IRENA
International Renewable Energy Agency

UNTAPPED POTENTIAL FOR CLIMATE ACTION

RENEWABLE ENERGY IN NATIONALLY DETERMINED CONTRIBUTIONS

#Renewables4Climate

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About IRENA

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

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ABBREVIATIONS

°C	Degrees centigrade
AREI	Africa Renewable Energy Initiative
CO_2	Carbon dioxide
CSP	Concentrated solar power
CVF	Climate Vulnerability Forum
DHC	District heating and cooling
EV	Electric vehicle
GDP	Gross domestic product
GHG	Greenhouse gas
GW	Gigawatts
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
MDG	Millennium Development Goal
MW	Megawatts
NDC	Nationally Determined Contribution
PV	Photovoltaic
SDG	Sustainable Development Goal
SHS	Solar home system
SIDS	Small Island Developing States
TW	Terawatts
UNFCCC	United Nations Framework Convention on Climate Change
USD	U.S. dollar

EXECUTIVE SUMMARY

Nationally Determined Contributions (NDCs) are a cornerstone of the Paris Agreement on climate change. They set out the actions that countries plan to undertake to achieve the agreement's objectives, focused on limiting the rise in average global temperatures to well below 2°C, ideally to 1.5 °C. Renewable energy features prominently in most of these NDCs, confirming that the transition to a renewable energy future has come to be recognised globally as central to addressing climate change.

Governments are well underway with implementing the first set of NDCs and will begin to review them in 2018. This entails taking stock of the adequacy of those NDCs to meet the objectives set out in the historic 2015 climate agreement. NDCs will be revised or updated by 2020, and every five years thereafter – with each revision aimed at being more ambitious than the previous one.

As a contribution to this process, the International Renewable Energy Agency (IRENA) has undertaken an analysis of current NDCs. These were compared with national renewable energy targets, plans, programmes and policies, as well as with current trends in renewable energy deployment.

IRENA's analysis suggests that while renewable energy targets and policies are indeed critical components of NDCs, there is substantial scope for countries to increase their renewable energy ambitions. This is true not only for the purposes of mitigation, but also to build resilience in the face of growing climate change impacts.

