

# **MALDIVES FIRST BIENNIAL UPDATE REPORT TO THE UNFCCC**

**MINISTRY OF ENVIRONMENT**



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# ACRONYMS AND ABBREVIATIONS

<b>ADB</b>	Asian Development Bank
<b>ADRC</b>	Asian Disaster Reduction Center
<b>AFOLU</b>	Agriculture, Forestry and Land Use
<b>ARI</b>	Acute Respiratory Infection
<b>BAU</b>	Business As Usual
<b>CO<sub>2</sub>e</b>	Carbon dioxide equivalent
<b>DHI</b>	Danish Hydraulic Institute
<b>DNP</b>	Department of National Planning
<b>ENSO</b>	El-Nino Southern Oscillations
<b>ERC</b>	Environment Research Center
<b>FAO</b>	Food and Agricultural Organization
<b>GCF</b>	Green Climate Fund
<b>GDP</b>	Gross Domestic Product
<b>GEF</b>	Global Environment Facility
<b>GCM</b>	Global Climate Model
<b>Gg</b>	Giga Grams
<b>GHG</b>	Greenhouse Gas
<b>GNI</b>	Gross National Index
<b>GWP</b>	Global Warming Potential
<b>HDI</b>	Human Development Index
<b>HPA</b>	Health protection Agency
<b>ICAO</b>	International Civil Aviation Organization
<b>IOD</b>	Indian Ocean Dipole
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>JCM</b>	Joint Crediting Mechanism
<b>kWh</b>	Kilo Watt Hour
<b>LCOE</b>	Levelized Cost of Electricity
<b>LDCF</b>	Least Developed Countries Fund
<b>ME</b>	Ministry of Environment
<b>MEE</b>	Ministry of Environment & Energy
<b>MEEW</b>	Ministry of Environment Energy and Water
<b>MHAHE</b>	Ministry of Home Affairs Housing and Environment
<b>MHE</b>	Ministry of Housing and Environment
<b>MHTE</b>	Ministry of Housing Transport and Environment
<b>MJO</b>	Madden-Julian Oscillation
<b>MMS</b>	Maldives Meteorological Services
<b>MoFA</b>	Ministry of Fisheries and Agriculture
<b>MoFT</b>	Ministry of Finance and Treasury
<b>MoH</b>	Ministry of Health
<b>MoHG</b>	Ministry of Health and Gender
<b>MoT</b>	Ministry of Tourism
<b>MoTAC</b>	Ministry of Tourism Arts and Culture
<b>MPND</b>	Ministry of Planning and National Development
<b>MPNI</b>	Ministry of Planning and Infrastructure
<b>MRC</b>	Marine Research Center
<b>MWSA</b>	Maldives Water and Sanitation Authority

<b>NAI</b>	Non Annex I
<b>NAPA</b>	National Adaptation Program of Action
<b>NBS</b>	National Bureau of Statistics
<b>NCSA</b>	National Capacity Self-Assessment
<b>NDMA</b>	National Disaster Management Authority
<b>NEAP</b>	National Environmental Action Plan
<b>NGIS</b>	National Geographic Information System
<b>NSDS</b>	National Sustainable Development Strategy
<b>OTEC</b>	Ocean Thermal Energy Conversion
<b>PPP</b>	Power Purchasing Parity
<b>SAARC</b>	South Asian Association for Regional Cooperation
<b>SGP</b>	Small Grants Programme
<b>SIDAS</b>	SEARO Integrated Data Analysis System
<b>SIDS</b>	Small Island Developing States
<b>SLCP</b>	Short Lived Climate Pollutants
<b>SRES</b>	Special Report on Emissions Scenarios
<b>RIMES</b>	Regional Integrated Multi-Hazard Early Warning System
<b>TNA</b>	Technology Needs Assessment
<b>Toe</b>	Tons of Oil Equivalent
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>WB</b>	World Bank
<b>WTE</b>	Waste to Energy





# FOREWORD

Maldives is undeniably one of the lowest lying countries in the world. In fact, Maldives is among the most vulnerable and least defensible countries to the projected impacts of climate change. Climate Change is therefore a critical threat to the very existence of our island nation. On multiple fronts, the development of this island nation is severely challenged by this.

Global Warming has already reached 1 degrees Celsius above the pre-industrial levels. The ocean is warmer, more acidic and becoming less productive. Melting glaciers are causing sea level rise. Coastal extreme events are becoming more severe. The most recent IPCC special reports have shown an overwhelming degree of evidence for the benefits of limiting global warming to the lowest possible level which is in line with the commitments made under the Paris agreement. Hence, we see a dire need for collective global action.

Maldives is a party to the UNFCCC and one of the first countries to ratify the Kyoto Protocol and the Paris Agreement. In the international arena, Maldives has been tirelessly advocating for climate change. Our leadership as the Chair of AOSIS

took pains to ensure that the interests of all member states were heard without any exclusivity. Hence, our commitment to climate action is unparalleled.

Although our emissions are negligible compared to the global emissions, we are committed to estimate our greenhouse gas emissions and reduce them. This is the first Biennial Update Report of Maldives to the UNFCCC. We believe that this is the beginning of a promising process to achieve the reporting obligations of the country under the Convention and in the long run be able to track the progress of our NDC. This report contains the most up to date information on GHG emissions, mitigation efforts and support received and needed. The compilation of this report required co-operation and participation of multiple stakeholders. Hence, I take this opportunity to express my profound gratitude to all participants involved in different levels of this process. I am confident that this report will pave the way in formulating coherent and robust policy decisions in the country.

Dr. Hussain Rasheed Hassan

Minister of Environment

# EXECUTIVE SUMMARY

## INTRODUCTION

As per the decision 2/CP.17 under the UNFCCC, developing country Parties should submit the first BUR by December 2014 and every two years thereafter, consistent with the level of support provided for preparation of the report. However, the Least Developed Country Parties (LDCs) and Small Island Developing States (SIDS) are allowed to submit BUR at their discretion. The BUR should provide an update of the GHG inventories and have to be submitted along with the mitigation efforts undertaken, support received, gaps and constraints etc.

The Republic of Maldives is a Non-Annex 1 Party to the UNFCCC, which ratified the convention on 09 November

1992. Maldives submitted its Second National Communication (SNC) to UNFCCC in October 2016. This is the First Biennial Update Report (BUR) of the Republic of Maldives.

This BUR was prepared in close adherence to the guidelines set by Decision 2/CP.17 of the 17<sup>th</sup> Conference of the Parties (COP17) to the UNFCCC. Close attention was also given to the guidance provided by the Consultative Group of Experts (CGE) on preparing BURs and IPCC guidelines. Climate Change Department (CCD) worked with multi-stakeholder working groups for the compilation of this report (Figure 1).

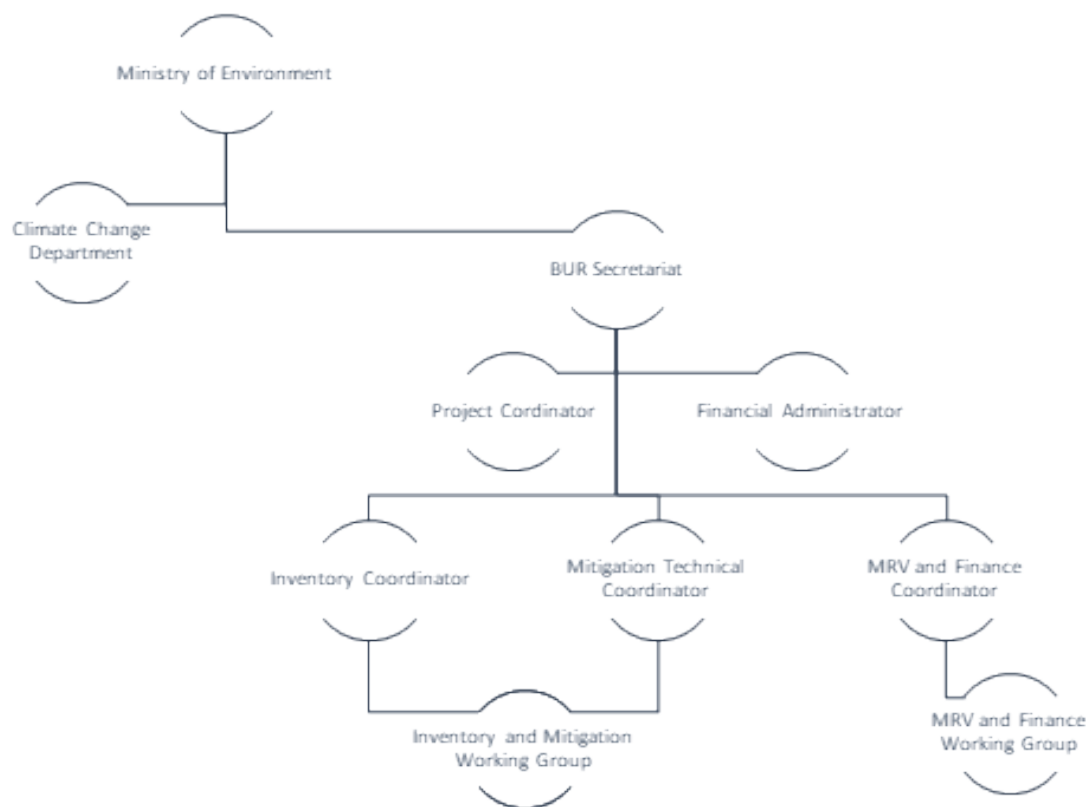


Figure 1: Institutional Setup for the BUR

# NATIONAL CIRCUMSTANCES

Maldives is one among the most vulnerable countries to the adverse impacts of anthropogenic climate change. Building the resilience and low emission development is a key priority of the country. The Table 1 provides key introductory facts about the Maldives

**Table 1: Maldives at a Glance**

Capital	Male' City
Government	Republic, Presidential System
Language	Dhivehi, English is spoken widely
Weather/Climate	Warm and humid tropical climate
Total Land Area	298 sq km <sup>1</sup>
Exclusive Economic Zone (EEZ)	859,000 sq. km <sup>1</sup>
Per Capita GDP for 2017 at Constant Prices (Million US\$)	9876 <sup>1</sup>
GDP Growth Rate (2017)	6.2% <sup>1</sup>
Main Economic Contributors	Tourism, Transportation & Communication, Construction and Fisheries
Resident Maldivian Population including expatriates (2014)	402,071 <sup>2</sup>
Total GHG emissions 2015	1,536.04 GgCO <sub>2</sub> e
Main GHG Sources	Energy and Waste

## GHG INVENTORY

In line with 2/CP.17, this report covers the inventory for the year 2015, which is no more than 4 years prior to the submission year. Attempts were also made to cover a time series of the inventory for the years 2011 to 2015 based on sectoral approach while emissions from energy were calculated for 2001 – 2015 using reference approach. The 2006 IPCC guidelines and the IPCC good practice guidance was used in preparing the inventories.

The total emissions of Maldives for the year 2015 is 1,536.04 Gg of CO<sub>2</sub> equivalent. Considering the IPCC emissions sectors, major emissions in Maldives are from energy and waste. Emissions from energy shares a 95.8% while waste shares 4.2% of the total emissions. Within the energy sector, major emissions are from electricity production and the second largest emissions is through energy use within transport sector. The most emitted gas is CO<sub>2</sub> (96%) and CH<sub>4</sub> (3%) of the total emissions.

When emissions are characterized by national economic

activities, tourism shares a total of 40% of the total emissions. The second largest emissions are from residential use (38%), followed by transport (18%). In order to ensure the Quality Control (QC) of data collected, data were cross referenced with the respective sectors and re-checked with the respective stakeholders. Independent review of the inventory was conducted for Quality Assurance (QA) purposes via inventory experts supported by the Global Support Programme (GSP).

With the start of this BUR process, a huge importance was placed to improve the consequent GHG inventories. Since the first national inventory, institutions have improved with regards to data collection and archiving. However, severe challenges still exists in getting quality/desirable data for GHG inventory. Hence, data collection and statistical procedures need to be revisited in areas such as transport and tourism. Nation-wide waste audits are also recommended in order to identify the volume and type of waste production and the ratio of waste burnt.



## MITIGATION

Maldives has embraced the low-carbon growth as means to achieve energy security, reduce pollutions how leadership in tackling climate crisis and for sustainable transition. Maldives has set NDC targets to reduce its emission by 10% from business as usual by 2030 voluntarily and enhance that target to 24 % from business as usual (BAU) by 2030 with international support. To assess the impact of the completed, ongoing and newly planned projects since the submission of NDC, the BAU was revisited using LEAP. Use of LEAP is a major step taken forward in this BUR process as this is the first-time mitigation assessments are undertaken in Maldives using a globally accepted mitigation assessment model. According to LEAP projections, power generation sector is the dominant source of GHG emissions and it grows by 292% by 2030 compared to 2011 emissions. Table 2 summarises the mitigation actions reported in this BUR. Given the current trajectory of mitigation actions from both the public and private sector, Maldives is on a pathway to achieve the voluntary NDC target of 10% under

BAU. However, significant increase in mitigation efforts across all sectors (Renewable Energy, Energy Efficiency, Transport and Waste) are required to achieve the 24% conditional target.

In order to facilitate the enhanced ambition target, the government has launched a number of initiatives such as removal of import duty from renewables, introduced net metering and feed in tariff for domestic use of RE. Financial instruments are also in place such as the Fund for Renewable Energy Systems Application (FRESA), Renewable Energy Development Fund (RED Fund) and Maldives Green Fund (MGF) to facilitate RE investments in the country. Additionally, the government has partnered up with research and development institutes to explore other potential renewable energy sources and feasible technologies for Maldives. The JCM agreement established between the Government of Maldives and Japan is one key initiative designed to make mitigation investments in Maldives commercially competitive.

**Table 2 Reported mitigation Actions and their estimated emission reductions**

Name of Mitigation Action	Estimated Emission Reduction
Project for the Clean Energy Promotion in Male'	799.2 tCO <sub>2</sub> e per year
Clean Energy for Climate Mitigation Project	589 tCO <sub>2</sub> e per year
Dhiffushi Solar Ice Project	43.2 tCO <sub>2</sub> e per year
Support of the Climate Neutrality Strategy of Maldives	349.9 tCO <sub>2</sub> e per year
Enhanced Water Security and Climate Resiliency in Maldives	123.1 tCO <sub>2</sub> e per year
Low Emission Climate Resilient Development (LECRd)	71.3 tCO <sub>2</sub> e per year
STELCO 6 Island Solar PV Project	704.2 tCO <sub>2</sub> e per year
Preparing Outer Islands for Sustainable Energy Development (POISED)	27,572 tCO <sub>2</sub> e per year
Accelerating Sustainable Private Investment in Renewable Energy (ASPIRE)	21,600 tCO <sub>2</sub> e per year
FAHI – ALI programme	76,948 tCO <sub>2</sub> e per year (by 2030)
Standard Labelling Programme	105,738 to 136,113 tCO <sub>2</sub> e per year (by 2030)
Greater Male Environmental Improvement and Waste Management Project	11,617 tCO <sub>2</sub> e per year (by 2030)
Islands Waste to Energy Project	2904 tCO <sub>2</sub> e per year (by 2030)

## OTHER INFORMATION

Climate Change is a cross cutting development issue for Maldives. Therefore, it is critical that we reflect on the development planning process in the Maldives. Challenges have been faced in linking all sectoral plans and policies into one integrated development vision. As a step towards long term planning and a vision, the Government has published a Strategic Action Plan in October 2019. More on this could be found under Climate Relevant Policies and Measures.

Many transformational efforts to climate change actions have been taken by the Government. Those include the following;

- National Spatial Plan
- Building Resilient Communities
- Initiative for Renewable Island Energy (IRIE)
- Initiative for Climate Smart Resilient Islands (CSRI)
- Maldives Biosphere Reserve Targets

## FINANCIAL RESOURCES, TECHNOLOGY TRANSFER, CAPACITY BUILDING AND TECHNOLOGY SUPPORT RECEIVED AND NEEDED

Maldives has been and continues to be working with a sizeable number of international donors and financiers in projects that directly concerns climate change adaptation and mitigation in the country. Based on the guidance provided by the CGE for the preparation of biennial updates reports, Maldives has established an overview of financial commitments, both nationally and internationally, related to climate change mitigation and adaptation covering the period 2014-2017(both years inclusive, although recordings for 2017 may not be complete). Amongst the donor funded projects reported, 23% of finances are allocated towards adaptation while 71% of the finances go towards climate mitigation. It is crucial to note that a significant proportion

of mitigation projects are also funded through concessional loans. Approximately 35% of the financing of climate change related actions and investments stem from the national budget (Public Sector Investment Programme) of the Maldives.

As a Small Island Developing State (SIDS), Maldives faces significant challenges in addressing climate change issues. Limited availability and access to low cost financial resources is the key barrier for implementation of climate change adaptation and mitigation efforts in the country. Several capacity building and technology transfer needs exist and these are documented in this chapter.

## DOMESTIC MEASUREMENT, REPORTING AND VERIFICATION (MRV)

Maldives strongly lacks a comprehensive national MRV system. However, individual projects/departments do collect information and track project progress. This is done on project requirements or on an ad-hoc basis and usually during the project time period. The evaluation of the existing institutional setup shows a dire need for the establishment of a robust MRV system in the country. Five key areas were highlighted for improvement during the process; Legal, Institutional, Procedural, Availability and Management of data for MRV systems and indicators for mitigation actions.

This gap analysis identifies the following needs, in order to build a system for tracking and managing GHG emissions for policy data and mitigation actions.

- To improve involvement of institutions within MRV systems at governmental level;
- for further capacity building for increasing expertise of officials of related institutions with MRV matters. This includes technical as well as organizational aspects;

- of institutional setting for data generation/collection and reporting, including limitations of staff;
- of institutional agreements for MRV data sharing;
- for IT infrastructure to store and maintain MRV data in the Government institutions

In addressing the gaps identified, Maldives is currently working with partners to design a comprehensive MRV system for mitigation in the country. Within this newly designed MRV system, Maldives aims to build the capacity of government, relevant institutions and stakeholders for GHG emissions data management, including the preparation of scenarios, projections and GHG emission reductions due to mitigation actions and long term tracking of climate finance.



# **1. NATIONAL CIRCUMSTANCES**

## 1.1 GEOGRAPHICAL CHARACTERISTICS

Maldives is an archipelago consisting of 1192 low-lying islands, clustered into 26 natural coral atolls. Geographically these islands are situated in the central Laccadives-Maldives-Chagos submarine ridge. The atolls are dispersed over an area of 115,300 km<sup>2</sup>. The average elevation of the islands are 1.5 meters above the mean sea level and approximately 80% of the islands have an elevation of less than 1 meter, making the country one of the flattest countries in the world (MEEW, 2007).

The islands of Maldives are extremely small. Most of the vegetated islands are less than 0.5 square kilometers in land area. Due to limited land area, the majority of the biodiversity of the country is found on the coral reef ecosystems which are globally known for their diverse nature (MEE, 2015a). The total coral reef area of the Maldives is approximately 4513 km<sup>2</sup> (Naseer and Hatcher, 2004) which is the 7<sup>th</sup> largest reef system in the world (UNEP, 2003).

The climate of the Maldives is dominated by two monsoons namely Southwest monsoon (*Hulhangu*) extending from May to November and Northeast monsoon (*Iruvvai*) extending

from January to March. Most of the rainfall occur during the Southwest monsoon and Northeast monsoon corresponds to a dryer period with limited rainfall. In spite of monsoonal variability there is a minor fluctuation in the ambient temperature of the country. The mean annual temperature of Maldives is 28-degree Celsius.

The geophysical characteristics of Maldives makes it highly vulnerable to changing climate and natural hazards. In particular, the location of Maldives near the equator in the Indian ocean exposes Maldives to tropical storms/surges, swell waves, gale-force winds, heavy rainfall, drought as well as tsunamis and earthquakes (MEE, 2015a). The low elevation and the small size of these islands makes the human settlements defenseless against extreme weather events, as retreat inland or to higher grounds is not possible (MHTE, 2010).

## 1.2 SOCIO-ECONOMIC CHARACTERISTICS

### 1.2.1 Demography

The resident population (including registered expats) of Maldives is 402,071 (NBS, 2014). The population is geographically dispersed into 187 inhabited island. Male' City hosts more than 38% of the entire population as of 2014 census. The population growth rate is 1.69% as per the census of 2014. Congestion of population in the urban centers particularly in Male' City is a key development challenge for the Maldives. The main reason for the population to gravitate towards Male City is availability of better education and health care facilities and economic opportunities. The key challenges which arises from this include, deterioration of environmental quality, inability to keep up with the growing demand for education, health care and housing and increased living cost and decreased living standards. To address the issue of this population pressure, several efforts are undertaken by the government. These are highlighted in Chapter 5.

### 1.2.2 Human Development

The national Human Development Index (HDI) for Maldives, placed it in the medium human development category, with an

HDI of 0.688 (UNDP, 2014). The average HDI of the Small Island Developing States (SIDS) was 0.648, indicating that Maldives performed better than the average SIDS (UNDP, 2014). The human development performance of Maldives shows progress as well as the underlying income disparity of the population. According to the national poverty line, 8.2% of the population lives below the poverty line (NBS, 2016).

### 1.2.3 Economy

The Gross Domestic Product (GDP) indicates a significant economic growth for the past few years. Maldives has the highest GDP per capita with in the South Asian countries. The GDP per capita of Maldives was USD 9876 in the year 2017 (NBS, 2018).

The Maldivian economy is extremely vulnerable to external shocks. The main reason being high dependence on imported fossil fuel and limited diversification of economic activities. The Figure 2 illustrates how external shocks impacted the GDP growth of the Maldives for a period of 25 years. Following up from SNC, Figure 3 provides an update of the main contributing sectors to the GDP.

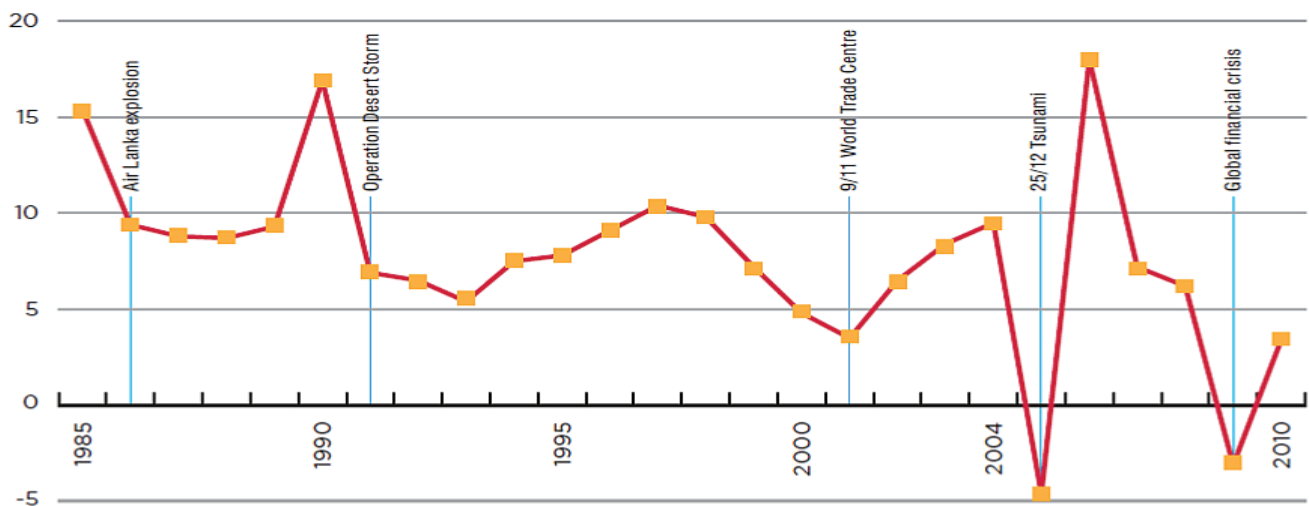


Figure 2: Real GDP growth at 1995 constant prices 1985-2010. Source (MED, 2013)

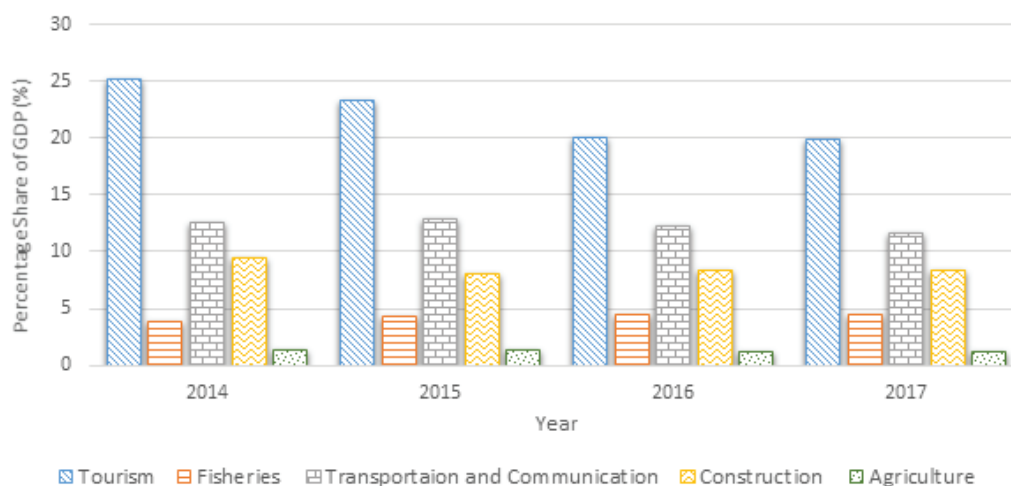


Figure 3: Percentage Share of GDP per activity from 2014-2017 (NBS 2017)

### 1.2.3.1 Tourism

Since its introduction, tourism has been the biggest contributor to the economy of this country, accounting for 19.9% of the GDP in 2017 (NBS, 2017a). Tourism in Maldives began in 1972, with just 2 resorts which has now increased to a total of 126 resorts (NBS, 2017a).

Tourism industry is the highest contributor to GHG emissions in the Maldives. Tourism in the Maldives is a luxury service based industry which require significant energy consumption for transport, cooling/freezing and desalination. (MoT, 2017). The one island- one resort concept of the Maldives islands has resulted in this sector contributing the highest towards energy consumption from transport; accounting for 40%.

### 1.2.3.2 Fisheries

Maldives is a nation highly dependent on tuna fishing and this long tradition dates back hundreds of years. Fishery products are the main export of the country accounting for 2.9 billion MVR (NBS, 2018). Tuna is also the main source of protein for many Maldivians, Contribution of fisheries to the GDP has been significantly declining since the introduction of tourism in 1970s. For instance, fisheries contributed 22% to the GDP in 1999 (NBS, 2017b) and this contribution had decreased to a mere 4% in 2016.

Fisheries is one of the most energy intensive sectors in the country accounting for 2% of GHG emissions in 2015. This is mainly due to two factors; the presence of fish canneries, processing plants and ice manufacturing plants across the country

and the widening of the fish catching zone in the EEZ which has led to higher fuel consumption per fish catch.

### 1.2.3.3 Agriculture

Agriculture is a small sector in terms of economic activity contributing only 1% towards the GDP (NBS, 2017a). The main constraints of this sector are the limited availability of cultivable land, poor quality of soil and scarce sources of fresh water (MHAHE 2001). Even with the inadequate resource base, agricultural activities are a key part of livelihoods in more than 2/3<sup>rd</sup> of the inhabited islands (FAO, 2012). In Maldives, livestock farming is limited due to lack of land and limited feed availability. Chicken farming in cages, contained free range and backyard poultry is practiced widely throughout the country (FAO, 2012).

## 1.3 KEY MITIGATION SECTORS IN THE COUNTRY

### 1.3.1 Energy

Maldives relies almost entirely on fossil fuels to meet its energy demand. This is the dominant source of GHG emissions in the country, where electricity generation accounted for 67% of emissions in 2015. According to data from the Maldives Customs Services, 537,059 MT of fossil fuels were imported in 2016. The major fuel types imported are diesel, petrol (gasoline), aviation fuel (Jet A-1) and liquefied petroleum gas (LPG) as shown in Figure 4.

Fuel import expenditure account for 7% of the GDP in 2016. Due to the dispersed nature of the Maldivian islands, the country operates on a stand-alone grid and power generation

system. This results in costly electricity services. Currently Maldives have 16 MW of renewable energy (solar PV) installed in the country. Maldives has also successfully achieved universal access to electricity in 2008, with 24 hours electricity service in all inhabited islands and resorts in the country.

A number of policies have been initiated by the government towards achieving low carbon transformation of the energy sector. The Maldives Scaling up Renewable Energy Investment Plan (2012) outlined a plan for scaling up of renewable energy in the country. Under the Maldives energy policy and strategy (2016) (See Table 4) various policy measures and programmes are being implemented which are predominantly focused on increasing the share of renewable energy in the energy mix and

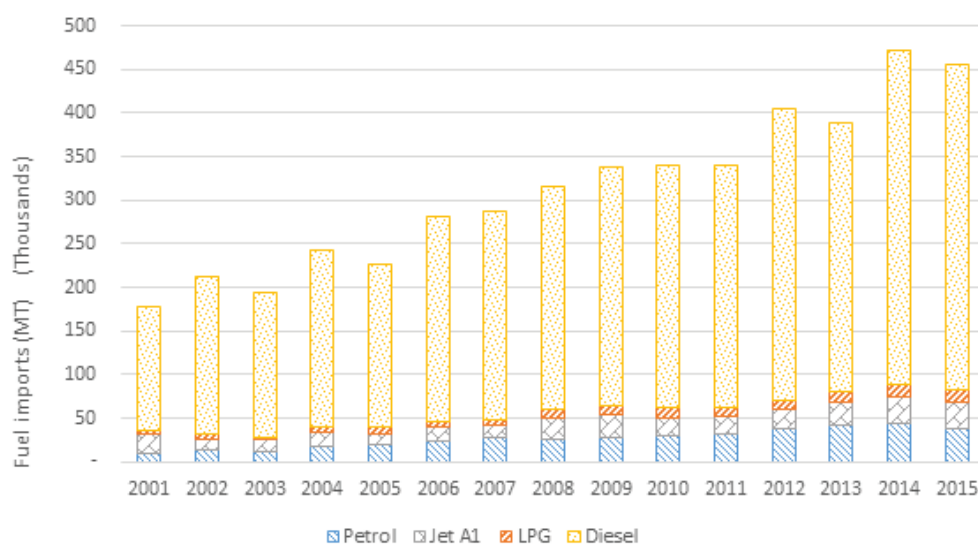


Figure 4: Fuel imports 2001 - 2015



mainstreaming energy efficiency into development activities. The Low-Carbon Energy Island Strategies (LCEI) project is one of the key initiatives which promotes energy efficiency practices and technologies for public buildings and the incorporation of energy efficiency measures to the building codes. Since 2010, import duty has been exempted from all renewable energy equipment. Moreover, the Accelerating Sustainable Private Investments in Renewable Energy Programme (ASPIRE) which is currently implemented aims to reduce risks for private sector investments in renewable energy in the Greater Male' Region. The Preparing Outer Islands for Sustainable Energy Development Programme (POISED) in another significant initiative which aims to transform the existing energy grids in islands outside the greater Male' Region into a hybrid renewable energy system. Government has also pledged to meet 70% of day-time peak demand of electricity in inhabited islands using renewable energy technologies.

### 1.3.2 Transport

The geographically dispersed nature of the islands makes sea transport the most prominent mode of transport in the Maldives. The number of registered vehicles have been continuously increasing due to socio economic growth. As demonstrated in Figure 5, land transport system in the Maldives is dominated by motorcycles and cars. Due to population growth and under-developed public transport system and rapid urbanization, the total fleet size has increased drastically over the years; number of registered motorcycles and cars have doubled during the period 2009-2016 (See Figure 5). Most of this land transport is concentrated in the Male' city. The high density of vehicles has resulted in this sector as the second largest emitter of GHG emissions in the country, accounting for 25% of total emissions in 2015. Air transport infrastructure has also shown

a rapid development over the years, mainly due to the establishment of domestic and international airports at various regions in the country. Currently there are three international airports and nine domestic airports in the country (NBS, 2019).

To improve the transport systems in the country and mitigate the corresponding emissions, the government has undertaken several initiatives. The largest public transport network (both land and sea) is operated by Maldives Transport and Contracting Company (MTCC). Scheduled intra and inter atoll ferry services are operated daily for Zone 1 (Ha, HDh, Sh), Zone 2 (N, R, B), Zone 3 (K, A.A, Dh, V), Zone 5 (Th, L) and Zone 6 (Ga, Gdh). Government have been implementing measures to improve road conditions and reduce congestion and facilitate public transport. There are initiatives from the government to introduce vehicle emission standards, however, this is subject to wider acceptability of stakeholders in road transport. There is a risk of delayed implementation of such measures as has been the case for many of the previous policy/regulatory measures directed towards road transport. These are further explained in Chapter 4. Efforts are also taken by the private sector in introducing energy efficient sea vessels.

### 1.3.3 Waste

Considering the limited land area of the islands, solid waste management has been one of the biggest environmental threats the country faces. The main method of waste management is uncontrolled open burning. However, composting and small scale incineration is practiced in some islands. The country generates an estimate of 170,000 T of waste per year. The waste management varies among islands depending on the availability of solid waste disposal facilities and local custom. Household level segregation of waste is not practiced in the

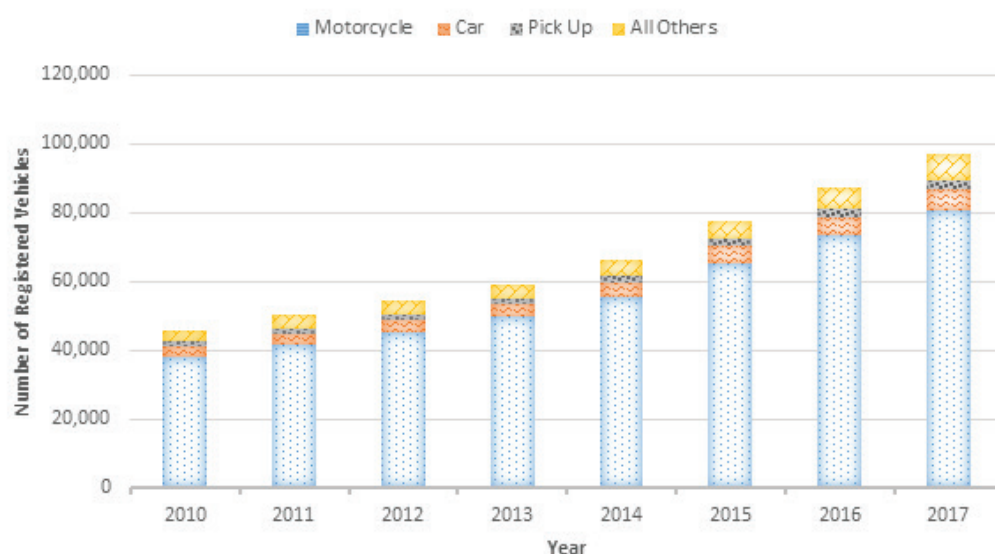


Figure 5: Increase in Land Vessels over the years (NBS 2018). All Other vehicles are heavy vehicles

country. The Male' region is responsible for a huge proportion of waste generated within the country. GHG emissions from waste accounted for 5% of the total emissions in 2015.

National Solid Waste Management Policy was formulated in 2008 and a Waste Management Regulation was enacted in 2013. National Solid Waste Management Policy was further updated in 2015. Under this policy, regional waste management centres are to be established for 7 regions (Table 3). These improved facilities will have state of the art solid waste management equipment and some of the facilities will have Waste to Energy facilities. After the implementation of the projects,

each island of the Maldives will have island level waste management facilities with equipment to manage household waste. The solid waste which cannot be managed at island level will be transferred to the regional waste management centres. The aforementioned project is anticipated mitigate GHG emissions from the waste sector. Other initiatives such as the 'Saafu Raajje Initiative' was launched in 2015 during the 6<sup>th</sup> Regional 3R Forum in Asia and the Pacific held in Male' City.

