

IRENA'S ENERGY TRANSITION SUPPORT TO STRENGTHEN CLIMATE ACTION

INSIGHT TO IMPACT

2023



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About IRENA

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. 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. www.irena.org

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ABBREVIATIONS

°C	degrees Celsius
AIIB	Asian Infrastructure Investment Bank
APRA	Accelerated Partnership for Renewables in Africa
CO₂	carbon dioxide
COP28	28 th Conference of the Parties to the United Nations Framework Convention on Climate Change
ETAF	Energy Transition Accelerator Financing
EU	European Union
G7	Group of Seven
G20	Group of Twenty
GW	gigawatt
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
MRV	monitoring, reporting and verification
NDC	Nationally Determined Contribution
LT-LEDS	long-term low-emissions development strategies
PDR	People's Democratic Republic
PES	Planned Energy Scenario
PPA	power purchase agreement
PV	photovoltaic
REmap	Renewable Energy Roadmap
RRA	Renewables Readiness Assessment
SDG	Sustainable Development Goal
SIDS	small island developing state
TES	Transforming Energy Scenario
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar
VRE	variable renewable energy

EXECUTIVE SUMMARY

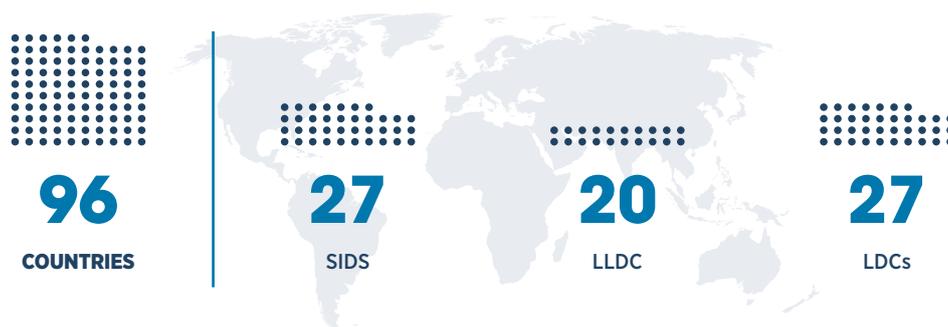
Achieving net-zero greenhouse gas emissions by 2050 will require much more ambitious actions by 2030. Renewable energy is key for the energy transition to 2030, as it is a readily available and economically feasible option for mitigating the impacts of climate change. In 2022, the world added a record 300 gigawatts (GW) of renewable power capacity, and global investment across all energy transition technologies totalled USD 1.3 trillion. Despite progress in the energy transition, the current pace of renewable energy growth is still behind the level required to achieve the 2050 climate goal.

At the national level, countries are pledging ambitious medium-term climate targets through their Nationally Determined Contributions (NDCs) and long-term low-emission development strategies (LT-LEDS). Analysis from the International Renewable Energy Agency (IRENA) demonstrates that the LT-LEDS underscore opportunities for energy transition powered by renewables and new energy sources informed by the best available science. Aligning energy transition efforts with national long-term climate planning will aid the implementation of necessary energy transition measures consistent with the Paris Agreement.

The pathways outlined in NDCs and LT-LEDS are the national commitments that guide country, regional and international stakeholders in both energy and climate action. However, consistent with the current pace of the energy transition, which needs to be accelerated, the level of national climate ambitions so far is insufficient to reach the internationally agreed goal of keeping the global average temperature rise below 1.5 degrees Celsius (°C). As noted in the 2023 Global Stocktake, the implementation of climate action must be accelerated rapidly to meet the long-term goals of the Paris Agreement.

IRENA will continue efforts to engage with its Members to realise their climate change mitigation ambitions and adaptation actions, harmonising with respective national priorities as pledged in countries' NDCs and LT-LEDS. As the leading inter-governmental organisation on renewable energy, IRENA supports its membership in their transition to a sustainable energy future. It aims to provide state-of-the-art knowledge, the foundation of the Agency's capacity building, technical assistance, policy advice and investment activities.

IRENA has been engaged with 96 Members, who are also Parties to the 2015 Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC), to support the implementation of their climate goals and action plans to achieve the energy transition through renewables. This includes support on countries' NDCs, long-term strategies, and national plans, which are the basis for developing NDCs and LT-LEDS.



IRENA's engagement with its Members covers a total population of around 5.2 billion people and combined greenhouse gas emissions totalling an estimated 30 250 megatonnes of carbon dioxide equivalent in 2022 (EDGAR, 2023). The Agency's support activities dedicated to the energy transition offer a unique opportunity for countries and relevant stakeholders to participate in implementing their climate change mitigation and adaptation actions.

As the world hastens to achieve the 1.5°C pathway, critical milestones that reaffirm global alignment with the long-term temperature target and the collective ambition for the energy transition include the 28th Conference of the Parties to the UNFCCC (COP28) held in Dubai, United Arab Emirates in 2023, together with the Global Stocktake and the upcoming NDC cycle in 2025.

IRENA intends to support an annual 1000 GW increase in the global renewables-based electricity capacity, which represents a tripling of capacity deployment to 2030. It aims to do this through three main pillars for accelerating the energy transition: modernisation of physical infrastructure; supportive policy and regulations; and improved human and institutional capacities. With the remaining years to 2030 being critical for efforts to achieve the 1.5°C pathway and long-term global climate goals, IRENA is determined to contribute to accelerating the pace of the energy transition.



Hon. Eng. Collins Nzovu, MP
MINISTER OF GREEN ECONOMY &
ENVIRONMENT, REPUBLIC OF ZAMBIA,
CHAIR OF AFRICAN GROUP OF
CLIMATE NEGOTIATORS

"Increased access to finance is essential for Africa to ensure energy access and drive the tripling of renewables capacity. We urge the developed countries to meet their climate finance pledges to developing countries. Zambia in collaboration with IRENA improved energy data and developed capacities to update the statistics on energy balances. Enhanced energy data assists policy development and planning for scaling up renewables deployment."



**H.E. Fatumanava-o-Upolu III
Dr Pa'olelei Luteru**

CHAIR OF ALLIANCE OF SMALL ISLAND
STATES

PERMANENT REPRESENTATIVE OF
SAMOA TO THE UNITED NATIONS,
SAMOA

"The Alliance of Small Island States (AOSIS) and IRENA are committed, through a Memorandum of Understanding, to deepen a partnership to spearhead innovative co-operation for energy transition in vulnerable communities while strengthening their adaptative capacity to climate change. For Small Island Developing States, renewable energy plays a huge role in the process of development, and we believe that renewables can bolster our response to the challenges we face. IRENA, as a steadfast supporter of SIDS in accelerating transition, will enable island countries to respond to climate change."



Ms. MADELEINE DIOUF SARR

LDC GROUP CHAIR

HEAD OF THE CLIMATE CHANGE
DIVISION, MINISTRY OF ENVIRONMENT
AND SUSTAINABLE DEVELOPMENT
(MEDD),
SENEGAL

"The 1.5°C long-term temperature goal is a lifeline for the Least Developed Countries (LDCs), and the adverse impacts of climate crisis have already led to setbacks in development efforts. We are in the critical decade to urgently achieve deep global emissions reductions. Cooperation and support are increasingly needed to address the climate crisis, closing the gap between NDCs and Paris Agreement's 1.5°C goal while strengthening resilience. IRENA will collaborate with LDCs in order to increase the ambition to achieve the 1.5°C temperature goal."

1 PROGRESS IN REALISING THE 1.5°C PATHWAY

1.1 GLOBAL OUTLOOK

As stated in the recent Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), the world is far off track to limit the average global temperature rise to 1.5°C (IPCC, 2023). Global greenhouse gas emissions need to be cut by nearly half by 2030 to be on track for achieving net-zero emissions by 2050. The current level of global climate ambition to 2030, as pledged in countries' Nationally Determined Contributions (NDCs) submitted under the Paris Agreement, suggests that warming is likely to exceed 1.5°C this century. Countries will need to urgently enhance their climate ambition in the short term to ratchet up the energy transition. The recent Synthesis Report of the Global Stocktake raises alarm that climate action must be accelerated rapidly to meet long-term temperature goals in line with the Paris Agreement (UNFCCC, 2023a). Increasing renewable energy capacity worldwide will contribute to a global energy transition aligned with the 1.5°C climate pathway.

Achieving net-zero greenhouse gas emissions by mid-century requires much more ambitious levels of actions by 2030. Renewable energy is key for the energy transition to 2030, as it is a readily available and economically feasible option for mitigating the impacts of climate change. In 2022, the world added a record 300 gigawatts (GW) of renewable power capacity, and global investment across all energy transition technologies totalled USD 1.3 trillion (IRENA, 2023a). The newly added renewable energy capacity represented 83% of total new power capacity additions from all sources in 2022 (IRENA, 2023b).

Solar energy continued to lead capacity expansion in 2022, followed by wind, hydropower and bioenergy. Solar and wind energy together accounted for 90% of net renewable energy additions in 2022. Renewables reached a record 40% share of installed power generation capacity globally. This trend has been supported by the improved economic competitiveness of renewable power due to the continuous cost reduction of solar and wind technologies in recent decades (IRENA, 2023c)¹. Despite the accelerated increase in renewable power, the current growth of renewables is still behind the level required to achieve the 2050 climate goal.

¹ Between 2021 and 2022, the global weighted-average levelised cost of electricity from renewable power generation fell 3% for solar photovoltaic (PV), 5% for onshore wind, 13% for bioenergy and 22% for geothermal (IRENA, 2023b).

The International Renewable Energy Agency (IRENA), in its *World Energy Transitions Outlook 2023*, notes that the progress achieved to date has been mainly in the power sector, with improvements in technology, policy and innovation (IRENA, 2023a). However, to stay on the 1.5°C pathway, the annual deployment of some 1000 GW of renewable power is critical. Significant acceleration is needed across energy sectors and technologies, including not only electrification with renewables, but also end-use electrification of transport and heat, direct-use of renewables in end uses, energy efficiency, hydrogen, and negative emission technologies such as carbon capture and storage (CCS) and bioenergy with carbon capture and storage (BECCS).

- The most significant reduction in CO₂ emissions would come from the use of renewables in power generation and for direct uses in heat and transport, combined with energy conservation and efficiency. Emission reductions in these areas can provide more than half the required cuts in global emissions to 2050.
- Electrification of various end-use sectors, including transport and heating, would account for around 20% of emission reductions.
- Another 12% of reductions comes from the use of hydrogen and its derivatives, including synthetic fuels and feedstocks.
- The remaining CO₂ emitted in the period to 2050 would need to be captured and stored through carbon capture, utilisation and storage (CCUS) and other carbon removal measures.

To achieve climate goals consistent with the 1.5°C target, both the scale-up and strategic re-allocation of investment in energy transition technologies are needed. While annual investment in energy transition technologies broke USD 1.3 trillion in 2022, the current pace of the investment growth is still behind the estimated USD 5 trillion in annual investment required on average (IRENA and CPI, 2023). In total, a combined USD 150 trillion in energy transition investment is required to actualise the 1.5°C target by 2050. However, renewable energy investment remains concentrated in a limited number of countries and is focused on only a few technologies.

The adoption of low-emission technologies lags in much of the developing countries, particularly in least developed countries, due in part to limited finance, technology development and transfer, and capacity. Regulatory frameworks need to be supportive of mobilising financing for renewables. Policies should continue to be used to crowd-in private capital. To that end, international co-operation is an essential piece of the global energy transition. A holistic global policy framework is needed to bring countries together to commit to the energy transition with increased financial flows.



IRENA's 2023 *World Energy Transitions Outlook* envisages three pillars of enabling conditions for the global energy transition powered by renewables (see Table 1 for more detail):

1. building infrastructure and investing in grids at scale, both on land and at sea, to accommodate the latest product locations, trade patterns and demand centres;
2. facilitating targeted investment in the energy transition by advancing policy and regulatory frameworks; and
3. strategic realignment of institutional capacities, ensuring skills and capabilities to build the desired energy system by the end of the decade.

Table 1 **Three pillars for energy transition**

Pillar	Description
Physical infrastructure	Modernising physical infrastructure is crucial to build a more resilient and flexible energy system. Power sector Infrastructure, including transmission and distribution networks and interconnections, should be upgraded to accommodate the decentralised nature of renewable sources. Other infrastructure is also important for the energy transition, such as transport infrastructure for hydrogen and its derivatives, and utility-scale energy storage solutions, among others.
Policy and regulatory enablers	Policies and regulations play an essential role in facilitating targeted investment in the energy transition. While fossil fuels still underlie today's policy and regulatory systems, these systems should be updated to support the accelerated replacement of fossil fuels with renewables. To that end, having a high-level political commitment, such as a net-zero emission target, is an important step for countries, followed by concrete policies and regulations supportive of achieving the target.
Well-skilled workforce	Strategic realignment of institutional capacities is needed to build the desired energy system. To ensure the skills and capacities of the energy transition workforce, governments have a critical role in co-ordinating efforts to align the offerings of the educational sector with projected industry needs. Tens of millions of additional jobs will be created in the coming decades as investments in the energy transition grow.

Source: IRENA (2023a).

With these three enabling conditions, it is possible to speed the progress in transitioning the global energy system towards achieving the 1.5°C scenario. The key components include renewables, energy efficiency, end-use electrification, cleaner fuels such as green hydrogen and advanced biofuels, and carbon removal technologies. To actualise these three pillars, it is essential for countries to foster enabling conditions through implementable policies, regulations and measures to attain sufficient funding.

A positive trend is occurring as countries pledge ambitious medium-term climate targets through their Nationally Determined Contributions (NDCs) and long-term low-emission development strategies (LT-LEDS), which provide a roadmap for countries to pursue the energy transition through climate action commitment towards the Paris Agreement goals. As of October 2023, 67 countries and the European Union (EU) had pledged their long-term strategies (LT-LEDS) for climate change, and many countries have set targets towards achieving net-zero emissions by around mid-century. Cities, private sector companies and other actors have also made net-zero commitments.

Each national plan displays a country's ambition, progress, and vision towards and beyond 2030. These commitments feature relevant stakeholders to facilitate, enhance and implement the country, regional, and international community's goals to accelerate the energy transition. Despite the increased ambition in countries' latest climate commitments, however, the current ambition for climate action still falls short of the levels required to achieve the Paris Agreement's long-term goal. IRENA's *World Energy Transitions Outlook 2023* notes that pledges fail to achieve the 1.5°C climate goal by 2050, leaving an emission gap of around 16 gigatonnes of CO₂ in 2050. Thus, it is critical to examine progress towards a just energy transition through NDCs, LT-LEDS and the Global Stocktake process.

Given this urgency, scaled-up efforts on climate action through energy transition are clearly required at the regional and national levels. The remainder of this chapter provides an overview of the status and prospects of national-level commitments on climate action.

Box 1. IRENA's engagement in the G7 and G20

To continue the achievements and progress in the energy transition, IRENA is increasing its efforts to strengthen partnerships towards climate action. The Agency has been engaged in key events and summits, such as those involving the Group of Seven (G7) and the Group of Twenty (G20).

IRENA joined the **G7 Ministers' Meeting on Climate, Energy, and Environment** held in April 2023. The Ministers' Communique noted with concern the findings of IRENA's *World Energy Transitions Outlook 2023* and indicated that the G7 will contribute to the expansion of renewable energy through a collective increase in offshore wind capacity of 150 GW and an increase in solar PV of 1 terawatt (TW) by 2030, as estimated by IRENA. The Agency also provided input through a series of annexes. The Ministers requested IRENA to prepare an analysis of the innovation and sustainability of floating offshore wind.

In the context of the **G20 Energy Transitions Ministerial Meeting (ETMM)** in July 2023, IRENA, in partnership with the Indian G20 Presidency under the Energy Transition Working Group, launched the report *Low-Cost Finance for the Energy Transition* (IRENA, 2023d). The report presents a toolBox to increase the availability of low-cost finance to drive the deployment of technologies, such as hydrogen, offshore wind, and energy storage in G20 countries and beyond, including both public and private institutional capital flows. In line with the report, the G20 New Delhi Leaders' Declaration included that the world needs an annual investment of over USD 4 trillion for a high share of renewables in the primary energy mix.

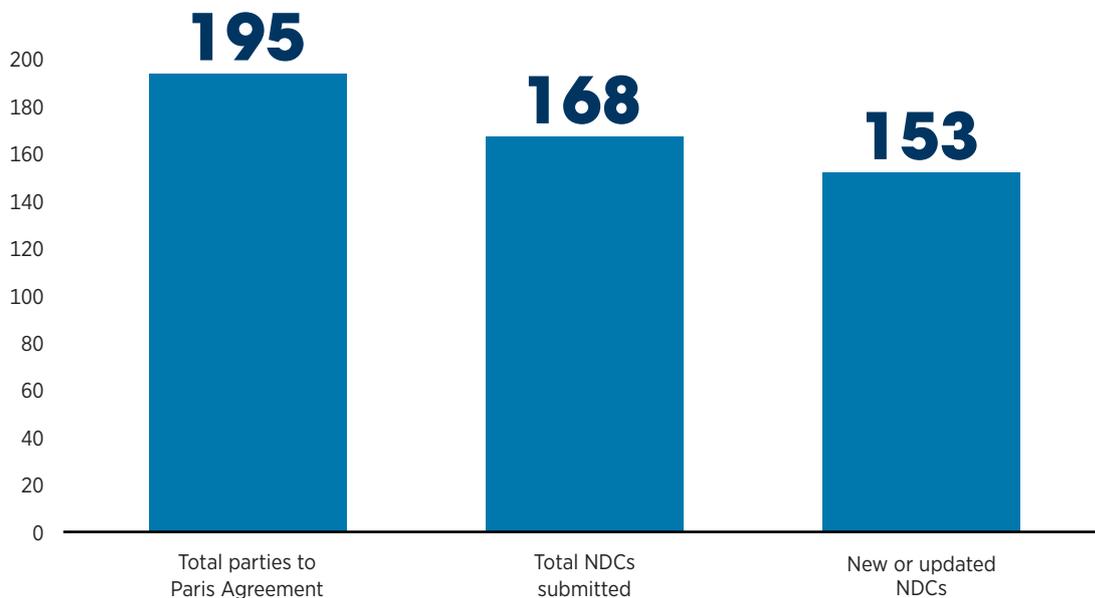


1.2 COUNTRY COMMITMENTS THROUGH NATIONALLY DETERMINED CONTRIBUTIONS

Article 4 of the Paris Agreement mandates countries to enhance their Nationally Determined Contributions every five years, and the next round of submissions is scheduled for 2025. Most countries updated their NDCs in response to the Sharm el Sheikh Implementation Plan of 2022 and the Glasgow Climate Pact of 2021, which urges countries to communicate new or updated NDCs as soon as possible before COP28 in 2023 and to revisit and strengthen their 2030 targets (UNFCCC, 2022). Countries taking the initiative to communicate their NDCs will demonstrate their efforts towards transparency and towards achieving their long-term climate targets.

Among the 168 NDCs submitted so far under the Paris Agreement, a total of 153 new or updated NDCs have been communicated as of 25 September 2023 (Figure 1).

Figure 1 **Status of NDC submissions to the UNFCCC as of 23 September 2023**



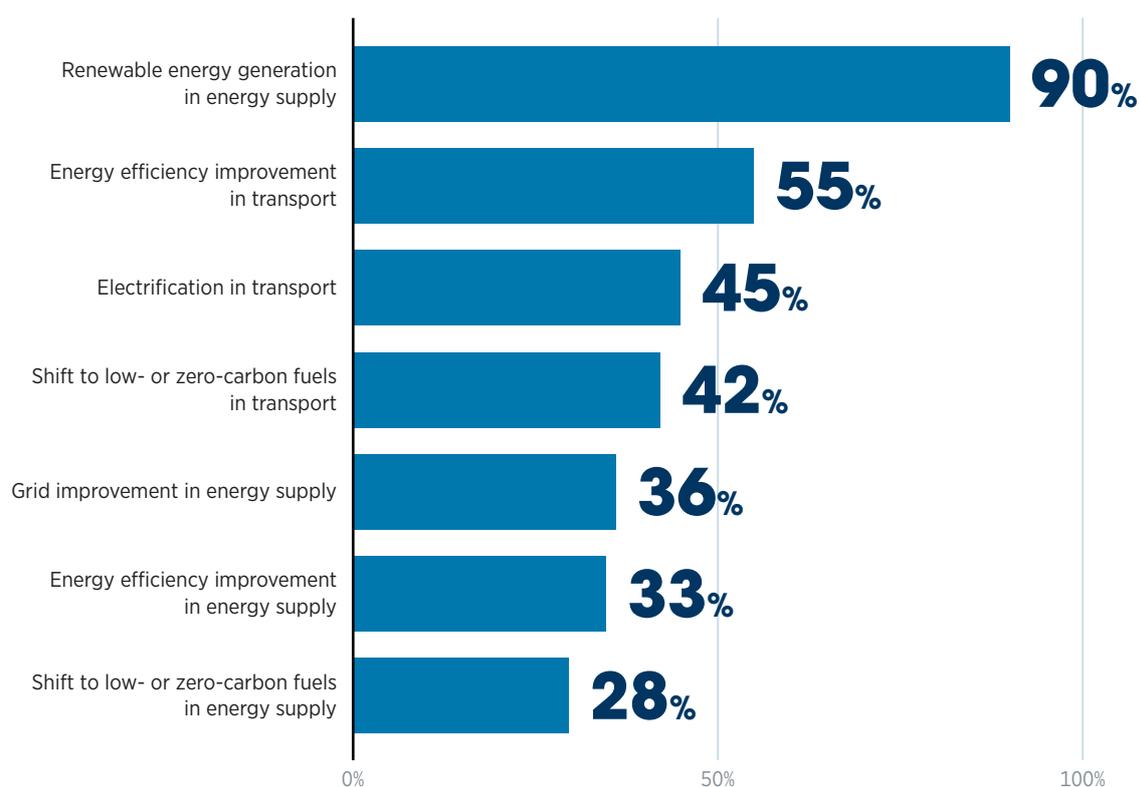
Source: IRENA (2023a).

The NDC Synthesis Report, released by the UNFCCC Secretariat in November 2023, provides a landscape of climate commitments in the NDCs (UNFCCC, 2023b). The report articulates that if all of the current NDCs are implemented, including conditional and unconditional pledges, then total greenhouse gas emissions in 2030 will range from 48.3 gigatonnes to 51.4 gigatonnes of carbon dioxide (CO₂) equivalent. This would result in emissions being 55.2% higher than the level in 1990, 12.2% higher than in 2010 and 4.6% higher than in 2015.

Because the goal of the Paris Agreement is to limit the rise in the global average temperature to 1.5°C, greenhouse gas emissions would need to be reduced by around 43% below the 2019 level by 2030 to achieve net-zero emissions by 2050 (IPCC, 2023a). Decarbonising the energy sector remains indispensable for future climate neutrality, since the sector accounts for more than two-thirds of all greenhouse gas emissions. To achieve carbon neutrality by mid-century, significant efforts must be made to minimise the carbon footprint of the energy sector.

The latest analysis from the UNFCCC Secretariat indicates that all of the submitted NDCs mention the energy sector as a key area for reducing emissions (UNFCCC, 2023b). 90% of Parties referred to renewable energy generation while 23% of Parties communicated quantitative targets for the total share of renewable energy in electricity generation by 2030. 15% of Parties indicated quantitative targets for increasing total renewable energy capacity by 2030 (Figure 2). In addition to renewables, grid improvement (36%), energy efficiency improvement (33%) and shifting to low- or zero-carbon fuels including biofuels and hydrogen (28%) remained as frequently indicated mitigation options.

Figure 2 Energy sector measures mentioned in updated NDCs submitted to the UNFCCC

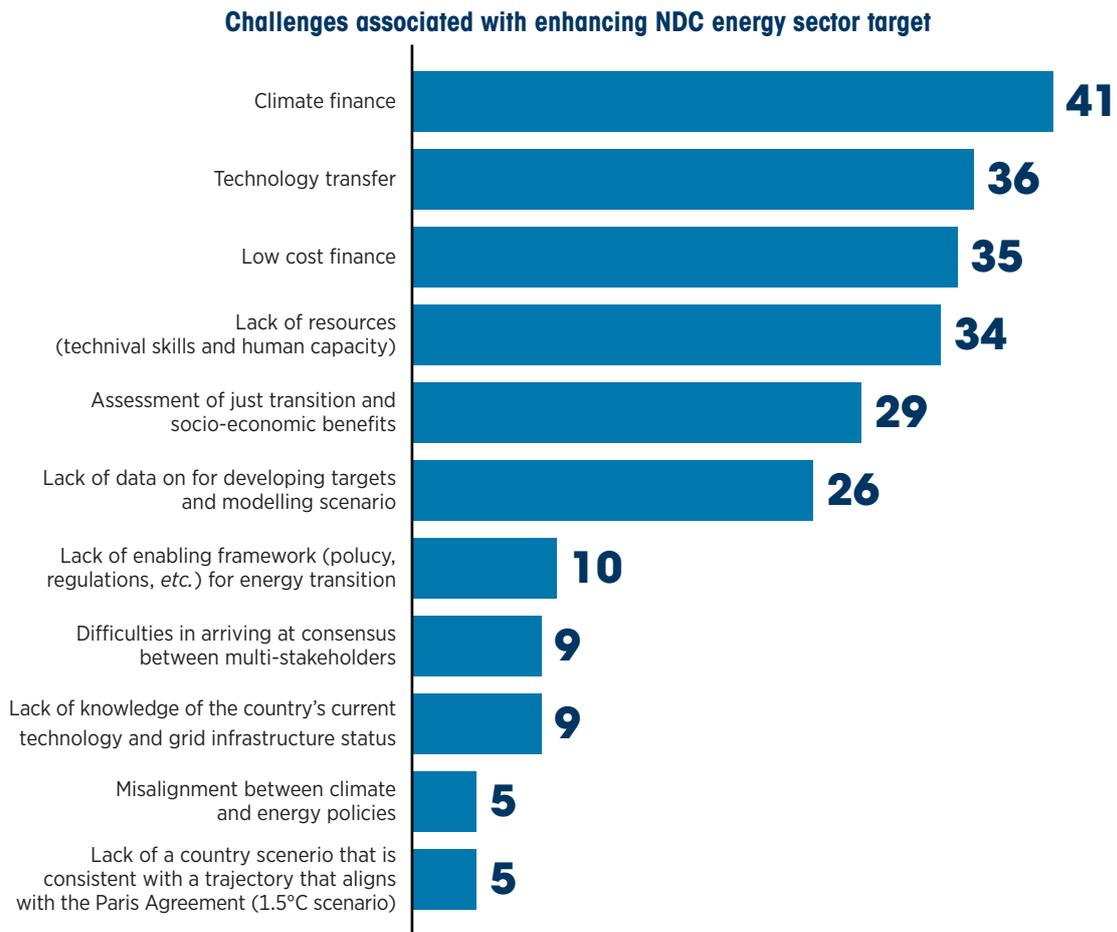


Source: UNFCCC (2023b).

Countries will be preparing for the next round of NDC submissions in 2025. IRENA surveyed its Members to further understand the lessons learned from the NDC enhancement and implementation process². In their responses, Members most frequently mentioned climate finance as a key challenge, followed by technology transfer, low-cost finance, and just transition and socio-economic benefits, as well as the lack of data for developing targets and modelling scenarios (Figure 3). Adequate financial mobilisation will ensure countries' confidence in enhancing and implementing the level of ambition in energy sector targets. There is a need to continue to support Members in the assessment of renewable energy options for considering technology transfer and socio-economic benefits for a just transition.

² IRENA undertook the survey on NDCs from 26 June to 31 October 2023 by using a common questionnaire circulated to Members to clarify the provisional plans, challenges and support needs on their energy sector NDC implementation. As of 31 October 2023, a total of 56 responses had been received.

Figure 3 **Challenges associated with NDC enhancement**



Based on: IRENA assessment of 57 responses from 52 Members



1.3 NATIONAL LONG-TERM CLIMATE STRATEGIES

Another key element of the Paris Agreement process is the long-term low-emission development strategies (LT-LEDS) communicated by countries. LT-LEDS provide a long-term vision of a country's plans, corresponding to its national climate targets in its NDC, and can therefore provide a roadmap for the country to evaluate and demonstrate ways to strengthen and achieve its NDC targets. Coherent linkages between short- and medium-term climate plans and long-term objectives demonstrate the necessity embedded in the development of LT-LEDS. Because climate action occurs in most economic sectors, it is essential also to align the LT-LEDS with national medium- and long-term development strategies and sectoral planning. This includes, most importantly, planning in the energy sector, but also in other sectors such as infrastructure and agriculture.

Such a coherent roadmap enables countries to facilitate a clear objective to pursue a just energy transition. LT-LEDS may introduce the country's instruments for channelling structural changes together with socio-economic benefits in an equitable and inclusive manner.

LT-LEDS development also is an opportunity for countries to reflect on their climate financing plan for decarbonisation. Climate change mitigation requires cross-sectoral efforts, to enable co-benefits among sectors. Deliberative consultation with relevant national actors is required to ensure financing, including national public finance, such as through the national budget and national financial institutions. LT-LEDS would eventually indicate a country's intent to access international climate financing and domestic climate finance from the private sector.

In 2023, in accordance with the Glasgow Climate Pact and the Sharm el-Sheikh Implementation Plan, which urged the Parties to the UNFCCC to communicate their LT-LEDS by COP28, there has been increased communication of these long-term strategies. As of September 2023, a total of 68 LT-LEDS had been communicated to the UNFCCC Secretariat (Figure 4) (UNFCCC, 2023c). These represent 75 countries that are Party to the Paris Agreement, of which 73 are IRENA Member States and three are States in Accession. The LT-LEDS cover a total population of 3.8 billion (World Bank, 2023), with total annual greenhouse gas emissions of 1.5 million tonnes of CO₂ equivalent (EDGAR, 2023), 3.7 million megawatts of total renewable energy capacity (IRENA, 2023b) and 7.1 million gigawatt hours of total renewable energy generation (IRENA, 2023b).



Figure 4 Countries that have communicated LT-LEDS, as of September 2023



1 Andorra	15 Costa Rica	30 India	45 North Macedonia	60 Thailand
2 Argentina	16 Cyprus	31 Indonesia	46 Norway	61 Tonga
3 Australia	17 Czechia	32 Ireland	47 Oman	62 Tunisia
4 Austria	18 Denmark	33 Japan	48 Portugal	63 Ukraine
5 Belgium	19 Ethiopia	34 Latvia	49 Republic of Korea	64 United Kingdom of Great Britain and Northern Ireland
6 Belize	20 European Union	35 Lithuania	50 Russian Federation	65 United States of America
7 Benin	21 Fiji	36 Luxembourg	51 Singapore	66 Uruguay
8 Bhutan	22 Finland	37 Malta	52 Slovakia	67 Vanuatu
9 Bosnia and Herzegovina	23 France	38 Marshall Islands	53 Slovenia	68 Zimbabwe
10 Cambodia	24 The Gambia	39 Mexico	54 Solomon Islands	
11 Canada	25 Georgia	40 Morocco	55 South Africa	
12 Chile	26 Germany	41 Nepal	56 Spain	
13 China	27 Guatemala	42 Netherlands	57 Sri Lanka	
14 Colombia	28 Hungary	43 New Zealand	58 Sweden	
	29 Iceland	44 Nigeria	59 Switzerland	

Source: UNFCCC (2023c).

Of the 68 LT-LEDS submitted so far, all of them communicate a long-term goal for mitigating greenhouse gas emissions, referring to a specific year for achieving either carbon neutrality or net-zero emissions. Although the time frames differ depending on countries' circumstances and capabilities, 70% of the LT-LEDS mention the year 2050 or "mid-century", with the rest targeting the years 2030, 2045, 2060, 2065 or 2070. A few (less than 10%)³ of the LT-LEDS provide different years for net-zero emissions according to sector, including residential, commercial, service, industry and transport.

Many of the LT-LEDS discuss long-term mitigation goals for net-zero CO₂ emissions based on a peak year, expressing their ambition to reduce greenhouse gas emissions. The peak year target can serve as a signal to national stakeholders for urging short- and medium-term efforts. It becomes a key milestone for achieving the national long-term climate vision, which is also important to inform the level of targets in the NDC cycles every five years.

³ This section uses the following terms to describe the status of LT-LEDS: "a few" is less than 10%; "some" is 10-40%; "many" is 40-60%; "frequently" is 60-80%; and "nearly all" is more than 90%.

To concretise specific action, nearly all of the submitted LT-LEDS describe mitigation measures to achieve their LT-LEDS goals, with the main mitigation options being energy transition measures; within these, energy supply and transport sector measures are most frequently mentioned.

Thus, a majority of LT-LEDS highlight quantitative targets on renewable energy, with a specific time frame and project details to pursue long-term goals. LT-LEDS frequently refer to clean power generation targets as a main mitigation measure. This is expressed in various ways, including:

- reference to technology types and an ambition to use specific technologies in the energy mix;
- projected value of renewable energy, either by percentage, power capacity, or potential greenhouse gas emission reduction in CO₂ equivalent value.
- indication of the target year to achieve the renewable energy generation or capacity.

LT-LEDS frequently specify the types of renewable energy sources being used to pursue their mitigation contribution, which include solar, wind, hydropower, biomass, geothermal, bioenergy and hydrogen. Further, some LT-LEDS specify the forms of zero-carbon fuels to be used, such as green hydrogen, biofuels, coconut oil and other renewables.

Overall, many LT-LEDS present quantifiable renewable energy targets; however, the majority cite government energy planning policy documents that incorporate national energy scenarios that provide a quantifiable target. Although LT-LEDS are relatively new, countries are encouraged to present quantifiable renewable energy targets in the LT-LEDS itself to demonstrate clarity, especially on renewable energy capacity and generation. Noting quantifiable targets in the LT-LEDS will further enable international stakeholders to understand and implement targeted renewable energy projects aligned with the respective LT-LEDS scenario.

Although quantifiable targets indicate clarity, they also depend on the availability of qualified data. Many countries note quantifiable targets and cite relevant national policies and initiatives in their LT-LEDS and NDCs, to strengthen their projected decarbonisation targets for 2030 and 2050. In many cases, these targets are expressed as the percentage of renewable energy in electricity generation or power generation. However, few LT-LEDS allude to descriptive targets, such as aims to increase renewable energy targets.

The availability and reliability of data on renewable energy projections is a key challenge that needs to be addressed. Identifying quantifiable targets requires sufficient disaggregated data to evaluate the electricity supply and demand and to model the projections to 2050. More specific and quantified targets based on data would make it possible to back-cast and signal the necessary policies, measures and actions for the short- and medium term, to achieve the long-term vision.

Many LT-LEDS mention long-term infrastructure planning, especially the construction of renewable power plants to increase renewable energy capacity. These targets show countries' plans for increasing renewable energy capacity, generation, grid improvement and flexibility. 81% of LT-LEDS mention the plan to accommodate large shares of renewables by strengthening the electricity grid network, while 63% mention the expansion of energy storage (UNFCCC, 2023c). However, the statements tend to imply aims to build plants, rather than outlining the operationalisation and implementation of the plan. Because these statements remain conditional pledges that may occur, countries will need to concretise the measures to support implementation, and to specify a financing plan.

LT-LEDS often quantify finance needs by providing information on the estimated amount needed for project implementation. Some LT-LEDS discuss potential project finance and investment from international organisations, multilateral banks, bilateral donors, domestic finance and investments to build power plants, in alignment with country roadmaps. Others indicate potential project financing from specific international organisations to increase their exposure to climate finance.

Besides financial needs for implementing large power plants, some LT-LEDS mention the needs for technology development and international technology transfer. Given the set of technologies required for energy infrastructure, strengthening international co-operation to accelerate deployment can help countries access technologies for infrastructure development.

For most countries, the LT-LEDS highlights potential linkages and synergies with the country's latest NDC, the Sustainable Development Goals (SDGs), and national energy policies on renewable energy capacity, generation, grid improvement and flexibility. Frequent linkages are made with the latest NDC communications on emission reductions and ambitions to achieve a just energy transition through renewables, identifying synergies between socio-economic development and the deployment of renewables for the energy transition. This includes long-term development planning with infrastructure development, affordable and clean energy with improved energy security, innovation and technology development.

Further synergies noted in the LT-LEDS correspond to elements of the SDGs, particularly SDG 7 (affordable and clean energy), SDG 13 (climate action) and SDG 17 (partnerships to advance the goals). Maximising synergies and alignments among LT-LEDS, NDCs, national energy scenarios and strategies, and the SDGs will accelerate the pace of the energy transition. As discussed in the next section, another important step is incorporating global-level reflections on climate – through the Global Stocktake – into national-level climate and development planning and policies.

The analysis above demonstrates how the LT-LEDS underscore opportunities for an energy transition powered by renewables and new energy sources, informed by the best available science. Communication of long-term strategies can be conducted based on differing planning time horizons and sectoral coverage, with respective national priorities and capabilities. IRENA's report *Long-term energy scenarios and low-emission development strategies: Stocktaking and alignment* (IRENA, 2023e) notes that institutional co-ordination on long-term energy, together with climate planning, will lead to more actionable and implementable LT-LEDS. Aligning energy transition efforts with long-term climate planning helps countries implement necessary energy transition measures consistent with the Paris Agreement goals. To that end, global-level stocktaking in 2023 will provide a guiding light for countries to further scale up their efforts.

1.4 TRANSLATING THE 2023 GLOBAL STOCKTAKE INTO NATIONAL ACTIONS

The Global Stocktake mandates taking stock of the implementation of the collective progress towards achieving the long-term goals related to climate change – including mitigation, adaptation, and facilitating implementation and support – with an emphasis on the mechanisms to enhance countries' climate action and support (UNFCCC, 2023c). The Global Stocktake technical dialogue concluded in September 2023, resulting in a synthesis report that reflects the outcome of the round table discussions.

During 2022-2023, three technical dialogues took place, with a series of round table discussions and breakout sessions. The dialogues focused on 'what is being done', 'how to bridge gaps' and 'what are next steps to accelerate collective progress and implementation of support' to inform countries, experts and stakeholders in discussing the energy transition. The discussions were aimed at broadening the scope to understand and present an outlook for a collective climate goal. A key framing theme in the technical dialogues, including the round table discussions and breakout sessions, was energy transformation towards low-greenhouse gas emissions and climate-resilient development.