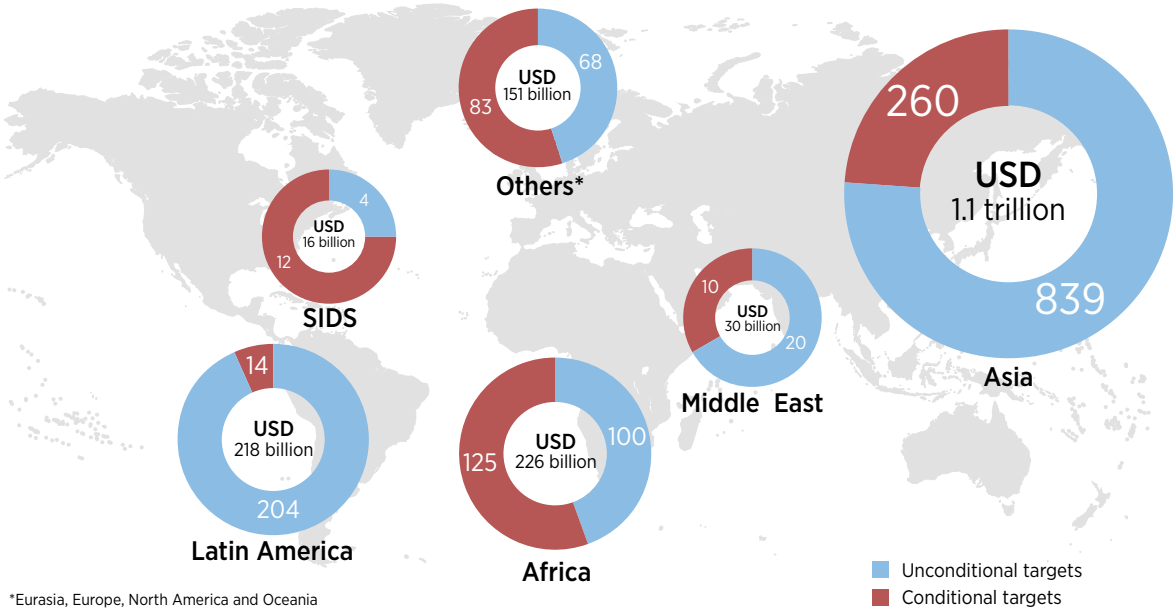
Key findings and recommendations

Most countries have included renewable energy in their NDCs, recognising that accelerating the energy transition will be essential to achieve the climate goals agreed worldwide in 2015. Of the 194 Parties to the United Nation Framework Convention on Climate Change (UNFCCC) that submitted NDCs, 145 referred to renewable energy action to mitigate and adapt to climate change, while 109 Parties included some form of quantified target for renewables.

While 85 Parties to the UNFCCC have not included quantified targets for renewables in their NDCs, many of them have ambitious national energy plans in place. Others also show significant cost-effective potential for renewables. Given the importance of renewables to achieve the objectives of the Paris Agreement, countries should consider reflecting progressively their national renewable energy targets in their NDCs.

The inclusion of renewable energy components in NDCs can help attract additional investment in the renewable energy sector. In fact, over USD 1.7 trillion would be needed by 2030 (see Figure ES-1) to implement renewable energy targets contained in NDCs, of which 70% relates to unconditional targets that countries plan to implement unilaterally. Embarking on this investment path will unleash the dynamics that can accelerate the energy transition. In order to mobilise private investment, stable, consistent and transparent enabling frameworks for renewables are required. Furthermore, the use of public finance should focus more on risk mitigation instruments and structured finance mechanisms and less on direct financing, i.e., grants and loans.

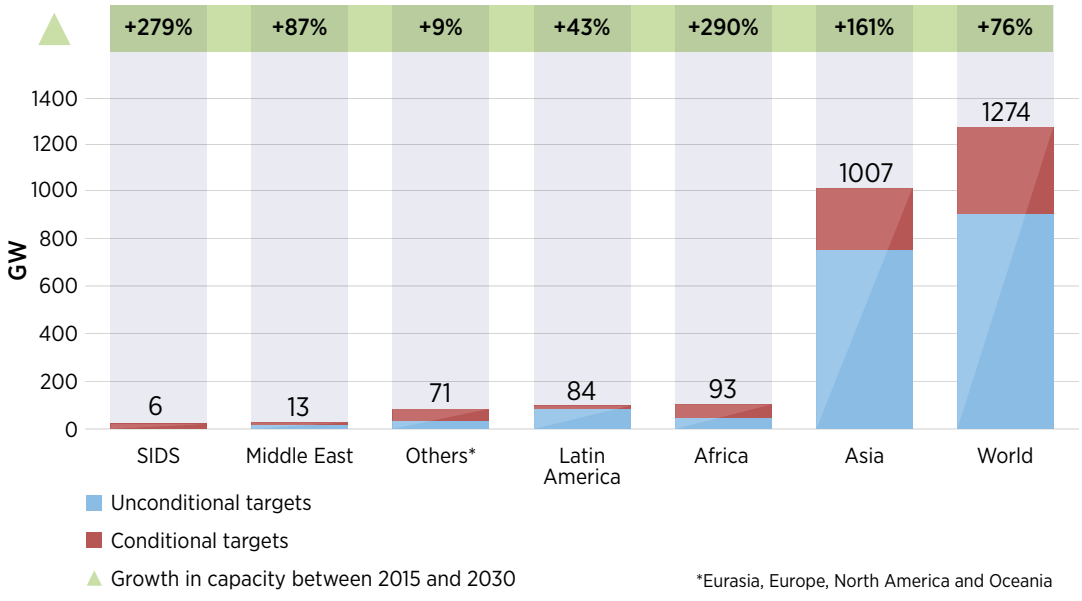
Figure ES- 1 **Total investment needed by 2030 for the implementation of renewable energy targets in current NDCs (USD billion)**



*Eurasia, Europe, North America and Oceania

At least 1.3 terawatts (TW) of renewable power installed capacity would be added globally in the years between 2015 and 2030 as a result of NDC implementation. This represents a 76% increase in the world's total installed capacity compared to 2014 (see Figure ES-2).