**Table 3 Ongoing Waste Management Projects**

Regional Waste Management Centre	Waste Management Region	Geographical Significance	Donor Agency
R. Vandhoo	1 and 2	Upper North and North Region	OPEC Fund for International Development (OFID) World Bank
K. Thilafushi	3	Greater Male' Region and central region	Asian Development Bank (ADB)
Ongoing feasibility studies	4 -5	Upper South Region	World Bank
S. Hithadhoo	6-7	Southern Region	International Renewable Energy Agency (IRENA)

## 1.4 NATIONAL PLANS AND POLICIES

**Table 4 Climate Relevant Policies and National Plans**

Key Policies	Description
Environment Protection and Preservation Act (4/93)	<p>Fundamental legislation, which governs environmental issues in the country. This act is yet to be amended to better address the changes Maldives has undergone over the past 25 years.</p> <p>Currently, work is ongoing to update this law as well as initiated work on a Climate Change Act, Energy Act and Water Act.</p>
Strategic Action Plan (2019-2023)	<p>This document outlines the developmental targets and priorities of the Government for the 5-year period 2019 – 2023, which sets out realistic strategic goals, which would help achieve the key development milestones in the country.</p>
Maldives Climate Change Policy Framework (2015)	<p>Principle policy document, which addresses and mainstreams climate change issues in the country. The vision of this Policy is 'to recognize the status of Maldives as a nation suffering from the adverse impacts of climate change and to build its capacity to ensure a safe, sustainable, resilient and prosperous future'</p> <p>Consists of 5 thematic Strategic Goals;</p> <ul style="list-style-type: none"> <li>• Ensure and integrate Sustainable Financing into Climate Change adaptation opportunities and low emission development measures</li> <li>• Strengthen a low emission development future and ensure energy security for the Maldives</li> <li>• Strengthen adaptation actions and opportunities and build climate resilient infrastructure and communities to address current and future vulnerabilities</li> <li>• Inculcate national, regional and international climate change advocacy role in leading international negotiations and awareness in cross-sectorial areas in favour of the most vulnerable and small island developing states</li> <li>• Foster sustainable development while ensuring security, economic sustainability and sovereignty from the negative consequence of the changing climate.</li> </ul>
Nationally Determined Contributions to Paris Agreement	<p>This policy sets country specific targets to achieve in the short to medium term for mitigation and adaptation activities.</p> <p><b>Mitigation Contribution</b> With the aim of achieving a low emission development future and ensure energy security, the Maldives intends to reduce unconditionally 10% of its GHG emissions (below BAU) for the year 2030, which could be increased to 24% in a conditional manner. This is to be achieved through interventions in energy, transport and waste sectors,</p> <p><b>Adaptation Contribution</b> Aims to strengthen adaptation actions and opportunities via strategies for enhancing food security, infrastructure resilience, public health, enhancing water security, coastal protection, safe guarding coral reef and its biodiversity, tourism, fisheries, early warning and systematic observation and cross cutting issues.</p>
Energy Policy and Strategy (2016)	<p>The Key objective of the Maldives Energy Policies are to provide affordable and reliable electricity to the people, simultaneously reducing the economic, social and environmental implications of high fossil fuel dependence.</p> <p>5 Key policy statements;</p> <ul style="list-style-type: none"> <li>• Strengthen the institutional and regulatory framework of the energy sector</li> <li>• Promote energy conservation and efficiency</li> <li>• Increase the share of renewable energy in the national energy mix</li> <li>• Improve the reliability and sustainability of electricity service and maintain universal access to electricity</li> <li>• Increase national energy security</li> </ul>
National Solid Waste Management Policy (2015)	<p>This policy aims to manage waste effectively which involves building awareness on waste management in the country and the establishment of Waste Management Centres in all inhabited islands in the country.</p>
Maldives Water and Sewerage Policy (2017)	<p>The key objective of this policy is to enhance the livelihoods of all Maldivians by developing efficient tools for the provision of adequate water and sewerage services and proper management of water resources in the country.</p>
Health Master Plan (2016-2025)	<p>The mission of this master plan is to ensure nation's participation in quality health services, in an affordable and accessible manner leading to a healthy population.</p> <p>In this regard, output 2.7 on 'providing clean, safe and supportive environment to enable healthy choices and prevent injuries and spread of diseases', aims to monitor health impacts of climate change and develop strategies for reorienting programmes to address the emerging health issues. This output also aims to develop strategies to reduce the carbon footprint related to health services in alignment with national strategies</p>
Disaster Management Act (ratified 2015)	<p>This Act refers to the responsibility of the State to protect its people, their health and well-being, their property, and the natural and built-up environment they live in from natural and man-made disasters, and hazards.</p>
4th Tourism Master Plan (2013-2017)	<p>Articulates a 5-year strategic agenda and action plan to provide strategic guidance for private sector, investors and new entrepreneurs. In this regard, strategy 2.5 on 'Implementing Climate Change Adaptation Programme for tourism industry' aims to initiate a long term climate change adaptation plan in the sector</p>
National Action Plan on Air Pollutants (2019)	<p>This action plan describes all pollutants in detail, including the emission levels of different pollutants in the Maldives, and their likely progression in the future. The aim of this action plan is to direct towards reduction of GHG emissions</p>

## 1.5 DESCRIPTION OF FINANCIAL, TECHNICAL AND CAPACITY NEEDS

Maldives being a small island developing state with very limited resources and small population, faces unique and significant challenges in addressing adverse impacts of global climate change. Limited availability and access to low cost financial resources is the key barrier for implementation of climate change adaptation and mitigation efforts in the country. There

are significant needs in capacity building and transfer of technology as well. The following

Table 5 summarizes these needs. Refer to Chapter 6 for details.

**Table 5 Summary of existing financial, capacity building and technology needs in the country**

Need	Financial	Capacity Building	Technology Transfer
<b>Adaptation and Climate Resilience</b>			
Enhancing weather and climate monitoring in the Maldives and developing human resource capacity at Maldives Meteorological Service		✓	✓
Coastal Protection and Institutional strengthening for coastal monitoring	✓	✓	
Assessment of vulnerabilities and risk reduction of health sector to vector borne diseases due to climate change impacts		✓	
Enhancing Infrastructure Resilience to Climate Change Impacts	✓		
Strengthening Health Sector Emergency Response to floods and sea swells.	✓	✓	
Island-Smart Agriculture; food storage, climate risk insurance mechanisms and scaling up of climate-smart agricultural practices	✓		
Blue Growth and climate-resilient livelihoods for Maldives Fisheries	✓		
Adaptation in the tourism sector	✓		
Enhancing Water Security	✓		
Establishing GIS Integrated national level systems for disaster management information, communication and coordination	✓	✓	✓
Assessment of health risks due to air pollution	✓	✓	
<b>Implementation of Mitigation Actions and NDC</b>			
Detailed study on Solar Water heaters with electrical back up at the resorts and plan to phase out or reduce conventional water heaters in resorts	✓		✓
Business loan programme for GHG Emission reductions	✓		
Explore financial schemes to finance solar PV, wind systems, LNG and bioethanol blend creating awareness to households	✓		
Deployment of clean Energy in the outer islands of the Maldives	✓		
Establish Health Care Waste Management systems in health facilities to reduce emissions	✓		
<b>Support Needed for reporting to the enhanced transparency framework under the Paris Agreement</b>			
Enhanced GHG Inventory		✓	
Improved Reporting of Mitigation Actions and tracking of NDC		✓	
Enhanced adaptation reporting under the Paris Agreement		✓	
Improved reporting of support received and needed		✓	

## **2. INSTITUTIONAL ARRANGEMENTS**

The lead coordination agency for the BUR process in the Maldives is Ministry of Environment. The Climate Change Department (CCD) of Ministry of Environment is mandated with coordination of NCs and BUR preparation. CCD works in collaboration with multi-stakeholder working groups which

includes data providers for various chapters of the BUR. The Figure 6 illustrates the institutional arrangement for preparation of BUR. The Table 6 enlists the different stakeholders and their contribution to the BUR process.

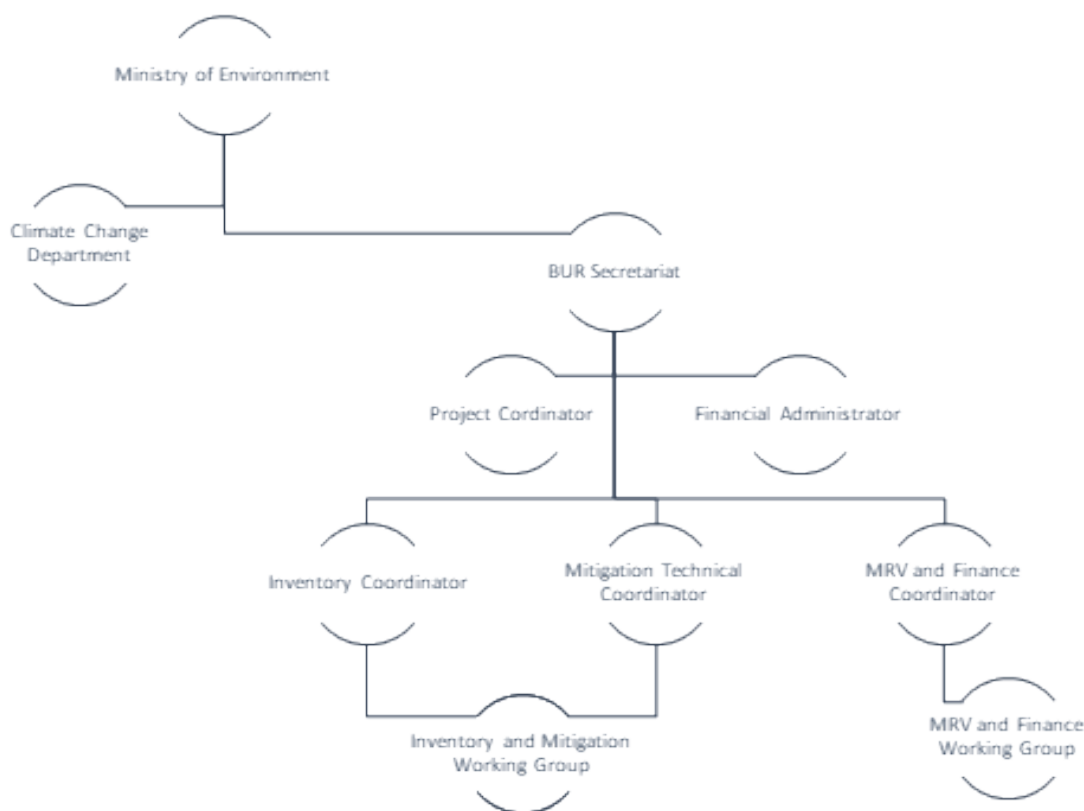


Figure 6: Institutional arrangement for the preparation of BUR1

Table 6 List of Stakeholders and their contribution to the BUR process

Stakeholders	General Roles and Responsibilities	Data Provided for BUR	Contributing Chapters	Working Groups	
				IMWG	MFWG
Waste and Pollution Control Department, Ministry of Environment	The department responsible for pollution control and waste management policy making and implementation of solid waste management projects in the Maldives	Data on total disposed quantity and composition of waste, finance data of climate related projects and Sector overview	National Circumstance, GHG Inventory, Mitigation Actions, Domestic MRV and Constraints & Gaps; financial, capacity building and technology transfer needed and received	✓	✓
Energy Department, Ministry of Environment	The department responsible for policy making and implementation of renewable energy projects in the Maldives	Data on Electricity Generation and Financial information on Renewable Energy Projects	National Circumstances, GHG Inventory, Mitigation Actions, Other Information, Domestic MRV and Constraints & Gaps; financial, capacity building and technology transfer needed and received	✓	✓
Water Department, Ministry of Environment	Mandated to provide safe drinking water in the Maldives	Country overview , Financial Data on Climate Change Adaptation Projects and Information on Support Needed	National Circumstances and Constraints & Gaps; financial, capacity building and technology transfer needed and received		✓
Coastal Protection and Disaster Risk Reduction Unit, Ministry of Environment	The government entity responsible for implementation of the coastal protection projects in the local islands of the Maldives.	Financial Data on Climate Change Adaptation Projects and Information on Support needed	Constraints & Gaps; financial, capacity building and technology transfer needed and received		✓

Stakeholders	General Roles and Responsibilities	Data Provided for BUR	Contributing Chapters	Working Groups	
				IMWG	MFWG
Maldives Energy Authority (MEA)	The Regulator of the Energy Sector in Maldives	Power Data, Fuel Consumption Data, Billing Data, Appliance Import Data, Data on Approved Net metering applicants and renewable energy applicants	GHG Inventory, Mitigation Actions and Domestic MRV	✓	
Maldives Meteorological Services (MMS)	The national meteorological agency which provide systematic climate data and early warning and observation service.	Financial Data on Climate Change Adaptation Projects, Information on support needed and Climate Data	National Circumstances and Constraints & Gaps; financial, capacity building and technology transfer needed and received		✓
Waste Management Corporation (WAMCO)	A state owned company mandated to provide a sustainable waste management solution throughout the country, WAMCO is responsible for the waste management functions of the Greater Male' Region	Grass root level data on Waste Quantity and Composition	GHG Inventory	✓	
Ministry of Tourism	The policy making institution for tourism sector development in the Maldives	Sector Overview, Electricity and Waste data of resorts and Financial data on Climate related Projects and adaptation needs for tourism sector	National Circumstances and GHG Inventory, Domestic MRV and Constraints & Gaps; financial, capacity building and technology transfer needed and received	✓	✓
Ministry of Transport and Civil Aviation	The main policy making institution in the transport sector and maintains data regarding land and sea transport	Sector Overview, Data on land and sea transport vessels  Finance data on climate related projects	National Circumstances, GHG Inventory, Mitigation Actions and Constraints & Gaps; financial, capacity building and technology transfer needed and received	✓	✓
Ministry of Fisheries, Marine Resources and Agriculture	Mandated to ensure the development and sustainable management of marine and agricultural resources of Maldives	Country Overview , Financial Data on Climate Change Adaptation Projects and Information on Support Needed	National Circumstances and Constraints & Gaps; financial, capacity building and technology transfer needed and received		✓
Ministry of Youth, Sports and Community Empowerment	Government entity overseeing NGOs	Financial Data on Climate Change Projects carried out by registered NGOs	Constraints & Gaps; financial, capacity building and technology transfer needed and received		✓
Ministry of Finance	The main financial institution of the country responsible for national budgeting and management of external financial resources.	Financial Data on climate relevant PSIP projects and Information on Development Planning and Budgeting Process	Other Information and Constraints & Gaps; financial, capacity building and technology transfer needed and received		✓
Ministry of Health, Health Protection Agency (HPA)	The government institution responsible for implementation of the public health programmes.	Financial Data on Climate Change Adaptation Projects and Information on support needed	Constraints & Gaps; financial, capacity building and technology transfer needed and received		✓
Ministry of Planning and Infrastructure	The main government institution responsible for policy making and implementation of all infrastructure projects in the Maldives	Financial Data on Climate Change Adaptation Projects, Information on Development Planning and support needed	Other Information and Constraints & Gaps; financial, capacity building and technology transfer needed and received		✓
National Bureau of Statistics (NBS)	Responsible for the core statistical activities in the country; conducting population census survey, compiling and disseminating economic and social statistics	Data on Country overview, demography, GDP and electricity data	National Circumstances, GHG Inventory, Mitigation Actions and Domestic MRV	✓	✓
National Disaster Management Authority (NDMA)	Agency of the Ministry of Home Affairs whose primary purpose is to coordinate response to natural or man-made disasters and for capacity-building in disaster resiliency and crisis response	Financial Data on Climate Change Adaptation Projects and Information on support needed	Constraints & Gaps; financial, capacity building and technology transfer needed and received		✓
State Electric Company (STELCO)	State Owned Enterprise responsible for the generation and supply of electricity to customers throughout the Maldives	Grass-root level data on electricity	GHG Inventory	✓	

Stakeholders	General Roles and Responsibilities	Data Provided for BUR	Contributing Chapters	Working Groups	
				IMWG	MFWG
Fenaka Cooperation Pvt. Ltd	A government owned utility company with a mandate to provide island communities with electricity, water and sewerage services	Data on electricity generation	GHG Inventory	✓	
Maldives Transport and Contracting Company (MTCC)	State owned Enterprise which oversees and operates public transport	Activity data and data on fuel consumption	GHG Inventory and Mitigation Actions	✓	
State Trading Organization (STO)	Main importers of oil and LPG in the Maldives	Import and consumption data on oil and LPG	GHG Inventory	✓	
Maldives Posts Limited (MPL)	Operated the Male' Commercial Harbour and two regional ports	Fuel Import Data	GHG Inventory	✓	
Maldives Customs Services (MCS)	Independent entity responsible to carry out all the necessary activities pertaining to customs in relation to import and export of goods to and from Maldives and to maintain all the concerned accounts	Fuel Import Data	GHG Inventory	✓	
Maldives Airports Cooperation Limited (MACL)	International aviation fuel bunkering services	Fuel data regarding International aviation and fuel bunkering	GHG Inventory	✓	
Maldives Industrial Fisheries Company (MIFCO)	Operates Energy Intensive Fish Processing plants and freezing systems	Electricity Generation Data	GHG Inventory	✓	
Island Aviation (Maldivian Airlines)	National Airline of Maldives	Activity Data and Data on fuel consumption	GHG Inventory	✓	
Flyme Airlines	Domestic Airline based in Maldives	Activity Data and Data on fuel consumption	GHG Inventory	✓	



# **3. GREENHOUSE GAS INVENTORY**

Maldives first greenhouse gas inventory was compiled for the year 1994 as part of the first national communication. The second inventory was compiled as part of the second national communication where the inventory for the year 2011 was presented.

According to the 2/CP.17, the BUR should cover an inventory

for no more than 4 years prior to the submission year. Therefore, this BUR will cover the inventory for the year 2015. However, attempts are made to cover a time series of the inventory for the years 2011 to 2015 based on a sectoral approach while 2001 to 2015 emissions are also calculated based on a reference approach.

## 3.1 INSTITUTIONAL ARRANGEMENT FOR THE INVENTORY COMPILATION

The arrangement in place for the preparation of the BUR is described under the institutional arrangement in Chapter 2 of this report.

## 3.2 INFORMATION & DATA SOURCES

The sources of data information used is similar to the data sources used in the previous inventory as the key categories are similar and is provided in Table 7.

**Table 7: Summary of data sources**

Sectors	Data sources
Electricity production	<p>Energy balance reports 2010-2012</p> <p>Power production data from STELCO and FENAKA Power production data from MACL</p> <p>Power production data from Regional airports</p> <p>Power production data from MWSC</p> <p>Power production from resorts (limited data)</p> <p>Tourist bed-nights from tourism statistics year books</p> <p>Population data from National Bureau of Statistics</p>
Aviation data	<p>Fuel sold statistic from MACL</p> <p>Fuel import and re-export data Customs</p>
Transport (land and marine)	<p>Vehicle and vessels registration from National Bureau of Statistics</p> <p>Resort transport from resorts (limited data)</p> <p>Tourist bed-nights from tourism statistics year books</p>
Other energy usage	<p>Energy balance reports 2010-2012</p> <p>LPG usage from Maldives Gas and Villa Gas</p> <p>LPG import from Customs</p> <p>LPG resort usage from Carbon Audit 2009</p>
Waste	<p>North Province Regional Waste Management Project: Technical and Financial Feasibility Report (2011)</p> <p>Malé waste audit 2008</p> <p>Population data from National Bureau of Statistics</p> <p>Assessment of solid waste management practices and its vulnerability to climate risks in Maldives Tourism Sector, 2013</p>

### 3.3 EMISSION YEARS COVERED UNDER THIS BUR

As a part of this BUR, emissions in the following years are covered using the approach described in Table 8. However, as per the decision of 2/CP.17, the inventory for the year 2015 is discussed in detail for this BUR.

Emissions from the energy sector for the years 2001 to 2010 was calculated using the reference approach as sector data was not available for that duration. However, from 2011 onwards, emissions were estimated using both the sectoral and reference approach.

**Table 8: Years of emission estimates made in this BUR**

Approach	2001 – 2010	2011	2012	2013	2014	2015
Reference approach	✓	✓	✓	✓	✓	✓
Sectoral approach		✓	✓	✓	✓	✓

### 3.4 ARCHIVING AND DOCUMENTATION

Since the Second National Communications, efforts have been made to collect and archive the data for inventory calculations in a systematic manner. With this BUR process, stakeholders have been informed on the importance of collecting the data, quality control of the data and archiving of data. Some of the stakeholder informed that some of their data are made available on the public domain and other detailed information could be provided on request. Stakeholders such as Customs, Airport and electricity providers have their internal databases in place where data are archived.

central storage of the Ministry of Environment. The inventory is established using the IPCC inventory software. The database is backed up using this software. In addition to this, cloud storage facilities are also used to store the data for redundancy. Although a separate database is not developed to store the data obtained from the sectors, the raw and processed data are stored in excel sheets. The analysis sheets are documented with comments where possible, to indicate the assumptions and approximates used. In addition, the commenting feature in the IPCC software is also used to input remarks in respective fields for continuity and improvement of the inventory in the future.

The datasets used for inventory preparation are archived on a

### 3.5 OVERVIEW OF THE 1994 – 2011 NATIONAL GHG INVENTORIES

As part of the First National Communication, the first GHG inventory of Maldives was established for the year 1994. The emissions of 1994 was mainly from energy and waste sectors. Emissions from the energy sector was estimated to be 128.995 Gg of CO<sub>2</sub> and CH<sub>4</sub> emission from waste was estimated to be 1.142 Gg of CH<sub>4</sub>. The total GHG emissions for 1994 was estimated to be 152.977 Gg of CO<sub>2</sub>e (MHAHE, 2001).

the emissions. Emissions from energy sector was 1152.869 Gg CO<sub>2</sub>e and that from waste sector was 72.729 Gg CO<sub>2</sub>e using the sectoral approach. The total emissions for 2011 was 1225.598 Gg CO<sub>2</sub>e using the sectoral approach. Total emissions from energy sector using the reference approach was 1146.512 Gg CO<sub>2</sub>e.

The inventory of 2011 was established as part of the Second National Communication. Table 9 shows the summary of the emissions for 2011 which was estimated as part of the 2<sup>nd</sup> National Communication. Due to availability of data, both the sectoral and reference approach was used to calculate

Greenhouse gas source and sink categories	Net CO <sub>2</sub> (Gg)	CH <sub>4</sub> (Gg)	N <sub>2</sub> O (Gg)	Total (Gg CO <sub>2</sub> eq)
Total National Emissions and Removals	1161.573	2.253	0.054	1225.6
1 - Energy	1146.512	0.083	0.015	1152.9
1A - Fuel Combustion Activities	1146.512	0.083	0.015	1152.9
1A1 - Energy Industries	775.820	0.031	0.006	778.3
1A3 - Transport	260.673	0.039	0.008	264.0
1A4 - Other Sectors	110.019	0.013	0.001	110.6
6 - Waste	15.060	2.170	0.039	72.7
6C - Waste Incineration	15.060	2.170	0.039	72.7
Memo Items				
International Bunkers	400.277	0.003	0.011	
1A3a1 - International Aviation	400.277	0.003	0.011	

**Table 9: Emissions of 2011 (extracted from 2nd NatCom)**

As part of this BUR, efforts were made to estimate the emissions for the years 2001 to 2015 using a reference approach for the energy sector and from 2011-2015 using a sectoral approach. The emission levels are discussed under the chapter timeseries analysis.

### 3.5.1 Methodology

The inventory of 1994 was based on the reference approach for the energy sector and no sectoral approach was conducted due unavailability of data. CH<sub>4</sub> emissions were assessed from the solid waste disposal site. The inventory was based on IPCC 1996 guidelines using a tier 1 approach.

As the data availability within sectors have significantly improved compared to 1994, a better estimate was made for the 2011 inventory. The inventory of 2011 comprised of two approaches, sectoral and reference approach. The inventory for 2011 was based on the IPCC 2006 guidelines. Key category analysis using a level approach was carried to assess the key categories for the 2011 inventory. Verification of the data was done based on available literature from respective sectors, statistical data and internal stakeholder's interviews where ambiguities were identified within the data.

IPCC default emission factors were used for 1994 and the 2011 inventory.

For the years 2001 to 2010, emissions estimates were calculated using a reference approach for the energy sector. Fuel import data was made available by the Customs Authority and this was used as the primary energy source which was used in the reference approach.

### 3.5.2 Recalculation of inventories

If there is a change in the methodology, new data sources become available, change in assumptions used or changes in emission factors used, the previous inventories established needs to be recalculated for consistency and comparability. In this BUR, inventory of 2011 was recalculated using the new data made available, the new assumptions and the approximations used to establish the 2012 to 2015 inventory.

Electricity production data was reviewed using the methodology explained in Annex B.3 for the inventory of 2011. Additionally, the methodology used for emissions from waste in 2011 was based on segregated open burning. However, based on sector expert opinion, this segregation was based on old data not representative of the time and was advised to recalculate based on bulk waste open burning. In addition, there was methodological changes brought in the transportation and electricity production for calculation of emissions of 2015 which is explained in the annex. Therefore, for consistency, inventory of 2011 was recalculated for both the sectoral and reference approach. Recalculation of the 2011 inventory shows a slight increase of 5% in total GHG emissions compared to the total emissions of 2011 reported in the SNC.

### 3.5.3 Improvements since FNC

Since there was a long-time lapse between the inventories of 1994 and 2011, significant efforts were made to improve the 2011 inventory. Importance was given to improve the data collection procedure and the data quality. In addition, the institutional capacity to data collection, management and analysis have been enhanced. Sectoral agencies have been establishing their data collection and quality management procedures and data collection and storage platforms. They have invested in

increasing the human resource capacity. Therefore, inventories since 2011 was able to perform a sectoral approach to establish the inventory. It is suggested for improvement of the subsequent GHG inventories, extra waste audits and transport usage statics to be performed to improve the emissions estimations.

## 3.6 OVERVIEW OF THE 2012 – 2015 NATIONAL GHG INVENTORY

As per the decision of 2/CP.17, this BUR will cover the inventory for the year 2015 in detail. Following describes the process of establishing the inventory for the years 2011 to 2015. Emissions were calculated using both the sectoral and reference approach.

### 3.6.1 Methodology

Emissions were not directly measured for the sectors and estimations methods were used on the activity data from the sectors. The methodology followed during the inventory process was the IPCC 2006 guidelines using the Tier 1 method. In addition, the IPCC good practice guidance was also used to ensure that the inventory was transparent, accurate, consistent and comparable and complete (TACCC). Activity data was collected from the respective sectors to compile the sectoral approach. Sectors did not have enough information to do a

higher tier. There are no country specific emission factors (EF) and therefore, default IPCC emission factors are used.

Reference approach was also calculated based on import data for comparison and validation of the sectoral approach. Data was analysed and quality controlled before used in the inventory. Table 10 shows the method and the emission factors used in the estimations. Statistical analysis methods were used for filtering, smoothing, interpolation and extrapolation of the data where necessary. The details of the data analysis procedures used are explained in the sections below. IPCC GHG inventory software is used to estimate the final emissions. The estimated emissions of the gases, CH<sub>4</sub> and N<sub>2</sub>O, was converted to CO<sub>2</sub> equivalent using the 1995 IPCC Second Assessment Report (SAR) Global Warming Potential (GWP) values based on effect of greenhouse gas on a 100-year horizon. The GWP values used are provided in Table 11.

**Table 10: Method and emission factors used**

Greenhouse gases sources and sink categories	CO <sub>2</sub> (Gg)		CH <sub>4</sub> (Gg)		N <sub>2</sub> O (Gg)	
	Method	EF (kgCO <sub>2</sub> /TJ)	Method	EF (kgCH <sub>4</sub> /TJ)	Method	EF (kgN <sub>2</sub> O/TJ)
1 - Energy						
1.A - Fuel Combustion Activities						
1.A.1 - Energy Industries						
1.A.1.a.i – Electricity Generation	Tier 1	74100	Tier 1	3	Tier 1	0.6
1.A.3 - Transport						
1.A.3.1.a.i - International Aviation (International Bunker)	Tier 1	71500	Tier 1	0.5	Tier 1	2
1.A.3.1.a.ii – Domestic Aviation	Tier 1	71500	Tier 1	0.5	Tier 1	2
1.A.3.b.i.1 - Passenger cars with 3-way catalyst - Motor Gasoline	Tier 1	69300	Tier 1	33	Tier 1	3.2
1.A.3.b.ii1 - Light duty trucks with 3-way catalyst - Motor Gasoline - Gas/Diesel Oil	Tier 1 Tier 1	69300 74100	Tier 1 Tier 1	33 3	Tier 1 Tier 1	3.2 0.6

Greenhouse gases sources and sink categories	CO <sub>2</sub> (Gg)		CH <sub>4</sub> (Gg)		N <sub>2</sub> O (Gg)	
1.A.3.b.iii.1 - Heavy duty trucks and buses						
- Motor Gasoline	Tier 1	69300	Tier 1	33	Tier 1	3.2
- Gas/Diesel Oil	Tier 1	74100	Tier 1	3	Tier 1	0.6
1.A.3.b.iv – Motorcycles						
- Motor Gasoline	Tier 1	69300	Tier 1	33	Tier 1	3.2
1.A.3.d.ii - Domestic water borne navigation						
- Motor Gasoline	Tier 1	69300	Tier 1	7	Tier 1	2
- Gas/Diesel Oil	Tier 1	74100	Tier 1	7	Tier 1	2
1.A.4 - Other Sectors						
1.A.4.a - Commercial/Institutional (LPG)	Tier 1	63100	Tier 1	5	Tier 1	0.1
1.A.4.b - Residential	Tier 1	63100	Tier 1	5	Tier 1	0.1
4 - Waste						
4.C - Incineration and Open Burning of Waste	0.58 – oxidation fact 0.08 – frac of CO <sub>2</sub>		6500 (kgCH <sub>4</sub> /Gg Wet waste)		150 (kg N <sub>2</sub> O/Gg Dry waste)	

**Table 11: GWP used in conversion**

	Methane	Nitrous oxide
Formula	CH <sub>4</sub>	N <sub>2</sub> O
GWP	21	310

## 3.6.2 Data collection

Data collection initially was followed based on the 2011 inventory key categories. In addition, a key category analysis was done for the years 2012 to 2015 to check on the requirements for data collection. Data was obtained from existing literature for the various sectors and further it was complimented by data provided from the sectors. The sources of data used were explained in Table 7.

**Table 12: 2011 Key category using level assessment**

IPCC Category code	IPCC Category	Greenhouse gas	Cumulative Total
1.A.1	Energy Industries - Liquid Fuels	CO <sub>2</sub>	0.64
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO <sub>2</sub>	0.77
1.A.4	Other Sectors - Liquid Fuels	CO <sub>2</sub>	0.85
1.A.3.a	Civil Aviation	CO <sub>2</sub>	0.91
1.A.3.b	Road Transportation	CO <sub>2</sub>	0.96

## 3.6.3 Key category analysis

Two methods were used to analyse the key categories for 2014 to identify the categories for 2015. A level approach and a trend assessment were carried for 2014 to determine the key categories for the inventory. The Table 12 and Table 13 shows the key categories identified for the 2015 inventory using both the methods. It shows that both the methods showed the same categories and same gases which shows more importance to be given to these sectors. Therefore, consideration on those categories were given in data collection procedures for the improvement of the inventory. The details of the sectors identified for the other years are found in the Annex of this report.

**Table 13: 2014 Key category using trend assessment, 2011 as base year**

IPCC Category code	IPCC Category	Greenhouse gas	% Contribution to Trend	Cumulative Total
1.A.1	Energy Industries - Liquid Fuels	CO <sub>2</sub>	0.29	0.71
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO <sub>2</sub>	0.08	0.93
1.A.3.a	Civil Aviation	CO <sub>2</sub>	0.14	0.85
1.A.3.b	Road Transportation	CO <sub>2</sub>	0.04	0.97

### 3.6.4 Quality assurance (QA) and quality control (QC)

A significant importance was given for the quality assurance and quality control while data collection and analysis. In some of the sectors, they have their own established procedures for data collection. Minimal data checks for consistency and quality checks are carried out by the sectors. Electricity production data is the most widely collected data as power logs are kept for operation and maintenance purposes. Some of the well-established industries such as aviation industry, systems are in place for archiving on the fuel information. Where QA/QC measures are undertaken, described below are the measures used for data sources. Data was also cross referenced with the respective sectors and if any issues were identified with the data, it was discussed with the respective sectors and were re-checked for the quality. Moreover, previous trends of the data in literature were also considered and expert opinion was also sought for reassurance of the quality. Additionally, an Independent review was also conducted for quality assurances via inventory experts supported by the Global Support Programme for National Communications and Biennial Update Reports (GSP). The following explains the process used for the QA/QC from the sectors.

#### 3.6.4.1 Electricity production

Electricity production data from the power producers were provided in different forms. The stakeholders themselves had their own internal procedures for data quality control. Some stakeholders provided monthly data while others provided annual totals.

For the stations where fuel volume and units produced (kWh) were provided, number of units per litre (kWh/L) estimate, was used as a quality measure of the data provided. Additionally, total usage growth trend was also considered to check for consistency and outliers to further check on the data. When inconsistencies are found, the issues were further discussed with the data providers to rectify the issue. Where significant data gaps were found, proxy methods and interpolation techniques were

used to fill the gaps. Statistical analysis of the long-term data sets was done to analyze on the lower and upper bound of the estimate (kWh/L). A lower bound of 2 kWh/L and an upper bound of 4 kWh/L were used to filter the data. The details of the method applied is found in the annex of this report.

For the tourism sector, limited amount of actual power production data with the bed nights capacity was provided by the tourism sector. The above thresholds were used to filter and quality control the datasets. Additionally, the quality-controlled data was used to estimate the fuel usage per bed night. This estimate was then applied to the total number of annual bed nights to estimate the fuel usage for the entire tourism sector on the assumption that fuel consumption per night is same for the entire sector. This would however be a potential source of uncertainty which needs to be further addressed in future inventories.

#### 3.6.4.2 Aviation

Aviation fuel consumption data was provided by MACL. MACL keeps the records of fuel data provided to domestic and international usage. This data was used as the activity data. Additionally, fuel import data was obtained by Maldives Customs and STO for verification and for reference approach data. Discussions with the MACL and Customs reveal that there are differences in the density conversion factors used between the two authorities which led to some differences in the volume of the fuel reported by two authorities. Customs provided the data in terms of weight while MACL and STO provided in volume. This issue was rectified using the MACL and STO datasets as the base for input to the emissions estimations.

#### 3.6.4.3 Transport sector

One of the main criteria used in the transport sector is the vehicle registration data provided by the NBS. Information on the number of retired or destroyed vehicles or vessels are limited and therefore, it is assumed that all the registered vehicles provided in the statistics are in use.



For the land and marine transportation, km/day and km/litre estimates used in the previous energy balances and GHG inventories were used as there was no information on this provided by the stakeholder. This information with the number of registered vehicles and vessels were used to estimate the GHG emission for the transport sector.

The number of fishing trips by fishing vessels are provided by the NBS. The estimated fuel usage per trip used in the previous energy balances were used with this number of trips, to estimate the emissions by the fishing vessels.

In 2015, a field survey was conducted in the tourism on limited number of resorts to estimate the fuel usage for transportation in the tourism. This data was used to estimate the fuel usage for transportation per bed night and the total number of bed nights was used to estimate the emissions for transportation for the tourism. However, for the safari vessels, the estimate used for fuel usage per bed night was the estimate used in the energy balance 2010-2012 as use of fuel by the safaris were not assessed during the field survey in 2015.

#### 3.6.4.4 Other sectors (fuel combustion)

Other sectors considered is the fuel combustion activities are as follows:

Other sectors	Diesel	LPG	Kerosene
Domestic & Commercial use		✓	
Fishing vessels	✓	✓	✓

Import data of LPG was obtained by the Maldives Customs. This data was used in the reference approach. For the activity data, information provided by the two suppliers (STO Maldiv Gas and Villa Gas) were used. They provided information segregated to domestic and commercial. Use of diesel, LPG and kerosene for the fishing vessels were based on the assumption used in the 2010-2012 energy balance. Additionally, stock change information was not used as according to the suppliers, no storage is kept. As a QA/QC procedure, the total import statistics was compared with the total sales by the two suppliers where they were matched with reasonable accuracy.

#### 3.6.4.5 Waste sector

For the emissions produced by the waste sector, it was assumed that all the waste produced are open burnt. Maldives do not have large land-filled sites and large-scale incineration. According to the stakeholder, limited number of studies were conducted in the past to assess the volume of waste produced

by the locals and the industries. Spatial variation in the volume and type of waste produced exists within the country due to variation of the tourism and industrial activity within the country.

Previous studies conducted has attempted to assess the per/capita waste production for the greater Malé population and the atoll population. Studies conducted by Ministry of Tourism (MoTAC, 2013) provided an estimate of 7.2 kg/cap/day for tourist and a 3.8 kg/cap/day for safaris.

The estimates used for the greater Malé and the other atolls are different since the nature of waste produced is different. The estimate used for the Malé is 1.8 kg/cap/day (World Bank, 2017b). For the other atolls, the estimate used is 1.3 kg/cap/day. This estimate was based on a waste audit conducted for the establishment of a regional waste management center in the north of Maldives (Regional Solid Waste Management Zone One Waste Audit 2018, unpublished report). These estimates were used with the respective populations for the atolls and the respective bed night occupancies for the tourism sector to determine the emissions by waste sector. For quality assurance and consistency, available audits were compared and expert judgment were sought for finalizing on the estimate.

#### 3.6.5 Uncertainty analysis

Assessment of the uncertainty requires detailed information of the data, collection procedure, quality control measures and assumptions used in data processing and analysis used by the sectors. According to the guidelines, a combined uncertainty has to be given for the entire sector which involves combination of the individual uncertainties. However, this detailed level of information was not available from the sectors partly due to unavailability of the data and partly due to confidentiality of the data. Therefore, since tier 1 sectoral approach was used, the default IPCC emission factors and the associated uncertainty values were used in the uncertainty analysis. Year 2011 is used as the base year to determine the trend uncertainty. Uncertainty assessment was done using the IPCC inventory software. Using these default values, the uncertainty in total inventory of 2015 is 4.58% and the trend uncertainty is 4.69%. Uncertainty calculations for the other years are attached in the annex of this report.

During the inventory process, there were assumptions made in the sectors which will contribute to the uncertainty. Although the magnitude of the uncertainty was not assessed, following are the assumptions used.



Sector	Assumptions
Energy Industries  (emissions from electricity generation, desalination and LPG for cooking)	Emissions factors (EF) at the power houses of the individual island vary significantly due to energy generation and transmission losses. However, individual emissions factors are not available to all the islands. Therefore, EF Tier 1 of the IPCC used in the in emissions estimations.  Information on the fugitive emissions are not assessed or recorded by the sectors and is considered insignificant. Thus, this is not considered in the estimations.
Transport  (emissions from land, sea and domestic air transport)	Usage of road vehicles was based small sample population and extrapolated to a larger population. This assumption was used in the 2011 inventory.  Marine transport in the tourism sector is based on a small population and extrapolated to the entire sector.  Marine transport assumptions used are same assumptions used in previous 2011 inventory.
Waste sector	It was assumed all waste were opened burned.  Per capita waste generation figures used are from old surveys as recent field assessed surveys were not available.

## 3.6.6 Emission trends

The following sub chapters analyses the emissions by sectors and by gases.

### 3.6.6.1 Sectoral trends

Figure 7 shows the trend in the total emissions by the sectors from 2011 to 2015. All the sectors have a growing emission except for the Other sectors. The declination of emissions in the Other sectors is due to the declined emissions in the fisheries mobile combustion.