The technical dialogues strongly underscored the importance of the energy transition, including the implementation of zero-carbon and zero-emission technologies. Participants discussed how to envisage a net-zero CO₂ energy system and what is required to rapidly scale up renewable energy, electrification of end uses and the use of clean fuels. Participants assessed enabling actions and key facets to transform existing energy and industrial systems.

The dialogues further underscored the necessary pieces to achieve key messages in the Global Stocktake synthesis report. Important aspects that the energy transition should consider include the issue of life-cycle emissions associated with renewable energy technologies as well as electric vehicles. Moreover, renewable energy, often discussed as a mitigation solution, can also support adaptation actions. However, realising and achieving systematic change will require greater discussion at COP28, where countries will express their political will in conjunction with their ambition to update and enhance their NDCs.

With the technical basis for the Global Stocktake now concluded, the political outcome will be informed and delivered at COP28, identifying key political messages, measures and practices. The First Biennial Transparency Report, slated for 2024, will track the progress of the previous NDC submissions. Further, the Parties to the UNFCCC will communicate their next round of NDCs by 2025 to reflect on the urgency of advancing climate change mitigation through the enhancement of NDC targets and measures. The designated timeline to assess progress will capture avenues for IRENA to provide effective, timely and relevant support to the Parties.

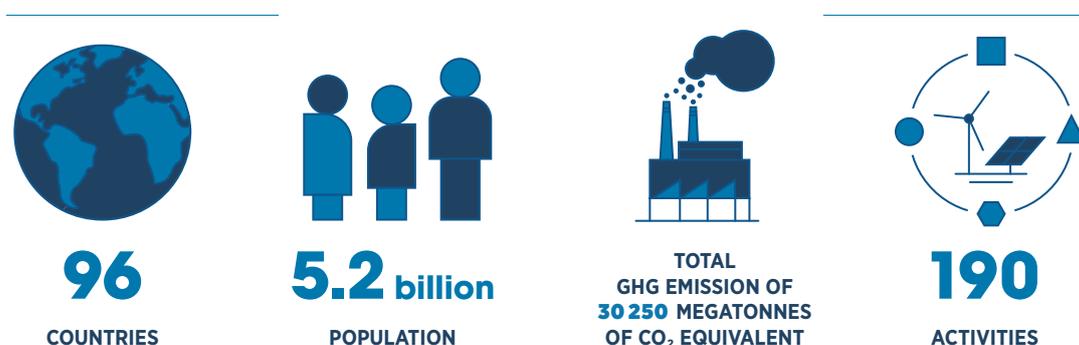
The pathways outlined in the NDCs and LT-LEDS are guiding documents towards country, regional and stakeholder roadmaps for the energy sector. The following sections take stock of IRENA's climate action support to illustrate the wide range of targeted support that the Agency is undertaking to enhance the global renewable energy capacity, improve energy infrastructure and strengthen international co-operation.

2 IRENA'S CLIMATE ACTION SUPPORT IN 2023

IMPACT TO DATE

IRENA's climate action support continues to increase as Members show growing interest in engaging with the Agency to receive targeted support on climate action to implement their NDCs and LT-LEDS to actualise the energy transition. IRENA is engaged with regions and countries in line with the 1.5°C scenario at a global level, as articulated in the *World Energy Transitions Outlook*. Analyses of regional energy transition pathways⁴, examine the 1.5°C scenario at regional levels to assess outlooks on key energy system components and technologies for the transition. These global and regional outlooks also inform the countries' engagement, so that IRENA can provide targeted support activities for the energy transition at the country level, contributing to the process of NDC and LT-LEDS implementation.

As of November 2023, IRENA's climate action support cumulatively includes 96 countries and 190 activities, to support the commitment of Members that are Party to the 2015 Paris Agreement (Figure 5).



⁴ See IRENA (2022a), IRENA (2022b).

Figure 5 IRENA's engagement with Parties to the Paris Agreement

- 47** Support provided
- 29** Implementation of support
- 6** Work plan development
- 14** Scoping

Europe

Albania	Moldova
Belarus	North Macedonia
Bosnia and Herzegovina	Türkiye
Georgia	Ukraine

Asia and the Pacific

Afghanistan	Iraq	Mongolia	Solomon Islands
Bhutan	Jordan	Myanmar	Syria
Cambodia	Kazakhstan	Nepal	Thailand
China	Kiribati	Oman	Tonga
Fiji	Kyrgyz Republic	Pakistan	Tuvalu
India	Lao PDR	Palau	United Arab Emirates
Indonesia	Lebanon	Papua New Guinea	Uzbekistan
Iran	Micronesia (Federal State of)	Saudi Arabia	Vanuatu

Latin America and the Caribbean

Antigua and Barbuda	Dominica	Panama
Argentina	Dominican Republic	Paraguay
Bahamas	Ecuador	Peru
Barbados	El Salvador	Saint Kitts and Nevis
Belize	Grenada	Saint Lucia
Colombia	Honduras	Saint Vincent and Grenadines
Costa Rica	Jamaica	Trinidad and Tobago
Cuba	Nicaragua	Uruguay

Africa

Angola	Egypt	Liberia	Seychelles
Benin	Eswatini	Mali	Sierra Leone
Burkina Faso	Ethiopia	Mauritius	Somalia
Cameroon	Gabon	Mozambique	South Africa
Chad	Gambia (The)	Niger	Sudan
Comoros	Ghana	Nigeria	Uganda
Congo	Kenya	São Tomé and Príncipe	Zambia
Côte d'Ivoire	Lesotho	Senegal	Zimbabwe

Disclaimer: This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply any official endorsement or acceptance by IRENA.

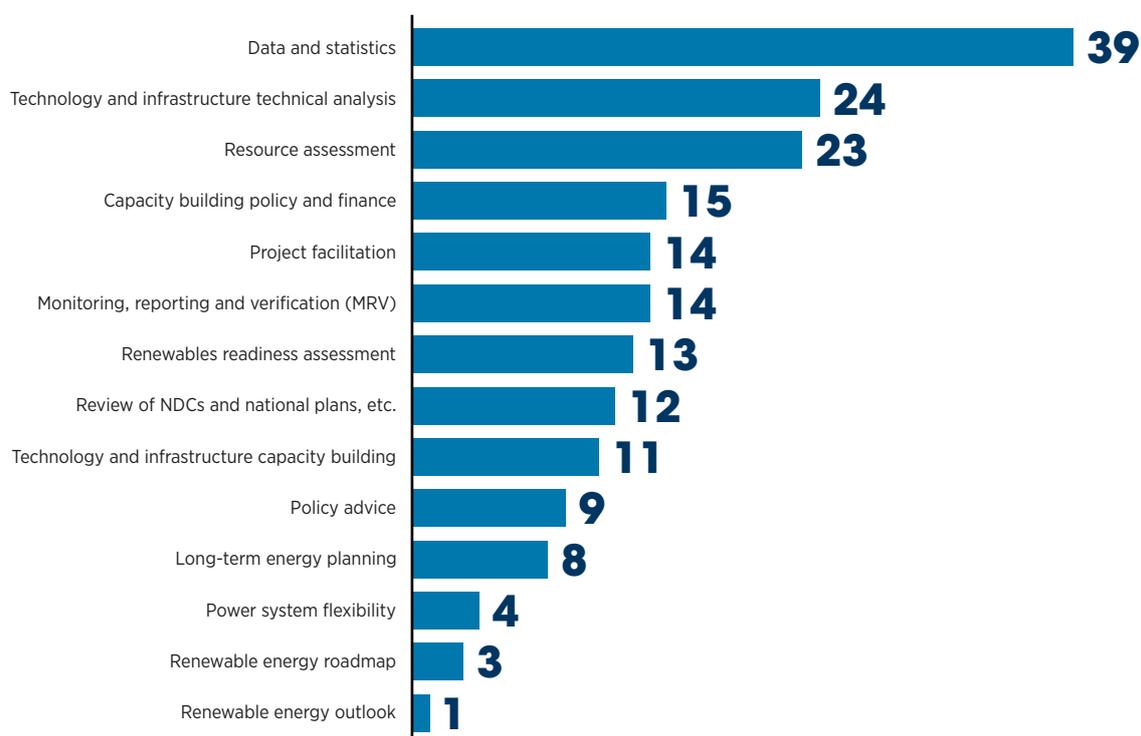
IRENA engages with its Members based on work packages that demonstrate the Agency's immense knowledge and expertise on different facets of the energy transition. These work packages provide substantive input to countries' NDC enhancement and implementation, LT-LEDS, and reviews of national renewable energy targets, policies and investment plans. Each work package has a diverse depth of sub-activities: some work packages include energy modelling and scenario assessments, while others build on IRENA's available data and tools to provide inputs to countries' climate policy and planning processes. The various work packages are described in Table 2.

Table 2 IRENA's categories of climate action support work packages

Work package	Description
Data and statistics	Providing energy data through IRENA's repository of statistics for energy balances, renewable energy capacity and generation, and energy finance and costs.
Technology and infrastructure technical analysis	Supporting countries in planning and implementing climate change mitigation and adaptation measures for the enhancement and implementation of NDCs and LT-LEDS. The support covers the analysis of mitigation potential, associated costs and performance, and adaptation co-benefits of renewables for relevant infrastructure in the power, building, industry and transport sub-sectors.
Monitoring, reporting and verification (MRV)	Technical assistance and capacity building on energy data collection, analysis, recording and reporting. The support can also cover the MRV support on greenhouse gas emission reduction through the energy transition.
Resource assessment	Assisting countries in assessing their renewable energy potential and building their capacities to undertake the analysis. This includes site assessment, suitability assessment, zoning assessment and the SolarCity simulator, which is a web application to evaluate the prospects for electricity generation using rooftop solar PV installations.
Policy and finance advice	Undertaking technical analysis of the current policies and financial landscape for the energy transition. Support can also include the analysis of existing barriers to renewables deployment and provide policy-relevant recommendations to support mobilising investment in the energy transition, leading to climate action.
Renewables Readiness Assessment	Undertaking comprehensive assessment of the conditions for renewable energy deployment to support decision makers in countries to expand ambitions for renewables deployment.
Long-term energy planning	Enhancing long-term renewable energy planning and developing capacity of the countries for undertaking their energy planning and modelling. This includes institutional arrangements, modelling capabilities, scenario use and stakeholder communication for guiding energy policy decisions.
Power system flexibility	Analysing the flexibility in the power system to identify cost-effective and sound solutions for integrating variable renewable energy (VRE). These include demand-side flexibility, energy storage, and sector coupling options, such as electric vehicles, power-to-heat and power-to-hydrogen.
Renewable Energy Roadmap (REmap)	Assessing the potential of renewable energy in the power, cooling, heating and transport sectors. It also covers the analysis of possible technology avenues and assessment of other metrics including technology options, costs, financing, and potential externalities, including emissions, air pollution and various economic indicators.
Project facilitation services	Facilitating the development of project pipelines aligned with the priorities of governments in collaboration with the financial sector, the private sector and project developers; assisting in bankability assessment and access to finance for projects. The Climate Investment Platform and IRENA's regional Investment Forums leverage support for countries' access to project finance.

IRENA has engaged in 190 different work packages to support the Parties to the Paris Agreement in enhancing and implementing their energy transition plans (Figure 6). The distribution of these climate action work packages, aligned to support NDCs and LT-LEDS, demonstrates the commitment among IRENA Members to climate goals through the energy transition. Many countries have communicated that their LT-LEDS correspond with their NDCs and national policies and plans, to ensure effective implementation and harmonisation of short-, medium- and long-term plans to achieve the collective climate goal of a low-carbon resilient economy by the end of the century. IRENA is working, upon request, to provide the Parties with substantive input to strengthen their LT-LEDS towards carbon neutrality under the Paris Agreement.

Figure 6 **Distribution of IRENA’s climate action support work packages**



IRENA works with its Members as well as with development agencies and partners to expand opportunities to support climate action powered by renewables. The Agency has been collaborating via multiple institutional partnerships with the United Nations Development Programme, the UNFCCC, and the UNFCCC Regional Pacific NDC Hub, and has received requests from the NDC Partnership. IRENA has been building stronger co-operation by partnering with international organisations to enhance renewable energy ambition and widen the scope of access on renewable energy investment.

IRENA, as an intergovernmental agency on renewables, continues to work with a diverse set of countries to expand on the collective goal for energy transition by supporting climate action. IRENA’s climate action support harmonises with the Agency’s mandate as well as with its Medium-Term Strategy 2023-2027, which is focused on urgent and targeted action, international co-operation, and continuous innovation to serve its Members.

2.1 AFRICA

Historically, Africa has been among the lowest regional contributors to greenhouse emissions, with the lowest per capita emissions in the world. However, the region has been greatly affected by the impacts of climate change. Related responses to climate change in Africa pose risks for both ecosystems and people, including loss of food production, poverty, health, ecosystem disruption, increased water and energy insecurity, and the loss and damage of natural and cultural heritage (IPCC, 2022a). In the face of such looming challenges, renewables-based energy solutions are key for the region to grow economically and to support socio-economic development and livelihoods while also addressing climate concerns.

Sub-Saharan Africa has a 71% renewable share in its energy supply because of the predominance of traditional uses of biomass for heating and cooking (IEA *et al.*, 2023). However, Africa accounts for only 2% of the global renewable power generation capacity. The population without access to electricity remained unchanged between 2021 and 2010, and 560 million people in the region continue to be unserved by electricity (IEA *et al.*, 2023). There is an urgent need to increase electrification rates, especially in Sub-Saharan Africa. Africa's renewable generation capacity has continued to expand steadily, increasing by 2.7 GW in 2022 (IRENA, 2023b). However, there is a need to explore untapped renewable power potential to accelerate the pace of the energy transition while developing the region's economy.

IRENA's engagement in Africa is aimed at contributing to countries' responses to climate change through support that advances the region's energy transformation.

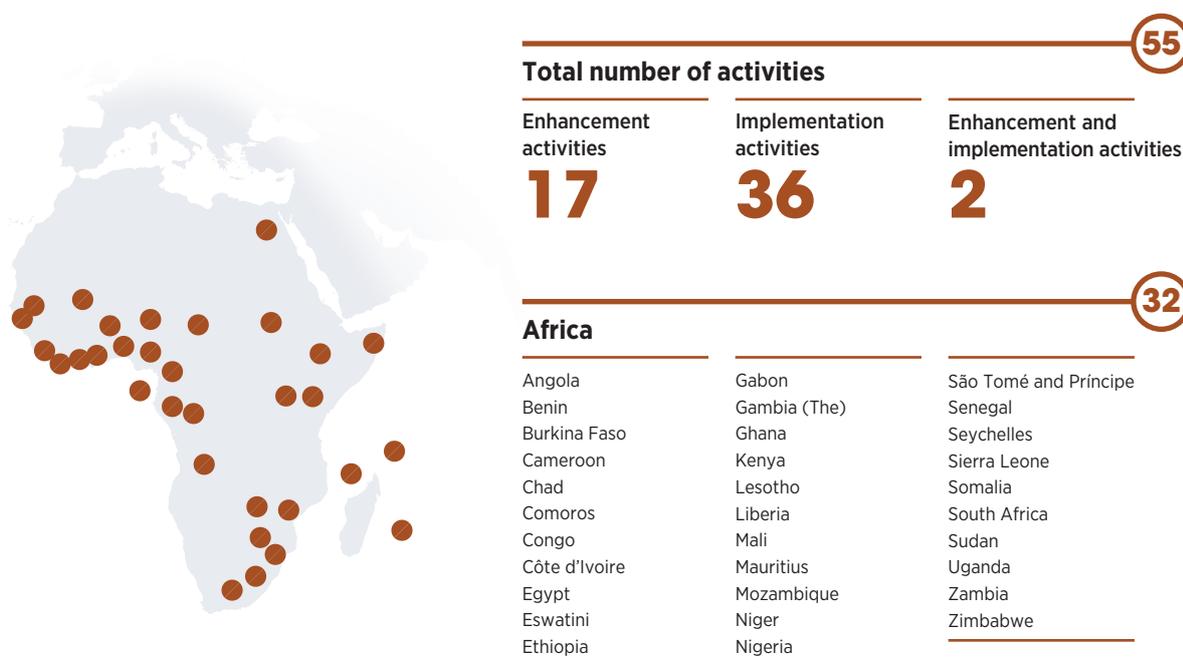
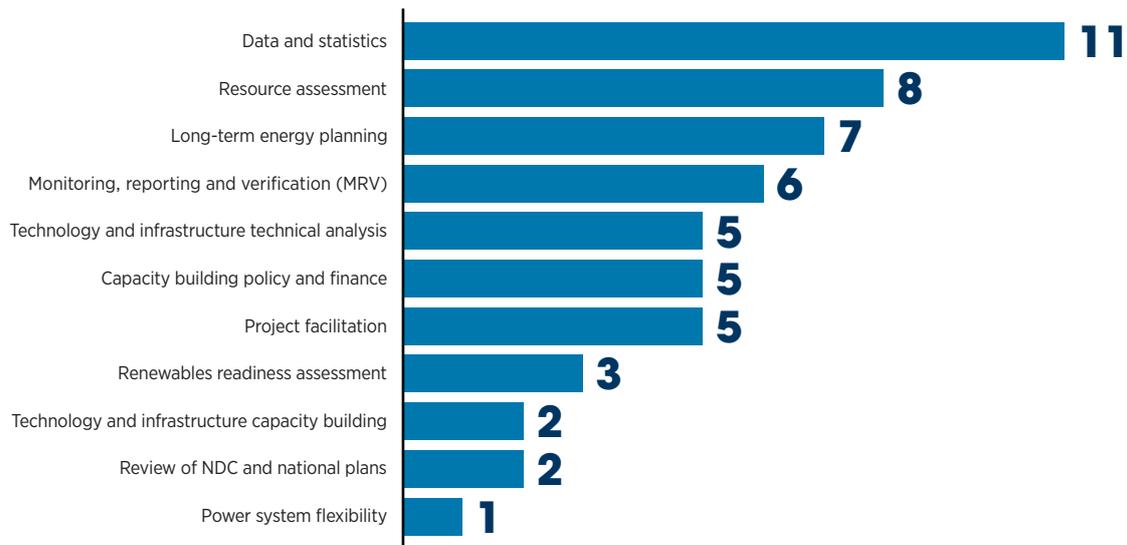


Figure 7 **Distribution of IRENA's climate action support in Africa**



Progress of IRENA's climate action support in 2023

- In **Chad**, a Renewables Readiness Assessment (RRA) is under way to provide a comprehensive evaluation of the deployment conditions for renewable energy. The assessment will identify a set of actions to scale up renewable energy that contribute to climate change mitigation. The findings and recommendations from the RRA will contribute to Chad's broader context on climate action through co-ordination with stakeholders in the country.
- **Burkina Faso** is also collaborating with IRENA on an RRA. Relevant stakeholders for the development of renewables – including governments, energy regulators and planners, financiers, civil society and academia – are being convened to enable a shared understanding of the challenges and ways to address them, so that the country can seize energy transition opportunities through renewables.
- In **Somalia**, the RRA is based on five main themes: national energy policy and strategy, institutions and markets, resources and technologies, business and financing models, and human and institutional capacity needed to scale up renewables. While renewable energy remains the most viable option for Somalia to close its energy access gap, the capacity of diesel generators for electricity generation is four times larger than the current combined capacity of solar and wind. IRENA's support aims to improve the enabling conditions for deploying more renewables.
- **Ethiopia, Ghana, Lesotho** and **Sudan** have been supported through IRENA's energy survey project, which aims to contribute to the enhancement of energy statistics. More specifically, the project will strengthen bioenergy data for more accurate and transparent NDC and SDG monitoring and reporting.

- To inform implementation of the NDC in **São Tomé and Príncipe**, an assessment of cost-effective mitigation options was developed, which demonstrated that all of the power sector mitigation measures studied are economically viable and result in greenhouse gas emission reductions. This reinforces the importance of deploying renewable energy and energy efficiency technologies to achieve the country's NDC.
- In **Senegal**, a capacity building programme for long-term energy planning was conducted through a partnership of IRENA, the German international co-operation agency (GIZ), and the Senegal Ministry of Petroleum and Energy. Public institutions in Senegal's energy sector participated in training sessions for planning the power system capacity expansion to cultivate institutional capacities for energy scenario development. Such capacities to devise planning and modelling based on scenario analysis are needed to develop a robust national energy plan to implement it.
- In **Seychelles**, IRENA is collaborating with the Ministry of Transport to conduct a *Technology and Grid Infrastructure Plan for Renewable Energy and Electric Mobility Integration*. The aim is to evaluate the early stages of transport sector decarbonisation with electric mobility that can support the country in reaching and enhancing its mitigation targets using renewable energy sources.
- IRENA conducted a grid assessment study for the **Republic of Mozambique** to assess the impact of variable renewable energy on the reliability of Mozambique's national electricity network. The results of the study indicated that despite the high proposed VRE capacity addition, the system continues to operate securely and stably under the analysed scenarios and critical snapshots.
- Project facilitation support has been undertaken in **Côte d'Ivoire, Kenya and Sierra Leone** to strengthen renewable energy project pipelines. Because these countries face challenges in securing the resources to implement the priority actions in their NDCs, match-making the project concepts and proposals with potential financiers from IRENA partners can provide opportunities for project developers to mobilise investment.

In Focus **Renewable Energy Roadmap: Nigeria**

Nigeria is among the African countries facing a rapidly growing population alongside economic growth. Nigeria's economy needs to ramp up sustainable energy sources to meet expanding energy demand while ensuring low-carbon development pathways. In this context, IRENA collaborated with the Energy Commission of Nigeria to develop a Renewable Energy Roadmap (REmap) to analyse the potential of additional renewable energy deployment towards 2030 and 2050.

REmap analysis, offered by the IRENA Innovation and Technology Centre, accentuates the long-term potentials of renewable energy, looking at technology options, cost assessment, investment requirements and contribution to climate objectives. The REmap process is entirely country-driven to ensure national ownership through close co-ordination with energy sector stakeholders. To assess a country's renewable energy potential, Planned Energy Scenarios (PES) and Transforming Energy Scenarios (TES) are developed to provide perspectives on energy system development based on current national energy plans and on an energy transformation pathway to meet the 1.5°C scenario with renewables and energy efficiency measures.



A key recommendation from Nigeria's REmap is that expanding investment in renewables as per the TES is more cost effective than the PES to deliver the same energy service towards 2050, considering the country's vast untapped renewable energy resources. Hence, it is recommended to avoid investment in fossil fuel lock-in infrastructure in the short term while mobilising investment in renewables. By doing so, the share of renewables in final energy consumption should reach 52% by 2030 and 59% by 2050 to align with the country's emissions pathway in a 1.5°C scenario, for which electrification plays a significant role.

For the power sector, total electricity generation capacity needs reach 62 GW in 2030 (77% of the total capacity) and 178 GW (92%) in 2050 as per the TES. Distributed solar PV is a key for Nigeria to explore a renewables-based electricity system. To follow the TES, the country should devise policies supportive to the energy transition to unlock investment. Cross-cutting co-ordination among relevant government agencies and bodies is essential to develop consensus, plans and policies for accelerating the deployment of renewables.

Source: IRENA (2023f).

In Focus **Accelerated Partnership for Renewables in Africa**

In September 2023, IRENA launched the Accelerated Partnership for Renewables in Africa (APRA) in collaboration with the governments of Denmark, Germany, Kenya and the United Arab Emirates. APRA aims to accelerate progress on the African continent in the deployment of renewable energy and the growth of green industry through key targeted interventions in support of: 1) financial mobilisation, 2) technical assistance and capacity building, and 3) private sector engagement. Africa has accounted for only 2% of global investment in renewable energy in the last two decades, and the electrification rate was only 46% in 2019 (IRENA, 2022c). APRA covers six countries – Ethiopia, Kenya, Namibia, Rwanda, Sierra Leone and Zimbabwe – and will serve to translate their climate ambition to reality. Partnerships such as APRA are crucial for driving the energy transition in the continent.

In Focus **Capacity building programme on sustainable biofuels**

IRENA, in collaboration with Eni, developed a capacity building programme on sustainable biofuels and provided training in six countries in 2022-2023. Of the supported countries, biofuel capacity building contributed to the NDC implementation processes of **Angola**, the **Republic of the Congo**, and **Mozambique**, as their NDCs indicated bioenergy among the targeted measures. This capacity building initiative is aligned with the enabling conditions emphasised by IRENA in the *World Energy Transitions Outlook 2023*, which identifies the strategic realignment of institutional capacities as one of the three key drivers of the energy transition, together with the need to scale up investments in physical infrastructure and to introduce adequate policies and regulations.

The programme is aimed at strengthening the competencies and skills of national institutions involved in the biofuels value chain, enhancing the ability of African countries to mainstream and advance the development of biofuels in their energy plans and projects. The programme consists of two main sections. In the first part, participants engage in classroom training sessions at Eni Corporate University in Rome. Experts from Eni, IRENA and the Food and Agriculture Organization of the United Nations present on the biofuels value chain and its sustainability considerations, as well as on policy and regulatory aspects related to the sector's development. The second part of the programme includes site visits to a biorefinery and a biofeedstock laboratory in Italy. To date, 49 government representatives have participated in the programme, with two more rounds scheduled for 2024.

2.2 ASIA AND THE PACIFIC

Asia and the Pacific is the largest regional contributor to global greenhouse gas emissions (IPCC, 2022b). Intensified warming has become a threat to the region’s social and economic sustainability through the growing likelihood of heatwaves across Asia; droughts in arid and semi-arid areas of West, Central and South Asia; and floods in monsoon regions of South, South-east and East Asia (IPCC, 2022a). Additionally, climate change has caused infrastructure damage and service disruptions that have affected supply chains in Asia. Advancing the energy transition is crucial for the region’s sustainable development.

Asia and the Pacific is leading the expansion of renewables in energy systems. In 2020, East Asia recorded an increase in modern uses of renewable energy, driven mainly by China, where wind, hydropower and solar PV dominated growth (IEA *et al.*, 2023). For the power sector, around 60% of new capacity was from renewable energy sources in 2022, and the renewable capacity expanded by 174.9 GW to reach a total of 1.63 TW (IRENA, 2023a). Asia accounts for 48% of the global renewable power capacity and attracted two-thirds of the total global investment in the energy transition in 2022 (IRENA and CPI, 2023).

Nevertheless, the region’s power sector relies heavily on fossil fuels, and Asia accounts for more than one-third of total global greenhouse gas emissions (EDGAR, 2023). Decarbonising the energy sector in Asia is indispensable for achieving global net-zero emissions. For countries located in the Middle East sub-region, the energy transition towards renewables is under way. Many countries have enhanced their climate ambition in NDCs and LT-LEDs, and some Gulf countries have set targets for net-zero emissions by 2050. These targets need to be followed up by effective policies and sufficient investment in renewables and energy efficiency.

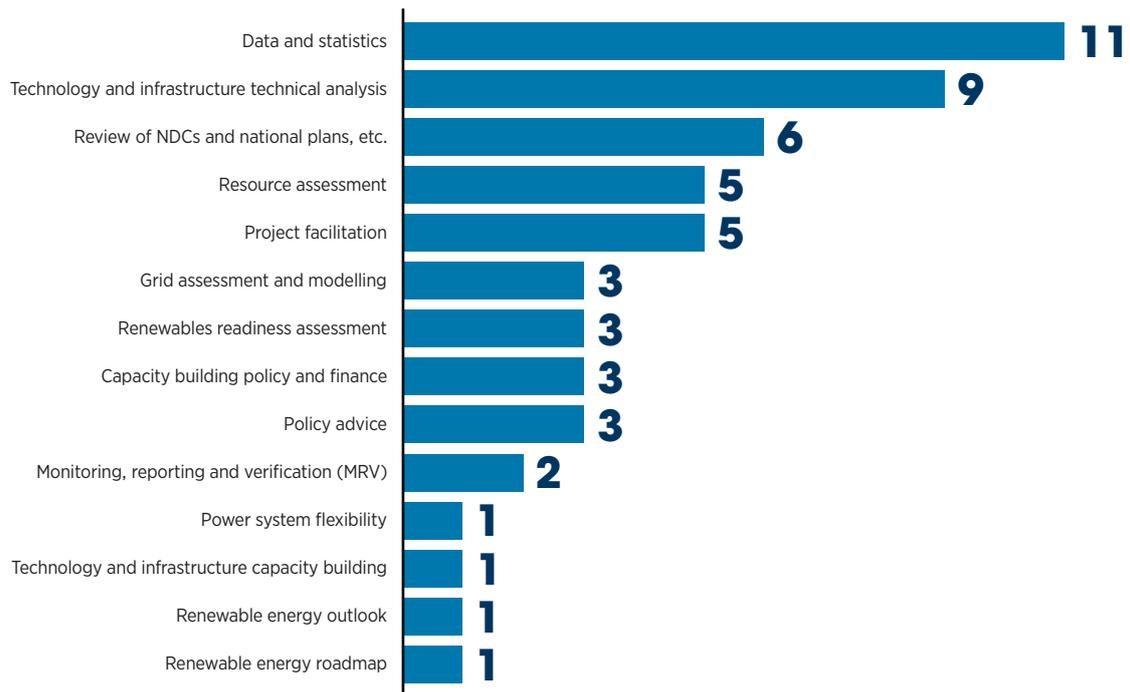


Asia and the Pacific



Afghanistan	India	Kazakhstan	Pakistan
Bhutan	Indonesia	Kiribati	Palau
Cambodia	Iran	Kyrgyz Republic	Papua New Guinea
China	Iraq	Lao PDR	Saudi Arabia
Fiji	Jordan	Lebanon	Solomon Islands
		Micronesia (Federal State of)	Syria
		Mongolia	Thailand
		Myanmar	Tonga
		Nepal	Tuvalu
		Oman	United Arab Emirates
			Uzbekistan
			Vanuatu

Figure 8 **Distribution of IRENA's climate action support in Asia and the Pacific**



Progress of IRENA's climate action support in 2023

- In **Uzbekistan**, IRENA provided resource assessment support through the SolarCity simulator to analyse the potential for electricity generation from solar PV in Tashkent. The simulator, an innovative web-based platform to support planning and deployment of rooftop solar PV systems, facilitated assessment of the technical and financial potential for rooftop PV installations by testing different policy instruments, incentive schemes and installation scenarios that will lead to potential socio-economic benefits, contributing to decarbonising the electricity system in the country. The support is crucial to NDC and LT-LEDS implementation, as Uzbekistan has pledged to prioritise energy efficiency measures and the expansion of renewables for both its medium- and long-term targets.
- The engagement in **Kazakhstan** includes support for strategic planning and reforms to conduct an energy end-use survey focused on the residential sector. The activity contributes to improving the data required for energy reporting and developing energy efficiency indicators for NDC implementation. This will help improve the availability of energy end-use data required to develop comprehensive energy balances, statistical yearbooks, and energy commodity accounts, among others. Additionally, the collection of updated data on energy end-use consumption will support the development of evidence-based national energy efficiency policies and indicators.
- In **Iraq**, IRENA has begun preparing the renewable energy assessment for developing an action plan to achieve the energy transition through renewables and other energy transition components, including electrification, energy efficiency, and alternative and advanced clean fuels. The assessment aims to create an effective enabling framework to support the accelerated development of renewables.

- To assist **Lao PDR** with mainstreaming climate action, IRENA supports the development of sectoral plans in key areas, as set out in the country's NDC. Project facilitation support has been provided for **India, Iran, Oman** and **Uzbekistan** through the Energy Transition Accelerator Financing (ETAF) investment platform, which IRENA manages, to help mobilise funds for NDC implementation. Solar projects in Uzbekistan were agreed with financiers in the first quarter of 2023 (see In Focus).

In Focus **Malaysia's Energy Transition Outlook**

Situated in South-East Asia, Malaysia is an emerging economy with a rapidly growing population. The country stands at a crossroads: either continue using oil and gas resources, or explore the huge potential of renewable energy resources. The *Energy Transition Outlook for Malaysia* analysed that renewable energy could provide a more cost-efficient future energy system for the country, as it is an affordable and local alternative to fossil fuels. IRENA's Energy Transitions Outlook series at the country level provides long-term perspectives for energy system transformation in line with the global-level World Energy Transitions Outlook series.

Malaysia has been a producer of oil and natural gas, with reserves located across Sabah and Sarawak states on the island of Borneo and in offshore areas off Peninsular Malaysia. However, the country could become a net oil and gas importer due to the limited availability of resources in these reserves. Alternatively, the country has the potential to supply more than 50% of its final energy consumption with renewables, up from today's share of only 5%. According to Malaysia's NDC and National Energy Policy, the transition to renewables is aligned with the country's climate plan and its target for net-zero emissions as early as 2050, as well as its unconditional 45% reduction in emission intensity by 2050. To that end, deep electrification with renewables across all end-use sectors is important, making up 40% of final energy consumption.

Bioenergy, geothermal and hydrogen have a role towards this pathway. In addition, renewables direct-use is important. The power sector also needs to ramp up the use of renewables: for Malaysia to achieve a 100% renewables-based electricity system in 2050, the solar PV capacity needs to exceed 150 GW, with support from around 20 GW of battery storage and 36 GW of other renewables.

Source: IRENA (2023g).

In Focus **Pacific regional capacity building for energy management**

IRENA's SIDS Lighthouses Initiative, aimed at small island developing states (SIDS), co-organised a regional training programme to strengthen the skills and capacities of policy makers, power utilities and other energy stakeholders for undertaking energy audits to assess and manage energy consumption. The event was organised in collaboration with the Pacific Community, the Pacific Centre for Renewable Energy and Energy Efficiency, and the Ministry of Public Works, Transport and Meteorological Services of Fiji. The programme served as an opportunity to provide participants with practical sessions on the implementation of energy audits and guidance on energy-savings measures and linkage with climate change mitigation. The programme discussed best practices of energy management and auditing so that participants could gain usable knowledge and insights. Fourteen Pacific SIDS participated in the event, including Cook Islands, Fiji, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

Source: IRENA (2023h).

In Focus **Mongolia's planning for strategic heating**

Mongolia's first NDC, submitted in October 2020, targets a 22.7% reduction in greenhouse gas emissions by 2030 compared with projected emissions under a business-as-usual scenario in 2010. Mongolia relies on domestically produced coal to fuel district heating systems and individual household heating, and heavy coal use has caused air pollution and led to respiratory issues in the population. Improving the heat supply system to achieve health benefits is an imminent challenge. IRENA has worked with Mongolia to develop a renewables-based strategic heating plan by assessing the techno-economic potential to use local renewable resources in heating networks (IRENA, 2023i).

The assessment focused mainly on the heating sector in the capital, Ulaanbaatar City, with the following activities:

- Evaluation of locally available renewable energy resources, mainly geothermal, solar thermal, wind and sustainable waste heat.
- Assessment of existing and projected demand in local heating demand and energy efficiency potential.
- Analysis of a possible renewable energy mix, estimated cost, emission impacts and air pollution reduction potential.

To decarbonise Mongolia's heating system, it is important to improve policies and regulations to promote the use of renewables. This can be done by establishing enabling regulations, implementing ambitious targets to phase out coal in heating systems, and assessing the renewable energy potential for district heating, such as geothermal energy. In addition, a review of the current tariff for heating should advance consumption-based billing while ensuring that it covers all the costs associated with heat generation and distribution. Therefore, it is critical to advance energy efficiency measures in buildings through policy measures, including the development of minimum energy performance standards, implementation of energy audits and thermal insulation. It is also recommended to expand coverage of district heating systems in dense areas and to lower the supply temperature level to enable the use of locally available renewable energy sources, which occur at low temperature, for heating.

In Focus **Solar projects in Uzbekistan**

The Energy Transition Accelerator Financing (ETAF) platform, managed by IRENA, facilitated commitments from partners, including Masdar and the Asian Infrastructure Investment Bank (AIIB), to commit capital to three solar projects in Uzbekistan in April 2023.

ETAF is a multi-stakeholder climate finance platform that targets the deployment of 5 GW of additional renewable power in developing countries by 2030. The platform leverages its partners' financial solutions to mobilise capital for renewable energy projects in IRENA Members. IRENA, as the platform manager, facilitates co-operation with and among the partners, from project evaluation to financial close. As of September 2023, the partners include the Abu Dhabi Fund for Development, the AIIB, the Inter-American Development Bank, Masdar, the OPEC Fund for International Development and Swiss Re.

The solar project development that ETAF has supported will help Uzbekistan meet its climate targets, including a pledge to achieve carbon neutrality by 2050. The government aims to reach 7 GW of solar and 5 GW of wind capacity by 2030, with the aim of meeting 25% of the country's electricity demand through renewable sources. ETAF facilitated investment in the Sherabad, Samarkand and Jizzakh solar projects, which at full capacity are expected to provide electricity to more than 1 million people, resulting in 1 million tonnes of annual CO₂ emission reduction.

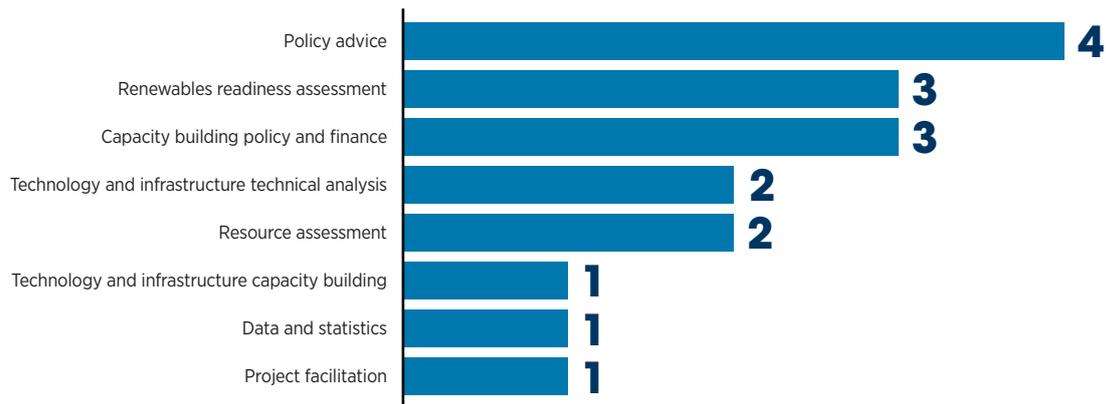
2.3 EUROPE

Europe has been warming at a faster pace than the global average, with more frequent and intensified extreme hazards related to climate change (UN, 2023). Among European sub-regions, the Western Balkans has been severely hit by pressing climate challenges, such as more frequent droughts, heat waves, and tropical storms, which can potentially heighten existing post-conflict tensions. The sub-region also suffers from high pollution levels due to its reliance on fossil fuels and resource-intensive industrial sectors, damaging people’s health and quality of life. The energy transition is key for climate change mitigation, given the region’s large domestic energy potentials from hydropower and other renewables.