Figure ES-2 **NDC-driven increases in renewable power installed capacity up to 2030 by region and target**



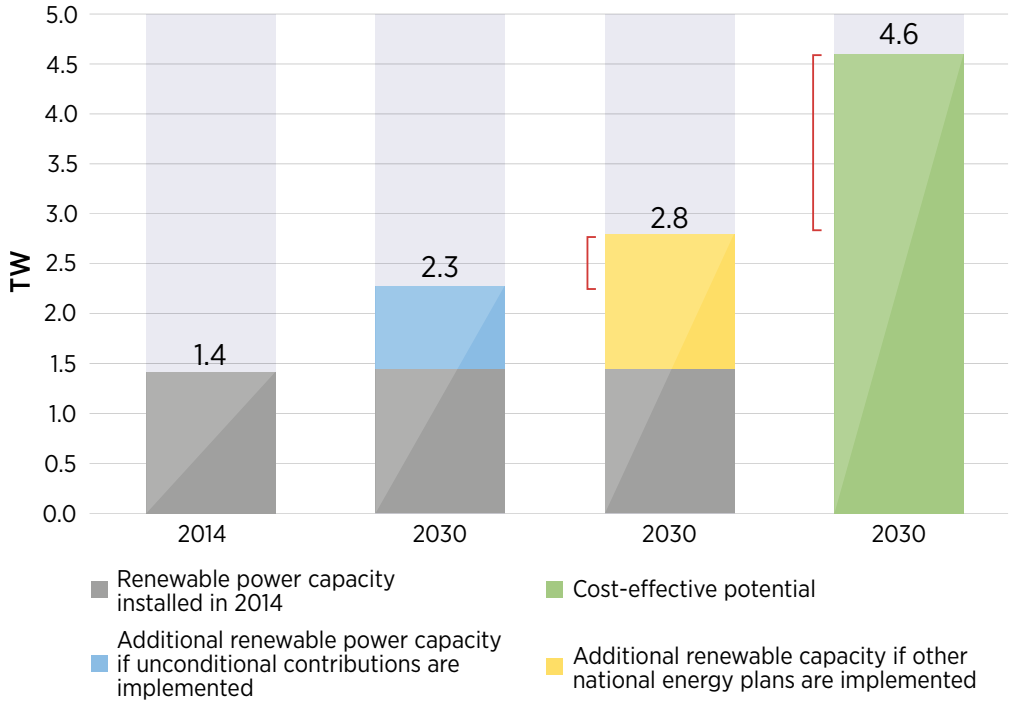
*Eurasia, Europe, North America and Oceania

NDCs, however, have not kept up with the recent rapid growth in renewables. While the global installed capacity of renewable power grew by an average 8.5% per year between 2010 and 2016, implementation of the renewable energy targets in NDCs would only lead to an average annual increase in renewable energy deployment of 3.6% over 2015-2030. Countries can use the opportunity presented by the 2020 NDC update to examine whether their renewable energy components can be strengthened to reflect at least the current pace of renewable energy deployment.

Renewable energy targets in NDCs are often less ambitious than targets that countries have already established in national energy plans and strategies. For example, the implementation of unconditional contributions in Africa would bring online an additional 40 gigawatts (GW) of renewable power installed capacity. This could be raised to at least 110 GW, just by ensuring the alignment of NDCs with existing national energy plans and strategies. Setting renewable energy targets in NDCs that are consistent with national energy strategies and plans can considerably strengthen the impact of NDCs and send a strong signal to investors.