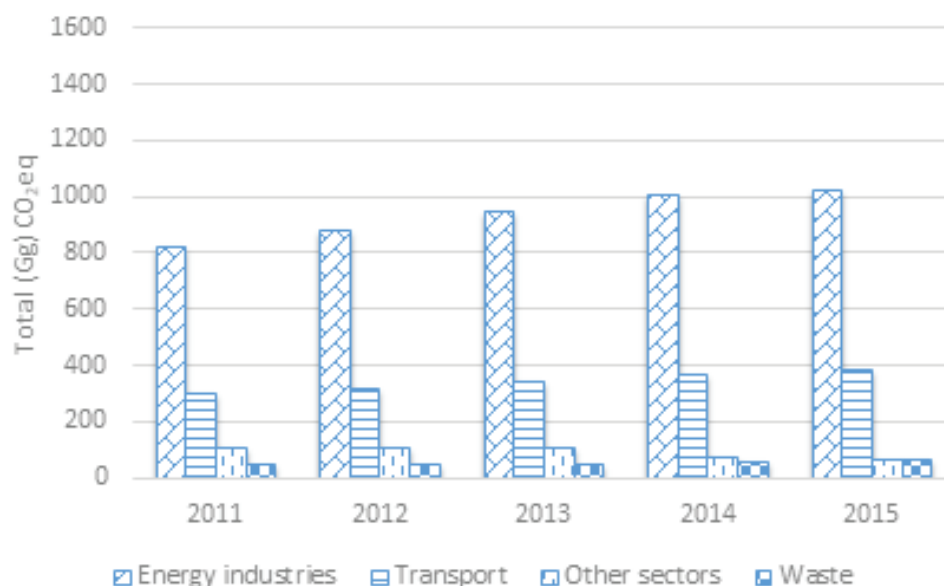


Figure 7: Emission trends by sectors

### 3.6.6.2 Emissions by gases trend

Table 14 shows the trend in the emissions of the individual gases. The most dominant gas is the CO<sub>2</sub> since most of the emissions are from the energy combustion. Emission by all the gases has an increasing trend.

**Table 14: Trend in the emission of gases (CO<sub>2</sub>eq)**

	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
2011	1236.97	31.79	13.00
2012	1305.99	32.37	13.40
2013	1400.01	33.42	14.09
2014	1453.55	38.85	15.81
2015	1476.89	42.27	16.88

## 3.7 NATIONAL GREENHOUSE GAS INVENTORY OF 2015

As per the decision of 2/CP.17, this BUR will cover the inventory for the year 2015 in detail. Following describes the details of the inventory of the year 2015. The inventory of 2015 is calculated both on a reference and a sectoral approach.

### 3.7.1 Total emissions

The total emissions of Maldives for the year 2015 is 1,536.04 Gg of CO<sub>2</sub> equivalent. A breakdown of the total emissions of

2015 is presented in Table 15. Similar to the previous GHG inventories the major sectors of emissions in Maldives is from energy and waste. Emissions from energy shares a 95.8% while waste shares 4.2% of the total emissions. Emissions from the international bunkering in presented but is not counted in the national totals. The complete tables for the years and 2011 to 2015 are attached in the annex.

**Table 15: 2015 emissions by sources and sinks**

Greenhouse gases sources and sink categories	CO <sub>2</sub> (Gg)	CH <sub>4</sub> (Gg)	N <sub>2</sub> O (Gg)	Total (Gg) CO <sub>2</sub> eq
Total National Emissions and Removals	1476.887	2.013	0.054	1,536.04
1 - Energy	1463.635	0.104	0.020	1472.05
1.A - Fuel Combustion Activities	1463.635	0.104	0.020	1472.05
1.A.1 - Energy Industries	1020.502	0.041	0.008	1023.93
1.A.3 - Transport	376.095	0.056	0.012	380.8
1.A.4 - Other Sectors	67.038	0.007	0.000	67.27
4 - Waste	13.252	1.909	0.034	63.99
4.C - Incineration and Open Burning of Waste	13.252	1.909	0.034	63.99
Memo Items				
International Bunkers	320.202	0.002	0.009	
1.A.3.a.i - International Aviation (International Bunkers)	320.202	0.002	0.009	323.03

Considering the contribution of greenhouse gases, CO<sub>2</sub> is the most emitted, sharing a 96% of the total emissions while CH<sub>4</sub> is 3% of the total emissions as shown in the Figure 8.

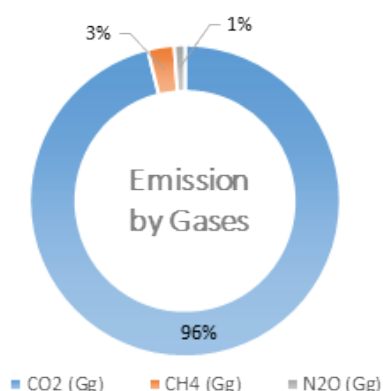


Figure 8: 2015 emissions by gases

### 3.7.2 Emission by sectors

Emissions by sources and sinks shows that emissions are from energy and waste. Figure 9 shows the breakdown of emissions by sectors. It shows that 67% of the emissions is from energy industries which is electricity generation. Next largest is transportation which is 25% of the total emissions. Emissions from waste is 4% and from Other sectors is also 4% of the total emissions. Following provides a description of a breakdown of the IPCC sectors.

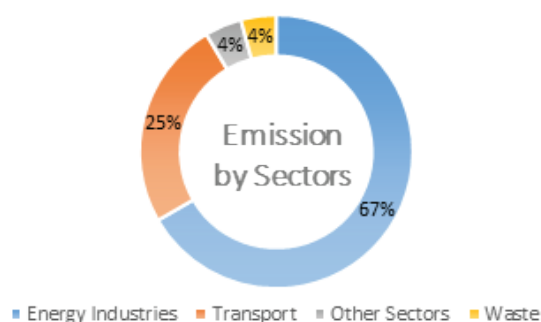


Figure 9: Emissions by sectors

#### 3.7.2.1 Energy sector

Almost all of the power generation in Maldives is from

diesel-based fossil fuel. Every island and every resort have their own power facility. With the growing population and growth in economic industries, the demand for power production is increasing. There are two state owned companies, STELCO and FENAKA who provides electricity services. Resorts and large industries have their own power generation facilities. The following sub-chapters provide a description of the sectors contributing to the energy sector.

##### 3.7.2.1.1 Electricity Generation

Emissions by energy industries is the largest contributor to the national emissions and it is mainly fuel combustion for electricity generation. Figure 10 shows a breakdown of the electricity generation. It shows that 47% of the emissions is from the tourism sector while a 26% of the emissions is from residential use. The residential use includes electricity production for household uses for all islands. Commercial use (excluding tourism) shares a 15% of the emissions by electricity production. A total of 1023.93 Gg of CO<sub>2</sub> equivalent is emitted from electricity production.

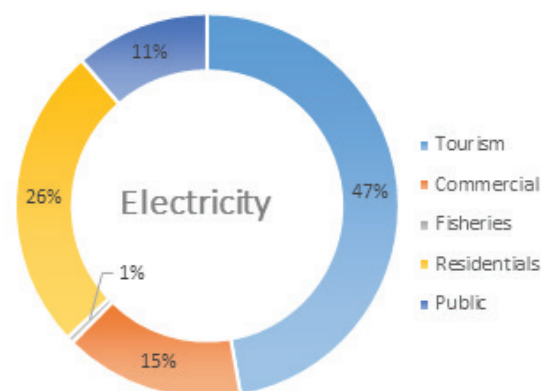


Figure 10: Emissions from electricity consumption by sectors.

##### 3.7.2.1.2 Transport sector

Second largest energy consumption is from transportation. Due to the dispersed nature of the islands, main mode of transport is via either diesel or petrol based sea transport. Land transportation involves cars, buses, lorries and a significant amount of motor bikes. There are no railways in Maldives. In recent years number of domestic airports has increased and domestic air transfer is also getting as a popular mode of transport.

A total emission of 380.84 Gg of CO<sub>2</sub> equivalent is emitted from transport sector. Figure 11 shows the breakdown of emissions

from the transportation sector. It shows that 28% of the emissions is from the tourism (passenger, leisure, safari) and the second largest is from domestic air transportation while 24% and 22% is from land and other marine transportation respectively. With the increase in number of resorts and domestic airports, the largest share from these sectors is envisaged.

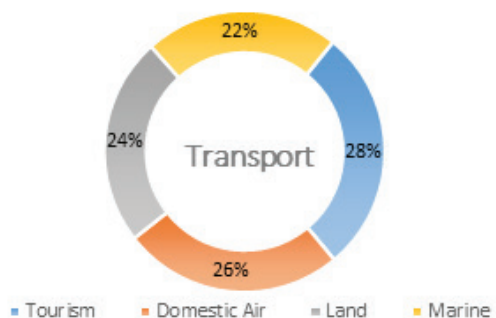


Figure 11: Emissions from the transport sector

### 3.7.2.1.3 Other sectors

Energy combustion in Other sectors are from as those explained in 3.6.4.4. Largest emission (43%) is from fisheries mobile combustion. Second largest is the LPG usage by the residential use, which is 30% and tourism sector LPG usage contributes to 27% of the emissions as in Figure 12. A total of 67.27 Gg of CO<sub>2</sub> equivalent is emitted from Other Sector usage.

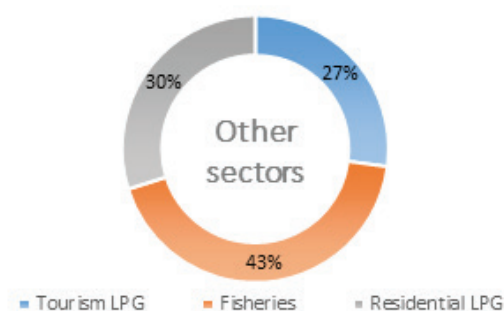


Figure 12: Breakdown of emissions from Other sectors

### 3.7.2.1.4 Manufacturing and construction

This sector involves emissions from energy intensive, manufacturing and construction industries due to direct fuel usage for the processes. Maldives does not have high energy intensive manufacturing and construction industries such as sugar production, textiles, Aluminum etc. therefore, emissions from this sector is not estimated.

### 3.7.2.1.5 Fugitive emissions

Fugitive emissions are emissions which occur as leaks or other unintentional or irregular emissions. Most common examples include emissions from storage, venting and flaring at oil and gas refineries. The most likely fugitive emissions in Maldives is due to fuel storage. However, according to the stakeholders responsible for fuel storage, they do not measure this as this will be a negligible amount due to small storage capacity and due to quick roll over of the volumes. Therefore, emissions for this category is not estimated.

### 3.7.2.1.6 International bunkers

International bunkering in this BUR is counted as the fuel used on international flights. Emissions from international bunkering is not counted in the national total emissions although it is reported separately.

### 3.7.2.1.7 Reference and sectoral approach

For comparison purposes, the emissions were also calculated using the reference approach. Table 16 shows the comparison between the reference and sectoral emissions for 2014 and 2015. On the individual fuel types, emissions by motor gasoline it shows a significant difference between the reference and sectoral approach. In 2014 its more by 13.92% and in 2015 it is less by 11.7% compared to sectoral approach. This could be attributed to the fact that some fuel imported and counted as emission in reference approach in a given year could be utilized in different sectors in the next subsequent year which would be counted as the activity data in the sectoral approach.

It was indicated by the customs that there could be time lags of recording the fuel import. Most of the motor gasoline is used in the marine and land transportation. The approximations and the estimate statistics needs to be revised or revisited to improve on the emissions on this sector. Considering the overall emissions, reference approach is +4% and -4% less than emissions from sectoral approach in 2014 and 2015 respectively.

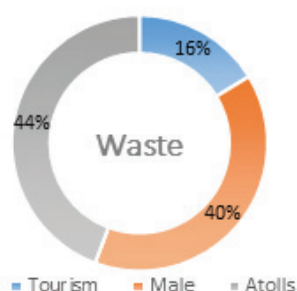
**Table 16: Reference vs sectoral approach 2014 and 2015**

Fuel	Reference Approach		Sectoral Approach		Difference	
	Apparent Consumption (TJ)	CO <sub>2</sub> Emissions (Gg)	Energy Consumption (TJ)	CO <sub>2</sub> Emissions (Gg)	Energy Consumption (%)	CO <sub>2</sub> Emissions (%)
2014						
Motor Gasoline	1985.68	137.61	1743.03	120.79	13.92	13.92
Jet Kerosene	1260.09	90.10	1311.67	93.78	-3.93	-3.93
Gas/Diesel Oil	16633.55	1231.99	16027.09	1187.61	3.78	3.74
Liquefied Petroleum Gases	645.93	40.74	616.04	38.87	4.85	4.80
2015						
Motor Gasoline	1652.06	114.49	1871.01	129.66	-11.70	-11.70
Jet Kerosene	1258.07	89.95	1340.29	95.83	-6.13	-6.13
Gas/Diesel Oil	15690.38	1162.13	16181.50	1199.05	-3.04	-3.08
Liquefied Petroleum Gases	637.37	40.20	615.47	38.84	3.56	3.50

### 3.7.3 Waste

With the growing population, management of solid waste has been a big environmental issue. Waste produced are disposed and open burnt. Waste segregation is not a common practice at household although a minimal sorting is done at waste management centres. Waste generated in Malé City, nearby island and most of the resorts are transferred to Thilafushi island where waste is open burnt. To manage the waste, waste management centres are being established on the islands and regional waste management centres are also being established. Emissions from waste sector considered in this BUR is due to open burning. Emissions from anaerobic decay in waste dumping sites are not estimated as the waste is pre-burned and due to mixing with salty high-water table.

**Figure 13: Emissions contribution by the waste sector**



A total of 63.99 Gg of CO<sub>2</sub> equivalent is emitted from the waste sector. Figure 13 shows the breakdown of the emissions from the waste sector. Most of the emissions (44%) from the waste is generated by burning of waste in the atolls. Greater

Malé composes of 40% while emissions from tourism sector is 16%.

### 3.7.4 Industrial Processes and Product Use (IPPU) sector

Emissions from the IPPU consists of emissions released due industrial applications that involves physical or chemical process producing emissions or use of products that contains greenhouse gases which are released in to the atmosphere. For example, cement, lime, glass production are industries where emissions are produced during the process. Maldives do not have any of the industries which are categorized as IPPU sector. Therefore, emissions for this sector is estimated.

### 3.7.5 Agriculture, Forestry, and Other Land Use (AFOLU)

Emissions from AFOLU involves emissions from the use of agricultural land, husbandry, land use and land use changes. Maldives do not have large scale agriculture and husbandry farming. In addition, there are no large-scale forests to be cleared for land use. Therefore, emissions from this sector is not estimated.

## 3.8 TIME SERIES OF GREENHOUSE GAS EMISSIONS

Under this BUR, an attempt was made to establish a timeseries of emissions from 2001 to 2015. Since reference approach level data was available for this duration, a complete time series data was established. In addition, for comparison and due to availability of sectoral data, time series was also established from 2011 to 2015. An inventory of 2011 was available which was completed in the Second National Communication. However, with some changes in the assumptions and methodology used in this BUR, it was recalculated for consistency

and comparability. Reference approach excludes emissions by waste.

Figure 14 shows the timeseries of CO<sub>2</sub>e emissions from fuel consumption with reference approach and sectoral approach. The proximity of the two profiles indicates that the emissions from both the methodologies are in agreement with reasonable accuracy. Except for two years (2011 and 2013, where the difference is within 10%) the difference is less than 5%.

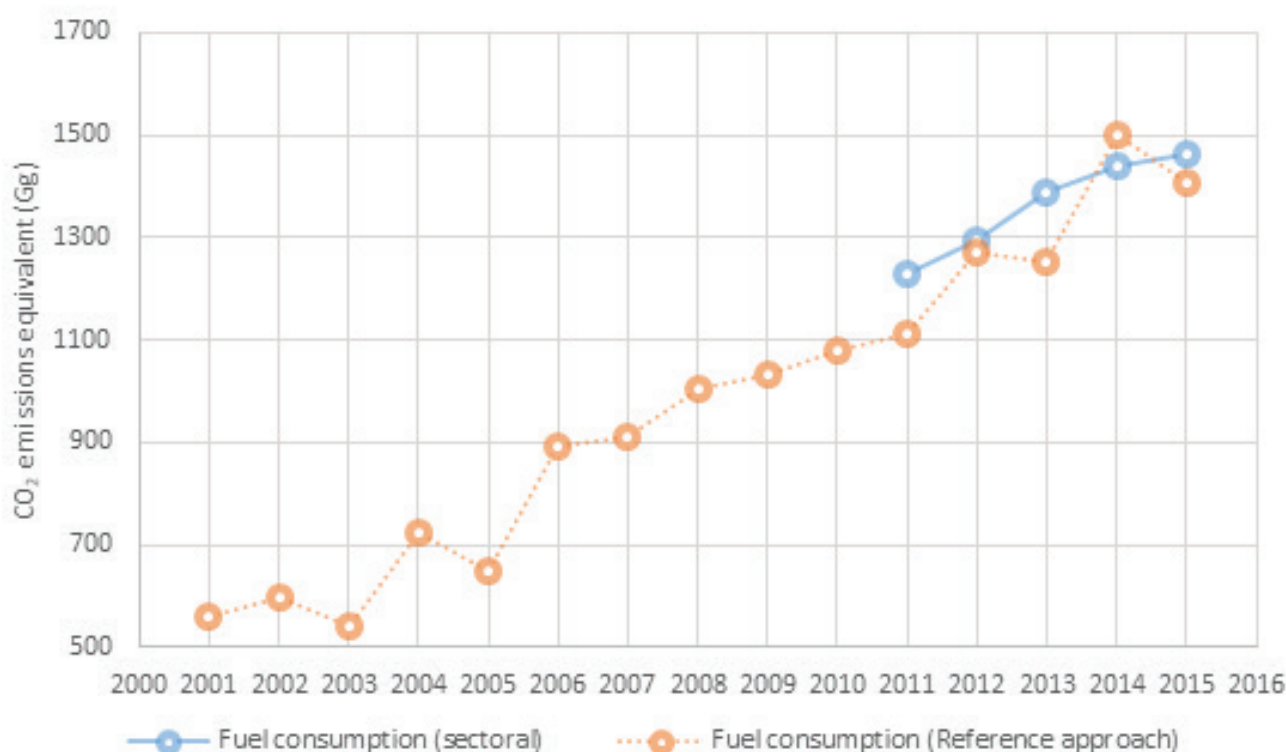


Figure 14: Timeseries of CO<sub>2</sub>emissions (excluding waste) reference vs sectoral approach.

Figure 15 shows the timeseries of the total GHG emissions from 2011 to 2015. The first inventory emissions reported in the FNC was for the year 1994 where the total emissions

were 152.977 Gg of CO<sub>2</sub> equivalent. Considering this emission, the national total GHG emissions is on an increasing trend with an annual rate of 11.61%.

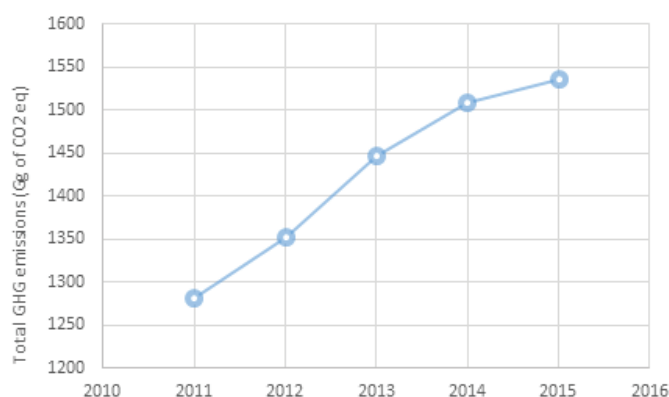


Figure 15: Time series of total GHG emissions in sectoral approach

### 3.9 SUGGESTIONS FOR IMPROVEMENT OF THE GREENHOUSE GAS INVENTORY

With the start of the BUR process, a great importance was given to improve the consequent GHG inventories. The first national inventory of 1994 was compiled in 2001. Since then, institutions have been improving gradually on their respective process of data collection and archiving for the respective sectoral use. However, some of the data collected are not in the most desirable form to be used to estimate emissions. Some key data needed were not available or collected. These issues were also discussed with the stakeholders during the stakeholder consultation of the BUR process. Challenges and possible means to address those issues were also discussed. Based on these discussions and the challenges identified during this BUR, the following suggestions are made for the improvement of the next GHG inventory.

Some of the sectors such as transport, the estimates used are based on assumptions used in the previous inventories. The assumptions need to be revisited. Possible means to revise this would be to conduct a field survey to improve the statistic or the approximation used especially for the fuel used per km. In addition, the data on number of vehicles and vessels use needs to be further assessed to refine the assumptions on the usage pattern in urban and rural areas. The number of retired vehicles and vessels needs to be identified and recorded. In this assessment it is assumed all registered vehicles are in use and a single value for mileage is used for all vehicles. The mileage covered would be different geographically given the small sizes life styles in different parts. Therefore, if these differentiations could be made through a field assessment, the statistics used could be improved. Moreover, the vehicle type based on the type of fuel used is also based on a previous estimate and that needs to be updated.

To improve on the emissions from waste, a nation-wide waste audit needs to be carried. This will help to refine the estimate for the volume, type of waste and the ratio of waste burnt. This needs to be carried for both the residential and tourism sector to improve on the assumption used.

Power production data has been well maintained for the Malé region and the quality of the data received reflected this. In the atolls, some of the power houses needs improvements and the data received shows that this is gradually improving. Power production data from the commercial industries such as harbours, ports and some of the regional airports were not provided by the time of compilation of this inventory and is considered to insignificant compared to national power production information. This has to be reconsidered in the next inventory. For the tourism sector the assumption explained in 3.6.4.1 needs to be further improved by collecting power production data from all the resorts.

Emissions in the fisheries sector showed a decline. The methodology and the statistics used needs to be revised or revisited to reflect on the changes in the fishing patterns and operation of the vessels.

Moreover, formal arrangements need to be established between sectors for data sharing. This includes legal agreements (e.g. MOUs), access to established platforms for data collection and clear clarification of mandates for data collection, handling and analysis. For further information refer to section 7.3.

## 4. MITIGATION



## 4.1 INTRODUCTION

The total GHG emission for the Maldives for the year 2015 was 1,536.04Gg CO<sub>2</sub>e which is an increase of 19.8% from 2011(an average annual growth of 4.95%). In Maldives, GHG emission shows a close relation to economic growth (Figure 16). Maldives has embraced the low-carbon growth as means to achieve energy security, reduce pollution and show leadership in tackling climate crisis. Maldives has set NDC targets

to reduce its emission by 10% from business as usual (BAU) by 2030 voluntarily and enhance that target to 24 % from BAU by 2030 with international support. This chapter outlines the future prospects of GHG emissions for Maldives and the status of ongoing and planned mitigation measures and its impacts on the GHG inventory and the NDC target of the Maldives.

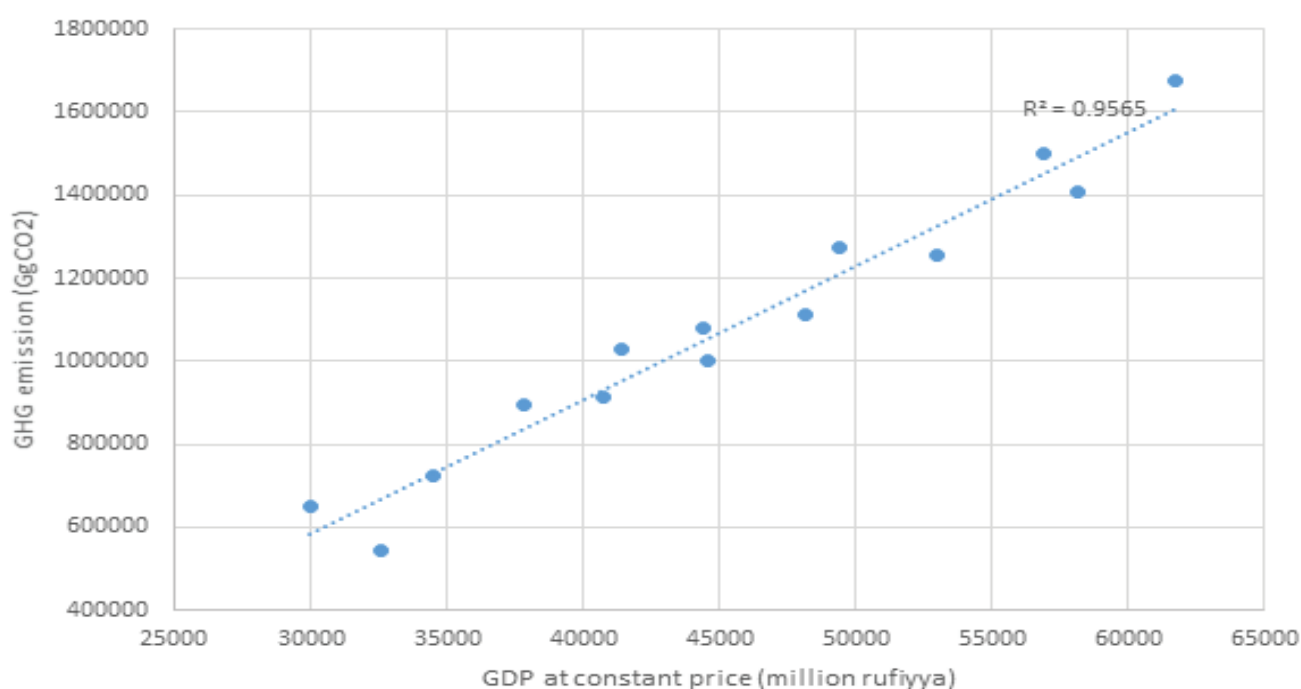


Figure 16: Correlation between GHG emission and GDP in Maldives (2003-2015)

## 4.2 BASELINE PROJECTION

Maldives presented its NDC target as deviation from BAU. To assess the impact of the ongoing and newly planned projects since the submission of NDC, the BAU was revisited as part of this BUR assessment. Long-range Energy Alternatives Planning system (LEAP) was used to re-assess the baseline. The new baseline was compared with the actual emissions calculated in this BUR as well as in previous GHG estimates and NDC projection from GACMO model to check the fidelity of the model (Figure 17).

Projection is in strong agreement with the actual emission. Comparing the new projection with the projection done for NDC, new projection is 0.72% higher for 2030. However, in the GACMO model used in NDC, non-energy sectors were excluded. After excluding waste sector from the new projections in the LEAP model, it was found to be 1.75% lower than GACMO projection for 2030. This difference is small and can be attributed to the underlying assumptions and methodology employed for the respective models. According to the new

projections, under the business as usual scenario, emission is expected grow as much as 163% by 2030 compared to 2011. However, emission per GDP is expected to reduce by 33% during the same period. It is important to note this reduction for emission per GDP is a common trait found in many developing countries.

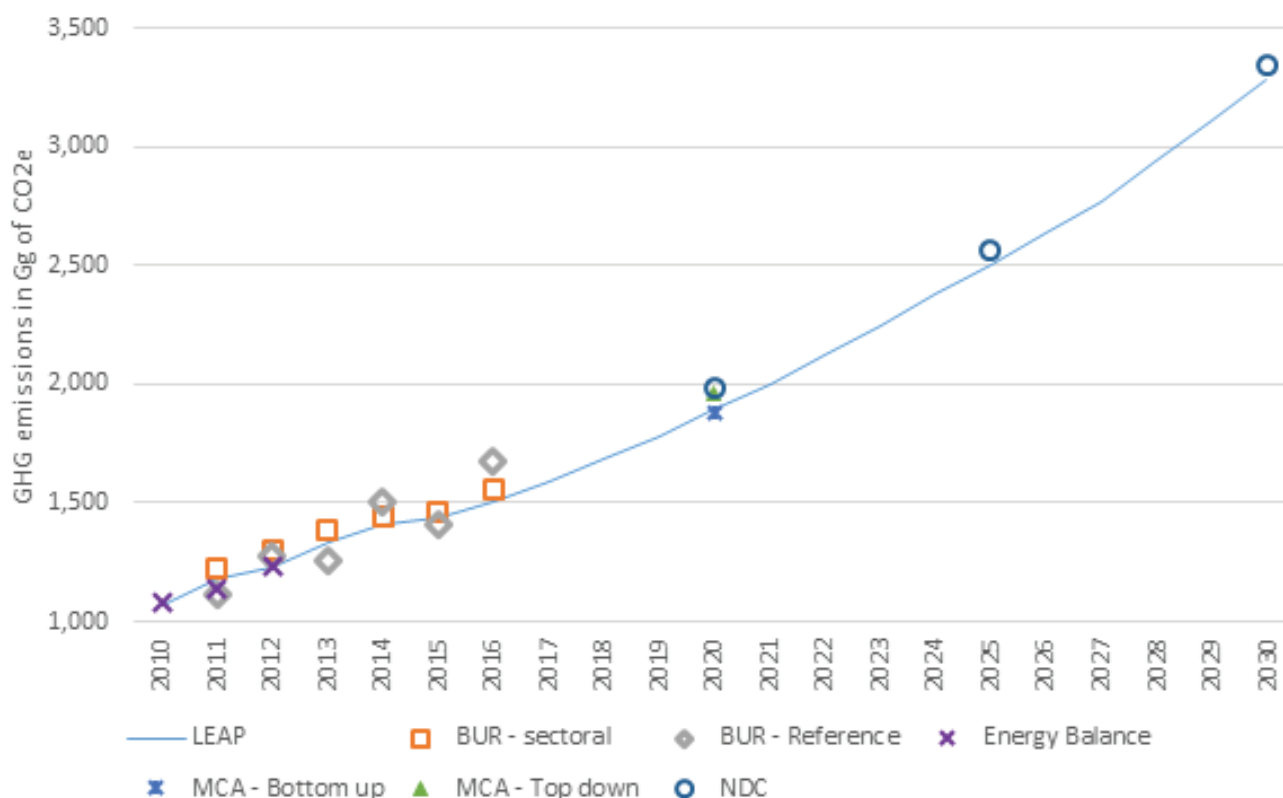


Figure 17: Baseline Projection compared with actual emission and NDC projection

Table 17 shows the emission projection segregated to different sectors. Power generation sector is the dominant source of GHG emissions and it grows by 292% by 2030 compared to the 2011 emission levels. In terms of GHG emitting activities, commercial (including public service), other industries and residential sectors are the fastest growing sectors with 381%, 368% and 313% respectively. These sectors growth rate is higher than the average growth rate of the GHG emissions. The remaining sectors grew slower than average. There are number of reasons for it. For example, though not explicitly included in the model, this would be a logical progression given the emergence of local community tourism. This shifts tourism-based emission from resorts to inhabited islands. Similarly fishing industry emission increases the least in BAU mainly attributed to the slow growth of the sector and the change in the pattern of the industry, the vessels, the fishing methods. This is also seen in the actual emission in the previous chapter showing a net negative growth over the 2011-2015 period.

Table 17: Sectoral Breakdown of the emission projection (GgCO<sub>2</sub>e)

Source of Emission	2011	2030	Percentage change
Commercial and Public Services	176.4	671.5	380.8%
Transport	263.9	740.4	280.5%
Industry	35.8	131.8	368.1%
Resorts	419.2	962.4	229.6%
Residential	226.2	707.3	312.7%
Fishing	58.0	71.4	123.1%

## 4.3 MITIGATION ACTIONS

The mitigation actions reported for BUR are defined using the following criteria,

- Projects and programmes that includes components that lead to an emission reduction
- Projects and actions which has quantifiable indicators (e.g. power generation or power consumption) which can be utilized to compute emission reduction

- Projects that are concrete in terms of its objectives, timelines and scale.

- Projects and programmes that are either completed, ongoing or planned since 2010 to the present day.

Based on the above criteria, the identified mitigation actions are detailed below. The detailed methodologies for impact of mitigation actions are included in the annex.

Name of Mitigation Action	Project for the Clean Energy Promotion in Male'	
Nature of Action/ Description of project	Promotion of PV in Greater Male area. Install 740 kW of solar PV	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	Greater Male Region
Implementing Entity	Ministry of Housing and Environment (currently Ministry of Environment)	
Start Year	2010	
Status	Completed	
Objective of the action/project	Promotion of PV in Greater Male area. Install 740 kW of solar PV	
If an ongoing project: Steps taken or envisaged to achieve mitigation action	Not applicable	
Estimated Emission Reduction	799.2 tCO <sub>2</sub> e per year	
Progress Indicator	Electricity supplied annually from RE displacing fossil fuel	
Methodology and Assumptions	Energy produced multiplied by grid emission factor	
Any Co-Benefits if available from project documents and if quantifiable	Increase energy security Contributes to emission reduction	
Contact Point	Ahmed Ali	

Name of Mitigation Action	Clean Energy for Climate Mitigation Project	
Nature of Action/ Description of project	Installation of 558 kWp of PV together with automated monitoring and control technologies to support grid operations and PV-diesel optimization.	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	GDh Thinadhoo
Implementing Entity	Ministry of Environment and Energy (currently Ministry of Environment)	
Start Year	2011	
Status	Completed	
Objective of the action/project	Installation of 558 kWp of PV together with automated monitoring and control technologies to support grid operations and PV-diesel optimization.	
If an ongoing project: Steps taken or envisaged to achieve mitigation action		
Estimated Emission Reduction	589 tCO <sub>2</sub> e per year	
Progress Indicator	Electricity supplied annually from RE displacing fossil fuel	
Methodology and Assumptions	Energy produced multiplied by grid emission factor	
Any Co-Benefits if available from project documents and if quantifiable	Increase energy security Contributes to emission reduction	
Contact Point	Ahmed Ali	

Name of Mitigation Action	Dhiffushi Solar Ice Project	
Nature of Action/ Description of project	installation of a 40 kW grid-connected photovoltaic system (PV)	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	GDh Thinadhoo
Implementing Entity	Ministry of Environment and Energy (currently Ministry of Environment)	
Start Year	2011	
Status	Completed	
Objective of the action/project	installation of a 40 kW grid-connected photovoltaic system (PV)	
If an ongoing project: Steps taken or envisaged to achieve mitigation action		
Estimated Emission Reduction	43.2 tCO <sub>2</sub> e per year	
Progress Indicator	Electricity supplied annually from RE displacing fossil fuel	
Methodology and Assumptions	Energy produced multiplied by grid emission factor	
Any Co-Benefits if available from project documents and if quantifiable	Increase energy security Contributes to emission reduction	
Contact Point	Akram Waheed	

Name of Mitigation Action	Support of the Climate Neutrality Strategy of Maldives	
Nature of Action/ Description of project	Diesel-solar-hybrid systems have been built on two pilot islands (324kW)	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	R.Ungoofaaru Dh.Kudahuvadhoo
Implementing Entity	Ministry of Environment and Energy (currently Ministry of Environment)	
Start Year	2011	
Status	Completed	
Objective of the action/project	Diesel-solar-hybrid systems have been built on two pilot islands (324kW)	
If an ongoing project: Steps taken or envisaged to archive mitigation action		
Estimated Emission Reduction	349.9 tCO <sub>2</sub> e per year	
Progress Indicator	Electricity supplied annually from RE displacing fossil fuel	
Methodology and Assumptions	Energy produced multiplied by grid emission factor	
Any Co-Benefits if available from project documents and if quantifiable	Increase energy security Contributes to emission reduction	
Contact Point	Ahmed Ali	

Name of Mitigation Action	Enhanced Water Security and Climate Resiliency in Maldives	
Nature of Action/ Description of project	Diesel-solar-hybrid systems (114kW) to cater for the Desalination plant power requirements	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	ADh Mahibadhoo GDh. Gahdhoo Ha. Ihavandhoo
Implementing Entity	Ministry of Environment and Energy (currently Ministry of Environment)	
Start Year	2009	
Status	Completed	
Objective of the action/project	Diesel-solar-hybrid systems (114kW) to cater for the Desalination plant power requirements	
If an ongoing project: Steps taken or envisaged to achieve mitigation action		
Estimated Emission Reduction	123.1 tCO <sub>2</sub> e per year	
Progress Indicator	Electricity supplied annually from RE displacing fossil fuel	
Methodology and Assumptions	Energy produced multiplied by grid emission factor	
Any Co-Benefits if available from project documents and if quantifiable	Increase energy security Contributes to emission reduction	
Contact Point	Mohamed Musthafa	

Name of Mitigation Action	Low Emission Climate Resilient Development (LECRd)	
Nature of Action/ Description of project	installation of a 66kW grid-connected photovoltaic system (PV)	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	Laamu
Implementing Entity	Ministry of Environment and Energy (currently Ministry of Environment)	
Start Year	2011	
Status	Completed	
Objective of the action/project	installation of a 66kW grid-connected photovoltaic system (PV)	
If an ongoing project: Steps taken or envisaged to archive mitigation action		
Estimated Emission Reduction	71.3 tCO <sub>2</sub> e per year	
Progress Indicator	Electricity supplied annually from RE displacing fossil fuel	
Methodology and Assumptions	Energy produced multiplied by grid emission factor	
Any Co-Benefits if available from project documents and if quantifiable	Increase energy security	
	Contributes to emission reduction	
Contact Point	Ali Shareef	

Name of Mitigation Action	STELCO 6 Island Project	
Nature of Action/ Description of project	installation of a 652kW grid-connected photovoltaic system (PV)	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	Subnational
Implementing Entity	Ministry of Environment and Energy (currently Ministry of Environment)	
Start Year	2010	
Status	Completed	
Objective of the action/project	installation of a 652kW grid-connected photovoltaic system (PV)	
If an ongoing project: Steps taken or envisaged to achieve mitigation action		
Estimated Emission Reduction	704.2 tCO <sub>2</sub> e per year	
Progress Indicator	Electricity supplied annually from RE displacing fossil fuel	
Methodology and Assumptions	Energy produced multiplied by grid emission factor	
Any Co-Benefits if available from project documents and if quantifiable	Increase energy security	
	Contributes to emission reduction	
Contact Point	STELCO	

Name of Mitigation Action	Preparing Outer Islands for Sustainable Energy Development (POISED)	
Nature of Action/ Description of project	installation of a ~23MW grid-connected photovoltaic system (PV) for all inhabited islands	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	GDh Thinadhoo
Implementing Entity	Ministry of Environment	
Start Year	2012	
Status	Ongoing	
Objective of the action/project	installation of a ~23MW grid-connected photovoltaic system (PV) for all inhabited islands	
If an ongoing project: Steps taken or envisaged to achieve mitigation action	Phase1 completed Phase 2: 90% complete Phase 3 and 4 preparations on going	
Estimated Emission Reduction	27,572 tCO <sub>2</sub> e per year	
Progress Indicator	Electricity supplied annually from RE displacing fossil fuel	
Methodology and Assumptions	Energy produced multiplied by grid emission factor	
Any Co-Benefits if available from project documents and if quantifiable	Increase energy security	
	Contributes to emission reduction	
Contact Point	Ahmed Ali	

