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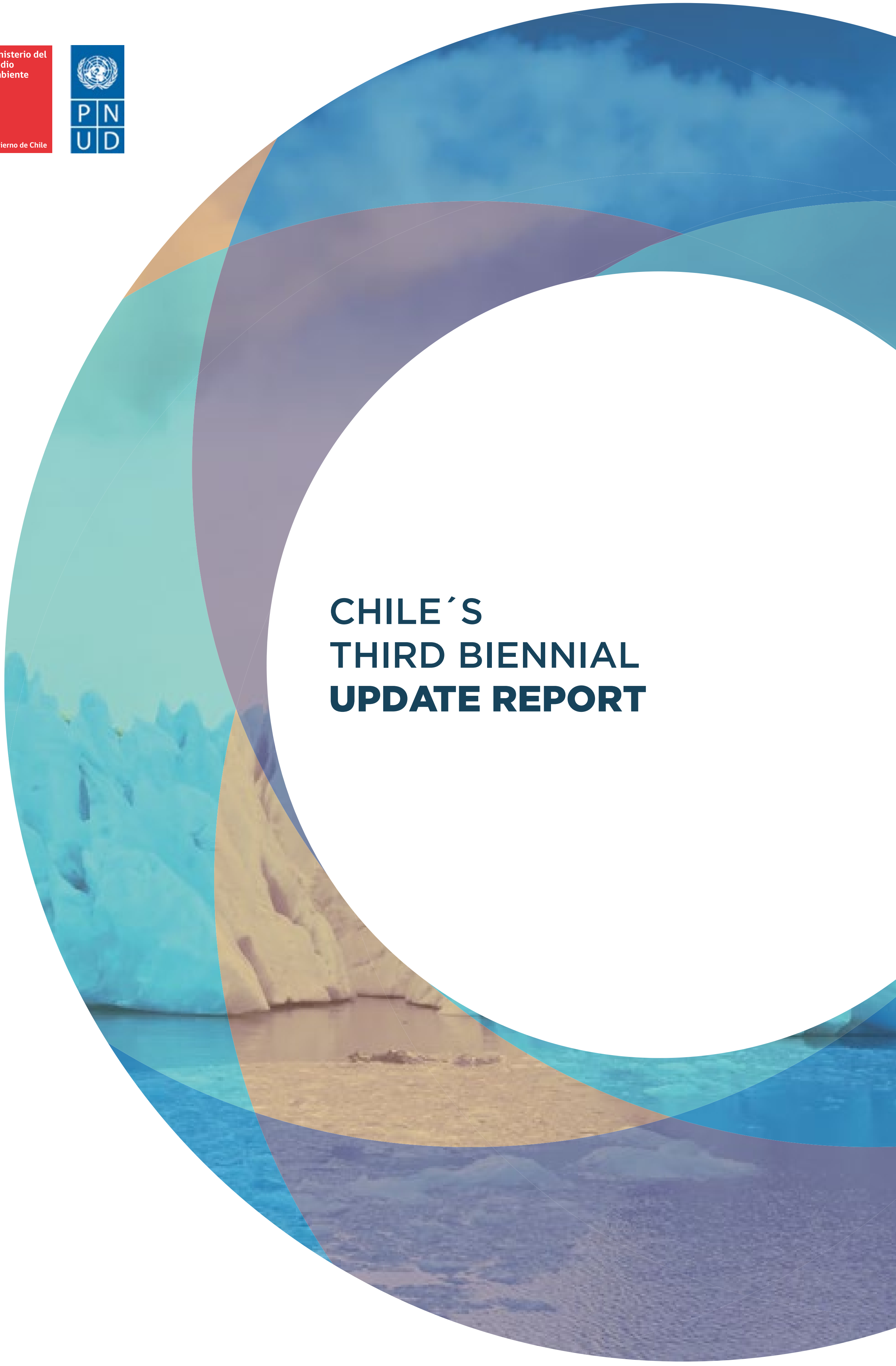

CHILE´S THIRD BIENNIAL **UPDATE REPORT**

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CHILE´S THIRD BIENNIAL UPDATE REPORT

To the United Nations Framework Convention on Climate Change

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PROLOGUE

Climate change and its effects in Chile has been a permanent concern during the last years, which transcends governments and has become one of the most significant environmental issues in the country, as well as in the World. Within the commitments undertaken by Chile with the United Nations Framework Convention on Climate Change, we present for the third time our Biennial Update Report which accounts for progress achieved regarding greenhouse gases mitigation.

Chile ratified the Paris Agreement in February, 2017. A key aspect of such Agreement consists in having an enhanced transparency framework so as to provide a clear view on the measures adopted to face climate change in the light of the Convention's purpose. For this reason, the effort we make as a country at delivering this Third Biennial Update Report shows our interest in drawing attention to the actions carried out by the public and private sectors, reflecting the country's commitment towards a sustainable, resilient and low-carbon emission development.

This report presents the update of our greenhouse gas national inventory from 1990 to 2016. This inventory is developed under the best standards and information available per sector. In addition, the biennial report presents the progress in public policies that are contributing to GHG emissions reduction in the country, as is the case of the 2050 Energy Policy, the Energy Roadmap, the National Strategy on Climate Change and Vegetation Resources and the Electro-mobility Strategy, among other.

The report shows, in turn, information on international support the country has received for the development of activities related to climate change, in addition to an identification of the main needs still existing at the sectors, so that we as a country move forward in the fulfillment of our commitments.

Having this type of reports is not only positive as regards our country's transparency, but it also allows us to make timely decisions and to design public policies based on the best information available, apart from creating an instance of capacity building and collaboration among the different organizations.

Commitment, collaboration and the excellent job performed by each of the public organizations participating in the preparation of this report are specially highlighted, as well as the technical and financial support delivered to Chile by the international cooperation projects.

Our challenges related to climate change are numerous and urgent. President Sebastián Piñera, in his first public statement of 2018, has considered climate change as one of the three main challenges for the country. This report provides us with valuable information regarding what we have been doing in the country, and how is our greenhouse gas emissions trajectory behaving. In this respect, we in Chile are working on climate action and also on the Climate Change Framework Law project; in the development of a Long-Term Climate Strategy and in the review and update of our Nationally Determined Contribution.

All of the above shall provide us with the necessary climate institutions, in order to approach the commitments and challenges of the future, those allowing us to leave a more sustainable and resilient to climate change country for the future generations.

Carolina Schmidt Zaldívar
Minister of Environment of Chile
Santiago, Chile, November 2018

EXECUTIVE SUMMARY

1. NATIONAL CIRCUMSTANCES AND INSTITUTIONAL ARRANGEMENTS

1.1. Geographical Profile

Chile is a tri-continent country which territory is located at the western and southern part of South America, between parallels 17° 30' and 56° 30' South latitude. It includes Easter Island, in Oceania, and extends to the South in Antarctica, at an area between the meridians 53° and 90° west longitude and to the South Pole. Its maritime territory extends to the North, from the maritime boundary with Peru to the banks of the Antarctic continent in the South. Although it has multiple climates mainly governed by latitude and height conditions, temperate climate characteristics are dominant.

Chilean population experienced an important growth during the twentieth century, but the growth rate slowed in the first decade of the 21st century and it is projected to decline even further towards 2050. The continued development of the country has improved the quality of life of its inhabitants. The positive evolution of the human development index (HDI)[1] in recent years is a proof of these transformations (Undp, 2015).

1.2. Economic Profile

Chile has an open and stable economy model, which promotes trade and investment. During 2017, the economic activity grew by 1.5 % compared to 2016. From an origin perspective, increases were observed in most of the activities, being personal services and trade those with the largest contribution to the GDP outcome; meanwhile, the main negative effects came from business services, construction and mining.

Table RE1 shows some key indicators for Chile, obtained from the information presented in the Third National Communication of Chile to the United Nations Framework Convention on Climate Change (3CN 2016) as updated for this report.

Table RE1. Key indicators for Chile

INFORMATION		SOURCE
Geography and population		
Area:		
Total surface area (km^2)	2,006,096	The Military Geographic Institute (IGM)
South American Surface (km^2)	755,915	
Surface in Oceania (Easter Island) (km^2)	181	
Use of Land:		
Areas of agricultural use (%)	4.2	National Forestry Corporation (CONAF), 2017[2]
Native forests (%)	19.4	
Forest plantations and mixed forests (%)	4.4	
Grassland and bushes (%)	27.5	
Urban and industrial areas (%)	0.6	
Areas without vegetation (%)	31.7	
Marine protected areas (1,000 ha)	46,323	Ministry of Environment (MMA), 2018 National Register of protected areas www.bdrnap.mma.gob.cl
The National System of Protected Wild Areas (SNASPE) (thousand ha)	15,329	

[1] *The human development index evaluates the progress of countries considering health (life expectancy), education (average years of schooling and those expected) and income (gross domestic product per capita).*

[2] *Regarding the surface of South America and Oceania.*

INFORMATION		SOURCE
Population:		
Population year 2002 (individuals)	15,116,435	The National Institute of Statistics (INE), 2017 Census www.censo2017.cl
Population year 2017 (individuals)	17,574,003	
Male year 2017 (%)	48.9	
Female year 2017 (%)	51.1	
Rural population year 2017 (%)	12.5	
Indigenous population year 2017 (individuals)	2,185,792	
Migrant population year 2017 (individuals)	746,465	
Social Development		
Life expectancy year 2017 (years)	79.3	The National Institute of Statistics (INE), 2017
Infant mortality year 2015 (per thousand live births)	6.9	
Literacy rate year 2013 (%)	96.26	UNESCO
Urban population connected to sewerage system year 2016 (%)	96.83	Superintendence of Sanitary Services (SISS), 2016
Urban population with potable water supply year 2016 (%)	99.92	
Wastewater treated at treatment plants year 2016 (%)	99.93	
Human Development Index Year 2015	0.847	The United Nations Development Program (UNDP), 2016 (Undp, 2016)
Population in extreme poverty year 2015 (%)	3.5	MDS, 2016
Population living in poverty year 2015 (%)	11.7	
Rate between richer 10 % and poorer 10 % year 2015	27.2	
Gini Coefficient (autonomous) year 2015	0.495	
Economic Activity		
GDP year 2017 (million USD)	277,075.9	World Bank, 2018
GDP per capita, year 2017 (USD)	15,346.4	
Estimated GDP growth as of 2017 (%)	1.5	
Trade in Goods year 2016 (% GDP)	47.8	
Exports of goods and services year 2017 (% GDP)	28.7	
Trade Balance year 2017 (Million USD Fob)	7,922	Central Bank of Chile Statistics www.bcentral.cl
Mining exports year 2017 (million USD Fob)	37,957	
Agriculture and Forestry exports year 2017 (million USD Fob)	5,610	
Industrial exports year 2017 (million USD Fob)	25,663	

Source: Climate Change Office of the MMA.

1.3. Institutional Arrangements for Climate Change

1.3.1. Environmental Institutional framework

National policies aimed to sustainable development are a part of the integral development strategy of the country. The Political Constitution guarantees, as a fundamental right, living in an environment free of contamination, and grants to the Government the duty to safeguard and preserve nature and the environmental heritage (Government of Chile, 2002). The consolidation process of the Chilean environmental institutions has been marked by the creation of the Ministry of Environment (MMA), the Environmental Assessment Service (SEA) and the Superintendence for Environment (SMA) in 2010, together with the Council of Ministers for Sustainability (CMS).

1.3.2. National Climate Institutional framework

Since Chile's ratification in 1994 of the United Nations Framework Convention on Climate Change (UNFCCC) and by becoming a part of the Kyoto Protocol in 2002, it has been actively participating in discussions and international efforts, and it has faithfully fulfilled the commitments made in its position as a developing country. The Paris Agreement, adopted in December 2015, was enacted in Chile in February 2017 through Supreme Decree N° 30 of the Ministry of Foreign Affairs[3].

Climate Change Office (OCC) of the Ministry of Environment

The Climate Change Office, which directly depends from the Environment Undersecretary was created in 2010. According to the MMA Resolution N° 278, of April 2018, the OCC is responsible for (a) generating and collecting technical and scientific information to support the design of policies and plans and programs formulation in the field of climate change; (b) following up and advising the Ministry on the progress in the implementation of public policy on climate change instruments in the country, among other functions indicated in the above-mentioned resolution. In addition, it acts as: National Designated Authority of the Clean Development Mechanism (NDA), Technical Advisor to the Committee for International Negotiation, Designated Authority for the Adaptation Fund, the Focal Point of the IPCC, Focal Point of the Iberian-American Network of Climate Change Offices, Focal Point of the EUROCLIMA+ Project, Focal Point of NAMA Registry, Focal Point of the Climate and Clean Air for Reduction of Short Life pollutants, representative to the Inter-American Institute for Global Change (IAI), among other. In addition, the OCC participates in various networks for information exchange, such as the Iberian-American Network of Climate Change Offices (RIOCC), the Regional Cooperation Program between the European Union and Latin America (EUROCLIMA), the Latin American Network of GHG inventories (REDINGEI), the Scientific Committee for Climate Change of the Pacific Alliance and the Independent Association of Latin America and the Caribbean (AILAC).

Sectorial Institutional framework

National public institutions comprise a series of institutions, agencies or entities that, without belonging to the MMA, are related to the climate change issue. Among the ministries that currently have units, departments or offices specifically associated to this matter those standing out are: Ministry of Foreign Affairs (MINREL), Ministry of Finance (MINHACIENDA), Ministry of Energy (MINENERGIA) and the Ministry of Agriculture (MINAGRI). In addition, other outstanding agencies that have advanced significantly in the issue of climate change inside their institutions include: Ministry of Housing and Urban Development (MINVU), Ministry of Social Development (MDS), the Agency for Energy Sustainability and CORFO.

Termas de Polloquere, Juan Ernesto Jaegger - Imagen de Chile

[3] *Supreme Decree N° 30, 13 February 2017, of the Ministry of Foreign Affairs, promulgates the Paris Agreement, adopted at the twenty-first meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change may be accessed at the link: https://www.leychile.cl/Navegar?idNorma=1103158*

2. NATIONAL GREENHOUSE GAS INVENTORY, 1990-2016

Key points of the Chile NGHGI 1990-2016 Series

• In 2016, the country´s total GHG emissions (excluding LULUCF) amounted to 111,677.5 kt CO_2 eq, increasing by 114.7 % compared to 1990 and by 7.1 % compared to 2013. The main GHG emitted was CO_2 (78.7 %), followed by CH_4 (12.5 %), N_2O (6.0 %), and fluorinated gases (2.8 %).

• The Energy sector is the largest GHG emitter in the country, accounting for 78.0 % of total emissions in 2016, mainly due to the consumption of coal and diesel for power generation and consumption of liquid fuels in road transport.

• Land use, land-use change and forestry (LULUCF) sector is the only sector that consistently removes GHG in the country and remains as a sink for the entire time series. In 2016, the balance of GHG emissions recorded -65,492.3 kt CO_2 eq, mainly due to the increase of biomass in second-growth native forest and forest plantations.

• The balance between GHG emissions and removals for Chile (including LULUCF) reached 46,185.2 kt CO_2 eq.

2.1. Introduction

This is the Fifth National Greenhouse Gas Inventory (NGHGI) submitted by Chile to the United Nations Framework Convention on Climate Change (UNFCCC) in fulfillment of Article 4, paragraph 1(a) and article 12, paragraph 1(a) of such Convention, and decision 1 of the Conference of the Parties N°16 of Cancun.

The Chilean NGHGI was prepared according to the *2006 IPCC Guidelines for National Greenhouse Gas Inventories,* and it covers the entire national territory and includes emissions and removals of carbon dioxide (CO_2) and methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), and sulfur hexafluoride (SF_6) in a series of time from 1990 to 2016.

Estimates of greenhouse gas (GHG) emissions and removals refer to 2016, the year of Chile's last NGHGI.

2.2. Institutional Arrangements and Preparation of Chile's NGHGI

Since 2012, the GHG inventories area, located at the Climate Change Office of the Ministry of Environment (OCC of the MMA) has designed, implemented and maintained the National System of Greenhouse Gas Inventories of Chile (SNICHILE). SNICHILE contains the institutional, legal and procedural arrangements established for the biennial update of the Chile's NGHGI, thus ensuring sustainability in the preparation of GHG inventories in the country, the consistency of the GHG flows notified and the quality of the results. The permanent work of SNICHILE is divided into five lines of action:

• Operation of the SNICHILE
• Update of Chile's NGHGI
• Quality assurance and quality control system
• Creation and maintenance of capabilities
• Filing and communication

The SNICHILE maintains a work plan consisting in a biennial cycle of activities. During the first year of the cycle, sectorial GHG inventories (SGHGI) are updated by the Sectorial Technical Teams, while in the second year SGHGIs are compiled, and crossed subjects of Chile's NGHGI are developed by the Coordinating Technical Team.


Central eléctrica, ICP

The preparation of the current NGHGI began during the first half of 2017, and concluded in mid-2018. The Energy SGHGI was updated by the Division of Foresight and Energy Policy of the Ministry of Energy; the Industrial processes and product use (IPPU) SGHGI was updated by the OCC of the MMA; the Agriculture SGHGI was updated by the Ministry of Agriculture through the Agricultural Research Institute (INIA), the LULUCF NGHGI was updated by the Ministry of Agriculture through the Forestry Institute (INFOR) and the National Forestry Corporation (CONAF); and the Waste SGHGI was updated by the Office of Legislative Implementation and Circular Economy in collaboration with the OCC, both of the MMA. Once the updating process ended, the SGHGIs were compiled by the OCC of the MMA for the preparation of Chile's NGHGI and its corresponding *National GHG Inventory Report,* which undergoes a review process at national and international levels.

In conclusion, Chile's NGHGI is the result of a collective and permanent effort by the Ministries of Agriculture, Energy and the Environment, which have worked in coordination within the framework of the SNICHILE, strengthening the preparation of Chile's NGHGI by adding expert knowledge from the different sectors' participating ministries.

2.3. Trends in Greenhouse Gas emissions and removals of Chile

In 2016, the balance of GHG emissions[4] and removals of Chile accounted for 46,185.2 kt CO_2 eq, while total GHG emissions[5] in the country accounted for 111,677.5 kt CO_2 eq, a 114.7 % increase since 1990, and a 7.1 % since 2013 (Table RE2). The main causes of this trend are the Energy and LULUCF sectors. The values that are outside the trend in the balance (Figure RE1) are mainly a result of forestry fires accounted in the LULUCF sector.

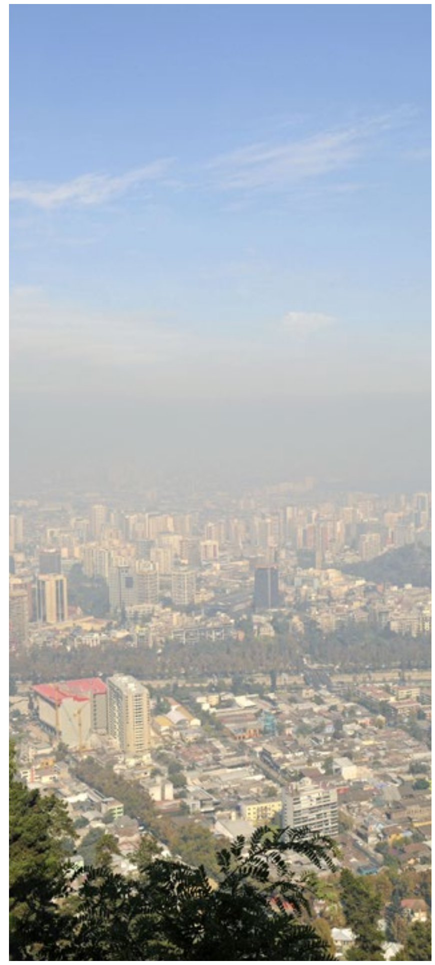

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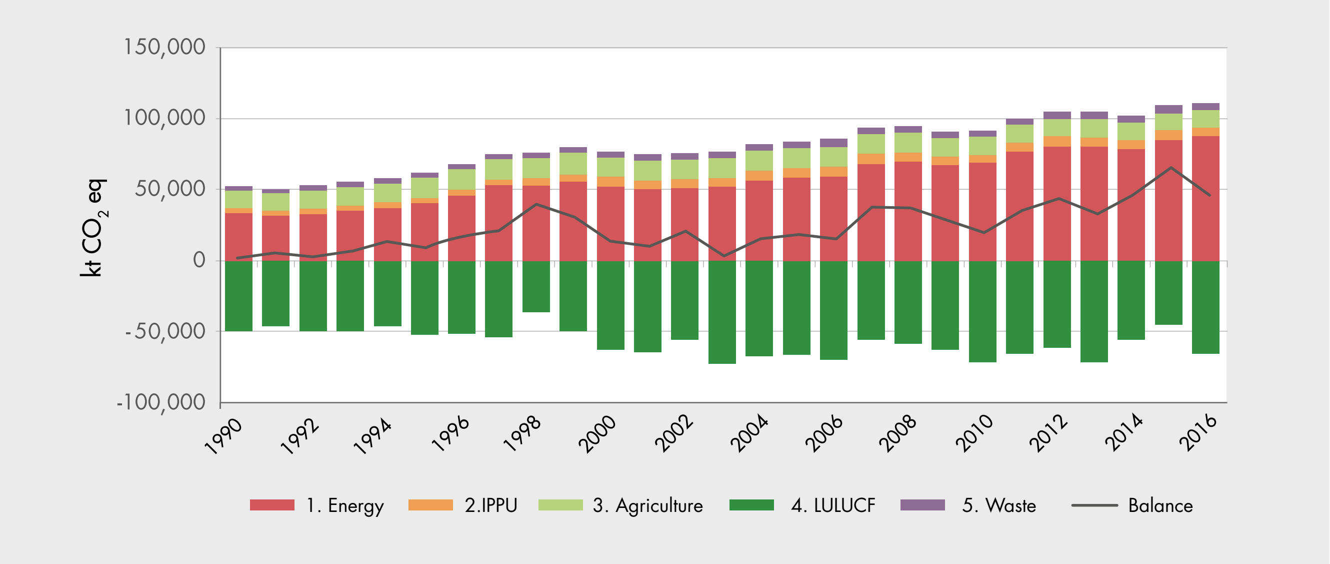
Table RE2. Chile's NGHGI: balance and total GHG emissions (kt CO_2 eq) by sector, 1990 - 2016 series

Sector	1990	2000	2010	2013	2014	2015	2016
1. Energy	33,679.7	52,511.9	68,623.5	79,993.7	77,417.0	83,713.4	87,135.6
2. IPPU	3,295.4	6,243.6	5,492.5	6,144.0	6,233.9	6,584.8	6,939.3
3. Agriculture	12,071.4	14,008.7	13,244.1	12,848.4	12,419.1	12,210.6	11,801.6
4. LULUCF	-50,061.0	-62,676.4	-71,930.9	-71,887.5	-55,722.4	-44,972.4	-65,492.3
5. Waste	2,969.3	3,822.4	4,502.2	5,318.4	5,403.9	5,734.5	5,801.1
Balance	**1,955.0**	**13,910.3**	**19,931.4**	**32,416.9**	**45,751.5**	**63,270.9**	**46,185.2**
Total	**52,015.9**	**76,586.7**	**91,862.3**	**104,304.3**	**101,473.9**	**108,243.3**	**111,677.5**

Source: Coordinating Technical Team of MMA.

[4] The term "balance of GHG" refers to the addition of GHG emissions and removals, expressed in carbon dioxide equivalent (CO_2 eq). This term includes the LULUCF sector as a whole.
[5] In the present report, the term "total GHG emissions" refers only to the addition of the national GHG emissions expressed in carbon dioxide equivalent (CO_2 eq). This term excludes the emission sources and absorption sumps of the LULUCF sector.

Figure RE1. Chile's NGHGI: balance of GHG (kt CO_2 eq) by sector, 1990 - 2016 series



Source: Coordinating Technical Team of MMA.

Total GHG emissions were dominated by CO_2, which accounted for 78.7 %, followed by CH_4 with 12.5 %, and N_2O with 6.0 %. Fluorinated gases collectively accounted for 2.8 % of GHG total emissions for the country as of 2016.

The Energy sector is the main GHG national emitter, with 78.0 % of the total GHG emissions in 2016. In the same year, GHG emissions in the sector accounted for 87,135.6 kt CO_2 eq, which represents an increase of 137.5 % from 1990 and of 16.6 % since 2013. In general, the main cause for this growth is the increase in the country's energy consumption, including the consumption of coal and natural gas for power generation, as well as liquid fuels for road transportation, mostly diesel and gasoline. Regarding the categories, Fuel combustion activities in 2016 accounted for 98.9 % of the sectorial emissions, and the remaining 1.1 % to the category *Fugitive emissions from fuels*. Within the category *Fuel combustion activities*, the subcategory *Energy Industries* is the most important with 41.5 % share, followed by a 31.3 % of Transport, 18.7% of *Manufacturing industries and construction* and finally, 8.5 % from *Other sectors*. On the other hand, within the *Fugitive emissions from fuels* category, the subcategory *Oil and natural gas* is the one with the greatest relevance, with 90.8 % followed by *Solid fuels* with a the remaining 9.2 %.

The IPPU sector accounted for 6.2 % of the total GHG emissions in 2016. In the same year, their emissions amounted to 6,939.3 kt CO_2 eq, increasing by 110.6 % since 1990 and 12.9 % since 2013. In general, the main causes are the sustained rise in the production of iron and steel, lime, nitric acid, cement, and the increased use of HFCs for refrigeration. Regarding categories, 41.4 % of GHG emissions correspond to *Product uses as substitutes for ozone depleting substances*, followed by 23.1% of *Mineral Industry*, 19.1 % of *Metal Industry*, 10.6 % of *Chemical industry*, 3.9 % of *Other product manufacture and use and finally*, 1.9 % of *Non-energy products from fuels and solvent use.*

The Agriculture sector accounted for 10.6 % of the total GHG emissions in 2016. In the same year, their emissions reached 11,801.6 kt CO_2 eq, a 14.7 % decrease since 1990 and 11.5 % since 2013, largely due to the low population of cattle and sheep that has been recorded during the last decade. This in spite of the sustained increase in the number of pigs and poultry; and the use of nitrogen fertilizers. With regard to the categories, 39.7 % of GHG emissions correspond to *Enteric Fermentation*, followed by 38.0 % of *Agricultural soils*, 17.1 % of *Manure management*, 3.0 % to *Urea application*, 1.1 % to *Rice cultivations*, 0.7 % to *Liming* and 0.3 % corresponding to *Field burning of agricultural residues.*

The LULUCF sector is the only one that consistently absorbs CO_2 in the country, making of it one of the most relevant sectors given its mitigation potential. In

2016, the balance of GHG emissions in the sector accounted for -65,492.3kt CO_2 eq, increasing its sink condition by 30.8 % since 1990 and decreasing it by 8.9 % since 2013. This is due to the effect of emissions caused by forest fires, since although the increase in biomass and harvest are stable for this period, the fires in recent years of the series are greater, causing a less-conducive to absorption balance. This demonstrates how forest fires adversely affect GHG balance. With respect to GHG emissions and removals in absolute terms by category, -94.4 % corresponds to *Forest* land, followed by 2.3 % of *Grassland*, 2.1 % of *Cropland*, 0.7 % of *Other land*, 0.5 % of *Settlements* and finally, 0.03 % corresponding to *Wetlands*.

The Waste sector accounted for 5.2 % of the total GHG emissions in 2016. In the same year, GHG emissions in the sector accounted for 5,801.1 kt CO_2 eq, increasing by 95.4 % since 1990 and 9.1 % since 2013, due to the population increase and their waste generated. Regarding categories, the 74.2 % of GHG emissions correspond to the *Solid waste* disposal, followed by a 24.7 % of Wastewater *treatment and discharge*, 1.0 % of *Biological treatment of solid waste* and finally, 0.01 % of *Incineration and open burning of waste.*

In accordance with the requirements of the UNFCCC and the *2006 IPCC Guidelines*, GHG emissions from fossil fuel consumption in international aviation and maritime transport, and CO_2 emissions from biomass burned for energy purposes, were quantified and reported as memo items, but they were excluded from the balance of emissions and removals of the country.

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3. GREENHOUSE GAS MITIGATION POLICIES AND ACTIONS

In relation to the last BUR of 2016, progresses in mitigation policies have been significant given the greater sectorial involvement. This has allowed the development of new public policies aimed to support the reduction of GHG emissions. In addition, the growing involvement of the private sector will enable the implementation of concrete actions that will lead the country to comply with its commitments and increase its ambition. The announcement of the preparation of a climate change law and the development of a strategy to 2050 undertake the creation of new management tools allowing the country to take a sustainable and low-emission pathway, an effort that will be in line with the international objectives subscribed in the Paris Agreement.

3.1. International Commitments in the field of Mitigation

Voluntary pledge 2020

The voluntary commitment, officially communicated to the UNFCCC secretariat in 2010, argues that "Chile shall conduct nationally appropriate mitigation actions to achieve a 20 % deviation below its business as usual (BAU) emissions rising trajectory in 2020, projected since 2007". The 2020 voluntary pledge has led to the development of various mitigation activities in the country, such as the Nationally Appropriate Mitigation Actions (NAMA), whose main objective is to reduce GHG emissions. In addition, it has served to identify sectorial actions that, despite not having a focus on the reduction of GHG emissions, have also contributed to the decarbonization of public policies.

During 2017 the exercise carried out by MAPS Chile to determine BAU emissions was updated, this time with updated information from the country's inventory, in order to have an approximation to the progress of the voluntary pledge, finding that, in general, since 2007 emissions have been in line with the fulfillment of such commitment.

Nationally determined contribution

Chile submitted its NDC to the UNFCCC secretariat in September 2015. The country's commitments are divided into five pillars: i) mitigation, ii) adaptation, iii) capacity building, iv) development and transfer of technologies; and v) financing.

For the mitigation pillar, Chile chose to present its contribution using the format of emission intensity (CO_2 equivalent tons per unit of gross domestic product in millions of CLP$ at 2011). Methodologically, the Land use, land-use change and forestry (LULUCF) sector was separated from the national commitment to mitigation due to the high annual variability of their captures and emissions, and for being less dependent on the economic growth.

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Chile's Nationally Determined Contribution (NDC) in terms of Mitigation

Carbon Intensity Target:

a) Chile is committed to reduce its CO_2 emissions per GDP unit by 30 % below their 2007 levels by 2030, considering a future economic growth which allows to implement adequate measures to reach this commitment.

b) In addition, and subject to the grant of international monetary funds, the country is committed to reduce its CO_2 emissions per GDP unit by 2030 until it reaches a 35 % to 45 % reduction with respect to the 2007 levels, considering, in turn, a future economic growth which allows to implement adequate measures to achieve this commitment.

Specific contribution to the LULUCF sector:

a) Chile has committed to the sustainable development and recovery of 100,000 hectares of forest land, mainly native, which will account for greenhouse gas sequestrations and reductions of an annual equivalent of around 600,000 tons of CO_2 as of 2030. This commitment is subject to the approval of the Native Forest Recovery and Forestry Promotion Law.

b) Chile has agreed to reforest 100,000 hectares, mostly with native species, which shall represent sequestrations of about 900,000 and 1,200,000 annual equivalent tons of CO_2 as of 2030. This commitment is conditioned to the extension of Decree Law 701 and the approval of a new Forestry Promotion Law.

During 2017, the MMA coordinated a Working Group of the Public Sector focused on discussing the NDC update (WGPS-NDC) in 2020, as required in the Paris Agreement. The ultimate purpose of this group was to develop a shared diagnosis on which elements should be updated, along with identifying possible institutional arrangements that contribute managing the NDC, and also to propose guidelines and next steps to move forwards in this matter.

3.2. Mitigation in the National Action Plan on Climate Change

On 19 June 2017, the Council of Ministers for Sustainability adopted the new National Action Plan on Climate Change 2017 - 2022 (PANCC 2017-2022). The preparation of the National Plan is the result of the collaboration of over 20 public institutions[6], including ministries and services with competences in the field of climate change, and it was coordinated by the Climate Change Office of the Ministry of Environment. As an articulating instrument of the national policy on climate change, the PANCC 2017 - 2022 integrates the actions to be carried out by the various public institutions with jurisdiction on these matters in the next 5 years. In addition, the new National Plan emphasizes, for the first time, the implementation of measures at a local level, looking for the generation of capacities and institutional strengthening on climate change at subnational government levels.

3.3. Sectorial Mitigation Actions

Regarding the second BUR submitted in 2016, sectorial policies have made progress to increasingly include climate change as a variable for analysis. Also, emitting sectors have begun to design specific policies that will allow GHG emission reductions in the mid-term.

[6] Ministry of Finance, Ministry of Foreign Affairs, Ministry of National Defense, Ministry of Social Development, Ministry of Agriculture, Ministry of Economy, Ministry of Education, Ministry of Energy, Ministry of Health, Ministry of Housing and Urban Development, Ministry of Public Works, Ministry of Transport and Telecommunications, Ministry of Mining, National Office of Emergencies and Secretary for Regional Development of the Home Office and Public Security, Undersecretary for Fisheries and the Production Development Corporation of the Ministry of Economy, Oceanography and Hydrography Service of the Chilean Navy and Weather Forecast Directorate in of the Ministry of National Defense, General Water Directorate of the Ministry of Public Works, National Commission for Scientific and Technological Research of the Ministry of Education, Chilean Copper Commission of the Mining Ministry, Agency of Sustainability and Climate Change.

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This report includes the progress in actions and policies of various sectors. Regarding the Energy sector, regulated and governed by the Ministry of Energy, at the end of 2015 it published the *Chile's Energy Policy*, developed through a participatory process called *Energy 2050*, which outlines a vision of the energy sector as reliable, sustainable, inclusive and competitive. In addition, during 2018 the 2018 - 2022 *Energy Road Map* was developed. This Energy Pathway seeks to prioritize work during the next four years on the energy sector, around 7 pillars. Framed by these two instruments of governance, one with a short-term look and the other with a long-term vision, various initiatives are being carried out that aim to the reduction of GHG emissions, as well as to adaptation to climate change in the energy sector.

As regards the Transportation sector, the Ministry of Transportation and Communications makes its contribution through its Transportation Undersecretary, the public institution responsible for generating policies, standards and conditions for the development of transport systems. In accordance with the National Energy Policy, its strategic guideline N° 34 sets the improvement of energy efficiency in vehicles and their operation, and sets as a goal in 2050 for Chile having adopted the highest international standards on energy efficiency in the various transportation means. In this context, the Ministries of Energy; Transportation and Communications and of the Environment developed an Electro-mobility Strategy for Chile, in order to systematize efforts and articulate the various relevant actors to promote the introduction of technologies with greater energy efficiency in the country's vehicles market.

The Agriculture, forestry and other land use (AFOLU) sector is the only one that presents GHG emissions and removals of CO_2, which is why its mitigation potential is relevant. Carbon sinks are mainly from second-growth natural forest; from regeneration of managed native forest, and from mostly exotic forest plantations. As a key instrument to achieve the goal contained in the NDC, the National Forestry Corporation (CONAF) is implementing the National Strategy on Climate Change and Plant Resources (ENCCRV). This strategy aims to reduce the social, environmental and economic vulnerability generated by climate change in addition to GHG mitigation. Among the challenges of the sector is, to move forward in the research to bring down the GHG emissions curve in the agriculture sector, working in good practices on nitrogen fertilization, livestock management practices or soil carbon sequestration, to name a few and analyzing forest policies leading to the capture of carbon in forests and fires prevention to achieve a carbon-neutral agriculture and forestry sector.

In the Waste sector, most of GHG emissions in Chile are generated by municipal solid waste, whose management is delivered to municipalities through the Organic Constitutional Law on Municipalities and is regulated by the Sanitary Code. The MMA is responsible for the design and implementation of policies, plans and programs on environmental matters, including waste management programs. With regard to progress on regulatory matters, in May 2016, Law N° 20,920 was enacted, which establishes a framework for Waste Management, the Extended Producer Responsibility and Recycling Promotion, whose purpose is to reduce waste generation and to promote reuse, recycling, or valuation, in order to protect people's lives and the environment. At the international level, during the COP22 in November 2016, the Minister of the Environment and Climate Change of Canada undertook to reduce the pollutants that damage the climate in Canada and around the world, and to contribute with USD10.7 million to reduce Short-Lived Climate Pollutants through bilateral alliances with Chile and Mexico.

Regard to the Building, urbanization and public infrastructure sector, the entities responsible for public policies associated to mitigation and adaptation to climate change are the Ministry of Public Works (MOP) and the Ministry of Housing and Urban planning (MINVU). Within the instruments that have an impact on mitigation, the National Urban Development Policy stands out, which states that is key to move towards a sustainable urban development which considers both sustainable construction in the city as well as the efficient management of energy and handling of natural resources and waste which, as a consequence, will result in a reduction of GHG emissions generation. In addition, in 2016 the MOP updated its Policy of Environmental Sustainability, and also developed a Plan for Adaptation and Mitigation of Infrastructure Services to Climate Change 2017 - 2022. In the same line, the MINVU, through the National Strategy for Sustainable Construction sets the main guidelines to promote integration of sustainable development concept in the building area in Chile.

In addition to the actions and policies implemented and carried out by the different sectors, there is a growing interest from local governments to generate and maintain actions that identified with the realities of each of the localities they represent. Progress is highlighted by the Municipal Environmental Certification System (SCAM) and the regional efforts developed through international and domestic funds such as the Environmental Protection Fund.

Regarding the private sector, it engages each year with greater strength in initiatives related to the reduction of GHG emissions in the country. In this line, one of the first steps carried out by private organizations is to know their sources and emission levels, which may help them at the decision-making process. The achievements through the clean production agreements and the systems of recognition of the Footprint Chile Program (HuellaChile) should be highlighted.

3.4. Nationally Appropriate Mitigation Actions

With the opening of the prototype for the NAMA registration and subsequent official recording (NAMA Registry), Chile was able to complete the task and in October 2012 it was the first country in the world to register a NAMA with the UNFCCC. However, despite the initial enthusiasm for the instrument, it has not been possible to increase the interest of project developers with a mitigation potential. In Chile, six sectorial NAMAS are identified, with different levels of maturity and information availability. All of them are registered with the NAMA Registry of the UNFCCC.

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Table RE3. Chile's NAMA

Name	Gas and Sector	Period	Estimated GHG reduction	State
Self-supply renewable energies in Chile (SSREs)	Energy CO_2	2015-2022	1.5 $MtCO_2eq$	Under implementation
Green Zone for Transport in Santiago	Transport and Infrastructure CO_2	2014-2022	1.43 $MtCO_2eq$	Under implementation and development of MRV system
Design and Implementation of Strategy on Climate Change and Plant Resources	UTCUTS CO_2	2013-2025	42 $MtCO_2eq$	Under implementation
Clean Production Agreements (APL) in Chile	Transversal	2012-2020	18.4 $MtCO_2eq$	Under implementation
Energy recovery from industrial waste program (former National Program for Industrial and Commercial Catalyzation and Organic Waste Management in Chile)	Energy, Waste CO_2, CH_4	To be defined	Transversal	Suspended
Carbon sequestration through sustainable land management	Agriculture, Forestry/ AFOLU CO_2	To be defined	65 to 80 $MtCO_2eq$	Under design, seeking support for implementation

3.5. Application of Instruments and Mechanisms of Carbon Price to address Environmental Externalities

While the world continues to explore global GHG mitigation efforts post-2012, countries such as Chile are searching new and profitable ways to intensify emission reductions and encourage financial flows, including market-based instruments. Chile has already used market instruments for the management of natural resources, mainly in water rights, fishing and air quality.

With respect to CDM, from 2003 to date, Chile's DNA has granted National Approval Letter to 153 projects, 102 of which (61 %) have been successfully registered with the CDM Executive Board, 7 (4 %) are under validation phase, 56 (34 %) have been rejected and 1 (1 %) was voluntarily withdrawn by its proponents.

As from January 1, 2017 the first green taxes regime (or pigouvian) was enacted in the country. The main objectives of this instrument are to support and complement efforts to decrease the local air pollution - the main environmental problem in Chile- as well as mitigating greenhouse gases in a cost-efficient manner. On April 30, 2018 the first year of operation of the green tax ended. A total of 94 affected establishments, including 303 sources (boilers and turbines), reported their emissions and paid their tax. The total amounted to USD 191.3 MM. The CO_2 tax explains the major portion of the total (88 %).

3.6. Measurement, reporting and verification of mitigation actions

The objective of making MRV in Chile is to promote transparency of GHG mitigation activities implemented in the country through mechanisms that allow monitoring compliance with its objectives. Although Chile reported the implementation of mitigation actions to the international community through the BUR and their national communications, as requested by the UNFCCC, to possess MRV systems of individual actions is key to evaluate the effectiveness of such actions.

In this sense, since 2011 Chile has been working on independent MRV systems that have served as management tools for NAMA, in addition to creating capacities in this area through the international support of various projects, for example, to the preparation in 2014 of the document "Guidelines for a generic framework of MRV for NAMAs", which explains how can the impacts on GHG emissions and other co-impacts generated through the implementation of mitigation actions be measured, reported and verified. While developed for NAMAs, this framework can be used for any type of action that generates mitigation of GHG emissions. Also, during 2016, the Department of Climate Change of the MMA, through the project Low Emission Capacity Building (LECB) developed a study to define basic accounting rules for mitigation actions in Chile and preliminarily design the contents of a possible platform for centralized MRV.

In addition, other agencies stand out that have made significant progress in the issue of monitoring, reporting and verification within their institutions, such as the Ministry of Energy and the Ministry of Agriculture, through the National Forestry Corporation (CONAF).

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4. NEEDS AND SUPPORT RECEIVED IN THE FIELD OF CLIMATE CHANGE

4.1. Methodology and Analysis Period

For the development of the present chapter, the UNFCCC reporting guidelines have been applied as methodological framework for the presentation of the biennial update reports from Parties not included in annex I to the Convention (Annex III, Decision 2/CP17[7]), which specifies that those countries, which includes Chile, shall provide updated information on needs and support received for climate action.

The analysis of support and needs was made for the three following areas: (1) financial resources, (2) capacity building and technical assistance, and (3) technology transfer. In turn, these areas were subdivided into five areas of analysis: report, mitigation, adaptation, national inventory of climate change and international negotiation, while maintaining the same structure of the First and Second BUR.

To gather the information the process was divided into three stages: (i) sending a formal survey to public institutions that make up the Inter-Ministerial Technical Team on Climate Change (ETICC) requesting (a) information regarding needs, gaps and barriers identified in their sector for the development of the climate change agenda and (b) information on initiatives with international support approved in the reporting period (ii) workshop with these public institutions for participatory identification of needs, barriers, opportunities, etc., and (iii) bilateral meetings to validate and/ or complete the previously gathered information.

The information presented covers the period immediately following the data gathering phase from the Second BUR (from July 2016 until March 2018).

4.2. Needs for climate action

In recent years institutions have developed and capacity has been generated on climate change issues in Chile. However, needs, gaps and barriers can still be identified, which hamper the development of a more effective climate action. The major crossed needs relate to the generation of an adequate institutional system to facilitate the development of actions on climate change in the country, and a financing strategy consistent with the requirements that are generated during the process.

With the adoption of the National Plan for Adaptation to Climate Change in December 2014, an operational structure was proposed that has served as the basis for strengthening the institutional framework of climate change in recent years. This structure is composed of an Inter - Ministerial Technical Team on Climate Change (ETICC) and 15 Regional Committees on Climate Change (CORECC). However, there is still a need to develop and strengthen the institutional framework through regulations that support its construction beyond the sectorial intentions; in addition, financial needs are detected, ranging from access to international funds to the capacity to receive financial resources, in particular in the public sector.

Reporting

Although Chile has developed and submitted their national reports on a regular basis, responding to the delivery time committed to the UNFCCC, the challenge of the installation of permanent capacities for the generation of reports subsists, which necessarily requires specific budgets to support the reporting activity with due continuity. Compared to the work of the Second BUR, for this Third Report the sectorial teams are more familiar with the requirements of information requested by the Ministry of Environment (which works as the compiling entity), however it is still necessary to move forward in the information systematization so that it is possible to count on it in a timely manner, and that this information also serves for the internal management of each agency.

[7] *http://unfccc.int/resource/docs/2011/cop17/spa/09a01s.pdf*

Mitigation

The generation of information on mitigation actions has progressed through time and also the experience gained by the preparation of the national reports. With respect to the previous reporting period, Chile maintains the need to strengthen its information management system, which would allow the systematization and management, in a transparent manner, of the information associated with the mitigation efforts in the country. Between 2018 and 2020 Chile will perform a set of activities under the CBIT initiative to improve its reporting capabilities within the context of the Paris Agreement and of the newly established requirements under the Enhanced Transparency Framework. It is important to emphasize the need to strengthen inter-sectorial coordination and institutional strengthening, both to perform actions and to evaluate and project the progress of compliance with domestic and international goals.

National Greenhouse Gas Inventory

Chile has made efforts to ensure the operation and continuous improvement of its National GHG Inventories System (SNICHILE). It permanently maintains a line of work at the Ministries of Agriculture, Energy and the Environment, where staff has been appointed and technical and financial resources have been granted for the regular update of the inventory. In spite of the progress, there is a need to ensure the permanent recruitment of specialists on the basis of local budget. We identify the need to strengthen technical capacities for the development of specific country emission factors. The appropriate technology to perform measurements (carbon content in fossil fuels, soil carbon, GHG emissions from soils, firewood and animals, among others) is currently not available.

Adaptation

During the period covered by this report, the following advances have been made with respect to adaptation policies involved in the National Plan for Climate Change Adaptation PNA (2014): sector plans reported in the second BUR (Agriculture and Forestry; Biodiversity; Fisheries and Aquaculture and Health), in addition to the adoption, in 2017, of the Adaptation and Mitigation Plan of Infrastructure Services to Climate Change and in 2018, Climate Change adaptation plans for Chilean cities and for the Energy Sector. In addition, during 2018 has started the development of the plans for the sectors of Water Resources and Tourism, thus complementing the adaptation plans for the 9 areas defined as priorities by Chile in the PANCC. Also, the first steps have been taken to update the Agriculture and Forestry and biodiversity adaptation plans, which are close to completion of their first implementation cycle, and that should initiate a second cycle, as committed in the Chile's NDC.

In general terms, the needs for adaptation to climate change are summarized in three areas: (1) Strengthening the mechanisms of coordination between the different sectorial ministries involved, and to endow them with trained and permanent professionals, both at national and regional levels; (2) Better climate and territorial information for adaptation, including research on climate variables, interrelationships and impacts of climate change; (3) Incorporating climate change to the design of public policies and investment decisions, considering funding for the implementation of actions, so as to meet the challenges of medium and long term.

International Negotiation

In the area of negotiation and international climate agenda, the main need continues to be enhancing the current negotiating team in the country, along with establishing permanent teams in the relevant sectorial ministries, with adequate financial and technical capacity for the preparation, follow-up and transfer of international issues to a domestic level.

Private Sector

The private sector maintains a relevant role in both investment and the implementation of innovative measures for mitigation and adaptation to climate change. Private sector respondents expressed willingness to deepen instances of public - private work as a mechanism to mobilize resources and respond to interests of both sectors. The current NDC helps to understand the vision of the medium-term, however for the private sector it would be useful to have more information on sectorial implementation and climate planning in the long run. The sector sees potential for development and technology transfer, but poses the need to establish the appropriate mechanism to facilitate this result.

Needs identified in the process of analysis and international consultation

During 2017 the Second BUR of Chile was subject to the process of international consultation and analysis (ICA), which main objective is to help countries No-Annex I to identify their needs in capacity building. The final report of the process was published by the UNFCCC[8] on December 4, 2017. In this section of the BUR appears the summary of the identified needs and its states at the time of elaboration of this Third BUR.

4.3. Support for Climate Action

Below the information on support received (international) and delivered (national) for activities related to climate change is presented.

Support received for activities related to climate change

During the reporting period (July 2016 to March 2018), donor countries and institutions have approved to Chile a total of USD 40,207,701 to carry out activities of the national climate agenda. Bilateral contributions represent approximately 28 % of the financial resources approved in the period. Resources channeled through "Financial Institutions and Multilateral Initiatives" are equivalent to a 72 %.

In this third Biennial Update Report it has been chosen not to include information about financial resources channeled to private sector projects because it was not possible to compile robust data on this type of projects and resources. There is limited information available, in addition to different definitions and methodologies. At the time of preparing this report, the OECD database for Official Development Assistance (ODA) contains information about flows for climate action updated to the 2016. However, this report includes information as from July 2016, so it is likely that it includes information that does not correspond to the period of analysis. In addition, as of 2017 Chile no longer qualifies as a beneficiary country of ODA.

Regarding the area of capacity building and technical assistance, the scope of the support received is broad, covering projects, workshops, studies and expert visits to and from abroad. After the COP 21 in 2015, the focus of programs and international initiatives has been to facilitate the successful implementation of the Paris Agreement. Access to this type of support and activities has been fundamental to the development of capabilities and instruments to facilitate climate public policy. The progress made regarding GHG inventories, reporting and transparency capabilities and planning of mitigation and adaptation actions stands out.

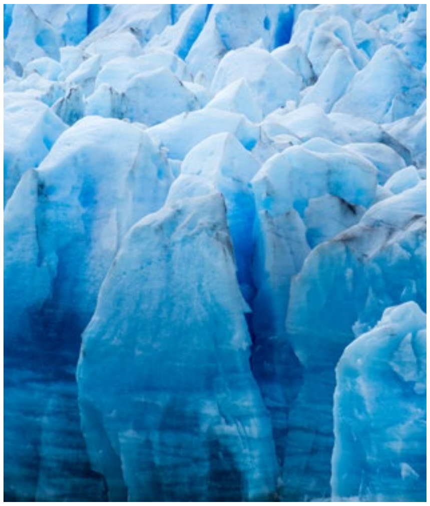
It is important to note that, given the global nature of these initiatives and their way of functioning, in most cases no information is available on the specific amounts intended to finance the activities Chile is participating in.

With regard to technology transfer, a set of projects has been identified that promotes technological development in geothermal energy and emissions reduction in industrial processes, including waste. Components of technological transfer in adaptation projects of the agricultural sector have also been identified.

Domestic support for climate change related activities

In the context of the work to develop a strategy for climate financing (commitment of its NDC), the Chilean Government is implementing measures to define and assess domestic resources intended for actions related to climate change.

According to Chile's NDC, specifically to the pillar of Capacity Building and Strengthening, Chile undertook to work in cooperation with other countries, to develop and strengthen the capabilities of nations that so require. The above through coaching and trainings based on the information and knowledge acquired in the preparation of national communications, greenhouse gas inventories and biennial update reports, among others. In addition, Chile maintains bilateral cooperation programs that address different areas of work, including climate change. Among them stands out the Joint Cooperation Fund Chile-Mexico, managed in Chile by the International Agency for International Cooperation for Development (AGCID).



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[8] *https://unfccc.int/sites/default/files/resource/docs/2017/tasr/chl.pdf*


Antofagasta, Claudio Badilla

I.
NATIONAL CIRCUMSTANCES

1. NATIONAL PROFILE

1.1 Physical Context

Territory and Administrative Division

Chile is a tri-continental country, whose territory lies on the western and southern part of South America, between 17° 30' and 56° 30' south latitude, reaching up to Easter Island in Oceania and extends to the south at Antarctica, in an area between the meridians 53° and 90° west longitude until the South Pole. The country has a total area of 2,006,096 km^2, without considering its territorial sea, the exclusive economic zone and the continental shelf, and it is distributed in 755,915 km^2 that corresponds to South America, 1,250,000 km^2 to Antarctica and 181 km^2 to Oceania, according to the mapping records made by the Military Geographic Institute (IGM) in 2005. Also, Juan Fernández archipelago, the Islands Salas y Gómez, San Felix and San Ambrosio are part of the national territory.

The Chilean maritime territory extends from the maritime border with Peru in the north until the Antarctic continental shores in the south, excepting the offshore area along the Drake Passage between Cape Horn and the Antarctic Peninsula (Ministerio de Defensa Nacional, 2010).

Chile is a unitary republic whose political-administrative framework is based on three territorial government levels: administrative regions, provinces and districts[1].

Geography and morphology

The topography of the country is mainly determined by the following three morphological units: the Andes mountain range to the east; the Coastal mountain range to the west; and the Intermediate Depression located between these two mountains. There are also other smaller scale areas such as the Coastal Plains, the Altiplano and the Magellanic Steppe. These geological variety shapes become a very rugged terrain where the flat terrains do not exceed 20 % of the continental territory.

Chile has a variety of climates determining mainly by its latitude and height, which originate four macro bio-climates: tropical, Mediterranean, temperate and anti-boreal, with 127 terrestrial ecosystems are distributed, and 96 marine ecosystems along the Chilean coast.

Land use

Most part of the territory corresponds to areas without vegetation (31.7 %), grassland and natural bushes (27.5 %) and native forest (19.4 %); urban and industrial areas represent only 0.6 % of the total surface area, but showing a sustained upward trend (CONAF, 2017). The Table 1 presents the land use change.

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[1] *The Constitution of the Republic of Chile points out in his article 110 that "For the internal governance and administration of the State, the territory of the Republic is divided into regions and these into provinces. For the purposes of the local administration, the provinces are divided into districts. The creation, abolition and designation of regions, provinces and districts; the modification of their limits, as well as the appointment of the regions and provinces capitals, will be subject of the Organic Constitutional Law" and of exclusive initiative by the President of the Republic.*

Table 1. Land use change, disaggregated by type according to the CONAF

Land use	1990	2000	2010	2013	2014	2015	2016
Forest Land	17,902,864	18,801,801	19,388,946	19,544,709	19,596,630	19,648,551	19,700,472
Native Forest	16,233,959	16,181,672	16,241,849	16,266,573	16,274,814	16,283,055	16,291,296
Mixed Forest	127,938	163,371	169,838	169,210	169,001	168,792	168,583
Plantations	1,540,968	2,456,758	2,977,259	3,108,926	3,152,815	3,196,704	3,240,593
Cropland	3,750,485	3,396,772	3,213,739	3,170,459	3,156,032	3,141,606	3,127,179
Grassland	18,622,715	17,969,037	17,482,413	17,346,384	17,301,042	17,255,699	17,210,356
Wetland	4,918,863	4,948,188	4,951,155	4,951,189	4,951,201	4,951,212	4,951,224
Settlements	165,765	279,459	369,113	394,957	403,572	412,187	420,802
Other Land	28,916,341	28,881,776	28,871,668	28,869,334	28,868,556	28,867,778	28,867,001
Total	74,277,034	74,277,034	74,277,034	74,277,034	74,277,034	74,277,034	74,277,034

1.2. Environment status

Regarding the air quality according to the Third Report of the Environment Status (MMA, 2017) this topic remains as one of the priorities in the environmental management. Most of the national territory is affected by air pollution, by which various actions are being implemented that including 9 decontamination plans in force, others in elaboration process set by the *Decontamination Strategy*, and the work with the communities in order to improve the household energy efficiency. In this matter, as shown by various statistics at a national level, the combustion of firewood remains the main emitter of PM2.5 for 2015, while mobile sources, thermal power plants and other industrial processes are mainly responsible for emissions of nitrogen oxide (NO_x). Emissions of sulfur dioxide (SO_2) are led by copper smelters and thermal power plants, due to the sulfur content of the raw materials processed in both industrial activities.

In relation to waste, also according to the Third Report of the Environment Status (MMA, 2017), it remains as a significant problem and if the economic growth continues that will be worse. Chile shows an average daily rate of 1.1 kg of waste per person for 2017, that is 396 kg per person of waste generation annually. For this reason, the Government promoted Law N° 20,920 Framework for Waste Management, Extended Producer Responsibility and Recycling Promotion, known as the REP Law under the principle of "polluter pays".

On the other hand, Chile has water shortage problems. Between 2008 and 2017, the General Directorate of Water (DGA), declared 82 areas with water shortage between the regions of Atacama and Aysén, mainly in the regions of Coquimbo, Valparaíso, Maule and the Metropolitan Region. In addition, in 2008 the Ministry of Agriculture informed that the most geographically extensive drought was reported, declaring an agricultural emergency for 225 districts across the country which has continued as a "Mega-drought". This means that the drought at a national level affects 72 % of the country's land in different categories (mild, moderate, severe), corresponding approximately to 55 million hectares. The affected population is 16 million inhabitants (90 %) (Ministerio de Agricultura, 2016).

Regarding the climate, although there are differences according to the country's areas, at the aggregate level there is a considerable increase of temperature, particularly in the daily maximum. According to the Meteorological Directorate of Chile (DMC), during 2017, there were thirty records, in absolute terms and monthly and annual averages. As a result of this rise, there has been an increase in the frequency and the intensity of heat waves, with more than 50 consecutive ones between 2015 and 2016, and between 2016 and 2017 (Dirección Meteorológica de Chile, 2018).

Based on DMC data, it could be said that even though in most areas of the country there is a trend to a decrease in rainfall during the period 1961-2016, it can be noted that its intensity shows a great variation. The extreme rainfall events tend to be more prevalent in regions of scarce rainfall, such as Antofagasta, Atacama and Coquimbo regions, which it is important to highlight given the occurrence of mass movements and floods, such as those that happened in May and January 2017. However, the central area of the country continues with a deficit in the total annual rainfall, ending the year of 2017 with a 17 % less rainfall in average, extending to 9 consecutive years with deficit. In the south-austral area of the country, during 2017, the annual rainfall was in the normal ranges (Dirección Meteorológica de Chile, 2018).

In the summer of 2017, the south-central zone of the country was affected by a mega-fire that covered over 500,000 hectares, known as "Storm Of Fire" because of the intensity of the line of fire exceeding 60,000 kW/m, thus defining a new range in the measurement of fire scale (CONAF, 2017).

Regarding biodiversity, the National Biodiversity Strategy in force suggested to protect 10% of the surface of the most relevant ecosystems in the country, reaching this goal in a number of terrestrial ecosystems described at a national level. This strategy is being updated in line with the "Strategic Biodiversity Plan for 2011-2020 and the Aichi Goals". In 2017, it was found that the vegetation formations with greater protection percentage in the National System of Protected Areas correspond to the evergreen thicket and peatland, mainly through the creation of national parks and forest reserves.

1.3. Social Context

Population

According to the last census of 2017, the Chilean total population is 17,574,003 inhabitants, 48.9 % of which are men and 51.1 % women (INE, 2017). The Chilean population experienced an important growth during the 20th century, but the growth rate slowed in the first decade of the 21st century, and it is projected to further decline toward 2050.

Through the years, the population has aged, which can be observed in changes in the distribution of age groups: there is a decrease in the number of people between 0-14 years and an increase in the number of people 65 years old or elder. This is also reflected in the dependency ratio, because while dependence of older adults has increased, that of children has decreased (Table 2 and Figure 1) (INE, 2017).

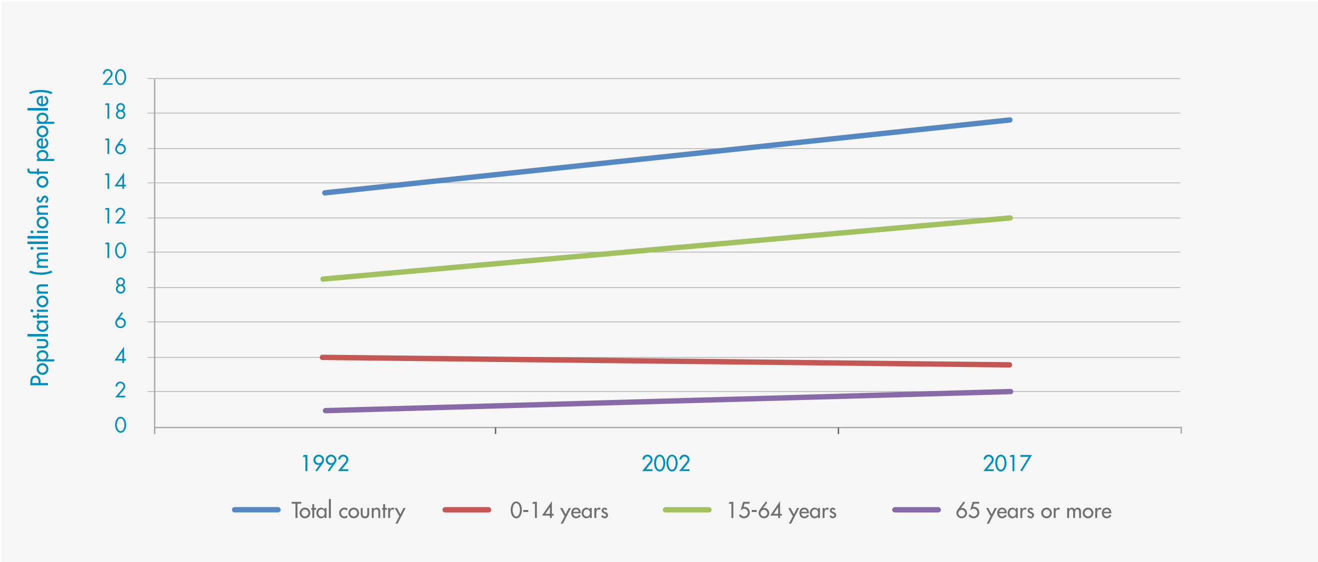
Table 2. Population Indicators of Chile, disaggregated per age group, based on the Population Census 2017, INE

POPULATION	1992 CENSUS	2002 CENSUS	2017 CENSUS
Total population	13,348,401	15,116,435	17,574,003
Population 0-14 years	29.4%	25.7%	20.1%
Population 15-64 years	64.0%	66.2%	68.5%
Population 65 years or elder	6.6%	8.1%	11.4%
Urban population percentage	83.5%	86.6%	87.8%
Elderly/children ratio	22.3%	31.3%	56.9%

Source: INE, Census 2017.

Pueblo de San Pedro de Atacama, Juan Ernesto Jaegger - Imagen de Chile

Figure 1. Evolution of the population in Chile according to age group



Prepared by MMA. Data source: (INE, 2017)

Social Development

Although Chile presents a positive evolution of the Human Development Index (HDI)[2] with a growth of 30 % from 1980 to 2014 (0.64 to 0.83) (UNDP, 2015) inequality remains one of the biggest challenges of the country, considering that the income of 10 % of the richest population of the country is 30 times higher than the 10 % poorest population and shows a Gini[3] coefficient of 0.502, according to autonomous income (MDS, 2017).

The Ministry of Social Development (MDS) based on data from the CASEN survey, estimates poverty both by income and multidimensional poverty. The latter includes the following relevant dimensions of well-being: education, health, labor and social security, housing and environment, along with networks and social cohesion. According to this survey in 2017, poverty by income and multidimensional were 8.6 % and 20.7 % respectively. Between 2006 and 2015[4] there was a significant reduction of poverty (Figure 2).

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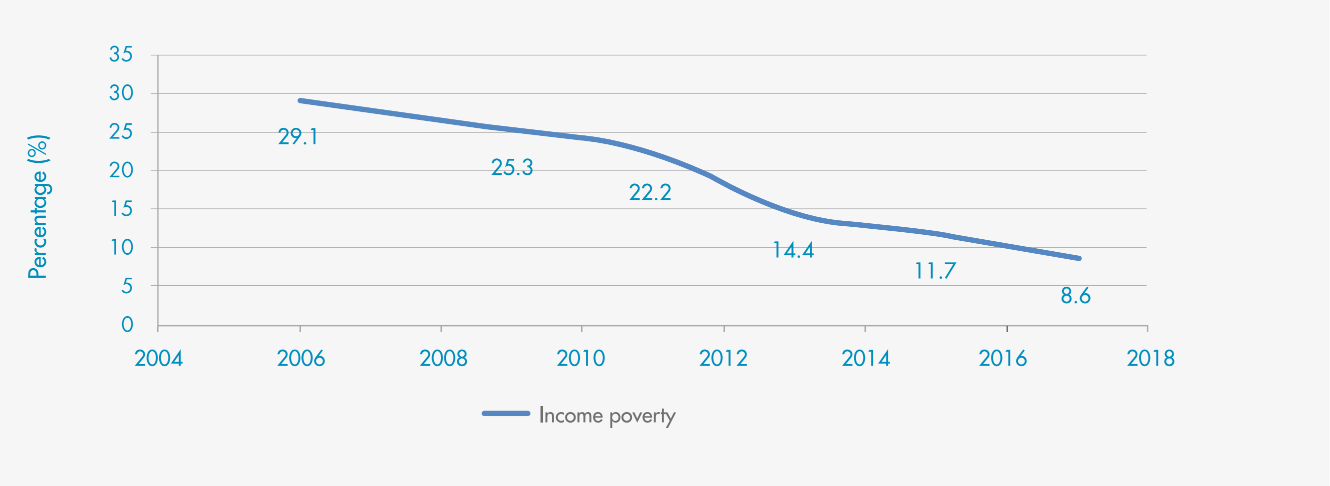
[2] *The Human Development Index evaluates the progress of countries considering health (life expectancy), education (average years of schooling and those expected) and income (gross national income per capita).*
[3] *Index of inequality that shows the distance between the distribution of income with respect to a situation of perfect equality, which value is within the range (0.1). 0 corresponds to perfect equality.*
[4] *The series of data on poverty by income (estimated through the new measurement methodology) is available for years 2006, 2009, 2011, 2013 and 2015.*

Figure 2. Evolution of poverty in Chile



Prepared by MMA. Data source: (MDS, 2017)

Education

Regarding climate change contents in the curricula of primary and secondary education, these are addressed through a Crosswise Learning Objective (OAT 16. Protecting the natural environment and its resources as a context of human development), which from a social-cultural dimension raises the commitment with the environment and social responsibility, which it is approved for all levels except for the last years of high school which is in revision process.

1.4. Economic profile

Chile has an open and stable economic model, which promotes trade and investment. During 2017, the economic activity grew by 1.5 % compared to 2016. There were increases in most of the activities, being services and trade the largest contribution to the GDP; meanwhile, the main negative effects came from business services, construction and mining. More details of the GDP from 2013 to 2017 are presented in Table 3.

Table 3. Gross domestic product by type of economic activity, at current prices, reference 2013 (Billions of Chilean pesos)

SERIES DESCRIPTION	2013	2014	2015	2016	2017
Agriculture-forestry	4,031	4,543	5,202	5,854	5,598
Fishing	631	1,295	800	960	1,296
Mining	15,144	16,214	13,689	13,661	18,135
Copper mining	13,466	14,743	12,494	12,042	16,220
Other mining activities	1,677	1,471	1,195	1,619	1,915
Manufacturing Industry	15,326	16,547	18,455	18,316	18,372
Food	3,993	4,421	4,902	5,245	5,534
Beverages and tobacco	2,039	2,166	2,768	2,542	2,594
Textiles, clothing, leather and footwear	377	362	342	350	306
Wood and Furniture	792	1,041	1,145	1,113	1,062
Pulp, paper and printing presses.	1,214	1,461	1,685	1,552	1,703
Oil Refining	1,153	1,464	1,729	1,691	1,612

SERIES DESCRIPTION	2013	2014	2015	2016	2017
Chemical, rubber and plastic products	2,202	2,227	2,328	2,141	1,951
Non-metallic minerals and base metals	897	855	840	825	684
Metallic products, machinery and equipment, and other	2,658	2,552	2,716	2,858	2,926
Electricity, gas, water and waste management	3,544	3,673	4,719	5,479	5,633
Construction	8,995	9,413	10,498	11,511	11,713
Trade	12,516	13,777	14,730	15,993	16,497
Restaurants and hotels	2,552	2,832	3,219	3,546	3,825
Transportation	6,500	6,974	8,586	9,074	9,152
Communications and Information services	4,309	4,424	4,612	4,751	4,747
Financial services	6,898	6,961	7,495	7,719	8,129
Business services	14,728	15,542	16,535	16,992	17,406
Housing and real estate services	9,805	10,710	12,024	13,240	14,025
Personal Services	15,022	16,194	17,674	19,612	21,322
Public administration	6,188	6,837	7,498	8,137	8,433
GDP at factor cost	126,187	135,938	145,737	154,846	164,281
Value added tax	11,041	11,967	13,120	13,722	14,705
Import duties	648	718	749	696	791
Gross Domestic Product	**137,876**	**148,624**	**159,606**	**169,264**	**179,776**

Source: Central Bank of Chile, 2018

1.5. General indicators

In synthesis, Table 4 presents some key indicators for Chile obtained from the information presented in the Chile's Third National Communication to the United Nations Framework Convention on Climate Change (3CN 2016) and updated for this report.

Table 4. Key indicators for Chile

INFORMATION		SOURCE
Geography and population		
Area:		
Total surface area (km²)	2,006,096	The Military Geographic Institute (IGM)
South American surface area (km²)	755,915	
Surface in Oceania (Easter Island) (km²)	181	
Land uses:		
Areas of agricultural use (%)	4.2	National Forestry Corporation (CONAF), 2017[5]
Native forest (%)	19.4	
Forest plantations and mixed forests (%)	4.4	
Grassland and bushes (%)	27.5	
Urban and industrial areas (%)	0.6	
Areas without vegetation (%)	31.7	

[5] *With respect to the area of South America and Oceania.*

INFORMATION		SOURCE
Marine protected areas (1,000 ha)	46,323	Ministry of Environment (MMA), 2018 National Register of protected areas www.bdrnap.mma.gob.cl
The National System of Protected Wild Areas (SNASPE) (thousand ha)	15,329	
Population:		
Population year 2002 (persons)	15,116,435	The National Institute of Statistics (INE), 2017 Census www.census1520.cl
Population year 2017 (persons)	17,574,003	
Male year 2017 (%)	48.9	
Female year 2017 (%)	51.1	
Rural population year 2017 (%)	12.5	
Indigenous population year 2017 (persons)	2,185,792	
Migrant population year 2017 (persons)	746,465	
Social development		
Life expectancy year 2017 (years)	79.3	The National Institute of Statistics (INE), 2017
Infant mortality year 2015 (per thousand live births)	6.9	
Literacy rate year 2013 (%)	96.26	UNESCO
Urban population connected to sewerage systems year 2016 (%)	96.83	Superintendence of Sanitary Services (SISS), 2016
Urban population with potable water year 2016 (%)	99.92	
Wastewater treated at treatment plants year 2016 (%)	99.93	
Human Development Index Year 2015	0.847	The United Nations Development Program (UNDP), 2016 (Undp, 2016)
Population in extreme poverty year 2015 (%)	3.5	MDS, 2016
Population living in poverty year 2015 (%)	11.7	
Rate between richer %10 and poorer %10 year 2015	27.2	
Gini Coefficient (autonomous) year 2015	0.495	
Economic Activity		
GDP year 2017 (million USD)	277,075.9	World Bank, 2018
GDP per capita, year 2017 (USD)	15,346.4	
Estimated GDP growth as of 2017 (%)	1.5	
Trade in Goods year 2016 (% GDP)	47.8	
Exports of goods and services year 2017 (% GDP)	28.7	
Trade Balance year 2017 (million USD Fob)	7,922	Central Bank of Chile Statistics www.bcentral.cl
Mining exports year 2017 (million USD Fob)	37,957	
Agriculture and Forestry exports year 2017 (million USD Fob)	5,610	
Industrial exports year 2017 (million USD Fob)	25,663	

Source: Climate Change Office of the MMA

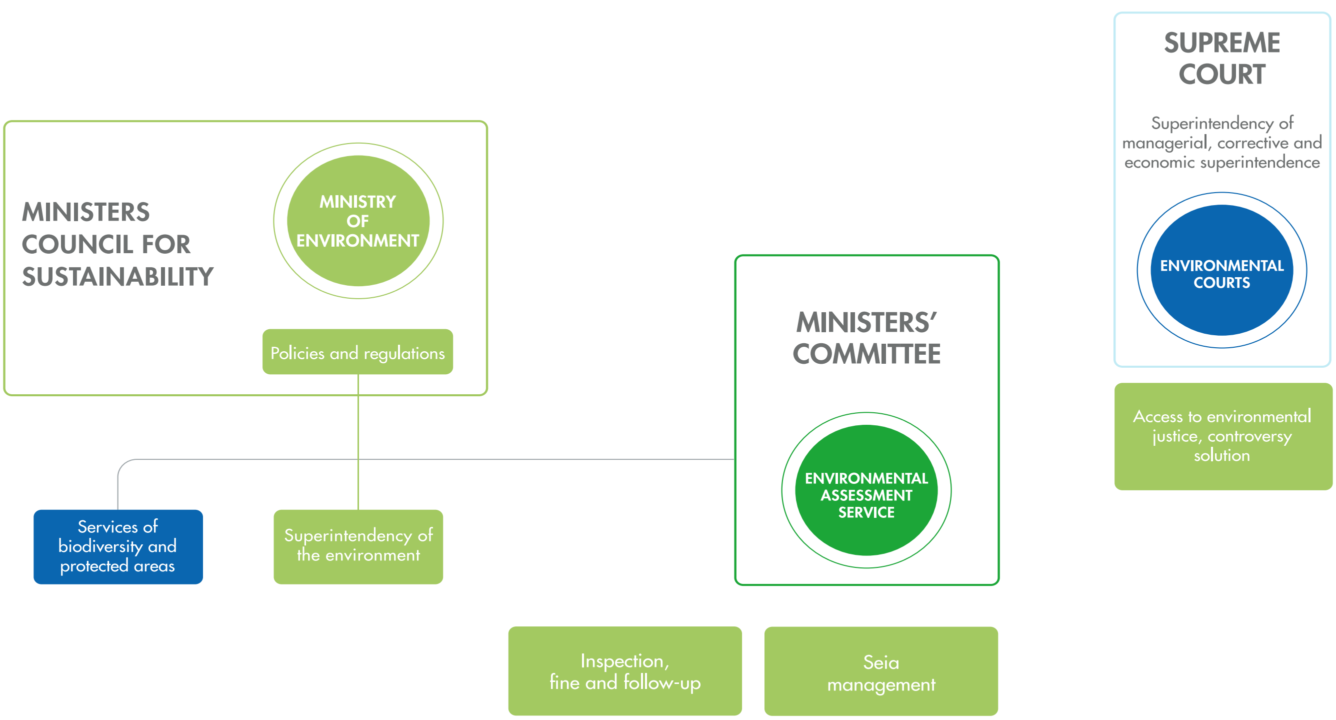
2. INSTITUTIONAL ARRANGEMENTS FOR CLIMATE CHANGE

Below is presented the existing institutional framework. The intention is promoting the coordination and collaboration between different levels of decision-making, including different partners, actors and sectors, in environment matters focused on climate change.

2.1. Environmental Institutions

The Constitution of Chile guarantees, as a fundamental right, to live in a pollution free environment assigning to the State liabilities on protecting and preserving the nature and the environmental heritage (Gobierno de Chile, 2002). On March 1994, Law N° 19,300 of General Bases of the Environment was enacted, laying down the bases for the environmental institutional framework and creating the National Environment Commission (CONAMA), the first Chilean environmental agency and supervising compliance in the matter. On April 1997, the Environmental Impact Assessment System (SEIA) started as an environmental management instrument. On January 2010, Law N° 20,417 created the Ministry of Environment (MMA), the Environmental Assessment Service (SEA) and the Superintendence of the Environment (SMA). On the other hand, Law N°20,600 of 2012 created the Environmental Courts. A brief overview of the national institution framework related to environmental issues and climate change is summarized in Figure 3.

Figure 3. Organization chart of the Chilean environmental institutional framework and its main functions



Source: MMA, 2018.

2.1.1. President of the Republic

According to the Government Program 2018 - 2022 of the current President of the Republic, Mr. Sebastián Piñera, there are six major axes related to the Environment: environmental institutional framework, air quality, biodiversity and green areas, circular economy, waste management and environmental remediation, and climate change.

Regarding to climate change, the main objectives are to:

I. Implement a Law on climate change in order to comply with our international commitment to the year 2030.

II. Create or strengthen the National System of National Inventories of Greenhouse Gases (GHG), the National System for prospective GHG emissions and the Pollutants Release and Transfer Register.

III. Integrate the adaptation of climate change into the National Investment System, the National Strategy for Disaster Risk Reduction, the Strategic Environmental Assessment and the standards for infrastructure and buildings.

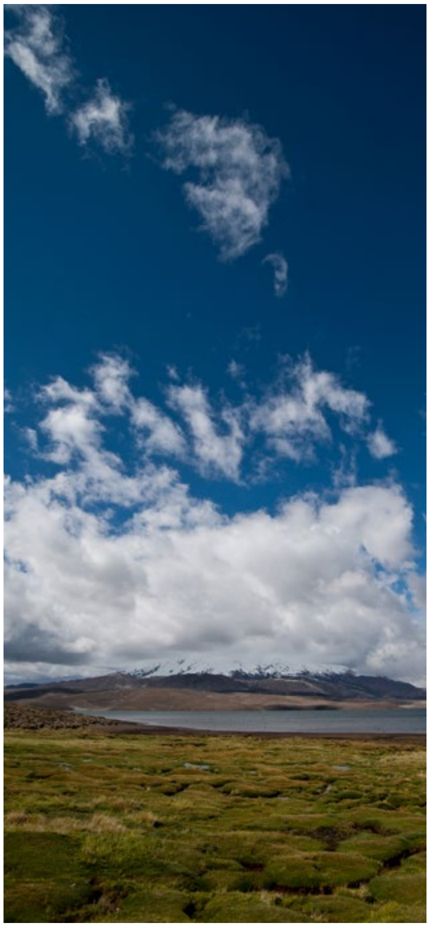
IV. Assign sectorial responsibilities for reducing global emissions, update the adaptation plans and strengthen the supervising over the carbon tax by the Superintendence of the Environment.

V. Create a Climate Change Forum to promote the inclusive and participatory approach to the prevention and adaptation to climate change.

VI. Decentralize and regionalize the actions of mitigation, adaptation and capacity building in the field of climate change.

VII. Create a Scientific Advisory Committee of climate change in order to promote science-based decision-making.

VIII. Create a funding strategy, along with the creation of a National Climate Fund for scientific research, information generation, measures design and the transfer of technologies.



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On Thursday, July 5, 2018 the President of the Republic, Mr. Sebastián Piñera, together with the Minister of Environment, Ms. Marcela Cubillos and with the special participation, as a guest, of the economist and French diplomatic PhD Ms. Laurence Tubiana, CEO of the European Climate Foundation, officially launched the designing process of a law on climate change for Chile. Among the major announcements of this activity, it was indicated that it is needed to move toward a country more resilient to climate change, so the law will have a medium and long-term vision and it will be built from the regions through a highly participatory process. The law will establishes the objectives of greenhouse gas reduction and adaptation to climate change, in addition to establishing a system of climate governance, allowing to face the challenges of this reality adequately.

Until December 2018, the "Dialogue about the Framework Law on Climate Change" will be carried out through the MMA at each of the regions in the country, where is expected that ONGs, academia, communities, associations, private sector, congressmen, authorities from various ministries and local authorities participate, among others.

Between January and February 2019, the preliminary draft shall be prepared, to be submitted to Public Consultation (PAC) in March. The Government aims to complete the process before July 2019 in order to present it to the Congress.

2.1.2. Ministry of Environment (MMA)

The MMA, is the State's entity responsible for collaborating with the President of the Republic in the design and implementation of policies, plans and programs on environmental matters, as well as in the protection and conservation of biodiversity and renewable natural and water resources, promoting sustainable development, the integrity of the environmental policy and its regulation. Law N° 20.417 of 2010, which created the Ministry, the Environmental Assessment Service and the Superintendency of Environment, establishes that the MMA must "propose policies and formulate plans, programs and action plans on climate change.

In the exercise of this competence, it must collaborate with the different entities of the State Administration at a national, regional and local level in order to be able to determine their effects, as well as the establishment of the necessary measures for adaptation and mitigation[6]". The different components of the environmental institutional framework and the main function of each are shown in Figure 3.

2.1.3. Ministers Council for Sustainability (CMS)

The Law N° 20.417 of 2010 also created the Ministers Council for Sustainability (CMS), chaired by the MMA and integrated by its peers of Agriculture; Finance; Health; Economy, Development and Tourism; Energy; Public Works; Housing and Urban Planning; Transportation and Communications; Mining and Social Development. Its main objective is to promote policies and regulations focused on sustainability.

2.2. National Climate Institutions

Since Chile ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1994 and also joined the Kyoto Protocol in 2002, it has actively participated in the discussions and international efforts, in addition to faithfully fulfill the commitments as a developing country.

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On 13 February 2017, through Supreme Decree N°30 of the Ministry of Foreign Affairs[7], the Paris Agreement was enacted, adopted at the twenty-first meeting of the Conference of the Parties to the UNFCCC.

2.2.1. Climate Change Office (OCC) of the Ministry of Environment

In 2010, the Climate Change Office was created, which is directly dependent of the Undersecretary of Environment.

According to the MMA Resolution No. 278, April 2018, the OCC is responsible (a) to generate and collect technical and scientific information to support the design of policies and formulation of plans and programs in the field of climate change; (b) to follow up and to advise the Ministry on progress in the implementation of the public policy instruments on climate change in the country; among other functions indicated in the resolution.

In addition, the National Ozone Unit established in Chile since 1993 is part of the OCC, which is responsible for compliance with the Montreal Protocol and its amendments, supporting the country through the implementation of investment projects and technical assistance, public outreach, and preparation or amendment of standards.

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[6] Law 20.417, Article 70 letter h.

[7] Supreme Decree N° 30, of February 13, 2017 of the Ministry of Foreign Affairs enacts the Paris Agreement, adopted at the twenty-first meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change, may be accessed in the link: https://www.leychile.cl/Navegar?idNorma=1103158

The OCC coordinates the activities of the Inter-Ministerial Technical Committee on Climate Change (ETICC), it acts as: National Designated Authority of the Clean Development Mechanism (CDM), Technical Advisor to the Committee for International Negotiation, Designated Authority for the Adaptation Fund, Focal Point of the IPCC, Focal Point of the Iberian-American Network of Climate Change Offices, Focal Point of the Project EUROCLIMA+, Focal Point of NAMA Registry, Focal Point of the Climate and Clean Air for the reduction of short-life pollutants, representative for the Inter-American Institute for Global Change (IAI), among others. In addition, the OCC participates in various networks for the exchange of information, such as the Iberian-American Network of Climate Change Offices (RICCO), the Regional Cooperation Program between the European Union and Latin America (EUROCLIMA), the Scientific Committee for Climate Change of the Pacific Alliance and the Independent Association of Latin America and the Caribbean (AILAC) and the Latin America Network of GHG Emission Inventory (REDINGEI).

2.2.2. Inter-Ministerial Technical Committee on Climate Change (ETICC)

The ETICC is an instance of inter-ministerial coordination, created in 2015 and coordinated by the OCC, whose members are focal points of the Ministries related with Climate Change: Ministry of Finance, Ministry of Foreign Affairs, Ministry of National Defense, Ministry of Social Development, Ministry of Agriculture, Ministry of Education, Ministry of Energy, Ministry of Health, Ministry of Housing and Urban Planning, Ministry of Public Works, Ministry of Transportation and Communications, Ministry of Mining, Ministry of Economy, Ministry of National Assets, Ministry of Women and Gender Equity and Ministry of Environment.

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2.2.3. Agency for Sustainability and Climate Change (ASCC)

In 2016, it was formed the Agency of Sustainability and Climate Change, located in the Committee of the Production Development Corporation (CORFO) of the Ministry of Economy, Development and Tourism, the successor of the National Council for Clean Production. The role of the ASCC is to promote the inclusion of the climate change and sustainable development issue in the private sector through public-private agreements and the implementation of programs and projects that contribute to the construction of a low-carbon economy and the fulfilment Chile commitments in the Paris Agreement. Its fields of action are the promotion, entrepreneurship, innovation, the implementation of climate actions for mitigation and adaptation to climate change, mitigation and adaptation technologies, the funding for mitigation and adaptation actions and capacity building. Its main instrument is the Clean Production Agreements which involve the private sector and which was the first nationally appropriate mitigation action recognized by the UNFCCC in 2012. It is also a focal point of the Network and Climate Technology Center in Chile (CTCN).

2.2.4. Permanent Presidential Advisory Commission on Climate Change

With the objective of strengthening the technical quality and harmony of the public policy on climate change, on November 22, 2017, through Supreme Decree N° 52 of the Ministry of Environment, it was created the Permanent Presidential Advisory Commission on Climate Change, which mission is to advise the President of the Republic in everything related to the identification and formulation of policies, plans, programs, measures and other activities related to climate change, as well as the fulfillment of Chile's international commitments, in particular, the Paris Agreement, and in the development and proposal of a national public climate policy [8].

[8] Supreme Decree N° 52, November 22, 2017 the Ministry of Environment creates permanent the Permanent Presidential Advisory Commission on climate change may be accessed at the link: https://www.leychile.cl/Navegar?idNorma=1113261

This Commission is composed of 36 members, among which are authorities, former presidents of the Republic, representatives of trade associations, academia, representatives of non-governmental organizations and a representative of the President of the Republic.

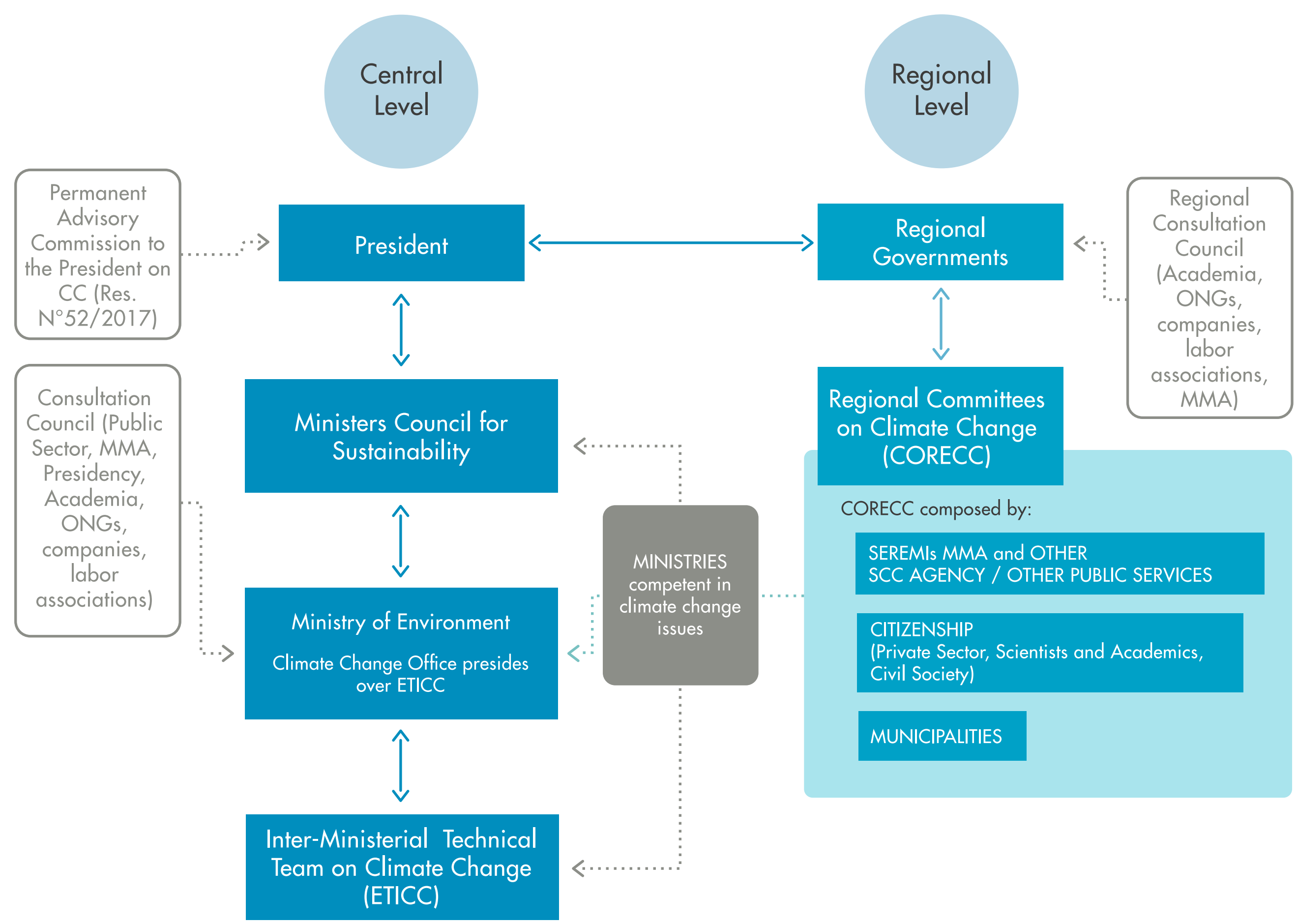
2.2.5. Regional Committees on Climate Change (CORECC)

CORECCs are committees established at each of the administrative regions of the country, through a summons by the Intendente (top regional authority) to the rest of the regional authorities, considering the Regional Secretary of Environment to act as the Executive Secretary of the CORECC, and including representatives of other ministries and municipalities interested in the implementation of climate change adaptation or mitigation activities in their respective jurisdictions. Local actors from the private sector, civil society, academia, ONGs, among others, can also participate, depending on each region.

CORECCs are an instance of the regional authorities' leadership to address the challenges of climate change. Their function is to promote and facilitate the implementation, at regional and local level, both of climate change policies arising at their own territory and those driven by the national level, for example the National Action Plan on Climate Change (PANCC) 2017-2022, the National Plan for Adaptation on Climate Change, the sectorial plans of adaptation among other actions in the field of climate change, according to the needs and possibilities at regional and local level.

The framework within which the CORECCs are inserted as a leadership institution on climate change at a regional level, is shown in Figure 4.

Figure 4. Outline of the institutional structure for implementing climate change policies



The Citizens Participation (Civil Society organizations) is represented in this structure by a National Consultative Council at the national government level, and by Regional Advisory Councils (one at each region) at the regional government level. Citizens' participation is organized by the corresponding CORECC, with the purpose of achieving the support of the local citizens affected by the implementation of the measures (Moraga, 2016).

2.2.6. Chile's Technical Team for monitoring, reporting and verification

Within the context of the ever greater challenges that climate change poses and, in particular, the new demands that the regime of the Paris Agreement projects on the field of monitoring, reporting and verification (MRV), in January 2018 the "Technical Team for monitoring, reporting and verification" of Chile (ETMRV-CHILE) was created, consisting of nine public sector institutions which is constituted as an instance of work permanently aimed to encourage communication and interaction among various actors that follow-up the efforts to mitigate climate change in the country, exchange experiences and lessons learnt on MRV, and the development of different objectives associated with this issue in the short and in the medium term.

More detailed information regarding the ETMRV-Chile can be found in Chapter III of the current Biennial Update Report.

2.3. Sectorial institutions

The national institutional public framework has a series of institutions, agencies or entities that, without belonging to the MMA, are linked to the climate change. The following are the ministries that currently have units, departments or offices specifically associated to this matter:

2.3.1. Ministry of Foreign Affairs (MINREL)

The focal point of Chile for the UNFCCC is the Directorate of Environment and Ocean Affairs (DIMA). The follow-up of climate change, both bilateral and multilateral, resides in the DIMA, unit responsible for coordinating the position of Chile in the UNFCCC negotiations, seeking that the country is recognized as a relevant and constructive actor in climate change negotiations.

On the other hand, the General Directorate for International Economic Relations (DIRECON) of MINREL coordinates the Bunker Fuels, Aerial and Maritime Transportation Tables. The purpose of the tables is to discuss and agree on the position of Chile regarding actions aimed to reduce GHG emissions from international aviation and maritime transportation. These issues are addressed in the framework of the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO), respectively.

2.3.2. Ministry of Finance (MINHACIENDA)

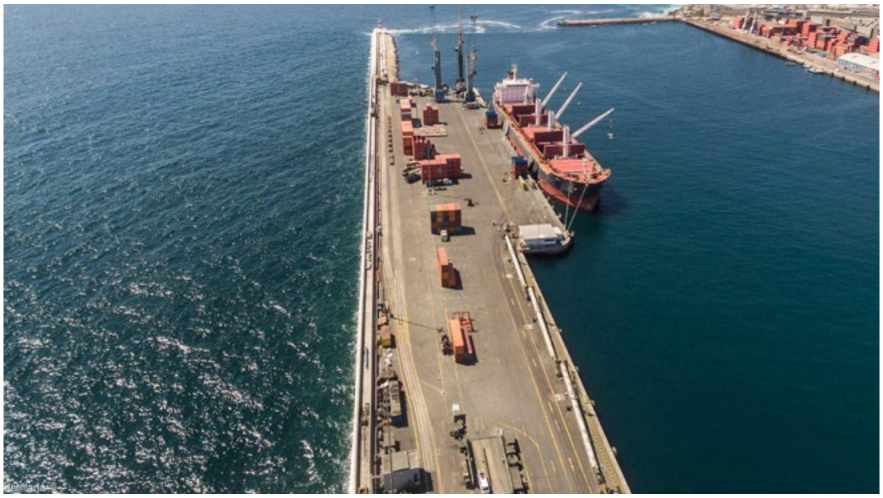
The Ministry of Finance is the Designated National Authority of Chile to the Green Climate Fund (FVC), created as a financing mechanism of UNFCCC, through which it is intended to support the efforts of developing countries to limit or reduce their emissions, and help them adapting to the effects of climate change.

Also, the Ministry of Finance is part of the Green Climate Fund Board through a group composed by Argentina, Chile, Mexico and Peru.

To support the work of the National Authority of the FVC, a Technical Secretariat has been created, composed of: MINHACIENDA, MINREL and MMA.

2.3.3. Ministry of Energy (MINENERGIA)

The Ministry of Energy develops and coordinates, in a transparent and participatory manner, plans, policies and standards for the proper functioning and development of the sector, ensures compliance and advises the Government on matters related to energy; ensuring that all Chileans can access energy in a safe way and at reasonable and competitive prices. Among the various divisions belonging to the institution, in the field of climate change stand out: The Prospective and Energy Policy Division which is responsible, among other functions, to prepare the inventory of



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GHG emissions in the Energy sector, and the Division for Sustainable Development which main objective is to coordinate and reconcile the energy policy with the local development, climate change and care for the environment.

MINENERGIA is the Technical Focal Point of project PMR (Partnership for Market Readiness, World Bank, www.thepmr.org) whose objective is to strengthen the institutional, regulatory and industrial capacity to implement carbon pricing instruments (IPC) and a robust MRV system to capture co-benefits and enabling a low-carbon development in the Energy sector.

2.3.4. Ministry of Agriculture (MINAGRI)

The Ministry of Agriculture is responsible for promoting, guiding and coordinating the forestry-agricultural activities of the country. All institutions belonging to the ministry are related to the issue of climate change. Technical coordination between the different services of MINAGRI in the field of climate change is made by the Intra-ministerial Technical Committee on Climate Change (CTICC), created in 2015 and formalized through the Exempt Decree N° 360 of 2017[9]. The objective is to be able to coordinate all Agricultural Services to advise the Minister of Agriculture on climate change policies for the agriculture sector. The Agricultural Studies and Policies Office (ODEPA) is responsible for its coordination.

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The National Forestry Corporation is part of the MINAGRI (CONAF), a private entity which main task is to manage the forest policy in Chile and foster the development of the sector through promotion, environmental-forestry control, forestry protection of vegetation resources and the conservation of biological diversity for the benefit of society. CONAF is the Focal Point and responsible for implementing the approach of incentives policy on the Reduction of Greenhouse Gas Emissions caused by Deforestation and forest Degradation, the conservation and the increase in CO_2 capture known as REDD+, of the UNFCCC. CONAF is also the national focal point of the United Nations Convention to Combat Desertification (UNCCD) and of the United Nations Forum on Forests (UNFF), through the Unit for Climate Change and Environmental Services (UCCSA).

It is highlighted that MINAGRI, through ODEPA, coordinate the preparation of the GHG inventory of the Agriculture and Land use, land-use change and forestry (LULUCF) sectors, which is developed through two technical teams, including the Agriculture sector composed of the Institute of Agricultural Research (INIA) and LULUCF sector composed of CONAF and INFOR.

2.3.5. Other agencies featured

In addition, other agencies stand out that have significantly advanced in the issue of climate change within their institutions, including: Ministry of Housing and Urban Planning (MINVU), Ministry of Social Development (MDS), the Energy Sustainability Agency and CORFO.

2.4. Institutional Arrangements for the preparation of reports to the UNFCCC

Chile, as a signatory country to the UNFCCC and as a developing country (non-Annex I), has submitted three national communications, the last one was prepared by the MMA and presented in 2016.

The Conference of the Parties (COP), at its seventeenth session, adopted the guidelines contained in decision 2/CP.17[10], annex III, for the preparation of biennial update reports (BUR) of the Parties not included in annex I to the Convention. These guidelines outline the objectives and the scope of the information to be communicated. Also, by decision 2/CP.17, the COP decided that the Parties not included in annex I, in accordance with their capabilities and the level of support provided for information, shall submit their first BUR no later than December 2014. Chile has submitted two BURs, the second one in 2016.

[9] *Available at http://www.odepa.gob.cl/wp-content/uploads/2017/12/Dex-360.pdf*
[10] *http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf*

Arrangements made by Chile for the fulfilment of these commitments are in line with the institutional framework presented above. The Climate Change Office has coordinated the preparation of the present report, by developing a process to gather information, together with public institutions with environmental competence.

The specific arrangements for the development of the national inventory of GHG emissions in Chile are described in detail in Chapter 2 of this report.

2.5. Analysis process of the second BUR

The first BUR from Chile was submitted to the UNFCCC on December 10, 2014 in compliance with the time limit established at COP 17 in Durban. During 2015 Chile was subject to the process of International Consultation and Analysis (ICA). This process consisted in a week of technical analysis carried out between May 18 and 22, 2015, in Bonn, Germany, with the participation of experts belonging to the Consultative Group of Experts and the Secretariat of the Convention, in addition to experts from five countries that belong to Annex I and non-Annex I. The report of the process was completed in November, 2015.

The second BUR of Chile was submitted to the UNFCCC on November 12, 2016. During 2017, Chile was subject to the process of International Consultation and Analysis (ICA). This process consisted in a week of technical analysis carried out between May 22 and 26, 2017, in Bonn, Germany, with the participation of experts belonging to the Consultative Group of Experts and the Secretariat of the Convention, in addition to experts from five countries that belong to Annex I and non-Annex I. The report of the process was completed in December 2017, and the conclusions presented in the process[11] are:

I.That the information provided by the report is consistent with the UNFCCC guidelines, concluding that the information analyzed is completely transparent.

II. The country is congratulated for the progress made in subjects of institutional framework, and recognizes that the plans to improve the MRV systems will allow achieving sustainability of the report to the Secretariat.

III. The country is congratulated for its efforts in utilizing the most recent guidelines in the preparation of its GHG inventory, reporting both the level of emissions and trends, such as the propagation error to estimate uncertainty.

IV. Chile reported data and additional actions with respect to the implementation of mitigation measures, providing more detailed and transparent information in comparison with its first BUR.

V. This second BUR clearly identifies a number of needs related to the development of the GHG inventory, mitigation and support.

VI. The Consultative Group of Experts in consultation at the country identified the capacity-building needs related to the facilitation of the report according to the UNFCCC guidelines and its participation at the ICA.

The process of analysis of the second BUR from Chile concluded with the fifth workshop of the "Facilitative Sharing of Views" (FSV), developed on May 4, 2018, in Bonn, Germany, within the framework of session number 48 of the Subsidiary Body on Implementation (SBI) of the UNFCCC. During the workshop, Chile presented the BUR document, in addition to sharing the experience and lessons learnt during its preparation and process of technical analysis[12].

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[11] *https://unfccc.int/sites/default/files/resource/docs/2017/tasr/chl.pdf*
[12] *https://unfccc.int/documents/69441*

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II.
NATIONAL GREENHOUSE GAS INVENTORY OF CHILE 1990-2016

1. INTRODUCTION

This chapter is the summary of the *National Greenhouse Gas Inventory Report in Chile, series 1990-2016*[1] which contains the Fifth National Greenhouse Gas Inventory of Chile (Chile's NGHGI) presented by the country to the United Nations Framework Convention on Climate Change (UNFCCC) in compliance with article 4, paragraph 1(a) and article 12, paragraph 1(a) of that Convention, and decision 1 of the 16th Conference of the Parties of Cancun, in 2010.

Chile's NGHGI covers the entire national territory and includes emissions and removals of greenhouse gas (GHGs) of anthropogenic origin not controlled by the Montreal Protocol[2], emissions of precursors and black carbon emissions in a time series that goes from 1990 to 2016. The results of the estimates of GHG emissions, precursor gases and black carbon are presented at the national level; in kilotons[3] (kt), and they refer to 2016, the last year of the inventory, unless otherwise expressed. The positive numbers represent GHG emissions, precursor gases and black carbon, while the negative correspond to removals.

This section presents the general background on the INGEI of Chile, institutional arrangements, updating process, methodology, key categories, uncertainty and completeness. In Section 2 details trends in greenhouse gas emissions and removals in Chile. Sections 3 to 7 present detailed information of the four sectors: *Energy* (which includes the reporting items); *Industrial processes and products use; Agriculture; Land use, Land-use Change and Forestry; and Waste.* Section 8 summarizes recalculations.

1.1. General background

On March 21, 1994 the UNFCCC came into force, ratified by Chile in the same year, with the purpose of stabilizing GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. In order to achieve this objective, all members of the UNFCCC shall prepare, periodically update, publish and facilitate national GHG inventories (NGHGI).

NGHGIs consist of a comprehensive numeric listing of the entry of each of the anthropogenic GHG emissions released or absorbed from the atmosphere in an area during a specific period, usually corresponding to a calendar year. NGHGIs are aimed to determine the magnitude of GHG emissions and removals that are directly attributable to human activity, as well as the specific contribution of the country to the phenomenon of climate change.

For a quantification to ensure credibility, consistency and comparability among the NGHGIs, UNFCCC proposes methodological guidelines developed by the Intergovernmental Panel on Climate Change (IPCC) to prepare or update their inventories. In the NGHGIs, economic sectors of the countries are grouped into sectors that share characteristics relating to the processes that generate emissions or removals. These sectors are *Energy Industrial Processes and product use (IPPU); Agriculture; Land use, land - use change and forestry (LULUCF),* and *Waste.*

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[1] *The Report of the National GHG Inventory in Chile, series 1990-2016 is included as technical annex of the Third Biennial Update Report from Chile submitted to the UNFCCC.*
[2] *The GHG inventories included are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulfur hexafluoride (SF_6).*
[3] *One kilotonne (kt) is equivalent to a gigagram (Gg) or 1,000 tonnes.*

According to the international agreements, developing countries, such as Chile, must submit their NGHGIs to the UNFCCC as a part of the national communications (every four years) and of the biennial update reports (every two years since 2014).

In addition, Chile's NGHGI will include the report on black carbon, aerosol considered a climate short-life enforcer, because it has the ability to absorb solar radiation, transforming it into heat and significantly contribute the radiative forcing (Bond et al., 2013). Black carbon is the product of incomplete combustion of fossil fuels, biofuels and biomass. Chile, in its contribution determined for the Paris 2015 Climate Agreement (NDC), paragraph 2.6: "Chile Paper on short-life pollutants", includes the commitment to mitigate short-lived pollutants, so the accounting of this contaminant is of great importance.

1.2. Institutional Arrangements for the preparation of the Chile's NGHGI

In response to the commitments made by the country to report and present its NGHGIs to the United Nations, the Climate Change Office of the Ministry of Environment of Chile designed, implemented and has maintained, since 2012, the National GHG Inventory System of Chile (SNICHILE), which contains the institutional, legal and procedural arrangements established for the biennial update of Chile GHGIs, in order to ensure sustainability in the preparation of NGHGIs in the country and to maintain the consistency of GHG flows notified, and the quality of results. In addition, since the current NGHGI estimates of black carbon are included and reported.

The permanent work of the SNICHILE is divided into five lines of action covering the areas and activities required for the fulfilment of the objectives. These lines of action are:

SNICHILE Operation: ongoing management of SNICHILE through the maintenance of an organizational structure with defined roles and responsibilities. SNICHILE has an internalized organizational structure within the State apparatus and independent of other pollutants inventories, coordinated by the MMA. Thus, Chile's NGHGI is the result of a collective and permanent effort from the Ministries of Agriculture, Energy and Environment, which have worked in coordination within the framework of SNICHILE, strengthening Chile's NGHGI preparation by adding the expert knowledge of the different participating sectorial ministries. SNICHILE is composed of the National Technical Team (the Coordinating Technical Team, AFOLU Coordinating Team and Sectorial Technical Teams), the Coordinating Reports Team, the Council of Ministers for Sustainability, and internal and external experts (Figure 1).

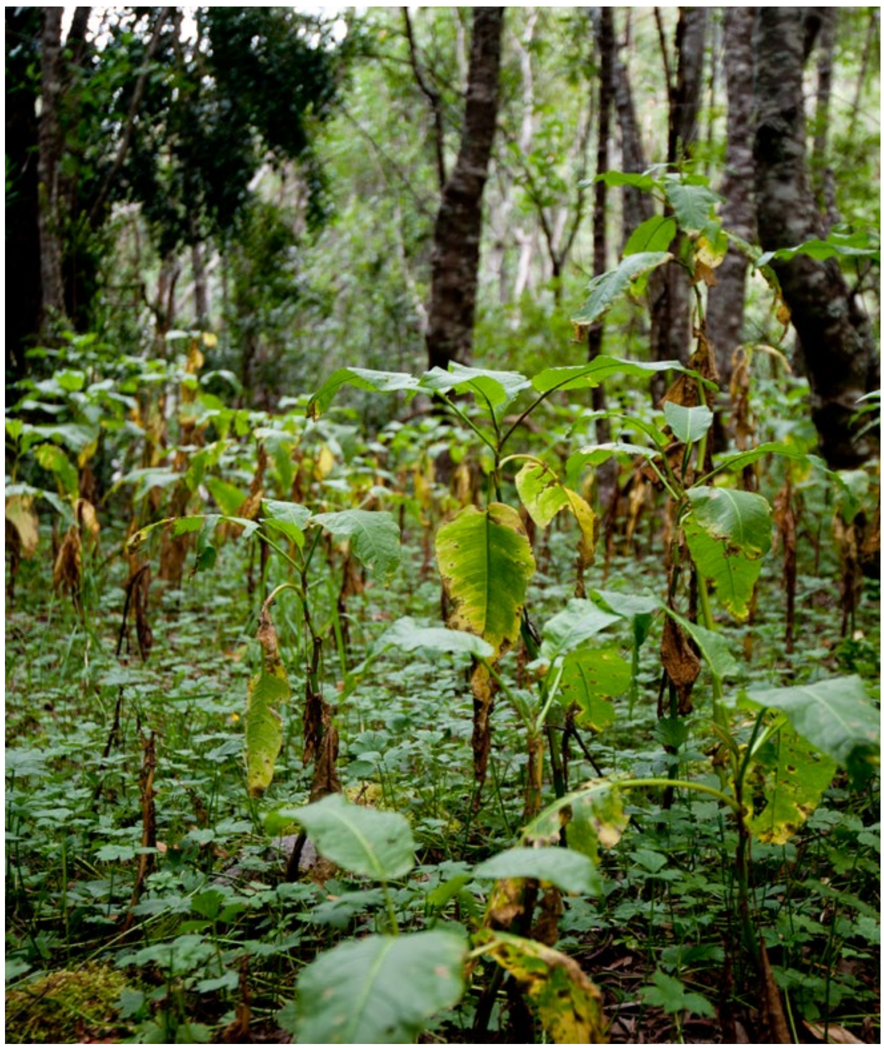

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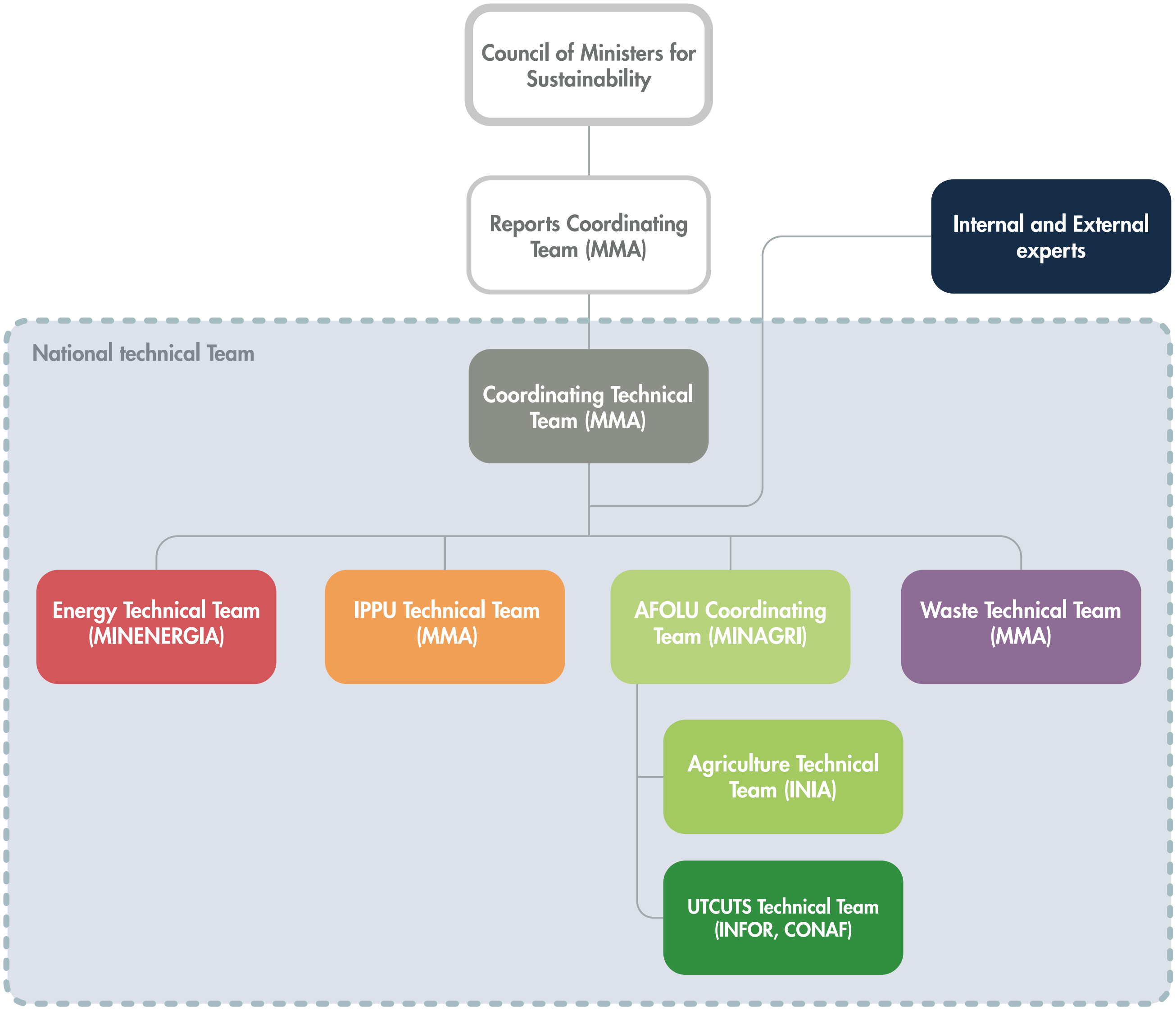
Figure 1. Organizational structure of SNICHILE



Source: Coordinating Technical Team of the MMA

Update of Chile's NGHGI: implementation and maintenance of a Biennial Work Plan with activities, timelines and budgets to guide the permanent task of the National Technical Team. In general, during the first year of the biennial cycle of the work plan, Sectorial GHG inventories (SGHGI) are updated, while in second year crosswise themes in the Chile's NGHGI are compiled and developed; the inventory of black carbon; local GHG inventories; and preparation of the reports (the NIR in Chile and the chapters for BURs or national communications).

Quality Assurance and Quality Control System: Improving the quality of the Chile's (transparency, completeness, consistency, comparability and accuracy) through the establishment and implementation of quality assurance and quality control procedures, and verification. In addition, to identify and prioritize potential improvements of the Chile's NGHGI a Continuous Improvement Plan is prepared. Since 2015, the SNICHILE implemented a Quality Assurance and Quality Control System (QA/QC) in accordance with the IPCC good practice guidance for the NGHGI's preparation.

Building and maintaining capacities: increase of the technical capacities of the professionals in the National Technical Team of SNICHILE to generate a NGHGI of the highest quality. To identify training needs, the Coordinating Technical Team performs a diagnosis of needs by identifying gaps, barriers and obstacles, and then prioritizes these needs.

Filing and communication: management and protection of the information related to Chile's NGHGI and the adaption of such information, so as to ensure access and transparency of Chile's NGHGI. To facilitate information management, since 2015 the Tabular Registration System (TRS) was implemented, which consists of a set of standardized folders and files. From the same year the web platform of SNICHILE (www.snichile.cl) exists aimed to disseminating Chile's NGHGI.

1.3. Update Process of Chile's NGHGI

The process of preparation of the current Chile's NGHGI began the first semester of 2017 and concluded in mid-2018. As noted in the Figure 2, each Sectorial Technical Team prepares the GHG inventory of its own sector which implies gathering the information; the calculation of GHG emissions and removals; and the preparation of the report. Then the Coordinating Technical Team compiles the SGHGI and develops cross-cutting issues, generates the inventory of black carbon and with that material prepares Chile's NGHGI, local GHG inventories and their respective reports. Then each Sectorial Technical Team approves the *National Inventory Report in its final version*

On the quality assurance process, it should be noted that during the previous inventory (series 1990-2013) a review by experts of the Federal Environment Agency of Germany culminated, who are thanked for their contribution, as well as the Project Information Matter of the German Society for International Cooperation (GIZ) for the coordination, and the Low Emission Capacity Building (LECB-Chile) project of UNDP which partially financed this process.

In the same area, the current NGHGI went through a brief quality assurance process for the Energy, Agriculture and LULUCF sectors performed by an external professional, which purpose was to review the information reported, activity data, emission factors, GHG trend among other. In addition to this process, the intention is going through a more comprehensive review within the framework of the work carried out by the Latin American Network of GHG inventories (RedINGEI).