Because of favourable conditions for hydropower and the expansion of solar PV and wind capacity, Europe accounted for more than a quarter of the year-on-year growth in the use of modern renewables in 2020 (IEA *et al.*, 2023). The region represents 21% of the global renewable energy generation capacity, with 709 GW installed, and has enabling conditions for increased wind and solar PV capacity and the use of hydropower (IRENA, 2023a). Following the European Green Deal, which commits EU Member States to reduce net emissions at least 55% below 1990 levels by 2030, Europe’s Green Deal Industrial Plan for the Net-Zero Age provides investment aid and tax breaks for green industries, including renewables and hydrogen (IRENA and CPI, 2023). Still, the progress varies by sub-region, and IRENA is working with its Members in South-East Europe to support the acceleration of renewable solutions in the energy system.



Figure 9 Distribution of IRENA's climate action support in Europe



Progress of IRENA's climate action support in 2023

- In **Bosnia and Herzegovina**, IRENA has engaged with energy sector stakeholders on the finalisation of an RRA to help the country transition from fossil fuel reliance to renewables-based energy and power systems (see In Focus). IRENA also provided an assessment and recommendations for ensuring alignment between the country's NDC and the upcoming National Energy and Climate Plan by benchmarking climate change mitigation actions.
- In **Georgia**, in response to the country's request for support, IRENA assists with diversifying the energy supply and cleaning up energy end uses by assessing the renewable resource potential and readiness for deployment. The energy transition is key for the country's energy security, while addressing decarbonisation to achieve climate objectives. IRENA also provides techno-economic assessments of the use of locally available renewable energy solutions in end-use sectors, including buildings and agri-food, to drive the energy transition.
- For **Ukraine**, IRENA organised a workshop aimed at strengthening the institutional and human capacities of energy sector stakeholders to develop bankable project pipelines, especially for IRENA's ETAF platform.

In Focus Solar projects in Uzbekistan

IRENA collaborated with the Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina on an RRA to assess the country's readiness for renewable energy deployment. Despite a vast renewable resource potential, the energy sector is largely dependent on fossil fuels. However, the country bears the heavy cost of air pollution and health impacts related to fossil fuel use. A thorough assessment of renewables helps Bosnia and Herzegovina accelerate its energy transition and is a crucial step to align the country's upcoming National Energy and Climate Plan with the level of climate ambition in the EU Green Deal. At the sub-regional level, the Sofia Declaration on the Green Agenda of the Western Balkans also signalled a strong message to the country.



Bosnia and Herzegovina has a significant renewable energy resource potential, which includes hydropower, biomass, wind and solar. Geothermal resources could also be available, although the potential is yet to be confirmed. Continued reductions in the costs of solar and wind power offer a solid option for energy transition in the country, diversifying its power sources away from coal. Still, a just energy transition needs to be ensured, given that the coal mining industry is a non-negligible source of employment opportunity.

Although Bosnia and Herzegovina has undertaken efforts to make the necessary regulatory and legislative changes for scaling up the deployment of renewables, the outcome is still limited in the opening of the electricity market and the adoption of variable renewable energy sources. There is a need to streamline the administrative and authorisation procedures of renewable energy projects, including construction, operation, production and selling. In addition, understanding and reforming the country's regulatory frameworks is complex and requires capacity building for relevant policy makers and professionals in the energy industry.

The RRA suggests strengthening the financial framework to support renewable energy projects. To mitigate the project transaction cost, it is important to undertake feasibility studies and environmental impact assessments and to prepare a standardised project agreement template. Additionally, improving access to risk mitigation instruments is needed to attract investors for renewable energy projects: for the power sector, enhancing the creditworthiness of off-takers is important to protect developers and investors.

Source: IRENA (2023j).

In Focus **District heating and cooling in South-East Europe**

In countries of South-East Europe, district heating and cooling systems present ageing infrastructure that is in increasing need of refurbishment. This refurbishment is an opportunity for countries to replace their energy systems with more efficient options that rely on renewable heat sources, aligned with the energy transition and climate objectives.

In partnership with the Energy Community, IRENA has been engaged with countries in South-East Europe to support addressing technical challenges related to the integration of renewable heat sources into new and existing buildings and district heating networks. The Contracting Parties of the Energy Community – including Albania, Bosnia and Herzegovina, Georgia, Kosovo*, Moldova, Montenegro, North Macedonia, Serbia and Ukraine – adopted the Decarbonisation Road Map in 2021, as well as, in December 2022, ambitious targets for 2030 through the Ministerial Council. The targets aim for a 31% renewable share in total energy consumption at the level of the Energy Community. The heating and cooling sector will play a large role in achieving these goals.

To support the process, in April 2023 IRENA and the Energy Community jointly organised a regional Workshop on District Heating and Cooling to discuss challenges and opportunities for financing district heating and cooling projects and to highlight key enabling technologies. At the country level, a capacity building workshop on renewable energy solutions for heating and cooling systems was undertaken in November 2023 to enhance decarbonisation and heat transition efforts in Moldova through the integration of renewable solutions in district heating systems, as well as decentralised renewable heating solutions. This complements Moldova's efforts to advance the aligned implementation of its NDC and its National Energy and Climate Plan.

**Throughout this publication, this designation is without prejudice to positions on status and in line with the United Nations Security Council Resolution 1244 (1999).*

2.4 LATIN AMERICA AND THE CARIBBEAN

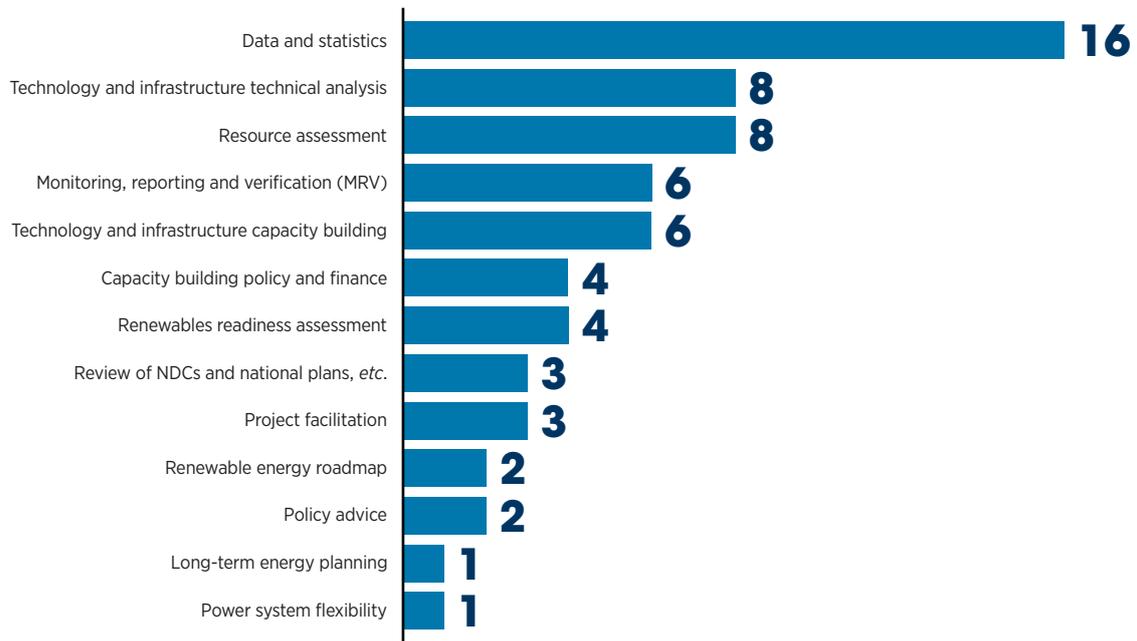
Although the greenhouse gas emissions of Latin America and the Caribbean are low when compared globally, the region is experiencing severe climatic impacts, such as extreme weather events due to a changing climate (UNDP, 2023). Climate change has exacerbated economic, social and ethnic inequalities in the region (IPCC, 2022a). While countries have made ambitious pledges through their NDCs and LT-LEDS, gaps exist between aspirations and actual action. For climate change mitigation, the current policies in countries of the region are not well aligned with pledged emission reductions and net-zero scenarios due to the region's economic dependence on fossil fuels and the growing emissions from deforestation (UNDP, 2023). Hence, energy transition measures are needed in the short as well as long term.

Latin America and the Caribbean has a 29% renewable share in total final energy consumption, which is the highest among world regions and twice the global average. This is due to the wide use of hydropower as well as bioenergy use in the industry sector (IEA *et al.*, 2023). In 2022, the region attracted only 4% of the total global investment in renewables (IRENA and CPI, 2023). This investment was concentrated in just a few countries, such as Brazil and Chile. Increasing the average investment in renewables, as well as other energy transition technologies, is essential to advance climate action in the region. Countries are beginning to diversify their electricity systems and to create more enabling policy and regulatory environments. IRENA, together with its Members, made efforts through its inaugural Latin America Investment Forum in November 2023.



Total number of activities 64		
Enhancement activities	Implementation activities	Enhancement and implementation activities
17	45	2
Latin America and the Caribbean 24		
Antigua and Barbuda	Dominica	Panama
Argentina	Dominican Republic	Paraguay
Bahamas	Ecuador	Peru
Barbados	El Salvador	Saint Kitts and Nevis
Belize	Grenada	Saint Lucia
Colombia	Honduras	Saint Vincent and Grenadines
Costa Rica	Jamaica	Trinidad and Tobago
Cuba	Nicaragua	Uruguay

Figure 10 **Distribution of IRENA's climate action support in Latin America and the Caribbean**



Progress of IRENA's climate action support in 2023

- **Antigua and Barbuda** requested IRENA support in assessing a technology plan for transport electrification with renewables to inform first steps towards implementation of the country's NDC targets. The technical analysis provided an assessment of the transport sector in Antigua, focusing on decarbonisation of the sector through the introduction of electric vehicles. Additionally, the study was linked with ongoing activities in the country as part of the Global Environment Facility's Antigua and Barbuda Sustainable Low-emission Island Mobility Project, which aims to support the transition from internal combustion engine vehicles to electric vehicles in public and private transport by coupling the transport and electricity sectors.
- In **Bahamas**, IRENA delivered two technical sessions as part of the regional virtual training programme for youth, with a focus on two identified national priorities: renewable energy and NDC enhancement. This regional training set the basis for specific engagement and integration of Bahamian youth into NDCs, as well as their enhanced understanding of the environmental, economic and social impacts of climate change as well as mitigation and adaptation opportunities.
- For **Colombia**, IRENA is assessing the renewable resource potential of solar and wind energy. Suitability assessment helps countries identify highly suitable areas for the planning and development of grid-connected and off-grid solar and wind projects.
- In **Ecuador**, support activity was launched to create the enabling mechanisms for implementation of the country's energy sector NDC, with enhanced transparency in collaboration with the NDC Partnership.

- An RRA was undertaken for **Honduras**, with a validation workshop organised in November 2023. IRENA reviewed the government’s short- and mid-term energy transition strategy to assess the direction of the country’s energy transition and ability to tap into abundant renewable resources. The assessment aims to contribute to the country’s goal of 80% renewables in the energy supply by 2038.
- Energy data surveys were undertaken for **El Salvador** and **Saint Lucia**. While NDCs depict technological and sectoral implementation roadmaps, many countries face challenges in collecting disaggregated baseline data for developing robust data-based roadmaps. IRENA’s support was aimed at helping the two countries implement energy end-use surveys and analysis for policy development, to contribute to NDC implementation.
- For **Panama**, IRENA supports the assessment of climate-resilient infrastructure development, particularly for renewable power infrastructure. Changing climate patterns, including extreme heat, may damage the energy infrastructure and affect its operation, which becomes a risk for energy security. IRENA provides this assessment for energy infrastructure, including generation, transmission, and distribution, in consideration of different climate events such as extreme heat, rainfall, drought and sea level rise (see In Focus).
- Following the launch of the SolarCity simulator for **Saint Kitts and Nevis** in November 2022, IRENA and the national government launched a training programme in January 2023 to facilitate the use of the simulator by local energy stakeholders. The tool will stimulate industry, municipalities and households to evaluate the electricity generation potential and related costs of rooftop PV systems.

In Focus **Capacity building on bankable power purchase agreements for Caribbean SIDS**

IRENA’s SIDS Lighthouses Initiative co-hosted a regional capacity building event on the design of bankable power purchase agreements for Caribbean SIDS from 28 November to 2 December 2022. The event was held in Saint Vincent and the Grenadines by the Ministry of Urban Development, Energy, Airports, Seaports, Grenadines Affairs and Local Government with support from the Organisation of Eastern Caribbean States through the programme “Geothermal Energy: Capacity Building for Utilisation, Investment and Local Development” (GEOBUILD).

Strengthening human and institutional capacities with support policy and regulatory frameworks is essential to scale up the energy transition through power purchase agreement (PPA) schemes. The capacity building event brought together governments, project developers, financial institutions and investors to discuss best practices and concrete lessons from project development to strengthen regional capacities to develop bankable PPAs for renewable energy projects. Through the enhancement of skills and capabilities for designing, negotiating, and implementing PPAs, the programme aimed to contribute to the mobilisation of private capital for the deployment of renewable energy projects in Caribbean SIDS. Attendance included 49 participants from 14 SIDS: Antigua and Barbuda, Aruba, the Bahamas, Barbados, Belize, Dominica, the Dominican Republic, Grenada, Guyana, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago.

Source: IRENA (2023h).

In Focus Latin American Energy Transition Investment Forum

IRENA hosted the first Latin American Energy Transition Investment Forum in Montevideo on 8-9 November 2023 in collaboration with the Government of Uruguay. The Forum gathered stakeholders in the energy transition to drive energy transition investments, convening governments and financial communities from public and private entities. It provided a unique opportunity for energy transition project developers in the region to pitch their project concepts and proposals to investors and discuss bilaterally with financiers. The platform served as a chance to engage in and facilitate dialogue and discussion on potential project development and financing.

In Focus Firm capacity in Central America

IRENA's Clean Energy Corridor of Central America (CECCA) promotes the accelerated deployment and cross-border trade of renewable power in Central America in the context of the regional electricity market and the regional transmission network (SIEPAC). As part of the initiative, IRENA assessed the PPAs of solar and wind to ensure a level playing field for renewables against conventional electricity generation. Current frameworks in Central America may offer limited investment incentives for variable renewable energy; hence, IRENA's analysis looks at the factors that inform the estimation of a more equitable firm capacity valuation in the region, with the aim of contributing to the integration of VRE into the sub-regional electricity system.

The nature of firm capacity varies in different countries, as their power sector profiles are heterogeneous regarding the electricity supply mix, demand profile and possible flexibility. Countries with high shares of hydropower generation can integrate high levels of VRE if strong transmission lines exist, possibly using energy storage solutions. To enable firm capacity with VRE, purchasing firm capacity through PPAs has been a driving factor to ensure the demand supply in the long term, going beyond the spot transaction of firm capacity. As IRENA analysed in country cases in Central American countries and beyond (IRENA, 2023k), recognition of firm capacity for wind and solar PV generation increases the economic competitiveness of projects by reducing the price of energy per megawatt-hour and lowering the project risks.



3 THE ROAD TO 2030

The world is faced with critical milestones that will assess our collective ambition and the gaps towards achieving a just energy transition. IRENA has continued to engage with its Members to provide climate action support powered by renewables in pursuit of the energy transition. Building on the Agency's expertise and experiences with its broad membership, IRENA is strongly committed to closely collaborating with the Parties to the Paris Agreement and with development partners to further accelerate the implementation and enhancement of countries' efforts in their NDCs and LT-LEDS.

IRENA extends its engagement with its membership to realise countries' climate change mitigation efforts along with adaptation actions, harmonising with respective national priorities as pledged in NDCs and LT-LEDS. IRENA's extensive expertise, as demonstrated by the Agency's work packages, will facilitate energy data and long-term planning, policy development, project development and financing.

The messaging from the Global Stocktake at COP28 will push the world towards far-reaching, forward-looking, action-oriented outcomes to accelerate the energy transition. With the upcoming round of NDC submissions in 2025 and onwards, IRENA is ready to continue enhancing countries' climate ambitions in their NDCs and LT-LEDS, with lessons learned from the previous NDC enhancement cycle.

Climate investment is and will become integral to actualising the energy transition by achieving climate objectives as pledged in the NDCs and LT-LEDS. As some countries highlighted during the 2023 Global Stocktake process, developing countries need more support on climate investment, especially in implementing activities for the conditional targets of their NDCs (UNFCCC, 2023b). IRENA will continue to join forces with partners and financiers in project facilitation and development of the project pipeline.

IRENA intends to support an annual 1000 GW increase in the global renewables-based electricity capacity, which represents a tripling of capacity deployment to 2030. It aims to do this through the aforementioned three main pillars for accelerating the energy transition: modernisation of physical infrastructure, supportive policy and regulations, and improved human and institutional capacities. With the remaining years to 2030 being critical for efforts to achieve the 1.5°C pathway and long-term global climate goals, IRENA is determined to contribute to accelerating the pace of the energy transition.

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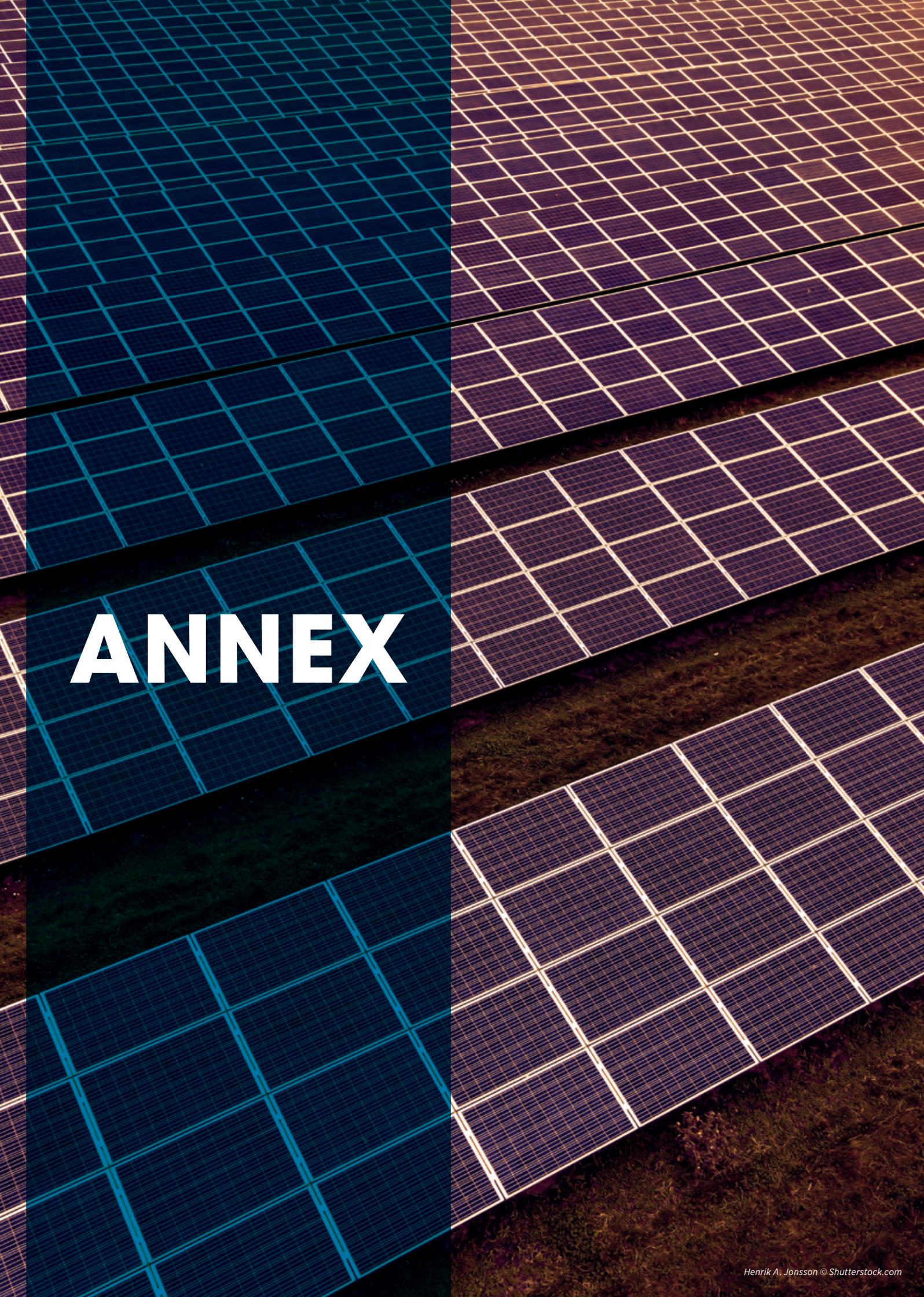
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An aerial photograph of a solar farm with rows of photovoltaic panels. The left side of the image is overlaid with a semi-transparent blue grid pattern. The word "ANNEX" is printed in white, bold, sans-serif font across the middle of the image.

ANNEX



AFGHANISTAN

Membership since		GDP per capita	Total greenhouse gas emissions
19 August 2016	LDC / LLDC	USD 363.67 (2021) ²	29.11 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
41 128 771(2022) ¹		Total: 187 519 TJ (2019) (Renewable: 36 518 TJ)	

Renewable energy targets in first NDC⁵

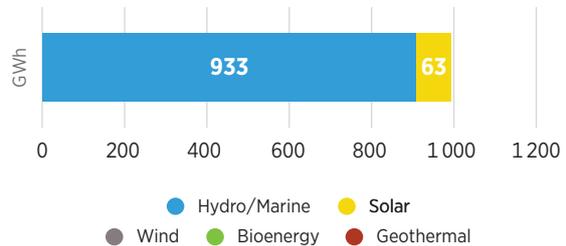
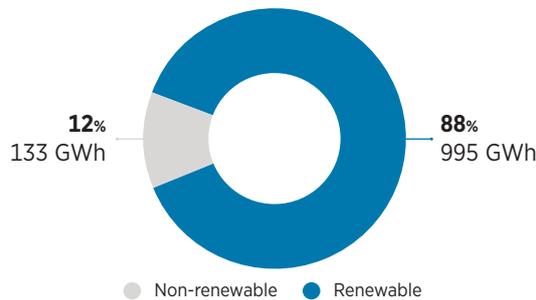
Behavioural change and opportunities for provision and development of alternative and renewable energy sources for 25% of the rural population above existing levels (15%)

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (17% area), 1.6-1.8 MWh/kWp/yr (28% area), 1.8-1.9 MWh/kWp/yr (37% area), 1.9-2.0 MWh/kWp/yr (17% area)
- **Wind:** 260 W/m² (65% area)
260-420 W/m² (18% area)
420-560 W/m² (5% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Afghanistan

Support in implementation

Support is currently paused due to the political situation in the country

Work package:

Source:

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2016), IRENA Statistical Profile



ALBANIA

Membership since	GDP per capita	Total greenhouse gas emissions
13 August 2010	USD 6 802.80 (2022) ²	7.98 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
2 775 634 (2022) ¹	Total: 91 851 TJ (2019) (Renewable: 39 638 TJ)	

Renewable energy targets in first NDC⁵

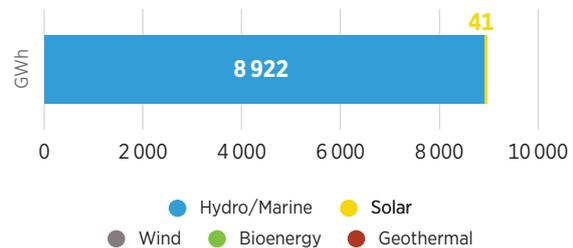
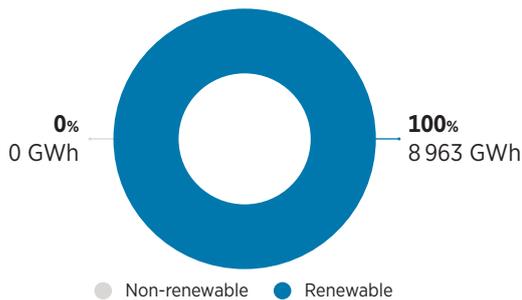
By 2030, 42% renewables in gross final energy consumption. For transport, achieve 10% biofuel consumption in 2020, 10% in 2025 and 10% in 2030, as compared to 3.55% in 2015

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (30% area)
1.4-1.8 MWh/kWp/yr (69% area)
- **Wind:** <260 W/m² (57% area)
260-420 W/m² (23% area)
420-560 W/m² (10% area)
- **Biomass:** 5.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Albania

Support completed

Comprehensive evaluations of the conditions for renewable energy deployment to identify a set of actions to scale up renewable energy and enhance greenhouse gas mitigation

1	Work package:	Source:
	Renewables readiness assessment	NDC Partnership

A workshop to provide assistance and capacity building for the design of renewable energy targets and policy frameworks to help define and achieve NDC targets

2	Work package:	Source:
	Capacity building on policy and finance	NDC Partnership

Support for calculation of renewable energy share from heat pumps

3	Work package:	Source:
	Data and statistics	Data and statistics

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



ANGOLA

Membership since		GDP per capita	Total greenhouse gas emissions
14 January 2012	LDC	USD 2 998.50 (2022) ²	66.48 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
35 588 987 (2022) ¹		Total: 511 481 TJ (2020) (Renewable: 324 757 TJ)	

Renewable energy targets in first NDC⁵

Unconditional target:

Installation of 500 MW of biomass plants,
100 MW of mini-hydropower,
700 MW of hydropower stations,
104 MW of large-scale solar power plants,
100 MW of small-scale solar panels,
2 MW of small-scale solar panels in industry and
100 MW of wind farms

Conditional target:

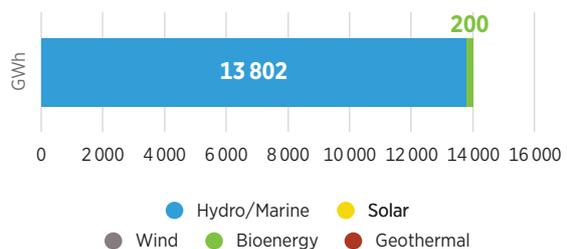
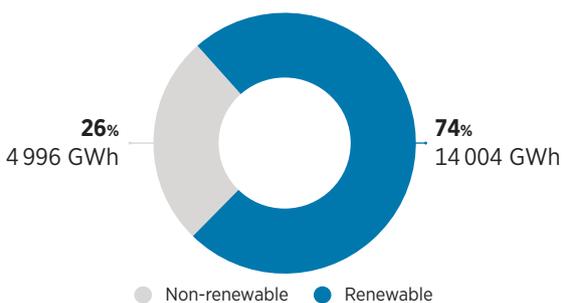
Installation of 500 MW of biomass plants,
150 MW of mini-hydropower,
2 050 MW of hydropower stations),
104 MW of large-scale solar power plants,
187 MW of small-scale solar panels,
2 MW of small-scale solar panels in industry,
15 MW of small-scale solar panels (NAMA Program)
and 100 MW of wind farms

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (10% area);
1.4-1.6 MWh/kWp/yr (20% area);
1.6-1.8 MWh/kWp/yr (55% area);
1.8-1.9 MWh/kWp/yr (22% area);
1.9-2.0 MWh/kWp/yr (3% area)
- **Wind:** <260 W/m² (100% area)
- **Biomass:** 7.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Angola

Support in implementation

Bioenergy Eni training

1

Work package:
Capacity building on policy and finance

Source:
Government of Angola

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



ANTIGUA AND BARBUDA

Membership since		GDP per capita	Total greenhouse gas emissions
10 October 2010	SIDS	USD 18 745.17 (2022) ²	0.36 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
93 763 (2022) ¹		Total: 8 716 TJ (2019) (Renewable: 73 TJ)	

Renewable energy targets in first updated NDC⁵

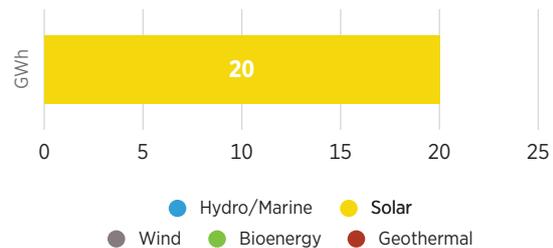
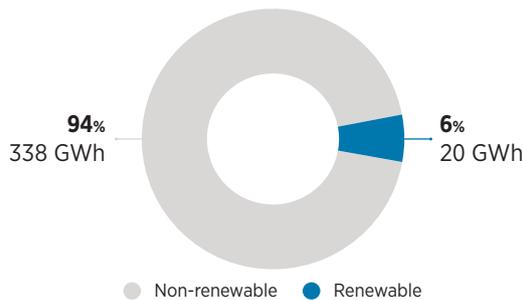
100 MW of renewable generation capacity available to the grid (2030); 86% renewable generation from local resources in the electricity sector (2030); 20 MW of wind energy generation; other targets

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (100% area)
- **Wind:** <260 W/m² (73% area)
260-420 W/m² (28% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



Acknowledgement of IRENA support

“Special thanks to our implementing partners International Renewable Energy Agency (IRENA)”; also clearly mentions IRENA’s Small Island Developing States (SIDS) Lighthouses Initiative as a method of NDC preparation, and cites REmap work.”

(ANTIGUA AND BARBUDA, FIRST NDC [UPDATED SUBMISSION], 2 SEPTEMBER 2021)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile

IRENA climate action engagement in Antigua and Barbuda

Support completed

Development of a rooftop solar PV city simulator for North Antigua			
1	<table border="0"> <tr> <td>Work package: Resource assessment</td> <td>Source: Government of Antigua and Barbuda</td> </tr> </table>	Work package: Resource assessment	Source: Government of Antigua and Barbuda
Work package: Resource assessment	Source: Government of Antigua and Barbuda		
Technical report with references to relevant existing published work that supports the assessment of technical needs of relevant sectors to achieve a just transition of the workforce to greener occupations and more wide-scale adoption of electric mobility			
2	<table border="0"> <tr> <td>Work package: Technology and infrastructure technical analysis</td> <td>Source: NDC Partnership</td> </tr> </table>	Work package: Technology and infrastructure technical analysis	Source: NDC Partnership
Work package: Technology and infrastructure technical analysis	Source: NDC Partnership		
Technology plan and mitigation analysis to evaluate the early stages of transport sector decarbonisation with electric mobility, including the techno-economic feasibility of electrifying high-use-factor fleets such as public bus transport			
3	<table border="0"> <tr> <td>Work package: Technology and infrastructure technical analysis</td> <td>Source: NDC Partnership</td> </tr> </table>	Work package: Technology and infrastructure technical analysis	Source: NDC Partnership
Work package: Technology and infrastructure technical analysis	Source: NDC Partnership		

Support in implementation

A socio-economic analysis of the impact of electric mobility on men, women, and vulnerable groups and communities			
1	<table border="0"> <tr> <td>Work package: Data and statistics</td> <td>Source: Government of Antigua and Barbuda</td> </tr> </table>	Work package: Data and statistics	Source: Government of Antigua and Barbuda
Work package: Data and statistics	Source: Government of Antigua and Barbuda		





ARGENTINA

Membership since	GDP per capita	Total greenhouse gas emissions
15 June 2013	USD 13 686.01 (2022) ²	382.99 MtCO ₂ eq (2022) ⁴
Population	TPES³	
46 234 830 (2022) ¹	Total: 3 286 655 TJ (2019) (Renewable: 325 545 TJ)	

Renewable energy targets in first NDC⁵

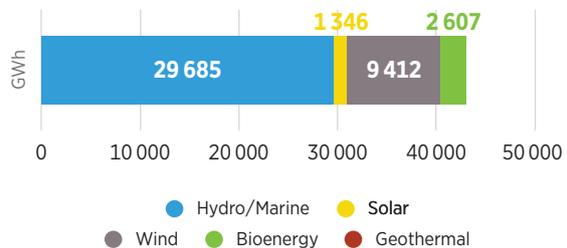
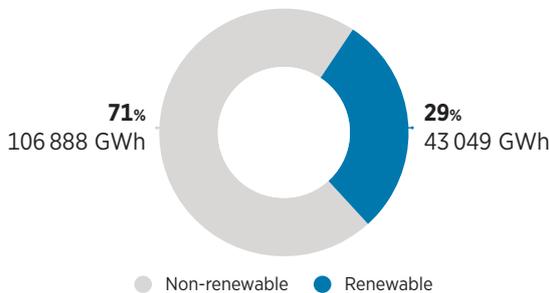
Does not indicate quantifiable renewable energy targets

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (46% area)
1.6-1.8 MWh/kWp/yr (39% area)
>2.0 MWh/kWp/yr (9% area)
- **Wind:** <260 W/m² (55% area)
260-420 W/m² (17% area)
260-420 W/m² (17% area)
420-560 W/m² (15% area)
>1 060 W/m² (15% area)
- **Biomass:** 3.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Argentina

Support in implementation

Solar City simulator

1	Work package: Resource assessment	Source: Government of Argentina
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, EDGAR, Nationally Determined Contribution (2021), IRENA Statistical Profile



BAHAMAS

Membership since		GDP per capita	Total greenhouse gas emissions
3 May 2014	SIDS	USD 31 458.30 (2022) ²	1.88 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
409 984 (2022) ¹		Total: 31 379 TJ (2020) (Renewable: 343 TJ)	

Renewable energy targets in updated first NDC⁵

Minimum of 30% renewables in the energy mix and 35% and 15% of vehicle purchases to be electric and hybrid by 2030

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (39% area)
1.6-1.8 MWh/kWp/yr (63% area)
- **Wind:** <260 W/m² (80% area)
260-420 W/m² (20% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

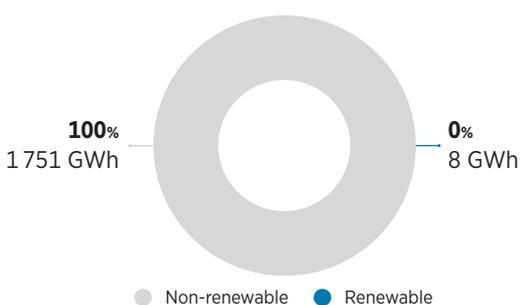
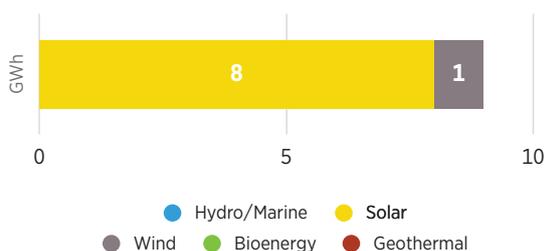


Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Bahamas

Support completed

- Develop and deliver two technical sessions as part of the virtual training programme for youth, focusing on two of the identified key national priorities: renewable energy and NDC enhancement. The sessions will focus on renewable energy technologies, innovation and specific energy topics relevant to the implementation of The Bahamas' NDC, with the aim of enhancing participants' understanding of renewable energy technology and costs, as well as mitigation and adaptation options for the country, thereby facilitating national capacity building and technology transfer

Work package: Technology and infrastructure technical analysis	Source: Government of Bahamas
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Support in implementation

- Solar City simulator

Work package: Resource assessment	Source: Government of Bahamas
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



BARBADOS

Membership since		GDP per capita	Total greenhouse gas emissions
25 September 2014	SIDS	USD 20 018.52 (2022) ²	0.93 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
281 635 (2022) ¹		Total: 16 846 TJ (2020) (Renewable: 838 TJ)	

Renewable energy targets in first updated NDC⁵

Conditional (by 2030):

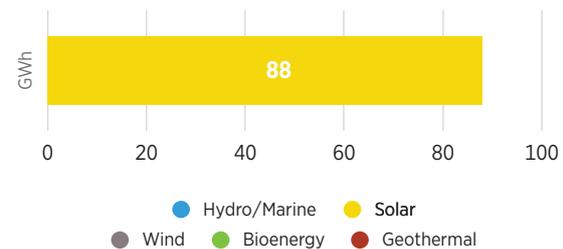
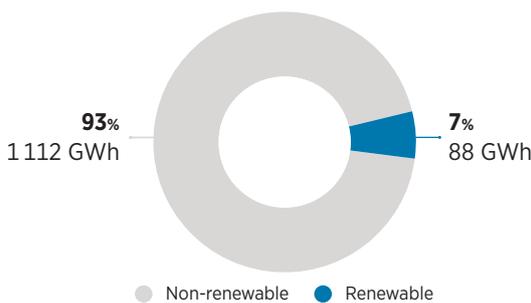
95% renewables in the electricity mix.
100% electric or alternatively fuelled vehicles in the passenger fleet

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (80% area)
1.8-1.9 MWh/kWp/yr (19% area)
- **Wind:** <260 W/m² (71% area)
260-420 W/m² (28% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Barbados

Support in implementation

Solar City simulator		
1	Work package: Data and statistics	Source: Government of Barbados
Socio-economic analysis		
2	Work package: Resource assessment	Source: Government of Barbados

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



BELARUS

Membership since	GDP per capita	Total greenhouse gas emissions
27 February 2011	USD 7 904.86 (2022) ²	99.87 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
9 208 701 (2022) ¹	Total: 1 051 643 TJ (2020) (Renewable: 75 391 TJ)	

Renewable energy targets in first updated NDC⁵

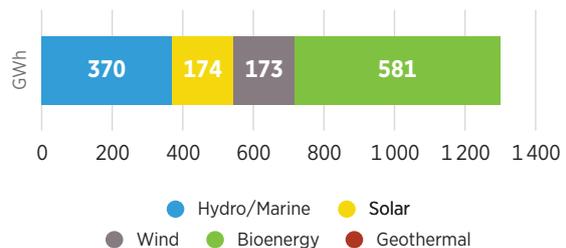
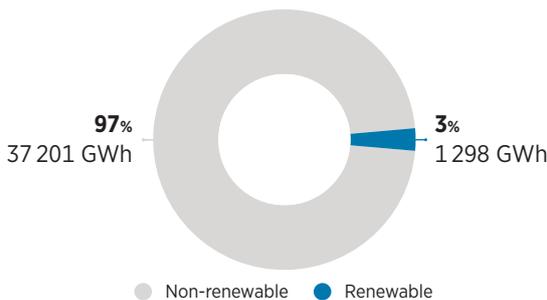
Does not include quantified renewable energy targets

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (100% area)
- **Wind:** 260 W/m² (97% area)
260-420 W/m² (5% area)
- **Biomass:** 5.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Belarus

Support completed

Assessment of the cost effectiveness of mitigation options for the power sector, focusing on renewable energy technologies

1

Work package:	Source:
Technology and infrastructure technical analysis	UNDP

Capacity building workshop on auction design, a key recommendation from the Renewables Readiness Assessment report

2

Work package:	Source:
Capacity building on policy and finance	Government of Belarus

^{1,2,3,4,5,6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



BELIZE

Membership since		GDP per capita	Total greenhouse gas emissions
27 January 2013	SIDS	USD 6 968.36 (2022) ²	0.998 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
405 272 (2022) ¹		Total: 14 942 TJ (2020) (Renewable: 6 060 TJ)	

Renewable energy targets in first NDC⁵

Conditional:

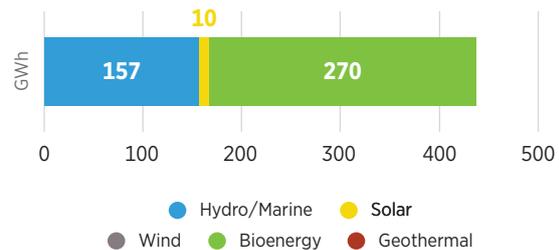
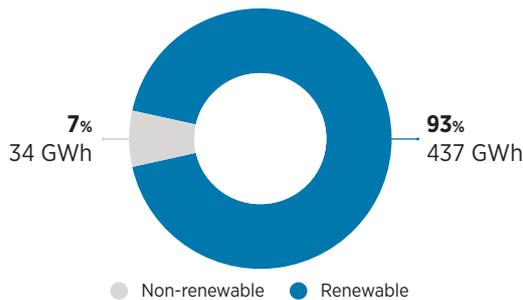
Reduce emissions by
2 514 Gg of CO₂ via hydropower
518 Gg of CO₂ via solar PV and
947 Gg of CO₂ via bagasse

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (78% area)
1.6-1.8 MWh/kWp/yr (18% area)
- **Wind:** <260 W/m² (100% area)
- **Biomass:** 5.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



Acknowledgement of IRENA support

"The updated NDC was supported by IRENA..."