Name of Mitigation Action	Accelerating Sustainable Private Investment in Renewable Energy (ASPIRE)	
Nature of Action/ Description of project	The project development objective of ASPIRE Project is to increase PV generation in Maldives through private sector investments (initial target is 20MW)	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	National
Implementing Entity	Ministry of Environment	
Start Year	2012	
Status	Ongoing	
Objective of the action/project	The project development objective of ASPIRE Project is to increase PV generation in Maldives through private sector investments (initial target is 20MW)	
If an ongoing project: Steps taken or envisaged to achieve mitigation action	Phase 1 of 1.5MW complete, Phase 2 of 5 MW – under procurement Phase 3 – in planning	
Estimated Emission Reduction	21,600 tCO <sub>2</sub> e per year	
Progress Indicator	Electricity supplied annually from RE displacing fossil fuel MW of PV installed under FIT	
Methodology and Assumptions	Energy produced multiplied by grid emission factor	
Any Co-Benefits if available from project documents and if quantifiable	Increase energy security Contributes to emission reduction Increased opportunity for SME growth in energy sector/ green job creation	
Contact Point	Akram Waheed	

Name of Mitigation Action	FAHI – ALI programme	
Nature of Action/ Description of project	Distribution of LED lights for public at zero cost	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	National
Implementing Entity	Ministry of Environment	
Start Year	2011	
Status	Ongoing	
Objective of the action/project	Distribution of LED lights for public at zero cost	
If an ongoing project: Steps taken or envisaged to achieve mitigation action	assistance from China and Germany completed, Indian assistance ongoing	
Estimated Emission Reduction	76,948 tCO <sub>2</sub> e per year (by 2030)	
Progress Indicator	No. of LED lights distributed	
Methodology and Assumptions	The avoided fuel due to increase in efficiency at the end user is multiplied by IPCC Tier 1 EF	
Any Co-Benefits if available from project documents and if quantifiable	Help phase out CFL which includes trace levels of mercury (contribute to Minamata convention) Assist in DSM, relieving future investment for increasing capacity of power generation	
Contact Point	Ahmed Ali	

Name of Mitigation Action	Standard Labelling Programme	
Nature of Action/ Description of project	Introduction of energy efficiency labelling for AC, Washing Machine and refrigerators. This is initiated sub-component of Strengthening Low Carbon Emission Island Strategy project	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	National
Implementing Entity	Ministry of Environment	
Start Year	2015	
Status	Ongoing	
Objective of the action/project	Introduction of energy efficiency labelling for AC, Washing Machine and refrigerators and introduce MEPS	
If an ongoing project: Steps taken or envisaged to achieve mitigation action	development of institutional arrangements and sustainability of the programme	
Estimated Emission Reduction	105,738 to 136,113 tCO <sub>2</sub> e per year (by 2030)	
Progress Indicator	Electricity supplied annually from RE displacing fossil fuel	
Methodology and Assumptions	End use energy efficiency increases due to increased use of higher efficiency appliances. The avoided fuel due to that increase in efficiency at the end user is multiplied by IPCC Tier 1 EF	
Any Co-Benefits if available from project documents and if quantifiable	Assist in DSM, relieving future investment for increasing capacity of power generation Increased disposable income	
Contact Point	Mohamed Inaz	

Name of Mitigation Action	Greater Male Environmental Improvement and Waste Management Project	
Nature of Action/ Description of project	8MW waste to energy plant installed at Thilafushi as solution for regional waste management	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	National
Implementing Entity	Ministry of Environment	
Start Year	2018	
Status	Ongoing	
Objective of the action/project	8MW waste to energy plant installed at Thilafushi as solution for regional waste management	
If an ongoing project: Steps taken or envisaged to achieve mitigation action	Ongoing (planning and design stage on going)	
Estimated Emission Reduction	11,617 tCO <sub>2</sub> e per year (by 2030)	
Progress Indicator	Quantity of waste incinerated MWh produced as electricity	
Methodology and Assumptions	The increased emissions from switching fuel from diesel to municipal waste is subtracted from emission avoided from reduced quantity of the waste managed by open burning	
Any Co-Benefits if available from project documents and if quantifiable	Decrease in pollution Increases energy security	
Contact Point	Ahmed Murthaza	

Name of Mitigation Action	Islands Waste to Energy Project	
Nature of Action/ Description of project	1.5MW waste to energy plant installed at Addu as solution for regional waste management	
Coverage	GHG	CO <sub>2</sub> , CH <sub>4</sub> , NO <sub>x</sub>
	Geographic Scope	Sub-national (Southern 3 Atolls)
Implementing Entity	Ministry of Environment	
Start Year	2018	
Status	Ongoing	
Objective of the action/project	1.5MW waste to energy plant installed at Addu as solution for regional waste management	
If an ongoing project: Steps taken or envisaged to achieve mitigation action	Ongoing (planning and design stage on going)	
Estimated Emission Reduction	2904 tCO <sub>2</sub> e per year (by 2030)	
Progress Indicator	Quantity of waste incinerated MWh produced as electricity	
Methodology and Assumptions	The increased emissions from switching fuel from diesel to municipal waste is subtracted from emission avoided from reduced quantity of the waste managed by open burning	
Any Co-Benefits if available from project documents and if quantifiable	Decrease in pollution Increases energy security	
Contact Point	Ahmed Murthaza	

### 4.3.1 Impact of Mitigation actions on NDC

The mitigation policies for the last 10 years, like the Maldives Energy Policy and Maldives Climate Change Policy Framework, have led to the projects listed above. In addition, these mitigation policies and projects have also prompted mitigation actions from private actors adding 4.6MW of solar PV to the energy mix in the last 10 years. This accounts for more than 40% of the total solar PV installation completed during that period. Similarly, the introduction of FAHI-ALI programme which distributed LED lights at zero cost has prompted the private sector to shift to LED lighting in their operations. These mitigation actions would contribute to reducing emissions from BAU by 2.4% for 2030. The ongoing

projects of renewable energy, waste management and energy efficiency slated for implementation over the next 5-10 years as listed in the table above further increase the emission reduction from BAU to 6.9% for 2030 as seen in Figure 18.

It is important to highlight that some mitigation actions have not been included due to lack of information. Some of these includes work ongoing on energy efficiency in building code, future/accelerated investment of RE and EE in resorts and other private properties/operations and impacts of potential legal mechanisms like emission standard for mobile and stationary sources.

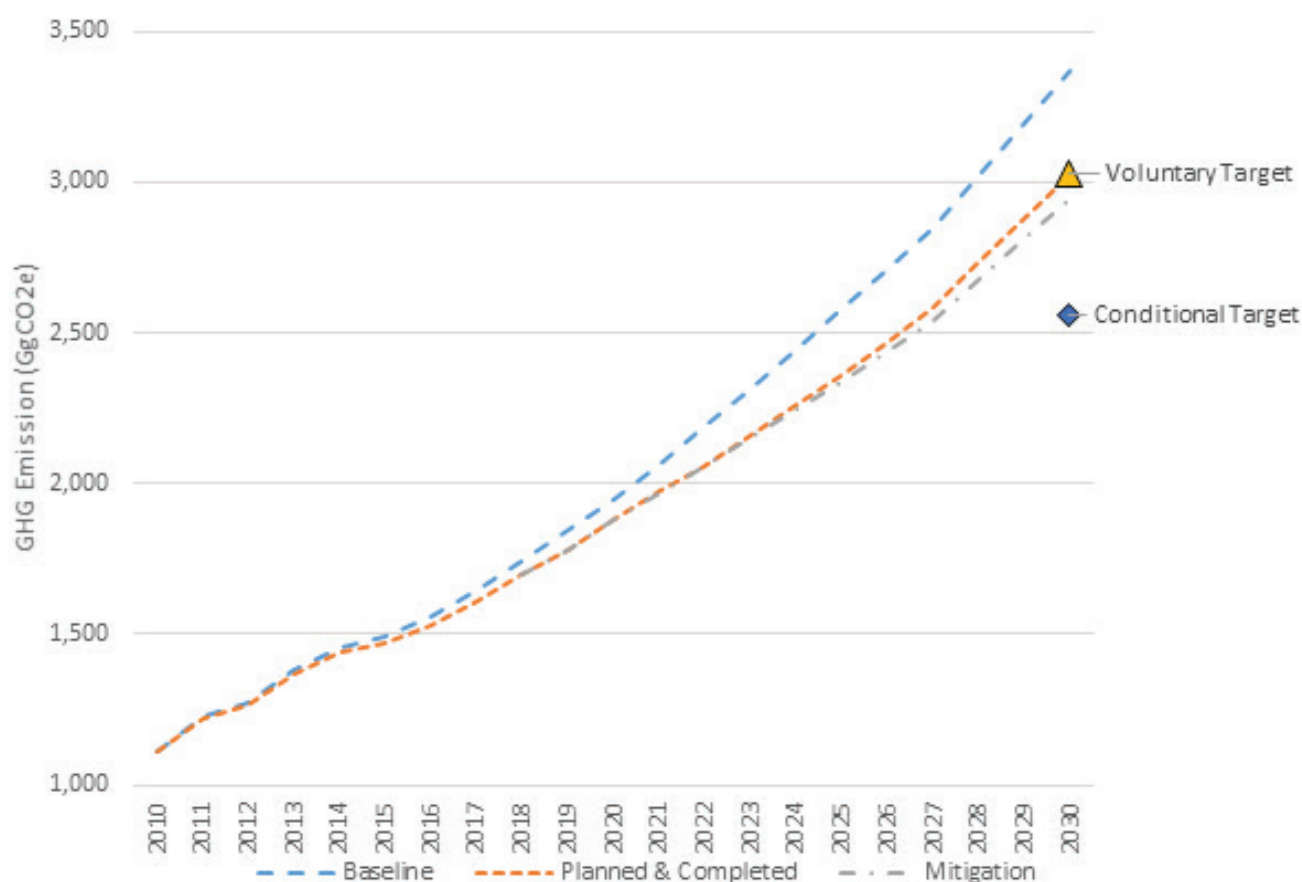


Figure 18: Emission pathways illustrating the progress towards the NDC targets from Mitigation Actions.

Government has also committed scaling up the efforts by revising its initial RE target of 30% of daytime peak being met by solar PV to 70% of daytime peak being met by solar PV. This covers all inhabited islands of Maldives and the government seems to be on route to achieving this target as the current installations being pursued in POISED and ASPIRE meets almost 70% of the current daytime peak (Energy Department, Ministry of Environment 2018). The implication of this policy for 2030 would be that the solar PV installation would need

to increase from the current (completed or under implementation) for Other atolls from 26MW to 45MW by 2030, and for greater Male' region from 22MW to ~80MW of solar PV by 2030. Keeping this target intact would contribute an additional 3% reduction from BAU for 2030. Given the current trajectory of mitigation actions from both public and private, Maldives is on a pathway to potentially achieve the unconditional NDC target of 10% from BAU (Figure 18). However, to achieve the conditional 24% target set in the NDC, there



needs significant increase in mitigation efforts across all sectors throughout the country. This certainly requires significant assistance from development partners as well as heavily depends on technology development globally.

## 4.4 OPPORTUNITY FOR ENHANCED ACTION

Though Maldives is on track to achieve the unconditional NDC target, there is a significant gap in achieving conditional target of 24% from BAU. There is a need for a significant increase in terms of ambitions for mitigation actions. Promoting and/or facilitating mitigation actions by private actors and other non-government actors is key requirement towards achieving this goal. As this is a conditional target, collaboration and assistance from the international partners is vital to achieve this goal. Some of the key sectors for focus includes

1. Renewable energy
2. Energy Efficiency
3. Transport
4. Waste

### 4.4.1 Renewable Energy

The most abundant source of renewable energy in the Maldives is solar and wind power. The levelized cost of electricity (LCOE) from grid connected solar is lower than the LCOE from fossil fuel based power generation in Maldives (Ministry of Environment and Energy, 2012). However, integration of intermittent sources like solar to power grid without storage does impact the stability of the grid and quality of service provided.

Just as government efforts motivated private actors to invest in renewables in the past, the enhanced ambitions by government would improve confidence for private sector to invest more on renewable energy technologies. As showcased by some of the resorts, it is possible to meet a significant portion of their power generation from renewables. This could be a resort development template which government can promote and celebrate to encourage climate action. If resort developers keep pace with 70% peak goal for inhabited islands, could lead to a reduction of 4% from BAU by 2030. Similar to resorts, there is scope for other industries and large-scale commercial operations to adopt renewables. The relative lower LCOE would also infer that the benefit is not only climate mitigation but also economic.

Though there are many success stories of intermittent renewable energy use in Maldives, unfortunately it is not enough to reach the unconditional mitigation target. Even with energy storage, the lack of space for solar PV and storage is a challenge in Maldives. It is important to identify a reliable and consistent source of energy to displace fossil fuel to meet the base load demand. Waste to Energy (WTE) is the most explored source of energy for this purpose. This has resulted in the planned WTE in Thilafushi and Addu. The main limiting factor for further proliferation of this technology is the lack of source material or waste generated within the country.

Maldives having more than 99% as ocean, there is potential for marine renewable energy resources. There are channels within atolls where ocean currents could be harnessed although further research needs to be done to estimate how much of these could be exploited for actual use. Currently, the government is undertaking a project with assistance from Government of Italy in assessing the hotspots and potential for ocean current energy utilization. Similarly, there are multiple private sector planned initiatives which involves various technologies such as wave energy converters. These pilot scale experiments are expected to provide valuable information on the feasibility of the concept in terms on installation and cost. Ocean thermal energy is also considered to have high potential in Maldives (Uehara and O'Connell, 2011). However, lack of commercial availability of the technology and high initial cost are barriers to adopting the technology.

### 4.4.2 Energy Efficiency

Mitigation by energy efficiency can be achieved through demand and supply side management. Demand side management focuses on awareness on reducing usage and increasing energy efficiency. These are considered as low hanging fruits as investment recovery for energy efficiency is short and it net beneficial to the economy. However, this requires a large involvement from end-users to realize the mitigation potential.

The government has showcased number of energy efficiency measures including use of centralized air-conditioning and energy efficient air conditioning systems for buildings and LED lights for public lightings. The government initiatives like

FAHI-ALI programme and “its cool at 25” awareness campaign has left its mark throughout the country. The standard labelling programme and the energy efficiency guidance for building being developed under ‘Strengthening low carbon energy island strategies’ would further enhance the proliferation of energy efficiency technologies at the end-user.

Mitigation through improvements in supply side considers increasing power generation efficiency and reducing losses in the transmission and distribution network. The ad-hoc development of power generation facilities and fast growth of demand has led to some poor and inefficient power generation facility especially in smaller islands. Supply side efficiency measures are addressed through SREP (Ministry of Environment and Energy, 2012) by upgrading the current transmission system for solar PV integration. However, incorporating intermittent RE can lead to a drop in overall efficiency off-setting the increased supply side efficiency from diesel power generation. This is currently planned to be addressed using high-end EMS systems and battery in select islands. This could be scaled up for other islands allowing greater penetration of RE in addition to the increased efficiency. In resorts, the scope for supply side energy efficiency is limited as many of the measures like waste heat recovery and co-generation are already in place.

#### 4.4.3 Transport

Transportation is second highest contributors to the emissions in the Maldives. The geographic uniqueness poses a challenge in mitigating these emissions. In the absence of mitigation in transport, it is projected to increase nearly 281% by 2030. Majority of transport activities is carried over the sea or air. The lack of mitigation options in in air and sea transport, the focus has been on managing the traffic and increasing efficiency of vessel.

In aviation, Velana International Airport provides the shortest and the most direct route available for airplanes to travel in Maldivian airspace in line with ICAO resolution (A38-18). Beyond traffic control there is almost no other mitigation measure available for aviation.

Similarly, sea-ferry operators in Malé City, have coordinated the routes to avoid congestion and reduce idle time as well as made efforts to maximize the distance travelled per litre of diesel in their vessels. However, these efforts are very limited in terms of scope and impact. Though there are encouraging efforts under taken by private sector (e.g. solar powered vessels and introduction of vessels with efficient hull designs) to introduce energy efficient vessels as well as renewable energy vessels into their operations. Unfortunately tracking emission

reduction from these measures remains a challenge.

Mitigation prospect of land transport is better in comparison. Land transport in Maldives is dominated by motorcycles followed by cars with much of the vehicles being concentrated in Malé City. Government have been implementing measures to improve road conditions and reduce congestion and facilitate public transport. Thus far though there has been very little deviation from business as usual from these measures as much of the new vehicles introduced (including those used for public transport) are of conventional technologies. There are initiatives from the government to introduce vehicle emission standards, this is subject to wider acceptability of stakeholders in road transport. There is a risk of delayed implementation of such measures as has been the case for many of the previous policy/regulatory measures directed towards road transport. These include, increased imports tax imposed in 2014 which got rolled back the same year, vehicle age regulation and many past attempts to develop mobile emission standards.

#### 4.4.4 Others Energy Sectors

This subsection covers energy usage in the Maldives other than electricity generation and transport and presents methods that can be used to mitigate emission in these areas. The consumption of LPG and kerosene in cooking represents 2.72% of the emissions. Replacing LPG for cooking with electricity would negatively contribute to emission reductions due to low penetration of renewable energy in grid power systems.

The Maldives fisheries industry is considered as a major emitting economic activity. The fisheries vessels in the Maldives travel far and long for the catch and thus most of the emissions are for transport. The trend of fisheries sector development is a decrease in daily fishing trips and increase in long multiple day fishing trip. For long distance vessels it is important to have provisions for cooking and to some extent cold storage of fish catch. Although mitigation in transport is limited, these additional energy use can be displaced to renewable sources (electrical cooking and mini cold storage). Mitigation potential of such an activity is less than 0.13% of the total emission from BAU. Currently government is promoting inclusion of mini cold storage for long distance vessels.

#### 4.4.5 Waste

Waste management has been a growing concern in the Maldives considering the limited land space and the fragile ecosystem of the country. The main method of waste management is unmanaged open burning. There is also limited incineration (mainly in resorts) and dumping biodegradable

waste into the sea (Department of National Planning, 2013). It is single most important sector for mitigation of short-lived climate pollutants (SLCPs) like methane and nitrous oxide. Mitigation of SLCPs also have almost immediate and socially relevant co-benefits by reducing air pollution and improve health outlook in the community.

The incineration technology can reduce emission from waste exclusive of energy production. Proper incineration technology reduces amount of incomplete combustion found in unmanaged open burning. Incomplete combustion is a key factor in the emission of SLCPs.

Waste management policy indicates that waste management would be two-tiered, community level waste management and regional level waste management. The proposed community level waste management includes segregation of waste, composting the organics, and recycling non-contaminated plastics and metals. The regional level waste management facility includes further recycling, incineration and managed land filling. This concept is being implemented throughout the country by segregating it into 5 regions.

In addition, government have launched 'Saafu-Raajje' (Clean Maldives) initiative, an awareness and behavioural change campaign, and established public company, Waste Management Corporation, with the exclusive mandate of developing and managing the waste management facilities throughout the country. The government is also working with Parley, an international NGO, to collect and recycle PET plastic bottles.

#### 4.4.6 Facilitating enhanced ambition

Government have launched number of initiatives with assistance from various development partners to facilitate green growth. These include key regulatory measures such as removal of import duty from all renewable energy equipment, introduction of regulation for independent power producers, feed in tariff (2011) and most recently net-metering (2015) for domestic scale use of RE. Work is under way to include energy efficient and environmentally friendly technologies to be duty exempted.

To facilitate RE investments government has established three financial instruments, Fund for Renewable Energy Systems Application (FRESA) in 2008, Renewable Energy Development Fund (RED fund) in 2011 and Maldives Green Fund (MGF) in 2018. FRESA focus on small scale private sector investment through concessional loans, RED fund is utilized to supplement utility scale RE investments and MGF would focus on invest in environmental including climate adaptation and mitigation investments. Work is currently ongoing to establish a financial mechanism targeted to energy efficiency products.

The financial institutes have started investing in climate mitigation activities. For example, Bank of Maldives established a Green Loan scheme<sup>1</sup> in 2016 to provide concessional loan financing for environmentally friendly technologies and projects. Introduction of the Maldivian private sector to the private sector window of GCF would increase their involvement in the climate action. However, complexities of working with international funds is a key barrier for small and medium level enterprises to take advantage of these opportunities.

In order to tap the maximum mitigation potential further actions are needed. This includes strengthening data collection systems to improve reporting of GHG emission trends. This would facilitate more informed mitigation choices. Both private sector and relevant regulatory institutions need to be involved need to work together to strengthen the reporting mechanisms. Further awareness raising and enhancement of the capacity of the sector is also needed in areas such as economic analysis of low carbon projects, new technologies and techniques available and their implementation and on MRV techniques associated with low carbon emissions projects.

Supportive and regulatory measures for mitigation also need to be strengthened. Some of these measures include development and implementation of a mechanism for monitoring, reporting and verification of compliance with targets, establishment of a fund to facilitate enabling activities for mitigation and establishment of a project development facility to facilitate investments in mitigation projects.

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1 <https://www.bankofmaldives.com.mv/personal-banking/personal-loans/bml-green-loan>

## 4.5 INTERNATIONAL COOPERATION

The government has partnered up with research and development institutes to explore other potential renewable energy sources and feasible technologies for Maldives (e.g. ocean energy harnessing). In addition to research and development, government have also made efforts to attract private sector investments through different international opportunities for mitigation. Government of Maldives entered into agreement with Government of Japan to establish Joint Crediting Mechanism in 2012. This is a carbon market mechanism designed to make mitigation investments in Maldives commercially competitive.

This market mechanism is promoted by the Japanese government with range of financial support from grants assistance, multi-lateral funds and concessional loans for the project developers. This mechanism been instrumental in the introduction state-of-the-art storage technologies to increase renewable technology penetration in the island grids and assisted the private sector to participate more in the national mitigation efforts. Table 18 summarizes the prospective projects lined up to be registered under JCM.

**Table 18: Projects under the Joint Crediting Mechanism**

No.	Project name	Description	Emission Reduction Units (tCO <sub>2</sub> e)	Focal Point
1	School Building Rooftop Solar Power Plant Project	180kW grid-connected solar PV system	155 (issued in 2019)	PACIFIC CONSULTANTS CO., LTD.
2	Preparing Outer Islands for Sustainable Energy Development (POISED) Project (Addu Component only)	Advanced Energy Management System, and Lithium-ion Battery	(Not issued)	FENAKA Corporation limited

## **5. OTHER INFORMATION**

## 5.1 NATIONAL DEVELOPMENT PLANNING AND RESOURCE MOBILIZATION

Maldives has had 5-year development plans over the years, but the only high level long term plan was the Vision 2020. Sectoral policies existed and these were largely formulated to realise the Millennium Development Goals. The lack of long-term national development plans in the country has created challenges in linking all plans and policies into one integrated development vision. This has often favoured delivery of short term priorities that do not address trade-offs which result in long term benefits and sustainability (Government of Maldives, 2019).

The Strategic Action Plan (SAP) is the latest development plan in the country, endorsed in October 2019. This is a step towards restoring the long term planning process in the country. Hence, SAP is the central policy framework and planning document that guides the overall development direction of Maldives for the upcoming 5 years. The Government wishes to institutionalize the SAP into a 5 year planning cycle that lays out implementation priorities. This is done with the purpose of achieving several of the long term transformations set in the SAP such as the blue economy, climate resilience and sustainability and good governance. SAP would also play a significant

role in aligning external/donor assistance to national priorities, Paris agreement and the UN 2030 Agenda.

Development planning in Maldives is results-based, in which the policies and accompanying strategies meet specific outcomes and the resources available to implement these are identified. The government places its decision on inclusion of policies and strategies in the plans depending on their relative priorities for each sector. These development plans are financed through the country's public and private sectors and assistance from development partners. In 2017, the New Policy Initiatives (NPIs) were introduced into the national budgeting process. With this change, government entities and agencies are to produce baseline estimates and provide proposals for new projects and programmes for the period 2018-2020 known as NPIs which will then be consolidated into the Medium Term Fiscal Framework (Government of Maldives, 2019). The introduction of NPIs presents an opportunity to align and prioritize budget allocations to national policy priorities. In ensuring the effective implementation of the SAP, implementing agencies would have to demonstrate linkages between all NPIs and the results matrix of SAP.

## 5.2 TRANSFORMATIONAL POLICY INITIATIVES TO ADDRESS CLIMATE CHANGE

### 5.2.1 National Spatial Plan (NSP)

Maldives is currently working on endorsing a National Spatial Plan for the years 2020 -2040. This is an initiative to bring about decentralized development through connectivity and accessibility. This is the first of its kind in the country. This plan comes integrated with strategic optimization of service accessibility and resource efficiency coupled with the establishment of a National Transportation Network in the country. NSP centres on the need to:

- Break free from the current ad hoc and centralized development
- Bring about a more equitable distribution of services and development benefits across the nation through regional development
- Optimize use of limited resources

- Harmonize development in terms of social, economic and environmental aspects

The regional structure of NSP is derived using an evidence based approach that broadly accounts for the socio-economic and resource factors together with the geographic position of the identified island clusters. The regions are classified into Urban Regions, Satellite Regions and Satellite Islands;

- Urban Regions – distributed in a balanced manner across the archipelago hosts higher order services and serves islands within the region and nearby regions of lower orders
- Satellite Regions and Islands - these are identified in order to provide special policy consideration to alleviate any marginalization which can arise from isolation and limited economies of scale



Therefore, this spatial plan will enable the country to tackle some of the pressing challenges including that of economies of scale and limited land and resources. This strategy aims to ensure a collective development of the regions rather than building stronger islands and cities in an effort to grow while smaller islands suffer to improve their conditions. The feasibility of this plan is strongly dependent on the effective, integrated and affordable transportation.

## 5.2.2 Building Resilient Communities

Building climate resilient communities is a key priority of the Government. Given the national circumstances of the country, climate induced vulnerabilities are extremely high in the country. Therefore, the SAP places a significant importance in building resilient communities through investments in coastal protection, transition to renewable energy, innovative water filtration and purification systems and enhancing the local and human capacity to respond to emergencies.

The following policies are in place to achieve the resilience of communities by 2023;

- Strengthen adaptation actions and opportunities and build climate resilient infrastructure and communities to address current and future vulnerabilities
- Promote environmentally sound technologies and practices towards building sustainable climate resilient island communities
- Foster strategic partnerships and enhance national and international cooperation and advocacy in climate

change

- Enhance island, atoll and city level preparedness, response and recovery capacities to manage recurring hazards
- Strengthening national level disaster management information, communication and coordination system
- Ensure and integrate sustainable financing into climate change adaptation opportunities and low emission development measures
- Strengthen aeronautical meteorology and multi-hazard early warning capacity

## 5.2.3 Climate Smart Resilient Islands (CSRI)

Maldives is currently leading the initiative for Climate Smart Resilient Islands for SIDS. This was launched at the UN Climate Action Summit 2019 by His Excellency President Ibrahim Mohamed Solih. The objective of this initiative is to provide a holistic approach for islands to address climate change in the context of sustainable development, this would contribute to the execution of bold NDC plans of SIDS. In other words, transforming islands to Climate Smart Resilient Islands (CSRI). The following table X gives an overview of the key features of this initiative.

Feature	Actions
Environmental Protected Areas	<p>Conserve and self-manage at least 10% of the terrestrial, coastal and marine areas in SIDS by 2020.</p> <p>Enhance healthiness of ocean through 100% ban of plastic littering in island waters by 2025.</p> <p>Boost natural resilience of islands through indigenous/climate proofing technologies and nature-based solutions.</p>
Climate Services	<p>SIDS are equipped with state-of-the-art technology to observe and predict both climate and non-climate induced hazards by 2030.</p> <p>Collaborate with all SIDS site-specific research centres that would enable island specific solutions for disaster risk reduction and ensuring scientific based policy directions in SIDS.</p>
Inter-Island Connectivity	<p>Introduction of low emission transport networks by 2050.</p> <p>Digital communication services between islands, including e-governance, e-commerce and telemedicine in SIDS by 2025</p>

Feature	Actions
Food Security	<p>Designate adequate number of sustainable fishing grounds in island waters for domestic consumption and as an economic fishing ground by 2030.</p> <p>Promote and advocate for innovative and sustainable marine and aquaculture farming practices in all SIDS.</p> <p>Promote SIDS specific urban agriculture and alternative agricultural farming in SIDS.</p> <p>Establish food storage facilities (for staple food) at least with inadequate of reach in the event of extreme weather events.</p> <p>Establish fair market and trading policy for trading food products in SIDS by 2030 that address concerns of all farmers, especially small subsistence farmers.</p> <p>Integrate agro-forestry and watershed management including climate change dimension.</p> <p>Develop sustainable land management, promoting fixed/permanent agriculture, reduce burning, reduce erosion, and increase soil fertility.</p>
Green Tourism	<p>Devise stringent governance and grievance mechanism for sustainable use of island ecosystem by 2022.</p> <p>Substantially increase energy efficiency and renewable energy in tourism service industry by 2022.</p>
Integrated Waste Management	<p>Phase-out of single use plastics by 2025.</p> <p>Reduce, reuse, recycle of at least 50% waste by 2023.</p> <p>Prepare and implement Sustainable Consumption Pattern (SCP) for SIDS with support from the 10-Year Framework Programme on SCP.</p>
Climate proof infrastructure	<p>Enhance standards, codes and regulations to ensure climate proofing is addressed in the SIDS critical infrastructure by 2025.</p> <p>Establish/enhance affordable insurance mechanism to protect infrastructures from slow on set of events or extreme events by 2030.</p> <p>Enhance multilateral cooperation to address permanent losses and damages, and climate displacement.</p>
Self-Sustaining, sustainable and smart energy systems	<p>Increase share and diversity of renewable energy and energy efficiency technologies in the national energy mix by 2030.</p> <p>Enhance collaboration within the framework of the SIDS Lighthouses Initiative for improved coordinated action to accelerate deployment of renewable energy solutions in all sectors</p>
Water Security	<p>Increase storage capacity and catchment management by 2022.</p> <p>Establish water distribution networks with treatment facilities by 2023.</p> <p>Waste water recycling technologies for enhancement of ground water aquifers by 2025.</p> <p>Increase the use of decentralized renewable solutions in water resource management</p>
Smart Health Facilities	<p>Strengthening the climate resilience and environmental sustainability of healthcare facilities.</p> <p>Work towards building green or eco-hospitals through mandating the incorporation of sustainable elements in the siting, design, construction and landscaping of new buildings, and in building expansion and/or retrofit projects.</p> <p>Support broader aspects of sustainability in the built environment. Support the use of local and regional materials (reducing transportation energy), utilize salvaged and recycled materials (reducing energy otherwise expended on new production), and support toxic-free products and manufacturing processes.</p> <p>Promote the use of modern and renewable energy solutions for resilient health facilities.</p>
Gender Equality and Intergenerational Partnership	<p>Engagement and empowerment of youth in all aspects of climate change.</p> <p>Inculcate climate change into educational curriculums.</p> <p>Advocate for youth programme on climate actions across the SIDS and at global level to demand for more ambition.</p> <p>Promoting and enhancing gender equality and women's equal participation, including in policies and programmes in the public and private sectors in SIDS.</p> <p>Enhancing human resource capacity to analyse climate risks for better adaptation policies and measures, including undertaking climate modelling and projection.</p>



## 5.2.4 Maldives Biosphere Reserve Targets

To address biodiversity loss in the country, B Atoll of Maldives was declared as a UNESCO Biosphere Reserve in 2011. This was developed as an alternative to the conventional approaches to conserve the natural environment. The B Atoll Biosphere Reserve was designed with the purpose of modelling an effective and sustainable management system for atoll ecosystem conservation and sustainable development, which could then be replicated throughout the country. Subsequently, a conservation fund was established to regulate the biosphere reserve and to promote sustainable livelihood, conservation, education

and research in B Atoll (MEE, 2015b). Currently, Maldives has the vision to have internationally recognized protected areas and is working towards establishing a network of biosphere reserves in the Maldives. In this regard, two atolls (Addu and Fuvamulah) has been nominated to UNESCO. If approved, Maldives would have three atolls as UNSECO biosphere reserves. In addition to this, the SAP states that by 2025 at least 10% of coral reef area and 20% of wetlands and mangroves from each atoll would be under protection and management.

# **6. FINANCIAL RESOURCES, TECHNOLOGY TRANSFER, CAPACITY BUILDING AND TECHNOLOGY SUPPORT RECEIVED AND NEEDED**

## 6.1 FINANCIAL SUPPORT RECEIVED

Maldives has been and continues to be working with a number of international donors and financiers on projects that directly concerns climate change adaptation and mitigation. As Maldives does not have a single entry system in place yet, the tracking of these activities is not straightforward. Nevertheless, recordings are thorough and most of the information ultimately rests with the Ministry of Finance. Corroborating the information with the most relevant line ministries brings a significant level of detail to this information.

The Ministry of Finance also tracks national budgets allocated either as co-financing for donor-funded projects or as stand-alone nationally prioritized activities. Furthermore, the agreements between donors and the Maldives government include information on national contributions, thus providing a comprehensive picture of the Maldives public sector financing for climate change related purposes. Even though climate finance data is available with various entities, there is no systematic collection and archiving of this data. Thus, it is difficult to easily access and report such information.

Based on the guidance provided by CGE for the preparation of biennial updates reports, this chapter gives an overview of financial commitments, both nationally and internationally,

related to climate change mitigation and adaptation covering the period 2014-2017 (both years inclusive, although recordings for 2017 may not be complete). Commitments that fall beyond or partially within the reporting period has been adjusted such that only the relative budgets for the years that fall within the period 2014-2017 are included (e.g. a commitment of 1 million USD for 2013-2016 will only count with 750,000 USD, because 2013 is excluded). National budget is also tracked with respect to allocations for climate change or other environmental challenges.

### 6.1.1 Donor Funded Climate Support

The following tables (Table 19, Table 20 and Table 21) outlines the climate change adaptation, mitigation and cross-cutting donor funded projects for the period 2014-2017. Amongst these, approximately 30% of finances are allocated towards adaptation while 59% of the finances go towards climate mitigation efforts (See Figure 20). It is crucial to note that a significant proportion of mitigation projects are also funded through concessional loans (See Figure 19 and Table 20).