Finally, Chile's NGHGI is delivered to the Coordinating Team of Reports for its inclusion in the *Third Biennial Update Report*, together with the annexes and other relevant information, as the needs and support received and delivered regarding inventories.

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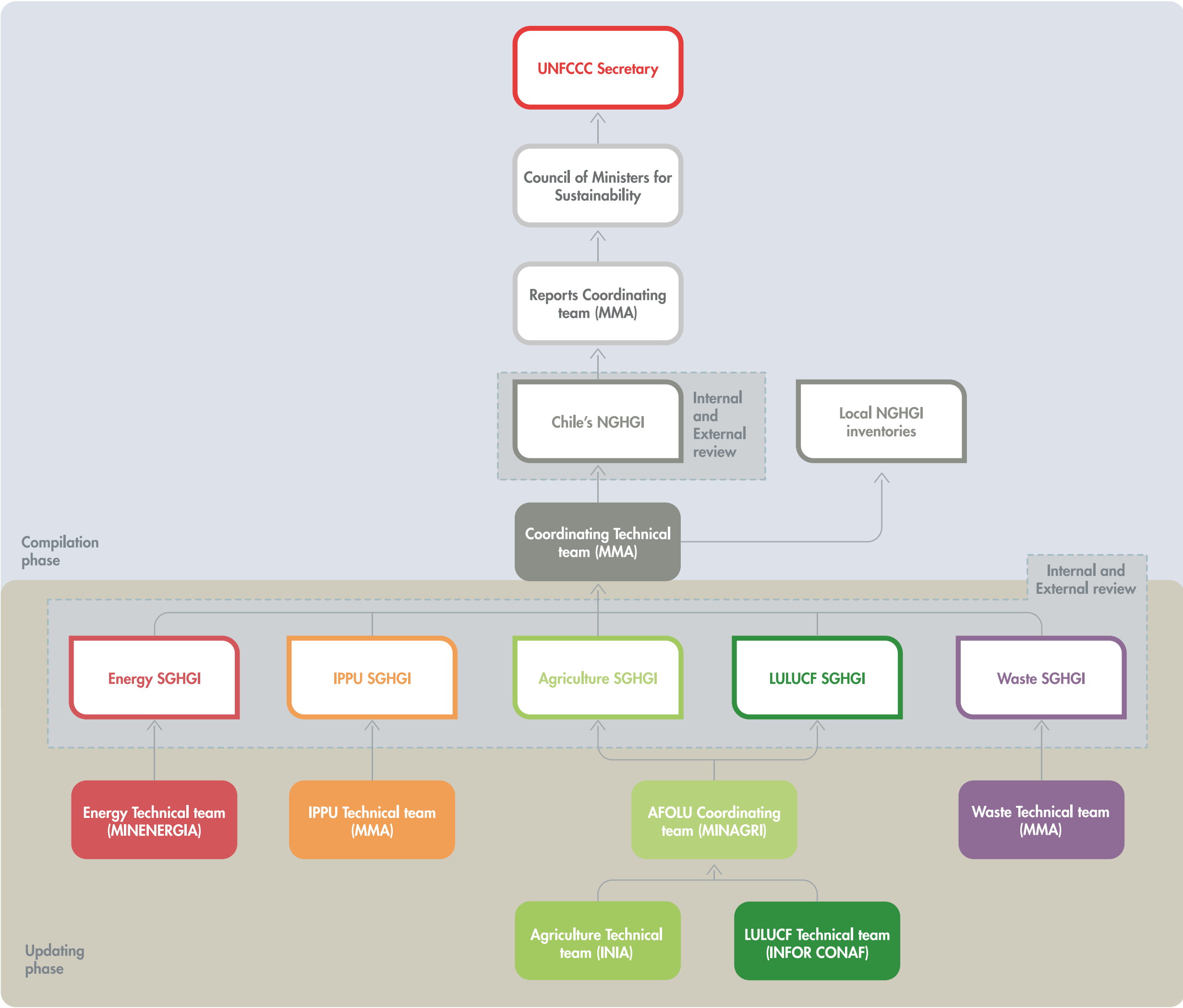
Figure 2. The process of updating Chile's NGHGI



Source: Coordinating Technical Team of the MMA

1.4. Methodology and main sources of information

GHGs and precursor gases estimates of the current Chile's NGHGI, series 1990-2016, were carried out in line with the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*[4] and applying the IPCC software[5] (with the exception of the Agriculture and LULUCF sectors; and some categories of IPPU sector for which a level 2) methodology was used; including the analysis of main categories, uncertainty assessment, completeness and recalculations assessment. In addition, Chile's NGHGI has been prepared to meet the information requirements of the *UNFCCC Reporting Guidelines for Biennial Update Reports from Parties not included in Annex I to the Convention*[6] *and the Guidelines for the Preparation of National Communications by Parties not included in Annex I to the Convention*[7]. ANNEX 1 presents a summary of the methods and levels applied in Chile's NGHGI.

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[4] *Recovered from www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/index.html*
[5] *Recovered from www.ipcc-nggip.iges.or.jp/software/index.html*
[6] *Annex to Decision 17/COP8. Recovered from http://unfccc.int/resource/docs/spanish/cop8/cp807a02s.pdf#page=2*
[7] *Annex III to Decision 2/COP17. Recovered from http://unfccc.int/resource/docs/2011/cop17/spa/09a01s.pdf#page=*

After estimating emissions and removals of each GHG, and to report these in an aggregate manner expressed in carbon dioxide equivalent (CO_2 eq), global warming potentials (GWP) were applied from the Fourth Assessment Report (AR4) of the IPCC. Table 1 displays the values.

Table 1. Global warming potentials used in Chile's NGHGI

GHG	GWP
CO_2	1
CH_4	25
N_2O	298
HFC-23	14,800
HFC-32	675
HFC-125	3,500
HFC-134a	1,430
HFC-143a	4,470
HFC-152a	124
HFC-227ea	3,220
HFC-236fa	9,810
HFC-245fa	1,030
HFC-365mfc	794
HFC-43-10mee	1,640
CF_4	7,390
SF_6	22,800

Source: Coordinating Technical Team of MMA, on the basis of AR4


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Regarding to the main sources of information:

• In the Energy sector activity and parametric data were used, the majority from the National Energy Balances, statistics of automotive park for Road Transportation and default emission factors.

• In the IPPU sector activity data from the public yearbooks of the productive companies, of Chile official statistics from the National Institute of Statistics (INE) and from the National Customs Service were used; in addition to country-specific emission factors for productions of lime, cement, glass, iron and steel, while for the rest of the categories default emission factors were used.

• In the Agriculture sector activity data were used mainly from *Agricultural Censuses*; in addition to country specific emission factors for enteric fermentation (cattle), manure management (cattle and pigs) and direct emissions for use of inorganic nitrogen fertilizers, while for the other categories default emission factors were used.

• In the LULUCF sector activity data were used mainly from the *Vegetation Record and Sectorial Statistics*; and country-specific emission factors for forest land mainly from the *National Forestry Inventory*, while for other uses of the land default emission factors were used.

• In the Waste sector activity data from the population censuses of the INE, statistics of solid wastes of the MMA, flow of waste water and sludge by the Superintendence of Sanitary Services (SISS) and the Survey of National Social-Economic Characterization (CASEN) prepared by the Ministry of Social Development (MDS) were used; in addition to default emission factors.

All default emission factors are from the *IPCC Guidelines of 2006*, while precursors estimate comes from the *Guide of Inventories of Air Pollutants Emissions EMEP/EEA 2016*. It should be noted that the most important information about Chile's NGHGI is generated by the same institutions to which Sectorial Technical Teams belong, and in many cases the same teams are also in charge of its preparation. This is an advantage given the data availability, the efficient use of resources and understanding the history behind the different trends.

Black carbon emissions were estimated using the same activity data raised by the corresponding Sectorial Technical Teams. Emissions were estimated for the sources that burn fossil fuel or biomass with energy purposes; Agricultural waste burning; forest fires; burning of hospital waste and cremation, among other. According to the source, the emission factor of fine particulate matter (MP2,5) was selected in addition to the corresponding black carbon speciation factor, according to the Guide for Inventories of Pollutants Emissions into the air of the European Monitoring and Evaluation Program (EMEP/EEA Air Pollutant Emission Inventory Guidebook 2016. Technical guidance to prepare national emission inventories. EEA Report N° 21/2016, ISSN 1977-8449, https://www.eea.europa.eu/publications/emep-eea-guidebook-2016). Regarding black carbon emissions of the LULUCF sector, the emission factor of black carbon of the associated to biomass burnt was used (Akagi et. al, 2011).

It should be noted that for black carbon emissions, emissions from biomass burning in furnaces that produce bricks (*Ladrilleras*) were not estimated, nor the burning of oil or gas in the vents of oil and natural gas production, due to the lack of specific activity data.

For more detail of the information, the reader is strongly encouraged to review the *National Inventory Report of Chile's GHG, series 1990-2016,* document included as technical annex to the *Chile's Third Biennial Update Report submitted to the UNFCCC.*

1.5. Key categories

The concept of key category allows identifying the categories that have a significant impact on the NGHGI of a country in terms of absolute level, trends and uncertainty of GHG emissions and removals. The main categories of Chile's NGHGI for 1990 and 2016 were identified according to the criteria of level and trend (N, TD), using the Method 1, which considers emissions and removals in an absolute manner and Method 2, which also considers uncertainty.

Table 2 summarizes the emission and sinks sources identified as key categories, showing in turn with an "X" the criterion or criteria and methods by which they were categorized this way. Some categories meet both level and trend criteria, as is the case of 9 sinks and sources of emission of *Forest Lands that Remain as Such*. On the other hand, there are sources of emission that are key category only because of one criterion, such is the case of *Foaming Agents* in the trend with Method 2.

This summary is the basis for discussions with Sectorial Technical Teams on the quality of the estimates and possible improvements. The key categories of Chile's NGHGI are also the subject of a more detailed documentation and a more exhaustive quality control.

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Table 2. Summary of the Key Categories of Chile's NGHG, series 1990-2016, according to the evaluations of level and trend, using Methods 1 and 2

IPCC Code	IPCC Category	GHG	Identification Criterion					
			L1 1990	L1 2016	TD1	L2 1990	L2 2016	TD2
1.A.1.	Energy industries - Solid Fuels	CO_2	X	X	X		X	
1.A.1.	Energy industries - Liquid Fuels	CO_2	X	X	X			
1.A.1.	Energy industries - Gaseous Fuels	CO_2	X	X	X			
1.A.1.	Energy industries - Biomass	N_2O						X
1.A.2.	Manufacturing industries and construction - Liquid Fuels	CO_2	X	X	X	X	X	X
1.A.2.	Manufacturing industries and construction - Solid Fuels	CO_2	X	X	X	X		X
1.A.2.	Manufacturing industries and construction - Gaseous Fuels	CO_2		X				
1.A.2.	Manufacturing industries and construction - Biomass	N_2O					X	
1.A.3.a.	Civil Aviation	CO_2	X	X	X			
1.A.3.b.	Road Transportation	CO_2	X	X	X	X	X	X
1.A.3.b.	Road Transportation	N_2O					X	
1.A.3.d.	Water-borne Navigation	CO_2	X		X			
1.A.4.	Other sectors - Liquid Fuels	CO_2	X	X	X	X	X	
1.A.4.	Other sectors - Biomass	CH_4	X		X	X	X	X
1.A.4.	Other sectors - Gaseous Fuels	CO_2		X				
1.B.1.	Solid fuels	CH_4	X		X	X		X
1.B.2.a.	Oil	CH_4	X		X	X		X
1.B.2.b.	Natural Gas	CH_4	X		X	X	X	X
2.A.1.	Cement production	CO_2	X	X	X			
2.B.8.a.	Methanol	CO_2	X		X			
2.C.1.	Iron and steel production	CO_2	X	X	X			
2.F.1.	Refrigeration and air conditioning	HFC		X	X		X	X
2.F.2.	Foaming agents	HFC						X
3.A.1.a.	Dairy cows	CH_4	X	X	X	X		X
3.A.1.b.i.	Beef cows	CH_4	X	X	X	X		X
3.A.1.b.ii.	Heifers	CH_4	X	X	X	X		X
3.A.1.b.iii.	Adult meat (heifers >2 years, bulls and studs, oxen)	CH_4	X		X			
3.A.1.b.iv.	Young meat (heifers 1-2 years)	CH_4	X		X			
3.A.1.b.v.	Calves	CH_4	X		X	X		
3.A.2.	Sheep	CH_4	X		X			
3.B.3.	Swine	CH_4	X	X			X	
3.D.1.a.	Inorganic fertilizer	N_2O	X	X	X	X	X	X
3.D.1.c.	Urine and manure deposited by grazing animals	N_2O	X	X	X	X	X	X
3.D.1.d.	Crop waste	N_2O	X		X	X		X
3.D.2.a.ii.1.	Animal manure applied to soils	N_2O				X	X	X
3.D.2.b.ii.1.	Animal manure applied to soils	N_2O				X	X	X

IPCC Code	IPCC Category	GHG	Identification Criterion					
			L1 1990	L1 2016	TD1	L2 1990	L2 2016	TD2
4.A.1.a.i.1.	Second-growth forest	CO_2	X	X	X	X	X	X
4.A.1.a.i.2.	Management Plans (Native Forest Law)	CO_2	X	X	X	X	X	X
4.A.1.a.i.3.	National parks and reserves	CO_2	X	X	X	X	X	X
4.A.1.a.ii.	Forest plantations	CO_2	X	X	X	X	X	X
4.A.1.b.i.1.	P. radiata roundwood	CO_2	X	X	X	X	X	X
4.A.1.b.i.2.	Eucalyptus spp. roundwood	CO_2	X	X	X	X	X	X
4.A.1.b.i.4.	Native species roundwood	CO_2	X		X	X		X
4.A.1.b.ii.1.	Native species firewood	CO_2	X	X	X	X	X	X
4.A.1.b.ii.2.	Exotic species firewood	CO_2	X	X	X	X	X	X
4.A.1.b.iii.1.a.	Native Forest fires	CO_2	X	X	X	X	X	X
4.A.1.b.iii.1.b.	Forest Plantations fires	CO_2	X	X	X		X	
4.A.1.c.ii.	Substitution	CO_2	X	X	X	X	X	
4.A.2.a.ii.	Croplands converted to forest plantations	CO_2	X	X	X	X	X	X
4.A.2.b.i.	Grasslands converted to native forest	CO_2		X	X			
4.A.2.b.ii.	Grasslands converted to forest plantations	CO_2	X	X	X	X	X	X
4.B.2.	Land converted to cropland	CO_2	X	X	X	X	X	
4.C.2.	Land converted to grassland	CO_2	X	X	X	X		X
5.A.	Waste disposal sites	CH_4	X	X	X	X	X	X
5.D.1.	Domestic wastewater treatment and discharge	CH_4		X		X	X	X

N1 1990: analysis of 1990 Level Method 1; N1 2016: analysis of 2016 Level Method 1; TD1: trend analysis 1990-2016 Method 1; N2 1990: analysis of 1990 Level Method2; N2 2016: analysis of 2016 Level Method 2; TD2: trend analysis 1990-2016 Method 2.

Source: Coordinating Technical Team of the MMA

1.6. General assessment of uncertainty

According to the *IPCC Guidelines of 2006*, uncertainty estimates are an essential part of a comprehensive inventory of GHG emissions and removals. The uncertainty analysis should be considered as a means to prioritize national efforts aimed to increase the accuracy and precision of future inventories and to guide decisions on the methodology selected.

For the analysis of Chile's NGHGI uncertainty, the Coordinating Technical Team compiled the uncertainties of emission factors, activity data and other estimation parameters of each SNGHGI and developed an analysis using Method 1: Propagation of error of the *IPCC Guidelines of 2006*, which estimates uncertainty in the individual categories of the entire inventory, and in the trends between one year of interest and the base year. It should be noted that the uncertainty of each individual category is weighted by the emissions or removals in that category to obtain the contribution to the total combined uncertainty.

According to this analysis the balance of emissions and removals of the country's GHG presents a combined uncertainty of -78,7 % and +79,2 %. In general terms, the sectors that most contribute to the uncertainty (contribution to variance) of 2016 are the LULUCF sector, followed by IPPU, the Energy sector, then the Waste sector and finally, the Agriculture sector. Although the combined uncertainty of the Energy sector is low (-3.0% and +4.3%) and that of Waste is high (-67,2% and +72,4%), the first one generates a greater contribution to uncertainty due to the emissions level. In general, the uncertainty of Chile's NGHGI is explained by the use of default emission factors from the *IPCC Guidelines of 2006*, more than by the uncertainty associated with the activity data.

1.7. General assessment of completeness

Completeness means that NGHGI estimates have been prepared for all categories and gases. In case this is not possible, countries must enumerate all categories and the categories gases that have been excluded, and provide a justification for such exclusion.

In general, Chile's NGHGI covers the entire national territory (continental, insular and Antarctic) and it includes GHG emissions and removals in a complete time series that goes from 1990 to 2016. Chile's GHG inventories included are: CO_2, CH_4, N_2O, HFC and SF_6. On the other hand, the precursors CO, NOx, NMVOC and SO_2 including, and for the first time, black carbon. At the same time, Chile's NGHGI includes almost all categories and subcategories of source and sink that make up the sectors.

The categories that have been excluded, either because of a lack of activity data or a lack of appropriate methodologies, they have been reported using notation keys[8] in all reporting tables of this document. In line with the good practice of the *IPCC Guidelines of 2006*, and for greater transparency, ANNEX 2 lists the categories identified as not estimated (NE) and those included elsewhere (IE), which shall be prioritized -depending on a cost/benefit analysis- in future NGHGIs in order to make completeness progress.

Regarding carbon deposits of LULUCF sector, in the current Chile's NGHGI living biomass was included (aerial and underground dead biomass with country-specific factors). Additionally, deposits corresponding to leaf litter and soil organic matter were included using default values.

In accordance with the requirements of the Convention and of the *IPCC Guidelines of 2006*, GHG emissions generated by the use of fossil fuels for international aviation and maritime transportation, and CO_2 emissions from burnt biomass for energy purposes have been quantified and reported as *Memo items*, but were not included in the balance of GHG emissions and removals of the country.

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[8] *Notation keys are: NE = Not estimated; IE = Included elsewhere; C = Confidential; NA = Not applicable; NO = Does not occur.*

2. NATIONAL GREENHOUSE GASES TREND

In 2016, GHG emissions at a national level and per type were as follows: net emissions[9] of CO_2 accounted for 22,186.4 kt; CH_4 emissions accounted for 562.6 kt and N_2O emissions accounted for 22.8 kt. In the case of fluorinated gases, emissions of HFC accounted for 2,869.5 kt CO_2 eq; and SF_6 emissions accounted for 272.3 kt CO_2 eq (Table 3).

Regarding precursor gases, in 2016 emissions throughout the country were as follows: NO_x accounted for 300.8 kt; CO accounted for 963.4 kt; non-methane volatile organic compounds (NMVOCS) accounted for 364.0 kt; and finally, SO_2 accounted for 357.4 kt (Table 3). On the other hand, black carbon emissions were 19.5 kt for the whole country.

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[9] *In this report, the term "net emissions" refers to the summation of GHG emissions and removals, it is also understood as "balance of GHG".*

Table 3. Chile's NGHGI: anthropogenic emissions by sources and anthropogenic removals by sinks of all GHG not controlled by the Montreal Protocol and GHG precursors, Year 2016

Categories of source and sink of greenhouse gases	Net CO_2	CH_4	N_2O
	(kt)		
All national emissions and removals	22,186.4	562.6	22.8
1. Energy	84,121.0	75.5	3.8
1.A. Fuel combustion activities(Sectorial approach)	84,119.8	35.5	3.8
1.A.1. Energy industries	35,483.7	1.6	0.6
1.A.2. Manufacturing industries and construction	15,684.7	6.7	0.9
1.A.3. Transport	26,231.2	5.3	1.9
1.A.4. Other sectors	6,720.0	21.8	0.3
1.A.5. Non-specified	IE, NE	IE, NE	IE, NE
1.B. Fugitive emissions from fuels	1.2	40.0	NA, NE
1.B.1. Solid fuels	NA, NE	3.7	NA
1.B.2. Oil and natural gas.	1.2	36.3	NA, NE
1.B.3. Other emissions from energy production	NE	NE	NE
1.C. Transportation and storage of CO_2	NO		
1.C.1. Transportation of CO_2	NO		
1.C.2. Injection and storage	NO		
1.C.3. Other	NO		
2. Industrial Processes and product use	3,322.5	0.9	1.5
2.A. Mineral industry	1,601.7		
2.B. Chemical industry	263.3	0.9	1.5
2.C. Metal industry	1,327.6	IE, NO	
2.D. Non-energy products from fuels and solvent use	129.9		
2.E. Electronics Industry			
2.F. Use of products as substitutes for ozone depleting substance	NA		
2.G. Other product manufacture and use			NA, NE
2.H. Other			
3. Agriculture	445.4	263.6	16.0
3.A. Enteric fermentation		187.3	
3.B. Manure management		69.9	0.9
3.C. Rice cultivation		5.3	
3.D. Agricultural soils			15.0
3.E. Prescribed burning of savannas	NO		
3.F. Field burning of agricultural residues		1.1	0.0
3.G. Liming	88.4		
3.H. Urea application	357.0		
3.I. Other carbon-containing fertilizers	NO		
3.J. Other	NA	NA	NA
4. Land use, land-use change and forestry	- 65,703.0	5.1	0.3
4.A. Forest land	- 69,851.9	4.9	0.3
4.B. Cropland	1,549.9	0.0	0.0
4.C. Grassland	1,661.2	0.1	0.0
4.D. Wetland	20.6		
4.E. Settlements	368.7		
4.F. Other Land	548.6	NO	NO
4.G. Collected wood products	NE		
4.H. Other (please specify)			
5. Waste	0.5	217.5	1.2
5.A. Solid waste disposal		172.2	
5.B. Biological treatment of solid waste		1.3	0.1
5.C. Incineration and open burning of waste	0.5	0.0	0.0
5.D. Wastewater treatment and discharge		44.0	1.1
5.E. Other			
Anx. Memo items			
Anx.1. International bunker	2,249.1	0.1	0.1
Anx.1.a. International aviation	1,479.7	0.0	0.0
Anx.1.b. International navigation	769.4	0.1	0.0
Anx.2. Multilateral operations	IE	IE	IE
Anx.3. CO_2 emissions from biomass	35,042.3		

0.0 values correspond to quantities lower than 0.05; C = Confidential Information; CS = specific country; D = by Default; IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does not occur;

Source: Coordinating Technical Team of the MMA

HFC	PFC	SF_6	NOx	CO	NMVOC	SO_2
CO_2 Equivalents (kt)			(kt)			
2,869.5	NA, NE, NO	272.3	300.8	963.4	364.0	357.4
			288.0	811.0	254.0	357.4
			285.9	794.2	248.6	357.4
			104.8	52.5	0.9	119.9
			98.0	143.1	66.6	88.7
			64.8	313.3	138.2	114.0
			18.4	285.2	43.0	34.8
			IE, NE	IE, NE	IE, NE	IE, NE
			2.1	16.9	5.4	NA, NE
			NA	NA	1.1	NA
			2.1	16.9	4.3	NA, NE
			NE	NE	NE	NE
			NO	NO	NO	NO
			NO	NO	NO	NO
			NO	NO	NO	NO
			NO	NO	NO	NO
2,869.5	NA, NE, NO	272.3	5.6	NE, NO, NA	0.1	NE, NO, NA
			NE	NE	NE	NE
NO			5.6	NE	0.0	NE
	NO	NO	NE, NO	NE, NO	0.1	NE, NO
			NE	NE	NE	NE
NO	NO	NO				
2,869.5	NE					
	NA, NO	272.3	NA, NE	NA, NE	NA, NE	NA, NE
			NA	NA	NA	NA
			3.8	36.3	98.8	
					5.3	
			IE		NE	
			2.8		93.6	
			1.0	36.3		
			3.3	116.1		
			3.2	112.7		
			0.0	1.1		
			0.1	2.3		
			NO	NO		
			0.0	0.0	11.0	0.0
					10.9	
					NE	
			0.0	0.0		
					0.1	
			2.7	23.7	1.0	21.9
			0.9	4.8	0.4	6.4
			1.8	18.9	0.7	15.5
			IE	IE	IE	IE

In addition to the information presented on (Table 3), and to comply with the information requirements of the *Guidelines for the preparation of national communications from Parties not included in annex I to the Convention*, Annex 3 includes the tables with GHG emissions and removals of the country for 1990, 1994, 2000, 2010, 2013 and 2016. In addition, Annex 4 GHG emissions are reported for the entire time series at a level which will allow the reader to understand all figures of the following sections of this report.

2.1. Trends in Aggregated GHG Emissions and Removals

In 2016, the balance of GHG emissions[10] of Chile recorded 46,185.2 kt CO_2 eq, increasing in a 2,262.5 % from 1990 and a 42.5 % since 2013 (Table 4). The main cause of the GHG balance trend (Figure 3) are the CO_2 emissions generated by the burning of fossil fuels (accounted for in the Energy sector) and removals of CO_2 from forest lands (accounted for in the LULUCF sector); the observed values out of the trend of the GHG emissions balance (especially in 1998, 2002, 2007, 2012 and 2015) are mainly consequences of GHG emissions generated by forest fires (accounted for in the LULUCF sector) and the changes in the participation of the main energy items consumed in the country (diesel, gasoline, natural gas and coal).

On the other hand, in 2016 total GHG emissions[11] in the country accounted for 111,677.5 kt CO_2 eq, increasing by 114.7 % from 1990 and 7.1 % since 2013 (Table 4). The main cause of the trend of total GHG emissions (Figure 4) are CO_2 emissions generated by the burning of fossil fuels (accounted for in the Energy sector), CH_4 emissions generated by livestock and N_2O emissions generated by the application of nitrogen in agricultural soils (the latter two accounted for in the Agriculture sector).


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Table 4. Chile's NGHGI: GHG emissions and removals (kt CO_2 eq) by sector, 1990-2016 series

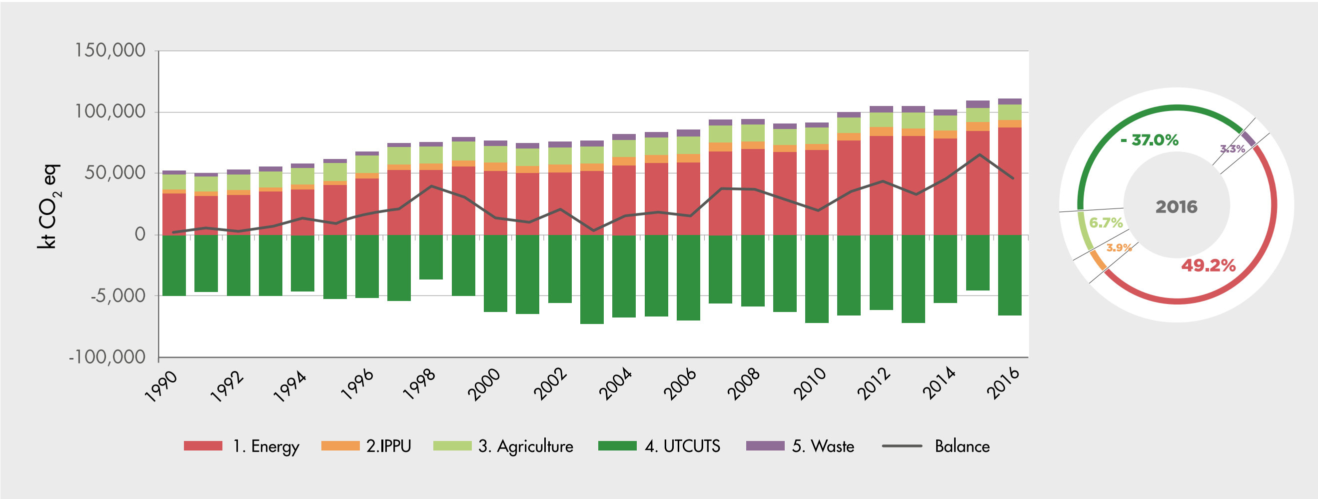
Sector	1990	2000	2010	2013	2014	2015	2016
1. Energy	33,679.7	52,511.9	68,623.5	79,993.7	77,417.0	83,713.4	87,135.6
2. IPPU	3,295.4	6,243.6	5,492.5	6,144.0	6,233.9	6,584.8	6,939.3
3. Agriculture	12,071.4	14,008.7	13,244.1	12,848.4	12,419.1	12,210.6	11,801.6
4. LULUCF	-50,061.0	-62,676.4	-71,930.9	-71,887.5	-55,722.4	-44,972.4	-65,492.3
5. Waste	2,969.3	3,822.4	4,502.2	5,318.4	5,403.9	5,734.5	5,801.1
Balance	**1,955.0**	**13,910.3**	**19,931.4**	**32,416.9**	**45,751.5**	**63,270.9**	**46,185.2**
Total	**52,015.9**	**76,586.7**	**91,862.3**	**104,304.3**	**101,473.9**	**108,243.3**	**111,677.5**

Source: Coordinating Technical Team of the MMA

Regarding participation in 2016 by each sector in the GHG emissions balance in absolute terms[12] (Figure 3), the Energy sector accounted for 49.2 %, followed by the LULUCF sector (- 37.0 %), the Agriculture sector (6.7 %), IPPU sector (3.9 %), and finally the Waste sector (3.3 %).

[10] The term "balance of GHG emissions" or "net emissions" refers to the summation of GHG emissions and removals, in carbon dioxide equivalent (CO_2 eq). This term includes to the LULUCF sector as a whole.
[11] In the present report, the term "total GHG emissions" refers only to the summation of the national GHG emissions in carbon dioxide equivalent (CO_2 eq). This term excludes the emission sources and removal sinks of the LULUCF sector.
[12] In this report, the term "absolute" refers to the magnitude of value. Its purpose is to compare the magnitudes between GHG emissions and removals. In this regard, the values that correspond to removals shall be accompanied by a negative sign to represent their condition of sink.

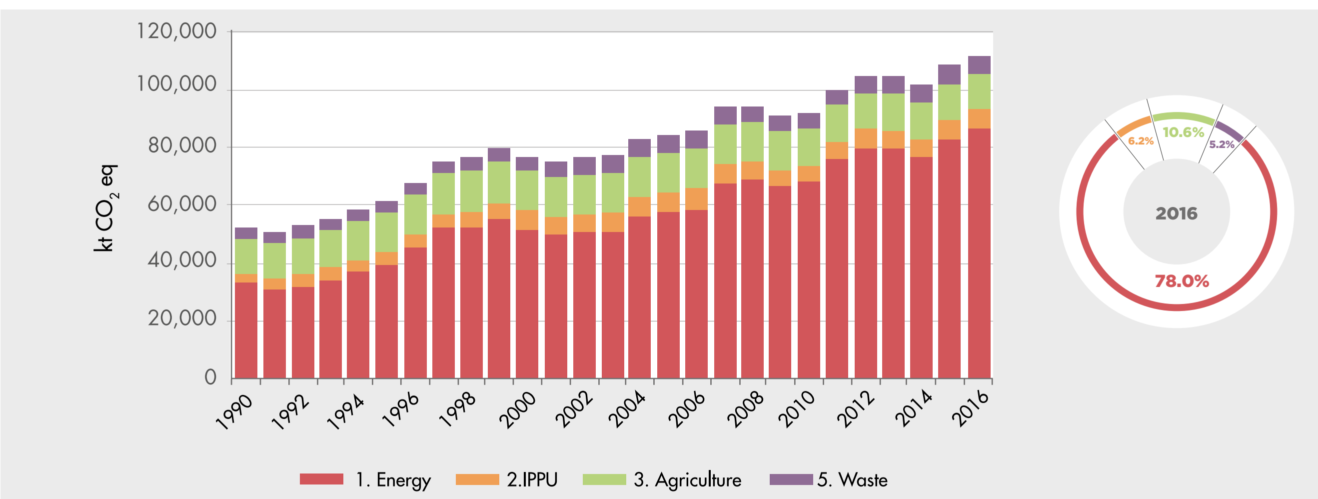
Figure 3. Chile's NGHGI: balance of GHG (kt CO_2 eq) by sector, 1990-2016 series



Source: Coordinating Technical Team of the MMA

Regarding participation of each sector in the total GHG emissions (Figure 4), The Energy sector accounted for 78.0 %, followed by the Agricultural sector (10.6 %), IPPU sector (6.2 %), and finally the Waste sector (5.2 %). This shows that, both in the balance of GHG emissions and in total emissions, the Energy sector is the most important.

Figure 4. Chile's NGHGI: total GHG emissions (kt CO_2 eq) by sector, 1990-2016 series



Source: Coordinating Technical Team of the MMA

2.2. Emissions Trends by GHG

The trend in emissions and removals of the country for each GHG varies according to whether it may or may not include the sources and sinks of the LULUCF sector, since its inclusion generates a balance between GHG emissions and removals, especially of CO_2 (Table 5).

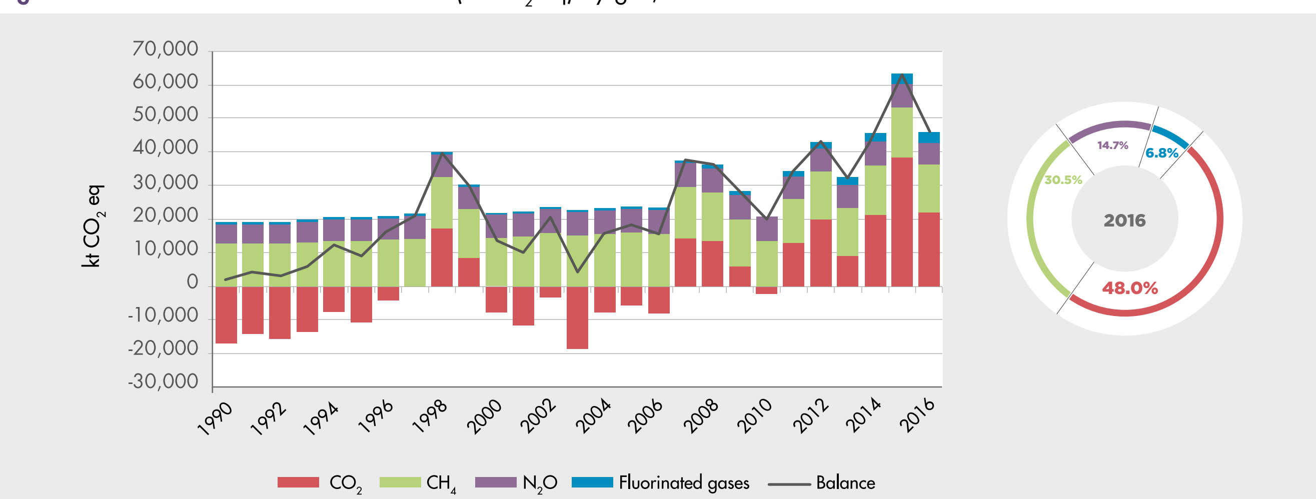
Table 5. Chile's NGHGI: GHG emissions and removals (kt CO_2 eq) by gas, 1990-2016 series

GHG emissions	1990	2000	2010	2013	2014	2015	2016
CO_2 (Incl. LULUCF)	- 16,787.,6	- 7,655.8	- 2,080.4	- 9,056.3	21,624.5	38,428.7	22,186.4
CO_2 (excl. LULUCF)	33,490.1	55,116.9	70,137.1	81,007.7	78,032.2	84,565.5	87,889.3
CH_4 (Incl. LULUCF)	13,024.9	14,681.5	13,562.8	14,265.8	14,375.3	14,684.7	14,064.3
CH_4 (excl. LULUCF)	12,894.5	14,623.7	13,390.7	14,227.5	13,962.9	13,983.9	13,937.7
N_2O (Incl. LULUCF)	5,656.3	6,708.6	7,206.2	6,992.8	7,181.5	7,326.4	6,792.8
N_2O (excl. LULUCF)	5,569.9	6,670.2	7,091.7	6,967.2	6,908.5	6,862.8	6,708.8
Fluorinated Gases	61.3	175.9	1,242.8	2,100.3	2,567.6	2,829.5	3,141.4
HFC	NO	81.9	1,000.1	1,868.1	2,337.4	2,588.8	2,869.5
PFC	NO	NE	NE	NE	NE	NE	NE
SF_6	61.3	94.1	242.7	233.8	232.9	242.3	272.3
Balance	**1,955.0**	**13,910.3**	**19,931.4**	**32,416.9**	**45,751.5**	**63,270.9**	**46,185.2**
Total	**52.015,9**	**76.586,7**	**91.862,3**	**104.304,3**	**101.473,9**	**108.243,3**	**111.677,5**

Source: Coordinating Technical Team of the MMA

In 2016, the balance of GHG emissions of Chile was dominated by CO_2, representing a 48.0 %, followed by CH_4 with a 30.5 %, N_2O with a 14.7 % and fluorinated gases, which collectively accounted for the remaining 6.8 % (Figure 5). It is clear that CO_2 is the GHG emission that moves the trend, as evidenced by the peaks (years 1998, 2002, 2007, 2012 and 2015) and valleys (2003, 2010) in the series. It is striking how the balance of CO_2 is conducive to absorption for the early years of the series (1990-1998), and for the period between 2000 and 2007. This is due to the absorption of forest lands and a greater use of natural gas for power generation compared to other fossil fuels.

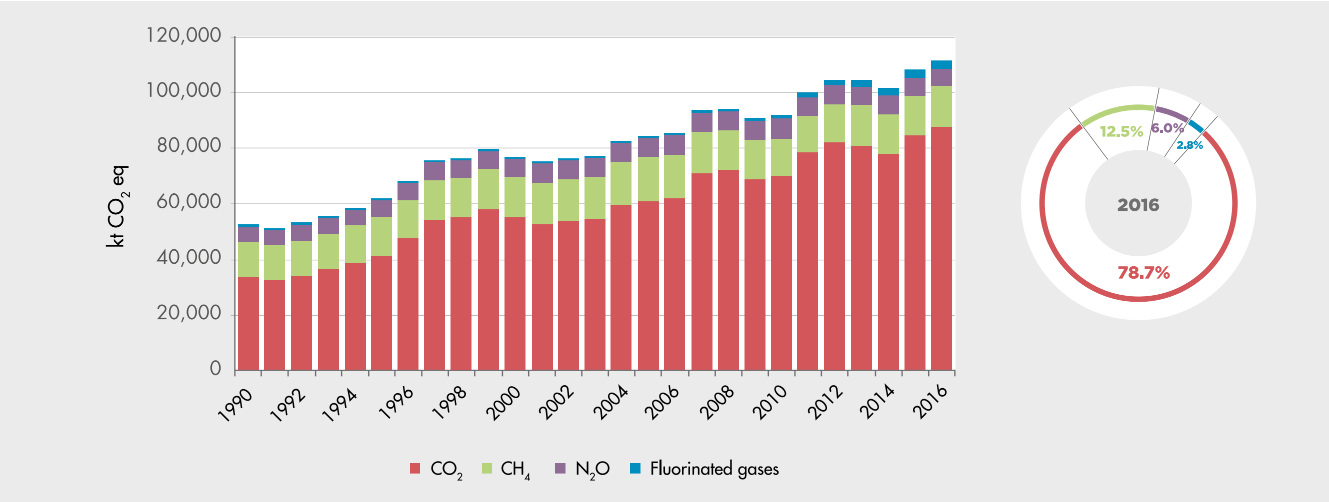
Figure 5. Chile's NGHGI: balance of GHG (kt CO_2 eq) by gas, 1990-2016 series



Source: Coordinating Technical Team of the MMA

In 2016, total GHG emissions were dominated by CO_2, representing a 78.7 %, followed by CH_4 with a 12.5 %, N_2O with a 6.0 % and fluorinated gases that collectively recorded a 2.8 % (Figure 6).

Figure 6. Chile's NGHGI: total GHG emissions (kt CO_2 eq) by gas, 1990-2016 series

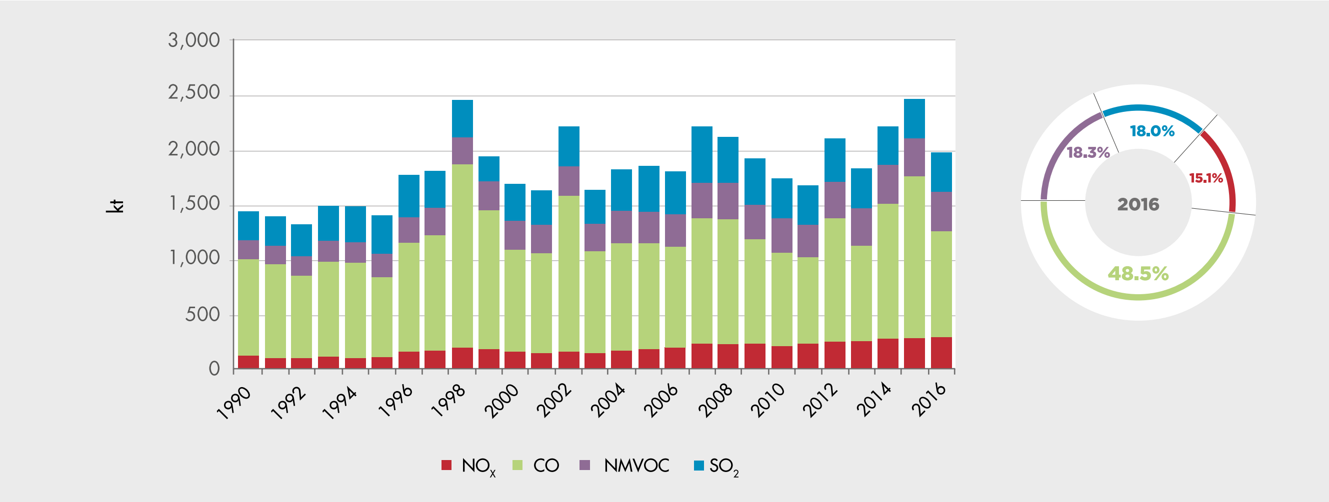


Source: Coordinating Technical Team of the MMA

2.3. Trends in Precursors Emissions and Black Carbon

In 2016, precursor emissions accounted for a total of 1,985.5 kt, which were dominated by CO, representing a 48.5 %, followed by a 18.3 % of NMVOCS, SO_2 with a 18.0 % and then NOx with a 15.1 % (Figure 7).

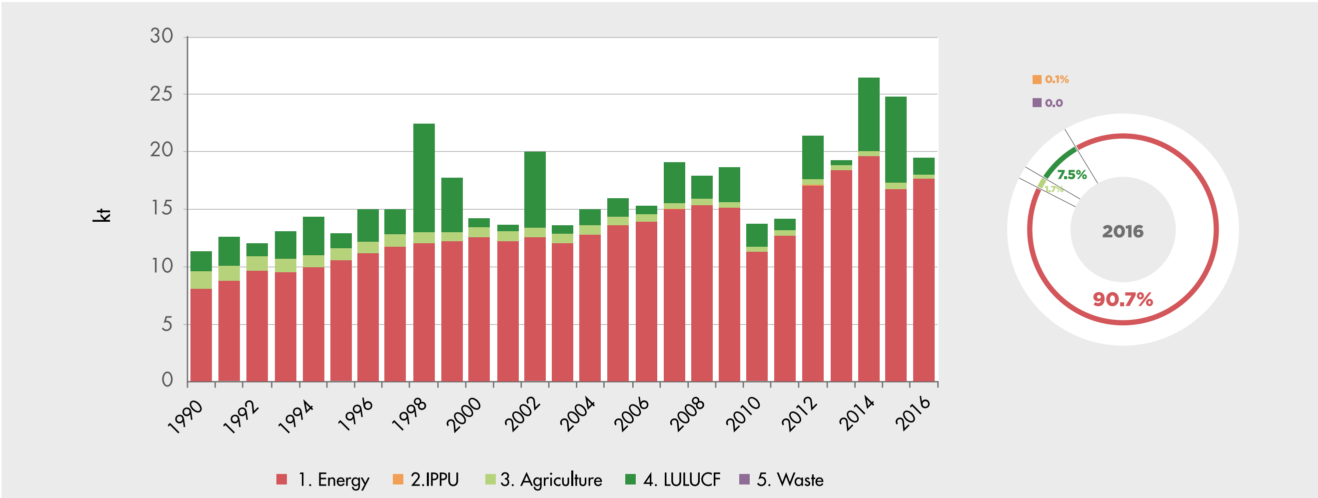
Figure 7. Chile's NGHGI: precursors emissions (kt) by type, 1990-2016 series



Source: Coordinating Technical Team of the MMA

In 2016, black carbon emissions accounted for 19.5 kt, increasing by 71.8 % from 1990 and a 0.8 % from 2013. The main cause of the trend are the emissions associated to the use of biomass for energy purposes in the Energy sector. The increases in years 1998, 2002, 2007, 2014 and 2015 are due to black carbon emissions related to forest fires. Regarding the participation of each sector (Figure 8), the Energy sector accounted for 90.7 %, followed by the LULUCF sector (7.5 %), the Agriculture sector (1.7 %), IPPU sector (0.1 %) and finally the Waste sector which percentage of participation is marginal.

Figure 8. Chile's NGHGI: black carbon emissions (kt) by sector, 1990-2016 series



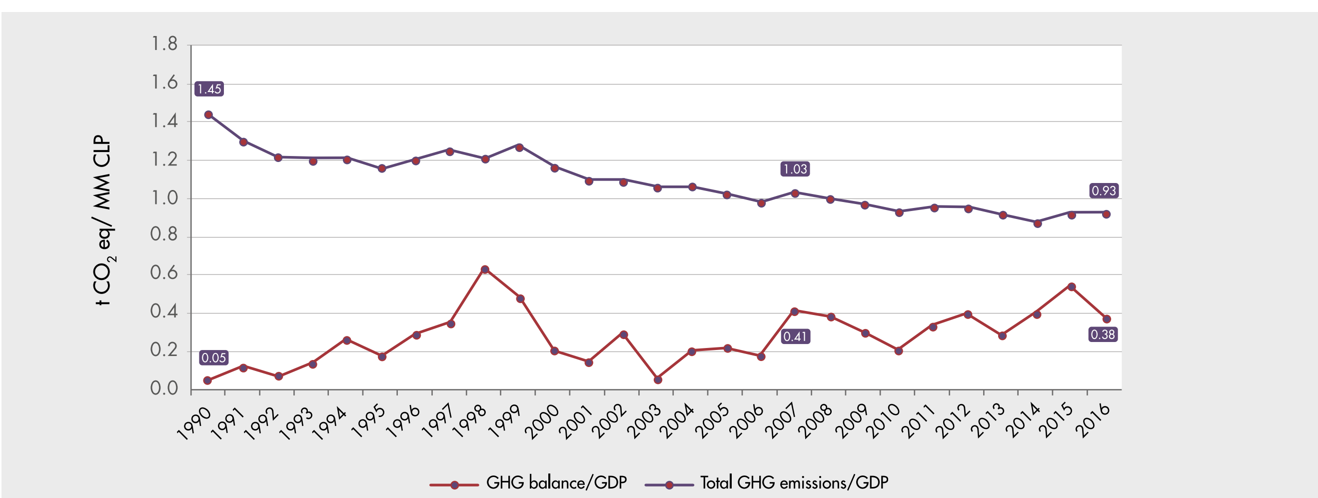
Source: Coordinating Technical Team of the MMA

2.4. GHG Intensity Indicators

It is important for the country to manage the information of Chile's NGHGI with the purpose of understanding the evolution of GHG emissions in a broad context. To do this, indicators have been defined that relate the balance of GHG emissions and total GHG emissions with the Gross Domestic Product (GDP) and the population (per capita). The GDP used is that of the Central Bank converted to prices of 2011 in thousands of millions Chilean pesos, and population corresponds to INE statistics based on 1992 and 2002 censuses and population projection to 2020.

In 2016, the balance indicator of GHG/GDP ratio was 0.38 t CO_2 eq/MMCLP, increasing by 605.0 % since 1990, but decreasing in 7.0 % since 2007, Chile's base year for its contribution determined at a national level (NDC). The interannual variation observed, with peaks in 1998 and 2015, is mainly due to the influence of forest fires in the balance of GHG emissions in the country. On the other hand, the indicator of GHG emissions/total GDP was 0.93 t CO_2 eq/MMCLP, a decrease of 35.9 % since 1990 and 9.9 % since 2007; the trend is influenced by emissions of the Energy sector that dominates the total GHG emissions in the country (Figure 9).

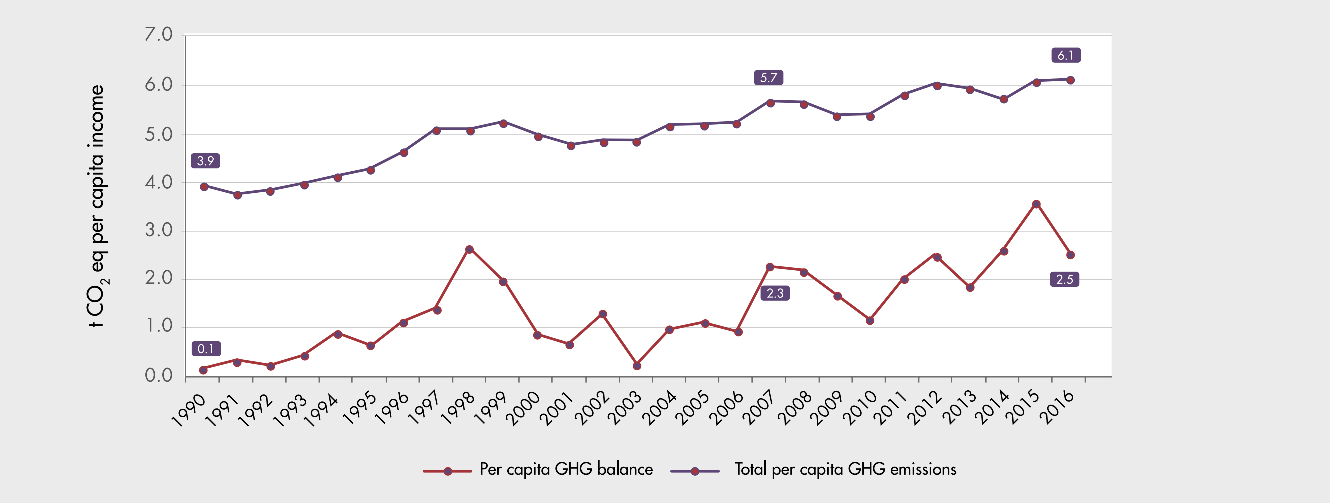
Figure 9. Chile's NGHGI: balance of GHG emissions per GDP and total GHG emissions per GDP (t CO_2 eq/MMCLP), series 1990-2016



Source: own preparation by the Coordinating Technical Team of the MMA, on the basis of information from the Central Bank of Chile

In 2016, the balance indicator of GHG emissions per capita was 2.5 t CO_2 eq per capita, increasing in 1,611.4 % from 1990 and 11.6 % since 2007. The interannual variation observed, with peaks in 1998 and 2015, is mainly due to the influence of forest fires in the balance of GHG emissions in the country. On the other hand, the indicator of total GHG emissions per capita was 6.1 t CO_2 eq per capita, increasing by 55.5 % from 1990 and in 8.2 % since 2007; the trend is influenced by emissions of the Energy sector that dominates the total GHG emissions in the country (Figure 10).

Figure 10. Chile's NGHGI: balance of GHG emissions per capita and total GHG emissions per capita (t CO_2 eq per capita), series 1990-2016



Source: own preparation by the Coordinating Technical Team of the MMA, on the basis of information from the National Institute of Statistics (INE)

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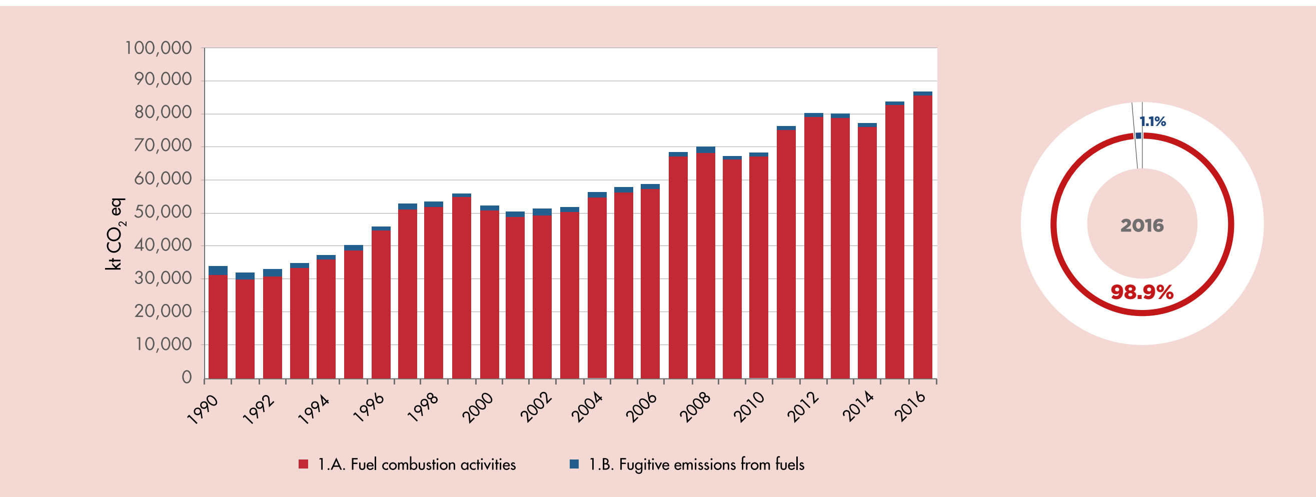
3. ENERGY SECTOR (1)

3.1. Overview

The Energy sector, which includes the consumption of fossil fuels in the country and their fugitive emissions associated, is the main GHG emitter sector in the country, with a 49.2 % of the balance of GHG emissions in 2016. This year, their emissions reached 87,135.6 kt CO_2 eq, increasing by 137.5 % since 1990 and 16.6 % since 2013, mainly due to the steady increase in the country's energy consumption, including the consumption of coal and natural gas for power generation; and consumption of liquid fuels for transportation, mostly diesel and gasoline (Figure 11).

Regarding the participation of each category, 98.9 % of GHG emissions of the sector corresponds to the category *Fuel combustion activities* and the remaining 1.1% to the category *Fugitive emissions from fuels.*

Figure 11. Energy Sector: GHG emissions (kt CO_2 eq) by category, series 1990-2016



Source: Energy Technical Team of MINENERGIA

In 2016, the main GHG emitted by the sector was CO_2, representing a 96.5 % of total GHG emissions in the sector, followed by CH_4 with a 2.2 %, and N_2O with a 1.3 %.

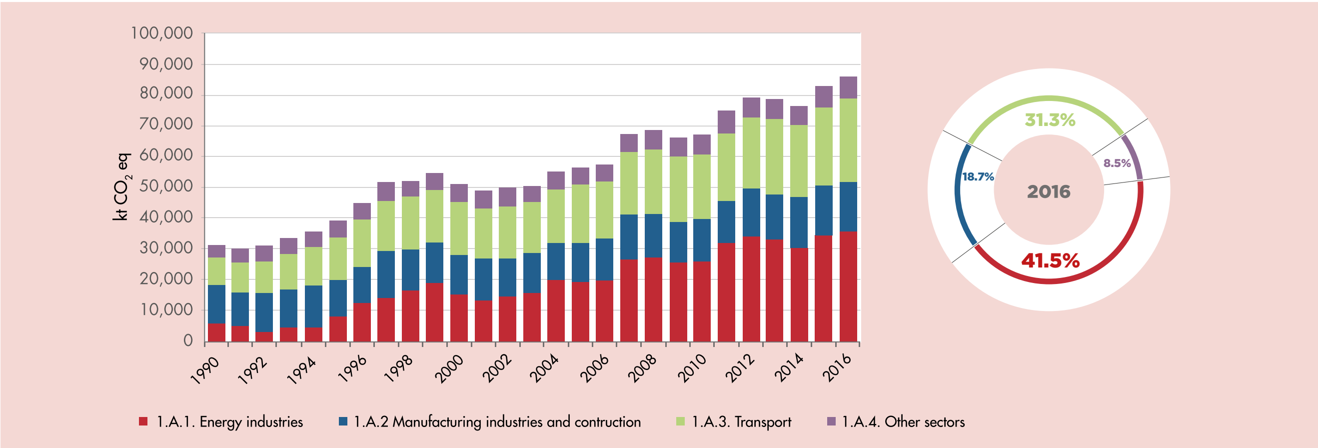
Regarding precursor emissions, in the last reported year they amounted to a total of 1,710.5 kt, of which 47.4 % corresponds to CO, followed in 20.9 % by SO_2, then NOx with 16.8 % and finally NMVOC with 14.9 %. On the other hand, black carbon emissions accounted for 17.7 kt.

3.2. Fuel combustion activities (1.A.)

This category includes emissions from fossil fuel burning, inside or outside of a device designed to heat, or provide heat to a process through heat or mechanical work.

In 2016, GHG emissions accounted for 86,133.9 kt CO_2 eq, increasing by 174.1 % from 1990, and in 9.1 % since 2013, mainly due to the steady increase in power generation from coal, and an increase in the use of liquid fuels (diesel and gasoline) for road transportation. Regarding power generation using coal, while in 2013 there was a decrease in this generation, it increased again mainly due to fluctuations in the hydroelectric generation, given the variability of this type of source. Within the category, the *Energy indutries* is the most important with a 41.5 %, followed by a 31.3 % of *Transport*, 18.7 % of *Manufacturing industries and construction* and 8.5 % of *Other sectors* (Figure 12).

Figure 12. Fuel combustion activities: GHG emissions (kt CO_2 eq) per subcategory, series 1990-2016



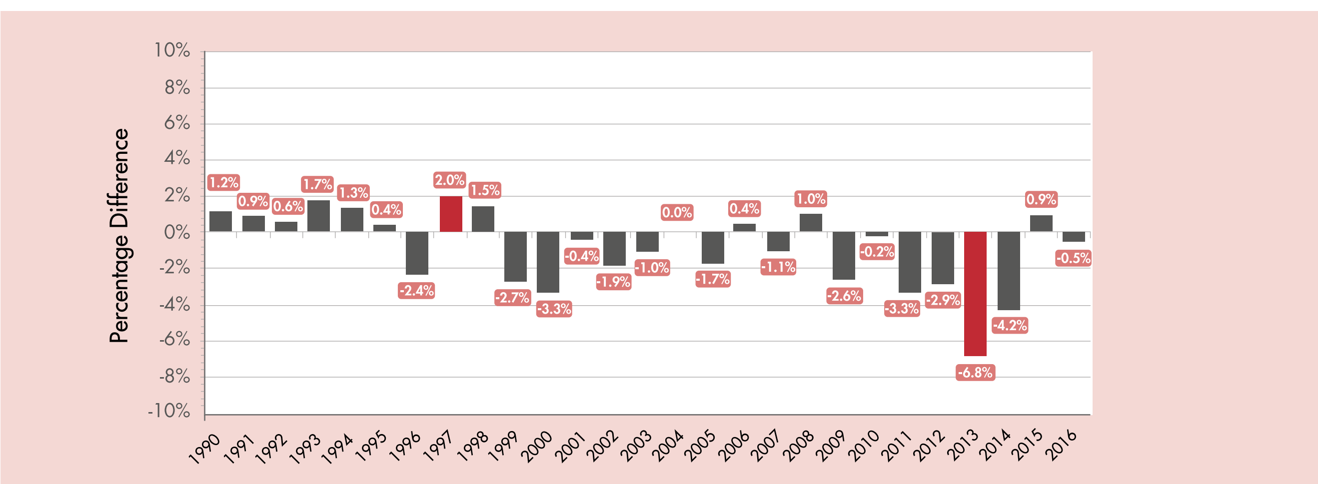
Source: Energy Technical Team of MINENERGIA

3.2.1. Comparison between the Reference approach and the Sectorial Approach

A comparison of the CO_2 emissions results obtained with the *Reference approach and the Sectorial Approach* allows verifying the validity of the calculations performed. The *Reference approach* uses the total values of energy national statistics, while the *Sectorial approach* uses biased values related to each category that as a whole add up to the national total Energy sector.

In general, the trend in CO_2 emissions does not present significant differences between both methods. Figure 13 shows the percentage of difference between the *Reference approach and the Sectorial Approach* for series 1990-2016. The absolutes average of these variations is 1.7 % with an absolute maximum of 6.8 % in 2013. On the other hand, 2004 presents the smallest difference, less than 0.01 %. All these values are below the 5 % indicated by the *IPCC Guidelines of 2006* as acceptable difference between both methods except in 2013 in which the difference is due to the redefinition of some fuels as fuels for non-energy purpose. Differences for the rest of the series are due to various considerations in the end use and transformation of fuels such as coal, natural gas, biomass and biogas.

Figure 13. Fuel combustion activities: percentage difference between CO_2 emissions with the Sectorial approach and the Reference approach, 1990-2016 series



Source: Energy Technical Team of MINENERGIA

3.2.2. Memo items

In accordance with the requirements of the UNFCCC and the *IPCC Guidelines of 2006*, GHG emissions from fossil fuel consumption in international transportation, aerial and maritime, and the CO_2 emissions from biomass that is burnt with energy purposes were quantified, but not included in the GHG balance of emissions and removals of the country, reporting them separately as *Memo items*.

Aerial Transportation and Bunker fuels: In 2016, GHG emissions from *International Aviation* accounted for 1,492.3 kt CO_2 eq, increasing by 342.2 % since 1990, and a 7.7 % since 2013. This growth is due directly to the increased fuel usage given a greater quantity of passengers per year, according to data from the Civil Aeronautics Board and the World Bank. GHG emissions from *International Navigation* accounted for 777.1 kt CO_2 eq, increasing by 143.3 % since 1990 and decreasing by 13.4 % compared to 2013. There is a trend towards a decline since 2008, due to the low international trade that began with the economic crisis of 2009.

CO_2 Emissions from Biomass: In 2016, CO_2 emissions from biomass burned for energy purposes accounted for 35,042.3 kt CO_2 eq, increasing by 192.0 % since 1990 and decreasing by 2.4 % since 2013. The main cause for the increase in firewood consumption is the sustained demand expansion from the residential sector, coupled with a change in the methodology of data collection activity since 2012 at the BNE with an increased consumption of *Pulp, paper and printing*.

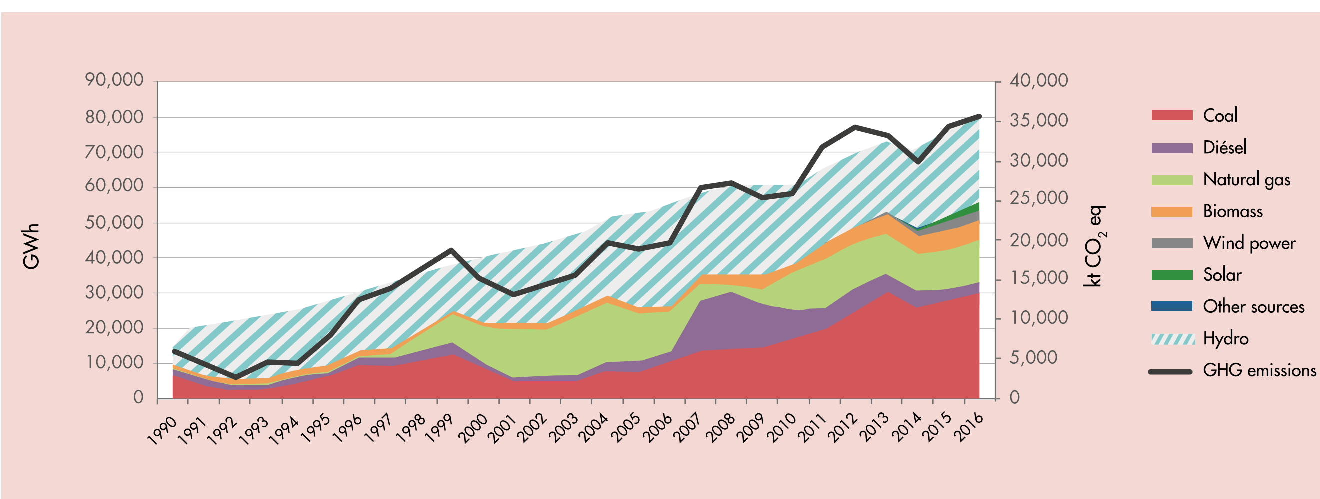
3.2.3. Energy industries (1.A.1.)

This subcategory considers GHG emissions from burning fossil fuels by the industries of energy production and fuels extraction.

The *Energy Industries* subcategory is the leading emitter of the Energy sector and, in turn, is the main source of emissions at a national level. In 2016, their emissions accounted for 35,711.1 kt CO_2 eq, increasing by 511.1 % since 1990 and 7.9 % since 2013. Within the subcategory, the *Main activity electricity and heat production* is the one of the greatest importance with a 96.8 %, followed by 2.1 % of *Manufacture of solid fuels and other energy industries* and a 1.0 % of *Petroleum refining*. The latter reflects the fact that the power generation is the largest source of GHG emissions in the country, representing 31.0 % of the total GHG emissions.

When analyzing GHG emissions by comparing them with the curves of power generation (GWh) from different sources (Figure 14), it can be noted that the emission peaks occur when generation from water source decreases, and the consumption of diesel and especially coal increases, as seen in 1999,2008 and 2012-2016. In the period 1999-2005 a decrease in GHG emissions is observed due to an increased consumption of natural gas, which displaces coal and diesel consumption. Also, since 2007 the cutoff of natural gas supply, accompanied by a lower water supply due to droughts, produces an increase in the consumption of diesel and coal, which in turn increases GHG emissions, thus restarting the upward trend observed between 1990 and 1998.

Figure 14. Power and heat production as main activity: power generation by source type and GHG emissions (kt CO_2 eq), series 1990-2016



Source: Technical Team of MINENERGIA

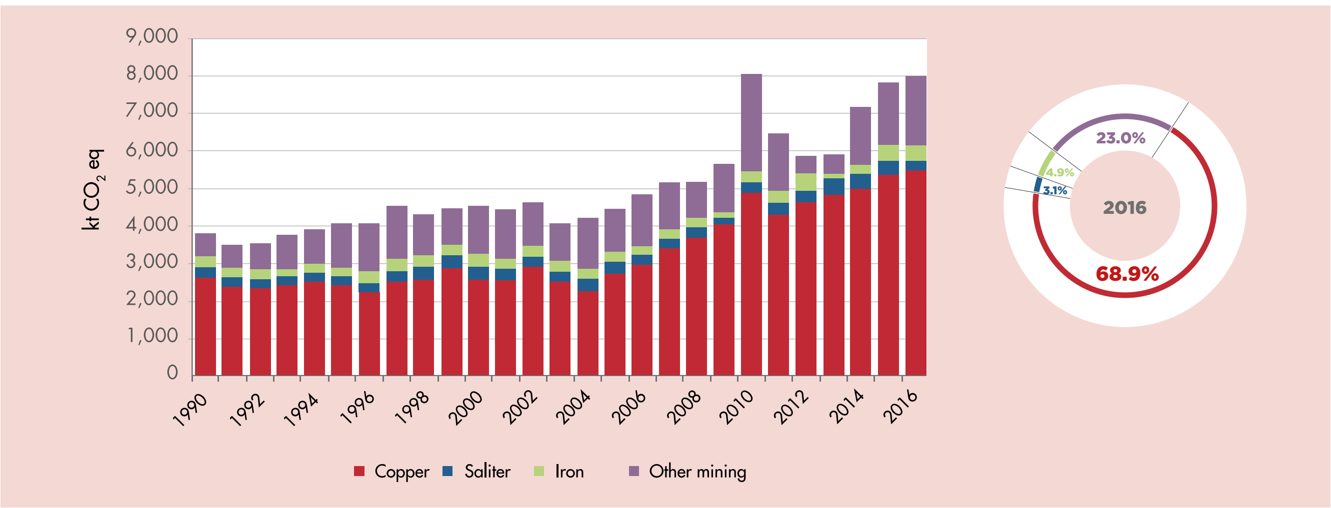
3.2.4. Manufacturing industries and construction (1.A.2.)

This subcategory includes GHG emissions generated by fossil fuels burning in the industry, including burning for power and heat generation for these industries own use.

In 2016, GHG emissions accounted for 16,129.2 kt CO_2 eq, increasing by 31.5 % since 1990 and 10.7 % since 2013. Although there is an increase compared to the early years of the series, there is a downward trend for the past 3 years due to the decrease in production of chemicals and different industries, despite the increase in the consumption by mining. Within the subcategory, *Mining and quarrying* is the most important with 49.4 %, followed by 29.1 % of *Non-specified industry*, 9.6 % of *Pulp, paper and printing*, 6.1 % of *Non-metallic minerals*, 2.1 % of *Chemicals*, 2.0 % of *Food processing, beverages and tobacco*, and 1.7 % *Iron and steel*.

In the case of *Mining and quarrying*, the 2016 GHG emissions accounted for 7,966.8 kt CO_2 eq, increasing by 109.7 % since 1990 and 34.5 % since 2013, mainly due to the sustained growth in copper extraction, mostly driven by the increase of this raw material price. 2010 shows a trend anomaly in the emissions of several mines, originated by the natural gas consumption in that sector reported at the BNE for that year. The steady increase since 2014 in emissions of *Other mining* is due to the increase in diesel consumption for this type of mining. Within the subcomponents, *Copper* is the most important with 68.9 %, followed by 23.0 % of *Other mining*, 4.9 % of *Iron* and 3.1 % of *Saliter* (Figure 15).

Figure 15. Mining (with the exception of fuels) and quarrying: GHG emissions (kt CO_2 eq) per subcomponent, 1990-2016 series



Source: Energy Technical Team of MINENERGIA

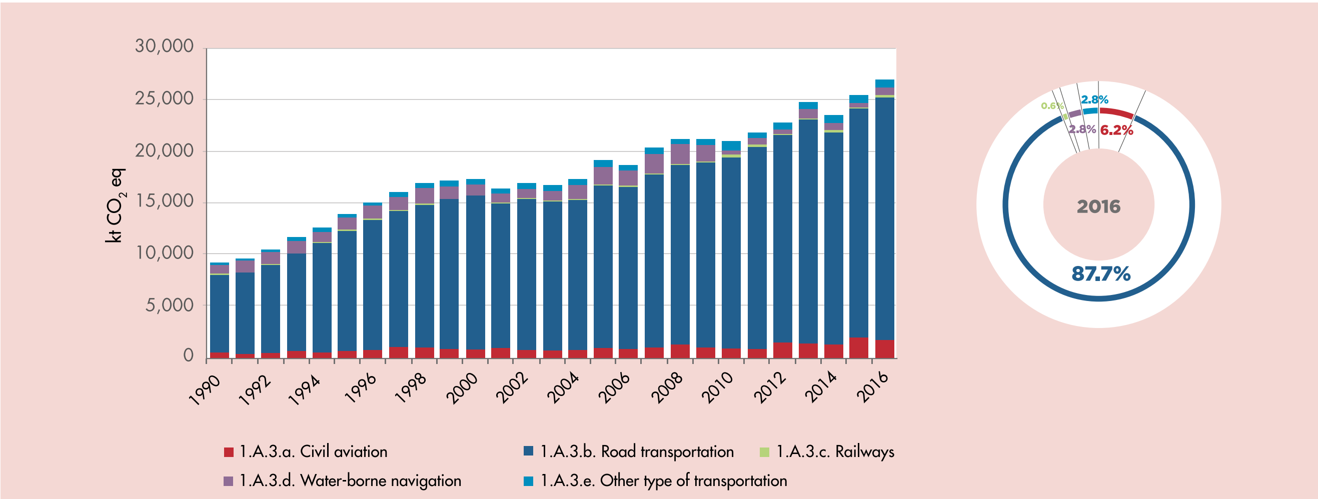
3.2.5. Transport (1.A.3.)

This subcategory includes GHG emissions generated by fossil fuels burning in all activities of the national transportation (aerial, terrestrial, railways, navigation, etc.), excluding military and international transportation (maritime and aerial), which are reported separately.

In 2016, GHG emissions accounted for 26,936.4 kt CO_2 eq, increasing by 191.8 % since 1990 and 8.4 % since 2013 (Figure 16), due to the growth of the national automotive park induced by population's expansion, greater purchasing power and improvement of the road infrastructure in the country.

Within the subcategory, *Road Transportation* is the most important with 87.7 % of GHG emissions, followed by a 6.2 % of *Civil aviation*, 2.8 % of *Water-borne navigation* 2.8 % of *Other type of transportation* and 0.6 % of *Railways*. At the emissions level by fuel type of *Road transportation*, diesel is the most important with 57.9 %, followed by 42.1 % of engine gasoline.

Figure 16. Transportation: GHG emissions (kt CO_2 eq) by component, 1990-2016 series



Source: Energy Technical Team of MINENERGIA

3.2.6. Other sectors (1.A.4.)

This subcategory includes GHG emissions from fossil fuels burnt in commercial and institutional buildings, in homes and in activities related to agriculture, forestry, fisheries and the fishing industry.

In 2016, GHG emissions accounted for 7,357.3 kt CO_2 eq, increasing 79.9 % since 1990 and 14.9 % since 2013, due mainly to an increase in the *commercial/ institutional* sector given the better economic conditions in the country. The sharp increase since 2010 corresponds to a higher diesel consumption reported in the BNE that year. Later years present a growth associated with increased consumption of power, the main energy consumed by the commercial industry.

Within the subcategory, emissions from *Residential* component are of greater relevance with 58.3 % of GHG emissions, followed by 29.7 % of *Commercial/ Institutional*, and 12.0 % of *Agriculture/ Forestry/Fisheries/Aquaculture*.

Within the *Residential* component by type of fuel, *Liquefied Petroleum Gas* (LPG) is the most important with 54.3 %, followed by 25.4 % of *Natural gas*, 14.1 % of *Biomass* (includes only emissions of CH_4 and N_2O), 6.1 % of *Kerosene* and 0.1 % of *Other fuels*.

3.3. Fugitive emissions from fuels (1.B.)

All intentional or unintentional GHG emissions are considered fugitive emissions released during the extraction, processing, storage and distribution of fossil fuels.

In 2016, GHG emissions from this category accounted for 1,001.6 kt CO_2 eq, a decrease of 55.6 % since 1990 and 5.9 % since 2013. This reduction is due mainly to the fall in supply and production of natural gas and, with respect to the early years of the series, the decrease in coal production of underground and superficial mining. Within the category, *Oil and natural gas* is of greater relevance with 90.8 %, followed by *Solid fuels* with 9.2 %.

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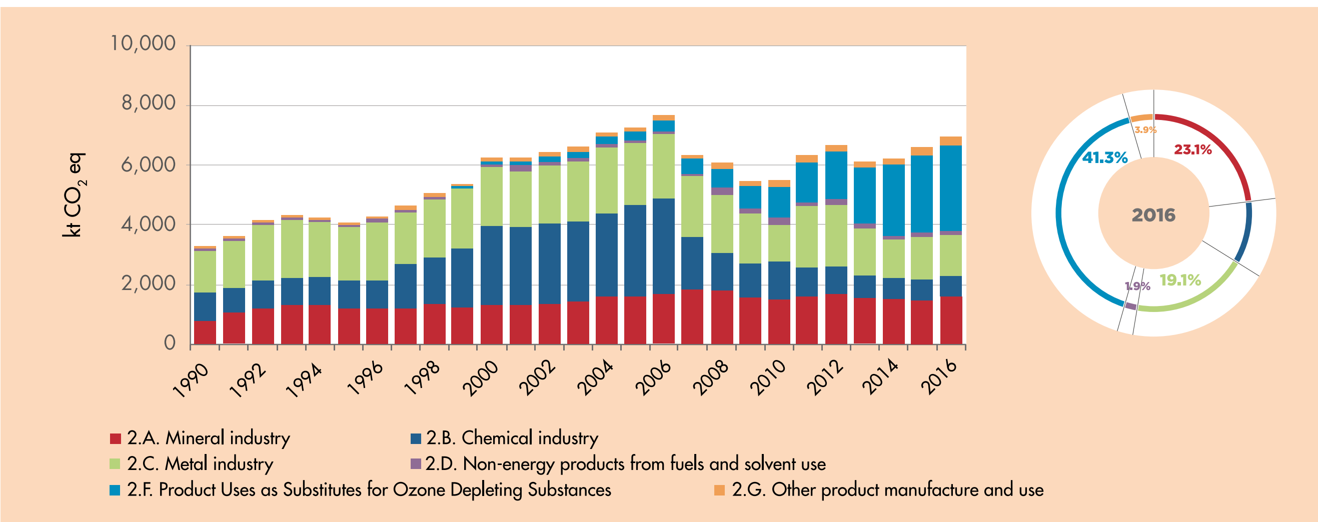
4. INDUSTRIAL PROCESSES AND PRODUCT USE SECTOR (2)

4.1. Overview

The IPPU sector, which includes GHG emissions produced by a variety of industrial activities that transform raw materials by chemical or physical means, represented 3.9 % of the GHG emissions balance in 2016. The same year, their emissions reached 6,939.3 kt CO_2 eq, increasing by 110.6 % since 1990 and 13.0 % since 2013, due to the steady increase in the productions of iron and steel, lime, cement, and the increase in the use of HFC in the refrigeration system (Figure 17).

Regarding the categories, 41.4 % of GHG emissions correspond to *Product Uses as Substitutes for Ozone Depleting Substances* , followed by 23.1 % of the *Minerals Industry*, 19.1 % of *the Metals Industry*, 10.6 % of the *Chemical industry*, 3.9 % of *Manufacture and use of other products* and finally, 1.9 % of *Non-energy products from Fuels and Solvent Use.*

Figure 17. IPPU Sector: GHG emissions (kt CO_2 eq) by category, series 1990-2016



Source: IPPU Technical Team of the MMA

In 2016, the main GHG emitted by the sector was CO_2, representing 47.9 % of the total GHG emissions in the sector, followed by HFC with 41.4 % and N_2O with 6.5 %. SF6 amounts to 3.9 % of the emissions and CH_4 to 0.3 %.

With respect to precursor emissions, the last year reported amounted to 5.7 kt, of which 97.8 % corresponds to NO_x and 2.2 % to NMVOC. On the other hand, black carbon emissions accounted for less than 0.01 kt.

4.2. Mineral industry (2.A.)

This category includes CO_2 emissions related to the processes resulting from the use of carbonated raw materials in the production and use of a variety of industrial mineral products.

In 2016, GHG emissions accounted for 1,601.7 kt CO_2 eq, increasing by 105.3 % since 1990, and 2.7 % since 2013, mainly due to the increase in the production of lime despite the decline in the production of cement. Within the category, *Cement production* is of greater relevance with a 55.1 %, followed by 38.5 % of *Lime production* and 6.4 % of *Glass production*.

4.3. Chemical industry (2.B.)

This category includes GHG emissions resulting from the production of several inorganic and organic products for which the experience of several countries has confirmed that contribute significantly to global emission levels or national GHG emissions.

In 2016, GHG emissions accounted for 738.3 kt CO_2 eq, a decrease of 22.5 % since 1990 and 3.2 % since 2013. This is due to the sharp decline in the production of methanol, associated with the decrease in the supply of natural gas, the main inputof the industry and the incorporation of N_2O abatement systems in the nitric acid industry since 2007. Within the category, the *Nitric acid production* is of greater relevance with a 61.3 %, followed by 38.7 % of *Petrochemical and Carbon Black production.*

4.4. Metal industry (2.C.)

This category includes GHG emissions resulting from the production of metals such as iron and steel, ferro-alloys, lead, zinc, aluminum, etcetera.

In 2016, GHG emissions accounted for 1,327.6 kt CO_2 eq, a decrease of 6.9 % since 1990 and 15.8 % since 2013, due to the fall of iron and steel production in the country associated with the price of these metals. Towards 2016, *Iron and steel production* is the sole emitter considered in this category as of 2016. With regard to the production of ferroalloys, these are not estimated since 2014 due to the absence of activity data. The trend in the production suggests that this activity is not conducted in the country.

4.5. Non-energy products of fuels and use of solvents (2.D.)

The category includes GHG emissions that result from the first uses of fossil fuels as products for purposes of primary ends, except: (i) combustion for power purposes, and (ii) the use as a feeding substance of processes, or as a reducing agent.

In 2016, GHG emissions accounted for 129.9 kt CO_2 eq, increasing by 72.9 % since 1990, but decreasing in 8.5 % since 2013, due to the decrease in stocks of this type of product. Within the category, the *Use of lubricants* is of greater relevance with 92.3 %, while *Use of paraffin* wax contributes with the remaining 7.7 %.

4.6. Product uses as substitutes for ozone depleting substances (2.F.)

This category includes gases of the hydrofluorocarbons families (HFCs) and perfluorocarbons (PFCs) which have a high greenhouse gas effect. HFCs and, to a very limited extent PFCs, serve as alternatives to ozone depleting substances (ODS) which are being withdrawn from circulation under the Montreal Protocol.

In 2016, GHG emissions accounted for 2,869.5 kt CO_2 eq, increasing by 53.6 % since 2013, due to the abrupt increase since 1999 of HFC consumption for cooling and air-conditioning. Within the category, emissions from the subcategory *Refrigeration and air conditioning* are of greater relevance with 95.9 %, followed by 2.0 % of *Fire protection*, 0.9 % of *Foam Blowing Agents*, 0.6 % of *Aerosols*, 0.4 % of *Solvents* and 0.2 % of *Other Applications.*

4.7. Manufacture and use of other products (2.G.)

This category includes GHG emissions for the use of SF_6, PFC and N_2O in different applications based on the different physical properties of these substances, such as high dielectric constant of SF_6, PFCs stability and the anesthetic effects of N_2O.

In 2016, GHG emissions accounted for 272.3 kt CO_2 eq, increasing by 344.0 % since 1990 and 16.4 % since 2013, due to the increase in emissions from *Electrical equipment*, the only subcategory posted.

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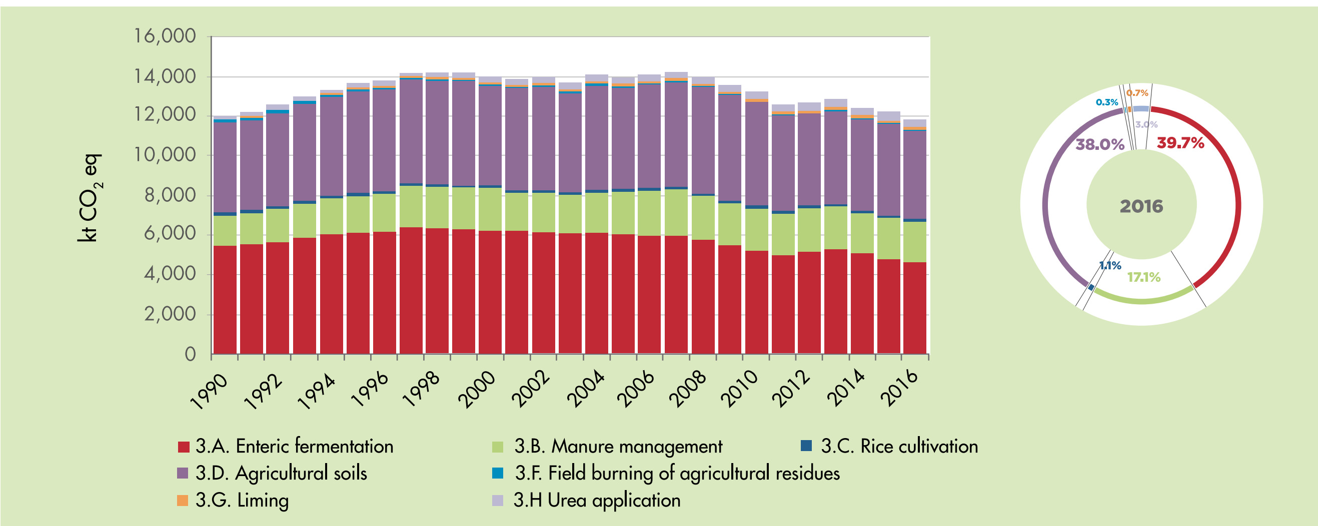
5. AGRICULTURE SECTOR (3)

5.1. Overview

The Agriculture sector, which includes GHG emissions associated with agricultural activities, represented 7.2 % of the GHG emissions balance in 2016. In the same year, its emissions reached 11,801.6 kt CO_2 eq, a decrease of 2.2 % since 1990 and 8.1 % since 2013, largely due lower population of cattle and sheep (animal population responsible for more than 60 % of total emissions from the sector) that has been recorded during the last decade. This is in spite of the steady increase shown by swine and poultry, and the use of nitrogen fertilizers (Figure 18).

With regard to categories, 39.7 % of GHG emissions correspond to *Enteric fermentation*, followed by *Agricultural soils* with 38.0 %, 17.1 % for *Manure management*, 3.0 % for *Urea application*, 1.1 % for *Rice cultivation*, 0.7 % for *Liming* and 0.3 % corresponding to *Field burning of agricultural residues*.

Figure 18. Agriculture Sector: GHG emissions (kt CO_2 eq) by category, series 1990-2016



Source: Agriculture Technical Equipment of MINAGRI

In 2016, the main GHG emitted by the sector was CH_4 representing 55.8 % of total GHG emissions in the sector, followed by N_2O with 40.4 % and CO_2 with 3.8 %.

With respect to precursor emissions, a total of 138.9 kt were reported in the last year, 71.1 % of which correspond to NMVOCS, followed by CO with 26.1 % and NO_x with 2.7 %. On the other hand, black carbon emissions accounted for 0.3 kt.

5.2. Enteric fermentation (3.A.)

This category includes CH_4 emissions from herbivores as a by-product of the enteric fermentation. Ruminants are important sources while non-ruminants produce moderate amounts.

In 2016, GHG emissions from this category accounted for 4,682.0 kt CO_2 eq, a decrease of 14.7 % since 1990 and 11.5 % since 2013, due mainly to a fall in the population of cattle, sheep, goats and horses, which together account for 97.1 % of the category's emissions. Within the category, *Cattle* accumulates most of the emissions, representing 85.9 % of the category, followed by *Sheep* with 7.6 %, *Other species* with 4.0 % and *Swine* with 2.4 %.

5.3. Manure management (3.B.)

This category includes CH_4 and N_2O emissions of manure decomposition under conditions of low oxygen or anaerobic conditions. These conditions often occur when handling large numbers of animals in a confined area, in which manure is usually stored in large piles, eliminated in lagoons or in other types of manure management systems.

In 2016, the GHG emissions from this category accounted for 2,022.1 kt CO_2 eq, increasing by 32.9 % since 1990 and decreasing 5.9 % since 2013. Despite the growth of swine and poultry population, the decrease in emissions over the past few years is due to the low cattle population. Within the category, *Swine* accumulates most of the emissions, representing 52.7 % of the subcategory, followed by *cattle* with 36.2 %, 7.5 % for *Indirect emissions of N_2O resulting from manure management*, 3.0 % for *Other Species* and 0.5 % for *Sheep*.

5.4. Rice cultivation (3.C.)

This category includes emissions of CH_4 by the anaerobic decomposition of organic material in flooded rice paddies. N_2O emissions due to the use of nitrogen-based fertilizers in rice cultivation are reported in agricultural soils.

In 2016, GHG emissions from this category accounted for 133.7 kt CO_2 eq, a decrease of 18.6 % since 1990 and an increase of 26.4 % since 2013. This change in the trend of rice cultivation is directly related with the international price of cultivation and production by the international competitors, which results in a high interannual variability of area sown, so there is a great variability in emissions within the time series.

5.5. Agricultural soils (3.D.)

This category includes direct and indirect emissions of N_2O generated from the surface of soils as a result of microbial processes associated to the application of nitrogen in the form of synthetic and organic fertilizers; urine and manure deposited by grazing animals; crop waste; mineralization/immobilization of nitrogen linked to the gain/loss of soil organic matter resulting from land-use change or management of mineral soils, and drainage/management of organic soils (histosols).

In 2016, GHG emissions from this category accounted for 4,483.6 kt CO_2 eq, a decrease of 1.4 % since 1990 and 5.5 % since 2013. As in the emission sources that have to do with cattle, there has been a decrease in emissions due to the decreased population of livestock. This decrease in emissions has been offset by the use of synthetic nitrogen fertilizers that have presented a significant increase of 163.2 % since 1990.

Within the category, *Direct Emissions of N_2O from agricultural soils* represent 82.9 % of the emissions, while i*ndirect emissions of N_2O from agricultural soils* represent 17.1 %. On the other hand, within the emissions (both direct and indirect) of the category it can be noted that the source urine and manure deposited in pastures, meadows and paddocks represents 42.7 %, followed by 30.3 % of synthetic fertilizers, 16.9 % of animal manure, compost, sludge and other and finally, 10.1 % of agricultural waste.

5.6. Field burning of agricultural residues (3.F.)

This category includes CH_4 and N_2O emissions generated by biomass burning of agricultural waste at cropland.

In 2016, GHG emissions from this category accounted for 34.8 kt CO_2 eq, a decrease of 76.6 % since 1990 and 25.8 % since 2013, due to the prohibition and regularization of this practice. Additionally, there has been a change in the use of agricultural waste, which are mostly used to feed animals, baled or incorporated in the soil. Within the category, emissions of *Cereals and other crops* are the most important representing 58.7 % of the category, while *Fruit* represents 41.3 %.

Packing de carozos, San Francisco de Mostazal, Cristóbal Correa Montalva - Imagen de Chile

5.7. Liming (3.G.)

This category includes the CO_2 emissions generated by the use of lime in agricultural soils, soils from sustainably managed forests or lakes.

In 2016, GHG emissions from this category accounted for 88.4 kt CO_2 eq, increasing by 187.0 % from 1990 and decreasing by 18.9 % since 2013. The increase is due to the sustained growing demand of calcite until 2011. The further decline in demand is because the soils where dolomite or calcite has been applied are stabilized, decreasing the need for high annual applications, and also the increase in price during the last years of these products at an international level.

5.8. Urea application (3.H.)

This category includes the CO_2 emissions generated by the application of urea in agricultural soils and forestry.

In 2016, emissions for this category accounted for 357.0 kt CO_2 eq, increasing by 110.4 % since 1990 and decreasing 10.8 % since 2013. This case is similar to that of liming, which for several years had a sustained and considerate increase, but has declined in recent years due to the fact that in several agricultural crops the application doses have decreased, generating a lower demand for the product. Additionally, the development of country-specific emission factors, lower than the default value recommended by IPCC for certain regions of the country, has resulted in an emissions reduction.

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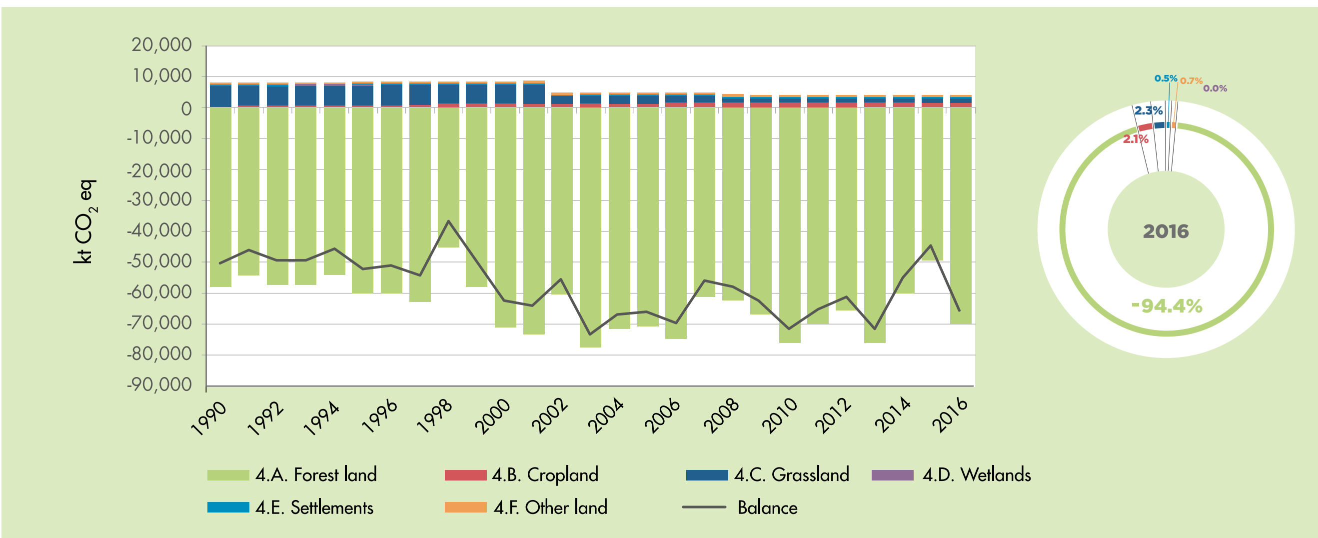
6. LAND USE, LAND USE CHANGE AND FORESTRY SECTOR (4) [13]

6.1. Overview

The *LULUCF sector*, which includes GHG emissions and removals associated with silvicultural activities and land-use change, is the only sector that consistently absorbs CO_2 in the country, making of it the most relevant for its mitigation potential. This sector represented -37.0 % of the GHG emissions balance in 2016. In the same year, its emissions and removals reached -65,492.3 kt CO_2 eq, increasing its status as a sink in 30.8 % since 1990, and decreasing it by 8.9 % since 2013. This is due to the effect of the emissions caused by forest fires, because although the increase in biomass and harvest are stable for this period, fires in recent years of the series have been greater causing a balance less conducive to absorption. This demonstrates how forest fires adversely affect GHG balance (Figure 19).

With respect to GHG emissions and removals in absolute terms by category, -94.4 % corresponds to *Forest land*, followed by 2.3 % of *Grassland*, 2.1% of *Cropland*, 0.7 % of *Other land*, 0.5 % by *Settlements* and finally, 0.03 % corresponding to *Wetlands*.

Figure 19. LULUCF Sector: GHG emissions and removals (kt CO_2 eq) by category, series 1990-2016



Source: Technical Team of LULUCF MINAGRI

In 2016, the main GHG emissions and removals in absolute terms was CO_2, representing -99.7 % of the sector, followed by CH_4 with 0.2 % and N_2O with 0.1 %.

With respect to precursor emissions, a total of 119.4 kt was reported the last year, 97.2 % of which corresponds to NO_x and 2.8 % to CO, and black carbon emissions accounted for 1.5 kt.

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[13] In this report, the term "absolute" refers to the magnitude of value. Its purpose is to compare the magnitudes between GHG emissions and removals. In this regard, the values that correspond to removals shall be accompanied by a negative sign to represent their quality of sink.

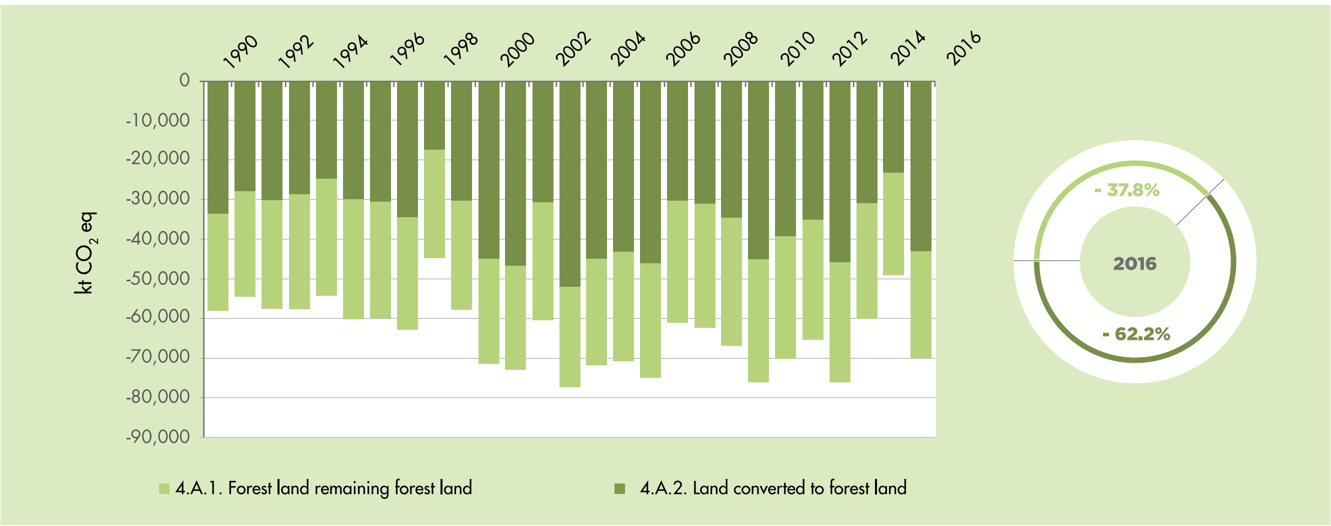
6.2. Forest land (4.A.)

This category includes GHG emissions and removals generated as a result of changes in biomass, dead organic matter and soil carbon in *Forest land that remain as such* and in *Land converted to forest land.*

In 2016, the balance of GHG emissions recorded -69.646.6 kt CO_2 eq, increasing its status as sink in 20.0 % since 1990, and decreasing it in 8.5 % since 2013 (Figure 20). The increase in the sink condition during the 1990-2016 time series is mainly due to the increase of forestry plantation; of the biomass in seedlings of native forests, and native forest under management plans. While in the same period emissions increase - due to the increase in harvest and firewood consumption - the increase in removals is greater compared to the sector's emissions. This way, *Forest land* is the only land use that presents the status of sink in its CO_2 balance, while the other land uses are net GHG emitters (Figure 20).

At a subcategory level, *Forest land remaining forest land* contribute with -62,2 % to the CO_2 net balance, and *Land converted to forest land* with -37,8 %.

Figure 20. Forest land: GHG emissions and removals (kt CO_2 eq) per subcategory, series 1990-2016



Source: LULUCF Technical Team of MINAGRI

At a component level within this category, the ones contributing with a greater amount in removals are the native forest through the increase of biomass in *Second-growth forest, National parks and reserves*, and forests with *Management plans* (-19.7 %; -8.2 % and -5.1 % respectively), followed by tree plantations that contribute both to the increase of biomass in forest lands remaining forest land, as in land converted to forest land with -19.2 % and -10.7 % respectively. Emissions of greater importance come from *Harvest* with 26.8 %, followed by *Firewood* with 7.7 % and *Disturbances and Controlled burning of forest residues* with 1.4 % (Figure 21).

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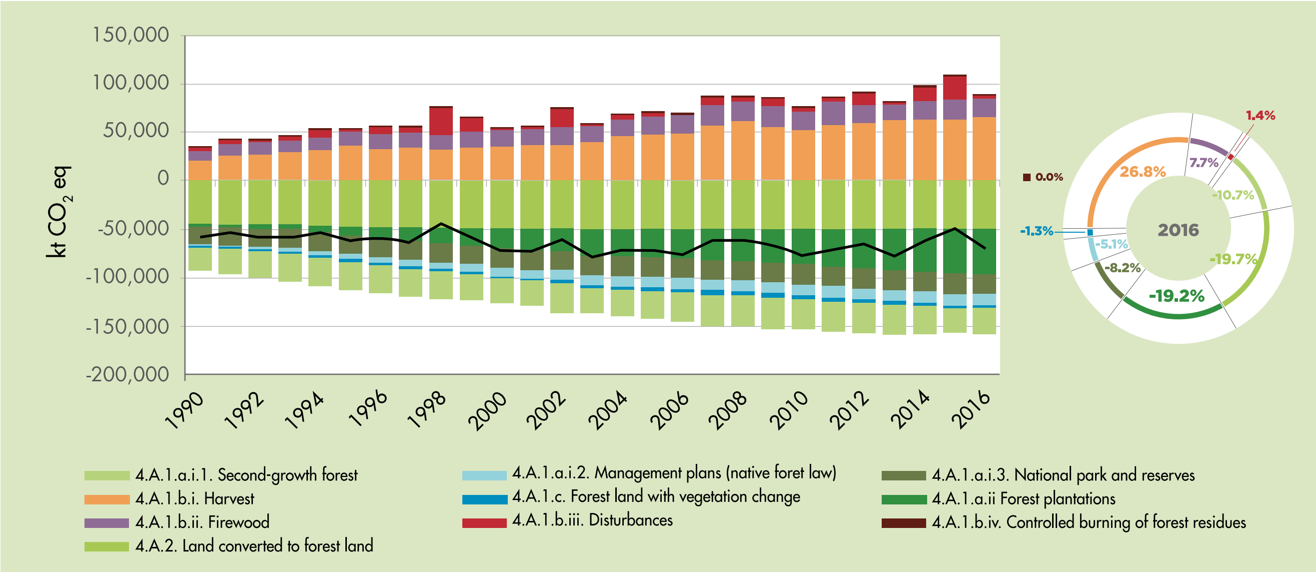
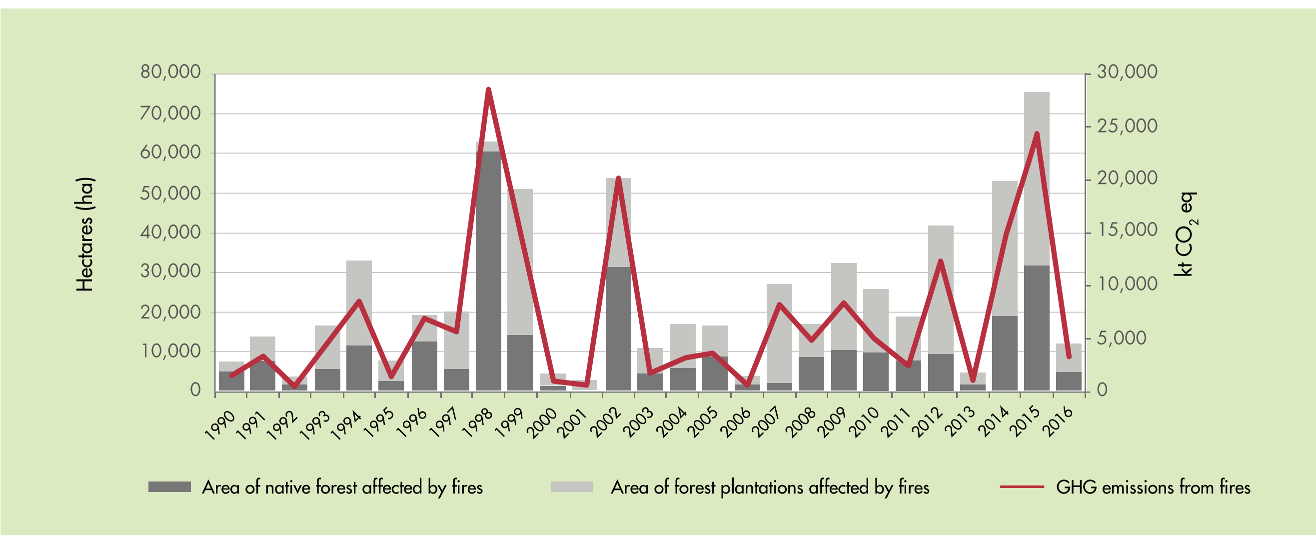
Figure 21. Forest land: GHG emissions and removals (kt CO_2 eq) by its main subcomponents, 1990-2016 series



Source: LULUCF Technical Team of MINAGRI

Wildfires have an important effect on the trends in GHG emissions and removals. Figure 22 shows that in the years 1998 and 2015 more than 60,000 hectares have been affected by fires, with an impact on the net balance of GHG emissions.

Figure 22. Wildfires in forest land remaining forest land: annual area affected by fires (ha) and CO_2 emissions (kt CO_2 eq), series 1990-2016



Source: Technical Team of LULUCF MINAGRI


Conaf

6.3. Cropland (4.B.)

This category includes CO_2 emissions and removals of generated in arable and plowable land, rice fields and agroforestry systems, where the vegetation structure is below the thresholds used for *Forest land* and it is not expected that they exceed them in the future.

In 2016, the CO_2 balance accounted for 1,551.0 kt CO_2 eq, increasing by 144.5 % since 1990, but decreasing in 3.3 % since 2013. The trend towards growth undergoes a turning point since 2009, due to the decrease in lands that are passed to cultivation. Within the category, 99.9 % corresponds to *Land converted to cropland*, followed by 0.1 % corresponding to *Cropland remaining cropland.*

6.4. Grassland (4.C.)

This category includes GHG emissions and removals generated in land that are not considered arable land or forest land, and all the grassland of wild land for recreational areas, as well as agricultural systems and silvopasture according to national definitions.

In 2016, the GHG emissions balance accounted for 1,665.5 kt CO_2 eq, a decrease of 74.9 % since 1990 and increasing by a 1.9 % since 2013, due to the decrease of land converted to grassland. Within the category, 99.7 % corresponds to *Land converted to grassland* and the remaining 0.3 % to *Grassland remaining grassland.*

6.5. Wetland (4.D.)

This category includes GHG emissions and removals generated in land covered or saturated by water most of the year. It includes reservoirs as a managed subdivision, and natural rivers and lakes as unmanaged subdivisions. Wetland include all kinds of land that are covered or saturated by waters all year round or most of it, that do not fall within the categories of Forest land, Cropland or grassland. The inventory includes only the land converted to wetland.

In 2016, the balance of GHG emissions accounted for 20.6 kt CO_2 eq, a decrease of 82.4 % since 1990 which remains unchanged since 2013, due to the decrease of land converted to wetland. Within the category, 100 % corresponds to *Land converted to wetland.*

6.6. Settlements (4.E.)

This category includes GHG emissions and removals generated in land where there are human settlements, urban areas and infrastructure, unless it has already been included in other categories.

In 2016, the balance of GHG emissions accounted for 368.7 kt CO_2 eq, increasing by 35.5 % since 1990 decreasing by 1.2 % since 2013. Within the category, 100 % corresponds to *Land converted to settlements.*

6.7. Other land (4.F.)

This category includes GHG emissions and removals generated in areas of bare soil, rock, ice and all areas of unmanaged lands that do not belong to any of the other five categories.

In 2016, the balance of GHG emissions accounted for 548.6 kt CO_2 eq, increasing by 60.2 % since 1990 and decreasing by 1.4 % since 2013. Within the category, 100 % corresponds to *Land converted to other land.*

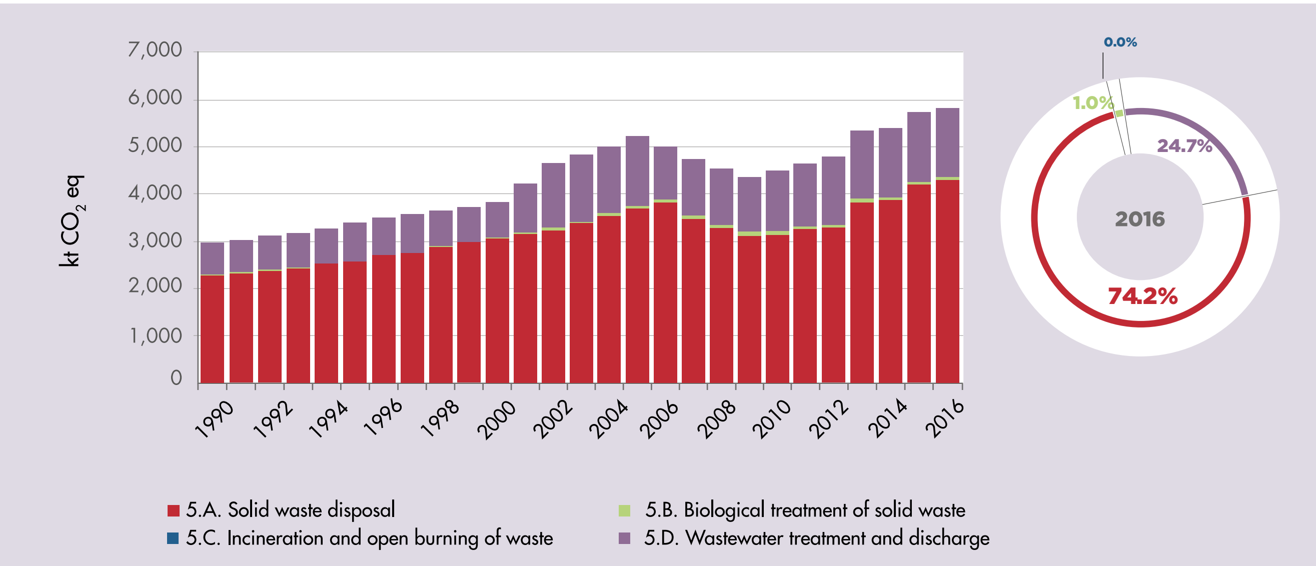
7. WASTE SECTOR (5)

7.1. Overview

The Waste sector, which includes the GHG emissions from microbiological processes that occur in the organic matter of solid waste under anaerobic degradation, and the anaerobic treatment of domestic and industrial wastewater represented 3.3 % of the GHG emissions balance in 2016. In the same year, its emissions reached 5,801.1 kt CO_2 eq, increasing by 95.4 % since 1990 and 9.1 % since 2013, due to the increase in population and their generated waste (Figure 23).

With regard to categories, 74.2 % of GHG emissions correspond to the *Solid waste disposal*, followed by 24.7 % of *Wastewater treatment and discharge*, 1.0 % of *Biological treatment of solid waste* and finally, 0.01 % of *Incineration and open burning of waste.*

Figure 23. Waste Sector: GHG emissions (kt CO_2 eq) by category, series 1990-2016



Source: Waste Technical Team of the MMA

In 2016, the main GHG emitted by the sector was CH_4, representing 93.7 % of GHG emissions in the sector, followed by N_2O with 6.3 % and CO_2 with less than 0.01 %.

Additionally, in the last year reported, the precursor emissions were dominated by NMVOC, representing 99.9 %, which is equivalent to 11.0 kt. The remaining percentage is composed of NO_X, CO and SO_2. On the other hand, black carbon emissions were marginal.

7.2. Solid waste disposal (5.A.)

This category includes CH_4 emissions in the treatment and disposal of municipal solid waste, industrial and others, which are eliminated on solid waste disposal sites (SWDS).

In 2016, GHG emissions accounted for 4,305.3 kt CO_2 eq, increasing by 88.1 % since 1990 and 12.3 % since 2013, due to population growth. Between 2006 and 2010 there is a reduction in the trend which is due to the CH_4 recovery in some landfills in the country; however, the total CH_4 that is recovered in Chile has declined, attributed to the drop in the price of carbon credits generated by the projects of the Clean Development Mechanism. Within the category, *Managed waste disposal sites* (landfills) is the most important with 74.2 %, followed by 21.4 % of *Uncategorized waste disposal sites* (dump) and 4.4 % of *Unmanaged waste disposal sites (open dump).*

7.3. Biological treatment of solid waste (5.B.)

This category includes the GHG emissions of the processes that affect the amount and composition of waste, such as compost manufacture and anaerobic digestion of organic waste. These processes allow the reduction in volume, stabilization of the residue, and destruction of pathogens. In addition, in the case of digestion, it allows the production of biogas for energy use. In the case of composting, the end product can be used as fertilizer and compost in soils, or being eliminated in SDRS.

In 2016, GHG emissions accounted for 59.9 kt CO_2 eq, increasing by 251.7 % since 1990 and decreasing 1.8 % since 2013, without major changes in trend over the past few years since the quantity of composting plants has been maintained.

7.4. Incineration and open burning of waste (5.C.)

This category includes GHG emissions resulting from combustion of solid and liquid waste without energy recovery, while open incineration of waste mainly addresses the combustion of unwanted materials, so that smoke and other emissions are released directly into the air or through incineration devices that do not control the combustion air.

In 2016, GHG emissions accounted for 0.5 kt CO_2 eq, increasing by 29,574.2 % since 1990 and 55.6 % since 2013, due to the increasing amount of hospital waste incinerated.

7.5. Wastewater treatment and discharge (5.D.)

This category includes GHG emissions of the treatment or disposal of wastewater in anaerobic means, such as domestic wastewater, commercial and industrial, and which can be treated on site (not collected), transferred through the sewerage service to a central facility (collected), or eliminated without treatment in the vicinity or by means of drains.

In 2016, GHG emissions accounted for 1,435.3 kt CO_2 eq, increasing by 116.3 % since 1990 and 0.8 % since 2013, due to the increase in population and coverage of the network of domestic water treatment. Although an increase is identified in recent years of the series, this is not in line with population growth due to increased burning of methane recovered. Within the category, *Domestic wastewater treatment* and discharge is the almost unique emitter, with 98.9 % of participation, while *Industrial wastewater treatment and discharge* amounts only to 1.1 %.

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8. RECALCULATIONS

The methodological changes and the refinement of activity data are an essential part of the improvement of NGHGIs quality; but when this occurs, it is required to recalculate the entire time series to ensure consistency. Then it will justify the new calculations and its implications for GHG emissions and removals of the country.

8.1. Chile's NGHGI recalculations

Both the current Chile's NGHGI (INGEI2018, series 1990-2016) and the previous (INGEI2016 series, 1990-2013), which was submitted by the country to the United Nations in 2016 as a part of its *Second Biennial Update Report* were prepared according to the *IPCC Guidelines of 2006*. For the preparation of the present Chile's NGHGI, new sources of information along with their respective refinement have been sought in all sectors. In addition, new country-specific emission factors were developed in the sectors of IPPU and Agriculture, and new sources and sinks were incorporated in Agriculture and LULUCF causing differences between the magnitudes of previously reported GHG emissions.

In general, the balance of GHG emissions of INGEI2018 shows an average decrease between 1990 and 2013 of 18,653.2 kt CO_2 eq, in comparison to the INGEI2016 thus generating a decrease of 116.1 % for 2013, the last comparable year (Table 6 and Figure 24). This is mainly attributed to an increase in removals of the category *Forest land* of the *LULUCF sector*, which included new carbon sinks and also assumptions and related values were refined. While the other sectors of Chile's NGHGI show variations, changes in *Forest land* are equivalent to magnitudes of GHG emissions that noticeably have an impact on the general trend. Additionally, it is important to mention that the change of GWP (previously based on the SAR values and now based on the AR4 values) causes an increase in the value of the emissions when taking them to CO_2 equivalent.