(BELIZE'S FIRST [UPDATED] NDC SUBMISSION, 1 SEPTEMBER 2021)

^{1,2,3,4,5,6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile

IRENA climate action engagement in Belize

Support completed

- 1 Technical inputs from the Renewable Energy Roadmap (REmap) to determine the potential to scale up the use of renewable energy, focusing on renewable technologies and on heating, cooling and transport technology options

Work package: Renewable energy roadmap	Source: UNFCCC
--	--------------------------

- 2 Review and analysis of existing mechanisms and frameworks for the collection and management of all data relevant to the development of a monitoring, reporting and verification (MRV) system, including identifying the key public and private sector stakeholders necessary for its design, development and sustainability

Work package: Data and statistics	Source: NDC Partnership
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- 3 Recommendations on the policy, legal and institutional frameworks necessary for the development and implementation of the energy sector MRV system, as well as the supporting co-ordination mechanisms, based on international best practices

Work package: Capacity building on policy and finance	Source: NDC Partnership
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- 4 Design of an MRV system to support tracking of greenhouse gas emissions, the impact of mitigation and adaptation actions, and climate finance flows that collectively contribute to the pursuit of communicated NDC targets

Work package: Monitoring, reporting and verification (MRV)	Source: NDC Partnership
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BENIN

Membership since		GDP per capita	Total greenhouse gas emissions
21 November 2012	LDC	USD 1 303.22 (2022) ²	20.69 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
13 352 864 (2022) ¹		Total: 231 498 TJ (2020) (Renewable: 124 249 TJ)	

Renewable energy targets in first updated NDC⁵

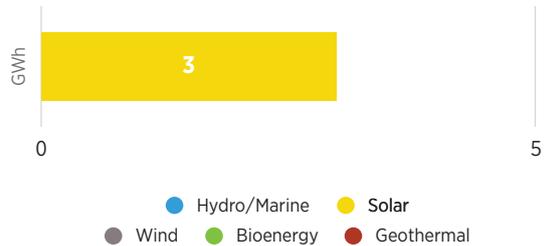
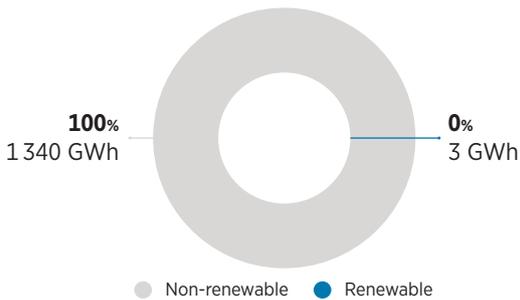
By 2030, install 843 MW of renewable capacity in the energy mix

Resource Potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (22% area)
1.4-1.6 MWh/kWp/yr (70% area)
1.6-1.8 MWh/kWp/yr (9% area)
- **Wind:** <260 W/m² (100% area)
- **Biomass:** 2.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA Climate Action Engagement in Benin

Support completed

Capacity building support on a quantification study of greenhouse gas emissions from the NDC projects by sector

1

Work Package:
Data and statistics

Partner:
NDC Partnership

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Climate Watch, Nationally Determined Contribution (2021), IRENA Statistical Profile



BHUTAN

Membership since		GDP per capita	Total greenhouse gas emissions
1 June 2016	LDC / LLDC	USD 3 266.36 (2021) ²	3.07 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
782 455 (2022) ¹		Total: 65 525 TJ (2019) (Renewable: 57 149 TJ)	

Renewable energy targets in second NDC⁵

Medium-term targets (2020-2028):

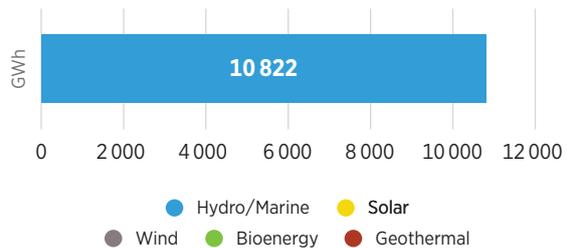
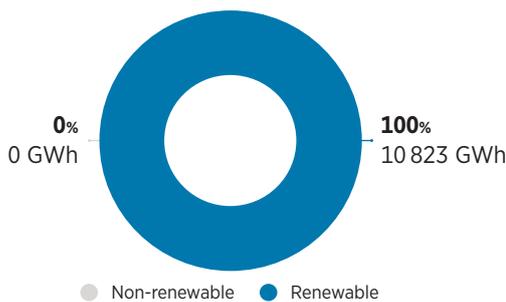
71.11 MW of utility-scale solar and wind energy; alternative renewable energy project to install roof-mounted solar PV on 300 rural households to enable access to clean energy and displace fuelwood consumption

Resource potential⁶

- **Solar PV:** 1.2-1.6 MWh/kWp/yr (50% area)
- **Wind:** <260 W/m² (99% area)
420-560 W/m² (5% area)
- **Biomass:** 3.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Bhutan

Support completed

- 1 Comprehensive evaluations of the conditions for renewable energy deployment to identify a set of actions to scale up renewable energy and enhance greenhouse gas mitigation

Work package:

Renewables readiness assessment

Source:

Government of Bhutan

Acknowledgement of IRENA support

"The Renewables Readiness Assessment (RRA) has been developed in cooperation with International Renewable Energy Agency with a view to complement the country's efforts in enabling the wider penetration of various renewable energy technologies..."

(BHUTAN'S SECOND NDC, 25 JUNE 2021)

^{1,2,3,4,5,6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



BOSNIA AND HERZEGOVINA

Membership since	GDP per capita	Total greenhouse gas emissions
12 January 2011	USD 7 585.38 (2022) ²	29.32 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
3 233 526 (2022) ¹	Total: 305 808 TJ (2020) (Renewable: 76 388 TJ)	

Renewable energy targets in first NDC⁵

Conditional (by 2030):

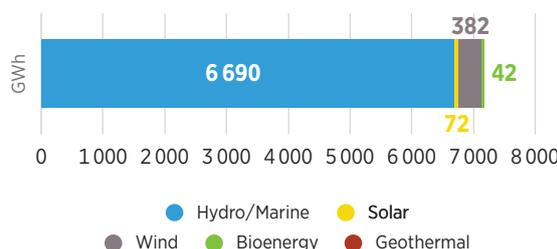
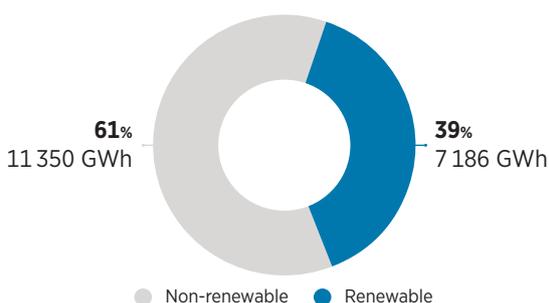
70 MW of biomass co-generation plants
120 MW of mini-hydropower plants
175 MW of wind farms and
4 MW of solar PV modules

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (20% area)
1.2-1.4 MWh/kWp/yr (65% area)
1.4-1.6 MWh/kWp/yr (15% area)
- **Wind:** <260 W/m² (69% area), 260-420 W/m² (17% area), 420-560 W/m² (10% area)
- **Biomass:** 5.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Bosnia and Herzegovina

Support completed

Capacity building workshops on the socio-economic benefits of the energy transition, design of policy and measures in the heating and cooling sectors, and financing instruments for renewable energy

1	Work package: Capacity building on policy and finance	Source: Government of Bosnia and Herzegovina
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Technical report with recommendations and actions for revising and aligning the NDC and National Energy and Climate Plan (NECP) mitigation options

2	Work package: Technology and infrastructure technical analysis	Source: Government of Bosnia and Herzegovina
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Support in implementation

Renewables Readiness Assessment (RRA) report including a chapter on bankability, combined with provisional notes that will serve the finalisation of the NECP

3	Work package: Renewables readiness assessment	Source: Government of Bosnia and Herzegovina
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



BURKINA FASO

Membership since	LDC / LLDC	GDP per capita	Total greenhouse gas emissions
25 July 2013		USD 832.88 (2022) ²	36.50 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
22 673 762 (2022) ¹		Total: 198 887 TJ (2019) (Renewable: 133 278 TJ)	

Renewable energy targets in first NDC⁵

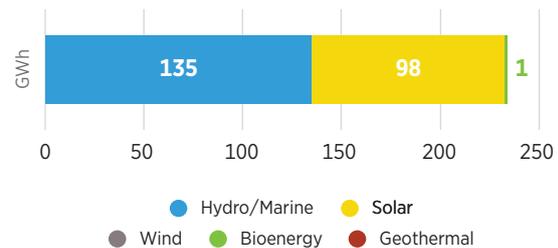
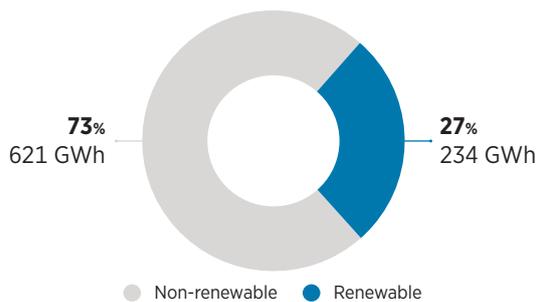
By 2030, 36% renewable energy in total installed capacity, corresponding to 318 MW of renewable installed capacity, including 100 MW of small hydropower, 205 MW of solar and 13 MW of bioenergy

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (22% area)
1.6-1.8 MWh/kWp/yr (78% area)
- **Wind:** <260 W/m² (100% area)
- **Biomass:** 1.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Burkina Faso

Support completed

Suitability assessment based on the Global Atlas for Renewable Energy

1	Work package: Resource assessment	Source: Government of Burkina Faso
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Support completed

Preparation of a Renewables Readiness Assessment

1	Work package: Renewables readiness assessment	Source: Government of Burkina Faso
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, EDGAR, Nationally Determined Contribution (2021), IRENA Statistical Profile



CAMBODIA

		GDP per capita	Total greenhouse gas emissions
State in accession	LDC	USD 1 786.56 (2022) ²	50.02 MtCO ₂ eq (2022) ⁴
Population		TPES³	
16 767 842 (2022) ¹		Total: 361 937 TJ (2020) (Renewable: 171 746 TJ)	

Renewable energy targets in first NDC⁵

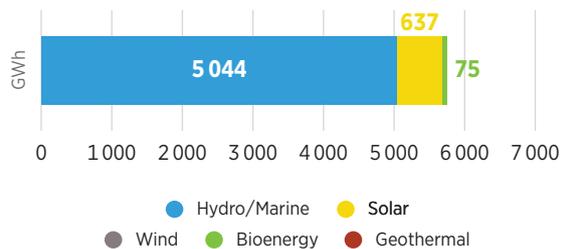
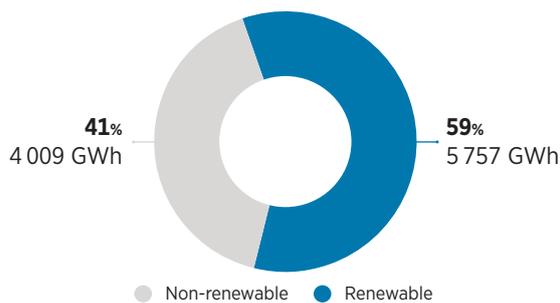
25% renewables in the energy mix (solar, wind, hydropower, biomass) by 2030

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (16% area)
1.4-1.6 MWh/kWp/yr (83% area)
- **Wind:** <260 W/m² (98% area)
260-420 W/m² (3% area)
- **Biomass:** 5.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Cambodia

Support in Implementation

- 1 Technical costing study of mitigation options in the power sector based on quantitative analysis of energy sector scenarios using software tools and models

Work package: Technology and infrastructure technical analysis	Source: NDC Partnership
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



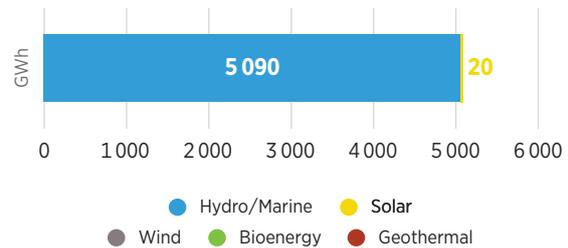
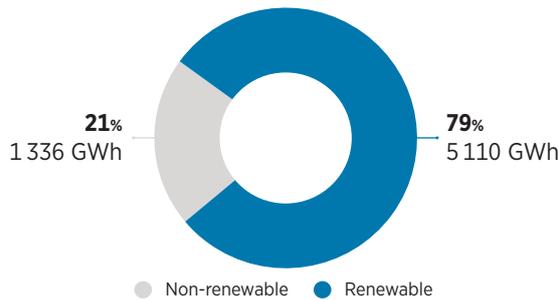
CAMEROON

Membership since	GDP per capita	Total greenhouse gas emissions
20 August 2011	USD 1 588.48 (2022) ²	43.17 MtCO ₂ eq (2022) ⁴
Population	TPES³	
27 914 536 (2022) ¹	Total: 421 437 TJ (2020) (Renewable: 316 341 TJ)	

Renewable energy targets in first NDC⁵	Resource potential⁶
25% renewables in the electricity mix by 2035	<ul style="list-style-type: none"> • Solar PV: 1.2-1.4 MWh/kWp/yr (23% area) 1.4-1.6 MWh/kWp/yr (36% area) 1.6-1.8 MWh/kWp/yr (37% area) • Wind: 260 W/m² (98% area) 260-420 W/m² (2% area) • Biomass: 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Cameroon

Support completed

- Assessment of technology options for power sector mitigation measures; capacity building for renewables, including dissemination of up-to-date technical information and know-how on renewables;
- 1 capacity building on long-term energy planning

Work package: Technology and infrastructure capacity building	Source: NDC Partnership
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Support in implementation

- Capacity building workshops
- 1 **Work package:**
Long-term energy planning
- | |
|-----------------------------------|
| Source:
NDC Partnership |
|-----------------------------------|

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



CHAD

Membership since		GDP per capita	Total greenhouse gas emissions
24 May 2018	LDC / LLDC	USD 716.80 (2022) ²	89.84 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
17 723 315 (2022) ¹		Total: 101 813 TJ (2020) (Renewable: 75 912 TJ)	

Renewable energy targets in first NDC

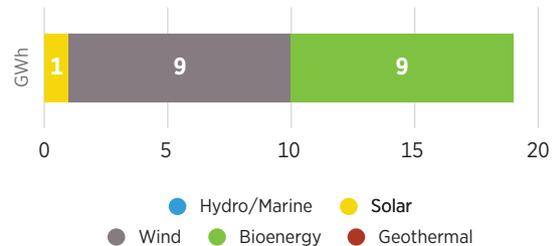
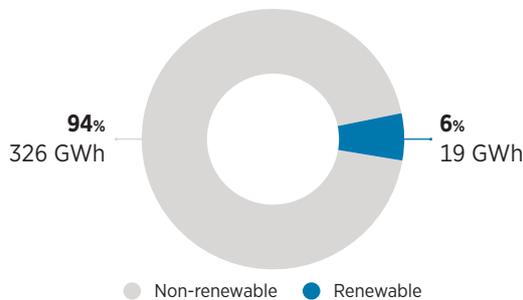
Does not include quantified renewable energy targets

Resource potential⁵

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (56% area)
1.8-1.9 MWh/kWp/yr (20% area)
1.9-2.0 MWh/kWp/yr (22% area)
>2.0 MWh/kWp/yr (5% area)
- **Wind:** <260 W/m² (44% area)
260-420 W/m² (30% area)
420-560 W/m² (21% area)
560-670 W/m² (7% area)
670-820 W/m² (5% area)
>1060 W/m² (2% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Chad

Support in implementation

1 Comprehensive evaluations of the conditions for renewable energy deployment to identify a set of actions to scale up renewables and enhance greenhouse gas mitigation

Work package:	Source:
Renewables readiness assessment	Government of Chad

2 The findings and recommendations of the Renewables Readiness Assessment (RRA) to elaborate and implement country to scale up renewable energy

Work package:	Source:
NDC Note based on RRA findings	NDC Partnership

^{1, 2, 3, 4, 5} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, IRENA Statistical Profile



CHINA

Membership since	GDP per capita	Total greenhouse gas emissions
2 February 2014	USD 12 720.24 (2022) ²	15 684.63 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
1 412 175 000 (2022) ¹	Total: 141 059 431 TJ (2020) (Renewable: 12 119 545 TJ)	

Renewable energy targets in first updated NDC⁵

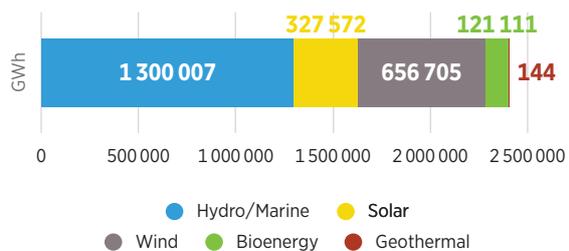
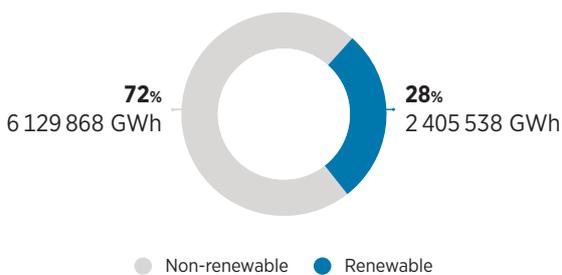
Increase total installed capacity of wind and solar power to over 1.2 billion kW by 2030

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (22% area),
1.2-1.4 MWh/kWp/yr (17% area),
1.4-1.6 MWh/kWp/yr (27% area),
1.6-1.8 MWh/kWp/yr (24% area),
1.8-1.9 MWh/kWp/yr (7% area),
1.9-2.0 MWh/kWp/yr (5% area),
>2.0 MWh/kWp/yr (6% area)
- **Wind:** <260 W/m² (65% area)
260-420 W/m² (22% area)
420-560 W/m² (8% area)
560-670 W/m² (2% area)
>1 060 W/m² (2% area)
- **Biomass:** 2.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in China

Activity in implementation

Activity is currently under discussion

1	Work package:	Source:
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



COLOMBIA

Membership since	GDP per capita	Total greenhouse gas emissions
7 February 2015	USD 6 630.28 (2022) ²	215.54 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
51 874 024 (2022) ¹	Total: 1 720 617 TJ (2020) (Renewable: 450 404 TJ)	

Renewable energy targets in first NDC⁵

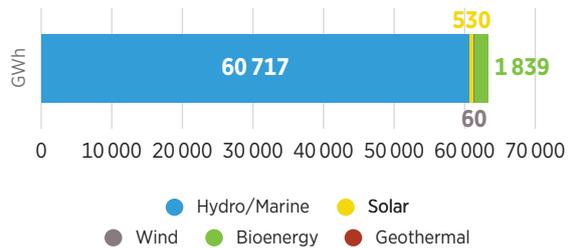
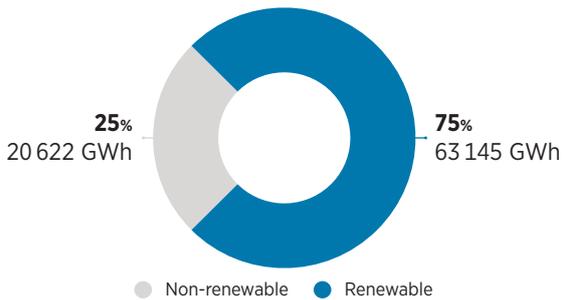
Does not include quantifiable renewable energy targets

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (10% area)
1.2-1.4 MWh/kWp/yr (45% area)
1.4-1.6 MWh/kWp/yr (45% area)
- **Wind:** <260 W/m² (96% area)
260-420 W/m² (3% area)
- **Biomass:** 9.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Colombia

Support in implementation

Suitability assessment to enable finding highly suitable areas for grid-connected and off-grid solar and wind project planning

1

Work package:
Resource assessment

Source:
Government of Colombia

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



COMOROS

Membership since		GDP per capita	Total greenhouse gas emissions
8 November 2015	SIDS	USD 1 484.89 (2022) ¹	0.92 MtCO ₂ eq (2022) ³
Population		TPES ²	
836 774 (2022) ¹		Total: 421 437 TJ (2015) (Renewable: 3 578 TJ)	

Renewable energy targets in first NDC⁴

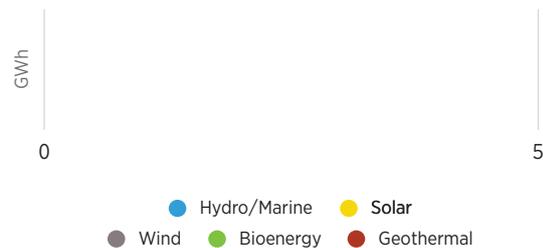
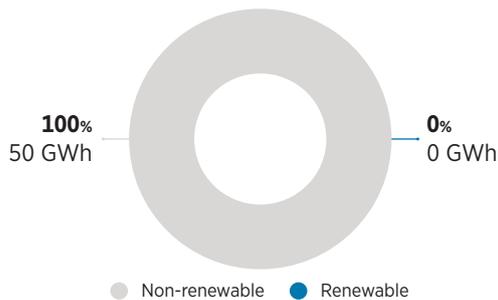
Increase renewable energy (by 2030), including 14 MW of solar and 14 MW of geothermal

Resource potential⁵

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (30% area)
1.6-1.8 MWh/kWp/yr (70% area)
- **Wind:** 260 W/m² (100% area)
- **Biomass:** 6.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Comoros

Support in implementation

SolarCity Simulator

1

Work package:
Resource assessment

Source:
Government of Comoros

^{1,2,3,4,5} World Bank national account data, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



CONGO

		GDP per capita	Total greenhouse gas emissions
State in accession	SIDS	USD 2 447.99 (2022) ²	25.96 MtCO ₂ eq (2022) ⁴
Population		TPES³	
5 970 424 (2022) ¹		Total: 136 779 TJ (2020) (Renewable: 73 482 TJ)	

Renewable energy targets in first NDC⁵

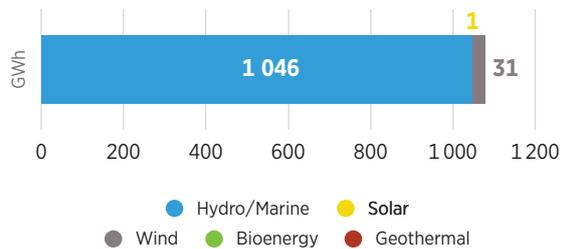
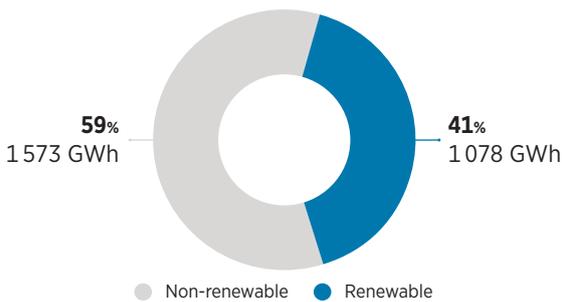
Increase renewable electricity generation from 20% in 2020 to 35% in 2030, and 9% energy efficiency distributed among residential, services and industry. Implementation through measures listed in the national strategy action plan; CSP of 100 MW and 300 MW

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (7% area)
1.2-1.4 MWh/kWp/yr (45% area)
1.4-1.6 MWh/kWp/yr (55% area)
- **Wind:** 260 W/m² (100% area),
- **Biomass:** 9.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Congo

Support completed

Bioenergy Eni training

1

Work package:

Capacity building on policy and finance

Source:

Government of Congo

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



COSTA RICA

Membership since		GDP per capita	Total greenhouse gas emissions
18 May 2018	SIDS	USD 13 198.82 (2022) ²	16.86 MtCO ₂ eq (2022) ⁴
Population		TPES ⁵	
5 180 829 (2022) ¹		Total: 207 556 TJ (2020) (Renewable: 114 117 TJ)	

Renewable energy targets in first updated NDC⁵

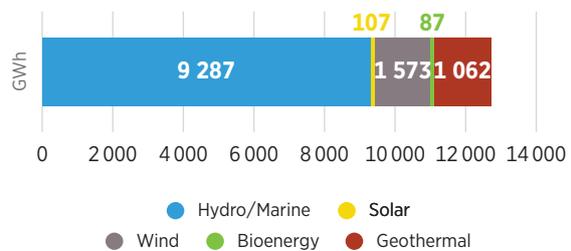
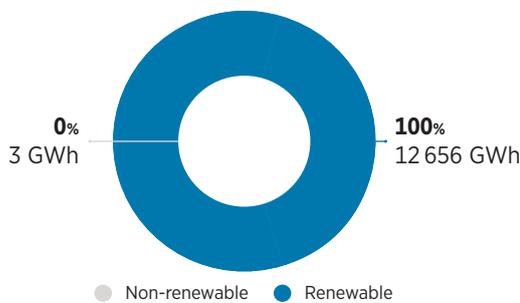
Achieve and maintain 100% renewable electricity generation by 2030

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (7% area)
1.2-1.4 MWh/kWp/yr (40% area)
1.4-1.6 MWh/kWp/yr (37% area)
1.6-1.8 MWh/kWp/yr (7% area)
- **Wind:** : <260 W/m² (79% area)
260-420 W/m² (7% area)
420-560 W/m² (5% area)
560-670 W/m² (2% area)
670-820 W/m² (2% area)
820-1 060 W/m² (2% area)
>1 060 W/m² (6% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Costa Rica

Support in implementation

Project facilitation support connecting financiers for an electric transport project to install 311 buses, resulting in a reduction of greenhouse gas emissions of 186 300 tCO₂eq

1

Work package:
Project facilitation

Source:
Government of Costa Rica

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



CÔTE D'IVOIRE

Membership since	GDP per capita	Total greenhouse gas emissions
16 September 2013	USD 2 486.41 (2022) ²	36.18 MtCO ₂ eq (2022) ⁴
Population	TPES³	
28 160 542 (2022) ¹	Total: 457 274 TJ (2020) (Renewable: 286 034 TJ)	

Renewable energy targets in first NDC⁵

Increase electricity supply through renewable sources by 2030.

Unconditional:

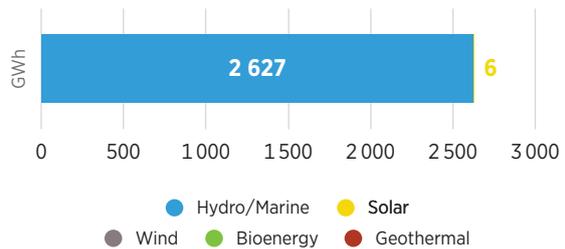
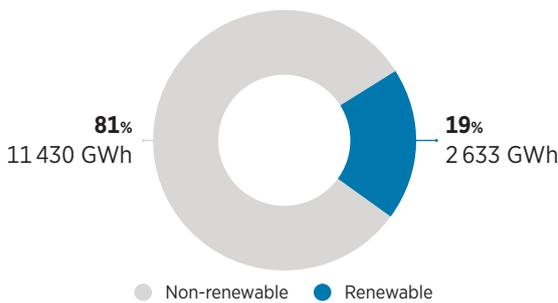
490 MW of solar,
311 MW of biomass,
29 MW of small hydropower and
662 MW of large hydropower

Resource potential⁶

- **Solar PV:** 1.2-1.4 kWh/kWp/yr (45% area)
1.4-1.6 kWh/kWp/yr (55% area)
1.6-1.8 kWh/kWp/yr (5% area)
- **Wind:** 260 W/m² (100% area),
- **Biomass:** 5.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Côte d'Ivoire

Support in implementation

Project facilitation	
1 Work package: Project facilitation	Source: Government of Côte d'Ivoire

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



CUBA

Membership since		GDP per capita	Total greenhouse gas emissions
29 April 2012	SIDS	USD 9 499.6 (2020) ²	44.38 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
11 212 191 (2022) ¹		Total: 340 947 TJ (2020) (Renewable: 40 719 TJ)	

Renewable energy targets in first NDC⁵

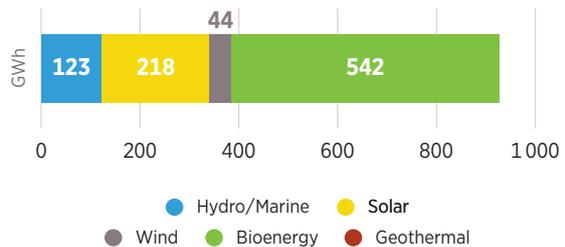
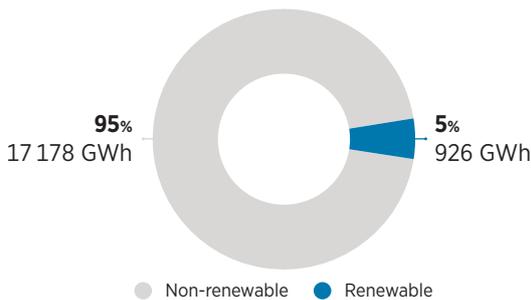
By 2030, up to 24% renewable generation in the electricity matrix

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (21% area)
1.6-1.8 MWh/kWp/yr (78% area)
- **Wind:** 260 W/m² (83% area)
260-420 W/m² (18% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Cuba

Support completed

Review and feedback on the energy component of the NDC	
1 Work package: NDC review	Source: Government of Cuba

Support in implementation

Financing for efficient lights programme through IRENA's financing facilities, such as the Climate Investment Platform (CIP)	
1 Work package: Project facilitation	Source: Government of Cuba

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



DOMINICA

Membership since		GDP per capita	Total greenhouse gas emissions
8 November 2020	SIDS	USD 8 414.54 (2022) ²	0.15 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
72 737 (2022) ¹		Total: 2 358 TJ (2020) (Renewable: 2 216 TJ)	

Renewable energy targets in first NDC⁵

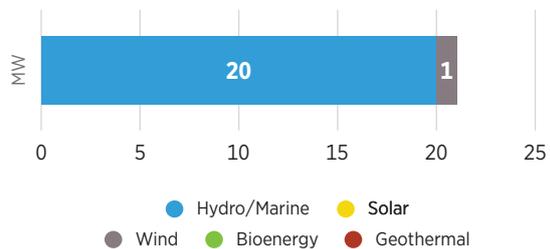
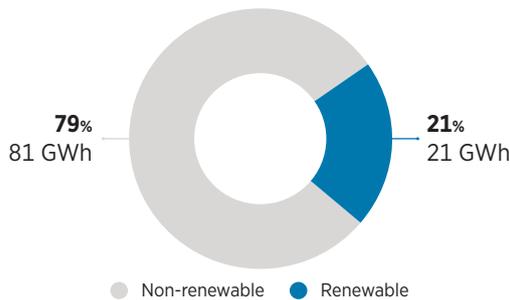
Sustain the current growth rate of renewables and other zero- and low-carbon power generation until 2025 to reach 100% share by 2050 using geothermal, solar, wind and hydropower as well as biofuels, hydrogen and ammonia

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (15% area)
1.4-1.6 MWh/kWp/yr (20% area)
1.6-1.8 MWh/kWp/yr (65% area)
- **Wind:** <260 W/m² (60% area)
260-420 W/m² (30% area)
420-560 W/m² (7% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Dominica

Support in implementation

- 1 Assessment of data gaps for the emission calculation, revision of the methodology for calculating emissions in the energy sector and facilitating intra/inter-institutional co-ordination to establish a functional, long-term system for the monitoring and verification of NDC implementation in the energy sector

Work package:
Monitoring, reporting and verification (MRV)

Source:
UNDP

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



DOMINICAN REPUBLIC

Membership since		GDP per capita	Total greenhouse gas emissions
9 July 2010	SIDS	USD 10 120.55 (2021) ²	41.86 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
11 228 821 (2022) ¹		Total: 347 309 TJ (2020) (Renewable: 47 378 TJ)	

Renewable energy targets in first NDC⁵

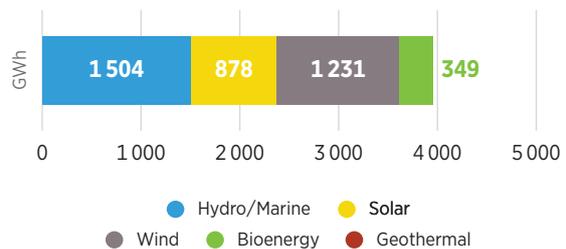
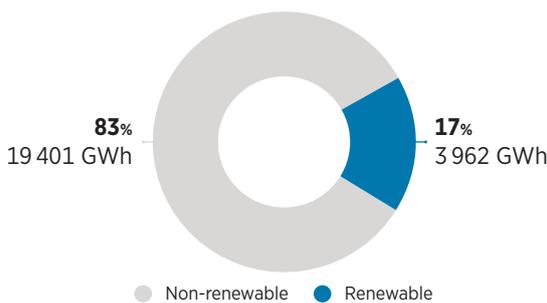
Installation of new wind farms, solar PV, and small-scale biomass power generation, and increase in small hydropower plants

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (40% area)
1.6-1.8 MWh/kWp/yr (57% area)
- **Wind:** <260 W/m² (90% area)
260-420 W/m² (10% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



Acknowledgement of IRENA support

"In the energy sector, the options were identified and evaluated with technical assistance from IRENA..."