Table 19: Donor Funded adaptation Projects

Project	Description of project	Start Year	End Year	Donor	Implementing Entity	Supporting Entity	Support Received (USD)					Total budget allocated for the Reporting Period (USD)
							Grants	Loans	Co-Finance	Total		2014-2017 (in pro-rata basis)
Increasing Climate Resilience through an Integrated Water Resource Management Programme in HA, Ihavandhoo, Adh. Mahibadhoo and Gdh. Gandhoo Island	The objective of this project is to ensure reliable and safe freshwater supply for Maldivian communities in a changing climate. The project aimed to demonstrate climate-smart freshwater management in the Maldivian context and establish integrated and resilient water supply systems on the densely-populated islands, with a view on country-wide replication and up-scaling	2011	2015	Adaptation Fund	Ministry of Environment	UNDP	8,285,000.00	-	1,800,000.00	10,085,000.00		4,034,000.00
Climate Change Adaptation Project	The development objective of the Climate Change Adaptation Project (CCAP) is to demonstrate climate adaptive planning and management through the adoption of a multi-sectoral approach in Addu and Gnaviyani atolls	2015	2019	EU & Maldives Climate Change Trust Fund	Ministry of Environment	World Bank	4,210,000.00	-	100,000.00	4,310,000.00		2,586,000.00
Support of Vulnerable Communities in Maldives to Manage Climate Change-Induced Water Shortages	This project aims to deliver safe and secure freshwater to 105,000 people in the islands of Maldives in the face of climate change risks, through scaling up an integrated water supply system to provide safe water to vulnerable households, Introduction of decentralized and cost-effective dry season water supply systems and groundwater quality improved to secure freshwater reserves for long term resilience.	2015	2020	GCF	Ministry of Environment	UNDP	23,736,364.00	-	4,493,940.00	28,230,304.00		14,114,682.00
Integrating Climate Change Risk into Resilient Island Planning (ICCR)	The project aims to enhance capacity of national, provincial, atoll and island authorities and civil society leaders to integrate climate risk information into policy, planning and investment decisions	2010	2016	LDCF through GEF and UNISDR	Ministry of Environment	UNDP	4,720,000.00	-	4,851,211.00	9,571,211.00		4,001,233.29

Project	Description of project	Start Year	End Year	Donor	Implementing Entity	Supporting Entity	Support Received (USD)				Total budget allocated for the Reporting Period (USD)	
							Grants	Loans	Co-Finance	Total	2014-2017 (in pro-rata basis)	
Present cost-effective, locally appropriate coastal management and drainage management options contributing to climate change resilience of communities in Fares-Maathoda	The project proposed to expand the ICCR component to an additional site; the is-land of Fares Maathoda in Gaafu Dhaalu Atoll. Coastal management options will be demonstrated at the island in order to minimise the impacts from episodic storm events. Drainage management options will be put in place to minimise the flooding of the island during rainy season.	2010	2015	Danish Government	UNDP	UNOPS	881,660.00	-	-	881,660.00	293,886.67	
Increasing Climate Change Resilience of Maldives through Adaptation in the Tourism Sector (TAP)	TAP addressed key infrastructure issues in the country and aimed at formulating essential policies, standards, codes and regulatory guidance that would facilitate necessary investments to increase the resilience of the tourist infrastructure to climate change.	2012	2016	LDCF through GEF	Ministry of Tourism	UNDP	1,650,438.00	-	1,650,438.00	3,300,876.00	1,980,525.60	
ORIO Coastal Protection Project	This project aims at remedying the coastal erosion faced by the populations of Gn.Fuvahmulah, by protecting the threatened shorelines.	2017	2018	Government of the Kingdom of the Netherlands and Kuwait Fund	Ministry of Environment		10,027,841.56	11,745,754.78	2,444,737.68	24,218,334.02	12,109,167.01	
Provide support to UNOPS implementation of the construction component of the Enhance Water Security and Climate Resiliency in Maldives (Maldives GCC) Programme	Project specific objectives include; i) increase the availability and quality of drinking water for Hinnavaru's population, and; ii) collaborate closely with Chemonics, the other implementer under the Maldives GCC project, to provide training and capacity building that support the long term sustainability of the overall project interventions.	2014	2015	USAID	UNOPS		3,809,135.00	-	-	3,809,135.00	3,809,135.00	
Integrated Water Resource Management in Atlantic and SIDS; Groundwater protection through Sustainable Integrated Water Supply in AA, Thoddoo Island	This project is designed to address the problem of ground water pollution by providing an alternative integrated water supply while promoting good practices to check against groundwater pollution	2013	2015	GEF	Ministry of Environment	UNEP	500,000.00	-	512,200.00	1,012,200.00	674,800.00	

Project	Description of project	Start Year	End Year	Donor	Implementing Entity	Supporting Entity	Support Received (USD)				Total budget allocated for the Reporting Period (USD)
							Grants	Loans	Co-Finance	Total	2014-2017 (in pro-rata basis)
Enhancing National Capacity for Disaster Risk Reduction and Management in the Maldives	This project aims to develop capacities for DRRM at all three - tiers: at the enabling environment, organizational and individual. It is geared towards supporting the Government of Maldives strengthen its DRRM capacity, enhance preparedness and reduce risks, and achieve its global commitment to the Hyogo Framework for Action (HFA) and the MDGs.	2013	2015	UNDP Regional Centre	National Disaster Management Authority	UNDP	693,000.00	-	-	693,000.00	462,000.00
Scaling up the National Capacity for Disaster Risk Reduction and Management in the Maldives	This project seeks to increase capacities especially at the island level. It will directly result to: a) Enhancement of island level capacity for disaster response in 20 islands; b) Strengthening early warning systems in 4 island level; and c) Improve capacity of stakeholders through NDMC to report progress according to Sendai Framework 1 for DRR by making the stakeholders aware on their mandate on the Sendai Framework, what needs to be reported by when to NDMC.	2016	2018	Government of Japan	National Disaster Management Authority	UNDP	380,000.00	-	-	380,000.00	253,333.33
Japan's Non-Project Grant Aid for Provision of Japanese Disaster Reduction Equipment (FY2014) for the Republic of Maldives	Japanese Non-Project Grant Aid by the Government of Japan was extended to the Government of Maldives in response to the Male' Water Crisis event of December 2014. Through the grant aid NDMC procured disaster management equipment that would enhance and increase the disaster response capacity of the Maldives. This equipment would be used to establish disaster response	2015	2018	Government of Japan	National Disaster Management Authority	Japan International Corporation System	9,900,000.00	-	-	9,900,000.00	7,425,000.00
Establishment of the Regional Emergency Response Centre in Faafu Nilandhoo	This project was undertaken by NDMC in collaboration with the MNDF Fire and Rescue (FRS) and supported by the United Nations Children's Fund (UNICEF) to establish a Regional Emergency Response Centre which complements efforts of NDMC to strengthen the capacity of island communities to prepare for and respond to emergencies.	2017	2018	Emergency Preparedness Fund allocation from UNICEF Regional office	National Disaster Management Authority	UNICEF Maldives	150,000.00	-	-	150,000.00	75,000.00

Project	Description of project	Start Year	End Year	Donor	Implementing Entity	Supporting Entity	Support Received (USD)				Total budget allocated for the Reporting Period (USD)	
							Grants	Loans	Co-Finance	Total	2014-2017 (in pro-rata basis)	
Establishing Flood response pump stations in 9 islands that are severely affected by Flooding in the Maldives	The project focused on strengthening local level emergency response in HA, Dhihdhoo, GDh. Hoadehdhoo, GDh. Madella, GDh. Madaveli, M. Kolhufushi, R. Alifushi, L. Kunahandhoo, GA. Vilingili and Gn Fuvahmulah. frequency of severe weather events cause flooding in these islands, which leads to both damage to infrastructure as well as disrupts daily activities in the community. The project support the community to carry out a fast response	2015	2016	Emergency Preparedness: Fund allocation from UNICEF Regional office	National Disaster Management Authority	UNICEF Maldives	62,848.37	-	-	62,848.37	62,848.37	
Total							69,006,286.93	11,745,754.78	15,852,526.68	96,604,568.39	51,881,611.27	

**Table 20: Donor funded Mitigation Projects**

Project	Description of project	Start Year	End Year	Donor	Implementing Entity	Supporting Entity/s	Support Received (USD)				Total budget allocated for the Reporting Period (USD)
							Grants	Loans	Co-Finance	Total	2014-2017 (in pro-rata basis)
Project for Provision of a Solar Power Generation System to Dhiffushi Island	Support the construction of a core solar power system in K. Dhiffushi. Coupled with the advanced technology of Kansai Electric Power and designed from the bottom up, this project is expected to provide momentum in the Maldives for a shift from full dependence on diesel generator to a hybrid system with a renewable energy.	2016	2016	Government of Japan	Ministry of Environment & STELCO		361,254.00	-	-	361,254.00	361,254.00
Support of the Climate Neutrality Strategy of Maldives	This project aims to ensure that the public institutions and private stakeholders in the Maldives have the skills and expertise necessary to devise comprehensive strategies for minimising harmful greenhouse gas emissions and to take appropriate action.	2011	2015	Government of Germany	Ministry of Environment	GIZ	3,387,675.00	-	-	3,387,675.00	1,355,070.00
Preparing Outer Islands for Sustainable Energy Development (POISED)	The project will install solar-diesel hybrid grids on outer islands and the greater Male region. Skills development support will also be given to the Ministry of Environment and Energy and the main power utilities State Electricity Company and FENAKA Corporation Ltd. for the hybrid rollouts	2014	2018	Grant: ADB, Strategic Climate Fund and Japan Fund for Joint Crediting Mechanism  Loan: European Investment Bank and Islamic Development Bank	Ministry of Environment, Fenaka & STELCO		55,000,000.00	60,000,000.00	-	26,000,000.00	99,200,000.00



Project	Description of project	Start Year	End Year	Donor	Implementing Entity	Supporting Entity/s	Support Received (USD)					Total budget allocated for the Reporting Period (USD)
							Grants	Loans	Co-Finance	Total	2014-2017 (in pro-rata basis)	
Accelerating Sustainable Private Investment in Renewable Energy (ASPIRE)	The project development objective of ASPIRE Project is to increase PV generation in Maldives through private sector investments	2014	2018	Grant: Strategic Climate Fund/ SREP  Guarantee: IDA/World Bank	Ministry of Environment		11,684,000.00	16,000,000.00 (Guarantee)	-	27,684,000.00	22,147,200.00	
Strengthening Low-Carbon Energy Island Strategies (LCEI)	The overall objective of this project is to mainstream energy efficiency measures into housing policies, guidelines, standards and building practices in the Maldives and to achieve a substantial reduction of GHG emissions as a result of improved buildings and building management practices and to leverage substantial investment in activities leading to increased energy efficiency in the Maldives.	2015	2018	GEF	Ministry of Environment	UNEP	3,885,000.00	-	38,340,835.00	42,225,835.00	31,669,376.25	
ESMAP Renewable Energy Resource Mapping Project	The project focuses on solar resource mapping and measurement services as part of a technical assistance in the renewable energy development	2014	2019	ESMAP & ASTATE	World Bank		2,415,000.00	-	-	2,415,000.00	1,610,000.00	
Providing waste to energy component to incineration in RWMF	This project aims to establish a 2MW waste-to-energy and desalination plant in three islands; Hdh. Kulhudhufushi, R. Vandhoo and Addu City of Maldives	2017	2019	ADFD	Ministry of Environment & Fenaka	IRENA	3,483,500.00	-	-	3,483,500.00	1,161,166.67	
Total							80,216,429.00	76,000,000.00	38,340,835.00	194,557,264.00	157,504,066.92	

**Table 21: Cross- Cutting Donor funded Projects**

Activity	Description of Activity	Start Year	End Year	Donor	Implementing Entity	Supporting Entity/s	Support Received (USD)				Total budget allocated for the Reporting Period (USD)	
							Grant	Loan	Co-finance	Total		
The NIE Accreditation support to the Government	Develop the capacity of Maldives for direct access to the Adaptation Fund (AF) including project/program formulation, financial management, procurement, monitoring and evaluation that are needed for accreditation as NIEs by the AF and support NIE to develop project proposals to access the AF	2013	2017	UNEP	Ministry of Environment		300,000.00	-	-	300,000.00	240,000.00	
Maldives Readiness Project; Establishing and strengthening NDA and Developing Strategic Framework for Engagement with the GCF Maldives	Establishing and strengthening the National Designated Authority (NDA) and developing strategic framework for engagement with the GCF in Maldives	2017	2018	GCF	Ministry of Environment	UNEP	238,740.00	-	-	238,740.00	238,740.00	
Low Emission Climate Resilient Development (LECRed)	The programme assists the Laamu Atoll and its islands to realize low emission and climate resilient development (LECRed). The aim is that the local development plans will evolve from stand-alone action plans into more strategic and evidence-based instruments, which are climate smart and able to mobilize public and private investment	2013	2016	One UN Fund	UNDP		9,200,000.00	-	-	9,200,000.00	6,900,000.00	
Maldives Clean Environment Project	The development objective of Clean Environment Project for Maldives is to improve solid waste management in selected zones	2017	2023	IDA/ World Bank	Ministry of Environment		17,500,000.00	-	-	17,500,000.00	2,500,000.00	
Preparation of intended nationally determined contribution to the 2015 agreement under UNFCCC	To prepare and submit the Nationally Determined Contributions of Maldives to the 2015 UNFCCC agreement and to have institutional arrangement in place to support this	2015	2017	GEF	Ministry of Environment	UNEP	200,000.00	-	12,000.00	212,000.00	212,000.00	

Activity	Description of Activity	Start Year	End Year	Donor	Implementing Entity	Supporting Entity/s	Support Received (USD)				Total budget allocated for the Reporting Period (USD)
							Grant	Loan	Co-finance	Total	
Cooperation in the field of climate change vulnerability, risk assessment, adaptation and mitigation	This Bilateral Programme focuses on the following: Improving of Climate Data Collection, Management and Forecasting; Early Warning Systems Water Scarcity Challenges (Water Treatment, Mainly Water Desalinization), Development of the Use of Renewable Energies, in order to Achieve the Established National Target and Capacity Building; Environmental Education and Training	2015	2020	Government of Italy	Ministry of Environment		4,664,380.00	-	-	4,664,380.00	2,332,190.00
Maldives Environment Management Project (MEMP) Additional Finance	The main aim of the Project is to provide the Republic of Maldives with the capacity to effectively manage environmental risks and threats to fragile coral reefs as well as marine habitats resulting from tourism development, increased solid waste disposal, fisheries and global climate change.	2015	2016	IDA/World Bank	Ministry of Environment		3,300,000.00	-	183,000.00	3,483,000.00	3,483,000.00
Preparation of the Biennial Update Report to the UNFCCC	To prepare and submit the 1st Biennial Update Report of Maldives to the UNFCCC	2017	2019	GEF	Ministry of Environment	UNEP	342,000.00	-	48,000.00	390,000.00	130,000.00
Second National Communication	To prepare and submit the Second National Communication of Maldives to the UNFCCC	2012	2016	GEF	Ministry of Environment	UNEP	480,000.00	-	100,856.00	580,856.00	348,513.60
Maldives Climate Change Act	To develop a Climate Change Act in the Maldives	2017	2018	UNEP	Ministry of Environment		15,000.00	-	-	15,000.00	7,500.00
Total							36,240,120.00	-	343,856.00	36,583,976.00	13,891,943.00

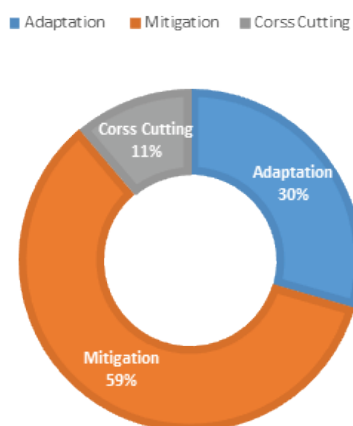


Figure 20: Percentage share of donor funded climate finance in the Maldives

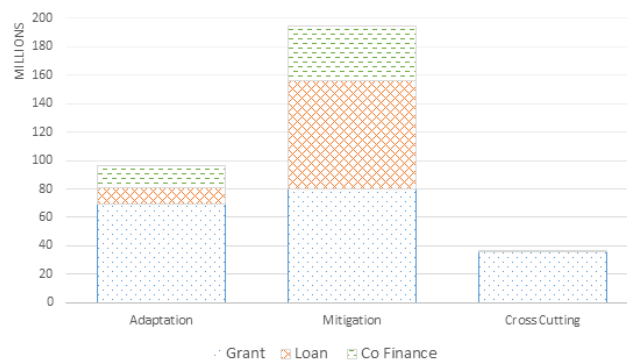


Figure 21: Summary of type and amount (USD) of support received towards adaptation, mitigation and cross cutting donor funded projects

## 6.1.2 Overall climate finance landscape of Maldives including own contributions

As per the UNFCCC guidelines for the preparation of Biennial Update Reports (BUR), Table 23 provides a summary of the overall climate finance landscape of Maldives;

- 35% of the financing of climate change related actions and investments stem from the national budget of the Maldives.
- Approximately a similar proportion is made up of concessional loans, i.e. financing that the Maldives eventually will repay.
- 85% of investments relates to physical infrastructure. (Coastal protection and Solar PV generators and waste infrastructure)
- About 30% of climate finance provided for capacity building according to donor recordings may not be recorded in Maldives; i.e. inconsistencies between those reported in donor reports and the recordings of the Ministry
- The annual climate finance attribution corresponds to about 2.4% of GDP (4.6 billion USD in 2017) and the direct national budget allocations correspond to 0.8% of Maldives' GDP in 2017

Table 22: Summary table showing the overall climate finance landscape of Maldives including both donor funded and own contributions

Reporting Period: 2014-2017 (both inclusive)											
Funding sources	Preparation of BUR (incl nat. comm)			climate change actions contained in BUR			of which				
	finance	capacity	tech supp.	techtrans	tech supp.	techtrans	total	grants	conc. loans	guaranties	% of total
<i>Multilateral</i>											
Global Environment Facility		414,000			2,913,750	2,283,403		5,823,153			
LDC Fund											
Special Climate Change Fund								990,263			
Adaptation Fund					3,314,000			3,314,000			
Green Climate Fund (GCF)					11,818,182	6,695,927		18,664,109			
Other UN											
UN Environment											
UNDP (LCDF)					1,922,142			427,500			
UNDP co-funding					939,875			1,922,142			
UNISDR					101,050			939,875			
								101,050			
<b>Subtotal</b>	-	414,000	-	-	21,008,999	8,979,330	32,182,092	32,182,092	-	-	7.35%
<i>Multilateral finance institutions</i>											
World Bank											
SREP					361,428	3,300,000		5,271,428	9,347,200		
CCAP									12,000,000		
CCTF					563,317			563,317			
IFC								1,313,927			
Asian Development Bank											
European Investment Bank					14,449,712	38,000,000			52,449,712		
OFID									34,834,000		
									43,566,261		
IDA Guarantee									16,000,000	16,000,000	
Islamic Development Bank									14,949,817		
<b>Subtotal</b>					16,059,712	42,613,927	190,295,662	7,148,672	167,146,990	16,000,000	43.46%
<i>Annex II and other developed Parties</i>											
Grants											
Italy											
Denmark									2,000,000		
Japan					293,886			4,168,110			
United Arab Emirates						16,793,040		21,793,040			
Germany						1,161,167		1,161,167			
EU comm								1,360,000			
Kuwait								2,526,000			
Concessional loans								14,693,061	12,500,000		
France (AFD)											
									5,557,219		
<b>subtotal</b>					2,819,886	30,454,207	65,758,597	47,701,378	18,057,219	-	15.02%
<i>Party contribution</i>											
In-kind support											
Indicative co-financing											
PSIP waste											
PSIP Coastal					6,205,420						
GOM Water & Sanitation											
PSIP water & sanitation											
private											
<b>subtotal</b>					6,205,420	-	149,643,558				34.17%
<b>Grand total</b>	-	414,000	-	-	46,094,017	82,047,464	437,879,909	87,032,142	185,204,209	16,000,000	
% of total					10.53%	18.74%	100.00%	19.88%	42.30%	3.65%	

## Barriers, Gaps and Needs for tracking Climate

Finance in the Maldives Ministry of Finance provides a sufficiently detailed purpose-based distribution of the budgets, however no attempts are made to divide budgets between adaptation and mitigation. Neither have any markers been used to grade the relevance of budgets to climate change ('primarily' or 'significantly' targeting climate change purposes), although many investments have dual purposes. Investments in the water sector protect the water resources in face of climate change, but it is also ensuring the provision of safe drinking water. Similarly, solar-PV panels supply electricity, but also helps mitigate climate change. Such investments are considered as fully climate related and 100% of their funds are included in the tracking of climate finance.

Apart from above mentioned discrepancies there is additional information from other sources that has not been tracked. These relate to;

- technical assistance delivered in programmes implemented directly by donor/development agencies
- lack of markers and lack of detail in the national budget
- programs implemented by the councils independent of government resources
- programmes implemented by NGOs
- private sector investments
- A more detailed stakeholder consultation process (see Annex for list of stakeholders consulted) undertaken highlighted the following barriers, gaps and needs for tracking climate finance in Maldives;
- Limited access to climate finance data for national projects and limited participation of line ministries in data analysis and reporting of finance data.
- The contributions from donors to the Maldives are trackable, but requires the consultation with several sources that in itself are not systematically organized. Improving data access, in either a separate system, a system linked with the national budget, or a system that improves the access to the current sources of information is needed.

- The MoU<sup>2</sup> system is incomplete as it covers only donor-funded activities that include financial contributions to entities within the Maldives. In-kind technical assistance or trainings are not recorded in the system. Incorporating this reporting requirement into the MoU could be a solution to capture these climate actions within the overall climate finance tracking system.
- MoUs are not centrally registered, although copies of the MoUs exist in the Ministry of Finance. A central registry of MoUs encompassing financial data, including values of training delivered in-kind is needed.
- There are inconsistencies between different publications/reports on climate finance, even some cases of the same institution. This is largely due to no defined categorization of recording data related to climate finance. A clear methodology and categorization of climate finance data by use and application is needed to ensure consistent assessment and reporting of climate data.
- The main challenge is recording and reporting of the private sector's climate-related investments. So far, there has been no recording of private climate finance in the Maldives. Among likely investors, more than 100 resorts are located on private islands that attract little public investment. The resorts may themselves undertake a number of investments, from water conservation to coastal protection and solar PV installations, in their local infrastructure, that may be classified as climate finance. Indirect assessment may be attempted through recordings by the port and customs authorities of imports of e.g. solar PV panels, but such recordings would only capture a fraction of project costs that also include engineering and construction. This is the case for many adaptation activities as well.

### 6.1.3 Scope for further work/improvements

Maldives is currently in the process of preparing a proposal for CBIT (Refer to Chapter 7 for more information), which would explicitly address the above discussed gaps and barriers. This project would focus on two key elements; a tagging system for identifying government budget allocation to address climate change; and, system to collate information on climate change support from non-governmental, national and international, actors. This will be built on existing elements of donor fund reporting system and tagging system being developed

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2 Most donor funded activities established as collaborative actions between a line ministry and the donor are based on a Memorandum of Understanding that also stipulates the budget.

for SDGs. Furthermore, methodology and tools for budget tagging as well as information on climate support from international donors and other non-state actors implemented either through government or directly through non-state actors. The key output of this would be a web based reporting system for climate finance and transparent display of finance received and its use which would allow long term and comprehensive tracking of climate finance.

## 6.2 NON-MONETIZED CAPACITY BUILDING AND TECHNOLOGY TRANSFER RECEIVED

Table 23 provides information on non-monetized capacity building and technology support received for the period 2014-2017. Maldives does not have a straight forward way of collecting this information, therefore the below table includes

information collect via the CTF tables submitted by Annex 2 countries and only those trainings recorded at the Ministry of Environment.

**Table 23 List of non-monetized capacity building and technology transfer received from 2014-2017**

Description of Activity	Climate Relevance	Donor	Recipient Type
Energy + supports development of low-carbon and energy sector strategies, establish reference levels, and strengthen technical and institutional capacity to support private sector investment in developing countries. In this regard it will support the implementation of policy and legal reforms and the establishment of monitoring and reporting systems, and will promote regulatory regimes that provide incentives for commercial investment	Cross- Cutting	Norway	Multi-Country
The European Capacity building initiative (CBIT) was launched by Oxford Climate Policy (OCP) and International Institute of Environment and Development (IIED). This initiative builds and sustains the negotiating capacity of developing countries and builds trust between the developing and developed country climate change negotiators, in support of the UN climate change negotiations	Cross-cutting	Sweden	Multi-Country
Initiative to support developing countries to increased capacity related to greenhouse gas reporting under the UN climate change convention. The support is channeled through the UNFCCC secretariat that holds training to improve MRV of greenhouse gas emissions, targeting non-annex 1 countries	Cross-Cutting	Sweden	Multi- Country
Support (and demonstration) to the technical and economic viability of floating solar systems; capacity building for Maldivian SMEs and policy makers on business opportunities and economic welfare effects such as lowering of power prices; development of hybrid solar PV financing and operation models for different stakeholders (including community owned mini-grid operators)	Mitigation (Energy Sector)	Austria	Multi- Country
Training on sustainable Tourism, Coastal Area Risk Management and Reef Area Monitoring	Adaptation	SAARC	Multi-Country
Workshop on coastal zone issues and impacts on Coastal Communities	Adaptation	SAARC	SAARC member Countries
Seminar on Climate Change and Green Low-Carbon	Mitigation	China	SAARC member countries
Annual International Training Course; Global Warming Mitigation and Adaptation by balancing sustainable energy management	Cross-cutting	Thailand	Multi-Country
Singapore Cooperation Programme Training Award (SCPTA)/ Small Island Developing States Technical Cooperation Programme (SIDSTEC); Climate Change and Energy Sustainability	Mitigation	Singapore	SIDS
JICA Enhancement and solid waste management capacity (Advanced, Planning and Policy)	Mitigation	Japan	Multi-Country
JICA Group and Regional focused training; Development of Strategies on Climate Change	Cross-Cutting	Japan	Multi-Country
JICA Master's Programme on Flood Disaster Mitigation	Mitigation	Japan	Multi-Country
International Training Course on wind turbine technology and applications	Mitigation	India	Multi-Country
Study for Wind Energy Project for Remote islands in the Maldives	Mitigation (Energy Sector)	Japan	Multi-Country



Description of Activity	Climate Relevance	Donor	Recipient Type
Singapore Cooperation Programme Training Award (SCPTA)/ Small Island Developing States Technical Cooperation Programme (SIDSTEC); Training on Climate Change Impacts and Adaptation Strategies	Adaptation	Singapore	SIDS
Master's Programme for global leaders in Environmental Policy	Cross Cutting	Korea	Multi-Country
Singapore Cooperation Programme Training Award (SCPTA)/ Small Island Developing States Technical Cooperation Programme (SIDSTEC); Energy Efficiency and Management- policies, preferences and practices	Mitigation	Singapore	SIDS
JICA; Adaptation to Climate Change	Adaptation	Japan	Multi-Country
Japan-Singapore Partnership Programme; Training on Climate Change Adaptation Strategies for Small Island Developing States	Adaptation	Singapore & Japan	SIDS
International Training Course on Climate Change	Cross Cutting	China	Multi-Country
SAARC Special Training Programme on Renewable Energy	Mitigation	SAARC	SAARC Member Countries
Thailand's Annual International Training Course (AITC); Best Available Technique and Best Environmental Practice under the context of United Nations Industrial Development Organization	Cross Cutting	Thailand	Multi-Country
GIZ Asian Regional Workshop on GHG and non-GHG Indicators	Mitigation	Germany	Multi-Country
Workshop on building of sustainable national greenhouse Gas inventory Management Systems and the use of 2006 IPCC guidelines	Mitigation	UNFCCC	Asia Pacific and Eastern Europe
Malaysia Technical Cooperation Programme: Renewable and Green Energy as Alternatives: TNB experience towards Greener Malaysia	Mitigation	Malaysia	Multi-Country
Malaysia Technical Cooperation Programme: Environmental Management and Pollution Control	Mitigation	Malaysia	Multi-Country
Provides (1) information on country performance in terms of the market conditions, policies, institutions, laws, and regulations that contribute to an enabling environment for private investment; (2) builds on existing measures, such as the World Bank's	Mitigation (Energy Sector)	United States	Multi Country
Provision of Goods for addressing climate change	Cross Cutting	China	Maldives

## 6.3 SUPPORT RECEIVED FOR BUR PREPARATION

Table 24 summarizes support received during the preparation of the BUR. Apart from the GEF financial support Maldives received (Table 23), the rest were mainly non monetized capacity building and technical assistance.

**Table 24 Summary of capacity building and technical assistance received during the preparation of the BUR**

Activity	Capacity Needed	Capacity Received	Source of Support
Training Workshop on Biennial Update Report (BUR)	Guidance on reporting provisions and approaches to report all chapters in the BUR  Elementary data handling and analysis	Reporting provisions under UNFCCC  Basic elementary data handling and analysis; including best practices for inventory compilation, modelling of mitigation potentials of identified mitigation actions and tracking of climate finance	UNEP DTU Partnership
Long-range energy Alternatives Planning System (LEAP) training and Data Set Development	Application of LEAP-IBC Software as a tool to develop mitigation strategies for climate and air pollutants	Demonstrated functions of the LEAP-IBC Software  Country specific LEAP- IBC datasets were developed with a complete emission inventory for the base year and baseline scenario to estimate emissions of SLCs, air pollutants and greenhouse gases  Initial list of mitigation scenarios prepared to be evaluated using LEAP-IBC	Stockholm Environment Institute, Sweden
Greenhouse Gas Inventory Training	Greenhouse Gas Management; enhance abilities for measurement, reporting and verification (MRV) of greenhouse gases in the Maldives	Sharing of know-how of the MRV for sectoral inventory compilation particularly in energy and waste sectors  Methods to improve existing GHG inventory in the Maldives	Greenhouse Gas Inventory and Research Centre of Korea, GIR



## 6.4 INFORMATION ON SUPPORT NEEDED

Table 25 contains the summary of information on the support needed (Financial, technical and capacity building needs) to be able to track and report climate change actions.

**Table 25 Support needed for Climate Change Actions**

Activity	Alignment to National Policies	Implementing Entities	Scope of Support Needed
<b>Adaptation and Building Climate Resilience</b>			
Enhancing weather and climate monitoring in the Maldives and developing human resource capacity at Maldives Meteorological Service	In line with Goal 3 of the Maldives Climate Change Policy Framework  Integrated Adaptation Planning goals under NDC  Strategic Action Plan	Ministry of Environment and Maldives Meteorological Service	Capacity Building and Technology Transfer
Institutional strengthening for coastal monitoring	In line with Goal 3 of Maldives Climate Change Policy Framework  Integrated Adaptation Planning goals under NDC  Coastal protection guidelines prepared under the ICCR project  Strategic Action Plan	Ministry of Environment and Ministry of National Planning and Infrastructure	Capacity Building and low-cost financial grant
Assessment of vulnerabilities and risk reduction of health sector to vector borne diseases due to climate change impacts.	In line with Goal 3 of Maldives Climate Change Policy Framework  Integrated Adaptation Planning goals under NDC  Strategic Action Plan	Ministry of Health	Capacity Building
Enhancing Infrastructure Resilience to Climate Change Impacts	In line with Goal 3 of Maldives Climate Change Policy Framework  Integrated Adaptation Planning goals under NDC  Strategic Action Plan  Building Regulations  Sustainable Development Goals	Ministry of National Planning and Infrastructure	Low Cost Financial Grant
Strengthening Health Sector Emergency Response to floods and sea swells.	In line with Goal 3 of Maldives Climate Change Policy Framework  Integrated Adaptation Planning goals under NDC  Strategic Action Plan  Health Master Plan  National Disaster Management Act  Health Emergency Operations Plan (2018)	Ministry of Health and National Disaster Management Authority (NDMA)	Low Cost Financial Grant and Capacity Building
Island-Smart Agriculture and ensuring Food Security	In line with Goal 3 of Maldives Climate Change Policy Framework  Integrated Adaptation Planning goals under NDC  Strategic Action Plan  National Agricultural Action Plan	Ministry of Fisheries, Marine Resources and Agriculture	Low cost financial grant

Activity	Alignment to National Policies	Implementing Entities	Scope of Support Needed
Blue Growth and climate-resilient livelihoods for Maldives Fisheries	In line with Goal 3 of Maldives Climate Change Policy Framework  Integrated Adaptation Planning goals under NDC  Strategic Action Plan	Ministry of Fisheries and Agriculture	Low cost financial grant and Capacity Building
Adaptation in the tourism sector	In line with Goal 3 of Maldives Climate Change Policy Framework  Integrated Adaptation Planning goals under NDC  Strategic Action Plan  4 <sup>th</sup> Tourism Master Plan  Tourism Act	Ministry of Tourism	Low-cost financial grant
Enhancing Water Security	In line with Goal 3 of Maldives Climate Change Policy Framework  Integrated Adaptation Planning goals under NDC  Strategic Action Plan  National Water and Sewerage Policy  National Spatial Plan	Ministry of Environment and Ministry of National Planning and Infrastructure	Low-cost financial grant
Establish a GIS integrated national level systems for disaster management information, communication and Coordination	Strategic Action Plan  NDMA Strategic Goals  Disaster Management Act (2015)  Sendai Framework for DRR	National Disaster Management Authority	Capacity Building _ Financial Grant + Tech Transfer
Assessment of Health risks due to air pollutants	Strategic Action Plan  Breathelife Action Plan  Health Master Plan  National Action Plan on Air Pollutants	Ministry of Health, HPA and Ministry of Environment	Capacity Building and Low cost financial grant
<b>Mitigation and Enhanced GHG</b>			
Explore financial schemes to finance solar PV, wind systems, LNG and bioethanol blend and creating awareness to households	In line with Goal 2 of the Maldives Climate Change Policy Framework  Goal 3 of Maldives Energy Policy and Strategy and Mitigation goals of NDC	Ministry of Environment, Ministry of Tourism & Utilities	Low-cost financial grant
Business Loan Programme for GHG emission reductions	In line with Goal 2 of the Maldives Climate Change Policy Framework  Mitigation goals of NDC  Goal 3 of the Maldives Energy Policy and Strategy	Bank of Maldives	Low-cost Financial grant
Detailed study on Solar Water heaters with electrical back up at the resorts and plan to phase out or reduce conventional water heaters in resorts	In line with Goal 2 of Maldives Climate Change Policy Framework  Maldives Energy Policy and Strategy  Mitigation goals of NDC	Ministry of Tourism	Low cost Financial grant

Activity	Alignment to National Policies	Implementing Entities	Scope of Support Needed
Deployment of clean Energy in the outer islands of the Maldives	In line with Goal 2 of the Maldives Climate Change Policy Framework  Mitigation goals of NDC and Goal 1 and 3 of the Maldives Energy Policy and Strategy	Ministry of Environment	Low-cost Financial grant
Establish Health Care Waste Management systems in health facilities to reduce emissions	In line with Goal 2 of the Maldives Climate Change Policy Framework  Mitigation goals of NDC and output 2.7 of the Health Masterplan	Ministry of Health	Low-cost Financial grant
<b>Enhanced transparency</b>			
Enhanced GHG Inventory	In line with Goal 4 of Maldives Climate Change Policy Framework	Ministry of Environment, Utilities, Line Ministries and Tourist Resorts	Capacity Building
Improved reporting of mitigation actions and tracking of NDC	In line with Goal 4 of the Maldives Climate Change Policy Framework	Ministry of Environment, Utilities, Line Ministries and Tourist Resorts	Capacity Building
Enhanced adaptation reporting under the Paris Agreement	In line with Goal 4 of the Maldives Climate Change Policy Framework	Ministry of Environment, Utilities, Line Ministries and Tourist Resorts	Capacity Building
Improved reporting of support received and needed	In line with Maldives Climate Change Policy Framework	Ministry of Environment, Ministry of Finance and other line ministries	Capacity Building

## **7. DOMESTIC MEASUREMENT, REPORTING AND VERIFICATION (MRV)**

Measurement, Reporting and Verification (MRV) systems are an important element of the mitigation framework developed under UNFCCC, with a key objective of increasing the transparency of mitigation efforts made by developing countries while also building a sense of mutual trust and confidence among parties. A robust MRV system would aid in effectively monitoring and evaluating a country's progress in implementing its mitigation actions in terms of greenhouse

gas reductions, cost effectiveness and sustainable development benefits (UNFCCC, 2014). MRV is also central to effectively implementing the Nationally Determined Contributions (NDC) submitted under the Paris Agreement, which describes the country's mitigation goals and policies. Keeping track of mitigation actions is imperative in driving a country towards low emission development.

## 7.1 DESCRIPTION OF EXISTING MRV IN MALDIVES

Maldives strongly lacks a comprehensive national MRV system. Individual projects/departments do collect and monitor data to a certain extent and this is usually done on an ad hoc basis and usually during the project time period. The list of key

stakeholders relevant to the mitigation sector in the country, their mandate, the level/type of data collected, means of data collection and verification means are included in Annex.

## 7.2 GAP ANALYSIS OF EXISTING MRV SYSTEM

The existing institutional arrangements for MRV were explained in Chapter 2. The evaluation of this institutional set-up shows a dire need for the establishment of a robust MRV system in the country. Five key areas were highlighted during the process; Legal, Institutional, Procedural, Availability and

Management of GHG data for MRV systems and indicators for mitigation actions. (via UNEP DTU tool<sup>3</sup>). These are enlisted in Table 26.

3 Assessment of the State of National Transparency Systems developed by UNEP DTU

**Table 26 Summary of the Existing gaps in the MRV system**

Legal Aspects	
Legal mandate	A legal mandate is only identified for the Maldives Climate Change Team at the Ministry of Environment and Energy. This follows its mandate to carry out the obligations of all climate change related International treaties and activities related to organizations that the Maldives is party to.
Compliance and Legal Frameworks	No compliance system defined and no existing legal frameworks for MRV in the country
Institutional Aspects	
Institutional Setup	Although the Department of Climate Change has a clear role as a coordinator of climate initiatives in the country, and stakeholders were identified, the official definition of a system with institutions participating on a regular basis is still missing. This implies that no coordination work made by the Department of Climate Change team is based upon a formal system.
Roles and Responsibilities	It is declared that roles and responsibilities of stakeholders (ministries, government departments, private sector and civil society) are only defined to a small extent and even for sub-national governments or academia they are not defined at all
Capacity and skills training	The core of the more solid climate expertise at Government level is limited to the members of the Department of Climate Change team, but technical capacities are lacking in top line ministries and stakeholders in general.
Sectoral arrangements for collaboration	Sectoral arrangements for collaboration is not in place
Procedural Aspects	
Database management systems and Information systems	Data base management systems and informational systems are not in place, but with initial level of development
Tools and Guidelines	Limited tools and guidelines for data collection and this is limited mostly to the team of the Department of Climate Change
Technical working groups	Technical Working groups are not identified on a regular basis, unless for the preparation of consolidated reporting documents to UNFCCC, including National Communications and BUR on a specific basis.
Baseline setting: Projections	Lacks the capacities to set baselines for projections
Verification	Data verification protocols are not in place
Stakeholder engagement	Stakeholder engagement is limited to publication of data

Availability and Management of GHG Data for MRV System	
Identification of key datasets and templates or guidelines for data collection and reporting at sectoral level	To a moderate extent
Obstacles identified for data collection	Cost of data;  Submission of data is non compulsory
Data collection performed on a voluntary basis	Not at all
Strategy for data management including regular updates, backup and archive routines	To some extent
Policies for data handling in place including confidentiality and privacy	To a small extent
National GHG registry for collecting emissions data from regulated facilities	Not at all
Public availability of GHG data	To some extent
Quality Assurance & Quality Control at national level including a plan with activities and responsibilities	Not at all currently, but external Quality Assurance will be used for GHG inventory compilation
Quality Assurance & Quality Control at sectorial level	Some level of quality control is done at sectorial level
Indicators for Mitigation Actions	
Initial identification of mitigation indicators, templates for compilation of data on indicators and timelines for compilation of data on indicators	To some extent
Data on indicators collected on a regular basis	Every two year
QA & QC for mitigation actions	To a small extent

This gap analysis identifies the following needs, in order to build a system for tracking and managing GHG emissions for policy data and mitigation actions.

- Need to improve involvement of institutions within MRV systems at governmental level;
- Need for further capacity building for increasing expertise of officials of related institutions with MRV matters. This

includes technical as well as organizational aspects;

- Need of institutional setting for data generation/collection and reporting, including limitations of staff;
- Need of institutional agreements for MRV data sharing;
- Need for IT infrastructure to store and maintain MRV data in the Government institutions.

## 7.3 ENHANCED MRV SYSTEM FOR MITIGATION ACTIONS IN THE MALDIVES

In addressing the gaps identified in section 7.2, Maldives is currently working with partners to design a comprehensive MRV system for mitigation in the country. The establishment of a national MRV system require institutional, legal and procedural arrangements to collect, verify and disseminate the information. It is relevant to consider that ensuring proper authorisations and delegation of responsibilities are important elements in the governance of such a scheme. Within this newly

designed MRV system, Maldives wishes to build the capacity of government and relevant institutions and stakeholders for GHG emissions data management, including the preparation of scenarios, projections and GHG emission reductions due to mitigation actions.

# RECOMMENDATIONS

Based on the gaps identified and in consideration with the national circumstances, Maldives considers the following recommendations to enhance the existing MRV system;

1. Strengthening national capacities for institutional arrangements. This includes;
  - Ability to engage all relevant stakeholders through consultations designed to elicit their input, so that this can be taken into consideration, thus increasing buy-in from stakeholders.
  - Competence to conduct a revision of the regulatory framework, to streamline and complement existing laws and regulations and strengthen related governmental processes and entities
  - Ability to monitor progress and report on it, making the best use of existing data collection mechanisms and strengthening related capabilities wherever needed.
2. Resources to train relevant government agency staff (and possibly non-government agency staff too) with a view to increasing the technical and managerial skills of these individuals.
3. Establishment of coordination mechanisms, where clear roles and responsibilities are defined for all relevant actors and laying out procedures that should guide their work. This includes setting up formal working groups and protocols to guide the coordination process.
4. Building the human capacities of government institutions charged with MRV mechanism. This also refers to the expertise and the enabling framework that is required to put the expertise into practical use. These include:
  - Integrating learning into the MRV mechanism process
  - Centralizing learning activities in one single entity
  - Introducing incentives to avoid high staff turnover
  - Considering the needs of all actors
5. Bridging gaps in stakeholder consultation capacity by introducing a consultation mandate and protocols to ensure an inclusive consultation process.
6. Identifying gaps in the existing regulatory framework, by taking an integrated approach and ensuring sufficient and timely communication flows.
7. Strengthening the monitoring and reporting system by using a modular approach and creating guidelines and protocols on how all activities associated with monitoring and reporting are conducted

## 7.3.1 Current initiatives to enhance existing MRV system to comply with enhanced transparency framework of Paris agreement

### 7.3.1.1 GHG Inventory Compilation, MRV of Mitigation Actions and tracking of NDC

Maldives is expected to begin work on the Capacity Building Initiative for Transparency (CBIT) project next year, which is aimed to strengthen the capacity for implementing a formal MRV system and enhancing the capacity of institutions in monitoring and evaluation of adaptation actions. Additionally, CBIT would also support in building the technical capacity of

the public institutions and other non-state actors for the development of the guidelines for tracking climate finance in the Maldives and enabling conditions for their implementation. The mitigation components of this proposed project is enlisted in Table 27.