The cost-effective potential for renewable energy is much higher than what is captured in NDCs. For example, significant untapped potential still exists in G20 countries for the development of renewables by 2030 (see Figure ES-3). For 10 of them in particular (Argentina, Australia, India, Indonesia, Mexico, the Republic of Korea, Saudi Arabia, South Africa, Turkey and the United States), the implementation of current NDCs would leave more than 65% of this potential untapped, providing these countries with the opportunity to progressively increase the ambition of renewable energy targets in the next round of NDCs. If countries include targets reflecting the cost-effective renewable energy potential in their NDCs, the world could be put on track to meeting the well below 2°C objective of the Paris Agreement through the implementation of NDCs.

Figure ES-3 Renewable energy components in G20 NDCs, national targets and cost-effective potential



The majority of NDCs include renewable energy targets only for electricity generation. However, 14 countries also include targets for the production of liquid biofuels, 11 call for the advancement of biogas, and 8 include the deployment of solar water heaters. More countries can explore opportunities for scaling up renewables in end-use sectors beyond electricity and increasingly reflect their efforts in the next round of NDCs. These sectors have an important role to play in achieving the objectives of the Paris Agreement. Specifically, significant carbon dioxide (CO_2) emission reductions will be needed by 2050 in heating and cooling in buildings (-73% compared to a business-as-usual scenario), energy use in transport (-70%) and energy use in industry (-56%).

Most NDCs treat renewable energy deployment primarily as a mitigation measure. However, renewable energy deployment can contribute to adaptation efforts, for example, by promoting the diversification of the power supply and by building resilience through improved energy access. Currently, 43 countries recognise the potential contribution of renewables in adapting to, and building resilience against, the adverse impacts of climate change. Larger numbers of countries, especially those most vulnerable to climate change impacts, have the opportunity to broaden the scope of their future NDCs, so as to increasingly include renewable energy targets as part of their adaptation strategies.

Given the cost-competitiveness of renewables, governments today have remarkable opportunities to utilise renewable energy targets in NDCs to accelerate the global energy transition and increase climate-resilience. Although current NDCs do not always reflect it, stronger targets for the uptake of renewables can significantly advance the energy transition.

Several countries have demonstrated increased ambition in their NDC renewable energy targets, both in terms of aiming for high share of renewables in the power mix and in setting targets for renewables in transport and heating and cooling. Other countries, especially where renewables are still viewed as a novelty, need to start this transition, which will become easier as experience is built and as technology costs decline further. Initiating the implementation of renewable energy components will help to unleash much of this potential, as well as to engage all the stakeholders needed to mobilise the investment dynamics that can drive further deployment.

Significant potential exists to strengthen renewable energy targets in the next round of NDCs. This can build on the strong current growth rates for renewables, it can pick up ambitious targets in national energy plans and strategies, and it can be informed by an assessment of the cost-effective potential of renewables in all sectors.

The rapid deployment of renewables, coupled with energy efficiency, can achieve around 90% of the emission reductions in the energy sector needed by 2050, while at the same time advancing economic growth and development. Advancing NDCs to match the actual potential of renewables will be crucial to ensure the viability of the Paris Agreement as a means to achieve global climate objectives.

1 INTRODUCTION

Approximately two-thirds of global greenhouse gas (GHG) emissions originate from energy production and use. The International Renewable Energy Agency (IRENA, 2017a) estimates that the rapid deployment of renewables, coupled with energy efficiency, can achieve around 90% of the emission reductions needed by 2050 in the energy sector to achieve agreed climate objectives.[1] The analysis in this report provides an assessment of the renewable energy components of Nationally Determined Contributions (NDCs) and compares targets for renewable energy defined in NDCs with national energy plans, with the cost-effective potential for renewables, and with recent historical deployment trends.