(DOMINICAN REPUBLIC FIRST [UPDATED] NDC SUBMISSION, 29 DECEMBER 2020)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile

IRENA climate action engagement in Dominican Republic

Support completed

1 Technical inputs from the Renewable Energy Roadmap (REmap) study to scale up renewable energy technologies and heating, cooling and transport technology options

Work package:
Renewable energy roadmap

Source:
Government of the Dominican Republic

Support under implementation

Data gap analysis and development of local greenhouse gas emission factors for the energy sector

- a. Identify data gaps: Comparison between current energy data flows and stakeholders versus required/best practices;
- b. Consolidation of data gaps into implementation solutions;
- 1 c. Implementation proposal for each data gap solution;
- d. Design of a programme for the calculation of local emission factors for the energy sector, including capacity building with academia

Work package:
Data and statistics

Source:
NDC Partnership

MRV analysis and implementation support (MRV design and implementation plan)

- a. Quality review of current MRV across energy sub-sectors;
- b. Identifying requirements from MRV stakeholders (emission calculations, reporting structure, *etc.*);
- 2 c. Design of modified/new MRV;
- d. Implementation plan for MRV across energy sectors

Work package:
Monitoring, reporting and verification (MRV)

Source:
NDC Partnership

- 3 Training module focused on solar energy solutions in response to the Dominican Republic's need to further expand capacity to deploy climate-resilient energy solutions, and in alignment with the key technology as part of the country's updated NDC and NDC implementation

Work package:
Technology and infrastructure capacity building

Source:
NDC Partnership





ECUADOR

Membership since	GDP per capita	Total greenhouse gas emissions
12 February 2011	USD 6 391.28 (2022) ²	76.94 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
18 001 000 (2022) ¹	Total: 530 677 TJ (2019) (Renewable: 111 510 TJ)	

Renewable energy targets in first NDC⁵

Conditional (by 2050):

Promote the use of geothermal and hydropower plants

Unconditional (by 2050):

Develop hydropower and non-conventional renewables (such as wind, solar and landfill gas) and power generation from landfill gas

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (36% area)
1.2-1.4 MWh/kWp/yr (47% area)
1.4-1.6 MWh/kWp/yr (11% area)
- **Wind:** 260 W/m² (97% area)
260-420 W/m² (3% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

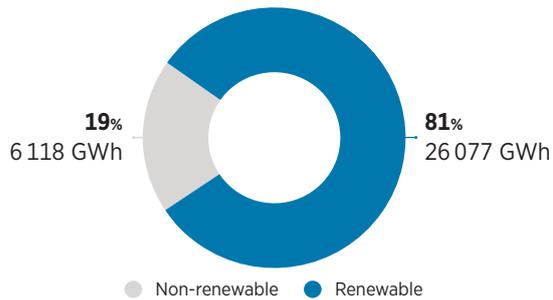
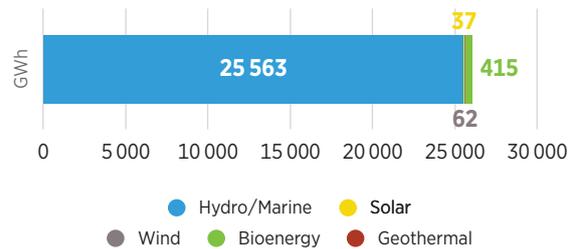


Figure 2 Renewable generation by technology (GWh)



^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2019), IRENA Statistical Profile

IRENA climate action engagement in Ecuador

Support completed

1 Support the country in drafting a concept note to access Green Climate Fund finance for implementation of a national biogas programme

Work package: Project facilitation	Source: NDC Partnership
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2 Long-term energy planning capacity building through a mix of online software training and hands-on workshops to support the process of revising the energy component of the NDC, strengthening the country's capacities for energy planning and contributing to the preparation of roadmaps and long-term sectoral plans

Work package: Long-term energy planning	Source: NDC Partnership
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3 Assess a total of seven solar PV and wind sites through the Global Atlas site appraisal service

Work package: Resource assessment	Source: Government of Ecuador
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4 Automatisation of calculations of the emission factors for the national grid to better predict emissions from energy generation

Work package: Data and statistics	Source: NDC Partnership
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5 Support to enhance data, information and methods required to produce robust NDCs and NDC tracking in the energy and waste sectors. Analysis of data management and data availability in institutions related to MRV, as well as the tools, methodologies and technological equipment needed for the automatisation of processes that deliver reliable and accurate data for emission reductions

Work package: Monitoring, reporting and verification (MRV)	Source: NDC Partnership
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Support in implementation

1 Creating an enabling mechanism for the transmission of information with entities responsible for the energy sector to achieve its NDC target

Work package: Data and statistics	Source: NDC Partnership
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EGYPT

Membership since	GDP per capita	Total greenhouse gas emissions
11 July 2012	USD 4 295.41 (2022) ²	377.78 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
110 990 103 (2022) ¹	Total: 3 706 997 TJ (2020) (Renewable: 267 722 TJ)	

Renewable energy targets in second updated NDC⁵

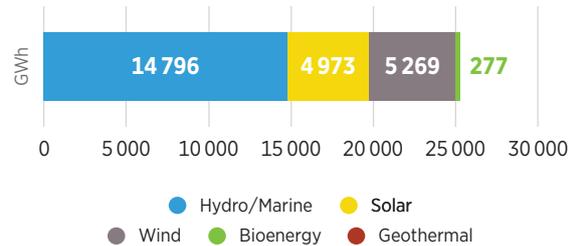
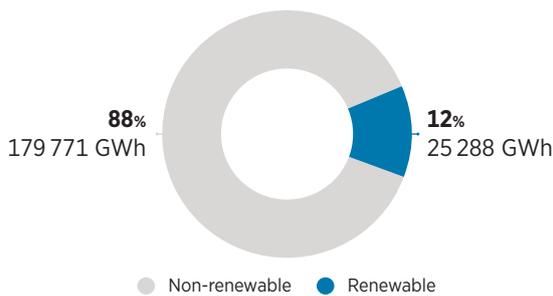
Install additional renewable energy capacities to reach a 42% share in electricity by 2030

Resource potential⁶

- **Solar PV:** 1.8-1.9 MWh/kWp/yr (23% area)
1.9-2.0 MWh/kWp/yr (65% area)
- **Wind:** 260-420 W/m² (57% area)
420-560 W/m² (10% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Egypt

Support in implementation

Develop an MRV system in line with international standards

1	Work package: Monitoring, reporting and verification (MRV)	Source: Government of Egypt
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



EL SALVADOR

Membership since	GDP per capita	Total greenhouse gas emissions
21 June 2017	USD 5 127.32 (2022) ²	13.07 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
6 336 392 (2022) ¹	Total: 181 471 TJ (2020) (Renewable: 90 809 TJ)	

Renewable energy targets in first updated NDC⁵

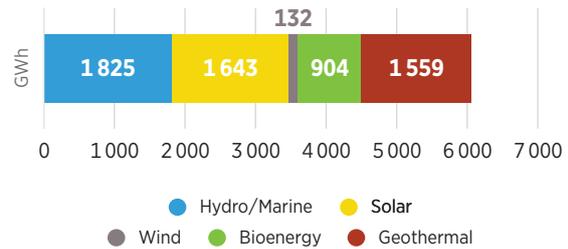
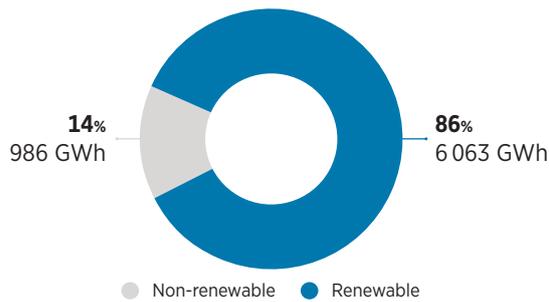
Solar: increase renewable energy capacity 50% compared to 2019, to reach 2 222 MW by 2030; generate between 86.1% and 85.7% of electricity from renewable sources by 2030

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (95% area)
- **Wind:** <260 W/m² (73% area)
260-420 W/m² (15% area)
420-560 W/m² (7% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile

IRENA climate action engagement in El Salvador

Support completed

1	Comprehensive evaluations of the conditions for renewable energy deployment to identify a set of actions to scale up renewable energy and enhance greenhouse gas mitigation	
	Work package: Renewables readiness assessment	Source: Government of El Salvador
2	Support the development of a renewable energy technology plan and mitigation analysis in the agro-industrial sector	
	Work package: Technology and infrastructure technical analysis	Source: Government of El Salvador
3	Revision of national greenhouse gas targets' mitigation potential under the best information available. Includes reviewing inventories to ensure that the targets are reasonable and ambitious under the best available information derived from the latest inventories, country GDP, population growth, and national priorities, to inform more accurate mitigation targets under the NDC	
	Work package: Data and statistics	Source: Government of El Salvador
4	MRV analysis and implementation support, ensuring quality review of current MRV systems across energy sub-sectors; identifying requirements from MRV stakeholders (emission calculations, reporting structure, etc.), adjusting and creating new MRV systems, and developing an implementation plan for MRV across energy sectors	
	Work package: Monitoring, reporting and verification (MRV)	Source: Government of El Salvador
5	Guidance in NDC drafting through the identification of best practices and peer-to-peer support with other countries in the region; follow-up on the NDC drafting process, providing reviews and inputs to the energy component	
	Work package: NDC drafting support	Source: Government of El Salvador

Support in implementation

1	Energy surveys for NDC implementation roadmaps	
	Work package: Data and statistics	Source: Government of El Salvador





ESWATINI

Membership since		GDP per capita	Total greenhouse gas emissions
3 April 2011	LLDC	USD 4 039.52 (2022) ²	3.39 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
1 201 670 (2022) ¹		Total: 45 833 TJ (2020) (Renewable: 31 156 TJ)	

Renewable energy targets in first NDC⁵

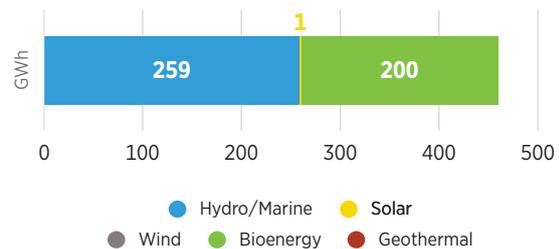
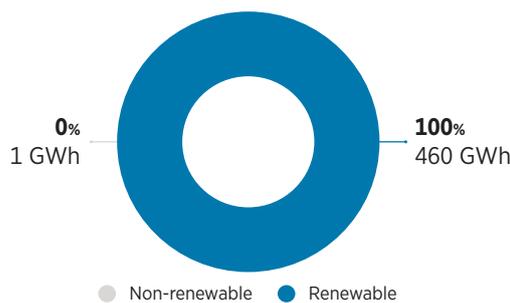
Double the share of renewables in the energy mix (from 16% to 32%) and achieve 10% ethanol blending by 2030

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (68% area)
1.6-1.8 MWh/kWp/yr (10% area)
- **Wind:** 260 W/m² (90% area)
260-420 W/m² (10% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Eswatini

Support completed

Technical power sector study to support the identification of cost-effective mitigation options for the energy sector to help country officials prioritise options that can serve as inputs to the

- 1 NDC for the power and other relevant sectors

Work package:
Long-term energy planning

Source:
Government of Eswatini

Acknowledgement of IRENA support

"During the course of preparing the NDC, at various stages, contributions to the drafting thereof were made by IRENA..."

(ESWATINI'S FIRST [UPDATED] NDC SUBMISSION, 9 OCTOBER 2021)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



ETHIOPIA

Membership since		GDP per capita	Total greenhouse gas emissions
10 March 2012	LDC / LLDC	USD 1 027.59 (2022) ²	192.47 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
123 379 924 (2022) ¹		Total: 1 625 928 (2020) (Renewable: 1 435 941 TJ)	

Renewable energy targets in first NDC⁵

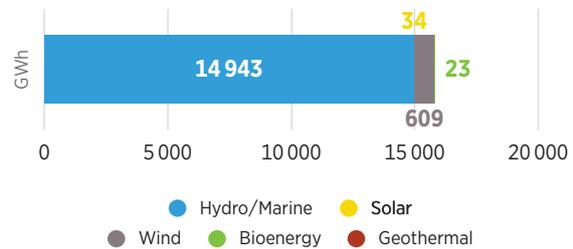
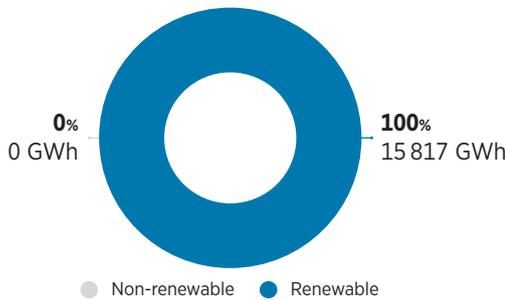
By 2030, install 25 GW of power capacity, including 22 GW of hydropower, 2 GW of wind and 1 GW of geothermal

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (20% area)
1.6-1.8 MWh/kWp/yr (65% area)
1.8-1.9 MWh/kWp/yr (18% area)
1.9-2.0 MWh/kWp/yr (2% area)
- **Wind:** <260 W/m² (89% area)
260-420 W/m² (10% area)
420-560 W/m² (2% area)
670-820 W/m² (3% area)
- **Biomass:** 4.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Ethiopia

Support in implementation

1 Strengthening bioenergy data for monitoring SDGs and NDCs; energy surveys for NDC implementation roadmaps

Work package:
Data and statistics

Source:
Government of Ethiopia

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



FIJI

Membership since		GDP per capita	Total greenhouse gas emissions
2 December 2010	SIDS	USD 5 316.66 (2022) ²	2.98 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
926 766 (2022) ¹		Total: 20 553 TJ (2019) (Renewable: 6 187 TJ)	

Renewable energy targets in first NDC⁵

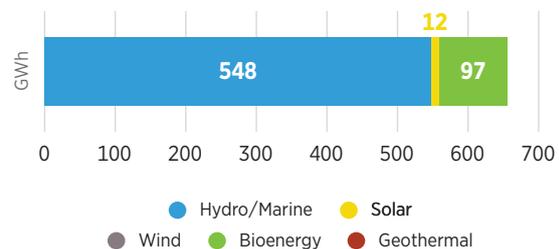
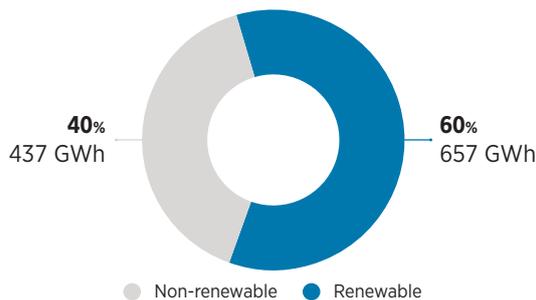
Conditional and unconditional (by 2030):
100% of electricity from renewables including: hydropower, geothermal, biomass, grid-connected solar and wind; 20% of energy sector CO₂ emissions under a business-as-usual scenario

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (22% area)
1.2-1.4 MWh/kWp/yr (56% area)
1.4-1.6 MWh/kWp/yr (17% area)
- **Wind:** <260 W/m² (60% area)
260-420 W/m² (37% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Fiji

Support completed

Activity on review of climate change bill		
1	Work package: Data and statistics	Source: Government of Fiji
Identification of data gaps and review of methodology for energy statistics to support the MRV process		
2	Work package: Monitoring, reporting and verification (MRV)	Source: Government of Fiji

Support in implementation

Socio-economic analysis		
1	Work package: Data and statistics	Source: Government of Fiji

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile (2020), Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile (2020)



GABON

Membership since	GDP per capita	Total greenhouse gas emissions
11 June 2015	USD 8 820.35 (2022) ²	18.63 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
2 388 992 (2022) ¹	Total: 107 801 TJ (2020) (Renewable: 60 197 TJ)	

Renewable energy targets in second NDC⁵

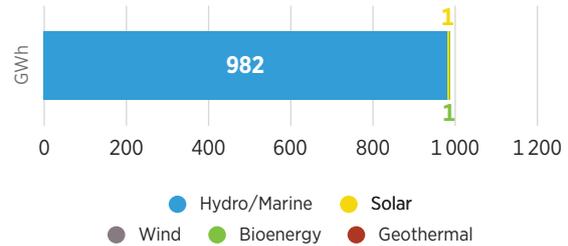
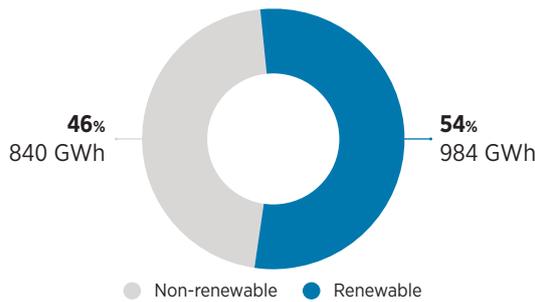
Achieve 80% electricity production from hydropower in 2020, with an additional 1 204 MW of hydropower by 2030

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (3% area)
1.2-1.4 MWh/kWp/yr (93% area)
1.4-1.6 MWh/kWp/yr (2% area)
- **Wind:** 260 W/m² (100% area)
- **Biomass:** 1.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Gabon

Support completed

1 Long-term energy planning capacity building through a mix of online software training and hands-on workshops to support the energy component of the NDC

Work package: Long-term energy planning	Source: NDC Partnership
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



THE GAMBIA

Membership since		GDP per capita	Total greenhouse gas emissions
31 March 2011	LDC	USD 840.01 (2022) ²	2.34 MtCO ₂ eq (2022) ⁴
Population		TPES ⁵	
2 705 992 (2022) ¹		Total: 16 776 TJ (2020) (Renewable: 7 153 TJ)	

Renewable energy targets in second NDC⁵

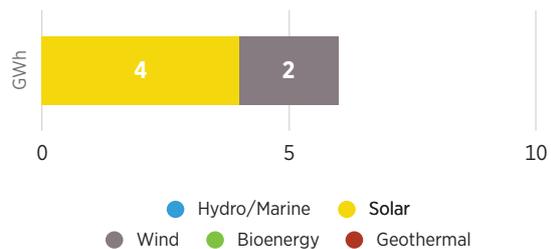
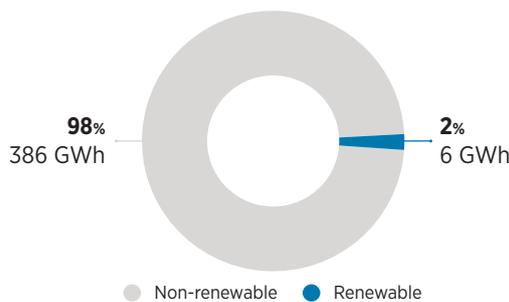
By 2030, achieve 38.9% renewable energy capacity, including 50 MW of solar PV and 20 MW of wind

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (100% area)
- **Wind:** 260 W/m² (100% area)
- **Biomass:** 1.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in The Gambia

Support completed

1 Assessment of the cost effectiveness of mitigation options for the energy sector, to assist the country in prioritising mitigation options supporting the NDC for the power and other relevant sectors

Work package: Technology and infrastructure technical analysis	Source: NDC Partnership
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Acknowledgement of IRENA support

"The NDC2 revises and strengthens those mitigation measures and includes additional ones identified through the metabolic analysis and IRENA's work on the power sector. An additional eight mitigation measures were identified through the metabolic analysis, while IRENA defined eight for the power sector through the cost-effectiveness analysis of renewable energy mitigation options (five of which from the NDC1 were strengthened)."

(THE GAMBIA'S SECOND NDC, 12 SEPTEMBER 2020)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



GEORGIA

Membership since	GDP per capita	Total greenhouse gas emissions
30 June 2010	USD 6 627.71 (2022) ²	18.05 MtCO ₂ eq (2022) ⁴
Population	TPES³	
3 712 502 (2022) ¹	Total: 215 112 TJ (2020) (Renewable: 51 209 TJ)	

Renewable energy targets in first NDC⁵

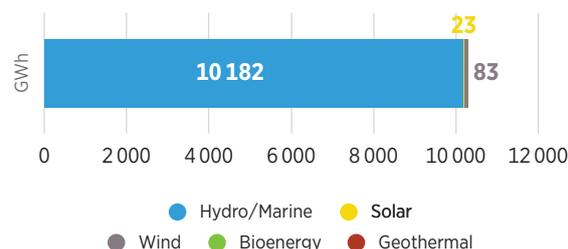
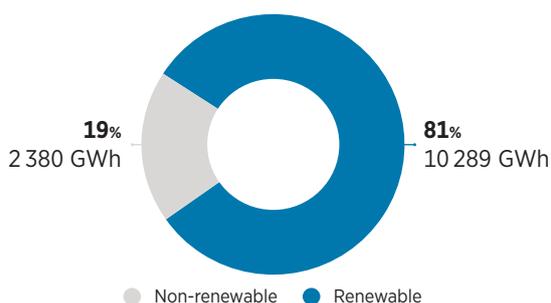
Does not mention renewables or include renewable energy targets

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (25% area)
1.2-1.4 MWh/kWp/yr (70% area)
- **Wind:** <260 W/m² (75% area)
260-420 W/m² (18% area)
420-560 W/m² (5% area)
- **Biomass:** 5.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Georgia

Support in implementation

Support is currently under discussion

1	Work package: Renewables readiness assessment	Source: Government of Georgia
2	Work package: Policy advice	Source: Government of Georgia
3	Work package: Resource assessment	Source: Government of Georgia
4	Work package: Technology and infrastructure capacity building	Source: Government of Georgia

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



GHANA

Membership since	GDP per capita	Total greenhouse gas emissions
6 February 2014	USD 2 175.85 (2022) ²	53.01 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
3 712 502 (2022) ¹	Total: 491 379 TJ (2020) (Renewable: 204 291 TJ)	

Renewable energy targets in first NDC⁵

By 2030:

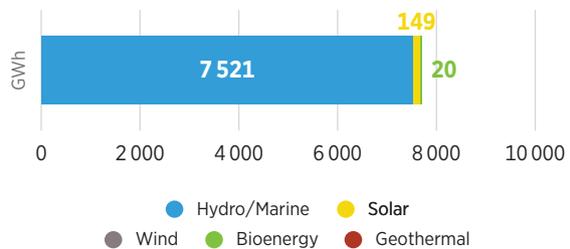
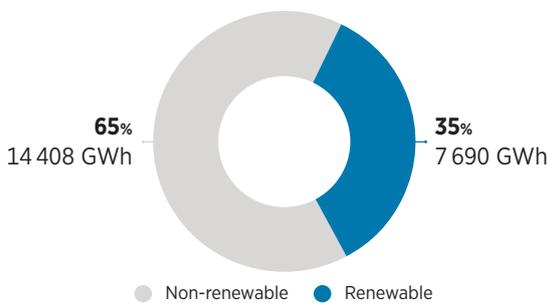
- 447.5 MW of utility solar
- 200 MW of distributed solar
- 20 MW of stand-alone solar PV
- 25 MW of solar street lighting
- 325 MW of utility-scale wind
- 2 MW of stand-alone wind systems
- 72 MW of utility-scale biomass
- 50.1 MW of utility-scale waste-to-energy
- 150.03 MW of small hydropower plants
- 50 MW of wave power and
- 12 MW of hybrid mini-grids

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (37% area)
1.4-1.6 MWh/kWp/yr (63% area)
- **Wind:** <260 W/m² (100% area)
- **Biomass:** 4.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Ghana

Support in implementation

- Strengthening bioenergy data for monitoring Sustainable Development Goals (SDGs) and NDCs; energy surveys for NDC implementation roadmaps

1	Work package: Data and statistics	Source: Government of Ghana
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



GRENADA

Membership since		GDP per capita	Total greenhouse gas emissions
15 July 2011	SIDS	USD 10 016.21 (2022) ²	0.19 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
125 438 (2022) ¹		Total: 4 419 TJ (2020) (Renewable: 329 TJ)	

Renewable energy targets in second NDC⁵

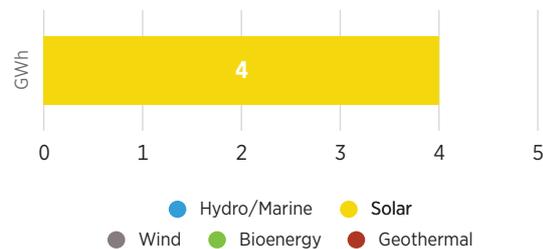
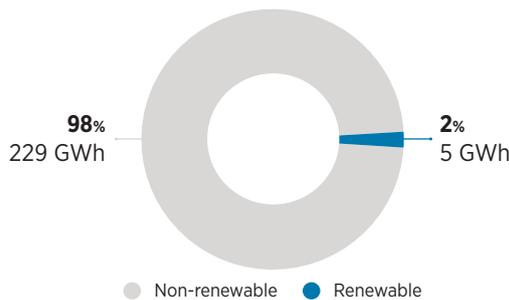
Scale up geothermal electricity as assumed in the first NDC (15 MW); incorporate 15 MW of intermittent renewables for rapid energy transition

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (90% area)
- **Wind:** <260 W/m² (48% area)
260-420 W/m² (45% area)
420-560 W/m² (5% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



Acknowledgement of IRENA support

"The Government of Grenada is appreciative of the support provided by ... the International Renewable Energy Agency (IRENA)."

(GRENADA'S SECOND NDC, 30 NOVEMBER 2020)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile (2020), Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile (2020)

IRENA climate action engagement in Grenada

Support completed

1 System analysis and maintenance and improvement of energy-related data collection and management for greenhouse gas emission reporting and tracking

Work package:
Data and statistics

Source:
NDC Partnership

2 Capacity building on energy management and energy auditing for various sectors, including residential, financial, hotel and government

Work package:
Capacity building on policy and finance

Source:
NDC Partnership

Support in implementation

1 Assessment of potential mitigation measures in the power sector. Identification and spatial characterisation of mitigation options based on national circumstances

Work package:
Technology and infrastructure technical analysis

Source:
UNDP



Mystic Stock Photo © Shutterstock.com



HONDURAS

Membership since	GDP per capita	Total greenhouse gas emissions
19 September 2021	USD 3 040.17 (2022) ²	23.74 MtCO ₂ eq (2022) ⁴
Population	TPES³	
10 432 860 (2022) ¹	Total: 229 464 TJ (2020) (Renewable: 107 019 TJ)	

Renewable energy targets in first NDC⁵

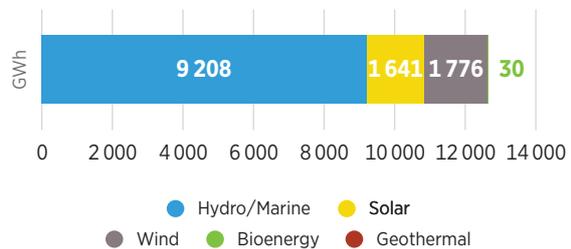
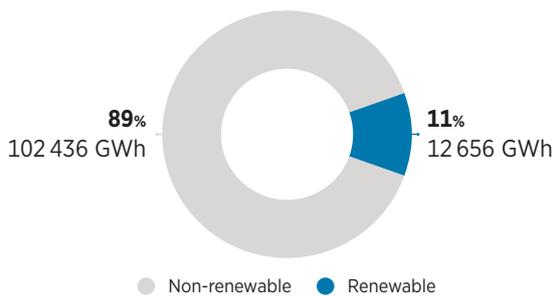
10% of electricity production by 2030 and 50% of electricity generation by 2050 from alternative sources (renewables and nuclear)

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (10% area)
1.4-1.6 MWh/kWp/yr (76% area)
1.6-1.8 MWh/kWp/yr (22% area)
- **Wind:** <260 W/m² (85% area)
260-420 W/m² (10% area)
420-560 W/m² (3% area)
820-1 060 W/m² (3% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Honduras

Support in implementation

Preparation of a Renewables Readiness Assessment to review and assess the direction of the country's energy transition, with the aims of developing long-term policies to provide a sustainable, reliable and

- 1 low-carbon energy supply and of increasing the renewable energy share to 80% by 2038

Work package:
Renewables readiness assessment

Source:
Government of Honduras

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2016), IRENA Statistical Profile



INDIA

Membership since	GDP per capita	Total greenhouse gas emissions
4 May 2010	USD 2 388.62 (2022) ²	3 943.26 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
1 417 173 173 (2022) ¹	Total: 38 162 838 TJ (2020) (Renewable: 9 072 449 TJ)	

Renewable energy targets in updated first NDC⁵

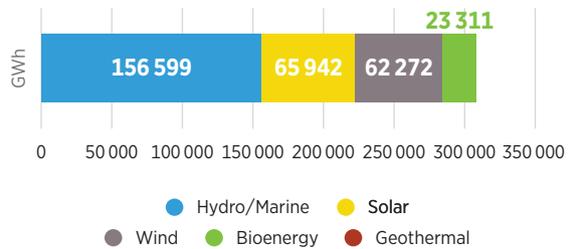
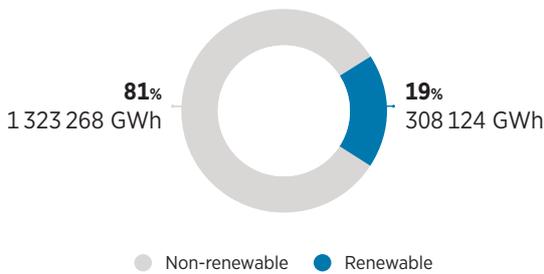
Achieve around 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (3% area)
1.2-1.4 MWh/kWp/yr (10% area)
1.4-1.6 MWh/kWp/yr (50% area)
1.6-1.7 MWh/kWp/yr (22% area)
1.8-1.9 MWh/kWp/yr (7% area)
1.9-2.0 MWh/kWp/yr (7% area)
>2.0 MWh/kWp/yr (8% area)
- **Wind:** <260 W/m² (95% area)
260-420 W/m² (7% area)
670-820 W/m (2% area)
- **Biomass:** 3.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in India

Support in implementation

Project facilitation	
1	<p>Work package: Project facilitation</p> <p>Source: Government of India</p>

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



INDONESIA

Membership since	GDP per capita	Total greenhouse gas emissions
7 September 2014	USD 4 787.99 (2022) ²	1 240.83 MtCO ₂ eq (2022) ⁴
Population	TPES ⁵	
275 501 339 (2022) ¹	Total: 10 449 433 TJ (2020) (Renewable: 2 221 260 TJ)	

Renewable energy targets in enhanced NDC⁵

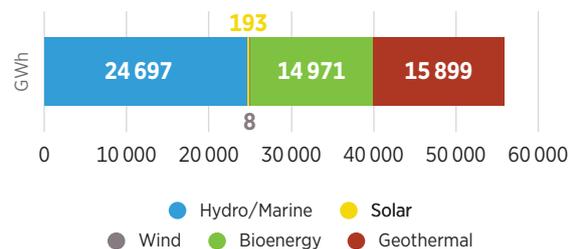
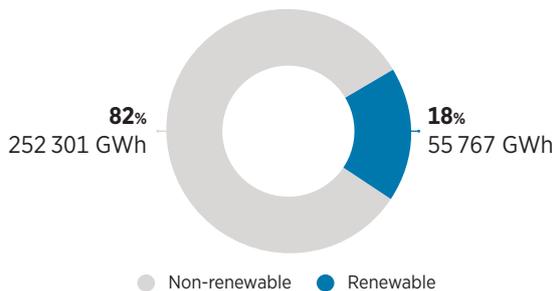
New and renewable energy (geothermal, hydropower, solar PV, wind turbines, biomass and biofuels) to contribute at least 23% in 2025 and at least 31% in 2050

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (60% area)
1.4-1.6 MWh/kWp/yr (30% area)
1.6-1.8 MWh/kWp/yr (9% area)
- **Wind:** <260 W/m² (98% area)
260-420 W/m² (2% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Indonesia

Support completed

- At the G20 Investment Forum on Energy Transitions, facilitate support for business matchmaking with investors for nine projects; prepare deep-dive workshops on addressing risks associated with project initiation, development and implementation towards creating strong enabling frameworks to finance energy transition projects

Work package:
Project facilitation

Source:
Government of Indonesia

- Provision of input on the report *Stocktaking of Economic, Social and Environmental Impacts of Sustainable Recovery*, including Impacts on NDC Implementation. The study was mentioned in the G20 Chair's Summary Joint Environment and Climate Ministers' Meeting

Work package:
Policy advice

Source:
NDC Partnership

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



IRAN (ISLAMIC REPUBLIC OF)

Membership since	GDP per capita	Total greenhouse gas emissions
21 February 2013	USD 4 387.83 (2022) ²	951.98 MtCO ₂ eq (2022) ⁴
Population	TPES⁵	
88 550 570 (2022) ¹	Total: 11 066 662 TJ (2020) (Renewable: 137 392 TJ)	

Renewable energy targets in NDC⁵

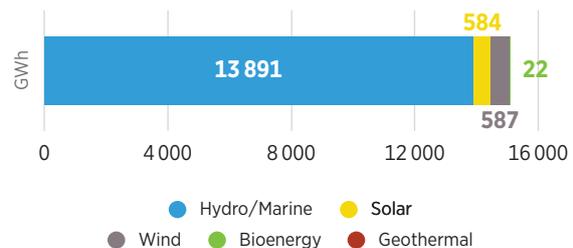
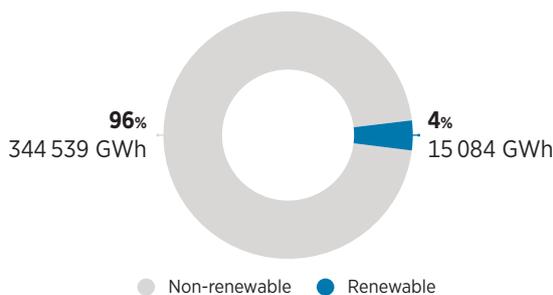
Does not indicate quantifiable renewable energy targets

Resource potential⁶

- **Solar PV:** 1.2 MWh/kWp/yr (1% area)
 - 1.2-1.4 MWh/kWp/yr (7% area)
 - 1.4-1.6 MWh/kWp/yr (8% area)
 - 1.6-1.8 MWh/kWp/yr (56% area)
 - 1.8-1.9 MWh/kWp/yr (21% area)
 - 1.9-2.0 MWh/kWp/yr (10% area)
- **Wind:** <260 W/m² (52% area)
 - 260-420 W/m² (30% area)
 - 420-560 W/m² (10% area)
 - 560-670 W/m² (2% area)
 - 670-820 W/m² (2% area)
 - 820-1 060 W/m² (2% area)
 - >1 060 W/m² (2% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Iran (Islamic Republic of)

Support in implementation

Project facilitation	
1 Work package: Project facilitation	Source: Government of Iran (Islamic Republic of)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



IRAQ

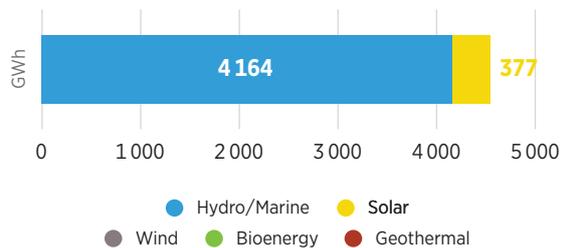
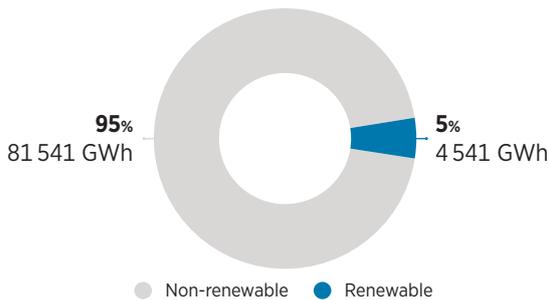
Membership since	GDP per capita	Total greenhouse gas emissions
30 December 2012	USD 5 937.20 (2022) ²	367.94 MtCO ₂ eq (2022) ⁴
Population	TPES³	
44 496 122 (2022) ¹	Total: 1 894 230 TJ (2020) (Renewable: 21 920 TJ)	

Renewable energy targets in first NDC⁵
 Increase renewables to 30% of the electricity supply by 2030

- Resource potential⁶**
- **Solar PV:** 1.4-1.6 MWh/kWp/yr (3% area)
1.6-1.8 MWh/kWp/yr (85% area)
 - **Wind:** <260 W/m² (20% area)
260-420 W/m² (70% area)
420-560 W/m (9% area)
 - **Biomass:** 4.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Iraq

Support in implementation

- 1 High-level assessment of grid hosting capacity and distribution to accommodate variable renewable energy integration and build the country's capacity on grid assessment studies; establishment of a working model of the electricity system through simulation software training

Work package: Technology and infrastructure technical analysis	Source: UNDP
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



JAMAICA

Membership since		GDP per capita	Total greenhouse gas emissions
27 February 2014	SIDS	USD 6 047.27 (2022) ²	7.71 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
2 827 377 (2022) ¹		Total: 102 725 TJ (2020) (Renewable: 12 349 TJ)	

Renewable energy targets in second NDC⁵

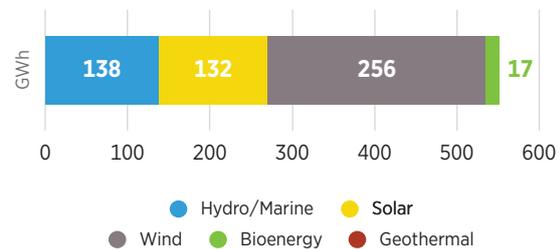
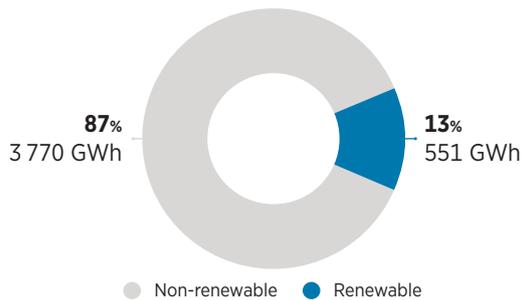
Increase the installed capacity of on-grid renewable electricity generation to 78% by 2030

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (5% area)
1.4-1.6 MWh/kWp/yr (50% area)
1.6-1.8 MWh/kWp/yr (48% area)
- **Wind:** <260 W/m² (90% area)
260-420 W/m² (10% area)
420-560 W/m (3% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Jamaica

Support in implementation

Support is currently under discussion

1	Work package:	Source:
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



JORDAN

Membership since	GDP per capita	Total greenhouse gas emissions
2 August 2014	USD 4 204.51 (2022) ²	34.54 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
11 285 869 (2022) ¹	Total: 350 757 TJ (2020) (Renewable: 33 468 TJ)	

Renewable energy targets in first NDC⁵

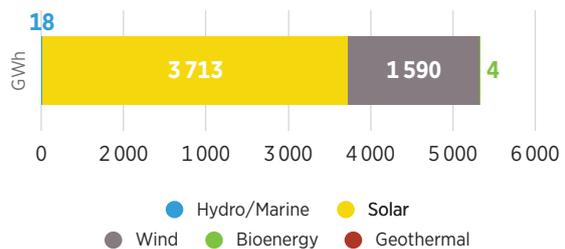
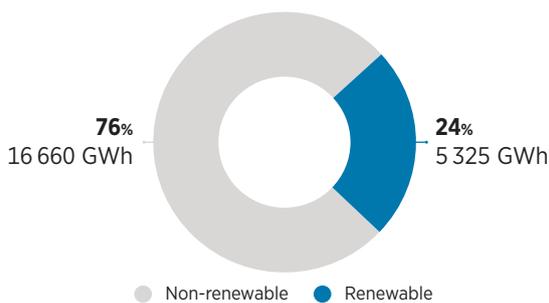
Increase renewable electricity generation from 20% in 2020 to 35% in 2030, and 9% energy efficiency distributed among residential, services and industry. Implementation through measures listed in the national strategy action plan; CSP of 100 MW and 300 MW

Resource potential⁶

- **Solar PV:** 1.8-1.9 MWh/kWp/yr (50% area)
1.9-2.0 MWh/kWp/yr (49% area)
- **Wind:** <260 W/m² (62% area)
260-420 W/m² (37% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Jordan

Support completed

Comprehensive evaluations of the conditions for renewable energy deployment to identify a set of actions to scale up renewables and enhance greenhouse gas mitigation

1

Work package:
Renewables readiness assessment

Source:
Government of Jordan

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



KAZAKHSTAN

Membership since		GDP per capita	Total greenhouse gas emissions
5 July 2013	LLDC	USD 11 243.67 (2022) ²	331.53 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
19 621 972 (2022) ¹		Total: 2 760 820 TJ (2020) (Renewable: 47 527 TJ)	

Renewable energy targets in first updated NDC⁵

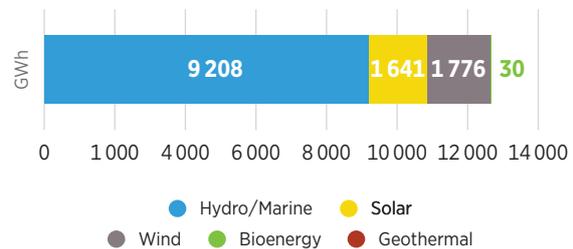
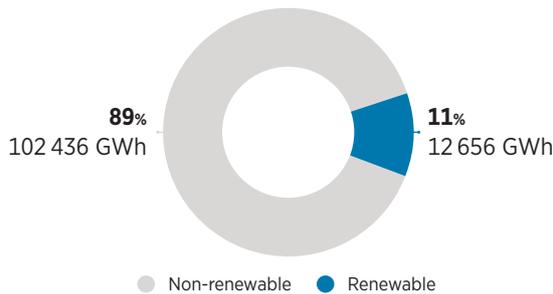
10% of electricity production by 2030 and 50% of electricity generation by 2050 from alternative sources (renewables and nuclear).