**Table 27 Expected outcomes and components of the project for NDC tracking and mitigation actions**

Components	Proposed Activities
Institutional arrangements, and processes to collect and assess information (i) for GHG inventory preparation and (ii) for tracking and reporting climate change Mitigation actions strengthened	Establishing a revised institutional arrangement which defines role and responsibilities to operationalize an MRV system at sectoral and national level;  Data sharing agreements and MOUs (possibly empowered by laws and regulations)
Indicators for tracking mitigation related CCAs, methods and tools for estimating indicators, templates and protocols for collecting data to estimate indicators, to ensure consistency, standardization and sustainability developed	Develop Indicators for mitigation actions, effects and co-benefits for key policies and measures in consultation with national experts under the coordination of the Ministry of Environment and Energy for inclusion in the national MRV framework.  Setting up an online national climate change data hub /data base managed by National Bureau of Statistics (NBS)
Data base storage and management system to enable data reporting, assessment and transparent sharing established and operationalized	enable coordination, maximize learning opportunities, and facilitate transparency enhancements;  encourage other countries, the GEF Partner Agencies, and other relevant entities and institutions with related programming activities to enhance national, multilateral, and bilaterally supported capacity-building initiatives;  facilitate the coordination of transparency-related initiatives and support (e.g. donor supporting efforts).
Training materials developed and key staff involved in operationalizing the systems trained to enable transparent and comprehensive reporting	Training staff and relevant stakeholders on emission factors;  Training of the staff and relevant stakeholders for all the established data bases;  Awareness raising and training staff and relevant stakeholders on data collection and archiving;  Training of staff on QA/QC;  Training of staff from utilities and stakeholders;  Training of staffs and stakeholders on statistical analysis

ICAT is an initiative which would strongly complement the components of CBIT. Maldives has identified waste as the focus sector of ICAT with the overall objective of achieving the following; develop and implement appropriate data collection, data management procedures and further legal instruments needed for the robust establishment of an MRV system in the waste sector. In this regard, ICAT would particularly address

the lack of data collection and data management methodologies and procedures in the sector. Below are the main 3 components of this project;

- Outcome 1: Data collection and data management methodologies and procedures for the waste management sector are developed and implemented



- Outcome 2: Stakeholders involved in generation of activity data in the waste management sector are trained in the usage of the methodologies for data collection and data management, and a continuous capacity building process is in place and operating
- Outcome 3: A guideline/roadmap for creating the best enabling environment for a continuous data reporting and data sharing has been developed.

## Tracking of support needed and received

Since 2011, the Government of the Maldives through its Ministry of Finance and Treasury has been preparing line-item budgets with some additional efforts to develop a programme-based budget. As a result, the national budget for

2012 grouped all projects into Socio-Economics Development Programme and Climate Change Adaptation Programme. However, this was not sustained for 2013 budget and since then the budget has been line-itemized. The analysis undertaken for the SNC report identified an important need to establish a system which enables tracking of climate finance in the country. To address this need, a tracking system is being developed under the BUR project. Furthermore, the GCF readiness proposal which is currently being implemented has a provision for monitoring, oversight and streamlining of climate finance.

On this basis, the CBIT project will support the Maldives through the following (See Table 28 ) outputs and activities:

**Table 28: Components and outputs for tracking climate support received under CBIT project**

Output	Proposed Activities
Tracking systems for financial allocations by government budgets to support climate change actions developed and integrated in national financial systems.	<p>Establish a working group for the coordination of the delivery of the above outputs;</p> <p>Elaborating on the tagging system in close collaboration with Ministry of Finance addressing the outputs mentioned above;</p> <p>Establishing a registry of bilateral projects based on MoUs and develop procedures for future registration of bilateral activities;</p> <p>Establish a working group with private sector representatives and other relevant stakeholders with the aim to develop elements of a tracking system for private financing of climate change related infrastructure.</p>
Systems for tracking and collating financial information on bilateral and multilateral projects for supporting climate change actions	<p>An objective to improve data access, either in a separate system, a system linked with the national budget, or a system that improves the access to the current sources of information;</p> <p>Development of a central registry of MoUs encompassing financial data, including values of training delivered in kind</p>
Training material developed and key staff in organizations trained on tracking of finances for climate change actions	<p>To identify training needs in sectors, tools/procedures/guidelines and other means to strengthen tracking of climate finance will be developed;</p> <p>To provide training on reporting climate finance level via pilot testing of climate finance tracking guidelines in at least one key Ministry/Department;</p>

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## 9. ANNEXES

### 9.1 EMISSIONS TABLES

The following annexes provides the emissions tables. Following notation keys are used in the table.

IE (Included Elsewhere) - Fuel combustion for Manufacturing Industries are mostly associated with fisheries industry and thus it is included under other sector/fisheries

NE (Not Estimated) - For existing emissions and removals which have not been estimated. Data not available for these estimations and is assumed to be small.

NE\*\* - HFC gases introduced as part of replacing HCFC, however national-wide replacement started post 2011. Relevant data such as life time of the equipment, leakage information was not available in the sector.

NO (Not Occurring) – for activities or processes that do not occur for a particular gas or source/sink category within the country

NA (Not Applicable) for activities in a given source/sink category which do not result in emissions or removals of a specific gas.

Greenhouse gas source and sink categories (Inventory Year: 2011)	Net CO2 (Gg)	CH4 (Gg)	N2O (Gg)	CO Gg	NOx (Gg)	NMVOCs (Gg)	SOx (Gg)
Total National Emissions and Removals	1236.972	1.514	0.042	NE	NE	NE	NE
1 - Energy	1227.072	0.088	0.016	NE	NE	NE	NE
1A - Fuel Combustion Activities	1227.072	0.088	0.016	NE	NE	NE	NE
1A1 - Energy Industries	818.854	0.033	0.007	NE	NE	NE	NE
1A2 - Manufacturing Industries and Construction (ISIC)	IE	IE	IE	NA	NA	NA	NA
1A3 - Transport	297.776	0.042	0.009	NE	NE	NE	NE
1A4 - Other Sectors	110.442	0.013	0.001	NE	NE	NE	NE
1A5 - Other	NO	NO	NO	NO	NO	NO	NO
1B - Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO
1B1 - Solid Fuels	NO	NO	NO	NO	NO	NO	NO
1B2 - Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO
2 - Industrial Processes	NO	NO	NO	NO	NO	NO	NO
2A - Mineral Products	NO	NO	NO	NO	NO	NO	NO
2B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO
2C - Metal Production	NO	NO	NO	NO	NO	NO	NO
2D - Other Production	NO	NO	NA	NO	NO	NO	NO
2E - Production of Halocarbons and Sulphur Hexafluoride	NA	NA	NA	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NA	NA	NA	NA	NO	NO	NO
2G - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
3 - Solvent and Other Product Use	NO	NO	NO	NO	NO	NO	NO
4 - Agriculture	NA	NE	NE	NE	NE	NE	NE
4A - Enteric Fermentation	NA	NE	NA	NE	NE	NE	NE
4B - Manure Management	NA	NE	NE	NE	NE	NE	NE
4C - Rice Cultivation	NA	NO	NA	NO	NO	NO	NO
4D - Agricultural Soils	NA	NO	NO	NO	NO	NO	NO
4E - Prescribed Burning of Savannas	NA	NO	NO	NO	NO	NO	NO
4F - Field Burning of Agricultural Residues	NA	NO	NO	NO	NO	NO	NO
4G - Other (please specify)	NA	NO	NO	NO	NO	NO	NO
5 - Land-Use Change & Forestry	NE	NE	NE	NE	NE	NE	NE
5A - Changes in Forest and Other Woody Biomass Stocks	NE	NA	NA	NE	NE	NE	NE
5B - Forest and Grassland Conversion	NE	NE	NE	NE	NE	NE	NE
5C - Abandonment of Managed Lands	NE	NA	NA	NE	NE	NE	NE
5D - CO2 Emissions and Removals from Soil	NO	NA	NO	NE	NE	NE	NE
5E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
6 - Waste	9.901	1.426	0.026	NE	NE	NE	NE
6A - Solid Waste Disposal on Land	NA	NO	NA	NO	NO	NO	NO
6B - Wastewater Handling	NA	NE	NE	NE	NE	NE	NE
6C - Waste Incineration	NE	NE	NE	NE	NE	NE	NE
6D - Other (please specify)	9.901	1.426	0.026	NO	NO	NO	NO
7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
Memo Items							
International Bunkers	372.217	0.003	0.010	NE	NE	NE	NE
1A3a1 - International Aviation	372.217	0.003	0.010	NE	NE	NE	NE
1A3d1 - International Marine (Bunkers)	NE	NE	NE	NE	NE	NE	NE
Multilateral operations	NO	NO	NO	NA	NA	NA	NA
CO2 emissions from biomass	NE	NA	NA	NA	NA	NA	NA

Inventory Year: 2011	HFC			PFC			SF6
Greenhouse gas source and sink categories	HFC-23 (Gg)	HFC-134 (Gg)	Other (Gg-CO2)	CF4 (Gg)	C2F6 (Gg)	Other (Gg-CO2)	SF6 (Gg)
Total National Emissions and Removals	NE**	NE**	NE**	NO	NO	NO	NO
1 - Energy	NA	NA	NA	NA	NA	NA	NA
1A - Fuel Combustion Activities	NA	NA	NA	NA	NA	NA	NA
1A1 - Energy Industries	NA	NA	NA	NA	NA	NA	NA
1A2 - Manufacturing Industries and Construction (ISIC)	NA	NA	NA	NA	NA	NA	NA
1A3 - Transport	NA	NA	NA	NA	NA	NA	NA
1A4 - Other Sectors	NA	NA	NA	NA	NA	NA	NA
1A5 - Other	NA	NA	NA	NA	NA	NA	NA
1B - Fugitive Emissions from Fuels	NA	NA	NA	NA	NA	NA	NA
1B1 - Solid Fuels	NA	NA	NA	NA	NA	NA	NA
1B2 - Oil and Natural Gas	NA	NA	NA	NA	NA	NA	NA
2 - Industrial Processes	NE**	NE**	NE**	NO	NO	NO	NO
2A - Mineral Products	NA	NA	NA	NA	NA	NA	NA
2B - Chemical Industry	NA	NA	NA	NA	NA	NA	NA
2C - Metal Production	NO	NO	NO	NO	NO	NO	NO
2D - Other Production	NA	NA	NA	NA	NA	NA	NA
2E - Production of Halocarbons and Sulphur Hexafluoride	NO	NO	NO	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NE**	NE**	NE**	NO	NO	NO	NO
2G - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
3 - Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA
4 - Agriculture	NA	NA	NA	NA	NA	NA	NA
4A - Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA
4B - Manure Management	NA	NA	NA	NA	NA	NA	NA
4C - Rice Cultivation	NA	NA	NA	NA	NA	NA	NA
4D - Agricultural Soils	NA	NA	NA	NA	NA	NA	NA
4E - Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA
4F - Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA	NA
4G - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
5 - Land-Use Change & Forestry	NA	NA	NA	NA	NA	NA	NA
5A - Changes in Forest and Other Woody Biomass Stocks	NA	NA	NA	NA	NA	NA	NA
5B - Forest and Grassland Conversion	NA	NA	NA	NA	NA	NA	NA
5C - Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA
5D - CO2 Emissions and Removals from Soil	NA	NA	NA	NA	NA	NA	NA
5E - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
6 - Waste	NA	NA	NA	NA	NA	NA	NA
6A - Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA
6B - Wastewater Handling	NA	NA	NA	NA	NA	NA	NA
6C - Waste Incineration	NA	NA	NA	NA	NA	NA	NA
6D - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
7 - Other (please specify)	NA	NA	NA	NA	NA	NA	NA

Greenhouse gas source and sink categories (Inventory Year: 2012)	Net CO2 (Gg)	CH4 (Gg)	N2O (Gg)	CO Gg	NOx (Gg)	NMVOCs (Gg)	SOx (Gg)
Total National Emissions and Removals	1305.991	1.541	0.043	NE	NE	NE	NE
1 - Energy	1295.931	0.092	0.017	NE	NE	NE	NE
1A - Fuel Combustion Activities	1295.931	0.092	0.017	NE	NE	NE	NE
1A1 - Energy Industries	879.113	0.036	0.007	NE	NE	NE	NE
1A2 - Manufacturing Industries and Construction (ISIC)	IE	IE	IE	NA	NA	NA	NA
1A3 - Transport	309.978	0.044	0.009	NE	NE	NE	NE
1A4 - Other Sectors	106.841	0.013	0.001	NE	NE	NE	NE
1A5 - Other	NO	NO	NO	NO	NO	NO	NO
1B - Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO
1B1 - Solid Fuels	NO	NO	NO	NO	NO	NO	NO
1B2 - Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO
2 - Industrial Processes	NO	NO	NO	NO	NO	NO	NO
2A - Mineral Products	NO	NO	NO	NO	NO	NO	NO
2B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO
2C - Metal Production	NO	NO	NO	NO	NO	NO	NO
2D - Other Production	NO	NO	NA	NO	NO	NO	NO
2E - Production of Halocarbons and Sulphur Hexafluoride	NA	NA	NA	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NA	NA	NA	NA	NO	NO	NO
2G - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
3 - Solvent and Other Product Use	NO	NO	NO	NO	NO	NO	NO
4 - Agriculture	NA	NE	NE	NE	NE	NE	NE
4A - Enteric Fermentation	NA	NE	NA	NE	NE	NE	NE
4B - Manure Management	NA	NE	NE	NE	NE	NE	NE
4C - Rice Cultivation	NA	NO	NA	NO	NO	NO	NO
4D - Agricultural Soils	NA	NO	NO	NO	NO	NO	NO
4E - Prescribed Burning of Savannas	NA	NO	NO	NO	NO	NO	NO
4F - Field Burning of Agricultural Residues	NA	NO	NO	NO	NO	NO	NO
4G - Other (please specify)	NA	NO	NO	NO	NO	NO	NO
5 - Land-Use Change & Forestry	NE	NE	NE	NE	NE	NE	NE
5A - Changes in Forest and Other Woody Biomass Stocks	NE	NA	NA	NE	NE	NE	NE
5B - Forest and Grassland Conversion	NE	NE	NE	NE	NE	NE	NE
5C - Abandonment of Managed Lands	NE	NA	NA	NE	NE	NE	NE
5D - CO2 Emissions and Removals from Soil	NO	NA	NO	NE	NE	NE	NE
5E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
6 - Waste	10.060	1.449	0.026	NE	NE	NE	NE
6A - Solid Waste Disposal on Land	NA	NO	NA	NO	NO	NO	NO
6B - Wastewater Handling	NA	NE	NE	NE	NE	NE	NE
6C - Waste Incineration	NE	NE	NE	NE	NE	NE	NE
6D - Other (please specify)	10.060	1.449	0.026	NO	NO	NO	NO
7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
Memo Items							
International Bunkers	315.838	0.002	0.009	NE	NE	NE	NE
1A3a1 - International Aviation	315.838	0.002	0.009	NE	NE	NE	NE
1A3d1 - International Marine (Bunkers)	NE	NE	NE	NE	NE	NE	NE
Multilateral operations	NO	NO	NO	NA	NA	NA	NA
CO2 emissions from biomass	NE	NA	NA	NA	NA	NA	NA

	HFC			PFC			SF6
Greenhouse gas source and sink categories (Inventory Year: 2012)	HFC-23 (Gg)	HFC-134 (Gg)	Other (Gg-CO2)	CF4 (Gg)	C2F6 (Gg)	Other (Gg-CO2)	SF6 (Gg)
Total National Emissions and Removals	NE**	NE**	NE**	NO	NO	NO	NO
1 - Energy	NA	NA	NA	NA	NA	NA	NA
1A - Fuel Combustion Activities	NA	NA	NA	NA	NA	NA	NA
1A1 - Energy Industries	NA	NA	NA	NA	NA	NA	NA
1A2 - Manufacturing Industries and Construction (ISIC)	NA	NA	NA	NA	NA	NA	NA
1A3 - Transport	NA	NA	NA	NA	NA	NA	NA
1A4 - Other Sectors	NA	NA	NA	NA	NA	NA	NA
1A5 - Other	NA	NA	NA	NA	NA	NA	NA
1B - Fugitive Emissions from Fuels	NA	NA	NA	NA	NA	NA	NA
1B1 - Solid Fuels	NA	NA	NA	NA	NA	NA	NA
1B2 - Oil and Natural Gas	NA	NA	NA	NA	NA	NA	NA
2 - Industrial Processes	NE**	NE**	NE**	NO	NO	NO	NO
2A - Mineral Products	NA	NA	NA	NA	NA	NA	NA
2B - Chemical Industry	NA	NA	NA	NA	NA	NA	NA
2C - Metal Production	NO	NO	NO	NO	NO	NO	NO
2D - Other Production	NA	NA	NA	NA	NA	NA	NA
2E - Production of Halocarbons and Sulphur Hexafluoride	NO	NO	NO	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NE**	NE**	NE**	NO	NO	NO	NO
2G - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
3 - Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA
4 - Agriculture	NA	NA	NA	NA	NA	NA	NA
4A - Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA
4B - Manure Management	NA	NA	NA	NA	NA	NA	NA
4C - Rice Cultivation	NA	NA	NA	NA	NA	NA	NA
4D - Agricultural Soils	NA	NA	NA	NA	NA	NA	NA
4E - Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA
4F - Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA	NA
4G - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
5 - Land-Use Change & Forestry	NA	NA	NA	NA	NA	NA	NA
5A - Changes in Forest and Other Woody Biomass Stocks	NA	NA	NA	NA	NA	NA	NA
5B - Forest and Grassland Conversion	NA	NA	NA	NA	NA	NA	NA
5C - Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA
5D - CO2 Emissions and Removals from Soil	NA	NA	NA	NA	NA	NA	NA
5E - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
6 - Waste	NA	NA	NA	NA	NA	NA	NA
6A - Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA
6B - Wastewater Handling	NA	NA	NA	NA	NA	NA	NA
6C - Waste Incineration	NA	NA	NA	NA	NA	NA	NA
6D - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
7 - Other (please specify)	NA	NA	NA	NA	NA	NA	NA

Greenhouse gas source and sink categories (Inventory Year: 2013)	Net CO2 (Gg)	CH4 (Gg)	N2O (Gg)	CO Gg	NOx (Gg)	NMVOcs (Gg)	SOx (Gg)
Total National Emissions and Removals	1400.013	1.592	0.045	NE	NE	NE	NE
1 - Energy	1389.641	0.097	0.019	NE	NE	NE	NE
1A - Fuel Combustion Activities	1389.641	0.097	0.019	NE	NE	NE	NE
1A1 - Energy Industries	945.292	0.038	0.008	NE	NE	NE	NE
1A2 - Manufacturing Industries and Construction (ISIC)	IE	IE	IE	NA	NA	NA	NA
1A3 - Transport	340.379	0.047	0.010	NE	NE	NE	NE
1A4 - Other Sectors	103.969	0.012	0.001	NE	NE	NE	NE
1A5 - Other	NO	NO	NO	NO	NO	NO	NO
1B - Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO
1B1 - Solid Fuels	NO	NO	NO	NO	NO	NO	NO
1B2 - Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO
2 - Industrial Processes	NO	NO	NO	NO	NO	NO	NO
2A - Mineral Products	NO	NO	NO	NO	NO	NO	NO
2B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO
2C - Metal Production	NO	NO	NO	NO	NO	NO	NO
2D - Other Production	NO	NO	NA	NO	NO	NO	NO
2E - Production of Halocarbons and Sulphur Hexafluoride	NA	NA	NA	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NA	NA	NA	NA	NO	NO	NO
2G - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
3 - Solvent and Other Product Use	NO	NO	NO	NO	NO	NO	NO
4 - Agriculture	NA	NE	NE	NE	NE	NE	NE
4A - Enteric Fermentation	NA	NE	NA	NE	NE	NE	NE
4B - Manure Management	NA	NE	NE	NE	NE	NE	NE
4C - Rice Cultivation	NA	NO	NA	NO	NO	NO	NO
4D - Agricultural Soils	NA	NO	NO	NO	NO	NO	NO
4E - Prescribed Burning of Savannas	NA	NO	NO	NO	NO	NO	NO
4F - Field Burning of Agricultural Residues	NA	NO	NO	NO	NO	NO	NO
4G - Other (please specify)	NA	NO	NO	NO	NO	NO	NO
5 - Land-Use Change & Forestry	NE	NE	NE	NE	NE	NE	NE
5A - Changes in Forest and Other Woody Biomass Stocks	NE	NA	NA	NE	NE	NE	NE
5B - Forest and Grassland Conversion	NE	NE	NE	NE	NE	NE	NE
5C - Abandonment of Managed Lands	NE	NA	NA	NE	NE	NE	NE
5D - CO2 Emissions and Removals from Soil	NO	NA	NO	NE	NE	NE	NE
5E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
6 - Waste	10.372	1.494	0.027	NE	NE	NE	NE
6A - Solid Waste Disposal on Land	NA	NO	NA	NO	NO	NO	NO
6B - Wastewater Handling	NA	NE	NE	NE	NE	NE	NE
6C - Waste Incineration	NE	NE	NE	NE	NE	NE	NE
6D - Other (please specify)	10.372	1.494	0.027	NO	NO	NO	NO
7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
Memo Items							
International Bunkers	363.460	0.003	0.010	NE	NE	NE	NE
1A3a1 - International Aviation	363.460	0.003	0.010	NE	NE	NE	NE
1A3d1 - International Marine (Bunkers)	NE	NE	NE	NE	NE	NE	NE
Multilateral operations	NO	NO	NO	NA	NA	NA	NA
CO2 emissions from biomass	NE	NA	NA	NA	NA	NA	NA



	HFC			PFC			SF6
Greenhouse gas source and sink categories (Inventory Year: 2013)	HFC-23 (Gg)	HFC-134 (Gg)	Other (Gg-CO2)	CF4 (Gg)	C2F6 (Gg)	Other (Gg-CO2)	SF6 (Gg)
Total National Emissions and Removals	NE**	NE**	NE**	NO	NO	NO	NO
1 - Energy	NA	NA	NA	NA	NA	NA	NA
1A - Fuel Combustion Activities	NA	NA	NA	NA	NA	NA	NA
1A1 - Energy Industries	NA	NA	NA	NA	NA	NA	NA
1A2 - Manufacturing Industries and Construction (ISIC)	NA	NA	NA	NA	NA	NA	NA
1A3 - Transport	NA	NA	NA	NA	NA	NA	NA
1A4 - Other Sectors	NA	NA	NA	NA	NA	NA	NA
1A5 - Other	NA	NA	NA	NA	NA	NA	NA
1B - Fugitive Emissions from Fuels	NA	NA	NA	NA	NA	NA	NA
1B1 - Solid Fuels	NA	NA	NA	NA	NA	NA	NA
1B2 - Oil and Natural Gas	NA	NA	NA	NA	NA	NA	NA
2 - Industrial Processes	NE**	NE**	NE**	NO	NO	NO	NO
2A - Mineral Products	NA	NA	NA	NA	NA	NA	NA
2B - Chemical Industry	NA	NA	NA	NA	NA	NA	NA
2C - Metal Production	NO	NO	NO	NO	NO	NO	NO
2D - Other Production	NA	NA	NA	NA	NA	NA	NA
2E - Production of Halocarbons and Sulphur Hexafluoride	NO	NO	NO	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NE**	NE**	NE**	NO	NO	NO	NO
2G - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
3 - Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA
4 - Agriculture	NA	NA	NA	NA	NA	NA	NA
4A - Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA
4B - Manure Management	NA	NA	NA	NA	NA	NA	NA
4C - Rice Cultivation	NA	NA	NA	NA	NA	NA	NA
4D - Agricultural Soils	NA	NA	NA	NA	NA	NA	NA
4E - Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA
4F - Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA	NA
4G - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
5 - Land-Use Change & Forestry	NA	NA	NA	NA	NA	NA	NA
5A - Changes in Forest and Other Woody Biomass Stocks	NA	NA	NA	NA	NA	NA	NA
5B - Forest and Grassland Conversion	NA	NA	NA	NA	NA	NA	NA
5C - Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA
5D - CO2 Emissions and Removals from Soil	NA	NA	NA	NA	NA	NA	NA
5E - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
6 - Waste	NA	NA	NA	NA	NA	NA	NA
6A - Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA
6B - Wastewater Handling	NA	NA	NA	NA	NA	NA	NA
6C - Waste Incineration	NA	NA	NA	NA	NA	NA	NA
6D - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
7 - Other (please specify)	NA	NA	NA	NA	NA	NA	NA

Greenhouse gas source and sink categories (Inventory Year: 2014)	Net CO2 (Gg)	CH4 (Gg)	N2O (Gg)	CO Gg	NOx (Gg)	NMVOCs (Gg)	SOx (Gg)
Total National Emissions and Removals	1453.548	1.850	0.051	NE	NE	NE	NE
1 - Energy	1441.398	0.100	0.020	NE	NE	NE	NE
1A - Fuel Combustion Activities	1441.398	0.100	0.020	NE	NE	NE	NE
1A1 - Energy Industries	1002.171	0.041	0.008	NE	NE	NE	NE
1A2 - Manufacturing Industries and Construction (ISIC)	IE	IE	IE	NA	NA	NA	NA
1A3 - Transport	362.889	0.051	0.011	NE	NE	NE	NE
1A4 - Other Sectors	76.339	0.008	0.000	NE	NE	NE	NE
1A5 - Other	NO	NO	NO	NO	NO	NO	NO
1B - Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO
1B1 - Solid Fuels	NO	NO	NO	NO	NO	NO	NO
1B2 - Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO
2 - Industrial Processes	NO	NO	NO	NO	NO	NO	NO
2A - Mineral Products	NO	NO	NO	NO	NO	NO	NO
2B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO
2C - Metal Production	NO	NO	NO	NO	NO	NO	NO
2D - Other Production	NO	NO	NA	NO	NO	NO	NO
2E - Production of Halocarbons and Sulphur Hexafluoride	NA	NA	NA	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NA	NA	NA	NA	NO	NO	NO
2G - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
3 - Solvent and Other Product Use	NO	NO	NO	NO	NO	NO	NO
4 - Agriculture	NA	NE	NE	NE	NE	NE	NE
4A - Enteric Fermentation	NA	NE	NA	NE	NE	NE	NE
4B - Manure Management	NA	NE	NE	NE	NE	NE	NE
4C - Rice Cultivation	NA	NO	NA	NO	NO	NO	NO
4D - Agricultural Soils	NA	NO	NO	NO	NO	NO	NO
4E - Prescribed Burning of Savannas	NA	NO	NO	NO	NO	NO	NO
4F - Field Burning of Agricultural Residues	NA	NO	NO	NO	NO	NO	NO
4G - Other (please specify)	NA	NO	NO	NO	NO	NO	NO
5 - Land-Use Change & Forestry	NE	NE	NE	NE	NE	NE	NE
5A - Changes in Forest and Other Woody Biomass Stocks	NE	NA	NA	NE	NE	NE	NE
5B - Forest and Grassland Conversion	NE	NE	NE	NE	NE	NE	NE
5C - Abandonment of Managed Lands	NE	NA	NA	NE	NE	NE	NE
5D - CO2 Emissions and Removals from Soil	NO	NA	NO	NE	NE	NE	NE
5E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
6 - Waste	12.149	1.750	0.032	NE	NE	NE	NE
6A - Solid Waste Disposal on Land	NA	NO	NA	NO	NO	NO	NO
6B - Wastewater Handling	NA	NE	NE	NE	NE	NE	NE
6C - Waste Incineration	NE	NE	NE	NE	NE	NE	NE
6D - Other (please specify)	12.149	1.750	0.032	NO	NO	NO	NO
7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
Memo Items							
International Bunkers	373.049	0.003	0.010	NE	NE	NE	NE
1A3a1 - International Aviation	373.049	0.003	0.010	NE	NE	NE	NE
1A3d1 - International Marine (Bunkers)	NE	NE	NE	NE	NE	NE	NE
Multilateral operations	NO	NO	NO	NA	NA	NA	NA
CO2 emissions from biomass	NE	NA	NA	NA	NA	NA	NA

Greenhouse gas source and sink categories (Inventory Year: 2014)	HFC			PFC			SF6
	HFC-23 (Gg)	HFC-134 (Gg)	Other (Gg- CO2)	CF4 (Gg)	C2F6 (Gg)	Other (Gg- CO2)	SF6 (Gg)
Total National Emissions and Removals	NE**	NE**	NE**	NO	NO	NO	NO
1 - Energy	NA	NA	NA	NA	NA	NA	NA
1A - Fuel Combustion Activities	NA	NA	NA	NA	NA	NA	NA
1A1 - Energy Industries	NA	NA	NA	NA	NA	NA	NA
1A2 - Manufacturing Industries and Construction (ISIC)	NA	NA	NA	NA	NA	NA	NA
1A3 - Transport	NA	NA	NA	NA	NA	NA	NA
1A4 - Other Sectors	NA	NA	NA	NA	NA	NA	NA
1A5 - Other	NA	NA	NA	NA	NA	NA	NA
1B - Fugitive Emissions from Fuels	NA	NA	NA	NA	NA	NA	NA
1B1 - Solid Fuels	NA	NA	NA	NA	NA	NA	NA
1B2 - Oil and Natural Gas	NA	NA	NA	NA	NA	NA	NA
2 - Industrial Processes	NE**	NE**	NE**	NO	NO	NO	NO
2A - Mineral Products	NA	NA	NA	NA	NA	NA	NA
2B - Chemical Industry	NA	NA	NA	NA	NA	NA	NA
2C - Metal Production	NO	NO	NO	NO	NO	NO	NO
2D - Other Production	NA	NA	NA	NA	NA	NA	NA
2E - Production of Halocarbons and Sulphur Hexafluoride	NO	NO	NO	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NE**	NE**	NE**	NO	NO	NO	NO
2G - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
3 - Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA
4 - Agriculture	NA	NA	NA	NA	NA	NA	NA
4A - Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA
4B - Manure Management	NA	NA	NA	NA	NA	NA	NA
4C - Rice Cultivation	NA	NA	NA	NA	NA	NA	NA
4D - Agricultural Soils	NA	NA	NA	NA	NA	NA	NA
4E - Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA
4F - Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA	NA
4G - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
5 - Land-Use Change & Forestry	NA	NA	NA	NA	NA	NA	NA
5A - Changes in Forest and Other Woody Biomass Stocks	NA	NA	NA	NA	NA	NA	NA
5B - Forest and Grassland Conversion	NA	NA	NA	NA	NA	NA	NA
5C - Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA
5D - CO2 Emissions and Removals from Soil	NA	NA	NA	NA	NA	NA	NA
5E - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
6 - Waste	NA	NA	NA	NA	NA	NA	NA
6A - Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA
6B - Wastewater Handling	NA	NA	NA	NA	NA	NA	NA
6C - Waste Incineration	NA	NA	NA	NA	NA	NA	NA
6D - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
7 - Other (please specify)	NA	NA	NA	NA	NA	NA	NA

Greenhouse gas source and sink categories (Inventory Year: 2015)	Net CO2 (Gg)	CH4 (Gg)	N2O (Gg)	CO Gg	NOx (Gg)	NMVOcs (Gg)	SOx (Gg)
Total National Emissions and Removals	1476.887	2.013	0.054	NE	NE	NE	NE
1 - Energy	1463.635	0.104	0.020	NE	NE	NE	NE
1A - Fuel Combustion Activities	1463.635	0.104	0.020	NE	NE	NE	NE
1A1 - Energy Industries	1020.502	0.041	0.008	NE	NE	NE	NE
1A2 - Manufacturing Industries and Construction (ISIC)	IE	IE	IE	NA	NA	NA	NA
1A3 - Transport	376.095	0.056	0.012	NE	NE	NE	NE
1A4 - Other Sectors	67.038	0.007	0.000	NE	NE	NE	NE
1A5 - Other	NO	NO	NO	NO	NO	NO	NO
1B - Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO
1B1 - Solid Fuels	NO	NO	NO	NO	NO	NO	NO
1B2 - Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO
2 - Industrial Processes	NO	NO	NO	NO	NO	NO	NO
2A - Mineral Products	NO	NO	NO	NO	NO	NO	NO
2B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO
2C - Metal Production	NO	NO	NO	NO	NO	NO	NO
2D - Other Production	NO	NO	NA	NO	NO	NO	NO
2E - Production of Halocarbons and Sulphur Hexafluoride	NA	NA	NA	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NA	NA	NA	NA	NO	NO	NO
2G - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
3 - Solvent and Other Product Use	NO	NO	NO	NO	NO	NO	NO
4 - Agriculture	NA	NE	NE	NE	NE	NE	NE
4A - Enteric Fermentation	NA	NE	NA	NE	NE	NE	NE
4B - Manure Management	NA	NE	NE	NE	NE	NE	NE
4C - Rice Cultivation	NA	NO	NA	NO	NO	NO	NO
4D - Agricultural Soils	NA	NO	NO	NO	NO	NO	NO
4E - Prescribed Burning of Savannas	NA	NO	NO	NO	NO	NO	NO
4F - Field Burning of Agricultural Residues	NA	NO	NO	NO	NO	NO	NO
4G - Other (please specify)	NA	NO	NO	NO	NO	NO	NO
5 - Land-Use Change & Forestry	NE	NE	NE	NE	NE	NE	NE
5A - Changes in Forest and Other Woody Biomass Stocks	NE	NA	NA	NE	NE	NE	NE
5B - Forest and Grassland Conversion	NE	NE	NE	NE	NE	NE	NE
5C - Abandonment of Managed Lands	NE	NA	NA	NE	NE	NE	NE
5D - CO2 Emissions and Removals from Soil	NO	NA	NO	NE	NE	NE	NE
5E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
6 - Waste	13.252	1.909	0.034	NE	NE	NE	NE
6A - Solid Waste Disposal on Land	NA	NO	NA	NO	NO	NO	NO
6B - Wastewater Handling	NA	NE	NE	NE	NE	NE	NE
6C - Waste Incineration	NE	NE	NE	NE	NE	NE	NE
6D - Other (please specify)	13.252	1.909	0.034	NO	NO	NO	NO
7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
Memo Items							
International Bunkers	320.202	0.002	0.009	NE	NE	NE	NE
1A3a1 - International Aviation	320.202	0.002	0.009	NE	NE	NE	NE
1A3d1 - International Marine (Bunkers)	NE	NE	NE	NE	NE	NE	NE
Multilateral operations	NO	NO	NO	NA	NA	NA	NA
CO2 emissions from biomass	NE	NA	NA	NA	NA	NA	NA

Greenhouse gas source and sink categories (Inventory Year: 2015)	HFC			PFC			SF6
	HFC-23 (Gg)	HFC-134 (Gg)	Other (Gg-CO2)	CF4 (Gg)	C2F6 (Gg)	Other (Gg-CO2)	SF6 (Gg)
Total National Emissions and Removals	NE**	NE**	NE**	NO	NO	NO	NO
1 - Energy	NA	NA	NA	NA	NA	NA	NA
1A - Fuel Combustion Activities	NA	NA	NA	NA	NA	NA	NA
1A1 - Energy Industries	NA	NA	NA	NA	NA	NA	NA
1A2 - Manufacturing Industries and Construction (ISIC)	NA	NA	NA	NA	NA	NA	NA
1A3 - Transport	NA	NA	NA	NA	NA	NA	NA
1A4 - Other Sectors	NA	NA	NA	NA	NA	NA	NA
1A5 - Other	NA	NA	NA	NA	NA	NA	NA
1B - Fugitive Emissions from Fuels	NA	NA	NA	NA	NA	NA	NA
1B1 - Solid Fuels	NA	NA	NA	NA	NA	NA	NA
1B2 - Oil and Natural Gas	NA	NA	NA	NA	NA	NA	NA
2 - Industrial Processes	NE**	NE**	NE**	NO	NO	NO	NO
2A - Mineral Products	NA	NA	NA	NA	NA	NA	NA
2B - Chemical Industry	NA	NA	NA	NA	NA	NA	NA
2C - Metal Production	NO	NO	NO	NO	NO	NO	NO
2D - Other Production	NA	NA	NA	NA	NA	NA	NA
2E - Production of Halocarbons and Sulphur Hexafluoride	NO	NO	NO	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NE**	NE**	NE**	NO	NO	NO	NO

2G - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
3 - Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA
4 - Agriculture	NA	NA	NA	NA	NA	NA	NA
4A - Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA
4B - Manure Management	NA	NA	NA	NA	NA	NA	NA
4C - Rice Cultivation	NA	NA	NA	NA	NA	NA	NA
4D - Agricultural Soils	NA	NA	NA	NA	NA	NA	NA
4E - Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA
4F - Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA	NA
4G - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
5 - Land-Use Change & Forestry	NA	NA	NA	NA	NA	NA	NA
5A - Changes in Forest and Other Woody Biomass Stocks	NA	NA	NA	NA	NA	NA	NA
5B - Forest and Grassland Conversion	NA	NA	NA	NA	NA	NA	NA
5C - Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA
5D - CO2 Emissions and Removals from Soil	NA	NA	NA	NA	NA	NA	NA
5E - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
6 - Waste	NA	NA	NA	NA	NA	NA	NA
6A - Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA
6B - Wastewater Handling	NA	NA	NA	NA	NA	NA	NA
6C - Waste Incineration	NA	NA	NA	NA	NA	NA	NA
6D - Other (please specify)	NA	NA	NA	NA	NA	NA	NA
7 - Other (please specify)	NA	NA	NA	NA	NA	NA	NA

## 9.2 KEY CATEGORY ASSESSMENT

Following is the key category assessment for the years 2011 – 2015. For the year 2011 there is no trend assessment carried as there no is no timeseries data. For the trend assessment, 2011 is considered as the base year.