The landmark Paris Agreement, which calls for holding the increase in global average temperature to well below 2°C above pre-industrial levels, and for pursuing efforts to limit the increase to 1.5°C, entered into force in November 2016. The agreement establishes a bottom-up framework for climate action and calls for substantial efforts from all countries. Under the agreement, all but one of the 195 Signatories[2] have put forward their climate action plans through intended NDCs (UNFCCC, 2017a). These typically contain a combination of conditional and unconditional contributions; conditional contributions depend on international support for their implementation, whereas unconditional contributions are those that Parties intend to implement regardless of international climate assistance. As of 15 October 2017, 168 Parties had ratified the agreement and submitted their first formalised NDCs (UNFCCC, 2017b). Renewable energy features prominently in 145 of these.

A "ratcheting mechanism" built into the Paris Agreement requires Parties to update or submit new NDCs over time, which must be progressively more ambitious. The second round of NDCs is due in 2020[3] with revisions planned every five years thereafter.

A Facilitative Dialogue is set to take place in 2018, during which Parties will take stock of initial progress towards the collective goals in the Paris Agreement. The findings of this process will inform the preparation of the revised NDCs. The Facilitative Dialogue will be followed by a Global Stocktake every five years, starting in 2023.

This report serves as an initial contribution to this process. In summary, IRENA's analysis suggests that renewable energy targets and policies are critical components of the mitigation strategies put forward in NDCs, and that their implementation could potentially unlock significant investment opportunities in renewables, accelerating low-carbon development towards the achievement of climate objectives.

At the same time, the analysis finds that many NDCs are not only missing out on cost-effective opportunities to expand renewable energy deployment, but in some cases they also fall short of anticipated expansion reflected in national energy plans. And in some cases, NDCs have been overtaken by reality, as they commit to lower levels of deployment than are actually being achieved in practice. This suggests that there is substantial scope for Parties to increase the renewable energy ambitions of their NDCs in a cost-effective way. By doing so, they would increase the viability of the Paris Agreement as a mechanism for limiting dangerous climate change.

[1] In 2017, IRENA and the International Energy Agency (IEA) each developed a core scenario that would be compatible with limiting the rise in global mean temperature to 2°C by 2100 with a probability of 66%, in line with the objectives of the Paris Agreement. See IRENA (2017a).

[2] As of 15 October 2017, Libya had not submitted its NDC.

[3] 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.

As the IRENA analysis is further developed, it should ultimately serve as a comprehensive analytic framework that can assist governments in implementing and further developing the renewable energy component of their NDCs. Its purpose is to support governments by:

- estimating the level of renewable energy deployment that would result when fully implementing existing NDCs and the additional greenhouse gas emission reduction that can be achieved by further increasing the share of renewables in the energy mix;
- helping them align NDCs with other national renewable energy plans or commitments;
- informing them about additional potential renewable energy deployment (beyond what is envisaged in NDCs or national energy plans) that could be achieved in a cost-effective way; and
- estimating the total investment needed to implement the renewable energy components in NDCs and the amount of public finance required to leverage such investment volumes.

