IRENA
International Renewable Energy Agency

ASSESSMENT OF THE RENEWABLE ENERGY COMPONENTS IN NATIONALLY DETERMINED CONTRIBUTIONS

Methodology

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This is a background document to *Untapped potential for climate action: Renewable energy in Nationally Determined Contributions* (IRENA, 2017a).

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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Contents

Abbreviations

°C	Degrees centigrade
CAGR	Compound annual growth rate
COP21	21st session of the Conference of the Parties
COP23	23rd session of the Conference of the Parties
CO_2	Carbon dioxide
CO_2eq	Carbon dioxide equivalent
CSP	Concentrated solar power
EIA	US Energy Information Administration
EU	European Union
EUR	Euro
FY	Fiscal year
GHG	Greenhouse gas
gpd	Gallons per day
GWh	Gigawatt-hour
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
kt	Kilotonne
ktoe	Thousand tonnes of oil equivalent
kW	Kilowatt
kWp	Kilowatt peak
LULUCF	Land Use, Land-Use Change and Forestry
m^2	Square meter
m^3	Cubic meter
MW	Megawatt
N_2O	Nitrous oxide
NDC	National Determined Contribution
OECD	Organisation for Economic Co-operation and Development
PV	Photovoltaic
SHS	Solar home system
SIDS	Small island developing state
SWH	Solar water heaters
t	Tonne
TJ	Terajoule
UNFCCC	United Nations Framework Convention on Climate Change
USD	US dollar
W	Watt

1 Introduction

The International Renewable Energy Agency (IRENA), as part of its work to promote the widespread adoption and sustainable use of renewables, has analysed the the Nationally Determined Contributions (NDCs) submitted by 194 Parties to the United Nation Framework Convention on Climate Change (UNFCCC). Specifically, this includes reviewing the renewable energy components of NDCs as developed by late 2017 and estimating the investment required to implement such components.

This background document provides an overview of the methodology for IRENA's analysis, which was first presented in the report *Untapped Potential for Climate Action: Renewable Energy in Nationally Determined Contributions* (IRENA, *2017a*). The report was released in November 2017, on the occasion of COP23, the 23rd Conference of the Parties to the UNFCCC, held in Bonn, Germany. The results of this analysis by country can be browsed through an online data tool published on IRENA's website (IRENA, 2017b).

This analysis lays the foundations for IRENA's comprehensive analytic framework, intended to inform continual updates of the renewable energy targets in NDCs and ensure their alignment with other national energy plans. This is especially significant as countries pursue an agreed 2018 Facilitative Dialogue and further revision of their NDCs.

2 Background

During the 21st session of the Conference of the Parties to the UNFCCC (COP21) in December 2015, countries[1] around the world adopted the Paris Agreement. The historic agreement sets the objective of holding the increase in global average temperature to well below 2 degrees centigrade (°C) above preindustrial levels, and of pursuing efforts to limit the increase to 1.5°C. To reach this objective, the Paris Agreement establishes a bottom-up framework for climate action and calls for substantial efforts from all countries, based on the principle of common but differentiated responsibilities and respective capabilities.

By the start of negotiations for the Paris Agreement, out of the 197 Parties to the UNFCCC, 195 had signed the Agreement and 194 had submitted their intended Nationally Determined Contributions (INDCs)[2] – national plans outlining each Party's efforts to reduce greenhouse gas (GHG) emissions and adapt to the impacts of climate change. These INDCs typically contain a combination of conditional and unconditional contributions. While conditional contributions are implemented subject to the availability of international support for their implementation, unconditional

[1] The term "country" is used in this report to indicate parties to the UNFCCC and does not imply the expression of any opinion on the part of IRENA concerning the legal status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

[2] As of 15 October 2017, Nicaragua and the Syrian Arab Republic had not signed the Paris Agrement, while Libya had not submitted its INDC.

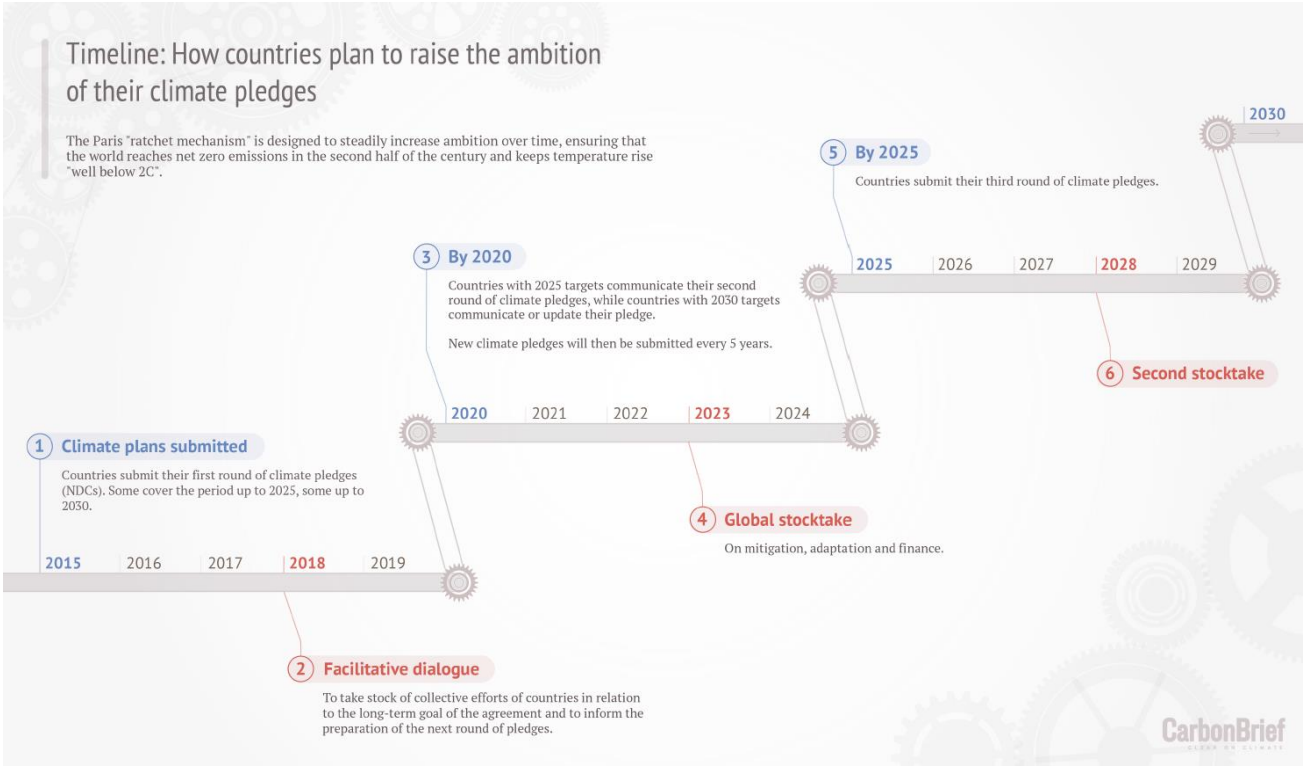
contributions are those that countries intend to implement regardless of international climate assistance

On 4 November 2016, the Paris Agreement entered into force with the ratification of 63 countries. As Parties progressively ratified the Paris Agreement, they submitted their first formalised NDCs, usually confirming their INDC. As of 15 October 2017 (the point captured in the report), the number of ratifying Parties had reached 168. [3]

The majority of NDCs include targets for renewables as a means of transitioning to a low-carbon economy and building climate resilience. To implement these targets, substantial investment will have to be mobilised in the renewable energy sector from various financing sources, both public and private, domestic and international.

A "ratcheting mechanism" built into the Paris Agreement requires Parties to update or submit new NDCs over time, which must be progressively more ambitious. As depicted in Figure 1, the second round of NDCs is due in 2020 with revisions planned every five years thereafter. In 2020, each Party will have to submit a new NDC if the first NDC runs to 2025, and an updated NDC if the first runs to 2030. Countries agreed to continue discussions through a so-called Facilitative Dialogue over the course of 2018, during which Parties were to take stock of initial progress towards the collective goals under the Paris Agreement. The findings of this process should inform the preparation of the revised NDCs. The Facilitative Dialogue is to be followed by a global stocktake every five years, starting in 2023.

Figure 1. The Paris Agreement's "ratchet mechanism"



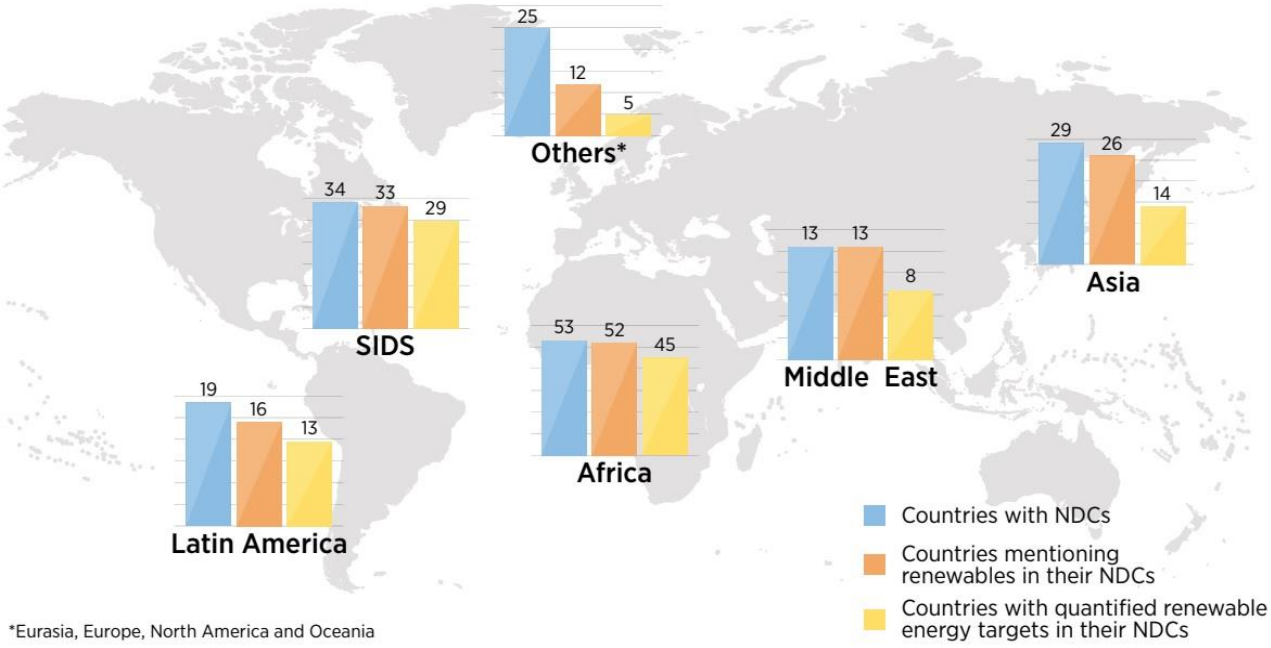
Source: IRENA (2016).

