

Mitigation Work Programme

IRENA Input to Global Dialogue Topics

As Per Decision -/CMA.4, the Mitigation Work Programme shall include two global dialogues to facilitate a focused exchange of views, information, ideas, as well as the active participation of and interaction between Parties and relevant non-Party stakeholders. Given that the Mitigation Work Programme aims to urgently scale up mitigation ambition and implementation referred to in paragraph 27 of decision 1/CMA.3, it is important to prioritize the sectors that have the highest mitigation potential, especially in the longer term.

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. In this context, IRENA suggests that the Mitigation Work Programme global dialogues should focus on “Accelerating the Energy Transition” to capture short-term priorities and the alignment of development and climate priorities.

Global Dialogue Topic: Accelerating the Energy Transition

Compounding crises underscore the pressing need to accelerate the global energy transition. Events of recent years have accentuated the cost to the global economy of a centralised energy system highly dependent on fossil fuels. At the same time, the impacts of human-caused climate change are increasingly evident around the globe.

Short-term interventions to ameliorate immediate challenges must be accompanied by a steadfast focus on a successful energy transition in the medium and long term. Governments today shoulder the challenging task of tackling seemingly opposing agendas of energy security, resilience, and affordable energy for all. In the face of uncertainty, policy makers must be guided by the overarching goals of arresting climate change and ensuring sustainable development. Any other approach, notably investing in new fossil fuel infrastructure, will only perpetuate the existing risks and raise the long-established threats of climate change.

Given the inadequate pace and scope of the energy transition, anything short of radical and immediate action will diminish – possibly eliminate - the chance of staying on the 1.5°C or even 2°C path. IRENA’s *World Energy Transitions Outlook*¹ stresses the importance of a wide-ranging shift in the current trajectory across all energy uses. While some progress has been made, it falls woefully short of what is required. The stimulus and recovery efforts associated with the pandemic have also proved a missed opportunity, with only 6% of the G20’s USD 15 trillion in COVID-19 recovery funding in 2020 and 2021 being channelled towards clean energy.

Acceleration of the energy transition is also essential for long-term energy security, price stability and national resilience. Some 80% of the global population lives in countries that are net energy importers. With the abundance of renewable potential yet to be harnessed, this percentage can be dramatically reduced. Such a profound shift would make countries less dependent on energy imports through diversified supply options and help decouple economies from wide swings in the prices of fossil fuels. This path would also create jobs, reduce poverty, and advance the cause of an inclusive and climate-safe global economy.

The G20 economies account for over 70% of global CO₂ emissions. Hence, the actions of these countries are critical, not only in terms of their fossil CO₂ emissions, but also in terms of their financial support of the

¹ World Energy Transitions Outlook: 1.5C Pathway (2022), IRENA, <https://www.irena.org/publications/2022/mar/world-energy-transitions-outlook-2022>.

decarbonisation efforts of less developed countries. These countries must act now, in view of competing priorities.

IRENA has assessed nearly 50 recent scenario studies covering all G20 members. The modelling studies considered indicate that:

- Renewables are key to the energy transition, reaching over 50% of the primary energy supply and up to 100% of electricity generation.
- Electrification of final energy use increases to about 50% across G20 members.
- Electric vehicles are key to electrification and emissions reduction, replacing fossil fuel vehicles in all G20 economies.
- Energy efficiency is a decarbonisation pillar in most studies across all end-use sectors.
- Clean hydrogen plays a key role across many studies, particularly in hard-to-abate sectors.

➤ **Short-term priorities: What is required over the next three to five years to accelerate the global energy transition?**

IRENA's 1.5°C pathway positions electrification and efficiency as key drivers of the energy transition, enabled by renewables, hydrogen, and sustainable biomass. This pathway, which requires a massive change in how societies produce and consume energy, would result in a cut of nearly 37 gigatonnes of annual CO₂ emissions by 2050. These reductions can be achieved through 1) significant increases in generation and direct uses of renewables-based electricity; 2) substantial improvements in energy efficiency; 3) the electrification of end-use sectors (e.g. electric vehicles and heat pumps); 4) clean hydrogen and its derivatives; 5) bioenergy coupled with carbon capture and storage; and 6) last-mile use of carbon capture and storage.