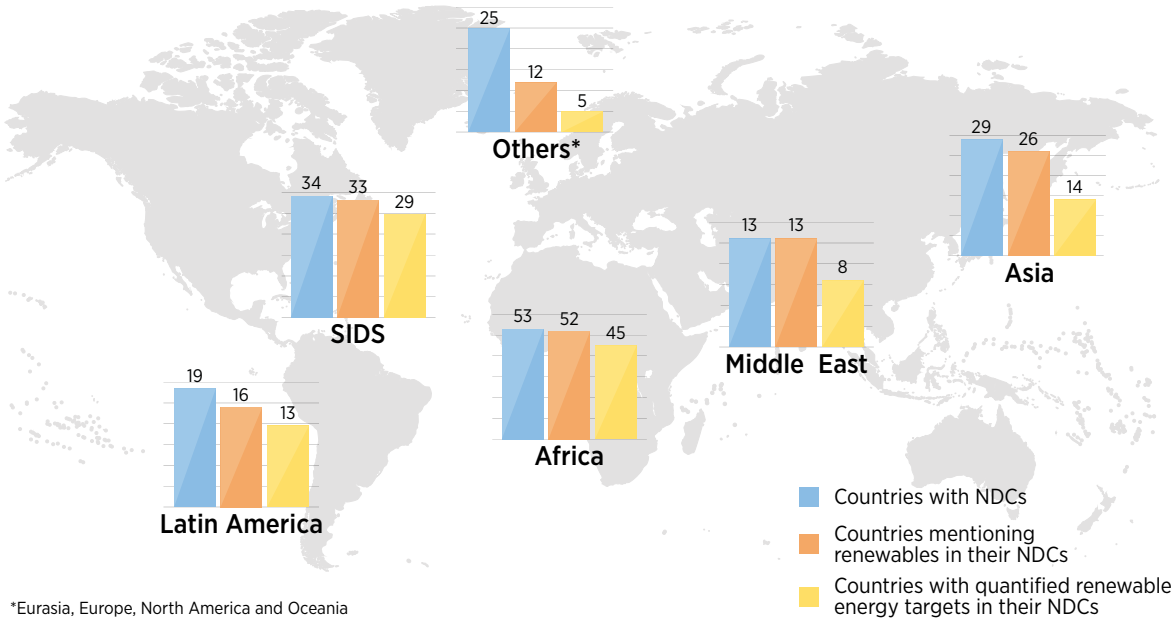
A complete overview of the methodology used to arrive at the results presented in this report is to be made available in a stand-alone paper (IRENA, forthcoming). In addition, the results of the analysis by country can be browsed through an online data tool, published on IRENA's website (IRENA, 2017b). The assessment of renewable energy NDC components presented in this report complements previous IRENA work conducted in 2017 to identify a pathway to meeting the objectives of the Paris Agreement.[4]

[4] *IRENA (2017a).*

2 RENEWABLE ENERGY IN NDCs

Given the key role of renewables to achieve both climate and development goals, most Countries have included renewable energy in their NDCs. Of the 194 Parties to the UNFCCC that submitted their NDCs, 145 referred to renewable energy action to mitigate and adapt to climate change, and 109 Parties included some form of quantified target for renewables in their NDCs (see Figure 1).

Figure 1: Renewable energy components in NDCs



*Eurasia, Europe, North America and Oceania

Global totals differ from the sum of regional totals as seven SIDS included simultaneously in other regional groupings; specifically Cabo Verde, Comoros, Mauritius, São Tomé and Príncipe, and Seychelles are included under Africa, and Maldives and Timor-Leste are included under Asia.

A variety of metrics are employed to express quantified renewable energy targets in NDCs; these can be expressed in terms of absolute physical units (e.g., additional power capacity in megawatts (MW), or number of new mini-grids installed), as shares of future total electricity generation or energy production/consumption, in terms of investment need, and/or with reference to emission reductions targeted. Several NDCs provide more than one type of renewable energy target, i.e., they employ more than one metric. The level of detail in renewable energy components varies considerably among countries; Table 1 shows the types of renewable energy targets included in current NDCs, broken down by region.