Table 6. Recalculations: comparison of the GHG balances (kt CO_2 eq) of INGEI2018 (1990-2016 series) and INGEI2016 (1990-2013 series)

INGEI	1990	2000	2010	2013	2014	2015	2016
INGEI2016	8,006.8	29,101.5	48,719.9	70,054.4			
INGEI2018	1,955.0	13,910.3	19,931.4	32,416.9	45,751.5	63,270.9	46,185.2
Difference	**-6,051.9**	**-15,191.2**	**-28,788.6**	**-37,637.6**			
Difference %	**-309.6%**	**-109.2%**	**-144.4%**	**-116.1%**			

Fuente: Equipo Técnico Coordinador del MMA

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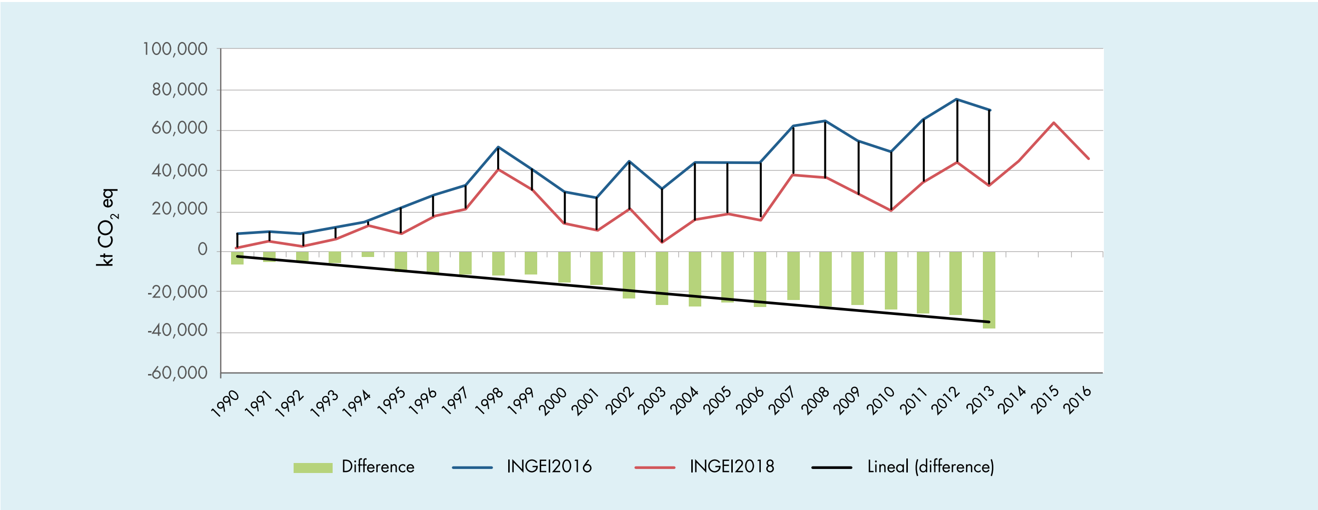
Figure 24. Recalculations: comparison of the GHG balances (kt CO_2 eq) of INGEI2018 (1990-2016 series) and INGEI2016 (1990-2013 series)

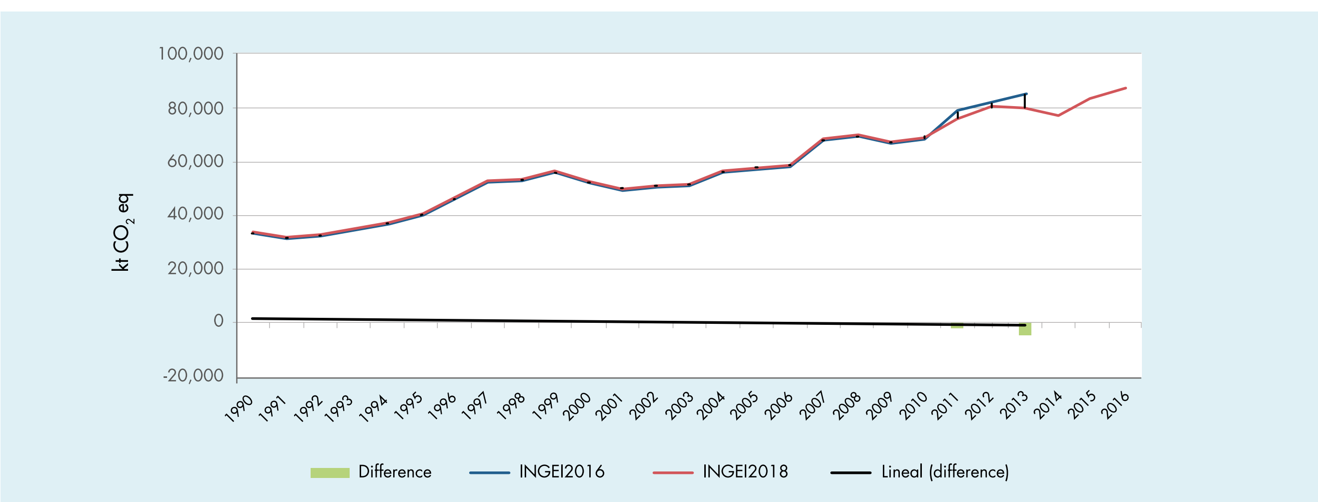


Source: Coordinating Technical Team of the MMA

8.2. Recalculations in the Energy sector

GHG emissions of the Energy sector (Figure 25) in the INGEI2018 presented an average decrease between 1990 and 2013 of -103,8 kt CO_2 eq (less than 1 %) in comparison to INGEI2016. Although there is no evidence of greater changes in the trend, since 2010 a significant decrease in emissions is shown. 2013, the last comparable year, shows a decrease in GHG emissions of 5,081.7 kt CO_2 eq which is equivalent to 6.4 %. This decrease is linked with the modification performed on the National Energy Balance (BNE) for series 2010-2015, which main consequence was the relocation of certain energy consumption, with special effect on refinery and road transportation. For 2013, there is a significant difference with respect to INGEI2016 mainly due to corrections in the consumption of electricity generation from coal and the reallocation of natural gas consumption at refineries. The slight increase in emissions for the first years of the series is due to the change of GWP and the increase in this value for CH_4.

Figure 25. Recalculation: comparison of GHG emissions in the energy sector (kt CO_2 eq) INGEI2018 (1990-2016 series) and INGEI2016 (1990-2013 series)

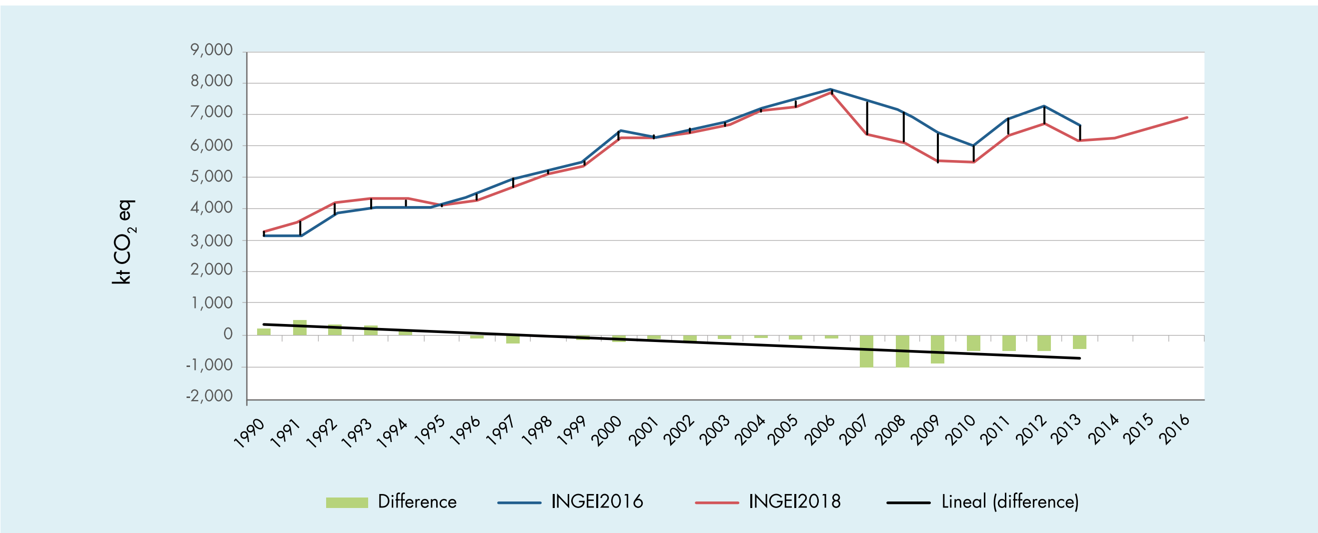


Source: Coordinating Technical Team of the MMA

8.3. Recalculations in the IPPU sector

In the IPPU sector (Figure 26), GHG emissions in the INGEI2018 presented an average decrease of 213.5 kt CO_2 eq compared to INGEI2016. Although there are no major changes in the trend, differences increased since 2007. This is primarily attributed to the improved methodology for estimating emissions of the *Nitric acid production* subcategory, by incorporating an emission factor that considers technologies of N_2O abatement despite the increase in emissions from the *Product uses as substitutes for ozone depleting substances* category to the change in activity data for this category. Other changes, which in summary do not alter the trend, were improvement of methodology for estimating *Iron and steel* emissions, changes in activity data for *Lime production* and for Methanol and Ethylene production.

Figure 26. Recalculation: comparison of GHG emissions in the IPPU sector (kt CO_2 eq) INGEI2018 (1990-2016 series) and INGEI2016 (1990-2013 series)

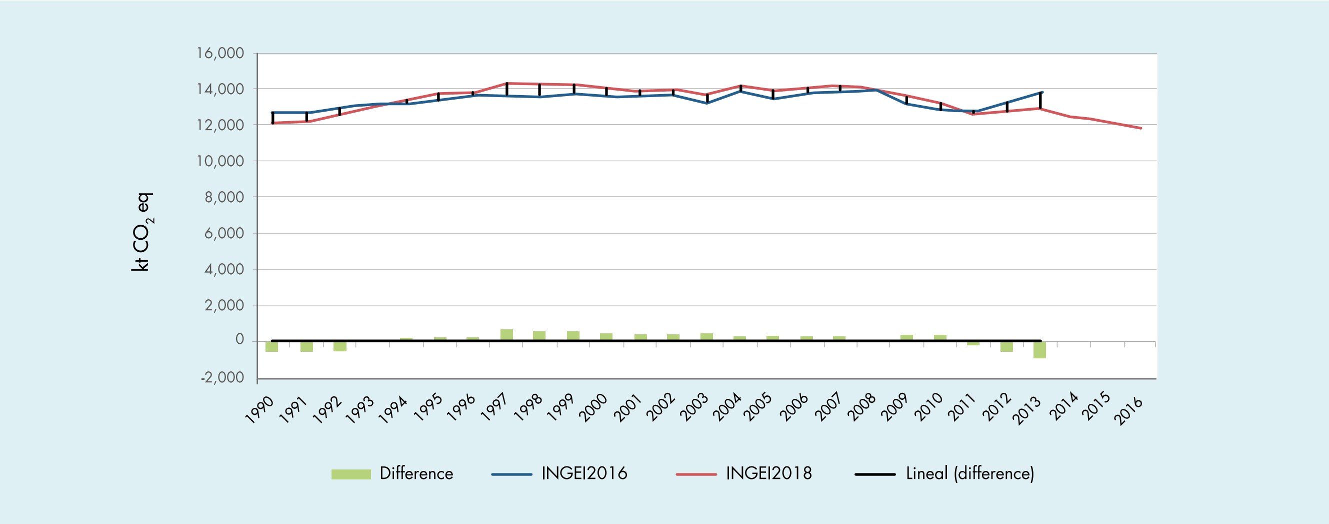


Source: Coordinating Technical Team of the MMA

8.4. Recalculations in the Agriculture sector

GHG emissions of the Agriculture sector (Figure 27) presented an average increase in the INGEI2018 of 126.0 kt CO_2 eq compared to the INGEI2016, thus generating a 6.9 % decrease for 2013, the last comparable year. The difference in the series is attributed to three situations: improvements in the management of activity data and emission factors; inclusion of new emission sources; and the change in the GWP of CH_4. Particularly, an improvement in the disaggregation of cattle population, evidencing a decrease of the whole population, particularly of dairy cows. In addition, new country-specific emission factors were developed for cattle, both for enteric fermentation and CH_4 emissions for manure management, moving from fixed factors to dynamic factors (i.e. regional and annually change throughout the entire time series); emission factors for CH_4 also improved in the management of swine manure, with a slight decrease with respect to the factors used in the INGEI2016 series. In addition, new species of livestock were added (warthog, deer and emus) and new components to the calculation of emissions that are related to organic soils (histosols). Regarding the GWP, given the increase in the potential of CH_4, the main GHG emitted by this sector, the decrease due to changes in the population and new factors is not apparent, which would explain the slight average rise of the series.

Figure 27. Recalculation: comparison of GHG balances of the Agriculture sector (kt CO_2 eq) INGEI2018 (1990-2016 series) and INGEI2016 (1990-2013 series)



Source: Coordinating Technical Team of the MMA

8.5. Recalculations in the LULUCF sector

The balance of GHG emissions from the LULUCF sector (Figure 28) in the INGEI2018 presents an average increase between 1990 and 2013 in the absorption of 19,085.6 kt CO_2 eq in comparison to the INGEI2016, which led to a favorable increase in the absorption of 44.6 % for 2013, the last comparable year. The difference in the series is attributed to the fact that the sector made a number of improvements in the management of activity data, new carbon sinks were included and new country-specific emission factors were developed.

More specifically, changes with the greatest effect are: the incorporation of parks and reserves as forests under management; the redefinition of the equilibrium status of second-growth forest, which changed from 50 cm to 60 cm of mean quadratic diameter[14]; the redefinition of the permanence period of forests with management plans, which is extended to perpetuity; reconstruction of the time series of the forest species *Eucalyptus nitens*; the incorporation of fuelwood consumption of exotic species; the incorporation of the carbon reservoir in the soil and litter, according to the *IPCC Guidelines of 2006*; more detailed information for wildfires; and parametric data on growth by forest type with greater accuracy. This causes an increase in net removals of the sector ranging from 30,000 to 40,000 kt CO_2 annual average for the entire series.

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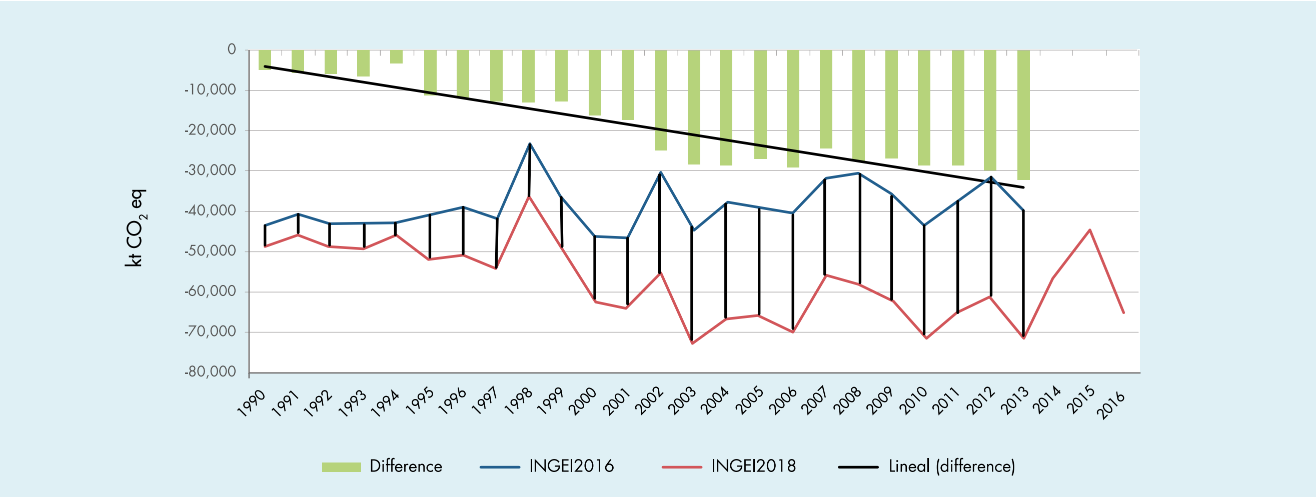
[14] *This was analyzed by a group of experts of the sector and it was demonstrated with data from the National Forest Inventory prepared by INFOR that the growth of these forests extends up to 60 cm of mean quadratic diameter.*

Figure 28. Recalculation: comparison of GHG emissions balance of the LULUCF sector (kt CO_2 eq) INGEI2018 (1990-2016 series) and INGEI2016 (1990-2013 series)

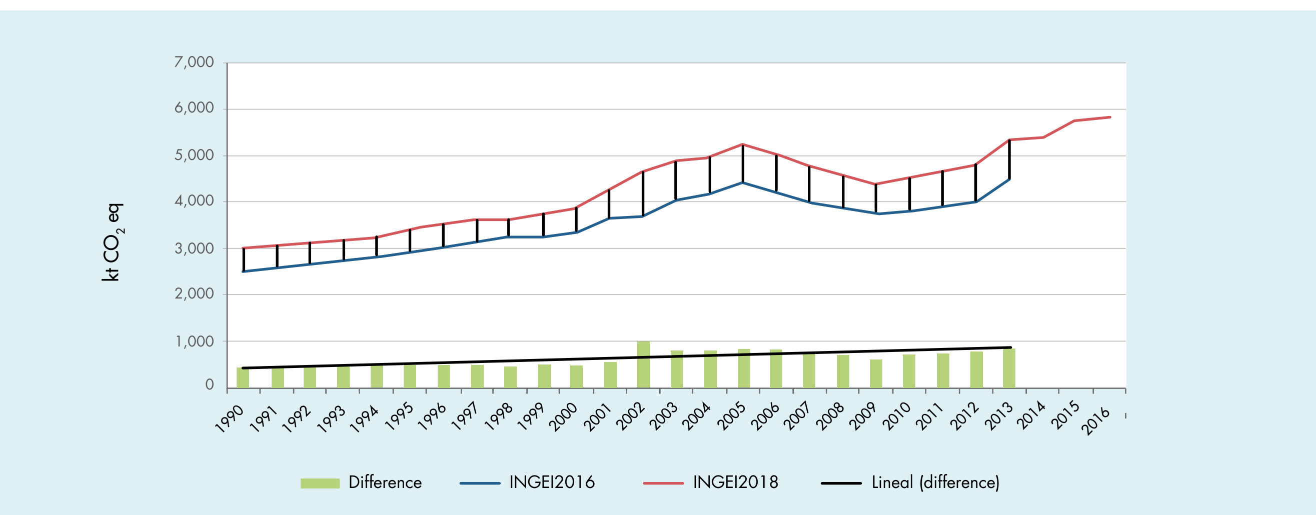


Source: Coordinating Technical Team of the MMA

8.6. Recalculations in the Waste sector

GHG emissions in INGEI2018 for the Waste sector (Figure 29), presented an average increase of 623.7 kt CO_2 eq per year compared to the INGEI2016. This represents for 2013, which is the last comparable year, an increase of 15.8 %. The difference in the series is mainly attributed to the increase in the value of the GWP of CH_4. In addition, there is a variation in emissions due to the data handling of the *Domestic wastewater treatment and disposal* subcategory, specifically associated to an improvement of the parameter that refers to the degree of use of water treatment systems for each income group and additionally, changes in the source of information to obtain data on CH_4 recovery from wastewater treatment plants.

Figure 29. Recalculation: comparison of GHG emissions of the Waste sector (kt CO_2 eq) INGEI2018 (1990-2016 series) and INGEI2016 (1990-2013 series)



Source: Coordinating Technical Team of the MMA

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Mirador Wulaia hacia canal Beagle, Felipe Gera Malgor - Imagen de Chile

III.
GREENHOUSE GAS MITIGATION POLICIES AND ACTIONS

1. INTRODUCTION

The increase in global temperature observed strongly correlates to increased concentrations of greenhouse gases in the atmosphere, therefore, reducing emissions of this type of gases or increase their capture becomes critical to deal with this problem. Within the context of climate change, mitigation is understood as a human intervention to reduce the sources or enhance sinks of greenhouse gases (IPCC WG3, 2014).

According to the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), an effective mitigation will not be achieved if the different agents prioritize their own interests independently. Climate change has the characteristics of a collective action problem at a global scale, since most of the greenhouse gas (GHG) emissions accumulate over time and combine globally, and emissions generated by any agent (e.g., individuals, communities, companies or countries) affect the other agents. Therefore, there is a need for international cooperation to effectively mitigate GHG emissions and address other issues of climate change (IPCC WG3, 2014).

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The importance of mitigation within the context of climate change lies not only in the net reduction of GHG emissions to the atmosphere, but also in the benefits that mitigation actions involve, often contributing directly to improvements in production processes, better planning, energy savings among others. Highlighting such benefits is key for the design of new policies to enable developing countries to increase their level of ambition with a vision of meeting the temperature objectives agreed under the Paris Agreement.

This chapter provides information on policies and mitigation actions developed in Chile explaining how these have been developed from the various sectorial contexts, and analyzes the new challenges found. This chapter is built on the basis of information collected with the different sectors that contribute to mitigation in Chile either through projects, actions or policies and generally reflects how this area has developed in the country.

2. INTERNATIONAL CONTEXT: THE PARIS AGREEMENT

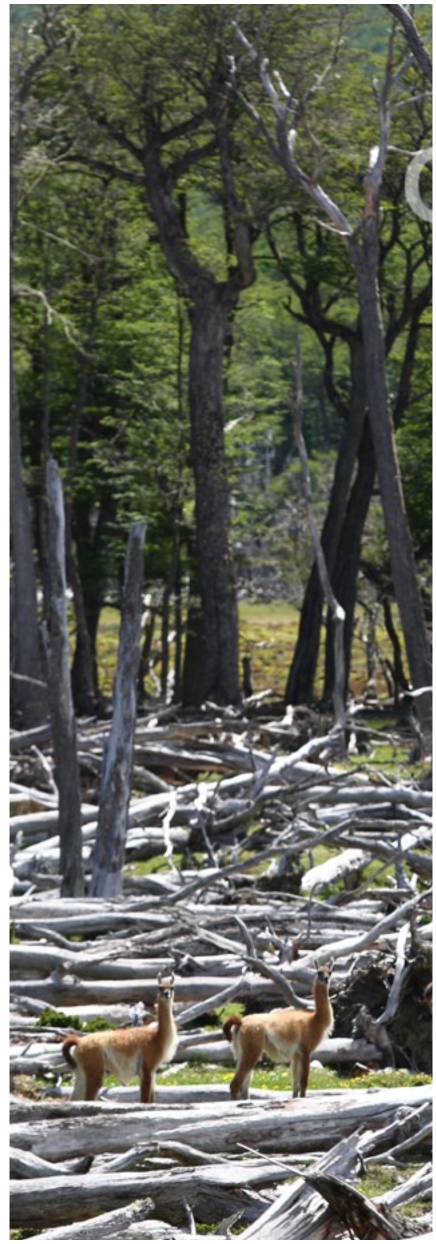
In 2011 the Parties to the UNFCCC launched the Durban Platform for Enhanced Action (ADP)[1], an instance to increase the ambition of global response to climate change and which purpose was to define a new protocol or other legal instrument to be applied to all Parties, allowing the achievement of the ultimate objective of the UNFCCC and the global goal of limiting the increase in average temperature of the planet to no more than 2 °C, the goal defined at 15th Session of the Conference of the Parties (COP15) in Copenhagen in 2009[2].

The ADP represented a fundamental change with respect to the previous framework defined by the UNFCCC and Kyoto Protocol: now not only developed countries would have legal duties to reduce their GHG emissions, but all Parties would be summoned to contribute and would have legal duties to reduce their emissions. The new binding instrument to limit global GHG emissions was adopted at the 21st Session of the Conference of the Parties (COP21) in December 2015, known as the Paris Agreement.

The Paris Agreement, ratified by Chile in February 2017, involves all parties for the first time in the common cause of fighting climate change and adapting to its effects. Its main objective is to strengthen the global response to the climate change threat, for which it proposes a limit of global temperature increase of less than 2°C toward the end of the century (compared to pre-industrial levels) and increase the effort to keep it even below 1.5°C. Regarding mitigation, it summons all the Parties to address their best efforts in their corresponding national contributions, and it establishes that countries must report regularly their emissions and their efforts to implement measures, and every five years it is expected that they communicate new mitigation goals, which in every opportunity must represent a progress in relation to the earlier commitment.

After the Agreement took effect and in view to its implementation starting in 2020, work has been made in different priorities during the negotiating sessions of the Convention:

- definition and adoption of rules for the application and follow-up of the Paris Agreement commitments;
- implementation by each country and with international support in the case of developing countries, of public policies that allows to achieve the commitments adopted in each national contribution;
- start-up of the pre-2020 commitments that would strengthen the ambition and prepare for fulfillment of the commitments undertaken, particularly after a first global balance in 2018, on the basis of the scientific reports, particularly on the limit of +1.5°C[3].



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[1] United Nations, "News of the Ad Hoc Working Group on the Durban Platform for Enhanced Action". Retrieved from http://unfccc.int/portal_espanol/newsletter/items/6753.php.
[2] UNFCCC "Copenhagen Climate Change Conference", December 2009. Retrieved from http://unfccc.int/meetings/copenhagen_dec_2009/meeting/6295.php.
[3] https://www.diplomatie.gouv.fr/es/asuntos-globales/cambio-climatico/eventos/article/acuerdo-de-paris-compendio-sobre-el-proceso-de-ratificacion

3. CHILE FACED TO MITIGATION

The UNFCCC, entered in force since March 1994, is the international framework within which it is intended to stabilize GHG emissions to avoid negative and unmanageable consequences in the climate system. One of the guiding principles of this Convention is "common but differentiated responsibilities and respective capabilities", in other words, the need for all parties to address the problem but differentiating the efforts to leave in the hands of developed countries the greatest responsibility to reduce emissions, in addition to support developing and least-developed countries to grow in a sustainable way. All the Parties should report their efforts to implement the Convention through a National Communication.

In 2002, Chile ratified the Kyoto Protocol, which entered in force only in 2005. This instrument establishes that the countries listed in Annex I of the UNFCCC must comply with a reduction percentage with respect to 1990. As Chile belongs to the group of developing countries Non-Annex I, has no binding commitments to reduce emissions under this Protocol, but it can participate in the flexible mechanisms that set the Clean Development Mechanism (CDM) particularly.

Within the international context, Chile is not a GHG relevant emitter. Its contribution to the total global emissions is approximately 0.25% as of 2015. The global average of CO_2 emissions is 4.4 tonnes per person (tCO_2/pp) for that same year and according to estimates by the National Greenhouse Gas Inventory, Chile exceeds by very little that figure with 4.7 tCO_2/pp, and is far below the average of OECD countries, which is 9.2 tCO_2/pp (IEA, 2015).

The OECD in its environmental assessment of Chile in 2016[4], points out that given the growth of GHG emissions in the country in recent years, it is expected that these will continue to increase. For this reason, it indicates that in order to fulfill its commitment of reducing by 30% the intensity of its emissions to 2030 (see 3.2), it is crucial that the policies of all emitting sectors are aligned with mitigation. Consequently, it proposed to strengthen and formalize the institutional framework on climate change policy, adopt and implement a set of national climate change policies, and implement a monitoring and evaluation framework for adaptation and mitigation policies.

In relation to the last BUR of 2016, significant progress in mitigation policies have been made given the greater sectorial involvement. This has allowed the development of new public policies aimed at supporting the reduction of GHG emissions. In addition, the growing involvement of the private sector will enable the implementation of concrete actions that will lead the country to comply with their commitments and increase their ambition. The announcement of the preparation of a law of climate change and the development of a strategy to 2050, undertake the creation of new management tools that allow the country to take a sustainable and low in emissions path, an effort that will be in line with the international objectives signed in the Paris Agreement.

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[4] *http://www.oecd.org/chile/oecd-environmental-performance-reviews-chile-2016-9789264252615-en.htm*

3.1. Chile´s Voluntary Pledge 20/20 for GHG emission mitigation

With the purpose of achieving a new agreement on long-term cooperation between the Parties, in 2009, The Conference of the Parties of the UNFCCC COP15 took place in Copenhagen. At that instance, the minister president of Chile's National Environmental Commission (CONAMA), an institution that preceded the Ministry of Environment, said that Chile was willing to contribute to the global mitigation efforts through a significant deviation from the baseline (projected since 2007) by up to 20 % to 2020, significantly funded with national resources.

During the first half of 2010, the CONAMA led an inter-ministerial work through the Inter-Ministerial Technical Committee on Climate Change to agree on the information that the country should deliver to the United Nations for its inclusion in Appendix II of the Copenhagen Accord. The same year, the President of the Republic, Sebastián Piñera, in his speech to the nation on May 21st, stated: "In the field of greenhouse gas emissions, global warming and biodiversity, Chile has undertaken and will comply with a reduction of 20 % to 2020".

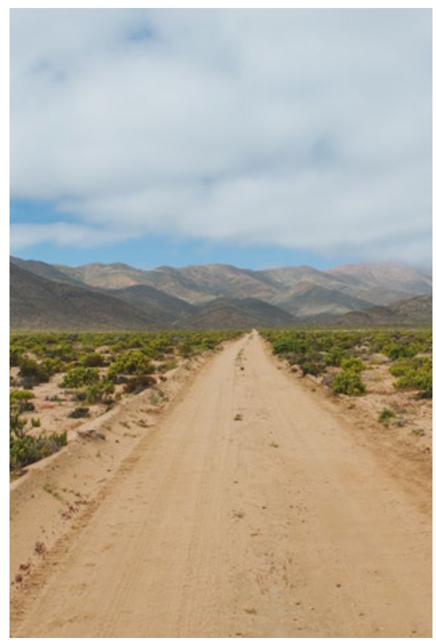
The Inter-Ministerial Technical Committee on Climate Change and the Inter-Ministerial Committee on Climate Change adopted Chile' statement at meetings held on July 27 and August 13, 2010. The voluntary pledge was officially reported to the UNFCCC Secretariat through Chile's national focal point, represented by the Ministry of Foreign Affairs, on August 23, 2010[5].

The voluntary pledge argues that "Chile will take nationally appropriate mitigation actions to achieve a 20 % deviation below the *business as usual* emissions growth trajectory by 2020, as projected from year 2007", and that "in order to achieve this goal, Chile will require a relevant level of international support." In addition, it was said that "energy efficiency measures, renewable energy and measures in land use, land-use change and forestry will be the main focus of Chile's nationally appropriate mitigation actions."

The voluntary pledge 2020 has led to the development of various mitigation activities in the country, such as the Nationally Appropriate Mitigation Actions (NAMAs), which main objective is to reduce GHG emissions. In addition, it has served to identify sectorial actions that, despite not being focused on the reduction of GHG emissions, have also meant a contribution to the decarbonizing of Chile.

Aided by the MAPS-Chile[6] project, in its first phase (2012), an initial "Business as usual" (or BAU) baseline was developed to be able to understand and analyze in a better manner the mitigation policies and options in the country with a view to meet the committed at COP15. This projection is used as information on the basis of the 1990-2007 emission series of the NGHGI developed in 2011, presented to the Second National Communication, and the expectations of economic growth defined in 2012 toward 2020.

In order to compare the MAPS vision with the new and better information raised by the subsequent processes of the inventory update, a simplified version of the model was capable of collecting these changes. This version keeps the expectations of economic development defined in phase 1 MAPS, but it uses as the basis of emissions information the series 1990-2007 of the last Chile's NGHGI available. With this simplified version, the baseline and the reduction commitment were recalculated on the basis of the new NGHGI update included in this report (INGEI2018), which finally generates a 2007-2020 revised BAU that is comparable with the GHG emissions balance in the country.



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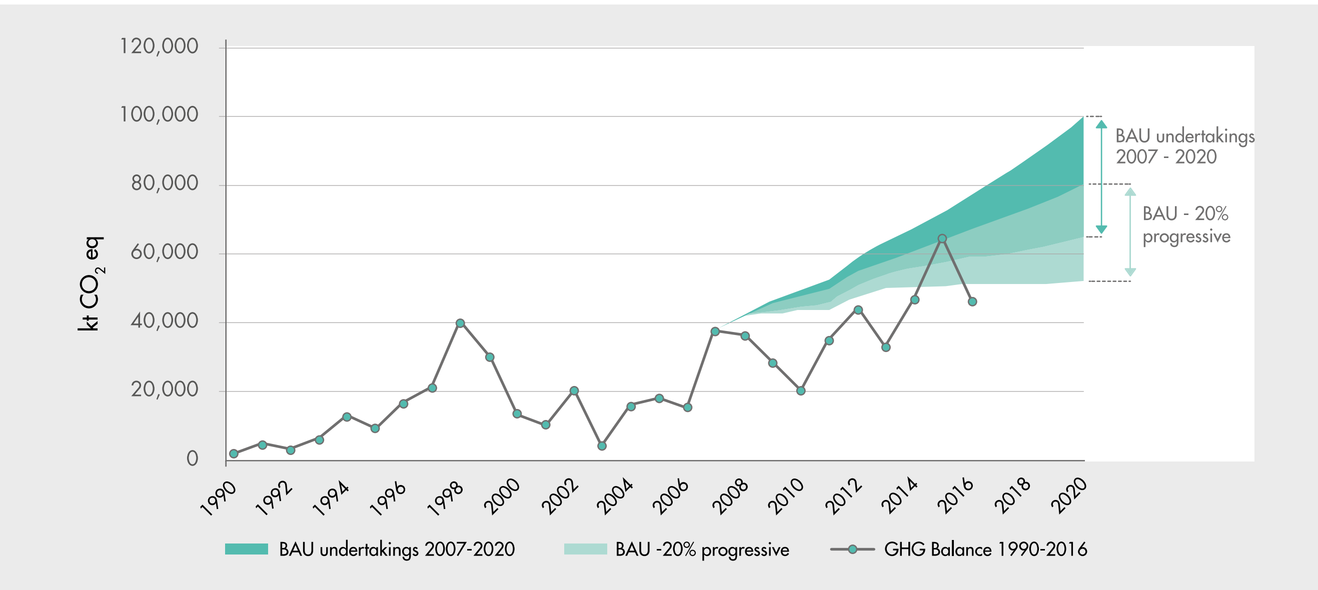
[5] *"Letter from the Undersecretary of Foreign Affairs to Christiana Figueres, Executive Secretary of the UNFCCC", August 23, 2010. Retrievedfrom http://unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/chilecphaccord_app2.pdf.*
[6] *MAPS Chile is a government project that delivered through a process of research and multi-actor participation evidence, projections, and options for reducing greenhouse gas emissions in Chile http://www.mapschile.cl*

By comparing the data of this inventory (INGEI 1990-2016) and the revised baseline (BAU 2007-2020) presented in Figure 1, a change has been noted in the trend of the GHG balance (downward). This change is due to several factors, including the greater energy efficiency and mitigation measures in different sectors. However, the main cause of this break in the trend is the economic growth that declined compared to the expected in the first phase of MAPS. The years 2012 and 2015 are closer to levels in the range of BAU 2007-2020 due to the emissions from forest fires those years. As a result of this, it is believed that for 2017, the year in which there were important forest fires, emissions will skyrocket reaching ranges even over those of the BAU.

When comparing the balance with the BAU deviation projection by 20 % (BAU -20 % progressive), it is noted that the country's emissions would be below the area of compliance, except for 2015. Due to the fact that the GHG balance of that year is particularly affected by the emissions associated to the forest fires, a similar situation is expected for 2017 (MMA - E2Biz, 2017).

Figure 1. GHG Balance 1990-2016 compared to BAU 2007-2020 revised, and 20 % progressive deviation respect to the BAU



Source: Own preparation based on the revised 1990-2016 NGHGI and BAU (MMA - E2Biz, 2017)

3.2. Chile's Nationally Determined Contribution (NDC)

The National Contribution or NDC (Nationally Determined Contribution) as mentioned above, is a commitment by the countries to the UNFCCC within the framework of the Paris Agreement, which describes their contribution to meet the objectives of the Agreement.

Chile introduced its NDC in September 2015, which is divided into 5 pillars: (i) Mitigation, (ii) Adaptation, iii) Capacity building and strengthening, (iv) Technology development and transfer, and (v) Financing.

The mitigation pillar considers a quantified reduction commitment of the indicator "intensity of GHG emissions" to 2030. This reduction is based on the sectorial analysis and mitigation scenarios developed in the framework of the project MAPS-Chile (Phase 2); on the results of the National Greenhouse Gas Inventory (1990-2010); on additional information provided by the Ministries of Environment, Energy, Finance and Agriculture, and on the comments received from the public consultation process of the Intended National Contribution (MMA, 2015a).

Methodologically, the LULUCF sector was separated from the national mitigation commitment due to the high annual variability of captures and emissions, and for being less dependent on the economic growth path.

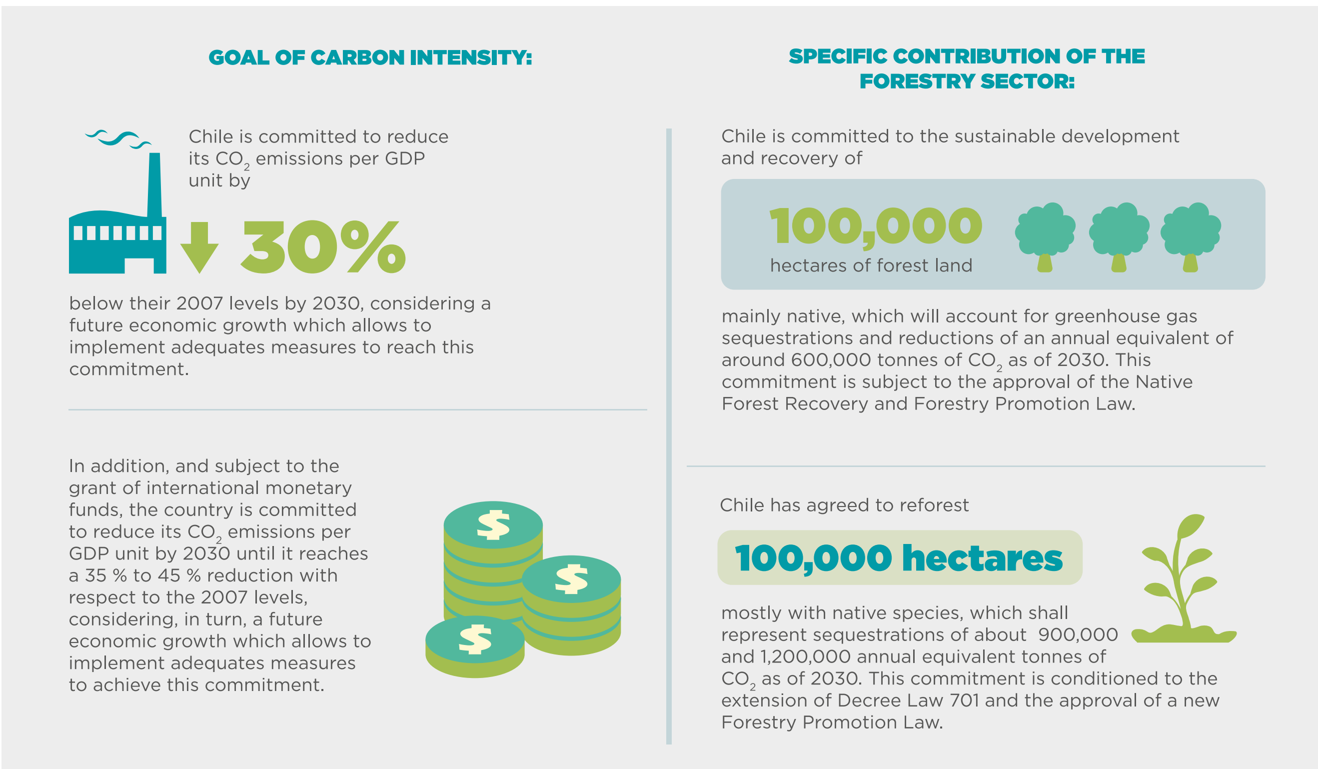
In this sense, two types of targets were identified:

- A carbon intensity target, expressed in GHG emissions per unit of GDP (tonnes of CO_2 equivalent per unit of GDP in millions of CLP, 2011), which includes all sectors quantified in the National Greenhouse Gas Inventory (1990-2010), except the LULUCF sector.

- A target expressed in tonnes of CO_2 equivalent of the LULUCF sector.

It should be noted that the gases considered in the carbon intensity target, without including the LULUCF sector, correspond to those of the National Inventory of Greenhouse Gases (1990-2010), that is, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCS), perfluorocarbons(PFCS).

Table 1. Chile's Nationally Determined Contribution in terms of Mitigation



Source: Chile's Intended National Contribution (MMA, 2015a)

During 2017 the MMA coordinated a Working Group of the Public Sector focused on discussing the NDC (WGPS-NDC) updating in 2020, as required in the Paris Agreement. The ultimate purpose of this group was to develop a shared diagnosis on what elements should be updated, along with identifying possible institutional arrangements contributing to manage the NDC and also, to propose guidelines and next steps to make progress in the matter.

This group met on six opportunities, and from the process developed, a series of elements were identified that should be considered in the update process, and that are keys to properly manage the country's climate commitments. Faced these elements, the coordinating team of the MMA has analyzed the main themes or key points that require priority treatment, in order to implement measures to comprehensively address the NDC in its next update.

In the light of the exercise carried out by the WGPS-NDC, a number of challenges that are keys to the formulation and implementation of the next NDC were identified. Among these challenges are the following:

- The definition of governance for climate change, in which the whole society and its actors - the State, civil society, the private sector- are included and converged towards a common, long-term goal. This will allow giving a response to the impacts - economic, social, environmental and human - generated by climate change; and it will ensure that climatic actions generate tangible benefits to move towards a low-carbon development and resilient to climate.

- Having a long-term vision of climate change. This allows guiding the definition of the goal and peak emissions, as well as the actions and instruments for its compliance. In addition, it will provide guidelines to the sectors and a time horizon to the financial strategies, creation and strengthening of capacities, and technology and development transfer. This will make it easier to project them in the long term, achieving order and integration with greater coherence to climate policy in Chile.

- The need to review and reconsider the design of the NDC which should include at least the following points: vision of climate policy, its role, content and structure, sectorial responsibilities, among others.

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In order to face these challenges, the WGPS-NDC developed a non-official document with a series of guidelines and concrete steps, neither prescriptive nor binding, to be considered by decision-makers and the authorities to whom will concern the NDC's update in 2020 (as established in the Paris Agreement). This will give continuity to the climate actions from the Authority, in compliance with the commitments of the country.

3.3. International projects of mitigation support in Chile

3.3.1. Low Emission Capacity Building Project (LECB-Chile)

The project of Low Emission Capacity Building (LECB-Chile) was implemented in Chile between 2012 and 2017, and it has been a part of an initiative led by the United Nations Development Program (UNDP) in 25 countries. The project, funded by the governments of Germany and Australia, and by the European Commission, sought to encourage and create public and private capacities for the measurement and mitigation of GHG emissions through appropriate actions for the country, within a trend toward its development with low carbon emissions, and improving public policies dealing with climate change.

From the achievements of this project in the country, the institutionalization of the update process of the national NGHGI; the implementation of HuellaChile Program, and the Climate Public Expenditure Review (CPER) are highlighted, among other. Furthermore, through the LECB project other relevant initiatives in the field of mitigation and MRV have been boosted.

3.3.2. NDC Support Program Project

In 2017, and on the basis of what was constructed with the LECB program, UNDP formally launched the global project to support the implementation of the NDC (NDC Support Program) with the support of the governments of Germany, Spain and the European Union. With this project it is expected to contribute to governments to achieve transformation changes using the implementation of National Determined Contributions (NDC), as a mechanism to expand investment in climate change and support sustainable development, included in the Paris Agreement, and the Sustainable Development Goals (SDG). The new initiative, which works in coordination with NDC Partnership program, shall make a progress in the implementation of the Paris Agreement within the context of the 2030 Agenda, and ten countries (including Chile) will make a progress in the integration of measures on gender approach in the planning and implementation of the NDC.

In Chile, the implementation of the NDC Support Program materializes through the continuity of the Low Emission Capacity Building-Chile (LECB-Chile) project, implemented by the Ministry of Environment, under which it is expected to move forward in the following areas:

- Evaluation of Chile's commitments and strengthening governance for the fulfillment of the NDC.
- Development of sectorial mitigation scenarios linked to the NDC for the planning of public policy.
- Strategy to increase the participation of the private sector in the implementation of actions by incorporating a gender approach.
- Implementation of an awareness strategy on climate change considering the gender approach.

3.3.3. Capacity Building Initiative for Transparency (CBIT) Project

Paragraph 84 of decision 1/CP.21 of the Conference of the Parties where the Paris Agreement[7] was adopted, it was decided to establish a "Capacity-building initiative for transparency in order to improve the institutional and technical capacity, both before and after 2020", that "will help the Parties that are developing countries, upon request, in meeting enhanced transparency requirements as defined in Article 13 of the Agreement in a timely manner".

As set out in paragraph 85 of the decision, the Capacity Building Initiative for Transparency (CBIT) aims to:

a) Strengthen national institutions for activities related to transparency, according to national priorities;

b) Provide tools, training and assistance for the implementation of the provisions of article 13 of the Agreement;

c) Help improving transparency through time;

This translates into a fund in charge of the Global Environmental Facility (GEF) aimed to meet the objectives defined in the decision. Chile applied to this fund through the project: "Strengthening Chile's Nationally Determined Contribution (NDC) Transparency Framework" in the amount of USD 1,232,000; which main objective is to **strengthen national capacities for a transparent follow-up system to Chile's NDC.**

The components and expected results of the project are shown in Table 1. It is expected that with this initiative capabilities are created, and the mechanisms needed to have a robust follow-up system to the NDC is designed, in addition to supporting the inputs for the development of a long-term climate strategy in the country.

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[7] *https://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf*

Table 1. Components and expected results of the CBIT-Chile project

Component	Outcomes	Project Outputs
1: Strengthen the existing framework of transparency in Chile for mitigation and adaptation actions	1.1. The analysis of climate data is integrated in the preparation of policies and international reports	1.1.1 Centralized platform of Climate Information 1.1.2 Training for data users and suppliers 1.1.3 Guidelines to ensure consistency and comparability of GHG emissions among sectors 1.1.4 Training to decision-makers in the use of the information available
	1.2. Chile's NDC is followed-up and evaluated	1.2.1 Establishment of a monitoring and evaluation system of Chile's NDC implementation 1.2.2 Development of metrics, indicators and methodologies for monitoring Adaptation actions
2: Institutionalization of the Climate public expenditure report	2.Public Institutions are able to report their climate expenditure and support received	2.1.1 Training Plan for public institutions on the report of climate finance 2.1.2 Improvement of the climate expenditure Form 2.1.3 Publication of a guide to report climate public expenditure

3.3.4. Supporting National Action and Planning on Short-Lived Climate Pollutants (SNAP)

Chile, through the Ministry of Environment is a part of the Climate & Clean Air Coalition (CCAC) since 2013. The CCAC is a global coalition which unites countries, governmental and non-governmental organizations, with the aim of joining efforts to move forward in an integrated view on the benefits of mitigating local climate pollutants, called short-lived climate pollutants (SLCPs); and internationally comply with the climate change challenge. In 2018, the members of the CCAC were close to 54 countries, 18 intergovernmental agencies and 60 non-governmental organizations[8].

In terms of coordination in 2017, the United Nations and the Ministry of Environment signed a Memorandum of Understanding for Cooperation[9], a document that includes, among other subjects "moving forward in policy actions for the mitigation of short-lived climate pollutants".

Chile's NDC, in its number 2.6 has a mitigation section of short-lived pollutants. It should be noted that currently at international level over 30 countries include in their NDCs some commitment to mitigate such pollutants. In this regard, Chile leads together with Norway the initiative of the CCAC called "Pathway Approach', which is the body to share on the mitigation path with local and global approaches, the experience on policies and regulations, learning, needs, assessment and updating of Chile's NDC to jointly reduce GHG and SLCPs.

In such a context, the project SNAP *Supporting National Action and Planning on Short Lived Climate Pollutants (SLCPs)* was implemented, which contributed to Chile with a total of USD 184 thousand, budget managed by UN-Environment. The objectives of the project include: 1) assess the nationally determined contribution (NDC) of the Paris Agreement (number 2.6) using LEAP-IBC; 2) to propose a new NDC for black carbon at the end of 2019, and 3) to have a National Plan of SLCP's mitigation at the end of 2020. The period of implementation of the project is from 2016 to 2020.

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[8] http://www.ccacoalition.org/en/partners.
[9] Acknowledgment by the Comptroller on December 14, 2017.

4. ACTIONS AND POLICIES ASSOCIATED TO MITIGATION IN CHILE

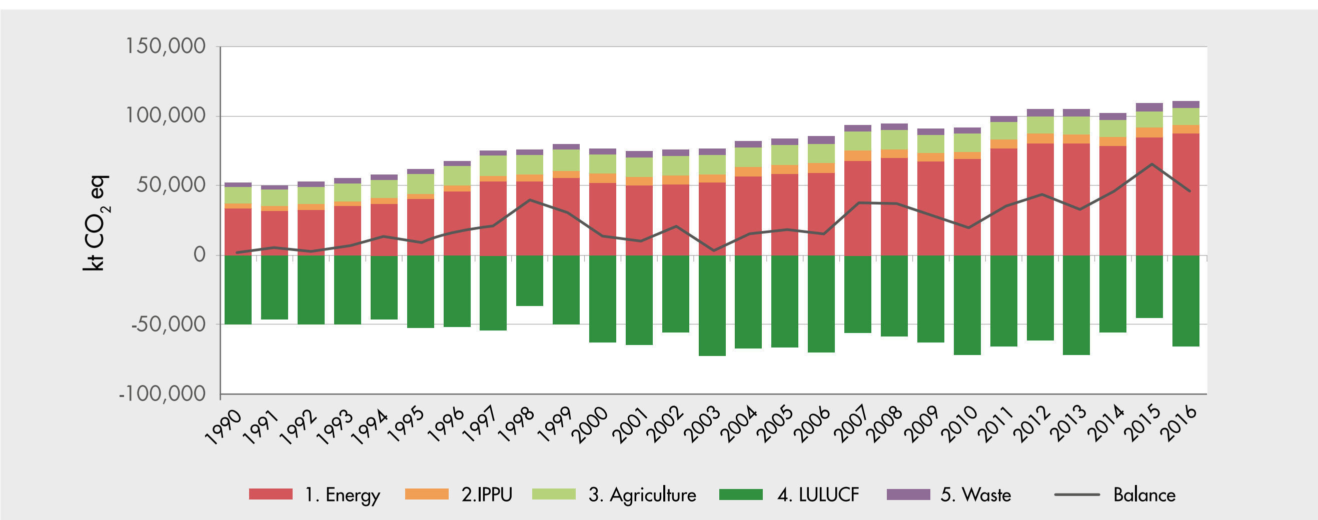
According to the National Greenhouse Gas Inventory of Chile (NGHGI) (see chapter 2), in 2016, the balance of GHG emissions and removals[10] from Chile accounted for 46,185.2 kt CO_2 eq, while total GHG emissions[11] in the country accounted for 111,677.5 kt CO_2 eq, increasing by 114.7 % from 1990 and 7.1 % since 2013 (Table 2). The main causes of the trend are the CO_2 emissions generated by the burning of fossil fuels (accounted for in the *Energy sector*) and removals of CO_2 of forest lands (accounted for in the *LULUCF sector*). The values observed that are out from the trend in the balance (Figure 2) are mainly consequences of forest fires, accounted for in the *LULUCF sector.*

Table 2. Chile's NGHGI: GHG emissions and removals (kt CO_2 eq) by sector, 1990-2016 series

Sector	1990	2000	2010	2013	2014	2015	2016
1. Energy	33,679.7	52,511.9	68,623.5	79,993.7	77,417.0	83,713.4	87,135.6
2. IPPU	3,295.4	6,243.6	5,492.5	6,144.0	6,233.9	6,584.8	6,939.3
3. Agriculture	12,071.4	14,008.7	13,244.1	12,848.4	12,419.1	12,210.6	11,801.6
4. LULUCF	- 50,061.0	- 62,676.4	- 71,930.9	- 71,887.5	- 55,722.4	- 44,972.4	- 65,492.3
5. Waste	2,969.3	3,822.4	4,502.2	5,318.4	5,403.9	5,734.5	5,801.1
Balance	**1,955.0**	**13,910.3**	**19,931.4**	**32,416.9**	**45,751.5**	**63,270.9**	**46,185.2**
Total	**52,015.9**	**76,586.7**	**91,862.3**	**104,304.3**	**101,473.9**	**108,243.3**	**111,677.5**

Source: Technical Coordination Team of the MMA

Figure 2. Chile's NGHGI: GHG emissions and removals (kt CO_2 eq) by sector, series 1990-2016

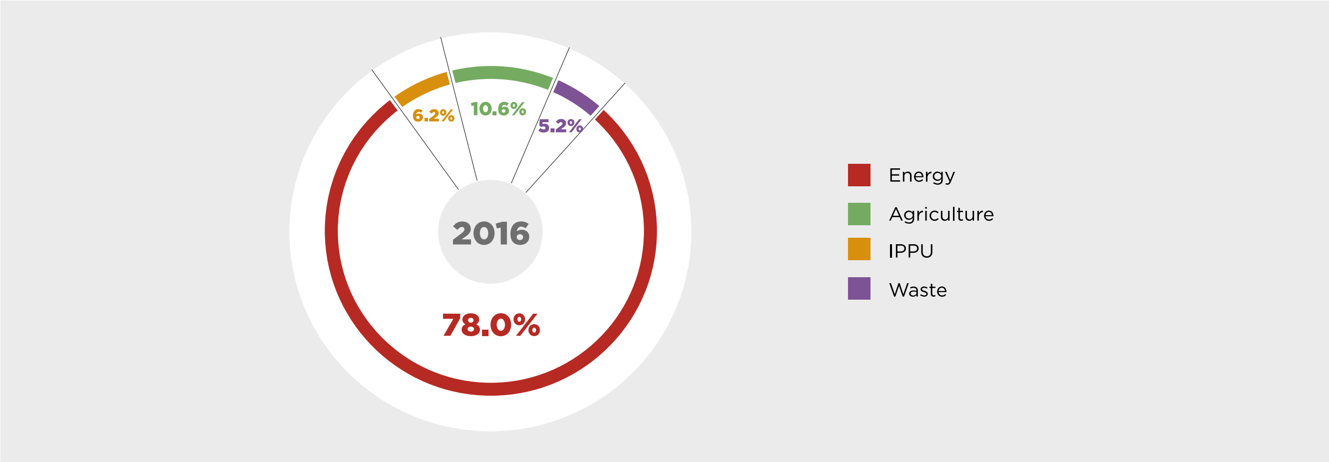


Source: Technical Coordination Team of the MMA.

[10] *The term "balance of GHG" refers to the addition of GHG emissions and removals expressed in carbon dioxide equivalent (CO_2 eq). This term includes the LULUCF sector as a whole.*
[11] *In the present report, the term "total GHG emissions" refers only to the addition of the national GHG emissions expressed in carbon dioxide equivalent (CO_2 eq). This term excludes the emission sources and absorption sumps of the LULUCF sector.*

At a sectorial level (Figure 3), The Energy sector accounted for 78.0% of the total GHG emissions, followed by the Agriculture sector (10.6 %), IPPU sector (6.2 %), and finally the Waste sector (5.2 %).

Figure 3. Distribution of Chile´s total GHG emissions by sector



Source: Technical Coordination Team of the MMA

The information presented in the inventory delivers the context and the basis to understand the relevance of sectorial mitigation actions, given that proceeds steps by step in the implementation of these actions could be reflected in the GHG emissions trend in the country.

4.1. Mitigation in the National Action Plan on Climate Change

On 19 June 2017, the Council of Ministers for Sustainability adopted the new National Action Plan on Climate Change 2017-2022 (PANCC 2017-2022), a public policy instrument that integrates and guides the actions to be taken with regard to climate change in the country. The PANCC 2017-2022 is structured in 4 main lines of action: 1) adaptation to climate change, 2) mitigation of GHG emissions, 3) means of implementation, and 4) management of climate change at regional and district levels, in order to comply with 16 specific objectives that translate in 20 lines of action and a total of 96 measures.

The preparation of the new National Plan is the fruit of the collaboration of over 20 public institutions[12], between ministries and services with competences in the field of climate change, and it was coordinated by the Climate Change Office of the Ministry of Environment. The design stage started in 2014, considering for its purpose the lessons learnt from implementation of the National Action Plan on Climate Change 2008-2012 (PANCC 2008-2012), the progress and future challenges the country must face, as well as the initiatives in development, the institutional and also financing aspects.

It was developed with a sustained inter-sectorial work, with inputs resulting from consultancies and visions of the representatives of ministries, academia, the private sector and citizens, at a central, regional and municipal levels. In addition, in 2015 a process of early citizen participation took place, through workshops in four cities of the country, extended surveys and interviews with key actors. Also, a public consultation was carried out between April and August 2016, where around 1200 observations were collected and analyzed by the corresponding ministries and services, from the point of view of its relevance and chance to be incorporated in the final draft of the National Plan.

[12] Ministry of Finance, Ministry of Foreign Affairs, Ministry of National Defense, Ministry of Social Development, Ministry of Agriculture, Ministry of Economy, Ministry of Education, Ministry of Energy, Ministry of Health, Ministry of Housing and Urban Development, Ministry of Public Works, Ministry of Transportation and Telecommunications, Ministry of Mining, National Office of Emergencies and Secretary of Regional Development of the Ministry of the Interior and Public Security, Undersecretary for Fisheries and the Production Development Corporation of the Ministry of Economy, Oceanographic and Hydrographic Service of the Chilean Navy and Chile´s Meteorological Directorate of the Ministry of National Defense, General Water Directorate of the Ministry of Public Works, National Commission for Scientific and Technological Research of the Ministry of Education, Commission Chilean Copper Mining Ministry, Agency of Sustainability and Climate Change.

As an instrument articulating the national policy on climate change, the PANCC 2017-2022 integrates the actions to be carried out by the various public institutions with jurisdiction on these matters in the next 5 years. In addition, the new National Plan emphasizes, for the first time, the implementation of measures at a local level, looking for the generation of capacities and institutional strengthening on climate change at a level of subnational governments and the concrete implementation of adaptation and mitigation measures.

As a part of the international agenda, the PANCC 2017-2022 also aims at the coordination of actions that allow Chile to move forward in fulfilling its commitments to the Paris Agreement, with preparatory actions for the implementation of the contribution, in view of 2030 and the intermediate milestones defined in the Agreement. The actions of the new Plan will also serve to meet the objectives of the Sustainable Development Goals (SDGs) related to climate change (objective 13) and with the recommendations made by the OECD to the Government of Chile in its assessment of 2016 with regard to climate change.

Acknowledging the crosswise nature of climate change, PANCC 2017-2022 includes measures to permeate and include the theme in other public policies aimed to planning and development. In turn, the gender and transparency focus are important seals that arise in a variety of ways throughout the Plan.

Given the nature of the new National Plan and its role in the preparation for the fulfilment of Chile's reduction commitments, different sectors have undertaken measures aimed directly or indirectly emissions reduction, or the gathering of information for policies design. An example of this is the work developed by the Ministry of Energy in the preparation of the Greenhouse Gas Mitigation Plan for the Energy Sector[13], established in line with the vision and goals of the National Energy Policy (PEN) to 2050, as well as with the PANCC 2017-2022.

Also, and in response to one of the commitments set out in the new National Plan, in 2017 the Ministry of Public Works jointly with the Ministry of Environment, developed the Plan for Adaptation and Mitigation of Infrastructure Services to Climate Change 2017- 2022[14], an initiative that seeks to adapt the infrastructure services to the impacts of climate change, within a resilience and sustainability framework, in addition to contributing to the mitigation of GHG emissions in the different phases in the life cycle of the projects carried out by the Ministry of Public Works (Ministerio de Obras Públicas, 2017).

Campo de estromatolitos en Porvenir, Juan Ernesto Jaegger - Imagen de Chile

[13] *http://www.energia.gob.cl/sites/default/files/plan_de_mitigacion_energia.pdf*
[14] *http://www.dgop.cl/Documents/PlanAccionMop.pdf*

On the other hand, from the new National Action Plan on Climate Change other sectorial plans arise, as for example, the forestry sector. Particularly, the National Strategy on Climate Change and Vegetation Resources[15] (ENCCRV), prepared by the Ministry of Agriculture through the National Forestry Corporation (CONAF), constitutes a "public policy instrument in the field of vegetation resources native to Chile, which guides and integrates the activities and measures to be taken as a country for mitigation and adaptation to climate change, as well as fighting desertification, land degradation and drought" (Ministerio de Agricultura, 2017).

In turn, the implementation of Law 20,920, enacted in 2016, which sets the framework for waste management, extended producer responsibility and the promotion of recycling, and that obliges manufacturers and importers of six priority products to collect and value, respectively, a percentage of their products after their useful life, is also a part of the commitments set out in the new Plan.

Finally, through a joint effort of the Ministries of Energy, Transportation and Communications and Environment, and as a contribution to the goals established for energy efficiency and mitigation of GHG emissions, at the end of 2017 the National Strategy for Electromobility was presented, an initiative that sets the axes and priority actions for the promotion of electromobility in Chile.

4.2. Sectorial Mitigation Actions

A series of actions -policies, laws, programs and specific projects- designed with sectorial purposes have had an impact on GHG emissions in the country. Thus, each sector that has developed them has measured their implementation and progress, either in qualitative or quantitative terms.

Although, some measures include estimates for their impact on the reduction of GHG emissions, it is recognized the need to assess the impacts of all measures, as well as calculating their impact as a contribution to the reduction targets in the country.

With regard to the second BUR delivered in 2016, sectorial policies have advanced to include climate change increasingly as a variable of analysis. In the same way, emitting sectors have begun to design specific policies that allow the reduction of GHG emissions in the medium term.

The following are the main actions that contribute to the reduction of emissions from the main sectors of the country.

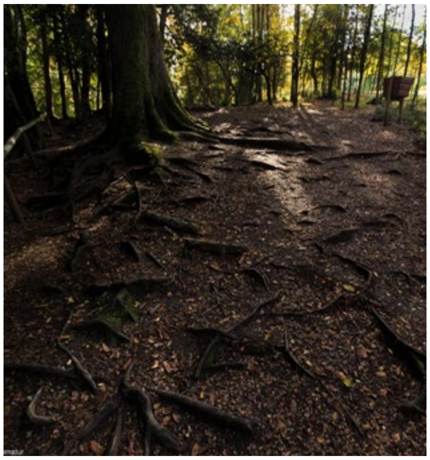
4.2.1. Energy Sector

In this sector, the regulatory role is exercised by the State through the Ministry of Energy and its dependent or related institutions, while private entities are responsible for making the investments.

The energy sector considers GHG emissions generated by the burning of fossil fuels in the country and their fugitive emissions associated. This sector is the main GHG emitter in the country, representing 78.0 % of total emissions in 2016. Their emissions stem mainly from the activities of energy production, energy consumption for freight and passengers, and energy consumption on the part of the different economy agents (industry, mining, trade and residential sector).

With regard to electricity generation, as of April 2018, the total installed capacity in Chile is 23,010 MW, separated mainly in the National Electric System (SEN) (99.23 % of the installed capacity), in addition to the small systems at Los Lagos, Aysen, Magallanes and Easter Island (0.03 %, 0.27 %, 0.45 % and 0.02 % of installed capacity respectively) (CNE, 2018).

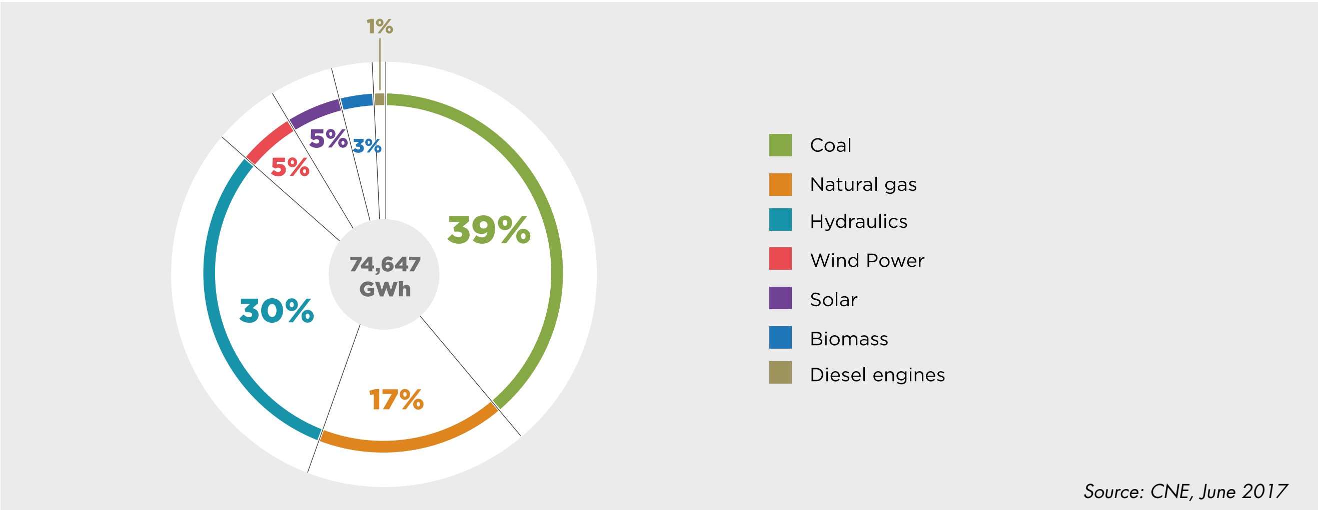
The components of energy production include mainly emissions from power generation and to a lesser extent, from petroleum refining and manufacturing of other fuels. As shown in Figure 4, power generation in Chile during 2017 accounted for a total 76,647 GWh, which main energy source was coal, with a participation of 39 % of the national total. This high level of participation of coal, added to the contribution of the generation of the rest of fossil fuels makes this source of emissions represent 31 % of the total GHG emissions in the country for 2016.



Ojos del Caburgua, Sernatur - Imagen de Chile

[15] *https://www.enccrv-chile.cl/index.php/descargas/documentos-2017/90-documento-de-la-estrategia/file*

Figure 4. Electricity generation by source type, 2017



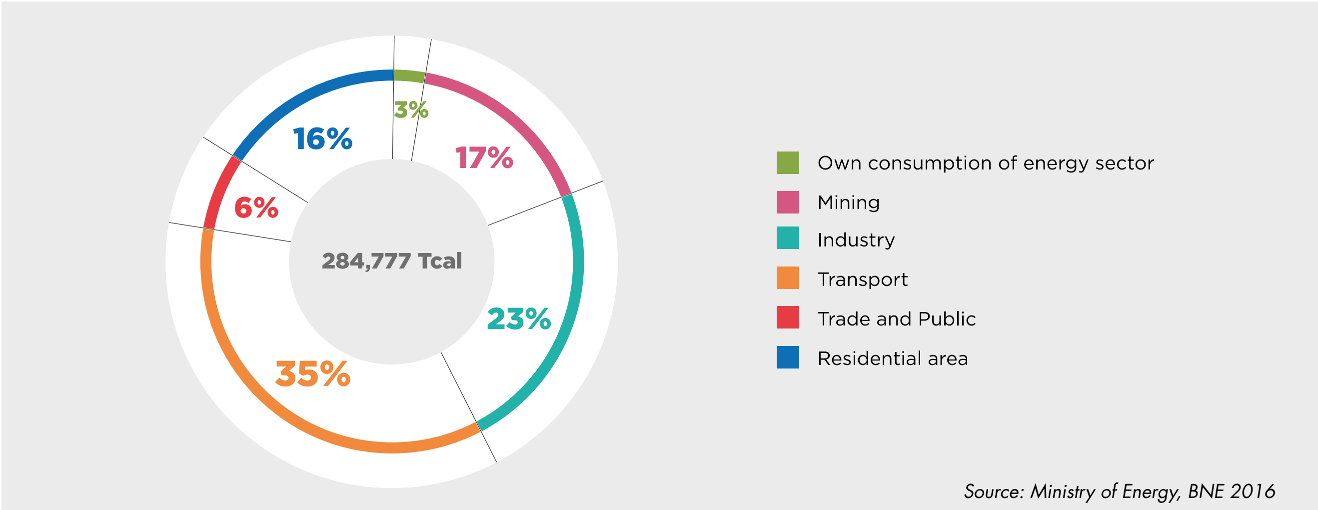
Parque Eólico Talinay, Felipe Cantillana - Imagen de Chile

Regarding Non-Conventional Renewable Energies[16] (NCRE), since 2010, by legislation[17], the Chilean electrical system must comply with a quota of incorporation of this type of energies. Subsequently this quota was raised, requiring that in 2025 a 20 % of energy generation comes from NCRE. In recent years, there has been an increase in this type of sources, from representing 2 % of the electrical generation in 2007 to 15 % in 2015. A wide participation of NCRE is recorded at a national level in the electricity matrix, above the minimum threshold required by the legislation, because the electrical generation of NCRE in 2017 was 11,087 GWh, while a contribution of 3,642 GWh was expected (being almost three times greater).

In terms of energy consumption incurred by transportation and the various economic sectors described by the secondary energy matrix of year 2016 (Figure 5), it can be noted that the most of consumption is from transportation, with a participation of 35 % of the national total (and in this, road transportation as one of the main emitting categories of the country), followed by the industrial consumption with a 23 %, and in the mining sector, with a 17 %.

[16] It is understood by Non-Conventional Renewable Energies or NCRE all those sources of energy generation in which consumption expenditure or depletion of its source are not incurred. Chilean legislation indicated as such the energy from the following technologies: small hydroelectric stations (less than 20 MW maximum power), and projects that use energy from biomass, geothermal, solar, wind, seas, among other.
[17] Law N° 20.257.

Figure 5. Secondary energy matrix by economic sector, 2016

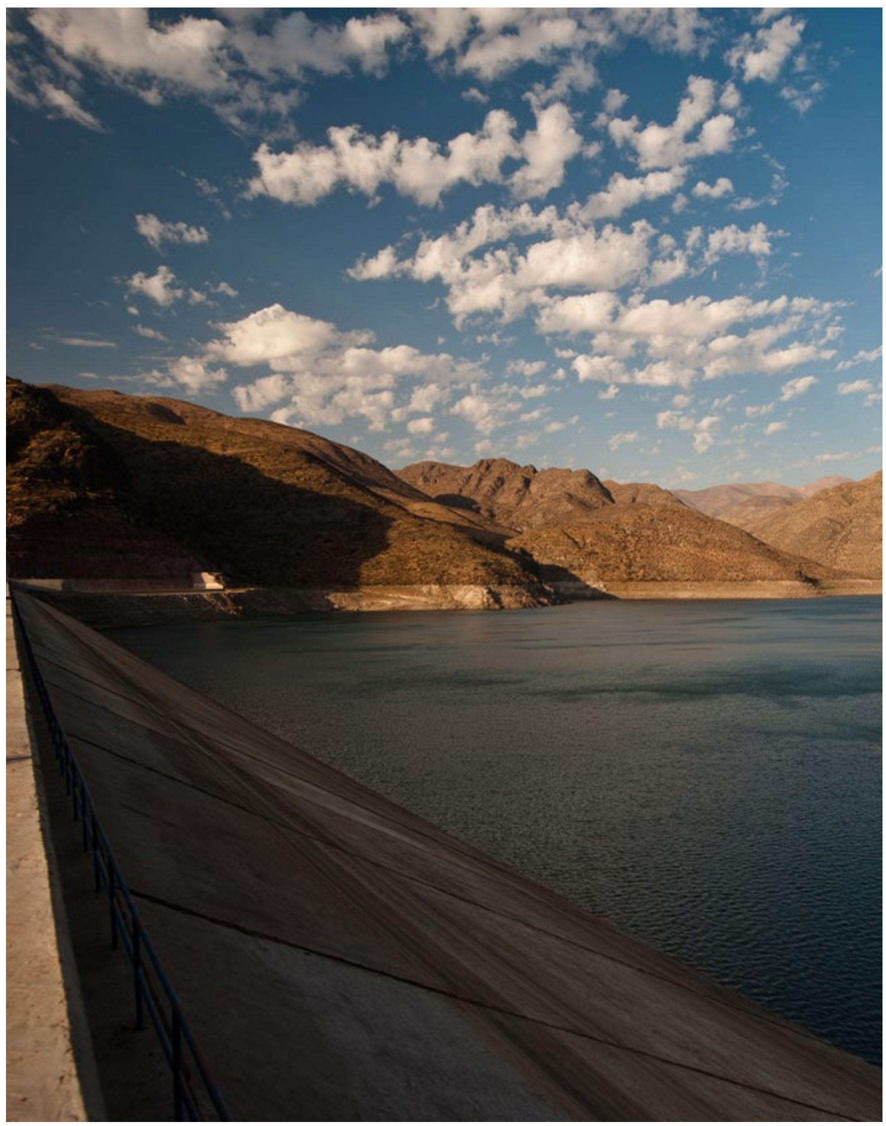


Source: Ministry of Energy, BNE 2016

Energy is an essential engine for economic and social development, so it is of the utmost importance to ensure supply for the future. The way in which energy is obtained and used also has a direct impact on economic growth, but at the same time, it generates an effect on the care for the environment and development opportunities for people. That is why policy definitions and an active role by the State are required, leading to a secure energy sector, inclusive, competitive and sustainable which benefits extrapolate to all areas in the life of Chilean people (Ministerio de Energía, 2017).

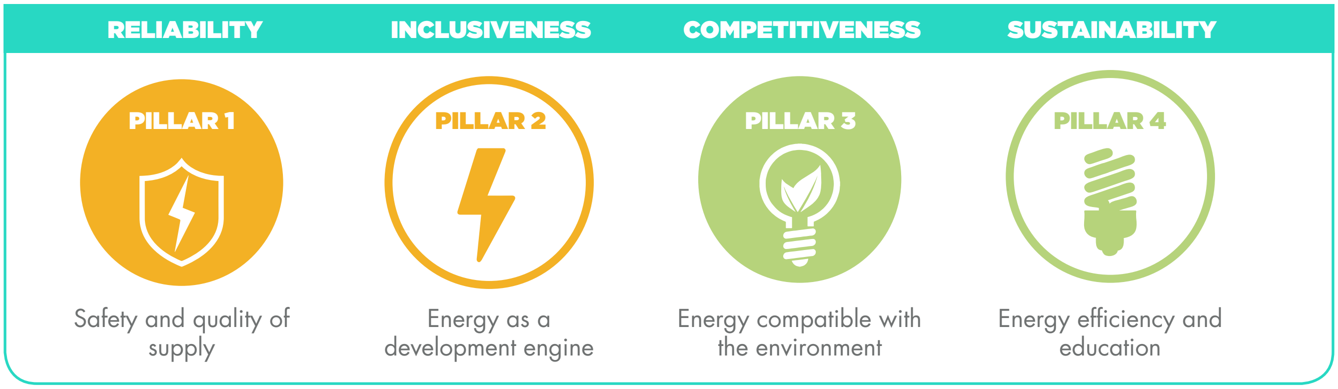
At the end of 2015, the Ministry of Energy published the National Energy Policy of Chile, a document that was prepared through a participatory process, called Energy 2050, which involved the public and private sectors, academia and civil society, based on an in-depth discussion, respectful of ideas and in search for consensus, for nearly two years.

The National Energy Policy proposes a vision of the Energy sector to 2050 which corresponds to a sector that is reliable, sustainable, inclusive and competitive. This vision is based in turn on four pillars, presented below.



Embalse Puclaro, Elqui, Felipe Cantillana - Imagen de Chile

Figure 6. Pillars of the National Energy Policy

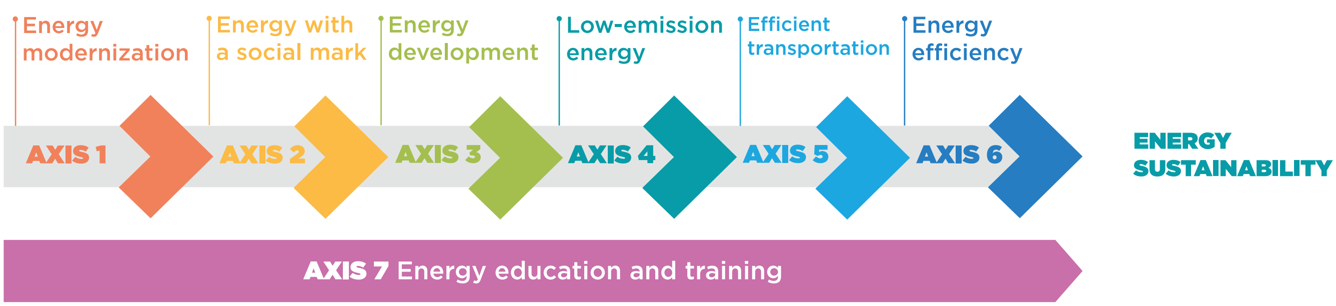


Source: Ministry of Energy, 2015.

In addition, but this time as a tool with a short-term span, during 2018 the *2018 - 2022 Energy Pathway* was developed. This energy pathway was built through a process of public consultation and dialogue throughout the country, that is, listening to the different actors from both the private and public sectors of civil society, including academia, ONGs, environmental groups, neighbors associations, trade unions, companies and representatives of indigenous peoples and communities, under the conviction that they are key agents for achieving sustainable development (Ministerio de Energía, 2018).

The work to prioritize during the following four years around the energy sector, was structured in seven axes, described in the following figure:

Figure 7. Axes of the Energy Path



Source: Ministry of Energy, 2018.

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Framed within these two instruments of governance, one with a short-term look, as the 2018-2022 Energy Pathway and another with a long-term vision, called the National Energy Policy to 2050; various initiatives are being carried out aimed at the reduction of GHG emissions, as well as to adaptation to climate change in the Energy sector:

- Greenhouse Gas Mitigation Plan for the Energy Sector, whose main objective is to encourage measures to address climate variability and support a gradual transition to an economy and energy matrix significantly lower in carbon.

- Energy efficiency law, which seeks to generate the necessary incentives to encourage efficient use of energy in the sectors of greatest consumption (large industry and mining, transportation and buildings) and create a greater energy culture throughout population.

- National Strategy for Electromobility, an initiative that sets the axes and priority actions for the promotion of electromobility in Chile, that will allow reducing GHG emission by obtaining their energy from an energy matrix with increasing participation of renewable sources. This initiative is being developed together with the ministries of Environment and Transportation.

- Decarbonization table, developed within the framework of the voluntary agreement signed by the companies members of the Association of Chilean Generators, AES Gener, Colbun, Enel and Engie, to carry out a process of decarbonization of the matrix, where the Ministry of Energy cooperates through a multidisciplinary coordination and the collection of background information, in order to strengthen the discussion in labor, security of supply, economic, environmental and health areas.

- Strategy for the development and penetration of renewable thermal technologies, which will enhance the use of renewable technologies for the supply of thermal or heat needs, replacing the use of fossil fuels and wet firewood.

- Renewable thermal programs, including program of direct uses of geothermal energy, the installation of solar thermal systems in homes and identification of the potential of biogas plants in industrial sectors.

- Public-private work table on adaptation to climate change in the Energy sector, in order to share experiences of adaptation applied, prioritize adaptation actions and address a timeline for implementation of the actions.

- Public-private table on mechanisms of tradable emission or other that generate a strategy proposal with the options of cost-effective instruments for the sector.

- Trading platform of renewable generation projects certificates, both at a large and small scale of distributed generation, in addition to energy efficiency measures.

- Coordinating Committee on Energy Innovation, which role is to identify and prioritize challenges and define the strategic guidelines to guide decision-making, in pursuit of the market competitiveness, social wellbeing and the sustainability of the sector.

- Promotion of distributed generation at a residential level, through the diffusion of benefits, consumer profiles, suppliers and financing sources.

- Educational energy strategy, an instrument that aims to bring the energy sector closer to society as a whole, improving the skills of individuals to make informed decisions, adopting new technologies, be responsible citizens and efficient managers of their natural resources.

The instances described above, along with many others, will move toward the fulfillment of various goals in the short, medium and long term. Some of these, linked to climate change, are presented below:

Table 3. National energy policy: measures in the short, medium and long term related to climate change

To 2022:	To 2035:	To 2050:
• Increase by at least 10 times the number of electric vehicles circulating in our country. • Establish a regulatory framework for energy efficiency (EE) to generate the necessary incentives to encourage the efficient use of energy in the sectors with the highest consumption (industry and mining, transportation and building), and create a culture of energy in the country. • Update and incorporation of new products to the EE labelling program. • Start the process of decarbonization of the energy matrix through the creation of a timeline for retirement or reconversion of coal power plants, and the introduction of concrete measures in electromobility. • Reach four times the current capacity of renewable distributed generation at small-scale (less than 300 kW).	• Over 60 % of the national electricity generation comes from renewable energy sources. • At least 50 % of fuels low in GHG emissions and pollutants in the fuels' matrix. • A Mitigation Plan of GHG emissions is applied in the Energy sector. • An Adaptation Plan to climate change is applied in the Energy sector, within the framework of a national plan in this regard. • 100 % of vehicle models for road transportation of new trade feature EE label. • 100 % of new vehicles tendered for public passenger transportation include EE criteria among the variables to evaluate.	• At least 70 % of national electricity generation comes from renewable energy sources. • The public, commercial and residence sectors takes advantage of distributed generation potential and management of the electricity demand. • The innovation policies in the industry contribute to achieve the potential reduction of energy consumption. • 100 % of the main categories, appliances and equipment that are sold in the market correspond to energy-efficient equipment. • 100 % of the new buildings are equipped with OECD standards of efficient building, as well as control and intelligent management energy systems.

Table 4. Measures related to the mitigation of GHG emissions in the Energy sector[18]

Name	Type[1]	Year and status
Administration of concessional system of geothermal energy	Regulatory	2004 Implemented and activet
Law of Non-Conventional Renewable Energies (ERNC) (Law 20.257/2008 amended by Law 20.698/2013)	Regulatory	2008 Implemented and active
Rural and social electrification program (PERyS)	Project	2008 Completed

[1] The type of instrument is classified as corresponding to a measure of Economic instrument, Education, Research, Information, Regulatory, Voluntary action, Project, Policy, Economic incentive, Governmental, Technological Development.

[18] *More detail of the various measures may be consulted in Annex 5 to this document.*

Name	Type[1]	Year and status
Energy Efficiency Program in Public Buildings (PEEEP)	Economic Incentive	2009 Implemented and active
Public information platforms for renewable energy	Information Education	2009 Implemented and active
Solar thermal systems in new households (Law 20.365/2009)	Government	2010 Implemented and active
Solar thermal systems in existing social housing	Government	2011 Implemented and active
Net Billing Act (Net Billing) (Law 20.571/2012)	Regulatory	2012 Implemented and active
Action Plan for Energy Efficiency (PAEE2020)	Policy	2013 Implemented and active
Energy efficiency labelling and minimum standards	Regulatory and Information	2013 Implemented and active
Replacement Program of Efficient Public Lighting for Municipalities	Project	2014 Implemented and active
Promoting the development of biogas energy in small and medium-sized agricultural industries selected at Los Ríos and Los Lagos regions (Biogas dairy sector)	Project	2014 Implemented and active
Draft Energy Efficiency Law	Economic Incentive Regulatory	2014 Planned
"More Dry Firewood" program	Project	2014 Implemented and active
100 Mini-hydros Plan	Policy	2014 Completed
Supply Improvement Program in isolated areas	Project	2014 Implemented and active
Fund for energy access[19]	Project	2014 Implemented and active
Energy District Program	Policy	2015 Implemented and active
Solar thermal systems at homes of the Reconstruction Programs	Government	2015 Implemented and active

[19] *http://atencionciudadana.minenergia.cl/tramites/informacion/18/*

Name	Type[1]	Year and status
Public Solar Roofs Program	Project	2015 Implemented and active
Policy of use of firewood and its derivates for heating	Policy	2015 Implemented and active
Energy Policy: Energy 2050 (PEN2050) (Decree N°148/2015)	Policy	2015 Implemented and active
Solar Strategic Program	Technology	2016 Implemented and active
Support mechanisms for funding the implementation of photovoltaic systems for self-consumption in micro and small enterprises	Economic Instrument	2016 Implemented and active
"My Home Efficient" Program	Project	2016 Implemented and active
Electromobility Strategy in Chile	Policy	2017 Implemented and active
SING-SIC interconnection	Project	2017 Completed
Greenhouse Gas Mitigation Plan for the Energy Sector	Policy	2017 Implemented and active
Long-term energy planning (Law N° 20.936/2016)	Regulatory	2017 Implemented and active
Decarbonization table of the energy matrix	Voluntary Actions	2018 Implemented and active
2018-2022 Energy Pathway	Policy	2018 Implemented and active

Source: Own preparation based on sectorial Information

4.2.2. Transportation Sector

The transportation sector considers the GHG emissions generated by fossil fuels burnt in all activities of the national transportation (terrestrial, railways, aerial and domestic Navigation). Under Chile's NGHGI, its emissions are reported in the subcategory Transportation (1.A.3.). Within the Energy sector emissions, it ranks second in importance, after the subcategory Energy industries. In 2016, its GHG emissions accounted for 26,936.4 kt CO_2 eq, increasing by 191.8 % from 1990 and 8.4 % since 2013, due to the growth of the national automotive fleet induced by the population growth, a greater purchasing power and the improvement of the road infrastructure in the country. The evidence demonstrates a great challenge for climate and local mitigation, which is why the development of policies that combine regulations, actions and programs is strategic.

Regarding the institutional framework of the sector, the Ministry of Transportation and Communications, through the Undersecretariat for Transportation, encourages the development of an efficient, safe and sustainable transportation system, through policies and regulations that favor the country's territorial integration, economic development, and to ensure high quality services to users (Subsecretaría de Transportes, 2018). To strengthen the developing and planning role of the Undersecretariat of Transportation, the Coordination Unit of Planning and Development exists, which brings together most of the technical capacity of the Undersecretariat and manages the objectives and tasks of the Program for Roads and Urban Transportation (SECTRA), the Operational Unit of Transit Control (UOCT), the Unit for Smart Cities (ICU), the Unit of Short-term Management (UGCP) and the Unit for Management of Infrastructure Projects (UGPI), which provide a crosswise view of planning and coordination issues for investments that belong to the Undersecretariat.

In agreement with the National Energy Policy, its strategic guideline N°34 sets the improvement of energy efficiency of vehicles and their operation, and sets as a goal for 2050 for Chile having adopted the highest international standards on energy efficiency in the various modes of transportation.

Within this context, the Ministries of Energy, Transportation and Communications and Environment developed a strategy for electromobility in Chile, in order to systematize the efforts and articulate the various relevant actors, in pursuit of promoting the introduction of technologies with greater energy efficiency to the country's vehicles market. The "National Strategy for Electromobility", published in 2017[20], compiles the result of a participatory process of collaboration among these ministries together with multiple public and private actors. The aim of the strategy is to outline the actions that Chile should take in order to achieve that 40 % of private vehicles and 100 % of public transportation vehicles are electric to 2050, thus contributing to the goals of energy efficiency and mitigation of GHG emissions and contributing to improving mobility and quality of individuals' life. (Ministerio de Energía, 2017); along with other benefits such as reduction of emissions of local pollutants and the adverse effects on the population's health.

The Energy Pathway described in the section of Energy sector confirms in its axes The National Strategy for Electromobility undertaking a goal at the end of the period of increasing by at least 10 times the number of electric vehicles circulating in the country. According to estimates of the Ministry of Energy, the entry of only electrical light vehicles will prevent the emission of 11 million tonnes of CO_2 per year, and will reduce expenditure on imported fossil fuels by more than USD 3,300 million annually, equivalent to about 1.5 % of GDP for year 2016 (Ministerio de Energía, 2017).

It should be noted that in the country other public transportation modes which are fed with electricity already exist, such as for example: the Santiago metro, Metro Regional de Valparaíso, the suburban train Biotren, the Tren Central and the Trolleybuses of Valparaíso, which give more strength and support to the Energy Pathway.

The National Strategy for Electromobility contemplates the following axes or specific objectives to implement in the short term, from 2017 to 2020:

1. Establish regulations and requirements that encourage efficient development of electromobility from the points of view of energy, environment and mobility.

2. Boost the penetration of electric vehicles in public transportation of cities across the country.

3. Support research and development of electromobility and enhance human capital training at different levels.

4. Encourage the development of electromobility, generating new balances that allow the market to sustain itself.

5. Generate spaces for the transfer of knowledge and dissemination of information, so that various actors can make optimal decisions with respect to electromobility.

[20] *http://www.minenergia.cl/archivos_bajar/2018/electromovilidad/estrategia_electromovilidad-27dic.pdf*

The following are the lines of action for each objective and axis of the National Strategy for Electromobility for the period 2017 to 2020.

Table 5. Lines of Action of the National Strategy for Electromobility, 2017-2020.

STRATEGIC AXIS 1: Regulation and Standards **Line of Action**
Action Line 1: Establishment of minimum standards of energy efficiency for passenger vehicles
Action Line 2: Definition of technical/economic standards for cargo
Action Line 3: Definition of rules of availability of loading facilities in buildings
Action Line 4: Definition of road safety rules of coexistence with other modes of transportation
Action Line 5: Establishment of constructive technical requirements and security for electric vehicles
Action Line 6: Explicit incorporation of vehicles and their components in the Recycling Law
STRATEGIC AXIS 2: Public Transportation as an Engine of Development **Line of Action**
Action Line 7: Incentives for major public transportation. The CORFO project of public service "Technological Consortium for the deployment of electromobility in Transantiago"
Action Line 8: Incentives to move to electrical technology for collective taxis (it should be noted that the "Renew your collective taxi" program already exists)
Action Line 9: Incentives to move to electrical technology for taxis (basic, executive and tourism)
STRATEGIC AXIS 3: Boost of Research and Development in Human Capital **Line of Action**
Line of Action 10: Boost of applied research and development to generate an electromobility business environment
Line of Action 11: Training researchers in electromobility
Line of Action 12: Incentives to the training of technicians and professionals specialized in electromobility
Line of Action 13: Training in electromobility for emergency, rescue and care of injured personnel
Line of Action 14: Work Table of technological prospecting
Line of Action 15: Training of public officials and decision-makers
Line of Action 16: Transformation of public fleet
Line of Action 17: Development of commercial fleet pilot projects
Line of Action 18: Promoting the electric car
STRATEGIC AXIS 5: Knowledge transfer and delivery of Information **Line of Action**
Line of Action 19: Creation of an electromobility observatory
Line of Action 20: Dissemination of electromobility

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Also, since March 2017, the Production Development Corporation (CORFO), an agency of the Government of Chile under the Ministry of Economy, Development and Tourism, encourages the Regional Strategic Program Santiago Smart City[21], which was established as an enabler and encourager of technology-based and social solutions to cope with the challenges of mobility, safety and the environment existing in the city. Aimed to resolve coordination failures and addressing collaborative solutions based on innovation and use of technologies, along with solutions relating to aspects of productive development and quality of life, this program includes the Freight Transportation Observatory as a technological tool for the systematic and permanent collection of data on the urban transportation system in the Metropolitan Region. The concretion of this public good will support the collection of information and decision-making in the public and private sectors. In addition, it will optimize delivery mechanisms of products in less time, improving service, reducing fuel consumption and emissions.

Another public good implemented by the Regional Strategic Program Santiago Smart City together with CORFO MR, Ministry of Transportation and Telecommunications, ENEL, SOFOFA and the VTT Technical Research Center of Finland Ltd., is the Consortium for Electromobility, which seeks to define and implement a strategy that allows for deployment of electric mobility in Santiago, making of it an enabler for the development of a smart city. The achievement of this consortium lies in the articulation of various actors defining a strategy of electric mobility in the city of Santiago, establishing public transportation as the first objective.

Also, CORFO has developed since October 2017 the Transforma Logistics Program, through which the Certification and Validation System for Energy Efficiency and Competitiveness in Road Cargo Transportation was launched, with the support of the Ministry of Energy, the Agency of Sustainability and Climate Change, the Agency of Energy Sustainability, the National Confederation of Truck Owners, Chile Transporte A.G., among other. The project encourages coordination with various actors of the logistics chain in order to achieve energy and cost savings by reducing fuel consumption, improved efficiency in freight transportation by truck and consequently in the logistics chain; and achieving the goal of a decrease in greenhouse gases emissions and short-life and local climate pollutants.

Regarding international maritime transportation, in 2017 the establishment of a system of MRV was agreed at the International Maritime Organization (IMO), with the aim that ships report annually their fuel consumption, transported cargo and distance run, which would begin to operate in January 2019. In addition, a reduction of greenhouse gases emissions was agreed, of at least 50% to 2050 considering 2008 as the base year; at the same time it will be sought to fully reduce them before the end of this century.

With regard to international aerial transportation, in 2016 a measure of global market was agreed called "Carbon Offsetting and Reduction Scheme for International Aviation - CORSIA". To move on in this, an MRV system must be in place as of January 2019 which accounts for the volume of GHG emissions to be reported to the International Civil Aviation Organization (ICAO).

Table 6 lists the most relevant initiatives in the sector from a mitigation point of view.

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[21] *http://www.chiletransforma.cl/2017/08/02/santiago-ciudad-inteligente/*

Table 6. Measures related to mitigation of GHG emissions in the Transportation sector[22]

Name	Type[1]	Year and state
Labelling of energy consumption and CO_2 emissions in light and medium vehicles	Regulatory	2016 Implemented and active
Management of the Public Transportation System in Santiago (Transantiago)	Policy	2017 Implemented and active
Renewal of the fleet of the Public Transportation System in Santiago (Transantiago)	Project	2018 Implemented and active
Renew your bus program	Economic Incentive	2011 Implemented and active
Renew your collective taxi program	Economic Incentive	2015 Implemented and active
Green Tax for New Motor Vehicles	Regulatory	2015 Implemented and active
Measures of the Transportation Sector in the Decontamination Plan of the Metropolitan Region (MR)[23]	Regulatory	2017 Implemented and active
Expansion of the Santiago Metro	Private Sector	2017 Implemented and active
Suburban Railway MetroTren Alameda Nos	Private Sector	2017 Implemented and active
Clean Turn Certification and Validation Project of the Freight Transportation of the Transforma Logistics Program by CORFO for cargo transportation by road and ports	Project	2017 Implemented and active
Sustainability Certification Project for ports of the Transforma Logistics Program by CORFO for cargo transportation by road and ports	Project	2017 Implemented and active
Suburban railway at Bio Bio region, Biotren	Project	2017 Implemented and enabled
Merval suburban train in Valparaíso Region	Project	2018 Implemented and active
Suburban trains of the Metropolitan Region	Project	2018 Implemented and active

[1] The type of instrument is classified as corresponding to a measure of Economic instrument, Education, Research, Information, Regulatory, Voluntary action, Project, Policy, Economic incentive, Governmental, Technological Development.

[22] More detail of the various measures may be consulted in Annex 5 to this document.
[23] Prevention and Atmospheric Decontamination Plan for the Metropolitan Region of Santiago, Decree N°31, 2016 of the MMA, published on November 24, 2017 in the Official Gazette.

Name	Type[1]	Year and state
Smart Cities Strategy 2014-2020	Policy	2014 Implemented and active
Measures for the Transportation Sector in the Energy Mitigation Plan	Policy	2017 Under implementation

Source: Own preparation based on sectorial information

4.2.3. Agriculture , forestry and other land uses Sector

The Agriculture, forestry and other land uses (AFOLU)[24] is the only sector presenting GHG emissions and CO_2 removals, which is why its mitigation potential is relevant. Sources of absorption are primarily seedlings of native forest, regeneration of managed native forest and forest plantations, mostly exotic. This sector is equivalent to the integration of Agriculture and LULUCF sectors of Chile's NGHGI.

This sector is high vulnerable to the effects of climate variability and climate change, being its challenge continuing with the increase of the sector's productivity and the sustainable use of natural resources. For this reason, MINAGRI and its services have a prevailing role regarding mitigation issues and in particular, climate change adaptation at a national level. For this reason, a number of instruments has been developed that seek to challenge and prepare the sector to address climate change. As mentioned in the section on national circumstances, technical coordination among the different services of MINAGRI in the field of climate change is carried out by the CTICC.

By virtue of the contribution capacity regarding mitigation of this sector, Chile's NDC presents a specific contribution associated to sustainable management and forest recovery, mainly native; and to forestation, mostly with native species.

As a key instrument for the fulfillment of this goal contained in the NDC, the National Forestry Corporation (CONAF), through the Unit for Climate Change and Environmental Services (UCCSA), is implementing the National Strategy for Climate Change and Vegetation Resources (ENCCRV), which was validated by the Council of Ministers for Sustainability in November 2016. This strategy aims to reduce the social, environmental and economic vulnerability generated by climate change, desertification, land degradation and drought over vegetation resources and human communities that depend on them, in order to increase ecosystems' resilience and contribute to mitigate climate change, promoting emissions reduction and increased capture of greenhouse gas in Chile.

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To meet this goal, 26 measures were established with operational goals, considering seven activities associated to the prioritized causes, and a crosswise activity to all causes, which respond to various areas of application: institutional management, operational, regulatory, monitoring, environmental education, research, planning and development.

[24] *This sector covers the Agriculture and use of land, land-use change and forestry (LULUCF) sectors, outlined in Chapter II: National Greenhouse Gas Inventory of Chile 1990-2016.*

For the formulation and validation of the ENCCRV, technical and financial support by the Forest Carbon Partnership Facility (FCPF), UNREDD Program and the Swiss Agency for Development and Cooperation (COSUDE) were received, among other.

In this sector also outstand the two Nationally Appropriate Mitigation Actions (NAMAS), which are under different development status:

- Support to the design and implementation of the ENCCRV. The objective of the NAMA was established within the framework of the ENCCRV, serving as technical and economic support for the development of studies and activities aimed at identifying and reducing weaknesses of baseline information, in addition to increasing the capacities of national technical teams and regional ENCCRV.

- Removal of atmospheric carbon through the recovery of degraded agricultural soils in Chile. This NAMA seeks to provide some sort of incentive to farmers who adopt practices for the recovery of degraded organic soils. This NAMA seeks support for its preparation.

On the other hand, it should be noted that for this sector adaptation actions can have impacts on GHG emission reductions, so the current plans for biodiversity and agriculture (SAP) adaptation directly contribute to climate change mitigation. Also relevant are the benefits for mitigation of future update of Adaptation Plan 2018 - 2022 SAP, and projects such as the technical cooperation activities in the measurement of carbon footprint and management of pests and diseases in non-traditional export products adapted to conditions of water scarcity, improvement in resilience to climate change of small agriculture in O'Higgins Region, Chile, among other.

On the other hand, in May 2016 the 2015-2035 Forest Policy was announced officially, which establishes the grounds for sustainable, participatory, inclusive and socially equitable forest development. The Forest Policy has been structured around four strategic axes: 1) Forestry institutions; 2) Inclusion and social equity; 3) Productivity and economic growth; and 4) Protection and restoration of the forest heritage, each of them broken down into impact targets and result objectives that present a synthesis of the base line or initial situation (year 2015) and of the situations expected in the short, medium and long term, set in periods of four (2020), ten (2025) and twenty years (2035), respectively.

Among the sector challenges, moving forward in research to bring down the curve of GHG emissions in the agricultural sector, working in good practices for nitrogen fertilization, livestock management practices or carbon sequestration in soils, to mention a few, and analyzing forest policies leading carbon capture in forests and prevent fires, to achieve a carbon neutral agricultural sector.

Regarding sectorial actions that contribute to the mitigation of GHG emissions and promote sequestration, they are presented in Table 7.

Table 7. Measures related to mitigation of GHG emissions of Agriculture, forestry and other use of land Sector [25]

Name	Instrument type[1]	Year and state
National Strategy on Climate Change and Vegetation Resources (ENCCRV) [26]	Economic Instrument Voluntary Actions Regulatory Framework Information Research Education	2010 -2025 Implemented and active

[1] The type of instrument is classified as corresponding to a measure of Economic instrument, Education, Research, Information, Regulatory, Voluntary action, Project, Policy, Economic incentive, Governmental, Technological Development.

Source: Own elaboration based on sectorial Information

[25] *Further detail of the various measures may be consulted in Annex 5 to this document.*
[26] *In the current BUR, an estimate of the Reference Levels in the Technical Annex of REDD+ results is included.*

4.2.4. Waste Sector

In this sector are accounted for GHG emissions generated by microbiological processes that occur in final disposal sites for solid waste, product of anaerobic degradation of organic matter. Disposal of solid waste corresponds to 74.2 % of the Waste Sector emissions to 2016 INGEI.

In Chile, Law No. 18,695 Constitutional Organic Law of Municipalities, the Ministry of the Interior, delivery to these entities the attribution of deprivation for the management of the waste generated in their distrital boundaries, whose duty is regulated in the Sanitary Code. The Municipalities of Chile develop this attribution in a direct way with own resources or by outsourcing the services of collection, transportation and disposal. With regard to the final disposal, mostly choose the option to outsource the service.

With respect to financials, Law N° 3.063 on Municipal Revenues, of the Ministry of the Interior, establishes that municipalities must annually determine the costs of their home cleaning services in order to establish rates for such services. These costs are equally divided among all users, which originates the rate value, or right to the cleaning service, which is charged to each user. The same law establishes those automatically exempt from such payment are those users whose house or housing unit that receives the service has a tax valuation equal or lower than 225 monthly tax units.

The Ministry of Environment is responsible for the design and implementation of policies, plans and programs in environmental matters, as well as for waste management programs through the Office of Legislative Implementation and Circular Economy.

Currently, over 90 % of municipal solid waste goes directly to final disposal in landfills, waste or garbage dumps, and close to 50 % of such waste, corresponds to organic waste (ECLAC, OECD, 2016).

As regards progress in regulatory matters, in May 2016 Law N° 20.920 was enacted, which establishes a framework for Waste Management, Extended Liability of the Producer and Promotion of Recycling, which objective is to reduce waste generation and to encourage reuse, recycling, or valuation, in order to protect the lives of people and the environment. This new instrument establishes that producers[27] of so-called "priority" products must take care of their management at the end of their useful life. This way, a series of products that are sold in the domestic market will be collected and valued, directing the interests of the country towards a sustainable economy. Priority products correspond to: lubricating oils, electrical and electronic appliances, batteries, packaging, tires and batteries.

Later in 2017, in accordance with Law N° 20.920, Decree N°8 Regulations of the Ministry of Environment was enacted, which sets the procedure to prepare the instruments intended to prevent waste generation or encouraging their recovery, as well as the procedure for setting targets and other related duties. As of 2018, two drafts are in developing which set goals for the collection and recovery for containers, packaging and tires.

In 2017, the regulations for the recycling fund, Decree N° 7 of the Ministry of Environment entered in force, which allows having a fund whose purpose is to finance all or part of the projects, programs and actions to prevent waste generation, encourage their source separation, selective collection, reuse, recycling and other type of valuation performed by municipalities or their associations. And as of 2018, a draft for a 2018-2022 National Plan of Ecodesign and Labelling, which objective is to establish requirements, demands and procedures for ecodesign and labelling of products and organizations.

At the international level, during the COP22 in November 2016, the Minister of Environment and Climate Change of Canada undertook to reduce the pollutants that damage the climate in Canada and throughout the world, and to contribute with USD 10.7 million to reduce Short-Lived Climate Pollutants through bilateral alliances with Chile and Mexico. In the case of Chile, this project was implemented through the current Agreement on Environmental Cooperation[28], where both ministries of Canada and Chile establish four lines of action:

[27] *Manufacturers and importers*
[28] *Https://acuerdochilecanada.mma.gob.cl/*

1) Reduction of methane emissions through technological deployment in at least seven cities.

2) Development of a system for tracking, monitoring and reporting emission reductions (MRV).

3) Leverage of public and private financing for the projects' implementation and support to create enabling conditions allowing for the scale up of the program.

4) Support with technical assistance of project's communications and dissemination opportunities.

The project takes place from April 2017 until March 2021, and with the support of 7 million Canadian dollars. For its coordination, a working group was established composed of professionals from both ministries of the environment, along with an implementing agency.

Table 8 shows a summary of the actions and policies associated with GHG mitigation in the Waste sector.

Table 8. Measures related to the mitigation of GHG emissions of the Waste sector[29]

Name	Type[1]	Year and status
National Solid Waste Management Program.	Policy	2005 Implemented and active
Law N° 20.920 Framework Law for Waste Management, Extended Liability of the Producer and Promotion of Recycling (REP).	Regulatory Framework	2016 Implemented and respective regulations under development
Recycling Fund.	Economic Incentive	2017 Implemented and active
Mitigation of Climate Pollutants in the Waste Sector through the Chile- Canada Program.	Project	2016 Implemented and active

[1] The type of instrument is classified as corresponding to a measure of Economic instrument, Education, Research, Information, Regulatory, Voluntary action, Project, Policy, Economic incentive, Governmental, Technological Development.

Source: Own preparation based on sectorial information

4.2.5. Mining Sector

Chile is the world's largest copper producer, contributing with 27 % of global production in 2017, with exports of approximately 5.5 million tonnes of fine copper (COCHILCO, 2018a). At a national level, copper mining is relevant for the economy, since it contributed with 9 % of Gross Domestic Product in 2017 (Banco Central, 2018)

The exploitation and production of copper in the country considers a series of processes that go from ore extraction (open pit or underground mine), passing through concentration and refining, in the case of sulphide minerals (pyrometallurgic processes); or leaching, solvent extraction and electro-winning, if it is leachable minerals (hydrometallurgical processes). The main copper products that Chile markets are: copper concentrate, copper cathodes obtained with electro-winning, and copper cathodes obtained with electro-refining.

In terms of GHG emissions, mining contributes in two main ways. In the first place, there are "in situ" emissions resulting from the fossil fuels combustion, mainly associated to transportation, heating, drying and material processing. On the other hand, and most importantly, mining consumes large amounts of electrical power, most of which is generated by processes that involve the fossil fuels combustion (COCHILCO, 2008).

[29] *Further details on the various measures may be consulted in Annex 5 to this document.*

With regard to emissions "in situ" of GHG emissions, the subcategory Mining and quarrying in 2016 accounted for 7,967.0 kt CO_2 eq, within which the copper mining remains as the most important with a 68.9 % with respect to other activities in mining (iron, saliter and other).

In relation to electricity consumption, on average over the past 15 years copper mining has had a one-third participation in national consumption: This situation can be largely explained by three trends that have put a pressure on the rising consumption: 1) gradual fall in the copper grade, which responds to the aging of the mines and the increase in the mineral hardness, 2) increasing use of sea water, given the restrictions for water supply and also due to the increasing preponderance in the production of concentrates, which is water-use intensive, 3) and the increase in the production of copper concentrates, a process with an intensive use of electrical energy (COCHILCO, 2017). The Chilean Copper Commission forecasts that in 2028 Chile will reach a copper production of 6.3 million tonnes of fine copper, requiring close to 29.2 TWh; that is, the increase of electricity consumption would grow by 38 % due to the above mentioned reasons (COCHILCO, 2017).

In this sense, to face the energy needs the application of energy efficiency policies and the incorporation of sources of renewable energy to the energy matrix currently constitute the main measures used by mining companies to reduce their carbon footprint (Fundación Chile, 2016).

For example, in 2017 CODELCO incorporated an indicator of energy efficiency in each of the initiatives identified as a potential impact on this matter, and a methodology for measurement and verification of energy savings. Moreover, the same year, the power supply contracts were modified to achieve a 22.5 % of the total electricity consumption of CODELCO in renewable energies. The state-owned company has a Master Plan for Sustainability[30], where energy efficiency is one of the dimensions to improve in the environmental area, through a management system focused on optimizing the specific indicators of energy use in the production processes (CODELCO, 2018).

Another important instrument is the "Greenhouse Gas Mitigation Plan for the Energy Sector", which establishes a framework of policies and actions of GHG emissions reduction in energy efficiency for mining and industry, emphasizing the following measures (Ministerio de Energía, 2017):

- Establishing a regulation for a Minimum Energy Performance Standard (MEPS) for electric motors power under 10 HP or 7.5 kW; and between 10 and 100 HP, or 75 kW for equipment of industrial use and mining, such as boilers and mining trucks.
- Implementing a mandatory energy management system for major energy consumers.
- Establishing a new regulatory framework to increase investment in energy efficiency projects.
- Having a 2020 Action Plan for Energy Efficiency.
- Developing a market for energy services companies or ESCO.
- Seek out financial support for scaling of energy efficiency programs.

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[30] *"A Master Plan to sustain the future of Codelco", available at: https://www.codelco.com/prontus_codelco/site/artic/20170104/asocfile/20170104182607/pms_2016.pdf*

Since 2017, it should be noted that CORFO encourages through consortia formed by the academy and mining companies, two projects for the development of a technology that allows using hydrogen based on solar energy to supply mining transportation. The objectives of the projects correspond to: checking technical and economic feasibility of the transformation of conventional operation of mining extraction trucks to a dual internal combustion of hydrogen and diesel mixtures; and to develop hydrogen fuel cells for smaller equipment (ACEE, 2018).

Likewise, and with the purpose of generating an internal market that supplies a future demand of hydrogen for transportation, new and better ways for its production have begun being explored. It should be noted that the case of hydrogen production from solar energy, abundant in our country, have already been built scenarios to quantify its production cost (GIZ, 2018).

Table 9 shows the measures for Mining related to mitigation of GHG emissions.

Table 9. Measures related to mitigation of GHG emissions of the Mining sector [31]

Name	Type[1]	Year and status
Measures for the industry and mining sector of the Greenhouse gases Mitigation Plan for the Energy sector.	Policy	2017 Under implementation
Energy efficiency measures for mining of the Chilean Agency for Energy Efficiency.	Projects	2014 Under implementation

[1] The type of instrument is classified as corresponding to a measure of Economic instrument, Education, Research, Information, Regulatory, Voluntary action, Project, Policy, Economic incentive, Governmental, Technological Development.

Source: Own preparation based on sectorial information

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[31] *More detail the various measures may be consulted in Annex 5 of this document.*

4.2.6. Building, urbanization and public infrastructure Sector

With the aim of proposing a State policy to guide the development of cities and population centers in the country, in April 2012 a Presidential Advisory Commission was formed. This commission, composed of representatives from the academia, political and civil society, began a process that in March 2014 ended with the enactment of the new National Urban Development Policy[32] (PNDU).

The PNDU, based on the concept of sustainable development, establishes five goals: achieving a better quality of life for people; supporting the country's decentralization; providing an explicit framework that enables an institutional reorganization and orders the actions of the various agencies, and public and private actors participating in the cities and the territory; providing sustenance and a sense of unity and coherence to the reformulation of the various legal and regulatory bodies that need to be modernized and adapt to the new requirements of society; and generating certainties favoring the coexistence of citizens in the territory and enable an environment conducive to the development of society and public and private investment initiatives.

One of the PNDU axes is the environmental balance scope, which states that "cities are important consumers of energy and water, as well as large generators of emissions into the atmosphere, water bodies and also of soil polluters" (Ministerio de Vivienda y Urbanismo, 2014). According to this, the PNDU points out that the key is to move toward a sustainable urban development, that considers both sustainable construction in the city as well as the efficient management of energy, natural resources and waste which, as a consequence, will result in a reduction in GHG emissions generation. In this sense, the institutional responsibility lies mainly in the Ministries of Public Works (MOP) and Housing and Urban Planning (MINVU), in coordination with the Ministry of Environment (MMA), which provides relevant inputs to address such actions.

This is how in 2016, the MOP updated its Environmental Sustainability Policy, contemplating in one of its lines of action "tending to minimize the risk associated to natural events and anthropogenic interventions in the territory, within a context of climate change" (Ministerio de Obras Públicas, 2016). In this context, the MOP has developed processes for the adequacy of its infrastructure services, both for adaptation to climate change impacts and mitigation of GHG emissions, in order to contribute to the goals that Chile has set in the field of GHG emissions reduction (Ministerio de Obras Públicas, 2016).

In coherence with this policy and within the framework of the commitments established in the PANCC 2017-2022, the MOP, together with the MMA, prepared the 2017- 2022 Plan for Adaptation and Mitigation of Infrastructure Services to Climate Change[33], which main objective is aimed at "incorporating the climate change issue to the infrastructure services it provides, in order to adapt to future hydro-meteorological changes in a framework of resilience and sustainability, in addition to contributing to mitigate greenhouse gases at the different phases in the life cycle of projects" (Ministerio de Obras Públicas, 2017).

The Plan, approved by the Council of Ministers for Sustainability in November 2017, provides a reference framework that lays the foundation in the field of climate change for those Directorates associated to the performance of infrastructure works inside the MOP. During its preparation, it was subject to a process of dissemination and public consultation, which allowed gathering the views and comments from representatives of Ministries, academia, the private sector and of citizenship.