[3] IRENA's initial NDC analysis considers the ratification status of the Paris Agreement as of 15 October 2017.

3 Description of the data

The analysis in the main report (IRENA, 2017a) encompasses 166 Nationally Determined Contributions (NDCs) covering 194 Parties to the UNFCCC,[4] of which 26 were still in the form of Intended Nationally Determined Contributions (INDCs). A total of 145 NDCs explicitly mention renewables as part of their mitigation and/or adaptation strategies to achieve overall climate commitments; of these, 109 NDCs include quantified renewable energy targets (see Figure 2), although the metric used and the level of detail to express such targets vary considerably.

Figure 2. Renewable energy components in NDCs



Global totals differ from the sum of regional totals as seven SIDS are included simultaneously in other regional groups.
Source: IRENA (2017a).

The majority of renewable energy targets are expressed in terms of absolute physical units. For the power sector, these can include installed additional or total future power capacity in megawatts (MW), electricity generation in gigawatt-hours (GWh), number of mini-grids, solar lanterns, solar pumps and/or solar home systems (SHS). For end-use sectors, i.e. heating, cooling and transport, targets can be expressed, for example, in terms of million litres of biofuel produced or as number of installed bio digesters and/or solar water heaters (SWH).

Very often renewable energy targets are expressed as shares of future total electricity generation or energy production/consumption. A number of NDCs also include targets in terms of investment need, either in US dollars (USD) or in local currency, and/or with reference to emission reductions targeted, either in carbon dioxide (CO_2) or carbon dioxide equivalent (CO_2eq).

Table 1 shows the types of renewable energy targets included in current NDCs, broken down by region. Notably, the majority of NDCs contain more than one type of renewable energy targets, e.g.

[4] The 28 EU Member Countries submitted a joint NDC.

they include a target in terms of share of electricity generation and further specify the amount of additional installed capacity and/or investment needed to achieve such target.

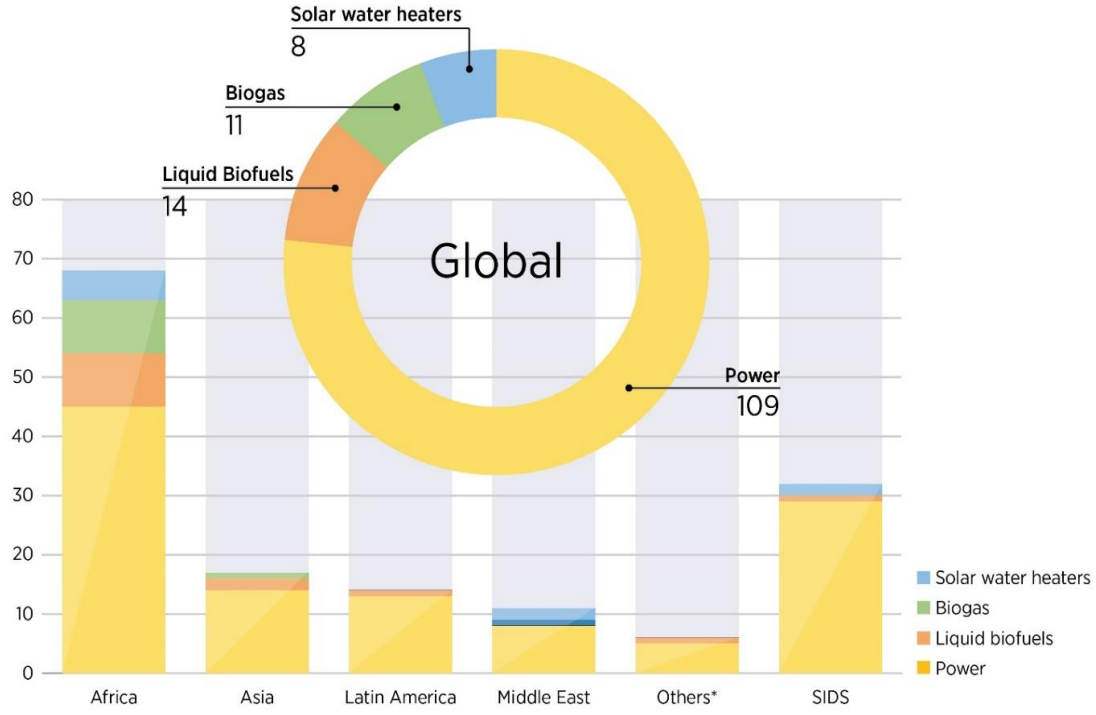
Table 1. Types of metric used in NDCs to express renewable energy targets

Renewable energy target	Global	Africa	Asia	Latin America	Middle East	Others*	SIDS
in terms of absolute physical units	74	32	12	7	3	5	20
as a share of electricity generation or energy production/consumption	64	21	10	10	7	5	19
in terms of emission reduction	12	6	0	1	0	1	5
in terms of investment needs	37	23	4	1	2	2	7

** Eurasia, Europe, North America and Oceania.*
Global totals differ from the sum of regional totals as seven SIDS are included simultaneously in other regional groups.
Based on compliation of Nationally Determined Contributions (NDCs) as published by governments.

While 109 NDCs include quantified renewable energy targets for the power sector, only 14 include them for liquid biofuels, 11 for biogas and 8 for solar water heaters (see Figure 3).

Figure 3. Renewable energy targets in NDCs by sector



** Eurasia, Europe, North America and Oceania.*
Global totals differ from the sum of regional totals as seven SIDS are included simultaneously in other regional groups.
Source: IRENA (2017a).

3.1 NDC-based targets for the power sector

A total of 109 Parties include quantified targets for electricity generated from renewable resources in their NDCs. Based on IRENA's definitions, this includes electricity produced from bioenergy, geothermal energy, hydropower (excluding pumped storage),[5] marine energy, solar energy, and wind energy. Details about each country's renewable energy targets for the power sector are included in the Annex.

3.2 NDC targets for liquid biofuels

A total of 14 Parties include quantified targets for liquid biofuels in their NDCs, as summarised in Table 2 below. Brazil has by far the largest contribution for liquid biofuels; IRENA estimates that achieving 18% of biofuels in Brazil's primary energy mix by 2030 will amount to an additional 2.5 million TJ of biofuels, at an estimated investment cost between USD 50.8 billion and USD 92.3 billion.

Table 2. NDC targets for liquid biofuels

Country	Unconditional targets in the NDC	Conditional targets in the NDC
Angola		23 million litres/year of ethanol at USD 0.54-1 billion
Brazil	18% share of biofuels in primary energy mix by 2030	
Central African Republic		USD 27.5 million worth of biofuels (or 250 kt CO_2eq)
Eritrea		107 kt CO_2eq/year worth of biodiesel by 2030
Eswatini		10% bioethanol blend by 2030
Guinea		3000 kWp from biofuels
Indonesia	90% mandatory B30 in transportation	100% mandatory B30 in transportation
Kiribati		Reduction of 11780 t CO_2eq in the transport sector and 12050 t CO_2eq in the power sector by 2025 through biodiesel from coconut oil
Lao People's Democratic Republic	10% of the demand for transport fuels coming from bioethanol and biodiesel by 2025	
Liberia		5% biodiesel blend
Malawi	18 million litres/year of ethanol and 2 million litres/year of biodiesel	Additional 22 million litres/year of ethanol and 18 million litres/year of biodiesel
Congo	EUR 0.65 million/year worth of biofuels	EUR 3.25 million/year worth of biofuels
The former Yugoslav Republic of Macedonia		5% share of biofuels by 2020 and 10% by 2025, to be maintained until 2035
Zimbabwe		Reduction of 202 t CO_2eq by 2030 from ethanol blending (at USD 100 million)

Based on compliation of Nationally Determined Contributions (NDCs) as published by governments.

[5] That is, excluding production from pumped storage in mixed plants and pure pumped storage facilities.

3.3 NDC targets for biogas

A total of 11 Parties include quantified biogas targets in their NDCs, as summarised in Table 3. Most targets are expressed in terms of number of biogas digesters, or bio-digesters. Most bio-digesters are domestic scale, although some NDCs also include targets for larger-scale ones. Burkina Faso, Malawi and Rwanda also include targets for methane recovery.

Biogas from bio-digesters is intended for direct use, as source of heating or cooking fuel; consequently, no installed power capacity equivalents (i.e. in MW) is provided. Methane recovery is intended for electricity generation in Malawi, the State of Palestine and Rwanda, whereas Burkina Faso's NDCs does not provide additional information.

Table 3. NDC targets for biogas

Country	Unconditional targets in the NDC	Conditional targets in the NDC
Burkina Faso	USD 19.7 million for bio-digesters	USD 189 million for 75000 bio-digesters, and USD 81.2 million for methane recovery from water treatment plant and landfill
Eritrea		Reduction of 28.1 kt CO_2eq/year by 2030 through bio-digesters
Ghana		USD 5 million for 200 large-scale bio-digesters
Lesotho		USD 108 million for 60000 bio-digesters
Malawi		95 GWh/year from methane recovery from landfill
Namibia		10% N_2O emissions reduction by 2030 through biogas
Nepal		130000 household systems, 1000 institutional and 200 community biogas plants
State of Palestine		Recovery of 14000 tonnes per year of landfill gases for electricity generation
Rwanda		35000 domestic bio-digesters, 15 large-scale bio-digesters, and unspecified landfill methane recovery for power generation
Senegal	27500 bio-digesters	49000 bio-digesters
Zimbabwe	1250 bio-digesters (50-80 m^3)	

Based on compliation of Nationally Determined Contributions (NDCs) as published by governments.

3.4 NDC targets for solar water heating

Eight Parties include quantified targets for solar water heating in their NDCs, as summarised in Table 4. These targets can be expressed in number of solar water heaters (SWH) installed, m^2 of solar collectors, targeted emission reductions, or investment need.