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (10% area)
1.2-1.4 MWh/kWp/yr (59% area)
1.4-1.6 MWh/kWp/yr (30% area)
- **Wind:** <260 W/m² (18% area)
260-420 W/m² (62% area)
420-560 W/m² (17% area)
- **Biomass:** 1.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Kazakhstan

Support in implementation

End user energy survey to improve and build comprehensive energy balances, annual energy reports and energy commodity accounts. The survey will focus on residential sector energy end use

1

Work package:
Data and statistics

Source:
Government of Kazakhstan

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2016), IRENA Statistical Profile



KENYA

Membership since		GDP per capita	Total greenhouse gas emissions
22 May 2009	LDC / LLDC	USD 2 099.30 (2022) ²	117.89 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
54 027 487 (2022) ¹		Total: 1 031 426 TJ (2020) (Renewable: 777 194 TJ)	

Renewable energy targets in first NDC

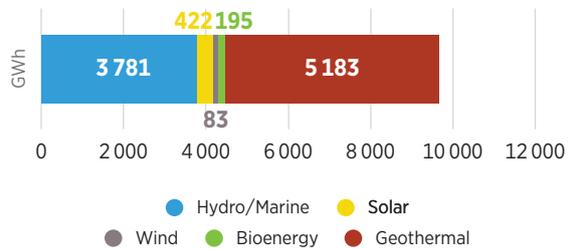
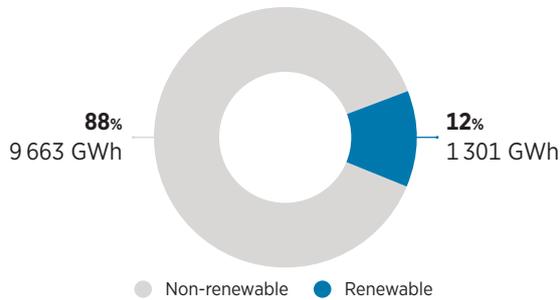
Does not include quantifiable renewable energy targets

Resource potential⁵

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (48% area)
1.6-1.8 MWh/kWp/yr (50% area)
1.8-1.9 MWh/kWp/yr (7% area)
- **Wind:** <260 W/m² (86% area)
260-420 W/m² (8% area)
420-560 W/m² (2% area)
820-1 060 W/m² (2% area)
>1 060 W/m² (2% area)
- **Biomass:** 3.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Kenya

Support in implementation

Project facilitation	
1 Work package: Project facilitation	Source: Government of Kenya

^{1, 2, 3, 4, 5} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, IRENA Statistical Profile



KIRIBATI

Membership since	GDP per capita	Total greenhouse gas emissions
17 September 2014 SIDS / LDC	USD 1 701.97 (2022) ²	0.11 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
131 232 (2022) ¹	Total: 1 598 TJ (2020) (Renewable: 597 TJ)	

Renewable energy targets in first NDC⁵

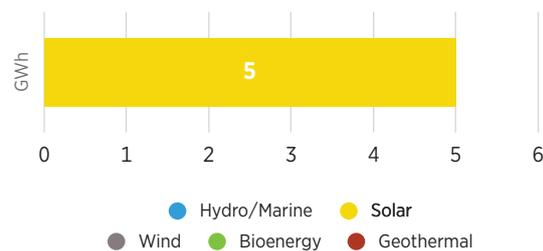
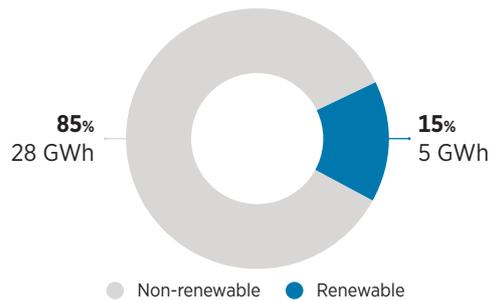
Increase installed solar capacity to 8 110 kWp with total renewable energy generation expected to lead to greenhouse gas emission reduction of 12.44 ktCO₂e in 2030

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (10% area)
1.6-1.8 MWh/kWp/yr (75% area)
1.8-1.9 MWh/kWp/yr (20% area)
- **Wind:** 260 W/m² (98% area)
260-420 W/m² (100% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Kiribati

Support in implementation

Socio-economic analysis

1

Work package:
Data and statistics

Source:
Government of Kiribati

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2023), IRENA Statistical Profile



KYRGYZ REPUBLIC

Membership since		GDP per capita	Total greenhouse gas emissions
14 May 2021	LLDC	USD 1 606.67 (2022) ²	21.94 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
6 803 300 (2022) ¹		Total: 145 928 TJ (2020) (Renewable: 46 810 TJ)	

Renewable energy targets in first updated NDC⁵

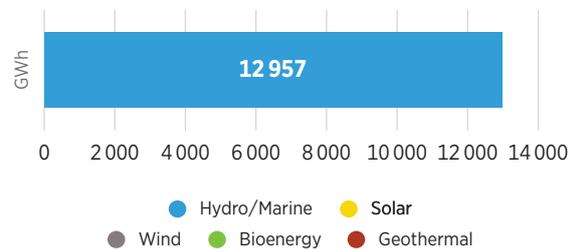
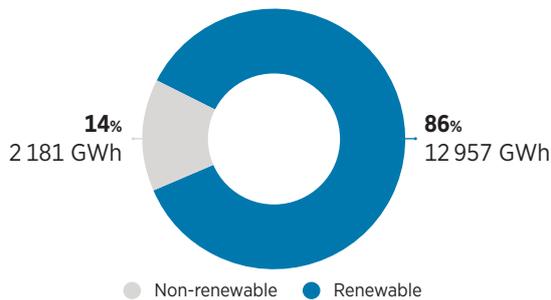
Expanding the use of biogas to reduce 1 311 980 of CO₂eq by 2030; electricity generation from small hydropower to reduce 2 737 of CO₂eq by 2030; construction of new hydropower plants to reduce 64 606 of CO₂eq by 2030; development of geothermal energy (heat pumps) to reduce 38 590 of CO₂eq by 2030

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (37% area)
1.4-1.6 MWh/kWp/yr (43% area)
1.6-1.8 MWh/kWp/yr (10% area)
- **Wind:** <260 W/m² (72% area)
260-420 W/m² (15% area)
420-560 W/m² (8% area)
- **Biomass:** 1.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



Acknowledgement of IRENA support

"During the course of preparing the NDC, at various stages, contributions to the drafting thereof were made by IRENA."

(KYRGYZ REPUBLIC'S FIRST [UPDATED] NDC SUBMISSION, 9 OCTOBER 2021)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile

IRENA climate action engagement in Kyrgyz Republic

Support completed

Comprehensive assessment of renewable energy sector background to identify a set of actions to scale up renewable energy in the context of the NDC

- | | | |
|----------|--|------------------------|
| 1 | Work package:
NDC Note based on preliminary Renewables readiness assessment (RRA) findings | Source:
UNDP |
|----------|--|------------------------|

Suitability maps for solar PV and wind with promising zones for development

- | | | |
|----------|---|------------------------|
| 2 | Work package:
Resource assessment | Source:
UNDP |
|----------|---|------------------------|

As part of the RRA process, technical support on the design of renewable energy targets, presenting the design elements of targets together with the trade-offs of selecting one option over the other

- | | | |
|----------|--|------------------------|
| 3 | Work package:
Capacity building on renewable energy target setting | Source:
UNDP |
|----------|--|------------------------|



Shevchenko Andrey © Shutterstock.com



LAO PEOPLE'S DEMOCRATIC REPUBLIC

	GDP per capita	Total greenhouse gas emissions
Non-membership LDC / LLDC	USD 2 088.38 (2022) ²	36.86 MtCO ₂ eq (2022) ⁴
Population	TPES³	
7 529 475 (2022) ¹	Total: 253 445 TJ (2020) (Renewable: 90 940 TJ)	

Renewable energy targets in first NDC⁵

Conditional:

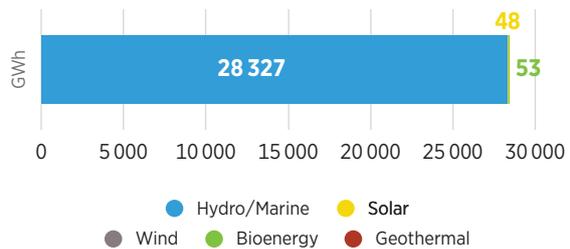
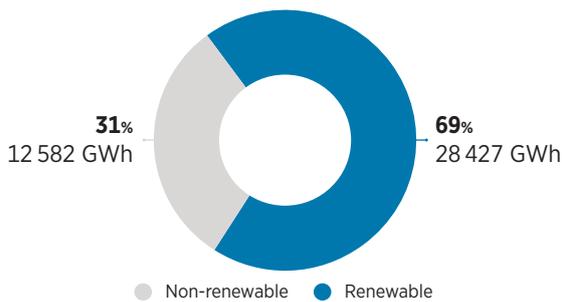
1 GW of solar and wind and 300 MW of biomass

Resource potential⁶

- **Solar PV:** 1.2-1.4 kWh/kWp/yr (57% area)
1.4-1.6 kWh/kWp/yr (35% area)
- **Wind:** <260 W/m² (90% area)
260-420 W/m² (9% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Lao People's Democratic Republic

Support in Implementation

Technology capacity building programme providing technical information and best practices on solar PV mitigation measures specified in the country's NDC to facilitate NDC implementation,

- 1 with a focus on performance, cost and planning requirements of solar PV solutions

Work package:

Technology and infrastructure capacity building

Source:

NDC Partnership

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



LEBANON

Membership since	GDP per capita	Total greenhouse gas emissions
4 November 2017	USD 4 136.14 (2021) ²	31.93 MtCO ₂ eq (2022) ⁴
Population	TPES ⁵	
5 489 739 (2022) ¹	Total: 308 166 TJ (2020) (Renewable: 8 835 TJ)	

Renewable energy targets in first NDC⁵

Unconditional (by 2030):
generate 18% of electricity demand and 11% of heat demand (in the buildings sector) from renewable sources

Conditional (by 2030):
generate 30% of electricity demand and 16.5% of heat demand (in the buildings sector) from renewable sources

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (13% area)
1.6-1.8 MWh/kWp/yr (62% area)
1.8-1.9 MWh/kWp/yr (25% area)
- **Wind:** <260 W/m² (82% area)
260-420 W/m² (13% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

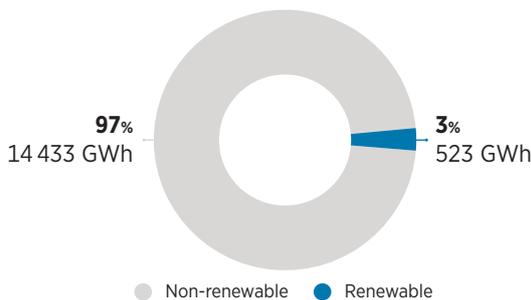
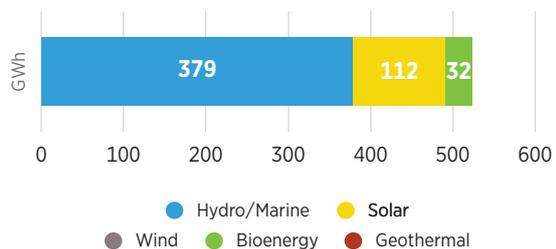


Figure 2 Renewable generation by technology (GWh)



Acknowledgement of IRENA support

“Lebanon commits to unconditionally generate 18% of the power demand (i.e. electricity demand) and 11% of its heat demand (in the building sector) from renewable energy sources in 2030, compared to a combined 15% in 2015. Conditionally, Lebanon commits to generate 30% of the power demand (i.e. electricity demand) and 16.5% of its heat demand (in the building sector) from renewable energy sources in 2030, compared to a combined 20% in 2015 (guided by the IRENA Renewable Energy Outlook: Lebanon).”

(LEBANON’S FIRST [UPDATED] NDC SUBMISSION, 16 MARCH 2021)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile

IRENA climate action engagement in Lebanon

Support completed

- 1 Combination of the two IRENA methodologies, Renewables Readiness Assessment (RRA) and Renewable Energy Roadmap (REmap), to inform decision makers on the potential to scale up renewable energy ambitions

Work package:
Renewable energy outlook

Source:
Government of Lebanon

Support in implementation

- 1 High-level assessment of the grid's hosting capacity and distribution to accommodate integration of variable renewable energy; capacity building to improve the ability of national stakeholders to perform grid assessment studies and to establish a working model of the electricity system through simulation software training

Work package:
Technology and infrastructure

Source:
Government of Lebanon





LESOTHO

Membership since	GDP per capita	Total greenhouse gas emissions
17 September 2014 LDC / LLDC	USD 1 107.40 (2022) ²	3.02 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
2 305 825 (2022) ¹	Total: 42 439 TJ (2020) (Renewable: 18 266 TJ)	

Renewable energy targets in first NDC⁵

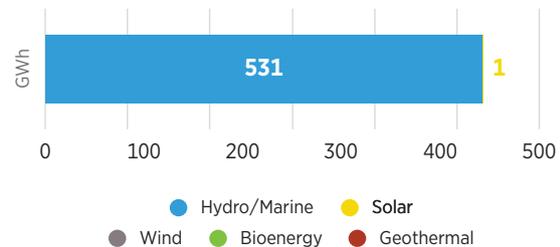
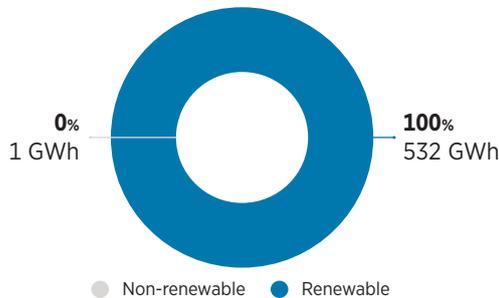
By 2030, additional renewable generation capacity of 200 MW

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (2% area)
1.6-1.8 MWh/kWp/yr (17% area)
1.8-1.9 MWh/kWp/yr (78% area)
1.9-2.0 MWh/kWp/yr (5% area)
- **Wind:** <260 W/m² (79% area)
260-420 W/m² (13% area)
420-560 W/m² (9% area)
560-670 W/m² (2% area)
820-1 060W/m² (2% area)
- **Biomass:** 4.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Lesotho

Support completed

Strengthening of bioenergy data for monitoring Sustainable Development Goals (SDGs) and NDCs; energy surveys for NDC implementation roadmaps

1

Work package:
Data and statistics

Source:
Government of Lesotho

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2018), IRENA Statistical Profile



LIBERIA

		GDP per capita	Total greenhouse gas emissions
State in accession	LDC	USD 754.53 (2022) ²	5.31 MtCO ₂ eq (2022) ⁴
Population		TPES³	
5 302 681 (2021) ¹		Total: 98 724 TJ (2020) (Renewable: 89 787 TJ)	
Renewable energy targets in first NDC⁵		Resource potential⁶	
By 2030, 95% renewable electricity capacity, corresponding to 1 011 MW, including, 503 MW of bioenergy, 456 MW of hydropower and 52 MW of solar PV		<ul style="list-style-type: none"> • Solar PV: 1.2-1.4 MWh/kWp/yr (46% area) 1.4-1.6 MWh/kWp/yr (55% area) • Wind: <260 W/m² (100% area) • Biomass: 7.5 tC/ha/yr 	

Figure 1 **Total electricity generation (GWh, %)**

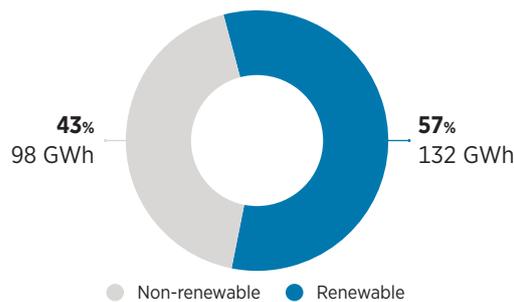
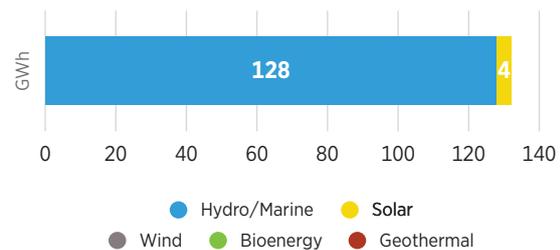


Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Liberia

Support completed

Regional capacity building on planning and operation of power grids with higher shares of variable renewable energy

1	Work package: Climate innovation and technology capacity building	Source: NDC Partnership
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Acknowledgement of IRENA support

"The robust process of the NDC revision would not have been possible without the support of the NDC Partnership... supported by: International Renewable Energy Agency..."

(LIBERIA FIRST [UPDATED] NDC SUBMISSION, 4 AUGUST 2021)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



MALI

Membership since	GDP per capita	Total greenhouse gas emissions
18 November 2010 LDC / LLDC	USD 833.30 (2022) ²	49.38 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
22 593 590 (2022) ¹	Total: 245 461 TJ (2020) (Renewable: 165 144 TJ)	

Renewable energy targets in first NDC⁵

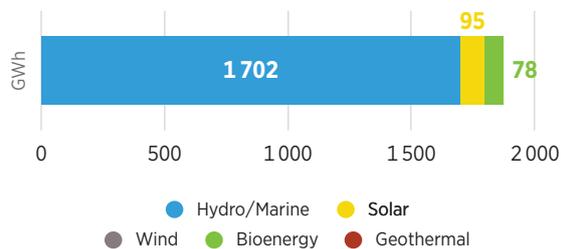
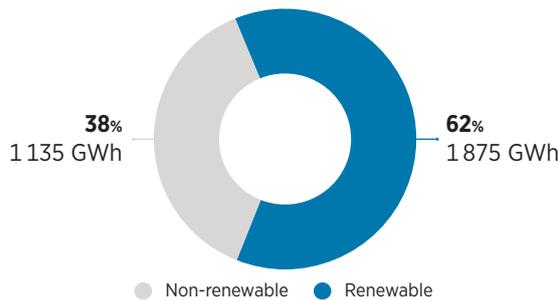
By 2030, 58.3% renewables in total installed electricity capacity, representing 37.1% of the generation mix, including:
 731 MW of medium and large hydropower,
 528 MW of solar,
 107 MW of small hydropower,
 30 MW of bioenergy and
 20 MW of wind

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (83% area)
1.8-1.9 MWh/kWp/yr (18% area)
- **Wind:** <260 W/m² (45% area)
260-420 W/m² (50% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Mali

Support completed

Support for on-site assessment					
1	<table border="1"> <tr> <th>Work package:</th> <th>Source:</th> </tr> <tr> <td>Resource assessment</td> <td>Government of Mali</td> </tr> </table>	Work package:	Source:	Resource assessment	Government of Mali
Work package:	Source:				
Resource assessment	Government of Mali				
Long-term energy planning capacity building through a mix of online software training and hands-on workshops to support the process of revising the energy component of the NDC, strengthening capacities for energy planning and contributing to the preparation of roadmaps and long-term sectoral plans					
2	<table border="1"> <tr> <th>Work package:</th> <th>Source:</th> </tr> <tr> <td>Long-term energy planning</td> <td>NDC Partnership</td> </tr> </table>	Work package:	Source:	Long-term energy planning	NDC Partnership
Work package:	Source:				
Long-term energy planning	NDC Partnership				

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



MAURITIUS

Membership since		GDP per capita	Total greenhouse gas emissions
24 April 2011	SIDS	USD 10 216.29 (2022) ²	6.41 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
1 262 523 (2022) ¹		Total: 57 326 TJ (2020) (Renewable: 8 330 TJ)	

Renewable energy targets in first updated NDC⁵

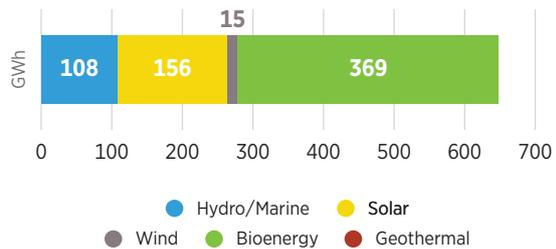
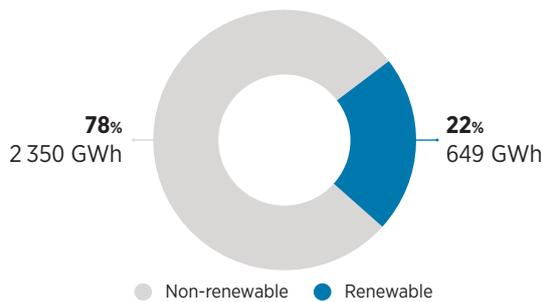
Achieve 35% to 60% renewable energy in the energy mix by 2030

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (17% area)
1.6-1.8 MWh/kWp/yr (76% area)
- **Wind:** <260 W/m² (10% area)
420-560 W/m² (80% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Mauritius

Support completed

SolarCity Simulator

1

Work package:
Resource assessment

Source:
Government of Mauritius

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



FEDERATED STATES OF MICRONESIA

Membership since		GDP per capita	Total greenhouse gas emissions
23 November 2014	SIDS	USD 3 741.06 (2022) ²	194.11 KtCO ₂ eq (2020) ⁴
Population		TPES ³	
114 164 (2022) ¹		Total: 2 162 TJ (2020) (Renewable: 44 TJ)	

Renewable energy targets in first updated NDC⁵

Conditional (by 2030):

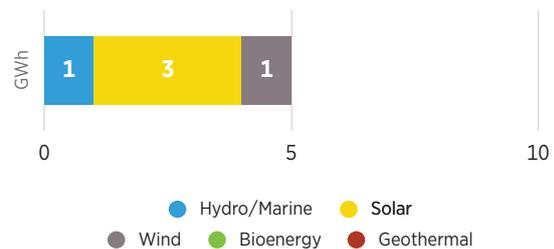
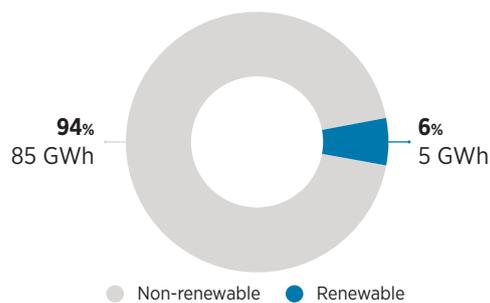
Increase renewable electricity generation to more than 70% of total generation.

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (10% area)
1.4-1.8 MWh/kWp/yr (90% area)
- **Wind:** <260 W/m² (98% area)
260-420 W/m² (5% area)
- **Biomass:** 4.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in the Federated States of Micronesia

Support in implementation

Grid integration analysis and capacity building

1	Work package: Technology and infrastructure technical analysis	Source: Government of the Federated States of Micronesia
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, OECD National Accounts data files, Nationally Determined Contribution (2022), IRENA Statistical Profile



REPUBLIC OF MOLDOVA

Membership since	GDP per capita	Total greenhouse gas emissions
3 August 2011	USD 5 562.61 (2022) ²	12.32 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
2 592 477 (2022) ¹	Total: 116 521 TJ (2020) (Renewable: 29 903 TJ)	

Renewable energy targets in first updated NDC⁵

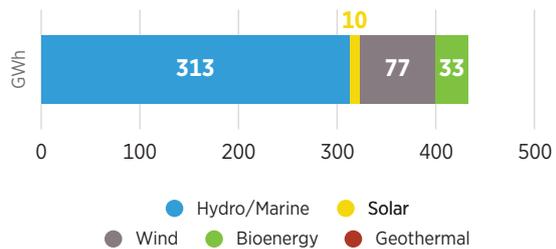
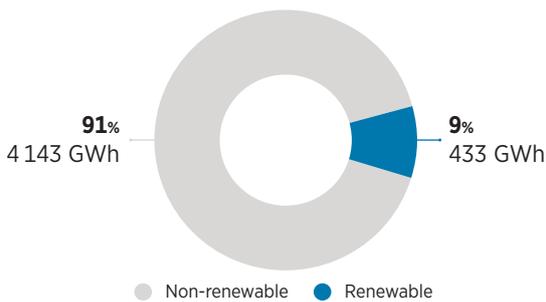
17% of gross final energy consumption from renewable sources by 2020

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (25% area)
1.2-1.4 MWh/kWp/yr (76% area)
- **Wind:** <260 W/m² (89% area)
260-420 W/m² (15% area)
- **Biomass:** 5.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Republic of Moldova

Support in implementation

Strategic planning support for district heating to enhance decarbonisation and heat transition efforts

1	Work package: Policy advice	Source: Government of Moldova
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



MONGOLIAN PEOPLE'S REPUBLIC

Membership since		GDP per capita	Total greenhouse gas emissions
11 April 2010	LLDC	USD 4 946.75 (2022) ²	62.79 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
3 398 366 (2022) ¹		Total: 429 652 TJ (2019) (Renewable: 9 245 TJ)	

Renewable energy targets in first NDC⁵

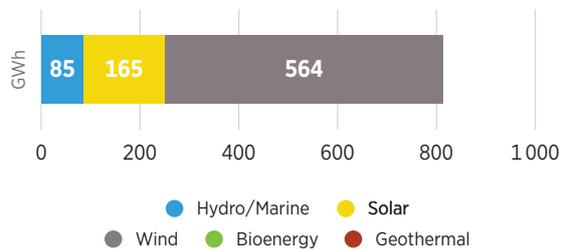
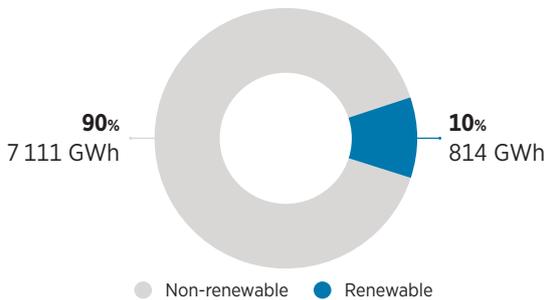
Use renewable energy sources, including hydro/wind/solar power plants, and heat pumps for heating utilities

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (16% area)
1.6-1.8 MWh/kWp/yr (56% area)
1.8-1.9 MWh/kWp/yr (25% area)
- **Wind:** <260 W/m² (40% area)
260-420 W/m² (40% area)
420-560 W/m² (18% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Mongolia

Support in Implementation

	Policy advice on heating and cooling in the buildings sector	
1	Work package: Policy advice	Source: Government of Mongolia
	Technical capacity building to support costing study of mitigation options in the power sector based on quantitative analysis of energy sector scenarios using software tools and models	
2	Work package: Technology and infrastructure capacity building	Source: Government of Mongolia

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



MOZAMBIQUE

Membership since		GDP per capita	Total greenhouse gas emissions
28 April 2011	LDC	USD 541.45 (2022) ²	40.07 MtCO ₂ eq (2020) ⁴
Population		TPES ³	
32 969 518 (2022) ¹		Total: 452 194 TJ (2020) (Renewable: 365 798 TJ)	

Renewable energy targets in first NDC⁵

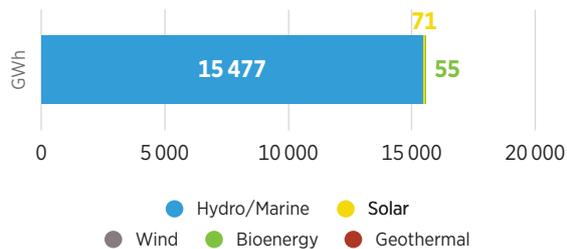
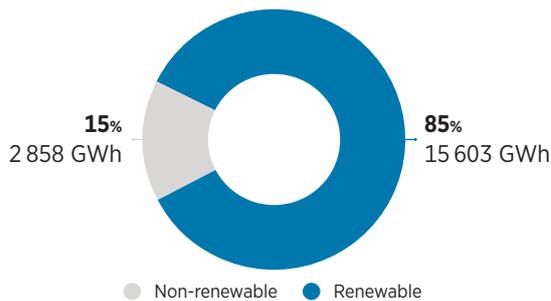
Above 50% renewables in total electricity production, up to and during 2030, including: 3.5 GW of large hydropower, 200 MW of small and mini-hydropower, 150 MW of wind, 50 MW of solar and 50 MW of biomass

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (61% area)
1.6-1.8 MWh/kWp/yr (39% area)
- **Wind:** <260 W/m² (97% area)
260-420 W/m² (1% area)
- **Biomass:** 6.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Mozambique

Support completed

Activity to develop and implement a training capacity building package		
1	Work package: Data and statistics	Source: NDC Partnership
Support for on-site assessment		
2	Work package: Resource assessment	Source: Government of Mozambique
Bioenergy Eni training		
3	Work package: Capacity building on policy and finance	Source: Government of Mozambique

Support in implementation

A study on the renewable energy off-grid regulatory framework and business models and a capacity building workshop on best practices in legal frameworks for licencing or concession for mini/micro grids and different business models		
1	Work package: Capacity building on policy and finance	Source: Government of Mozambique

^{1,2,3,4,5,6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



MYANMAR

		GDP per capita	Total greenhouse gas emissions
Non-member	LDC	USD 1 095.70 (2022) ²	169.39 MtCO ₂ eq (2022) ⁴
Population		TPES³	
54 179 306 (2022) ¹		Total: 969 366 TJ (2020) (Renewable: 493 791 TJ)	

Renewable energy targets in first NDC⁵

Conditional (by 2030):
new renewable energy target of 2 000 MW

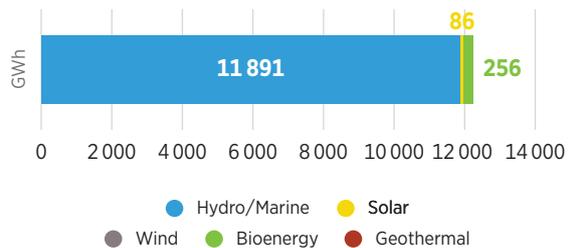
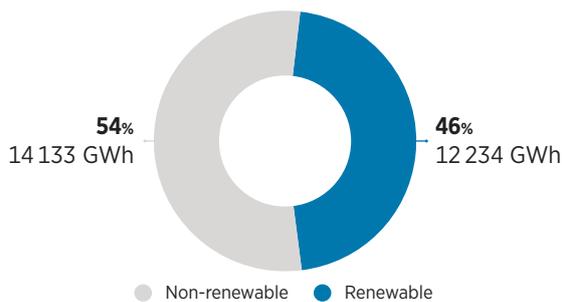
Conditional (by 2030):
3 070 MW of renewables (solar and wind)

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (75% area)
- **Wind:** <260 W/m² (98% area)
260-420 W/m² (5% area)
- **Biomass:** 4.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Myanmar

Support completed

- 1 Review and provide comments on draft NDC on clean cooking, encouraging the use of improved cookstoves and renewable energy sources to reduce emissions. The first updated NDC (Annex VII: Adaptation projects supplementary information, p. 81) reflects potential socio-economic benefits through improved cookstoves and training in renewable energy technologies as means of adaptation

Work package:
NDC review

Source:
Government of Myanmar

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profil



NEPAL

Membership since	GDP per capita	Total greenhouse gas emissions
14 December 2017 LDC / LLDC	USD 1 336.54 (2022) ²	56.74 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
30 547 580 (2022) ¹	Total: 640 554 TJ (2020) (Renewable: 480 625 TJ)	

Renewable energy targets in second NDC⁵

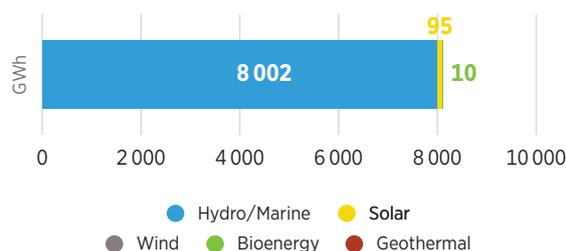
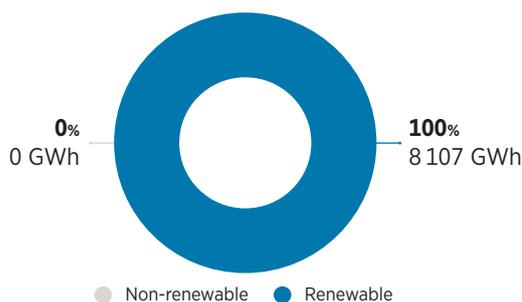
Expand clean energy generation to around 15 000 MW, of which 5-10% will be generated from mini and micro-hydro power, solar, wind and bioenergy. Of this, 5 000 MW is an unconditional target. Ensure that 15% of the total energy demand is supplied from clean sources

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (36% area)
1.4-1.6 MWh/kWp/yr (41% area)
1.6-1.8 MWh/kWp/yr (15% area)
- **Wind:** <260 W/m² (85% area)
260-420 W/m² (10% area)
- **Biomass:** 5.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Nepal

Support completed

Detailed review of the draft NDC identifying opportunities to increase ambition and provide actionable recommendations to include renewable energy technologies as mitigation options

1

Work package:
NDC review

Source:
Government of Nepal

Acknowledgement of IRENA support

“We would like to record our appreciation for the feedback from IRENA on [the] draft NDC received at short notice...”

(LETTER RECEIVED FROM GOVERNMENT OF NEPAL, 18 DECEMBER 2020)

^{1,2,3,4,5,6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



NICARAGUA

Membership since	GDP per capita	Total greenhouse gas emissions
23 October 2010	USD 2 255.43 (2022) ²	21.03 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
6 948 392 (2022) ¹	Total: 161 716 TJ (2020) (Renewable: 96 337 TJ)	

Renewable energy targets in first NDC⁵

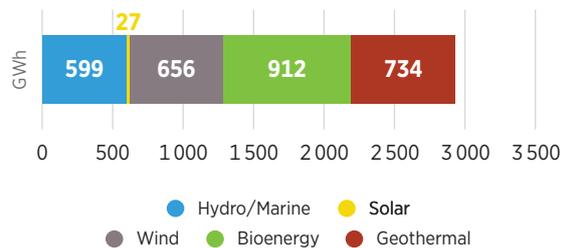
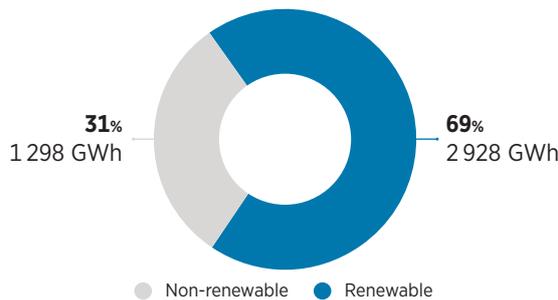
Conditional (by 2030):
up to 65% renewable sources in the energy mix

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (23% area)
1.4-1.6 MWh/kWp/yr (55% area)
1.6-1.8 MWh/kWp/yr (23% area)
- **Wind:** <260 W/m² (79% area),
260-420 W/m² (13% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Nicaragua

Support completed

1 Technical report with references to relevant existing published work to support the formulation of a strategy to continue expanding the energy matrix using renewable energy

Work package: Technology and infrastructure technical analysis	Source: NDC Partnership
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



NIGER

Membership since	GDP per capita	Total greenhouse gas emissions
16 December 2010 LDC / LLDC	USD 533.03 (2022) ²	43.24 MtCO ₂ eq (2022) ⁴
Population	TPES³	
26 207 977 (2022) ¹	Total: 113 744 TJ (2020) (Renewable: 73 482 TJ)	

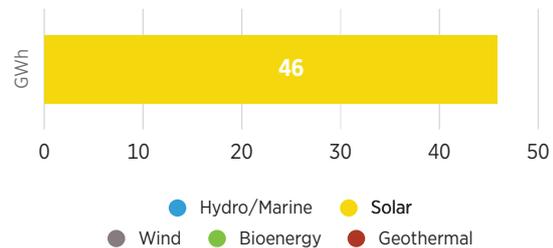
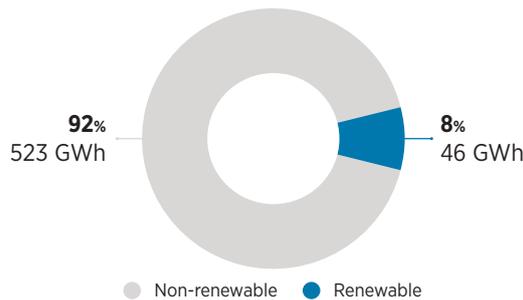
Renewable energy targets in first NDC⁵

By 2030, 28% renewable installed capacity and 57% renewable electricity generation, corresponding to 280 MW of renewables by 2030, including 130 MW of hydropower, 150 MW of solar PV and 100 MW off-grid

- Resource potential⁶**
- **Solar PV:** 1.6-1.8 MWh/kWp/yr (42% area)
1.8-1.9 MWh/kWp/yr (38% area)
1.9-2.0 MWh/kWp/yr (17% area)
 - **Wind:** <260 W/m² (50% area),
260-420 W/m² (43% area)
 - **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Niger

Support completed

1 Long-term energy planning capacity building through a mix of online software training and hands-on workshops to support the process of revising the energy component of the NDC, strengthen capacities for energy planning and contribute to the preparation of roadmaps and long-term sectoral plans

Work package: Long-term energy planning	Source: NDC Partnership
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2 Strengthening the monitoring mechanism for NDC implementation by establishing a sustainable monitoring system, training the stakeholders, defining the indicators, monitoring frequency, and good data collection, analysis and reporting. Development of mini greenhouse gas inventories and projections to inform new NDC targets

Work package: Monitoring, reporting and verification (MRV)	Source: NDC Partnership
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



NIGERIA

Membership since	GDP per capita	Total greenhouse gas emissions
30 September 2010	USD 2 184.42 (2022) ²	407.69 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
218 541 212 (2022) ¹	Total: 6 644 014 TJ (2020) (Renewable: 5 065 016 TJ)	

Renewable energy targets in first NDC⁵

43% installed renewable capacity in final electricity consumption, corresponding to 13 800 MW of renewables, including:
 5 000 MW of solar PV,
 4 700 MW of large hydropower,
 1 200 MW of small hydropower,
 1 100 MW of bioenergy,
 1 000 MW of CSP and
 800 MW of wind

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (37% area)
1.6-1.8 MWh/kWp/yr (45% area)
- **Wind:** <260 W/m² (97% area)
260-420 W/m² (2% area)
- **Biomass:** 2.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

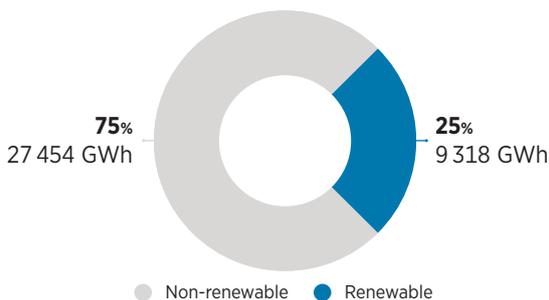
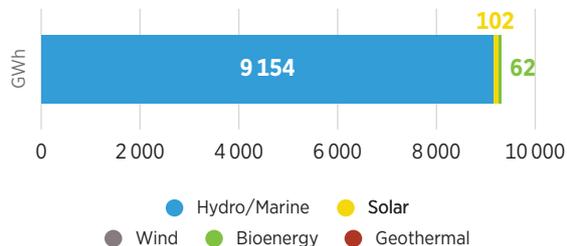


Figure 2 Renewable generation by technology (GWh)



Acknowledgement of IRENA support

“Nigeria has, with support from ... IRENA, in a coalition of development partners contributing through the NDC Partnership, carried out a significant enhancement program as part of the NDC update.”