In terms of structure and organization of information, the Plan consists of three strategic axes associated to adaptation, mitigation and management of knowledge on climate change, in order to comply with three specific objectives translated into nine lines of action and a total of 23 measures, five of which seek to add elements of GHG emissions mitigation, tending towards the construction of a low-carbon MOP Infrastructure; for example, measures aimed at the incorporation of non-conventional renewable energies (NCRE), to the incorporation of concepts of passive design and energy efficiency in public buildings, and to GHG emissions reduction at the stages of construction and life of infrastructures. These actions appear in the following table:

[32] *http://cndu.gob.cl/wp-content/uploads/2014/10/L4-Politica-Nacional-Urbana.pdf*
[33] *http://www.dgop.cl/Documents/PlanAccionMop.pdf*

Table 10. Measures related to the mitigation of GHG emissions of Building, Urbanization and Public Infrastructure sector (Public Works)[34]

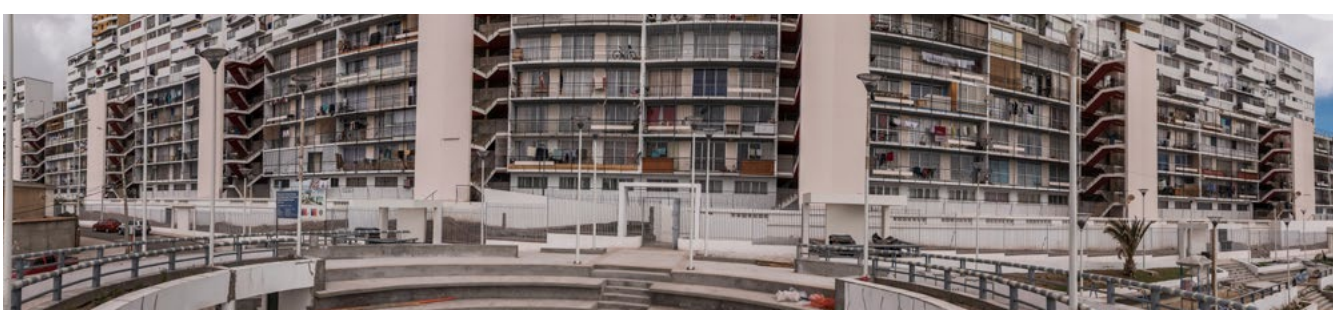
Name	Type[1]	Year and state
Incorporation of non-conventional renewable energies (NCRE) in the execution of Public Infrastructure MOP.	Policy Information	2017 Planned
Incorporation of energy efficiency and environmental comfort in public building that runs the MOP.	Policy Regulatory Framework Technological Development	2006 Implemented Planned
Measurement and management of the carbon footprint in the works of infrastructure and public building that runs the MOP.	Information	2018 Planned
Reduction of GHG emissions in the MOP´s machinery.	Technological Development	2017 Implemented Planned
Implement a platform to measure and account for the reduction of GHG emissions from the MOP.	Information	2018 Planned

[1] The type of instrument is classified as corresponding to a measure of Economic instrument, Education, Research, Information, Regulatory, Voluntary action, Project, Policy, Economic incentive, Governmental, Technological Development.

Source: Own elaboration based on sectorial Information

In the same line, it is well known that inappropriate construction and operation of houses significantly contributes to the emission of local and global atmospheric pollutants, the consumption of energy and materials, and waste generation. In this sense, the MINVU, within the framework of the National Strategy for Sustainable Building[35], "instrument intended to be an orientation tool establishing the main guidelines to encourage integration of the concept of sustainable development in Chile's building area" (Ministerio de Vivienda y Urbanismo, 2013), recently presented the Sustainable Building Standards for houses[36] and the Manual of Sustainable Urban Elements[37].

The first corresponds to a guide of good practices to improve the environmental, economic and social performance of housing, from design to their operation, and encourages continuous improvement in the practices tending towards a sustainable construction. These voluntary guidelines seek to contribute to the construction of inclusive housing, bearing in mind the different geographic issues and climate conditions of the country, giving priority to families' wellbeing and care for the environment, thus aiming to give the country's inhabitants access to adequate housing, resilient and sustainable.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[34] *Further detail on the various measures may be consulted in Annex 5 to this document.*
[35] *http://csustentable.minvu.gob.cl/wp-content/uploads/2014/11/Estrategia-Construccion-Sustentable_ENERO-2014_VF_Baja.pdf*
[36] *http://csustentable.minvu.gob.cl/edificacion-residencial/*
[37] *http://csustentable.minvu.gob.cl/espacio-publico/*

The Manual of Sustainable Urban Elements, on the other hand, encourages designs and constructive methods that optimize the use of resources, making them more environmentally-friendly and guaranteeing durability (Gobierno de Chile, 2017).

The Sustainable Building Standards for houses make up a set of six volumes covering six variables that may appear in buildings and infrastructure throughout their life cycle, when jointly implemented, allow building a sustainable construction, namely: health and wellbeing; energy; water; environmental impact; materials and waste; and immediate environment. At the same time, the use of these guidelines entails a series of economic, social and environmental benefits, among them reduction of GHG emissions of housing and the construction sector, along with waste. These standards will be the technical basis for the implementation of the Sustainable Housing Certification, an initiative that is currently under development and with the participation of relevant stakeholders of the sector related to the multiple aspects of interest of the certification.

On the other hand, within the framework of the National Action Plan on Climate Change 2017-2022, the MINVU defined that their mitigation actions could be categorized into measures of GHG emissions reduction of housing, through the energy efficiency of buildings, and actions that contribute to the reduction and capture of emissions through measures and programs of investment in design and urban management. These actions are presented in Table 11 below:

Table 11. Measures related to the mitigation of GHG emissions of Building, Urbanization and Public Infrastructure sector (Housing and Urban Planning)[38]

Name	Type[1]	Year and state
Subsidy for thermal conditioning of housing	Economic Incentive	2005 Implemented and active
Thermal regulation (3rd stage)	Regulatory	2000 Implemented and active
Energy Rating of houses	Information	2012, operation start-up. Between 2016 and 2017, development of updated version. 2018, in force of the updated version
Sustainable construction standards for Chilean houses	Information Voluntary Actions	In 2016, in force and updated in 2017
Certification of Sustainable Housing	Economic Instrument Information	Under development, launching in 2019
Reduce the deficit of green areas in the country, through investment in conservation and construction of parks and squares	Project	2015 Implemented and active
Bikeways Plan	Project	2014
Master Plan of Santiago´s bikeways	Project	2013 - 2032 Implemented and active

[1] The type of instrument is classified as corresponding to a measure of Economic instrument, Education, Research, Information, Regulatory, Voluntary action, Project, Policy, Economic incentive, Governmental, Technological Development.

Source: Own preparation based on sectorial Information

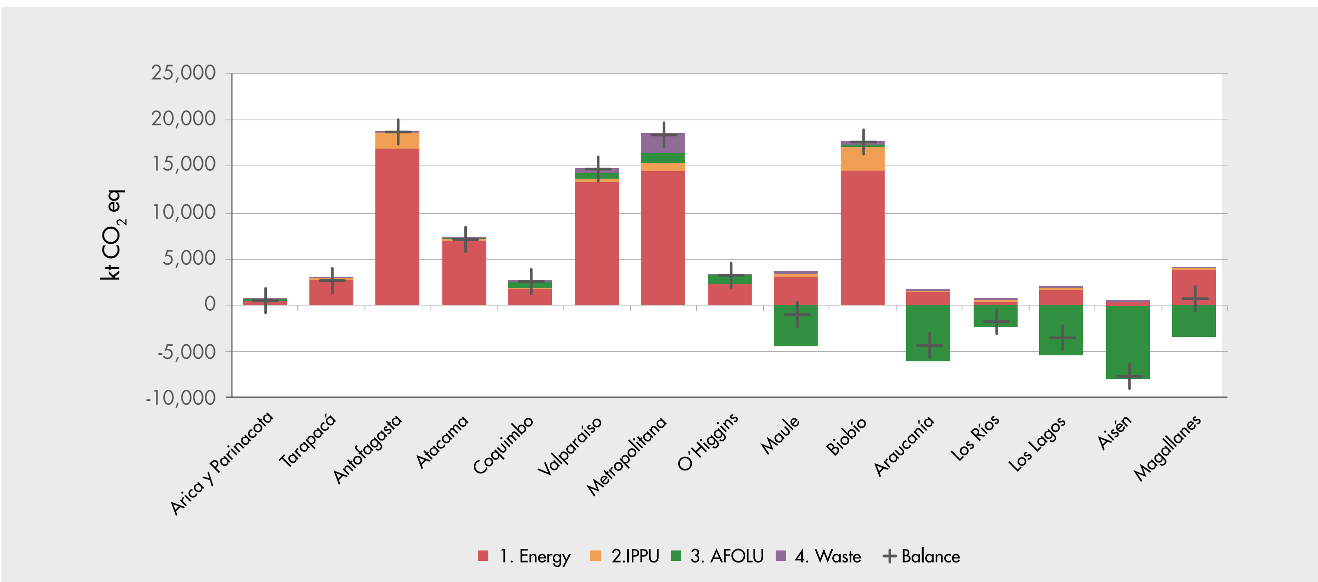
[38] *Further detail of the various measures may be consulted in Annex 5 to this document.*

4.3. GHG Mitigation efforts at a subnational level

In addition to the actions and policies raised and carried out by the different sectors, there is a growing interest on the part of local governments to generate and maintain actions identified with the realities of each one of the places they represent. Given the geography, the economy and the social reality of the country, regions have very distinctive characteristics among them.

These differences are apparent in the profiles of the regional inventories of GHG (RNGHGI) developed by the SNICHILE in early 2017, related to Chile's NGHGI Series 1990-2013[39]. When analyzing these profiles (Figure 8), a group of net emitting regions[40] is observed (Arica and Parinacota; Tarapacá; Antofagasta; Atacama; Coquimbo; Valparaiso; Metropolitan; O'Higgins; Biobío and Magallanes) and a second group of regions that are net sinks[41] (Maule; Araucanía; Los Ríos; Los Lagos; Aisén). Of the first group, it highlights that Biobio as a net sink of GHG in 1990, subsequently losing this condition. Of the second group, it is outstanding that each of the Regions has lost its status as a net sink for at least one year in the time series, a situation caused mainly by forest fires that release as CO_2, the carbon stored in the biomass.

Figure 8. Chile's NGHGI, series 1990-2013: GHG emissions and removals (kt CO_2eq) by region and sector, year 2013[42].



Source: Technical Coordination Team of MMA, 2017.

On the other hand, if the balances and GHG emissions are transformed to comparable indicators such as emission intensity per unit of GDP or per capita emissions, values from Table 12 are obtained. The analysis shows some interesting situations, such as the case of Metropolitan region, which although is one of the main emitting regions, all its indicators are below average. The opposite is the case of Magallanes, whose indicators pass the average, despite not being a great emitter.

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[39] *The values of RNGHGIs in this section do not consider the last Chile's NGHGI, series 1990-2016, presented in chapter 2 of the second BUR. In this regard, the values presented here have a primarily illustrative role.*
[40] *Its GHG balance is favorable to emission.*
[41] *Its GHG balance is favorable to absorption.*
[42] *The AFOLU sector corresponds to the addition of the Agriculture and LULUCF sectors.*

Table 12. Intensity of GHG: regional indicators per capita and Gross Domestic Product

REGION	POPULATION		GROSS DOMESTIC PRODUCT	
	Balance (tCO_2 eq/person)	Total Emissions (tCO_2 eq/person)	Balance (tCO_2 eq/MMCLP)	Total Emissions (tCO_2 eq/MMCLP)
Chile	4.0	6.2	0.6	1.0
Arica and Parinacota	2.9	2.9	0.9	0.9
Tarapacá	8.9	9.4	1.0	1.0
Antofagasta	31.2	31.2	1.6	1.6
Atacama	24.1	24.2	2.3	2.3
Coquimbo	3.7	3.4	0.8	0.7
Valparaiso	8.3	8.2	1.5	1.5
Metropolitana	2.6	2.5	0.3	0.3
O'Higgins	3.7	4.8	0.6	0.8
Maule	-0.8	4.6	-0.2	1.3
Biobío	8.5	9.0	2.1	2.3
Araucanía	-4.3	4.0	-1.6	1.5
Los Ríos	-4.1	5.7	-1.1	1.5
Los Lagos	-4.0	5.8	-1.0	1.5
Aisén	-70,6	8.4	-12.2	1.5
Magallanes	4.8	30.7	0.8	5.1

Source: Technical Coordination Team of the MMA on the basis of information from the National Institute of Statistics and Central Bank of Chile

The dissemination and generation of this type of information, along with that collected by local governments is crucial to the development of actions and local policies on mitigation, coherent and plausible. Currently, some local governments have proposed actions based on the knowledge they have on their region. These are described below.

4.3.1. Regional efforts in climate change

Throughout the country it is possible to show manifestations of climate change, making it more urgent to take actions at a local level to cope with them. From the preparation of the Adaptation National Plan, Chile has an operational structure at a regional level through the CORECCs (Regional Committees on Climate Change), which are the operational arm at a regional level for the coordination and implementation of actions on climate change.

At the same time, through their Regional Ministerial Secretaries (SEREMI), the Ministry of Environment has fostered the implementation of public policies for climate change, leading the regional coordination of the subject and encouraging the participation of other actors from the public, private sectors, academia and civil society.

Over the past few years it is possible to observe an increased activity at a regional level, particularly with regard to the gathering of local information on current and potential impacts of climate change on natural resources and regional biodiversity, as well as on economic activities and population' safety.

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Likewise, several regions have prompted a local agenda focused on public education and awareness, developing scientific seminars, citizens' lectures, trainings to teachers and students among other. The main theme of these activities has not only been to present the climate change phenomenon, but also posing the alternatives to contribute to mitigation from all levels.

The main themes of mitigation that have been addressed at a regional level are related to waste management, renewable energy and energy efficiency projects, among other. Activities related to adaptation are focused on natural disaster risk management and quality assurance of water for the population and productive activities.

Regarding activities financing at a regional level, the Environmental Protection Fund (FPA) of the Ministry of Environment has been used frequently as the main tool to finance research and education activities, other initiatives can also be highlighted that have resorted to financing sources and international cooperation for the development of larger projects.

It is expected that in the next few years the total regions of the country have their operating CORECC to facilitate coordination at the regional level, and that development of mitigation and adaptation actions are driven from the territory adapted to the local requirements and circumstances.

Table 13. Examples of regional initiatives on climate change

Region	Name of the Initiative	Description
Araucanía	"Assessment of Eco-systemic Services and risks for climate change in watersheds of Chile and Mexico."	Between March 2016 and March 2018, The Seremi Araucania led the project: (Project Chile Mexico). This was funded by the Chilean Agency for International Development Cooperation (AGCID) and the Mexican Agency for International Development Cooperation, AMEXCID for a total of USD 204,000. This project was carried out together with the National Institute of Ecology and Climate Change of Mexico and the Catholic University of Temuco. Within the framework of such project an international workshop was called: "Impact of climate change on natural resources: Challenges and experiences in the implementation of adaptation plans".
Tarapacá	"Support to the implementation of National Contributions in the Waste sector in Chile"	Project developed within the framework of the cooperation program between the Governments of Chile (represented by the Ministry of Environment) and Canada, with reduction of greenhouse gas emissions (GHG) within its main axes through the implementation of best practices in the Waste management at a municipal level (Mitigation). The region has been, given its climate characteristics and the issues presented by the Boro disposal site, where a technical visit was carried out with the objective of analyzing the mitigation potential associated with methane recovery.
Maule	Breathelife Campaign	Campaign led by the World Health Organization (WHO), together with the United Nations Environment Program and the Climate and Clean Air Coalition (CCAC), which aims to mobilize the cities and people to protect the health and the planet from the effects of air pollution. The city of Talca joined the initiative focusing its efforts on reducing the use of firewood for home heating, thus contributing to the reduction of polluting emissions by reducing the extreme pollution episodes experienced by city in previous years.

4.3.2. Municipal environmental certification system (SCAM)

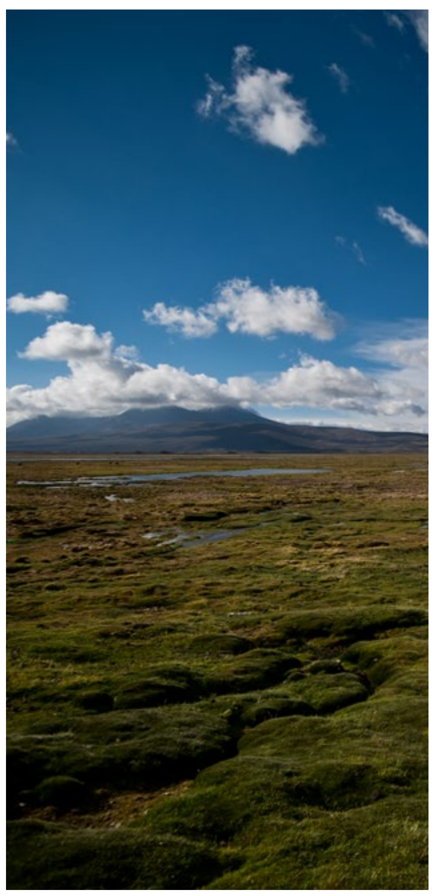
Since 2009 the Ministry of Environment has the Municipal Environmental Certification System, a voluntary program that seeks to install at the municipality and at the community technical capabilities to implement a model that allows for environmental management from the territory, thus addressing environmental challenges from a systematic and comprehensive perspective.

There are five levels of certification that correspond to: (i) Basic Certification, (ii) Intermediate Certification, iii) Advanced Certification/excellence, (iv) Outstanding excellence, and v) Accreditation of community environmental vocation (AVAC).

Figure 9. Stages of the Municipal Environmental Certification

Basic Certification: involves the development of municipal and district environmental diagnosis; the development of the strategy and its corresponding strategic line(s); the incorporation of the District's Environmental Committee Association; the incorporation of the Municipal Environmental Committee, and the execution of an agreement where the authority commits to the compliance with the required components in the certification system, involving financial resources and/or human.

Intermediate Certification: involves the development of plans, systems design and implementation of pilot projects in the area of recycling, water management and energy; the implementation of the strategy and the strategic line(s) committed; the permanent work of the District Environmental Committee and the Municipal Environmental Committee; designs of citizens' environmental participation systems; environmental ordinances; design or redesign of the GAL unit; and compliance with other requirements.



Parque Nacional Lauca, Felipe Cantillana - Imagen de Chile

Advanced Certification and excellence: This level involves the widespread implementation throughout the municipality of the above plans or projects created; the operation of the recycling systems; energy and water savings; municipal ordinance fully in force and operation; systems of environmental participation in operation; and the total compliance with the commitments of the strategic lines; District Environmental Committee and Municipal Environmental Committee, both consolidated.

Outstanding Excellence Certification: This level involves the widespread implementation throughout the municipality of plans or environmental projects, the work of the municipality to gather the information of its carbon footprint through the HuellaChile program, the review and reformulation of the environmental strategy, the development of a management plan of residential waste at a community level and deepening the work carried out by the environmental committees. (MMA, Manual SCAM, 2017a).

AVAC: the Accreditation of District Environmental Vocation (AVAC) is a process of continuity and to deepen of the Municipal Environmental Certification System (SCAM), which municipalities in the stage of outstanding excellence may select.

Eight years after its start-up, the system currently has the participation of 220 municipalities, 39 at the basic level, 51 at the intermediate level, 53 at the level of excellence, and 10 in AVAC. The remaining 27 municipalities joined the last year and have not yet been categorized. (MMA M. d., 2018).

Aware of the effectiveness achieved by the SCAM and the possibility delivered to incorporate new environmental issues in the territory, in the formulation of the National Action Plan on Climate Change (2017-2022) the progress in the climate change management at the level of municipalities was established as a line of action, by integrating it to the Environmental Certification System in the phase of Accreditation of District Environmental Vocation in the areas of energy, water, waste, urbanism and biodiversity. This is accompanied by actions to strengthen regulatory, educational and inter-sectorial work at a local level, (includes the generation of climate-environmental risks maps) (MMA, 2017b).

4.4. Mitigation initiatives in the private sector

In addition to the public sector, the private sector is involved each year with greater strength in initiatives related to the reduction of GHG emissions in the country. In this line, one of the first steps of private organizations is to know their sources and emission levels, which can help them in decision-making.

At a national level, it is difficult to group the private sector in terms of their emissions, because all sectors are involved in a direct and indirect way. However, characteristics may be highlighted in a generalized manner regarding emissions by sector: In the energy sector, on the one hand, power generators are private and on the other hand, private organizations are responsible for direct emissions due to energy self-production and transportation, and indirectly by electricity consumption. With regard to emissions from the IPPU sector, these correspond mainly to private industries, particularly in recent years, the use of refrigerants in the commercial sector. The Agriculture sector, on its part, also generates emissions mainly through private organizations. With respect to LULUCF, the private sector plays a minor role. Finally, in the Waste sector, sewage treatment plants and major landfills are private, and private industries generate liquid waste. It should be noted that an important part of the private sector is made up of companies that play an important role in the emissions by third parties, such as the real estate sector, recycling, sale of vehicles and bicycle services to mention a few examples.

This section describes initiatives that by their nature contribute to GHG mitigation, involving the participation of private organizations.

4.4.1. Public-private actions (CPA, HuellaChile)

The challenge of climate change involves all actors of society in their scales of administrative and geographic organization. This way, to include public-private mitigation actions is increasingly necessary, not only at a national level but also at the local level. In this context, the **Sustainability and Climate Change Agency (ASCC) and the program HuellaChile** were created.

The ASCC was created by the Agreement 2947/2016 of the Board of Heads of the Production Development Corporation (CORFO) and as a continuator of the National Council for Clean Production, is a committee of CORFO whose mission is to encourage the inclusion of climate change and sustainable development dimension in the private sector and in the territories. This through voluntary agreements, coordination with other public institutions, capacity-building initiatives and the implementation of programs and projects that contribute to the construction of a sustainable economy, resilient and low-carbon. At the same time, to support the implementation of international commitments of Chile in these matters.

One of the main instruments of the Agency are the Clean Production Agreements (CPA), as defined in article 10 of Law 20.416 of the Ministry of Economy that secures the special rules for small companies. An APL is an agreement between a business sector and the institutions of administration of the State which objective is to implement cleaner production through goals and specific actions, thus contributing to the sustainable development of companies.

Reserva Nacional Isla Mocha, Felipe Cantillana - Imagen de Chile

In 2012, APLs were registered and then validated with the UNFCCC as the first Nationally Appropriate Mitigation Actions (NAMAs) of Chile. From 2016, reductions achieved through the CPAs are publicly reported, based on the Guidelines for a generic framework for MRV for NAMAs in Chile of the Ministry of Environment. In total, between 2012 and 2017, 79 CPAs have been signed with a reduction of 457,438 tCO_2eq. More updated information on this NAMA can be found in section 5, here in below in this report.

Moreover, the Agency is promoting the Chilean Green Investment Platform (GIP) as an economic instrument. The objective of GIP is to mobilize investments towards low-carbon technologies and resilient to climate change ("Climate Investments") with an emphasis on micro, small and medium businesses. GIP is a public initiative that seeks to leverage private funding towards this type of investment through financial instruments backed by the State of Chile.

In January 2018, the Agency presented the document "Recommendations for a public-private work agenda to year 2030 in the field of sustainability and climate change" (Agencia de Sustentabilidad y Cambio Climático, 2018), developed under a participatory process with various actors. In particular, the following eight priority areas were identified where there is need for public-private action to make progress in emissions mitigation, adaptation to the impacts of climate change and the other components of sustainable development consisting of:

1. Financial Sector
2. Forestry Sector
3. Fisheries and Aquaculture Sector
4. Agricultural industry Sector
5. Freight Transportation Sector
6. Watersheds and water resources
7. Waste Sector
8. Cities

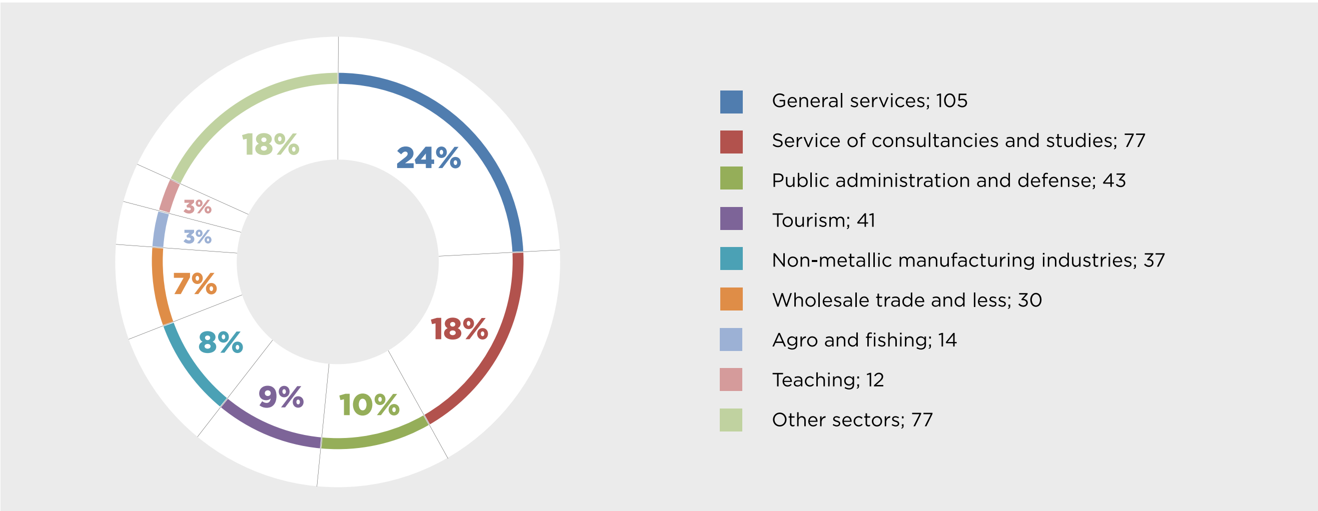
On the other hand, **the HuellaChile program** arises from the Ministry of Environment with the goal of fostering the quantification, reporting and management of Greenhouse gas (GHG) emissions at the organizational level in the public and private areas. It has been developed in accordance with the following standards: NCh-ISO 14064:2013 (Part 1, 2 and 3); NCh-ISO 14065:2014; NCh-ISO 14066:2012; NCh-ISO 14069:2014 and NCh 3300:2014.

The design and planning stage, implemented during the years 2013 and 2014, involved the development of the web page (www.huellachile.cl), a tool for calculating GHG emissions inserted into the Single Window System of the Pollutants Release and Transfer Register (PRTR), reporting formats, and the system of mutual recognition according to the level of management achieved. The development of the calculation tool included a pilot program with the voluntary participation of 40 organizations.

The second stage developed since 2015 corresponds to its implementation, which highlights three main elements: a calculation tool of GHG emissions at the organizational level, technical support (includes trainings, technical meetings, delivery of clarification by means of telephone or e-mail, among other) and delivery of recognition logos to participating organizations.

Until May 2018, a participation of 434 organizations from different economic sectors has been recorded, as it may be seen in Figure 10. The Program has delivered 118 HuellaChile recognitions for quantification (109), reduction (7), neutralization (1) and for excellence in the GHG management (1), of which 49 were delivered during 2016 and 69 in 2017.

Figure 10. Participation of the different sectors in the HuellaChile program



Source: HuellaChile, 2018

It should be noted that in 2017 a recognition of neutralization is delivered for the first time, giving a new perspective to the effective participation of the private sector to the potential voluntary implementation of national mitigation actions. It also delivers a logo of excellence for incorporating additional measures of climate change to a private company.

Until April 2018 more than 40 workshops have been organized on the calculation of GHG emissions and their management, with over 1,000 participants, in different cities across the country. Of the private sector, agricultural industries, tourism, energy, industry, mining, logistics and fishing areas have participated; in addition, professionals of municipalities and other public agencies have been trained.

Parque Pingüino Rey bahía inútil tierra del fuego, Juan Ernesto Jaegger - Imagen de Chile

The following activities were carried out during the implementation of the program:

• Implementers and verifiers table, which aims to reach agreements with respect to the verification process and propose methods for integration into the program, identifying benefits and barriers for different types of organizations.

• System of verifiers Accreditation: In 2015 arises from the Ministry of Environment, through the HuellaChile Program, the need to create a system of accreditation of verifiers in the management of GHG emissions. Currently, the National Institute of Standardization is developing such a system, based on international experiences on requirements for organizations which perform verification and validation activities, together with the start-up of the incorporation of the ISO/CASCO Mirror Committee, aimed to begin the discussion of the international standard ISO/IEC CD 17029 draft, General principles and requirements for bodies performing validation and verification activities.

• Support local environmental management: since 2015 HuellaChile and the team of Local Environmental Management (GAL) began supporting municipalities that are participating in the Municipal Environmental Certification System (SCAM), so that they can be part of the HuellaChile program. This support consisted in trainings to those responsible for the environmental certification of municipalities at advanced levels in different regions of the country.

• Negotiation and implementation of goals of GHG management in Clean Production Agreements (CPA). To date, there has been participation in the negotiation of the processed foods III and Transportation CPAs. Additionally, the team of HuellaChile has supported the implementation of the goals related to the management of GHG emissions of Containers and Packaging, Smelters III, San Antonio Port logistics APL, among other. This support involved training to those responsible for the facilities participating in the various agreements on quantification and reduction of GHG emissions, and about the use of the calculation tool of the program.

• Consultancy for the preparation of GHG reduction guides at offices and in the agricultural sector. During 2017 a consultancy developed for the preparation of a guide to best techniques and technologies for the reduction of GHG emissions at offices and in the agricultural sector. The objective was to support the generation of information for the encouragement of the implementation of GHG reduction actions in the sectors mentioned.

• Estimation of local emission factors. During 2017 and 2018, with the participation of interns, work was done in the obtaining of local emission factors, including electrical subsystems, raw materials and commodities, waste treatment and disposal, among other. The calculation of these factors is carried out through the life cycle assessment (ACV).

The challenging activities to be developed by the program are:

• Updating calculation tool, includes error fixing and improvements for quantification of GHG emissions. In addition, to incorporate into the tool a system for calculation and reporting of GHG reductions through implementation of mitigation actions, as well as reporting neutralization and excellence.

• Generation of local emission factors mainly associated with waste management.

• Preparation of guidelines and rules for the accounting of GHG reduction by the implementation of actions.

Parque Nacional Llano de Challe, Amelia Ortúzar - Imagen de Chile

4.4.2. Other mitigation initiatives in the private sector

As indicated in the report of 2016, the private sector remains a key player in the field of mitigation. On the one hand, the mitigation potential will significantly influence real options for compliance with international commitments; and, on the other hand, it has a main role in the implementation of potential mitigation public policies that are defined at national or local level.

The information on mitigation actions driven by the private sector was based on both the collection of public documents, as well as on opinions delivered in interviews of representatives of associations and other private organizations[43]. This methodology is the same that was used for the second BUR, but more actors were added.

As a general comment, it outstands that the companies identify that the implementation of mitigation actions represent an opportunity for business, including energy efficiency measures, waste management, eco-design, among other. Although this reason was mentioned in the information collection for the second BUR, now it was mentioned by the vast majority of the respondents.

On the other hand, it indicates that the following causes for the implementation of mitigation actions:

Corporate policies of large companies generally with international commitments and goals of sustainability and low-carbon development.

Requirements of some international markets with certification systems that include aspects of monitoring and reporting of GHG emissions (carbon footprint of products or corporate), as well as quantification of GHG reductions.

Low renewable energy price that encourages the implementation of new technologies as a source of energy.

In particular, to the power generation sector, greater possibility of renewable energies penetration are associated to the future prospects of the carbon market and regulatory changes associated to the bidding of regulated clients.

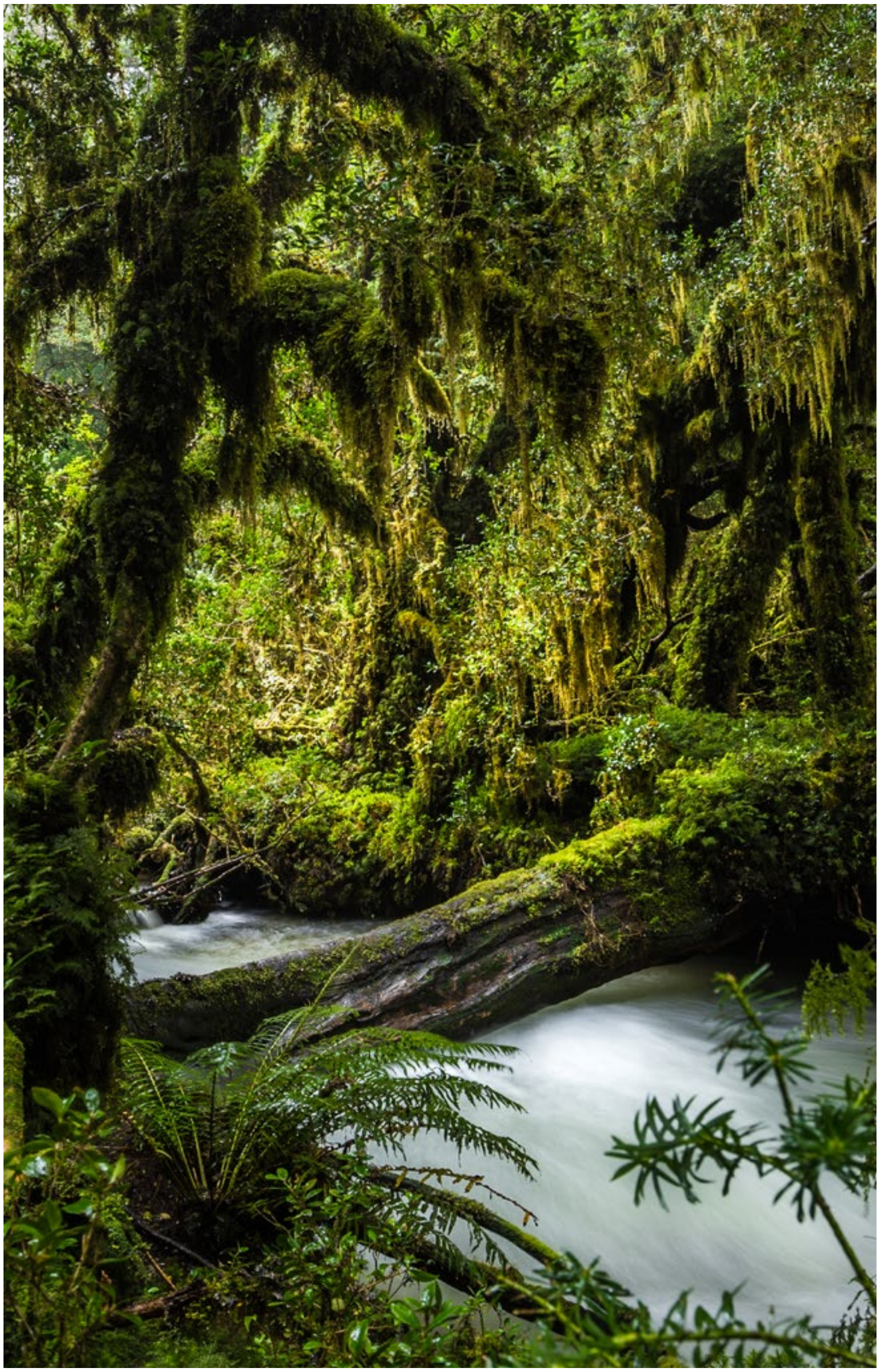
With regard to the agricultural sector, a major problem of this activity has been the water shortages as a result of the drought of the past few years, which has led to the private sector not being indifferent to the issue of climate change, assessing to implement adaptation and mitigation measures.

Local regulations, associated to atmospheric decontamination plans that drive to implement measures of technological replacement, or preparation for the entry in force of the Law 20.920 of Recycling, considering that the increased involvement of recycled materials in the country has an impact on the GHG emissions reduction.

[43] *Personal communication with Agency of Sustainability and Climate Change (ASCC), the Development Committee of the Solar Energy Industry (Solar) Committee, Business Leaders Against Climate Change (CLG-Chile), Action Companies, Global Compact Network Chile, Carbon Disclosure Project (CDP), Energy Efficiency Agency, Electric Companies A.G., Generators of Chile A.G., the Chilean Wood Corporation (CORMA), National Society of Agriculture (SNA), Association of Exporters of fruits of Chile (ASOEX), Association of Swine Producers of Chile (Asprocer), National Society of Fishing (SONAPESCA), Wines of Chile, ChileAlimentos, Mining National Society (SONAMI), Cement and Concrete Institute of Chile, FISEM, National Association of the Recycling Industry (ANIR), between March and April 2018.*

In addition, the creation of the Clean Development Mechanism (CDM) is mentioned as an enabling condition for companies to consider climate change in their management and not only as an outside event on the way of doing business. This allowed the creation of capacities within companies, which generated the continuation of new commitments related to the implementation of mitigation actions.

As a future trend in the development of new mitigation measures, it is expected that the housing sector is an important agent for promoting actions, as well as the ground transportation, mainly associated to the development of electromobility, or in mining based on hydrogen fuel cells. Regarding the latter sector, considering the general water deficit and its use in production processes, the need to assess new water sources is projected, such as desalination of water and driving of this resource with use of NCRE, which have an impact on both mitigation and adaptation.



Parque Nacional Queulat, Sernatur - Imagen de Chile

The agreement, at the beginning of 2018, between the Government of Chile and the companies partners of the Power Generator Association of Chile (AES Gener, Colbun, Enel and Engie) should be considered as a vision in the medium and long term, by which they undertake to end new developments of coal-fired power plants, and a phased withdrawal or reconversion of units of coal power in the framework of the Energy Pathway. In detail, they agreed (Gobierno de Chile y Generadoras de Chile, 2018):

1. The above-mentioned companies undertake not to start up new developments of coal-fired power projects that do not have systems of carbon capture and storage, or other technologies equivalent to this date.

2. A Work Table will be created to analyze the technological, environmental, social, economic, security and sufficiency elements of each plant and the electrical system as a whole, among other allowing to establish a timetable and conditions for the programmed and gradual cessation of the operation of coal-fired power plants that do not have systems of carbon capture and storage, or other equivalent technologies.

3. The Ministry of Energy will coordinate this Work Table to which all relevant institutions in this process will be invited.

Detalle bicicletas públicas en Santiago, Roderik Henderson - Imagen de Chile

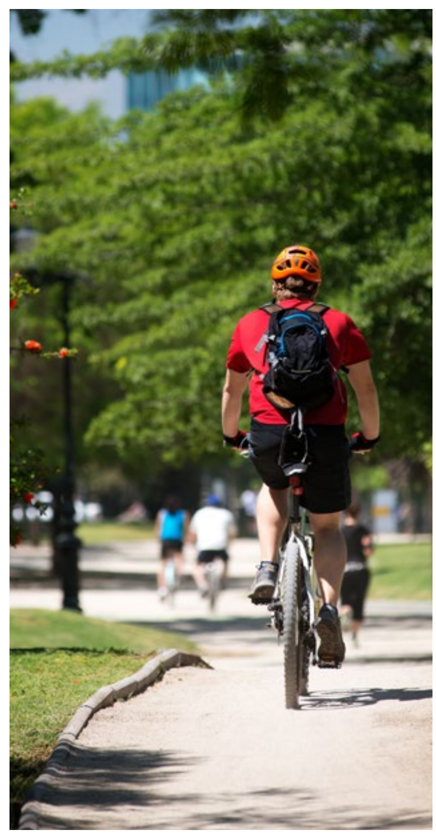
In this line, on June 11, 2018, the Table of Energy Decarbonization (MDE) met for the first time, which aims is the analysis of the effects of retirement and/or conversion of coal units, in order to strengthen the discussion about the decarbonization process. The MDE is integrated by power companies, public sector, independent institutions, unions, associations of consumers, ONGs, trade unions, municipalities, civil society, academics and international agencies (Ministerio de Energía, 2018).

At the same time, in 2013 started the first automated system of public bicycles of Chile, inter-districts initiative which currently covers 14 districts of the Metropolitan region, and which in its first two years of operation already had 200 stations, more than 2,000 bicycles and close to 25,000 registered users. (MMA, 2015). In addition, and to encourage a modern and sustainable system, the stations work with solar panels that give energy autonomy to its operation.

The balance of the authorities on this system is positive, and to enhance its preference and massive use, in some of the districts where it has been implemented, plans were started for the creation and/or improvement of the road infrastructure to support the coexistence of bikes with other means of motorized transportation.

Additionally, a bill has been presented that reduces the maximum speed for motor vehicles in urban roads to 50 Km/h, to facilitate the coexistence of cars and bicycles in areas where there is no road segregation.

Likewise, work has been done to incorporate high standards to the new bikeways and regulate the traffic of cyclists on sidewalks and walkways.



Parque Américo Vespucio, Cristobal Correa - Imagen de Chile

On the other hand, it highlights organizations that crosswise support the private sector on climate change initiatives, through workshops, work programs, seminars and platforms:

• Acción Empresas: Since 2018, it defines Climate Change and Circular Economy as one of its six thematic lines. This line has an Executive Committee, who will define the work program during the next two years, with indicators and specific goals. In addition, training courses and workshops that address a specific subject of climate change will be carried out. During 2016 and 2017 meetings and workshops were also held related to this topic.

• The Carbon Disclosure Project (CDP): during 2017, the implementation of 14 workshops which provide information on how to answer the CDP questionnaire related to climate change issues has been supported. On the other hand, an online platform for the whole Latin America to deliver an assessment to companies on their actions is expected in 2018.

• Business leaders against Climate Change (CLG-Chile): organization with the participation of 19 leading companies that are a part of a network of centers in the world that form the Corporate Leaders Network for Climate Action driven by Great Britain which, together with the academy, drive policies and instruments that facilitate the transition towards a low- carbon economy, that in turn translate into opportunities for sustainable development for our country, from a high level summons, leadership and business innovation. Outstanding is the co-organization of the seminar for the Financial Sector, as well as support in the implementation of the training workshop on tradable emission systems (GIZ and PMR).

•Red Chile Global Compact: in 2017, a specific work on climate change has begun to arise, through a group of leading companies in the ODS 13, Action for Climate. The objective of this group is to work together to achieve progresses that contribute to the goals 13.1, 13.2 and 13.3 of the corresponding ODS. Within the tasks assumed by the companies, individual commitments are identified that include defining measurable goals of GHG, consumption and energy efficiency, sustainable raw materials, in addition to sharing experiences and good practices. It is still in the initial phase, to then identify details of the goals, dates, benefited, and more information about the expected results. In addition, during 2016 and 2017 this organization held various meetings and workshops to strengthen capacities in the field of climate change.

Table 14 presents the update of mitigation initiatives and means of implementation in the sector.

Río Huasco, Vallenar, Felipe Cantillana - Imagen de Chile

Table 14. Mitigation initiatives and private means of implementation by sector

Sector	Description	Progress presented in BUR 2 (2016)
Energy (a,b,c)	Considers the opinion of professionals and experts in the sector, based on their knowledge and experience. Includes the vision of generators, distributors and transmitters in addition to government programs for the development of the industry.	Reduction of GHG emissions and generation through NCRE sources. The sector will be subject to the next taxation regarding its CO_2 emissions.
Transportation	The transportation sector has various edges. On the one hand, the companies of road cargo transportation represented by the Association of Chile Transportation are addressed in this table. Additionally, CORMA, which includes the transportation of wood, addresses this sector. Also, the actions of international maritime transportation and air transportation are also addressed in this row. In this section of the previous BUR actions of Metro, EFE and LATAM were reported. In this report the progress of METRO and EFE are reported in the public sector and LATAM in this section.	LATAM aviation company is working since 2011 to reduce its CO_2 emissions according to the sectorial strategy driven by the IATA (International Air Transportation Association). Improve efficiency in the use of fuel by 1.5 % per year. Reaching carbon neutral growth in 2020. Reduce emissions by 50 % in 2050, compared to 2005. Average annual reduction of 2.5 % in fuel use between 2012 and 2015.
Mining (d,e)	The sector in Chile can be separated into Large-scale mining and Small and Medium-sized mining. SONAMI gathers more than 3,000 entrepreneurs from both groups and the Mining Council represents only the great Mining (14 partners, 95 % of copper production) including the State's company Codelco. This update considers the opinion of professionals and experts of these institutions, based on their knowledge and experience.	Cooperation Agreement between the Ministry of Energy and Mining Council (2014) to encourage energy efficiency. Each partner conducted an audit and a plan of action was presented in 2015. In 2016, the 10 principles of the CM on Climate Change were published. SONAMI is a member of the International Council on Minerals and Metals (ICMM), which in 2015 presented a statement on climate change.

Updated initiatives of mitigation actions	Updated initiatives of implementation means
The Power Generators Association reported the following initiatives: 1) Agreement between the Power Generators Association of Chile and the Government of Chile in order not to develop new coal-fired power plants (Gobierno de Chile y Generadoras de Chile, 2018). In addition, the Energy Decarbonization Table (MDE) was incorporated to progress in the withdrawal and/or conversion of coal-fired units (Ministerio de Energía, 2018). 2) Greater investment in power plants of renewable source (PV, wind, hydro, biomass). 3) Development of I+D pilot projects (algae that capture CO_2). 4) Incorporation of an implicit price of carbon in the assessment of projects. The Solar Committee reported the following progresses: 5) Development of the Concentrated Solar Power (CSP) technology through the Solar District Technology. 6) Encourage technological adaptation, for example adapting the photovoltaic panels to local conditions in Chile. (Technology Program photovoltaic systems for deserts). 7) Financing 60 projects of self-supply in PYMES of up to 80 % of investment between 2015 and 2016 together with the Regional Government of Biobío. In addition, based on these projects an assessment was made to raise best practices and know about the development of the associated industry. On the other hand, electrical companies report on: 8) Participation of the association in energy efficiency projects such as the replacement of streetlights and labelling of electrical appliances.	Regarding the Power Generators Association: 1. Analysis and communication of environmental performance (e.g. reporting GHG emissions). Some report through Carbon Disclosure Project. 2. Participate in initiatives associated to climate change as Coal Pricing Leadership Coalition, CLG (Business Leaders Against Climate Change), and Presidential Permanent Advisory Committee on Climate Change. 3. Study on mitigation measures and expenses curve. (POCH, 2017).
In relation to freight transportation, in November 2016 the Clean Production Agreement of Road Transportation Sector was executed. This Agreement is addressed to 32 companies of cargo road transportation located in the national territory, in order to incorporate additional measures to those mandated by the regulations in force, associated to the decrease in fuel consumption, increased recycling and recovery of waste, thereby contributing to climate change mitigation. One of the goals of this agreement is to reduce GHG emissions, for which we have established training actions, calculation and reporting of annual GHG emissions at the organizational level, considering a base line. On the other hand, Chiletransporte association will consolidate the results of the previous action and calculate GHG reductions. Then, regarding the progress presented in the previous report, LATAM reports that it has achieved a 27 % less in the road transportation of 2012 to 2016 and during this period it has been compensated for, including travel of collaborators and other indirect emissions, 26,573 tCO_2eq (LATAM AIRLINES, 2017). The initiatives of eco-efficiency in fuel consumption also had a positive impact on GHG emissions, with the reduction of 440,300 tCO_2eq emissions of 2016 (LATAM AIRLINES, 2017).	Regarding the Clean Production Agreement of freight transportation, it is expected at the end of this agreement to have the results of GHG reductions of companies adhering to the agreement. With regard to LATAM, they annually monitor their GHG emissions. Throughout 2016, the work prioritized the pursuit of efficiencies in the cruise stage of flights, which comes to represent a 95 % of total consumption. A high-tech system began to process the information of flights and check it with the pre-established plans, allowing the identification of reduction opportunities for route to route. (LATAM AIRLINES, 2017).
It is estimated that the initiatives implemented of the Great mining action plans within the context of the cooperation agreement could generate reductions in energy consumption between 3 and 5 %. It includes improvements in logistics, operations and technology. According to SONAMI mitigation actions are under implementation in small and medium mining in the form of associations, together with the Agency of Energy Sustainability or through ENAMI.	The partners of the Mining Council have delivered 3 progress reports of the action plan (2015, 2016 and 2017), they have officials responsible for Energy Efficiency and incorporated the concept to the institutional culture. Both SONAMI and Mining Council provide information annually on direct GHG emissions to Cochilco. On the other hand, the sector participates in the solar technology institute of Corfo, in the technology RoadMap 2015-2035, and in the Corfo project "Integration of solar thermal technologies in the Chilean metallurgical industry to improve their competitive advantage".

Sector	Description	Progress presented in BUR 2 (2016)
Cement (f,g)	It considers the opinion of professionals and experts from the Inter-American Federation of Cement (Ficem) and the Institute of the Cement and Concrete of Chile (ICH) based on their knowledge and experience.	Participation in international associations such as the Cement Sustainable Initiative (CSI). The replacement of fossil fuels through the co-processing with industrial waste is limited by the lack of regulation.
Forestry (h)	It considers the opinion based on the knowledge and experience of professionals and experts in the sector that brings together companies throughout the production chain including plantations, native forest, transportation, cellulose, boards, sawmill, ports and research, represented by the Chilean corporation of wood (Corma).	Co-generation of energy through biomass as a solution to the industry's waste management.
Agriculture (i,j)	It considers the opinion based on the knowledge and experience of professionals and experts in the sector including the SNA, National Society of Agriculture, which objective is to support entrepreneurship in Chile and public actions in the agricultural sector (is subdivided by categories, such as Fedefruta, Fedeleche, Corma, etc.) and the Association of Exporters of Fresh Fruit (ASOEX).	
Wine (k)	It considers the opinion based on the knowledge and experience of professionals and experts in the sector represented by the association of Wines of Chile. It should be noted that in terms of production and participation in the market, it is concentrated in a few large companies, but at the same time it is a diverse sector with large number of stakeholders, including agricultural suppliers even to the production process.	Wine companies respond to a greater experience in the subject because of the requirements they have to comply with to export to certain countries.

Updated initiatives of mitigation actions	Updated initiatives of implementation means
The production of cement in Chile uses approximately 30 % of natural ash (pozzolan) which significantly reduces its carbon footprint with respect to cement in other countries. On the other hand, the use of waste as fuel additive and fuel material (debris, TAS sludge; household waste; construction aggregates) is still limited by lack of regulations, which could have an impact on reduction of GHG emissions in the sector. In the context of the law REP, of the energy use of waste tires, among other, has been offered as an alternative for final disposition. The construction of roads using concrete instead of asphalt has been encouraged, considering that this alternative can generate a reduction in fuel consumption of 5 %.	Development of a roadmap of the sector during this 2018, which includes an improvement in the estimation of GHG emissions in the sector, identifying gaps in knowledge and technical indicators of performance. The ICH together with MINVU and other actors are starting a proposal work to implement a calculator of GHG emissions from buildings.
Along with the use of biomass as an energy source, the sector has been actively involved in fire prevention (driven by the large fires of the summer 2016-2017). In 2017 the network of community prevention was created that has trained 350 local communities also with support by the ASCC. On the other hand, the use of wood in construction has been encouraged, considering that the use of this material might have a lower carbon footprint.	Corma is a part of the Council of Forestry Policy and Policy Council of Infrastructure, which are of interest to assess and encourage implementation of actions with impact on mitigation of GHG emissions, such as freight transportation
Among the initiatives implemented by these organizations that lead to a reduction of GHG emissions include: 1) Fertilizer Application Program based on an assessment of the need and not by schedule. It encourages the efficient use of fertilizer and research in biofertilizers. 2) To encourage the installation of photovoltaic panels as a source of energy for use in cold chambers. 3) To improve working conditions a break in the hours of higher temperature of the day was implemented, which brought as co-benefit a decrease in energy used to cool the fruit at the packing. 4) To foster more efficient irrigation actions including techniques and technologies according to the type of production. 5) To encourage genetic improvement associated to a lower use of agrochemicals and adaptation to new conditions with increased drought. 6) Program of Corfo for adaptation to climate change in the production of blueberries, includes actions of efficiency in the application of agrochemicals, irrigation, among others.	According to the SNA, in general, the actions that have been implemented have their focus on adaptation and mitigation, are not independent. Increase in certifications such as GAP (good agricultural practices) that require measurement of carbon footprint. ASOEX has developed guidelines for sustainability, use of agrochemicals and energy efficiency among others. SNA reports: - Participation in financing the agriculture climate atlas of Chile, 2017, being relevant to the actions of the sector. - Training and formation: "SNA educa" has 20 technical colleges which included as relevant topics energy efficiency and renewable energies. - Specialized Center of Irrigation by SNA educa in San Fernando, with the aim of providing the knowledge and skills in the use, operation and maintenance of these technologies to our students. - Awareness with radio programs in Radio Agricultura, the Radio that invites panelists specialized in climate change to discuss this issue.
The main initiative encouraged by the sector is the Sustainability Code of Wine, which goal is the sustainable production of wine. In the environmental aspect, it includes aspects energy efficiency, pest management, packaging, along with monitoring of GHG emissions at the corporate level. To fulfill this aspect, calculation tools of GHG emissions have been generated. Each establishment must have a base line and define their own GHG reduction goals with measures including energy efficiency, soil coverage, integrated pest management, conservation of biodiversity, among other.	This code has already certified 75 % of bottled wine exports. Through the Association of Wines of Chile it is expected in about a year to have data collection of the establishments' certificates that allow estimating a value with goal and total reduction of GHG emissions.

Sector	Description	Progress presented in BUR 2 (2016)
Fisheries (l)	It considers the opinion based on the knowledge and experience of professionals and experts in the sector represented by National Society of Fishing (SONAPESCA), which includes boats, processes, shipyards and exporters.	
Containers and packaging (m)	It considers the opinion based on the knowledge and experience of professionals and experts in the sector represented by Center of containers and packaging. (Cenem), which provides technical support to the development of industry with participation throughout the entire value chain: raw material, additives, services, manufacturers (70 %) and recycling.	
Waste (n)	It considers the opinion based on the knowledge and experience of professionals and experts in the sector represented by the National Association of the Recycling Industry (ANIR) which includes the participation of 21 partners.	

Source: Own preparation based on interviews with the following institutions: (a) Generators of Chile A.G; (b) Solar Committee; (c) Electric Companies A.G.; (d) The Mining Council; (e) SONAMI; (f) Cement and Concrete Institute of Chile; (g) FICEM; (h) CORMA; (i) ASOEX; (j) SNA; (k) Wines of Chile; (l) Sonapesca; (m) Cenem; (n) ANIR.

Updated initiatives of mitigation actions	Updated initiatives of implementation means
In 2014, in Coquimbo region a program of change of the material of fishing nets by one lighter was implemented, which generated a decrease in consumption of fuels in fishing vessels. This practice was afterwards implemented in other fisheries of the country. Alliance with Bureo Net Positiva in 2016 for reuse of fishing nets as an input for other products. This alliance includes study of number of networks and education and training on reuse of wastes.	Certifications, including the Marine Stewardship Council (MSC) program. Declaration for responsible and sustainable fishing on the basis of Conduct for Responsible Fisheries of FAO (2015)
In recent years, progress has been made in the optimization of materials and industrial waste, partly driven by the REP law. Highlighted, for example a decrease of 15 % of the thickness in the production of glass bottles in 2010 (ecoglass) and in 2017 the sector agrees to a reduction of 5 %. On the other hand, the technological replacement has made processes more efficient, with actions such as photovoltaic energy and projects development for the recovery of solvents in some companies.	The sector in general is interested in quantifying the carbon footprint of its products. Within the program TransformaAlimento is the measure of how to generate indicators of the country environmental impact assessment including life-cycle analysis of carbon footprint of packaging. The objective of this program, funded by Corfo, is to increase the exports between 2015 and 2025.
The REP law is very relevant to encourage actions in the sector. Among the companies, initiatives related to energy efficiency as well as decrease of waste generation have been implemented. The reductions of GHG emissions from recycling are not produced mainly by the implementation of initiatives within each company, but the greatest impact is reflected in the increase of recycled materials participation in the country, having a result on the reduction of GHG emissions.	

5. NATIONALLY APPROPRIATE MITIGATION ACTIONS (NAMAS)

According to the UNFCCC, the concept of NAMA refers to any action that reduces emissions in developing countries and is prepared under the umbrella of a government initiative. These actions can be policies to achieve transformational changes within a sector of the economy, or actions of all sectors for a broader national approach. NAMAs are supported and facilitated by technology, financing and capacity building, and are geared to achieve a reduction in emissions relative to the "business as usual" scenario in 2020 (CMNUCC, 2018).

5.1. Chile's NAMA

The Climate Change Office (OCC) of the Ministry of Environment initiated in October 2010 a process of gathering ideas and proposals for NAMAs of the major emitting sectors of Chile, for which it would seek international support, facilitated by a technical file developed for those purposes by the Ministry. The initial portfolio of Chile's NAMAs was constituted with several proposals, in particular from the Ministries of Agriculture, Energy and Transportation.

With the opening of the prototype for the registration of NAMAs and subsequently the official register (NAMA Registry), Chile was able to complete the work and in October 2012 it was the first country in the world to register a NAMA with the UNFCCC (NAMA of Clean Production Agreements). However, despite the initial enthusiasm for the instrument, it has not been able to increase the interest of project developers with mitigation potential. It is not that there is a lack of initiatives, but rather that the added value that provides the registry does not appear to be sufficient to encourage their widespread use. In general, the developers of mitigation actions have achieved international support for their preparation through mechanisms and international projects for which there is no requirement on the Convention record.

5.2. Summary of Chilean NAMAs

In Chile, six sectorial NAMAS are identified, with different levels of maturity and available information. All of them are registered in the NAMA Registry of the UNFCCC. Some of the NAMAs have undergone significant changes in their design that are embodied in the ANNEX 6. A brief summary of the Chilean NAMAs recorded in the NAMA Registry is presented in Table 15.

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Table 15. Nationally Appropriate Mitigation Actions of Chile recorded in the NAMA Registry

Name	Description	Gas and Sector	Period	Estimated GHG reduction	Progress
Renewable Energies for self-consumption in Chile (SSREs)	Encourage the incorporation of renewable energy systems for self-supply in Chile through the creation of financial and technical conditions suitable for the early stages of the development of this emerging industry.	Energy CO_2	2015-2022	1.5 $MtCO_2eq$.	Currently the NAMA of consumption is under implementation status. With regard to the technical component of the draft NAMA Support Project, this is at the stage of implementation, while the financial component is approved and in preparation.
Green zone for transportation in Santiago	It contains four specific initiatives (scale up and replicable) to encourage modes of transportation of low-carbon emissions content: 1) Promotion of vehicles from zero and low emissions in the fleets in light vehicles; 2) More efficient buses for public transportation; 3) Promotion of use of non-motorized vehicles 4) Management and redesign of transit system.	Transportation and Infrastructure CO_2	2014-2022	1.43 $MtCO_2eq$	The study *Baseline, System of Measurement, Reporting and Verification (MRV) and quantification of the co-benefits of NAMA "Green Zone for transportation in Santiago-ZVTS"* (completed in October 2016). The general objective was to carry out a plan of MRV to determine the baseline and the assessment of impacts on GHG emissions and co-benefits of the NAMA ZVTS. To carry out the main goal and specific objectives a methodology was developed which included three phases of work: **Phase 1 of "Update":** phase of the project which upgraded the NAMA Green Zone in its four initiatives, as well as identified relevant actors and characterized the national sectorial context in terms of policies and regulations. **Phase 2 of "quantification":** phase which characterized the base line, determined the reduction potential and developed the plan of MRV of the NAMA Green Zone that allows evaluating the impacts of the NAMA on emissions and co-benefits. **Phase 3 of "Sustainability":** phase which has the purpose to establish the conditions for sustaining the NAMA Green Zone in the medium and long term, analyzing barriers and the requirements for financial and technical assistance.

Name	Description	Gas and Sector	Period	Estimated GHG reduction	Progress
Design and Implementation of the strategy on climate change and vegetation resources	The objective of the NAMA is included in the framework of the ENCCRV, serving as technical and economic support for the development of studies and activities aimed at identifying and reducing weaknesses of baseline information in addition to increasing the capacities of national technical and regional teams related to ENCCRV. The goal of reducing emissions considers the implementation of the total of the ENCCRV, considering having the funding at international and national levels.	LULUCF	2013-2025	42 $MtCO_2eq$	During 2016 and 2017 interventions have been carried out in six projects of early implementation of preventive forestry and restoration. The surface of the total intervention corresponds to 58 hectares, with an area of influence of 976 hectares, benefiting directly 28 owners and indirectly to 18,634 inhabitants of rural areas. It is estimated an annual volume of reduced emissions of 3, 400 t/CO_2eq. On the other hand, CONAF has developed the first summary of information about the approach, concerning and compliance with safeguards for the formulation of the ENCCRV of Chile, which was presented to the UNFCCC secretariat in February 2018. International courses in the context of vegetation resources, climate change and desertification.
Clean Production Agreements (CPA) in Chile	CPAs are intended to implement cleaner production through goals and actions within a specified period of time. It is a standard that sets goals and specific actions to be implemented by a productive sector, based mainly on the best techniques available on the market.	Crosswise study	2012-2020	18.4 $MtCO_2eq$	Reduction of GHG emissions accumulated 2012-2017: 457,438 tCO_2e. On the basis of the schedule, the expected value is of 105 CPAs signed in 2017. There are 79 CPAs signed[44] as of 2017 in this period, resulting in a 75 % progress at signing CPAs. It is important to note that of these 79 CPAs signed in the period 2012 - 2017, only 9 CPAs are considered in this report. The site https://sites.google.com/cpl.cl/sfe/resumen-estadístico-ascc contains periodically updated operational data of the different Agreements managed by the Agency of Sustainability and Climate Change.

[44] This considers the pilots of new types of territorial agreements and pre-investment studies characterized by a methodology for generation and mode of operation different from that of the CPAs based on technical standard, 3 pre-investment associated to commitments in the framework of the installation of productive plants of sufficient size to have to issue statements or environmental assessments, 3 of watershed management and 1 of territory management for fire prevention.

Nombre	Descripción	Sector y Gases	Periodo	Reducción de GEI estimada	Progreso
Energy recovery of organic waste (former National Program for Industrial and Commercial catalyzing in the management of organic waste in Chile)	Energyc recovery of agricultural industrial organic waste (NAMA waste-to-energy or NAMA waste to energy) considers the mitigation of GHG emissions (methane) at a national level, through the implementation of technologies of energy recovery of waste: waste incineration with energy recovery, pyrolysis, gasification and anaerobic digestion.	Energy, Waste CO_2; CH_4	2018-2030	The reduction of emissions accumulated to 2030 for each technological alternative, considering a coverage of 70 % energy recovery of the priority waste of the country as of 2030, is: - Incineration with energy recovery: 7.42 $MtCO_2e$. - Pyrolysis: 6.84 $MtCO_2e$. - Gasification: 6.85 $MtCO_2e$. - Anaerobic Digestion: 60.96 $MtCO_2e$.	Between June 2016 and February 2017, through the project Low Emission Capacity Building (LECB), a study for the generation of technical inputs for designing the bases for a new NAMA waste-to-energy ("waste-to-energy"). The scope of work also considered the development of technical aspects that are used as inputs to, later, progress in the structure of the NAMA. To implement this, it is necessary to develop aspects not covered in this work (e.g. financial structure of the NAMA).
Carbon sequestration through sustainable management of soils	CO_2 Capture on the part of the soil, through its stabilization. The initiative consists of four (4) stages: Stage 1: Research basis for generating a Geographic Information System to assess the current conditions of soils. Design of NAMA and creation of a software that accounts for the measures of catches of C in soils and its impact, developed for the conditions of Chile. Stage 2: Plan Design for positioning and dissemination of the Software. Stage 3: Dissemination to the final beneficiaries of the software. Stage 4: implementation and promotion of conservative management of soils.	Agriculture, Forestry/ AFOLU CO_2	To be defined	65 to 80 $MtCO_2e$. Estimation Methodology to capture CO_2 expected. The calculation was made on the basis that 5% of the agricultural area of the country (rounded up in 100 thousand ha), will end up being handled in a conservative manner, and that the expected increase of soil organic carbon will be of 4 percentage points, meaning each point 45 tC or 169 tCO_2 per hectare. This comes from the following assumptions: • Apparent density= 1.5 g cc-1. • Impacted soil depth in the first 30 cm of the soil profile.	This initiative was registered as a NAMA in the UNFCCC in January 2018.

Source: Own preparation

6. APPLICATION OF INSTRUMENTS AND MECHANISMS OF CARBON PRICING TO ADDRESS ENVIRONMENTAL EXTERNALITIES

While the world continues to explore global mitigation efforts of post-2012 GHG emissions, countries such as Chile are looking for new and profitable ways to intensify the reduction of emissions and encourage financial flows, including market-based instruments. Chile has already used market instruments for the management of natural resources, mainly in water rights, fishing and air quality.

6.1. Clean Development Mechanism of the Kyoto Protocol

Since Chile ratified the Kyoto Protocol in 2002, it has actively participated in the Clean Development Mechanism (CDM) and has become an important actor of the registered projects in Latin America and the world. In 2003 it established its National Designated Authority (NDA), in accordance with the modality and procedures for the CDM, which features a technical committee, chaired by the MMA, to review and assess the background of each project to grant the National Approval Letter (LoA), and represent that the proponents of the CDM projects are involved on a voluntary basis, and that the project activities contribute to sustainable development in the country.

From 2003 to date, the NDA of Chile has granted approval letter to 153 national projects, of which 102 (61 %) have been registered with success before the CDM Executive Board, 7 (4 %) are under validation phase, 56 (34 %) have been rejected and 1 (1 %) were withdrawn voluntarily by its proponents (Figure 11).

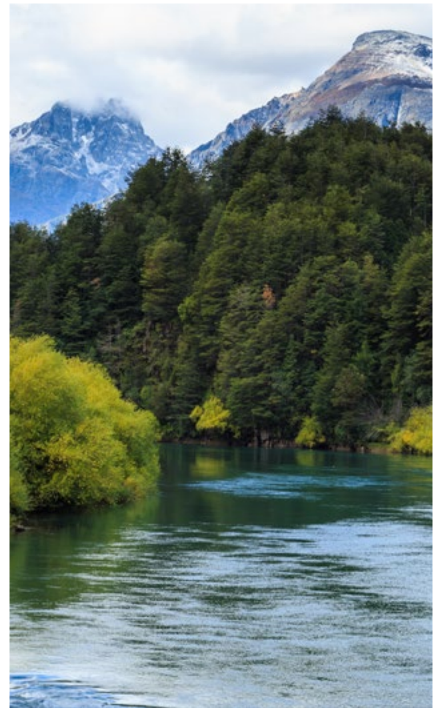

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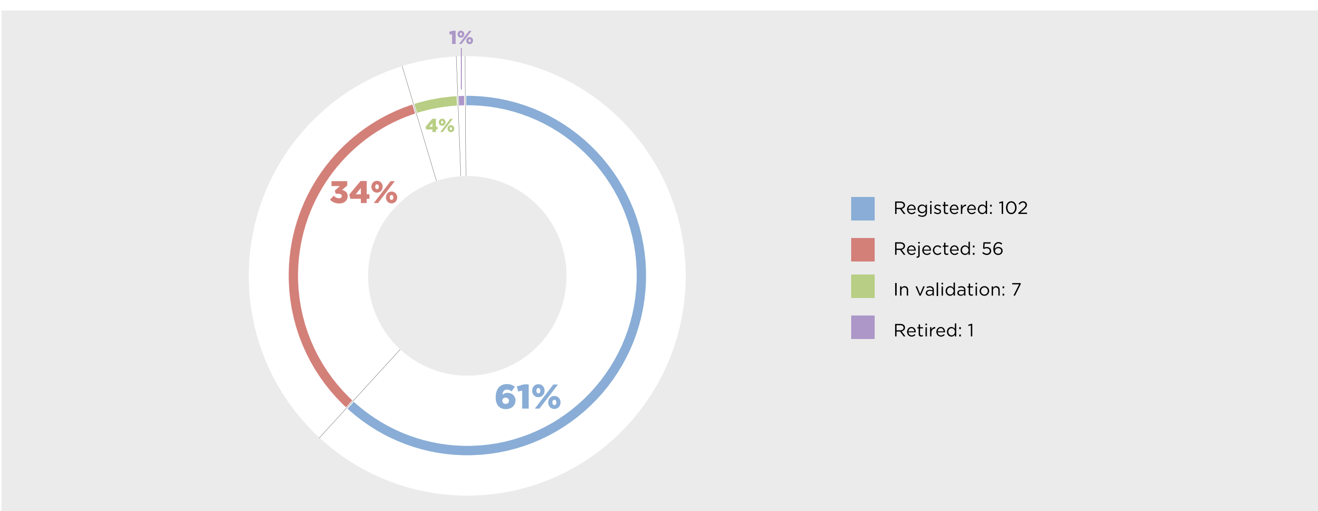
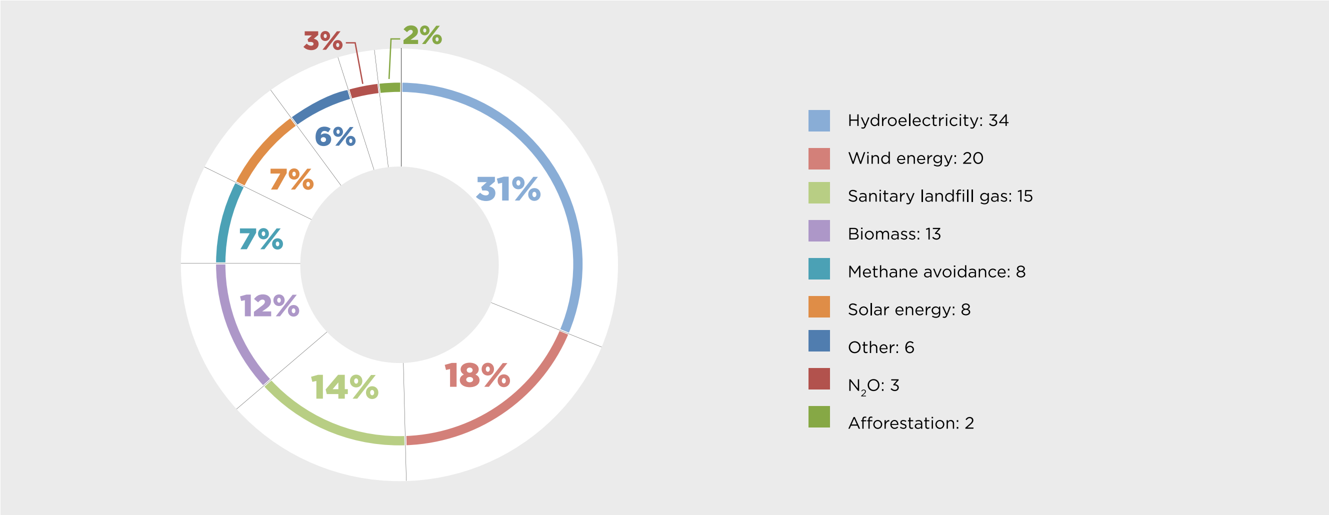
Figure 11. Status of the Chilean projects



Source: own preparation of the MMA based on information from United Nations

Projects registered or in the process of validation (109) represent 1.3 % of the projects of the world, with which the country is the ninth in the world, and 9.9 % in Latin America, which places the country in third place. Thirty of these projects (27.5 %) are small scale. Figure 12 shows that the majority are related to hydroelectricity (31 %), followed by wind energy (18 %), landfill gas (14 %), biomass (12 %), methane avoided (7 %), solar energy (7 %), nitrous oxide avoided (3 %), forestation (2 %) and other types (6 %).

Figure 12. Typology of registered CDM projects and under validation



Source: own preparation of the MMA based on information from United Nations

It is important to note that 77 MDL registered projects and under validation correspond to new forms of energy, which have contributed with 4,023 MW of installed capacity in the country. Figure 13 shows that the main contribution comes from wind energy (42.7 %), followed by hydroelectricity (35.7 %), solar energy (13.4 %), biomass (5.8 %), geothermal (1.8 %), landfill gas (0.5 %) and finally, the methane avoided (0.1%). Chile ranks fifth among the countries with the largest number of installed capacity for MDL projects of solar and wind energy.

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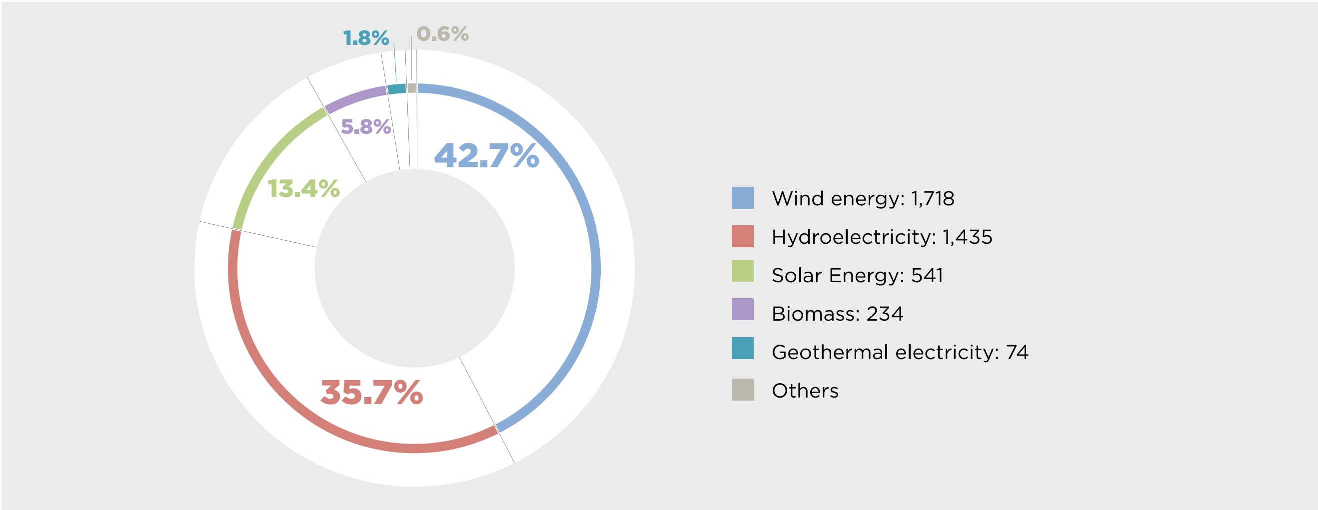
Figure 13. Installed Capacity (MW) of the registered CDM projects and validation by typology

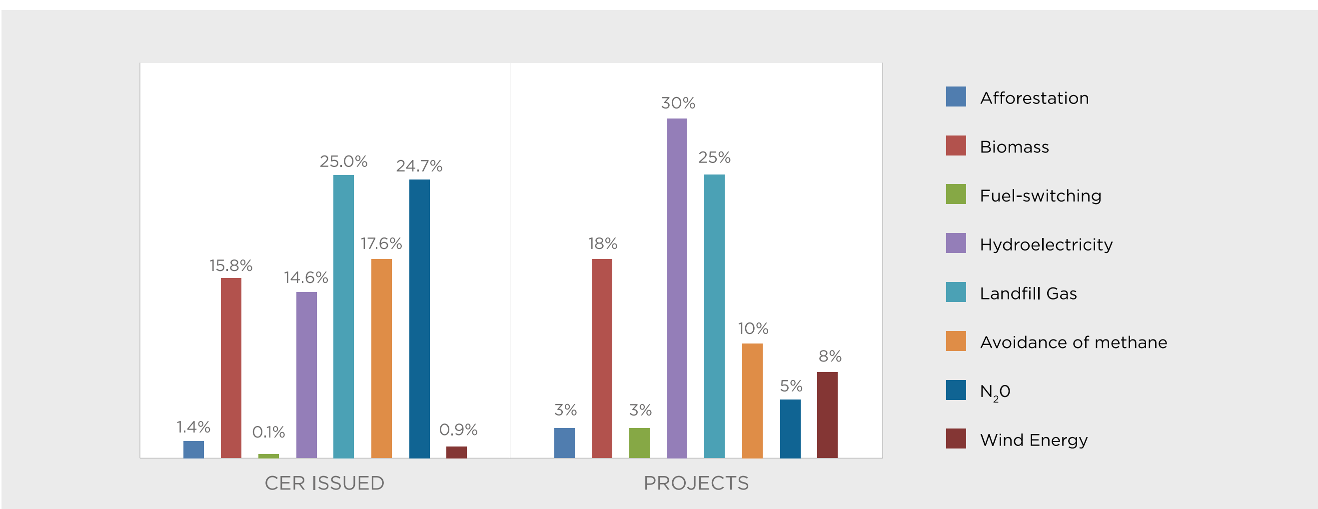


Source: own preparation of the MMA based on information from United Nations

With regard to the Certified Emission Reduction (CER) issued, 41 registered projects have already generated a total of 30 million CER, representing 1.6 % of the CERs issued in the world and 11.8% in Latin America, which positioned Chile as the sixth country with more CERs issued in the world and third in Latin America.

Figure 14 shows that the main typologies that have issued CERs are landfill gas (25%) followed by nitrous oxide (24.7%), methane avoided (17.6%), biomass (15.8%) hydroelectricity (14.6%), forestation (1.4%), wind energy (0.9%) and change of fuel (0.1%). On the other hand, while the methane and nitrous oxide avoided contribute with 42.3% overall of the CER, these represent only 10% and 5% of the projects emitting CER, respectively. Of these CER emitted, to date 747,190 have already been called off voluntarily (UNEP, 2018).

Figure 14. Percentage of CER issued and registered CDM projects that have issued CERS, by type



Source: own preparation of the MMA based on information from United Nations

6.2. Partnership for Market Readiness (PMR)

The PMR Chile project, implemented by the Ministry of Energy (MINENERGIA), ended its first phase of implementation on September 4, 2017 after its start up in 2014. The financial and technical resources provided by this platform, along with the institutional efforts deployed by both the MINENERGIA, MMA and the SMA, allowed implementing the MRV system that supports green taxes. It also enabled further discussion on the scaling of green taxes and potential transits toward new instrument choices of carbon pricing that contribute to achieving cost-effective national commitments for GHG mitigation.

Chile was the first country that implemented PMR to achieve full implementation of its components during the first stage. As a result, on March 22, 2017 the PMR Meeting of the World Bank approved an additional donation of USD 1.98 million for a second phase of implementation, which will run until 31 August 2019.

This additional funding has enabled to give continuity to the products generated in each of the technical components of the first phase of the PMR (i.e., components 1, 2 and 3) and progress towards the achievement of the following expected results: (i) Strengthen the scheme of the current carbon tax, assessing the feasibility of extending its scope to other sectors and sub-sectors and increase its rate, and the feasibility of implementing a system of mandatory reporting of GHG emissions; (ii) Implementation of an integrated platform of MRV for mitigation actions in the energy sector, in order to give account of those actions, their results and understand its sectorial contribution to the fulfillment of the NDC of Chile under the Paris Agreement, and (iii) continue the assessment of schemes for carbon pricing instruments for the energy sector in Chile.

Table 2. Additional phase components of the PMR project in Chile

The activities proposed for the additional phase are executed through two new components that are added to the PMR-Chile:
• Component 5: improvement and supplementation of the scope of current carbon tax and the registration system.
Considered to be within its expected results: (i) assess the first year of implementation of the carbon tax in order to deliver recommendations to address some of the impacts of its operation, such as costs of implementation, arrangements of regulated entities, fundraising, operation of the registration system and MRV system, among other; (ii) implement the recommendations identified in the assessment of the tax that permit their continuous improvement; (iii) support the efforts of the Ministry of Environment to implement a system of mandatory reporting of greenhouse gases. Its implementation is led by the Ministry of Environment (MMA), in coordination with the Ministry of Energy (MdE), Ministry of Finance (MdH), Superintendence for the Environment (SMA) and Internal Tax Service (SII).
• Component 6: Assessment alternative plans of carbon pricing for the energy sector.
Under this component, alternative carbon pricing in the medium and long term, their contribution to the reduction of GHG emissions in the context of compliance with national commitments on climate change under the Paris Agreement and their role in sectorial climate policies of our country in the future will continue being evaluated. In this context contributes to: (i) The implementation of a simulation tool of climate policies in the energy sector. Assessment of complementary initiatives of carbon pricing, including the identification of possible trajectories of emissions reductions and corresponding measures in the energy sector up to 2030; (ii) Development of an MRV scheme for accounting for emissions reductions of mitigation actions related to energy. Its implementation is led by the MdE, in coordination with the MMA and SMA.
• Component 3 and 4:
These two components will continue to be executed in the additional phase, as are crosswise and required to support two new components mentioned above. Thus, under Component 3, will continue running the strategy of communication, consultation and participation with decision-makers and other interested parties, and strengthening technical expertise in the public and private sector with regard to the new activities proposed for the additional phase of the Project PMR-Chile, while under Component 4, will include all the activities associated with the administrative, financial and management control of the PMR-Chile Project.

Source: Own preparation

6.3. Green taxes

Effective on January 1, 2017 the first green taxes regime (or pigovian) in the country. The main objectives of this instrument are to support and complement efforts to decrease the local air pollution - the main environmental problem in Chile- as well as mitigating greenhouse gases in a cost-efficient manner. The tax levies emissions of local pollutants (MP, NO_X and SO_2) and the main global pollutant (CO_2) of all those establishments that have boilers and/or turbines which together add up to a thermal power greater than or equal to 50 MWt (MW thermal).

Previously, in December 2016, the Regulation of green taxes was officially published and reported to the establishments affected that: (i) had to enter to the Pollutant Release and Transfer Register (PRTR) of the MMA; (ii) Inform the SMA the type of methodology that would use each of their sources to quantify their emissions, by adopting one of the 12 options proposed by the emission measurement protocol developed by the SMA; and (iii) report on a quarterly basis their emissions affected through the Single Window system of the PRTR (VU-PRTR).

On April 30, 2018 the first year of operation of the green tax was completed. A total of 94 establishments affected, including 303 sources (boilers and turbines) reported their emissions and made a payment of the tribute. The total collection amounted to USD 191.3 GM. The CO_2 tax explains the major portion of the total (88 %). Taxes on local pollutants explain the remaining 12 % (MP (8 %); (NO_X (3 %); and SO_2 (1%)). With respect to sectors, the greatest contribution focuses on the power generation sector (94 %). Other sectors contribute marginally (Cellulose (2 %); Agricultural (1 %); Fisheries (1 %), and other (2 %)).

6.4. Carbon Social Price

In Chile, the social price of carbon is studied at the Ministry of Social Development (MDS); this institution, which sets standards and manages the subsystem of ex-ante assessment of the National Investment System, performs a set of activities designed to support the decision-making process in the allocation of public resources.

In particular, the Division of Social Assessment of Investments, dependent from the Undersecretary of Social Evaluation, is composed of Investment, Studies, Methodologies Departments and the Training Unit. This Division is responsible for the development of standards, instructions, and procedures for the formulation and evaluation of investment, developing and updating of assessment methodologies initiatives, training of public workers on these matters and administration of the operating system of the Integrated Project Bank (BIP) (Ministerio de Desarrollo Social, 2018).

In addition, the National Investment System (SNI) is the entity that regulates and governs the process of public investment in Chile. It brings together all the principles, methodologies, standards, procedures and instructions that guide the formulation, evaluation and implementation of basic studies of investment initiatives that apply to public funds, with the aim of encouraging those who are more profitable for society and to respond to the strategies and policies of growth, economic and social development of the nation.

In this sense, the economic value of carbon, through a social price applicable on the social evaluation of public investment projects, enables to:

- Ensure that the climate impact of public investment is accounted for;
- Ensure consistency in decision-making in all policies of the State;
- Improve transparency scrutiny of decision-making of public investment;
- Contribute to efforts to reduce long-term emissions;
- And contributes with resilient infrastructure to climate change.

Sobrevuelo al Cabo de Hornos, Felipe Gera Malgor - Imagen de Chile

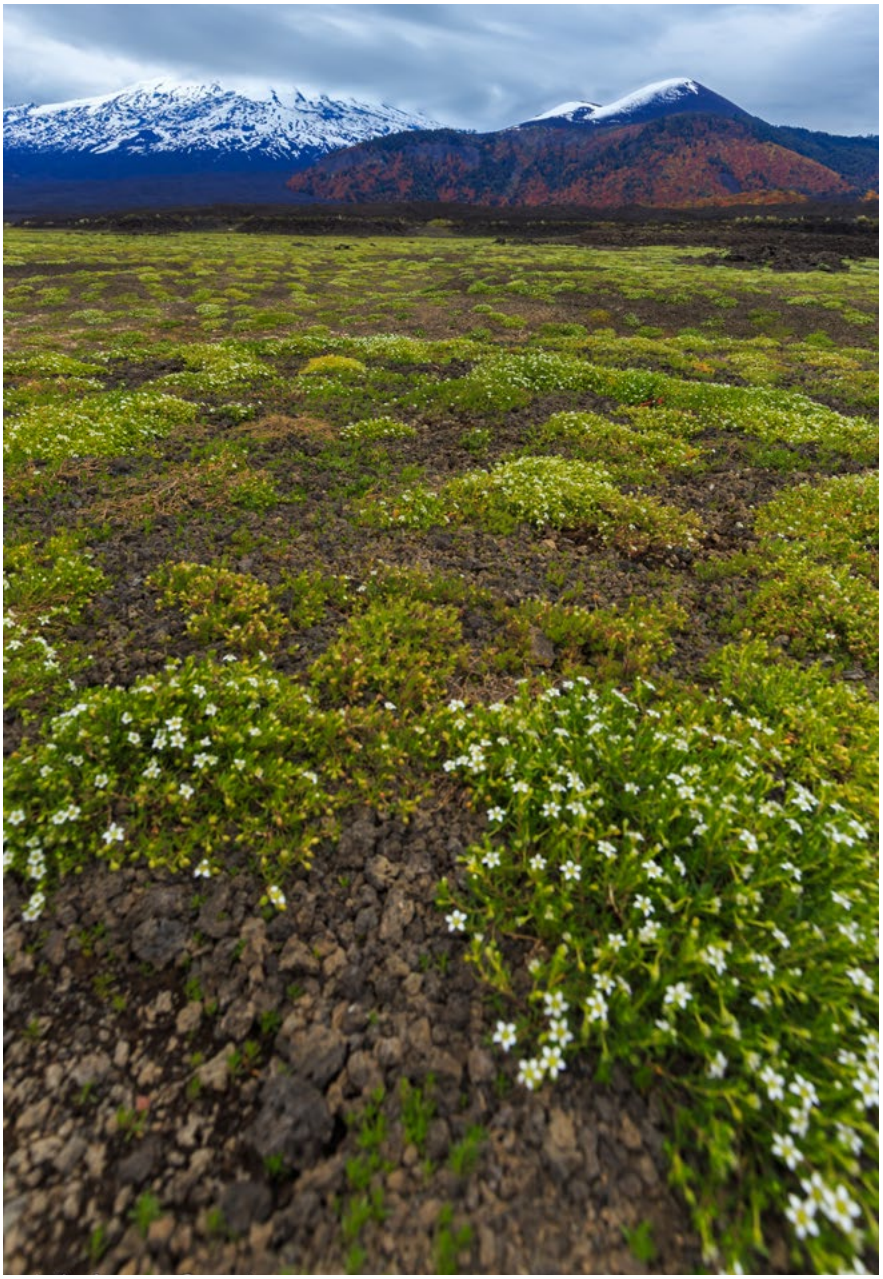
This is how, in 2013, the Division of Social Assessment of investments of the MDS, made an estimate of a social price of carbon using as estimating methodology the market price of the instruments that are traded under the Clean Development Mechanism (CDM). For 2013, the social price corresponded to 4.05 USD per ton of CO_2, and in 2016 it reached 8.45 USD per tonne of CO_2.

In 2016, with the support of the British Embassy in Chile, the consulting firm POCH conducted an update of concepts and methodologies for the quantification of social costs and shadow prices. From this review, the UK model was selected to estimate a shadow price of carbon from Chile's willingness to reduce greenhouse gas emissions, according to its goal of mitigation under the Paris Agreement. This way, with the new methodology used, the calculation of the shadow price is based on the abatement cost curve that enables meeting the goal of mitigation in the country, which delivers a range of 20 to 43 US$/t$CO_2$, with an average value of USD 32/tCO_2 (Ministerio de Desarrollo Social, 2017).

The applications carried out at the stage of ex-ante assessment of projects concluded that having a social price of carbon allows application to estimate changes in CO_2 emissions in projects of public buildings, roads, airports, rural potable water, railway cargo and passengers projects, among other.

The social price of carbon has been implemented in the social assessment of public building projects, through energy efficiency measures, applying the ECSE PROGRAM tool (efficiency and social costs in buildings), developed by the Center for Research in Building Technology at the University of Biobío (CITECUBB) for the MDS and MOP.

In addition, social assessment of projects integrates the quantification of externalities associated with the generation or reduction of greenhouse gases, being relevant for transportation, energy and waste projects.



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7. MEASUREMENT, REPORTING AND VERIFICATION OF MITIGATION ACTIONS

Since the start of the international climate regime, measurement, reporting and verification (MRV) of the progress of the Parties has been one of the most important components. For climate policy to be designed and implemented effectively, the parties need reliable information on emissions, actions and support both at international and national level ((Partnership on Transparency in the Paris Agreement, 2018). In this sense, the UNFCCC Parties must communicate to the Conference of Parties (COP), through the UNFCCC secretariat, information on the climate actions that have been taken or planned to take in order to implement the Convention. This allows them to keep each other informed about their actions at a national level and serves as the basis for the COP to evaluate the implementation of the Convention by the Parties (CMNUCC, 2015).

In this regard, the challenge of GHG mitigation in Chile and in the world not only has to do with the reduction of emissions or the increase of removals, but also with the transparency and consistency with which to report these commitments. For this reason, accounting rules that will be used within the framework of international agreements pre and post 2020 acquire relevance, in addition to the correct use and application of systems for MRV of mitigation actions in each country.

According to this, the goal of making MRV in Chile is to encourage the transparency of the activities of GHG mitigation through mechanisms to monitor compliance with its objectives. In this aspect, from 2011 Chile has worked in independent MRV systems that have served as management tools to NAMA, and to build capacity through the international support of various projects. This is how in 2014, thanks to the sponsorship of the United Kingdom through its Prosperity Fund, the Ministry of Environment (MMA) developed the document "Guidelines for a generic framework for MRV for NAMAs in Chile" (Ministerio del Medio Ambiente, 2015), which explains how impacts on GHG emissions and other co-impacts of mitigation actions can be measured, reported and verified, and whose main objective is to allow the consistency of the MRV approaches applied to these actions in Chile and to support the procedure of coordination between the various systems. While it was developed for NAMA, it can be used for any type of action that generates mitigation of GHG emissions.

On the other hand, during 2016, the Climate Change Department of the MMA, through the project Low Emission Capacity Building (LECB), developed a study to define basic accounting rules for mitigation actions in Chile and preliminarily design the contents of a possible platform for centralized MRV. This study had as additional objectives identify the linkages and synergies between the information generated by the National GHG Inventories (SNICHILE) and the MRV systems used in Chile, and count with a preliminary analysis of aspects related to accounting rules for mitigation actions, and MRV in Chile (double counting, methodological inconsistencies, assumptions, indicators, etc.). Among the results, mitigation actions that are developed in the country with different scopes and limits were identified, and a structure of analysis was proposed based on information maps to identify the interrelationships between actions and policies and to be able to apply the accounting rules.

7.1. MRV Chilean Technical Team

In the framework of the UNFCCC, the concept of MRV is not new, since it has been implicit in one way or another in the decisions and multilateral mechanisms such as a fundamental part in the follow-up to the progress of each of the Parties on issues of climate change mitigation. In Chile, since 2010 and after the declaration in Copenhagen on the voluntary reduction of GHG emissions through the NAMA, this subject became even more important becoming a standing item of work within the subjects related to the mitigation of GHG emissions in the country. At the same time, with the Paris Agreement, the importance of the NDC as essential tools for achieving low GHG emissions has been revealed. To meet these commitments, it is expected that mitigation actions, as well as other initiatives, play an important role in reducing emissions.

Among the various instruments that make up the climate change policy in our country, outstands the implementation of the mandate set out in the Statement of Cali, signed in June 2017 in the 12th Summit of the Pacific Alliance, which highlights the importance that our country can count on a robust system of follow-up through the MRV of actions and accounting of emissions of climate. In this sense and as a way to take advantage of existing synergies with the work associated with the current framework of MRV of the Convention, the MMA convened in January 2018 to a meeting that had as objective to the formation of a technical team to allow progress to be made in the national coordination of various existing initiatives on MRV of climate change. Nine public sector institutions[45] officially nominated a representative, resulting in the formation of a technical team for monitoring, reporting and verification of climate change, ETMRV-Chile.

The ETMRV-Chile is constituted as an instance of permanent work that aims to encourage communication and interaction between the various actors that give a follow-up to the efforts to mitigate climate change in the country, exchange of experiences and lessons learned on MRV, and the development of different objectives associated with this subject in the short and medium term; in addition, it acts as a channel of direct information on the main decisions and trends at the international level on MRV and its relationship with Chile's commitments to the UNFCCC and the Pacific Alliance. Account with a team, housed in the leadership of the Climate Change Office of the Ministry of Environment, which has the work of coordinating the actions pursued by the country, both nationally and internationally, around the MRV systems in the field of climate change.

Among the achievements of the ETMRV-Chile to date is the elaboration of a catalogue of documents composed of studies and reports made by the different institutions participating in the ETMRV-Chile on this matter, the generation of fact sheets that are intended to inform the various initiatives that these institutions are developing within the framework of the MRV of climate change, allowing all participants of the Technical Team have a basic knowledge on these. In addition, a survey was designed and processed, that allowed to raise information on the needs and challenges of the members of the ETMRV-Chile in the topic of the MRV, with the purpose of putting together a work program, products and activities for the period 2018-2019.

Cordillera del Valle de la Luna en San Pedro de Atacama, Juan Ernesto Jaegger

[45] *In alphabetical order: Energy Efficiency Agency, Agency of Sustainability and Climate Change, the Development Committee of the Solar Energy Industry, National Forestry Corporation, General Directorate for Civil Aviation, Ministry of Agriculture, Ministry of Energy, Ministry of Environment and the Superintendence for the Environment.*

7.2. MRV Initiatives under Development

7.2.1. MRV CO_2 taxes

The design and implementation of the system of measurement, reporting and verification (MRV) of emissions subject to green taxes, was built considering: (i) the consistency between the challenges of generating the information needed to operate both taxes on local pollutants (MP, NO_X, SO_2) and the global (CO_2); (ii) sectorial differences among the actors subject to the tax (technologies), and (iii) the regulatory consistency, in respect of the rules governing the different sectors (Pizarro, R., Pinto, F. y Ainzúa, S., 2017b). The institution responsible for developing and implementing the system of MRV for green taxes is the Superintendence for Environment (SMA).

The system of registration of establishments and their sources affected is a fundamental element prior to the subsequent configuration of the MRV system. The MMA, through the Single Window system of the Pollutant Release and Transfer Register (VU-PRTR), serving as we have set forth in regulation of green taxes, enabled a record for all natural or legal persons, owners of one or more boilers and/or turbines with a thermal power input of more than 5 MWt. However, the subject to the tax is only those that belong to an establishment which together add up to a thermal power equal to or greater than 50 MWt. In addition, it prepared and published a Handbook for Registration of boilers and turbines for payment of Green Taxes (Ministerio del Medio Ambiente, 2016).

Following the handbook of emissions quantification elaborated by the SMA (2016) , establishments subject to tax returns must express to the supreme audit institution (SMA) methodologies for the quantification of emissions that used for each one of their emission sources (boilers and/or turbines).

Quantification methods are concentrated in three types:

- **Dots or sampling:** through a team of sampling for posterior analysis in the lab or in situ measurement. Deliveries the concentration of output and the flow is representative of the time of measurement.
- **Continues:** Data Collection and analysis in real time of emissions, through a continuous emissions measurement system (CEMS).
- **Estimate:** indirect quantification of emissions through emission factors (associated with the specific productive process), and the level of annual activity (hours of operation, fuel consumption, among other).

From these three methodologies and depending on the Environmental Instruments (ICA) that regulate each establishment, 11 Measurement alternatives were originally established, plus an additional alternative (12), which could be proposed by the establishment and which later had to be validated by the sanctioning body (Superintendence for the Environment, 2016). However, after the first year of measuring emissions affected, by way of simplification, the SMA amended protocol of quantification of emissions, shortening it to 7 + 1 methodological alternatives (Superintendencia del Medio Ambiente, 2018).

The report of emissions responds to the protocol for report of emissions elaborated by the SMA (2018). It seeks to regulate the administrative duties relating to the drafting of the report of data and background information necessary for the calculation of the tax, for each source, which performs the Internal Tax Service. In addition, the instructive sets the rules for sending an individual report to the National Energy Commission (CNE) and the National Electrical Coordinator, containing the consolidated data, with hourly breakdown of the emissions generated for each of the power generation units (GEU) subject to coordination.

All the establishments subject to the green tax should report through the VU-PRTR. Like the measurement system, the reporting system is in conformity with the type of ICA that rules the establishment. Also, the sources report through the Information System of Thermal Power Plants (SICTER) if this affects to the Supreme Decree No. 13 of 2011 (D.S.13/2011), or through a system of green taxes (IMS) if it is not affected the Decree. In line with the periodicity of the report of the D.S.13/2011, the report of all sources subject to tax will be done quarterly.

The verification of emissions is governed by the protocol of emission verification implemented by the SMA (2018). This establishes a set of activities and procedures aimed at:

• Check that the systems and monitoring procedures comply with the indicated in the proposal of quantification sent by the regulated and approved through resolution by the SMA.

• Check that the methodologies for measuring/sampling are applied in compliance with the guidelines of reference methods upon which they are based.

• Check that the data reported are consistent with the operational data indicated by the establishments.

The verification exercise comes through an environmental audit activity previously set by the SMA (R.E. 1.184/2015). The activities are translated into tests of information, sampling, measurement and/or analysis, to an inspection, or a combination of these.

7.2.2. MRV of Energy sector mitigation actions

To fulfill international commitments that Chile has assumed and move toward a low-carbon development for the energy sector, actions that generate the correct incentives to encourage investment in low-carbon technologies and to encourage a change in production practices and energy consumption are being implemented. In pursuit of this objective, it is necessary to ensure the correct quantification of the reduction of GHG emissions that generate these actions.

The systems of MRV of mitigation actions represent an important management tool that countries use to identify national priorities in the field of disaster mitigation and track your progress toward the achievement of national goals of mitigation. The MRV of mitigation actions in the energy sector will make it possible to identify the impact of interventions such as: projects, programs and mitigation policies in the energy sector. This will facilitate the evaluation of the MRV change in emissions in the energy sector and will allow monitoring the progress of such actions throughout its implementation. Inspired by the standard policy and action of the World Resources Institute (WRI)[46], the six principles that govern this system are: Relevance, Completeness, Consistency, Transparency, Accuracy and Comparability.

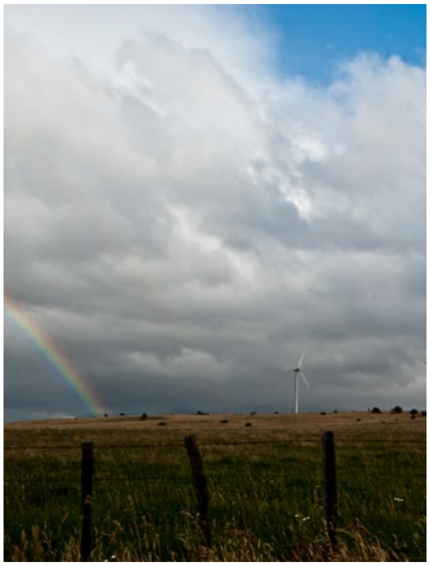
During 2017, the consultants Inodu and Carbon Trust, commissioned by the Ministry of Energy and the PMR-Chile Project, conducted the study "Determination of general requirements of a system of measurement, reporting and verification for the monitoring and follow-up of mitigation actions, and emission reduction projects; and proposal of a recognition program for emissions reduction in the Energy sector" which sets out the basis on which the system will be implemented. The scope of this MRV considers both public sector actions, and the private sector. The challenges presented are three:

1. Accounting for mitigation actions implemented by the national government.

2. Accounting for mitigation actions implemented by local governments.

3. Accounting for mitigation actions implemented by the private sector.

The first challenge is the one with the greatest progress, since to date a number of mitigation actions have a monitoring of their impacts and, in the case of those actions that do not have one, work is already being done on the determination of methodologies using methodologies validated internationally as a reference. As a solution to the last two challenges, work is being done on two complementary systems on MRV of mitigation actions in the energy sector: MRV of Energy District and Certification of Energy Savings in Energy Projects (CAPE).



Paisaje Patagonia, Aysén, Felipe Cantillana -Imagen de Chile

[46] *http://www.wri.org/publication/policy-and-action-standard*

7.2.5. MRV Energy District

The program the Energy District supports municipalities to develop local energy strategies with action plans designed from the community, giving the Energy District seal to those municipalities that have significant advances in local energy management. Also, as a boost to energy action, fosters a local energy investment market, generating the conditions that bring to households and local actors in the business of energy, encourage the implementation of energy projects raised in local action plans.

In order to strengthen the energy and climate action, the Program Energy District will develop a system of MRV to quantify GHG emission reductions associated with the implementation of projects at the local level in the framework of the Program. This with the purpose of having a solid basis of accounting, that supports to value the positive impacts of the Program and also to link the potential reductions to compensation and/or certificates of carbon in domestic or international markets.

For this, it will be developed a consultancy funded by the Development Bank of Latin America (CAF), within the framework of the application of Energy District to the Green Climate Fund. This consultancy is aimed at the development of a methodology of MRV of GHG emissions and the design of financial mechanisms for the implementation of projects in the framework of the Program.

7.2.6. Savings Certificate for Energy Projects (CAPE)

Currently, the Agency of Energy Sustainability manages the certification of savings for energy projects (CAPE), based on a standard mechanism (International Protocol IPMVP), which seeks to facilitate the information report of the results, energy and GHG mitigation obtained after the implementation of an energy project.

The certification is designed for enterprises, institutions, agencies or similar, with energy projects in their facilities, can validate the actual reductions in consumption as a result of its implementation. In the certification three bodies participate:

- Management Entity (Agency of Energy Sustainability): entity in charge of managing the CAPE mechanism. It is the one reviewing the assessment and issuing then certificates of Annual Energy Savings.

- CAPE Assessor: natural person accredited by the entity managing the CAPE mechanism, either dependent or independent worker. Who is responsible to assess and verify that the information declared by the customer is truthful, on the basis of the mechanisms and regulations of certification. It is also responsible for sending the information assessed from the different stages, for review by the Agency.

- Client: Legal Person (organization) that requests the entity managing to certify the savings of an energy project in particular.

In summary, the company requests the CAPE Assessor for advice in the determination of the savings through Protocol IPMVP, this develops the Plan of Measurement & Verification, which is validated by the Agency. The CAPE Assessor develops a report of savings according to a set format in an Assessment Tool Web site. The Agency reviews the foregoing and issues a certificate of savings, which delivers values in both units of energy avoided and in CO_2eq avoided emissions. These certificates will be reported to the manager of the MRV of mitigation actions in the energy sector.

Planta Solar Fotovoltaica María Elena, Felipe Cantillana - Imagen de Chile

7.2.7. MRV Renewable Energy for self-supply projects (SSREs)

One of the activities of the technical component of the project to support the self-supply NAMA (NAMA Support Project) is to support the design of an MRV system for the sector SSRE, which is currently being developed by the Ministry of Energy and the GIZ.

The MRV model under development will allow to quantify the reduction of GHG emissions from renewable energy projects for own consumption. This applies to GHG mitigation of renewable energy projects resulting from the NSP project, as well as to the mitigation achieved by the NAMA for national self-consumption. The MRV system in design does not consider the measurement of other impacts or co-benefits. In summary, the objective is to develop a system of MRV individually to calculate GHG reduction from a bottom-up approach. Renewable energy technologies considered in the quantification of emissions reduction are: photovoltaic, solar thermal, wind, micro and mini hydro, geothermal heat pumps, biogas and biomass.

7.2.8. MRV Reconditioning of existing housing projects

Under the project "Local Action to Support Chile's NDC Achievement", executed by the World Bank in conjunction with the Ministry of Energy, funded by the National Determined Contribution (NDC) Partnership Support Facility and the Energy Sector Management Assistance Program (ESMAP) Efficient and Sustainable Buildings Program, is developing an MRV system that allows them to monitor energy consumption savings and quantify GHG emissions reduced due to the implementation of energy efficiency measures applied through retrofits to existing homes in the residential sector in the whole national territory.

7.2.9. ENCCRV Measurement and Monitoring System

The system of measuring and monitoring[47] (SMM) of the National Strategy on Climate Change and Vegetation Resources 2017-2025 (ENCCRV), is intended to demonstrate the results of the activities related to the objectives, goals and commitments made during the implementation of the ENCCRV through transparent procedures, coherence and effective.

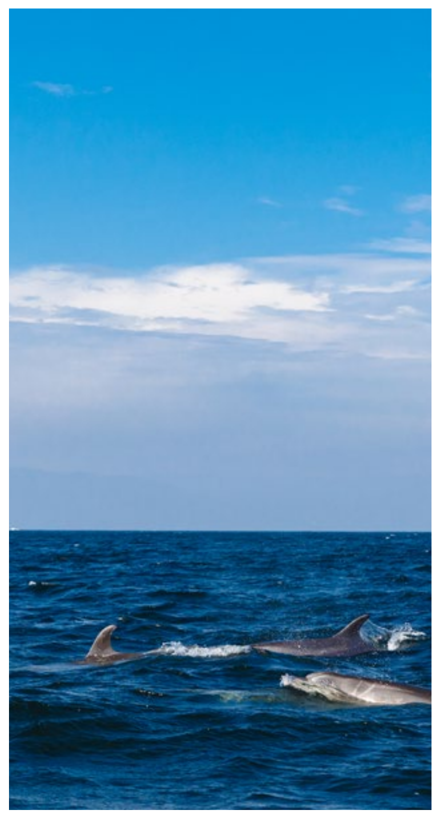
Its overall objective is to provide data and information transparent, consistent and accurate over time, which enables to present and prove the results of the interventions of the ENCCRV, in particular those that are implemented directly in the territory, by means of estimation of the historical situation, and initial through a robust system to measure, report and generate the essential inputs to verify the changes that occurred during the implementation of the measures of action and the achievement of the ENCCRV results.

The main areas are:

- Mitigation of climate change; GHG emissions and removals from forestry.
- Adaptation to climate change; desertification, land degradation and drought (DDTS).
- Other environmental services and additional social benefits to the previous ones.

7.2.10. MRV Pacific Alliance

The Pacific Alliance (AP) is an economic initiative and development established by Chile, Colombia, Mexico and Peru. On June 30, 2017 these countries signed the Declaration of Cali, which states in its Point 5: 'Our conviction to continue to encourage a green growth strategy as a way to meet the challenges of climate change, particularly affecting the region; and we reaffirm the Declaration which we signed at COP20/CMP10, in Lima, in December 2014, as well as our endorsement of the Paris Agreement of December 2015; and we will intensify the efforts of our countries in the field of measurement, reporting and verification of CO_2 and other greenhouse gases emissions with a view to identifying possible mechanisms of voluntary market in the region.



Fauna marina en Reserva Nacional Pingüino de Humboldt, Sernatur - Imagen de Chile

[47] *https://www.enccrv-chile.cl/index.php/documentos/item/455-sistema-de-medicion-y-monitoreo-de-la-estrategia-nacional-de-cambio-climatico-y-recursos-vegetacionales*

Geysers del Tatio, Felipe Cantillana - Imagen de Chile

In addition, and as an annex to the same statement (Appendix 16.1.), it undertook to 'Analyze the scope of systems of measurement, reporting and verification (MRV) in the field of climate change (accounting, emissions, etc.) in the countries of the AP'. This led to the emergence of initiatives to meet the mandate.

In this sense, at the regional level, in the inside of the AP the 'informal technical sub-group' was created in the field of MRV of emissions and reductions of GHG. The Sub-group responds to the Technical Group of the Environment and Green Growth (GTMACV), which aims to strengthen the growth and sustainable development among member countries of the Alliance.

The Secretariat of the Sub-group is held by the country that has the overall coordination of GTMACV. Currently, the coordination is the responsibility of Chile and its focal point is the Head of the Climate Change Office of the MMA. The Subgroup has met on three meetings. The first two meetings took place in January 2018 (Chile), and the last meeting took place in March 2018 (Colombia). It is currently working on a roadmap to guide the work of the Subgroup until 2020.

The Declaration of Cali attracted the interest of the international community. The Government of Canada, which had already formalized in 2016 a cooperation framework with the AP, committed resources by CAD 1.6 million to support a joint technical work on MRV, with a view to the establishment of a carbon price in the region.

Canadian support is implemented by the International Emissions Trading Association (IETA) and ClimateCHECK. The first is an organization that brings together a number of companies. It has extensive experience in the promotion of instruments of carbon pricing, particularly systems of tradable emission permits (STD), while the second offers digital services to support MRV systems.

The counterpart of the Canadian cooperation in the field of MRV is the informal technical sub-group of the MRV AP.

7.3. Next Steps

7.3.1. Registration and information platform

Given the different types of mitigation actions that are carried out in Chile, and the diversity of systems used to measure the progress of indicators associated with these actions, the study on accounting rules also addressed the conceptual and preliminary design of the contents of a centralized platform of MRV for the country.

Currently, Chile has MRV systems for NAMA (for example, NAMA in the forestry sector or NAMA of self-supply), for programs (for example, production agreements volunteers or programs monitored by the Agency of Sustainability Energy), for targets (for example, the goal of efficiency monitored by the Ministry of Energy), etc., all of which are or will be developed in different computing platforms (Centro de Energía , 2016).

The registration platform of mitigation actions, that it will be fed by the various MRV systems, must take into account the nature of the measures monitored by these systems. The proposal of the study of accounting rules is based mainly on the creation of a policies database or measures with an impact on the reduction and removal GHG. All the institutions that adopt measures would have access to this database, and it would work as an interface between the individual MRV systems and the institution that is responsible for canalizing the information reported to the UNFCCC, which is the Climate Change Office of the MMA (Energy Center, 2016).

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IV.
NEEDS AND SUPPORT RECEIVED IN THE FIELD OF CLIMATE CHANGE

1. INTRODUCTION

This chapter provides relevant information about needs in the field of Climate Change in Chile, including the existing barriers and gaps, and the international support received either through financial resources, capacity building and technical assistance, and technology transfer detected between 2016 and 2018.

For the development of this chapter, the UNFCCC reporting guidelines have been applied as a methodological framework of the presentation of biennial update reports from Parties not included in Annex I to the Convention (Annex III, decision 2/CP17) which specifies that those countries, including Chile[1], should provide updated information on:

- **Needs** for climate action with respect to financial resources, capacity building and technical assistance, and technology transfer including the analysis of gaps and barriers.

- **Support received** in the form financial resources, capacity building and technical assistance, and technology transfer received by the country from the Global Environment Facility, the Parties included in Annex II to the Convention and other Parties such as developed countries, the Green Climate Fund and other multilateral institutions.

The methodology used for gathering information regarding the support received and the needs is explained in the corresponding sections.

The information presented in this chapter covers the period from July 1st, 2016 (period immediately following the information gathering phase of the Second BUR, submitted to the UNFCCC in 2016) to March 31st, 2018 (deadline to gather information for this report).

1.1 Definitions

The concepts of financial resources, capacity building and technical assistance, and technology transfer will be understood as follows:

- **Financial resources (or financial support):** This refers to mobilizing funds which can come from public, private or alternative financing sources (UNFCCC, 2014). These funds are usually handed over the performers through an implementing agency.

- **Capacity building and technical assistance:** It is understood as a process that seeks to increase/improve the individuals, organizations and institutions capacity in developing countries and countries with economies in transition by identifying, planning and implementing ways to mitigate and adapt to climate change. This process takes place at three different levels:

·Individual level: through education, training and awareness activities;
· Institutional level: through fostering cooperation among organizations and sectors, as well as the development of organizations and institutions, including their missions, mandates, cultures, structures, competences and human and financial resources;
· At a systemic level: with the creation of favorable environments, through economic and regulatory policies, and the accountability frameworks operated by institutions and individuals. (UNFCCC, 2014)

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[1] *http://UNFCCC.int/resource/docs/2011/cop17/spa/09a01s.pdf#page=*

• **Technology transfer:** It is defined as a comprehensive set of processes covering the knowledge, financing and goods exchange among the different parties involved leading to the technology dissemination for the adaptation or the mitigation of climate change. This includes the process that encompasses the technologies dissemination - hardware and software - and technological cooperation through and within countries (IPCC, 2014).

1.2. Areas

Consistently with the Second BUR (MMA, 2016), the same five areas (scopes) are used, with regard to the support received and the needs required, sucha as financial resources, capacity building and technical assistance, and technology transfer. The information areas are as follows:

• **Report (R):** It refers to those activities, projects or programs developed to fulfill the commitments of the country as regards reporting on progress achieved on implementing the Convention's objectives on climate change, through National Communications (NC), Biennial Update Reports (BUR), and the corresponding nationally determined contributions (NDC).

• **Mitigation (M):** It refers to those actions, policies, projects and programs that are developed with the purpose of directly or indirectly contributing to reduce GHG emission sources or increase GHG removals.

• **Adaptation (A):** It refers to the development of policies, plans, programs and actions aiming to face and minimize adverse impacts and emerging risks of climate change and take advantage of possible opportunities arising from the changes caused about by this phenomenon. The activities should focus on generating tangible and visible results in practice through vulnerability reduction and resilience increase of human and natural systems to respond to climate change impacts.

• **National Greenhouse Gas Inventory (I):** It refers to those actions carried out within the aim of systematizing biennial update (every two years) of the Chile's National Greenhouse Gases Inventory (INGEI), thus ensuring the sustainability of the preparation of GHG inventories in the country, the consistency of the reported GHG flows and the quality of results.

• **International Negotiation (N):** It refers to the support received in order to strengthen national capacities with regard to climate change multilateral negotiations.

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2. NEEDS FOR CLIMATE ACTION

After COP21 and the ratification of the Paris Agreement by Chile, the domestic climate agenda has combined efforts to continue with the actions already planned along with actions focused on the next implementation of Chile's NDC (see definition for NDC in chapter III).

The implementation process of the current and upcoming Chile's NDC, together with the long-term action framework proposed by the Paris Agreement influence the type and scope of needs for planning and implementing climate action in the country.

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At a general level, the need to strengthen an institutional framework to facilitate planning of climate action for the medium and long-term is tangible. This process involves defining sector priorities, budgets and new capabilities. Its implementation requires a balance with other priorities at the local level. Although, Chile is classified as a high-income country according to the World Bank[2], with a very high human development index (HDI) according to the United Nations Development Program (UNDP), it still has significant gaps in income inequality, and health and education quality and coverage[3].