Table 4: NDC targets for solar water heating

Country	Unconditional targets in the NDC	Conditional targets in the NDC
Cuba		200000 m^2 of collectors
Gambia		Reduction of 19.3 t CO_2eq through SWH
Jordan		90000 units
Malawi	2000 units	18000 units
Seychelles		80% of needs in households by 2035 (estimated at 20000 units)
Tunisia		220 m^2 of collectors per 1000 inhabitants by 2030 (estimated at 1.5 million m^2 of collectors)
Yemen		200000 units by 2025
Zimbabwe		Reduction of 179 t CO_2eq by 2030, at a cost of USD 1.23 billion

Based on compliation of Nationally Determined Contributions (NDCs) as published by governments.

4 Description of the analysis

The analysis was conducted at the country level and focused primarily on the power sector. It first assessed the additional renewable power generation capacity (in MW) which is expected to be installed as a result of the full implementation of the NDCs (as described in Section 5). For a number of countries, the renewable energy components in the NDCs were compared with the targets included in other national energy plans and strategies (see Section 6).

As a next step, based on the capacity calculations, the analysis estimated the investment needs in USD and the amount of public finance required to leverage such investments (see Sections 7 and 8).

4.1 Unconditional vs conditional contributions

Building on the principle of common but differentiated responsibilities and respective capabilities, the Paris Agreement urges developed country Parties to support developing country Parties in the implementation of their NDCs, e.g. through the mobilisation of climate finance.

Consequently, NDCs typically contain a combination of unconditional and conditional contributions with the difference that, while conditional contributions implementation depends on international finance and other forms of assistance, unconditional contributions rely exclusively on the use of countries' domestic resources.

The analysis encompassed both unconditional and conditional renewable energy components. In the majority of cases, the split between unconditional and conditional targets is specified in the NDCs; in all other cases the following applied:

- If the information is missing or unclear, renewable energy targets were considered entirely conditional;
- If the split between unconditional and conditional is only specified for the overall NDCs, the same proportion was assumed for renewable energy-specific targets.

5 Assessment of additional renewable energy capacity

The computational steps and assumptions used to assess contributions in terms of additional renewable energy capacity are described in the following subsections; these vary based on the type of metric used and the level of detail included in each Nationally Determined Contribution (NDC). As already mentioned, 21 NDCs do not mention renewables and 36 do not include quantified renewable energy targets; hence these NDCs were excluded from the assessment.

For the 109 NDCs with quantified targets, the additional renewable energy capacity was calculated using either one or a combination of the approaches described in the following paragraphs. If NDCs included multiple targets, the one with the longest time horizon was taken into consideration for the analysis. In addition, if NDCs contained more than one type of targets (e.g. expressed in terms of both installed power capacity and share of electricity generation), the ones expressed in absolute physical units prevailed.

As countries prepared their intended NDCs in the lead up to COP21, 2014 was used as baseline year i.e. contributions are considered net of the installed capacity at the end of 2014, based on IRENA statistics (IRENA, 2017d).

5.1 Renewable energy targets expressed in terms of absolute physical units

A total of 74 NDCs express their renewable energy targets in terms of absolute physical units, including in terms of additional or total future power generation capacity (MW), electricity generation (GWh), number of mini-grids, solar lanterns, solar pumps and/or solar home systems (SHS).

When targets were expressed in terms of additional renewable energy installed capacity (MW), no further calculations were needed. When NDCs mentioned the development of specific renewable energy projects, capacity information was collected from official project documentation.

Targets expressed in terms of additional renewable electricity generation (GWh) were converted into MW using technology-specific capacity factors; specifically, for each country and technology, five-year average capacity factors were calculated based on IRENA statistics (IRENA, 2017d). When data was missing, capacity factors for countries with similar characteristics were used. If the technology breakdown was not provided, this was estimated by projecting each technology's share in the capacity mix using specific five-year average growth rates.

If targets were provided in terms of numbers of mini-grids, solar lanterns, solar pumps and/or solar home systems (SHS), the capacity was estimated using the average size in Table 5.

Table 5: Capital cost and average size of solar off-grid technologies

Technology	Cost	Size
Mini-grid	4 USD/W	50 kW
Solar Home System	10 USD/W	100 W
Solar Lantern	10 USD/unit	10 W
Solar Pump	2000 USD/unit	500 W

5.2 Renewable energy targets expressed as a share of future electricity generation or energy production/ consumption

A total of 64 NDCs express renewable energy targets as a share of future electricity generation. In such cases, total electricity has been projected using country-specific compound annual growth rates (CAGR). Whenever the NDC or other official documents did not provide growth rates or electricity projections, average regional CAGR estimates were used, specifically 3% for Africa and 2% for Latin America and SIDS, 3.5% for non-OECD Asia and 3% for Middle East.[6]

In some cases, targets were expressed as a share of future primary energy production or final energy consumption, rather than electricity generation. Calculations in such cases followed the same general approach, but included additional steps to calculate the portion of energy actually used to generate electricity. The average regional CAGR estimates employed for energy production/consumption are 2% for Africa, 1% for Latin America, SIDS and non-OECD Asia,[7] and 2.5% for Middle East.[8]

The year 2014 was used as a baseline for electricity and energy projections. Statistics for 2014 total electricity generation and energy production/consumption were collected from different sources; specifically, data for renewables was drawn from IRENA (2017d) whereas data for non-renewable sources was collected primarily from the International Energy Agency (IEA, 2016); for a small number

[6] The analysis did not require CAGR estimates for other regions.
[7] CAGR assumed for energy production/consumption in China is 1%.
[8] The analysis did not require CAGR estimates for other regions.

of countries not covered by the IEA, data was taken from the US Energy Information Administration (EIA, 2017).

The technology breakdown and respective installed capacities were estimated by projecting each technology's share in the capacity mix using specific five-year average growth rates.

5.3 Renewable energy targets expressed in terms of emission reduction

A total of 12 NDCs state renewable energy targets in terms of targeted emission reduction, be it in CO_2 or CO_2eq; in such cases, additional capacity was calculated using emission factors. When such data were not directly available in the NDCs, the analysis used emission factors provided by the Intergovernmental Panel on Climate Change in the *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation* (IPCC, 2011).

5.4 Renewable energy targets expressed in terms of investment needs

Finally, 37 NDCs express renewable energy targets in terms of investment needs. In such cases, additional capacity was calculated solving the equation below and using the appropriate cost factors.

$$Additional\ capacity = \frac{Investment\ need}{Cost\ factor}$$

Unless cost factors were provided in the NDCs, these were estimated based on actual cost differentials between markets from the IRENA's Renewable Cost Database (IRENA, 2017c). This includes information from about 15000 utility-scale power generation projects around the world. When cost estimates were required for countries with no previous significant market for individual technologies, the analysis used regional benchmarks.

Off-grid renewable electrification costs estimates are based on IRENA's analysis of solar PV costs in Africa (IRENA, 2016c).

Detailed costs factors used in the analysis are provided in Table 5 (for off-grid technologies) and Table 6 (for grid-connected renewables).

Average values for total installed costs have been used based on historical cost benchmarks, but trends in performance improvements and equipment cost reductions are likely to make these values conservative. As a result, the values considered here should be treated with caution, with significant potential for lower values to occur with early deployment.

Table 6: Capital cost for grid-connected renewable energy technologies, by region and technology (USD/W)

Region	Solar PV[9]	Solar CSP	Large hydropower	Small hydropower	Wind onshore[10]	Wind offshore	Geothermal	Biomass
Africa	1.17-1.58	6.99	1.614	2.95	1.803	-	4.917	5.208
Asia	0.70-1.59	5.90-7.02	0.97-1.38	1.1-2.24	1.04-2.49	2.80-4.61	2.18-6.16	1.40-4.27
Central America	1.39	6.06	3.23	2.28	2.013	-	4.765	2.23
Eurasia	1.11-1.66	7.30	2.30	2.45	1.66-1.80	-	4.00-4.60	3.60-3.70
Europe	0.74-1.54	7.00	1.02-4.48	1.17-4.63	1.65-1.81	3.44-4.99	3.29-8.50	2.25-4.70
Latin America	1.2-1.67	6.06	1.751	2.28	1.763-1.784	-	4.347	1.43
Middle East	1.71	6.10	1.08-1.70	1.10-1.72	1.77-2.10	-	2.40	5.50
North America	1.38-1.42	5.90-7.00	2.10	2.20	1.60-2.01	4.89	5.90	2.86
Oceania	1.21-1.47	5.90-7.00	1.68-2.70	1.88-2.90	1.95-2.15	-	3.50-4.50	2.27-3.27
SIDS	1.94	7.69	3.553	3.245	2.215	-	5.409	5.728

While most NDCs express their investment needs in USD, whenever other currencies were employed the United Nations official exchange rate of 1 December 2015 was used.[11]

6 Comparison with other national renewable energy targets and cost-effective potentials

To evaluate the alignment of renewable energy components of the Nationally Determined Contributions (NDCs) with other national energy strategies and plans, IRENA has collected information on existing national targets for renewables in a number of countries, initially focusing on Africa and the G20. The additional renewable energy installed capacity resulting from the achievement of national targets was estimated using the same approach described in Section 5, and further compared with the level of renewable energy deployment foreseen in the NDCs.

[9] PV costs are cost-averaged until 2030 based on IRENA cost estimates for solar PV.
[10] Wind costs are cost-averaged until 2030 based on IRENA cost estimates for wind.
[11] This date was chosen arbitrarily, taking into consideration that COP 21 of the UNFCCC began on 30 November, 2015 and the Paris Agreement was reached on December 12, 2015.

Where available from previous IRENA work,[12] renewable energy targets in both the NDCs and other national energy plans were further compared with the estimated cost-effective potentials for renewables. This is based on the definition used in IRENA's REmap analysis and is calculated as a combination of technical potential and sustainable long-term market potential.

The estimated 2030 cost-effective potentials for the African continent and the G20 used in the analysis were taken respectively from IRENA (2015b) and IRENA (2016b).

7 Assessment of investment need

As a next step in the analysis, IRENA has estimated the total investment in renewable installed capacity that would be required to implement the renewable energy components in Nationally Determined Contributions (NDCs).

A number of NDCs already includes an assessment of investment needs in USD; in such cases no further calculations were needed. If other currencies were employed, investment needed was converted in USD using the United Nations official exchange rate of 1 December 2015.[13]

For the remaining NDCs, the investment needed was estimated by solving the equation below; this uses the capacity data calculated as described in Section 5 and cost factors as in IRENA (2017c).

$$Investment\ need = Additional\ capacity \times Cost\ factor$$

8 Assessment of public finance needed to leverage investments

As part of the analysis, IRENA has estimated the amount of public finance that would be required to leverage the total investment needed for the implementation of NDC-based renewable energy targets, calculated as described in Section 7. This was done at the global rather than country level.