(NIGERIA’S FIRST [UPDATED] NDC SUBMISSION, 30 JULY 2021)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile (2020), Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile (2020)

IRENA climate action engagement in Nigeria

Support in implementation

1 Enhance and establish an energy balance for Nigeria; establish a system to produce balances and MRV reporting for energy; capacity building on data collection and management

Work package: Data and statistics	Source: NDC Partnership
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2 Development of four sectoral MRV systems on agriculture, industry, transport, and oil and gas

Work package: Monitoring, reporting and verification (MRV)	Source: NDC Partnership
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3 Training programme on data, scope, methodology and processes for data collection and management for relevant officers of the Department of Climate Change and other line ministries. Development and adoption of appropriate templates for data collection and dissemination

Work package: Data and statistics	Source: NDC Partnership
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NORTH MACEDONIA

Membership since		GDP per capita	Total greenhouse gas emissions
29 December 2010	LLDC	USD 6 591.47 (2022) ²	11.18 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
2 057 679 (2022) ¹		Total: 117 790 TJ (2020) (Renewable: 22 542 TJ)	

Renewable energy targets in first NDC⁵

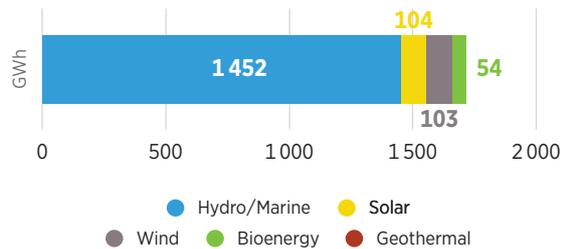
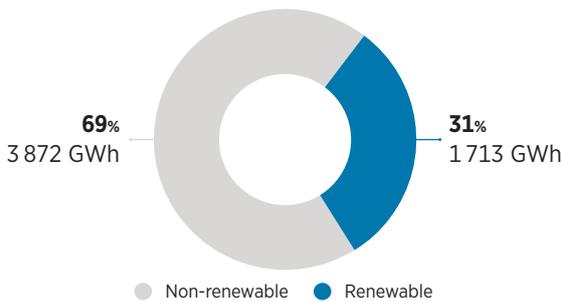
1 033 MW of hydropower
 180 MW of solar
 15 MW of biogas
 15 MW of biogas combined heat and power plants
 and 15 MW of geothermal

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (65% area)
1.4-1.6 MWh/kWp/yr (36% area)
- **Wind:** <260 W/m² (85% area)
260-420 W/m² (10% area)
- **Biomass:** 5.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in North Macedonia

Support completed

IRENA conducted the study *De-risking investments in North Macedonia: Renewable energy finance and policy focusing on power, heating and cooling*

1

Work package:
Policy advice

Source:
UNDP

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



OMAN

Membership since	GDP per capita	Total greenhouse gas emissions
5 August 2010	USD 25 056.79 (2022) ²	137.24 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
4 576 298 (2022) ¹	Total: 1 129 089 TJ (2020) (Renewable: 3 507 TJ)	

Renewable energy targets in second NDC⁵

Increase renewable energy consumption to 20% by 2030 and 35-39% by 2040. Between 2021 and 2027, secure at least 2 660 MW from solar PV and wind

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (10% area)
1.8-1.9 MWh/kWp/yr (50% area)
1.9-2.0 MWh/kWp/yr (39% area)
>2.0 MWh/kWp/yr (9% area)
- **Wind:** <260 W/m² (69% area)
260-420 W/m² (23% area)
420-560 W/m² (7% area)
560-670 W/m² (2% area)
670-820 W/m² (2% area)
>1 060 W/m² (2% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

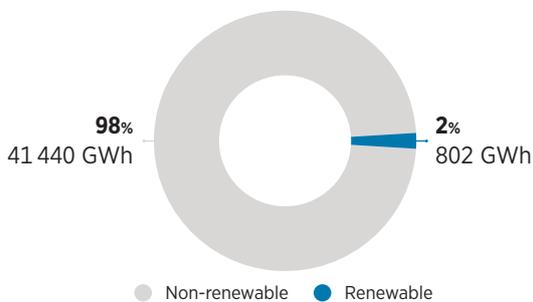
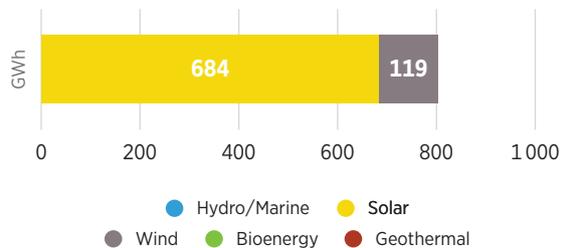


Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Oman

Support in implementation

Project facilitation	
1 Work package: Project facilitation	Source: Government of Oman

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



PAKISTAN

Membership since	GDP per capita	Total greenhouse gas emissions
23 June 2016	USD 1 596.66 (2022) ²	546.09 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
235 824 862 (2021) ¹	Total: 3 701 197 TJ (2020) (Renewable: 874 721 TJ)	

Renewable energy targets in first NDC⁵

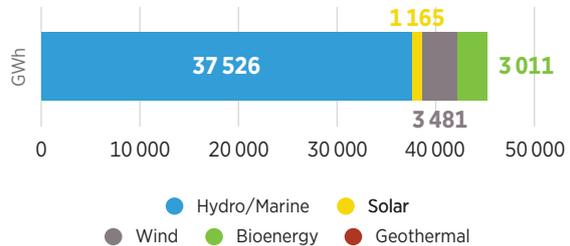
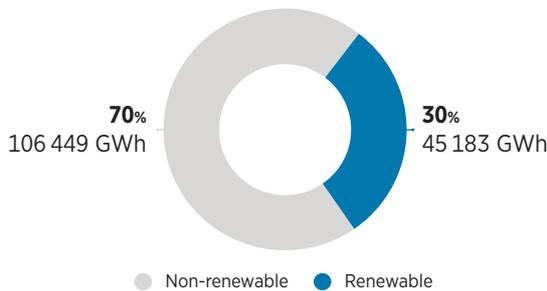
By 2030, generate 60% of all energy from renewable sources, including hydropower

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (30% area)
1.6-1.8 MWh/kWp/yr (39% area)
1.8-1.9 MWh/kWp/yr (16% area)
1.9-2.0 MWh/kWp/yr (10% area)
- **Wind:** <260 W/m² (77% area)
260-420 W/m² (16% area)
420-560 W/m² (5% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Pakistan

Support in implementation

Support is currently under discussion

1	Work package:	Source:
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



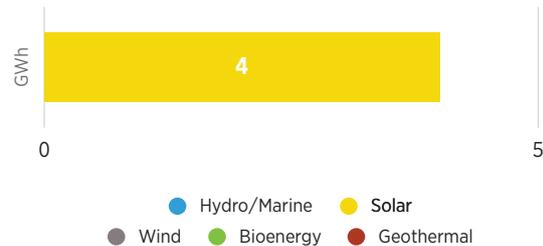
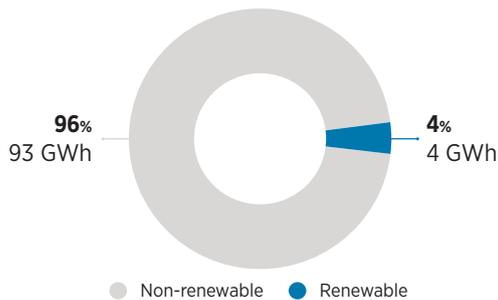
PALAU

Membership since	SIDS	GDP per capita	Total greenhouse gas emissions
27 December 2009		USD 12 083.89 (2021) ²	1.42 MtCO ₂ eq (2022) ⁴
Population		TPES³	
18 055 (2022) ¹		Total: 2 933 TJ (2019) (Renewable: 16 TJ)	

Renewable energy targets in first NDC⁵	Resource potential⁶
15 MW of solar and 10 MW of hydropower	<ul style="list-style-type: none"> • Solar PV: 1.2-1.4 MWh/kWp/yr (5% area) 1.4-1.6 MWh/kWp/yr (98% area) • Wind: <260 W/m² (100% area) • Biomass: 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Palau

Support completed

Support on the green hydrogen roadmap

1	Work package: Renewable energy roadmap	Source: Pacific NDC Hub
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Support in implementation

Training on implementing and analysing the MRV template based on international guidelines; socio-economic analysis

1	Work package: Data and statistics	Source: Government of Palau
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Training and the development of policies and the environment to attract more public-private sources for Palau Public Utilities Corporation to utilise appropriate ocean energy, ocean thermal energy conversion (OTEC) and green hydrogen

2	Work package: Capacity building on policy and finance	Source: Government of Palau
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2016), IRENA Statistical Profile



PANAMA

Membership since	GDP per capita	Total greenhouse gas emissions
15 January 2012	USD 17 357.63 (2022) ²	18.48 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
4 408 581 (2022) ¹	Total: 177 963 TJ (2020) (Renewable: 43 924 TJ)	

Renewable energy targets in first updated NDC⁵

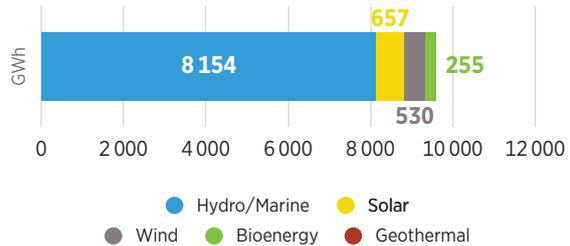
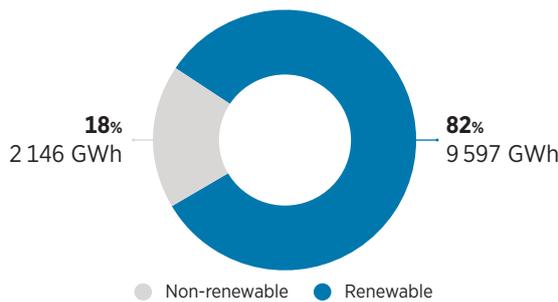
No quantifiable information is available

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (43% area)
1.4-1.6 MWh/kWp/yr (52% area)
- **Wind:** <260 W/m² (86% area)
260-420 W/m² (9% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Panama

Support in implementation

Support is currently under discussion

1	Work package:	Source:
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



PAPUA NEW GUINEA

		GDP per capita	Total greenhouse gas emissions
State in accession	SIDS	USD 3 020.27 (2022) ²	9.10 MtCO ₂ eq (2022) ⁴
Population		TPES⁵	
10 142 619 (2022) ¹		Total: 189 277 TJ (2020) (Renewable: 77 161 TJ)	

Renewable energy targets in second NDC⁵

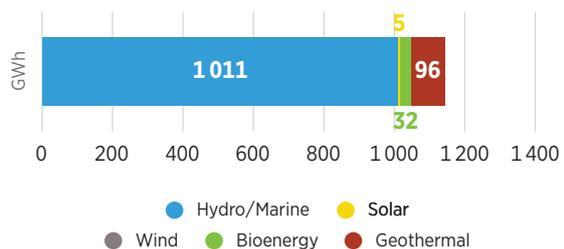
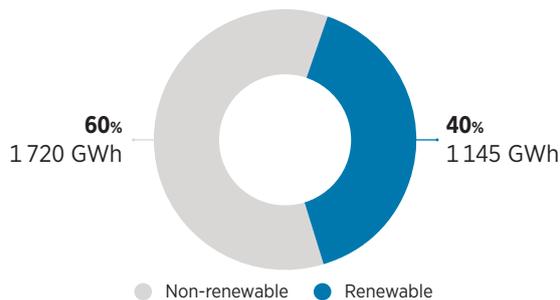
Increase the installed capacity of on-grid renewable electricity generation to 78% by 2030

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (16% area)
1.2-1.4 MWh/kWp/yr (62% area)
1.4-1.6 MWh/kWp/yr (22% area)
- **Wind:** <260 W/m² (89% area),
260-420 W/m² (10% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Papua New Guinea

Support completed

Developing a system to collect reliable country-specific energy data and creating an integrated energy data management system with other sectors for planning and development of the Global Database of

- 1 National GHG Inventory

Work package:
Data and statistics

Source:
NDC Partnership

Acknowledgement of IRENA support

"Special thanks also go to a number of development partners including IRENA for [their] invaluable support."

(PAPUA NEW GUINEA'S FIRST [UPDATED] NDC SUBMISSION, 16 DECEMBER 2020)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



PARAGUAY

Membership since		GDP per capita	Total greenhouse gas emissions
2 March 2018	LLDC	USD 6 153.06 (2022) ²	45.57 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
6 780 744 (2022) ¹		Total: 270 723 TJ (2020) (Renewable: 168 457 TJ)	

Renewable energy targets in first NDC⁵

Generate and promote alternative energy sources to hydropower in vulnerable communities

By 2030:

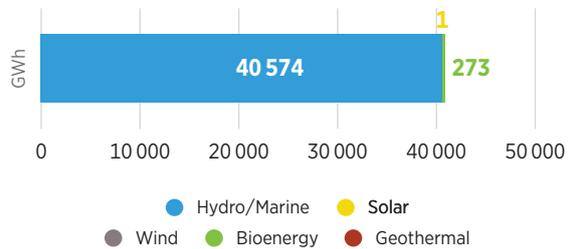
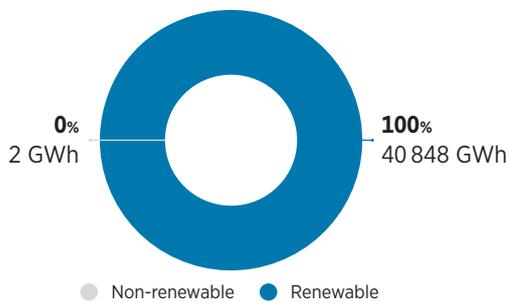
promote efficient stoves for vulnerable families in rural areas, especially those most dependent on biomass for cooking; promote distributed generation systems such as solar and wind in areas with limited access to energy sources; promote solar water heaters as a way to use solar thermal energy

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (100% area)
- **Wind:** <260 W/m² (100% area)
- **Biomass:** 5.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Paraguay

Support completed

1 Comprehensive evaluation of the conditions for renewable energy deployment to identify a set of actions to scale up renewable energy and enhance green-house gas mitigation

Work package:
Renewables readiness assessment

Source:
Government of Paraguay

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



PERU

Membership since	GDP per capita	Total greenhouse gas emissions
21 November 2013	USD 3 020.27 (2022) ²	9.1 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
10 142 619 (2022) ¹	Total: 887 644 TJ (2020) (Renewable: 236 302 TJ)	

Renewable energy targets in first updated NDC⁵

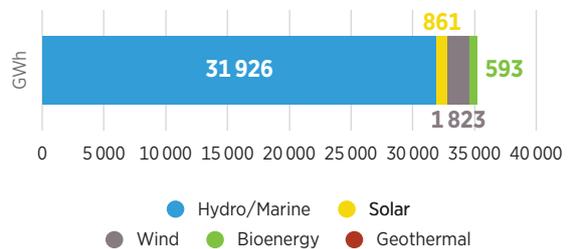
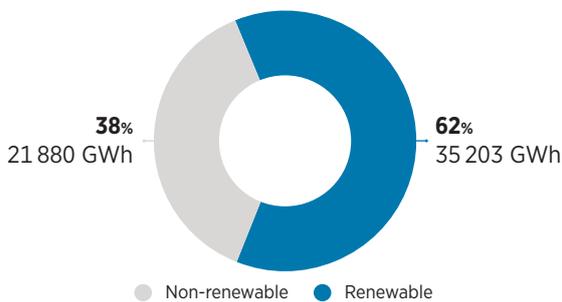
Does not include quantifiable renewable energy targets

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (43% area)
1.4-1.6 MWh/kWp/yr (23% area)
1.6-1.8 MWh/kWp/yr (10% area)
>2.0 MWh/kWp/yr (9% area)
- **Wind:** <260 W/m² (97% area)
260-420 W/m² (2% area)
670-820 W/m² (2% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Peru

Support in implementation

Conduct a technical costing study of mitigation options in the power sector based on quantitative analysis of energy sector scenarios using software tools and models

1

Work package: Technology and infrastructure technical analysis	Source: Government of Peru
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



SAINT KITTS AND NEVIS

Membership since		GDP per capita	Total greenhouse gas emissions
20 June 2013	SIDS	USD 20 176.75 (2022) ²	0.15 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
47 657 (2022) ¹		Total: 3 349 TJ (2020) (Renewable: 37 TJ)	

Renewable energy targets in first NDC⁵

Conditional (by 2030):
 35 MW of geothermal
 7.6 MW of wind
 1.9 MW of solar

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (100% area)
- **Wind:** <260 W/m² (63% area)
 260-420 W/m² (25% area)
 420-560 W/m² (15% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

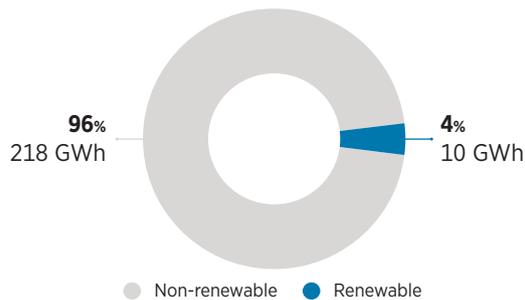
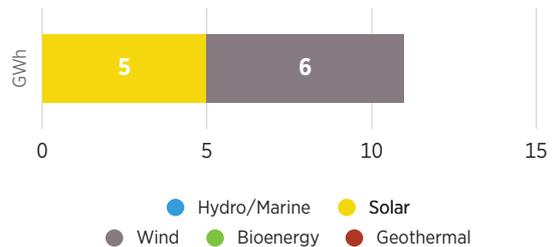


Figure 2 **Renewable generation by technology (GWh)**



^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile

IRENA climate action engagement in Saint Kitts and Nevis

Support completed

Technical capacity building programme consisting of several workshops on geothermal technology to facilitate NDC implementation, with a focus on performance, cost and planning requirements of

1 geothermal solutions

Work package:	Source:
Technology and infrastructure capacity building	UNFCCC

Support in implementation

Implementation of the MRV system in the framework of the NDC revision

1 Work package:	Source:
Monitoring, reporting and verification (MRV)	UNFCCC

Assessment for the cost effectiveness of mitigation options for the energy sector to support country officials prioritising mitigation options as the input to the country's NDC on power and other relevant sectors

2 Work package:	Source:
Technology and infrastructure technical analysis	UNFCCC

SolarCity Simulator

3 Work package:	Source:
Resource assessment	Government of Saint Kitts and Nevis

Facilitate the rapid dissemination of up-to-date technical information and know-how on renewable technologies and infrastructure. Potential support includes modern renewables for end-use sectors (increasing ambition beyond the power sector), bioenergy, e-mobility, sustainable towns and communities, climate-resilient systems, small-scale renewable energy, decentralised power generation, clean cooking.

4 Work package:	Source:
Technology and infrastructure capacity building	Government of Saint Kitts and Nevis





SAINT LUCIA

Membership since		GDP per capita	Total greenhouse gas emissions
31 March 2016	SIDS	USD 11 481.50 (2022) ²	0.43 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
179 857 (2022) ¹		Total: 7 603 TJ (2020) (Renewable: 601 TJ)	

Renewable energy targets in first NDC⁵

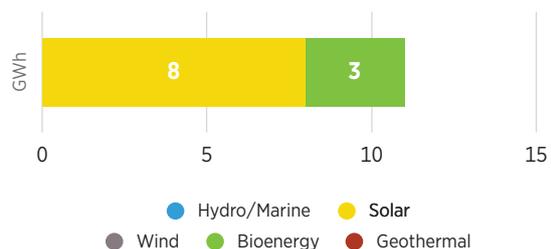
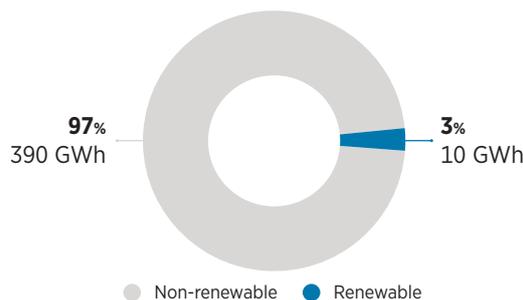
Conditional (by 2025 and 2030):
35%-50% of electricity from renewables through a mix of geothermal, wind and solar energy

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (16% area)
1.6-1.8 MWh/kWp/yr (83% area)
- **Wind:** <260 W/m² (53% area)
260-420 W/m² (40% area)
420-560 W/m² (8% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Saint Lucia

Support completed

Solar City simulator	
1	Work package: Resource assessment Source: Government of Saint Lucia
Energy surveys for NDC implementation roadmaps	
2	Work package: Data and statistics Source: Government of Saint Lucia

Support in implementation

Capacity building support for renewable energy mitigation technologies and adaptation, and climate action, while also contributing to accelerating Saint Lucia's NDC implementation	
1	Work package: Technology and infrastructure capacity building Source: NDC Partnership

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



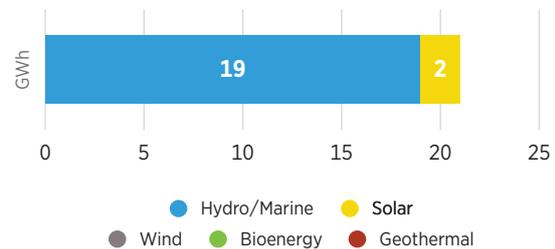
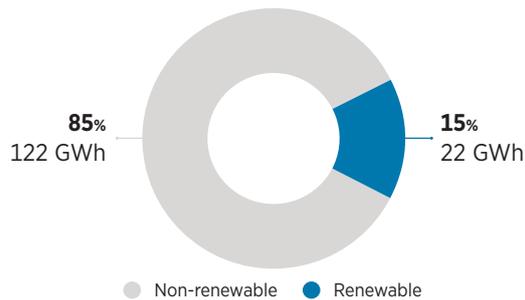
SAINT VINCENT AND THE GRENADINES

Membership since		GDP per capita	Total greenhouse gas emissions
9 November 2012	SIDS	USD 9 125.32 (2022) ²	0.15 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
103 948 (2022) ¹		Total: 3 689 TJ (2020) (Renewable: 141 TJ)	

Renewable energy targets in first NDC ⁵	Resource potential ⁶
Unconditional: 15 MW of geothermal	<ul style="list-style-type: none"> • Solar PV: 1.2-1.4 MWh/kWp/yr (5% area) 1.4-1.6 MWh/kWp/yr (10% area) 1.6-1.8 MWh/kWp/yr (90% area) • Wind: <260 W/m² (32% area) 260-420 W/m² (50% area) 420-560 W/m² (17% area) • Biomass: 8.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Saint Vincent and Grenadines

Support in implementation

Review the data needed for NDC enhancement and energy-related target tracking and its availability	
1	Work package: Data and statistics Source: UNDP
Energy management and energy audit	
2	Work package: Capacity building on policy and finance Source: Government of Saint Vincent and Grenadines

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2016), IRENA Statistical Profile



SÃO TOMÉ AND PRÍNCIPE

Membership since	GDP per capita	Total greenhouse gas emissions
1 November 2014 SIDS / LDC	USD 2 404.26 (2022) ²	0.26 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
227 380 (2022) ¹	Total: 3 036 TJ (2020) (Renewable: 1 072 TJ)	

Renewable energy targets in first NDC⁵

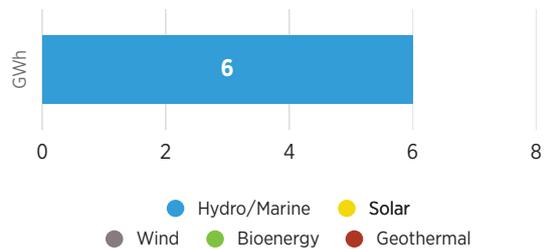
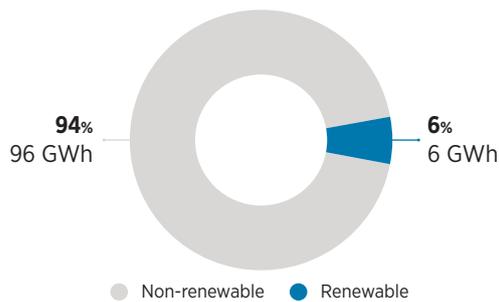
Conditional (by 2030):
12 MW of solar and 14 MW of hydropower

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (10% area)
1.2-1.4 MWh/kWp/yr (70% area)
1.4-1.6 MWh/kWp/yr (20% area)
- **Wind:** <260 W/m² (100% area)
- **Biomass:** 1.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



^{1, 2, 3, 4, 5, 6} World Bank national accounts data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile

IRENA climate action engagement in São Tomé and Príncipe

Support completed

SolarCity simulator		
1	Work package: Resource assessment	Source: UNDP
Assessment of the cost effectiveness of mitigation options for the energy sector to support country officials prioritising mitigation options that can serve as inputs for the NDC implementation phase for the power and other relevant sectors		
2	Work package: Technology and infrastructure technical analysis	Source: UNDP

Support in implementation

Training for long-term planning and scenario modelling to enhance skills and increase the group of technicians to lead the process		
1	Work package: Long-term energy planning	Source: UNDP
Assessment of renewable energy for primary healthcare		
2	Work package: Others	Source: UNDP



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SAUDI ARABIA

Membership since	GDP per capita	Total greenhouse gas emissions
29 January 2012	USD 30 436.28 (2022) ²	810.51 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
36 408 820 (2022) ¹	Total: 9 442 787 TJ (2020) (Renewable: 2 356 TJ)	

Renewable energy targets in first updated NDC⁵

Achieve 50% renewable energy in the total energy mix by 2030

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (10% area)
1.8-1.8 MWh/kWp/yr (95% area)
- **Wind:** <260 W/m² (43% area)
260-420 W/m² (55% area)
420-560 W/m² (5% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

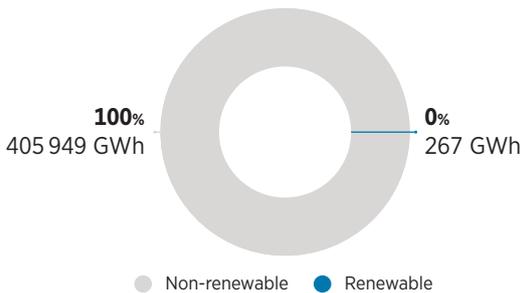
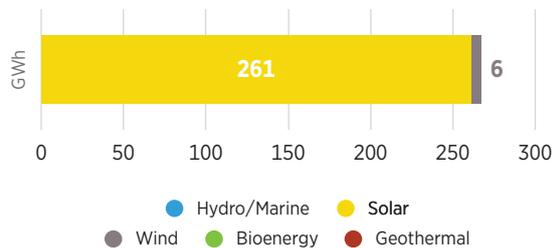


Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Saudi Arabia

Support in implementation

Support is currently under discussion

1	Work package:	Source:
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^{1, 2, 3, 4, 5, 6} World Bank national accounts data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



SENEGAL

Membership since		GDP per capita	Total greenhouse gas emissions
1 April 2012	LDC	USD 1 598.74 (2022) ²	30.61 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
17 316 449 (2022) ¹		Total: 194 771 TJ (2020) (Renewable: 85 237 TJ)	

Renewable energy targets in first NDC⁵

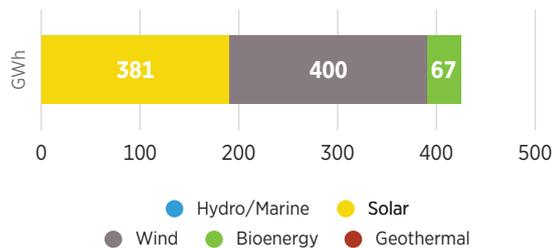
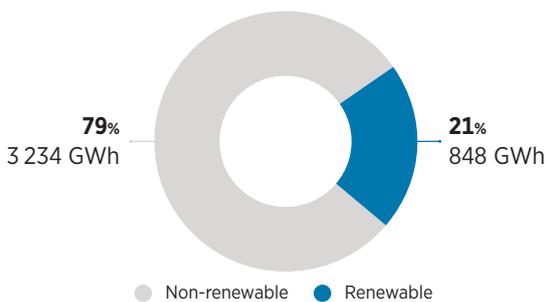
By 2030, 23% renewables in the electricity generation mix, corresponding to 632 MW, including 257 MW of solar, 225 MW of hydropower and 150 MW of wind

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (10% area)
1.6-1.8 MWh/kWp/yr (89% area)
- **Wind:** <260 W/m² (100% area)
- **Biomass:** 1.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Senegal

Support in implementation

Capacity building workshops

1	Work package: Long-term energy planning	Source: Government of Senegal
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile



SEYCHELLES

Membership since		GDP per capita	Total greenhouse gas emissions
2 June 2011	SIDS	USD 15 874.54 (2022) ²	0.61 MtCO ₂ eq (2019) ⁴
Population		TPES ³	
100 060 (2022) ¹		Total: 8 453 TJ (2020) (Renewable: 102 TJ)	
Renewable energy targets in first NDC ⁵		Resource potential ⁶	
Conditional (by 2030): 15.8 MW of solar		<ul style="list-style-type: none"> • Solar PV: 1.6-1.8 MWh/kWp/yr (100% area) • Wind: <260 W/m² (53% area) 260-420 W/m² (46% area) • Biomass: 6.5 tC/ha/yr 	
Unconditional (by 2030): 90 MW of solar			

Figure 1 **Total electricity generation (GWh, %)**

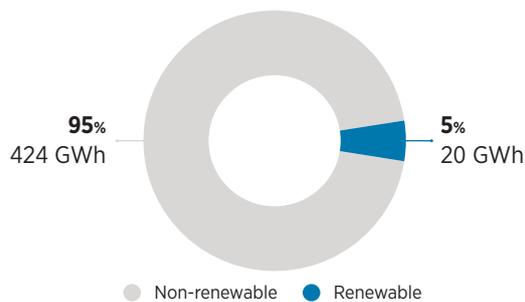
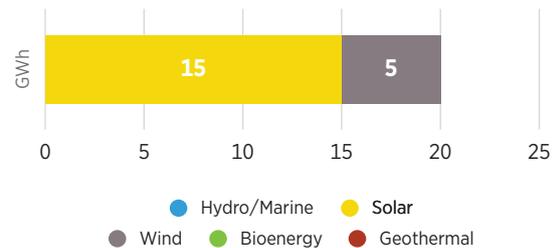


Figure 2 **Renewable generation by technology (GWh)**



Acknowledgement of IRENA support

“The supporting partners assisting Seychelles technically and financially to raise our ambitions by updating mitigation and adaptation targets and broadening the scope of our NDCs to cover a greater part of the economy, [include] IRENA...”

(SEYCHELLES’ FIRST [UPDATED] NDC SUBMISSION, 30 JULY 2021)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile

IRENA climate action engagement in Seychelles

Support completed

SolarCity simulator		
1	Work package: Resource assessment	Source: Government of Seychelles
Capacity building on climate investment and financial flows in the energy sector		
2	Work package: Project facilitation	Source: NDC Partnership

Support in implementation

Development of a technology infrastructure plan to support the decarbonisation of the transport sector using software tools and models		
1	Work package: Technology and infrastructure technical analysis	Source: NDC Partnership
Analysis of the grid stability and operation of the national power system for the integration of higher shares of renewable energy using software tools and models		
2	Work package: Technology and infrastructure technical analysis	Source: NDC Partnership



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SIERRA LEONE

Membership since		GDP per capita	Total greenhouse gas emissions
25 March 2011	LDC	USD 461.36 (2022) ²	7.12 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
8 605 718 (2022) ¹		Total: 70 893 TJ (2020) (Renewable: 56 155 TJ)	

Renewable energy targets in first updated NDC⁵

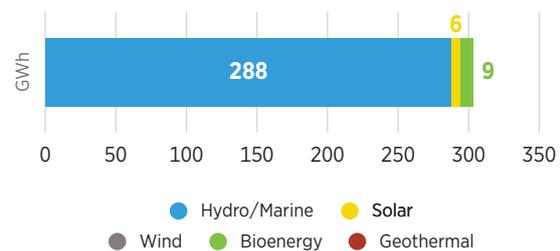
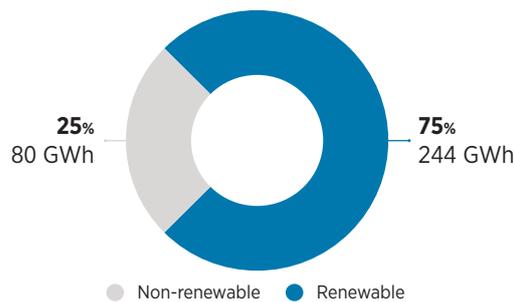
Improve energy efficiency and increase access to grid connections by 42% in 2025; increase off-grid mini-grid systems by 27% and solar stand-alone systems by 10% by 2030.