In general, financing, capabilities and technology needs are similar to those reported previously by the country. However, at this time the identified needs for implementation of specific actions in mitigation, particularly in the energy and forestry sectors have been highlighted.

Financial needs include demand for resources to expand public programs, generating or improving information and also capacity strengthening. From 2017, Chile no longer qualifies as a beneficiary country for international resources of "development assistance". This scenario restricts access to some support sources to strengthen Chile's public climate agenda. Additionally, the Budget Law of Chile does not allow to the public agencies to receive resources directly in their current annual budget. For some public agencies, it is complex devoting budget resources to climate change matters because climate change is not explicitly defined in their organic law.

[2] http://datos.bancomundial.org/pais/chile
[3] http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components

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NDCs implementation and the design of a long-term climate strategy are related to the need for a vision of technological investments type that Chile should promote in the coming years. Currently, there is no updated analysis on the status of technological transfer needs in the country. There are two papers that address the issue in 2003 and 2009 (Deuman Ingenieros, 2003); (Poch Ambiental, 2009) which provided relevant information, but with limited usefulness at the present.

Chile has continued carrying out studies to identify and strengthen technical aspects for climate action, including its information systems and prospective capabilities. The proposal with the CBIT (GEF) support is the main implementation instrument in this area. Our experience has shown us that increasing and improving the transparency of climate action facilitates the design and implementation of public policies and also allows building confidence with investors and other relevant stakeholders.

The methodology applied for gathering information with regards to the needs, gaps and barriers for climate action presented in this section was as follows:

1) A formal survey was sent to the public institutions composing the Inter-Ministerial Technical Team on Climate Change (ETICC) requesting information regarding needs, gaps and barriers identified by the sector for the development of actions of the climate change agenda.

2) A workshop was held with the institutions belonging to the ETICC, with the objective of deepening in the identification and discussion about the needs, barriers and gaps identified, in addition to clarifying doubts.

3) Meetings and/or phone calls were coordinated with the focal points of the ETICC to validate the information collected and to raise additional needs, gaps and barriers.

4) The information collected was consolidated in tabular format and classified according to the field and area of need. For the mitigation field, in the cases where it was possible needs, gaps and barriers are reported for sector-specific actions (actions reported in chapter III).

2.1. Needs identified by field

For each field identified in 1.2, the main needs, gaps and barriers have been identified in terms of financial resources and capacity building and technical assistance. Moreover, this report incorporates for the second time the needs identified by the private sector.

2.1.1. Report

Despite the fact that Chile has managed to organize the preparation of reports on a regular basis in response to the delivery terms committed with the UNFCCC, the challenge for the final installation of permanent reporting systems on National Communications, Biennial Update Reports and National Contributions continues, necessarily involving the dedication of a specific budget to continue supporting the reporting activity. Regarding the second BUR, the sectors included in the report are already more familiar with the information requirements by the Ministry of the Environment, which acts as a compiling entity. However, it is still necessary to move forwards in the information systematization so that the information will be available in a timely manner and, and it will be useful for the internal management of each institution.

For the preparation of the third BUR (2018) the funding of USD 852,000 from GEF is under implementation, since this time the funding is both for the preparation of the BUR and the Fourth National Communication (CCN). The report is prepared as an effort by the OCC's technical and administrative team, based on the interpretation of the UNFCCC guidelines. As regards to the NDC and its update process, it will be mainly covered with national resources, specifically through the creation of a permanent NDC's table. Regarding some inputs for discussion at the table, it is expected to use the support of the CBIT-Chile project (described in chapter III) to develop the NDC updated.

Table 1 presents the identified needs, gaps and barriers within the field of the report.

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Table 1: Summary of needs, gaps and barriers identified within the field of the report

Report	Area	Gap
BUR	Financial Resources	Restricted budget for the administrative technical team devoted to the document's preparation. Lack of possibilities for professionals to continue participated in the reports.
	Capacity building and technical assistance	Methodological and technical gaps for information collection, lack of a clear mandate on the type of information to be collected on a permanent basis, especially regarding to progress indicators related to mitigation policies and actions, and support received.
NC	Financial Resources	Restricted budget for administrative, technical team devoted to the document's preparation.
	Capacity building and technical assistance	Lack of technical capacity at local and regional level.

Barrier	Need	Prioritization
Limited financial resources make it difficult to establish a sustainable system for the fulfilment of the report's commitments	Budget supporting the activity in an iterative manner, as set out in the decisions by the COP.	Very High
Lack of specific knowledge in the sectorial and institutional level; difficulties to access training both in financial resources as per English language.	Methodological and training guides for the implementation of guidelines in order to understand the prioritization of mandatory information to report, and the level of detail expected.	High
Professionals from public institutions with access to the information required in the BUR have other functions and priorities, making slow and complicated the process of gathering information.	Building capacity for sectors' report (other ministries and institutions) for BUR's preparation.	
	Systematizing gathering of sectors, public and private information for report preparation: permanent system active during the years covered by the report.	
Limited financial resources make it difficult to establish a sustainable system for reporting	A budget that supports the activity in an iterative manner, as set out in the decisions by the COP. It requires support from specialized professionals, to give continuity to information collection and the document's preparation, because nowadays the technical content is created through consultancies.	Very High
There is no mechanism for knowledge transfer at a sector and institutional level.	Having regional experts.	High

Report	Area	Gap
		Lack of knowledge in sectors regarding the guidelines for NCs preparation.
		Lack of systematization in the form of an information report to make periods in between NCs comparable.
NDC	Financial Resources	As the negotiation makes progress and the new NDC communication and transparency framework are defined, it will be possible to estimate an implementation cost and identify the gap.
	Capacity building and technical assistance	Lack of capacity for early content definition and political agreement for its approval. Limited capacity of economic modeling for mitigation scenarios.
General	Technology transfer	Lack of systematization and efficiency in the reports related to climate change.
		Information to citizens and stakeholders is dispersed and not prioritized.

Source: Prepared by the authors, Climate Change Office, MMA

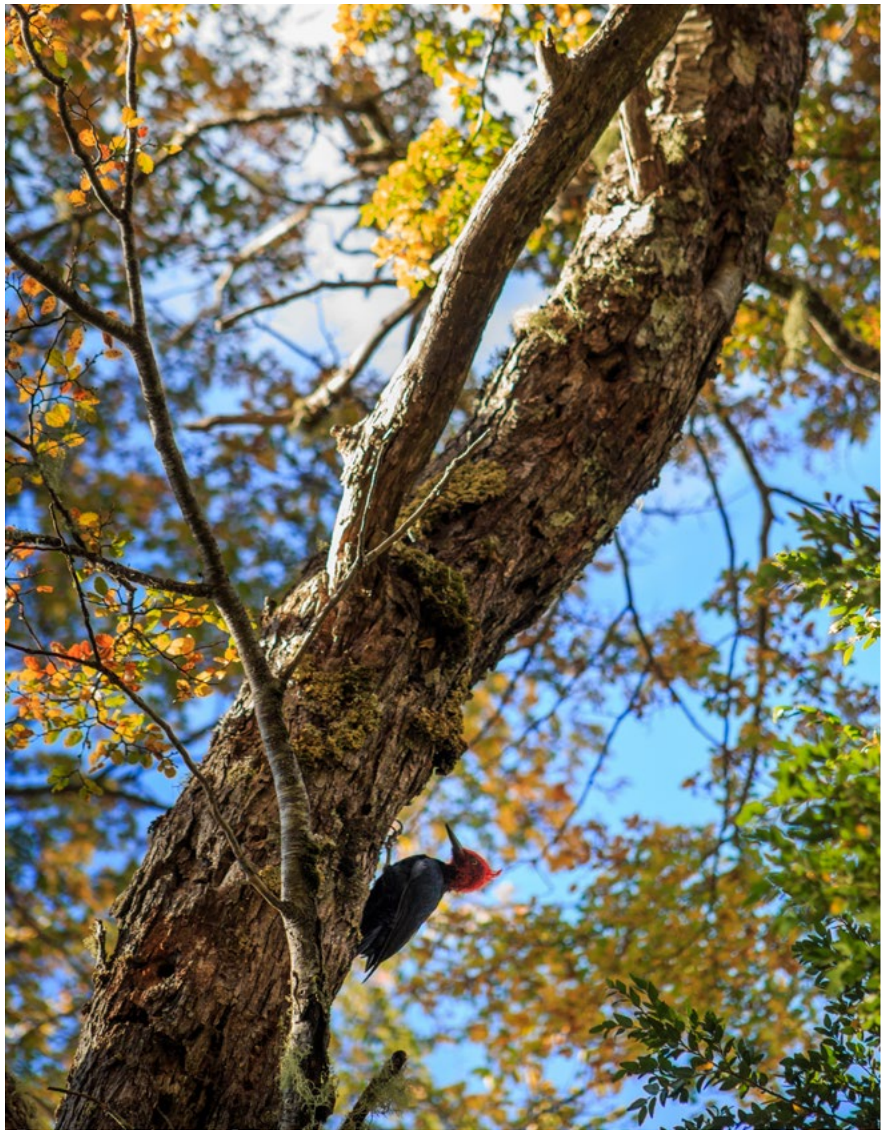
Barrier	Need	Prioritization
Professionals of public institutions with access to the information required at the NC have other functions and priorities, making the process of gathering information slow and complicated.	Building capacity for sector reporting (other ministries and institutions) for the NC preparation.	
Financial and language difficulties to access training.	Systematizing the gathering of sectors, public and private information for the preparation of the report: permanent system active during the years covered by the report.	
There is no information systematization procedure.	Cross-cutting platform to incorporate the initiatives of the sectors and the regional and local initiatives.	
Limited financial resources make it difficult to establish a sustainable system for reporting.	Financial resources to gather information and methodologies associated to the NCD updates, in accordance with the review systems to be negotiated within the framework of the post 2020 agreement.	High
Sector interests sometimes prevail over technical criteria.	To strengthen coordination between technical design and policy priorities. To establish permanent capacity in sector ministries to facilitate the systematization of NCD's development. Integration capacity of sector exercises to have a model at a national level.	High
Lack of effective coordination between stakeholders on the subject, both on supply and demand for technology transfer.	To have a technological platform that brings together existing information on climate change for its use in the sector report of actions on climate change, and efficient handling of information which is systematized. This platform must gather all information on topics related to climate change, generated by various public, private institutions, academia, etc. with differentiated privileges for institutional use and citizenship. It is expected to move forward in this area through the CBIT-Chile project.	Very High

2.1.2. Mitigation

In recent years, mitigation in Chile has been mainly marked by inter-sector cooperation and the commitment undertaken by the Chilean Government in the designing of public policies that promote a low carbon-emission economy. A proof of this is the launching of the National Action Plan on Climate Change 2017-2022, and the Mitigation Plan of the Energy Sector, among others.

In addition, the commitment to have a robust monitoring and updating system of the NCD, together with building a long-term climatic vision in line with the objectives of the Paris Agreement, have demonstrated the new and urgent needs that must be addressed in order to comply with the deadlines established under the international negotiation within the UNFCCC's framework.

With respect to the previous reporting period, Chile still needs to improve its information management system, to systematize and manage in a transparent manner the information associated to the mitigation efforts in the country. Not only through a digital platform, but also through accounting rules allowing in quantifying the impact of such efforts.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Chile continues developing robust sector policies aimed to a low-carbon development. At a sector level, it is highlighted the efforts of long-term planning in the energy and the agriculture, forestry and other land uses (AFOLU) sectors described in the previous chapter. However, climate action in mitigation also records significant progress in other sectors (infrastructure, investment assessment). Within this context, it is necessary to insist in the need to strengthen inter-sectors coordination and institutional strengthening, both to perform actions and to assess and focus progress of compliance with domestic and international goals.

In those cases where it was possible, it is reported the needs, gaps and barriers to some of the specific actions at the energy and AFOLU sector reported in the mitigation actions chapter. Therefore, the information about requirements for the mitigation area is summarized and presented in three sub-sections:

· Needs reported for the energy sector
· Needs reported for the AFOLU sector
· Needs reported for other sectors

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Needs reported for the energy sector

Table 2 summarizes the needs identified for the energy sector, linked to the actions and/or mitigation measures developed by the sector.

Needs are mainly concentrated in the capacity building area, mainly linked to the implementation of the "Energy Policy: Energy 2050". In terms of the type of needs, these are linked to the areas of financing, technical skills and knowledge about technologies that enable implementation of measures within the policies instruments in force in the energy sector.

In general, a crosswise prioritization within the public sector is required, so as to allocate the financial, human and technological resources demanded by the implementation of measures. In this sense, the international cooperation has played a relevant role since it allows counting with projects that incorporating experts within the professional teams of the various portfolios with needs in that line.

In addition, the table also reflects the needs expressed in actions related to energy efficiency that are including in the Action Plan of Energy Efficiency.

Table 2. Summary of needs, gaps and barriers reported by the energy sector (mitigation)

Area	Action/measure	Need
Financial Resources	Action plan of Energy Efficiency (PAEE2020)*	Agency for Energy Sustainability To expand coverage of energy efficiency projects.
	2018-2022 Energy Pathway 2050 Energy Policy	Ministry of Energy Financial resources are required to enable industries implementing an energy management system within the framework of the future Energy Efficiency Law, and to support the thermal reconditioning of existing housing.
Capacity building and technical assistance	2018-2022 Energy Pathway 2050 Energy Policy	Ministry of Energy Technical assistance to define, implement and monitor a portfolio of projects of the Mitigation Plan in the energy sector.
		Ministry of Energy Generate sub-national capacity on the mitigation issue and adaptation in the energy sector.
		Ministry of Energy Capacity building to implement the MRV system of local energy strategies.
		Ministry of Energy Increased participation of Non- conventional Renewable Energy in the energy matrix.
		Ministry of Energy Technical and technological assistance to maintain information platforms in Renewable Energies.
		Promotion of biogas in the industry.

Gap	Barrier	Priority
Lack of financial resources (USD 13,000,000) to replicate and expand the recipients of energy efficiency projects.	Potential beneficiaries have limited resources allocated to priority actions, making the necessary investment for the execution of the project difficult. Little trained market, client/beneficiary does not have information and knowledge on the subject.	High
Lack of adequate financial instruments to finance energy efficiency projects in the industrial and housing sectors. (USD 326,000,000 per year).	Projects financing	Very High
It is required a prioritization methodology to carry out the mitigation project portfolio, with coordination between the public and private sectors. (USD 1,400,000 per year).	Projects financing. Access to and/or development of cost-effective technologies to mitigate, store, renewable energy and/or deliver flexibility to the network in supporting the renewable energy. Regulatory policies.	High
It is required to improve the knowledge on the climate change issues in the energy sector. To increase the number of professionals trained in the climate change issues at an institutional level in the sub-national level. Not quantified.	This is a new work line that will require allocating funds, professional support, advice and taking advantage of synergies with other lines of work.	Very high
It is required to increase the knowledge on the climate change issues and specifically on the monitoring, reporting and verification of mitigation measures at a local level. This gap is valued at USD 100,000.	In many cases the municipalities do not have the budget and staff that can devote time to these issues.	High
There is a need to improve forecasting systems, implementation of the market of complementary services (entry in force) and development of transmission systems to avoid cuts of renewable generation, and maintain the safety standard of the system.	Need for regulatory changes to overcome obstacles and coordination with the industry.	Very high
It is required to increase the technical knowledge and technology improvements to develop a high-quality platform information.	Updating the base information source requires considerable time, as well as computing capacity both for modeling and storage. Also, to deliver faster results and greater volume a secure web service is required and constantly available.	Very High
Lack of information with regarding quantification and georeferencing of organic waste generated in the industry.	There is a need to improve the base information available at a local level.	High

Area	Action/measure	Need
Capacity building and technical assistance	**2018-2022 Energy Pathway** **2050 Energy Policy**	Ministry of Energy Technical assistance to replace projects based on fossil fuel per photovoltaic projects.
		Ministry of Energy Financial assistance to support the implementation of projects with renewable energy and energy efficiency for internal consumption in micro and small companies.

*The main scope of this measure corresponds to mitigation. However, some of its activities also cover the scope of adaptation.

Source: Climate Change Office, MMA based on consultations with sector ministries.

Gap	Barrier	Priority
Lack of offer by specialist companies in the maintenance of photovoltaic plants. Lack of alternatives of renewable electricity supply to reduce peak demand by trade and industry to be able to replace the diesel engines.	Immature market in this type of service, lack of specialized human capital.	Very high
Lack of adequate financial instruments to finance self-consumption projects with RE and energy efficiency.	Low availability of suitable financial instruments to finance self-consumption projects with RE and energy efficiency.	High

Needs reported for the AFOLU sector

Table 3 summarizes the needs identified by the AFOLU sector linked to the mitigation actions and/or measures developed by the sector.

Their needs concentrate in the area of financial resources, mainly for the implementation of the action measures contemplated in the National Strategy on Climate Change and Vegetation Resources (ENCCRV). They identify budget shortcomings, mainly due to the lack of alternative sources of public budget funding.

With regard to the identified needs in the area of capacity building, these are concentrated in the need for trained people and the necessary expertise to develop the actions defined in the priority programs.

Finally, it is highlighted as a barrier the lack of articulation between the public and private sectors, so as to generate governance arrangements allowing for implementation of programs and actions in a coordinated and joint manner, with enough validation thus ensuring the measures' sustainability.

Table 3. Summary of needs, gaps and barriers reported for the AFOLU sector (mitigation)

Area	Action/measure	Need
Financial Resources	Implementation of action measures contemplated in the ENCCRV	Leveraging new financial resources for the implementation of the action measures of ENCCRV at a national level.
		Financial resources for the development and implementation of the of reforest and revegetation program at prioritized districts/areas in 140,000 hectares.
		Financial resources to strengthen and implement the ecological restoration program at prioritized districts/areas in 20,000 hectares.
		Financial resource to implement the education and environmental dissemination program at a national level
		Financial support to implement the Adaptation Program for management of vegetation resources within the framework of climate change, desertification, land degradation and drought, in 80 districts.
	Strengthening and updating of Management Plans for SNASPE areas within the context of the ENCCRV	Financial resource for strengthening and updating the Management Plans in 50% of SNASPE areas within the context of the ENCCRV.
	Strengthening of the Communities Prepared against Forest Fires program	Financial resources to strengthen the program "Communities Prepared against Forest Fires", to establish the program in 40 districts.

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Gap	Barrier	Priority
Lack of permanent budget (USD339,919,050) to implement ENC-CRV at a national level.	The lack of funding to escalate in the implementation of the strategy at a national level.	Very High
Lack of permanent budget (USD168,150,000) to implement the ENCCRV at a national level.	The lack of funding to escalate in the implementation of the strategy at a national level.	Very High
Lack of permanent financial resources (USD41,140,480) to implement the ENCCRV at a national level.	The lack of funding to escalate in the implementation of the strategy at a national level.	Very High
Lack of permanent financial resources (USD2,220,000) to implement the ENCCRV at a national level.	The lack of funding sources to escalate in the implementation at a national level	Very High
Lack of permanent financial resources (USD9,437,940) to implement the ENCCRV at a national level.	The lack of funding sources to escalate in the implementation at a national level	High
Lack of permanent financial resources (USD1,970,000) to implement the ENCCRV at a national level.	Funding to escalate in the management plans update for all SNASPE areas, training of rangers and other professionals in these topics.	High
Lack of permanent financial resources (USD2,126,250) to implement the ENCCRV at a national level.	Obtaining supplies to strengthen the program, financing to escalate the program at a national level.	High

Area	Action/measure	Need
Capacity building and technical assistance	Technology transfer program of alternatives for management and use of forest-farming waste	Financial resource to develop and implement at a national level the technology transfer program of alternatives management and use of forest-farming waste.
	Agricultural and Livestock Research Program	Financial resource to develop the agricultural and livestock research program.
	Strengthening of forestry and environmental control programs	Strengthening the institutional and technological capacity of CONAF's forestry and environmental control.
	Strengthening and expansion of the Management Boards of summer pastures	Strengthening and expansion of the Management Boards of summer pastures.
	Strengthening of a phytosanitary protection program for native vegetation resources	Strengthening the of Phytosanitary protection Program for native vegetation resources.
Technology transfer	Agricultural NAMA	NAMA Lack of capacity and technical assistance to implement NAMA at a country level. The cost of this gap has been estimated at USD450,000.
	Not Reported	Not Reported

Source: Climate Change Office, MMA based on consultations with sector ministries

Gap	Barrier	Priority
Lack of permanent financial resources (USD1,309,000) to implement the ENCCRV at a national level.	Obtaining supplies to strengthen the programandfinancing.	High
Lack of permanent financial resources (USD805,250) to implement the ENCCRV at a national level.	Lack of funding sources to escalate in the implementation at a national level.	High
Lack of financial resources to widely cover the requirements associated with the enforcement. Lack of capacity and knowledge by civil society regarding the enforcement and monitoring, together with the existing systems to file claims. The cost of these gaps has been estimated at USD 1,070,000.	Funding in order to strengthen programs at a national level, and to improve the coordination with municipalities.	Very High
Lack of resources to strengthen the operational effectiveness of the Management Boards of summer pastures, as well as knowledge to promote the best management practices. The cost of this gap has been estimated at USD 50,000.	Involvement and articulation of the stakeholders of civil society, public sector and related owners. To promote a public-private network associated to the administration and management of these areas; financing to escalate the implementation.	High
Lack of resources to technically assist the program at a national scale. Lack of the necessary infrastructure needed to carry out the required analyzes in the program. This gap has been estimated at USD4,080,000.	Involvement and articulation of the stakeholders of civil society, public sector and related owners. Funding to escalate the implementation.	High
Targeting of incentives, currently delivered to farmers to encourage farm management plans.	Implementing the Agricultural NAMA. Training SIRSD's operators on issues of sustainable soils management and to create incentives for their application.	Medium
Does not apply.	Does not apply.	Does not apply

Needs Reported for other sectors

Table 4 summarizes the needs in the field of mitigation of other sectors. In terms of the type of need, most are concentrated in the capacity building and technical assistance area, followed by technology transfer and finally, financial resources.

Regarding the creation of capacity building and technical assistance, most applications are aimed to the implementation of sector actions identifying requirements for assistance in the preparation of methodologies at different areas, as well as for formulation of studies allowing for data generation and the necessary information for the decision-making process.

As regards the technology transfer area, the mining sector reveals a lack of technological development related to the energies used by vehicles and machinery of the sector, and they also highlight the lack of feasible technologies allowing to replace contaminating equipment, thus reducing their emissions. In line with the above, the needs of the public works sector are revealed identifying as a priority to use filters equipment allowing for reduction of black carbon emissions from machinery used by the Roads Directorate.

Table 4. Summary of needs, gaps and barriers reported by other sectors (mitigation)

Area	Sector	Gap
Financial Resources	Tourism	Sector Actions Lack of funding to develop programs for climate action in the tourism sector, particularly regarding energy efficiency, energy consumption record, efficiency in touristic transportation and for waste management at consolidated touristic destinations.
	Infrastructure	Sector Actions Lack of financial resources (USD 318,000) to implement a strategy of low carbon infrastructure.
Capacity building and technical assistance	Infrastructure	Sector Actions Lack of specific parameters to estimate carbon capture in different sectors associated to social assessment of public investment projects. This gap has an estimated cost of USD 500,000.
		Lack of coordination between public-private sector allowing to include the measurement of carbon footprint in all MOP's biddings.
		Lack of technical expertise and availability of key information to perform feasibility study.
		Lack of inclusion of the infrastructure sector as a contribution to Chile's commitments on the GHG emissions reduction.
	Agriculture and Livestock	NAMA Lack of capacity and technical assistance to implement NAMA at national level. The cost of this gap has been estimated at USD 450,000.


Palafitos de Castro, Sernatur - Imagen de Chile

Barrier	Need	Priority
Lack of sources and financial resources to promote climatic actions in the tourism sector. Lack of strengthening a cross view of waste management among the various institutions related to this topic.	Financial resources to develop climate actions in the tourism sector.	High
There is a need for prioritization in the public expenditure that enables the implementation of the strategy.	Financial resources to design a strategy for low carbon infrastructure.	Very High
1) Existence of general and not precise parameters, involving underestimating the benefit or cost related to GHG emissions. 2) Not having parameters to estimate emissions of other GHG prevents incorporating the cost or benefit to social assessment of public investment projects.	Development of specific parameters of carbon capture for public building.	High
Lack of basic studies and stakeholders' articulation	Development of strategy for measurement of carbon footprint in infrastructure works and public building performed by the MOP.	High
Availability of resources and associated studies to reveal this incorporation in terms of economic, social and environmental aspects.	Development of technical feasibility at a territorial level on the incorporation of Non-Conventional Renewable Energy (NCRE) in public infrastructure.	High
Gathering baseline and methodologies to characterize the sector.	Technical advisory for the development of low carbon infrastructure, through the measurement of carbon footprint and incorporation of NCRE.	High
Targeting of incentives currently delivered to farmers so as to encourage farm management plans.	Implementing the Agricultural NAMA. Training SIRSD-S operators on issues of sustainable management of soils and creating incentives for their application.	Medium

Area	Sector	Gap
Technology transfer	Mining	Lack of technological development to move to a clean energy source in identified vehicles and mining machinery.
		Lack of technological alternatives for replacement of current technology to increase the emission capture.
	Infrastructure	Transportation Sector Lack of filters implementation to reduce black carbon emissions in 543 machineries belong to the Roads Directorate.
	Other industries	Industrial Sector Lack of information and specific requirements that must be entered as an improvement to the platform to achieve its functionality in the carbon market. This gap has an estimated cost of USD 700,000.

Source: Climate Change Office, MMA, based on consultations with sector ministries

Barrier	Need	Priority
There are no available specific vehicles required in an electric version.	Development of technological improvements to use clean energy in vehicles and mining machinery.	Medium
High cost of replacing smelting technology by a more novel technology.	Development of technological improvements for emissions capture in smelting and refinery.	High
Financial resources to implement this measure.	Extending coverage of black carbon filters reduction to the total existing machinery.	High
Lack of resources in the annual budget of the Agency for Sustainability and Climate Change (ASCC).	Identification of improvements to the ASCC platform so that APL companies have access to the carbon market.	Very High

2.1.3. National Greenhouse Gas Inventory

Regarding the estimation of Chile's GHG emissions and removals, the country continues working in the operation and continuous improvement of its National GHG Inventory System (SNICHILE). It maintains a permanent line of work in the Ministries of Agriculture, Energy and the Environment where staff has been assigned, as well as technical and financial resources for the inventory's regular update.

The SNICHILE not only enables for the preparation and coordination of Chile's NHGHI, but which also seeks to make progress systematically on technical aspects such as the continual improvement of GHG estimates quality; quality of the data used; the research of country-specific emission factors of the main categories; quality assurance and quality control; development of procedural manuals for the implementation of crosswise issues (uncertainty, documentation and archive, other); and the creation and maintenance of adequate technical capabilities. A further detail on SNICHILE is found in Chapter 2.

Respect to financial resources, during 2017-2018, the SNICHILE was financed, as in previous years, through the national budget of the Chilean Government and funds from international projects, such as the Biennial Update Report.

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Regarding the professionals of the SNICHILE technical teams, team leaders are permanent staff of the Chilean Government, therefore, they are financed with the national budget. On the other hand, professionals in charge of the day-to-day tasks for the preparation of Chile's NGHGI (mainly information collection and compilation) were funded in a mixed manner: some of them are State's employees, while others were external consultants hired specifically for the preparation of Chile's NGHGI with funding from international projects. In recent years, several of the technical teams have hired their external as permanent staff, or have integrated to the position profile of their professionals the capability to prepare GHG inventories. In this sense, rather than a need for capacity-building, there is a need to maintain the existing ones through institutional arrangements that allow SNICHILE to face situations such as staff turnover due to changes in the administration.

Embotellado de productos farmacéuticos Biosano, Santiago, Cristóbal Correa Montalva - Imagen de Chile

At least one professional of each technical team of SNICHILE has participated in international workshops and experience exchanges for capacity-building on NGHGI. This has undoubtedly been useful to increase the technical team capacity.

As of July 2018, the country has eight professionals qualified as NGHGI expert reviewers, of Annex I Parties to the Convention, one more than in 2016. These professionals implement their specific knowledge at different stages of Chile's NGHGI process, collaborating in its quality assurance.

With regard to the information needed to prepare Chile's NGHGI, according to the experience of the consolidated sector technical teams and guidance received during the voluntary external review process of the previous NGHGI, SNICHILE has made progress in the improvement of activity data, parametric data and emission factors. This has been done mainly with its own resources. However, despite the progress in this field, it has become a priority to improve national research and information related to the development of specific emission factors for the country. This way it is expected to represent the national reality more accurately and with less uncertainty.

What the SNICHILE expects continues to be having the largest possible number of permanent and competent professionals, constituting stable technical teams to ensure the sustainability of the system and the quality of GHG emissions estimates. In addition, it is expected to count with the greater amount of country-specific emission factors to more accurately reflect the national reality in terms of their GHG emissions and removals, particularly in the main categories identified in Chile's NGHGI.

Table 5 presents a summary of the needs related to the NGHGI scope in Chile, in addition to the most relevant gaps and barriers identified.

Table 5. Summary of gaps, barriers and needs in the NGHGI field

Area	Gap
Financial Resources	In the short term, the national funding is insufficient for the permanent recruitment of suitable personnel at the technical teams, and the development of country-specific emission factors.
Capacity building and technical assistance	There are still gaps in the technical capabilities of professionals who are a part of the technical teams at SNICHILE, particularly in the development of country-specific emission factors. This is due to a combination of variables such as: • All SNICHILE professionals have other responsibilities within their position profile, added to the reduced number of professionals which causes a work overload, translating into each professional being forced to prioritize their working hours, abandoning the opportunity to train themselves in the NGHGI; • Staff turnover inherent to work at State agencies, and to the fixed-term retention of external consultants that leave the teams at the end of the service provision; • The limited number of experts in the NGHGI field inside the country, in both the public and private sectors, which reduces the chances of a frequent exchange of experiences at a national level.
Technology transfer	Having information that better reflects the national reality, the country does not possess the adequate technology to perform measurements (fuel carbon content, soil carbon, GHG from soils, firewood and animals, among other).

Source: Technical Team Coordinator of the MMA

Barrier	Need	Priority
The NGHGI preparation has acquired a certain relevance within political priorities and techniques of the ministries involved in the SNICHILE. However, its importance regarding other issues continues being minor, having an impact on the lack of budget. Added to the above is the fact that the country has less possibilities to replace the lack of resources with international funds because it is less eligible for these.	Increasing the national funding for the recruitment of new permanent and competent professionals in the different technical teams of SNICHILE. In addition, a permanent financing is required for scientific research and development of country-specific emission factors, particularly for the Energy and LULUCF sectors.	Very high
Little relevance of the NGHGI within political and technical priorities of the ministries involved in the SNICHILE, which has an impact on the lack of profiles for positions to retain professionals with the adequate technical qualifications to develop the NGHGI in Chile. Lack of Governmental incentives for the promotion of scientific research in the NGHGI field, particularly for the scientific and academia community. Lack of budget allocated to activities of creation and maintenance capabilities. Limited interest, at the level of the scientific and academia community, in the research that will allow the development of country-specific emission factors. In addition to the above, a significant barrier is related to a lack of an official definition of the roles of some participants of the SNICHILE.	Increasing and maintaining the technical capabilities of the SNICHILE professionals through onsite courses, online courses, workshops, seminars, or experience exchange with international experts. Technical support is required by the Parties included in Annex I to the Convention, of this same UNFCCC or other expert parties, such as the IPCC. Increasing and promoting scientific research in the development of country-specific emission factors, particularly for the Energy and LULUCF sectors. It requires technical support by the Parties included in Annex I to the Convention with circumstances similar to the national, in the understanding that these Parties have already made considerable progress in this matter and that the similarity of conditions makes it feasible to replicate the GHG measurement methods.	High
Little relevance of the NGHGI within political and technical priorities of the ministries involved in the SNICHILE, which has an impact on the lack of technological equipment suitable to develop scientific research. Lack of government incentives to promote scientific research in the NGHGI field, particularly for the scientific and academia community. Lack of budget allocated to the development or acquisition of technologies. Bureaucracy and procedural barriers for the development or acquisition of technological equipment and software.	Development or acquisition of equipment (hardware and software) for the development of country-specific emission factors. Particularly, it is required: • To purchase a 110 units Perkin Elmer autosampler to be connected to the second GC available. This increases the analytical capacity and generates specialized equipment to determine GHG in soils and animals. • Having ground measurements of carbon in the soil of the LULUCF sector. • Having measurements of the fuel carbon content.	High

2.1.4 Adaptation

During the period covered by this report, the following progress has been made regarding adaptation policies committed in the National Plan for Climate Change Adaptation NAP (2014): to the sector plans reported in the second BUR (Forest-Farming; Biodiversity; Fisheries and Aquaculture and Health) adds the adoption, in 2017, of the Adaptation and Mitigation Plan for Infrastructure Services to Climate Change, and in 2018, of the Plans for Adaptation to Climate Change for Chilean Cities and for the Energy Sector. In addition, during 2018 the preparation of the plans for the Water Resources and Tourism sectors has begun, which would complement the adaptation plans for the 9 sectors defined as priorities by Chile at the NAPCC. In addition, the first steps have been taken to update the Forest-Farming and Biodiversity adaptation plans, which are close to completing their first implementing cycle, and that should initiate a second cycle, as committed in the Chile's NDC.

Progress in the development of these policies has been possible thanks to the active participation of sector ministries, which have led their adaptation to Climate Change processes in a joint effort to identify vulnerabilities and formulation of actions and measures to address the impacts of climate change, coordinated by the Ministry of the Environment.

In addition, during this period two NAP progress reports have been prepared, one in 2016 and another in 2017, which include sector plans under implementation. These reports contain information about the progress status of the measures as well as of the amounts invested, and constitute the first progress report on adaptation policies in the country. The involvement of the Inter-Ministerial Technical Team on Climate Change (ETICC), in operation since 2015, has been crucial in the coordination of these actions.

Between 2016 and 2018, the need to strengthen capacities at the territories level in the field of Climate Change has also been taken care of. In this sense, the Regional Committees on Climate Change (CORECC) have already been incorporated in the 15 regions of the country. The CORECCs, proposed at the 2014 NAP, are led by the Regional Governor, who is the top political-administrative authority in each region and are composed by the Regional Secretariats of the Environment and other sectors related to the design and implementation of climate policies. Their role is to lead, define and coordinate the implementation of the climate change policy in the country regions.

Personas consechando hierbas y verduras, Diego Fontecilla - Imagen de Chile


Cultivo de salmónes, Cristóbal Correa Montalva - Imagen de Chile

During this period, this has also been emphasized on the development of information to be used at CORECCs, Regional and Municipal Governments regarding climate projections and impacts. This information has been generated with a higher resolution, at a regional and district scale, to be used in the design of policies, measures and actions to be implemented at the territory. Currently, we have the "Digital database of the District Climate in Chile: baseline (1980-2010) and projection to 2050" (2016)[4] and the "Regional Climate Simulations and Vulnerability Assessment Framework" (2018)[5] project. Both initiatives contain extensive information regarding the future climate variations caused by climate change for indicators such as rainfall, temperature, winds. These projections are currently being supplemented, with studies for the Chilean insular territory and Antarctica.

Regarding institutional capacities, at the Climate Change Office of the MMA, a permanent team works on adaptation issues formed by three professionals: two hired by the MMA and one partially funded by the Federal Republic of Germany and the MMA. However, it is necessary to strengthen the work teams devoted to adaptation in the sector ministries and at a subnational level.

The new National Action Plan on Climate Change 2017-2022, published in July 2017, proposes three specific objectives for the country's adaptation: i. Periodically assess vulnerability of human and natural systems faced to the impacts of climate change, establishing the risks and opportunities posed by this phenomenon; ii. Adapt to climate change, through the implementation of measures to reduce vulnerability and to increase adaptation capacity of human and natural systems of the country, and iii. Monitor and periodically report on the progress of adaptation in the country, to establish improvements to planning through adaptation policies. The second specific objective reflects the actions of the sectors, through the nine sector adaptation plans and their updates. The other two specific objectives propose crosswise measures for adaptation, and are based on the main current needs of the country in the adaptation issue, which are summarized in Table 6.

[4] *http://basedigitaldelclima.mma.gob.cl/*
[5] *http://simulaciones.cr2.cl/*

Table 6. Summary of needs, gaps and barriers in the adaptation field

Area	Gap	Barrier
Financial Resources	Lack of permanent budget of the public sector, at ministries, regional and local governments level, for the recruitment of specific staff to work on issues of climate change.	No relevance has been assigned to adaptation within budgetary priorities and funding by ministries, regional and local governments. Lack of alignment and agreement to increase public spending on issues that are already prioritized within the adaptation agenda.
	Lack of permanent budget for the development of research on adaptation.	There are other priorities in the country that make it difficult to allocate resources to this area. Lack of effective mechanisms to allocate public resources for scientific research aimed to subjects of interest of public institutions.
	Lack in strengthening coordination and unifying criteria among the various entities responsible for monitoring and financing the improvement of different variables' monitoring systems.	There is coordination between public entities given the institutions' willingness, in the lack of regulatory requirement regarding each institution's competences.
	Forestry: Lack of funding for the implementation of measures and actions contained in the sector plans for adaptation of existing legislation and of the National Climate Change Strategy and Vegetation Resources (ENCCRV).	Given the country's needs and priorities in other areas, no necessary relevance has been given to climate change adaptation within the allocation of fiscal budget for implementation of the sector plans measures already approved. The categorization of Chile as a medium-high income country, makes access to international funds difficult. Without prejudice of such categorization, fiscal funds are not sufficient to deal with the issue of climate change and associated disasters to which the country has been exposed.
	Tourism: Lack of additional financing for the development of the adaptation plan for the tourism sector.	The Tourism Undersecretariat does not have the financial resources to cover the development of workshops at the 84 destinations defined as priorities in relation to the impact of climate change.
	Water resources: Lack of additional funding to prepare the plan.	The necessary financial resources are not available, to cover all the activities planned for the preparation of the adaptation plan for water resources (studies, workshops development, among other activities).
	Infrastructure: Funding is required for the implementation of adaptation measures in the design area, planning and monitoring to reduce public works infrastructure vulnerability.	The resources to implement a resilient and carbon-low infrastructure strategy are not available.

Need	Priority
It is required to increase financial resources for permanent full-time staff to work on issues of adaptation to climate change at the institutions belonging to the ETICC and regional and local institutions, considering the growing requirements of the country in the field of adaptation.	Very High
Permanent financing is required for research and academia initiatives to continue with this type of projects.	High
Financing to improve and expand monitoring of environmental and climatic variables: oceanographic data, rivers flow, ice extension, glaciers, high Andean wetlands, biodiversity, among other.	High
Permanent fiscal budget allocation is required at the MMA and at each of the sector ministries that have been prioritized in the field of adaptation to implement the measures contained in the plans. International financial support is required for implementation of adaptation and risk reduction measures contained in the plans.	Very High
Having an adaptation plan for the tourism sector. Performing a vulnerability analysis for the 84 touristic destinations defined by the Tourism Undersecretary and Sernatur, at a national level, considering the more developed tourism activities therein.	Very High
Having an adaptation plan to Climate Change 2018-2023 for Water Resources.	Very High
Having a strategy that directs the efforts of the Adaptation and Mitigation Plan for Climate Change Infrastructure Services in the areas of resilient and carbon-low infrastructure.	Very High

Area	Gap	Barrier
Capacity building and technical assistance.	**Institutions:** Lack of robust and adequate institutions of climate change at the sector ministries at national level, with their corresponding coordination at regional level, through Regional Secretariats.	The necessary relevance has not been given to adaptation within the work priorities of the sector ministries involved in the matter. Intermittent political willingness to develop the adaptation issue, who are in charge of public agencies should express themselves.
	There is a limited number of experts for the development of research and studies on vulnerability, adaptation and risks of climate change issues.	The Government has few instruments to influence the content of higher education programs, which translates into a limited inclusion of climate change issues in programs, and a lack of knowledge of the national scientific community to develop research and projects on adaptation to climate change matters.
	There is a lack of knowledge and capacity in the national, regional and local public sector levels for projects preparation and presentation to specific Funds and financial institutions. Lack of information on existing funds and their characteristics, for projects identification by the different institutions. Shortage of expert consultants that can submit projects to specific international Funds.	Minimum or inexistent dissemination of the various national and international existing Funds on the part of the institutions that manage and/or know them.
	Lack of capacity by the public services to promote and supervise innovation initiatives in adaptation to climate change at the Forestry-Farming sector	Internal prioritization is required to enhance training activities at the appropriate public services.
	Lack of a greater involvement by the private sector in the field of adaptation, as well as awareness by this sector on how Climate Change will affect them. Lack to develop and strengthen relationships between the private sector and public institutions in the field of adaptation.	Lack of Government's capacity, means and coordination tools with the private sector on the matter.
	Lack of knowledge and capacity in various sectors of society (formal and non-formal education, education professionals, citizens in general) on impacts, vulnerability and adaptation to climate change and risk.	The permanent training of teachers and professionals of the institutions is not mandatory.

Need	Priority
Strengthening the mechanisms for coordination among the different sector ministries involved, and endowing them with trained professionals, both at national and regional levels. Strengthening the Climate Change Regional Committees as the coordinating entity for decision-making at a political level at regions. Establishing a regional institutional arrangement inter-sectors of technical level (Regional ETICC) Improve the involvement of local stakeholders in the whole process of measures, from their design to their monitoring, considering their environmental implications and coordination with other policies and projects.	Very High
Researchers and specialized Academia in vulnerability, adaptation and risks at all regions of the country. Ongoing and excellence research in the areas of adaptation to climate change, from both national and territorial standpoints, considering the particulars of each territory which responds to local problems in adaptation.	High
Development of knowledge and capabilities on international and national existing support Funds, their requirements, coverage, presentation formats and other specific aspects to apply to each of them.	High
Strengthening professionals capacities in the public sector regarding the scope of adaptation to climate change, to promote and monitor innovation initiatives to face the effects of climate change, and also to take advantage of their opportunities for the Forestry-Farming industry in Chile, and the opening of new technological areas (and technologies) that can answer the challenges faced by the sector, because of the behavioral changes in climate.	High
Improving and strengthening the task of the Agency of Sustainability and Climate Change (ASCC) at regional and local level, for the coordination and generation of joint strategies with the private sector. Development of strategic alliances and commitments by the private sector for the implementation of adaptation measures.	High
Developing adaptation to climate change contents and incorporate them to the curricula at all educational levels handled by MINEDUC. Dissemination of adaptation to climate change subject among children, young people and society in general. Capacity building in adaptation to climate change to teachers of different levels. Incorporation of adaptation to climate change issues in post-graduate careers.	High

Area	Gap	Barrier
Technology transfer	Water Resources: Lack of introduction of various technologies in different sectors aiming to address water scarcity, with long-term solutions.	Reluctance to changes in the use of water resources and new sources of supply. Uses of inland waters are restricted to obtaining water rights.
	Meteorology: Lack of introduction of new technological solutions and cutting-edge equipment, weather radars for climate monitoring, focused on management of climate risk.	Different institutions have monitoring stations, so that the transfer of data requires inter-institutional agreements.
	Infrastructure: It requires implementation of Monitoring Measures to reduce Vulnerability of public works infrastructure.	Not identified.
	Health: Insufficient capacity to predict the possible geographical distribution and likely proliferation of zoonotic and vector diseases throughout the country allowing to prevent health effects associated to them, at a local level.	Limited resources due to other priorities of the health sector.
	Biodiversity: Lack of funding to implement the biodiversity and climate change monitoring network, which already has a design proposed.	It requires inter-sectors coordination and capacity development.

Source: Climate Change Office, MMA based on consultations with sector ministries

Need	Priority
Introduction of various technologies and technology management to adapt to water scarcity.	Very High
Use of technologies to improve and expand the coverage of services and products information required to support the climate risk management. .	High
To provide with a system of control and remote monitoring for the infrastructure of coastal edge (DOP), fluvial defenses (DOH) and bridges (DV) to reduce the disaster risk (as proposed in the Sector Plan)	Medium
Need for technological solutions to know the burden of diseases associated to climate change and the Establishment of predictive models on the behavior of vector-borne diseases and zoonoses associated to climate change (proposed in the Sector Plan)	High
Specific software for remote sensing, statistical, and specialized in data analysis, and technologies and storage capacity for biodiversity and climate change monitoring network.	Medium

2.1.5 International Negotiation

In the area of negotiation and international climate agenda, the main need continues to enlarging the current negotiating team in the country, as well as establishing permanent teams at the relevant sector ministries, with the adequate financial and technical capacity for the preparation, follow-up and transfer of international issues at a domestic level.

The team of professionals involved in the negotiations is smaller than the number necessary for an adequate follow-up of negotiations: some strategic sector ministries (energy, agriculture) do not have permanent staff at negotiations. This inter-ministries team addresses negotiation issues as one of several items in their domestic work agenda, thus reducing the time available for planning and coordination in detail of the international negotiation agenda. Table 7 summarizes the needs, gaps and barriers in this area.

Table 7. Summary of needs, gaps and barriers in the field of International Negotiation

Area	Gap	Barrier	Need	Priority
Financial Resources	A minimum of three additional and permanent negotiators, with priority dedication to the issues of the international agenda on climate change.	Lack of knowledge about the content and scope of the international negotiation process on climate change. Nature of the process of negotiations makes it difficult to demonstrate the benefit of participating. Limited resources compete with other sector policy's needs. Restricted availability of negotiators and supporting professionals due to the need to allocate time to other tasks of the climate agenda.	Lack of specific budget allowing to form and to maintain a specialized and permanent negotiating team. Permanent inter-ministries team specialized in the international agenda on climate change of at least five professionals. Planning ahead and regular meetings to address issues of international negotiation in a coordinated and coherent manner.	Very High
Capacity building and technical assistance	Resources to meet the demand for adequate capacities at the negotiation agenda. Some officials with technical capacity to participate in negotiations are not fluent in the English language at an appropriate level for negotiation work.	Lack of knowledge of the links in the negotiation issues with the sector agenda of public policy.	Development of capacities in the different sectors and ministries regarding international negotiation, in specific topics of each sector. Creation and strengthening in English language capacities.	High

Source: Prepared by the authors, Climate Change Office, MMA

Parque Nacional Huerquehue, Sernatur - Imagen de Chile

2.1.6. Needs identified by the private sector

In accordance to the second BUR, the domestic private sector has played an important role both in the investment and in the implementation of mitigation and adaptation to climate change measures, allowing fulfillment of the NDC, which is why it is important to know the main needs, gaps and barriers that affect their action on climate change.

A survey was carried out directly with the private sector through interviews with trade associations, companies and organizations of production. Information was gathered on the barriers, gaps and needs that crosswise affect all industries in the sector, and other attributable to a particular sector. Based on the above, the table reported in the second BUR was updated with new elements and new sectors. Listed below are the main changes:

As reported in the second BUR, it is noted that the implementation of actions with an impact on climate change depends to a great extent on the interest, commitment and continuity of those responsible for the areas of sustainability or environment in the companies.

In general, the needs, gaps and cross barriers indicated in the second BUR remain, and additionally new items are added. On the other hand, the energy sector highlights that in the previous report the need was aimed to a territorial organization preventing communities' rejection to renewable energy projects. However, based on the opinions delivered, it has been indicated that this need is not currently present, since the new renewable energy projects do not have a significantly negative impact on environment. The biggest challenge observed by the sector now is related to a more homogeneous electrical consumption throughout the day and as regards energy efficiency, more precise information about consumption at a household level. With respect to the mining sector, the need reported in the second BUR has decreased, since there are greater opportunities for the penetration of renewable energies as a result of changes in the bidding rules and lower prices of these technologies. The main need of the sector reported in this BUR is the development of technologies for alternative fuels such as gas and hydrogen. The other sectors, Forestry and Cement maintain their needs and new supplementary elements are added. While the first looks for the increase of wood in construction, the second aims to increase the use of concrete on roads, both measures to reduce GHG emissions. Table 8 presents the main needs, barriers and gaps of the private sector.

Table 8. Needs, gaps and barriers reported by the private sector

	Needs
Transversal	Generating greater instances and efforts to promote a low-carbon economy and sustainable development considering the exchange of public-private information.
	As regards education and awareness, there is a lack in communicating with greater clarity and transparency the risks and limitations of not implementing mitigation or adaptation actions.
	Promoting technology transfer for implementation of climate actions according to stakeholder is required: 1) For Small and Medium-sized companies (PYMES) which install and use technologies from domestic markets, more support is needed for capacity building, financing, innovation, among other aspects. 2) There are specific sectors, such as mining and aquaculture, where fostering innovation is required.

Source: Climate Change Office, MMA based on consultation with private sector stakeholders

Gaps	Barriers
There is no coordinated and strategic implementation of mitigation measures in the private sector. It is required that small and medium-sized companies initiate actions currently mostly implemented at larger organizations.	Creating instances of public-private dialogue and of knowledge transfer within the private sector. Lack of transfer of general knowledge to reach this type of organizations.
The main barrier is information dissemination. There are many entities that have already gained experience in carrying out management in adaptation and implementation of mitigation actions to climate change, so a instance is needed to share those ideas and search for coordination among stakeholders, both public and private.	Transferring knowledge to the public and also to entities is required. These, in turn, should be more transparent by means of a general awareness plan at a Governmental level, which could be developed with support from the private sector, addressed to the general population in order to achieve greater awareness and to change consumption behaviors, among other impacts.
The introduction of technology implies an important initial investment, which leaves out small businesses that do not access a credit. In addition, it requires articulation of the entire Science, Technology and Innovation (CTI) ecosystem, so as to provide capacity to develop new technologies and/or adopting already proven technologies.	There is a significant technological barrier between technologies currently used and the best technology available in the market. Mobilization of financial resources and/or creation of crosswise instruments to promote technology introduction and implementation of mitigation measures in the companies. It is necessary to involve the private sector in the applied research to its business activities to detect the environmental impact of its operations, and to strengthen their capacities to develop sustainable technologies and operations related to climate change. Need to increase spending in research and general development of the country with the active participation of the private sector. Also, it is necessary to promote a research for technologies development, the so-called "Business pull", in which the private sector plays an active role together with academy, for the development of new technologies.

2.1.7. Needs identified in the process of analysis and international consultation

During 2017, the second Chile's BUR was submitted to the International Consultation and Analysis process (ICA). The main purpose of this process is helping non-Annex I countries to identify their needs in capacity building. As a result, a report was delivered for Chile, published on December 4th, 2017, available on the UNFCCC's webpage[6]. Table 9 presents the needs in terms of capacity building identified in the ICA process and the need status in the current reporting period.

Table 9. Needs identified in ICA 2017

Needs identified in ICA of the 2nd BUR
(a) Development of improved methodology for collecting and consolidating information on financial resources received, so as to be able to differentiate the amount of resources disbursed in the period versus the total amount of resources committed for the project, among other methodologies required. (UNFCCC, 2017) (Unfccc, 2017).
(b) Improving the estimation of GHG emissions in the waste sector. (UNFCCC, 2017) (Unfccc, 2017).
(c) Increasing and promoting scientific research on the development of emission factors specific to each country, particularly for the energy sector. (UNFCCC, 2017) (Unfccc, 2017).
(d) Strengthening institutional arrangements (roles and responsibilities) of the different units involved in the preparation of the GHG inventory. (UNFCCC, 2017) (Unfccc, 2017).
(e) Improving institutional arrangements for a better interaction with all institutions that have information on methodologies and assumptions that are used to track the progress of mitigation actions and their effects for the BUR report. (UNFCCC, 2017) (Unfccc, 2017).
(f) Strengthening the capacity to quantify the impact of the real and expected GHG mitigation actions and their effects.(UNFCCC, 2017) (Unfccc, 2017).
(g) Building capacity on mitigation actions involving other ministries and institutions for BUR preparation.(UNFCCC, 2017) (Unfccc, 2017).
(h) Improving the systematization of information collection, from public and private sectors through the development of a permanent active system expected in the report.(UNFCCC, 2017) (Unfccc, 2017).

Source: Climate Change Office, MMA based on ICA report (UNFCCC, 2017)

[6] *https://UNFCCC.int/sites/default/files/resource/docs/2017/tasr/chl.pdf*

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Need Status
The need to improve the way in which information on support received is recorded and compiled at a sector level subsists, and how we could centralize its management. The information reported does not allow identifying and accurately differentiate the resources committed from those disbursed for a particular project over a specific period of time.
To increase the quality of the emissions estimate from the waste sector the Capacity Building Initiative for Transparency (CBIT) project is considered, which includes resources for data activity and parameters improvement of this sector, particularly those related to solid waste.
Emission factors have been developed for some categories of Agriculture and LULUCF sectors. However, it is necessary to continue promoting scientific activity (through training and technology transfer) for a continuous research of these values. In the case of the energy sector, it is required to improve the collection of information on fuels characteristics for the subsequent development of country-specific emission factors. Notwithstanding the above, the MINENERGIA does not yet have the means (legal and technical) to begin this process.
Although a working agreement with the MINENERGIA is maintained, there is a need to institutionalize the links with the MINAGRI and its institutions. Such strengthening is still pending, but in spite of its absence, the sector teams' willingness has allowed the good performance of the SNICHILE work plan.
Work has been done towards the delivery of technical support on the MRV issue, as well as in the follow-up of policies related to mitigation. We have also participated in the development of sector policies linked to the issue of climate change. In the short term, it is intended to develop a platform for registration and information of mitigation actions, allowing to permanently maintain communication and systematization of information through the registration of mitigation actions that include sector policies. It is expected to develop this platform through the Capacity Building Initiative for Transparency (CBIT) project.
The Ministry of the Environment is looking for ways to strengthen the capacity to quantify the impact of the real and expected GHG mitigation actions within sectors. So far, the most important progress is associated to the development of the future Chilean Climate Change Law, where it is expected to define certain sector responsibilities that include this point.
This work was undertaken for the preparation of the present report, strengthening the capacities on mitigation actions in different sectors. Among them, the Energy sector entirely assumed the development of its section in the preparation of this BUR. It is soon expected to have some type of platform that allows keeping involved the various ministries and institutions in the BUR development.
As mentioned in point e), it is expected to have a registration of mitigation actions platform to gather the information necessary for reports on a permanent basis.

3. SUPPORT FOR CLIMATE ACTION

This chapter of the report presents information on support received (international) and delivered (national) for activities related to climate change. The supporting information is presented in the following three categories and corresponding subcategories:

- Support received for activities related to climate change
  - Financial Resources
  - Capacity building and technical assistance
  - Technology transfer
- Domestic support for activities related to climate change

Gathering the information in this section was performed using the following methodology:

- Stage I: Identification of the various initiatives and international support received about climate change in the country, those coordinated by the MMA and those performed by other public institutions. It was reviewed the information reported in the second BUR and all initiatives known by the MMA.

- Stage II: Afterthe information was collected and identified various initiatives and the support that was received, a formal survey was sent to public institutions that are a part of the Inter-Ministrial Technical Team on Climate Change (ETICC), requesting for validation and updating of such initiatives, as well as for incorporation of new information on support received for the reporting period of this report.

- Stage III: A review process was carried out with some public institutions to clarify and/or to complete the information reported.

- Stage IV: For support information to private sector initiatives, it was reviewed and analyzed the web pages of funds and multilateral institutions that contribute with concession loans or other financial instruments.

- Stage V: For information on domestic support, it was included an update study on the public spending, as well as information on resources and activities designed to bilateral cooperation.

The time scope of the information contained in this section focuses on those initiatives that were granted support during the period between **August 2016 and March 2018.**

However, it also includes information on projects started prior to the reporting period, but still under performance during the term July 2016 - March 2018. This information is presented separately from the figures for new financial resources awarded during this period.

3.1. Support received for activities related to Climate Change

This section summarizes the Climate Change initiatives for which Chile has received international support in their development and/or implementation. The information is classified according to the type of support received, as per the following three categories:

- Financial Resources

- Capacity building and technical assistance

- Technology transfer

3.1.1. Financial Resources

Support in the preparation and publication of National Communications

Para la preparación y publicación del The support committed through the GEF for the preparation and publication of the Third Biennial Update Report and Fourth National Communication is USD$ 852,000, amount that will be put in place during the period 2017 - 2021. Approximately 73 % of the budget (USD$625 thousand) is intended for the preparation of information on adaptation and mitigation components included in the reports (Table 10).

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Table 10. Support to the Third Biennial Update Report and Fourth National Communication

Support in the preparation of Chile's Third Biennial Update Report (3BUR) and the Fourth National Communication (4NC) to the UNFCCC	
Objective: Assist the country in the preparation of the national reports on climate change to be submitted by Chile to the UNFCCC in 2018 and 2020.	
Project description: Preparation and publication of the Third Biennial Update Report and Fourth National Communication.	
Component	**Amount (USD)**
Vulnerability and adaptation assessment	345,000
Mitigation and MRV systems	280,000
Creation and capacity-building	86,050
Presentation of the reports to the UNFCCC and learnt lessons	63,500
Project Management	77,450
TOTAL (USD)	852,000

Source: Prepared by the authors, Office of Climate Change, MMA

Para el desarrollo de los reportes For the development of the international reports, Chile contributes with the assignment of specialized staff to the report preparation tasks, a contribution valued at USD $77,265. In addition, a domestic contribution of USD $4,337 in expenses associated with logistical support (Table 11) is estimated.

Table 11. Domestic contribution to the preparation of the Third Biennial Update Report and Fourth National Communication

Source and type of non-monetary contribution	Valuation (USD)
Government of Chile: Hours worked in the preparation and publication of reports	77,256
Government of Chile: Logistics support (use of offices, infrastructure, equipment, rooms rental)	4,337
TOTAL	81,593

Source: Prepared by the authors, Office of Climate Change, MMA.

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Other financial resources managed through the public sector

This section summarizes information regarding those financial resources allocated to Chile to facilitate the fulfillment of commitments in the areas of report: mitigation, NGHGI, adaptation and international negotiation. These contributions refer to direct flows of money received by the country to develop specific activities or programs of the national climate agenda. It does not include flows of money to the private sector.

The information of financial resources in this section does not include resources for preparation and publication of national communications, which have already been presented separately in the previous section.

The flows of financial resources were categorized according to the type of donor, as follows:

- Bilateral: Resources from a specific country that performs a joint project with the Chilean Government, or sponsored by the Chilean Government.

- Financial Institutions and Multilateral Initiatives: this classification includes the funds/programs that receive contributions from several developed countries to be subsequently distributed to developing countries (e.g. Global Environment Facility GEF, the Adaptation Fund, UNFCCC), being possible to allocate these resources through multilateral financial institutions (for example, PMR and CTF with World Bank).

During the reporting period (July 2016 to March 2018), donor countries and institutions have approved a total of $ 40,207,701 for Chile to perform the activities of the national climate agenda (Table 13).

Bilateral contributions represent approximately 28% of the financial resources approved during the period. The resources allocate through "Financial Institutions and Multilateral Initiatives" are equivalent to 72 %.

For the reporting period, the vast majority of bilateral contributions approved (92%) come from the governments of Canada and Germany.

In the category "Financial Institutions and Multilateral Initiatives", the outstanding contributions are those of Adaptation Fund, the Forest Carbon Partnership Facility (FCPF), the National Program UN REDD and the Clean Technology Fund (CTF), which together contribute with about 66 % of this category's resources.

Regarding the scope of international negotiation, the German Government continues to provide financial resources to the countries of the regional AILAC negotiation group to advice to delegations, their experts and to perform logistics tasks. As a member country of AILAC, Chile has access to this support; however, as these contributions are intended to finance activities of the entire AILAC, there is no detail of the specific contribution aimed to each country.

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Table 12. Detail of financial resources allocated, by type of donor, period July 2016-March 2018

Type of donor	Financial resources (USD)	Scope					Sectors
		R	M	I	A	N	
Bilateral/countries	11,268,388						
Germany	5,055,559		•				Crosswise | Energy |
Canada	5,300,000		•		•		Waste
Switzerland	800,000		•		•		Forestry
United Kingdom	62,829		•		•		Crosswise
Korea	50,000		•		•		Forestry
Initiatives and Multilateral Financial Institutions	28,939,313						
Adaptation Fund (United Nations)	9,960,000				•		Agriculture
Readiness Fund Forest Carbon Partnership Facility (FCPF-World Bank)	4,000,000		•		•		Forestry
UN-REDD Targeted Support	560,000		•		•		Forestry
UN-REDD National Program	1,000,000		•		•		Forestry
The Clean Technology Fund (World Bank)	3,500,000		•				Energy
Various GEFs	2,680,000				•		Forestry| Energy |Fishing
Partnership for Market Readiness PMR (World Bank)	1,980,000		•				Crosswise |Energy
UNFCCC Green Climate Fund GCF (World Bank)	2,000,000		•		•		Crosswise
CBIT-GEF	1,200,000	•	•		•		Crosswise
NDC Support Program UNDP Federal Republic of Germany | Spain | European Commission	802,500		•				Crosswise
Energy Sector Management Assistance Program ESMAP	500,000		•		•		Energy| Housing
Other IDB	307,813		•		•		Crosswise |Energy
CCA-SNAP (Supporting National Action and Planning on Short Lived Climate Pollutants)	184,000		•				Energy| Waste | Transportation
APEC fund	170,000				•		Agriculture
Euroclima Plus - GIZ /ECLAC	95,000		•				Energy | Transport | Crosswise
Total	40,207,701						

R = Report; M = Mitigation; I = NGHGI; A = Adaptation; N = International Negotiation

Source: Prepared by the authors, Climate Change Office of the MMA

Table 13 presents information on the major projects that receive financial resources during the period (including those for a total value higher than USD$500,000). These projects represent 97 % of the resources approved during the period. These projects and their amounts are included in the consolidated table 12 above.

Table 13. Main projects approved to receive support in financial resources, period July 2016 - March 2018

Project	Objective
"Enhancing resilience to climate change of the small agriculture in the Chilean Region of O'Higgins" (2016-2019).	Increasing the resilience capacity of rural communities at the coast and dry land of the O'Higgins Region in Chile.
Chile - Canada cooperation program for the reduction of greenhouse gas emissions associated to municipal organic waste management.	Implementing measures to improve the municipal organic waste management to reduce GHG emissions; Adaptation of Canadian MRV protocols for Landfills that capture biogas, anaerobic digestion and compost plants.
Crosswise activities in causes of deforestation, vegetation and degrading of vegetation resources. Design of a payment structure for environmental services.	Crosswise support to the preparation of the ENCCRV phase Supporting the design of a payment structure for environmental services within the context formulated by the ENCCRV and other instruments and related programs under performance in the country.
CO_2 emissions reduction through the use of Cogeneration in Industry and Commerce	Accelerating the incorporation of co-generation technologies in Chile.
Strengthening of products necessary for the implementation of ENCCRV in the territory.	Reducing emissions from deforestation and forests degradation.
Support for the ENCCRV implementation phase.	Reducing emissions attributed to deforestation, forestry degradation and increased stocks by conservation and management.
Technical assistance for the Sustainable Geothermal Project Development.	Promoting sustainable development in the use of geothermal marketable resources in the country.
Strengthening the capacity of adaptation to climate change in the Chilean fishery and aquaculture sector.	Reducing vulnerability and increasing capacity of adaptation to climate change of Chilean fishery and aquaculture sector.

Description	Donor Institution Fund	Financial resources (USD)
Designing and implementing measures to reduce vulnerability of small farmers respect to changes in agricultural production, ecosystem services and biodiversity.	The Adaptation Fund (UNFCCC- World Bank)	9,960,000
Identifying projects' feasibility at different municipalities throughout the country, in order to act as pilots; The typology of projects can be: compost, anaerobic digestion or energy, whether thermal or electric energy. Using MRV protocols in projects related to solid waste management, so as to consider the market of tradable emissions.	Government of Canada	5,300,000
Studies associated to generating synergy links in order to comply with the goal of the forestry sector in the Nationally Determined Contribution (NDC).	Forest Carbon Partnership Facility (FCPF).	4,000,000
The project supports the introduction to the market and to the Chilean energy sector of efficient cogeneration technologies, particularly in the industry and commerce and it contributes, through specialized training and the efficient use of fossil fuels and renewable sources, for reduction of GHG emissions.	Germany	4,538,418
Support for the design of an Environmental Forest Fund (FFA) as a financial architecture tool of the National Climate Change Strategy and Vegetation Resources (ENCCRV) of Chile and implementation of pilot projects in the territory.	UN-REDD Targeted Support	560,000
Through the UN-REDD's NP, it will strengthen and answer the four elements of the Cancun Agreements included in the Warsaw Framework for REDD+, where there are still gaps in the country, in the case of Chile correspond to: the National ENCCRV, Forest Monitoring System (NFMS), Reference Level of Forestry Emissions/ Forestry Reference Level (NREF/NRF) and the Safeguards Information System (SIS), through the NP it will develop a system allowing to issue the reports required by the UNFCCC.	UN-REDD National Program	1,000,000
Technical assistance to mitigate barriers and to improve conditions in the sector of geothermal energy in Chile: management of geothermal energy concessions system, indigenous consultation processes for geothermal energy exploitation concessions, the analysis of the conditions for the development of geothermal projects for power generation, and their contribution to the electrical system and the implementation of the Low Enthalpy Geothermal Program driven by the DER.	CTF	3,500,000
Strengthening institutional capacities to CC adaptation; improving adaptability of small fishermen and aqua-farmers; communicating and disseminating the impacts of climate change in small fishery and aquaculture.	GEF	2,500,000

Project	Objective
Partnership for Market Readiness (PMR) 2017-2019	Providing technical assistance to the monitoring, reporting and verification (MRV) and designing economic instruments to set carbon prices.
Support to the implementation of activities of the Green Climate Fund (GCF).	Strengthening the task of DNA and the GCF in Chile.
Strengthening the Chile's NDC Transparency Framework	Strengthening and improving the mechanisms of national institutions for international and domestic reporting.
NDC Programme UNDP Support	Expanding investment in Climate Change and supporting sustainable development, using NDC as instrument and vehicle.
Institutionally strengthening of the regions for implementation of the ENCCRV.	Contributing to consolidation of the overall objective of ENCCRV.
Global Carbon Market Chile	Supporting the development of carbon pricing instruments and exploring climate financing mechanisms that can contribute to the fulfillment of Chile's commitments in terms of greenhouse gases reduction.
TOTAL	

Source: Office of Climate Change, MMA.

Description	Donor Institution Fund	Financial resources (USD)
Financial and technical support to build the technical and institutional capacities that enable a robust implementation of carbon tax, and analysis and design of supplementary proposals of carbon price instruments, such as a national emissions trading system (ETS) and carbon offset systems, among other.	Several donors through World Bank	1,980,000
Developing a country program and build a portfolio of projects that can be submitted to the GCF. Developing an accreditation process for local entities. Supporting to the DNA. Developing the institutional framework to get a no objection letter of the projects.	GCF	2,000,000
Strengthening and improving the mechanisms of national institutions for international and domestic reporting, with emphasis on emissions prospective work, climate actions follow-up and public and international financing.	GEF-CBIT	1,200,000
Supporting the implementation of the NDC, transparency systems, commitment by the private sector and integration of the measures on gender approach in the planning and implementation of the NDC.	UNDP Germany | Spain | European Commission	802,500
Implementation of activities and actions of the National Strategy on Climate Change and Vegetation Resources at Puren district "Ecological restoration project of the basin of high Puren river" Knowledge-sharing activities with the Andean Forests Program Knowledge Management activities (international courses, among other).	Swiss Confederation	800,000
Supporting Chile's efforts for the fulfilment of its Climate Change international commitments, through the generation of the necessary knowledge for decision-makers in the public and private sectors to be prepared for development and implementation of ad-hoc mitigation actions for the national context.	Government of Germany	517,141
		38,658,059

Considering the difficulty to identify and accurately differentiate the resources approved and disbursed during the analysis period, Table 14 also presents information on projects under implementation during the analysis period, but which resources were approved prior to July 2016. Most of these projects will continue under implementation beyond 2018.

Table 14. Main projects under implementation reported by public agencies, with resources approved before July 2016. Amounts reported correspond to the total cost of the project.

Project	Objective	Donor Institution Background	Financial resources (USD)
Self-sufficiency NAMA: Renewable Energies for self-consumption in Chile (SSREs) 2015-2022	Promoting incorporation of renewable energy systems for self-sufficiency in Chile through the creation of financial and technical conditions adequate for the early stages of this emerging industry's development.	NAMA Facility Germany – United Kingdom	19,820,000
Solar Energy Promotion (focus on CSP) 2014-2019	Establishing markets for renewable energies on a large scale, focusing on the use of solar power with solar thermal concentrate systems (CSP) and photovoltaic systems, in order to significantly contribute to the reduction of greenhouse gas emissions in Chile.	Germany	9,554,000
Integrated Monitoring System of Native Forest Ecosystems (SIMEF) 2015-2019	Developing and implementing an Integrated Monitoring System of Native Forests Ecosystems in support to the definition of policies, regulations and Sustainable Forest Management Practices, incorporating REDD+, biodiversity and conservation in forest ecosystems, as well as supporting the National Inventory of Greenhouse Gases.	GEF	6,300,000
Sustainable Land Management 2012-2019	Facing the high vulnerability of Chile to desertification and land degradation.	GEF	5,800,000
Solar energy for electricity and heat generation 2012-2017	Developing a favorable regulatory framework and supporting the increase of the solar energy market for electrical and thermal-consumption. In addition, work has done to strengthen local expertise through training.	Germany	4,180,122
Biogas Project - Dairy Sector. 2015-2019	Reducing greenhouse gas emissions (GHG) by promoting investment and market development of biogas-based energy technologies in selected agro-industries in Chile.	GEF	1,715,151
Low Emission Capacity Building - Chile (LECB-Chile) 2012 - 2017	Promoting and building capacity in the public and private sector for measurement and mitigation of GHG emissions.	European Commission, Germany, Australia	1,614,000
Supporting to the Chilean energy agenda 2015-2018	Non-reimbursable Technical Cooperation contributed by the IDB to the Ministry of Energy for the implementation of a series of studies and consultancies within the framework of the Energy Agenda in Chile 2014-2018.	IDB	550,000
Emerging and Sustainable Cities Initiative (ESCI) for the Metropolitan Area of La Serena/ Coquimbo and Puerto Montt/Puerto Varas 2015-2018	Establishing the conditions and formalities allowing the solution of common problems to a metropolitan government, through municipal, provincial and regional associativity.	IDB	1,000,000
TOTAL			50,533,273

Source: Prepared by the authors, Office of Climate Change, MMA.

Financial resources channeled to private sector projects

In the second BUR, a section to report information on financial resources channeled from the outside to private sector projects related to climate change was included in an exploratory manner. This section considered financial support from development banking institutions, in addition to institutions and funds focused on financing climate change mitigation actions, and the transition towards a low-carbon economy.

In this third Biennial Update Report, it has been selected not to include this information because it was not possible to compile robust data on this type of projects and resources. There is limited information available, in addition to different definitions and methodologies. At the time of this report's preparation, the OECD database for Official Development Assistance (ODA) contains information about flows for climate action updated as of 2016. However, this report includes information as from July 2016, hence it is likely that it includes information not corresponding to the period of analysis. In addition, as from 2017 Chile no longer qualifies as an ODA's beneficiary country.

OECD's information on "other official (financial) flows" (OOF) and other private flows is available online at the aggregate level. Having access to detailed information at a recipient country level, amount, type of instrument and destination sector of resources would allow for further progress in a figure more useful to the report.

The work to generate a robust figure would require going beyond the identification of investment flows toward low-carbon investment in the domestic private sector, and also making an analysis of the financial sources , for example, flows mobilized (leveraged) through public interventions and direct private flows, in addition to information on intermediaries, the type of instrument and the investment sector.

This is anarea with room for improvement, but it will greatly depend on the availability and accessibility to information in international institutions that are already performing this type of analysis.

3.1.2. Capacity building and technical assistance

This section discusses the support received by the country in the area of capacity building and technical assistance. The concept of capacity building and technical assistance is developed in Chile through two lines of work:

- **National:** at a domestic efforts level, capacity building and technical assistance is understood as "a process that seeks to improve the individuals, organizations and institutions capacity to identify, plan and implement ways of mitigation and adaptation to climate change" (NAPCC 2017-2022). This process takes place at different levels through research, education, training and awareness activities, and the promotion of cooperation among organizations and sectors both at a national and international level. The current National Action Plan on Climate Change, 2017-2022 NAPCC, considers two main lines of action to move forward in this process: *(1) Promotion of research on climate change issues, and (2) Education and awareness strategy to address climate change.*

- **Internacional:** In the period covered by this report, Chile has received the contribution from various countries which have contributed with projects and/or access to training initiatives and technical support on different matters related to the climate agenda. Most of these activities have contributed to the strengthening of technical capabilities within public entities for the construction of the public agenda on climate change.

Table 15 presents a summary of international initiatives for technical assistance and capacity building where Chile participates permanently. The scope of the support received is broad covering projects, workshops, studies and expert visits to and from abroad.

After the COP 21, in 2015, the focus of the programs and international initiatives has been facilitating the successful implementation of the Paris Agreement. Access to this type of support and activities has been crucial to the development of capabilities and instruments to facilitate climate public policy. It highlights the progress made regarding GHG inventories, reporting capabilities and transparency and planning of mitigation and adaptation actions.

The country's participation in the Latin American Network of Inventories of National Inventories of Greenhouse Gases (RedINGEI) is highlighted, arising from the need of the regional countries to share their experiences given their common needs. The RedINGEI has been an important initiative for the country, allowing the development of capacities in the inventory of SNICHILE professionals; and being a platform for the generation of cooperation networks among the countries of the region.

It is important to note that, given the global nature of these initiatives and their way of operating in most cases no information is available on the specific amounts intended to finance the activities in which Chile participates.

Table 15. Major International Initiatives focused on capacity building with permanent participation by Chile, 2016-2018

Scope	Initiative Name	Objective
M, A	2050 Pathways Platform	Supporting countries in the formulation of development of low-emission strategies for long-term,
M,A	UNDP NDC Support Programme	Supporting countries in the domestic implementation of the Paris Agreement.
M,A	NDC Partnership	Facilitating access to technical and financial support so that countries accelerate climate action objectives achievement.
M,N,R	Partnership on Transparency in the Paris Agreement (PATPA)	Facilitating the exchange and communication among countries to strengthen the implementation effort towards an improved framework for transparency of the Paris Agreement.
M, I	Low Emission Capacity Building Programme LECB	Promoting and building capacity in the public and private sector for measurement and mitigation of greenhouse gas emissions.
R,M,I	Information Matters	Supporting institutions of participating countries in the analysis of their monitoring and communication processes, reducing gaps, improvement of these processes in accordance with international standards and requirements by the UNFCCC
M,A	EUROCLIMA PLUS	Facilitating the strategies and measures for mitigation and adaptation to climate change integration into the development of public policies and plans in Latin America.
M,A	Regional Platform for Latin America and the Caribbean: LEDS LAC	Strengthening quality, support and leadership of LEDS strategies in the region, adopting their effective implementation, driving their development at a national and sub-national level.

Description	Donor	Starting Year	Status
Multilateral initiative that brings together different types of stakeholders to share ideas and best practices for the construction of, low emission development strategies for long-term	France, Sweden, The European Climate Foundation, The Children's Investment Fund Foundation.	2016	Under performance
The program uses the NDC as an instrument for the design of comprehensive, inclusive and sustainable policies of resilient and low-carbon development. This is a part of the work carried out within the context of the NDC Partnership.	Germany, European Commission	2017	Under performance
Focusing on implementation of the NDC of developing countries, combining work at the household level and dissemination of information	Australia, Denmark, Germany, France, Holland, Ireland	2016	Under performance
Their approach is based on sharing experiences and good practices to identify robust options and practices that strengthen the transparency of climate global action. Prior to the COP 22, this was the International Partnership on Mitigation and MRV.	Germany, Korea, South Africa	2016	Under performance
The Chilean LECB chapter is concentrated in five components: (1) Updating the national GHG inventory and the creation of a national inventories system, (2) Implementation of the national carbon management program, HuellaChile, (3) System of measurement, reporting and verification (MRV) for appropriate mitigation actions in the public and private sectors. (4) Design of a low-carbon national development strategy for (LEDS) and (5) Promoting the involvement of the private sector in mitigation, increasing financing options in mitigation measures and analyzing climate change public and private expenditure.	European Commission, Germany, Australia	2012	Completed in 2017
In consultation with counterparts, identifying the specific needs and priorities of MRV systems and of GHG emissions monitoring, and improving these systems through customized workshops and courses developed.	Germany	2013	Completed in 2017
Regional cooperation program between the European Union and Latin America, focused on climate change. The Program seeks to achieve the following results: Improving the exchange of information and experiences on climate change, increasing political awareness and strengthening institutional capacities; identifying and prioritizing adaptation and mitigation measures "useful in any case" and/or with additional benefits; and strengthening food security in Latin America, contributing to a sustainable agriculture with a greater capacity to mitigate the effects and adapt to climate change.	European Commission	Phase III	Under Performance
It is a part of the Global Alliance on Low-Carbon Development Strategies (LEDS-GP) founded in 2011, which operates through an innovative model of distributed leadership, with regional institutions managing the local platforms from the countries, and international organizations providing technical support (LEDS GP, 2012)	Multilateral	2011	Under Performance

Ámbito	Nombre iniciativa	Objetivo
M,A	Iberian-American network of Climate Change Offices (LARIOCC).	It works as an instrument for permanent dialog on mitigation and adaptation of climate change.
M,I	Global Research Alliance (GRA)	Join the countries to finding ways to produce more food without increasing GHG emissions
M,N	Mitigation Action Implementation Network (MAIN)	Driving ambitious mitigation actions by means of identifying best practices, effective financing mechanisms and MRV.
N,M,A	Cartagena Dialogue for Progressive Action.	Building an ambitious, comprehensive and legally binding regime under the UNFCCC.
N	Ambition Leaders: Supporting the AILAC countries at the climate negotiations	To support AILAC countries to provide advice to delegations, their experts and the performance of logistic tasks, both during negotiations and in-between sessions.
I	Latin American Network of National Inventories of Greenhouse Gases.	Facilitate the sustainable development of technical and institutional capacities in national inventories of greenhouse gases through the exchange of experiences, lessons learned and the adoption of good practices among the member countries.

R = Report; M = Mitigation; I = NGHGI; A = Adaptation; N = International Negotiation

Source: Prepared by the authors, Climate Change Office, MMA

Descripción	Donante	Año inicio	Estado
It is integrated by the offices or national climate change units in the ministries of the environment of the countries of the Iberian-American Community of Nations (21 countries). The network establishes relationships with other networks, organizations and institutions, particularly with those regional to promote synergies between studies and experiences in the region (LARIOCC, 2012).	Kingdom of Spain	2004	Under Performance
The GRA focuses on research, development and extension of technologies and practices that help providing ways to produce more food, without an increase in GHG emissions. The objective of the members of the Alliance is to deepen and increase research efforts through the mitigation at rice, crops and livestock agricultural sub-sectors, and crosswise issues on measurement of soil carbon, the nitrogen cycle, and GHG inventories	New Zealand | GRA	2011	Under Performance
Technical Cooperation, organization of workshops and regional and global dialogues on development and implementation of specific NAMAs in the transportation, energy and waste sectors.	Germany | Kingdom of Denmark | Canada	2012	Under Performance
Chile is participating in this informal forum for dialogue on Climate Change, which brings together the countries maintaining a high level of commitment to the GHG reduction targets, which support a process in a universal and legally binding agreement.	Multilateral	2011	Under Performance
For the fulfilment of the objectives, a reliable and efficient supporting infrastructure is under performance allowing analyzing complex issues and summarizing this information to delegations, as well as developing negotiating strategies, establishing effective communication structures and negotiation skills.	Germany	2013	Under Performance
Triangular South-South Cooperation Initiative between Spanish-speaking Latin American countries and international donors that aims to increase the quality of inventories and their reports through capacity-building activities and the exchange of experience among the member countries.	Multilateral	2016	Under Performance

3.1.3. Technology transfer

This line of action led by the Corporación de Fomento de la Producción (CORFO), seeks to have an updated strategy for the development and transfer of technology towards 2020. As input for its preparation, it is expected to analyze the baseline on expenditure and investments in technology, identifying needs and establishing technological priorities for climate change.

This section discusses the support received by the country in the area of technology transfer. Table 16 presents information on initiatives aimed at the transfer of any specific technology, as well as the technical support and capacity building to develop it.

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Table 16. Initiatives related to technology, transfer period 2016-2018

Scope	Starting Year	Ending Year	Initiative Name	Objective	Description	Donor
M	2015	-	Geothermal Risk Mitigation Program (MiRiG).	Financial instrument aimed to mitigate the risk of deep geothermal exploration and development of geothermal steam field.	Instrument financed by the Clean Technology Fund (CTF) and administered by the IDB for a total of US 72 million. MiRiG covers the stage of drilling wells for a maximum amount to be defined in each case: In the event of success in perforation, it becomes a long-term credit and if it fails, it becomes a donation up to a certain limit value.	CTF
To	2016	2020	Enhancing resilience to Climate Change of the small agriculture in the Chilean region of O'Higgins.	Increasing the capacity of resilience in rural communities on the coast and dry land in the O'Higgins Region of Chile.	Designing and implementing measures to reduce vulnerability of small farmers faced to changes in agricultural production, ecosystem services and biodiversity.	Adaptation Fund
M	2017	2020	Chile - Canada cooperation program for the reduction of greenhouse gas associated to the municipal organic waste management.	Implementing measures to improve the municipal organic waste management ; Protocols Adaptation of Canadian MRVs, for Landfills that capture biogas, anaerobic digestion and compost plants.	The program seeks to identify feasibility of pilot projects at different municipalities throughout the country. The typology of projects can be: compost, anaerobic digestion or energy, either thermal or electricity. It will implement MRV protocols, considering the participation of tradable emissions in the market.	Canada
M	2017	2020	Reduction of CO_2 emissions through the use of co-generation in Industry and Commerce.	Accelerating the introduction of co-generation technology in Chile.	The project supports the introduction to the market and the Chilean energy sector of efficient co-generation technologies, particularly in industry and commerce and it contributes, through specialized training and the efficient use of fossil fuels and renewable sources, to the reduction of GHG emissions.	Germany
M	2017	2020	Technical assistance for the Sustainable Geothermal Project Development.	Promoting sustainable development of the use of marketable geothermal resources in the country.	Technical assistance to mitigate barriers and improve conditions in the sector of geothermal energy in Chile: management of geothermal energy concessions system, indigenous consultation processes for concessions of geothermal energy exploitation, the analysis of conditions for the development of geothermal projects for power generation and their contribution to the electrical system and implementation of the Program of Low Enthalpy Geothermal energy driven by the DER.	CTF

R = Report; M = Mitigation; I = NGHGI; Adaptation; N == International Negotiation

Source: own elaboration, Climate Change Office, MMA

A summary of the training and capacity building activities attended by public sector professionals during the period 2016 - 2018 is presented in Annex 7.

3.2. Domestic support for activities related to climate change

3.2.1. National Climate Financing Strategy

It is important to note that since the beginning of 2017 Chile no longer belongs to the list of countries eligible for official development assistance (ODA). This new scenario has derived into a decrease of financial support flows towards the country in relation to the period reported in the second BUR.

Within the context of the work to develop a strategy for climate financing (commitment in its NDC), the Chilean Government is implementing measures to define and assess domestic resources intended for actions related to climate change.

The Ministry of Environment, in collaboration with the Ministry of Finance and with the support of the LECB-Chile Program, implemented between 2015 and 2017 the 'Climate Expense' pilot project. In addition, the Budget Office (DIPRES), the United Nations Development Program (UNDP) and the Economic Commission for Latin America and the Caribbean (ECLAC) granted technical support. The second BUR reported the progress of the first phase of this project. This third BUR presents the main results of the second and final phases of the initiative.

For its implementation, the methodology 'Climate Public Expenditure and Institutional Review' (CPEIR) was applied. In this second stage, the methodology was applied under a *bottom-up* approach to a specific sample by the Central Government, particularly in the Ministries of Energy, Agriculture, Public Works and Environment.

Within the main results of the project is the *ad hoc* definition of expenditure on climate change agreed with the participating ministries, in order to distinguish climate initiatives. Following the nomenclature established at the NDC Chile, initiatives were classified with a direct or indirect guidance according to four principles. For the first orientation the principle of purpose was applied, while for the second the principles of consistency, comprehensiveness and contingency were applied.

Given the pilot and provisional nature of the exercise, the figures of the study are not official. However, it is worth mentioning that, according to its classification, climate change expenditure was distributed in 63 % to adaptation, 19 % to mitigation, and the remaining 18 % to mixed efforts (adaptation-mitigation). An interesting result is the expenditure orientation classification: 99 % of the expenditure had an indirect guidance and only 1 % a direct guidance.

In addition, another product obtained from the project is the proposal for a unique-integrated form of climate expense (GCC), and environmental protection expenditure (GPA). This considers that for the GPA report are available agreed methodologies at an international level, and that Chile has already reported official figures (2015). Accordingly, in order to be consistent and synergistic in the information report, the GCC is integrated to the methodology used to calculate the GPA.

The following steps to be implemented are:

- The incorporation of other ministries (e.g.: Ministry of Social Development).
- Validating the definition of climate expenditure emerged from the Project.
- Validating (updating and/or reformulating) the GPA-GCC unique-integrated form.
- Reactivating the GPA report platform used in 2015, and integrating the new GPA-GCC form once validated.
- Using the form as a pilot in the platform at a central level and with regional governments.
- Training the services that will report on GPA-GCC.
- Developing a manual for the GPA-GCC report.

The development of the described activities will be supported by the *Capacity Building Initiative for Transparency* (CBIT) *managed by the Global Environmental Facility* (GEF).

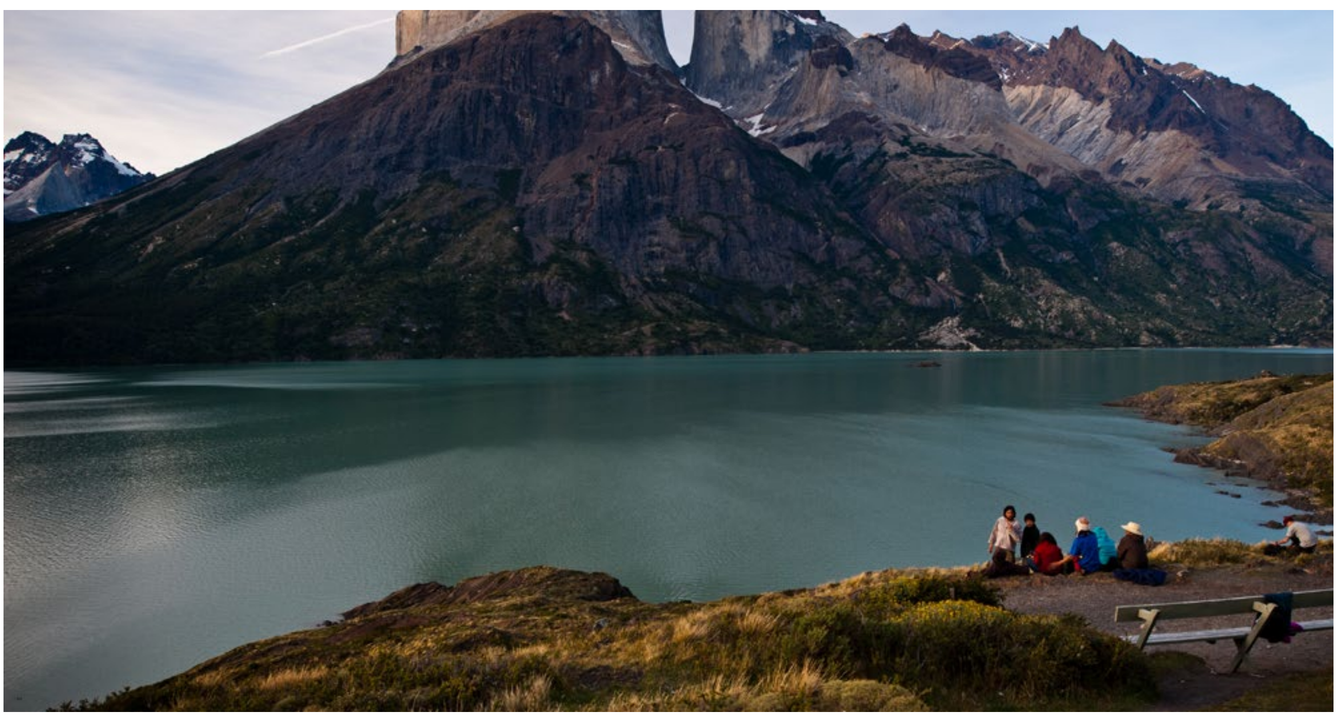
3.2.2. Support delivered

According to the Chile's NDC, particularly the pillar of Building and Strengthening Capacities, Chile undertook to work in cooperation with other countries, developing and strengthening the capabilities of nations so requiring. The above through education and training based on the information and knowledge acquired in the preparation of national communication, inventories of greenhouse gas emissions and biennial update reports among other.

In the case of inventories, the country has achieved in presenting five NGHGI in different reports, three of which have been developed within the framework of the SNICHILE. Since its formation in 2012, the SNICHILE has learnt a number of lessons that have allowed it generating a permanent system, it is able to meet the reporting requirements for the preparation of inventories in the context of biennial reports and, in addition, to go a little further by generating relevant information such as regional inventories. This occurs mainly by the continuing creation and maintenance of capacities of technical teams and by the increasing state funding for the team formation.

The SNICHILE has transformed this experience into support to other countries in the region that they are in a situation similar that the Chilean system was in the beginning. It highlights the support delivered directly to other countries for the creation and strengthening of capabilities such as support missions to Paraguay, intended to strengthen the NGHGI for the implementation of the improved transparency framework of the Paris Agreement, generating a series from 1990 to 2012 and developing an NGHGI national system for Paraguay. The activities consisted of three technical visits carried out between September 2017 and July 2018. Other direct supports have been remotely delivered to a number of countries in the region including Ecuador, Colombia, Peru and Cuba among other. Additionally, the Chilean experience has been shared within contexts (workshops, seminars and other) organized by the UNFCCC, IPCC or the INGEI Network. More detail on the support delivered during the period covered by this report is presented as a table in the Annex 7.

In addition, Chile maintains bilateral cooperation programs that address different areas of work, including climate change. Among them, the Chile-Mexico Joint Cooperation Fund, managed in Chile by the International Agency for International Cooperation (AGCI). This Fund has an annual budget of 2 million dollars, contributed in equal amounts by both countries (contribution of one million dollars each country). This budget finances projects in different areas of the Fund, not only projects related to climate change.



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ABBREVIATIONS AND ACRONYMS

AFOLU	:	Agriculture, forestry and other land uses
IEA	:	International Energy Agency
ASPROCER A.G.	:	Association of Pig Producers in Chile
BNE	:	National Energy Balance
C	:	Confidential Information
CH_4	:	Methane
UNFCCC	:	United Nations Framework Convention on climate change
CN	:	National Communications
CO	:	Carbon Monoxide
CO_2	:	Carbon dioxide
CO_2 eq	:	Carbon dioxide equivalent
COCHILCO	:	Chilean Copper Commission
CONAF	:	National Forestry Corporation
NMVOC	:	Non-methane volatile organic compounds
CS	:	Country specific
D	:	By default
DA	:	Activity data
FAO	:	United Nations Food and Agriculture Organization
FE	:	Emission Factor
FOLU	:	Forestry and other land uses
GHG	:	Greenhouse Gas
Gg	:	Gigagrams (109 grams)
GIZ	:	Gesellschaft für Internationale Zusammenarbeit (German Society for International Cooperation)
LPG	:	Liquefied petroleum gas
GWh	:	Gigawatt hour
HFC	:	Hydrofluorocarbons
BUR	:	Biennial Update Report
IE	:	Included elsewhere
IIN	:	National Inventory Greenhouse Gases Report
INE	:	National Institute of Statistics
INFOR	:	Forestry Institute
NGHGI	:	National Greenhouse Gas Inventory (INGEI)
INGEI2016	:	National greenhouse gas inventory of Chile series 1990-2013. Presented by the country to the United Nations Framework Convention on Climate Change in its Second Biennial Update Report (MMA, 2016)
INGEI2018	:	National greenhouse gas inventory of Chile series 1990-2016. Presented by the country to the United Nations Framework Convention on Climate Change in its Third Biennial Update Report (MMA, 2018)
INIA	:	Institute of Agricultural Research
IPCC	:	Intergovernmental Panel on Climate Change
IPPU	:	Industrial Processes and Use of Products

SGHGI	:	Sectorial Inventory of Greenhouse Gases
LECB	:	Low Emission Capacity Building (capacity building program for the development of low-carbon emissions for Chile)
kt	:	Kilo tons
MINAGRI	:	Ministry of Agriculture
MINENERGIA	:	Ministry of Energy
MMA	:	Ministry of Environment
M_W	:	Magnitude Moment
N_2O	:	Nitrous Oxide
NA	:	Does not apply
NDC	:	Nationally Determined Contribution (determined at a national level)
NE	:	Not estimated
NO	:	It does not occur
NO_x	:	Nitrogen oxides
ODEPA	:	Agricultural Studies and Policies Office
GWP	:	Global Warming Potential
PFC	:	Perfluorocarbons
PMC	:	Continuous Improvement Plan
UNDP	:	The United Nations Development Programs
RCA	:	Environmental Qualification Resolution
REDINGEI	:	Latin American Network of GHG Inventories.
RSM	:	Municipal Solid Waste
SAO	:	Substances Depleting the Ozone Layer
SAR	:	IPCC Second Assessment Report
SDRS	:	Sites of Solid Waste Disposal
SERNAGEOMIN	:	National Service of Geology and Mining
SF_6	:	Sulfur hexafluoride
SGCC		Quality Assurance and Quality Control System
SISS	:	Superintendence of Sanitary Services
SNICHILE	:	National GHG Inventory System of Chile
SO_2	:	Sulfur dioxide
SRT	:	Tabular Registration System
T1	:	Tier 1 method
T2	:	Tier 2 method
T3	:	Tier 3method
TJ	:	Terajoules
USGS	:	United States Geological Survey
LULUCF	:	Land use, Land-use change and forestry

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ANNEXES

ANNEX 1. METHODS APPLIED IN CHILE'S NGHGI 1990-2016 SERIES

Table A. 1. Methods applied in Chile's NGHGI, 1990-2016 series

Categories of source and sink of greenhouse gases t	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor
1. Energy	**T1, IE, NA, NE, NO**	**D, IE, NA, NE, NO**	**T1, T2, IE, NA, NE, NO**	**D, IE, NA, NE, NO**	**T1, T2, IE, NA, NE**	**D, IE, NA, NE**						
1.A. Fuel combustion activities(Sectorial approach)	T1, IE, NE	D, IE, NE	T1, T2, IE, NE	D, IE, NE	T1, T2, IE, NE	D, IE, NE						
1.A.1. Energy industries	T1, IE	D, IE	T1, IE	D, IE	T1, IE	D, IE						
1.A.2. Manufacturing industries and construction	T1, IE	D, IE	T1, IE	D, IE	T1, IE	D, IE						
1.A.3. Transport	T1, IE, NE	D, IE, NE	T1, T2, IE	D, IE	T1, T2, IE	D, IE						
1.A.4. Other sectors	T1, IE	D, IE	T1, IE	D, IE	T1, IE	D, IE						
1.A.5. Non-specified	IE, NE	IE, NE	IE, NE	IE, NE	IE, NE	IE, NE						
1.B. Fugitive emissions from fuels	T1, NA, NE	D, NA, NE	T1, NA, NE, NO	D, NA, NE, NO	NA, NE	NA, NE						
1.B.1. Solid fuels	NA, NE	NA, NE	T1, NA, NE, NO	D, NA, NE, NO	NA	NA						
1.B.2. Oil and natural gas.	T1, NE,	D, NE,	T1, NE	D, NE	NA, NE	NA, NE						
1.B.3. Other emissions from energy production	NO	NO	NO	NO	NO	NO						
1.C. Transportation and storage of CO_2	NO	NO										
1.C.1. Transportation of CO_2	NO	NO										
1.C.2. Injection and storage	NO	NO										
1.C.3. Other	NO	NO										
2. Industrial Processes and product use	**T1, T2, NA, NE, NO**	**D, NA, NE, NO**	**T1, IE, NA, NO**	**D, IE, NA, NO**	**T2, NA, NE, NO**	**D, NA, NE, NO**	**T1, NA, NE, NO**	**D, NA, NE, NO**	**NA, NE, NO**	**NA, NE, NO**	**T1, NA, NO**	**D, NA, NO**
2.A. Mineral industry	T2, NE, NO	D, NE, NO										
2.B. Chemical industry	T1 , NO	D, NO	T1 , NO	D, NO	T2, NO	D, NO	NO	NO				
2.C. Metal industry	T1, T2, NO	D, CS, NO	IE, NO	IE, NO					NO	NO	NO	NO

Categories of source and sink of greenhouse gases †	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor
2.D. Non-energy products from fuels and solvent use	T1	D										
2.E. Electronics Industry							NO	NO	NO	NO	NO	NO
2.F. Use of products as substitutes for ozone depleting substance							T1	D	NE	NE		
2.G. Other product manufacture and use					NA, NE	NA, NE			NA, NO	NA, NO	T1, NA, NO	D, NA, NO
2.H. Other												
3. Agriculture	**T1, NO, NA**	**D, NO, NA**	**T1, T2, NE, NO, NA**	**CS,D, NE , NO, NA**	**T1, T2, NE, NO, NA**	**CS, D, NE, NO, NA**						
3.A. Enteric fermentation			T1, T2, NO	CS, D, NO								
3.B. Manure management			T1, T2, NO	CS, D, NO	T1, T2, NO	CS, D, NO						
3.C. Rice cultivation			T1	D, NE, NO								
3.D. Agricultural soils					T1, T2, NE	D, CS, NE						
3.E. Prescribed burning of savannas	NO	NO										
3.F. Field burning of agricultural residues			T1	D	T1	D						
3.G. Liming	T1	D										
3.H. Urea application	T1	D										
3.I. Other carbon-containing fertilizers	NO	NO										
3.J. Other	NA	NA	NA	NA	NA	NA						
4. Land use, land-use change and forestry	**T1, T2, NE, NO**	**D, CS, NE, NO**	**T1, T2**	**D, CS**	**T1, T2**	**D, CS**						
4.A. Forest land	T1, T2, NE, NO	D, CS, NE, NO	T1, T2	D, CS	T1, T2	D, CS						
4.B. Cropland	T1, T2, NO	D, CS, NO	T1	D	T1	D						
4.C. Grassland	T1, T2, NO	D, CS, NO	T1, T2	D, CS	T1, T2	D, CS						
4.D. Wetland	T1, T2, NO, NE	D, CS, NO, NE										
4.E. Settlements	T1, T2, NE	D, CS, NE										
4.F. Other Land	T1, T2, NE, NO	D, CS, NE, NO	T1, T2	D, CS	T1, T2	D, CS						
4.G. Collected wood products	NE	NE										
4.H. Other (please specify)												

Categories of source and sink of greenhouse gases t	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor	Method Applied	Emission Factor
5. Waste	**T1, NE**	**D, NE**	**T1, NE**	**D, NE**	**T1, NE**	**D, NE**						
5.A. Solid waste disposal			T1	D								
5.B. Biological treatment of solid waste			T1	D	T1	D						
5.C. Incineration and open burning of waste	T1, NE	D, NE	T1, NE	D, NE	T1, NE	D, NE						
5.D. Wastewater treatment and discharge			T1	D	T1	D						
5.E. Other												
Anx. Memo items	T1, IE	D, IE	T1, IE	D, IE	T1, IE	D, IE						
Anx.1. International bunker	T1	D	T1	D	T1	D						
Anx.1.a. International aviation	T1	D	T1	D	T1	D						
Anx.1.b. International navigation	T1	D	T1	D	T1	D						
Anx.2. Multilateral operations	IE	IE	IE	IE	IE	IE						
Anx.3. CO_2 emissions from biomass	T1	D										

T1 = Level 1; T2 = Level 2; T3 = Level 3; C = Confidential Information; CS = specific country; D = By default; IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

ANNEX 2. COMPLETENESS SUPPLEMENT

The non-estimated (NE) categories in Chile's NGHGI, series 1990-2016, due to lack of activity data are the following:

- 1.A.3.b.vi. Urea-based catalysts (CO_2)
- 1.A.5.a. Non specified stationary (CO_2, CH_4 and N_2O)
- 1.B.1.a.i.3. Abandoned underground mines (CH_4)
- 1.B.1.b. Uncontrolled combustion and burning coal dumps (CO_2)
- 1.B.2.a.ii. Flaring (CO_2, CH_4 and N_2O)
- 1.B.2.a.iii.1. Exploration (CO_2, CH_4)
- 1.B.2.a.iii.3. Transport (CO_2)
- 1.B.2.a.iii.4. Refining (CO_2)
- 1.B.2.a.iii.5. Distribution of Oil Products (CO_2, CH_4)
- 1.B.2.a.iii.6. Other (CO_2, CH_4)
- 1.B.2.b.ii. Flaring (CO_2, CH_4 and N_2O)
- 1.B.2.b.iii.1. Exploration (CO_2, CH_4)
- 1.B.2.b.iii.4. Transmission and storage (CO_2)
- 1.B.2.b.iii.6. Other (CO_2, CH_4)
- 2.A.4.a. Ceramics (CO_2)
- 2.A.4.b. Other uses of Soda Ash (CO_2)
- 2.A.4.c. Non Metallurgical Magnesia Production (CO_2)
- 2.A.4.d. Other (specify) (CO_2)
- 2.F.3. Fire Protection (PFC)
- 2.F.5. Solvents (PFC)
- 2.F.6. Other applications (PFC)
- 2.G.3.a. Medical applications (N_2O)
- 2.G.3.b. Propellant for Pressure and Aerosol Products (N_2O)
- 3.C.2. Rain-fed (CH_4)
- 3.C.3. Deep Water (CH_4)
- 3.D.1.b.ii. Sludge applied to the soil (N_2O)
- 3.D.1.b.iii. Other organic fertilizers applied to the soil (N_2O)
- 3.D.2.a.ii.2. Sewage sludge applied to soils (N_2O)
- 3.D.2.a.ii.3. Other organic fertilizers applied to the soil (N_2O)
- 4.A.1.b.iii.2. Other (CO_2)
- 4.D.1. Wetlands remaining wetlands (CO_2)
- 4.E.1. Settlements remaining settlements (CO_2)
- 4.F.1. Other land remaining other land (CO_2)
- 4.G. Harvested wood products (CO_2)
- 5.C.2. Open burning of waste (CO_2, CH_4 and N_2O)

The non-estimated (NE) categories in Chile's NGHGI, series 1990-2016, due to lack of a relevant methodology, are:

- 1.B.3. Other emissions from energy production (CO_2, CH_4 and N_2O)

The categories included elsewhere (IE) in the Chile's NGHGI, series 1990-2016, due to lack in data disaggregation and the category in which they were included appear in the following table:

Table A. 2. Categories included elsewhere (IE) and the corresponding category including them

Category included elsewhere (IE)	Corresponding Category
1.A.1.a.ii. Combined heat and power generation (CHP) (CO_2, CH_4 and N_2O)	1.A.2. Manufacturing industries and construction
1.A.1.a.iii. Heat Plants (CO_2, CH_4 and N_2O)	1.A.2. Manufacturing industries and construction
1.A.2.b. Non-ferrous metals (CO_2, CH_4 and N_2O)	1.A.2.i. Mining (excluding fuels) and quarrying
1.A.2.g. Transport equipment (CO_2, CH_4 and N_2O)	1.A.2.m. Non-specified industry
1.A.2.h. Machinery (CO_2, CH_4 and N_2O)	1.A.2.m. Non-specified industry
1.A.2.j. Wood and Wood Products (CO_2, CH_4 and N_2O)	1.A.2.m. Non-specified industry
1.A.2.k. Construction (CO_2, CH_4 and N_2O)	1.A.2.m. Non-specified industry
1.A.2.l. Textiles and leather (CO_2, CH_4 and N_2O)	1.A.2.m. Non-specified industry
1.A.3.E.i. Pipeline transport (CO_2, CH_4 and N_2O)	1.A.4.a. Commercial / Institutional, 1.A.3.b. Road Transportation
1.A.4.c.i. Stationary (CO_2, CH_4 and N_2O)	1.A.4.c.iii. Fishing (mobile combustion), 1.A.2.m. Non-specified industry
1.A.5.b. Mobile (CO_2, CH_4 and N_2O)	1.A.4.a. Commercial / Institutional
1.A.5.c. Multilateral Operations (CO_2, CH_4 and N_2O)	1.A.4.a. Commercial / Institutional
2.C.1. Iron and Steel Production (CH_4)	1.A.2.a. Iron and Steel

Source: Coordinating Technical Team of the MMA

ANNEX 3. GHG EMISSIONS AND REMOVALS OF CHILE IN THE FORMAT PARTY NOT INCLUDED IN ANNEX I TO THE CONVENTION

Table A. 3. Chile's NGHGI: anthropogenic emissions by sources and anthropogenic removals by sinks of all GHGs not controlled by the Montreal Protocol and GHGs precursors, Year 1990

Categories of source and sink of greenhouse gases	CO_2 emissions (kt)	CO_2 removals (kt)
Total national emissions and removals	84,837.1	-101,624.7
1. Energy	30,405.6	0.0
A. Fuel combustion activities (sectorial approach)	30,403.0	
1. Energy industries	5,822.2	
2. Manufacturing industries and construction	12,139.4	
3. Transport	9,036.9	
4. Other sectors	3,404.6	
5. Other (non-specified)	IE, NE	
B. Fugitive emissions from fuels	2.6	
1. Solid fuels		
2. Oil and natural gas	2.6	
2. Industrial Processes	2,808.9	0.0
A. Mineral products	780.3	
B. Chemical industry	603.3	
C. Metal industry	1,425.3	
D. Other production	Do not	
E. Production of halocarbons and sulfur hexafluoride		
F. Consumption of halocarbons and sulfur hexafluoride		
G. Other	Do not	
3. Solvent and other products use	75.1	
4. Agriculture		
A. Enteric fermentation		
B. Manure management		
C. Rice cultivation		
D. Agricultural soils		
E. Prescribed burning of savannas		
F. Field burning of agricultural waste		
G. Other		
5. Land use, land-use change and forestry	51,547.4	-101.624.7
A. Forest land	43,343.8	-101.607.2
B. Cropland	834.4	0.0
C. Grassland	6,638.1	-17,5
D. Wetlands	116.7	NA
E. Settlements	272.0	NA
F. Other Land	342.4	NA
G. Other	NA	NA
6. Waste	0.0	
A. Solid waste disposal		
B. Wastewater treatment and discharge		
C. Incineration of waste	0.0	
D. Other		
7. Other	NA	NA
Memo items		
International Bunker	923.9	
International Aviation	334.6	
International Navigation	589.3	
CO_2 emissions from biomass	12,001.1	

IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: CoordinatingTechnical Team of the MMA

CH_4 (kt)	N_2O (kt)	NOx (kt)	CO (kt)	NMVOC (kt)	SO_2 (kt)
521.0	19.0	133.4	882.7	169.1	255.2
118.1	1.1	123.0	608.5	99.3	255.2
28.0	1.1	120.1	578.7	86.9	255.2
0.1	0.1	30.3	12.9	0.2	114.5
1.8	0.3	13.2	68.4	4.6	98.1
2.5	0.4	60.9	132.0	19.6	9.5
23.6	0.3	15.8	365.4	62.6	33.1
IE, NE	IE, NE	IE, NE	IE, NE	IE, NE	IE, NE
90.1		2.9	29.9	12.4	NA, NE
22.9		NA	NA	9.3	NA
67.2		2.9	29.9	3.2	NA, NE
2.2	1.0	1.1	NO, NE, NA	0.0	NO, NE, NA
		NE	NE	NE	NE
2.168	1.0	1.1	NE	0.0	NE
0.0	NA, not	NE, NOT	NE, NOT	NE, NOT	NE, NOT
		Do not	Do not	Do not	Do not
Do not	Do not	NA	NA	NA	NA
	NE			0.1	
284.0	16.0	5.9	155.0	63.6	
219.5					
53.4	0.6			6.5	
6.6		IE		NE	
NE	15.3	1.7		57.1	
NO	NA	NA	NA	NA	
4.5	0.1	4.2	155.0	NA	
NA	NA	NA	NA	NA	
5.2	0.3	3.4	119.1	NA	NA
5.2	0.3	3.3	117.4	NA	NA
0.0	0.0	0.0	0.4	NA	NA
0.0	0.0	0.1	1.3	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NO	NO	NO	NO	NA	NA
NA	NA	NA	NA	NA	NA
111.5	0.6	0.0	0.0	6.0	0.0
91.5				6.0	
0.4	0.0			NE	
0.0	0.0	0.0	0.0		0.0
19.6	0.6			0.0	
NA	NA	NA	NA	NA	NA
0.1	0.0	15.2	1.6	0.6	17.1
0.0	0.0	0.7	0.2	0.1	0.6
0.1	0.0	14.5	1.4	0.5	16.5

Table A. 4. Chile's NGHGI: anthropogenic emissions of HFC, PFC and SF_6, year 1990

Categories of source and sink of greenhouse gases	HFC-23	HFC-32	HFC-125	HFC-134a
Total national emissions and removals	NO	NO	NO	NO
1. Energy				
A. Fuel combustion activities (sectorial approach)				
1. Energy industries				
2. Manufacturing industries and construction				
3. Transport				
4. Other sectors				
5. Other (non-specified)				
B. Fugitive emissions from fuels				
1. Solid fuels				
2. Oil and natural gas				
2. Industrial Processes	NO	NO	NO	NO
A. Mineral products				
B. Chemical industry	NO	NO	NO	NO
C. Metal industry				
D. Other production				
E. Production of halocarbons and sulfur hexafluoride	NO	NO	NO	NO
F. Consumption of halocarbons and sulfur hexafluoride	NO	NO	NO	NO
G. Other				
3. Solvent and other products use				
4. Agriculture				
A. Enteric fermentation				
B. Manure management				
C. Rice cultivation				
D. Agricultural soils				
E. Prescribed burning of savannas				
F. Field burning of agricultural waste				
G. Other				
5. Land use, land-use change and forestry				
A. Forest land				
B. Cropland				
C. Grassland				
D. Wetlands				
E. Settlements				
F. Other Land				
G. Other				
6. Waste				
A. Solid waste disposal				
B. Wastewater treatment and discharge				
C. Incineration of waste				
D. Other				
7. Other	NA	NA	NA	NA
Memo items				
International bunker				
International aviation				
International navigation				
CO_2 emissions from biomass				

IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

HFCs (kt)							PFC (kt)	SF_6 (kt)
HFC-143a	HFC-152a	HFC-227ea	HFC-236fa	HFC-245fa	HFC-365mfc	HFC-43-10mee	CF_4	
NO	NO	NO	NO	NO	NO	NO	NA, NO	0.003
NO	NO	NO	NO	NO	NO	NO	NA, NO	0.003
NO	NO	NO	NO	NO	NO	NO		
							NO	NO
NO	NO	NO	NO	NO	NO	NO	NO	NO
NO	NO	NO	NO	NO	NO	NO	NO	
							NA, NO	0.003
NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A. 5. Chile's NGHGI: anthropogenic emissions by sources and anthropogenic removals by sinks of all GHGs not controlled by the Montreal Protocol and GHGs precursors, Year 1994

Categories of source and sink of greenhouse gases	CO_2 emissions (kt)	CO_2 removals (kt)
Total national emissions and removals	110,111.4	-117.733.8
1. Energy	34,632.1	0.0
A. Fuel combustion activities (sectorial approach)	34,630.2	
1. Energy industries	4,577.4	
2. Manufacturing industries and construction	13,191.5	
3. Transport	12,298.9	
4. Other sectors	4,562.4	
5. Other (non-specified)	IE, NE	
B. Fugitive emissions from fuels	1.9	
1. Solid fuels		
2. Oil and natural gas	1.9	
2. Industrial Processes	3,767.5	0.0
A. Mineral products	1,319.0	
B. Chemical industry	611.4	
C. Metal industry	1,837.1	
D. Other production	NO	
E. Production of halocarbons and sulfur hexafluoride		
F. Consumption of halocarbons and sulfur hexafluoride		
G. Other	NO	
3. Solvent and other products use	86.2	
4. Agriculture		
A. Enteric fermentation		
B. Manure management		
C. Rice cultivation		
D. Agricultural soils		
E. Prescribed burning of savannas		
F. Field burning of agricultural waste		
G. Other		
5. Land use, land-use change and forestry	71,625.7	-117.733.8
A. Forest land	63,048.9	-117.646.5
B. Cropland	1,129.4	0.0
C. Grassland	6,638.1	-87,3
D. Wetlands	116.7	NA
E. Settlements	306.4	NA
F. Other Land	386.1	NA
G. Other	NA	NA
6. Waste	0.0	
A. Solid waste disposal		
B. Wastewater treatment and discharge		
C. Incineration of waste	0.0	
D. Other		
7. Other	NA	NA
Memo items		
International bunker	1,715.4	
International aviation	655.6	
International navigation	1,059.8	
CO_2 emissions from biomass	14,268.6	

IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

CH_4 (kt)	N_2O (kt)	NOx (kt)	CO (kt)	NMVOC (kt)	SO_2 (kt)
547.87	21.3	111.8	867.4	194.1	320.2
97.520	1.3	97.8	482.1	114.8	320.2
34.06	1.3	97.1	480.0	109.9	320.2
0.08	0.0	9.7	4.2	0.1	41.8
1.89	0.3	38.7	74.6	16.8	177.3
3.44	0.6	36.7	71.7	41.2	66.5
28.65	0.4	12.0	329.5	51.7	34.5
IE, NE	IE, NE	IE, NE	IE, NE	IE, NE	IE, NE
63.46		0.8	2.1	4.9	NA, NE
9.55		NA	NA	1.4	NA
53.92		0.8	2.1	3.5	NA, NE
2.190	1.0	1.1	NO, NE, NA	0.0	NO, NE, NA
		NE	NE	NE	NE
2.18	1.0	1.1	NE	0.0	NE
0.01	NA, NO	NE, NO	NE, NO	NE, NO	NE, NO
		NO	NO	NO	NO
NO	NO	NA	NA	NA	NA
	NE			0.1	
314.77	17.6	5.2	117.0	72.7	
242.21					
63.00	0.7			4.4	
6.12		IE		NE	
NE	16.8	2.1		68.3	
NO	NA	NA	NA	NA	
3.43	0.1	3.2	117.0	NA	
NA	NA	NA	NA	NA	
11.75	0.7	7.6	268.3	NA	NA
11.60	0.6	7.4	264.1	NA	NA
0.01	0.0	0.0	0.4	NA	NA
0.13	0.0	0.2	3.8	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NO	NO	NO	NO	NA	NA
NA	NA	NA	NA	NA	NA
121.64	0.7	0.0	0.0	6.5	0.0
101.08				6.5	
0.36	0.0			NE	
0.00	0.0	0.0	0.0		0.0
20.20	0.7			0.0	
NA	NA	NA	NA	NA	NA
0.1	0.0	2.8	28.1	1.1	38.3
0.0	0.0	0.4	2.1	0.2	3.9
0.1	0.0	2.4	26.0	0.9	34.4

Table A. 6. Chile's NGHGI: anthropogenic emissions of HFCS, pfcs and SF6, year 1994

Categories of source and sink of greenhouse gases	HFC-23	HFC-32	HFC-125	HFC-134a
Total national emissions and removals	NO	NO	NO	NO
1. Energy				
A. Fuel combustion activities (sectorial approach)				
1. Energy industries				
2. Manufacturing industries and construction				
3. Transport				
4. Other sectors				
5. Other (non-specified)				
B. Fugitive emissions from fuels				
1. Solid fuels				
2. Oil and natural gas				
2. Industrial Processes	NO	NO	NO	NO
A. Mineral products				
B. Chemical industry	NO	NO	NO	NO
C. Metal industry				
D. Other production				
E. Production of halocarbons and sulfur hexafluoride	NO	NO	NO	NO
F. Consumption of halocarbons and sulfur hexafluoride	NO	NO	NO	NO
G. Other				
3. Solvent and other products use				
4. Agriculture				
A. Enteric fermentation				
B. Manure management				
C. Rice cultivation				
D. Agricultural soils				
E. Prescribed burning of savannas				
F. Field burning of agricultural waste				
G. Other				
5. Land use, land-use change and forestry				
A. Forest land				
B. Cropland				
C. Grassland				
D. Wetlands				
E. Settlements				
F. Other Land				
G. Other				
6. Waste				
A. Solid waste disposal				
B. Wastewater treatment and discharge				
C. Incineration of waste				
D. Other				
7. Other	NA	NA	NA	NA
Memo items				
International bunker				
International aviation				
International navigation				
CO_2 emissions from biomass				

IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

HFCs (kt)							PFC (kt)	SF_6 (kt)
HFC-143a	HFC-152a	HFC-227ea	HFC-236fa	HFC-245fa	HFC-365mfc	HFC-43-10mee	CF_4	
NO	NO	NO	NO	NO	NO	NO	NA, NO	0.003
NO	NO	NO	NO	NO	NO	NO	NA, NO	0.003
NO	NO	NO	NO	NO	NO	NO		
							NO	NO
NO	NO	NO	NO	NO	NO	NO	NO	NO
NO	NO	NO	NO	NO	NO	NO	NO	
							NA, NO	0.003
NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A. 7. Chile's NGHGI: anthropogenic emissions by sources and anthropogenic removals by sinks of all GHGs not controlled by the Montreal Protocol and GHGs precursors, Year 2000

Categories of source and sink of greenhouse gases	CO_2 emissions (kt)	CO_2 removal (kt)	CH_4 (kt)
Total national emissions and removals	128,103.7	-135.759.5	587.3
1. Energy	49,367.0	0.0	102.3
A. Fuel combustion activities (sectorial approach)	49,365.3		40.7
1. Energy industries	14,855.1		0.2
2. Manufacturing industries and construction	12,856.2		2.3
3. Transport	16,946.8		4.3
4. Other sectors	4,707.2		33.9
5. Other (non-specified)	IE, NE		IE, NE
B. Fugitive emissions from fuels	1.7		61.6
1. Solid fuels			3.5
2. Oil and natural gas	1.7		58.1
2. Industrial Processes	5,268.5	0.0	6.8
A. Mineral products	1,312.2		
B. Chemical industry	1,961.0		6.8
C. Metal industry	1,995.4		IE, NO
D. Other production	NO		
E. Production of halocarbons and sulfur hexafluoride			
F. Consumption of halocarbons and sulfur hexafluoride			
G. Other	NO		NO
3. Solvent and other products use	114.8		
4. Agriculture			332.4
A. Enteric fermentation			249.8
B. Manure management			74.8
C. Rice cultivation			5.2
D. Agricultural soils			NE
E. Prescribed burning of savannas			NO
F. Field burning of agricultural waste			2.6
G. Other			NA
5. Land use, land-use change and forestry	73,353.3	-135.759.5	2.3
A. Forest land	64,147.3	-135.567.6	2.3
B. Cropland	1,641.4	0.0	0.0
C. Grassland	6,638.1	-192,0	0.0
D. Wetlands	116.7	NA	NA
E. Settlements	358.0	NA	NA
F. Other Land	451.7	NA	NO
G. Other	NA	NA	NA
6. Waste	0.1		143.4
A. Solid waste disposal			122.9
B. Wastewater treatment and discharge			0.4
C. Incineration of waste	0.1		0.0
D. Other			20.1
7. Other	NA	NA	NA
Memo items			
International bunker	3,082.1		0.2
International aviation	1,046.4		0.0
International navigation	2,035.6		0.2
CO_2 emissions from biomass	18,952.6		

C = Confidential Information; CS = specific country; D = by Default; IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

N_2O (kt)	NOx (kt)	CO (kt)	NMVOC (kt)	SO_2 (kt)
22.5	164.4	930.9	263.6	338.4
2.0	156.4	789.3	179.9	338.4
2.0	153.0	757.3	174.3	338.4
0.2	36.6	17.3	0.4	68.3
0.3	46.6	65.8	22.2	142.6
1.0	56.7	225.2	84.7	93.0
0.5	13.0	449.0	67.1	34.5
IE, NE	IE, NE	IE, NE	IE, NE	IE, NE
	3.5	32.0	5.6	NA, NE
	NA	NA	0.5	NA
	3.5	32.0	5.1	NA, NE
1.7	1.9	NO, NE, NA	0.0	NO, NE, NA
	NE	NE	NE	NE
1.7	1.9	NE	0.0	NE
NA, NO	NE, NO	NE, NO	NE, NO	NE, NO
	NO	NO	NO	NO
NO	NA	NA	NA	NA
NE			0.1	
17.9	4.6	88.6	76.4	
0.8			5.1	
	IE		NE	
17.0	2.2		71.3	
NA	NA	NA	NA	
0.1	2.4	88.6	NA	
NA	NA	NA	NA	
0.1	1.5	53.0	NA	NA
0.1	1.5	51.8	NA	NA
0.0	0.0	0.3	NA	NA
0.0	0.1	1.0	NA	NA
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA
NO	NO	NO	NA	NA
NA	NA	NA	NA	NA
0.8	0.0	0.0	7.1	0.0
			7.1	
0.0			NE	
0.0	0.0	0.0		0.0
0.8			0.0	
NA	NA	NA	NA	NA
0.1	5.3	53.3	2.0	69.5
0.0	0.7	3.4	0.3	4.4
0.1	4.7	49.9	1.7	65.1

Table A. 8. Chile's NGHGI: anthropogenic emissions of HFCS, PFC and SF_6, year 2000

Categories of source and sink of greenhouse gases	HFC-23	HFC-32	HFC-125	HFC-134a
Total national emissions and removals	0.000	0.000	0.003	0.037
1. Energy				
A. Fuel combustion activities (sectorial approach)				
1. Energy industries				
2. Manufacturing industries and construction				
3. Transport				
4. Other sectors				
5. Other (non-specified)				
B. Fugitive emissions from fuels				
1. Solid fuels				
2. Oil and natural gas				
2. Industrial Processes	0.000	0.000	0.003	0.037
A. Mineral products				
B. Chemical industry	NO	NO	NO	NO
C. Metal industry				
D. Other production				
E. Production of halocarbons and sulfur hexafluoride	NO	NO	NO	NO
F. Consumption of halocarbons and sulfur hexafluoride	0.000	0.000	0.003	0.037
G. Other				
3. Solvent and other products use				
4. Agriculture				
A. Enteric fermentation				
B. Manure management				
C. Rice cultivation				
D. Agricultural soils				
E. Prescribed burning of savannas				
F. Field burning of agricultural waste				
G. Other				
5. Land use, land-use change and forestry				
A. Forest land				
B. Cropland				
C. Grassland				
D. Wetlands				
E. Settlements				
F. Other Land				
G. Other				
6. Waste				
A. Solid waste disposal				
B. Wastewater treatment and discharge				
C. Incineration of waste				
D. Other				
7. Other	NA	NA	NA	NA
Memo items				
International bunker				
International aviation				
International navigation				
CO_2 emissions from biomass				

C = Confidential Information; CS = specific country; D = by Default; IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

HFC (kt)							PFC (kt)	SF_6 (kt)
HFC-143a	HFC-152a	HFC-227ea	HFC-236fa	HFC-245fa	HFC-365mfc	HFC-43-10mee	CF_4	
0.004	0.000	0.000	0.000	0.000	0.000	0.000	NO, NE, NA	0.004
0.004	0.000	0.000	0.000	0.000	0.000	0.000	NA, NO, NE	0.004
NO	NO	NO	NO	NO	NO	NO		
							NO	NO
NO	NO	NO	NO	NO	NO	NO	NO	NO
0.004	0.000	0.000	0.000	0.000	0.000	0.000	NE	
							NA, NO	0.004
NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A. 9. Chile's NGHGI: anthropogenic emissions by sources and anthropogenic removals by sinks of all GHGs not controlled by the Montreal Protocol and the precursors of GHGs, Year 2010

Categories of source and sink of greenhouse gases	CO_2 emissions (kt)	CO_2 removals (kt)	CH_4 (kt)
Total national emissions and removals	154,450.1	-156.530.5	542.5
1. Energy	65,978.1	0.0	76.5
A. Fuel combustion activities (sectorial approach)	65,976.8		28.2
1. Energy industries	25,711.8		0.4
2. Manufacturing industries and construction	13,758.0		2.8
3. Transport	20,394.2		4.5
4. Other sectors	6,112.8		20.4
5. Other (non-specified)	IE, NE		IE, NE
B. Fugitive emissions from fuels	1.3		48.3
1. Solid fuels			1.9
2. Oil and natural gas	1.3		46.4
2. Industrial Processes	3,447.6	0.0	2.3
A. Mineral products	1,551.1		
B. Chemical industry	645.1		2.3
C. Metal industry	1,251.4		IE, NO
D. Other production	NO		
E. Production of halocarbons and sulfur hexafluoride			
F. Consumption of halocarbons and sulfur hexafluoride			
G. Other	NO		NO
3. Solvent and other products use	241.0		
4. Agriculture			289.9
A. Enteric fermentation			210.0
B. Manure management			73.4
C. Rice cultivation			4.9
D. Agricultural soils			NE
E. Prescribed burning of savannas			NO
F. Field burning of agricultural waste			1.5
G. Other			NA
5. Land use, land-use change and forestry	84,783.1	-156.530.5	6.9
A. Forest land	79,817.6	-156.259.5	6.8
B. Cropland	2,128.2	0.0	0.0
C. Grassland	1,874.8	-271,0	0.1
D. Wetlands	20.6	NA	NA
E. Settlements	377.6	NA	NA
F. Other Land	564.3	NA	NO
G. Other	NA	NA	NA
6. Waste	0.3		167.0
A. Solid waste disposal			125.7
B. Wastewater treatment and discharge			1.7
C. Incineration of waste	0.3		0.0
D. Other			39.6
7. Other	NA	NA	NA
Memo items			
International bunker	3,631.9		0.2
International aviation	1,336.2		0.0
International navigation	2,295.7		0.2
CO_2 emissions from biomass	15,830.1		

C = Confidential Information; CS = specific country; D = by Default; IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

N_2O (kt)	NOx (kt)	CO (kt)	NMVOC (kt)	SO_2 (kt)
24.2	209.8	861.7	312.9	364.0
2.5	195.3	654.1	180.8	364.0
2.5	192.5	628.4	176.2	364.0
0.3	62.6	29.0	0.5	104.9
0.4	66.1	67.5	27.8	119.6
1.5	47.6	263.2	107.6	96.2
0.3	16.2	268.6	40.2	43.3
IE, NE	IE, NE	IE, NE	IE, NE	IE, NE
	2.8	25.7	4.7	NA, NE
	NA	NA	0.4	NA
	2.8	25.7	4.3	NA, NE
1.7	5.1	NO, NE, NA	0.0	NO, NE, NA
	NE	NE	NE	NE
1.7	5.1	NE	0.0	NE
NA, NO	NE, NO	NE, NO	NE, NO	NE, NO
	NO	NO	NO	NO
NO	NA	NA	NA	NA
NE			0.1	
18.5	4.9	50.3	122.6	
0.9			5.2	
	IE		NE	
17.6	3.6		117.4	
NA	NA	NA	NA	
0.0	1.4	50.3	NA	
NA	NA	NA	NA	
0.4	4.5	157.4	NA	NA
0.4	4.3	154.3	NA	NA
0.0	0.0	0.3	NA	NA
0.0	0.2	2.8	NA	NA
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA
NO	NO	NO	NA	NA
NA	NA	NA	NA	NA
1.1	0.0	0.0	9.3	0.0
			9.3	
0.1			NE	
0.0	0.0	0.0		0.0
1.0			0.1	
NA	NA	NA	NA	NA
0.1	6.1	60.7	2.3	78.3
0.0	0.8	4.4	0.3	5.9
0.1	5.3	56.3	1.9	72.4

Table A. 10. Chile's NGHGI: anthropogenic emissions of HFC, PFC and SF_6, year 2010

Categories of source and sink of greenhouse gases	HFC-23	HFC-32	HFC-125	HFC-134a	HFC-143a
Total national emissions and removals	0.000	0.020	0.076	0.292	0.064
1. Energy					
A. Fuel combustion activities (sectorial approach)					
1. Energy industries					
2. Manufacturing industries and construction					
3. Transport					
4. Other sectors					
5. Other (non-specified)					
B. Fugitive emissions from fuels					
1. Solid fuels					
2. Oil and natural gas					
2. Industrial Processes	0.000	0.020	0.076	0.292	0.064
A. Mineral products					
B. Chemical industry	NO	NO	NO	NO	NO
C. Metal industry					
D. Other production					
E. Production of halocarbons and sulfur hexafluoride	NO	NO	NO	NO	NO
F. Consumption of halocarbons and sulfur hexafluoride	0.000	0.020	0.076	0.292	0.064
G. Other					
3. Solvent and other products use					
4. Agriculture					
A. Enteric fermentation					
B. Manure management					
C. Rice cultivation					
D. Agricultural soils					
E. Prescribed burning of savannas					
F. Field burning of agricultural waste					
G. Other					
5. Land use, land-use change and forestry					
A. Forest land					
B. Cropland					
C. Grassland					
D. Wetlands					
E. Settlements					
F. Other Land					
G. Other					
6. Waste					
A. Solid waste disposal					
B. Wastewater treatment and discharge					
C. Incineration of waste					
D. Other					
7. Other	NA	NA	NA	NA	NA
Memo items					
International bunker					
International aviation					
International navigation					
CO_2 emissions from biomass					

C = Confidential Information; CS = specific country; D = by Default; IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

HFC (kt)						PFC (kt)	SF_6 (kt)
HFC-152a	HFC-227ea	HFC-236fa	HFC-245fa	HFC-365mfc	HFC-43-10mee	CF_4	
0.003	0.004	0.000	0.000	0.001	0.001	NO, NE, NA	0.011
0.003	0.004	0.000	0.000	0.001	0.001	NA, NO, NE	0.011
NO	NO	NO	NO	NO	NO		
						NO	NO
NO	NO	NO	NO	NO	NO	NO	NO
0.003	0.004	0.000	0.000	0.001	0.001	NE	
						NA, NO	0.011
NA	NA	NA	NA	NA	NA	NA	NA

Table A. 11. Chile's NGHGI: anthropogenic emissions by sources and anthropogenic removals by sinks of all GHGs not controlled by the Montreal Protocol and the precursors of GHGs, Year 2013

Categories of source and sink of greenhouse gases	CO_2 emissions (kt)	CO_2 removals (kt)	CH_4 (kt)
Total national emissions and removals	170,502.8	-161,446.5	570.6
1. Energy	77,018.3	0.0	77.2
A. Fuel combustion activities (sectorial approach)	77,016.8		34.7
1. Energy industries	32,924.3		1.1
2. Manufacturing industries and construction	14,076.3		7.5
3. Transport	24,234.6		4.8
4. Other sectors	5,781.7		21.3
5. Other (non-specified)	IE, NE		IE, NE
B. Fugitive emissions from fuels	1.5		42.5
1. Solid fuels			4.4
2. Oil and natural gas	1.5		38.1
2. Industrial Processes	3,337.7	0.0	0.8
A. Mineral products	1,559.8		
B. Chemical industry	200.5		0.8
C. Metal industry	1,577.4		IE, NO
D. Other production	NO		
E. Production of halocarbons and sulfur hexafluoride			
F. Consumption of halocarbons and sulfur hexafluoride			
G. Other	NO		NO
3. Solvent and other products use	142.0		
4. Agriculture			291.9
A. Enteric fermentation			211.7
B. Manure management			74.6
C. Rice cultivation			4.2
D. Agricultural soils			NE
E. Prescribed burning of savannas			NO
F. Field burning of agricultural waste			1.4
G. Other			NA
5. Land use, land-use change and forestry	90,004.5	-161,446.5	1.5
A. Forest land	85,066.2	-161,204.2	1.5
B. Cropland	2,113.3	0.0	0.0
C. Grassland	1,874.8	-242.3	0.0
D. Wetlands	20.6	NA	NA
E. Settlements	373.2	NA	NA
F. Other Land	556.4	NA	NO
G. Other	NA	NA	NA
6. Waste	0.3		199.1
A. Solid waste disposal			153.3
B. Wastewater treatment and discharge			1.3
C. Incineration of waste	0.3		0.0
D. Other			44.5
7. Other	NA	NA	NA
Memo items			
International bunker	2,596.6		0.1
International aviation	1,374.5		0.0
International navigation	1,222.1		0.1
CO_2 emissions from biomass	35,893.2		

C = Confidential Information; CS = specific country; D = by Default; IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

N_2O (kt)	NOx (kt)	CO (kt)	NMVOC (kt)	SO_2 (kt)
23.5	264.7	870.4	349.1	358.7
3.5	253.9	786.4	254.9	358.7
3.5	252.0	772.1	248.9	358.7
0.5	89.0	43.6	0.8	122.9
1.0	87.8	154.8	74.0	96.2
1.7	60.7	292.8	132.1	110.3
0.3	14.4	280.9	42.0	29.3
IE, NE	IE, NE	IE, NE	IE, NE	IE, NE
	2.0	14.3	6.1	NA, NE
	NA	NA	1.3	NA
	2.0	14.3	4.7	NA, NE
1.8	6.1	NO, NE, NA	0.0	NO, NE, NA
	NE	NE	NE	NE
1.8	6.1	NE	0.0	NE
NA, NO	NE, NO	NE, NO	NE, NO	NE, NO
	NO	NO	NO	NO
NO	NA	NA	NA	NA
NE			0.1	
16.9	3.7	48.9	83.6	
0.9			5.5	
	IE		NE	
15.9	2.4		78.1	
NA	NA	NA	NA	
0.0	1.3	48.9	NA	
NA	NA	NA	NA	
0.1	1.0	35.1	NA	NA
0.1	0.9	33.9	NA	NA
0.0	0.0	0.2	NA	NA
0.0	0.1	1.1	NA	NA
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA
NO	NO	NO	NA	NA
NA	NA	NA	NA	NA
1.1	0.0	0.0	10.4	0.0
			10.4	
0.1			NE	
0.0	0.0	0.0		0.0
1.0			0.0	
NA	NA	NA	NA	NA
0.1	3.7	34.5	1.4	31.3
0.0	0.9	4.5	0.3	6.1
0.0	2.8	30.0	1.0	25.2

Table A. 12. Chile's NGHGI: anthropogenic emissions of HFCs, PFCs and SF_6, year 2013

Categories of source and sink of greenhouse gases	HFC-23	HFC-32	HFC-125	HFC-134a
Total national emissions and removals	0.000	0.057	0.172	0.442
1. Energy				
A. Fuel combustion activities (sectorial approach)				
1. Energy industries				
2. Manufacturing industries and construction				
3. Transport				
4. Other sectors				
5. Other (non-specified)				
B. Fugitive emissions from fuels				
1. Solid fuels				
2. Oil and natural gas				
2. Industrial Processes	0.000	0.057	0.172	0.442
A. Mineral products				
B. Chemical industry	NO	NO	NO	NO
C. Metal industry				
D. Other production				
E. Production of halocarbons and sulfur hexafluoride	NO	NO	NO	NO
F. Consumption of halocarbons and sulfur hexafluoride	0.000	0.057	0.172	0.442
G. Other				
3. Solvent and other products use				
4. Agriculture				
A. Enteric fermentation				
B. Manure management				
C. Rice cultivation				
D. Agricultural soils				
E. Prescribed burning of savannas				
F. Field burning of agricultural waste				
G. Other				
5. Land use, land-use change and forestry				
A. Forest land				
B. Cropland				
C. Grassland				
D. Wetlands				
E. Settlements				
F. Other Land				
G. Other				
6. Waste				
A. Solid waste disposal				
B. Wastewater treatment and discharge				
C. Incineration of waste				
D. Other				
7. Other	NA	NA	NA	NA
Memo items				
International bunker				
International aviation				
International navigation				
CO_2 emissions from biomass				

C = Confidential Information; CS = specific country; D = by Default; IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

HFC (kt)							PFC (kt)	SF_6 (kt)
HFC-143a	HFC-152a	HFC-227ea	HFC-236fa	HFC-245fa	HFC-365mfc	HFC-43-10mee	CF_4	
0.125	0.002	0.009	0.000	0.001	0.007	0.000	NO, NE, NA	0.010
0.125	0.002	0.009	0.000	0.001	0.007	0.000	NA, NO, NE	0.010
NO	NO	NO	NO	NO	NO	NO		
							NO	NO
NO	NO	NO	NO	NO	NO	NO	NO	NO
0.125	0.002	0.009	0.000	0.001	0.007	0.000	NE	
							NA, NO	0.010
NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A. 13. Chile's NGHGI: anthropogenic emissions by sources and anthropogenic removals by sinks of all GHGs not controlled by the Montreal Protocol and the precursors of GHGs, Year 2016

Categories of source and sink of greenhouse gases	CO_2 emissions (kt)	CO_2 removals (kt)	CH_4 (kt)
Total national emissions and removals	183,728.1	-161,541.7	562.6
1. Energy	84,121.0	0.0	75.5
A. Fuel combustion activities (sectorial approach)	84,119.8		35.5
1. Energy industries	35,483.7		1.6
2. Manufacturing industries and construction	15,684.7		6.7
3. Transport	26,231.2		5.3
4. Other sectors	6,720.2		21.8
5. Other (non-specified)	IE, NE		IE, NE
B. Fugitive emissions from fuels	1.2		40.0
1. Solid fuels			3.7
2. Oil and natural gas	1.2		36.3
2. Industrial Processes	3,192.6	0.0	0.9
A. Mineral products	1,601.7		
B. Chemical industry	263.3		0.9
C. Metal industry	1,327.6		IE, NO
D. Other production	NO		
E. Production of halocarbons and sulfur hexafluoride			
F. Consumption of halocarbons and sulfur hexafluoride			
G. Other	NO		NO
3. Solvent and other products use	129.9		
4. Agriculture			263.6
A. Enteric fermentation			187.3
B. Manure management			69.9
C. Rice cultivation			5.3
D. Agricultural soils			NA
E. Prescribed burning of savannas			NO
F. Field burning of agricultural waste			1.1
G. Other			NA
5. Land use, land-use change and forestry	96,284.1	-161,541.7	5.1
A. Forest land	91,476.1	-161,328.1	4.9
B. Cropland	1,995.2	0.0	0.0
C. Grassland	1,874.8	-213.6	0.1
D. Wetlands	20.6	NA	NA
E. Settlements	368.7	NA	NA
F. Other Land	548.6	NA	NO
G. Other	NA	NA	NA
6. Waste	0.5		217.5
A. Solid waste disposal			172.2
B. Wastewater treatment and discharge			1.3
C. Incineration of waste	0.5		0.0
D. Other			44.0
7. Other	NA	NA	NA
Memo items			
International bunker	2,249.1		0.1
International aviation	1,479.7		0.0
International navigation	769.4		0.1
CO_2 emissions from biomass	35,042.3		

C = Confidential Information; CS = specific country; D = by Default; IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

N_2O (kt)	NOx (kt)	CO (kt)	NMVOC (kt)	SO_2 (kt)
22.8	300.8	963.4	364.0	357.4
3.8	288.0	811.0	254.0	357.4
3.8	285.9	794.2	248.6	357.4
0.6	104.8	52.5	0.9	119.9
0.9	98.0	143.1	66.6	88.7
1.9	64.8	313.3	138.2	114.0
0.3	18.4	285.2	43.0	34.8
IE, NE	IE, NE	IE, NE	IE, NE	IE, NE
	2.1	16.9	5.4	NA, NE
	NA	NA	1.1	NA
	2.1	16.9	4.3	NA, NE
1.5	5.6	NO, NE, NA	0.0	NO, NE, NA
	NE	NE	NE	NE
1.5	5.6	NE	0.0	NE
NA, NO	NE, NO	NE, NO	NE, NO	NE, NO
	NO	NO	NO	NO
NA, NE	NA	NA	NA	NA
NE			0.1	
16.0	3.8	36.3	98.8	
0.9			5.3	
	IE		NE	
15.0	2.8		93.6	
NA	NA	NA	NA	
0.0	1.0	36.3	NA	
NA	NA	NA	NA	
0.3	3.3	116.1	NA	NA
0.3	3.2	112.7	NA	NA
0.0	0.0	1.1	NA	NA
0.0	0.1	2.3	NA	NA
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA
NO	NO	NO	NA	NA
NA	NA	NA	NA	NA
1.2	0.0	0.0	11.0	0.0
			10.9	
0.1			NE	
0.0	0.0	0.0		0.0
1.1			0.1	
NA	NA	NA	NA	NA
0.1	2.7	23.7	1.0	21.9
0.0	0.9	4.8	0.4	6.4
0.0	1.8	18.9	0.7	15.5

Table A. 14. Chile's NGHGI: anthropogenic emissions of HFC, PFC and SF_6, year 2016

Categories of source and sink of greenhouse gases	HFC-23	HFC-32	HFC-125	HFC-134a	HFC-143a
Total national emissions and removals	0.000	0.078	0.286	0.569	0.209
1. Energy					
A. Fuel combustion activities (sectorial approach)					
1. Energy industries					
2. Manufacturing industries and construction					
3. Transport					
4. Other sectors					
5. Other (non-specified)					
B. Fugitive emissions from fuels					
1. Solid fuels					
2. Oil and natural gas					
2. Industrial Processes	0.000	0.078	0.286	0.569	0.209
A. Mineral products					
B. Chemical industry	NO	NO	NO	NO	NO
C. Metal industry					
D. Other production					
E. Production of halocarbons and sulfur hexafluoride	NO	NO	NO	NO	NO
F. Consumption of halocarbons and sulfur hexafluoride	0.000	0.078	0.286	0.569	0.209
G. Other					
3. Solvent and other products use					
4. Agriculture					
A. Enteric fermentation					
B. Manure management					
C. Rice cultivation					
D. Agricultural soils					
E. Prescribed burning of savannas					
F. Field burning of agricultural waste					
G. Other					
5. Land use, land-use change and forestry					
A. Forest land					
B. Cropland					
C. Grassland					
D. Wetlands					
E. Settlements					
F. Other Land					
G. Other					
6. Waste					
A. Solid waste disposal					
B. Wastewater treatment and discharge					
C. Incineration of waste					
D. Other					
7. Other	NA	NA	NA	NA	NA
Memo items					
International bunker					
International aviation					
International navigation					
CO_2 emissions from biomass					

C = Confidential Information; CS = specific country; D = by Default; IE = Included elsewhere; NA = Not applicable; NE = Not estimated; NO = Does Not Occur

Source: Coordinating Technical Team of the MMA

HFC (kt)						PFC (kt)	SF_6 (kt)
HFC-152a	HFC-227ea	HFC-236fa	HFC-245fa	HFC-365mfc	HFC-43-10mee	CF_4	
0.004	0.017	0.000	0.001	0.015	0.000	NO, NE, NA	0.012
0.004	0.017	0.000	0.001	0.015	0.000	NA, NO, NE	0.012
NO	NO	NO	NO	NO	NO		
						NO	NO
NO	NO	NO	NO	NO	NO	NO	NO
0.004	0.017	0.000	0.001	0.015	0.000	NE	
						NA, NO	0.012
NA	NA	NA	NA	NA	NA	NA	NA

ANNEX 4. GHG EMISSIONS AND REMOVALS FROM CHILE, 1990-2016 SERIES

Table A. 15. GHG emissions and removals (kt CO_2 eq), series 1990-2003

IPCC Code	Categories of source and sink of greenhouse gases	1990	1991	1992	1993
	All national emissions and removals	1,955.0	4,435.7	3,257.3	6,154.4
1.	Energy	33,679.7	31,861.9	32,751.2	34,974.1
1.1A.	Fuel combustion activities (reference approach)	30,051.9	28,635.7	29,723.1	31,636.9
1.A.	Fuel combustion activities (sectorial approach)	31,425.0	29,970.9	31,024.3	33,356.7
1.A.1.	Energy industries	5,843.4	4,671.5	2,849.7	4,353.5
1.A.1.a.	Main Activity Electricity and heat production	3,871.9	2,607.6	665.2	1,936.1
1.A.1.a.i.	Electricity Generation	3,871.9	2,607.6	665.2	1,936.1
1.A.1.a.ii.	Combined heat and power generation (CHP)	0.0	0.0	0.0	0.0
1.A.1.a.iii.	Heat plants	0.0	0.0	0.0	0.0
1.A.1.b.	Petroleum Refining	1,691.9	1,708.7	1,779.3	1,931.1
1.A.1.c.	Manufactur of solid fuels and other energy industries	279.6	355.3	405.2	486.3
1.A.1.c.i.	Manufacture of solid fuels	279.6	355.3	405.2	486.3
1.A.1.c.ii.	Other energy industries	0.0	0.0	0.0	0.0
1.A.2.	Manufacturing industries and construction	12,261.5	11,152.3	12,722.0	12,259.2
1.A.2.a.	Iron and steel	1,495.0	1,532.8	1,917.1	1,950.7
1.A.2.b.	Non-ferrous metals	0.0	0.0	0.0	0.0
1.A.2.c.	Chemical	141.1	108.4	168.2	170.6
1.A.2.d.	Pulp, paper and print	557.5	751.3	822.6	755.9
1.A.2.e.	Food processing, beverages and tobacco	3,600.3	2,682.8	3,050.6	1,981.7
1.A.2.f.	Non-metallic minerals	572.7	517.0	708.0	701.6
1.A.2.g.	Transport equipment	0.0	0.0	0.0	0.0
1.A.2.h.	Machinery	0.0	0.0	0.0	0.0
1.A.2.i.	Mining (excluding fuel) and quarrying	3,799.9	3,506.5	3,521.9	3,764.1
1.A.2.j.	Wood and wood products	0.0	0.0	0.0	0.0
1.A.2.k.	Construction	0.0	0.0	0.0	0.0
1.A.2.l.	Textiles and leather	0.0	0.0	0.0	0.0
1.A.2.m.	Non-specified industry	2,095.0	2,053.5	2,533.6	2,934.6
1.A.3.	Transport	9,229.9	9,658.6	10,477.0	11,620.9
1.A.3.a.	Civil aviation	567.8	331.6	465.2	581.9
1.A.3.a.i.	International aviation (international Bunkers)				
1.A.3.a.ii.	Domestic aviation	567.8	331.6	465.2	581.9
1.A.3.b.	Road Transportation	7,493.7	7,861.9	8,543.8	9,459.5
1.A.3.b.i.	Cars	2,402.3	2,272.3	2,499.8	2,708.8
1.A.3.b.i.1.	Passenger cars with 3- way catalysts	0.0	0.0	0.0	0.0
1.A.3.b.i.2.	Passenger cars without 3-way catalysts	2,402.3	2,272.3	2,499.8	2,708.8
1.A.3.b.ii.	Light-duty trucks	1,844.5	1,745.4	1,922.0	2,084.5
1.A.3.b.ii.1.	Light duty trucks with 3-way catalysts	0.0	0.0	0.0	0.0
1.A.3.b.ii.2.	Light duty trucks without 3-way catalysts	1,844.5	1,745.4	1,922.0	2,084.5
1.A.3.b.iii.	Heavy-duty trucks and buses	3,217.9	3,814.7	4,090.4	4,633.7
1.A.3.b.iv.	Motorcycles	29.0	29.5	31.6	32.5
1.A.3.b.v.	Evaporative emissions from vehicles	0.0	0.0	0.0	0.0
1.A.3.b.vi.	Urea-based catalysts	0.0	0.0	0.0	0.0
1.A.3.c.	Railways	64.2	62.5	67.5	57.3
1.A.3.d.	Water-borne Navigation	880.5	1,169.1	1,143.7	1,235.9
1.A.3.d.i.	International waterborne navigation (International bunkers)				
1.A.3.d.ii.	Domestic water-borne Navigation	880.5	1,169.1	1,143.7	1,235.9

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
12,489.2	9,370.8	16,445.8	20,845.7	39,677.5	30,065.7	13,907.1	10,372.8	20,472.5	4,019.2
37,458.9	40,297.3	46,119.2	52,784.0	53,254.6	55,977.3	52,508.7	50,408.9	51,143.7	51,802.6
34,166.7	37,470.2	44,433.0	49,040.5	49,772.4	54,486.3	50,829.5	47,415.0	48,884.4	49,269.3
35,870.4	38,941.2	44,849.0	51,545.6	52,053.0	54,644.0	50,967.2	48,805.5	49,596.2	50,363.8
4,591.9	7,894.3	12,280.4	13,910.2	16,424.4	18,698.3	14,908.3	13,078.2	14,228.6	15,610.6
2,489.6	5,932.1	10,056.5	11,888.8	14,053.2	16,505.6	13,035.4	10,867.6	11,457.8	13,083.0
2,489.6	5,932.1	10,056.5	11,888.8	14,053.2	16,505.6	13,035.4	10,867.6	11,457.8	13,083.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,667.3	1,632.7	1,831.0	1,624.0	1,943.6	1,765.9	1,470.8	1,785.4	2,378.2	2,100.5
435.0	329.5	392.9	397.4	427.6	426.8	402.1	425.3	392.6	427.1
435.0	329.5	392.9	397.4	427.6	426.8	402.1	425.3	392.6	427.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13,321.9	11,815.0	11,958.1	15,469.1	13,575.2	13,398.5	13,012.7	13,657.8	12,796.7	12,808.3
1,697.8	1,710.1	1,830.5	1,918.9	1,946.4	1,990.4	1,948.6	1,883.9	1,916.0	1,924.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
169.1	149.5	139.1	281.5	297.7	446.9	472.1	476.3	415.0	421.4
893.1	917.1	777.3	753.5	831.4	808.4	909.8	658.4	819.1	752.5
3,140.4	573.9	505.5	452.6	519.7	515.6	471.3	462.3	500.0	322.2
795.9	988.0	857.2	872.0	708.5	746.7	745.9	704.9	619.9	869.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3,901.8	4,051.1	4,074.1	4,518.3	4,317.4	4,460.1	4,540.2	4,421.5	4,605.5	4,057.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2,723.7	3,425.4	3,774.3	6,672.1	4,954.1	4,430.4	3,924.7	5,050.4	3,921.3	4,461.3
12,562.1	13,898.2	15,119.9	16,039.6	16,910.5	17,097.0	17,354.0	16,406.9	16,944.1	16,717.1
467.9	657.6	757.2	1,021.8	990.7	817.8	682.7	906.5	764.6	598.3
467.9	657.6	757.2	1,021.8	990.7	817.8	682.7	906.5	764.6	598.3
10,665.0	11,671.3	12,620.5	13,219.9	13,914.6	14,562.3	14,996.0	14,075.5	14,623.0	14,616.3
3,060.6	3,360.3	3,639.6	3,815.8	4,001.8	4,224.5	4,295.5	3,955.2	3,929.5	3,871.1
0.0	291.6	603.6	910.9	1,224.4	1,538.9	1,801.4	1,868.5	2,052.1	2,207.5
3,060.6	3,068.6	3,036.0	2,904.9	2,777.4	2,685.6	2,494.0	2,086.7	1,877.5	1,663.6
2,358.1	2,541.6	2,709.2	2,800.7	2,902.6	3,042.8	3,098.9	2,846.8	2,882.3	2,827.4
0.0	172.0	358.7	545.2	739.2	947.6	1,137.2	1,200.5	1,370.9	1,497.1
2,358.1	2,369.7	2,350.5	2,255.5	2,163.4	2,095.1	1,961.7	1,646.3	1,511.4	1,330.2
5,210.6	5,734.7	6,238.2	6,571.9	6,980.7	7,266.9	7,577.8	7,253.5	7,793.4	7,901.5
35.6	34.7	33.4	31.4	29.5	28.1	23.9	20.0	17.8	16.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48.7	41.5	51.3	46.1	52.3	65.2	63.8	61.2	66.1	66.5
1,046.5	1,158.1	1,285.9	1,322.8	1,494.4	1,151.3	1,079.0	848.2	927.1	876.0
1,046.5	1,158.1	1,285.9	1,322.8	1,494.4	1,151.3	1,079.0	848.2	927.1	876.0

IPCC Code	Categories of source and sink of greenhouse gases	1990	1991	1992	1993
1.A.3.e.	Other transportation	223.7	233.4	256.8	286.3
1.A.3.e.i.	Pipeline transport	0.0	0.0	0.0	0.0
1.A.3.e.ii.	Off-road	223.7	233.4	256.8	286.3
1.A.4.	Other sectors	4,090.2	4,488.5	4,975.6	5,123.2
1.A.4.a.	Commercial / Institutional	499.0	530.3	605.5	368.6
1.A.4.b.	Residential	3,080.3	3,228.5	3,695.6	4,131.4
1.A.4.c.	Agriculture / Forestry / Fishing / Fish Farms	510.9	729.7	674.5	623.3
1.A.4.c.i.	Stationary	0.0	0.0	0.0	0.0
1.A.4.c.ii.	Off-road Vehicles and Other Machinery	32.7	8.5	9.5	10.5
1.A.4.c.iii.	Fishing (mobile combustion)	478.3	721.2	665.0	612.7
1.A.5.	Non-specified	0.0	0.0	0.0	0.0
1.A.5.a.	Stationary	0.0	0.0	0.0	0.0
1.A.5.b.	Mobile	0.0	0.0	0.0	0.0
1.A.5.b.i.	Mobile (aviation component)	0.0	0.0	0.0	0.0
1.A.5.b.ii.	Mobile (waterborne component)	0.0	0.0	0.0	0.0
1.A.5.b.iii.	Mobile (other)	0.0	0.0	0.0	0.0
1.A.5.c.	Multilateral operations (Information item)				
1.B.	Fugitive emissions from fuels	2,254.7	1,891.0	1,726.9	1,617.3
1.B.1.	Solid fuels	573.2	534.9	410.3	351.6
1.B.1.a.	Coal mining and handling	573.2	534.9	410.3	351.6
1.B.1.a.i.	Underground mines	548.5	507.4	389.1	333.7
1.B.1.a.i.1.	Mining	481.6	445.5	341.7	293.0
1.B.1.a.i.2.	Post-mining seam gas emissions	66.9	61.9	47.5	40.7
1.B.1.a.i.3.	Abandoned underground mines	0.0	0.0	0.0	0.0
1.B.1.a.i.4.	Flaring of drained methane or conversion ofmethane to CO_2	0.0	0.0	0.0	0.0
1.B.1.a.ii.	Surface Mines	24.6	27.5	21.2	17.9
1.B.1.a.ii.1.	Mining	22.8	25.4	19.6	16.5
1.B.1.a.ii.2.	Post-mining seam gas emissions	1.9	2.1	1.6	1.4
1.B.1.b.	Uncontrolled combustion and burning coal dumps	0.0	0.0	0.0	0.0
1.B.1.c.	Other	0.0	0.0	0.0	0.0
1.B.2.	Oil and natural gas	1,681.5	1,356.1	1,316.6	1,265.7
1.B.2.a.	Oil	757.5	693.2	567.7	536.5
1.B.2.a.i.	Venting	0.3	0.2	0.2	0.2
1.B.2.a.ii.	Flaring	0.0	0.0	0.0	0.0
1.B.2.a.iii.	All other	757.3	693.0	567.5	536.3
1.B.2.a.iii.1.	Exploration	0.0	0.0	0.0	0.0
1.B.2.a.iii.2.	Production and Upgrading	752.3	688.1	562.5	530.9
1.B.2.a.iii.3.	Transport	1.0	1.0	1.0	1.1
1.B.2.a.iii.4.	Refining	4.0	3.9	4.0	4.3
1.B.2.a.iii.5.	Distribution of oil products	0.0	0.0	0.0	0.0
1.B.2.a.iii.6.	Other	0.0	0.0	0.0	0.0
1.B.2.b.	Natural Gas	924.0	662.9	748.9	729.3
1.B.2.b.i.	Venting	23.1	17.4	19.6	19.1
1.B.2.b.ii.	Flaring	0.0	0.0	0.0	0.0
1.B.2.b.iii.	All other	900.9	645.5	729.3	710.1
1.B.2.b.iii.1.	Exploration	0.0	0.0	0.0	0.0
1.B.2.b.iii.2.	Production	719.0	540.2	609.4	594.8
1.B.2.b.iii.3.	Processing	17.0	9.8	11.2	10.8
1.B.2.b.iii.4.	Transmission and storage	42.8	24.8	28.2	27.2
1.B.2.b.iii.5.	Distribution	122.1	70.7	80.5	77.4
1.B.2.b.iii.6.	Other	0.0	0.0	0.0	0.0
1.B.3.	Other emissions from Energy Production	0.0	0.0	0.0	0.0
1.C.	Carbon dioxide Transport and storage	0.0	0.0	0.0	0.0

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
334.1	369.8	405.0	429.1	458.5	500.5	532.3	515.6	563.2	560.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
334.1	369.8	405.0	429.1	458.5	500.5	532.3	515.6	563.2	560.1
5,394.5	5,333.8	5,490.5	6,126.7	5,142.8	5,450.3	5,692.2	5,662.6	5,626.8	5,227.8
663.6	677.3	645.6	927.0	532.3	583.0	612.6	540.7	622.7	793.2
4,092.9	4,176.9	3,981.8	4,239.3	4,018.7	4,317.8	4,451.9	4,592.4	4,374.7	3,974.2
637.9	479.5	863.0	960.4	591.9	549.5	627.7	529.5	629.5	460.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12.1	12.9	13.6	14.0	10.7	11.5	12.7	12.4	13.3	14.4
625.8	466.6	849.4	946.4	581.2	538.0	615.0	517.1	616.2	445.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,588.5	1,356.0	1,270.2	1,238.4	1,201.6	1,333.3	1,541.6	1,603.4	1,547.4	1,438.8
238.7	194.1	152.7	111.5	100.3	64.8	88.3	59.1	51.6	51.5
238.7	194.1	152.7	111.5	100.3	64.8	88.3	59.1	51.6	51.5
216.2	172.7	129.5	86.1	77.6	57.4	82.6	49.9	44.6	46.9
189.8	151.6	113.7	75.6	68.1	50.4	72.5	43.8	39.2	41.2
26.4	21.1	15.8	10.5	9.5	7.0	10.1	6.1	5.4	5.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22.5	21.4	23.2	25.3	22.8	7.4	5.7	9.2	7.0	4.6
20.8	19.7	21.4	23.4	21.0	6.8	5.3	8.5	6.5	4.2
1.7	1.6	1.8	1.9	1.8	0.6	0.4	0.7	0.5	0.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,349.8	1,162.0	1,117.5	1,126.9	1,101.2	1,268.6	1,453.2	1,544.3	1,495.8	1,387.3
542.9	384.5	335.9	252.9	228.4	225.8	253.0	240.2	201.0	166.2
0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
542.7	384.4	335.8	252.8	228.4	225.8	252.9	240.1	201.0	166.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
536.9	378.3	329.4	246.1	221.1	218.1	245.2	232.4	193.3	157.9
1.1	1.2	1.3	1.3	1.4	1.5	1.5	1.5	1.5	1.6
4.6	4.9	5.1	5.4	5.8	6.2	6.2	6.2	6.2	6.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
806.9	777.4	781.7	874.0	872.8	1,042.7	1,200.3	1,304.1	1,294.8	1,221.1
21.4	20.6	20.7	21.8	19.5	22.0	23.9	25.3	24.9	21.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
785.5	756.8	761.0	852.2	853.2	1,020.7	1,176.4	1,278.8	1,269.9	1,199.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
666.1	641.1	643.8	678.9	607.3	684.7	742.6	787.1	774.0	663.3
11.1	10.8	10.9	16.2	23.0	31.4	40.5	45.9	46.3	50.1
28.1	27.3	27.6	40.8	57.9	79.1	102.2	115.8	116.8	126.4
80.1	77.7	78.6	116.3	165.1	225.5	291.1	330.0	332.8	360.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

IPCC Code	Categories of source and sink of greenhouse gases	1990	1991	1992	1993
1.C.1.	Transport of CO2	0.0	0.0	0.0	0.0
1.C.1.a.	Pipelines	0.0	0.0	0.0	0.0
1.C.1.b.	Ships	0.0	0.0	0.0	0.0
1.C.1.c.	Other (please specify)	0.0	0.0	0.0	0.0
1.C.2.	Injections and storage	0.0	0.0	0.0	0.0
1.C.2.a.	Injection	0.0	0.0	0.0	0.0
1.C.2.b.	Storage	0.0	0.0	0.0	0.0
1.C.3.	Other	0.0	0.0	0.0	0.0
2.	Industrial processes and product use	3,295.4	3,592.7	4,155.0	4,306.1
2.A.	Minerals industry	780.3	1,088.0	1,216.2	1,308.0
2.A.1.	Cement Production	650.1	959.8	1,073.0	1,166.2
2.A.2.	Lime production	118.2	113.6	126.0	122.0
2.A.3.	Glass Productio	12.0	14.6	17.2	19.8
2.A.4.	Other Process Uses of Carbonates	0.0	0.0	0.0	0.0
2.A.4.a.	Ceramics	0.0	0.0	0.0	0.0
2.A.4.b.	Other uses of soda ash	0.0	0.0	0.0	0.0
2.A.4.c.	Non Metallurgical Magnesia Production	0.0	0.0	0.0	0.0
2.A.4.d.	Other (specify)	0.0	0.0	0.0	0.0
2.A.5.	Other (please specify)	0.0	0.0	0.0	0.0
2.B.	Chemical industry	953.2	836.3	938.6	912.9
2.B.1.	Ammonia Production	0.0	0.0	0.0	0.0
2.B.2.	Nitric acid production	295.7	295.7	295.7	295.7
2.B.3.	Adipic acid Production	0.0	0.0	0.0	0.0
2.B.4.	Caprolactam, Glyoxal and Glyoxylic Acid Production	0.0	0.0	0.0	0.0
2.B.5.	Carbide Production	0.0	0.0	0.0	0.0
2.B.6.	Titanium dioxide production	0.0	0.0	0.0	0.0
2.B.7.	Soda ash production	0.0	0.0	0.0	0.0
2.B.8.	Petrochemical and carbon black production	657.5	540.6	642.9	617.2
2.B.8.a.	Methanol	609.5	494.5	599.5	575.9
2.B.8.b.	Ethylene	48.0	46.1	43.4	41.3
2.B.8.c.	Ethylene dichloride and vinyl chloride monomer	0.0	0.0	0.0	0.0
2.B.8.d.	Ethylene oxide	0.0	0.0	0.0	0.0
2.B.8.e.	Acrylonitrile	0.0	0.0	0.0	0.0
2.B.8.f.	Carbon Black	0.0	0.0	0.0	0.0
2.B.9.	Fluorchemical production	0.0	0.0	0.0	0.0
2.B.9.a.	By-product Emissions	0.0	0.0	0.0	0.0
2.B.9.b.	Fugitive Emissions	0.0	0.0	0.0	0.0
2.B.10.	Other (specify)	0.0	0.0	0.0	0.0
2.C.	Metals industry	1,425.4	1,549.5	1,860.3	1,959.6
2.C.1.	Iron and Steel Production	1,393.7	1,517.8	1,825.7	1,906.6
2.C.2.	Ferroalloys Production	31.7	31.7	34.6	53.0
2.C.3.	Aluminium Production	0.0	0.0	0.0	0.0
2.C.4.	Magnesium Production	0.0	0.0	0.0	0.0
2.C.5.	Lead Production	0.0	0.0	0.0	0.0
2.C.6.	Zinc Production	0.0	0.0	0.0	0.0
2.C.7.	Other (specify)	0.0	0.0	0.0	0.0
2.D.	Non-Energy Products from Fuels and Solvent Use	75.1	75.1	90.5	78.9
2.D.1.	Lubricant Use	68.1	68.1	82.8	71.8
2.D.2.	Paraffin Wax Use	7.1	7.1	7.7	7.2
2.D.3.	Solvent Use	0.0	0.0	0.0	0.0
2.D.4.	Other (specify)	0.0	0.0	0.0	0.0
2.E.	Electronics industry	0.0	0.0	0.0	0.0
2.E.1.	Integrated circuits or semiconductors	0.0	0.0	0.0	0.0
2.E.2.	TFT Flat Panel Display	0.0	0.0	0.0	0.0

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4,274.0	4,097.7	4,284.7	4,619.7	5,065.7	5,375.4	6,243.6	6,243.9	6,404.9	6,610.2
1,319.0	1,202.4	1,192.4	1,185.2	1,383.2	1,252.0	1,312.2	1,331.9	1,372.5	1,448.5
1,158.7	1,009.6	978.5	962.9	1,151.1	967.9	1,028.6	1,031.4	1,098.5	1,133.3
138.0	167.9	180.7	180.1	187.8	239.3	231.0	249.7	218.8	256.4
22.3	24.9	33.3	42.1	44.3	44.7	52.6	50.8	55.2	58.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
961.7	942.3	954.3	1,507.8	1,559.3	1,999.6	2,645.3	2,610.4	2,695.8	2,683.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
295.7	295.7	295.7	295.7	295.7	295.7	513.3	563.0	541.0	698.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
666.0	646.5	658.6	1,212.1	1,263.6	1,703.9	2,132.0	2,047.4	2,154.8	1,984.4
623.7	600.1	608.7	1,166.7	1,213.2	1,647.8	2,077.9	1,986.8	2,092.4	1,928.9
42.3	46.4	49.9	45.3	50.4	56.1	54.1	60.6	62.5	55.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,837.3	1,788.9	1,969.6	1,732.4	1,905.1	1,951.4	1,995.4	1,860.9	1,924.4	1,984.8
1,792.8	1,750.5	1,929.5	1,710.8	1,885.9	1,939.4	1,986.9	1,857.5	1,924.4	1,984.8
44.5	38.5	40.1	21.6	19.2	11.9	8.5	3.3	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86.2	87.6	93.6	95.3	95.8	31.0	114.8	186.7	126.0	147.3
77.8	79.3	84.1	85.9	86.9	28.6	105.7	177.4	116.1	137.6
8.4	8.4	9.5	9.4	8.9	2.4	9.1	9.3	9.9	9.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

IPCC Code	Categories of source and sink of greenhouse gases	1990	1991	1992	1993
2.E.3.	Photovoltaics	0.0	0.0	0.0	0.0
2.E.4.	Heat Transfer fluids	0.0	0.0	0.0	0.0
2.E.5.	Other (specify)	0.0	0.0	0.0	0.0
2.F.	Product uses as substitutes for ozone depleting substances	0.0	0.0	0.0	0.0
2.F.1.	Refrigeration and air conditioning	0.0	0.0	0.0	0.0
2.F.1.a.	Refrigeration and stationary air conditioning	0.0	0.0	0.0	0.0
2.F.1.b.	Mobile air conditioning	0.0	0.0	0.0	0.0
2.F.2.	Foam Blowing Agents	0.0	0.0	0.0	0.0
2.F.3.	Fire protection	0.0	0.0	0.0	0.0
2.F.4.	Aerosols	0.0	0.0	0.0	0.0
2.F.5.	Solvents	0.0	0.0	0.0	0.0
2.F.6.	Other applications (specify)	0.0	0.0	0.0	0.0
2.G.	Other Product Manufacture and Use	61.3	43.7	49.4	46.6
2.G.1.	Electrical equipment	61.3	43.7	49.4	46.6
2.G.1.a.	Manufacture of electrical equipment	25.5	0.0	5.6	1.1
2.G.1.b.	Use of electrical equipment	35.8	43.7	43.7	45.5
2.G.1.c.	Disposal of Electrical Equipment	0.0	0.0	0.0	0.0
2.G.2.	SF_6 and PFC from other product uses	0.0	0.0	0.0	0.0
2.G.2.a.	Military applications	0.0	0.0	0.0	0.0
2.G.2.b.	Accelerators	0.0	0.0	0.0	0.0
2.G.2.c.	Other (specify)	0.0	0.0	0.0	0.0
2.G.3.	N_2O of product uses	0.0	0.0	0.0	0.0
2.G.3.a.	Medical applications	0.0	0.0	0.0	0.0
2.G.3.b.	Propellant for pressurized products and aerosol products	0.0	0.0	0.0	0.0
2.G.3.c.	Other (specify)	0.0	0.0	0.0	0.0
2.G.4.	Other (specify)	0.0	0.0	0.0	0.0
2.H.	Other	0.0	0.0	0.0	0.0
2.H.1.	Pulp and paper industry	0.0	0.0	0.0	0.0
2.H.2.	Food And Beverages industry	0.0	0.0	0.0	0.0
2.H.3.	Other (specify)	0.0	0.0	0.0	0.0
3.	Agriculture	12,071.4	12,167.0	12,562.0	12,987.3
3.A.	Enteric fermentation	5,488.7	5,535.8	5,672.4	5,869.5
3.A.1.	Cattle	4,556.3	4,612.0	4,752.2	4,940.9
3.A.1.a.	Dairy cows	946.9	955.5	993.0	1,033.9
3.A.1.b.	Other cattle	3,609.4	3,656.5	3,759.2	3,907.0
3.A.1.b.i.	Beef Cows	1,022.1	1,028.2	1,070.1	1,108.4
3.A.1.b.ii.	Heifers	793.1	836.8	839.7	872.9
3.A.1.b.iii.	Adult meat (>2 years heifer, bulls and stud bull, oxen)	434.7	444.7	458.0	468.8
3.A.1.b.iv.	Young meat (1-2 year heifer)	666.4	627.5	667.8	681.5
3.A.1.b.v.	Calves	693.2	719.4	723.7	775.5
3.A.2.	Sheep	600.1	586.1	577.7	581.1
3.A.3.	Swine	37.8	40.4	42.7	45.0
3.A.3.a.	Pigs	5.0	5.4	5.7	6.0
3.A.3.b.	Male pigs	0.1	0.1	0.1	0.1
3.A.3.c.	Juvenile	32.6	34.9	36.9	38.8
3.A.4.	Other species	294.6	297.2	299.8	302.4
3.A.4.a.	Buffalo	0.0	0.0	0.0	0.0
3.A.4.b.	Goat	109.6	107.1	104.7	102.2
3.A.4.c.	Horses	152.2	157.2	162.1	167.0
3.A.4.d.	Mules and donkeys	8.9	8.8	8.6	8.5
3.A.4.e.	Poultry	0.0	0.0	0.0	0.0
3.A.4.f.	Camels (Llamas and alpacas)	23.0	23.3	23.6	23.8
3.A.4.g.	Other	0.8	0.8	0.9	0.9

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	38.3	81.9	155.3	190.2	210.0
0.0	0.0	0.0	0.0	0.0	35.5	77.7	132.6	165.3	204.0
0.0	0.0	0.0	0.0	0.0	35.5	77.7	132.6	165.3	204.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.2	0.7	1.6	3.1	3.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	2.6	3.5	21.1	21.8	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69.8	76.5	74.8	99.0	122.4	103.1	94.1	98.6	96.0	136.5
69.8	76.5	74.8	99.0	122.4	103.1	94.1	98.6	96.0	136.5
24.0	23.2	14.3	34.1	46.9	13.1	0.0	4.6	0.5	40.8
45.8	53.3	60.5	64.9	75.5	90.0	94.1	94.1	95.5	95.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13,357.7	13,665.2	13,809.2	14,217.7	14,185.0	14,199.8	14,008.7	13,870.1	13,966.0	13,693.1
6,055.4	6,140.4	6,144.5	6,413.5	6,364.4	6,305.5	6,245.1	6,238.3	6,184.7	6,119.2
5,123.3	5,217.3	5,298.7	5,572.1	5,525.3	5,463.3	5,406.4	5,384.0	5,326.1	5,266.3
1,074.5	1,104.4	1,125.5	1,207.7	1,188.0	1,153.6	1,124.6	1,130.4	1,101.1	1,070.3
4,048.8	4,112.9	4,173.2	4,364.4	4,337.3	4,309.7	4,281.8	4,253.6	4,224.9	4,195.9
1,144.1	1,162.4	1,187.1	1,289.7	1,286.7	1,283.7	1,280.6	1,277.6	1,274.5	1,271.5
931.0	958.1	960.0	998.9	993.1	987.1	980.9	974.6	968.1	961.4
481.3	486.6	504.6	533.2	518.6	504.0	489.3	474.5	459.6	444.7
676.0	690.7	674.2	682.2	678.1	673.8	669.5	665.0	660.4	655.6
816.3	815.1	847.2	860.4	860.8	861.2	861.5	861.9	862.3	862.7
578.2	564.5	479.3	463.8	466.0	468.3	470.5	472.7	474.9	477.2
48.8	50.9	56.2	64.6	65.1	70.8	70.1	88.4	95.5	92.5
6.5	6.8	7.5	8.6	8.7	9.4	9.3	11.8	12.7	12.3
0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
42.2	44.0	48.5	55.8	56.2	61.1	60.5	76.4	82.5	79.9
305.1	307.7	310.3	312.9	308.0	303.1	298.1	293.2	288.2	283.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
99.7	97.2	94.8	92.3	92.3	92.3	92.3	92.3	92.3	92.3
172.0	176.9	181.8	186.8	182.5	178.3	174.0	169.8	165.5	161.3
8.3	8.1	8.0	7.8	7.6	7.4	7.2	7.0	6.8	6.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24.1	24.4	24.7	24.9	24.0	23.1	22.2	21.3	20.4	19.5
1.0	1.1	1.1	1.2	1.6	2.0	2.4	2.8	3.2	3.6

IPCC Code	Categories of source and sink of greenhouse gases	1990	1991	1992	1993
3.A.4.g.i.	Deer	0.8	0.8	0.9	0.9
3.A.4.g.ii.	Warthog	0.0	0.0	0.0	0.0
3.B.	Manure management	1,521.9	1,579.2	1,641.7	1,707.1
3.B.1.	Cattle	912.0	932.6	963.2	995.1
3.B.1.a.	Dairy cows	136.4	137.9	143.7	150.0
3.B.1.b.	Other cattle	775.6	794.7	819.5	845.1
3.B.1.b.i.	Beef Cows	222.0	224.3	233.0	240.9
3.B.1.b.ii.	Heifers	181.2	191.0	191.5	198.8
3.B.1.b.iii.	Adult meat (>2 year heifer, bulls and stud bulls, oxen)	154.4	158.1	163.1	167.1
3.B.1.b.iv.	Young meat (1-2 year heifer)	171.8	173.4	183.7	186.6
3.B.1.b.v.	Calves	46.1	47.9	48.2	51.7
3.B.2.	Sheep	18.0	17.6	17.4	17.4
3.B.3.	Swine	465.7	498.2	524.8	553.6
3.B.3.a.	Pigs	109.1	116.7	123.1	129.9
3.B.3.b.	Male pigs	2.9	3.1	3.3	3.5
3.B.3.c.	Juvenile	353.7	378.4	398.5	420.2
3.B.4.	Other species	50.8	52.5	54.1	55.8
3.B.4.a.	Buffalo	0.0	0.0	0.0	0.0
3.B.4.b.	Goat	3.7	3.6	3.6	3.5
3.B.4.c.	Horses	13.9	14.3	14.8	15.2
3.B.4.d.	Mules and donkeys	0.8	0.8	0.8	0.8
3.B.4.e.	Poultry	26.9	28.1	29.4	30.6
3.B.4.f.	Camels (Llamas and alpacas)	5.5	5.6	5.7	5.7
3.B.4.g.	Other	0.0	0.0	0.0	0.0
3.B.4.g.i.	Deer	0.0	0.0	0.0	0.0
3.B.4.g.ii.	Warthog	0.0	0.0	0.0	0.0
3.B.5.	Indirect Emissions of N_2O resulting from manure management	75.5	78.4	82.2	85.2
3.B.5.a.	Cattle	27.8	28.2	29.4	30.5
3.B.5.b.	Sheep	0.0	0.0	0.0	0.0
3.B.5.c.	Swine	3.4	3.8	4.4	4.3
3.B.5.d.	Other Species	44.3	46.4	48.4	50.4
3.B.5.d.i.	Buffalo	0.0	0.0	0.0	0.0
3.B.5.d.ii.	Goat	0.0	0.0	0.0	0.0
3.B.5.d.iii.	Horses	0.0	0.0	0.0	0.0
3.B.5.d.iv.	Mules and donkeys	0.0	0.0	0.0	0.0
3.B.5.d.v.	Poultry	44.3	46.4	48.4	50.4
3.B.5.d.vi.	Camels (Llamas and alpacas)	0.0	0.0	0.0	0.0
3.B.5.d.vii.	Other	0.0	0.0	0.0	0.0
3.C.	Rice cultivation	164.2	149.9	160.0	146.5
3.C.1.	Irrigated	164.2	149.9	160.0	146.5
3.C.2.	Rain-fed	0.0	0.0	0.0	0.0
3.C.3.	Deep Water	0.0	0.0	0.0	0.0
3.C.4.	Other	0.0	0.0	0.0	0.0
3.D.	Agricultural soils	4,547.3	4,536.6	4,709.3	4,895.0
3.D.1.	Direct N_2O emissions from managed soils	3,764.5	3,761.1	3,905.8	4,061.7
3.D.1.a.	Inorganic N fertilizer	669.3	640.9	709.3	798.7
3.D.1.b.	Organic N fertilizer	203.5	208.6	218.1	224.6
3.D.1.b.i.	Animal manure applied to soils	203.5	208.6	218.1	224.6
3.D.1.b.ii.	Sewage sludge applied to soils	0.0	0.0	0.0	0.0
3.D.1.b.iii.	Other organic fertilizers applied to soils	0.0	0.0	0.0	0.0
3.D.1.c.	Urine and dung deposited by grazing animals	2,452.0	2,456.7	2,499.7	2,562.6
3.D.1.d.	Crop residues	438.8	453.6	475.7	473.6
3.D.1.e.	Mineralization / immobilization associated loss / gain of soil organic matter	0.0	0.0	0.0	0.0

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1.0	1.1	1.1	1.2	1.6	1.9	2.3	2.7	3.1	3.4
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
1,789.7	1,839.7	1,920.2	2,087.2	2,080.4	2,136.1	2,111.2	1,910.9	1,950.0	1,910.4
1,026.7	1,045.7	1,058.1	1,114.3	1,099.2	1,082.4	1,066.1	1,053.5	1,036.9	1,020.0
156.1	160.6	164.2	177.2	172.6	166.4	160.8	159.0	153.3	147.3
870.6	885.1	893.9	937.1	926.6	916.0	905.3	894.5	883.7	872.7
248.2	251.7	256.6	278.3	277.2	276.1	275.1	274.0	272.9	271.8
211.8	217.7	217.9	226.5	225.0	223.4	221.8	220.1	218.4	216.7
171.8	173.8	180.6	191.3	185.3	179.2	173.1	167.0	160.8	154.6
184.3	187.4	182.2	183.5	181.6	179.7	177.7	175.8	173.8	171.8
54.5	54.4	56.6	57.5	57.6	57.6	57.6	57.7	57.7	57.7
17.3	16.9	14.4	13.9	14.0	14.0	14.1	14.2	14.2	14.3
599.6	623.0	687.3	789.4	795.6	864.3	855.1	639.3	690.6	668.6
140.7	146.4	161.5	185.5	187.0	203.3	201.1	149.2	161.2	156.1
3.8	3.9	4.3	5.0	5.0	5.5	5.4	4.0	4.3	4.2
455.1	472.8	521.5	598.9	603.5	655.6	648.6	486.1	525.1	508.4
57.4	59.1	60.7	62.4	62.6	62.9	63.2	63.5	63.8	64.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.4	3.3	3.2	3.1	3.1	3.1	3.1	3.1	3.1	3.1
15.7	16.1	16.6	17.0	16.6	16.2	15.9	15.5	15.1	14.7
0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6
31.8	33.0	34.3	35.5	36.4	37.3	38.2	39.0	39.9	40.8
5.8	5.9	5.9	6.0	5.8	5.5	5.3	5.1	4.9	4.7
0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
88.7	95.0	99.7	107.2	109.0	112.5	112.7	140.5	144.5	143.3
31.5	32.2	33.2	35.9	34.9	33.9	32.9	31.9	30.8	29.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.7	8.4	10.0	12.8	14.1	17.2	17.0	44.3	47.8	46.3
52.4	54.5	56.5	58.5	60.0	61.4	62.9	64.3	65.8	67.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52.4	54.5	56.5	58.5	60.0	61.4	62.9	64.3	65.8	67.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
152.9	170.9	161.4	129.8	134.5	74.0	129.8	143.8	140.9	142.2
152.9	170.9	161.4	129.8	134.5	74.0	129.8	143.8	140.9	142.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5,008.3	5,139.9	5,140.4	5,225.7	5,208.1	5,272.5	5,071.0	5,147.7	5,215.8	5,016.2
4,162.4	4,272.2	4,277.2	4,347.5	4,334.5	4,382.3	4,219.1	4,276.0	4,331.3	4,170.4
798.9	880.7	919.6	905.5	885.0	973.4	833.6	895.3	981.6	838.9
233.4	248.1	260.1	287.0	290.8	299.0	299.1	358.6	367.2	364.2
233.4	248.1	260.1	287.0	290.8	299.0	299.1	358.6	367.2	364.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2,622.4	2,613.4	2,561.0	2,699.1	2,673.9	2,652.6	2,631.5	2,538.2	2,519.4	2,498.7
495.6	520.2	530.3	450.7	470.0	454.7	451.8	477.3	452.4	462.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

IPCC Code	Categories of source and sink of greenhouse gases	1990	1991	1992	1993
3.D.1.f.	Cultivation of organic soils (histosols)	0.9	1.4	3.0	2.3
3.D.1.g.	Other	0.0	0.0	0.0	0.0
3.D.2.	Indirect N_2O emissions from managed soils	782.8	775.5	803.5	833.3
3.D.2.a.	Atmospheric deposition	300.1	297.1	307.1	321.0
3.D.2.a.i	Inorganic N fertilizer	66.4	63.6	70.4	79.4
3.D.2.a.ii.	Organic N fertilizer	207.8	207.0	209.0	213.1
3.D.2.a.ii.1.	Animal manure applied to soils	207.8	207.0	209.0	213.1
3.D.2.a.ii.2.	Sewage sludge applied to soils	0.0	0.0	0.0	0.0
3.D.2.a.ii.3.	Other organic fertilizers applied to soils	0.0	0.0	0.0	0.0
3.D.2.a.iii.	Urine and dung deposited by grazing animals	25.9	26.5	27.8	28.6
3.D.2.b.	Leaching and runoff	482.7	478.4	496.4	512.3
3.D.2.b.i.	Inorganic N fertilizer	97.8	93.6	103.5	116.2
3.D.2.b.ii.	Organic N fertilizer	299.5	298.2	301.4	307.4
3.D.2.b.ii.1.	Animal manure applied to soils	299.5	298.2	301.4	307.4
3.D.2.b.ii.2.	Sewage sludge applied to soils	0.0	0.0	0.0	0.0
3.D.2.b.ii.3.	Other organic fertilizers applied to soils	0.0	0.0	0.0	0.0
3.D.2.b.iii.	Urine and dung deposited by grazing animals	21.2	21.1	21.8	22.1
3.D.2.b.iv.	Crop residues	64.1	65.5	69.7	66.5
3.D.2.b.v.	Mineralization / immobilization associated loss / gain of soil organic matter	0.0	0.0	0.0	0.0
3.E.	Prescribed burning of savannahs	0.0	0.0	0.0	0.0
3.F.	Field burning of agricultural residues	148.9	140.1	133.8	121.3
3.F.1.	Cereals and other crops	89.4	82.2	77.6	67.5
3.F.2.	Fruit	59.5	57.9	56.2	53.8
3.F.3.	Other	0.0	0.0	0.0	0.0
3.G.	Liming	30.8	33.1	35.5	37.8
3.G.1.	Limestone	30.8	33.1	35.5	37.8
3.G.2.	Dolomite	0.0	0.0	0.0	0.0
3.H.	Urea Application	169.7	192.4	209.3	210.1
3.I.	Other carbon-containing fertilizers	0.0	0.0	0.0	0.0
3.J.	Other	0.0	0.0	0.0	0.0
4.	Land use, land-use change and forestry	-50,061.0	-46,217.6	-49,320.9	-49,276.8
4.A.	Forest Land	-58,049.6	-54,275.5	-57,442.2	-57,466.6
4.A.1.	Forest land remaining forest land	-33,324.3	-27,781.5	-30,164.1	-28,476.1
4.A.1.a.	Annual biomass increase	-65,996.8	-68,094.8	-70,469.5	-72,777.0
4.A.1.a.i.	Native Forest	-63,374.2	-64,758.3	-66,342.8	-67,878.7
4.A.1.a.i.1.	Seedlings	-43,965.4	-44,410.3	-44,920.4	-45,491.6
4.A.1.a.i.1.a.	Larch	-31.0	-31.0	-30.9	-30.9
4.A.1.a.i.1.b.	Guaitecas cypress	-429.0	-429.0	-429.0	-429.0
4.A.1.a.i.1.c.	Araucaria	-488.1	-486.5	-485.2	-484.2
4.A.1.a.i.1.d.	Mountain Range cypress	-384.6	-385.8	-386.9	-388.2
4.A.1.a.i.1.e.	Chilean Palm	0.0	0.0	0.0	0.0
4.A.1.a.i.1.f.	Lenga	-8,003.6	-8,056.0	-8,117.8	-8,174.9
4.A.1.a.i.1.g.	Coihue Magallanes	-2,522.0	-2,587.1	-2,665.7	-2,751.9
4.A.1.a.i.1.h.	Ro-Hualo	-1,372.2	-1,375.4	-1,379.0	-33,517.2
4.A.1.a.i.1.i.	RoRaCo	-15,922.4	-16,167.1	-16,453.8	-16,804.2
4.A.1.a.i.1.j.	CoRaTe	-2,244.6	-2,254.3	-2,265.5	-2,265.7
4.A.1.a.i.1.k.	Sclerophyll	-1,345.7	-1,346.1	-1,346.5	-1,347.0
4.A.1.a.i.1.l.	Evergreen	-11,222.0	-11,292.1	-11,360.3	-11,420.5
4.A.1.a.i.2.	Management Plans (Native Forest Law)	-1,225.9	-1,931.0	-2,751.6	-3,471.2
4.A.1.a.i.2.a.	Larch	0.0	0.0	0.0	0.0
4.A.1.a.i.2.b.	Guaitecas cypress	-4.9	-5.8	-6.9	-8.8
4.A.1.a.i.2.c.	Araucaria	-86.0	-99.3	-104.8	-115.9
4.A.1.a.i.2.d.	Mountain Range cypress	0.0	0.0	-0.1	-0.1

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
12.1	9.6	6.2	5.3	14.7	2.5	3.1	6.6	10.7	6.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
845.8	867.7	863.1	878.2	873.6	890.2	851.9	871.7	884.5	845.8
325.9	334.0	331.1	342.6	339.4	348.0	332.4	340.1	348.6	332.6
79.4	87.5	91.4	90.1	88.1	97.1	82.9	89.1	97.7	83.4
216.8	214.9	206.5	216.0	214.3	212.9	211.4	205.4	204.2	202.8
216.8	214.9	206.5	216.0	214.3	212.9	211.4	205.4	204.2	202.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29.7	31.6	33.1	36.5	37.0	38.1	38.1	45.6	46.7	46.4
519.9	533.8	532.1	535.6	534.2	542.2	519.4	531.6	535.9	513.2
116.3	128.3	133.8	131.4	128.5	140.7	121.1	130.1	142.5	121.9
312.7	310.7	297.0	309.8	308.3	306.8	305.4	301.3	300.1	298.8
312.7	310.7	297.0	309.8	308.3	306.8	305.4	301.3	300.1	298.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22.7	23.8	24.7	28.1	27.8	27.7	26.9	30.3	29.7	28.4
68.1	71.0	76.6	66.3	69.5	67.0	66.1	69.9	63.6	64.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
112.3	110.4	100.9	104.3	102.0	82.5	85.1	88.4	85.8	84.4
63.1	63.5	56.2	62.6	62.9	46.2	51.4	56.2	55.0	54.9
49.3	46.9	44.6	41.7	39.1	36.3	33.6	32.2	30.8	29.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.1	41.1	45.8	51.0	58.7	56.9	63.6	67.5	80.2	77.7
40.1	41.1	45.8	51.0	58.7	56.9	63.6	67.5	80.2	77.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
198.9	222.8	296.1	206.3	236.9	272.3	302.9	273.4	308.6	343.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-45,8585	-52,080.8	-51,267.5	-54,356.5	-36,471.4	-49,210.4	-62,676.4	-64,355.8	-55,703.5	17,867.4
-54,116.4	-60,400.5	-59,654.2	-62,809.8	-45,019.5	-57,802.0	-71,325.9	-73,070.8	-60,489.6	-77,770.3
-24,662.5	-29,857.6	-30,632.6	-34,470.3	-17,199.6	-30,172.7	-45,028.6	-46,735.4	-30,859.0	-52,004.4
-75,844.2	-79,716.5	-84,063.4	-87,893.7	-91,355.7	-93,975.2	-98,122.8	-100,783.1	-101,725.2	-107,115.1
-69,514.7	-71,240.6	-72,782.1	-74,187.7	-75,636.4	-76,896.7	-77,918.7	-80,167.9	-79,646.3	-80,250.5
-46,109.6	-46,772.0	-47,350.9	-47,896.7	-48,428.2	-48,905.7	-49,248.1	-49,505.8	-49,721.4	-49,904.5
-30.9	-30.8	-30.8	-30.8	-30.8	-30.7	-30.7	-30.7	-30.7	-30.6
-429.0	-429.0	-429.0	-429.0	-428.9	-428.9	-428.9	-428.9	-428.9	-428.9
-483.1	-482.0	-481.0	-479.8	-477.3	-475.2	-473.4	-471.8	-470.1	-468.6
-389.7	-391.4	-393.7	-396.1	-398.2	-400.8	-403.7	-407.2	-410.9	-414.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-8,222.3	-8,254.2	-8,286.4	-8,309.8	-8,324.3	-8,326.1	-8,321.9	-8,322.8	-8,340.0	-8,331.8
-2,836.3	-2,915.2	-2,987.5	-3,053.2	-3,109.4	-3,155.2	-3,192.5	-3,223.4	-3,249.4	-3,272.7
-1,387.8	-1,393.1	-1,400.5	-1,409.6	-1,411.3	-1,429.2	-1,439.6	-1,451.1	-1,463.9	-1,478.7
-17,214.4	-17,697.9	-18,104.0	-18,492.1	-18,889.7	-19,258.9	-19,517.0	-19,691.9	-19,811.3	-19,924.1
-2,290.0	-2,301.3	-2,313.1	-2,325.6	-2,338.3	-2,352.6	-2,364.8	-2,376.5	-2,391.6	-2,402.9
-1,347.6	0,263.2	0,263.3	-1,350.8	-1,352.7	-1,354.5	-1,356.6	-1,358.8	-1,361.5	€ -1,363.9
-11,478.6	-11,528.8	-11,575.6	-11,620.1	-11,659.4	-11,693.5	-11,719.0	-11,742.7	-11,763.1	-11,787.8
-4,263.4	-5,133.3	-5,932.1	-6,651.8	-7,450.5	-8,143.5	-8,747.6	-9,346.5	-9,818.3	-10,120.9
0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
-10.2	-11.1	-12.1	-12.8	-13.7	-13.7	-13.7	-13.7	-13.7	-13.7
-119.9	-127.1	-137.7	-145.4	-164.9	-177.5	-187.9	-199.7	-207.9	-211.5
-0.1	-0.1	-0.1	-0.1	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3

IPCC Code	Categories of source and sink of greenhouse gases	1990	1991	1992	1993
4.A.1.a.i.2.e.	Chilean Palm	0.0	0.0	0.0	0.0
4.A.1.a.i.2.f.	Lenga	-170.5	-322.8	-489.9	-655.5
4.A.1.a.i.2.g.	Coihue Magallanes	-0.3	-1.3	-2.8	-5.2
4.A.1.a.i.2.h.	Ro-Hualo	-24.6	-49.4	-88.8	-113.6
4.A.1.a.i.2.i.	RoRaCo	-204.0	-347.7	-500.7	-647.4
4.A.1.a.i.2.j.	CoRaTe	-95.7	-137.3	-198.8	-257.6
4.A.1.a.i.2.k.	Sclerophyll	-192.8	-269.0	-349.8	-395.1
4.A.1.a.i.2.l.	Evergreen	-447.1	-698.5	-1,009.1	-1,272.0
4.A.1.a.i.3.	National parks and reserves	-18,183.0	-18,416.9	-18,670.7	-18,915.8
4.A.1.a.i.3.a.	Larch	-30.9	-30.9	-30.8	-30.8
4.A.1.a.i.3.b.	Guaitecas cypress	-1,305.5	-1,305.5	-1,305.5	-1,305.5
4.A.1.a.i.3.c.	Araucaria	-477.6	-476.8	-476.3	-475.7
4.A.1.a.i.3.d.	Mountain Range cypress	-7.7	-7.7	-7.8	-7.8
4.A.1.a.i.3.e.	Chilean Palm	0.0	0.0	0.0	0.0
4.A.1.a.i.3.f.	Lenga	-2,834.3	-2,836.5	-2,839.0	-2,840.5
4.A.1.a.i.3.g.	Coihue Magallanes	-5,182.7	-5,363.0	-5,569.9	-5,787.5
4.A.1.a.i.3.h.	Ro-Hualo	0.0	0.0	0.0	0.0
4.A.1.a.i.3.i.	RoRaCo	-22.4	-22.6	-22.9	-23.2
4.A.1.a.i.3.j.	CoRaTe	-1,212.8	-1,216.2	-1,219.5	-1,222.6
4.A.1.a.i.3.k.	Sclerophyll	0.0	0.0	0.0	0.0
4.A.1.a.i.3.l.	Evergreen	-7,109.0	-7,157.6	-7,199.0	-7,222.2
4.A.1.a.ii.	Forest plantations	-2,622.6	-3,336.5	-4,126.7	-4,898.3
4.A.1.a.ii.1.	Pinus radiata	-2,403.2	-3,117.1	-3,907.3	-4,678.9
4.A.1.a.ii.2.	Eucalyptus globulus	-45.7	-45.7	-45.7	-45.7
4.A.1.a.ii.3.	Eucalyptus nitens	0.0	0.0	0.0	0.0
4.A.1.a.ii.4.	Prosopis chilensis and Prosopis tamarugo	-125.8	-125.8	-125.8	-125.8
4.A.1.a.ii.5.	Pseudotsuga menziensii	-29.3	-29.3	-29.3	-29.3
4.A.1.a.ii.6.	Populus spp.	-9.7	-9.7	-9.7	-9.7
4.A.1.a.ii.7.	Other Species	-9.0	-9.0	-9.0	-9.0
4.A.1.b.	Annual biomass loss	33,890.3	42,027.8	42,298.9	46,758.1
4.A.1.b.i.	Harvest	21,054.7	26,058.8	27,847.1	29,749.2
4.A.1.b.i.1.	P. radiata logs	14,227.4	15,098.6	18,594.0	19,415.4
4.A.1.b.i.2.	Eucalyptus spp. logs	2,248.3	5,102.4	3,558.0	3,390.3
4.A.1.b.i.3.	Other exotic logs	171.0	255.0	266.6	207.2
4.A.1.b.i.4.	Native species logs	4,408.0	5,602.9	5,428.5	6,736.3
4.A.1.b.ii.	Firewood	11,094.8	12,407.0	13,761.6	12,755.8
4.A.1.b.ii.1.	Native species firewood	6,731.2	7,527.3	8,349.2	7,739.0
4.A.1.b.ii.2.	Exotic species firewood	4,363.6	4,879.7	5,412.5	5,016.9
4.A.1.b.iii.	Disturbances	1,607.2	3,404.6	577.4	4,122.3
4.A.1.b.iii.1.	Fires	1,607.2	3,404.6	577.4	4,122.3
4.A.1.b.iii.1.a.	Native forest	1,071.2	1,647.5	189.4	564.5
4.A.1.b.iii.1.b.	Forest plantations	535.9	1,757.1	388.0	3,557.8
4.A.1.b.iii.2.	Other	0.0	0.0	0.0	0.0
4.A.1.b.iv.	Controlled burning of forest waste	133.6	157.3	112.8	130.7
4.A.1.c.	Forest land with vegetation change	-1,217.7	-1,714.5	-1,993.5	-2,457.2
4.A.1.c.i.	Restitution	-16.1	-31.9	-47.7	-63.5
4.A.1.c.ii.	Replacing	-1,201.6	-1,682.6	-1,945.7	-2,393.7
4.A.2.	Land converted to forest land	-24,725.2	-26,494.0	-27,278.2	-28,990.4
4.A.2.a.	Cropland	-12,933.4	-13,728.4	-13,812.7	-14,534.8
4.A.2.a.i.	Agricultural land converted to native forest	48.2	35.7	23.1	10.6
4.A.2.a.ii.	Agricultural land converted to forest plantations	-12,981.7	-13,764.1	-13,835.8	-14,545.4
4.A.2.b.	Grassland	-11,697.7	-12,664.0	-13,360.0	-14,343.4
4.A.2.b.i.	Grassland converted to native forest	390.1	282.1	174.2	66.2

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-851.8	-1,103.7	-1,333.7	-1,545.6	-1,784.7	-1,996.2	-2,229.5	-2,426.1	-2,614.5	-2,736.5
-7.0	-9.3	-11.9	15.0	-22.8	-25.2	-28.7	-36.7	-39.47	-43.9
-152.7	-171.9	-189.4	-202.4	-212.0	-224.3	-232.4	-236.6	-242.7	-243.7
-795.2	-927.7	-1,062.7	-1,166.3	-1,265.2	-1,360.4	-1,406.8	-1,450.1	-1,500.2	-1,521.2
-305.3	-384.2	-455.9	-523.9	-588.7	-628.4	-653.1	-680.4	-697.9	-707.1
-438.3	-472.8	-499.9	-519.3	-533.3	-551.1	-561.2	-566.7	-574.3	-576.7
79,833.0	-1,925.4	-2,228.6	-2,520.8	-2,853.0	-3,166.2	92,633.9	-3,736.1	-3,927.2	-4,066.1
-19,141.7	-19,335.3	-19,499.1	-19,639.3	-19,757.6	-19,847.5	-19,923.0	-20,009.6	-20,106.6	-20,225.2
-30.8	-30.8	-30.8	-30.7	-30.7	-30.7	-30.6	-30.6	-30.6	-30.6
-1,305.5	-1,305.5	-1,305.5	-1,305.5	-1,305.5	-1,305.5	-1,305.5	-1,305.5	-1,305.5	-1,305.5
-475.1	-474.6	-474.2	-473.7	-472.6	-471.1	-470.2	-469.3	-468.6	-467.9
-7.8	-7.9	-8.1	-8.2	-8.4	-8.6	-8.7	-8.9	-9.1	-9.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-2,843.2	-2,841.8	-2,841.3	-2,839.5	-2,833.2	-2,825.3	-2,815.1	-2,806.9	-2,800.1	-2,793.8
-5,989.5	-6,166.0	-6,318.0	-6,443.6	-6,548.0	-6,630.3	-6,695.6	-6,748.7	-6,797.5	-6,841.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-23.5	-23.8	-24.2	-24.5	-24.8	-25.0	-25.0	-25.1	-25.0	-24.9
-1,225.9	-1,229.0	-1,231.8	-1,234.9	-1,238.0	-1,241.2	-1,244.2	-1,247.6	-1,251.6	-1,254.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-7,240.4	-7,256.0	-7,265.4	-7,278.6	-7,296.5	-7,309.8	-7,327.9	-7,366.9	-7,418.6	-7,497.3
-6,329.5	-8,475.9	-11,281.3	-13,705.9	-15,719.4	-17,078.4	-20,204.1	-21,921.2	-22,078.9	-26,864.6
-6,110.1	-8,053.6	-10,593.8	-12,789.2	-14,612.4	-15,843.0	-18,250.0	-20,056.9	-19,698.8	-24,553.2
-45.7	-190.5	-379.8	-543.4	-679.2	-770.9	-1,283.0	-1,140.0	-1,576.7	-1,418.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-125.8	-125.8	-125.8	-125.8	-125.8	-125.8	-125.8	-123.6	-123.6	-146.8
-29.3	-45.4	-66.5	-84.7	-99.8	-110.0	-151.4	-161.5	-169.6	-169.6
-9.7	-20.0	-33.3	-44.9	-54.5	-61.0	-96.1	-90.6	-93.4	-93.0
-9.0	-40.7	-82.1	-117.9	-147.7	-167.8	-297.8	-348.5	-416.9	-483.0
53,777.5	52,678.4	55,790.8	55,579.0	76,158.8	65,747.2	54,640.6	55,570.1	75,241.6	58,597.1
31,655.6	36,844.6	33,427.6	34,488.1	31,268.2	34,074.2	35,882.6	37,332.2	37,099.1	39,820.2
21,246.9	24,621.5	23,888.0	24,384.3	21,782.7	23,548.3	24,964.8	27,059.9	26,798.7	29,320.5
3,772.1	4,328.6	3,517.5	3,958.3	4,629.2	6,463.3	7,794.5	7,769.9	8,579.3	8,984.7
253.3	255.3	210.9	274.7	212.0	301.7	280.5	304.2	269.6	271.4
6,383.3	7,639.2	5,811.3	5,870.8	4,644.3	3,761.0	2,842.9	2,198.3	1,451.6	1,243.6
13,379.2	14,306.0	15,336.5	15,267.9	16,389.0	16,984.6	17,742.0	17,707.1	17,990.2	17,025.8
8,117.1	8,679.5	9,304.7	9,263.1	9,943.2	10,304.5	10,764.1	10,742.9	10,914.7	10,329.6
5,262.0	5,626.6	6,031.9	6,004.9	6,445.8	6,680.0	6,977.9	6,964.2	7,075.6	6,696.2
8,643.9	1,438.1	6,963.1	5,774.1	28,430.2	14,643.7	967.9	491.4	20,107.3	1,730.9
8,643.9	1,438.1	6,963.1	5,774.1	28,430.2	14,643.7	967.9	491.4	20,107.3	1,730.9
1,151.6	359.8	5,596.4	1,133.0	27,799.6	2,761.9	169.4	90.8	13,195.7	425.0
7,492.3	1,078.3	1,366.7	4,641.2	630.6	11,881.8	798.5	400.6	6,911.6	1,305.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98.8	89.7	63.6	48.8	71.4	44.7	48.1	39.4	44.9	20.2
-2,595.8	-2,819.6	-2,360.0	-2,155.6	-2,002.7	-1,944.7	-1,546.5	-1,522.5	-4,375.4	-3,486.4
-79.3	-95.1	-110.9	-126.7	-142.5	-158.3	-174.1	-189.9	-194.3	-199.0
-2,516.5	-2,724.4	-2,249.1	-2,028.9	-1,860.2	-1,786.4	-1,372.3	-1,332.6	-4,181.1	-3,287.4
-29,453.8	-30,542.9	-29,021.6	-28,339.5	-27,819.9	-27,629.3	-26,297.3	-26,335.4	-29,630.5	-25,765.9
-14,443.0	-15,094.4	-14,112.0	-13,449.4	-12,933.6	-12,731.4	-11,855.6	-11,775.4	-14,550.6	-12,243.0
-2.0	-14.5	-27.1	-39.7	-52.2	-64.8	-77.3	-89.9	-124.3	-129.7
-14,441.0	-15,079.8	-14,084.9	-13,409.7	-12,881.4	-12,666.6	-11,778.3	-11,685.6	-14,426.3	-12,113.4
-14,893.7	-15,326.1	-14,790.5	-14,768.6	-14,763.7	-14,776.7	-14,322.7	-14,440.5	-14,967.9	-13,423.3
-41.7	-149.7	-257.7	-365.6	-473.6	-581.5	-689.5	-797.4	-994.9	-1.056.0

IPCC Code	Categories of source and sink of greenhouse gases	1990	1991	1992	1993
4.A.2.b.ii.	Grassland converted to forest plantations	-12,087.8	-12,946.1	-13,534.1	-14,409.6
4.A.2.c.	Wetland	-94.1	-101.6	-105.5	-112.2
4.A.2.c.i.	Wetland converted to native forest.	0.0	0.0	0.0	0.0
4.A.2.c.ii.	Wetland converted to forest plantations	-94.1	-101.6	-105.5	-112.2
4.A.2.d.	Settlements	0.0	0.0	0.0	0.0
4.A.2.d.i.	Settlements converted to native forest	0.0	0.0	0.0	0.0
4.A.2.d.ii.	Settlements converted to forest plantations	0.0	0.0	0.0	0.0
4.A.2.e.	Other Land	0.0	0.0	0.0	0.0
4.A.2.e.i.	Other land converted to native forest.	0.0	0.0	0.0	0.0
4.A.2.e.ii.	Other land converted to forest plantations	0.0	0.0	0.0	0.0
4.B.	Cropland	634.4	699.1	762.5	826.7
4.B.1.	Cropland remaining Cropland	0.4	1.0	0.4	0.5
4.B.2.	Land converted to cropland	633.9	698.0	762.1	826.2
4.B.2.a.	Forest Land converted to cropland	263.8	275.8	287.8	299.9
4.B.2.b.	Grassland converted to cropland	366.2	414.4	462.5	510.7
4.B.2.c.	Wetland converted to cropland	3.9	7.9	11.8	15.7
4.B.2.d.	Settlements converted to cropland	0.0	0.0	0.0	0.0
4.B.2.e.	Other Land converted to cropland	0.0	0.0	0.0	0.0
4.C.	Grassland	6,623.1	6,608.2	6,588.6	6,573.3
4.C.1.	Grassland remaining Grassland	2.5	5.0	2.9	5.0
4.C.2.	Land converted to grassland	6,620.6	6,603.2	6,585.7	6,568.3
4.C.2.a.	Forest Land converted to grassland	6,376.1	6,376.1	6,376.1	6,376.1
4.C.2.b.	Cropland converted to grassland	244.6	227.1	209.7	192.2
4.C.2.c.	Wetland converted to grassland	0.0	0.0	0.0	0.0
4.C.2.d.	Settlements converted to grassland	0.0	0.0	0.0	0.0
4.C.2.e.	Other Land converted to grassland	0.0	0.0	0.0	0.0
4.D.	Wetland	116.7	116.7	116.7	116.7
4.D.1.	Wetland remaining Wetland	0.0	0.0	0.0	0.0
4.D.2.	Land converted to wetland	116.7	116.7	116.7	116.7
4.D.2.a.	Forest Land converted to wetland	85.9	85.9	85.9	85.9
4.D.2.b.	Cropland converted to wetland	14.0	14.0	14.0	14.0
4.D.2.c.	Grassland converted to wetland	16.8	16.8	16.8	16.8
4.D.2.d.	Settlements converted to wetland	0.0	0.0	0.0	0.0
4.D.2.e.	Other Land converted to wetland	0.0	0.0	0.0	0.0
4.E.	Settlements	272.0	280.6	289.2	297.8
4.E.1.	Settlements remaining Settlements	0.0	0.0	0.0	0.0
4.E.2.	Land converted to Settlements	272.0	280.6	289.2	297.8
4.E.2.a.	Forest Land converted to Settlements	52.7	53.7	54.7	55.7
4.E.2.b.	Cropland converted to Settlements	182.5	187.0	191.4	195.9
4.E.2.c.	Grassland converted to Settlements	36.7	39.7	42.8	45.8
4.E.2.d.	Wetland converted to Settlements	0.1	0.2	0.4	0.5
4.E.2.e.	Other Land converted to Settlements	0.0	0.0	0.0	0.0
4.F.	Other Land	342.4	353.3	364.2	375.2
4.F.1.	Other land remaining Other Land	0.0	0.0	0.0	0.0
4.F.2.	Land converted to other land	342.4	353.3	364.2	375.2
4.F.2.a.	Forest Land converted to other land	332.7	340.0	347.3	354.6
4.F.2.b.	Cropland converted to other land	0.0	0.0	0.0	0.0
4.F.2.c.	Grassland converted to other land	9.6	13.3	16.9	20.6
4.F.2.d.	Wetland converted to other land	0.0	0.0	0.0	0.0
4.F.2.e.	Settlements converted to other land	0.0	0.0	0.0	0.0
4.G.	Harvested wood products	0.0	0.0	0.0	0.0
4.H.	Other (please specify)	0.0	0.0	0.0	0.0

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
-14,852.0	-15,176.4	-14,532.9	-14,403.0	-14,290.2	-14,195.2	-13,633.2	-13,643.0	-13,972.9	-12,367.3
-117.1	-122.4	-119.0	-121.5	-122.6	-121.2	-119.0	-119.5	-112.0	-99.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-117.1	-122.4	-119.0	-121.5	-122.6	-121.2	-119.0	-119.5	-112.0	-99.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
890.8	954.9	1,019.1	1,083.2	1,147.1	1,211.9	1,275.2	1,339.3	1,319.4	1,364.2
0.4	0.5	0.5	0.6	0.3	1.0	0.3	0.3	1.1	0.1
890.3	954.4	1,018.5	1,082.6	1,146.7	1,210.8	1,274.9	1,339.0	1,318.3	1,364.1
311.9	323.9	335.9	348.0	360.0	372.0	384.0	396.0	436.1	446.0
558.8	607.0	655.1	703.3	751.4	799.5	847.7	895.8	833.8	868.3
19.6	23.6	27.5	31.4	35.4	39.3	43.2	47.2	48.5	49.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6,557.9	6,536.0	6,519.3	6,502.3	6,499.8	6,472.9	6,447.9	6,429.7	2,595.7	2,585.4
7.0	2.6	3.3	3.8	5.1	7.8	1.8	1.0	5.4	4.4
6,550.8	6,533.4	6,515.9	6,498.5	6,494.7	6,465.1	6,446.1	6,428.7	2,590.3	2,581.0
6,376.1	6,376.1	6,376.1	6,376.1	6,389.8	6,377.6	6,376.1	6,376.1	2,660.9	2,660.9
174.8	157.3	139.9	122.4	105.0	87.5	70.1	52.6	-70,7	-79,9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
116.7	116.7	116.7	116.7	116.7	116.7	116.7	116.7	40.5	40.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
116.7	116.7	116.7	116.7	116.7	116.7	116.7	116.7	40.5	40.5
85.9	85.9	85.9	85.9	85.9	85.9	85.9	85.9	28.4	28.4
14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	7.2	7.2
16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	4.9	4.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
306.4	315.0	323.6	332.2	340.8	349.4	358.0	366.6	326.0	333.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
306.4	315.0	323.6	332.2	340.8	349.4	358.0	366.6	326.0	333.2
56.7	57.7	58.7	59.7	60.7	61.7	62.7	63.7	83.9	85.1
200.3	204.8	209.2	213.7	218.1	222.5	227.0	231.4	165.2	167.9
48.8	51.8	54.8	57.9	60.9	63.9	66.9	70.0	75.3	78.6
0.6	0.7	0.9	1.0	1.1	1.2	1.4	1.5	1.5	1.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
386.1	397.0	408.0	418.9	443.7	440.8	451.7	462.7	504.5	513.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
386.1	397.0	408.0	418.9	443.7	440.8	451.7	462.7	504.5	513.6
361.9	369.2	376.5	383.8	404.9	398.3	405.6	412.9	457.8	465.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24.2	27.9	31.5	35.2	38.8	42.5	46.1	49.8	46.7	47.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

IPCC Code	Categories of source and sink of greenhouse gases	1990	1991	1992	1993
5.	Waste	2,969.3	3,031.7	3,110.0	3,163.8
5.A.	Solid waste disposal	2,288.7	2,336.8	2,386.2	2,439.0
5.A.1.	Managed waste disposal sites	0.5	0.5	0.5	735.5
5.A.2.	Unmanaged waste disposal sites	507.4	496.3	430.3	429.3
5.A.3.	Uncategorized waste disposal sites	1,780.8	1,840.0	1,955.5	1,274.2
5.B.	Biological treatment of solid waste	17.0	17.0	17.0	17.0
5.C.	Incineration and open burning of waste	0.0	0.0	0.0	0.0
5.C.1.	Waste Incineration	0.0	0.0	0.0	0.0
5.C.2.	Open Burning of Waste	0.0	0.0	0.0	0.0
5.D.	Wastewater Treatment and discharge	663.6	677.9	706.7	707.8
5.D.1.	Domestic Wastewater Treatment and Discharge	596.2	601.5	615.1	611.3
5.D.2.	Industrial Wastewater Treatment and Discharge	67.4	76.4	91.6	96.5
5.E.	Other	0.0	0.0	0.0	0.0
Anx.	Memo items				
Anx.1.	International bunker	932.7	1,205.8	1,248.1	1,374.3
Anx.1.a.	International Aviation	337.5	560.3	573.7	596.3
Anx.1.b.	International Navigation	595.2	645.5	674.4	778.0
Anx.2.	Multilateral Operations	0.0	0.0	0.0	0.0
Anx.3.	CO_2 emissions from biomass	12,001.1	13,238.2	14,697.1	13,579.4

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
3,257.1	3,391.3	3,500.2	3,580.9	3,643.7	3,723.5	3,822.4	4,205.7	4,661.4	4,846.6
2,527.1	2,616.2	2,704.9	2,795.8	2,889.1	2,981.0	3,071.7	3,162.4	3,252.4	3,389.9
770.4	805.3	888.0	987.2	1,025.1	1,062.5	1,106.6	1,181.7	2,071.0	2,311.4
374.5	372.7	345.4	348.6	355.4	364.3	347.4	343.9	244.7	239.6
1,382.1	1,438.3	1,471.5	1,460.0	1,508.6	1,554.2	1,617.7	1,636.8	936.7	838.9
17.0	17.0	17.0	19.3	19.3	19.3	20.4	23.1	35.5	35.5
0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
713.0	758.1	778.1	765.7	735.2	723.1	730.3	1,020.0	1,373.4	1,421.1
603.4	618.5	632.2	608.5	586.5	588.1	585.4	758.8	1,120.0	1,146.3
109.6	139.5	145.9	157.2	148.7	135.0	144.9	261.2	253.4	274.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,731.6	1,827.1	1,532.3	1,959.5	2,402.8	2,483.0	3,111.3	3,327.7	3,661.3	3,982.8
661.2	646.9	647.5	749.1	1,076.4	1,105.7	1,055.4	1,056.0	1,200.5	1,081.2
1,070.4	1,180.2	884.8	1,210.4	1,326.4	1,377.4	2,056.0	2,271.7	2,460.9	2,901.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14,268.6	15,280.7	16,382.4	16,309.1	17,506.3	18,142.4	18,952.6	18,915.9	19,216.5	18,154.8

Table A. 16. GHG emissions and removals (kt CO_2 eq), series 2004-2016

IPCC Code	Categories of source and sink of greenhouse gases	2004	2005	2006	2007
	All national emissions and removals	15,739.4	18,234.0	15,630.4	37,556.9
1.	Energy	56,472.0	57,958.9	58,805.0	68,348.7
1.1A.	Fuel combustion activities (reference approach)	53,367.9	55,718.9	55,449.8	63,664.7
1.A.	Fuel combustion activities (sectorial approach)	55,014.6	56,472.7	57,409.7	67,207.3
1.A.1.	Energy industries	19,636.5	18,955.2	19,789.5	26,632.8
1.A.1.a.	Main Activity Electricity and heat production	16,080.9	15,429.9	16,327.6	23,969.4
1.A.1.a.i.	Electricity Generation	16,080.9	15,429.9	16,327.6	23,969.4
1.A.1.a.ii.	Combined heat and power generation (CHP)	-	-	-	-
1.A.1.a.iii.	Heat plants	-	-	-	-
1.A.1.b.	Petroleum Refining	2,475.0	2,506.6	2,437.3	1,675.1
1.A.1.c.	Manufactur of solid fuels and other energy industries	1,080.6	1,018.7	1,024.6	988.3
1.A.1.c.i.	Manufacture of solid fuels	1,077.8	1,017.7	1,023.3	985.0
1.A.1.c.ii.	Other energy industries	2.8	1.0	1.3	3.3
1.A.2.	Manufacturing industries and construction	12,172.1	12,969.2	13,543.8	14,543.7
1.A.2.a.	Iron and steel	1,290.7	1,452.2	1,485.7	1,523.9
1.A.2.b.	Non-ferrous metals	-	-	-	-
1.A.2.c.	Chemical	354.7	1,258.5	586.7	272.3
1.A.2.d.	Pulp, paper and print	760.7	828.6	1,011.5	1,234.1
1.A.2.e.	Food processing, beverages and tobacco	393.2	415.4	361.9	324.5
1.A.2.f.	Non-metallic minerals	961.2	867.5	869.6	960.2
1.A.2.g.	Transport equipment	-	-	-	-
1.A.2.h.	Machinery	-	-	-	-
1.A.2.i.	Mining (excluding fuel) and quarrying	4,215.9	4,459.7	4,837.7	5,134.1
1.A.2.j.	Wood and wood products	-	-	-	-
1.A.2.k.	Construction	-	-	-	-
1.A.2.l.	Textiles and leather	-	-	-	-
1.A.2.m.	Non-specified industry	4,195.7	3,687.2	4,390.8	5,094.7
1.A.3.	Transport	17,338.9	19,096.9	18,707.4	20,273.5
1.A.3.a.	Civil aviation	702.6	949.0	886.8	980.8
1.A.3.a.i.	International aviation (international Bunkers)				
1.A.3.a.ii.	Domestic aviation	702.6	949.0	886.8	980.8
1.A.3.b.	Road Transportation	14,581.7	15,740.3	15,683.1	16,767.2
1.A.3.b.i.	Cars	3,911.1	4,004.5	3,957.8	4,184.9
1.A.3.b.i.1.	Passenger cars with 3- way catalysts	2,440.5	2,677.5	2,857.6	3,255.7
1.A.3.b.i.2.	Passenger cars without 3-way catalysts	1,470.6	1,327.0	1,100.2	929.3
1.A.3.b.ii.	Light-duty trucks	2,730.1	2,787.5	2,722.5	2,857.2
1.A.3.b.ii.1.	Light duty trucks with 3-way catalysts	1,595.1	1,783.6	1,896.4	2,153.8
1.A.3.b.ii.2.	Light duty trucks without 3-way catalysts	1,135.0	1,004.0	826.1	703.4
1.A.3.b.iii.	Heavy-duty trucks and buses	7,926.2	8,932.2	8,981.5	9,692.2
1.A.3.b.iv.	Motorcycles	14.3	16.0	21.3	32.8
1.A.3.b.v.	Evaporative emissions from vehicles	-	-	-	-
1.A.3.b.vi.	Urea-based catalysts	-	-	-	-
1.A.3.c.	Railways	62.8	59.8	64.9	68.6
1.A.3.d.	Water-borne Navigation	1,419.2	1,763.3	1,545.3	1,942.7
1.A.3.d.i.	International waterborne navigation (International bunkers)				
1.A.3.d.ii.	Domestic water-borne Navigation	1,419.2	1,763.3	1,545.3	1,942.7
1.A.3.e.	Other transportation	572.6	584.6	527.2	514.2
1.A.3.e.i.	Pipeline transport	-	-	-	-
1.A.3.e.ii.	Off-road	572.6	584.6	527.2	514.2
1.A.4.	Other sectors	5,867.1	5,451.3	5,369.1	5,757.2
1.A.4.a.	Commercial / Institutional	954.6	841.9	874.9	1,014.2
1.A.4.b.	Residential	4,197.9	4,107.2	4,149.6	4,406.7

2008	2009	2010	2011	2012	2013	2014	2015	2016
36,246.8	28,347.6	20,252.9	34,756.8	43,568.8	32,946.2	46,552.0	64,530.1	46,184.4
69,661.4	67,513.6	68,945.1	76,700.1	80,830.9	80,524.6	78,220.2	84,974.1	87,135.2
66,992.6	63,823.0	66,079.5	76,091.9	79,668.1	78,615.3	77,578.6	80,085.8	84,570.0
68,627.2	66,280.9	67,733.7	75,569.7	79,775.1	79,474.1	77,240.0	84,019.0	86,133.5
27,161.8	25,510.5	25,809.8	31,940.0	34,173.5	33,097.1	30,196.9	34,500.0	35,711.1
24,452.4	22,799.9	24,028.5	29,759.3	32,176.5	30,080.9	28,275.4	32,752.1	34,579.6
24,452.4	22,799.9	24,028.5	29,759.3	32,176.5	30,080.9	28,275.4	32,752.1	34,579.6
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
1,698.8	1,776.5	1,129.7	1,200.1	1,065.8	2,123.5	1,030.4	931.6	366.1
1,010.6	934.2	651.6	980.5	931.2	892.7	891.1	816.2	765.3
1,010.6	933.9	651.6	980.5	931.2	892.7	800.8	816.0	765.3
-	0.3	-	-	-	-	90.3	0.3	-
14,223.5	13,323.7	13,844.3	13,651.2	15,491.4	14,548.5	17,382.7	16,902.0	16,129.2
1,435.2	1,303.3	215.3	592.7	849.8	258.7	271.2	258.7	272.1
-	-	-	-	-	-	-	-	-
204.9	183.0	481.3	428.3	823.1	797.2	1,363.9	893.1	337.1
1,062.4	1,205.8	808.7	776.6	1,776.3	1,442.5	1,774.5	1,375.8	1,543.1
241.7	168.2	263.9	393.4	318.7	286.0	292.3	294.0	328.3
1,105.5	1,114.3	985.9	876.7	957.5	1,054.5	892.5	911.5	985.6
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
5,183.3	5,648.1	8,059.3	6,438.1	5,854.7	5,923.9	7,149.0	7,823.6	7,967.0
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
4,990.5	3,701.0	3,029.9	4,145.5	4,911.3	4,785.7	5,639.2	5,345.3	4,696.0
21,227.9	21,229.6	20,912.4	21,816.4	22,825.1	24,818.4	23,541.4	25,475.9	26,936.2
1,308.0	899.6	789.6	805.7	1,457.3	1,323.4	1,265.2	1,864.9	1,674.5
1,308.0	899.6	789.6	805.7	1,457.3	1,323.4	1,265.2	1,864.9	1,674.5
17,395.2	18,036.3	18,710.4	19,662.4	20,106.9	21,756.9	20,530.5	22,256.5	23,611.4
4,316.2	4,762.1	5,733.9	5,637.8	6,124.2	6,856.4	7,343.2	7,638.0	8,289.7
3,606.0	4,097.9	5,058.5	5,082.6	5,622.2	6,389.1	6,929.1	7,281.5	7,968.3
710.2	664.2	675.3	555.2	502.0	467.3	414.2	356.5	321.4
2,951.8	3,133.8	4,057.2	4,216.9	4,456.0	4,829.6	4,624.3	5,042.1	5,441.6
2,402.1	2,612.2	3,524.0	3,771.0	4,040.4	4,428.2	4,253.6	4,705.7	5,121.9
549.7	521.7	533.2	445.9	415.6	401.5	370.7	336.5	319.7
10,083.9	10,089.7	8,860.7	9,750.1	9,458.6	9,992.4	8,473.3	9,485.3	9,784.8
43.4	50.6	58.7	57.5	68.1	78.4	89.7	91.1	95.2
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
159.8	153.7	152.6	158.2	159.8	155.2	199.4	112.9	153.4
1,882.1	1,571.4	434.4	621.9	467.7	889.2	797.2	505.3	745.0
1,882.1	1,571.4	434.4	621.9	467.7	889.2	797.2	505.3	745.0
482.8	568.7	825.4	568.3	633.5	693.7	749.0	736.3	752.0
-	-	-	-	-	-	-	-	-
482.8	568.7	825.4	568.3	633.5	693.7	749.0	736.3	752.0
6,014.0	6,217.2	7,167.2	8,162.1	7,285.0	7,010.1	6,119.0	7,141.1	7,357.0
1,329.5	1,272.8	1,681.3	2,292.6	1,777.3	1,420.0	1,506.2	1,619.5	2,188.7
4,194.8	4,396.8	4,555.3	4,633.8	4,711.9	4,875.1	3,969.5	4,791.1	4,286.8

IPCC Code	Categories of source and sink of greenhouse gases	2004	2005	2006	2007
1.A.4.c.	Agriculture / Forestry / Fishing / Fish Farms	714.7	502.2	344.5	336.3
1.A.4.c.i.	Stationary	-	-	-	-
1.A.4.c.ii.	Off-road Vehicles and Other Machinery	14.7	16.6	17.0	18.4
1.A.4.c.iii.	Fishing (mobile combustion)	699.9	485.5	327.5	317.8
1.A.5.	Non-specified	-	-	-	-
1.A.5.a.	Stationary	-	-	-	-
1.A.5.b.	Mobile	-	-	-	-
1.A.5.b.i.	Mobile (aviation component)	-	-	-	-
1.A.5.b.ii.	Mobile (waterborne component)	-	-	-	-
1.A.5.b.iii.	Mobile (other)	-	-	-	-
1.A.5.c.	Multilateral operations (Information item)				
1.B.	Fugitive emissions from fuels	1,457.4	1,486.2	1,395.3	1,141.4
1.B.1.	Solid fuels	50.3	60.3	46.4	65.5
1.B.1.a.	Coal mining and handling	50.3	60.3	46.4	65.5
1.B.1.a.i.	Underground mines	48.1	47.4	33.9	63.2
1.B.1.a.i.1.	Mining	42.3	41.6	29.7	55.5
1.B.1.a.i.2.	Post-mining seam gas emissions	5.9	5.8	4.1	7.7
1.B.1.a.i.3.	Abandoned underground mines	-	-	-	-
1.B.1.a.i.4.	Flaring of drained methane or conversion ofmethane to CO_2	-	-	-	-
1.B.1.a.ii.	Surface Mines	2.1	12.9	12.5	2.3
1.B.1.a.ii.1.	Mining	2.0	11.9	11.6	2.1
1.B.1.a.ii.2.	Post-mining seam gas emissions	0.2	1.0	1.0	0.2
1.B.1.b.	Uncontrolled combustion and burning coal dumps	-	-	-	-
1.B.1.c.	Other	-	-	-	-
1.B.2.	Oil and natural gas	1,407.1	1,425.8	1,348.9	1,075.9
1.B.2.a.	Oil	162.7	152.7	135.7	119.1
1.B.2.a.i.	Venting	0.1	0.0	0.0	0.0
1.B.2.a.ii.	Flaring	-	-	-	-
1.B.2.a.iii.	All other	162.6	152.7	135.7	119.1
1.B.2.a.iii.1.	Exploration	-	-	-	-
1.B.2.a.iii.2.	Production and Upgrading	154.4	144.4	127.1	111.3
1.B.2.a.iii.3.	Transport	1.6	1.6	1.7	1.5
1.B.2.a.iii.4.	Refining	6.6	6.6	6.9	6.2
1.B.2.a.iii.5.	Distribution of oil products	-	-	-	-
1.B.2.a.iii.6.	Other	-	-	-	-
1.B.2.b.	Natural Gas	1,244.5	1,273.1	1,213.2	956.8
1.B.2.b.i.	Venting	20.6	10.4	21.6	20.2
1.B.2.b.ii.	Flaring	-	-	-	-
1.B.2.b.iii.	All other	1,223.8	1,262.6	1,191.6	936.6
1.B.2.b.iii.1.	Exploration	-	-	-	-
1.B.2.b.iii.2.	Production	641.5	699.3	670.3	629.3
1.B.2.b.iii.3.	Processing	54.3	52.6	48.6	28.7
1.B.2.b.iii.4.	Transmission and storage	137.2	132.7	122.8	72.4
1.B.2.b.iii.5.	Distribution	390.8	378.1	349.9	206.2
1.B.2.b.iii.6.	Other	-	-	-	-
1.B.3.	Other emissions from Energy Production	-	-	-	-
1.C.	Carbon dioxide Transport and storage	-	-	-	-
1.C.1.	Transport of CO2	-	-	-	-
1.C.1.a.	Pipelines	-	-	-	-
1.C.1.b.	Ships	-	-	-	-
1.C.1.c.	Other (please specify)	-	-	-	-
1.C.2.	Injections and storage	-	-	-	-
1.C.2.a.	Injection	-	-	-	-