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

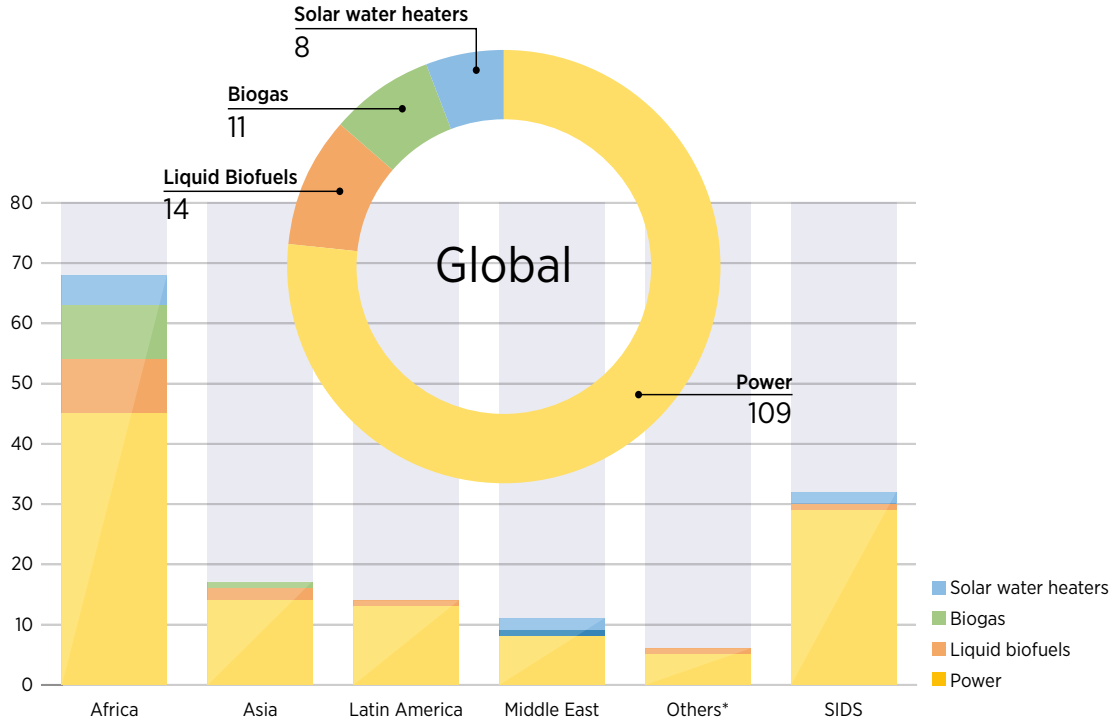
Renewable energy target	Global	Africa	Asia	Latin America	Middle East	Others*	SIDS
in terms of absolute physical units	**74**	32	12	7	3	5	20
as a share of electricity generation or energy production/ consumption	**64**	21	10	10	7	5	19
in terms of emission reduction	**12**	6	0	1	0	1	5
in terms of investment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

Notably, most NDCs focus on renewable electricity generation. End-use energy sectors, such as transport or heating and cooling in buildings, which remain largely dependent on fossil fuels, are addressed only by a few countries. Figure 2 shows that 14 NDCs include targets for the production of liquid biofuels, 11 call for the advancement of biogas, and 8 include the deployment of solar water heaters. While some of these sectors can be electrified, other untapped opportunities exist for deploying renewables for these end-uses.

Figure 2: Renewable energy targets in NDCs by end-use application



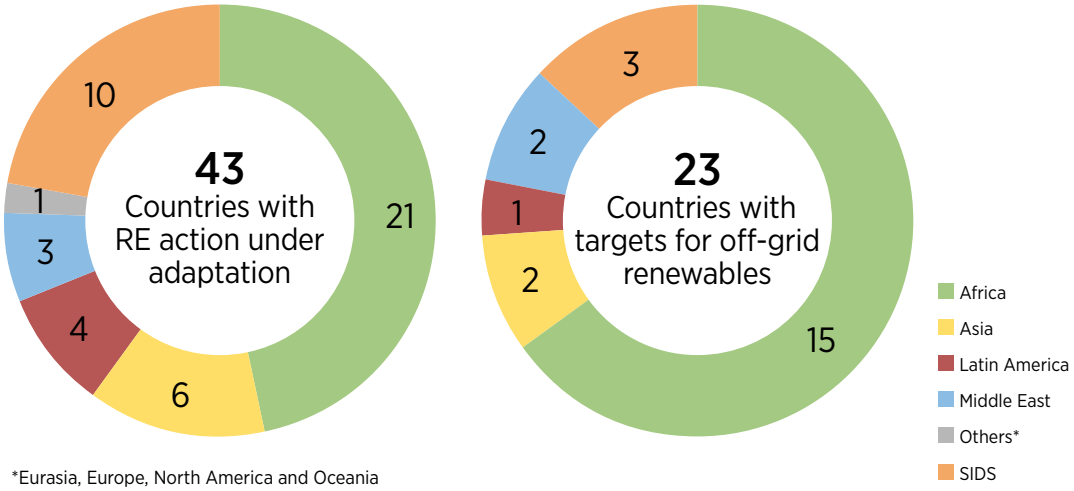
Global totals differ from the sum of regional totals, as seven SIDS are included simultaneously in other regions