**Table 29: 2011 Key category analysis using level assessment**

IPCC Category code	IPCC Category	Greenhouse gas	Cumulative Total
1.A.1	Energy Industries - Liquid Fuels	CO <sub>2</sub>	0.6
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO <sub>2</sub>	0.8
1.A.4	Other Sectors - Liquid Fuels	CO <sub>2</sub>	0.9
1.A.3.a	Civil Aviation	CO <sub>2</sub>	0.9
1.A.3.b	Road Transportation	CO <sub>2</sub>	1.0

**Table 30: 2012 Key category analysis using level assessment**

IPCC Category code	IPCC Category	Greenhouse gas	Cumulative Total
1.A.1	Energy Industries - Liquid Fuels	CO <sub>2</sub>	0.7
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO <sub>2</sub>	0.8
1.A.4	Other Sectors - Liquid Fuels	CO <sub>2</sub>	0.9
1.A.3.a	Civil Aviation	CO <sub>2</sub>	0.9
1.A.3.b	Road Transportation	CO <sub>2</sub>	1.0

**Table 31: 2012 Key category analysis using trend assessment**

IPCC Category code	IPCC Category	Greenhouse gas	% Contribution to Trend	Cumulative Total
1.A.1	Energy Industries - Liquid Fuels	CO <sub>2</sub>	0.5	0.5
1.A.4	Other Sectors - Liquid Fuels	CO <sub>2</sub>	0.3	0.8
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO <sub>2</sub>	0.2	0.9
4.C	Incineration and Open Burning of Waste	CH <sub>4</sub>	0.0	0.9
1.A.3.b	Road Transportation	CO <sub>2</sub>	0.0	1.0

**Table 32: 2013 Key category analysis using level assessment**

IPCC Category code	IPCC Category	Greenhouse gas	Cumulative Total
1.A.1	Energy Industries - Liquid Fuels	CO <sub>2</sub>	0.7
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO <sub>2</sub>	0.8
1.A.4	Other Sectors - Liquid Fuels	CO <sub>2</sub>	0.9
1.A.3.a	Civil Aviation	CO <sub>2</sub>	0.9
1.A.3.b	Road Transportation	CO <sub>2</sub>	1.0

**Table 33: 2013 Key category analysis using trend assessment**

IPCC Category code	IPCC Category	Greenhouse gas	% Contribution to Trend	Cumulative Total
1.A.4	Other Sectors - Liquid Fuels	CO <sub>2</sub>	0.3	0.3
1.A.1	Energy Industries - Liquid Fuels	CO <sub>2</sub>	0.3	0.6
1.A.3.a	Civil Aviation	CO <sub>2</sub>	0.2	0.8
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO <sub>2</sub>	0.1	0.9
4.C	Incineration and Open Burning of Waste	CH <sub>4</sub>	0.0	1.0

**Table 34: 2014 Key category analysis using level assessment**

IPCC Category code	IPCC Category	Greenhouse gas	Cumulative Total
1.A.1	Energy Industries - Liquid Fuels	CO <sub>2</sub>	0.7
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO <sub>2</sub>	0.8
1.A.3.a	Civil Aviation	CO <sub>2</sub>	0.9
1.A.3.b	Road Transportation	CO <sub>2</sub>	0.9
1.A.4	Other Sectors - Liquid Fuels	CO <sub>2</sub>	1.0

**Table 35: 2014 Key category analysis using trend assessment**

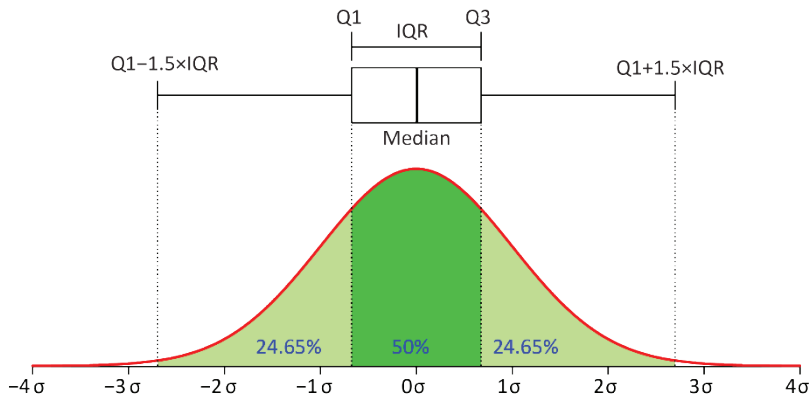
IPCC Category code	IPCC Category	Greenhouse gas	% Contribution to Trend	Cumulative Total
1.A.1	Energy Industries - Liquid Fuels	CO <sub>2</sub>	0.3	0.7
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO <sub>2</sub>	0.1	0.9
1.A.3.a	Civil Aviation	CO <sub>2</sub>	0.1	0.8
1.A.3.b	Road Transportation	CO <sub>2</sub>	0.04	1.0

## 9.3 POWERHOUSE DATA

To accommodate the varying status of the power generation facilities, a statistical method was used to filter the data based on the kWh/L estimate. A one-year monthly power production data was used to determine this estimate. Quartiles and the inter-quartile range of the data (as in Figure 23) was used to determine a cut-off value which could be applied to all the datasets for filtering. The following statistics were found for the estimate.

- First quartile  $Q_1 = 2.843$
- Second quartile (median) = 3.088
- Third quartile  $Q_3 = 3.300$
- Inter-quartile range (IQR) = 0.457
- Lower bound,  $1.5 \times \text{IQR} = Q_1 - 1.5 \times \text{IQR} = 2.157 \approx 2 \text{ kWh/L}$
- Upper bound,  $1.5 \times \text{IQR} = Q_3 + 1.5 \times \text{IQR} = 3.986 \approx 4 \text{ kWh/L}$





**Figure 23: Use of the quartiles for the data filtering**

The lower and upper bounds were used to filter all the electricity production data sets provided by the stakeholders. FENAKA data for the islands were used to calculate the per capita fuel usage and this ratio was used to calculate the total fuel usage for the atoll population. For the greater Malé region and the island operated under STELCO, the actual data provided was used. For the years data were not provided by these utility companies, data from energy balances were used. Additionally, interpolation techniques were used to fill in the missing data gaps.

## 9.4 UNCERTAINTY ANALYSIS

Base year for assessment of uncertainty in trend: 2011, Year T: 2012

A	B	C	D	E	F	G	H	I	J	K	L	M
2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO <sub>2</sub> equivalent)	Year T emissions or removals (Gg CO <sub>2</sub> equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
1 A - Fuel Combustion Activities												
1 A.1 a.i - Electricity Generation - Liquid Fuels	CO <sub>2</sub>	818.85	879.11	5.00	6.14	7.92	17.35	0.03	0.53	0.20	3.75	14.11
1 A.1 a.i - Electricity Generation - Liquid Fuels	CH <sub>4</sub>	0.70	0.75	5.00	228.79	228.84	0.01	0.00	0.00	0.01	0.00	0.00
1 A.1 a.i - Electricity Generation - Liquid Fuels	N <sub>2</sub> O	2.06	2.21	5.00	228.79	228.84	0.09	0.00	0.00	0.02	0.01	0.00
1 A.3 a.i - International Aviation (International Bunkers) - Liquid Fuels	CO <sub>2</sub>	372.22	315.84	5.00	4.17	6.51	1.52	0.04	0.19	0.15	1.35	1.84
1 A.3 a.i - International Aviation (International Bunkers) - Liquid Fuels	CH <sub>4</sub>	0.05	0.05	5.00	100.00	100.12	0.00	0.00	0.00	0.00	0.00	0.00
1 A.3 a.i - International Aviation (International Bunkers) - Liquid Fuels	N <sub>2</sub> O	3.23	2.74	5.00	150.00	150.08	0.06	0.00	0.00	0.05	0.01	0.00
1 A.3 a.ii - Domestic Aviation - Liquid Fuels	CO <sub>2</sub>	64.73	68.43	5.00	4.17	6.51	0.07	0.00	0.04	0.01	0.29	0.09
1 A.3 a.ii - Domestic Aviation - Liquid Fuels	CH <sub>4</sub>	0.01	0.01	5.00	100.00	100.12	0.00	0.00	0.00	0.00	0.00	0.00
1 A.3 a.ii - Domestic Aviation - Liquid Fuels	N <sub>2</sub> O	0.56	0.59	5.00	150.00	150.08	0.00	0.00	0.00	0.00	0.00	0.00
1 A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO <sub>2</sub>	6.15	6.49	5.00	3.07	5.87	0.00	0.00	0.00	0.00	0.03	0.00
1 A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH <sub>4</sub>	0.06	0.06	5.00	244.69	244.74	0.00	0.00	0.00	0.00	0.00	0.00
1 A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N <sub>2</sub> O	0.09	0.09	5.00	209.94	210.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO <sub>2</sub>	12.11	12.51	5.00	5.00	7.07	0.00	0.00	0.01	0.00	0.05	0.00
1 A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH <sub>4</sub>	0.09	0.09	5.00	25.00	25.50	0.00	0.00	0.00	0.00	0.00	0.00
1 A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N <sub>2</sub> O	0.13	0.13	5.00	60.00	60.21	0.00	0.00	0.00	0.00	0.00	0.00
1 A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO <sub>2</sub>	7.23	7.52	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.03	0.00
1 A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH <sub>4</sub>	0.01	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1 A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N <sub>2</sub> O	0.02	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1 A.3.b.iv - Motorcycles - Liquid Fuels	CO <sub>2</sub>	35.78	39.00	5.00	3.07	5.87	0.02	0.00	0.02	0.01	0.17	0.03
1 A.3.b.iv - Motorcycles - Liquid Fuels	CH <sub>4</sub>	0.36	0.39	5.00	244.69	244.74	0.00	0.00	0.00	0.00	0.00	0.00
1 A.3.b.iv - Motorcycles - Liquid Fuels	N <sub>2</sub> O	0.51	0.56	5.00	209.94	210.00	0.00	0.00	0.00	0.01	0.00	0.00

1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CO2	171.79	176.03	5.00	4.30	6.60	0.48	0.00	0.11	0.01	0.75	0.56
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CH4	0.35	0.36	5.00	50.00	50.25	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	N2O	1.47	1.50	5.00	140.00	140.09	0.02	0.00	0.00	0.00	0.01	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	CO2	15.78	12.98	5.00	6.14	7.92	0.00	0.00	0.01	0.01	0.06	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	CH4	0.03	0.02	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	N2O	0.01	0.01	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	CO2	17.10	15.26	5.00	6.14	7.92	0.01	0.00	0.01	0.01	0.07	0.00
1.A.4.b - Residential - Liquid Fuels	CH4	0.03	0.03	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	N2O	0.01	0.01	5.00	236.36	236.42	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CO2	77.57	78.60	5.00	6.14	7.92	0.14	0.00	0.05	0.00	0.34	0.11
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CH4	0.22	0.22	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	N2O	0.19	0.19	5.00	236.36	236.42	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.vi - Urea-based catalysts	CO2	0	0	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste												
4.C.1 - Waste Incineration	CO2	0	0	0	0	0	0	0	0	0	0	0
4.C.1 - Waste Incineration	CH4	0	0	0	0	0	0	0	0	0	0	0
4.C.1 - Waste Incineration	N2O	0	0	0	0	0	0	0	0	0	0	0
4.C.2 - Open Burning of Waste	CO2	9.90	10.06	0	0	0	0	4.87E-05	0.006	0	0	0
4.C.2 - Open Burning of Waste	CH4	29.95	30.43	0	0	0	0	0.00	0.018	0	0	0
4.C.2 - Open Burning of Waste	N2O	7.94	8.09	0	0	0	0	3.91E-05	0.0048	0	0	0
4.D - Wastewater Treatment and Discharge												
4.D.1 - Domestic Wastewater Treatment and Discharge	CH4	0	0	0	0	0	0	0	0	0	0	0
4.D.1 - Domestic Wastewater Treatment and Discharge	N2O	0	0	0	0	0	0	0	0	0	0	0
4.D.2 - Industrial Wastewater Treatment and Discharge	CH4	0	0	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)												
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3												
5.B - Other (please specify)												
Total												
		Sum(C): 1657,266	Sum(D): 1670,389				Sum(H): 19,786					Sum(M): 16,752
							Uncertainty in total inventory: 4,448					Trend uncertainty: 4,093

A	B	C	D	E	F	G	H	I	J	K	L	M
2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Year T emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)	
1.A - Fuel Combustion Activities												
1.A.1.a.i - Electricity Generation - Liquid Fuels	CO2	818.85	945.29	5.00	6.14	7.92	17.01	0.03	0.57	0.18	4.03	16.30
1.A.1.a.i - Electricity Generation - Liquid Fuels	CH4	0.70	0.80	5.00	228.79	228.84	0.01	0.00	0.00	0.01	0.00	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	N2O	2.06	2.37	5.00	228.79	228.84	0.09	0.00	0.00	0.02	0.01	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO2	372.22	363.46	5.00	4.17	6.51	1.70	0.03	0.22	0.11	1.55	2.42
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH4	0.05	0.05	5.00	100.00	100.12	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N2O	3.23	3.15	5.00	150.00	150.08	0.07	0.00	0.00	0.03	0.01	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO2	64.73	83.48	5.00	4.17	6.51	0.09	0.01	0.05	0.03	0.36	0.13
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH4	0.01	0.01	5.00	100.00	100.12	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N2O	0.56	0.72	5.00	150.00	150.08	0.00	0.00	0.00	0.01	0.00	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO2	6.15	6.99	5.00	3.07	5.87	0.00	0.00	0.00	0.00	0.03	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH4	0.06	0.07	5.00	244.69	244.74	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N2O	0.09	0.10	5.00	209.94	210.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO2	12.11	13.17	5.00	5.00	7.07	0.00	0.00	0.01	0.00	0.06	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH4	0.09	0.09	5.00	25.00	25.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N2O	0.13	0.14	5.00	60.00	60.21	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO2	7.23	7.71	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.03	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH4	0.01	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N2O	0.02	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO2	35.78	42.67	5.00	3.07	5.87	0.02	0.00	0.03	0.01	0.18	0.03
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH4	0.36	0.43	5.00	244.69	244.74	0.00	0.00	0.00	0.01	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	N2O	0.51	0.61	5.00	209.94	210.00	0.00	0.00	0.00	0.01	0.00	0.00
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CO2	171.79	186.35	5.00	4.30	6.60	0.46	0.00	0.11	0.00	0.80	0.63

1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CH4	0.35	0.38	5.00	50.00	50.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	N2O	1.47	1.59	5.00	140.00	140.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	CO2	15.78	16.45	5.00	6.14	7.92	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	CH4	0.03	0.03	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	N2O	0.01	0.01	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	CO2	17.10	18.91	5.00	6.14	7.92	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	CH4	0.03	0.03	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	N2O	0.01	0.01	5.00	236.36	236.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CO2	77.57	68.61	5.00	6.14	7.92	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CH4	0.22	0.19	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	N2O	0.19	0.17	5.00	236.36	236.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.vi - Urea-based catalysts	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>4.C - Incineration and Open Burning of Waste</b>															
4.C.1 - Waste Incineration	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CO2	9.90	10.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CH4	29.95	31.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	N2O	7.96	8.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>4.D - Wastewater Treatment and Discharge</b>															
4.D.1 - Domestic Wastewater Treatment and Discharge	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.1 - Domestic Wastewater Treatment and Discharge	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.2 - Industrial Wastewater Treatment and Discharge	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>4.E - Other (please specify)</b>															
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3															
<b>5.B - Other (please specify)</b>															
Total		Sum(C): 1657.266	Sum(D): 1814.189				Sum(H): 19.581							Sum(M): 19.618	
							Uncertainty in total inventory: 4.425							Trend uncertainty: 4.429	

A	B	C	D	E	F	G	H	I	J	K	L	M
2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO <sub>2</sub> equivalent)	Year T emissions or removals (Gg CO <sub>2</sub> equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
<b>1.A - Fuel Combustion Activities</b>												
1.A.1.a.i - Electricity Generation - Liquid Fuels	CO <sub>2</sub>	818.85	1002.17	5.00	6.14	7.92	17.72	0.04	0.60	0.26	4.28	18.35
1.A.1.a.i - Electricity Generation - Liquid Fuels	CH <sub>4</sub>	0.70	0.85	5.00	228.79	228.84	0.01	0.00	0.00	0.01	0.00	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	N <sub>2</sub> O	2.06	2.52	5.00	228.79	228.84	0.09	0.00	0.00	0.02	0.01	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO <sub>2</sub>	372.22	373.05	5.00	4.17	6.51	1.66	0.03	0.23	0.13	1.59	2.55
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH <sub>4</sub>	0.05	0.05	5.00	100.00	100.12	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N <sub>2</sub> O	3.23	3.23	5.00	150.00	150.08	0.07	0.00	0.00	0.04	0.01	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO <sub>2</sub>	64.73	93.78	5.00	4.17	6.51	0.10	0.01	0.06	0.05	0.40	0.16
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH <sub>4</sub>	0.01	0.01	5.00	100.00	100.12	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N <sub>2</sub> O	0.56	0.81	5.00	150.00	150.08	0.00	0.00	0.00	0.02	0.00	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO <sub>2</sub>	6.15	7.87	5.00	3.07	5.87	0.00	0.00	0.00	0.00	0.03	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH <sub>4</sub>	0.06	0.08	5.00	244.69	244.74	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N <sub>2</sub> O	0.09	0.11	5.00	209.94	210.00	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO <sub>2</sub>	12.11	14.14	5.00	5.00	7.07	0.00	0.00	0.01	0.00	0.06	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH <sub>4</sub>	0.09	0.10	5.00	25.00	25.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N <sub>2</sub> O	0.13	0.15	5.00	60.00	60.21	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO <sub>2</sub>	7.23	8.12	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.03	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH <sub>4</sub>	0.01	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N <sub>2</sub> O	0.02	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO <sub>2</sub>	35.78	47.49	5.00	3.07	5.87	0.02	0.00	0.03	0.01	0.20	0.04
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH <sub>4</sub>	0.36	0.47	5.00	244.69	244.74	0.00	0.00	0.00	0.01	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	N <sub>2</sub> O	0.51	0.68	5.00	209.94	210.00	0.01	0.00	0.00	0.01	0.00	0.00
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CO <sub>2</sub>	171.79	191.49	5.00	4.30	6.60	0.45	0.00	0.12	0.01	0.82	0.67
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CH <sub>4</sub>	0.35	0.39	5.00	50.00	50.25	0.00	0.00	0.00	0.00	0.00	0.00

1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	N2O	1.47	1.63	5.00	140.00	140.09	0.01	0.00	0.00	0.01	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	CO2	15.78	18.80	5.00	6.14	7.92	0.01	0.00	0.01	0.08	0.01
1.A.4.a - Commercial/Institutional - Liquid Fuels	CH4	0.03	0.03	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	N2O	0.01	0.01	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	CO2	17.10	19.26	5.00	6.14	7.92	0.01	0.00	0.01	0.08	0.01
1.A.4.b - Residential - Liquid Fuels	CH4	0.03	0.03	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	N2O	0.01	0.01	5.00	236.36	236.42	0.00	0.00	0.00	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CO2	77.57	38.28	5.00	6.14	7.92	0.03	0.02	0.18	0.16	0.06
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CH4	0.22	0.11	5.00	200.00	200.06	0.00	0.00	0.02	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	N2O	0.19	0.09	5.00	236.36	236.42	0.00	0.00	0.02	0.00	0.00
<b>4.C - Incineration and Open Burning of Waste</b>											
4.C.1 - Waste Incineration	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CO2	9.90	12.15	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CH4	29.95	36.76	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	N2O	7.96	9.77	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
<b>4.D - Wastewater Treatment and Discharge</b>											
4.D.1 - Domestic Wastewater Treatment and Discharge	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.1 - Domestic Wastewater Treatment and Discharge	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.2 - Industrial Wastewater Treatment and Discharge	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>4.E - Other (please specify)</b>											
<b>5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3</b>											
<b>5.B - Other (please specify)</b>											
Total											
		Sum(C): 1657.266	Sum(D): 1884.544				Sum(H): 20.198				Sum(M): 21.857
							Uncertainty in total inventory: 4.494				Trend uncertainty: 4.675

Base year for assessment of uncertainty in trend: 2011, Year T: 2015

A	B	C	D	E	F	G	H	I	J	K	L	M
2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Year T emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
	1.A - Fuel Combustion Activities											
	CO2	818.85	1020.50	5.00	6.14	7.92	18.88	0.06	0.62	0.38	4.35	19.10
	CH4	0.70	0.87	5.00	228.79	228.84	0.01	0.00	0.00	0.01	0.00	0.00
	N2O	2.06	2.56	5.00	228.79	228.84	0.10	0.00	0.00	0.04	0.01	0.00
	CO2	372.22	320.20	5.00	4.17	6.51	1.26	0.06	0.19	0.24	1.37	1.93
	CH4	0.05	0.05	5.00	100.00	100.12	0.00	0.00	0.00	0.00	0.00	0.00
	N2O	3.23	2.78	5.00	150.00	150.08	0.05	0.00	0.00	0.08	0.01	0.01
	CO2	64.73	95.83	5.00	4.17	6.51	0.11	0.01	0.06	0.06	0.41	0.17
	CH4	0.01	0.01	5.00	100.00	100.12	0.00	0.00	0.00	0.00	0.00	0.00
	N2O	0.56	0.83	5.00	150.00	150.08	0.00	0.00	0.00	0.02	0.00	0.00
	CO2	6.15	9.23	5.00	3.07	5.87	0.00	0.00	0.01	0.00	0.04	0.00
	CH4	0.06	0.09	5.00	244.69	244.74	0.00	0.00	0.00	0.00	0.00	0.00
N2O	0.09	0.13	5.00	209.94	210.00	0.00	0.00	0.00	0.00	0.00	0.00	
Fuels	CO2	12.11	15.65	5.00	5.00	7.07	0.00	0.00	0.01	0.01	0.07	0.00
CO2	CH4	0.09	0.11	5.00	25.00	25.50	0.00	0.00	0.00	0.00	0.00	0.00
Fuels	N2O	0.13	0.17	5.00	60.00	60.21	0.00	0.00	0.00	0.00	0.00	0.00
Fuels	CO2	7.23	9.12	5.00	5.00	7.07	0.00	0.00	0.01	0.00	0.04	0.00
CO2	CH4	0.01	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
N2O	CO2	0.02	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
CO2	CH4	35.78	55.11	5.00	3.07	5.87	0.03	0.01	0.03	0.03	0.24	0.06
CO2	CH4	0.36	0.55	5.00	244.69	244.74	0.01	0.00	0.00	0.02	0.00	0.00
CO2	N2O	0.51	0.79	5.00	209.94	210.00	0.01	0.00	0.00	0.03	0.00	0.00
CO2	CO2	171.79	191.17	5.00	4.30	6.60	0.46	0.00	0.12	0.00	0.82	0.67
CO2	CH4	0.35	0.39	5.00	50.00	50.25	0.00	0.00	0.00	0.00	0.00	0.00
CO2	N2O	1.47	1.63	5.00	140.00	140.09	0.02	0.00	0.00	0.00	0.01	0.00
CO2	CO2	15.78	18.19	5.00	6.14	7.92	0.01	0.00	0.01	0.00	0.08	0.01



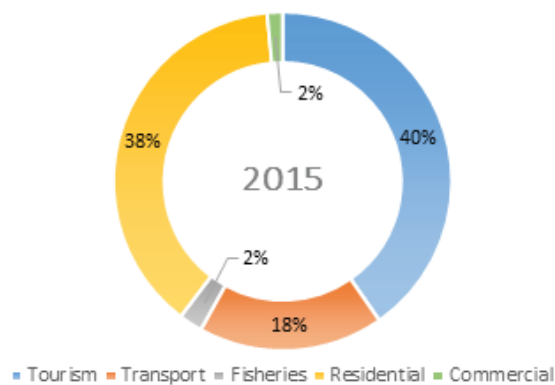
1.A.4.a - Commercial/Institutional - Liquid Fuels	CH4	0.03	0.03	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	N2O	0.01	0.01	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	CO2	17.10	20.03	5.00	6.14	7.92	0.01	0.00	0.01	0.00	0.09	0.01
1.A.4.b - Residential - Liquid Fuels	CH4	0.03	0.03	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	N2O	0.01	0.01	5.00	236.36	236.42	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CO2	77.57	28.81	5.00	6.14	7.92	0.02	0.04	0.02	0.22	0.12	0.06
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CH4	0.22	0.08	5.00	200.00	200.06	0.00	0.00	0.00	0.02	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	N2O	0.19	0.07	5.00	236.36	236.42	0.00	0.00	0.00	0.02	0.00	0.00
<b>4.C - Incineration and Open Burning of Waste</b>												
4.C.1 - Waste Incineration	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CO2	9.90	13.25	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CH4	29.95	40.09	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	N2O	7.96	10.65	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
<b>4.D - Wastewater Treatment and Discharge</b>												
4.D.1 - Domestic Wastewater Treatment and Discharge	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.1 - Domestic Wastewater Treatment and Discharge	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.2 - Industrial Wastewater Treatment and Discharge	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>4.E - Other (please specify)</b>												
<b>5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3</b>												
<b>5.B - Other (please specify)</b>												
Total												
		Sum(C): 1657/266	Sum(D): 1859/067				Sum(H): 20/968				Sum(M): 22/011	
							Uncertainty in total inventory: 4.579				Trend uncertainty: 4.692	

## 9.5 EMISSIONS BY NATIONAL SECTORS

Emissions were also assessed in major national sectors. The following sectors were identified.

- Tourism
- Transport
- Fisheries
- Residential
- Commercial

Figure 24 shows the emissions categorized by national sectors. Emissions by the tourism sector contributes a major share of 40% of the total national emissions. These emissions include the sectors power production, transportation (excluding domestic air transport), LPG usage and waste. Tourism is the largest contributor to the economy of the country and the annual visit of number of tourists are on a consistent rise. Second largest emissions are from the residential use contributing 38% of the total emissions. The third major contribution is from the transport sector. This is mainly composing of domestic air transport, land and marine transport (excluding marine transportation of tourism sector).



**Figure 24: Contribution to emissions by national sectors**

Figure 25 and Figure 26 shows a breakdown of the tourism and the residential sector respectively. It shows that electricity generation contributes to most of the emissions in both sectors. In tourism sector, 78% of the emissions is from electricity generation. Maldives tourism operates on a one-island-one resort concept. Therefore, each resort has their own power generation, which contributes to a large share from the sector emissions. Transport sector shares a 17% of the tourism sector emissions. This excludes the air transportation and is solely based on marine transport including transfers and leisure activities within the sector. In the residential sector 87% emissions is from electricity generation as this compose of electricity generations for the entire country. There are no other alternative power generation sources other than diesel-powered generators except for few renewable energy power productions.

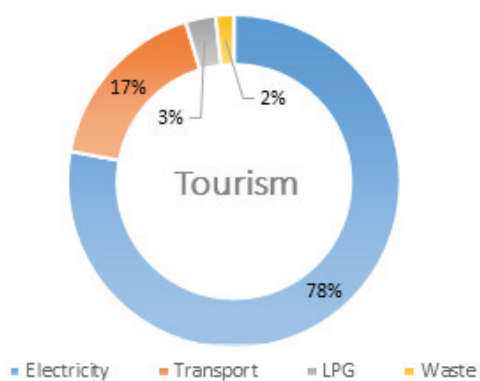


Figure 25: Breakdown of the emissions from tourism sector

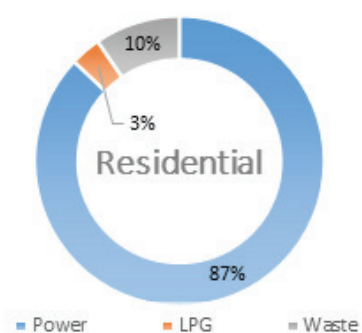


Figure 26: Breakdown of emissions from residential sector

Timeseries of these national sector emissions were assessed as shown in Figure 27. Overall, an increase in the emissions are observed in all the sectors except for the fisheries, where a general decline is observed.

In the fisheries sector, contributors for the emissions were for the electricity generation and emissions from the fishing vessels. The estimate used for the emissions from the vessels were based on the number of fishing trips reported in the national statistics. There was a decline in the number of fishing trips which explains the general declining trend in the emissions. This was discussed with the sector and it was found that with the development within in the industry, the type, sizes and time spent for fishing has dramatically changed. A trip is counted as a when a vessel leaves and returns to the port. In recent times the size of the vessels used has increased and the number of days they spend on a trip also has increased thus increasing the catch. Therefore, the need to make frequent trips decreased which is why the number of trips are shown to decrease leading to a decrease in emissions.

Residential sector has shown a consistent increase. Contributors to this sector are electric production, LPG usage and waste produced (Figure 26). With the increase in population, the use of all utilities increases and production of waste also increases leading to an increase in emissions of the sector.

Tourism sector also shows a consistent increase. Contributors are electricity production, transportation, LPG usage and waste (Figure 25). As the emission estimate used for these contributors are linked to the number of bed nights, the trend depends on the tourist arrival.

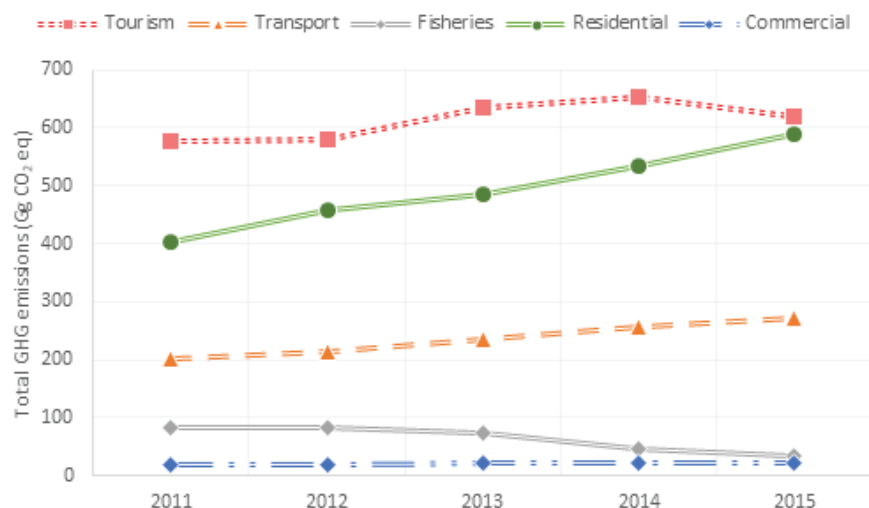


Figure 27: Timeseries of sectoral emissions

## 9.6 MALDIVES GREENHOUSE GAS EMISSION SCENARIOS

Domestic GHG emission was not a major focus for Maldives in its climate action till 2008. Prior to that the only GHG inventory reported was for 1994. Governments announcement of a mitigation target in 2009, prompted a focus on expanding domestic activities on Mitigation. This led to development of sectoral inventories and projections. The table 36 below summarizes the work done related to GHG inventory and its projections.

Table 36: Summary of previous emission inventories and projections done for Maldives

Document	Year of Inventory	Emission	Projection
First National Communication	1994	152.977 GgCO <sub>2</sub> e	N/A
Energy Supply and Demand Report 2002	2002	665 GgCO <sub>2</sub> e (energy only)	N/A
Energy Supply and Demand Report 2006	2003	572.563 GgCO <sub>2</sub> e (energy only)	N/A
	2004	768.627 GgCO <sub>2</sub> e (energy only)	
	2005	676.223 GgCO <sub>2</sub> e (energy only)	
Energy Supply and Demand Report 2010	2009	1034.354 GgCO <sub>2</sub> e (energy only)	N/A
Maldives Carbon Audit 2009	2009	1284.165 GgCO <sub>2</sub> e (bottom up)	2020: 2494.04 (-12.5%, 11%) GgCO <sub>2</sub> e (bottom up) (energy only: 1879.432 GgCO <sub>2</sub> e)
		1326.415 GgCO <sub>2</sub> e (top down)	2020: 2573.379 (-15.5%, 13.7%) GgCO <sub>2</sub> e (top down) (energy only: 1958.77 GgCO <sub>2</sub> e)
Low Carbon Development Strategy	2009	1133 GgCO <sub>2</sub> e (energy only)	2020 : 1968 GgCO <sub>2</sub> e (energy only)
Energy Supply and Demand Report 2013	2010	1078.561 GgCO <sub>2</sub> e (energy only)	N/A
	2011	1138.852 GgCO <sub>2</sub> e (energy only)	
	2012	1229.615 GgCO <sub>2</sub> e (energy only)	
Second National Communication	2011	1225.598 GgCO <sub>2</sub> e	N/A
Intended Nationally Determined Contribution	2011	1037 GgCO <sub>2</sub> e (energy only)	2020: 1984 GgCO <sub>2</sub> e (energy only)
			2025: 2568.9 GgCO <sub>2</sub> e (energy only)
			2030: 3342.6 GgCO <sub>2</sub> e (energy only)

As seen in the table above the only comprehensive inventories done for the years 1994, 2009 and 2011. Though must note that inventories done for 1994 and 2009 both consider that a significant portion of the waste emission is coming from landfills. The inventory on 2011 considers that all waste are open burnt as no waste is kept for long period of time at the dumping site and those that remain does not accumulate to height to allow anaerobic decomposition of waste (ie conditions needed for methane generation in landfills).

The Projections are only seen in MCA 2009, LCDS 2011, and INDC. LCDS and INDC projections omitted waste sector as the model used (GACMO) was not equipped to handle non-energy sector projections. The MCA projections used individual sectoral growth, either using historical growth or existing plans, and total aggregated. All the modelling done shows considerable agreement between each other for 2020 projections. Only projection that goes beyond 2020 is the INDC.

## 9.6.1 Baseline

For the BUR LEAP was chosen to model baseline and mitigation scenario due to its flexibility. The LEAP model could provide yearly emission information sectorally. Baseline year for the model was set for 2010. The reason being, there is host of data available which was collected independently allowing for cross verification as well as a more complete data set.

To set the baseline, data structure was built primarily mirroring the energy balance reports as it was reflective of the national context. The waste sectors and HFC sectors were considered as non-energy sectors. In addition, a set of key assumptions were identified for the projection as relevant to different sectors. Table below is the outline of the data structure

**Table 37: Data Structure for LEAP model and the data sources for sectors**

	Data Sources
Key Assumptions	
Demography	Energy Balance 2010 – 2012, Maldives Population Projection 2014-2054
Economics	Maldives Debt Sustainability Analysis – IMF2017 HIES 2016
Demand	
Commercial and Public services	Energy Balance 2010-2012
Transport	Energy Balance 2010-2012, GHG emission Sea Transport Activities in Tourist Resorts
Industry	Energy Balance 2010-2012
Resorts	Energy Balance 2010-2012, Tourism Yearbooks, Maldives Debt Sustainability Analysis – IMF2017
Residential	Energy Balance 2010-2012
Fishing	Energy Balance 2010-2012
Transformation	Energy Balance 2010-2012
Resources	
Non-Energy Use	
Waste	SNC, Waste Department

The base year estimations, though primarily taken from the underlying data used for the 2010 energy balance were compared with the data and estimates available from MCA, Energy Balance 2009, 2011 and 2012, SNC estimates regressed to 2010. The domestic energy flow diagram from source import to end use is shown in figure below.

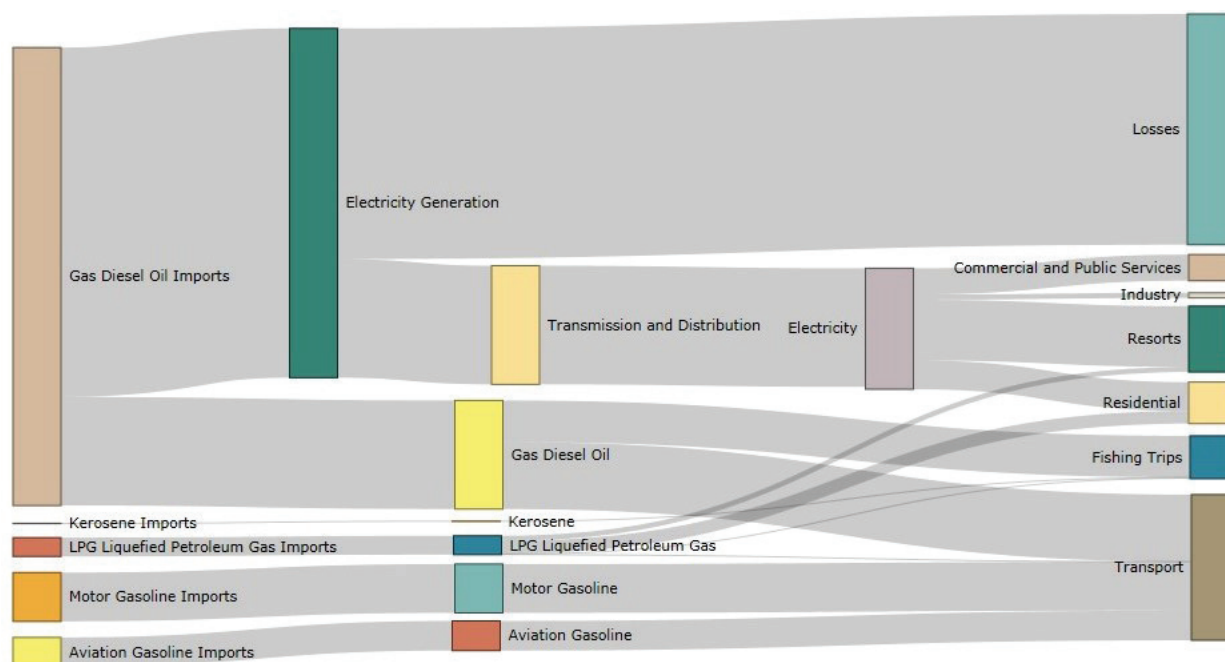


Figure 28: Sankey Diagram showing energy flow in Maldives for Base year (2010)

For the baseline projection to 2035 key assumptions, sector specific assumptions, proxies and expert opinion was utilized. And the specific assumption and proxies used for individual sectors are provided sections below.