The assessment draws from previous IRENA analysis (IRENA, 2015a) and is based on a collection of very diversified leverage ratios[14] actually recorded for clean energy investment deals. The leverage ratios observed apply to very different realities and can, therefore, differ significantly, ranging from as low as 1:3 to as high as 1:26; for most renewable energy projects, IRENA estimates that they would fall somewhere in the middle of this range.

[12] IRENA's Renewable Energy Roadmaps (REmap programme) http://www.irena.org/remap.
[13] This date was chosen arbitrarily, taking into consideration that COP 21 of the UNFCCC began on 30 November 2015, and the Paris Agreement was adopted by the Conference of the Parties to the UNFCCC on 12 December 2015.
[14] For the purpose of this paper, leverage ratios are defined as the ratio of private funding to public funding. For example, a leverage ratio of 1:3 would indicate that every USD 1 of public funding leveraged USD 3 from private sources.

Uncertainty related to leverage ratios for renewable energy projects led to a very wide range of estimated public finance required. Further analysis will be needed to narrow down this range and provide more accurate estimates of public finance needed for the implementation of renewable energy targets in NDCs.

9 Data sources

The analysis in the main report (IRENA, 2017a) was primarily based on the information provided in Nationally Determined Contributions (NDCs), as retrieved from the UNFCCC's NDC Interim Registry (UNFCCC, 2017a). For Parties that had not ratified the Paris Agreement as of 15 October 2017, information was drawn from the UNFCCC's INDC platform (UNFCCC, 2017b).

When additional data were needed, priority was given to other official documentation to ensure that the analysis be based as much as possible on information provided by governments. In the case of specific projects mentioned in the NDCs, information was collected from official project documentation. In this sense, this analysis represents a first attempt to estimate the renewable energy components of NDCs, with a view to closely work with countries and provide increasingly accurate estimates to support the successful implementation and revision of renewable energy targets.

Table 7 provides a comprehensive list of additional data sources used throughout the various steps of the analysis to estimate additional renewable energy capacity and investment needs, as described in the paragraphs above.

Table 7. List of data sources used for capacity and investment estimations in the analysis

Data needed	Data source
Renewable energy statistics (i.e. installed capacity, electricity generation, energy production and consumption)	IRENA (2017d)
Non-renewable energy statistics (installed capacity, electricity generation, energy production and consumption)	IEA (2016); EIA (2017)
Emission factors	IPCC (2011)
Cost factors	IRENA (2017c); IRENA (2016c)
Estimated cost-effective potentials	IRENA (2015); IRENA (2016b)

10 Regional classification

Countries have been grouped regionally as described in Table 8 below. The designations employed in this report and the presentation of material herein do not imply the expression of any opinion on the part of IRENA concerning the legal status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

For the purpose of the analysis, 7 small island developing states (SIDS) are also included as part of other regions; specifically Cabo Verde, Comoros, Mauritius, Sao Tome and Principe, and Seychelles are included under Africa, and Maldives and Timor-Leste are under Asia. As a consequence, global estimates of renewable energy targets are not exactly equal to the sum of regional estimates.

Table 8. Regional classification used in the analysis

Region	Number of countries	Countries
Africa	54	Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, United Republic of Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe
Asia	29	Afghanistan, Azerbaijan, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Democratic People's Republic of Korea, India, Indonesia, Kazakhstan, Kyrgyzstan, Lao People's Democratic Republic, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Republic of Korea, Singapore, Sri Lanka, Tajikistan, Thailand, Timor-Leste, Turkmenistan, Uzbekistan, Viet Nam
Latin America	20	Argentina, Belize, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Uruguay, Venezuela (Bolivarian Republic of)
Middle East	14	Bahrain, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, State of Palestine, Syrian Arab Republic, United Arab Emirates, Yemen
Eurasia, Europe, North America and Oceania	25	Albania, Andorra, Armenia, Australia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canada, European Union, the former Yugoslav Republic of Macedonia, Georgia, Liechtenstein, Republic of Moldova, Monaco, Montenegro, Iceland, New Zealand, Norway, Russian Federation, San Marino, Serbia, Switzerland, Turkey, Ukraine, United States
SIDS	34	Antigua and Barbuda, Bahamas, Barbados, Cabo Verde, Comoros, Cook Islands, Cuba, Dominica, Dominican Republic, Fiji, Grenada, Haiti, Jamaica, Kiribati, Maldives, Marshall Islands, Mauritius, Micronesia (Federated States of), Nauru, Niue, Palau, Papua New Guinea, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Seychelles, Solomon Islands, Tonga, Trinidad and Tobago, Tuvalu, Vanuatu

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Annex

This section summarises the renewable energy component as included in the Nationally Determined Contributions (NDCs) for each of the Parties to the UNFCCC that are the objects of this study.

Afghanistan

The renewable energy targets in Afghanistan's NDC are conditional. Under mitigation, they include an unspecified amount of energy production from hydropower, solar, wind and biomass. Under adaptation, they include the development of alternative and renewable energy sources for 25% of the rural population above existing levels (15%) at an estimated cost of USD 105 million.

Albania

Albania's NDC contains no renewable energy component. In this context, it mentions that current electricity generation is dominated by renewable sources, particularly hydropower, leaving "limited opportunity for further policies and measures in this sector to reduce emissions."

Algeria

The renewable energy targets in Algeria's NDC are conditional, and include reaching 27% of electricity generation from renewables by 2030.

Andorra

The renewable energy targets in Andorra's NDC are as in its first biennial report to the United Nations Framework Convention on Climate Change (UNFCCC). They include generating 100.03 GWh from hydropower, 12 GWh from wind (at an estimated cost of EUR 30 million), 5.69 GWh from solar PV (at an estimated cost of EUR 75 million), and 30 GWh from biomass by 2030. The NDC does not specify how contributions are split between unconditional and conditional.

Angola

The renewable energy targets in Angola's NDC [15] are both unconditional and conditional. Unconditional contribution includes 760 MW of large hydropower (Cambambe I and Cambambe II projects) and 100 MW of wind (Tombwa Wind Farm). Conditional contributions include, under mitigation, 69 specific renewable energy projects[16] amounting to 8 491 MW of installed capacity for an estimated cost of USD 11.34 billion. Under adaptation, they include 100 MW of off-grid solar at an estimated cost of USD 150 million. In addition, Angola's unconditional targets include 23 million litres of biofuel per year at an estimated cost of USD 540-1 000 million.

Antigua and Barbuda

The renewable energy targets in Antigua and Barbuda's NDC are conditional. They include 50 MW of renewable energy by 2030 and 100% of electricity demand in the water sector by 2030, including the desalination of 8 million gallons of water per day (gpd) by 2025.

[15] As of 15 October 2017, Angola had not ratified the Paris Agreement. The country's Nationally Determined Contribution, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

[16] The 69 projects listed in the NDC have the following aggregate capacities by technology: hydropower 6540 MW, wind 681 MW, biomass 640 MW, solar 438 MW, and small hydropower 192 MW.

Argentina

Argentina's NDC includes the development of renewable energy as part of the country's unconditional and conditional contributions to achieve respectively 15% and 30% GHG emission reductions; however, it does not provide any quantified renewable energy targets.

Armenia

Armenia's NDC contains no specific targets for renewables, though it mentions them as part of the country's mitigation strategy.

Australia

Australia's NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

Azerbaijan

Azerbaijan's NDC mentions the "use of alternative and renewable energy sources," including small hydro power, biomass, solar, wind and geothermal; however, it does not provide any quantified renewable energy target.

Bahamas

The renewable energy targets in the Bahamas' NDC are unconditional and include 30% of electricity from renewables by 2030.

Bahrain

The renewable energy targets in Bahrain's NDC include the construction of the BAPCO 5 MW PV plant, as well as a 5 MW hybrid solar-and-wind plant. Whether these contributions are unconditional or conditional, however, is not clear.

Bangladesh

The renewable energy targets in Bangladesh's NDC are both unconditional and conditional. Unconditional targets include reaching 10% of renewable electricity by 2020, as established by the 2008 Renewable Energy Policy, and scaling up the potential of solar irrigation pumps (at an estimated cost of USD 600 million) as well as solar mini and nano grids (at an estimated cost of USD 620 million). Additionally, the NDC mentions a number of activities already undertaken by the government that will help meet the unconditional targets, including the Solar Homes Programme, the installation of 4 million solar home systems, and 14 MW installed under the Solar Roof-top Programme. Conditional targets include developing, by 2030, 400 MW of wind (at an estimated cost of USD 600 million) and 1 000 MW of utility-scale solar (at an estimated cost of USD 1.3 billion), scaling up biomass production from sugar (at an estimated cost of USD 200 million), and expanding the Solar Homes Programme (estimated cost of USD 1.2 billion).

Barbados

The renewable energy targets in Barbados' NDC are conditional and include renewable energy contributing for 65% of electricity peak demand by 2030, mainly through wind, solar and biomass.

Belarus

Belarus' NDC contains no renewable energy targets and only briefly mentions past national commitment to improve its deployment.

Belize

The renewable energy targets in Belize's NDC are conditional and include reaching 85% renewable energy in the electricity mix by 2027.

Benin

The renewable energy targets in Benin's NDC are both conditional and unconditional. Unconditional targets include 20 MW of solar PV (at an estimated cost of USD 40 million) and 1 million solar PV lamps (at an estimated cost of USD 151 million). Conditional targets include 260 MW of hydropower (at an estimated cost of USD 892 million) and an additional 20 MW of solar PV (at an estimated cost of USD 40 million).

Bhutan

Bhutan's NDC mentions hydropower development as a priority action under mitigation, as well as the promotion of other renewable energy sources (solar, wind, small hydro and biomass) to diversify the energy supply under adaptation. However, it contains no specific renewable energy targets.

Bolivia (Plurinational State of)

The renewable energy targets in the NDC of Bolivia (Plurinational State of) are both unconditional and conditional. Unconditional targets include reaching 79% renewable energy by 2030, an additional 1 197 MW of combined cycle and renewables other than hydropower, and reaching 8 930 MW of hydropower, mainly for export. Conditional targets include 81% renewable energy by 2030, an additional 1 347 MW of combined cycle and renewables other than hydropower, and reaching 10 489 MW of hydropower, mainly for export.