Progress will depend on political will, well-targeted investments, and a mix of technologies, accompanied by policy packages to put them in place and optimise their economic and social impact. IRENA sees the following as priority actions over the next few years:

Resolutely replacing coal power with clean alternatives, notably renewables, is vital. It is evident that phasing-out fossil fuels is a complex task for countries heavily reliant on coal, especially given the imperative of a just and fair transition for affected workers and communities. Innovation, concerted action, and international co-operation are therefore essential for timely progress. Replacing coal in industry must be tackled as well, as almost 30% of all coal is used in iron and steel, cement, and other industries. IRENA's latest global cost study² shows how the competitiveness of renewables continued amid the fossil fuel crisis and highlights cost trends for major renewable electricity sources, making the business case for an accelerated energy transition.

Ramping up renewables, together with an aggressive energy efficiency strategy, is the most realistic path towards halving emissions by 2030, as prescribed by IPCC. In the power sector, renewables are faster and cheaper to deploy than the alternatives. But to meet the IPCC goal, annual additions of renewable power capacity will have to be three times the current rate of deployment. Such an increase is possible if the right conditions are in place. Technology-specific targets and policies are especially needed to support less mature technologies, such as ocean energy and CSP, as well as auction designs for these technologies. According to

² Renewable Power Generation Costs 2021 (2021), IRENA, <https://www.irena.org/publications/2022/Jul/Renewable-Power-Generation-Costs-in-2021>.

IRENA³, at the end of 2021, global renewable generation capacity amounted to 3 064 GW – a 9.1% growth in renewable capacity since 2020. With the right policies, innovations, and support, these trends can continue around the world.

Infrastructure upgrades, modernisation, and expansion are needed to increase system resilience and build flexibility for a diversified and interconnected system capable of accommodating high shares of variable renewable energy. In addition to many technological solutions, markets will need to be adapted, both in liberalised and regulated systems. The current structure was developed during the fossil fuel era, to reduce operational costs of large, centralized power plants with differing fuel and opportunity costs. In the age of variable renewable energy, electricity should be procured considering the characteristics of decentralised generation technologies, with no fuel or opportunity cost. Power system organisational structures designed with the blueprint of the fossil fuel era can constrain flexibility, limit the supply of renewable power, increase electricity costs and reinforce social inequalities. IRENA sets out the need for power system structures that are fit for the renewable era.⁴

Green hydrogen should move from niche to mainstream. Hydrogen commands a great deal of policy attention, so the coming years should bring concrete actions to develop the global market and reduce costs. In this regard, the development of standards and guarantees of origin, along with support schemes to cover the cost gap for green solutions, will ensure that hydrogen offers a meaningful contribution to climate efforts in the long term. IRENA's hydrogen analysis showcases how to create a global hydrogen market to enable trade,⁵ accelerate hydrogen deployment in the G7,⁶ what key actions are necessary for market creation, infrastructure and regulation, certification, technology, cost gaps and financing,⁷ the cost and potential of green hydrogen production,⁸ as well as a technology review of hydrogen carriers,⁹ among others.

Modern bioenergy's contribution to meeting energy demand, including demand for feedstock, will have to triple by 2030. At the same time, the traditional use of biomass (such as firewood) needs to be replaced by clean cooking solutions. There is scope for biomass supply to expand, but the expansion will need to be managed carefully to ensure sustainability and minimise adverse outcomes. IRENA's analysis¹⁰ provides an overview of the challenges and related policy measures required to scale up the deployment of key bioenergy applications. IRENA has also taken this analysis to a more granular level, looking at the potential for bioenergy in Southeast Asia.¹¹

³ Renewable Energy Capacity Statistics 2022 (2022), IRENA, <https://www.irena.org/publications/2022/Apr/Renewable-Capacity-Statistics-2022>.