2008	2009	2010	2011	2012	2013	2014	2015	2016
489.7	547.6	930.6	1,235.7	795.8	715.1	643.3	730.4	881.5
-	-	-	-	-	-	-	-	-
19.9	21.2	20.5	22.5	21.9	23.2	32.1	36.8	35.2
469.7	526.4	910.1	1,213.3	773.9	691.8	611.2	693.6	846.3
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
1,034.2	1,232.7	1,211.5	1,130.4	1,055.8	1,050.5	980.2	955.2	1,001.6
79.9	51.9	47.6	56.5	60.9	109.6	153.4	119.3	91.9
79.9	51.9	47.6	56.5	60.9	109.6	153.4	119.3	91.9
72.9	40.6	36.4	45.1	48.5	49.6	66.9	53.9	39.4
64.0	35.7	32.0	39.6	42.5	43.5	58.7	47.3	34.6
8.9	5.0	4.4	5.5	5.9	6.0	8.2	6.6	4.8
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
7.0	11.3	11.2	11.4	12.4	60.1	86.5	65.4	52.5
6.5	10.4	10.3	10.5	11.5	55.4	79.9	60.4	48.4
0.5	0.9	0.9	0.9	1.0	4.6	6.7	5.0	4.0
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
954.3	1,180.8	1,163.9	1,073.9	994.9	940.9	826.8	835.8	909.7
123.6	170.6	195.9	215.4	279.5	308.5	306.1	222.9	187.2
0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
-	-	-	-	-	-	-	-	-
123.5	170.5	195.9	215.3	279.4	308.4	306.0	222.8	187.1
-	-	-	-	-	-	-	-	-
115.5	162.7	189.3	208.3	272.6	301.2	298.7	216.0	180.4
1.6	1.6	1.3	1.4	1.3	1.4	1.4	1.4	1.3
6.5	6.3	5.3	5.6	5.4	5.8	5.8	5.5	5.4
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
830.7	1,010.2	968.0	858.5	715.4	632.3	520.7	613.0	722.5
9.6	24.7	19.1	15.5	12.1	9.5	7.7	7.7	7.7
-	-	-	-	-	-	-	-	-
821.1	985.4	948.9	843.0	703.3	622.9	513.0	605.2	714.7
-	-	-	-	-	-	-	-	-
642.8	769.2	593.9	482.0	375.5	294.3	240.9	306.8	367.2
16.6	20.2	33.1	33.7	30.6	30.7	25.4	27.8	32.4
42.0	50.9	83.6	85.0	77.2	77.4	64.1	70.3	81.9
119.7	145.2	238.3	242.3	220.0	220.5	182.6	200.3	233.2
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

IPCC Code	Categories of source and sink of greenhouse gases	2004	2005	2006	2007
1.C.2.b.	Storage	-	-	-	-
1.C.3.	Other	-	-	-	-
2.	Industrial processes and product use	7,067.5	7,236.2	7,643.1	6,352.8
2.A.	Minerals industry	1,597.8	1,613.4	1,703.4	1,856.8
2.A.1.	Cement Production	1,214.9	1,172.6	1,258.6	1,340.1
2.A.2.	Lime production	316.5	373.1	371.3	416.3
2.A.3.	Glass Productio	66.4	67.7	73.5	100.4
2.A.4.	Other Process Uses of Carbonates	-	-	-	-
2.A.4.a.	Ceramics	-	-	-	-
2.A.4.b.	Other uses of soda ash	-	-	-	-
2.A.4.c.	Non Metallurgical Magnesia Production	-	-	-	-
2.A.4.d.	Other (specify)	-	-	-	-
2.A.5.	Other (please specify)	-	-	-	-
2.B.	Chemical industry	2,790.9	3,075.1	3,197.1	1,740.4
2.B.1.	Ammonia Production	-	-	-	-
2.B.2.	Nitric acid production	811.4	856.8	873.5	374.5
2.B.3.	Adipic acid Production	-	-	-	-
2.B.4.	Caprolactam, Glyoxal and Glyoxylic Acid Production	-	-	-	-
2.B.5.	Carbide Production	-	-	-	-
2.B.6.	Titanium dioxide production	-	-	-	-
2.B.7.	Soda ash production	-	-	-	-
2.B.8.	Petrochemical and carbon black production	1,979.5	2,218.3	2,323.6	1,365.9
2.B.8.a.	Methanol	1,921.1	2,161.3	2,270.8	1,314.0
2.B.8.b.	Ethylene	58.5	57.0	52.8	51.9
2.B.8.c.	Ethylene dichloride and vinyl chloride monomer	-	-	-	-
2.B.8.d.	Ethylene oxide	-	-	-	-
2.B.8.e.	Acrylonitrile	-	-	-	-
2.B.8.f.	Carbon Black	-	-	-	-
2.B.9.	Fluorchemical production	-	-	-	-
2.B.9.a.	By-product Emissions	-	-	-	-
2.B.9.b.	Fugitive Emissions	-	-	-	-
2.B.10.	Other (specify)	-	-	-	-
2.C.	Metals industry	2,211.2	2,046.2	2,126.2	2,026.4
2.C.1.	Iron and Steel Production	2,211.2	2,046.0	2,126.1	2,026.2
2.C.2.	Ferroalloys Production	-	0.2	0.1	0.3
2.C.3.	Aluminium Production	-	-	-	-
2.C.4.	Magnesium Production	-	-	-	-
2.C.5.	Lead Production	-	-	-	-
2.C.6.	Zinc Production	-	-	-	-
2.C.7.	Other (specify)	-	-	-	-
2.D.	Non-Energy Products from Fuels and Solvent Use	99.2	108.3	106.5	101.9
2.D.1.	Lubricant Use	88.9	96.9	96.6	92.7
2.D.2.	Paraffin Wax Use	10.2	11.4	9.9	9.2
2.D.3.	Solvent Use	-	-	-	-
2.D.4.	Other (specify)	-	-	-	-
2.E.	Electronics industry	-	-	-	-
2.E.1.	Integrated circuits or semiconductors	-	-	-	-
2.E.2.	TFT Flat Panel Display	-	-	-	-
2.E.3.	Photovoltaics	-	-	-	-
2.E.4.	Heat Transfer fluids	-	-	-	-
2.E.5.	Other (specify)	-	-	-	-
2.F.	Product uses as substitutes for ozone depleting substances	245.9	279.8	380.3	482.1
2.F.1.	Refrigeration and air conditioning	235.7	259.5	357.4	459.4

2008	2009	2010	2011	2012	2013	2014	2015	2016
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
6,073.2	5,463.2	5,492.4	6,335.9	6,689.1	6,142.4	6,231.2	6,583.2	6,938.9
1,826.4	1,556.2	1,551.1	1,619.7	1,709.0	1,559.8	1,527.2	1,503.4	1,601.7
1,330.9	1,100.0	1,065.3	1,099.5	1,147.7	966.4	870.9	841.9	882.0
396.5	371.2	412.4	432.9	476.6	498.7	560.7	564.8	616.7
99.0	85.0	73.4	87.3	84.7	94.6	95.7	96.7	103.0
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
1,229.2	1,138.0	1,206.3	932.5	913.2	762.8	696.9	712.2	738.3
-	-	-	-	-	-	-	-	-
401.9	413.0	504.0	486.4	594.7	541.3	528.2	538.7	452.2
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
827.4	725.0	702.3	446.0	318.5	221.5	168.8	173.5	286.1
776.3	672.1	667.6	395.2	223.9	145.4	118.0	145.5	281.6
51.1	52.9	34.7	50.8	94.7	76.1	50.8	27.9	4.5
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
1,947.2	1,701.9	1,251.4	2,092.0	2,062.9	1,577.4	1,293.2	1,392.9	1,327.6
1,947.1	1,701.9	1,251.2	2,092.0	2,062.8	1,577.4	1,293.2	1,392.9	1,327.6
0.1	0.0	0.2	0.0	0.1	0.1	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
247.9	140.9	241.0	128.9	188.0	142.0	146.2	145.2	129.9
238.7	134.2	231.8	119.9	179.3	130.3	136.2	134.4	119.9
9.2	6.7	9.3	9.0	8.7	11.7	10.0	10.7	10.0
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
643.5	757.5	1,000.0	1,318.0	1,582.8	1,866.5	2,334.7	2,587.2	2,869.1
610.7	706.9	931.8	1,238.8	1,495.3	1,760.3	2,192.5	2,435.2	2,753.2

IPCC Code	Categories of source and sink of greenhouse gases	2004	2005	2006	2007
2.F.1.a.	Refrigeration and stationary air conditioning	235.7	259.5	357.4	459.4
2.F.1.b.	Mobile air conditioning	-	-	-	-
2.F.2.	Foam Blowing Agents	4.0	13.0	12.8	9.7
2.F.3.	Fire protection	4.7	5.6	7.1	8.6
2.F.4.	Aerosols	-	0.1	0.1	-
2.F.5.	Solvents	1.3	1.4	2.7	4.1
2.F.6.	Other applications (specify)	0.2	0.2	0.1	0.2
2.G.	Other Product Manufacture and Use	122.5	113.3	129.7	145.2
2.G.1.	Electrical equipment	122.5	113.3	129.7	145.2
2.G.1.a.	Manufacture of electrical equipment	14.2	0.6	16.8	27.1
2.G.1.b.	Use of electrical equipment	108.3	112.7	112.9	118.1
2.G.1.c.	Disposal of Electrical Equipment	-	-	-	-
2.G.2.	SF_6 and PFC from other product uses	-	-	-	-
2.G.2.a.	Military applications	-	-	-	-
2.G.2.b.	Accelerators	-	-	-	-
2.G.2.c.	Other (specify)	-	-	-	-
2.G.3.	N_2O of product uses	-	-	-	-
2.G.3.a.	Medical applications	-	-	-	-
2.G.3.b.	Propellant for pressurized products and aerosol products	-	-	-	-
2.G.3.c.	Other (specify)	-	-	-	-
2.G.4.	Other (specify)	-	-	-	-
2.H.	Other	-	-	-	-
2.H.1.	Pulp and paper industry	-	-	-	-
2.H.2.	Food And Beverages industry	-	-	-	-
2.H.3.	Other (specify)	-	-	-	-
3.	Agriculture	14,104.9	13,906.7	14,074.6	14,212.7
3.A.	Enteric fermentation	6,084.1	6,045.7	6,017.0	5,971.8
3.A.1.	Cattle	5,229.0	5,184.1	5,145.4	5,098.8
3.A.1.a.	Dairy cows	1,062.5	1,047.3	1,038.8	1,022.7
3.A.1.b.	Other cattle	4,166.5	4,136.8	4,106.6	4,076.1
3.A.1.b.i.	Beef Cows	1,268.4	1,265.4	1,262.3	1,259.2
3.A.1.b.ii.	Heifers	954.6	947.6	940.4	933.1
3.A.1.b.iii.	Adult meat (>2 years heifer, bulls and stud bull, oxen)	429.7	414.6	399.4	384.2
3.A.1.b.iv.	Young meat (1-2 year heifer)	650.8	645.8	640.6	635.4
3.A.1.b.v.	Calves	863.1	863.4	863.8	864.2
3.A.2.	Sheep	479.4	481.6	483.8	486.1
3.A.3.	Swine	97.3	106.6	119.3	123.5
3.A.3.a.	Pigs	13.0	14.2	15.9	16.5
3.A.3.b.	Male pigs	0.3	0.3	0.4	0.4
3.A.3.c.	Juvenile	84.1	92.1	103.0	106.6
3.A.4.	Other species	278.3	273.4	268.4	263.5
3.A.4.a.	Buffalo	-	-	-	-
3.A.4.b.	Goat	92.3	92.3	92.4	92.4
3.A.4.c.	Horses	157.1	152.8	148.6	144.3
3.A.4.d.	Mules and donkeys	6.3	6.1	5.9	5.7
3.A.4.e.	Poultry	-	-	-	-
3.A.4.f.	Camels (Llamas and alpacas)	18.6	17.7	16.8	15.9
3.A.4.g.	Other	4.0	4.4	4.8	5.2
3.A.4.g.i.	Deer	3.8	4.2	4.6	5.0
3.A.4.g.ii.	Warthog	0.2	0.2	0.2	0.2
3.B.	Manure management	2,059.8	2,155.7	2,251.8	2,340.8
3.B.1.	Cattle	1,005.5	990.0	975.0	959.1
3.B.1.a.	Dairy cows	143.9	139.5	135.8	131.2

2008	2009	2010	2011	2012	2013	2014	2015	2016
610.7	706.9	931.8	1,238.8	1,495.3	1,760.3	2,192.5	2,435.2	2,753.2
-	-	-	-	-	-	-	-	-
8.2	8.2	8.3	8.4	8.3	12.9	11.9	21.9	25.5
10.7	13.9	16.5	22.4	27.4	29.1	36.0	45.3	56.5
8.9	19.6	30.7	35.7	35.4	43.1	72.8	60.7	15.6
4.6	8.2	11.7	10.8	12.2	14.7	13.2	14.9	11.2
0.4	0.6	1.0	2.0	4.2	6.4	8.3	9.2	7.1
178.9	168.7	242.7	244.8	233.1	233.8	232.9	242.3	272.3
178.9	168.7	242.7	244.8	233.1	233.8	232.9	242.3	272.3
52.3	25.9	54.0	34.7	16.5	16.5	14.8	24.0	50.9
126.5	142.8	150.8	164.0	170.4	171.1	171.9	172.1	175.2
-	-	37.9	46.2	46.2	46.2	46.2	46.2	46.2
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
13,983.4	13,541.0	13,244.1	12,582.8	12,679.5	12,848.4	12,419.1	12,210.6	11,801.6
5,740.4	5,466.5	5,250.4	5,012.8	5,164.4	5,292.1	5,064.1	4,833.5	4,682.0
4,884.0	4,626.8	4,423.7	4,206.8	4,370.6	4,535.0	4,350.9	4,150.6	4,022.0
1,011.1	957.8	959.1	947.2	994.8	1,043.3	988.9	917.6	895.4
3,872.9	3,669.1	3,464.6	3,259.6	3,375.8	3,491.7	3,362.0	3,233.0	3,126.6
1,195.3	1,132.0	1,069.3	1,007.2	1,070.3	1,132.7	1,053.6	975.1	941.0
904.0	874.5	844.5	814.1	845.1	876.5	862.5	848.3	836.7
345.3	306.1	266.8	227.4	237.0	246.7	239.4	232.2	212.8
600.0	564.2	527.8	490.8	493.3	495.9	514.4	533.2	519.5
828.2	792.2	756.2	720.1	730.1	740.0	692.1	644.2	616.6
475.2	464.4	453.6	444.2	434.7	425.3	398.4	371.5	357.1
120.0	116.3	116.5	120.6	133.3	119.4	110.8	115.5	114.5
16.0	15.5	15.5	16.1	17.8	15.9	14.8	15.4	15.3
0.4	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3
103.6	100.4	100.6	104.1	115.2	103.1	95.7	99.8	98.9
261.2	258.9	256.6	241.2	225.7	212.4	204.1	195.9	188.3
-	-	-	-	-	-	-	-	-
95.4	98.3	101.3	91.2	81.0	70.8	67.1	63.3	59.6
140.1	135.8	131.6	127.4	123.1	118.9	114.6	110.4	106.1
5.5	5.3	5.1	4.9	4.7	4.5	4.3	4.2	4.0
-	-	-	-	-	-	-	-	-
15.0	14.1	13.2	12.3	11.4	12.5	12.3	12.3	12.6
5.3	5.3	5.4	5.5	5.6	5.6	5.7	5.8	5.9
5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
2,253.5	2,160.7	2,112.9	2,101.5	2,252.8	2,147.9	2,031.3	2,057.4	2,022.1
910.4	857.5	809.8	760.8	787.7	812.7	786.0	757.9	732.1
128.4	121.4	119.8	116.8	121.3	124.1	117.6	109.6	106.3

IPCC Code	Categories of source and sink of greenhouse gases	2004	2005	2006	2007
3.B.1.b.	Other cattle	861.6	850.5	839.3	827.9
3.B.1.b.i.	Beef Cows	270.7	269.6	268.5	267.4
3.B.1.b.ii.	Heifers	215.0	213.2	211.4	209.6
3.B.1.b.iii.	Adult meat (>2 year heifer, bulls and stud bulls, oxen)	148.4	142.1	135.7	129.3
3.B.1.b.iv.	Young meat (1-2 year heifer)	169.8	167.8	165.8	163.8
3.B.1.b.v.	Calves	57.7	57.8	57.8	57.8
3.B.2.	Sheep	14.4	14.4	14.5	14.6
3.B.3.	Swine	830.8	937.2	1,040.7	1,142.3
3.B.3.a.	Pigs	193.6	217.7	241.0	264.3
3.B.3.b.	Male pigs	5.2	5.8	6.4	7.1
3.B.3.c.	Juvenile	632.0	713.7	793.3	870.9
3.B.4.	Other species	64.3	64.6	64.9	65.2
3.B.4.a.	Buffalo	-	-	-	-
3.B.4.b.	Goat	3.1	3.1	3.1	3.1
3.B.4.c.	Horses	14.3	13.9	13.5	13.2
3.B.4.d.	Mules and donkeys	0.6	0.6	0.5	0.5
3.B.4.e.	Poultry	41.7	42.6	43.5	44.4
3.B.4.f.	Camels (Llamas and alpacas)	4.5	4.2	4.0	3.8
3.B.4.g.	Other	0.2	0.2	0.2	0.2
3.B.4.g.i.	Deer	0.0	0.0	0.1	0.1
3.B.4.g.ii.	Warthog	0.1	0.1	0.1	0.2
3.B.5.	Indirect Emissions of N_2O resulting from manure management	144.8	149.5	156.7	159.7
3.B.5.a.	Cattle	28.7	27.7	26.6	25.6
3.B.5.b.	Sheep	-	-	-	-
3.B.5.c.	Swine	47.3	51.6	58.4	61.0
3.B.5.d.	Other Species	68.7	70.2	71.6	73.1
3.B.5.d.i.	Buffalo	-	-	-	-
3.B.5.d.ii.	Goat	-	-	-	-
3.B.5.d.iii.	Horses	-	-	-	-
3.B.5.d.iv.	Mules and donkeys	-	-	-	-
3.B.5.d.v.	Poultry	68.7	70.2	71.6	73.1
3.B.5.d.vi.	Camels (Llamas and alpacas)	-	-	-	-
3.B.5.d.vii.	Other	-	-	-	-
3.C.	Rice cultivation	125.4	126.1	140.9	109.6
3.C.1.	Irrigated	125.4	126.1	140.9	109.6
3.C.2.	Rain-fed	-	-	-	-
3.C.3.	Deep Water	-	-	-	-
3.C.4.	Other	-	-	-	-
3.D.	Agricultural soils	5,313.4	5,129.4	5,203.7	5,348.5
3.D.1.	Direct N_2O emissions from managed soils	4,409.0	4,264.2	4,322.0	4,436.3
3.D.1.a.	Inorganic N fertilizer	1,087.1	925.5	1,002.7	1,168.5
3.D.1.b.	Organic N fertilizer	370.3	381.9	399.5	407.4
3.D.1.b.i.	Animal manure applied to soils	370.3	381.9	399.5	407.4
3.D.1.b.ii.	Sewage sludge applied to soils	-	-	-	-
3.D.1.b.iii.	Other organic fertilizers applied to soils	-	-	-	-
3.D.1.c.	Urine and dung deposited by grazing animals	2,479.5	2,460.2	2,434.1	2,409.2
3.D.1.d.	Crop residues	472.1	482.2	479.0	442.2
3.D.1.e.	Mineralization / immobilization associated loss / gain of soil organic matter	-	-	-	-
3.D.1.f.	Cultivation of organic soils (histosols)	-	14.5	6.6	8.9
3.D.1.g.	Other	-	-	-	-
3.D.2.	Indirect N_2O emissions from managed soils	904.4	865.2	881.7	912.2

2008	2009	2010	2011	2012	2013	2014	2015	2016
782.0	736.1	690.0	644.0	666.4	688.6	668.4	648.3	625.8
253.4	239.6	226.0	212.5	225.6	238.5	221.3	204.3	196.9
202.8	195.9	189.0	181.9	188.8	195.7	192.7	189.6	187.0
116.3	103.3	90.1	76.9	78.4	79.9	78.7	77.5	70.9
154.0	144.3	134.4	124.5	124.7	124.9	129.1	133.4	129.5
55.4	53.0	50.6	48.1	48.9	49.7	46.5	43.4	41.6
14.3	13.9	13.6	13.3	13.0	12.8	12.0	11.1	10.7
1,109.7	1,075.9	1,080.0	1,118.1	1,236.4	1,107.2	1,028.2	1,073.8	1,065.8
256.8	249.0	249.7	258.5	285.8	256.0	237.6	248.0	246.1
6.9	6.7	6.7	6.9	7.6	6.8	6.3	6.6	6.6
846.0	820.3	823.7	852.7	942.9	844.4	784.2	819.1	813.1
63.9	62.6	61.3	60.5	59.5	61.1	59.0	61.7	61.4
-	-	-	-	-	-	-	-	-
3.2	3.3	3.4	3.1	2.8	2.4	2.3	2.2	2.0
12.8	12.4	12.0	11.6	11.2	10.8	10.4	10.1	9.7
0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4
43.6	42.8	42.1	42.2	42.2	44.3	42.8	46.0	46.2
3.6	3.4	3.2	2.9	2.7	3.0	3.0	3.0	3.0
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
155.3	150.8	148.2	148.9	156.3	154.1	146.2	152.9	152.1
24.1	22.7	21.2	19.8	20.9	22.0	20.8	19.6	18.8
-	-	-	-	-	-	-	-	-
59.3	57.5	57.6	59.6	65.9	59.0	54.9	57.5	57.2
71.9	70.6	69.4	69.6	69.5	73.1	70.5	75.8	76.1
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
71.9	70.6	69.4	69.6	69.5	73.1	70.5	75.8	76.1
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
105.6	119.3	123.6	126.5	120.9	105.8	112.8	119.5	133.7
105.6	119.3	123.6	126.5	120.9	105.8	112.8	119.5	133.7
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
5,403.1	5,355.7	5,238.7	4,802.1	4,611.6	4,746.2	4,683.2	4,621.7	4,483.6
4,476.7	4,433.0	4,336.3	3,980.8	3,831.2	3,943.5	3,887.9	3,837.8	3,718.3
1,303.5	1,374.8	1,369.4	1,097.6	871.0	911.4	1,004.6	1,032.8	1,092.0
395.6	383.6	376.1	376.9	395.2	390.8	371.1	387.4	385.2
395.6	383.6	376.1	376.9	395.2	390.8	371.1	387.4	385.2
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
2,318.1	2,227.1	2,136.4	2,035.2	2,084.9	2,133.3	2,019.0	1,905.9	1,843.1
452.1	442.0	444.9	463.0	478.7	506.2	491.6	507.4	396.8
-	-	-	-	-	-	-	-	-
7.4	5.7	9.5	8.1	1.4	1.7	1.5	4.3	1.2
-	-	-	-	-	-	-	-	-
926.4	922.7	902.4	821.3	780.5	802.7	795.3	783.8	765.4

IPCC Code	Categories of source and sink of greenhouse gases	2004	2005	2006	2007
3.D.2.a.	Atmospheric deposition	356.9	340.9	349.1	365.1
3.D.2.a.i	Inorganic N fertilizer	108.3	92.1	99.8	116.5
3.D.2.a.ii.	Organic N fertilizer	201.5	200.2	198.4	196.8
3.D.2.a.ii.1.	Animal manure applied to soils	201.5	200.2	198.4	196.8
3.D.2.a.ii.2.	Sewage sludge applied to soils	-	-	-	-
3.D.2.a.ii.3.	Other organic fertilizers applied to soils	-	-	-	-
3.D.2.a.iii.	Urine and dung deposited by grazing animals	47.1	48.6	50.8	51.9
3.D.2.b.	Leaching and runoff	547.5	524.3	532.6	547.1
3.D.2.b.i.	Inorganic N fertilizer	157.5	134.2	145.5	169.0
3.D.2.b.ii.	Organic N fertilizer	297.6	296.4	295.0	293.7
3.D.2.b.ii.1.	Animal manure applied to soils	297.6	296.4	295.0	293.7
3.D.2.b.ii.2.	Sewage sludge applied to soils	-	-	-	-
3.D.2.b.ii.3.	Other organic fertilizers applied to soils	-	-	-	-
3.D.2.b.iii.	Urine and dung deposited by grazing animals	27.6	27.1	26.7	25.7
3.D.2.b.iv.	Crop residues	64.8	66.5	65.4	58.6
3.D.2.b.v.	Mineralization / immobilization associated loss / gain of soil organic matter	-	0.0	0.0	0.0
3.E.	Prescribed burning of savannahs	-	-	-	-
3.F.	Field burning of agricultural residues	81.7	73.2	65.2	46.8
3.F.1.	Cereals and other crops	53.4	46.1	39.4	22.5
3.F.2.	Fruit	28.4	27.1	25.8	24.3
3.F.3.	Other	-	-	-	-
3.G.	Liming	89.1	81.3	83.9	86.4
3.G.1.	Limestone	89.1	81.3	83.9	86.4
3.G.2.	Dolomite	-	-	-	-
3.H.	Urea Application	351.3	295.2	312.1	308.6
3.I.	Other carbon-containing fertilizers	-	-	-	-
3.J.	Other	-	-	-	-
4.	Land use, land-use change and forestry	- 66,866.3	- 66,096.3	- 69,921.3	- 56,095.4
4.A.	Forest Land	- 71,757.0	- 70,956.0	- 74,927.8	- 61,160.2
4.A.1.	Forest land remaining forest land	- 44,833.1	- 43,247.3	- 46,013.9	- 30,180.6
4.A.1.a.	Annual biomass increase	- 108,509.4	- 109,864.8	- 111,289.4	- 112,506.1
4.A.1.a.i.	Native Forest	- 80,619.5	- 80,776.9	- 80,891.6	- 80,956.0
4.A.1.a.i.1.	Seedlings	- 50,001.2	- 49,934.4	- 49,839.2	- 49,719.8
4.A.1.a.i.1.a.	Larch	- 30.6	- 30.6	- 30.5	- 30.5
4.A.1.a.i.1.b.	Guaitecas cypress	- 428.9	- 428.9	- 428.9	- 428.9
4.A.1.a.i.1.c.	Araucaria	- 467.2	- 465.8	- 464.6	- 463.3
4.A.1.a.i.1.d.	Mountain Range cypress	- 418.1	- 421.9	- 425.3	- 428.3
4.A.1.a.i.1.e.	Chilean Palm	-	-	-	-
4.A.1.a.i.1.f.	Lenga	- 8,316.3	- 8,291.6	- 8,264.3	- 8,232.5
4.A.1.a.i.1.g.	Coihue Magallanes	- 3,290.9	- 3,307.9	- 3,329.2	- 3,351.9
4.A.1.a.i.1.h.	Ro-Hualo	- 1,494.7	- 1,512.4	- 1,528.6	- 1,543.9
4.A.1.a.i.1.i.	RoRaCo	- 19,987.9	- 19,907.0	- 19,800.0	- 19,676.2
4.A.1.a.i.1.j.	CoRaTe	- 2,413.4	- 2,419.8	- 2,425.6	- 2,428.5
4.A.1.a.i.1.k.	Sclerophyll	- 1,366.5	- 1,369.7	- 1,372.7	- 1,375.7
4.A.1.a.i.1.l.	Evergreen	- 11,786.6	- 11,778.8	- 11,769.4	- 11,760.1
4.A.1.a.i.2.	Management Plans (Native Forest Law)	- 10,358.9	- 10,550.5	- 10,727.8	- 10,868.9
4.A.1.a.i.2.a.	Larch	- 0.1	- 0.1	- 0.1	- 0.1
4.A.1.a.i.2.b.	Guaitecas cypress	- 13.7	- 13.7	- 13.7	- 13.7
4.A.1.a.i.2.c.	Araucaria	- 212.7	- 214.9	- 216.7	- 218.5
4.A.1.a.i.2.d.	Mountain Range cypress	- 0.3	- 0.3	- 0.3	- 0.3
4.A.1.a.i.2.e.	Chilean Palm	-	-	-	-

2008	2009	2010	2011	2012	2013	2014	2015	2016
370.6	369.6	361.6	326.7	308.1	313.3	310.7	306.3	306.6
130.0	137.1	136.6	109.4	86.7	90.8	100.1	102.9	108.8
190.2	183.7	177.2	169.3	171.1	172.8	163.4	154.1	148.8
190.2	183.7	177.2	169.3	171.1	172.8	163.4	154.1	148.8
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
50.3	48.8	47.9	48.0	50.3	49.7	47.2	49.3	49.0
555.8	553.0	540.8	494.6	472.4	489.4	484.6	477.5	458.7
188.4	198.8	198.0	159.0	126.3	132.0	145.5	149.6	158.2
282.7	271.6	260.6	250.2	255.2	260.3	246.0	231.9	224.2
282.7	271.6	260.6	250.2	255.2	260.3	246.0	231.9	224.2
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
24.3	22.9	21.7	20.9	22.4	22.6	21.7	21.3	20.7
60.4	59.7	60.4	64.5	68.4	74.5	71.3	74.7	55.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-	-	-	-	-	-	-	-	-
49.4	46.7	48.3	50.7	44.3	46.9	46.0	50.6	34.8
28.9	29.2	34.1	36.6	30.3	33.0	31.9	36.2	20.5
20.5	17.5	14.3	14.1	14.0	13.9	14.1	14.4	14.4
-	-	-	-	-	-	-	-	-
88.7	90.9	92.9	115.3	113.2	108.9	100.2	95.1	88.4
88.7	90.9	92.9	94.8	95.3	93.6	87.5	85.0	80.9
-	-	-	20.5	17.9	15.3	12.7	10.1	7.5
342.8	301.3	377.2	373.8	372.3	400.4	381.5	433.0	357.0
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
- 58,011.6	- 62,534.9	- 71,930.9	- 65,516.1	- 61,431.2	- 71,887.5	- 55,722.4	- 44,972.4	- 65,492.3
- 62,375.1	- 66,782.1	- 76,160.8	- 69,732.4	- 65,641.2	- 76,076.4	- 59,907.0	- 49,144.0	- 69,646.6
- 30,990.3	- 34,482.9	- 44,987.6	- 39,030.1	- 35,047.0	- 45,725.7	- 31,052.5	- 23,165.3	- 43,305.4
- 113,738.6	- 115,355.5	- 117,436.7	- 120,241.9	- 121,785.4	- 123,513.7	- 125,183.5	- 127,773.3	- 128,475.3
- 81,111.7	- 81,088.9	- 81,052.7	- 81,041.1	- 81,018.1	- 81,038.7	- 81,057.5	- 81,118.0	- 81,194.1
- 49,651.8	- 49,530.2	- 49,405.6	- 49,272.4	- 49,127.3	- 48,984.5	- 48,840.0	- 48,693.2	- 48,536.1
- 30.5	- 30.5	- 30.4	- 30.4	- 30.4	- 30.3	- 30.3	- 30.3	- 30.3
- 428.9	- 428.9	- 428.9	- 428.9	- 428.9	- 428.9	- 428.9	- 428.9	- 428.9
- 461.3	- 459.6	- 457.5	- 455.5	- 453.3	- 451.1	- 449.1	- 447.1	- 445.0
- 431.3	- 434.0	- 436.2	- 438.1	- 439.8	- 441.5	- 442.8	- 443.9	- 444.6
-	-	-	-	-	-	-	-	-
- 8,199.7	- 8,164.4	- 8,127.5	- 8,090.4	- 8,052.7	- 8,014.4	- 7,975.3	- 7,936.2	- 7,897.6
- 3,400.8	- 3,400.8	- 3,400.1	- 3,397.8	- 3,394.5	- 3,390.4	- 3,385.4	- 3,379.9	- 3,372.8
- 1,559.9	- 1,577.1	- 1,593.1	- 1,607.4	- 1,620.9	- 1,632.2	- 1,641.2	- 1,648.9	- 1,655.4
- 19,577.6	- 19,477.6	- 19,380.4	- 19,280.2	- 19,172.4	- 19,072.1	- 18,974.6	- 18,878.4	- 18,774.1
- 2,432.1	- 2,435.2	- 2,437.7	- 2,438.6	- 2,438.3	- 2,437.1	- 2,435.7	- 2,433.4	- 2,431.3
- 1,379.1	- 1,382.7	- 1,385.9	- 1,388.6	- 1,391.3	- 1,393.7	- 1,395.6	- 1,396.9	- 1,398.6
- 11,750.6	- 11,739.5	- 11,728.0	- 11,716.6	- 11,704.9	- 11,692.9	- 11,681.1	- 11,669.3	- 11,657.5
- 11,022.5	- 11,143.1	- 11,255.2	- 11,404.2	- 11,557.2	- 11,753.4	- 11,951.7	- 12,194.6	- 12,468.5
- 0.1	- 0.1	- 0.1	- 0.1	- 0.1	- 0.1	- 0.1	- 0.1	- 0.1
- 13.7	- 13.7	- 13.7	- 18.6	- 18.8	- 18.9	- 19.2	- 20.2	- 23.6
- 223.3	- 224.7	- 226.6	- 228.0	- 229.6	- 229.8	- 229.8	- 229.8	- 229.8
- 0.3	- 0.3	- 0.3	- 0.3	- 0.3	- 0.3	- 0.4	- 0.4	- 0.6
-	-	-	-	-	-	-	-	-

IPCC Code	Categories of source and sink of greenhouse gases	2004	2005	2006	2007
4.A.1.a.i.2.f.	Lenga	- 2,831.8	- 2,906.4	- 2,989.7	- 3,028.1
4.A.1.a.i.2.g.	Coihue Magallanes	- 45.4	- 47.5	- 47.9	- 48.0
4.A.1.a.i.2.h.	Ro-Hualo	- 245.1	- 245.7	- 246.2	- 246.4
4.A.1.a.i.2.i.	RoRaCo	- 1,541.3	- 1,552.2	- 1,559.4	- 1,570.2
4.A.1.a.i.2.j.	CoRaTe	- 714.2	- 722.9	- 731.6	- 748.6
4.A.1.a.i.2.k.	Sclerophyll	- 582.7	- 587.5	- 590.5	- 593.5
4.A.1.a.i.2.l.	Evergreen	- 4,171.5	- 4,259.3	- 4,331.6	- 4,401.5
4.A.1.a.i.3.	National parks and reserves	- 20,259.4	- 20,292.0	- 20,324.6	- 20,367.3
4.A.1.a.i.3.a.	Larch	- 30.5	- 30.5	- 30.5	- 30.5
4.A.1.a.i.3.b.	Guaitecas cypress	- 1,305.5	- 1,305.5	- 1,305.5	- 1,305.5
4.A.1.a.i.3.c.	Araucaria	- 467.2	- 466.6	- 466.2	- 465.7
4.A.1.a.i.3.d.	Mountain Range cypress	- 9.6	- 9.8	- 10.1	- 10.3
4.A.1.a.i.3.e.	Chilean Palm	-	-	-	-
4.A.1.a.i.3.f.	Lenga	- 2,787.0	- 2,779.2	- 2,771.1	- 2,763.0
4.A.1.a.i.3.g.	Coihue Magallanes	- 6,878.4	- 6,919.1	- 6,965.8	- 7,027.7
4.A.1.a.i.3.h.	Ro-Hualo	-	-	-	-
4.A.1.a.i.3.i.	RoRaCo	- 24.9	- 24.7	- 24.5	- 24.3
4.A.1.a.i.3.j.	CoRaTe	- 1,256.8	- 1,257.2	- 1,257.2	- 1,256.9
4.A.1.a.i.3.k.	Sclerophyll	-	-	-	-
4.A.1.a.i.3.l.	Evergreen	- 7,499.5	- 7,499.3	- 7,493.6	- 7,483.4
4.A.1.a.ii.	Forest plantations	- 27,889.9	- 29,087.9	- 30,397.8	- 31,550.0
4.A.1.a.ii.1.	Pinus radiata	- 25,276.8	- 26,221.4	- 27,222.3	- 28,195.8
4.A.1.a.ii.2.	Eucalyptus globulus	- 1,580.7	- 1,737.6	- 2,035.0	- 2,209.0
4.A.1.a.ii.3.	Eucalyptus nitens	-	-	-	-
4.A.1.a.ii.4.	Prosopis chilensis and Prosopis tamarugo	- 146.8	- 149.3	- 149.5	- 149.4
4.A.1.a.ii.5.	Pseudotsuga menziensii	- 174.3	- 200.6	- 217.8	- 209.7
4.A.1.a.ii.6.	Populus spp.	- 87.3	- 85.6	- 85.6	- 94.8
4.A.1.a.ii.7.	Other Species	- 623.9	- 693.3	- 687.6	- 691.3
4.A.1.b.	Annual biomass loss	67,333.1	70,409.4	69,341.1	86,876.5
4.A.1.b.i.	Harvest	46,281.9	47,593.7	48,797.2	57,736.1
4.A.1.b.i.1.	P. radiata logs	34,250.7	34,154.6	33,896.3	36,498.7
4.A.1.b.i.2.	Eucalyptus spp. logs	10,441.3	11,630.9	13,233.4	19,661.4
4.A.1.b.i.3.	Other exotic logs	388.8	558.3	636.1	583.3
4.A.1.b.i.4.	Native species logs	1,201.0	1,249.9	1,031.4	992.7
4.A.1.b.ii.	Firewood	17,980.0	19,177.7	19,727.2	20,785.5
4.A.1.b.ii.1.	Native species firewood	10,908.5	11,635.1	11,968.5	12,610.6
4.A.1.b.ii.2.	Exotic species firewood	7,071.5	7,542.6	7,758.7	8,174.9
4.A.1.b.iii.	Disturbances	3,020.0	3,597.4	758.4	8,220.1
4.A.1.b.iii.1.	Fires	3,020.0	3,597.4	758.4	8,220.1
4.A.1.b.iii.1.a.	Native forest	715.9	1,486.6	354.4	219.8
4.A.1.b.iii.1.b.	Forest plantations	2,304.1	2,110.8	404.0	8,000.4
4.A.1.b.iii.2.	Other	-	-	-	-
4.A.1.b.iv.	Controlled burning of forest waste	51.2	40.6	58.3	134.8
4.A.1.c.	Forest land with vegetation change	- 3,656.8	- 3,791.9	- 4,065.6	- 4,551.0
4.A.1.c.i.	Restitution	- 203.6	- 208.3	- 212.9	- 217.6
4.A.1.c.ii.	Replacing	- 3,453.2	- 3,583.6	- 3,852.7	- 4,333.5
4.A.2.	Land converted to forest land	- 26,923.8	- 27,708.7	- 28,913.9	- 30,979.6
4.A.2.a.	Cropland	- 12,542.6	- 12,794.3	- 13,359.4	- 14,262.1
4.A.2.a.i.	Agricultural land converted to native forest	- 135.0	- 140.4	- 145.8	- 151.1
4.A.2.a.ii.	Agricultural land converted to forest plantations	- 12,407.5	- 12,653.9	- 13,213.7	- 14,111.0
4.A.2.b.	Grassland	- 14,277.3	- 14,807.1	- 15,444.9	- 16,600.3
4.A.2.b.i.	Grassland converted to native forest	- 1,117.0	- 1,178.1	- 1,239.1	- 1,300.2

2008	2009	2010	2011	2012	2013	2014	2015	2016
- 3,080.0	- 3,111.9	- 3,151.2	- 3,188.4	- 3,217.3	- 3,259.2	- 3,304.2	- 3,363.4	- 3,439.9
- 48.3	- 48.3	- 50.7	- 51.1	- 51.2	- 51.7	- 52.5	- 52.8	- 54.8
- 246.6	- 247.6	- 249.6	- 251.3	- 253.4	- 256.4	- 259.8	- 260.7	- 263.0
- 1,579.5	- 1,589.3	- 1,603.0	- 1,630.5	- 1,662.9	- 1,709.7	- 1,752.8	- 1,809.7	- 1,870.0
- 751.3	- 765.1	- 770.5	- 782.4	- 789.6	- 806.5	- 824.1	- 845.0	- 874.3
- 597.4	- 599.7	- 601.4	- 607.8	- 618.3	- 631.7	- 642.8	- 656.7	- 672.3
- 4,482.1	- 4,542.2	- 4,588.0	- 4,645.5	- 4,715.7	- 4,789.1	- 4,866.0	- 4,955.9	- 5,040.1
- 20,437.4	- 20,415.7	- 20,391.8	- 20,364.5	- 20,333.6	- 20,300.8	- 20,265.8	- 20,230.1	- 20,189.5
- 30.4	- 30.4	- 30.4	- 30.4	- 30.3	- 30.3	- 30.3	- 30.2	- 30.2
- 1,305.5	- 1,305.5	- 1,305.5	- 1,305.5	- 1,305.5	- 1,305.5	- 1,305.5	- 1,305.5	- 1,305.5
- 464.9	- 464.3	- 463.5	- 462.3	- 461.1	- 459.9	- 458.9	- 457.4	- 456.2
- 10.5	- 10.7	- 10.8	- 10.9	- 11.1	- 11.1	- 11.2	- 11.3	- 11.3
-	-	-	-	-	-	-	-	-
- 2,755.1	- 2,746.9	- 2,738.4	- 2,729.3	- 2,720.0	- 2,710.3	- 2,700.0	- 2,689.6	- 2,678.6
- 7,119.1	- 7,119.6	- 7,119.1	- 7,116.4	- 7,111.1	- 7,104.1	- 7,095.5	- 7,085.7	- 7,074.0
-	-	-	-	-	-	-	-	-
- 24.3	- 24.1	- 23.9	- 23.8	- 23.7	- 23.5	- 23.3	- 23.2	- 23.1
- 1,256.1	- 1,255.7	- 1,254.7	- 1,253.4	- 1,252.1	- 1,250.7	- 1,249.1	- 1,247.1	- 1,244.0
-	-	-	-	-	-	-	-	-
- 7,471.5	- 7,458.5	- 7,445.5	- 7,432.4	- 7,418.9	- 7,405.3	- 7,392.0	- 7,380.0	- 7,366.5
- 32,627.0	- 34,266.6	- 36,384.1	- 39,200.8	- 40,767.3	- 42,475.0	- 44,126.1	- 46,655.4	- 47,281.1
- 29,058.9	- 30,174.2	- 31,427.6	- 33,008.2	- 32,893.6	- 33,101.0	- 33,209.8	- 32,818.0	- 32,905.8
- 2,476.7	- 2,969.0	- 3,787.7	- 4,834.4	- 6,177.1	- 6,908.8	- 7,540.0	- 10,023.5	- 9,630.6
-	-	-	- 175.6	- 509.3	- 1,236.4	- 2,068.5	- 2,472.2	- 3,359.5
- 149.6	- 149.6	- 149.6	- 149.6	- 149.6	- 149.7	- 150.0	- 150.0	- 150.1
- 211.3	- 211.6	- 215.8	- 223.1	- 225.4	- 224.9	- 228.4	- 229.6	- 229.6
- 91.0	- 91.5	- 92.7	- 96.1	- 97.6	- 99.6	- 99.6	- 100.5	- 105.5
- 639.5	- 670.7	- 710.7	- 713.8	- 714.6	- 754.7	- 829.7	- 861.5	- 900.1
87,055.1	85,279.8	76,568.2	85,259.0	90,650.1	81,637.9	97,657.4	107,719.7	88,272.5
60,918.2	55,527.0	53,085.6	59,979.3	59,664.7	61,995.8	64,145.2	64,450.1	65,900.3
35,778.6	32,858.7	30,384.3	34,795.2	35,072.7	38,316.8	40,177.7	40,738.1	40,948.4
23,566.1	21,327.4	21,268.2	23,867.3	23,118.9	22,378.3	22,745.3	22,192.2	23,718.8
582.0	549.9	615.5	611.6	829.6	693.4	709.5	790.2	654.9
991.5	791.0	817.6	705.2	643.5	607.2	512.6	729.7	578.2
21,325.5	21,385.3	18,508.4	22,754.5	18,581.4	18,600.0	18,803.9	18,839.3	19,002.9
12,938.2	12,974.5	11,229.1	14,195.7	9,161.9	9,203.9	9,256.9	9,304.1	9,357.7
8,387.3	8,410.8	7,279.4	8,558.8	9,419.4	9,396.1	9,546.9	9,535.2	9,645.2
4,761.9	8,317.5	4,911.9	2,497.0	12,384.8	1,028.7	14,690.0	24,399.0	3,331.7
4,761.9	8,317.5	4,911.9	2,497.0	12,384.8	1,028.7	14,690.0	24,399.0	3,331.7
2,723.9	1,952.3	909.2	630.6	2,585.7	303.7	3,090.5	11,010.4	1,404.3
2,038.1	6,365.2	4,002.7	1,866.4	9,799.1	725.0	11,599.5	13,388.7	1,927.4
-	-	-	-	-	-	-	-	-
49.5	50.0	62.3	28.2	19.1	13.4	18.4	31.2	37.6
- 4,306.8	- 4,407.2	- 4,119.1	- 4,047.3	- 3,911.7	- 3,850.0	- 3,526.4	- 3,111.7	- 3,102.6
- 219.5	- 221.4	- 207.6	- 193.7	- 179.9	- 166.0	- 152.2	- 138.3	- 124.5
- 4,087.3	- 4,185.8	- 3,911.5	- 3,853.5	- 3,731.8	- 3,683.9	- 3,374.2	- 2,973.4	- 2,978.1
- 31,384.9	- 32,299.1	- 31,173.2	- 30,702.3	- 30,594.2	- 30,350.7	- 28,854.5	- 25,978.7	- 26,341.2
- 14,648.7	- 15,179.5	- 14,638.3	- 14,353.2	- 14,488.8	- 14,571.2	- 14,064.2	- 12,476.2	- 12,890.1
- 158.8	- 163.0	- 154.7	- 146.4	- 138.0	- 129.7	- 121.4	- 113.0	- 104.7
- 14,489.9	- 15,016.5	- 14,483.7	- 14,206.8	- 14,350.7	- 14,441.5	- 13,942.8	- 12,363.1	- 12,785.4
- 16,643.4	- 17,024.3	- 16,445.8	- 16,261.5	- 16,017.9	- 15,693.9	- 14,710.9	- 13,433.1	- 13,381.7
- 1,378.0	- 1,430.8	- 1,375.6	- 1,320.4	- 1,265.2	- 1,210.1	- 1,154.9	- 1,099.7	- 1,044.5

IPCC Code	Categories of source and sink of greenhouse gases	2004	2005	2006	2007
4.A.2.b.ii.	Grassland converted to forest plantations	- 13,160.3	- 13,629.0	- 14,205.8	- 15,300.1
4.A.2.c.	Wetland	- 104.0	- 107.3	- 109.5	- 117.1
4.A.2.c.i.	Wetland converted to native forest.	-	-	-	-
4.A.2.c.ii.	Wetland converted to forest plantations	- 104.0	- 107.3	- 109.5	- 117.1
4.A.2.d.	Settlements	-	-	-	-
4.A.2.d.i.	Settlements converted to native forest	-	-	-	-
4.A.2.d.ii.	Settlements converted to forest plantations	-	-	-	-
4.A.2.e.	Other Land	-	-	-	-
4.A.2.e.i.	Other land converted to native forest.	-	-	-	-
4.A.2.e.ii.	Other land converted to forest plantations	-	-	-	-
4.B.	Cropland	1,410.3	1,364.7	1,501.4	1,548.8
4.B.1.	Cropland remaining Cropland	0.5	0.7	0.1	1.8
4.B.2.	Land converted to cropland	1,409.8	1,364.1	1,501.3	1,547.0
4.B.2.a.	Forest Land converted to cropland	455.9	446.0	475.6	485.5
4.B.2.b.	Grassland converted to cropland	902.9	868.3	972.0	1,006.6
4.B.2.c.	Wetland converted to cropland	51.1	49.8	53.7	55.0
4.B.2.d.	Settlements converted to cropland	-	-	-	-
4.B.2.e.	Other Land converted to cropland	-	-	-	-
4.C.	Grassland	2,576.8	2,573.2	2,568.8	2,563.5
4.C.1.	Grassland remaining Grassland	4.7	7.9	2.3	2.2
4.C.2.	Land converted to grassland	2,572.1	2,565.3	2,566.4	2,561.3
4.C.2.a.	Forest Land converted to grassland	2,661.2	2,663.7	2,674.0	2,668.9
4.C.2.b.	Cropland converted to grassland	- 89.1	- 98.4	- 107.6	- 107.6
4.C.2.c.	Wetland converted to grassland	-	-	-	-
4.C.2.d.	Settlements converted to grassland	-	-	-	-
4.C.2.e.	Other Land converted to grassland	-	-	-	-
4.D.	Wetland	40.5	40.5	40.5	40.5
4.D.1.	Wetland remaining Wetland	-	-	-	-
4.D.2.	Land converted to wetland	40.5	40.5	40.5	40.5
4.D.2.a.	Forest Land converted to wetland	28.4	28.4	28.4	28.4
4.D.2.b.	Cropland converted to wetland	7.2	7.2	7.2	7.2
4.D.2.c.	Grassland converted to wetland	4.9	4.9	4.9	4.9
4.D.2.d.	Settlements converted to wetland	0.0	0.0	0.0	0.0
4.D.2.e.	Other Land converted to wetland	-	-	-	-
4.E.	Settlements	340.4	347.7	354.9	362.1
4.E.1.	Settlements remaining Settlements	-	-	-	-
4.E.2.	Land converted to Settlements	340.4	347.7	354.9	362.1
4.E.2.a.	Forest Land converted to Settlements	86.3	87.5	88.7	89.9
4.E.2.b.	Cropland converted to Settlements	170.7	173.4	176.1	178.8
4.E.2.c.	Grassland converted to Settlements	81.8	85.1	88.3	91.6
4.E.2.d.	Wetland converted to Settlements	1.6	1.7	1.7	1.8
4.E.2.e.	Other Land converted to Settlements	-	-	-	-
4.F.	Other Land	522.7	533.6	541.0	549.9
4.F.1.	Other land remaining Other Land	-	-	-	-
4.F.2.	Land converted to other land	522.7	533.6	541.0	549.9
4.F.2.a.	Forest Land converted to other land	473.6	483.4	489.6	497.4
4.F.2.b.	Cropland converted to other land	-	-	-	-
4.F.2.c.	Grassland converted to other land	49.1	50.2	51.4	52.5
4.F.2.d.	Wetland converted to other land	-	-	-	-
4.F.2.e.	Settlements converted to other land	-	-	-	-
4.G.	Harvested wood products	-	-	-	-
4.H.	Other (please specify)	-	-	-	-

2008	2009	2010	2011	2012	2013	2014	2015	2016
- 15,265.4	- 15,593.5	- 15,070.2	- 14,941.1	- 14,752.7	- 14,483.8	- 13,556.0	- 12,333.4	- 12,337.2
- 92.8	- 95.3	- 89.0	- 87.6	- 87.5	- 85.6	- 79.4	- 69.4	- 69.4
-	-	-	-	-	-	-	-	-
- 92.8	- 95.3	- 89.0	- 87.6	- 87.5	- 85.6	- 79.4	- 69.4	- 69.4
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
1,630.5	1,676.8	1,658.4	1,640.3	1,624.7	1,604.1	1,588.3	1,569.0	1,551.0
0.5	0.7	0.3	0.2	2.7	0.1	2.3	1.1	1.1
1,630.1	1,676.1	1,658.1	1,640.1	1,622.0	1,604.0	1,586.0	1,567.9	1,549.9
530.4	540.7	538.9	537.1	535.4	533.6	531.8	530.1	528.3
1,044.1	1,079.2	1,066.3	1,053.3	1,040.4	1,027.4	1,014.5	1,001.5	988.6
55.6	56.2	52.9	49.6	46.3	43.0	39.7	36.4	33.0
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
1,744.2	1,603.8	1,609.0	1,617.7	1,631.0	1,634.6	1,650.3	1,660.7	1,665.5
3.4	5.0	5.2	4.3	8.0	2.1	8.2	9.0	4.3
1,740.7	1,598.8	1,603.8	1,613.4	1,623.0	1,632.5	1,642.1	1,651.6	1,661.2
1,883.2	1,749.2	1,744.7	1,744.7	1,744.7	1,744.7	1,744.7	1,744.7	1,744.7
- 142.5	- 150.4	- 140.9	- 131.3	- 121.7	- 112.2	- 102.6	- 93.0	- 83.5
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6
-	-	-	-	-	-	-	-	-
20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6
11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-	-	-	-	-	-	-	-	-
372.0	379.1	377.6	376.1	374.6	373.2	371.7	370.2	368.7
-	-	-	-	-	-	-	-	-
372.0	379.1	377.6	376.1	374.6	373.2	371.7	370.2	368.7
99.1	100.4	100.7	100.9	101.2	101.5	101.7	102.0	102.2
176.8	179.4	177.5	175.7	173.8	172.0	170.1	168.3	166.4
94.2	97.4	97.6	97.8	98.0	98.1	98.3	98.5	98.7
1.8	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.3
-	-	-	-	-	-	-	-	-
596.3	566.9	564.3	561.7	559.1	556.4	553.8	551.2	548.6
-	-	-	-	-	-	-	-	-
596.3	566.9	564.3	561.7	559.1	556.4	553.8	551.2	548.6
544.6	514.8	515.4	516.1	516.7	517.3	517.9	518.6	519.2
-	-	-	-	-	-	-	-	-
51.7	52.1	48.8	45.6	42.4	39.1	35.9	32.6	29.4
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

IPCC Code	Categories of source and sink of greenhouse gases	2004	2005	2006	2007
5.	Waste	4,961.2	5,228.6	5,029.1	4,738.2
5.A.	Solid waste disposal	3,541.7	3,698.7	3,829.5	3,483.2
5.A.1.	Managed waste disposal sites	2,430.4	2,610.8	2,861.5	2,590.9
5.A.2.	Unmanaged waste disposal sites	241.1	240.2	239.4	214.1
5.A.3.	Uncategorized waste disposal sites	870.3	847.8	728.6	678.1
5.B.	Biological treatment of solid waste	48.0	48.7	54.2	70.5
5.C.	Incineration and open burning of waste	0.1	0.1	0.2	0.2
5.C.1.	Waste Incineration	0.1	0.1	0.2	0.2
5.C.2.	Open Burning of Waste	-	-	-	-
5.D.	Wastewater Treatment and discharge	1,371.3	1,481.1	1,145.1	1,184.3
5.D.1.	Domestic Wastewater Treatment and Discharge	1,019.8	1,051.0	1,128.2	1,143.0
5.D.2.	Industrial Wastewater Treatment and Discharge	351.5	430.1	16.9	41.4
5.E.	Other	-	-	-	-
Anx.	Memo items				
Anx.1.	International bunker	4,292.7	4,567.1	5,354.9	5,367.2
Anx.1.a.	International Aviation	1,142.0	1,117.1	1,221.8	1,372.0
Anx.1.b.	International Navigation	3,150.7	3,449.9	4,133.1	3,995.3
Anx.2.	Multilateral Operations	-	-	-	-
Anx.3.	CO_2 emissions from biomass	19,205.0	20,486.3	21,071.4	22,203.0

2008	2009	2010	2011	2012	2013	2014	2015	2016
4,540.4	4,364.6	4,502.2	4,654.0	4,800.6	5,318.4	5,403.9	5,734.5	5,801.1
3,282.6	3,106.1	3,142.1	3,274.0	3,293.8	3,832.8	3,867.9	4,209.2	4,305.3
2,403.7	2,196.8	2,279.6	2,455.2	2,478.5	2,719.7	2,796.9	3,089.0	3,194.4
221.5	231.6	229.0	159.9	147.5	275.0	186.7	194.3	189.1
657.3	677.7	633.4	659.0	667.9	838.0	884.3	926.0	921.8
69.6	112.0	78.1	55.9	47.5	61.0	59.9	59.9	59.9
0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.5	0.5
0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.5	0.5
-	-	-	-	-	-	-	-	-
1,188.0	1,146.4	1,281.7	1,323.8	1,458.9	1,424.2	1,475.6	1,464.8	1,435.3
1,153.6	1,125.8	1,265.1	1,308.2	1,451.5	1,416.8	1,441.6	1,433.0	1,419.5
34.4	20.5	16.6	15.6	7.4	7.4	34.0	31.9	15.8
-	-	-	-	-	-	-	-	-
5,300.7	4,104.9	3,666.2	3,740.6	2,785.8	2,620.6	2,601.1	2,317.0	2,269.4
1,431.7	1,340.9	1,347.5	1,449.9	1,387.6	1,386.2	1,401.4	1,412.6	1,492.3
3,868.9	2,764.0	2,318.7	2,290.6	1,398.2	1,234.3	1,199.7	904.4	777.1
-	-	-	-	-	-	-	-	-
22,794.8	22,844.0	21,752.6	24,262.2	39,548.6	43,876.5	39,703.7	32,672.5	35,042.3

ANNEX 5. INFORMATION ON SECTORIAL MITIGATION ACTIONS

Table A. 1. Measures related to the mitigation of GHG emissions in the Energy sector

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
Management concessional system of geothermal energy	Regulatory	2004 Implemented and active	In the framework of Law 19,657/2000 and its rules of procedure, establishes the procedure by which every natural or legal person to request a grant of geothermal energy and to participate in a public tender for the granting of a concession of geothermal energy.	The objective of the **exploration** grant is to perform a set of operations to determine the potential of geothermal energy. The objective of the **exploitation** grant is to give the right to use and take advantage of the geothermal energy that exists within its boundaries.	In July 2015, Regulation was modified in order to be more precise for the requirements to obtain an exploration grant in perpetuity, adding the ability to incorporate conditioning factors in the decree to give accounting of the territorial reality of grants, among other subjects.
Law of Non-Conventional Renewable Energies (NCRE) (Law 20,257/ 2008 amended by the Law 20,698/2013)	Regulatory	2008 Implemented and active	The law establishes the mandatory nature for power generation companies with installed capacity of over 200MW, to certify the participation of NCRE in Chile's power generation matrix.	Law 20,257/2008 established that between 2010 and 2014, a 5% of power should come from NCRE, increasing from 2015 in a 0.5% per year until achieving a 10% in 2024.	In 2013 Law 20,257 was amended by Law 20,698, extending the quota to a 20% of NCRE to 2025 for contracts signed after July 1st, 2013.
Rural and social electrification program (PERyS)	Project	2008 Completed	Program coordinated with other State agencies (Regional Governments, Municipalities, etc.) developed in three lines of action: - Rural Schools and Emergency Rooms Electrification - Demonstration Projects o the Application of Renewable Energies (RE) - Technology Transfer and Human Capital Development for the Development of solutions with RE on a small scale.	Contributing to the access and improvement of rural electricity supply in an equitable, efficient and sustainable manner through training of technical units and transfer of successful experiences. Promoting and disseminating solutions with RE. Generating conditions for research, development and innovation. Developing a regulatory framework and encouragement for access and improvement of rural and social energy supply.	Electrification of rural schools and emergency rooms without power supply or a deficit of it. Developing demonstration projects with small-scale renewable energy. Implementing a program for strengthening local capacities.

[1] *Information source of: https://sic.coordinador.cl/informes-y-documentos/fichas/energias-renovables-no-convencionales-ernc/*
[2] *Information Source: Access and Equity Division of the Ministry of Energy and web page: http://www.energia.gob.cl/programa-de-energiza-cion-rural-y-social-perys*

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
As of August 2018, there are: 4 exploration grants in force, 8 matured exploration grants but with exclusive right that gives the exploitation grant and 11 exploitation grants. As of August 2018, Cerro Pabellon plant (first geothermal plant in South America, located at the Antofagasta region with an installed power of 48 MW). The plant is a testing stage, prior to its commercial operation start-up planned for late 2018.	Commercial operation start-up of Cerro Pabellón Project. Amendment of Law 19,657 /2000, in order to improve the system of geothermal grants. Promoting the direct thermal uses of geothermal energy.	-	-	-
In 2017 the requirement imposed by Law 20,698 for NCRE generation was 3,642GWh and it was achieved 11,087 GWh, which is equivalent to a 300% compliance[1].	The integration of NCRE in the matrix will be analyzed to increase participation while maintaining the system security.	CO_2, N_2O, CH_4	As of 2017, the mitigation of GHG is estimated at around 13,100 $ktCO_2eq$.	An estimate of monthly emissions was calculated avoided from a monthly balance of generation from non-conventional renewable sources, and it was multiplied by the factor of emissions of the electrical system during that month. Then, the total avoided emissions correspond to the addition of avoided monthly emissions. This balance was performed separately for the systems before called SIC and SING.
Between June 2016 and December 2017, projects were implemented with renewable energies (bio-digesters, solar thermal systems) at 18 educational and health establishments (bio-digesters, solar thermal systems)[2].	The program is discontinued in 2018, and since 2019 two new programs will be implemented associated to the improvement of power supply in establishments with a public role and for productive enterprises.	-	-	-

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
Energy Efficiency Program in Public Buildings (PEEEP)	Economic Incentive	2009 Implemented and active	Part of Efficient Residential Lighting and public lighting programs. It includes the Diagnosis, Implementation, Measurement and Verification, and Capacity Building, aimed to tackle energy efficiency projects in public buildings integrally.	5% reduction of electricity consumption in public buildings.	Ministry of the Interior and Public Security and the Ministry of Energy formalize a protocol on the application of energy-saving measures in public administration. The follow-up of it will be led by the Agency of Energy Sustainability through the platform for the registration of energy consumption in public buildings.
Public information platforms for renewable energy	Information Education	2009 Implemented and active	The Ministry of Energy keeps a public platform for renewable energies, focused on providing information for the development of projects. Delivery of geo-referenced information on potential renewable energies and projects.	These platforms allow providing public information on our resources, guiding private investment decisions, the adequacy or design of public policies on renewable energies and supporting energy planning processes in accordance with current legislation.	Development of browsers: wind, solar, rights of non-consumptive water use (DAANC), forestry bioenergy and marine. Measuring campaigns of wind and solar resources.
Solar thermal systems in new households (Law 20,365/2009)	Fiscal	2010 Implemented and active	Law 20,365/2009 establishes a tax exemption for solar thermal systems (SST) for hot water in new houses and a direct subsidy for SST installation in new social housing. The tax benefit is equal to 100% of the aggregated cost of the installation investment, plus the cost of a maintenance program for houses under UF2,000 with a linear decrease until 0% for houses of UF3,000.	Development of market for solar thermal systems (SST) through demand stimulation. Providing access and energy equity to the most vulnerable population through a means to get sanitary hot water. Expected impact between 2015-2020: Approximately 66,500 housing units will be benefited	Law 20,897 of 2016 renewed the validity of the tax exemption for the installation of solar thermal systems (SST) for the period 2015 to 2020 and it adds a direct subsidy for the provision of this technology in new social housing.
Solar thermal systems in existing social housing	Fiscal	2011 Implemented and active	Direct subsidy for SST installation in existing social housing, driven by Law N°20,365 through the Program for Protection of the Family Property by MINVU.	Improving the existing housing of the most vulnerable and deprived population, with the installation of a solar system for heating water.	Transfer of funds from MINENERGIA to MINVU. Development of regulatory bodies. Training to SERVIUs to assess and grant subsidies.

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
To date, works of EE have been implemented at 39 hospitals, fulfilling the goal proposed, reaching 100% of high complexity hospitals potentially possible to intervene with EE measures. The total amount of the investment was CLP9,043 million, CLP2,370 million corresponding to the 2017 budget. The total annual savings in fuels and electricity expenditure is estimated at CLP2,953 million, which is equivalent to 54 GWh of energy savings.	This program starts to be implemented under the sponsor of "Manage Energy" of the Public Sector, which goal in the Energy Roadmap is the intervention of 100 buildings under the ESCO modality of contract and the installation of smart meters in 1000 buildings during the 2018-2022 period.	CO_2, N_2O, CH_4	An estimated 17 $ktCO_2eq$ avoided per year for all of the 39 hospitals.	To calculate the estimated emission reduction, first the reduction of energy per energy source was calculated, and then an emission factor was used, corresponding to the average of the SIC and SING systems for electricity, and for natural gas, diesel or coal, IPCC tier 1 emission factors were used.
The browser was updated with a self-consumption approach for SST and SFV, orienting households, trade and industry.	It considers renewing the Wind Browser and updating the Marine Browser. In addition, improving the Solar Browser information, keeping the focus on self-consumption. It is intended to approach thermal technology different from the Thermal Solar Systems.	-	-	-
Law 20,897 of 2016 renewed the validity of the tax exemption for the installation of solar thermal systems (SST) for the period 2015 to 2020 and adds a direct subsidy for the provision of this technology (SST) in new social housing. Between 2010 and July 2018 61,841 houses have been benefited.	Launching by MINVU of new subsidy to finance SST in new social housing. Incorporating the Superintendency of Electricity and Fuels (SEC) in the enforcement of SST installed in social housing with grants from MINVU.	-	-	-
From 2011 to 2017 SST has been installed in 43,530 existing social housing: 131,395 houses in 2016, and 15,347 houses in 2017.	Incorporating the SEC in the enforcement of SST that are installed in social housing through MINVU grants.	-	-	-

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
Net Billing Act (Net Billing) (Law 20,571/2012)	Regulatory	2012 Implemented and active	Grants regulated clients of distribution companies the right to generate their own electricity, self-consuming it and that the value of their surpluses contributed to the network are discounted from their bills. Projects can only be of renewable or efficient cogeneration, with an installed capacity per customer not over 100 kilowatts.	Establishes a right without specific goals. Without prejudice to the foregoing, envisages the increasing use of such right, in particular for photovoltaic projects.	Development of policy and regulatory framework supplementing the Law. Training seminars on the Law. Creation of specialized unit for support and control projects. Supporting the development of photovoltaic systems suppliers, through the Program of Public Solar Roofs. Generation of public information about costs and suppliers. Implementation of online tools for self-assessment projects.
Action Plan for Energy Efficiency (PAEE2020)	Policy	2013 Implemented and active	The PAEE2020 poses efficiency actions in the work areas of: - Industry and Mining - Transportation - Building - Appliances - Firewood - Other	Reducing by 12% the final energy demand projected to 2020 compared to 2010, equivalent to savings of 43,000 Tcal.	The Inter-ministries Committee on Energy Efficiency (CIEE) was created. The appliances labeling program has been strengthened and actions were started to define EE minimum standards (MEPS). The EE seal for companies was launched. Programs were created for promotion and implementation of EE measures in the public sector ("Program for Energy Efficiency in Public Buildings" and "Replacement of Efficient Public Lighting for Municipalities") and households ("My efficient home"), some supported by the Agency of Sustainability Energy (ASE).

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
As of January 2018, 2,188 projects hosted in the right granted by the Law, equivalent to 12.5 MW. A bill was introduced to the National Congress to amend the boundary of these systems, raising it from 100 kWh to 300 kWh. As of August 2018, amendments to Law 20,571 were approved at the Finance Commission of the Congress Chamber, and should be submitted to the vote of the Lower Chamber to continue its processing at the Senate.	Modification of the Regulation pursuant to the amendment of the Law.	CO_2, N_2O, CH_4	In the period 2015-2017 it is estimated a reduction of emissions of around 17.5 $ktCO_2eq$. In the period 2018-2022 it is expected to get emission reductions close to 70 $ktCO_2eq$.	The estimated GHG reduction of implemented projects was calculated considering an estimated annual production of the projects declared, which depends of the district of the location project, and multiplied by an emission factor of 0.77 tCO_2eq/MWh (similar to the SING). For the projection of avoided emissions, a projection of facilities was considered from the current trend, and avoided emissions were estimated considering an emission factor of 0.77 tCO_2eq/MWh.
In industry, during 2016 and 2017, three companies were certified in SGE, with estimated savings of 280 Tcal/year. As a result of the implementation of ASE programs since 2010 until the end of 2017, savings close to 85 Tcal /year have been achieved. Progress in the programs of housing and public sector can be reviewed below.	The sectorial programs will continue, but the discussion and processing of the draft bill for energy efficiency can be highlighted, which will provide a framework of legal support in the areas of industry and mining, transportation, public sector and residential sector, for the development of energy efficiency measures.	-	-	-

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
Energy efficiency labelling and minimum standards	Regulatory and Information	2013 Implemented and active	The labelling of energy efficiency (EE) allows improving consumer information at the time of making a purchase and encourages companies to produce and import more efficient products.	Fostering energy efficiency in order to achieve a 20% reduction in the use of energy projected for year 2025.	Labelling of energy efficiency on appliances . EE minimum standards .
Replacement Program of Efficient Public Lighting for Municipalities	Project	2014 Implemented and active	Support program for energy management of municipalities through the replacement of public streetlights for more efficient ones, allowing inhabitants to enjoy better levels of lighting and energy savings to the municipality.	The program will change around 205,000 streetlights in 121 towns, approximately 10% of the total streetlights in the country	Training on Replacement of streetlights
Promoting the development of the biogas energy in small and medium-sized agricultural industries selected at Los Ríos and Los Lagos regions (Biogas dairy sector)	Project	2014 Implemented and active	The project seeks to increase biogas generation at PYMES in the dairy industry of Los Lagos and Los Ríos regions, granting value to a waste, reducing energy costs and mitigating greenhouse gas (GHG) emissions. The focus is on dairy farms between 100 and 500 cows.	Reducing GHG emissions by promoting investment and development of the biogas energy technologies market at PYMES of the dairy sector.	Study of gaps for the biodigesters registration with the SEC. Technical and economic pre-feasibility of biogas projects. Promotion and dissemination of information and best practices in biogas technologies for small and medium-sized agricultural industries. Construction of an experimental biodigester for the dairy sector. Handbook I for the design, construction, operation and maintenance of biogas plants in Chile. Development of existing digesters diagnosis.

[3] *Information Source : http://www.minenergia.cl/biogaslechero/*

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
Currently there are 26 products with EE label and 3 must meet EE minimum standards. EE minimum standards were established for engines up to 10 HP and air conditioners. . Minimum energy performance standards for refrigerators (only class A or higher can be marketed) was enforced, and marketing of incandescent light bulbs was eliminated. In 2016 the growth in residential electricity demand was almost null. Penetration of efficient technology has increased, e.g. in 2017, 1 of 3 light bulbs is LED and 2 of 3 is efficient.	Updating and incorporating new products to the labelling program for energy efficiency, at least stoves, washing machines, vacuum cleaners, microwave and electric ovens. Updating labels on light bulbs and refrigerators. Adding new products with a minimum standard of efficiency. Updating the standards for lighting and refrigerators.	-	-	-
As of April 2018, close to 175 thousand streetlights have been replaced, with estimated savings of 34 GWh/year.	The program will finish at the end of 2018. After 2019, the Ministry will continue supporting the municipalities in the creation of EE projects for public lighting.	-	-	-
Performance of 57 pre-feasibility studies of biogas. Technological Tour with 14 farmers to Costa Rica and Mexico. Handbook for the design, construction, operation and maintenance, biogas plants in Chile. Training to biogas plant operators. In progress: 9 feasibility studies, bidding for digestate market study, biogas calculator implementation, monitoring of 2 biogas plants[3].	A forum of circular economy will take place at the end of 2018, where it is expected that it will be proposed continuing activities of the Biogas program.	-	-	-

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
Energy Efficiency Draft Law	Economic Incentive Regulatory	2014 Planned	The Draft Law will include at least three components: (a) Energy Efficiency in Industry and Mining; (b) Energy Efficiency for households, small industries and businesses; (c) Energy Efficiency in the public sector.	Its purpose is promoting, guiding and regulating the rational and efficient use of energy resources, with the aim of fostering improvements in productivity and competitiveness of our economy, improving people's quality of life, thus contributing to the sustainable development of the country.	During the first quarter of 2018 amendments were made to the Draft Law.
"More Dry Firewood" Program	Project	2014 Implemented and active	The program promotes the production and marketing of dry wood in the south-central zone of the country, for which a fund exists to finance the construction and implementation of collection and drying of wood centers.	It seeks to increase the supply of firewood with a humidity level of less than 25%, which generates more heat, spends less and produces less pollution.	The program envisages incorporating technology and innovative techniques for drying wood, in addition to training and human capital development in drying techniques and business development.
100 Plan Mini-hydros	Policy	2014 Completed	Plan developed to promote development of mini-hydro projects (<20 MW) in the country.	To promote the development of 100 new mini-hydro projects in the period 2014-2018.	A register of existing projects. Identification of relevant aspects that delay the obtaining permits or postpone the investment decision. Monitoring of main barriers for the development of projects. Meetings with financial institutions. Design and implementation of public policies.
Supply improvement program in isolated areas	Project	2014 IImplemented and Active	It comprises the technical and financial support for the execution of projects of: (I) improvement of existing electrical service in different islands and isolated locations in the country that currently are supplied with energy from diesel; (Ii) deliver power to houses that did not have electricity supply; (Iii) increase the number of hours of electricity supply in those cases in which supply was of 6, 12 or 18 hours.	The purpose is to reduce the dependence on diesel fuel and improve the quality of life of communities, prioritizing the use of renewable energy sources and technological improvements in electricity supply. In addition, to reduce the cost of subsidy to operation granted by Regional Governments.	Implementation of projects for electrical supply in islands by incorporating renewable sources (hybrid systems). Implementation of individual photovoltaic systems.

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
The Draft Law on Energy Efficiency started processing at the Senate.	Institutional preparation to render the Law operational.	-	-	-
Between 2016 and April 2017, the development of 160 collection centers was benefited, with estimated sales of 150 thousand m3 of dry wood estereo, equivalent to an avoided consumption of firewood of 50 Tcal/year.	The program will continue its implementation in the context of the Energy Roadmap that sets the support to investment initiatives associated to the market of solid biofuels.	-	-	-
Since March 2014 58 mini-hydro (191 MW) power plants have been start up, and 10 stations (64 MW) are under construction.	The plan was completed in March 2018. However, to date there is a follow-up of the projects under construction, so that they are completed in a satisfactory manner.	CO_2, N_2O, CH_4	In 2017 an emissions reduction of around 224 $ktCO_2eq$ was estimated, and for the period 2014-2017 a cumulative emissions reduction of approx. 540 $ktCO_2eq$ was estimated.	For the estimation of emissions reduction the annual installed power and an average plant factor of 40% were considered. The annual emission factor of the SIC published by the Ministry of Energy at www.energiaabierta.cl was also considered.
With the support of the SUBDERE and Regional Governments, 2 projects have been implemented in islands, 4 islands are under construction and 6 are in the definition phase. In addition, 5 projects of individual photovoltaic generation were implemented (2016-2018).	The program will continue implementing generation projects both in islands and isolated systems, in addition to individual projects of photovoltaic energy self-generation.	-	-	-

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
Fund for Energy Access[4]	Project	2014 Implemented and active	Competitive Fund aimed at communities, social organizations, neighborhood councils and municipalities, among other organizations, to finance small-scale RE projects to facilitate and promote access to energy in vulnerable, rural and/or isolated communities.	Allowing social organizations to access energy resources in a sustainable way by means of small-scale solutions based on NCRE.	Projects for energizing community facilities and public spaces, through the installation of solar thermal systems, photovoltaic systems and photovoltaic lighting.
Energy District Program	Policy	2015 Implemented and Active	The program is a tool aimed to contribute to the energy development of Chile, through the analysis of the power scenario of each district and implementing allowing for exploitation of the potential of energy efficiency and use of renewable energies from the local community. Intended to raise awareness by citizens on the subject of global energy and to generate a responsible and participative consumption behavior.	10% of all the municipalities of the country involved and participating in this program in 2018 (approx. 36 districts).	Development of a methodological guide for preparation of local energy strategies. Funding for development of local energy strategies. Implementation of BOILER 30+ project (installation of SFV in at least 30 roofs in districts of Caldera, Copiapo and Tierra Amarilla). Delivery of Portable Solar Kits to population that given the conditions of their productive work are without electricity part of the day.
Solar thermal systems in houses of the Reconstruction Programs	Fiscal	2015 Implemented and active	Subsidy for the installation of Solar Thermal Systems (SST), to heat sanitary water and photovoltaic systems (SFV), for electricity generation at houses that are the subject of the reconstruction program where there is technical feasibility.	In response to the reconstruction needs arising from the earthquake of the Great North and the fire of Valparaiso in 2014, it was determined to promote a subsidy for SST installation, at the households covered by the Reconstruction Program. In addition, in 2015 a new Program of Reconstruction was implemented to face the consequences of the flood experienced at Atacama and Antofagasta regions. On this occasion, it was determined that both the houses to be rebuilt as those to be repaired would benefit from SST and SFV.	Transfers from MINENERGIA to MINVU. Training public and private actors. Donation of SST laboratories to technical education centers of the regions involved.

[4] *http://atencionciudadana.minenergia.cl/tramites/informacion/18/*

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
In 2017, 18 projects were implemented awarded in 2016, and in 2018, 23 projects have been implemented out of a total of 67 awarded in 2017.	The Fund will continue its performance in 2019, within the framework of a new program associated with the improvement of energy supply in establishments with a public role	-	-	-
Currently 35 districts participate in the program, 23 municipalities have completed their Local Energy Strategy and are implementing specific projects in their territory.	It is expected that in the next 4 years 25% of municipalities in Chile will participate in the Program. Development of a monitoring, reporting and verification system (MRV) to quantify GHG emission reductions of projects at a local level. Promotion of inclusion of the concept of energy resilience to climate change at a local level.	-	-	-
As of July 2018, 5,694 subsidies have been allocated for SST and around 2,475 grants for photovoltaic systems. Of these, approximately 3,630 are installed.	Incorporating the SEC in the enforcement of SST that are installed in social housing with grants by MINVU.	-	-	-

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
Public Solar Roofs Program	Project	2015 Implemented and Active	The program is an initiative oriented to install photovoltaic systems (SFV) on the roofs of public buildings, in order to contribute to the maturing of the photovoltaic market for self-consumption.	Stimulate the market for photovoltaic solutions through the demand by the State to be installed in public buildings. Generate information of public and free access on costs and conditions of the FV projects oriented to consumption within Chilean reality. To assess in practice the rules and procedures for PV facilities for self-consumption. To contribute to the reduction of energy costs in public buildings.	Identification of public buildings. Project selection. Solution design. Invitation to tender for installation projects. Assessment of the program (annual monitoring).
Policy of use of firewood and its derivatives for heating	Policy	2015 Implemented and active	The policy delivers guidelines and defines the lines of work in the short, medium and long term to improve the manner in which wood and its derivatives are produced, marketed and consumed as the main source of energy for heating buildings in the country. The policy is divided into 6 strategic areas: I. More efficient buildings; II. Sustainable and quality firewood; III. Other sources of energy derived from wood for heating; IV. More efficient technologies for heating; V. institutional framework, and VI. Education.	Contributing to the efficient and sustainable use of firewood in Chile, with emphasis on the center south of the country, under a State vision, in a comprehensive and inter-ministries manner, prioritizing air pollution reduction, matrix diversification and progress towards energy independence, integrating the current productive actors of the sector to improve the quality of life of both rural and urban citizens.	Creation of the Firewood Unit at the Ministry of Energy. Creation of the Inter-ministries Committee on Firewood. EE standards for heaters. Training.

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
Until March 2018 projects were awarded for 133 buildings, with an aggregate installed capacity of 5.2 MW; 104 projects are built and connected. During the first half of 2018 it is expected to complete and connect the remaining projects.	Follow-up to installed SFV and support in maintenance management through a monitoring platform. To promote and strengthen relationship with public institutions that offer advising and guidance in project assessment, SFV design, in addition to training, strengthening and promoting operation competences and good practices, and medium scale SFV maintenance. Assessing, designing and implementing SFVfor self-consumption with technological variations (i.e SFV connected with accumulation). Systematization and dissemination of the Program.	-	-	-
During 2016 a proposal for a quality standard of firewood with the collaboration of a committee of academic experts was developed. During the second half of 2017 regional work tables were set up for the discussion of the standard. Energy efficiency labels have been developed for wood and pellet heaters.	Preparation of the firewood standard and control strategy. At the same time, the implementation strategy and the institutional framework required to establish a standard of firewood quality will be discussed.	-	-	-

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
Energy Policy: Energy 2050 (PEN2050) (Decree N°148/2015)	Policy	2015 Implemented and active	The policy proposes a vision of the energy sector to 2050 which corresponds to a sector that is reliable, sustainable, inclusive and competitive, based on 4 pillars: 1. Security and quality of supply, 2. Energy as an engine for development, 3. Compatibility with the environment and 4. Efficiency and Energy Education.	PEN proposes goals in renewable energies (at least 60% of electricity generation comes from renewable sources in 2035 and 70% in 2050), in EE (i.e. 100% of large consumers haveenergy management systems and in 2050 100% of main appliances are energy efficient), in the use of fuel low in GHG emissions and atmospheric pollutants (50% in the energy matrix in 2035 and 65% in 2050), in addition to application of the Mitigation Plan by 2035. In 2050 it is expected that GHG emissions in the sector are consistent with defined boundaries by the science and national goal, promoting cost-effective measures.	There have been multiple actions aimed at promoting the penetration of renewable energies in the energy matrix and the implementation of energy efficiency measures. The progress in the goals can be reviewed in the annual follow-up reports of PEN2050[5]. At the end of 2017 the Plan for GHG mitigation in the Energy Sector was approved at the Council of Ministers.
Solar Strategic Program	Technological	2016 Implemented and Active	This program, implemented by CORFO' Solar Committee, aims to take advantage of the unique landscape of the Atacama Desert to develop a national solar industry with relevant technological capabilities to face local challenges and competitively insert in the international solar industry. In its implementation institutions in the public, private, academia and civil society, both at central and regional level, work collaboratively. As a part of the pathway more than 50 initiatives to be developed between 2016 and 20125 have been considered, within which it is possible to highlight: - Technological Program modules and photovoltaic systems for deserts. - Solar Technology Center. - Strengthening of quality infrastructure. - Open Innovation platform and funding for innovation. - Solar Corridor of Salado River Basin.	The main goals of the program are: • LCOE technologies PV adapted USD 25 MWh. • Investment Attraction. • Local Value Capture 55 %. • Export of: engineering services, technological services, photovoltaic systems, etc. • 100 companies to 2025 as a part of the value chain in the solar industry.	To date, pre-feasibility studies are being carried out.

[5] *http://www.energia2050.cl/es/*

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
Emissions of greenhouse gases (GHG) in the energy sector have increased in the last decades, but at a rate lower than the growth of Gross Domestic Product (GDP).	As established by Supreme Decree N°148 which approves the long-term Energy Policy, annually a process of monitoring and follow-up of its implementation shall continue. In addition, in 2020, the update of the PEN2050 will be carried out in a participatory manner, with Strategic Environmental Assessment.	-	-	-
To date, pre-feasibility studies are being carried out .	-	-	-	-

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
Support mechanisms for funding the implementation of photovoltaic systems for self-consumption in micro and small enterprises	Economic Instrument	2016 Implemented and Active	Design and implementation of support mechanisms for financing of NCRE projects in micro and small companies.	Having one more financial support mechanism to enable micro and small business to finance the implementation of photovoltaic systems for energy self-generation.	Preparation and implementation of a browser for financing of self-consumption projects NCRE[6] (active and updated monthly) which collects information from state institutions that have lines of financing or co-financing for NCRE projects on a small scale. Design and implementation of a financing mechanism for photovoltaic systems for self-consumption in micro and small companies.
"My Efficient Home" Program	Project	2016 Implemented and Active	Training program created in 2016 by the Ministry of Energy, which delivers training for energy efficiency to the most vulnerable families in the country, a certificate, educational material and an efficient kit. Its implementation is carried out by the Regional Ministerial Secretaries (SEREMIS) of energy through collaboration agreements with the municipalities of each region and/or Provincial Governors.	To sensitize and to train beneficiaries in matters related to energy efficiency, regarding the benefits brought by technological replacement and other practical advice that can be performed both inside and outside the home. Enable the most vulnerable sectors to access energy-efficient technologies.	Training and delivery of efficient kits to families of the municipalities in the program. Preparation of a booklet with practical EE advice for the home. EE campaigns focused on all citizens.
Electromobility Strategy in Chile	Policy	2017 Implemented and active	The Strategy deliveries guidelines and defines the lines of work in the short, medium and long term, to facilitate the arrival and use of electric cars, considering the technical and regulatory aspects.	Articulating public and private efforts in this field, in order to accelerate the introduction of more efficient technologies in the country's vehicles and that Chile is prepared for the massive arrival of electric vehicles.	"Energy Roadmap 2018-2022" Agenda which features measures that should be implemented in the short term. Development of work and international dissemination of electromobility.

[6] Browser for financing (http://www.minenergia.cl/pfinanciamiento/)
[7] Information source: http://www.energia.gob.cl/programa-de-capacitacion-mi-hogar-eficiente

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
During the first quarter of 2017 the self-consumption credit with NCRE and energy efficiency for small businesses was completed, and in the second quarter the credit for micro businesses, both offered by Banco Estado. In addition, during 2016, work was performed together with CORFO in the preparation of a credit for self-consumption projects with NCRE within the framework of the "Loan Contract and performance of the Renewable Energy and Energy Efficiency Program: “Refinancing Line or Phase 1 " held by the Chilean State and the KfW.	Banco Estado is developing, together with the Ministry of Energy, a credit to apply EE measures and self-consumption in existing houses, which is expected to be launched during 2018.	-	-	-
As of December 2017, 111,737 families had already been trained who were handed over a pack of efficient light bulbs with estimated savings of 58 GWh/year. 4 booklets were developed with practical advice for: i. Replacement of heating equipment, ii. Replacement of lighting in homes, iii. Use and maintenance of SST and SFV, and iv. Infiltration seals in doors and windows. Platform for energy rehabilitation of existing housing developed by the Ministry of Energy during 2017, which shall be published during 2018. EE campaigns focused for all citizens[7].	It is intended that the program continues until the end of 2018.	-	-	-
Performing International Seminar on Electromobility (1 and 2 February 2018)	Within the framework of the energy efficiency law a regulation will be included to promote efficient transportation, with emphasis on electromobility. Development of a platform for management of fleets energy.	-	-	-

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
SING-SIC Interconnection	Project	2017 Completed	The interconnection of the two largest electrical systems in the country (the Central Interconnected System and Great North) on a single system (National Electric System).	Take advantage of the clean energy generated in various areas of Chile that previously were not interconnected; provide security in the delivery of electric supply for families and businesses; to allow for entry of new players to the sector; and in the future, increase the flow of energy to be exchanged through the international interconnection with neighboring countries.	Creation of the National Electric System (SEN). Creation of the National Electrical Coordinator.
Greenhouse Gas Mitigation Plan for the Energy Sector	Policy	2017 Implemented and active	The GHG mitigation plan in the energy sector performs an analysis of mitigation actions proposed in the PEN2050 and proposes a package of mitigation measures for the sub-sectors of energy generation, transportation, industry and mining and commercial, public and residential (CPR).	Contributing to the mitigation objectives in the country.	Plan Dissemination Development of studies and proposal of alternative carbon pricing instruments (IPC), within the framework of the PMR Chile project.
Long-term energy planning (Law N° 20,936/2016)	Regulatory	2017 Implemented and Active	Within the framework of the Electricity Transmission Law (Law N° 20,936 of 2016), the Ministry of Energy develops the Long-Term energy planning process (PELP) every five years for the different energy scenarios of expansion in generation and consumption, in a horizon of at least thirty years, so that these scenarios are considered in the planning of the transmission systems to be carried out by the National Energy Commission.	Develop a process of long-term energy planning every five years for the various energy scenarios for expansion in generation and consumption, in a horizon of at least thirty years, so that these scenarios are considered in the planning of transmission systems to be carried out by the National Energy Commission.	The Ministry of Energy developed the first Long-Term Energy Planning Process (PELP), which considers scenarios of future development of the sector and the respective development poles.

[8] *Information source: www.coordinador.cl*
[9] *Information source: http://pelp.minenergia.cl/ and https://www.leychile.cl/Navegar?idNorma=1092695*

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
Currently operational line. The National Electrical Coordinator is standardizing processes and delivery information to the SEN Public Information System[8].	-	-	-	-
Currently, the Ministry is in the process of dissemination of the plan, and promptly will begin its process of implementation. In the IPC area, in August 2017 the first stage of the PMR Chile was completed, during which the implementation of the green tax was supported, and studies were developed to assess IPC alternatives in Chile, and a proposal for IPC alternatives was made. In September 2017 the additional phase of the project was started.	Define a portfolio of mitigation projects. Monitoring of the measures. Start a process at a regional level. Within the framework of the PMR Chile additional phase: developing a platform of mitigation actions in the energy sector. Development of a model of impact analysis of climate change policies.	CO_2, N_2O, CH_4	Expected reductions to 2030 with respect to BAU: - PEN Goals Scenario: 17,330 $ktCO_2eq$ - Additional Effort Scenario: 24,140 $ktCO_2eq$	The plan has defined three mitigation scenarios: - Case of Reference "Current Policies": projection of emissions based on current policies (BAU). - PEN Goals: It consists principally of goals and policies associated with the National Energy Policy. - Additional Effort: built under the assumption of a more demanding goal of reduction, always within the PEN framework .
On March 9, 2018 the Long-term Energy Planning Decree was published, in the time and manner as determined by the General Law for Electrical Services and the respective Regulation[9].	Every five years the PELP will be updated pursuant to Law N° 20,936. Annually, the inputs used in the PELP can be updated, keeping the energy scenarios. A new PELP could be triggered before five years, if the Ministry considers it appropriate due to important modifications of the assumptions applied in the previous year.	-	-	-

Name	Type	Year and status	Description	Objectives/Goals	Actions implemented
Decarbonization table of the energy matrix	Voluntary Actions	2018 Implemented and active	Under a market vision the companies signed a voluntary agreement to undertake a process of decarbonization of the matrix. The Ministry cooperates through a multidisciplinary coordination and the collection of background information, in order to strengthen the discussion at the labor, supply security , economic and environmental areas.	Not to build more coal-fired power plants that do not include CO_2 capture. It is expected in the future not to count on emissions by coalpower plants, either through the gradual cessation of their operation or reconversion of the plants, or the implementation of technology to capture CO_2.	Currently, the Ministry is carrying out the work tables.
2018-2022 Energy Roadmap	Policy	2018 Implemented and active	The 2018-2022 Energy Roadmap defines the work to be prioritized in the energy sector over the next four years, based on 7 axes of work: 1: Energy Modernization 2: Energy with a social seal 3: Energy Development 4: Low-carbon energy 5: Efficient transportation 6: Energy Efficiency 7: Energy Education and Training	Some of the main goals in mitigation are: - Increase in at least 10 times the electric vehicles in the country. - Establish a regulatory framework for energy efficiency (EE). - Updating and incorporation of new products to the EE labelling program. - Start Process of decarbonization of the energy matrix - Reach four times the current capacity of small scale renewable distributed generation. - Create public-private work tables on mechanisms of tradable emission and tradable certificates. - Implement the GHG Mitigation Plan in the Energy Sector.	In June 2018, the decarbonization table of the energy matrix was started. In July 2018, the tradable emission mechanisms table and the tradable emission certificates table were started.

Source: Own preparation based on sectorial Information

S/I: no information.

[10] *https://www.cne.cl/wp-content/uploads/2018/05/rutaenergetica2018-2022.pdf*

Progress	Planned actions	Gases included	Emission reductions achieved or expected ($ktCO_2eq$)	Methodology and Assumptions
In June 2018 the work table started and will last throughout the 2018 until the beginning of 2019, with monthly meetings.	Development of the planned work tables to provide background information on the environmental, labor, social-economic, electrical, and health effects.	-	-	-
Progress has been made in the implementation of actions of the 7 axes of the Energy Roadmap.	Implementation and follow-up of the measures of the Energy Roadmap within the next four years[10].	-	-	-

Table A. 2. Measures related to the mitigation of GHG emissions in the Transportation sector

Name	Type	Year and status	Description	Objectives/Goals
Labelling of energy consumption and CO_2 emissions in light and medium vehicles	Regulatory	2016 Implemented and active	Supreme Decree N° 107, of 18 July 2016, the Ministry of Energy, extends the application of labelling to light, medium, electric and hybrid commercial vehicles and instructs on the regulation of labelling of energy consumption for motor vehicles. It should be noted that Chile was the first Latin American country to implement a mandatory labelling for these purposes.	Allow consumers to include in their decision to purchase information on vehicle fuel consumption and CO_2 emissions, contributing to strive in making informed decisions to reduce energy consumption by the transportation sector and contribute to the mitigation of climate change and air pollution.
Management of the Public Transportation System in Santiago (Transantiago)	Policy	2017 Implemented and active	In order to comply with this specific measure, there are plans to carry out the following actions: A1. Build new axes of mobility with segregated public transportation provided with buses. A2. Enable new priority lanes for the public transportation provided with buses. A3. Renew fleet of buses. A4. Promote the use of buses with clean technologies	Generation of infrastructure to support transportation and inclusion of more clean technologies. A1. 30 kilometers of segregated lanes. A2. 60 kilometers of priority lanes. A3. 40 % of the current buses fleet renewed by 2022. A4. 100 clean technology buses in operation.
Renewal of the fleet of the Public Transportation System in Santiago (Transantiago)	Project	2018 Implemented and active	Santiago's Public Transportation System (Transantiago) needs to renew 2,855 operating buses out of a total of approx. 6,500 by means of a tender of new buses with better technology.	Improve the quality of transportation, increase the efficiency of the transportation system, and reduce local and global emissions.
Renew your bus program	Economic Incentive	2011 Implemented and active	Subsidy associated to the law of Subsidy to Public Transportation (Law 20,378), which allows to access for funding the renovation of old buses for public transportation, either in regions and in the rural area of the Metropolitan Region, by new buses with better technology and less polluting.	Modernize the existing fleet public transportation buses with less polluting vehicles, more efficient and safer. Replace old buses with newer and more efficient buses in different areas of the city of Santiago. The program considers the possibility of scrapping and replacement with used vehicles.
Renew your collective taxi Program	Economic Incentive	2015 Implemented and active	The Law of National Subsidy to Public Transportation creates a subsidy delivered by Regional Governments (GORE) for the replacement of collective taxis with less polluting vehicles in regions. Replacement program of collective taxis with more efficient vehicles. Delivery of subsidies for replacement of light vehicles used as collective taxis with more modern vehicles, considering scrapping of vehicles replaced in some cases.	Modernization of the existing collective taxis fleet with less polluting vehicles, with standards of superior quality, more efficient and safer.

[11 And 12] *Ministry of Transportation and Communications, Public Account, 2017*

Actions implemented	Progress	Planned actions
In June 2017 expands the labelling to medium, commercial and different energy matrix cars, such as different models that use electricity or whose engine is hybrid.	S/I	S/I
Vicuña Mackenna corridor implementation in March 2018, and segregated bus lanes of 8.8 kilometers from a total of 24 kilometers of new only buses lanes in streets of high traffic flow between 2014 and 2017. 2 electric buses operating in Transantiago since 2017.	Improvement by 34% in the buses' movement by the new corridor Vicuna Mackenna during the first month of full operation of the segregated lane project, that allows exclusive movement of buses between Puente Alto and Santiago. The works have also made it possible to reduce travel times between 20 and 30 minutes.	During 2018 the new authorities will continue conducting assessments to the various infrastructure projects that have been made in recent years, and that are beginning to operate to make progress in new segregated lanes for public transportation or priority lanes.
In 2017, a preliminary definition was carried out of the conditions for the bidding process to renew the fleet of the Transantiago, where an instance of public consultation was carried out in order to consider and gather the opinion of the citizenship.	In June 2018, the bidding process is in the process of re-structuring.	During the second half of 2018 the bidding rules will be prepared. During 2019, a new tender system will be awarded, which is an essential part of the Transportation Project of the Third Millennium[11].
Implementation of the program in all regions of the country.	Since the start of the program and until 2017, there has been a replacement of 4,094 more modern buses with better technology, environmentally friendly[12].	The renew your bus program will continue to perform at least until 2020.
Implementation of the program in all regions of the country.	The program for the renewal of collective taxis allowed to subsidize until 2017 the replacement of more than 6,200 older vehicles with more modern cars, efficient and safer for users.	The program renew your collective taxi will continue to perform until at least 2020.

Name	Type	Year and status	Description	Objectives/Goals
Green Tax for New Motor Vehicles	Regulatory	2015 Implemented and active	The tax reform, incorporated green taxes in order to reduce pollution locally and globally, through incentives that seek to generate changes in the behavior of the actors responsible of emissions, as pointed out by the principle of the Law of General Bases on the Environment in the "polluter pays" principle. Article N°3 of Law 20,780, indicates that: "new motor vehicles, light and medium, with the exceptions in this article, shall pay, only once, an additional tax expressed in monthly tax units". The tax began to govern all those who buy a new vehicle for private use, recorded in the Register of Motor Vehicles of the Civil Registry and Identification Service (SRCEI), starting in December 29, 2014. The tax is associated to the Tax Reform Act, which applies only once to new cars, light and medium, depending on their urban performance.	Encourage the entry of less polluting vehicles, allowing a cleaner and more efficient fleet of vehicles. Mobile sources are a part of the most polluting sectors at a national level and the second that contributes the most to the generation of greenhouse gases. These, in addition, represent about 30 % of the emissions at a national level and 90% in the Metropolitan Region of nitrogen oxide (NOx). These gases are considered toxic, irritating and precursors to the formation of PM2.5 and ozone, harmful to the health of the people.
Measures of the Transportation Sector in the Decontamination Plan of the Metropolitan Region (RM)[13].	Regulatory	2017 Implemented and active	Compulsory measure referred to in the Decontamination Plan of the RM. In 1997 the first Cleanup Plan was formalized in the RM. After 20 years, the Plan is updated for the fourth time, focusing its efforts on reducing emissions of fine particles (MP2,5), with the co-benefit of reducing black carbon (BC), short-lived climate contaminant. This measure will be mandatory from November 24, 2019.	Reduce emissions of fine particles (called MP2,5) and reduce black carbon (BC) short-lived climate contaminant contained in the fine particles, with the aim of improving air quality in the Metropolitan Region, contribute to the climate and reduce the cost in health.
Expansion of Metro de Santiago network	Private Sector	2017 Implemented and active	In 2012 the construction of 2 new metro lines was announced, line 6 and line 3, which would start their operation in 2017 and 2018 respectively, adding a total of 37 km to the current network. The total investment of lines 3 and 6 is USD3,049 million.	Increase in 37 kilometers the Metro de Santiago network, benefiting about 1.1 million inhabitants, improving public transportation by reducing travel times considerably, and therefore the quality of life of Santiago inhabitants.
Suburban Railway MetroTren Alameda Nos	Private Sector	2017 Implemented and active	The service of the suburban railway MetroTren Alameda Nos is a part of the Integrated System of Public Transportation and is an alternative of mobilization for thousands of people who must travel to the center of Santiago, it was inaugurated in March 2017. The investment was USD635 MM.	Reduce travel times from the south area of Nos to Santiago downtown, and increase the number of passengers moved downtown safely and more efficiently.

[13] Plan of Prevention and Atmospheric Decontamination for the Metropolitan Region of Santiago, S.D. N°31, 2016, the MMA, published 24 November 2017 in the Official Gazette
[14], [16] and [17] Ministry of Transportation and Communications, Public Account 2017
[15] Metro de Santiago, retrieved on July 23, 2018: https://www.metro.cl/minisitio/linea-3-y-6/noticias/presidenta-bachelet-visita-obras-de-la-nueva-linea-3-de-metro-y-destaca-beneficios-de-su-extension-hacia-quilicura.html

Actions implemented	Progress	Planned actions
In 2017, the tax meant a collection of USD99 million, of which 40% corresponds to vehicles using diesel oil and a 60% to vehicles using gasoline. It should be noted that diesel vehicles account for about 15% of the sale of light vehicles. While the years 2015 and 2016, the collection amounted to USD35 million (US dollar year 2015) and USD 73 million (US dollar year 2016) respectively, recording an increase of 39.4% compared to 2015. Meanwhile, the average emission of nitrogen oxides of the new vehicles was reduced by 10.5% compared to 2015.	In April 2018 a study entitled: "Retrospective Analysis of the implementation of Green Taxes on Cars" was completed, which results show that there are areas of improvement in terms of green taxes for the tax to be more effective.	Continue with the collection of the green tax on motor vehicles.
It is an action of compulsory nature contemplated in a decree of the Ministry of Environment, published in the Official Gazette in November 2017.	S/I	From November 2019, the new buses of public transportation in the Metropolitan Region must comply with the Euro VI standard or EPA2010, emission control methods will be implemented in the public roads for diesel vehicles to detect damaged vehicles, machinery out of route with a power between 56 and 560 kW shall use particle filters used by the public sector, other machinery shall comply with the emission standard Stage IIIA of the European Community of 2004.
Line 6 was inaugurated on November 2nd 2017, with an extension of 15 kilometers, 10 stations and a route that connects 7 districts[14].	Line 3 is in 80% of progress status. In addition, it is expected that 60% of the energy requirements in Line 3 of metro are covered with NCRE[15].	In January 2019 Line 3 will open, with an extension of 22 kilometers and 18 stations. Considering the next Line 3, the metro network will have 140 kilometers of tracks and will mobilize daily more than 2.3 million people[16].
It features 20.3 kilometers long, connects the district of Estación Central with Nos district, with 10 stations.	On February 19, 2018 the service of the suburban railway reached 10 million trips, which means a shift of 50,000 passengers daily on average on work days of week. While the weekends the average is 24,960. https://www.trencentral.cl/	Starting in 2019, progress will be made in the construction of underground paths to implement a new service of Metrotren Rancagua[17].

Name	Type	Year and status	Description	Objectives/Goals
Giro Limpio Project for Certification and Validation of the Freight Transportation of the Transforma Logistics Program by CORFO for cargo transportation by road and ports.	Project	2017 Implemented and active	The Giro Limpio project seeks to implement a public - private program at a national level to improve energy efficiency in road cargo transportation through the reduction in fuel consumption, thus to reduce transportation costs and greenhouse gas emissions in the sector.	Certify carriers and load generators, particularly with diesel, through the creation of the of certification seal, called"Giro Limpio" (Clean Turn)", for reduction in fuel consumption and reduction of emissions generated by your fleet, which will have a monitoring system to enter key indicators and to verify compliance with the reductions.
Sustainability Certification Project for ports of the Logistics Program Transforma by CORFO for cargo transportation by road and ports.	Project	2017 Implemented and active	The project seeks to generate an evaluation tool allowing to address major environmental, economic and social challenges of port activity in Chile, considering feasibility, gradualness and willingness as key points in the implementation. It is led by the Agency of Sustainability and Climate Change, and at the Committee participate SEP, UNAB, Transforma Logística, Under Secretary of Transportation, CEPAL, Grupo EFE, Embassy of Denmark, Camport, Corfo. In addition, other collaborators are the port of Valparaiso, port of San Antonio, Agunsa, Portuaria TSV, Ultramar, SAAM, SAG, Direcon, Directemar, Anagena, port of Arica, GNL Quintero, Puerto Ventanas.	Having a tool validated by the sector to assess the sustainability of public and private ports at the end of 2018. Its objective is to consolidate and ensure the viability of clean production agreements in all public and private ports.
Suburban railway in Biobio region, Biotren.	Project	2017 Implemented and active	Biotren is a suburban metropolitan service that has gradually evolved to position itself in the public transportation of Greater Concepcion. Extended to Coronel district on February 29, 2016, the passengers increased from 5,500 to more than 18,000 per day.	Increase the suburban passenger transportation in greater Concepción, reducing travel time and the consumption of fossil fuels.
Merval Suburban train in Valparaíso Region	Project	2018 Implemented and active	Merval is a suburban metropolitan service of integrated public transportation of passengers, through an efficient and reliable system, which contributes to improve mobility in the conurbation of Great Valparaiso and the quality of life of its inhabitants.	Increase the suburban passenger transportation of the Great Valparaiso reducing travel time and the consumption of fossil fuels.

Actions implemented	Progress	Planned actions
In 2017, Andrés Bello University was awarded a public good of energy efficiency, with which the certification system is under development.	A seminar was conducted to launch the project, organized together with the SmartWay group of US EPA on August 23, 2018.	This program will end in December 2019.
As of March 2018, the results of the study: "Sustainability Standard for ports of Chile", prepared by Deloitte and the German-Chilean Chamber, developed during 2017, and which objective is to generate an assessment tool that allows to address major environmental, economic, and social challenges of port activity in Chile.	Currently, the Agency of Sustainability and Climate Change submitted to the Managing Committee a proposal for the next steps, including validation activities with public and private ports, and the performing of a pilot that allows to test the tool in some ports of Chile on a voluntary basis, to test the applicability of the tool proposed by the above mentioned study.	The goal during 2018 is collecting the base line in at least all public ports.
The last extension of Biotren was to Coronel and considered the construction of 40 kilometers of tracks.	Biotren frequency has been improved.	Continue promoting Biotren service, through the use of the Law of National Subsidy to Public Transportation, and the acquisition of new rolling material and infrastructure improvement.
Studies on the line expansion from Limache to La Calera.	Studies in the development stage of detailed engineering are available, which is the last stage prior to the tender.	It is expected to initiate a bidding process for the expansion of the Merval line.

Name	Type	Year and status	Description	Objectives/Goals
Suburban trains in the Metropolitan Region	Project	2018 Implemented and active	To extend the coverage of suburban trains in the Metropolitan Region.	Increase the suburban passenger transportation in the Metropolitan Region reducing travel time the consumption of fossil fuels.
Smart Cities Strategy 2014-2020	Policy	2014 Implemented and active	Sets the framework for the development of smart cities for transportation in Chile, also known as Smart Mobility, which is based on the definition of a vision, objectives, fundamental principles, agents involved, approach to the process of transformation, base conditions, priority focus and roadmap.	Guide the actions towards the technological development of the transportation system (ITS) and ecosystems in collaboration around it, where different actors that are a part of the city co-build collaborative, sustainable and inclusive spaces, to respond to the current and future mobility needs.
Measures for the Transportation Sector contained in the Energy Mitigation Plan.	Policy	2017 Under implementation	The Plan of Greenhouse Gas Mitigation for the Energy Sector was published in December, 2017 and it considers five lines of action for the Transportation Sector: 1) To foster the market for low-emission means of transportation; 2) technological replacement of public transportation; 3) investment in efficient ways; 4) Increasing the standards of energy efficiency in road transportation; and 5) supporting policies to improve urban planning for sustainable urban mobility.	Reduce GHG emissions in the Transportation sector, in particular the most important subsector: road transportation, which is responsible for 88.9% of the total emissions of the sector. Emphasizes that the Energy Plan also mentions that the objective is to reduce the local and global pollutants.

Source: Own preparation based on sectorial Information

S/I: no information.

Table A. 3. Measures related to the mitigation of GHG emissions from Agriculture, Forestry and Other Land Uses

Name	Type	Year and status	Description
National Strategy on Climate Change and Vegetation Resources (ENCCRV)	• Economic Instrument • Voluntary Actions • Regulatory • Information • Research • Education	2010 -2025 Implemented and active	Basic principles that guide the ENCCRV: - To stimulate the provision of environmental services such as water resources, land productivity, cultural values and landscape, among others, through the reduction of deforestation and devegetation, forest degradation and vegetational resources, and at the same time promoting the sustainable management of forests and vegetation resources, mainly afforestation and revegetation with native species, and the restoration of degraded forests and xerophytic formations. - A key instrument to fulfill the goal contained in the INDC forest: A) 100,000 ha of plantations mainly with native species. Indicator: forested area per year with spatial representation. B) 100,000 ha of sustainable forest management. Indicator: Area of managed forests, including areas where degradation and deforestation was avoided with spatial representation.

Source: Own preparation based on sectorial Information

S/I: no information.

[18] *Ministry of Transportation and Communications, Public Account 2017*

Actions implemented	Progress	Planned actions
Studies of two new suburban train lines: 1) From Batuco until Quinta Normal; 2) from Melipilla to Maipu.	Studies of basic and detailed engineering are available. Currently, the projects for these two lines are being tested in the Environmental Assessment System - SEA.	It is expected to initiate the bidding process when the environmental approval is obtained, a favorable environmental qualification resolution by the SEA.
Collaboration has been given to companies and public entities to analyze traffic patterns through mobile signals, developing pilot use of GPSs and bluetooth for transit management. In addition, an agreement was signed with Waze company, that allows reporting incidents of transit in the mobile app. In partnership with Google and Moovit, travel planners were implemented in 19 cities across the country[18].	Continue to improve access to transit information for both private vehicles and public transportation.	No later than June 2019, a mobile app will be launched that allows users to review journey times and the arrival of public transportation buses, without meaning a decrease in data traffic from your mobile plan.
S/I	S/I.	S/I

Objectives/Goals	Actions implemented	Progress	Planned actions
To facilitate the establishment of a legal, technical, operational and financial platform to regulate and promote the conservation, recovery and rational use of resources of vegetation, from a rationale that contribute to climate change mitigation and adaptation, and the consequent processes of desertification, drought and land degradation, with emphasis on those territories with higher social, economic and environmental vulnerability of the country.	ENCCRV document under public consultation process includes: - Definition of main causes of GHG emissions in the sector. - Definition of activities and courses of action, operational goals over time within a span of 2017 to 2025. - Determination of sub-national reference levels (Maule to Los Lagos regions). Starting the implementation of restoration projects of forest ecosystems affected by fires and forestry prevention.	Commitment of 100,000 ha of afforestation: between 900,000 and 1,200,000 tCO_2eq / year mainly with native species, and 100,000 ha of recovery and sustainable management of native forest: 600,000 tCO_2eq / year, both commitments starting in 2030. It is expected to report in 2018 the first monitoring milestone, and accounting for reductions and effective capture.	S/I

Table A. 4. Measures related to the mitigation of GHG emissions of the Waste sector

Name	Type	Year and status	Description	Objectives/Goal
National Solid Waste Management Program	Policy	2005 Implemented and active	Promotes the proper disposal of solid waste in landfills (RS), and the closure of final disposal facilities without sanitary or environmental authorization.	The Solid Waste National Unity from the Secretary of Regional Development (SUBDERE) runs the National Plan for Solid Waste Management, with the aim of improving health conditions and environmental quality issues in urban and rural centers at the national level, through the implementation of comprehensive and sustainable systems for the efficient management of solid waste.
Law N° 20,920 Framework Law for Waste Management, Extended Liability of Producer and Promotion of Recycling (REP).	Regulatory	2016 Implemented and respective regulations under development	It establishes that producers (manufacturers and importers) of "priority products" must be accountable for the goods once they finish their useful life. For this, the law sets goals for the collection and recovery differences by product. Priority products are: lubricating oils, electrical and electronic equipment, batteries, packages and packing material, tires.	The objective is to reduce waste generation and to promote reuse, recycling or valuation, thus protecting the lives of people and the environment, which requires both manufacturers and importers of six priority products to recover a percentage of their products once they finish their life: lubricating oils, electrical and electronic equipment, automotive batteries and batteries, packages and packing material, tires.
Recycling Fund	Economic Incentive	2017 Implemented and active	Fund for the prevention of generation, the promotion of waste reuse and recovery. Allows financing projects of municipalities and associations of municipalities, aimed at preventing the generation of waste in their districts and to promote its separation, reuse, recycling and other type of recovery, in two lines of action: citizens awareness, and promotion of municipal technical knowledge and of base recyclers.	The objective is to finance all or part of projects, programs and actions to prevent the generation of waste, encourage their source separation, selective collection, reuse, recycling and other valuation performed by municipalities or their associations.

Actions implemented	Progress	Planned actions
It is emphasized that in 2017, for the first time a composting plant of organic waste, located in Santa Juana Biobio Region, was financed by the National Plan for Solid Waste from the Secretary of Regional Development (SUBDERE), with the support of the Regional Government (GORE) and its directors, in addition to receiving the support of the mitigation project of climate pollutants in the Waste Sector through the Chile- Canada Program. Investment in civil works was approximately 500 million pesos and in equipment and vehicles, approximately 300 million pesos that are in the process of acquisition. The program Chile – Canada supplied the equipment for the plant, with a cost of USD200,000 in addition to training for plant operators during commissioning and operation instructions which will translate into an operational handbook.	During 2017 4,672 million pesos were invested, 80% of these resources will be concentrated in the acquisition of equipment, in particular in the acquisition of collection trucks, the remaining 20% in construction of solid waste management plants, training of public workers related to the preparation of waste projects, and closure of landfill sites.	S/I
Enacted on May 17, 2016, and published in the Official Gazette on June 1, 2016.	1) D.S. N° 8 of the Ministry of Environment, which regulates the procedure for the preparation of supreme decrees that establish instruments designed to prevent the generation of waste or promote their recovery, as well as the procedure for the preparation of supreme decrees which set goals and other related obligations. 2) D.S. N° 7 establishes that the Ministry of Environment has a fund for prevention of generation, promotion of reuse and recovery of waste. 3) Exempt Resolution N° 1,491 of the Ministry of Environment, of December 22, 2017, which started the preparation process of the supreme decree that establishes goals for the collection and recovery and other duties associated with tires. 4) Exempt Resolution N° 1.492 of the Ministry of Environment, of December 22, 2017, which started the preparation process of the supreme decree that establishes goals for the collection, valuation and other obligations associated to packages and packing material, and regulates a packages deposit-refund system.	Continue with the law implementation through the development and implementation of regulations to establish recovery goals for the priority products.
Enacted on March 17, 2017 and published in the Official Gazette on October 17, 2017	33 Proposals were awarded at 8 regions. The total amount allocated is approx. 359 million pesos.	Currently, projects that have applied are under evaluation and on June 12 of June projects to be financed will be awarded.

Name	Type	Year and status	Description	Objectives/Goal
Mitigation of Climate Pollutants in the Waste Sector through the Chile - Canada Program	Project	2016 Implemented and active	Cooperation Program to reduce pollutants that damage the climate, and to contribute with funding to reduce Short-Lived Climate Pollutants.	1) Reduction of methane emissions through the implementation of technology in at least seven cities. 2) Development of a system for tracking, monitoring and reporting of methane reductions (MRV). 3) Leverage of public and private financing for the implementation of the projects and support to create enabling conditions that allow scale up of the program. 4) Support with technical assistance communication opportunities and dissemination of the project.