Bosnia and Herzegovina

The renewable energy targets in Bosnia and Herzegovina's NDC are conditional. They include installing 70 MW of biomass co-generation plants, 120 MW of mini-hydropower plants, 175 MW of wind and 4 MW of solar PV by 2030. Targets also include renewable energy-fueled district heating systems.

Botswana

Botswana's NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

Brazil

The renewable energy targets in Brazil's NDC are unconditional and include reaching 45% renewable energy in the primary energy mix by 2030 (up from 40% in 2014); achieving 28-33% renewable energy other than hydropower in the primary energy mix by 2030; reaching 23% of renewable electricity other than hydropower (wind, biomass and solar) by 2030; and achieving 18% of biofuels in the primary energy mix.

Brunei Darussalam

The renewable energy targets in Brunei Darussalam's NDC are unconditional and include 10% of electricity production from renewables by 2035. This will be mainly achieved through increased use of solar, as well as the construction of a 10-15 MW waste-to-energy facility. The NDC further mentions that other alternative energy sources, such as wind power, hydropower and tidal power, are currently being researched by the government.

Burkina Faso

The renewable energy targets in Burkina Faso's NDC are both unconditional and conditional. Unconditional targets include the implementation of 18 renewable electricity projects, as well as off-grid capacity, as follows: hydropower (Ouessa Aval, Samendeni and Bagré dams) for USD 548 million; solar for USD 188.7 million; 20.9 MW of small hydropower (Bontioli, Gongouro, Folonzo) for USD 109 million; mini-grids for USD 72 million; and 5 MW of biomass. Conditional targets include USD 164 million for solar and off-grid, as well as USD 12.5 million for bioenergy. Burkina Faso's targets also include biogas, with unconditional USD 19 million allocated to bio-digesters under mitigation, and conditional USD 189 million for 75 000 bio-digesters by 2030. In addition, unconditional targets include USD 81.2 million for methane recovery from water treatment and landfill facilities, although whether this also includes electricity generation is not specified.

Burundi

The renewable energy targets in Burundi's NDC [17] are both unconditional and conditional. Unconditional targets include three hydropower projects (Jiji, Mulembwé, and Kaju) with an estimated capacity of 60 MW. Conditional targets include the development of hydropower, off-grid solar PV and biogas, although no detail or quantifiable information is provided in the NDC.

Cabo Verde

The renewable energy targets in Cabo Verde's NDC are both unconditional and conditional. Unconditional targets include reaching 30% renewable electricity by 2025. Conditional targets include reaching 100% renewable electricity by 2025, at an estimated cost of EUR 1 billion.

Cambodia

Cambodia's NDC mentions the development of grid-connected renewable energy including solar, hydropower, biomass and biogas, as well as of solar home systems and small scale hydropower for off-grid electricity. It further mentions the use of renewables in manufacturing industries, for irrigation and solar lamps. The NDC, however, does not provide quantified renewable energy targets.

Cameroon

The renewable energy targets in Cameroon's NDC are conditional and include 25% renewable electricity other than hydropower by 2035, of which 11% from micro-hydropower, 7% from biomass, 6% from solar PV and 1% from wind. The NDC further specifies energy generation contributions from renewable energy by 2035 as follows: 11 353 GWh from hydropower, 2 579 GWh from small hydropower, 1 345 GWh from solar, 1 547 GWh from biomass, and 464 GWh from wind. Cameroon's

[17] As of 15 October 2017, Burundi had not ratified the Paris Agreement. The country's Nationally Determined Contribution, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

NDC mentions that that 262 small hydropower and 25 biomass sites were already identified, for a total of 284 MW.

Canada

Canada's NDC mentions that the emission reduction target will be achieved through the implementation of measures included in the Pan-Canadian Framework on Clean Growth and Climate Change. Renewable energy is a key element of the Framework and a number of provincial and territorial actions are mentioned to promote its expansion.

Central African Republic

The renewable energy targets in the Central African Republic's NDC are conditional and include the development of 312 MW of hydropower at an estimated cost of USD 1 007 million; the reduction of 250 kt CO_2eq through the Bangui solar PV plant (USD 110 million), and the reduction of 250 kt CO_2eq through biofuels (USD 27.5 million).

Chad

The renewable energy targets in Chad's NDC are both unconditional and conditional; unconditional targets are 10% of conditional targets in terms of investment. Targets include the generation of 750 GWh of renewable energy by 2030, of which 500 GWh from hydropower imported from Cameroon, 200 GWh from solar PV and 50 GWh from wind. Costs are estimated at USD 600 million for hydropower (transmission line), USD 2 025 million for solar PV and USD 138 million for wind. Targets under adaptation also include deploying renewables for the agriculture and pastoral sectors at a cost of USD 22 million.

Chile

The renewable energy targets in Chile's NDC are unconditional and include the production of 20% of renewable electricity other than hydropower by 2025.

China

The renewable energy targets in China's NDC are unconditional. The country aims to increase the "share of non-fossil fuels in primary energy consumption to around 20% in 2030"; this includes both renewable energy (hydropower, wind, solar, geothermal and bioenergy) and nuclear power. China's NDC further contains specific targets for solar and wind capacity to reach respectively 200 GW and 100 GW by 2020.

Colombia

Colombia's NDC[18] contains no renewable energy targets and makes no mention of renewable energy technologies.

[18] As of 15 October 2017, Colombia had not ratified the Paris Agreement. The country's Nationally Determined Contribution, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Comoros

The renewable energy targets in Comoros's NDC are conditional and include 43% renewable electricity by 2030, of which 16% geothermal. Targets also include the development of 14 MW of solar PV by 2020, 14 MW of geothermal by 2030 and an estimated 12 MW of hydropower by 2030.

Congo

The renewable energy targets in the Congo's NDC are both unconditional and conditional; unconditional targets are typically 20% of conditional targets in terms of investment. Unconditional targets include the development of hydropower (EUR 38.4 million/year); electricity from biomass (EUR 6 million/year); solar PV (EUR 0.76 million/year); biofuels (EUR 0.65 million/year). Conditional targets include the development of hydropower for 85% of the electricity mix by 2025 (EUR 192 million/year); electricity from biomass (EUR 30 million/year); solar PV (EUR 3.81 million/year); biofuels (EUR 3.25 million/year).

Cook Islands

The renewable energy targets in Cook Islands' NDC are both unconditional and conditional. Unconditional targets include reducing GHG emissions from electricity generation by 38% by 2020, mainly through the development of renewables to substitute electricity generation from diesel. Conditional targets include 100% renewable electricity by 2020.

Costa Rica

The renewable energy targets in Costa Rica's NDC are unconditional and include 100% renewable electricity by 2030.

Côte d'Ivoire

The renewable energy targets in Côte d'Ivoire's NDC are conditional and include 42% renewable electricity by 2030, of which 26% from hydropower, at an estimated cost of USD 12.9 billion. The NDC also mentions the development of small hydropower, off-grid solar, biomass and biogas, although no quantified target is included.

Cuba

The renewable energy targets in Cuba's NDC are conditional and include 2 144 MW of renewable electricity capacity, divided as follows: (i) 19 sugarcane bagasse and forest biomass cogeneration plants totaling 755 MW; (ii) 13 windfarms totaling 633 MW; (iii) 700 MW of solar PV; (iv) 74 small hydropower power plants; and (v) 200 000 m^2 of solar water heating collectors. The total cost is estimated at least USD 4 billion.

Democratic People's Republic of Korea

The renewable energy targets in the Democratic People's Republic of Korea's NDC are conditional and include the construction of 1 000 MW of grid-connected solar PV systems, 500 MW of offshore wind farms and 500 MW of onshore wind power plants. The NDC also contains unspecified targets for large, medium and small-scale hydropower, solar water heaters, and biogas.

Democratic Republic of the Congo

The renewable energy targets in the Democratic Republic of Congo's NDC[19] are conditional and include USD 2 billion for hydropower and USD 240 million for industrial biomass. Whether the biomass is for electricity or heat generation is not specified.

Djibouti

The renewable energy targets in Djibouti's NDC are both unconditional and conditional. Unconditional targets include 1 200 MW of geothermal by 2030, 250 MW of solar and 60 MW of wind by 2025. Conditional targets include 30 MW of wind, 10 MW of biomass and 5 MW of tidal turbines.

Dominica

The renewable energy targets in Dominica's NDC are conditional. They include 10.5 MW of geothermal at an estimated cost of USD 75 million, USD 3.7 million worth of solar PV for hotels and commercial sector, and 3.4 MW of hybrid mini-grids (solar, wind, bio-diesel, diesel) at an estimated cost of USD 12.3 million.

Dominican Republic

The Dominican Republic's NDC contains no renewable energy contributions and makes no mention of renewable energy technologies.

Ecuador

The renewable energy targets in Ecuador's NDC are both unconditional and conditional. Unconditional targets include 90% electricity from hydropower by 2017, specifically through the development of 2 828 MW of hydropower installed capacity. Conditional targets include over 90% renewable electricity by 2025, as well as the development of 4 382 MW of hydropower.

Egypt

Egypt's NDC defines "increased use of renewable energy as an alternative to non-renewable energy sources" as one of the five pillars of mitigation policies, although it provides no quantified renewable energy targets.

El Salvador

The renewable energy targets in El Salvador's NDC are conditional and include producing by 2025 renewable electricity equivalent to 12% of total electricity generation in 2014.

Equatorial Guinea

The renewable energy targets in Equatorial Guinea's NDC[20] are conditional. They include USD 544 million worth of hydropower by 2030, including hydropower development of the Wele River and 8 MW of small hydropower (Musola, Riaba and Bikomo). The NDC also mentions the development of solar, wind and tidal technologies for remote islands, although no quantified target is included.

[19] As of 15 October 2017, the Democratic Republic of Congo had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

[20] As of 15 October 2017, Equatorial Guinea had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Eritrea

The renewable energy targets in Eritrea's NDC[21] are both unconditional and conditional, and include 70% renewable electricity by 2030 through geothermal, solar, wind, biogas and biodiesel. The cost for unconditional mitigation targets is estimated at USD 393 million, while total mitigation cost is estimated at USD 1 086 million.

Eswatini

The renewable energy targets in Eswatini's NDC are conditional and include doubling the share of renewable energy in the energy mix (from 16% to 32%) by 2030, and reaching a 10% bioethanol blend by 2030.

Ethiopia

The renewable energy targets in Ethiopia's NDC are unconditional and include USD 4 billion for the Grand Renaissance dam, a 6 GW hydropower project under construction. The NDC also mentions renewables as one of four pillars for mitigation and includes, as part of adaptation, the expansion of geothermal, wind and solar to minimise the impact of drought electricity generation from hydropower. These contributions, however, are not quantified.