⁴ Reorganising the Power System for a Renewable-based Future (2022), IRENA, <https://www.irena.org/publications/2022/Jun/RE-organising-Power-Systems-for-the-Transition>

⁵ Creating a global hydrogen market: Certification to enable trade (2023), IRENA, <https://www.irena.org/Publications/2023/Jan/Creating-a-global-hydrogen-market-Certification-to-enable-trade>.

⁶ Accelerating hydrogen deployment in the G7: Recommendations for the Hydrogen Action Pact (2022), IRENA, <https://www.irena.org/Publications/2022/Nov/Accelerating-hydrogen-deployment-in-the-G7>.

⁷ Global Hydrogen Trade to Meet the 1.5°C Climate Goal: Trade Outlook for 2050 and Way Forward (2022), IRENA, <https://www.irena.org/Publications/2022/Jul/Global-Hydrogen-Trade-Outlook>.

⁸ Global Hydrogen Trade to Meet the 1.5°C Climate Goal: Green Hydrogen Cost and Potential (2022), IRENA, <https://www.irena.org/Publications/2022/May/Global-hydrogen-trade-Cost>

⁹ Global Hydrogen Trade to Meet the 1.5°C Climate Goal: Technology Review of Hydrogen Carriers (2022), IRENA, <https://www.irena.org/Publications/2022/Apr/Global-hydrogen-trade-Part-II>.

¹⁰ Bioenergy for the Transition: Ensuring Sustainability and Overcoming Briers (2022), IRENA, <https://www.irena.org/Publications/2022/Aug/Bioenergy-for-the-Transition>.

¹¹ Scaling Up Biomass for the Energy Transition: Untapped Opportunities in Southeast Asia (2022), IRENA, <https://www.irena.org/Publications/2022/Feb/Scaling-up-biomass-for-the-energy-transition-Untapped-opportunities-in-Southeast-Asia>.

The majority of car sales by 2030 should be electric. In 2021, EVs were already at 8.3% of global car sales; this share will rise rapidly in the coming years. Annual battery manufacturing capacity is set to quadruple between 2021 and 2025, to approximately 2 500 GWh. EV growth ultimately depends on a massive ramp-up of recharging infrastructure, as well as financial and fiscal incentives to promote the uptake of EVs, charger mandates, and bans on combustion engine vehicles. In addition, greater efforts should be made to reduce travel demand and promote a switch to public transport and cycling where possible. IRENA's analysis¹² shows how smart charging for EVs minimises their load impact and unlocks the flexibility to use more solar and wind power.

All new buildings must be energy efficient, and renovation rates should be significantly increased. Improving the measures and regulations for buildings can make an immense difference in the near term. Decarbonising heating and cooling will require changes to building codes, energy performance standards for appliances, and mandates for renewables-based heating and cooling technologies, including solar water heaters, renewables-based heat pumps and geothermal heating. IRENA's analysis¹³ supports policy makers accelerate efforts to create sustainable cities powered by renewable energy.

Demand-side management would help alleviate multiple challenges in the short term while contributing to the long-term security of energy and materials supply. Transforming the energy system is not simply about switching energy sources; it extends to ensuring the efficient use of energy across sectors. The coming years should see increased investment in research and development (R&D) and pilot projects along the value chains of all six of the technological avenues described above. This should be accompanied by efforts to cut unnecessary consumption and to move away from a system based on continuously increasing consumption. IRENA's analysis¹⁴ maps out uses, solutions and examples of demand-side flexibility involving different maturity levels and different timescale impacts.

Increasing ambition in national energy plans and NDCs must be firm to provide certainty of direction and guide investment strategies. In addition to increasing ambition in their revised NDCs, Parties need to develop national implementation plans that include clearly defined targets, including efficiency, renewables and end uses. IRENA's analysis¹⁵ assesses current climate pledges in light of the challenge ahead, and explores the transformative opportunity offered by renewable energy that can serve as an important vehicle for delivering the needed emission reductions, as well as multiple SDGs.