Source: Own preparation based on sectorial information

S/I: no information.

Table A. 5. Measures related to the mitigation of GHG emissions of the Mining sector

Name	Type	Year and status	Description
Measures for the Industry and Mining sector of the Greenhouse Gases Mitigation Plan for the Energy sector	Policy	2017 Under implementation	Greenhouse Gas Mitigation Plan for the Energy Sector was published in December 2017, which main objective is to assess the impact on emissions reduction measures laid down in the National Energy Policy and its role is to support the country in order to achieve an economy and energy matrix significantly lower in carbon. This Plan establishes actions towards 2030 for industry and mining, such as of energy efficiency measures through minimum standards of efficiency in industrial and mining equipment, and the development of the energy efficiency market in mining and industry to reduce fuel consumption.
Energy efficiency measures for mining by the Agency of Sustainable Energy. .	Projects	2014 Under implementation	Since 2014, an agreement exists between the Mining Council and the Ministry of Energy which aim is that mining companies implement and/or strengthen the Energy Management System (SSG) with international standards, to incorporate Energy Efficiency in the assessment and design of mining projects, awareness their staff and suppliers in the efficient use of energy resources".

Source: Own preparation based on sectorial information

S/I: no information.

Table A. 6. Measures related to mitigation of GHG emissions of the Building, Urbanization and Public Infrastructure (Public Works) sector

Name	Type	Year and status	Description
Incorporation of non-conventional renewable energies (NCRE) in the execution of MOP Public Infrastructure	Policy Information	2017 Planned	Currently, several of the Directorates implementing projects include NCRE in their infrastructure works, such as the Port Works Directorate, the Airports Directorate and the Roads Directorate. These initiatives do not respond to a public policy of the MOP, rather to isolated actions related to the budget allocated to the work.

Actions implemented	Progress	Planned actions
The Chile - Canada program contributed with equipment for the composting plant of Santa Juana district, in particular with a front loader and a shovel from the charger, with a cost of USD200,000, in addition to training plant operators for commissioning and operation instructions that will translate into an operation handbook of composting plants for future composting projects.	Currently, work is done with seven cities to design and implement projects that will stop disposal of organic waste in landfills using technologies such as composting or anaerobic digestion. In addition, the possibility of increasing the capture of biogas from landfills is being evaluated, of the landfills that are feasible in these seven cities. Finally, these projects are expected to serve as an example to leverage other similar projects in Chile.	The project is developed from April 2017 until March 2021, expecting that at the end of the period emissions of climate pollutants are reduced significantly in the projects implemented at the end of 2021.

Objectives/Goal	Actions implemented	Progress	Planned actions
Reduce greenhouse gas emissions in the sector of industry and mining in 2.38 $MtCO_2eq$ by 2030.	Currently, updating the information of the sector to establish minimum standards for energy efficiency, it also is engaging the sector through workshops and/or seminars for the dissemination within the sector during 2018.	S/I	S/I
Incorporating Energy Efficiency in the assessment and design of mining projects, reducing fuel consumption and greenhouse gas emissions.	The companies members of the Council underwent independent energy audits, on the basis of which action plans were developed, analyzed with the Ministry of Energy.	S/I	S/I

Objectives/ Goals	Actions implemented	Progress	Planned actions
That 25% of the bids in public infrastructure include criteria for energy efficiency and sustainability by 2022.	The inclusion of NCRE is currently envisioned in some projects, but not as a public policy.	S/I	During 2018 it considers the development of a methodology that will quantify GHG reduction in infrastructure works.

Name	Type	Year and status	Description
Incorporation of energy efficiency and environmental comfort in public building performed by the MOP	Policy Regulatory Technological	2006 Implemented Planned	Inside the MOP an institution has been created from this subject, with the Sub-department of Energy Efficiency at the Architecture Directorate. However, all this effort has not been linked to climate change, even if there is a direct relationship. Therefore, it is necessary to account for and systematize GHG reduction that is being carried out through the construction of public building, so as to make visible and contributing to the commitments that Chile has undertaken regarding mitigation to climate change.
Measurement and management of the Carbon Footprint in the works of infrastructure and public building performed by the MOP	Information	2018 Planned	It is in the interest of the Ministry to calculate the Carbon Footprint (HdC) during the construction phase of the infrastructure works in order to assess the measures that allow for reduction in the short, medium and long-term. In order to facilitate the incorporation of this management tool, it is considered to incorporate this tool gradually, and to carry out the calculation through pilot cases by the type of work, in particular emphasizing the measures related with the reduction of GHG emissions.
Reduction of GHG emissions in the MOP machinery.	Technological	2017 Implemented Planned	Currently, the Roads Directorate (DV) has heavy machinery and it is in its interest to provide the machinery with the eco-efficiency criterion, thereby contributing to the reduction of GHG emissions. To this end, there are plans to incorporate equipment to the fleet, to measure and report GHG emissions in the stage of idle speed.
Implementing a platform to measure and account for the reduction of GHG emissions from the MOP	Information	2018 Planned	It is required to implement a technological development so that executing Directorates may enter a GHG reduction per project, and at the same time having tools that enable measuring, reporting and verifying such reductions.

Source: Own preparation based on sectorial Information

S/I: no information.

Table A. 7. Measures related to the mitigation of GHG emissions of the Building, Urbanization and Public Infrastructure (Housing and Urban Planning) sector

Name	Type	Year and status	Description	Objectives/ Goals
Subsidy for Thermal Conditioning of Housing	Economic Incentive	2005 Implemented and active	This grant allows to improve the thermal insulation of social housing or whose appraisal does not exceed 650 UF, allowing benefitted families to make savings in heating and decrease the condensation effects inside of the house.	Decrease by 30% of the demand for consumption of fuels for residential heating.

Objectives/ Goals	Actions implemented	Progress	Planned actions
• 25% of the bids in public building include energy efficiency and sustainability criteria to 2019 and with Certification of Sustainable Buildings (CES). • 30% of the bids in public building include criteria for energy efficiency and sustainability to 2021 and CES Certification. • 40% of the bids in public building include criteria for energy efficiency and sustainability to 2022 and CES Certification.	Of a total of 24 projects designed by the Architecture Directorate of the MOP in 2017, 20 considered energy efficiency in their designs. And of these, 22 had the CES Certification.	For 2018, 5 projects CES certified and 37 pre-certified were available. It should be noted that, as a result of the rationale for projects performance of the Architecture Directorate, which acts on the basis of third parties' requirements, the projects portfolio of is determined during the year.	During 2018, in accordance to what was considering in the Infrastructure plan, work will be done on the development of a methodology to quantify GHG emissions, both at the base line as savings resulting from the implementation of energy efficiency criteria and, in addition, to incorporate this calculation in the Certification of Sustainable Building.
• Counting with methodologies for measuring and managing HdC by typologies of MOP works. • In 2022, having 35% of MOP portfolio incorporating measurement and management of HdC to tenders.	To date, a study carried out in 2012 is available, which analyzed a public building and proposed a methodology to measure the HdC in the stage of operation.	In 2018, it will start with the development of studies to fulfill the commitment incrementally.	Carry out trainings to MOP workers; search for funding to carry out specific studies and development of pilot cases.
• Implement eco-efficiency measures to DV fleet of machinery. • Training operators of machinery of the DV of the MOP, regarding to the importance of avoiding idling in the operation of the machinery, in order to avoid generation of GHG emissions. • Incorporating measures of efficiency in public works contracts for the operation of machinery off road. • In 2022, 25% of machinery off road of the DV incorporate eco-efficiency criteria, considering both new machinery and the already existing.	A pilot case was conducted to determine the filters and implementing then in the DV machinery. The total fleet of the DV is 550 machines.	Currently there are 7 machines with particle filter for black carbon.	The installation of filters for 5 machines per year has been scheduled until completing the entire machinery of the DV.
• In 2022 to have a 100% operational platform and that 45% of MOP projects report their GHG emissions.	There are not implemented actions.	Measure to be implemented in five years.	Search for financing and/or strategic alliances with other ministries for the fulfillment of this measure.

Actions implemented	Progress	Planned actions
• Within the framework of the Energy Agenda, MINVU committed the annual delivery of at least the equivalent to 1 million UF in thermal conditioning grants for housing located between Coquimbo and Magallanes, and a special allowance in areas with Atmospheric Decontamination Plans.	▪ During 2017, 12,449 grants have been allocated (UF1,392,808) for thermal conditioning according to standard in force, and 7,199 subsidies (UF1,652,255) have been applied under standards defined by Atmospheric Decontamination Plans that year, totaling UF3,045,064 for improving the thermal conditioning of households.	In 2018 the implementation of regular subsidies will continue, and thermal application in new areas with Atmospheric Decontamination Plans (PDA new and 2nd stage).

Name	Type	Year and status	Description	Objectives/ Goals
Thermal regulation (3rd stage)	Regulatory	2000 Implemented and active	It intends to make progress in the implementation of a new standard for the thermal house wrap, improving their performance and livability. This involves the corresponding modifications to the specific regulations (General Ordinance of Urbanism and Construction - OGUC).	The gradual implementation of this standard would make it possible to reduce energy demand for heating in houses by 30%. The increase of the standard over the current demands, will have a positive impact on the energy performance of housing and its livability (ventilation and air infiltration, thermal bridges, doors and condensation), which could reduce pathologies and ensure the quality of the indoor air. This objective is a part of the commitments set out in the Energy Agenda.
Energy Rating of Houses	Information	In 2012, starts to operate. Between 2016 and 2017, development of updated version. In 2018, entry into force of the updated version.	The Energy Rating of Housing (CEV) is an instrument designed and implemented by the MINVU and the Ministry of Energy. This tool allows making an objective and standardized assessment to estimate and classify the energy requirement of a house to obtain a temperature considered comfortable for its users.	Promoting energy efficiency through the delivery of objective information about the energy performance of a house (incorporate energy criterion in the decision to purchase).
Sustainable construction standards for Chilean houses	Information Voluntary Actions	In 2016, in force, and updated in 2017	The standard corresponds to voluntary standards of sustainable construction for houses in six categories: Health and Wellbeing, Energy, Water, Environmental impact, Materials and Waste and surrounded environment.	Being a reference document of high standard for the design, construction and operation of new or renovated houses, based on the incorporation of sustainability parameters, promoting continuous improvement in sustainable construction.
Certification of Sustainable Housing	Economic Instrument Information	Under development, to be launched in 2019	Voluntary system of housing environmental certification, which assess different sustainability criteria of the construction throughout its life cycle (design, construction, operation).	Accelerating the transition towards a construction that incorporates sustainability attributes, through the valuation of housing providing objective and reliable information.
Reduce the deficit of green areas in the country, through investment in conservation and construction of parks and squares.	Project	2015 Implemented and active	Parks are an urban equipment offering multiple eco-systemic services. They offer open spaces allowing to carry out a wide variety of outdoor activities that are beneficial for people's health. They also play an important environmental role in climate regulation, runoff regulation, infiltration of rainwater, capture of pollutants, being the habitat for wildlife and contribute with biodiversity to urban habitats.	▪ Parks Construction Plan: 34 new Urban Parks. ▪ Park Conservation Program: according to the budget for the following years, the corresponding annual goals will be defined.

Actions implemented	Progress	Planned actions
▪ In 2000 the first phase of the thermal regulation (thermal insulation in roofs) was implemented. ▪ In 2007 the second phase of the regulations (thermal conditioning of walls, ventilated floors, and percentage of windows) is implemented. ▪ Development of a handbook for Implementation of theRegulation. ▪ In 2013, a study was developed to update the thermal regulation (Art. 4.1.10 - OGUC). ▪ Between 2016 and 2017, a study was conducted to analyze the impact of the series of initiatives and regulatory changes, proposed and approved in the housing market.	▪ The new thermal standard for housing has been incorporated at zones enacting new Atmospheric Decontamination Plans (Art. 4.1.10 Bis, OGUC).	▪ It is expected to move forward in the corresponding regulatory modification to generate a residential thermal standard at a national level.
▪ Nine processes of accreditation for energy assessors. ▪ Development of updated version that refines the calculation engine and includes new parameters of the thermal regulations contained in article 4.1.10 bis of the OGUC (for areas with PDA). ▪ Development of control protocol.	In December 31, 2017: ▪ 744 accredited energy assessors ▪ About 37,000 houses have been assessed (approximately 69% social and 31% private). ▪ Approximately 60% of the homes assessed achieved rating D or higher (houses with good efficiency standard). In the private houses assessed, more than 60% achieves rating C or higher.	▪ Implementation of updated version during 2018. ▪ The performance of two accreditation processes for energy assessors per year is expected. ▪ It is expected to implement the control protocol. . ▪ It is expected that the CEV is used as an Accreditation mechanism of thermal regulation.
In November 2016 the Sustainable Construction Standards were launched, based on the sustainable construction code.	During 2017 standards were updated simplifying some processes, references, formulas and calculation methodologies were amended.	There is not any planned action.
The following stages have been completed so far: ▪ Definition of minimum variables to declare a housing sustainable. ▪ A weighting pattern for scores was established by category and by variables. ▪ Scores were set using the weighting pattern mentioned above, regarding as reference surveys conducted at a national level. ▪ A model of governance and sustainability has been defined for the system. ▪ Definition of a regulatory framework. ▪ Definition of a documentary control system. ▪ Guidelines for the implementation of a computer platform for the management of the certification.	Currently, under calibration phase and starting in May the pilot stage will start.	2018 activities are: Application Guide, finish computer platform, system control, development of courses for advisors and a communications event.
• Begins the implementation of the Urban Parks Construction Plan, and financing for the Conservation of new Urban Parks.	▪ Urban Parks Construction Plan: the construction of 16 urban parks has been completed. There are 17 parks under construction, and 1 park in the awarding process. ▪ Conservation Program for Urban Parks: Currently the MINVU runs the conservation of 11 urban parks, distributed in different regions of the country.	▪ It is projected that in 2018 the construction of 16 urban parks will be completed. One park at the end of 2019 and another in 2020. ▪ Regarding the Conservation of Parks Program, it is expected that 3 of the parks that are currently under construction complete this process during the current year, and initiate their Conservation.

Name	Type	Year and status	Description	Objectives/ Goals
Bikeways Plan	Project	2014	Initiative at a national level that includes the construction of 190 kilometers of high standard bikeways, distributed in the 15 regions of the country, benefiting 32 cities.	Construction of 190 kilometers of high standard bikeways.
Master Plan of Santiago´s Bikeways[19]	Project	2013 - 2032 Implemented and active	Initiative that includes the design and construction of a network of 932 km of bikeways for Santiago, and that is a part of the Santiago Transportation Master Plan 2025.	Design and construction of 932 kilometers of bikeways.

Source: Own preparation based on sectorial Information

S/I: no information.

[19] *Information provided by the Planning Department of the Metropolitan Regional Government of Santiago (March 2018).*

Actions implemented	Progress	Planned actions
▪ Construction of bikeways. ▪ Modification of OGUC to facilitate the construction of bikeways in all road categories and to increase staff at bikes' parking in new projects. ▪ Publication of a Design Handbook. ▪ Implementation of a network of automatic meters in the bikeways of the plan 190K throughout Chile. ▪ Open publication of data counts of flows at bikeways of the plan 190K.	▪ As of December 2017, 162 km of bikeways had been finished in all regions. It is projected that as of 2019, a total of 246 km will be built. ▪ The OGUC was modified by Decree 109 of June 4th ,2015, incorporating aspects of bikeways and bicycles parking. ▪ In 2015 the recommendations design handbook "Vialidad Ciclo-Inclusiva" was published, which has become the standard for the implementation of bikeways since its publication. ▪ Currently, there is a network of 114 counters distributed in 23 cities, which together have counted more than 4 million trips since 2016 to date. ▪ The information counters, interactive maps with geo-referenced data, design handbooks and studies on behavior and use of bikeways, is material of public access through the web page www.ciclovías.minvu.cl	MINVU will continue promoting the use of the bicycle as a manner of urban transportation, focusing on this new period on the aspects of coordinated and participatory planning of cycle -inclusive networks. To this aim it is developing a series of studies scheduled to modernize the planning tools, management and assessment of projects in this line, elements that will be made available to MDS, Sectra, Municipalities, Regional Governments, Housing and Urbanization services, and private organizations to developing master plans, designs and cycle-inclusion works.
▪ Construction of bikeways.	▪ As of March 2018, there are 311.2 km of existing bikeways and 98.73 km of bikeways finished, in progress or at tender.	Bikeways planned: 63.7 km.

ANNEX 6. UPDATE NAMA CARDS

Table A. 1. Renewable energy for self-supply in Chile (SSREs).

General Background to the NAMA	
Full Name	Renewable energies for self-supply in Chile (SSREs).
Short name	Self-Supply NAMA
Stage	☐ Conceptual/Feasibility. ☐ Planned or in planning. X Adopted: under implementation. ☐ Implemented.
Registered with United Nations	X Yes ☐ No
Category	☐ Unilateral in search of recognition ☐ Bilateral in search of support for planning ☐ Bilateral in search of support for implementation X Bilateral with implementation ☐ Credits

Description	The Ministry of Energy and the Chilean Economic Development Agency (CORFO), have developed a NAMA in the self-supply energy systems based on renewable energies. The overall objective of the NAMA is to encourage the incorporation of renewable energy systems for the self-supply in Chile through the creation of financial and technical conditions suitable for the early stages of the development of this emerging industry. The NAMA will address the technical and financial obstacles for renewable energy systems of small and medium scale in self-supply in the industrial, agricultural and commercial sectors, through financial instruments, technical assistance, and outreach and awareness activities, with the support of the Ministry of Energy and CORFO. The NAMA aims to: 1. Increase the insertion of renewable non-conventional energy systems at a small and medium-scale for self-consumption in the different productive sectors, through the creation of technical and financial conditions for the early stages of development of this emerging industry. 2. Contribute to the achievement of the national goal of Chile to reach a deviation of 20% of GHG emissions below BAU to 2020 3. Overcome barriers for SSREs. 4. Encourage the development of an industry and market maturity of the for non-conventional renewable energy technologies for self-supply in Chile. 5. Improve the knowledge and local capacities in SSRE technologies through technical support. The NAMA will achieve these objectives through a comprehensive program that addresses simultaneously the technical and financial barriers for the implementation of renewable energies at a small scale. The NAMA is coordinated by the Division of Renewable Energies of the Ministry of Energy The NAMA components are: 1. Financial component: (i) Co-financing for pre-investment studies; (ii) Co-financing for investment projects; (iii) partial credit guarantee fund for local financial institutions; and (iv) counselling services for institutions of the financial sector. 2. Technical Support Component: i) Dissemination and awareness: The NAMA will help raising awareness on the options of use of ERNCs for self-supply in the Chilean industry. Technological tours and field trips sponsored by the NAMA will contact potential investors with the technologies and with current users. ii) Training and capacity building: through workshops and training courses. Stakeholders in the private and public sectors (excluding the financial sector, which is covered by the financial component) will be trained in the following areas: analysis of SSREs projects' feasibility; projects assessment and management; introduction to ERNC technologies; etc. Design and carry out an exchange program with national and international experts, to share experiences and knowledge. (iii) Preparation of projects: technical assistance through a technical help desk and a virtual platform that provides guidance and technical support to projects' developers on queries related to the technologies, projects development, connection to the network and regulatory and legal affairs. Technical support will be the main entry point for project developers and other interested parties. (iv) Measurement, Reporting and Verification (MRV): Development of a system of MRV for the NAMA. Design of templates and formats for the report, data inclusion and process of the NAMA verification.
Nature or type of action	X Strategy, Policy, or Programs. Specify instrument related[1]: Dissemination and awareness, Training and capacity development, Technical assistance through a technical help desk , Platform for monitoring, Reporting and Verification, Pre-investment subsidies, Subsidies to investment, the guarantee fund to facilitate access to bank credit and capacity building. ☐ Project or set of projects (investment in technology or infrastructure) ☐ Other (s) …………………………………….

[1] Instrument of economic, governmental, inventive, voluntary agreements, regulatory, normative, information management, capacity building, research, etc. type

<table>
<tr><td>Sector (IS) that considers the NAMA</td><td colspan="2">X Agriculture
☐ Construction
X Power Generation
Energy Use
☐ Forestry/LULUCF
X Industrial and industrial processes</td><td>X Waste
☐ Transportation and its infrastructure
X Crosswise (mark all that apply)
☐ Other(s)..........................</td></tr>
<tr><td>Technology</td><td colspan="3">Solar Energy, Geothermal Energy, Bioenergy, hydroelectric power.</td></tr>
<tr><td>Gas (es) covered by the NAMA</td><td colspan="2">X Carbon dioxide (CO_2)
X Methane (CH_4)
X Nitrous oxide ((N_2O)</td><td>☐ Hydrofluorocarbons (HFC)
☐ Perfluorocarbonos (PFC)
☐ Sulfur hexafluoride (SF_6)
☐ Nitrogen trifluoride (NF_3)</td></tr>
<tr><td>Jurisdiction</td><td colspan="3">X National ☐ Regional ☐ Interregional</td></tr>
<tr><td rowspan="3">Implementation Dates</td><td>Period</td><td colspan="2">7 years</td></tr>
<tr><td>Start-up Year or year of expected start-up</td><td colspan="2">2015</td></tr>
<tr><td>Year-end</td><td colspan="2">2022</td></tr>
<tr><th colspan="4">Objectives of the NAMA</th></tr>
<tr><td colspan="4">1. Increase the insertion of the non-conventional renewable energies systems on a small scale for self-supply in different sectors, through the creation of technical and financial conditions for the early stages of development of this emerging industry.
2. Contribute to the achievement of the national goal of Chile to reach a deviation of 20 % of GHG emissions below the BAU to 2020.
3. Overcoming barriers for SSREs.
4. Encourage the development of an industry and maturity of the market for non-conventional renewable energy technologies for self-supply in Chile.
5. Improve the knowledge and local capacities in SSRE technologies through technical support.</td></tr>
<tr><th colspan="4">Barriers of the NAMA</th></tr>
<tr><td colspan="4">The main barriers identified in earlier versions of this document persist, however it is possible to identify some progress in overcoming these barriers, which are outlined below.</td></tr>
<tr><td colspan="4">1. Human Resources:
(i) SSRE projects face a lack of access to qualified technicians because the market is new and underdeveloped) which will depend on the particular RE technology. There is a limited number of consultants or consulting firms specializing in the development of projects. At the same time, there is a limited availability of installers that can implement the projects.
(ii) Insufficient companies with experience and a lack of monitoring to projects development causes an increased perception of the risk involved in SSRE projects.
(iii) Once the SSRE projects have been implemented, there is a limited number of qualified technicians to operate and maintain plants and equipment, in particular in those cities located outside the Metropolitan Region.</td></tr>
</table>

2. Financial barriers:

(i) The amount of SSRE projects that can be funded is limited, mainly due to a lack of willingness to invest in (pre) feasibility studies, particularly in less developed Renewable Energy technologies, due to high initial costs and a high-risk perception.

(ii) There is a limited access to loans offered by financial institutions because these entities prefer to invest in projects of greater capacity so as to achieve scale economies.

(iii) The lack of familiarity of the banks with respect to the investment in SSRE projects leads to higher costs of credits resulting from the perception of risk, which reduces the financial feasibility of SSRE projects.

(iv) The high transaction costs for projects such as "Small Means of Distributed Generation" (PMGD) could become significant economic barriers.

(v) Generally, the high expectations of companies are being overshadowed by the high costs of some technologies, the low return on investment and long payback for investors, which could slow down the investment in projects SSRE since the investment could be less attractive compared to other business opportunities.

3. Awareness Barriers:

(i) The general knowledge in relation to Renewable Energy systems is limited, in particular in specific applications of SSRE addressed to certain industrial sectors.

The owners of companies in various industrial sectors do not understand the working of SSRE technologies, so they do not have certainty with respect to the technological and economic potential that technologies offer in the operation of their business.

Quantitative Goals of the NAMA		
Quantitative targets (reductions)	Progress indicators for each goal (reductions)	Additional information for each goal
Reduces near 1.5 $MtCO_2e$.	Cumulative Reduction in $MtCO_2e$	The expected reduction considers the useful life of the projects implemented in an average of 25 years, at an average cost per program of USD11.3 per ton.

Methodologies and assumptions (scope, purpose, goals and evaluation of progress)	
Methodologies	Assumptions
1. Construction of projection with NAMA.	The composition of the portfolio: PV 72 %, thermal biomass 2 %, thermal biogas 4.5 %, biogas cogeneration 6 %, solar water heaters 7 %, micro hydraulic 8.5 %. Average cost of delivery: PV 2,046 \$/kWe, thermal Biomass 812 \$/kWt, thermal Biogas 4,000 \$/kWt, cogeneration Biogas 4,500 \$/kWe, solar water heaters 1,345\$/kWt, hydraulic micro 5,500 \$/kWe. Expected annual change of costs: PV -6 %, 0 % of thermal biomass, biogas thermal and cogeneration 0 %, solar water heaters 0%, hydraulic micro 0 %. Average emission factors: 598 gCO_2e/kWhe replacing electrical installations and 204 gCO_2e/kWt substituting thermal installations. Half-life of the facilities: PV 25 years, thermal Biomass 25 years, thermal and Cogeneration Biogas 25 years, solar water heaters 27 years, hydraulic micro 30 years. Average Plant Factor: PV 18.5 %; thermal biomass 50 %; thermal Biogas 50 %; biogas cogeneration 80%; solar water heaters 27 %; hydraulic micro 50 %.

Planning and progress in implementation		
Planning	Progress	Results achieved and expected (Progress Indicators)
Steps from the Action (s): activities/years	Status of Progress	Reductions achieved or expected[2]
Technical component: **2016-2020** 1. Outreach and awareness - Development of information material regarding technical and economic feasibility and implementation of seminars. - Technological tours and site visits to contact potential investors and current users. 2. Capacity building - Design and implementation of trainings. 3. Preparation of projects - Support for the development of potential SSRE projects. Implementation of technical assistance to support projects developers through a technical help desk. - Development of a virtual information platform related to SSRE projects. 4. Monitoring, Reporting and Verification (MRV) - Support to the design of an MRV system for the SSRE sector comprising the NAMA Support Project (NSP) **Financial Component: 2017-2021** 1. Design and implementation of a subsidy to pre- investments studies in self-supply projects of renewable energies 2. Design and implementation of a subsidy to investments in projects of self-supply of renewable energies 3. Training and advice of Financial Entities 4. Design and implementation of a partial guarantee fund to credits aimed to self-supply projects of renewable energies	Currently self-supply NAMA is in a status of implementation. With regard to the technical component of the NAMA Support Project draft, this is at the stage of implementation, while the financial component is approved and in preparation.	Self-supplyNAMA The Ministry of Energy is strongly encouraging self-supply with RE, removing regulatory, information and management barriers. As a result: In October 2014, Law 20,571[3] was enacted and as of December 2017, 2,076 declared facilities of electric generation are recorded with the Superintendence of Electricity and Fuels in Chile (SEC), which constitutes an installed power of 12.2 MW. Information requirements of measuring and monitoring for PMGD[4] between 100kW and 1,500 kW have been simplified. SFV 128 have been tendered for public buildings within the framework of the PTSP[5], totaling 4.9 MW of installed capacity and of which 105 are finished and operating. The scope and benefits of Law 20,571 of Distributed Generation have been formally introduced in the tenders of Law 18,450 of Irrigation and Drainage encouragement, and as a result of which tenders[6] have been developed that have helped more than 23 irrigation projects with energy supply through RE (470 kW). A credit was obtained for self-supply through RE and EE addressed to micro and small companies, through the joint work with Banco Estado. The incorporation of the ESCO model for energy supply is being encouraged. The first SFV was implemented through the ESCO model in the building of a public service. Technical component of the NSP The results achieved of the technical component are listed in the following table of "Co-benefits achieved or expected by stage". Financial component of the NSP: Still no results have been achieved through NSP with regard to reduction of GHG emissions since the financial component is still under planning. The goal of reduction of GHG emissions of the NSP is to reduce about 1.5 $MtCO_2e$, considering the useful life of the projects being implemented, at an average cost per program of USD11.3 per ton.

[2] *They can be time series.*
[3] *Allows customers to regulate the right to generate their own electricity, self-consume it and sell their surpluses to the distribution company.*
[4] *Small means of Distributed Generation.*
[5] *Public Solar Roofs Program which main objective is to contribute to the maturing of the photovoltaic market for consumption in Chile, through the implementation of photovoltaic projects connected to the electrical distribution networks under the scheme of the Law of Distributed Generation.*
[6] *Other tenders are under development.*

Co-benefits achieved or expected by Stage		
Steps (defined earlier)	Indicator Name[7] (co-benefit)	Results achieved and expected
- Development of a portfolio of bankable projects. - Training and advisory services for the financial sector. - Support to investment. - Support to pre-investment studies. - Creation of the guarantee fund - Education and training of project developers and other relevant entities. - Technical help desk. - Dissemination and awareness. - MRV system.	- Renewable Energy Capacity installed: It indicates the total amount of MW of renewable energy installed. This indicator is divided into subsets according to technology. - Job Creation: Indicates the number of permanent and temporary positions created as a result of renewable energy projects that are a part of the program. Expressed in units of full-time equivalent positions. - Leverage ratio in the private sector: It indicates the private sector contribution to renewable energy projects within the framework of the program. It is expressed as a percentage of the funds (NAMA: private funds)[8].	Expected results: - Installed renewable energy capacity: 44.9 MW. - Leverage of about USD100 million. - Increase in the number of companies developing NCRE projects: 10 companies. - 100 individuals (developers, project installers) trained. - 40 individuals participated in visits to plants of good practice or in exchange programs of international knowledge. - 200 potential projects were given technical support through the help desk. - A virtual information platform is operating. - Dissemination and awareness events for at least 300 people of at least 3 industrial sectors, in 3 regions. - An MRV system for the NSP is implemented and operating. Results achieved: - Installed renewable energy capacity: 0 MW. - Leverage is equivalent to zero (0). - Increase in the number of companies developing NCRE projects: 34 companies. - 142 individuals (developers, project installers) trained. - 60 individuals participated in visits to plants of good practice or in exchange programs of international knowledge. - 78 potential projects were given technical support through the help desk. - A virtual platform of information is working: under development. - Dissemination and awareness events for at least 282 people of at least 3 industrial sectors, in 3 regions. - A system of MRV for the NSP is implemented and operating: under development.
Costs of the NAMA		
Estimated cost of preparation	Cost	S/I (Without Information)
	Calculation description	S/I
Estimated cost of implementation	Cost	EUR 46.4 million
	Calculation description	S/I
Incremental implementation cost	Cost	S/I
	Calculation description	S/I

[7] *Co-benefits may consider social, economic and environmental effects other than the reduction of GHG emissions. They can be qualitative or quantitative.*
[8] *For example, a value of 1:2 would indicate that for every $1 spent in the program $2 were provided by the private sector.*

Funding Source		
Own resources	EUR 6.01 million	
Resources received	EUR 17.03 million NAMA Facility	
Resources to be requested (total, since detail appears below)	N/A (Not Applicable)	

Support Required		
Financial Resources	Required amount	0
	Type of resources required	N/A
	Comments	N/A
Technology	Required amount	N/A
	Type of resources required	N/A
	Comments	N/A
Capacity building	Required amount	0
	Type of resources required	N/A
	Comments	S/I

Description of MRV

The National Center for Innovation and Promotion of Sustainable Energy Development (CIEDS, an institution that currently has been dissolved), fullfilled the creation of a digital platform to obtain a database of NCRE projects. The platform was initially conceived as a project management system that allows to: standardize and organize projects; monitor the variables of each project; collect information, indicators, state, etc. of different kinds of NCRE projects.

From its initial conception the possibility has emerged that this platform becomes an MRV system for the management of SSRE projects information that are implemented through the NAMA Support Project. The platform is currently not in use as since a computing point of view, it is not possible to update it (it has an obsolete system), consequently it will be necessary to create a new MRV system.

The development of an MRV model will allow the Technical Component of the NSP project to contribute with an MRV system for the Renewable Energy sector, for self-supply. This applies to both the mitigation of GHG emissions resulting from the NSP, as to the NAMA for domestic self-supply, without focusing on additional activities, impacts or co-benefits implemented for or resulting from the NSP project. The goal is an MRV system to individually calculate GHG reduction from a bottom-up approach.

This way, the future goal of the platform is that professionals of public institutions have the information available so that they can develop reports as they deem necessary, in accordance with the requirements established by, for example, the MMA or donor funds. The platform should specify, at each stage, what are the parameters that should be controlled and generate the indicators that allow to optimize projects management.

Currently, an MRV system is being implemented for the SSRE sector, which is being developed jointly with the Division of Renewable Energies (DER) of the Ministry of Energy. This will make it possible to quantify the reduction of GHG emissions from renewable energy projects for self-supply. The purpose is to develop an MRV system allowing to individually calculate GHG reduction from a bottom-up approach. Renewable energy technologies considered in the quantification of emissions reduction are: photovoltaic, solar thermal, wind, micro and mini hydro, geothermal heat pumps, biogas and biomass.

Policies and related regulation

Chile's Energy Policy / Energía 2050,link:

http://www.minenergia.cl/archivos_bajar/LIBRO-ENERGIA-2050-WEB.pdf

NDC, Nationally Determined Contribution of Chile toward the Climate Agreement of Paris 2015, link: http://www4.unfccc.int/submissions/INDC/Published%20Documents/Chile/1/INDC%20Chile%20english%20version.pdf

Web page of the DER self-supply, link:

http://www.minenergia.cl/autoconsumo/

Website of the Technical Component of the NSP project:

Https://www.4echile.cl/nama-energias-renovables-para-autoconsumo/

Related NAMAs	
NAMA CPA, which clean production agreements may consider some SSREs projects co-financed by the funds of NAMA SSRE.	
Contact details that coordinates and manages the NAMA	
Responsible Institution	Renewable Energy Division, Ministry of Energy, Government of Chile.
Professional to be contacted	Marcel Silva, Professional of the Ministry of Energy. Alameda 1449, floors 13 and 14, Santiago, Chile (562) 23656686, Msilva@minenergia.cl
Alternate Contact	
Alternate Contact	N/A

Table A. 2. Green Zone for transportation in Santiago.

General Background to the NAMA	
Full Name	Green Zone for Transportation in Santiago
Short name	NAMA ZVTS
Stage	☐ Conceptual/Feasibility Study. ☐ Planned or under planning. X Adopted: in implementation. ☐ Implemented.
Registered in United Nations	X Yes ☐ No
Category	☐ Unilateral in search of recognition ☐ Bilateral in search of support for planning X Bilateral in search of support for implementation ☐ Credits

Description	The NAMA is composed of four specific initiatives to encourage transportation modes with a low content of carbon emissions: 1) Promotion of vehicles from zero and low emissions in the fleets of light vehicles (taxis and municipal fleet) and charging stations; 2) More efficient buses for public transportation; 3) Promotion of use of non-motorized vehicles, including the implementation of new lanes of high standard for bicycles, a system of public bicycles, a solution for connectivity of existing bikeways, and signals for bikes in two areas of the ZVTS; 4) Management and redesign of transit, with new pedestrian streets and semi pedestrian streets, exclusive bus lanes of zero and low emission levels, and bicycle parking. These initiatives are scalable and replicable. The first target set for the NAMA (2011 and under implementation since 2014) would be carried out within a defined area of Santiago downtown, Chile, area which corresponds to the jurisdiction of the Municipality of Santiago. The geographical perimeter proposed for the ZVST was defined together with the Municipality of Santiago. The area includes the historical triangle of the city's downtown, which covers about two square kilometers. Many historical places of interest may be found within the ZVST, including Plaza de Armas, the Cathedral of Santiago, the Government Palace "La Moneda", the Municipal Theater, the Central Market of Santiago and the Forest Park, among other. The selected area is a very popular area, for tourism and commercial, which guarantees a high impact and high visibility for all the initiatives of the ZVST. One of the main conclusions of the participatory process with the actors interested in developing the ZVST, is that it must be regarded as a pilot project with great potential for scaling and replicability, contributing to the redefinition of a model of urban passenger transportation with a new approach to integrated transportation and sustainable development. The implementation of the ZVTS will also provide new ways to reduce greenhouse gas emissions and local pollutants. In its 2016 update (April and September) work was done on the scalability of the entire city of Santiago and replication of two (2) Green Zones: one in a city in the north of the country and another in the south of the country.
Nature or type of action	X Strategy, Policy, or programs. Specify related instrument [9]: program or sectorial policy… X Project or set of projects (investment in technology or infrastructure) ☐ Other(s) ………………………………………
Sector (s) the NAMA considers	☐ Agriculture ☐ Construction ☐ Power Generation ☐ Use of Energy ☐ Forestry/LULUCF ☐ Industrial and industrial processes ☐ Waste X Transportation and its infrastructure ☐ Crosswise (mark all that apply) ☐ Other(s) ………………………
Technology/methodology	Zero or low-emission vehicles. A modal shift, from private vehicle to other modes such as cycling or public transportation.
Gas (es) covered by the NAMA	X Carbon dioxide (CO_2) ☐ Methane (CH_4) ☐ Nitrous oxide (N_2O) ☐ Hydrofluorocarbons (HFC) ☐ Perfluorocarbonos (PFC) ☐ Sulfur hexafluoride (SF_6) ☐ Nitrogen trifluoride (NF_3)
Jurisdiction	☐ National X Regional RM ☐ Interregional

[9] *Instrument of economic, fiscal, voluntary agreements, regulatory, information management, capacity building, research, etc. type*

Implementation Dates	Period	IImplementation Goal between 2014 and 2018. Scalability Gran Santiago implementation and replicability in Regions 2017 to 2022.
	Start-up Year or expected start-up year	2014, with the implementation of measures encouraging pedestrianization, semi-pedestrianization and bikeways.
	Year of completion	2018-2022, depending on renewal of Transantiago contracts, technological replacement.

Objectives of the NAMA
Reduce GHG emissions in the transportation sector by encouraging sustainable transportation initiatives, scalable and replicable, through the use of new low carbon vehicle technologies and encouraging integration and modal shift.

Barriers of the NAMA
Technology: the two technological initiatives have the problem of requiring specialized technical assistance. This capability is not within the resources that maintain the fleet of buses or taxis. However, at this early stage in the use and testing of technologies, suppliers of technologies would make an accompaniment by delivering a complete of post-sale and training service to the staff of the technology decision makers. Economic: technological measures involve a high increase in the capital cost which makes the holder of technology (buses and taxis operators) assume too much risk in the investment, considering that it is a non-proven technology in the country. For this early stage, providers are offering, in several cases, the financial instrument of operating lease which includes instalment. Cultural: the measures for the promotion of non-motorized vehicles and management and redesign of transit are smaller in popularity because it implies removing space for private vehicles to give space to bicycles and pedestrians, respectively. To overcome this barrier, technology exists of flow automatic meters, both for pedestrians and bicycles, which may argue with real figures the impact of these measures in terms of mobility of individuals and not of vehicles. Also, the electric vehicle technologies are unknown by the operators and users, which requires making dissemination of results and testing such as those covered by the first goal of the Green Zone NAMA for transportation in Santiago.

Quantitative goals of the NAMA		
Quantitative targets (reductions)	Progress indicators for each goal (reductions)	Additional information for each goal
1.43 $MtCO_2e$ in total, during the entire period (10 years).	Accumulated tCO_2 emission reduction	Considers evaluation for 10 years of the fully implemented goal: 10 municipal electric light vehicles 5 municipal plug-in light vehicles 38 electric taxis 5 electric buses 5 hybrid buses 1.25 km bikeways 130 public bicycles 150 bicycle parking lots 8 Tricycles
Goal for Great Santiago: 260.6 M tCO_2	Accumulated tCO_2 emission reduction	Considers evaluation for 10 years of the fully implemented goal: -250 electric vehicles 200 electric buses 300 hybrid buses 300 km bikeways
Scalability Goal: 120.4 MM tCO_2	Activities undertaken (quantity of vehicles ZLEV, quantity of buses ZLEV, km of high standard bikeways, managed blocks).	Considers evaluation for 10 years of the fully implemented goal: -300 electric vehicles 150 electric buses 300 hybrid buses 18 km bikeways

Methodologies and assumptions (scope, effects, goals and evaluation of progress)	
Methodologies	Assumptions
Estimate of expected reduction.	The stated goal represents the emission reductions estimated at 10 years, in a scenario of greater coverage to ZVTS. It includes 15% of the fleet of taxis in Santiago (3,525 substituted drives) and 15% of the Transantiago fleet (975 substituted drives), both of which replaces the existing technology with electrical technology. This potential reduction could be more if replacing a greater percentage of the fleet. If the ZVTS considers only two square kilometers of the intervention in Santiago, reduces 13,000 tCO_2eq in 10 years.

Implementation Planning and Progress		
Planning	Progress	Results achieved and expected (Progress Indicators)
Steps from (s) Action (s): activities/ years	Progress Status	Reductions achieved or expected[10]
Initiative 1: Promotion of ZLEV light vehicles (vehicles of zero and low emission).	In December 2015, 3 electric taxis were inaugurated, which quotas were granted by the SEREMITT RM. For the operation of such vehicles there are 2 chargers installed in the area covered by ZVTS.	The initiative includes 39 taxis and 15 municipal vehicles. Expected reductions under estimation process.
Initiative 2: More efficient buses for public transportation	In May 2016, the first electric bus in Chile was inaugurated for the transportation of passengers, with a free, district tour.	Initiative 2 includes 5 electric buses and 5 hybrid buses. Expected reductions under estimation process.
Initiative 3: Promotion of non-motorized vehicles	Regarding the system of public bicycles, the SIPB[11] has been implemented with great success. 18 stations were installed in the territory instead of the projected 13, widely exceeding the demand estimates for this service. Bikeways at Rosas and Teatinos streets in operation with high rates of daily use.	Expected reductions under estimation process.
Initiative 4: Transit management and redesign	Compañía axis implemented 2016 (semi-pedestrianization) San Antonio axis under implementation in 2016 (semi-pedestrianization) Santo Domingo axis to be implemented in 2016 (semi-pedestrianization) 100 bike-racks on the surface have been implemented.	Expected reductions under estimation process.

Co-benefits achieved or expected by Stage		
Steps (earlier defined)	Indicator Name[12] (co-benefit)	Results achieved and expected
1 to 4 initiatives.	- Funds paid by donors. -Funds disbursed by the local government and the private sector. - Rate of accidents - Generation of technical capabilities associated to the use of new technologies - Improvements in trade within the area of intervention in the ZVTS - Reduction of PM and NOx emissions	S/I

[10] These can be time series.
[11] SIBP: Integrated System of public bicycles, it integrates 10 districts.
[12] Co-benefits may consider social, economic, environmental and other than the reduction of GHG emissions. Can be qualitative or quantitative.

Costs of the NAMA		
Estimate cost of preparation	Cost	USD $193,070
	Calculation description	It considers the development of three technical assistances that have helped in the design, update and strengthening of the NAMA Green Zone for Transportation: -Design of the NAMA ZVTS, funded by the British Embassy in Santiago 2011 (USD $73,500) -Update of the NAMA ZVTS for its implementation, financed by the IDB, 2014 (USD $25,600) - MRV design of NAMAS ZVTS and its proposal for scalability, funded by CAF, 2016 (USD $93,970)
Estimate of implementation cost	Cost Goal, defined as the first Green Zone which is currently on top at the Municipality of Santiago.	USD 51.1 million
	Calculation description	The 2016 update of the goal that defines the first Green Zone for transportation in Santiago includes: 50 light vehicles of zero and low emission, 21 electric charging points, 5 stops, 21 indications of electric taxi and municipal fleet stops, 5 hybrid buses and 4 electric buses for Transantiago, 1 municipal electric bus, 4 km of new bikeways, 4 Automatic meter of bicycles flow, 104 blocks intervened to expand spaces for pedestrians, 1 underground parking, 1 and 7 tricycles with pedaling electrical assistance for the transportation of people.
	Cost Scalability (Great Santiago) defined as the scaling at a city level (Great Santiago) of the first Green Zone which is currently led by the Municipality of Santiago.	USD 366 million, within a period of 3 years
	Calculation description	The total cost includes 200 light vehicles of zero and low emission, 100 electric and 300 hybrid buses (both for Transantiago),300 km of bikeways and according to the number of inhabitants, transit management and urban redesign of initiative 4 were estimated. It should be noted that the cost of full implementation considers the entire implementation of each initiative, for example, in the case of Initiative 1, it includes: charging points, stops, indications. These figures are in addition to those considered in the Goal or first Green Zone.
	Cost to Replicate (Regions) Defined on how to replicate the Green Zone for transportation, but in other regions of the country different from the MR.	USD 215 million, within a period of 3 years
	Calculation description	The total cost includes 300 light vehicles of zero and low emission, 150 electric buses and 300 hybrids, 180 km of bikeways and according to the number of inhabitants, transit management and urban redesign of initiative 4 were estimated. It should be noted that the cost of full implementation considers the entire implementation of each initiative, for example, in the case of Initiative 1, it includes: charging points, stops, indications.
Incremental cost of implementation	Goal Cost	USD 3.6 million

	Calculation description	Referred only to the cost differential for full implementation of initiatives 1 and 2 that are of a technological issue. Then, it includes the difference in cost of capital between the conventional light vehicle and vehicles of zero and low emission, with their charging systems. (Initiative1); difference in capital cost between an Euro VI diesel bus and buses of zero and low emission, with their charging systems.
	Cost Scalability Great Santiago)	USD 58.5 million
	Calculation description	Referred only to the differential cost for full implementation of initiatives 1 and 2 that are of a technological issue. In addition, it considers 200 charging points for Great Santiago.
	Cost to Replicate (Regions)	USD 74 million
	Calculation description	Referred only to the cost differential for full implementation of initiatives 1 and 2 that are of a technological issue. In addition, it considers 200 charging points at regions

Funding Source	
Own resources for the Goal	In relation to what has already been implemented, for the case of the goal, defined as the first Green Zone for transportation in Santiago, the national contribution amounts to USD 31.7 million (95% public and 5%private contribution). The contribution has been mainly granted to initiatives 3 and 4 of the NAMA ZVTS, which are those of integration of sustainable modes of transportation. Another contribution which considered in the future implementation of the Goal corresponds to the amount equivalent to a conventional technology for the case of light vehicles and buses, equivalent to USD 2.8 million.
Own Resources for Scaling (Santiago)	Contribution that is considered in the future implementation to scale the NAMA ZVTS to the Great Santiago, it corresponds to the amount equivalent to a conventional technology in the case of light vehicles and buses, equivalent to USD 83.4 million (within 3 years).
Own resources to replicate (Regions)	Contribution that is considered in the future implementation to replicate the NAMA ZVTS in regions of Chile, corresponds to the amount equivalent to a conventional technology for the case of light vehicles and buses, equivalent to USD 95.1 million (within 3 years). In addition, for the case of electric taxis in regions, a public contribution is considered (subsidy from the Ministry of Transportation to renew fleet of this segment). For 300 taxis in regions, the additional public contribution would be USD 2.7 million (additional to the previous amount).
Resources received	No international resources have been received
Resources to be requested for the goal (for Initiatives 1 and 2)	USD 3.6 million
Resources to be requested for scaling (for Initiatives 1 and 2)	USD 58.5 million
Resources to be requested to replicate (for Initiatives 1 and 2)	USD 71.3 million (incremental cost less the regions subsidy to renew taxis)

Support Required		
Financial Resources	Required amount	The amounts that will be required, estimated at a span of 2 to 3 years, are: - Goal: USD 3.6 million - Great Santiago Scaling: USD 58.5 million - Replication at Regions: USD 71.3 million
	Type of resources required	Soft loan and subsidies from the State and private investment
	Comments	The funding required given the current level of implementation (2016) has its main focus financing the technological components of the NAMA Green Zone for transportation in its initiatives 1 and 2.

Technology	Amount required	0
	Type of resources required	N/A
	Comments	No support is required in technology at this first stage, since suppliers of vehicles of zero and low emission are available, who will provide the necessary technical support and post-sales service.
Capacity building	Amount required	USD 0.36 million
	Type of resources required	Institutional development, human resources and institutional-regulatory.
	Comments	The Municipality of Santiago would require additional human resources in order to adequately lead the NAMA ZVTS during the implementation process and the MRV process. In addition, the implementation of international financing will require a high administrative work to put in place the budget and support properly, and to inform to international donors.

MRV Description

In 2015, CAF - Development Bank of Latin America - through the Climate Change Unit (UCC), signed a cooperation agreement with the Municipality of Santiago (IMS). The objective of this cooperation was to provide technical support, guidance and knowledge deemed necessary for the review, adjust and supplement of the NAMA ZVTS, with special emphasis on the preparation of the base line, the measurement, reporting and verification system (MRV), and the quantification of the co-benefits.

So, with the financing of CAF and the sponsorship of the IMS, the study called Baseline, Measurement, Reporting and Verification System (MRV) and quantification of the co-benefits of the NAMA "Green Zone for Transportation in Santiago-ZVTS" was prepared by Sustainable Systems. The overall objective of the study was to carry out a plan of Measurement, Reporting and Verification (MRV) to determine the baseline and assessment of impacts on greenhouse gas emissions (GHG) and co-benefits of the NAMA ZVTS.

To carry out the main goal and specific objectives, a methodology was developed which included three (3) phases of work:

Phase 1 of "Update". This phase of the project updated the NAMA Green Zone in its four (4) initiatives, in addition to identifying relevant actors and characterize the national sectorial context in terms of policies and regulations.

Phase 2 of "Quantification". In this phase the base line was characterized, the reduction potential was determined and the plan for Monitoring, Reporting and Verification (MRV) was developed for the NAMA Green Zone allowing assessing the impacts of the NAMA on emissions and co-benefits.

With regard to the MRV design, standardized methodologies were used for the assessment of GHG mitigation projects and corresponding co-benefits: 1) the document prepared by the Ministry of Environment "Guidelines for a generic framework of MRV for NAMAs in Chile"; and 2) the international document of the World Research Institute "Standard for Policy and Action". The result of the MRV system design for the Green Zone allows assessing the impacts of projects in different scopes (local, regional, national) that integrate into any of the four (4) initiatives of the NAMA Green Zone. All the products associated to the MRV system leave standardized tools in order to be able to give continuity to the escalation phase of the NAMA Green Zone, which has been called the "National Strategy for Sustainable Transportation". These standardized tools allow evaluating both ex-ante and ex-post the impacts defined in consulting, through the definition of six (6) input indicators, 17 indicators of activity, 23 indicators of intermediate effect, four (4) GHG Indicators and 18 non-GHG indicators where 10 of the latter are co-benefits. All these indicators have detailed protocols for their assessment, framed in the MRV Plan for the NAMA Green Zone, in addition to a tool that allows for follow-up and assessment of each of these indicators and the entire NAMA Green Zone.

Phase 3 of "Sustainability". This phase was intended to establish the conditions to support the NAMA Green Zone in the medium and long term, analyzing barriers and the requirements for financial and technical assistance.

Related Policies and regulation

1. The SEREMIT RM made a tender at the end of 2013 for quotas for exclusive taxis with electric engine, awarding a total of 19 quotas for basic taxis. As reported by this agency of the MTT it is expected to continue with this initiative to the extent that results of the first vehicles operating in October 2014 are obtained.
2. The DTPM[13] is developing a study to improve the incentive program in the contracts to operators to encourage the use of clean technologies, in view of the fleet renovation associated with current contracts and also for the upcoming concessions that begin in 2018.
3. The promotion of Non-motorized vehicles is being diverted mainly to partnerships between local governments or municipalities, which are supported by the central government, represented by the SEREMIT and the MTT
4. In the case of management and redesign, something similar happens as in the previous initiative, majors are searching to improve their civic centers, giving more space to pedestrians.

Related NAMAs

N/A.

[13] *DTPM: Board of Metropolitan Public Transportation*

Contact details of the NAMA's coordinator and manager	
Responsible Institution	Municipality of Santiago, Chile Amunategui 980, Santiago, Chile
Contact professional	Miguel Olivares, Coordinator of Urban Mobility. Amunategui 980, Floor 2, Santiago, Chile (+56 2) 2827 1215 molivares@munistgo.cl
Alternate Contact	N/A
Alternate Contact	N/A

Table A. 3. Support to the design and implementation of the ENCCRV

NAMA's General Background	
Full Name	Support to the design and implementation of the National Strategy on Climate Change and Vegetation Resources (ENCCRV)
Short name	Technical Inputs for the ENCCRV
Stage	☐ Conceptual/Feasibility Study. X Planned or under planning. X Adopted: under implementation. ☐ Implemented.
Registered in United Nations	X Yes[14] ☐ No
Category	☐ Unilateral in search of recognition X Bilateral in search of support for planning X Bilateral in search of support for implementation ☐ Credits
Description	The objective of the NAMA is included within the framework of the ENCCRV, serving as technical and economic support for the development of studies and activities aimed at identifying and reducing weaknesses of baseline information, in addition to increasing the capacities of national and regional technical teams related to ENCCRV. During the preparation stage of the ENCCRV, funding obtained through the NAMA has been used to; 1. Define initial conceptual frameworks and preliminary approaches for estimating changes in forest carbon content and in xeric formations, which will be key inputs for the future development of reference levels of forest emissions for the northern regions of the country and island territories. 2. Develop a preliminary design of the scope that an MRV system should include, and a registration system for carbon dioxide. 3. Design Indicators of adaptation and vulnerability to climate change. 4. Develop models of forestry territorial management preventing forest fires. 5. Training activities have been developed crosswise, aimed at the creation and promotion of regional capacities through the South-South exchange on issues related to the ENCCRV.
Nature or type of action	X Strategy, Policy, or programs[15]: National Strategy on Climate Change and Vegetation Resources of Chile (ENCCRV). ☐ Project or set of projects (investment in technology or infrastructure ☐ Other(s) …………………………………….

[14] *http://www4.unfccc.int/sites/nama/Lists/NAMA/DispForm.aspx?ID=5*
[15] *Instrument of economic, governmental, voluntary agreements, regulatory, information management, capacity building, research, etc. type*

Sector (s) considered by the NAMA	☐ Agriculture ☐ Construction ☐ Power Generation ☐ Use of Energy X Forestry/LULUCF ☐ Industrial and industrial processes	☐ Waste ☐ Transportation and its infrastructure ☐ Crosswise (mark all that apply) ☐ Other(s)………………………
Technology/methodology	The ENCCRV aims to reduce social, environmental and economic vulnerability generated by climate change, desertification, land degradation and drought on the vegetation resources and human communities that depend on them, in order to increase the resilience of ecosystems and contribute to mitigate climate change by encouraging emissions reduction and increased capture of greenhouse gas in Chile. To meet this goal, 26 actions with operational goals have been proposed, considering seven activities associated to the direct prioritized causes and an activity of crosswise nature to all causes, which respond to various areas of application: institutional management, operational, regulatory, monitoring, environmental education, research, territorial planning and encouragement. The activities and action measures of the ENCCRV have been prepared on the basis of multiple technical studies, projects, programs, and participatory programs and processes, which have made it possible to generate the necessary inputs for the implementation phase, an important part of which were generated within the framework of the forest NAMA which has the technical and financial support of the Swiss Agency for Development and Cooperation (COSUDE), representing the first international support received by CONAF within the framework of the ENCCRV. It is also important to clarify that all actions developed with the NAMA's technical support and funds are inserted and aligned within the activities developed in the framework of the ENCCRV. At present, the NAMA project has already been completed, being its main contributions and products the following: Developing a methodological protocol to determine the degree of vulnerability to climate change reduction. Through this framework, attributes of adaptation and vulnerability to climate change were defined, effectively measurable from the technical and economic point of view, generating a protocol for the assessment of measures implemented to reduce vulnerability and strengthen resilience where these are implemented. The inputs used for the creation of the protocol were technical studies conducted by experts and professionals of CONAF and the participatory consultation process already described. This protocol contributes with key inputs in the determination of the Social and Environmental Indicators framework of the ENCCRV, which shall be used as a basis to generate the reports that will contain the Safeguards Implementation System (SIS). This study was carried out with the support of a consortium formed by the Santiago Climate Exchange (SCX), FORECOS, CQuest Capital, Global Adaptation Institute (GAIN) and Winrock International. Two projects of territorial nature at Maule and Valparaiso regions were performed with the purpose of implementing forestry activities for the prevention of forest fires in the forest-urban interface, in addition the costs of implementation of these activities were determined and incorporated in the table of values of Law N° 20,283, as well as improving the definition of action measures linked to preventive forestry activities of forest fires. Forestry projects were implemented with the technical support of the Protection Management against Forest Fires (GEPRIF) by CONAF, the University of Chile and professionals of Valparaiso and Maule Regions. Another objective of this implementation project is related to the generation of inputs and management models in the territory, scalable at a national level to reduce the potential danger of fire spreading, with activities that are replicable in other areas of the country, contemplating modeling that identify risk levels in other areas of the country. Demonstration modules have been used for training practices to various stakeholders, such as decision-makers (congressmen, government authorities) and owners of forest land, with the purpose of having communities more aware and adapted to forest fires. Also, a powerful line of work that has been fostered by COSUDE is South-South Cooperation, where Chile has positioned itself as a leader in the region, with countries in Latin America strengthening the dissemination of the work carried out by CONAF in the framework of the ENCCRV, inside and outside the country through the performance of thematic courses with international participants in the context of vegetation resources, climate change and desertification, as well as, the generation of cooperation partnerships with other regional projects funded by the Swiss government, such as the Andean Forests Program. The international courses are conducted jointly with the Chilean International Cooperation Agency (AGCI) of the Ministry of Foreign Affairs, offering scholarships to ensure the attendance of participants from countries that maintain government actions relating climate change to their vegetation resources, or are, just as Chile, developing their strategies to tackle climate change and fight against desertification.	
Gas (es) covered by the NAMA	X Carbon dioxide (CO_2) X Gas Methane (CH_4) X Nitrous oxide (N_2O)	☐ Hydrofluorocarbons (HFC) ☐ Perfluorocarbonos (PFC) ☐ Sulfur hexafluoride (SF_6) ☐ Nitrogen trifluoride (NF_3)
Jurisdiction	X National ☐ Regional ☐ Interregional	

<table>
<tr><td rowspan="3">Implementation Dates</td><td>Period</td><td colspan="2">2012-2025 referred to the ENCCRV</td></tr>
<tr><td>Start-up Year or expected Start-up Year</td><td colspan="2">2012</td></tr>
<tr><td>Year-end</td><td colspan="2">ENCCRV activities are contemplated until 2025, however it is intended to become a line of permanent action within the current and future development and regulatory instruments endorsed by law.</td></tr>
<tr><th colspan="4">Objectives of the NAMA</th></tr>
<tr><td colspan="4">The objectives of the NAMA fall under the general and specific objectives of the ENCCRV described in the item referred to the use of land, land-use change and forestry Sector.</td></tr>
<tr><th colspan="4">Barriers of the NAMA</th></tr>
<tr><td colspan="4">The barriers and risks of the NAMA are included within those determined by the future implementation of the different strategic activities and courses of action considered by the ENCCRV, which are described in the item referred to the Use of land, land-use change and forestry Sector.</td></tr>
<tr><th colspan="4">Quantitative goals of the NAMA</th></tr>
<tr><th>Quantitative targets (reductions)</th><th>Progress indicators for each goal (reductions)</th><th colspan="2">Additional information for each goal</th></tr>
<tr><td>The initial proposal considered a goal in terms of emissions reduction of 42,000,000 tCO_2e to 2020, however this goal has been readjusted based on various technical studies that have made it possible to clarify the results. Currently, the reduction goal of 20% of emissions from deforestation and forest degradation to 2025, on the basis of the emissions of the 2001-2013 period.
In addition, an alternative goal associated to adaptation to climate change is established, which stands as vulnerability reduction associated to the risk of land degradation through management of vegetation resources, through the intervention of at least 264,000 hectares directly, between 2017 and 2025.</td><td>During 2016 and 2017 interventions have been carried out in 6 projects of early implementation of preventive forestry and restoration. The surface of intervention corresponds to 58 hectares, with an area of influence of 976 hectares, benefiting 28 owners directly and indirectly 18,634 inhabitants of rural areas. An annual volume of reduced emissions of 3,400 t/CO_2eq is estimated.</td><td colspan="2">An accounting area of 5 regions is considered, where 40% of the native forest of Chile is located. In the current biennial update report the Technical Annex of REDD+ results is included, which reflects the achievements in terms of emissions reduction in the years 2014, 2015 and 2016.</td></tr>
<tr><th colspan="3">Methodologies</th><th>Assumptions</th></tr>
<tr><td colspan="3">The methodology for estimating emissions at the baseline is defined in detail in the Sub-national NREF/NRF of Chile.
The methods used to estimate results are the same used in the NREF/NRF in order to maintain consistency.

In the case of emissions that are associated with changes in land use, the "Gain and Loss" method was applied, defined by IPCC. Maps of Forest Cadastre and the dasometric information coming from the National Forest Inventory used as a source of information.

In the case of emissions that occur in forests that remain as forests, the "Stock Change" method was applied. In the latter case, a method of estimating carbon contents and flows is used based on forest inventory data and space extrapolation on satellite images through the K-nn methodology.</td><td>All assumptions that have been used for estimation are described in the Subnational NREF/NRF and in the Annex of REDD+ results.</td></tr>
</table>

Planning and Progress		
Planning	Progress	Results achieved and expected (Progress Indicators)
Steps of Action (s): activities/years	Progress Status	Reductions achieved or expected[16]
ENCCRV (2010-2016) Design, preparation phase.	The ENCCRV design began with the technical and financial support by COSUDE, then gradually progress was made in the application of different approaches, in an international scenario of progressive awareness on climate change. To date, we have developed several studies, projects, institutional arrangements, participatory processes of preparation and validation with the support of several national and international funds that have allowed the development of the ENCCRV[17] document, very robust in technical terms.	It does not consider direct reductions
Participatory process, phase of preparation and validation of the ENCCRV (2010-2016).	The results of 15 consultation workshops at a regional level, and a national workshop with a total of 1,392 participants were developed and analyzed during the process. Data obtained in self-assessment macro-zone workshops with the participation of 74 key stakeholders have been carried out and analyzed. We are in the process of performing the virtual citizen consultation document of the ENCCRV with over 500 participants. A process of dialogue and indigenous participation with over 1,800 participants has been developed.	It does not consider direct reductions
3 Estimate of the Reference Level (2012-2017).	Presented at a subnational level to the UNFCCC in January 2016. The current estimate includes the territory between Maule and Los Lagos regions, it will be scaled to national level during 2018.	It does not consider direct reductions
4 Determination of the causes of deforestation, absence of vegetation, vegetation resources degradation, and difficulties to increase carbon stocks and other co-benefits associated (2012-2016).	We have identified the main causes of deforestation, absence of vegetation, vegetation resources degradation and difficulties to increase carbon stocks and other co-benefits associated. In addition to the above, activities have been identified with their corresponding action measures, among other studies and relevant models. Currently, work is being done on the premise that with adequate funding, they can be replicated at a national level with the due support of governmental programs. In addition, as a result of this process priority districts for intervention have been identified.	It does not consider direct reductions
5 Early implementation of affirmative action measures to determine management models (2015-2017).	Projects have been carried out to determine management models that allow reducing emissions for unsustainable use of biomass, implement preventive forestry measures against forest fires, rehabilitation of areas affected by forest fires, revegetation at areas heading water-producing basins and models to improve landscape connectivity.	One of the objectives of these projects is to estimate reduced emissions with the implementation of various measures of action, hence there is no goal. However, emissions reduction will be effectively monitored. During 2016 and 2017 interventions have been carried out at six projects of the early implementation of preventive forestry and restoration. The surface of the total intervention corresponds to 58 hectares, with an area of influence of 976 hectares, directly benefiting 28 owners and indirectly, 18,634 inhabitants of rural areas. An annual volume of 3,400 t/CO_2eq reduced emissions is estimated.
6 Implementation and adjustments of measuring and monitoring systems for effective verification of GHG reductions/ captures (2016-2030).	Work has been started for the design of the SMM in joint support with INFOR.	It does not consider direct reductions

[16] *These can be time series*
[17] *http://www.enccrv-chile.cl/*

Safeguards	CONAF has developed the First Summary of Information on the Approach, Respect and Compliance with safeguards for the formulation of Chile's ENCCRV, which will be delivered to the UNFCCC secretariat in February.	By which Chile intends to comply with Decision 12 of the Conference of the Parties Issue 17 (12/CP171) of the UNFCCC, where it is stated that developing countries must provide a summary of the information on the manner in which they are addressing and respecting the safeguards listed in decision 1/CP.162, better known as the Cancun safeguards. The Summary of safeguards, as described in decision 17/CP.213, includes the following elements: Information on national circumstances to be taken into account when addressing and respecting safeguards; A description of each of the safeguards in accordance with the national circumstances; A description of the systems and processes that are relevant for addressing and respecting safeguards, including the information systems referred to in decision 12/CP.17 in accordance with the national circumstances; Information about the way in which each of the safeguards has been addressed and respected in accordance with the national circumstances;
Co-benefits achieved or expected		
The different dimensions to determine co-benefits and the variables associated to the corresponding monitoring are under formulation process by CONAF professionals, with the support of specialists. Updated progress is detailed in the item referred to the use of land, land-use change and forestry.		
Costs of the NAMA and source of funding		
Resources received to date within the framework of the NAMA	The budget related to the ENCCRV, of which the activities of the NAMA forestry are a part of, are included in the item referred to the use of land, land-use change and forestry. In particular, framed only within the NAMA, USD 1,600,000 has been received as technical and financial support by COSUDE.	
Support Required		
The financial support required for the implementation phase of the ENCCRV in general is specified in the item referred to use of land, land-use change and forestry.		
Related Policies and Regulations		
The policies and regulations related to the NAMA that are part of the ENCCRV describe the item referred to use of land, land-use change and forestry.		
Related NAMAs		
• NAMA of Georgia financed by the Ministry of Agriculture, Forestry, Environment and Water of Austria, under the name "Adaptive, Sustainable Forest Management in Borjomi-Bakuriani Forest District".		
• NAMA of Mali, which expects funding for implementation, under the name "NAMA in the forestry sector"		
• NAMA initiative "Green Route of the Panama Canal". Integrates reductions for vessels transiting the Canal, for energy efficiency and renewable energy use in the operation of the Canal and forest carbon projects in the Panama Canal basin.		
Contact details with coordination and management of the NAMA		
Responsible Institution	National Forestry Corporation (CONAF) of the Ministry of Agriculture.	
Contact professional	José Antonio Prado, National ENCCRV, Chief of Climate Change and Environmental Services Unit (UCCSA), Management of Forestry Development and Encouragement (GEDEFF), CONAF. jose.prado@conaf.cl	

Table A. 4. Clean Production Agreements in Chile.

NAMA's General Background		
Full Name	Clean Production Agreements in Chile	
Short name	NAMA CPA	
Stage	☐ Conceptual/Feasibility. ☐ Planned or under planning. X Adopted: under implementation. X Implemented.	
Recorded with United Nations	X Yes ☐ No	
Category	X Unilateral in search of recognition ☐ Bilateral in search of support for planning ☐ Bilateral in search of support for implementation ☐ Credits	
Description	In Chile, the promotion of cleaner production is carried out by the Agency of Sustainability and Climate Change (ASCC), Committee depending of Corporación de Fomento - Chilean Economic Development Agency (CORFO) CORFO. The ASCC is defined as an instance for dialogue and joint action among the public sector, companies, their workers, communities and civil society, in order to establish and disseminate an environmentally productive management approach that focuses on prevention and promotion of production. The ASCC goal for 2020 is contributing to the reduction of GHG emissions through its main instrument, the Cleaner Production Agreement (CPA). This instrument is developed by the Government of Chile with staff dedicated to its participation, management and coordination, as well as through a financial support instrument: The Clean Production Fund[18], which co-finances up to 70% of the costs associated to the elaboration of an CPA, which are divided into three lines of financing: the preparation of a general diagnosis of a productive sector, the implementation phase and the acceptance asssement. The remaining fraction is funded by associations or organizations representing the companies adhering to CPAs. In the early years, CPAs did not consider actions aimed specifically to GHG reduction, however, a number of measures that were agreed within the framework of these agreements have the effect of obtaining reductions. That is why in 2010, with 54 implemented CPAs and certified by the ASCC until that year, a study was retained to calculate GHG reductions of 16 CPAs in different industrial sectors. The results estimated reductions in GHG emissions of 4,050,973 tCO_2e[19]. In 2012 the ASCC registered CPAs with the UNFCCC[20] as the first Nationally Appropriate Mitigation Actions (NAMAS) of Chile and the world. This NAMA is in operation and has incorporated a variety of actions with the effect of GHG mitigation, as well as indicators to track their progress, which are delivered in this report.	
Nature or type of action	X Strategy, Policy or Programs. Specify related instrument[21]: policy or national or sectorial or program, through Cleaner Production Agreements supported by the Fund for the Promotion of Cleaner Production. ☐ Project or set of projects (investment in technology or infrastructure) ☐ Other(s)	
Sector (s) considered by the NAMA	X Agriculture X Construction X Power Generation X Energy Use X Forestry/LULUCF X Industrial and industrial processes	X Waste X Transportation and its infrastructure X Crosswise (mark all that apply) ☐ Other(s) ....

[18] http://fpl.cpl.cl/.
[19] http://www.ascc.cl/resources/uploads/documentos/archivos/74/estudio_para_el_calculo_de_las_emisiones_de_carbono_equivalente_derivadas_de_la_implementacion_de_los_apl_realizados_en_chile.pdf.
[20] United Nations Framework Convention on Climate Change.
[21] Instrument of economic, fiscal, voluntary agreements, regulatory, information management, capacity building, research, etc. type.

Technology/methodology	One of the objectives of the ASCC is the promotion of clean technologies in the productive sectors[22], but it is the entrepreneur who decides which technology, technique or practice will be implemented. For this reason, technologies to be incorporated are diverse and dependent on the economic capacity and priorities of companies, the cost effectiveness of available technologies and of actions contained in each agreement, which in turn depend on the sectorial and/or territorial diagnoses that are a background for both CPA and the commitments contained in it.		
Gas (es) covered by the NAMA	X Carbon dioxide (CO_2) X Gas Methane (CH_4) X Nitrous oxide (N_2O)	X Hydrofluorocarbons (HFC) X Perfluorocarbons (PFC) X Sulfur hexafluoride (SF_6) X Nitrogen trifluoride (NF_3)	
Jurisdiction	X National ☐ Regional ☐ Interregional.		
Implementation Dates	Period	For reporting purposes as NAMA, 2012 to 2020.	
	Start-up Year or expected start-up year	1999	
	Year-end	Permanent policy of the Chilean State.	
Objectives of the NAMA			
Reduce GHG emissions by 18,400,000 tCO_2e since 2012 to 2020 thanks to the voluntary implementation of actions on the part of the productive sectors.			

Barriers of the NAMA

Barrier	What happened?
Lack of quantitative actions.	The lack of actions that set quantitative results generates the incentive to comply by making trivial changes and of little impact.
Volume of actions makes it difficult to report of Cause Chains.	Extensive and unclear presentation to explain relationship between CPA actions and their impact. With only a fraction of the actions several pages of the report 2016 were used, without providing a clear value for the reader. (According to feedback delivered by MMA).
	Amount of actions contained in agreements are very numerous, which makes it extremely difficult to establish cause chains for each of them or make a presentation of same[23].
Lack of standard and systems for data crossing that allow detection of Double Accounting.	Today it is not possible to identify double accounts between this NAMA and other mitigation actions at a reasonable cost due to lack of standard data exchange, and identification of sources or sinks making it possible to detect such double accounting .
Lack of reliable databases for products, inputs and Network Factor to estimate emission Outside of Jurisdiction, as well as to apportion carbon footprint in IPCC categories.	Currently, there are only emissions produced in Chile in the report, but eventually categories that have associated emissions outside the national territory for which it is not clear what fraction occurs within and outside the country will be included.
	Currently, there are categories that it is impossible to IPCC categorize because they show an emission data added at the footprint level.
Lack of Standardized Rules of Accounting and Collection to facilitate allocation of corresponding IPCC category.	Currently, the report is limited to establish equivalences with the categories of the IPCC second level, however it may be of interest for the exploration of relationship with NGHGI[24] and easy comparison with other mitigation actions, to have a breakdown equivalent to the maximum level existing for NGHGI.
Lack of definitions at the level of Standards in Calculation Methodologies and collection of independent variables to estimate Additionality and Resolution of double accounting.	Reductions calculation of the addition of facilities is different from the addition of calculations made for individual facilities[25]. Model used is probably very simplistic to adequately estimate of additionality, in general it assumes that what changes with CPA is the intensity of consumption or generation of an emissions precursor. On the other hand, even when solved the problem to identify sources of double accounting, the problem could not be decided due to incompatible assumptions.
Lack of standards regarding quantitative allocation of uncertainty to the values collected and reported	Qualitative uncertainty statement, not having an idea of the accuracy and precision of the values collected as well as the values finally delivered affects the quality of the current report, and does not allow to properly visualize challenges concerning data quality. If uncertainty is very high, values reported as reductions could have a significant probability to be emissions increases.
Carbon bonds report doubts that remain in CPA / Chile thanks to CPA. Additionality, Double Accounting.	Colbun donated carbon credits to tourism CPAs. These bonds would be sold to other countries or donated to other projects in the absence of CPAs, it is not clear how to estimate CPA additionality in this case.
Data Volume and Dimensionality of Impacts have the calculations support system close to its limit.	Spreadsheet near the limit of cells used. Intermediate solution to this generated an automated calculation process that could take several hours to complete.

[22] Regulation Committee National Council for Clean Production: https://drive.google.com/file/d/0B1n6nN79e7QgbFBrNVNqQTFkOVFLellRVzU0MS13X1dhNGlV/view?usp=sharing.
[23] Systematization of a little more than 30 agreements presents more than 1700 actions. See Working paper linked: https://docs.google.com/spreadsheets/d/1TbJb75uVtihNznSPT7Pll-2uXPei9TWhJ_qwwU1SQd0/edit#gid=255147832.
[24] National Greenhouse Gas Inventory.
[25] Calculation at the aggregate level contains implicit assumption that CPA is causing changes in productive structure of group of companies that adhere to it. Although this could occur to some extent, it is a strong untested assumption.

Errors due to wrong references in formulas.	Spreadsheet depended a lot on the fact that whoever introduced estimation formulas correctly referenced the cells with data sources, this is slow and generates high probability of mistakes.
Mistakes caused by data mistakenly copied from spreadsheets with data, or impact reports, or from sources to such supports, lack of Verification and clear control mechanisms for error detection	Risk always present which effect has been the erroneous estimate of reductions, which explained over 80% of the estimated reductions in previous reports. This was detected with verification, but only a negligible fraction of the data has been verified or possess means of verification, it is not clear how to solve this problem in a scalable manner.
Inadequate reporting structure.	Such a detailed table does not have a lot of additional value to what would be direct access to spreadsheet, leads to confusion.
Redundant Reporting Processes.	Report through this guideline and template for BUR[26] is redundant multiple fields are consolidated.
Significant underreporting of base data.	Many facilities do not report. Less than a third of CPA report something, and less than 10% of the facilities do. CompiteMAS system expected to fulfill that role, but due to the fact that the system was limited to loading data via web form and lacked a management module, the Agency could not manage the platform in a manner appropriate to their original purpose.
Report Understatement.	Staff dedicated to consolidate information of CPA to estimate impact is limited and dedicated to other tasks, so there is gap between data existence and consolidation of same for inclusion in the report. Also, it does not take advantage of all the information in impacts estimation.
Lack of MRV management capacity toward companies and CPA coordinating team.	Staff coordinating the Agreements and managing the documents, as well as the schedules to these texts with the data recording formats is not clear of which should be recorded, how it should be done and how it should be consolidated. There is no standardized procedure for it either. At an installation or consultants' level, the difference is even more dramatic.
Lack of Historical series on Report.	For the purposes of establishing an adequate baseline of the policy, at the beginning of 2017 the historic report prior to the registration of the NAMA was requested, however such calculations did not exist and if they did, they were usually not consistent with the current report.

Quantitative goals of the NAMA		
Quantitative targets (reductions)	Progress indicators for each goal (reductions)	Additional information for each goal
Expected reduction of a total 18,400,000 tCO_2e, with an average of 2,250,000 tCO_2e per year. A potential reduction of 31,600 tCO_2e per year for CPA is expected.	- Accumulated emissions 2012-2020 (tCO_2e). - GHG emissions per year (tCO_2e/a). - GHG emissions per CPA (tCO_2e/a)	- IPCC Guideline 2006, GHG Protocol[27] - IPCC Guideline 2006, GHG Protocol, 7.3.1 ODS.[28] - NAMA CPA.

Methodologies and assumptions (scope, purpose, goals and evaluation of progress)	
Methodologies	Assumptions
1. Goals: a. Data collection and data flow: Impact Reports of 16 selected CPAs, interviews with guilds to complete missing data on such impacts. Further processing by consultant with final results reflected in the calculation <u>final report</u> of emission reductions. b. Scenarios modeling: models 1, 2 and 3 mentioned in the previous section were used, or a base scenario equivalent to a % of the final one, depending on the CPA and the categories involved. c. Emissions Calculation: In general, emission factors supported by literature were used. 2. Effects and Progress Evaluation: See "Description of MRV" section, the calculation of effects is annually made and concurrently with progress assessment.	1. Goals: a. Check <u>green solutions final report</u> for detail of assumptions in each estimated reduction. b. For the calculation of emissions per CPA and projection of emissions reduction a value of 31,600 $tCO_2e/(CPA*year)$ was used, which is equivalent to the total reductions divided by the 16 CPA considered over 8 years. Subsequently, the value was projected assuming that the 45 CPA under diagnosis in 2012 would annually reduce that amount until 2016, and that also 10 CPA would be added annually, every year reaching a figure of 18,400,000 tCO_2e reduced accrued to 2020. 2. Effects and Progress Evaluation: See "Description of MRV".

[26] Biennial Update Report.
[27] It is the addition accrued from 2012 to 2020 of the GHG categories collected.
[28] This is the addition of GHG categories collected. It is also a value associated to an indicator 9.4.1 ODS, for which there is no data on sales price available, enabling to report it directly.

Implementation Planning and progress		
Planning	Progress	Results achieved and expected (Progress Indicators)
Steps of the Action (s): Activities / Years	Progress Status	Reductions achieved or expected[29]
According to the NAMA registration, to 2012 there were 45 CPA under diagnosis that should have reductions before 2016; over 10 CPAs signed per year from 2012 to 2020.	Based on the established planning, the expected value corresponds to 105 CPAs signed as of 2017. There are 79 CPAs signed in 2017[30], which means a 75% progress in CPA signing. It is important to note that of these 79 CPAs signed in the period 2012 - 2017, only 9 CPAs are considered in the current report. On site https://sites.google.com/cpl.cl/sfe/resumen-estadístico-ascc appear periodically updated operational data of the different Agreements managed by the Agency.	The expected reductions according to the NAMA registration are 13,500,000 tCO_2e in the period 2012-2017. However, the impact is estimated at 457,438 tCO_2e, a 3% of the anticipated. To explain part of this difference, it is worth reviewing the calculations and assumptions used in the original estimate of NAMA reductions: (1)[31] 16 CPA (2) over 8 years (3) 4,050,973 tCO_2e reduced. This result into 31,600 tCO_2e by CPA per year. Then it is assumed that the (4) 45 CPAs existing and under diagnosis at the date of the NAMA registration (5) would generate reductions equal to those 31,600 tCO_2e by CPA per year (6) since 2012 to 2016. This results into 7 MM tCO_2e. Then at assuming (7) that 10 CPAs per year will be additionally signed, which would generate (8) reductions of 31,600 tCO_2e by CPA per year (9) to 2020, which results into a value of approximately 11.4 mm tCO_2e which in addition to the above results into a total of 18.4 MM tCO_2e. Then, on that basis reductions are estimated for 2.25 tCO_2e per year. These assumptions are problematic for the following reasons: Assumptions (2), (6) and (9) are inconsistent, because they assume different periods of validity for CPAs. Assumption (6) includes in 2012 impact calculation 45 CPAs that are under diagnosis that same year, not yet signed. On the other hand, assumptions (4), (6) and (7) would lead to assume that in 2012, 55 CPAs were signed, a figure five times greater than the historical maxima existing prior to 2012. Assumptions (3), (5) and (8) assume that all CPAs behave as the average of CPAs used in the Green Solutions study. In practice, this has not been observed. The possible selection bias in the original study[32], that over 80% of the result is explained by a single CPA; verification of these values did not exist, and standard deviation is three times the average should have led to the selection of a more conservative or robust value. Related to the above, the assumption (2) of eight years is completely arbitrary, since the green solutions study conducted before/after analysis without setting years for these impacts, but a review of the individual results enables to infer them. On the other hand, the assumptions used for each CPA in this study are not equivalent to the assumptions currently used in the estimation of impacts[33]. Other reasons that significantly influence the result obtained is that most of the CPAs signed in the period 2012-2017 have not yet recorded their values[34], and that there still are emission categories that have not been estimated, such as reductions associated to recycling.

[29] These can be time-series.
[30] This considers the pilots of new types of territorial agreements and pre-investment studies characterized by a methodology for generation and mode of operation different from that of the CPA based on the technical standard, pre-investment 3 associated with commitments in the framework of the installation of productive plants of sufficient size to have to issue statements or environmental assessments, 3 of watershed management and management 1 territory for fire prevention.
[31] Assumptions in format (no course).
[32] It is reasonable to think that those CPAs envisaging greater reductions have been selected
[33] In the following worksheet it is possible to find a number of analyses in support of this paragraph: https://docs.google.com/spreadsheets/d/1Fn-spc_1oD2BOGVbSNeWrmCKf2y6a-GrOci1ozWTro8/edit#gid=0.
[34] Only 9 CPA of 78, with data of 60 of the 5,396 participating establishments in this period.

Co-benefits achieved or expected by Stage		
Steps (earlier defined)	Indicator Name[35] (co-benefit)	Results achieved and expected[36]
It is expected to sign and implement 10 agreements per year in the period 2012-2020.	• Fuel Energy Consumption Fixed Source • Fuel Energy Consumption Mobile Source • Electrical Energy Consumption • Consumption of Water Tank Truck • Channel Water Consumption • Consumption of Sea Water • Well Water Consumption • Water Consumption from the network • Women's participation in Teaching[37] • Women's participation as a Head Professor[38] • Women's participation in Agriculture, Livestock, Forestry and Fisheries[39] • Women's participation in Managerial position Agriculture, livestock, forestry and fisheries. • Investment in water. • Investment in emissions reduction. • Investment in Phytosanitary Management. • Investment in Measuring and Managing Carbon Footprint. • Investment in Food Safety. • Investment in Waste Management. • RESPEL investment management. • Investment in RSE shares. • Investment in Noise Management. • Investment in Labor security. • Investment in management of dangerous substances. • Investment in sustainability. • Evaluation CPA Actions. • CPA Participants Commitment Evaluation. • CPA Participants Relationship Assessment. • Assessment CPA Contribution Business Sustainability. • Person hours dedicated to training in Water use. • Man hours dedicated to training in Energy. • Man hours dedicated to training in Food safety. • Man hours dedicated to training in Occupational safety.	• -357,906,669 KWH • -117,511,319 KWH • -823,541,958 KWH • -794 m^3 • -21,845,219 m^3 • 37,737,775 m^3 • -8,357,014 m^3 • -26,682,100 m^3 • 0% (final variation – CPA Start-up) • 2% (final variation – CPA Start-up) • 5% (final variation – CPA Start-up) • 15% (final variation – CPA Start-up) • CLP $115,392,790 • CLP $70,524,906 • CLP $1,100,000 • CLP $66,906,570 • CLP $332,967,482 • CLP $19,951,945 • CLP $5,808,096 • CLP $11,227,858 • CLP $3,082,992 • CLP $26,398,276 • CLP $4,869,090 • $1,070,000 • 6.4 • 6.0 • 5.7 • 5.6 • 499 MH • 8,710 MH • 4,006 MH • 3,858 MH

[35] Co-benefits may consider social, economic and environmental other than GHG reduction. Can be qualitative or quantitative. There are other co-benefits that were not included in this report because data were not processed in term, but in following updates this list should increase significantly.
[36] Negative value indicates a reduction.
[37] This was an indicator registered in the Agreement because there was a measurement action of it, but as there are no direct actions variation, it is not attributable to the CPA.
[38] This was an indicator registered in the Agreement because there was a measurement action of it, but as there are no direct actions variation, it is not attributable to the CPA.
[39] This was an indicator registered in the Agreement because there was a measurement action of it, but as there are no direct actions variation, it is not attributable to the CPA.

Costs of the NAMA		
Estimate cost of preparation	Cost	USD 35,500
	Calculation Description	S/I
Estimate cost of implementation	Cost	USD 40 million
	Calculation Description	Budget Sustainability and Climate Change Agency approximately USD 5 MM per year, multiplied by 8 years.
Incremental cost of implementation	Cost	0
	Calculation Description	S/I

Funding Source	
Own resources	USD 40 million
Resources received	N/A, NAMA recognition
Resources to be requested (total, detail appears below)	N/A, NAMA recognition

Support Required		
Financial Resources	Amount required	N/A, NAMA recognition
	Type of resources required	N/A, NAMA recognition
	Comments	N/A, NAMA recognition
Technology	Amount required	N/A, NAMA recognition
	Type of resources required	N/A, NAMA recognition
	Comments	N/A, NAMA recognition
Capacity building	Amount required	N/A, NAMA recognition
	Type of resources required	N/A, NAMA recognition
	Comments	N/A, NAMA recognition

MRV Description
The measurement and estimation of impacts methodology starts with the definition of data to register in each CPA. The collection of data is done by each company at the establishments that are a part of the CPA. Subsequently, the following 5 scenarios may have occurred for the delivery of data once they have been collected by individual organizations: 1. Data are transferred to the association or to the consultant hired by the association, who conducts impact estimates in an impacts report once the CPA has finished, report that sometimes includes some of the data collected. More frequent case. 2. Data are transferred through a spreadsheet to the association or to the consultant hired by the association, who delivers them to the ASCC together with the impacts report. Recent practice as a result of changes introduced as a part of the MRV. 3. Data are transferred to NBC[40] or uploaded to CompiteMAS platform within the context of the CompiteMAS public good. Then NBC estimates GHG impact in a mitigation report which sometimes includes some of the data collected. Around 4 cases. 4. Data are delivered by company to verification entity (NBC) during the completion of a field verification, these data are subsequently sent to the ASCC. 13 cases, only one has been consolidated in this report. 5. Data are transferred from companies, Associations or consultant to the ASCC due to a subsequent process of data collection made from the ASCC in order to retrieve data by establishment not previously reported, or to verify data previously reported. Around 5 cases. Once obtained, data must be systematized in a spreadsheet and classified according to categories consistent with the existing ones in the national inventory, so as to be able to use the corresponding emission factors. In the case of categories not associated to the national inventory, data are categorized so that they can be compared between companies. In addition, all data are converted to a single base unit, which depends on the category. Additionally, a review is conducted to indicate if the category to which the data belongs was effectively managed at the CPA[41]. Calculations are then applied to estimate scenarios, as well as other control computations. A processing model is assigned to each base category, which usually coincides with an intermediate effect, for the calculation of base scenarios and scenario with CPA: 1. Model "0" is used for qualitative, informative or evaluation data of the CPA by the participants, where modelling a base scenario is not required. 2. Model "1" is used in cases where it is assumed that in the base scenario the value for the category was "0", and in the scenario with CPA values are those collected during it. This model is used in the statement of investments associated to the CPA or trainings for implementation of the CPA[42]. 3. Model "2" is used in those categories in which it is assumed that the CPA affects any productive parameter. The base scenario corresponds to the value of the parameter in the year prior to the execution of the CPA, or the first annual data available after execution. This value is projected by assuming that the parameter remains constant. For the case of a scenario with CPA, the data used are those actually measured for up to 7 years[43] since the CPA execution, after which it is assumed that the CPA has no effect because the companies would had made the changes anyway. If such data are not available, it is assumed that the last annual data available are kept constant. 4. Model "3" is used in those categories in which it is assumed that the CPA affects the intensity of use or generation of any substance given a certain level of activity[44] . The base scenario corresponds to the data prior to the CPA execution, or the first annual data available after execution. This value is projected by assuming that intensity remains constant, hence the use or generation of each substance is projected on the basis of data activity of each year. For the case of a scenario with CPA, the data used are those actually measured up to 7 years since the CPA execution, after which it is assumed that the CPA has no effect because the companies would had made the changes anyway. In case these data are not available, the last annual data available are used and projected on the basis of activity data for each year. If the activity data for a given year are not available, the adjustment of last year's production for which data were collected on the terms of variation of annual indicator of this particular sector are used as a proxy. If there are no sectorial data available, then the activity data is assumed constant from the last year collected. Calculation is performed by establishment whenever possible, and results are subsequently added. Once the modeling of categories on the basis of the resulting values are multiplied by emission factors, global warming potentials (GWP)[45] and/or other values[46], as appropriate, so as to obtain the scenarios for the impact categories that are derived from the base categories (as is the case in all categories of Greenhouse Gases reported). The difference between scenarios is the effect of the CPA.

[40] NBC: Biotechnological Nucleus Curauma Universidad Católica de Valparaíso.

[41] Under process of implementation at the time of publication this report.

[42] It is questionable whether to declare the hours of training, or if investment is effectively only those associated with CPA, which would have not been performed had it not existed. The shortage of historical data series makes it difficult to use a more sophisticated model.

[43] The value of 7 years is used according to rule 49 (a) of the Clean Development Mechanism http://cdm.unfccc.int/EB/rules/modproced.html, the choice of that period would be justified in time of technological change according to "The Complete Guide to Climate Change" section, page 83.

[44] This is inspired on some of the base lines of the Clean Development Mechanism.

[45] GWP used are those of the AR5 (Assessment Report 5) for all GHGs considered, with the possible exception of the emissions associated with the consumption of electric power, because the manner in which the Ministry of Energy estimates emission factors from the electric network is not clear.

[46] Default values were selected from the national inventory, in case it did not exist then national sectorial information was used, if this was not possible then the standard values for the IPCC Guidelines were used, and in case this was not possible, then any value found in the available literature.

Once finished all calculations formulas are used to mark those values that are atypical and that may require review and/or verification. Only those data that are not marked as atypical are reported in an official way, unless they have been checked and verified, giving as reference the value obtained without applying this exclusion. This methodology has been implemented on the basis of this report. In previous reports, atypical data were selected by visual inspection, performing afterwards a verification by a third party, through a contract with the NBC, or by a second party in case the previous is not possible[47], but these calculations were not excluded from the report[48] . The exact mechanism of correction/revision of data marked for review and/or verification during this period remains to be defined. One of the objectives of this report is to account for the change from the National Council for Clean Production to Sustainability and Climate Change Agency, so this report is in line with the new vision of the institution as well as to the commitments of the country in both issues. That is why different taxonomies are combined in the report, particularly those arising from IPCC[49], GHG Protocol[50] and ODS[51]. In addition, other categories are included for which there is evidence of their public interest or relevance for the interested parties of the companies participating in these agreements.	
Related Policies and regulation	
1. Law 20,416 which sets special rules for small companies. Link: https://www.leychile.cl/Navegar?idNorma=1010668. 2. Supreme Decree 160 which sets the rules of the "National Council of Clean Production". Link: https://www.leychile.cl/Navegar?idNorma=1042652. 3. Affected Resolution 242 implementing Council Agreement N° 2,947 of 2016, which modifies the name of the "National Council Committee for Clean Production - CPL" by "Agency for Sustainability and Climate Change - ASCC" and amends resolution (a) No. 303, of 2007, Corfo. Link: http://www.cpl.cl/archivos/transparencia/RA_242.pdf. 4. Agreement 22/2017 of the Council of Ministers for Sustainability that endorses the National Action Plan on Climate Change. Link: http://portal.mma.gob.cl/wp-content/uploads/2015/03/Acuerdo_N_22-2017.pdf.	
Related NAMAs	
CPAs may be related with all sectorial NAMAs accounting for reductions achieved by companies participating in both mitigation actions. Without prejudice to the foregoing, to date there has not been any case in which this effectively happens. The reason for the latter may be the low amount of companies considered in the report, but also the lack of a record allowing to identify these cases.	
Contact details for NAMA coordination and management	
Responsible Institution	Agency for Sustainability and Climate Change (ASCC), CORFO committee of the Ministry of Economy, Government of Chile.
Contact professional	Ambrosio Yobanolo, Responsible for Business Intelligence Unit and Process Design. Amanda Labarca 124, Second Floor, Santiago, Chile. (562) 2688 4500 ambrosio.yobanolo@ascc.cl
Alternate Contact	Ximena Ruz, Head of the Clean Production Agreements Office. Amanda Labarca 124, Second Floor, Santiago, Chile. (562) 2688 4500 ximena.ruz@ascc.cl

[47] Due to the fact that one of the companies involved declined the verification visit, the guild acted as an intermediary, and finally a correction to the data was made.
[48] Because in both cases the original data were incorrect, reductions were overestimated in more than a million tCO_2e, this is the main reason for the decision that from this report atypical results will be excluded from the official result.
[49] Intergovernmental Panel on Climate Change. Link: http://www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/index.html.
[50] Reporting standard of greenhouse gases. Link: http://www.ghgprotocol.org/.
[51] Objectives of sustainable development. Link: https://unstats.un.org/sdgs/indicators/indicators-list/.

ANNEX 7. WORKSHOPS, COURSES AND SEMINARS RELATED TO CAPACITY BUILDING AND TECHNICAL ASSISTANCE, PERIOD JULY 2016- MARCH 2018

Area	Year	Initiative Name	Objective	Donor/Organizer
M,R	2018	Workshop of the Informal Technical Sub-group of MRV and climate change of the Pacific Alliance (SGT-MRVCC), "National Systems for MRV - Towards Connectivity and Alignment"	• Improve connectivity and alignment between (and within) MRV teams for climate change in the countries of the Pacific Alliance (AP); • Increase awareness and familiarization of the scope and nature of MRV systems for climate change in each country of the AP; • Discuss the challenges, synergies and opportunities to improve MRV systems for climate change; • Define a multi-year work plan to develop the technical and systemic capacity of MRV systems for climate change among the countries of the AP.	Government of Canada/ IETA
T,N	2018	Meeting Cartagena Dialogue, Costa Rica	Develop contents for the main common messages of the member countries of the Cartagena dialogue regarding the: (1) Ambition toward COP24 and Dialogue of Talanoa, (2) Framework of transparency of AdP and (3) Means of implementation.	Donor countries Cartagena Dialogue
R,N	2017	PATPA Annual Retreat Georgia	To provide an analysis on recent developments in the UNFCCC negotiations and facilitate an understanding of the implications of the Paris Agreement for the implementation of the national policy. To facilitate the exchange and dissemination of good practices in the application of systems of transparency covering mitigation, adaptation and means of implementation.	Partnership on Transparency in the Paris Agreement PATPA
T	2017	Regional Workshop "Road to implementation of nationally determined contributions (NDCs)"	To meet and discuss the visions of countries in the region with regard to progress up to date and the next steps for implementation of the National Contributions (NDCs).	CDKN
M	2017	"Asia-Pacific Carbon Markets Roundtable"	Explore opportunities for the development of carbon markets in the region.	Government of New Zealand
R,M	2017	"Information Matters Capacity Building Workshop: Mitigation Action Reporting"	Support the understanding of identification and estimation of mitigation actions in relevant sectors; to familiarize participants with the guides on report for mitigation actions developed by the United Nations Framework Convention on Climate Change (UNFCCC).	GIZ
R	2017	Technical workshop on the "Capacity Building Initiative for Transparency (CBIT) Global Coordination Platform.	Share experiences on top of the existing initiatives of MRV and transparency, and discuss the efficient use and coordination of the Capacity Building Initiative for Transparency (CBIT) Program and providing inputs to the content of the next Platform of Global Coordination, under the responsibility of UNDP and UN Environment, with the purpose of making progress in the implementation of the enhanced transparency framework as defined by the Paris Agreement.	UNDP/UNEP
T	2017	Regional dialogue on Nationally Determined Contributions (NDC) Latin America	To facilitate exchange between representatives of the countries and geographical groups of countries, discussing in detail the continuity in the implementation of the technical and communication aspects of the NDC submitted by countries of the region to United Nations, on the occasion of the COP21 of Paris.	GIZ/UNDP

Area	Year	Initiative Name	Objective	Donor/Organizer
R	2017	Closing Meeting Phase II (last phase) of Project Information Matters- GIZ & International BUR Champions Workshop.	Facilitate final exchange of the implementation results in each of the countries; represent Chile in global workshop organized by the Partnership on Transparency in the Paris Agreement on instruments of compliance with the transparency elements in the Paris Agreement, with regard to reports to be submitted to the United Nations.	GIZ
M	2017	"Long-term strategies for the implementation of the Paris Agreement"	To facilitate exchange between the representatives of the countries of the Latin American region, discussing in detail the technical aspects of opportunities in respect of Article 4, paragraph19 of the AdeP.	Government of Canada and German and Danish Cooperation Agencies.
R	2017	Latin American Regional Forum: "Defining an agenda to improve transparency through the strengthening of MRV mechanisms"	To facilitate exchange between the representatives of the countries of the Latin American region, discussing in detail the technical aspects of opportunities for the implementation of MRV systems to improve transparency related to NDC contributions submitted to the United Nations, as a part of the commitments associated with the ratification of countries of the Paris Agreement (ADP). Specifically, what is referred to in Article 13 of the AdeP.	Government of Canada, GGGI and German Cooperation Agency.
R,M	2017	Workshop on construction of National Systems for GHG inventories and the Sustainable Use of the 2006 IPCC Guidelines for the Latin America and the Caribbean region.	To provide additional technical support to Parties not included in annex I to improve their internal capacities in order to facilitate the continuity of the fulfilment of the requirements of reporting, among other, training in the use of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, as well as the sustainable construction of national systems of management of greenhouse gas inventories.	UNFCCC
R,N	2017	Regional Workshop for Latin America and the Caribbean Partnership for Transparency in the Paris Agreement.	Exchange of regional experiences on progress in transparency and accounting of contributions determined at a national level (NDC).	PATPA
R	2017	Second Working Meeting of the Latin American Network of National Greenhouse Gas Inventories (RedINGEI).	To follow up on the activities of the network in the period 2016-2017; to exchange experiences regarding quality assurance and quality control, filing and dissemination of NGHGIs; agree and define the relevance to standardize NGHGI reports; and define activities and future products on the network.	UNDP
N,R	2017	"APA inter-sessional workshop on agenda item 5: modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement"	Inter-sessional workshop under item 5 of the APA agenda: modalities, procedures and guidelines for the enhanced framework of transparency for actions and support referred to in Article 13 of the Paris Agreement.	UNFCCC
A	2017	Regional Dialogue for the integration of climate change and biodiversity at a national level.	Exchange of regional experiences on the importance and opportunities for integration of climate change in its links with biodiversity conservation.	Convention on Biological Diversity
T	2017	Regional dialogue on Nationally Determined Contributions.	To meet and discuss the visions of the countries in the region regarding the next steps and challenges for the implementation of the National Contributions (NDCs).	European Commission.
R	2017	2nd Information Matters "Peer-to-Peer Exchange Workshop" + "International BUR Champions Workshop"	Exchange of experiences on capacity-building in transparency and reporting of climate action.	GIZ

Area	Year	Initiative Name	Objective	Donor/Organizer
A	2017	Sectorial workshops of EUROCLIMA+ "Forests, Biodiversity and Ecosystems" and "Disaster Risk Reduction"	To strengthen knowledge about the resilience of forests, ecosystems and local communities to climate change and environmental degradation in the framework of the Climate Change national plans of action. To support the adoption of plans of disaster risk reduction and management and, in particular, the integrated management of droughts and floods within a context of climate change.	EUROCLIMA
A,M	2017	Project Euroclima Workshop	Formally end Euroclima project, and launch of the second part of the project, called Euroclima+	EUROCLIMA
M	2017	Seminar/Workshop on Energy Policy for Sustainable Development and the use of the LEAP model	Development of methodological concepts for the design of the energy policy and energy planning, along with the development of the scenarios technique, and the training and intensive use of the LEAP model.	UNDP
A,M	2017	LEDS LAC Experts' Workshop on analysis of co-benefits and complementarities between mitigation and adaptation to climate change.	To exchange experiences for the use of co-benefits analysis to identify synergies and complementarities between mitigation and adaptation to climate change.	LEDS LAC
M	2017	Workshop on "Monitoring, Reporting and Verification (MRV) of emissions from the Waste Sector", associated to the Chile Program.	To learn more about the MRV systems of emissions from waste management centers in the province of Quebec, Canada.	Government of Canada
T	2016	Regional Workshop of the Green Climate Fund in Latin America.	(1) Increasing understanding on the FVC and advances related to their work, such as support for NDCs and national planning processes for adaptation; (2) To exchange experiences among the different actors on addressing climate change at a national level and expectations with respect to the role of FVC in the financing of adaptation and mitigation measures in Latin America (3) to develop a roadmap to articulate national priorities and opportunities of access to available resources with the Fund.	FVC
T	2016	Regional dialog on NDC, July 2016	To know and discuss the visions of the countries in the region regarding the next steps and challenges for the implementation of the National Contributions (NDCs).	UNDP, PMR, International Partnership on mitigation and MRV.
T	2016	XIII Annual Meeting of the Iberian-American Network of Climate Change Offices.	Discuss the main challenges and other relevant crosswise elements for the implementation of the national contributions to the Paris Agreement and opportunities for cooperation through the RIOCC taking into account the needs and strengths of the national contributions to the Paris Agreement and cooperation opportunities through the RIOCC taking into account the needs and strengths of the region.	LARIOCC
A	2016	VI Regional Seminar EUROCLIMA and EUROCLIMA+ Seminar.	Share the progress made by EUROCLIMA during the first half of 2016, which main emphasis was placed on the exchange of information and experience, capacity-building and advances in sustainable agriculture, food safety and climate change.	EUROCLIMA
M,R	2016	Workshop "MRV and Evaluation of Energy Efficiency Measures and related GHG Emission Reductions" and "International Energy Policies & Programs Evaluation Conference (IEPPEC)".	The main objective of the workshop "MRV and Evaluation of Energy Efficiency Measures and related GHG Emission Reductions" was giving an overview of the main elements and practical tools for the evaluation of energy savings and GHG emissions, as well as the exchange of experiences and good practices. The "International Energy Policies & Programs Evaluation Conference (IEPPEC)", for its part, whose primary purpose is to link both to evaluators as implementers of policies and low carbon programs in the field of energy efficiency.	Information Matters/Netherlands Enterprise Agency (RVO).

Area	Year	Initiative Name	Objective	Donor/Organizer
T	2016	Latin America & Caribbean Low Emission Development Strategies LED Global Partnership (LAC) Regional Platform & Steering Committee Meeting. X Latin American Carbon Forum 2016	Participate in the Annual Meeting of the LEDS LAC Platform for Latin America and the Caribbean), at the Meeting of the Executive Committee of the LEDS LAC Platform, and in the X Latin American Carbon Forum 2016.	LEDS-LAC
R	2017	Annual Retreat PATPA September 2017	To provide an analysis on recent developments in the UNFCCC negotiations and facilitate an understanding of the implications of the Paris Agreement for the implementation of the national policy. To facilitate the exchange and dissemination of good practices in the implementation of transparency systems covering mitigation, adaptation and means of implementation.	Partnership on Transparency in the Paris Agreement PATPA
T	2016	Regional dialogue on NDC, July 2016	To know and discuss the visions of the countries in the region regarding the next steps and challenges for the implementation of the National Contributions (NDCs).	UNDP, PMR, International Partnership on mitigation and MRV
T	2017	Regional Workshop "Road to the implementation of nationally determined contributions (NDCs)", January 2017	To know and discuss the vision of countries in the region with regard to progress up to date and next steps for the implementation of National Contributions (NDCs).	CDKN
T	2017	Regional workshop on "Public Policies facing climate change in Latin America and the Caribbe-an" June 2017	Discuss options for mitigation and adaptation to climate change measures and policies.	ECLAC
T	2017	Experts' Workshop: Anal-ysis of co-benefits as the basis for the integration of the agendas of mitigation, adaptation and develop-ment." May 2017	Exchange of experiences in the use of the analysis of co-benefits to make progress in the resilient promotion in countries at PAL.	LEDS LAC -UNDP
T	2017	"Workshop on initiatives to accelerate the deployment and technological transfer in companies" December 2017	Strengthening links between the UNFCCC mechanisms to accelerate the transfer of technologies in the countries, and being supported in the preparation of a strategy for tech-nology transfer through expert's support.	CTCN
M	2017	"Study Tour in Germany on the Emissions Trading System in the European Union", December 2017	To know and learn about experience of Germany with the EU ETS, how it was designed, how it was implemented, how it operates, and how much is the budget.	GIZ
T	2017	"Workshop on mobilization of private investment in the development of projects aligned with the NDCs of each country." September 2018	To know cases of countries in the region, and define objectives, performing sectors exploratory proposals of investment projects.	GIZ NDC PARTNERSHIP
T	2017	"Global NDC Conference 2017: integrated governance, finance and transparency for delivering climate goals" May 2017	Sharing experiences among countries with respect to the implementation of the NDC.	Global NDC
T	2017	"Enhancement of coopera-tion in climate action and sustainable development" July 2017	Presenting activities of cooperation on action in climate change and sustainable development matters. Identify areas that we can improve the cooperation between countries.	GIZ UNFCCC
T	2017	"Conference Green Banks and NBDs" June 2017	Contribute to the discussion on how national development banking and the model of green banking contribute to Latin American countries achieving the goals of the Paris Agreement.	OECD

Area	Year	Initiative Name	Objective	Donor/Organizer
T	2017	Experts' Workshop: Exploring financing and MRV for integration between mitigation and adaptation in climate policies" October 2016	Exchange of experiences, lessons learnt and best practices in financing, formulation and implementation of an agenda of integration between mitigation and adaptation to climate change.	LEDS LAC - EUROCLIMA
T	2016	"Regional Forum for national designated entities of the Center and Climate Technology Network CTCN for Latin American countries" December 2016	Strengthen the link between the technology and financial mechanism of the UNFCCC; in addition to the space to know innovations of climate technologies that are a priority for the region.	CTCN
M	2016	LEDS LAC V Regional Workshop: Moving toward a resilient and low in emissions development: implementing the "Paris Agreement" September 2016	Knowing the outcomes of recent studies, planning tools and case studies of countries, obtain relevant learning for the design of MRV of NAMAs APL	IDB, CDKN, World Bank
M	2016	Workshop of international good practices of MRV and Accounting.	Have experience of Chile in the use of guidelines of MRV, and receive feedback from other countries and entities.	GIZ
T	2016	Regional dialogue on NDC, July 2016.	To know and discuss the vision of the countries in the region regarding the next steps and challenges for the implementation of the National Contributions (NDCs).	UNDP, PMR, International Partnership on mitigation and MRV.
M	2016	Workshop "The Paris Agreement and the development of instruments for carbon pricing in Chile"	Disseminate and discuss the implications, challenges and opportunities of the Paris Agreement for the political, private, academic world and civil society in Chile.	PMR
R	2016	Workshop: Making Progress in Measurement, Reporting and Verification (MRV) in the Energy sector	Discussion on the importance and progress in the MRV methodologies for climate change,	PMR
R	2017	Annual Retreat PATPA Septiembre 2017	To provide an analysis on recent developments in the UNFCCC negotiations and facilitate an understanding of the implications of the Paris Agreement for the implementation of the national policy. To facilitate the exchange and dissemination of good practices for the application of transparency systems covering mitigation, adaptation and means of implementation.	Partnership on Transparency in the Paris Agreement PATPA
T	2017	Regional Workshop "Road to the implementation of nationally determined contributions (NDCs)", January 2017.	To know and discuss the vision of the countries in the region regarding progress up to date and the next steps for the implementation of the National Contributions (NDCs).	CDKN
M	2017	1St Training Workshop: The information as the cornerstone of mitigation and the instruments of carbon pricing in Chile	Training in national GHG inventories and national experience in the design and implementation of MRV systems.	PMR
M	2017	Workshop for Parliamentary Advisors	Workshop on Climate Change, New mitigation obligations for Chile resulting from the Paris Agreement, possibilities of instruments of carbon price in this respect"	PMR
M	2017	Training workshops at the regions of Valparaíso, Concepción and Antofagasta	Applications of the instruments of carbon price in the response of Chile and the region to climate change.	PMR
M	2017	Webinar: The CO_2 tax in Chile and its MRV system	Design and implementation of the carbon tax and its system of measurement, reporting and verification.	PMR
M	2017	Webinar: Instruments of carbon price in Chile and the world.	Progress and challenges of the instruments of carbon price in environmental management.	PMR

Area	Year	Initiative Name	Objective	Donor/Organizer
M	2017	Workshop of tradable emission Systems	Discussion on instruments of carbon price, their experience and global trend, and programs that are now working in Chile to promote its use. Development of a hands-on workshop on ETS through a simulation program on emissions trading -CarbonSim- developed by Environmental Defense Fund (EDF)	PMR and Global Carbon Market Project (GIZ)
R	2018	Hands-on regional training on the preparation and reporting of mitigation actions for the LAC region	Train, discuss and analyze the procedures for report of mitigation actions, and the necessary institutional arrangements, focused on the Biennial Update Reports (BUR) and National Communications (NDCs).	UN Climate Change Secretariat
N	2016	3rd Latin American Dialogue of Policies on Agricultural and Forestry issues in the United Nations Framework Convention on Climate Change	To provide national climate experts in the agricultural and forestry sectors responsible for participating in UNFCCC processes with a greater understanding and use of the framework and processes under the Convention, in order to improve formulation of the domestic policy, to better respond to the international developments, and to participate in technical discussions on issues related to agriculture and LULUCF sectors, MRV and NDCs within the context of the negotiation processes.	Climate Change, Agriculture and Food Safety (CCAFS)
A	2016	Internship and methodological workshop to learn about the Chilean experience in information management platforms of pests and diseases to generate early warnings.	Contribute to adaptation to climate change through the formation of networks of bilateral collaboration aimed at the generation of guidelines, programs, methodologies or good environmental practices aimed at strengthening capacities that promote the use of information platforms of pests and diseases to generate early warnings, in different climate scenarios.	Draft of the Cooperation Fund Chile Mexico called "Technical cooperation in the measurement of carbon footprint and management of pests and diseases, in non-traditional export products adapted to conditions of water scarcity".
M	2016	Course Of National Greenhouse Gas Inventories.	In this course, sponsored by CONAF and instructed by Ather Spain, it was sought to strengthen the training of national technicians on GHG inventories in the AFOLU and REDD+ sector, as well as its relationship with the reference levels for Forest emissions/ Forest Reference Levels (NREF/NRF). Specifically, the course addresses the guidelines of the IPCC and other methods of the AFOLU sector for the development of the National GHG Inventory, progress by ENCCRV REDD+ and its context with an emphasis on the development of the NREF/NRF, the uncertainty calculation of GHG estimates, and the use of the tool for the measurement of emissions reductions and increased removals.	FCPF/CONAF (UCCSA)
A, M	2016	Course of legal background for implementation of REDD+ in Chile	Training program on legal aspects associated to REDD+, with emphasis on the legislation related to payments for environmental services, transfer of carbon rights and national and international regulations on the matter, for lawyers and professionals related to the subject.	FCPF/CONAF (UCCSA)
A	2016	International Course for Forest Management and Recovery of Degraded Vegetation Formations	Strengthen technical capacities through theoretical classes and exchange of lessons learnt among the participants through the dissemination, review, systematizing experiences and results of different relevant stakeholders in Latin American and Caribbean countries that are currently developing initiatives of Ecological Restoration of vegetational resources, aimed to contribute to the mitigation and adaptation to climate change, in addition to promoting the reduction of desertification, land degradation and drought, with the aim of reducing social, environmental and economic vulnerability generated by these processes.	COSUDE; World Bank (MST)/ CONAF.
A	2017	Training on Dendroenergy	Improve the competence of the Dendroenergy Unit, reinforcing basic contents on biomass, utilization, energy efficiency and emissions.	FCPF/CONAF.
A	2017	International Course sustainable management for the conservation of mountain forests and wetland within the framework of the national climate change strategy and vegetation resources (ENCCRV)".	Strengthen technical capacities, exchange relevant lessons learnt and present synergies with countries that are currently developing initiatives of mitigation, adaptation to climate change and activities to reduce the effects of desertification, land degradation and drought through sustainable management for the conservation and recovery of mountain forests, wetland and other at height vegetation formations.	World Bank (MST); COSUDE/CONAF.

Area	Year	Initiative Name	Objective	Donor/Organizer
A	2017	“Participatory Regional Analysis: Sectorial plans of climate change in agriculture" workshop.	Strengthen the capacities of developing countries in South America for planning, implementation and monitoring of sectorial policies and programs aimed at increasing the resilience of production systems to climate change.	IICA - EU
A	2017	Seminar "Monitoring of extremps weather events of agricultural systems".	To present to farmers some of the tools developed or consolidated in Chile through the support of the FIA, that to tackle in a better manner the extreme weather events and more specifically, frosts.	FIA
A	2017	Dissemination and presentation of the Agroclimatic Atlas of Chile, developed through a project co-funded by the FIA (6 vols.): dissemination of Volume IV in Temuco, Volume VI in Coyhaique, Volume I in Iquique, Volume II in La Serena (Coquimbo region); Volume III in Santiago, Vol. V in Valdivia	Disseminate the instrument developed by the AGRIMED, Center of the School of Agricultural Sciences of the University of Chile, and supported by the Ministry of Agriculture through the Foundation for Agricultural Innovation, which seeks that farmers and producers, investors, researchers and advisers, and designers of public policy have agroclimatic information of high resolution, both of the current situation and projected climate change scenarios, in order to improve decision-making.	FIA

R = Report; M = Mitigation; I = NGHGI; A = Adaptation; N = International Negotiation; T= cross-sectional study

Source: Own preparation, Climate Change Office, MMA