European Union

The European Union's NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

Fiji

The renewable energy targets in Fiji's NDC are both unconditional and conditional. They include reaching 100% renewable electricity from hydropower, geothermal, biomass, grid-connected solar and wind by 2030. Unconditional targets are one third of the total. The costs of conditional renewable energy targets is estimated to be USD 500 million.

Gabon

The renewable energy targets in Gabon's NDC include 80% renewable electricity by 2025 to be achieved through the development of 510 MW of hydropower (Grand Poubara I, Fe II, Impératrice, Dibwangui, Ngoulmendjim, and Grand Poubara II). The NDC also mentions solar electrification of rural villages, although no quantified target is included. The NDC does not specify the split between unconditional and conditional targets.

Gambia

The renewable energy targets in Gambia's NDC are both unconditional and conditional. Unconditional targets include mitigation of 104 kt CO_2eq by 2030 through solar PV, wind and hydropower. Conditional targets include emission reduction of 174.4 kt CO_2eq by 2030 through solar PV, wind and hydropower, as well as the development of solar water heaters for a mitigation potential of 19.3 kt CO_2eq.

[21] As of 15 October 2017, Eritrea had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Georgia

Georgia's NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

Ghana

The renewable energy targets in Ghana's NDC are conditional and include 150-300 MW of hydropower (USD 2 214 million), 50-150 MW of solar PV, 50-150 MW of wind, 55 100 kW mini-grids, 200 000 solar home systems, 2 million solar lanterns (USD 300 million), and 200 institutional bio-digesters (USD 5 million).

Grenada

The renewable energy targets in Grenada's NDC are conditional and include 15 MW of geothermal, 10 MW of solar and 2 MW of wind by 2025.

Guatemala

The renewable energy targets in Guatemala's NDC are unconditional and include 80% renewable electricity by 2030, up from 70% in 2015.

Guinea

The renewable energy targets in Guinea's NDC are both unconditional and conditional; unconditional targets are represent 20% of total investment need. Targets include the development of 1 650 MW of hydropower, 47 MW of solar and 3 000 kWp of biofuels. The NDC also mentions 40 ktoe of butane and biogas, although it does not specify the share of each source.

Guinea-Bissau

The renewable energy targets in Guinea-Bissau's NDC[22] are conditional and include 80% renewable electricity from hydropower, solar PV and wind by 2030.

Guyana

The renewable energy targets in Guyana's NDC are both unconditional and conditional. Unconditional targets include 26 MW of wind power and the electrification of 6 townships with renewable energy mini-grids. Conditional targets include 100% renewable electricity by 2025, and the development of the Amaila Falls Hydropower project (165 MW).

Haiti

The renewable energy targets in Haiti's NDC are both unconditional and conditional. Unconditional targets include 37.5 MW of hydropower by 2020. Conditional targets include 47% renewable electricity by 2030, with 60 MW of hydropower, 50 MW of wind, 30 MW of solar and 20 MW of biomass.

[22] As of 15 October 2017, Guinea-Bissau had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Honduras

Honduras' NDC mentions hydropower infrastructure as one of seven priority areas for adaptation; however, it does not include any quantified renewable energy targets.

Iceland

Iceland's NDC contains no renewable energy contributions. The document mentions, however, that electricity and heating in the country are already almost 100% derived from renewables, with minimal emissions. Iceland, therefore, must look to other sectors for mitigation options, including transport, agriculture, fisheries, industrial processes, waste and LULUCF."

India

The renewable energy targets in India's NDC are conditional and include achieving "about 40% cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030." However, no further information is provided regarding the share of renewable energy.

Indonesia

Indonesia's NDC aims to achieve an unconditional 29% reduction in GHG emissions by 2030 compared to a BAU scenario; this target reduction is expected to reach 41% conditionally. The unconditional scenario assumes that by 2030, 19.6% of power generation will come from renewables, based on the Electricity Supply Business Plan (2016-2025). In the conditional scenario, renewable energy sources are projected to produce 132.74 TWh of electricity. The NDC also mentions the implementation of biofuels in the transportation sector as follows: 90% and 100% mandatory B30, respectively in the unconditional and conditional scenario.

Iran (Islamic Republic of)

The NDC[23] of Iran (Islamic Republic of) mentions renewable energy under mitigation; however, it contains no quantified targets.

Iraq

The renewable energy targets in Iraq's NDC[24] are both unconditional and conditional. Unconditional targets include the development of solar PV for residential areas, though no quantification is provided. Conditional targets include reaching 3.3% of electricity from hydropower by 2035.

Israel

The renewable energy targets in Israel's NDC are unconditional and include 17% of electricity generation from renewables by 2030.

[23] As of 15 October 2017, Iran (Islamic Republic of) had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

[24] As of 15 October 2017, Iraq had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Jamaica

The renewable energy targets in Jamaica's NDC are unconditional and include 20% of renewables in the primary energy mix by 2030. Although not explicitly stated, given Jamaica's energy mix this essentially represents 100% renewable electricity.

Japan

Japan's NDC aims to achieve a 26% reduction in GHG emissions by fiscal year (FY) 2030 compared to FY 2013. This assumes that by FY 2030, 22-24% of power generation would come from renewables, as follows: 7% from solar, 1.7% from wind, 1-1.1% from geothermal, 8.8-9.2% from hydropower, and 3.7-4.6% from biomass.

Jordan

The renewable energy targets in Jordan's NDC include reaching 11% of renewable energy in the total energy mix by 2025 (from 3% in 2013). This target is to be achieved through the implementation of projects included in its Third National Communication Report to UNFCCC and in subsequent documents. Renewable energy targets further include the installation of 90 000 solar water heaters. The NDC does not specify the split between unconditional and conditional targets.

Kazakhstan

Kazakhstan's NDC mentions the adoption of the law "On Supporting the Use of Renewable Energy Sources" but does not include any specific renewable energy targets.

Kenya

Kenya's NDC mentions the "expansion in geothermal, solar and wind energy production, other renewables, and clean energy options;" however, it does not include any quantified target for renewables.

Kiribati

The renewable energy targets in Kiribati's NDC are both unconditional and conditional. Unconditional targets include on-grid and off-grid solar PV totalling 2.1 MW by 2025. Conditional targets include 1.15 MW of solar PV mini-grids, 3 900 solar home systems, 12 community systems for solar water desalination, and biodiesel (coconut oil) for electricity generation (to achieve GHG emission reductions of 12 050 t CO_2eq) and transport (to achieve GHG emission reductions of 11 780 t CO_2eq) by 2025.

Kuwait

The renewable energy targets in Kuwait's NDC[25] are conditional. The NDC mentions that a number of renewable energy projects (solar PV, solar CSP and wind) are "expected to reach the maximum production capacity […] by 2030," though no further details is provided. The NDC also mentions energy production from municipal solid waste.

[25] As of 15 October 2017, Kuwait had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Kyrgyzstan

Kyrgyzstan's NDC[26] mentions that 90% of electricity in the country is currently generated from hydropower; however, it contains no renewable energy targets.

Lao People's Democratic Republic

The renewable energy targets in Lao People's Democratic Republic's NDC are both unconditional and conditional. Unconditional targets include the implementation of the Renewable Energy Development Strategy, which aims to increase the share of small scale renewable energy (<15 MW) to 30% of energy consumption by 2025, and the share of biofuels (bioethanol and biodiesel) to 10% of total demand for transport fuels by 2025. Renewable energy technologies included in the Strategy are small hydro, solar, biomass, biogas, municipal solid waste to energy and wind. Conditional targets include large-scale hydropower plants, for additional total capacity of 22.3 GW (2.3 GW to be built by 2020 and 20 GW after 2020).

Lebanon

The renewable energy targets in Lebanon's NDC[27] are both unconditional and conditional. Unconditional targets include meeting 15% of the power and heat demand using renewable energy sources by 2030. Conditional targets include additional 5% of the power and heat demand from renewable energy, so as to reach a total share of 20% by 2030.

Lesotho

The renewable energy targets in Lesotho's NDC are both unconditional and conditional. They include 200 MW of renewable energy sources by 2020 as follows: 40 MW of solar by 2018, 35 MW of wind by 2017, and 125 MW of hydropower by 2025. Total cost is estimated to be USD 702 million, half of which unconditional. Furthermore, unconditional targets include USD 10 million for mini-grids and USD 3 million for 3 MW of small hydropower. Conditional targets include USD 600 million for hydropower, USD 4 million for wind and USD 108 million for 60 000 household bio-digesters.

Liberia

The renewable energy targets in Liberia's NDC[28] are conditional and include 30% renewable electricity and 10% of primary energy by 2030; this is to be achieved mainly through the development of a 30 MW biomass plant. Furthermore, the NDC also considers a target of 5% biodiesel in transport.

Libya

As of 15 October 2017, Libya had signed the Paris Agreement but had not submitted its NDC.

Liechtenstein

Liechtenstein's NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

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[26] As of 15 October 2017, Kyrgyzstan had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

[27] As of 15 October 2017, Lebanon had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

[28] As of 15 October 2017, Liberia had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Madagascar

The renewable energy targets in Madagascar's NDC are conditional and include 79% renewable electricity by 2030, through the development of hydropower and solar. The NDC also mentions biogas, although no specific quantified targets are included.

Malawi

The renewable energy targets in Malawi's NDC are both unconditional and conditional. Unconditional targets include 351 MW of hydropower, 20 000 solar PV systems by 2030, 2 000 solar water heating systems by 2030, 18 million litres/year of ethanol, and 2 million litres/year of biodiesel. Conditional targets include 800 MW of hydropower by 2025, 95 GWh/year from landfill methane recovery, additional 30 000 solar PV systems, and additional 18 000 solar water heating systems, additional 22 million litres/year of ethanol and 18 million litres/year of biodiesel.

Malaysia

Malaysia's NDC contains no specific renewable energy targets. However it mentions that the formulation of contributions took into account, among others, existing national renewable energy policies.

Maldives

Maldives' NDC states that "the main area of focus for mitigation is fuel switching to alternative energy options." However, it concludes that "unfavourable conditions and barriers severely limit the use of alternative energy sources in the Maldives."

Mali

The renewable energy targets in Mali's NDC include 10% renewable electricity other than large hydropower by 2020, USD 258 million for 100 MW of large-scale renewable energy projects, USD 165 million for hydropower (Kénié) by 2020, and USD 7.2 million for off-grid renewables by 2020. The NDC does not specify whether contributions are conditional or unconditional.