A comprehensive set of policies covering all technological avenues is needed to achieve the necessary levels of deployment by 2030. Deployment policies should support market creation, thus facilitating reductions in technology costs and their scale up and increases in investment levels aligned with energy transition needs. Strong institutions will be needed to co-ordinate structural and just transition policies and manage potential misalignments. Only a holistic global policy framework can bring countries together to orchestrate a just transition that leaves no one behind and strengthens the international flow of finance, capacity and technologies. IRENA's *World Energy Transition Outlook (WETO)*¹⁶ outlines the broad set of policy measures

¹² Innovation Outlook: Smart charging for electric vehicles (2019), IRENA, <https://www.irena.org/Publications/2019/May/Innovation-Outlook-Smart-Charging>.

¹³ Renewable Energy Policies for Cities: Buildings (2021), IRENA, <https://www.irena.org/publications/2021/May/Policies-for-Cities-Buildings>.

¹⁴ Demand-side flexibility for power sector transformation (2019), IRENA, <https://www.irena.org/publications/2019/Dec/Demand-side-flexibility-for-power-sector-transformation>.

¹⁵ NDCs and Renewable Energy Targets in 2021 (2022), IRENA, <https://www.irena.org/publications/2022/Jan/NDCs-and-Renewable-Energy-Targets-in-2021>.

¹⁶ World Energy Transitions Outlook: 1.5C Pathway (2022), IRENA, <https://www.irena.org/publications/2022/mar/world-energy-transitions-outlook-2022>.

that are required to avoid a rise over 1.5°C and align short-term actions with longer-term climate and socio-economic development objectives. Further, IRENA's Collaborative Framework on Just & Inclusive Energy Transitions¹⁷ aims to bring countries and other relevant stakeholders together to identify priority areas, concrete actions and foster international collaboration to understand how to promote and support just and inclusive energy transitions.

IRENA's socio-economic analysis shows that progressive policy and regulatory measures generate greater benefits from the energy transition. To gain insights about the impact of different policy baskets, a sensitivity analysis examines how the more ambitious energy transition pathway to 1.5°C can result in different socio-economic outcomes depending on variations in international collaboration, carbon pricing, progressive fiscal measures and other government programmes. IRENA has been studying the socio-economic footprint of energy transitions for years now – globally through the WETO, regionally (e.g., ASEAN¹⁸) and nationally (e.g., Indonesia¹⁹ and Japan²⁰). Further, IRENA has published an annual review of renewable energy jobs since 2012, the latest of which²¹ found that worldwide employment in renewable energy accounted for 12.7 million jobs in 2021, up from 12 million in 2020.

➤ Alignment of development and climate priorities, particularly LDCs and SIDS

Despite not contributing much to global GHG emissions, developing countries are disproportionately affected by the impacts of climate change. Developing countries see the energy transition as a catalyst for alleviating poverty and spurring human development. However, to achieve this, developing countries require special attention and support to leapfrog to climate-consistent energy systems and reap the transition benefits. Funds and knowledge therefore must be made available to less wealthy nations to advance the quest for an inclusive and more equitable world.

International co-operation and the international flow of public financing will be more critical than ever to achieve a global energy transition that is just and inclusive. In 2019, international public financial flows to developing countries in support of renewable energy, for example, amounted to less than USD 11 billion, which is equivalent to less than 3.5% of global investments in renewables. Meanwhile, the majority of the developing world still faces great challenges in mobilising financing for critically needed energy projects ranging from electrifying health clinics to powering industry and development.

These challenges were prominent even before the pandemic but subsequently, the fiscal space for recovery and sustainable development efforts became further constrained by additional obstacles to access financing, limited public and private investments and continuing debt service obligations requisite financial resources will not always be available domestically; **international collaboration and cooperation** are needed to channel them, particularly to least developed countries and small island developing states. International co-operation can relax national-level budget constraints, thereby increasing state capability and enabling developing countries to

¹⁷ *Collaborative Framework on Just & Inclusive Energy Transitions*, <https://www.irena.org/How-we-work/Collaborative-frameworks/Just-and-Inclusive-Energy-Transition>.