## 9.6.1.1 Energy Sector

### 9.6.1.1.1 Demand

#### 9.6.1.1.1.1 Commercial and Public Services

Commercial and public services include retail, service industries operating in inhabited islands (excluding resorts), public infrastructure and services that consume grid electricity. The base year and the following 2 years (2011 and 2012) data is drawn from energy balance 2010-2012. Though in the energy balance information is segregated for commercial and public services as well as differentiated between Greater Male' Region and Other Atolls, for the purpose of this baseline projection these values have been combined to give a single value. The reason is that development data or indices like GDP are not segregated geographically and the attribution of growth for individual parts of this sector to GDP is difficult to ascertain. However, power consumption, especially commercial and public services sectors, have a close relation with economic development. Thus, for the future projection the sector would grow in tandem with the GDP growth projection provided by IMF 2017.

#### 9.6.1.1.1.2 Transport

The transport sector includes all forms of domestic travel and it has been segregated to land, marine and aviation subsectors for the purpose of projection.

Land transport has been segregated geographically to Greater Male' Region and Other Atolls. The reasoning behind this segregation due to significant difference of vehicle to population ratio in Male' and other atolls etc. Land transport is further segregated by the mode of transport. Table below shows key indicators utilized

**Table 38: Indicators and Assumption used for land transport**

Vehicle Types	Vehicle/100 persons		Fuel types	Distance travelled (km)	Fuel Consumption (l/ km)
	Fuel types				
	Male’	Other Atolls			
Urban Buses	0.63	0.18	25% Diesel 75% Gasoline	14600	0.142- 0.29
Motorcyces	27.09	4.11	Gasoline	5475	0.07
Heavy Duty Vehicles	0.74	0.22	5% Gasoline 95% Diesel	14600	0.14-0.15
Light Commercial Vehicles	1.30	0.30	45% Gasoline 55% Diesel	7300	0.068 – 0.071
Passenger Cars	2.15	0.45	Gasoline	9125	0.19

Given the high saturation of vehicles in Male' for the projection it is assumed that there will be no increase in vehicle per capita. Thus, the number of vehicle increase would depend solely on the increase in population in Greater Male' Region. As for the other Atolls, it is expected that as the country develops the number of vehicles per person increases according to increase in GDP.

For sea transport the segregation has been made between purely tourism activities (Safari and tourist excursions/water sports), passenger and cargo transport activities. For tourism activities base year value as well as projection is calculated as product of energy intensity per bed night multiplied by total bed night. For excursions and water sports bed night refers to resort bed nights and for safari bed nights were used. Bed nights prior to 2016 is taken from tourism yearbook and post 2016 value provided in IMF 2017 is used. Energy intensity per bed night is derived from data available from MEE 2017. For the future projections we do not assume there being an increase in final energy intensity for tourism related activities. Passenger transport sector was categorized further into 1. Dhoni, which is diesel based and 2. Speedboats, which is petrol based. For the base year assumption were made on hours of operation of each vessel and energy intensity of operation per hour for each vessel type. Number of vessels were taken from energy balance data. For the projection, we assumed the number of passenger vessels in operation will increase with population. We do not assume any increase in the energy intensity or operating hours per vessel. For cargo transport sector, further sub categorization was done based on the classification of vessel type as given in the transport authority. All cargo vessels are equipped with diesel based engines. For the base year assumption were made on hours of operation of each vessel and energy intensity of operation per hour for each vessel. Number of vessels were taken from energy balance data. For the projection, we assumed the number of cargo vessels in operation will increase with GDP. We do not assume any increase in the energy intensity or operating hours per vessel. The values described above are listed in the table

**Table 39: Indicators and assumptions used for passenger and cargo marine transport**

	Type of vessel	Registered Vessels	% of Active Vessels	Active vessels	Fuel consumption (l/hr)	Annual Hours of operation
Passenger	Dhoni	1320	0.6	792	39	625
	Speed boats	394	0.7	275.8	65	210
Cargo	Dhoni	172	0.5	86	39	500
	Bahtheli	147	0.5	73.5	27	375
	Barge	123	0.5	61.5	57	375
	Other	39	0.5	19.5	32	375

**Table 40: Indicator and assumption used for tourism sector transport**

	bed-nights	Energy Consumption/ bed night		
		diesel (litres)	LPG (kg)	Petrol (litres)
Safari	156753	15.87	0.20	1.06
Excursions and Water Sports (resorts)	5986340	3.04	N/A	2.85

For aviation, only domestic aviation is considered. The base year value was taken from energy balance report. For projection it is assumed that this sub sector will grow as same as GDP.

#### 9.6.1.1.1.3 Industrial Sector

In the industry sector, only sectors worth noting is the fish processing and freezing plants. The other industries include all industrial work done at Thilafushi. The data is available collectively for Thilafushi from the energy balance reports. The base year data was taken from energy balance 2010-2012 as energy intensity per GDP dollar.

#### 9.6.1.1.1.4 Resorts

Resort was treated separately from other industrial and commercial sector because its large share in energy use. For the purpose of modelling the energy use in resorts were segregated to the end use as well as fuel used as energy. The energy use of each end use was normalized using the number of ben-nights for future projections. It is assumed that there would be no growth in energy use per bednight for resort sector. Following table summarizes

**Table 41: Indicators and assumptions used for energy use at resort (transport excluded)**

End use	Fuel share	Energy intensity (kWh/ bed-night)	Notes
Cooking	LPG – 67%	10.8	
	Electricity – 33%		
Lighting	Electricity	7.9	
Appliances	Electricity	10.3	
Cooling	Electricity	31.8	
Other	Electricity	17.5	Unassigned usage can include energy used centralized, like hot water generation and laundry
Desalination	Electricity	7.9	

The base year data was taken from the energy balance 2010-2012. For the projection, resort bed nights from 2010 to 2017 was taken from annual tourism yearbook and the growth rate beyond 2017 was taken from IMF 2017.



#### 9.6.1.1.1.5 Residential

The residential is considered the energy used in households. For the purpose of this model the sector was first segregated geographically for Greater Male' Region and Other Atolls. And similar to resorts for each geographical area, it was further segregated based on end use. Population was used to normalize the energy at the end use. Table below

**Table 42: Indicators and assumption used for residential sector energy use**

End use	Greater Male'		Other Atolls	
	Fuel share	Energy intensity (kWh/capita)	Fuel share	Energy intensity (kWh/bed-night)
Cooking	LPG – 67% Electricity – 33%	299	LPG – 67% Electricity – 33%	349
Lighting	Electricity	167	Electricity	142
Appliances	Electricity	507	Electricity	162
Cooling	Electricity	321	Electricity	128
Other	Electricity	4	Electricity	7
Desalination	Electricity	137.24	Electricity	51.1

For the future projection growth rates were assumed for per capita energy use. For each of the sub category a different growth rates were assumed based on the current saturation and possibility for future expansion of each of the sub categories. The same principles were applied for differentiated growth in other atolls and Male' Region. The initial growth rates are based on the specific energy growth rate from energy balance report 2010-2012.

**Table 43: Assumed growth rate for baseline for Male region residential energy use**

Male' - End use	2011	2015	2020	2025	2030	2035
Cooking	5%	3%	2%	1.5%	1%	0.95%
Lighting	5%	3%	2%	1.5%	1%	0.95%
Appliances	5%	3%	2%	1.5%	1%	0.95%
Cooling	9%	5%	3%	2.1%	1%	0.55%
Other	5%	3%	2%	1.5%	1%	0.95%
Desalination	5%	3%	2%	1.5%	1%	0.95%

**Table 44: Assumed growth rate for baseline for Atolls (excluding Male' Region) residential energy use**

Atolls - End use	2011	2015	2020	2025	2030	2035
Cooking	5%	3%	2%	2%	1%	1%
Lighting	5%	3%	2%	2%	1%	1%
Appliances	21%	9%	7%	5.8%	3.1%	2.6%
Cooling	21%	9%	7%	5.8%	3.1%	2.6%
Other	5%	3%	2%	2%	1%	1%
Desalination	11%	9%	7%	7%	3%	3%

#### 9.6.1.1.1.6 Fishing Trips

Although it is primarily transport, the reason fishing was kept separate is there is a portion of fisheries which utilizes fossil fuel for other purposes, namely cooking and mini cold storages. The sector is sub-divided in to Male and Atolls. The energy use is divided in to fuel types that is given in liter/trip for liquid fuels and kg/trip for LPG. The assumptions are given in table below which is directly lifted off the energy balance 2010-2012.

**Table 45: Assumptions and Indicators used for Fisheries**

	Base year
Number of fishing trips	152,193
Greater Male' Region	16,517
Other Atolls	135,676
Assumed diesel used for transport per trip (litres/trip)	204.00
Assumed LPG used for cooking per trip (kg/trip)	4.00
Assumed Kerosene used for cooking per trip (litres/trip)	2.00

### 9.6.1.1.2 Transformation

#### 9.6.1.1.2.1 Electricity Generation

In Maldives the only energy transformation that occurs is electricity generation. For the LEAP model it is set up such that based on the demand requirement from various sectors, energy is produced from various sources which is proportional to the available capacity with the exception of Solar PV. It is assumed to be operating at full capacity irrespective of its share in capacity. The available capacity and the respective efficiency of electricity generation was borrowed from the energy balance. The assumptions and figures used are summarized in the table below.

**Table 46: Assumed Efficiency and Capacity of electricity generation from various sources**

Source	Conversion efficiency	Capacity at base year
Diesel – Male'	35%	61,621
Diesel – Other Atolls	33%	36,148
Diesel – Resort	34%	120,936
Diesel – Fisheries	28%	6,233
Diesel – Other	34%	5,244
Solar PV – Male'	100%	0.23
Solar PV – Atolls	100%	9.3
Solar PV – Resorts	100%	50.3
WTE – Male'	33%	0
WTE – Atolls	33%	0

For the baseline scenario the assumption was there would be no change to the energy mix over-time. And it would continue to grow proportionally with the demand. The conversion efficiency used here is the overall process efficiency which includes the losses from distribution networks. This approach was taken due to the lack of data available outside Male' to separate out the inefficiency in the generation and the losses in the grid. The sparse data available is unreliable. Therefore it was assumed that the distribution and transmission is at 100% for the LEAP model.

#### 9.6.1.1.3 Resources

It was assumed that all fuel required to meet the demands above would be imported. As it was assumed in the transformation section above that Maldives neither produces or refines any fossil fuel, the refined product was imported and used directly for the energy requirements of the country

### 9.6.1.2 Non-Energy sectors

The only non-energy sector considered in this projection is waste sector. For the projection waste sector was segregated to Male' Area, Other Atolls and Resorts. The total waste generated is calculated by multiplying the waste/capita rate with number of people for Male' and Atolls (refer

to table in GHG chapter). Whereas for resort sector, waste per bed-night was used to compute

the total waste generated (refer to table in GHG chapter). As projections was available for both population and tourist bed-nights, that was used to project total waste generated in the sector. To be consistent with the GHG inventory, it is assumed that all waste generated are open burnt as well as all CO<sub>2</sub> emission from waste burning is considered as inorganic CO<sub>2</sub>.

### 9.6.1.3 Comparison

The projection made would be the first projection that's projects emission annually for 25 years. The fidelity of the model was tested by comparing the model results with the actual emissions calculated in the BUR, energy balance studies as well as projection made in MCA and INDC. The average deviation of the LEAP model results compared to others are well below 5%. Waste sector was not considered in this comparison as there is a significant difference in the underlying methodology and assumption (Landfill vs Open Burning) between the different projections.

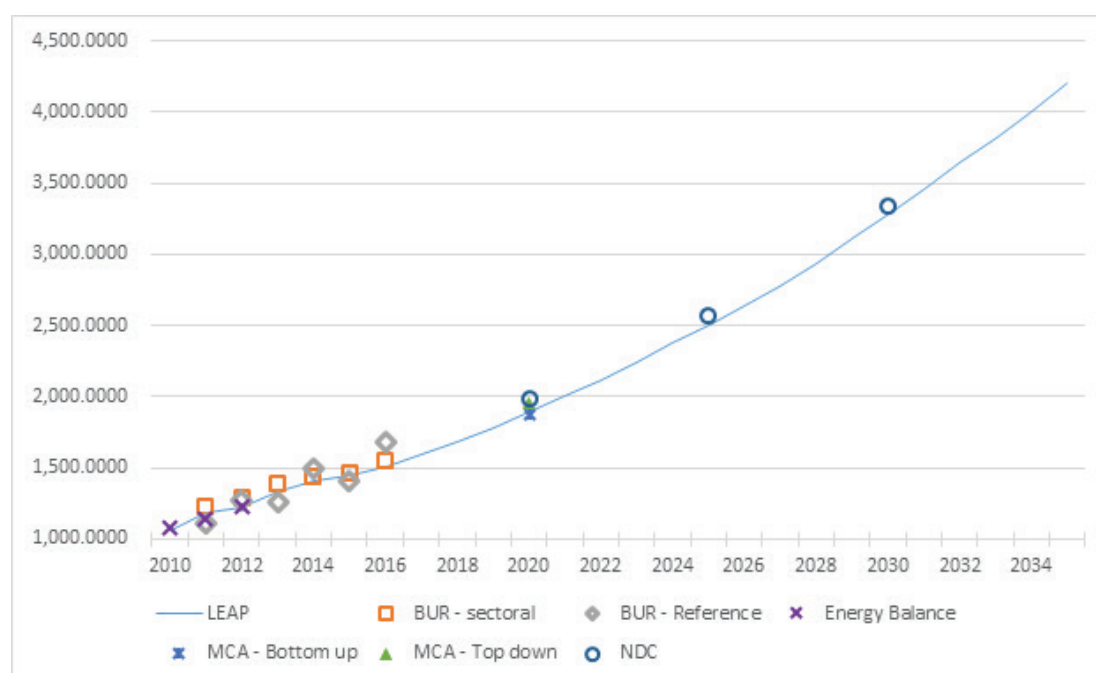


Figure 29: Inter-comparison of the LEAP model results with actuals measured from Energy Balance 2010-2012, BUR reference approach, BUR sectoral approach estimates and Maldives Carbon Audit Top Down and Bottom Up projection, NDC projection

### 9.6.2 Mitigation

For the mitigation assessment, the first step was to identify mitigation actions. Thus following criteria was developed to objectively identify mitigations action.

- Projects and programs that includes components that lead to an emission reduction
- Projects and actions which has quantifiable indicators (eg: power generation or power consumption) which can be utilized to compute emission reduction
- Projects that are concrete in terms of its objectives, timelines and scale.
- Projects and programs that are either completed, ongoing or planned since 2010 to the present day.

The mitigation actions identified using above criteria can be broadly classified into Solar PV projects, Energy efficiency Projects and Waste to Energy Projects. Interventions in transport sector has not been considered as none of the identified interventions meets the above requirement. Some of these interventions include potential introduction of vehicle/vessel emission standards and introduction of efficient vessels by private transportation operators.

### 9.6.2.1 Solar PV projects

For solar PV projects information was collected from energy department and verified using the historical documentation available for public projects. For private projects the information was only partly verified by the service provider for the private installations.

The PV installations are segregated among Male', Other Atolls and resorts. For each of the subcategory the PV installations were sorted chronologically starting from 2010. All installations prior to 2010 are included in the baseline. As the information of PV installations are given in kWp. That value needed to be converted to toe/year as given in the model. To convert it following formula was used

$$\text{Energy Capacity (toe/year)} = \text{PV installations (kWp)} \times \text{Hours of Irradiation} / 11630$$

In the above equation the hours of irradiation was taken as 1500. This is based on extensive literature review of studies done in Maldives and found that the values used in those reports fall within  $1500 \pm 5\%$ . The assumption made in entering the data to the model is that any installation done in a year is operating full year the following year, i.e. installations done in 2010 are entered in 2011. All projects completed from 2010 to 2018 have been included and projected to understand the impacts of these projects on the 2030 target.

As for the planned projects, all projects that are under implementation are considered separately. These projects include mostly planned activities under POISED and ASPIRE. It is assumed given the current speed of implementation that these installations would be completed before 2025. The components currently under procurement are added as a step change over the next two years while the rest is assumed to complete gradually until the project target is met by 2025. The completed and planned projects are considered as certain projects and are included together in a single scenario.

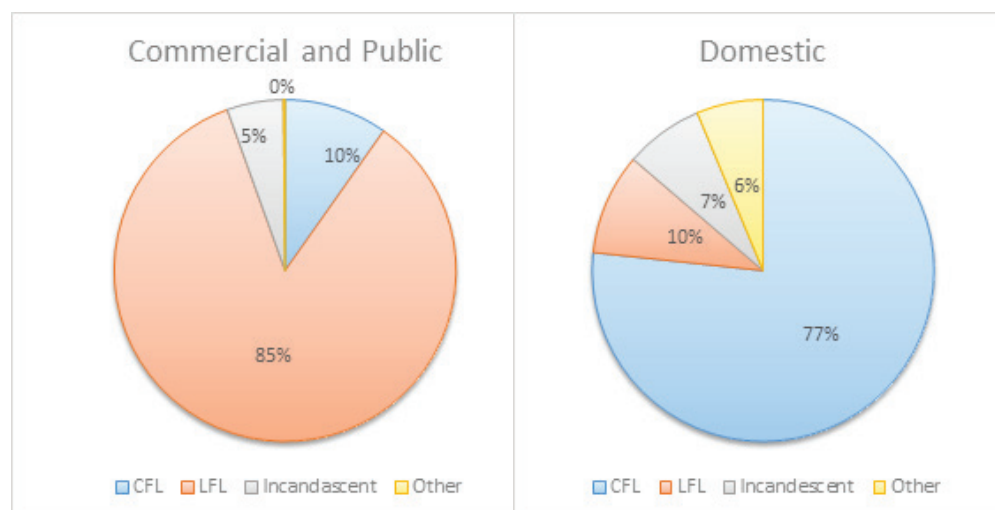
Other future installations beyond the POISED and ASPIRE installations it is assumed that government would be striving to meet the policy target of 70% peak demand (or about 14% of total energy consumption) in inhabited islands with PV. For the resort and tourism related PV installation is assumed to continue increase at the same rate as the sector growth. This leads to a doubling of the 2018 total PV installations by 2030. This is included as part of potential mitigation scenario.

For individual PV projects, the mitigation impact is calculated by multiplying the energy production from the PV projects with a grid emission factor (GEF). The energy produced is calculated as per the above equation without the conversion to toe (division by 11630). GEF value is assumed to be  $0.72 \text{ kgCO}_2\text{eq/kWh}$  (reference).

### 9.6.2.2 Energy Efficiency Mitigation Action

For energy efficiency measures, two nationwide mitigations were identified. That is FAHI-ALI programme and Standard Labeling Programme. The base methodology applied for energy efficiency measure is identifying avoided energy or fuel from increased energy efficiency

FAHI-ALI programme is focused on replacing existing light fixtures to LED lights. The programme involves distribution of 737,750 LED lights (270,250 tube lights and 467,500 bulbs) received as assistance from China, India and Germany. In addition, the programme also carries out awareness campaigns to the general public. The baseline information for lights used is available for 2011. As per the 2011 survey energy consumption for lighting segregated into technology is provided in Figure 30.



**Figure 30: Energy consumption by type of lighting for Commercial and Public lighting (right) and Domestic lighting (left)**

To assess the impact of this programme it is assumed based on the current trajectory of the market (2011-2018) that 95% of the lights would be converted to LED lights by 2030. Based on that assumption energy used was projected. The difference of energy use between the baseline and projection with the impact of FAHI-ALI programme is considered for the mitigation scenario. The avoided CO<sub>2</sub> is calculated by multiplying GEF with the avoided electricity.

Standard Labeling Programme (SLP) focuses on development comparative labels based on energy consumption and efficiency of the products. The programme focuses on Refrigeration appliances, air conditioners and washing machine. As the programme is still in draft stage, and is expected move to voluntary implementation phase in 2020, the mitigation impact of the project is estimated beyond 2020. As indicated in energy breakdowns in Table 41 and Table 42 cooling and appliances are the two key energy consumers in residential households and resorts.

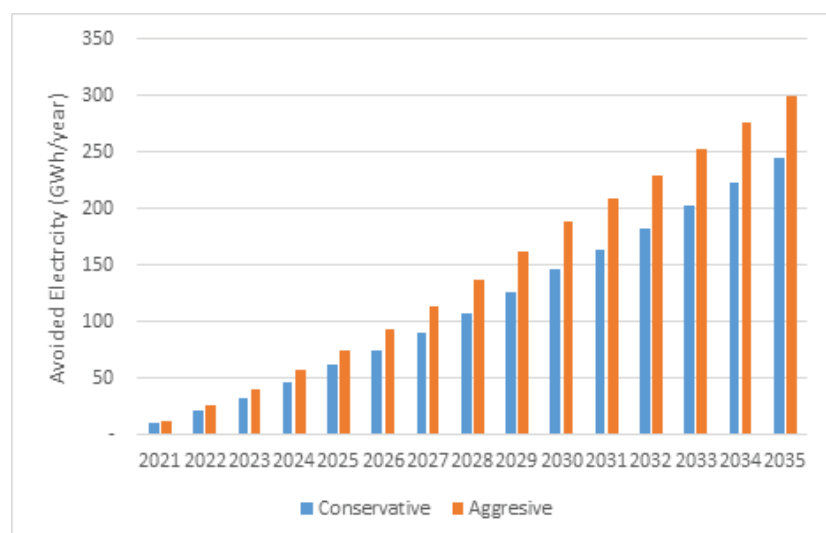
For baseline it is assumed that 22% and 14% of the energy consumed for cooling is for electric fan in Atolls and Male' region respectively. The remaining is utilized by air conditioners. The behavioral survey conducted for the SLP indicated 81% and 63% of the households has air conditioners in Male' and Atolls respectively. Based on the draft standards developed and baseline energy consumption for cooling, it was estimated that 77% of the air conditioners currently in use are lower than 3 star rating consuming (69%) 80% of the cooling load in Male Region. Similarly 79% of air conditioners used in Atolls are lower than 3 star rating consuming (65%) 83% of the cooling load.

For the mitigation impact of SLP two approaches of implementation were considered, a conservative approach and aggressive approach. The conservative approach assumed phasing out any appliance below 2 star rating by 2035. It is also assumed that by 2030, 56%, 52% and 48% of the appliances would be 4 star rating or higher (by the current standard) in Male', Atolls and Resorts

respectively.

The aggressive implementation approach assumed phasing out any appliances below 2 star rating by 2030. It is also assumed that 69%, 65% and 63% of the appliances would be 4 star rating or higher (by the current standard) in Male', Atolls and Resorts respectively by 2030.

For commercial (excluding resort) and public sector, similar approach was used. Though energy usage breakdown was not provided for this subsector, the electricity usage of resorts without desalination was used as a reference to calculate overall impact. The avoided electricity using two approaches are given in Figure 31.



**Figure 31: Avoided electricity (annually) from the conservative and aggressive implementation of Standard Labeling Programme**

Based on these two approaches avoided energy consumption was derived compared to the baseline scenario. Multiplying that with the GEF was used to calculate emission reduction. Note that in this calculation, impacts of water usage standard for washing machine was not included due to lack of baseline.

Other energy efficiency measures like behavioural change for energy conservation and building sector energy efficiency has not been considered due to lack of data needed for projection. Energy efficiency resulting from supply side interventions are not considered as the scope and extent of those interventions are not available for the projection timeframe. These interventions are ad-hoc and does not follow a set pattern. There was also an issue of available data not being reliable enough to assess the impact of such interventions.

### 9.6.2.3 Waste to Energy

Waste to Energy Projects are also considered as a key mitigation measures. There are two projects currently under implementation, that is;

- Greater Male Environmental Improvement and Waste Management Project
- Islands Waste to Energy Project

Greater Male Environmental Improvement and Waste Management Project, focuses on building 500 tons per day (TPD) incineration plant at Thilafushi catering to current waste that is deposited at Thilafushi (from Male Region and islands and resorts of the central region). It is to generate 8MW of power and is capable to providing the full energy requirement of Thilafushi Industrial works. The project is assisted by ADB.

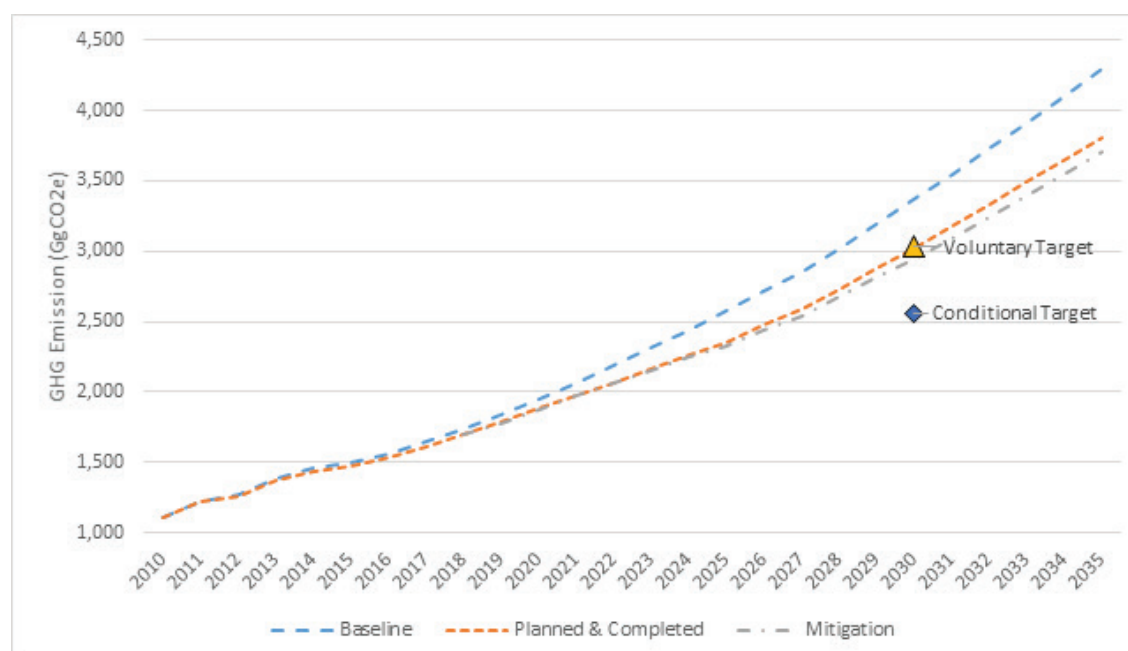
Islands Waste Energy Project focuses on building 500 TPD incineration plant at Addu City catering to the waste generated from southern 4 atoll (Gaafu Alifu, Gaafu Dhaalu, Fuvahmulah, Addu City). It generates 1.5 MW of electricity and the energy produced would be fed into Combined Power System Grid at Addu City. This project is assisted by IRENA.

In assessing the impact of these two projects any emission related to waste burnt in these Waste energy facilities was moved from non-energy sector to energy sector (under transformation). It is assumed, the ratio of power generated and rated power is reflected in the ration of waste burnt and total capacity of the incinerator. That is if the Waste energy facility is producing 50% of the maximum available power, it is only consuming 50% of the waste of maximum capacity. Note that 50% could be that the power is operating at 50% of the capacity throughout the year or it is operating at full capacity for half a year. The third and final assumption made using IPCC tier 1 default factor emission of energy production from waste for emission estimates from Waste to Energy.

It is important to also highlight that government have plans to have regional incineration facilities for waste management, however emission reduction due to shift in waste management practices (incineration, recycling and composting) is not considered in this assessment. The implementation time frame and technology for these are unclear at the time of this assessment.

#### 9.6.2.4 Mitigation Assessment Results

The results of the assessment shows that, the currently planned mitigation actions is leading to a 10.3% reduction from BAU and is going to achieve voluntary mitigation target set in Maldives Nationally Determined Contribution to Paris Agreement by 2030. With the additional mitigation action (RE installation beyond ASPIRE & POISED and [modest vehicle/vessel emission standards]) would allow to over achieve the voluntary target and achieve 12.6% [16.5%] reduction of emission from BAU. However, there is still a significant gap between the conditional target and mitigation scenario. Measures not included in this assessments due to lack of data would help reduce this gap but it is not going to close the gap. Measures not included may be added later when better data is available. However, there is need to accelerate mitigation action and look at innovative and new ways of emission reduction to meet the conditional target of 24%.





## 9.7 EXISTING MEASUREMENT, REPORTING AND VERIFICATION SYSTEMS

Table 47 Data Collection at Department Level

Department/ Authority	Role/Mandate	Types of Data Collected	Method of Data Collection	Means of Verification
Maldives Energy Authority (MEA)	The Regulator of the Energy Sector in the Maldives.	Power Data  (Average daily peak load, Average Daily Generated, Total Units generated, Max peak load, Max peak load date, Min peak load date) from all inhabited islands and resorts on monthly/yearly basis	Collected on a monthly basis, through the Enerstat Database  (The data collected by the Utilities is used for the database)	Utilities do not verify this data
		Fuel Consumption data  (Opening balance, closing balance, price per litre, received, wasted, consumed for power, consumed for other uses)		
		Billing Data  (Domestic, Commercial and Government)		
		Approved Net Metering applicants and the drawings.	Application via letters, no forms	Not Verified
		Appliance import data  Appliance Information segregated by type	Email requests to Customs, Forms	Not Verified
		Approved total amount for the renewable energy items and their applicants	Collected Quarterly via application letters and documents	By comparing with the total amount of duty exempted by the Customs at the request of MEA
Energy Department	The department responsible for policy making and implemen- tation of renewable energy projects in the Maldives	Electricity Data  (Daily Peak Load, Peak Load Time, Installed Capacity, Installed Generator Sets, Monthly Average Use, Yearly Electricity Production, Oil Consumption, Electricity Cable Installed Year, Distribution Cable Size)	Information is collected from utilities and Island councils via a form – Yearly	This data is verified at Utility Level (Engineer checks and signs off the monthly data sheets)
Climate Change Department (CCD)	CCD is tasked to carry out the obligations of all climate change related International treaties and activities related to organizations that the Maldives is party to. As the focal point for UNFCCC, CCD is responsible for the preparation of National Communications (NC) and Biennial Update Reports (BURs)	All data required for the com- pilation of GHG inventories	By writing to the respective ministries and depart- ments, done for NCs and BURs	Data collected for the process would undergo basic quality checks for data ambiguity and consistency. In addition, data from the existing sources, literature and stakeholder consul- tations will be used for validation and verification
Fenaka Cooperation Pvt Ltd	A government owned utility company with a mandate to provide island communities with electricity, water and sewerage services	MEE Annual Data Book, POISED Project  Electricity Loads, Genset Usage, Production, Fuel/Lub Oil, Consumers	From Islands via forms/ reports	100% not verified (due to damage to panel board and other issues)

Department/ Authority	Role/Mandate	Types of Data Collected	Method of Data Collection	Means of Verification
State Electric Company (STELCO)	State Owned organization responsible for the generation and supply of electricity to customers throughout the Maldives	Electricity Data		
National Bureau of Statistics (NBS)	Responsible for the core statistical activities in the country; conducting population census survey, compiling and disseminating economic and social statistics.	Number of registered vehicles; land, sea and air  Electricity produced and utilized	Via consultation with relevant departments / utilities	-
Waste Management Corporation Limited (WAMCO)	With a mandate to provide a sustainable waste management solution throughout the country, WAMCO is responsible for the waste management functions of the Greater Male' Region	Total Disposed Data (Male', Hulhumale' and Thilafushi)  Waste Quantity  Waste Composition	Collected Via forms, by considering the capacity of the vehicles and vessels.  Calculated by direct observation	Not Verified
Tourist Resorts	Every resort has their own waste management routines/functions	Total generated Waste  Total Waste dumped into the sea  Total Burnt Waste	By the relevant departments of the resorts (daily, weekly and monthly)	Data is not verified by all resorts
WAMCO Maldives and Parley Maldives	WAMCO is responsible for the waste management functions of the Greater Male' Region  Parley Maldives helps prevent, divert and reduce the plastic pollution in the Indian Ocean	Pet Plastics (tonnage) and Paper Tonnage	This is calculated from the exported paper.  WAMCO collects this data for paper and Parley Maldives collects this data for Plastics on a monthly basis	Not Verified
Maldives Transport Authority	Regulator for transport sector in the Maldives. Transport authority collects and maintains data regarding land and sea transport.	Land and Sea Transport Data:  Vehicle/Vessels type, Engine type, Type of fuel used, Engine/Motor Capacity, Seating capacity, Tonnage  Model Number, Chassis Number, Date of Import, Date of registration, Information on sea/road worthiness	Via Vehicle Registration Forms on a daily basis	To an extent- yes  It is verified by comparing it with other documents;  Road Worthiness Report  Customs Forms  Manufacture Certificate

**Table 48: Data Collected at Project Level**

Project	Description	Data Collected	Means of Collection	Verification
Preparing Outer Islands for Sustainable Energy Development (POISED) Project	The project will install solar-diesel hybrid grids on outer islands and the greater Male region.	Oil Import data  Quantity and Type of Oil Imported	Maldives Customs Service Format	Verified by the Customs Services
		Solar Resources Data  (Global Horizontal Irradiance, Direct Normal Irradiance, Diffuse Horizontal Irradiance, Global Tilted Irradiance, Monthly and Yearly Mean Temperature)	By measuring stations  Frequency: Timeseries  By LIDAR – ESMAP	Verified by an International consultant <sup>3</sup>  Data is verified by the consultant based on International standards
		Wind Resource data  (Minimum wind speed, Maximum Wind Speed, Mean wind speed, Vertical mean wind speed, Mean wind direction, Turbulence intensity)		
		Solar PV Installed Capacity	In excel sheets by the Energy Department	Not Verified – lack of systematic mechanism in the department
		Duty Exemption; projects for which customs duty have been exempted by the request of MEE	Maldives Customs Service format  (A cover letter along with the projects for which duty have been exempted in a particular year and their value are sent to MEE) – this is collected yearly	Yes, by Customs Services
		Power Consumption Data  Fuel Usage  Power Production	Data is recorded via Utilities (STELCO and Fenaka)	Yes, by comparing with the system and the actual records
Accelerating Sustainable Private Investments in Renewable Energy (ASPIRE) Project  Low Carbon Energy Island Strategies (LCEI Project)	This project would enable private sector investing in PV infrastructure development and diversify the investment base in the country through developing a local market and expertise in renewable energy  The overall objective of this project is to mainstream energy efficiency measures into policies, guidelines, standards and building practices in the Maldives and to achieve a substantial reduction of GHG emissions as a result of improved buildings and building management practices and to leverage substantial investment in activities leading to increased energy efficiency	Diesel based power production, operation and distribution related data Generated energy units, Diesel & lub-oil consumption, Distribution losses, etc.)	If not available internally via MEA or Energy Department, a request is made to the Utilities for data sheets	Not Verified
		Performance data of installed PV systems Note: (will be initiated once the 1 <sup>st</sup> subproject under ASPIRE becomes operational)	From project developers (ASPIRE subprojects) or through energy department for PV projects implemented under other RE projects of Ministry	Yes – Can be verified against theoretical performance obtained through PV soft wares
		Electricity Consumption & Demand (current and projected demand growths, Peak loads, daily demand profiles)	Utility Company collects original data. Project staff collects these data from utilities on a need basis	No
		Information on consumers' knowledge and behaviour towards energy efficiency in buildings and electrical appliances	Questionnaire  Designed by LCEI Project	Not Verified
		Market Study (import data from 2006-2016. Data includes from where the appliances are imported and from where the appliances are manufactured. Data is collected from Maldives Customs Service and from retailers)	Maldives Customs Service format and a questionnaire is prepared to collect data from the retailers	Not Verified
		Baseline data for buildings (building energy consumption data is collected by selecting samples in Greater Male' Region)	Data records from utilities, data records from MHI and specific buildings, data records from Ministry of Islamic affairs	Not Verified

Project	Description	Data Collected	Means of Collection	Verification
Accelerating Sustainable Private Investments in Renewable Energy (ASPIRE) Project	This project would enable private sector investing in PV infrastructure development and diversify the investment base in the country through developing a local market and expertise in renewable energy	MEA Database  Electricity Loads, Genset, Usage, Production, Fuel/Lub Oil, Consumers.	If not available internally via MEA or Energy Department, a request is made to the Utilities for data sheets	Not Verified
Accelerating Sustainable Private Investments in Renewable Energy (ASPIRE) Project	This project would enable private sector investing in PV infrastructure development and diversify the investment base in the country through developing a local market and expertise in renewable energy	National Bureau of Statistics (NBS)  Electricity Loads, Genset  Usage, Production, Fuel/Lub Oil, Consumers	From project developers (ASPIRE subprojects) or through energy department for PV projects implemented under other RE projects of Ministry	Yes – Can be verified against theoretical performance obtained through PV soft wares
		Inter- Departments  Electricity Loads, Genset Usage, Production, Fuel/Lub Oil, Consumers	Utility Company collects original data. Project staff collects these data from utilities on a need basis	No
Climate Change Adaptation Project (CCAP) Hithadhoo & Fuvahmulah	This project demonstrates climate adaptive planning and management through the adoption of a multi-sectoral approach in Addu and Gnaviyani atolls.	Total Waste dumped  &  Composting Waste	Data collected by Hithadhoo and Fuvamulah WAMCO Office, when needed only	Not Verified
Small scale Waste to Energy Project (R.Vandhoo, Adducity, Fuvahmulah City and Huvadhoo Atoll)	To establish waste to energy, regional waste management centres which can generate water and electricity.	Average waste collected and transferred to Vandhoo.  Average waste incinerated.  Bottom Ash – landfill	Incineration Facility logs the info on a daily basis	Not Verified

### (Footnotes)

1 NBS (2018), Statistical Year Book of Maldives, National Bureau of Statistics

2 NBS (2014), Maldives Census Report, National Bureau of Statistics

3 Prior to correlation with satellite-based solar data, the ground-measured solar radiation is quality-controlled by Solargis. Quality Control (QC) is based on methods defined in SERI QC procedures and Younes et al. [1, 2] and the in-house developed tests. The ground measurements are inspected also visually, mainly for identification of shading and other error patterns such as RSP shading ring malfunction