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (7% area)
1.2-1.4 MWh/kWp/yr (78% area)
1.4-1.6 MWh/kWp/yr (16% area)
- **Wind:** <260 W/m² (98% area)
260-420 W/m² (5% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Sierra Leone

Support in implementation

Project facilitation	
1 Work package: Project facilitation	Source: Government of Sierra Leone

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



SOLOMON ISLANDS

Membership since		GDP per capita	Total greenhouse gas emissions
4 August 2013	SIDS	USD 2 203.19 (2022) ²	0.59 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
724 273 (2022) ¹		Total: 7 559 TJ (2020) (Renewable: 3 350 TJ)	

Renewable energy targets in first NDC⁵

Unconditional (by 2030): 84 MW of hydropower and 1 250 MW of biodigesters

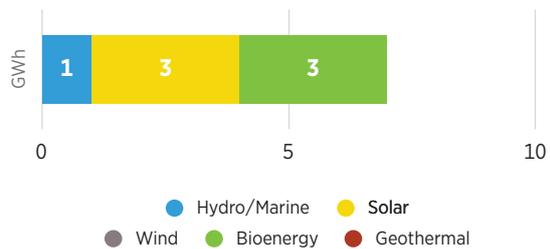
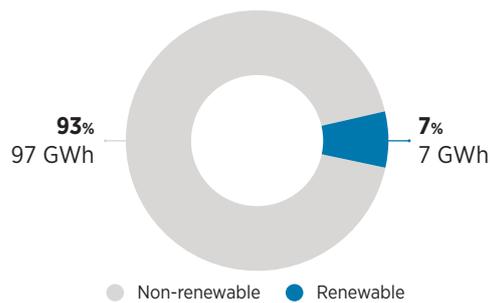
Conditional (by 2030): Reduce 15 316 Gg of CO₂eq via hydropower and 179 Gg of CO₂eq via solar

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (7% area)
1.2-1.4 MWh/kWp/yr (78% area)
1.4-1.6 MWh/kWp/yr (16% area)
- **Wind:** <260 W/m² (98% area)
260-420 W/m² (5% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Solomon Islands

Support in implementation

SolarCity Simulator	
1	<p>Work package: Resource assessment</p> <p>Source: Government of Solomon Islands</p>
2	<p>High-level assessment of grid hosting capacity and distribution to accommodate variable renewable energy integration and build the country's capacity for grid assessment studies; establishment of a working model of the electricity system through simulation software training</p> <p>Work package: Technology and infrastructure technical analysis</p> <p>Source: Government of Solomon Islands</p>
3	<p>Readiness assessment of the energy sector</p> <p>Work package: Renewables readiness assessment</p> <p>Source: Government of Solomon Islands</p>
4	<p>Socio-economic analysis</p> <p>Work package: Data and statistics</p> <p>Source: Government of Solomon Islands</p>

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



SOMALIA

Membership since		GDP per capita	Total greenhouse gas emissions
18 June 2011	LDC	USD 461.78 (2022) ²	33.36 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
17 597 511 (2022) ¹		Total: 159 232 TJ (2020) (Renewable: 150 834 TJ)	

Renewable energy targets in first NDC⁵

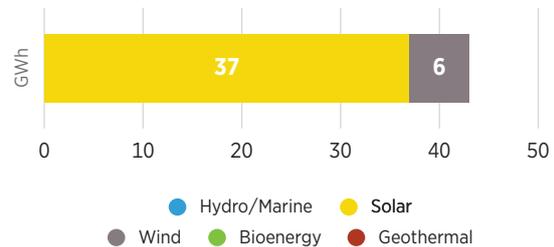
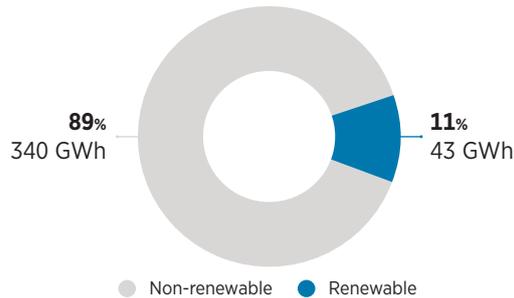
Does not include quantifiable renewable energy targets

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (36% area)
1.8-1.9 MWh/kWp/yr (40% area)
1.9-2.0 MWh/kWp/yr (23% area)
- **Wind:** <260 W/m² (48% area)
260-420 W/m² (38% area)
420-560 W/m² (10% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Somalia

Support in implementation

1 The Renewables Readiness Assessment (RRA) explores five main themes: national energy policy and strategy; institutions and markets; resources and technologies; business and financing models; and human and institutional capacity needed to scale up renewables. Through the RRA multi-stakeholder engagement process, the support intends to improve the enabling conditions for deploying renewables

Work package:
Renewables readiness assessment

Source:
Government of Somalia

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



SOUTH AFRICA

Membership since	GDP per capita	Total greenhouse gas emissions
30 December 2010	USD 6 776.48 (2022) ²	534.53 MtCO ₂ eq (2022) ⁴
Population	TPES³	
59 893 885 (2021) ¹	Total: 5 504 720 TJ (2020) (Renewable: 317 462 TJ)	

Renewable energy targets in first NDC⁵

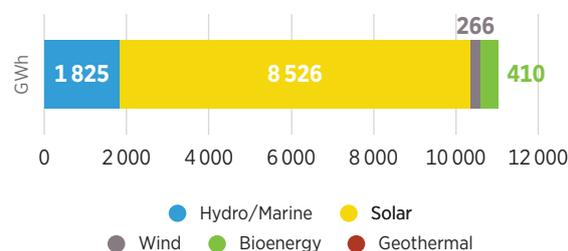
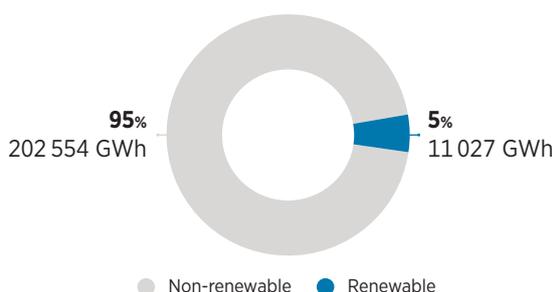
By 2030, produce 39.7% of electricity from renewable sources, including:
 17 742 MW of wind
 8 288 MW of solar
 4 600 MW of hydropower
 600 MW of CSP

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (17% area)
 1.6-1.8 MWh/kWp/yr (25% area)
 1.8-1.9 MWh/kWp/yr (29% area)
 1.9-2.0 MWh/kWp/yr (32% area)
 >2.0 MWh/kWp/yr (3% area)
- **Wind:** <260 W/m² (67% area)
 260-420 W/m² (18% area)
- **Biomass:** 4.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in South Africa

Support completed

1 Technical inputs from the FlexTool programme to assess the adequacy and flexibility of a more ambitious power expansion plan

Work package:
Power system flexibility

Source:
Government of the Republic of South Africa

Acknowledgement of IRENA support

"We are also very grateful ... [for] the support and advice provided by IRENA in the use of their FlexTool in the technical analysis."

(TECHNICAL ANALYSIS TO SUPPORT THE UPDATE OF SOUTH AFRICA'S FIRST NDC'S MITIGATION TARGET RANGES, APRIL 2021)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile (2020), Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile (2020)



SUDAN

Membership since		GDP per capita	Total greenhouse gas emissions
18 June 2011	LDC	USD 1 102.14 (2022) ²	107 114.21 KtCO ₂ eq (2020) ⁴
Population		TPES ⁵	
46 874 204 (2022) ¹		Total: 519 571 TJ (2020) (Renewable: 246 034 TJ)	

Renewable energy targets in first NDC⁵

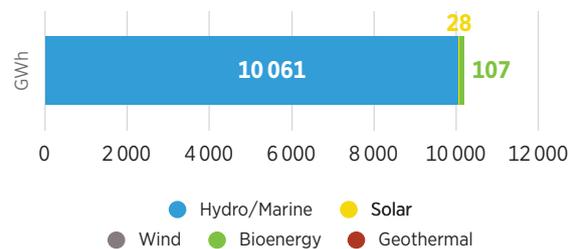
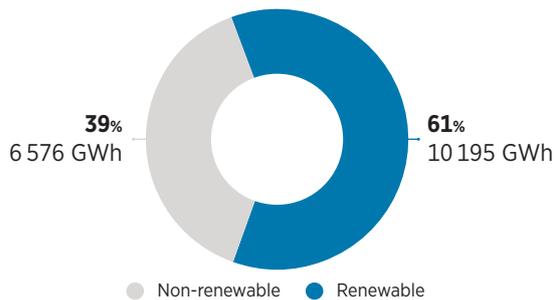
Utility-scale grid-connected solar and wind power plants; mini-grids for the residential, agricultural and industrial sectors; hydropower plant rehabilitation; energy-efficient appliances in the residential sector

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (36% area)
1.8-1.9 MWh/kWp/yr (40% area)
1.9-2.0 MWh/kWp/yr (23% area)
- **Wind:** <260 W/m² (48% area); 260-420 W/m² (38% area); 420-560 W/m² (10% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Sudan

Support completed

- Enhancement of ambition and other requirements for a good NDC specific to Sudan's circumstances; much more work is required, particularly country- and regional-specific data. Capacity building of sectoral institutions is needed to generate the data and information required for NDC work

Work package: Data and statistics	Source: NDC Partnership
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- Capacity building support on the design of auctions following a framework that classifies design elements according to auction demand (e.g. product, technology and volume auctioned). Capacity building support on Open Solar Contracts to empower the government with the practical skills to use these contracts in the procurement of affordable solar power

Work package: Capacity building on policy and finance	Source: NDC Partnership
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Support in implementation

- Support is currently under discussion

Work package:	Source:
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, World Bank national account data, Nationally Determined Contribution (2022), IRENA Statistical Profile



SYRIAN ARAB REPUBLIC

	GDP per capita	Total greenhouse gas emissions
State in accession	USD 537.2 (2020) ¹	46.31 MtCO ₂ eq (2022) ³
Population	TPES²	
22 125 249 (2022) ¹	Total: 368 349 TJ (2020) (Renewable: 3 198 TJ)	

Renewable energy targets in first NDC⁴

Conditional target:
10 GW of solar and 16 GW of wind

Resource potential⁵

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (3% area)
1.6-1.8 MWh/kWp/yr (77% area)
1.8-1.9 MWh/kWp/yr (25% area)
1.9-2.0 MWh/kWp/yr (2% area)
- **Wind:** <260 W/m² (42% area)
260-420 W/m² (50% area)
420-560 W/m² (10% area)
560-670 W/m² (2% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

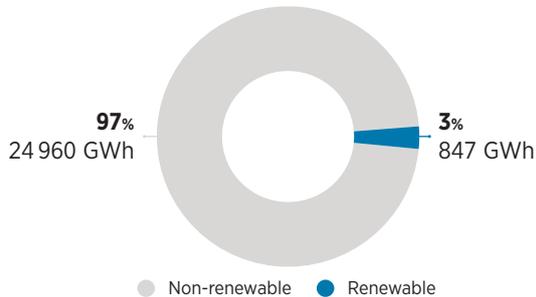
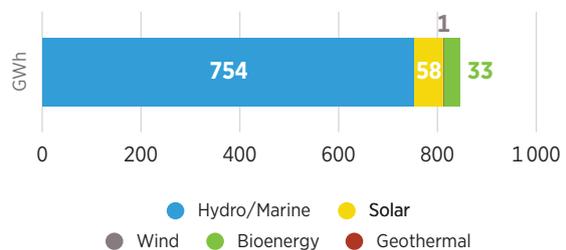


Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Syrian Arab Republic

Support in implementation

Support is currently under discussion

1	Work package:	Source:

^{1,2,3,4,5} World Bank national account data, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2018), IRENA Statistical Profile



THAILAND

Membership since	GDP per capita	Total greenhouse gas emissions
30 April 2016	USD 6 908.80 (2022) ²	463.87 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
71 697 030 (2022) ¹	Total: 5 2646 098 TJ (2020) (Renewable: 705 237 TJ)	

Renewable energy targets in second updated NDC⁵

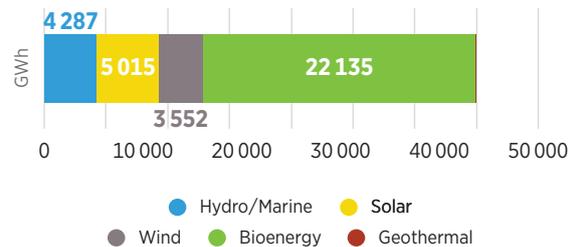
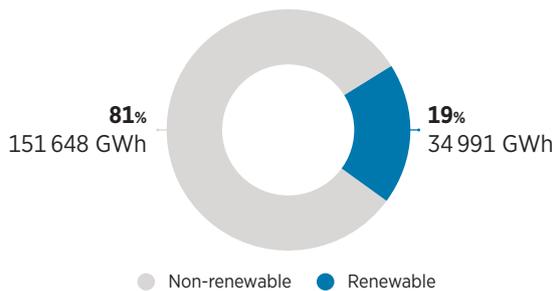
Achieve a 20% renewable share in power generation by 2036, a 30% renewable share in end-use energy by 2036, and a 30% reduction of energy intensity (compared to 2010) by 2036

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (20% area)
1.4-1.6 MWh/kWp/yr (80% area)
- **Wind:** <260 W/m² (96% area)
260-420 W/m² (2% area)
- **Biomass:** 6.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Thailand

Support in implementation

Support is currently under discussion

1	Work package:	Source:
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



TONGA

Membership since		GDP per capita	Total greenhouse gas emissions
6 March 2010	SIDS	USD 4 425.97 (2021) ²	0.28 MtCO ₂ eq (2019) ⁴
Population		TPES ³	
106 858 (2022) ¹		Total: 2 664 TJ (2020) (Renewable: 56 TJ)	

Renewable energy targets in the enhanced or second NDC⁵

By 2030, achieve a 3% (16 Gg) reduction in greenhouse gas emissions from the energy sector and 70% renewable electricity through solar, wind and battery storage

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (100% area)
- **Wind:** <260 W/m² (10% area)
260-420 W/m² (80% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

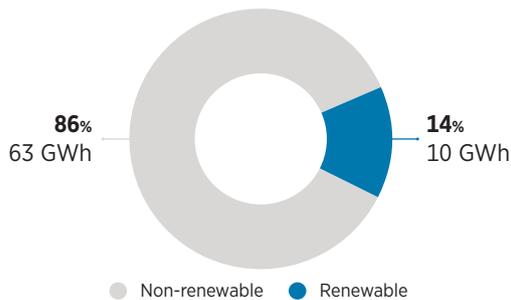
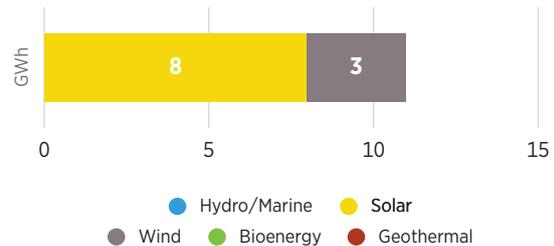


Figure 2 **Renewable generation by technology (GWh)**



^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2020), IRENA Statistical Profile

IRENA climate action engagement in Tonga

Support completed

- 1 Capacity building trainings on forestry inventory, greenhouse gas inventory system set-up and the information necessary for clarity, transparency and understanding. Support for data collection and collation to inform the defining of the adaptation goal and target and refining of sub-sector emission reduction targets for agriculture, energy, transport and waste. Strengthening and adding sectoral greenhouse gas reduction targets and sectoral non-greenhouse gas targets. Aligning NDC targets with the country's long-term strategies (LTS)

Work package: Data and statistics	Source: NDC Partnership
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- 2 Support for data collection and collation to inform the defining of the adaptation target/goal and refining of sub-sector emission reduction targets for agriculture, energy, transport and waste

Work package: Data and statistics	Source: Government of Tonga
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- 3 Strengthening and adding sectoral greenhouse gas reduction targets and sectoral non-greenhouse gas targets. Aligning NDC targets with Tonga's LT-LEDS

Work package: Data and statistics	Source: NDC Partnership
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Support in implementation

Grid integration study and resource assessment

- 1 **Work package:**
Power system flexibility
- Source:**
NDC Partnership

Energy surveys for NDC implementation roadmaps

- 2 **Work package:**
Data and statistics
- Source:**
Government of Tonga

Analysis of the grid stability and operation of the national power system for the integration of higher shares of renewable energy using software tools and models

- 3 **Work package:**
Data and statistics
- Source:**
Government of Tonga



Don Mammoser © Shutterstock.com



TRINIDAD AND TOBAGO

Membership since		GDP per capita	Total greenhouse gas emissions
15 February 2014	SIDS	USD 18 222.26 (2022) ²	45.91 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
1 531 044 (2022) ¹		Total: 614 838 TJ (2020) (Renewable: 296 TJ)	

Renewable energy targets in first NDC⁵

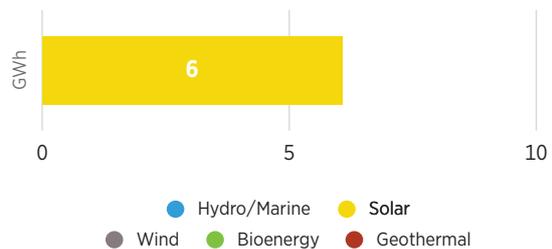
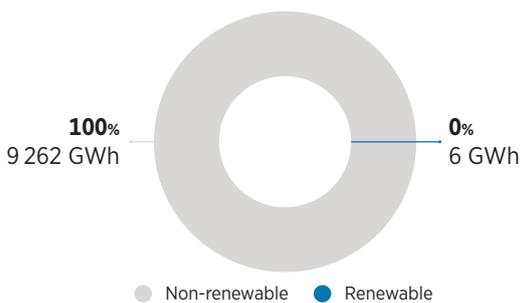
Does not include quantifiable renewable energy targets

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (10% area)
1.6-1.8 MWh/kWp/yr (92% area)
- **Wind:** <260 W/m² (95% area)
260-420 W/m² (8% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Trinidad and Tobago

Support in implementation

Assessment of the cost effectiveness of mitigation options for the power and transport sectors as input to the development of renewable energy policy and NDC implementation

1	Work package: Technology and infrastructure technical analysis	Source: Government of Trinidad and Tobago
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Readiness assessment of the energy sector

2	Work package: Renewables readiness assessment	Source: Government of Trinidad and Tobago
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Technology plan for renewable energy transport electrification to support the NDC enhancement and implementation

2	Work package: Technology and infrastructure technical analysis	Source: Government of Trinidad and Tobago
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2018), IRENA Statistical Profile



TÜRKIYE

Membership since	GDP per capita	Total greenhouse gas emissions
1 April 2012	USD 10 616.06 (2022) ²	687.53 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
85 341 241 (2022) ¹	Total: 5 996 214 TJ (2020) (Renewable: 871 745 TJ)	

Renewable energy targets in first updated NDC⁵

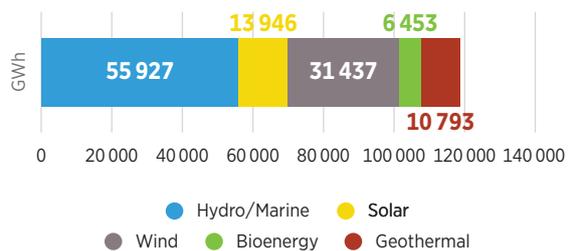
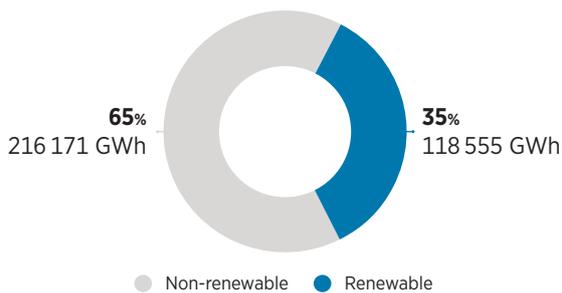
Increase renewable energy sources in primary energy consumption to 20.4% by 2030. By 2030, achieve around 33 GW of solar-installed power capacity, 18 GW of wind installed power capacity and 35 GW of hydropower installed capacity

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (17% area)
1.4-1.6 MWh/kWp/yr (45% area)
1.6-1.8 MWh/kWp/yr (37% area)
- **Wind:** <260 W/m² (82% area)
260-420 W/m² (10% area)
- **Biomass:** 3.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Türkiye

Support in implementation

Solar City simulator	
1	<p>Work package: Resource assessment</p> <p>Source: Government of Türkiye</p>
Overview of Türkiye's finance and policy landscape and the barriers affecting solar PV and solar thermal investments at the municipal level	
2	<p>Work package: Resource assessment</p> <p>Source: Government of Türkiye</p>

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2023), IRENA Statistical Profile



TUVALU

Membership since		GDP per capita	Total greenhouse gas emissions
12 February 2013	SIDS	USD 5 334.98 (2022) ²	21.74 KtCO ₂ eq (2020) ⁴
Population		TPES ³	
11 312 (2022) ¹		Total: 136 TJ (2020) (Renewable: 6 TJ)	

Renewable energy targets in first NDC⁵

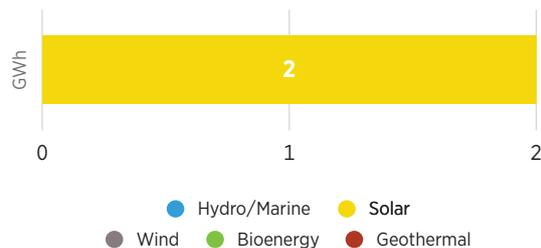
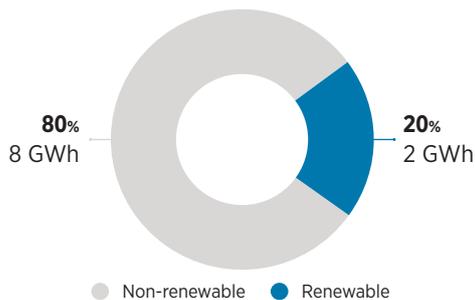
Generate around 90% of electricity from renewable sources

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (75% area)
- **Wind:** <260 W/m² (98% area)
260-420 W/m² (5% area)
- **Biomass:** 4.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Tuvalu

Support in implementation

Technical grid assessment of the stability of the grid to provide a path to reduce power generation's reliance on fossil fuels

1

Work package: Technology and infrastructure technical analysis	Source: Government of Tuvalu
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, World Bank national account data, Nationally Determined Contribution (2022), IRENA Statistical Profile



UGANDA

Membership since	LDC / LLDC	GDP per capita	Total greenhouse gas emissions
17 May 2012		USD 964.22 (2022) ²	56.49 MtCO ₂ eq (2022) ⁴
Population		TPES³	
47 249 585 (2022) ¹		Total: 1 222 614 TJ (2019) (Renewable: 1 150 984 TJ)	

Renewable energy targets in first NDC⁵

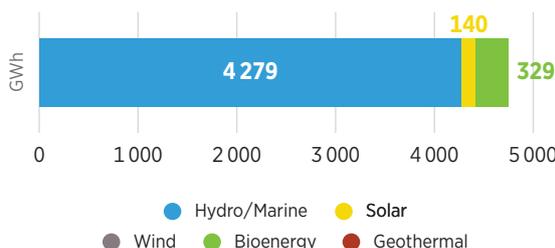
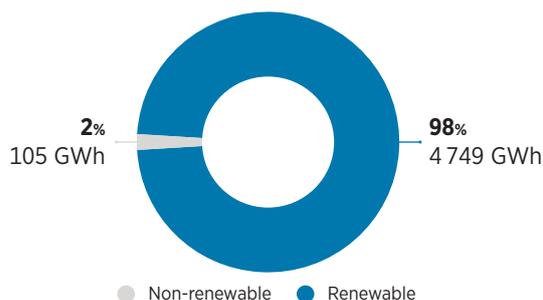
By 2030, promote use of renewable energy sources and energy-efficient technologies to reach 4 200 MW, aligning with the third National Development Plan

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (47% area)
1.6-1.8 MWh/kWp/yr (52% area)
- **Wind:** <260 W/m² (100% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Uganda

Support in implementation

- 1 Data collection and collation to inform the defining of the adaptation target/goal and refining of sub-sector emission reduction targets for agriculture, energy, transport and waste. Includes: conduct energy data audit, analyse results, identify gaps and prepare activities to bridge the gaps; train NDC stakeholders in the analysis of energy statistics, including their use for appraising and setting targets; support NDC stakeholders in the identification, appraisal and refinement of energy-related targets, including contribution to and/or peer review of the revised NDC

Work package:
Data and statistics

Source:
NDC Partnership

Acknowledgement of IRENA support

"On behalf of the Ministry of Water and Environment, I wish to take this opportunity to thank all the partners and stakeholders involved in the NDC update process for their technical and financial support. These include ... the International Renewable Energy Agency (IRENA)."

(UGANDA'S FIRST [UPDATED] NDC SUBMISSION, 12 SEPTEMBER 2022)

^{1, 2, 3, 4, 5, 6} World Bank national accounts data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profiles



UKRAINE

Membership since	GDP per capita	Total greenhouse gas emissions
24 February 2018	USD 4 533.98 (2022) ²	208.61 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
30 000 000 (2022) ¹	Total: 3 453 996 TJ (2020) (Renewable: 199 354 TJ)	

Renewable energy targets in first NDC⁵

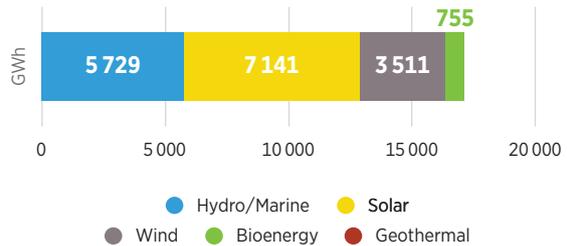
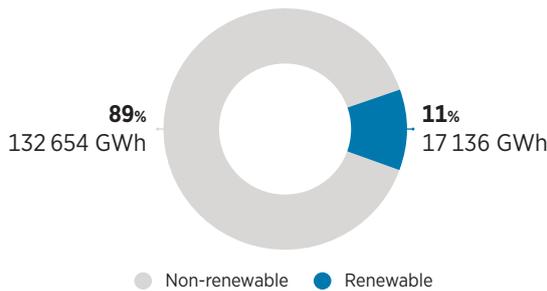
Does not include quantifiable renewable energy targets

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (17% area)
1.6-1.8 MWh/kWp/yr (76% area)
- **Wind:** <260 W/m² (10% area)
420-560 W/m² (80% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Ukraine

Support in implementation

Capacity building programme to increase renewable energy investment

1

Work package:
Project facilitation

Source:
Government of Ukraine

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



UNITED ARAB EMIRATES

Membership since

18 July 2009

Population

9 441 129 (2022)¹

GDP per capita

USD 53 757.86 (2022)²

TPES³

Total: 3 639 972 TJ (2020)
(Renewable: 26 239 TJ)

Energy related emissions relative to global

295.11 MtCO₂eq (2022)⁴

Renewable energy targets in third NDC⁵

Increase the share of clean energy, including solar PV, concentrating solar thermal power and nuclear, to 50% of the installed power capacity mix by 2050, and reduce energy consumption 40% by 2050

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (10% area)
1.8-1.9 MWh/kWp/yr (95% area)
- **Wind:** <260 W/m² (80% area)
260-420 W/m² (18% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

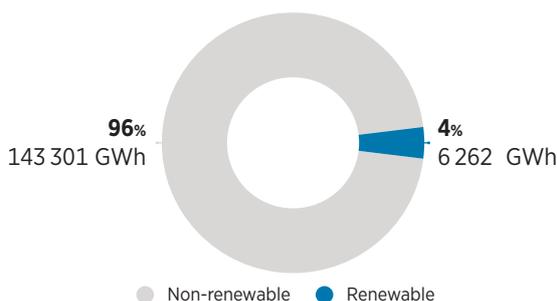
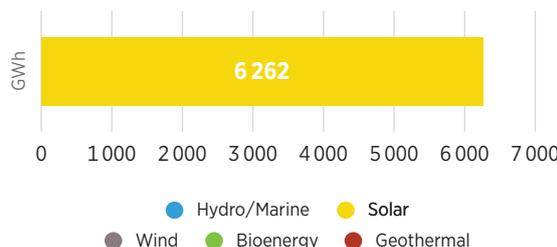


Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in United Arab Emirates

Support in implementation

Support is currently under discussion

1

Work package:

Source:

Acknowledgement of IRENA support

"In furthering bilateral and multilateral collaboration on technology development and deployment, the UAE has championed infrastructure and energy projects. These efforts have been pursued through formal channels including, but not limited to, the UAE-Pacific Partnership Facility for Pacific island countries, the UAE-Caribbean Renewable Energy Fund, and the joint project facility by IRENA and Abu Dhabi Fund for Development that supports renewable energy projects in developing countries."

(UNITED ARAB EMIRATES' SECOND NDC, 29 DECEMBER 2020)

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2023), IRENA Statistical Profile



URUGUAY

Membership since	GDP per capita	Total greenhouse gas emissions
28 August 2011	USD 20 795.04 (2022) ²	41.91 MtCO ₂ eq (2022) ⁴
Population	TPES ³	
3 422 794 (2022) ¹	Total: 221 134 TJ (2020) (Renewable: 132 382 TJ)	

Renewable energy targets in second NDC⁵

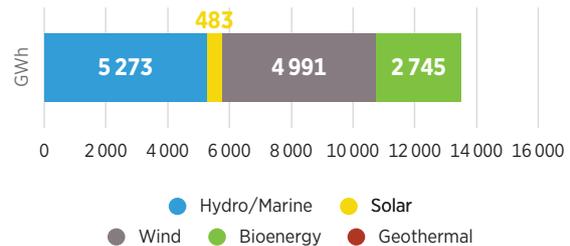
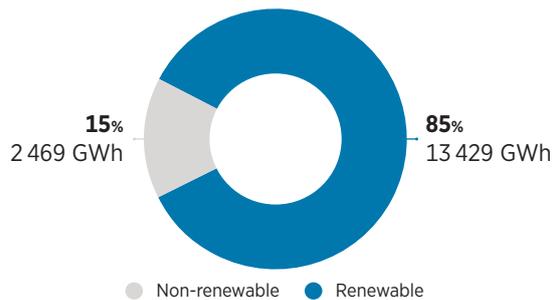
Achieve renewable energy shares of 58% of the global primary energy mix and 94% of electricity generation by 2020

Resource Potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (100% area)
- **Wind:** <260 W/m² (97% area)
260-420 W/m² (5% area)
- **Biomass:** 8.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Uruguay

Support completed

- Technical inputs from the FlexTool programme to assess the adequacy and flexibility of a more ambitious power expansion plan

Work package:	Source:
Power system flexibility	NDC Partnership
- Technical report with references to relevant existing published work that supports biomass gasification for production of hydrogen and methanol

Work package:	Source:
Technology and infrastructure technical analysis	NDC Partnership

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



UZBEKISTAN

Membership since		GDP per capita	Total greenhouse gas emissions
24 August 2017	LLDC	USD 2 255.15 (2022) ²	138.14 MtCO ₂ eq (2019) ⁴
Population		TPES ⁵	
35 648 100 (2022) ¹		Total: 1 795 704 TJ (2020) (Renewable: 21 409 TJ)	

Renewable energy targets in first NDC⁵

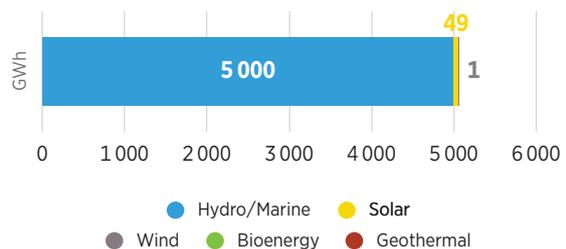
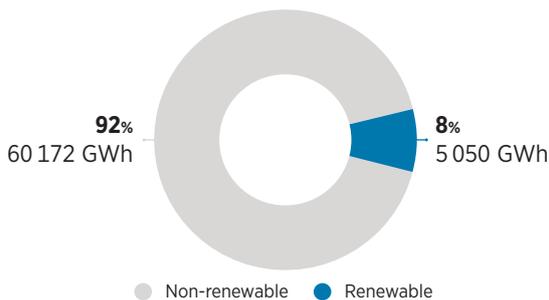
Increase renewables to 25% of total power generation; install a total capacity of 10 GW, including 5 GW of solar, 3 GW of wind and 1.9 GW of hydropower plants

Resource potential⁶

- **Solar PV:** 1.2-1.4 MWh/kWp/yr (10% area)
1.4-1.6 MWh/kWp/yr (90% area)
- **Wind:** <260 W/m² (25% area)
260-420 W/m² (58% area)
420-560 W/m² (15% area)
- **Biomass:** 0.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Uzbekistan

Support in implementation

Solar City simulator		
1	Work package: Resource assessment	Source: UNDP
Support for development of bankable projects		
2	Work package: Project facilitation	Source: Government of Uzbekistan

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



VANUATU

Membership since		GDP per capita	Total greenhouse gas emissions
1 March 2013	SIDS	USD 3 010.29 (2022) ²	0.59 MtCO ₂ eq (2022) ⁴
Population		TPES ³	
326 740 (2022) ¹		Total: 3 819 TJ (2020) (Renewable: 912 TJ)	

Renewable energy targets in updated first NDC⁵

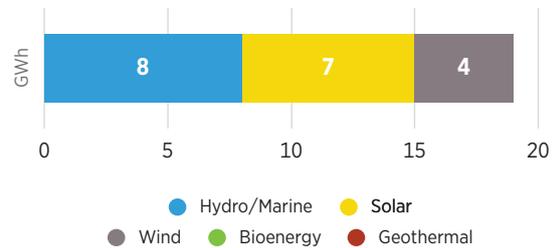
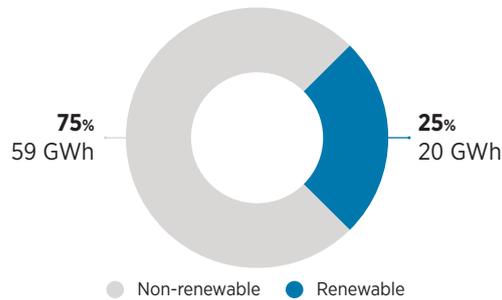
Transition to near-100% renewable electricity generation; grid-connected targets for renewable generation of 11.69% by 2010, 50% by 2025 and 100% by 2030; and other targets

Resource potential⁶

- **Solar PV:** <1.2 MWh/kWp/yr (10% area)
1.2-1.4 MWh/kWp/yr (47% area)
1.4-1.6 MWh/kWp/yr (42% area)
- **Wind:** <260 W/m² (76% area)
260-420 W/m² (18% area)
420-560 W/m² (5% area)
679-820 W/m² (2% area)
- **Biomass:** 10.5 tC/ha/yr

Figure 1 Total electricity generation (GWh, %)

Figure 2 Renewable generation by technology (GWh)



IRENA climate action engagement in Vanuatu

Support in implementation

1 Technical grid assessment of the stability of the grid to provide a path to reduce power generation's reliance on fossil fuels

Work package: Technology and infrastructure technical analysis	Source: Government of Vanuatu
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^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2022), IRENA Statistical Profile



ZAMBIA

Membership since	LDC / LLDC	GDP per capita	Total greenhouse gas emissions
22 June 2013		USD 1 487.91 (2022) ²	30.33 MtCO ₂ eq (2022) ⁴
Population		TPES³	
20 017 675 (2022) ¹		Total: 479 772 TJ (2020) (Renewable: 386 025 TJ)	

Renewable energy targets in first NDC⁵

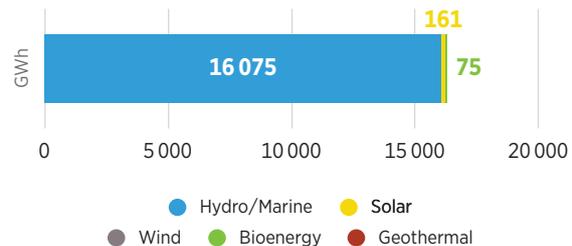
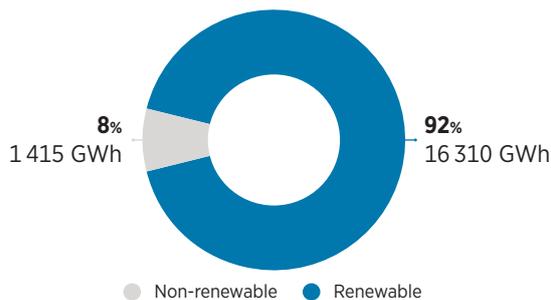
By 2030, achieve 30% renewables in the electricity generation mix (excluding large hydropower)

Resource potential⁶

- **Solar PV:** 1.6-1.8 MWh/kWp/yr (95% area)
1.8-1.9 MWh/kWp/yr (8% area)
- **Wind:** 260 W/m² (100% area)
- **Biomass:** 2.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Zambia

Support completed

Strengthen MRV system data collection, greenhouse gas projections analysis, and alignment of target with respective sector policies, strategies and plans. Integration of the NDC MRV system with the

- 1 Central Statistics Office for national reporting and communication of projections

Work package:	Source:
Monitoring, reporting and verification (MRV)	NDC Partnership

Integrate the NDC MRV system with the Central Statistics Office for national reporting and communication of projections

- 2 **Work package:** Monitoring, reporting and verification (MRV) **Source:** NDC Partnership

Capacity building to data providers and establishment of data sharing platforms for quality assurance

- 3 **Work package:** Data and statistics **Source:** NDC Partnership

^{1, 2, 3, 4, 5, 6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



ZIMBABWE

Membership since		GDP per capita	Total greenhouse gas emissions
17 September 2014	LLDC	USD 1 266.99 (2022) ²	30.19 MtCO ₂ eq (2022) ⁴
Population		TPES ⁵	
16 320 537 (2022) ¹		Total: 443 292 TJ (2020) (Renewable: 348 857 TJ)	

Renewable energy targets in first NDC⁵

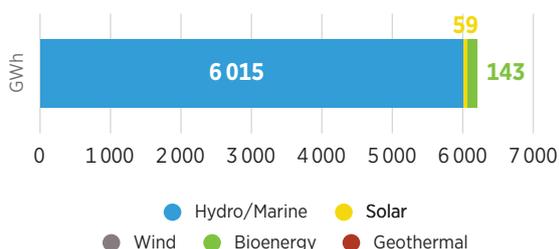
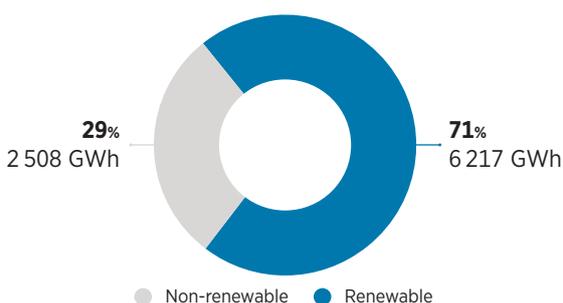
Increase electricity demand 16.5% by 2025 and 26.5% by 2030, corresponding to 2 100 MW of renewable energy capacity, including: 1 575 MW of solar, 275 MW of bioenergy, 150 MW of small hydropower, 100 MW of wind, 8 000 biodigesters and 288 institutional biodigesters

Resource potential⁶

- **Solar PV:** 1.4-1.6 MWh/kWp/yr (3% area)
1.6-1.8 MWh/kWp/yr (75% area)
1.8-1.9 MWh/kWp/yr (25% area)
- **Wind:** <260 W/m² (98% area)
260-420 W/m² (3% area)
- **Biomass:** 2.5 tC/ha/yr

Figure 1 **Total electricity generation (GWh, %)**

Figure 2 **Renewable generation by technology (GWh)**



IRENA climate action engagement in Zimbabwe

Support completed

1 Technical report referencing existing published works and providing support to the comparative analysis of energy scenarios to inform the country's NDC enhancement process

Work package:

Technology and infrastructure technical analysis

Source:

NDC Partnership

Acknowledgement of IRENA support

"Zimbabwe's Revised NDC Report was developed under the auspices of the ... International Renewable Energy Agency (IRENA). The Government of Zimbabwe (GOZ) would like to thank these organisations for their support in delivering Zimbabwe's revised Nationally Determined Contribution (NDC)."

(ZIMBABWE'S FIRST [UPDATED] NDC SUBMISSION, 24 SEPTEMBER 2021)

^{1,2,3,4,5,6} World Bank national account data, OECD National Accounts data files, IRENA Statistical Profile, Emissions Database for Global Atmospheric Research, Nationally Determined Contribution (2021), IRENA Statistical Profile



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