¹⁸ *Renewable Energy Outlook for ASEAN: Towards a Regional Energy Transition (2nd Edition)* (2022), IRENA, <https://www.irena.org/Publications/2022/Sep/Renewable-Energy-Outlook-for-ASEAN-2nd-edition>.

¹⁹ *Socio-economic footprint of the energy transition: Indonesia* (2022), IRENA <https://www.irena.org/Publications/2023/Jan/Socio-economics-of-the-energy-transition-Indonesia>.

²⁰ *Socio-economic Footprint of the Energy Transition: Japan* (2022), IRENA, <https://www.irena.org/Publications/2022/Sep/Socio-economic-Footprint-of-the-Energy-Transition-Japan>.

²¹ *Renewable Energy and Jobs – Annual Review 2022* (2022), IRENA, <https://www.irena.org/Publications/2022/Sep/Renewable-Energy-and-Jobs-Annual-Review-2022>.

implement policy frameworks that tie the energy transition to more equitable access to resources and economic opportunities.

IRENA works to support developing countries' access to financing and technical assistance required to accelerate their energy transitions. The Energy Transition Accelerator Financing (ETAF) Platform²² is an inclusive, multi-stakeholder climate finance platform. ETAF pursues facilitating capital mobilisation to scale up the development of renewable energy projects to advance the energy transition across developing markets. The Climate Investment Platform (CIP)²³ is a joint initiative with a mandate to increase capital mobilisation and renewable energy investment in developing countries. IRENA focuses on technical assistance for projects to reach commercial feasibility readiness for matchmaking with financial institutions or partners. In this context, IRENA organizes regional Investment Forums to support enabling investments in renewable energy projects and provide an effective organising framework for the implementation of the CIP through a sub-regional approach. The Forums have two main aims: to strengthen the ability of decision-makers to produce a strong enabling environment for renewable energy investments; and help the developers to prepare bankable projects and access finance.

Further, IRENA's Collaborative Frameworks²⁴ seek to facilitate peer-to-peer collaboration and knowledge exchange on key aspects of the energy transition. They also serve as multi-stakeholder platforms for co-operation and co-ordinated action, bringing public, private, intergovernmental and non-governmental actors together to support and accelerate the global energy transformation. The Frameworks cover critical materials, geopolitics, green hydrogen, high shares of renewables, hydropower, just & inclusive energy transitions, and offshore renewables.

These efforts can support developing countries, as well as developed countries, accelerate their energy transitions, which can, in turn, have a significant improvement in the distribution of the socio-economic benefits across societies and geographies. To support these positive outcomes, however, progressive policies and programmes will be essential.

²² ETAF, <https://www.irena.org/Energy-Transition/Partnerships/ETAF>.

²³ IRENA for Climate Investment Platform, <https://www.irena.org/Energy-Transition/Partnerships/CIP>.

²⁴ Collaborative Frameworks, <https://www.irena.org/How-we-work/Collaborative-frameworks>

About IRENA

The International Renewable Energy Agency (IRENA)²⁵ is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international cooperation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

With a mandate from countries around the world, IRENA encourages governments to adopt enabling policies for renewable energy investments, provides practical tools and policy advice to accelerate renewable energy deployment, and facilitates knowledge sharing and technology transfer to provide clean, sustainable energy for the world's growing population.

In line with these aims, IRENA provides a wide range of products and services, including:

- Annual reviews of renewable energy [employment](#);
- Renewable energy [capacity statistics](#);
- Renewable energy [cost studies](#);
- [Renewables Readiness Assessments](#), conducted in partnership with governments and regional organisations, to help boost renewable energy development on a country by country basis;
- The [Global Atlas](#), which maps resource potential by source and by location;
- Renewable energy [benefits studies](#);
- [REmap](#), a roadmap to double renewable energy use worldwide by 2030;
- Renewable energy [technology briefs](#);
- Facilitation of regional renewable energy planning.

With more than 180 countries actively engaged, IRENA promotes renewable resources and technologies as the key to a sustainable future and helps countries achieve their renewable energy potential.

²⁵ <https://irena.org/>