Marshall Islands

The renewable energy targets in Marshall Islands' NDC are unconditional and include reducing GHG emissions to 32% below 2010 levels by 2025, to be accomplished mostly by substituting diesel with renewable energy for electricity generation.

Mauritania

The renewable energy targets in Mauritania's NDC are unconditional and include 2 000 solar water pumps in rural areas. The NDC also mentions renewable energy as part of conditional contributions, although no quantified targets are provided.

Mauritius

The renewable energy targets in Mauritius' NDC are conditional and include a 30% GHG reduction by 2030, including through an unspecified expansion in solar, wind, biomass and other renewable energy sources.

Mexico

Mexico's NDCs contains no renewable energy targets and makes no mention of renewable energy technologies.

Micronesia (Federated States of)

The renewable energy targets in the NDC of Micronesia (Federated States of) are both unconditional and conditional and include reducing GHG emissions respectively by 28% and 35% by 2025. While no specific renewable energy targets are included, the NDC explicitly builds upon existing renewable energy and transport targets and policies.

Monaco

Monaco's NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

Mongolia

The renewable energy targets in Mongolia's NDC are conditional and include achieving 20% of electricity generation from renewables by 2020 and 30% by 2030. Specific measures to achieve this targets include installing 675 MW of large hydropower (at a cost of USD 1.35 billion), 354 MW of wind (USD 584 million), and 145 MW of solar PV (USD 573 million) by 2030.

Montenegro

Montenegro's NDC[29] states that the emission reduction target is to be achieved, among other things, through an increase in the share of renewables; however, it contains no specific renewable energy targets.

Morocco

The renewable energy targets in Morocco's NDC are conditional and include reaching 42% renewable electricity by 2020 (of which 14% from solar, 14% from wind, and 14% from hydropower) and 50% by 2025.

Mozambique

Mozambique's NDC[30] mentions increased access to renewable energy as a contribution towards mitigation; however, it contains no quantified target for renewables.

Myanmar

The renewable energy targets in Myanmar's NDC are conditional and include reaching 9.4 GW of total hydropower installed capacity by 2030, as well as 30% rural electrification through renewables, including mini-hydro, biomass, solar, wind and solar mini-grid.

[29] As of 15 October 2017, Montenegro had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

[30] As of 15 October 2017, Mozambique had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Namibia

The renewable energy targets in Namibia's NDC are conditional and include increasing renewable electricity from 33% to 70% by 2030 with hydropower, solar and wind projects. Targets also include the deployment of biogas from manure to reduce 10% of N_2O emissions by 2030.

Nauru

The renewable energy targets in Nauru's NDC are both unconditional and conditional. Unconditional targets include the development of 0.6 MW of solar PV at a cost of USD 5 million. Conditional targets include replacing diesel generation with large scale grid-connected solar PV (at an estimated cost of USD 42 million), along with demand side management improvements.

Nepal

The renewable energy targets in Nepal's NDC are conditional and include 80% electrification through renewables by 2050, 25 MW of mini and micro hydropower, 600 000 solar home systems, 1 500 solar power systems (solar PV and solar pumping systems), 130 000 biogas systems and 1 200 biogas plants. Furthermore, the NDC states that "by 2020, Nepal intends to expand its energy mix focusing on renewables by 20%."

New Zealand

New Zealand's NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

Nicaragua

As of 15 October 2017, Nicaragua had not signed the Paris Agreement.

Niger

The renewable energy targets in Niger's NDC are both unconditional and conditional. They include 250 MW of renewable energy capacity installed by 2030, of which 130 MW from hydropower (Kandadji) and 20 MW from wind. Targets also include reaching 30% primary energy from renewable energy sources by 2030. While the NDC allocates USD 830 million for unconditional mitigation and USD 7 billion for conditional mitigation, no information is provided as to how much of the unconditional contribution is for renewables. The NDC also includes the promotion of biogas and biofuels at both the industrial and family level, although not quantified targets are provided.

Nigeria

The renewable energy targets in Nigeria's NDC are unconditional and include developing 13 GW of solar PV for rural electrification. The NDC also mentions the development of "renewable energy, particularly decentralised," as part of conditional contributions; however, no quantified targets are provided. Renewable energy targets are expected to achieve a mitigation of 31 million t CO_2eq by 2030.

Niue

The renewable energy targets in Niue's NDC are both unconditional and conditional. Unconditional targets include reaching 38% renewable electricity by 2020. Conditional targets include achieving

80% renewable electricity by 2025; the NDC states this could be reached through 1.8 MW of solar PV.

Norway

Norway's NDC mentions renewable energy as a priority area for enhanced national climate policy efforts; however, it contains no specific renewable energy targets.

Oman

Oman's NDC[31] mentions the development of renewables among the mitigation measures to be implemented through international assistance; however, it contains no quantified renewable energy targets.

Pakistan

Pakistan's NDC mentions the development of large scale and distributed grid-connected solar, wind and hydropower as a high-priority mitigation option. Climate actions currently being undertaken at the sub-national level are also mentioned, including the construction of the 1 000 MW Quaid-e-Azam solar park in Punjab. However, the NDC contains no quantified renewable energy target.

Palau

The renewable energy targets in Palau's NDC include 5 MW solar PV and an additional 10 MW solar PV for the water sector. However, the NDC does not specify the split between unconditional and conditional targets.

Panama

The renewable energy targets in Panama's NDC are unconditional and include reaching 30% renewable electricity other than hydropower by 2050, through the development of 1 184 MW of solar and wind at an estimated cost of USD 2 232 million.

Papua New Guinea

The renewable energy targets in Papua New Guinea's NDC are conditional and include nearly reaching 100% renewable electricity by 2030 through solar PV, geothermal, biomass, and hydropower.

Paraguay

The renewable energy targets in Paraguay's NDC are both unconditional and conditional and include increasing renewable energy consumption by 60%. Unconditional targets are 50% of the total.

Peru

Peru's NDC mentions past deployment of renewables in the country but it includes no quantified renewable energy targets.

[31] As of 15 October 2017, Oman had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Philippines

The renewable energy targets in the Philippines' NDC are conditional, though no quantification is provided.

Qatar

Qatar's NDC mentions under mitigation the efforts undertaken towards the development of renewable energy (solar and wind), including power desalination plants; however, it contains no specific renewable energy targets.

Republic of Korea

The Republic of Korea's mentions measures undertaken by the government in support of renewable energy in the power sector; however, it does not include any specific targets.

Republic of Moldova

The Republic of Moldova's NDC mentions that considerable abatement is expected to be achieved through increased shares of renewables up to 2020. However, it contains no renewable energy targets for the period 2021-2030.

Russian Federation

The Russian Federation's NDC[32] states that the overall GHG emission reduction target is in line with the general objective of increasing the share of renewables in the energy balance, among other things. However, it contains no specific renewable energy targets.

Rwanda

The renewable energy targets in Rwanda's NDC are conditional and include the development of an unspecified amount of large scale hydropower and solar PV to reach over 46% renewable electricity by 2020. Targets also include 100 solar mini-grids totaling 9.4 MW, an unspecified capacity from landfill gas generation, 35 000 household bio-digesters and 15 large-scale bio-digesters.

Saint Kitts and Nevis

The renewable energy targets in Saint Kitts and Nevis' NDC are conditional and include increasing renewable electricity by 50% by 2030, through 35 MW of geothermal, 7.6 MW of wind, and 1.9 MW of solar PV.

Saint Lucia

The renewable energy targets in Saint Lucia's NDC are conditional and include reaching 35% renewable electricity by 2025 and 50% by 2030 through a mix of geothermal, wind and solar energy sources.

Saint Vincent and the Grenadines

The renewable energy targets in Saint Vincent and the Grenadines' NDC are unconditional and include the development of a geothermal plant which will provide over 50% of the country's

[32] As of 15 October 2017, the Russian Federation had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

electricity needs. The project, financed by the IRENA and the Abu Dhabi Fund for Development (ADFD) Project Facility is expected to have a capacity of 15 MW.

Samoa

The renewable energy targets in Samoa's NDC are conditional and include reaching 100% renewable electricity by 2025, through 12 MW of bioenergy, 6 MW of grid-connected solar PV, 3.5 MW of hydropower and 0.55 MW of wind.

San Marino

San Marino's NDC[33] mentions that due to the limited access to other renewable energy sources such as hydropower, wind or geothermal, in the last years, the government has promoted the development of solar PV in the country. However, the NDC contains no renewable energy targets.

Sao Tome and Principe

The renewable energy targets in Sao Tome and Principe's NDC are conditional and include reaching 47% renewable electricity by 2030 through 12 MW of solar PV, 13 MW of small hydropower and 1 mini-grid of 1 MW.

Saudi Arabia

Saudi Arabia's NDC mentions the intention to "invest and implement ambitious programs for renewable energy to increase its contribution to the energy mix," including through an unspecified expansion of solar PV, solar thermal, wind, geothermal, and waste to energy.

Senegal

The renewable energy targets in Senegal's NDC are both unconditional and conditional. Unconditional targets include 160 MW of solar PV, 150 MW of wind, 144 MW of hydropower, 392 mini-grids and 27,500 domestic bio-digesters. Conditional targets include an additional 200 MW of wind, 200 MW of solar PV, 165 MW of biomass, 55 MW of hydropower, and 55 MW of solar CSP, 5,000 solar mini-grids and 49 000 bio-digesters.

Serbia

Serbia's NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

Seychelles

The renewable energy targets in Seychelles' NDC are both unconditional and conditional. Unconditional targets include 15% renewable electricity by 2030, to be met mainly through the development of 90 MW of solar PV at an estimated cost of USD 191 million.

[33] As of 15 October 2017, San Marino had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Sierra Leone

Sierra Leone's NDC mentions the deployment of renewable energy (solar, wind, hydropower and biomass), particularly in rural areas, as one of six conditional mitigation strategies; however, no quantified target is provided.

Singapore

Singapore's NDC states that national circumstances strongly limit the use of renewables, such as hydropower, wind and geothermal, and that the government is promoting increased deployment of solar PV. Although the NDC contains no renewable energy targets, it cites an estimate that renewables could contribute up to 8% of peak electricity demand by 2030.

Solomon Islands

The renewable energy targets in Solomon Islands' NDC are both unconditional and conditional. Unconditional targets include the development of hydropower, mini hydropower, solar farms and solar home systems, for a total installed capacity of 9 MW by 2025. Conditional targets include the development of 13 renewable energy projects as follows: 20-40 MW of geothermal (USD 150 million), 3.8 MW of mini hydropower (USD 10.7 million), 2.5 MW solar (USD 9 million), and 0.55 MW of mini-grids (USD 1.05 million).

Somalia

The renewable energy targets in Somalia's NDC are both unconditional and conditional. Unconditional targets include 15 MW of solar PV. Conditional targets include USD 28.2 million for 4.6 MW (Fanoole Dam). The NDC also includes unspecified conditional targets for biogas and solar PV.

South Africa

The renewable energy targets in South Africa's NDC are unconditional and include the development of 11 543 MW of renewables, of which 5243 MW are approved (for an estimated cost of USD 16 billion) and 6 300 MW are under consideration.

South Sudan

The renewable energy targets in South Sudan's NDC[34] are conditional and include the development of the Fulla Rapids hydropower project, with estimated capacity of 42 MW. The NDC also mentions the development of solar and wind, but no quantified target is provided.

Sri Lanka

The renewable energy targets in Sri Lanka's NDC are both unconditional and conditional. They include the construction of power plants by 2020 as follows: 514 MW of large-scale wind, 115 MW of solar, 105 MW of biomass and 176 MW of mini hydropower. The NDC also mentions strengthening sustainable energy related policies with a view to increasing the share of renewable energy from the existing 50% to 60% by 2020. Unconditional targets are 20% of the total.

[34] As of 15 October 2017, South Sudan had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

State of Palestine

The renewable energy targets in the State of Palestine's NDC are both unconditional and conditional. Unconditional targets include the completion of two Sustainable Urban Demonstration Projects involving the installation of six net-metering PV systems on six public buildings, and the installation of a small-scale wastewater treatment plant powered by solar energy. Conditional targets include reaching 20-33% of electricity generation from solar PV by 2040, developing a 1 MW waste incineration unit and capturing 14 000 tonnes/year of landfill gases for power generation. Additional conditional actions identified include implementing the State of Palestine's Renewable Energy Strategy, which aims to generate 5% of electricity through renewables by 2020, and promoting the use of solar thermal energy (e.g. solar water heaters). Under adaptation, the State of Palestine aims to generate solar electricity (USD 99.55 million) and use renewables to reduce imported energy (USD 156.05 million).

Sudan

The renewable energy targets in Sudan's NDC are conditional and include 20% renewable electricity by 2030, at a cost of USD 4.3 billion; this is to be achieved through 1 GW of wind, 1 GW of solar PV, 300 MW of geothermal, 80 MW of solar CSP, and 50 MW of small hydropower. Conditional targets also include 1.1 million solar home systems for rural electrification.

Suriname

The renewable energy targets in Suriname's NDC [35] are conditional and include 168 MW of hydropower and 25 MW of bioenergy from biomass cogeneration.

Switzerland

Switzerland's NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

Syrian Arab Republic

As of 15 October 2017, the Syrian Arab Republic had not signed the Paris Agreement.

Tajikistan

Tajikistan's NDC states that a 65-75% reduction of GHG emissions by 2030 will be possible through the "promotion and diversification of renewable energy sources," among other things. However, no quantified targets is provided.

Thailand

Thailand's NDC mentions that the formulation of contributions took into account, among others, existing national renewable policies; however, it contains no specific renewable energy targets.

[35] As of 15 October 2017, Suriname had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

The former Yugoslav Republic of Macedonia

The former Yugoslav Republic of Macedonia's NDC[36] specifies that renewable energy targets are detailed in a background document which is an integral part of the country's submission. They include the construction of new power plants by 2035 as follows: large hydropower (8 plants for a total installed capacity of 853 MW); small hydro (180 MW); wind (263 MW); solar (180 MW); biogas power plants (15 MW); biomass combined heat and power plants (15 MW); and geothermal (15 MW). Other targets include the installation of solar thermal collectors leading to a reduction of 9.4 kt CO_2 by 2030, as well as 5% participation of biofuels by 2020 and 10% by 2025, to be maintained until 2035. The NDC does not specify the split between unconditional and conditional targets.

Timor-Leste

Timor-Leste's NDC identifies as potential conditional mitigation measure the installation of more than 450 MW of renewables, including 252 MW of hydropower, 72 MW of wind, 22 MW of solar and 6 MW of biomass/waste sources.

Togo

The renewable energy targets in Togo's NDC are conditional and include 4% renewable electricity by 2030, USD 40 million for renewable electricity and biofuels, as well as USD 30 million for mini-grids.

Tonga

The renewable energy targets in Tonga's NDC are both unconditional and conditional. Unconditional targets include 70% renewable electricity by 2030, as well as solar projects worth USD 7.9 million for solar freezing, solar pumping, solar home systems and mini-grids. Conditional targets include USD 40 million worth of wind, USD 30 million worth of solar, and USD 4.6 million worth of biomass.

Trinidad and Tobago

Trinidad and Tobago's NDC[37] contains no renewable energy targets; rather it specifies that priority is to achieve efficiency through combined cycle gas plants, with "renewable energy being the next stage for reducing emissions even further."

Tunisia

The renewable energy targets in Tunisia's NDC are both unconditional and conditional and include reaching 30% renewable electricity by 2030 (up from 4% in 2014), USD 7.9 billion for the development of 1 755 MW of wind, 1 610 MW of solar PV and 450 MW of solar CSP. Targets also include reaching 220 m² of collectors per 1 000 inhabitants by 2030 (up from 73 m^2 in 2015). Unconditional targets are 10% of the total.

[36] As of 15 October 2017, the former Yugoslav Republic of Macedonia had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

[37] As of 15 October 2017, Trinidad and Tobago had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Turkey

The renewable energy targets in Turkey's NDC[38] include increasing solar and wind power installed capacity to reach respectively 10 GW and 16 GW by 2030, and tapping the full hydroelectric potential. The NDC does not specify whether these targets are unconditional or conditional.

Turkmenistan

Turkmenistan's NDC mentions that the country has identified the "use of alternative energy sources" as a priority in its National Strategy on Climate Change; however, it contains no renewable energy targets.

Tuvalu

The renewable energy targets in Tuvalu's NDC are unconditional and include 100% renewable electricity by 2020, to be achieved through the development of 6 MW of renewable energy capacity.

Uganda

The renewable energy targets in Uganda's NDC are both unconditional and conditional and include the development of 2 471 MW of hydropower, solar, biomass and geothermal by 2030. The total investment needed is estimated at USD 5.4 billion, of which 30% is unconditional.

Ukraine

Ukraine's NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

United Arab Emirates

The renewable energy targets in the United Arab Emirates' NDC are unconditional and include increasing clean energy share in the total energy mix from 0.2% in 2014 to 24% in 2021, including both renewable and nuclear energy. The NDC further specifies that such target is underpinned by detailed emirate-level targets and policies.

United Republic of Tanzania

The United Republic of Tanzania's NDC[39] mentions the promotion of renewable sources such as geothermal, wind, solar and renewable biomass; although it provides no quantified targets.

United States

The United States' NDC contains no renewable energy targets and makes no mention of renewable energy technologies.

Uruguay

The renewable energy targets in Uruguay's NDC are both unconditional and conditional. In 2014 renewable energy accounted for 93% of Uruguay's electricity generation and for 59% of its primary energy. The NDC estimates that by 2017 Uruguay's electricity sector will reach an emissions level of

[38] As of 15 October 2017, Turkey had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

[39] As of October 2017, the United Republic of Tanzania had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

17 g CO_2/kWh. Unconditional targets include Uruguay's unconditional contribution is to maintain electricity emissions under 40 g CO_2/kWh by 2030. Uruguay's conditional contribution is to maintain electricity emissions under 20 g CO_2/kWh by 2030.

Uzbekistan

Uzbekistan's NDC[40] mentions the development of large solar PV, biogas and wind power plants; however, it does not contain any quantified renewable energy target.

Vanuatu

The renewable energy targets in Vanuatu's NDC are conditional and include nearing 100% renewable electricity by 2030, to be achieved through solar PV (10 MW by 2025 and 10 MW additional by 2030), 2.75 MW of wind by 2025, and geothermal (4 MW by 2025 and 4 MW additional by 2030). The NDC also mentions an unspecified amount of diesel substitution by coconut oil. The total cost of reaching renewable energy targets is estimated to be USD 180 million.

Venezuela (Bolivarian Republic of)

The renewable energy targets in the NDC of Venezuela (Bolivarian Republic of) are unconditional and include the development of two wind farms in Paraguaná and Guajira, with total estimated capacity of 180 MW.

Viet Nam

Viet Nam's NDC mentions the development of renewables among the mitigation measures identified; however, it contains no quantified renewable energy targets.

Yemen

The renewable energy targets in Yemen's NDC [41] are both unconditional and conditional. Unconditional targets include the development of the 60 MW Mocha Wind farm (with estimated cost of USD 144 million), the Expansion of Solar Power Technology Project (with estimated cost of USD 50 million), and part of the Rural Energy Access Project (USD 121.4 million). Conditional targets include 15% renewable electricity by 2025 (to be met through 400 MW of wind and 160 MW of geothermal), and 6 MW power stations using landfill gas and 200 000 solar water heaters.

Zambia

The renewable energy targets in Zambia's NDC are both unconditional and conditional and include off-grid PV, wind, small hydropower, fuels switch (diesel to biodiesel and coal to biomass), blending of biofuels, biogas and rural biomass electricity plants. The NDC mentions that the estimated costs for total unconditional (USD 15 billion) and conditional (USD 30 billion) targets, but does not provide sufficient information to quantify the cost for renewable energy-specific targets. A rough estimate indicates that Zambia's unconditional and conditional renewable energy targets could amount to approximately USD 1.6 billion and USD 3.7 billion, respectively.

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[40] As of 15 October 2017, Uzbekistan had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

[41] As of 15 October 2017, Yemen
had not ratified the Paris Agreement. The country's NDC, therefore, formally remained an "intended" contribution (INDC) within the timeframe of this analysis.

Zimbabwe

The renewable energy targets in Zimbabwe's NDC are both unconditional and conditional. Unconditional targets include 84 MW of hydropower (phase I Kariba) at a cost of USD 300 million, 27 MW of small hydropower, and 1 250 bio-digesters (50 to 80 m^3 in size) by 2030. Conditional targets include USD 5 billion of hydropower to mitigate 15 316 t CO_2eq by 2030, USD 3 billion for off-grid solar, USD 1.23 billion for solar water heaters (179 t CO_2eq) by 2030, and USD 100 million for ethanol blending (202 t CO_2eq) by 2030.

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