Given the focus of NDCs on both the mitigation of and adaptation to climate change, it is also noteworthy that most NDCs treat renewable energy deployment primarily as a mitigation measure. Many countries, in particular those most vulnerable to climate change – Small Island Developing States (SIDS) and developing countries in Africa, Asia and Latin America – are already experiencing the impacts of a changing climate. These countries generally take a more comprehensive approach in developing their NDCs: mitigating climate change while advancing social and economic development, and at the same time building resilience to the inevitable impacts they are facing.

Renewable energy deployment can contribute to adaptation efforts, for example, by promoting the diversification of the power supply and by building resilience through improved energy access (see Box 1). As depicted in Figure 3.a, 43 Parties currently recognise in their NDCs the potential contribution of renewables for adaptation and for building resilience, although only a handful of them include quantified targets.

Finally, at least 23 developing countries include quantified targets for off-grid renewable energy in their NDCs (see Figure 3.b).

Figure 3: NDCs with renewable energy action for adaptation (3.a) and targets for off-grid renewables (3.b)



*Eurasia, Europe, North America and Oceania

Global totals differ from the sum of regional totals, as seven SIDS are included simultaneously in other regions

Decentralised renewables are of particular importance in countries where a large share of the population still lacks access to modern energy services. Table 2 shows that out of the 23 countries where more than 70% of the population still lacks access to electricity, 8 specifically mention the development of off-grid renewables in their NDCs, and 6 have included some form of quantified targets.

Table 2: Off-grid renewable energy in the NDCs of countries where more than 70% of the population lacks access to electricity

Country	Share of population with access to electricity in 2014 (World Bank, 2017)	Off-grid renewable energy component in the NDC
South Sudan	4.5%	
Burundi	7%	Mention
Chad	8%	Quantified Target
Liberia	9%	
Malawi	11.9%	Quantified Target
Central African Republic	12.3%	
Sierra Leone	13%	
Democratic Republic of the Congo	13.5%	
Niger	14.3%	
United Republic of Tanzania	15.5%	
Madagascar	16.8%	
Guinea Bissau	17.2%	
Somalia	19%	
Burkina Faso	19.2%	Quantified Target
Rwanda	19.8%	Quantified Target
Papua New Guinea	20.3%	
Uganda	20.4%	
Mozambique	21.2%	
Ethiopia	27.2%	
Mali	27.3%	Quantified Target
Guniea	27.6%	
Lesotho	27.8%	Quantified Target
Zambia	27.9%	Mention

Box 1 The role of renewables in adaptation strategies and targets

The Intergovernmental Panel on Climate Change (IPCC) (Olsson et al., 2014) predicts that climate change will create new impoverished populations between now and 2100, threatening sustainable development in both developed and developing countries. Climate variability, climate change and extreme weather events will disproportionally affect rural and urban people living in poverty, bringing negative impacts on livelihoods such as losses in crop yields, destroyed homes and food insecurity. Lack of access to finance and technologies limits the ability of the poor to adapt to the impacts of climate change and further exacerbates inequalities.

Many of the most vulnerable countries have already recognised the role of renewables for adaptation. At the 2016 Marrakech Climate Change Conference, the 48 Members of the Climate Vulnerability Forum (CVF), a global partnership of countries that are highly vulnerable to the effects of climate change, agreed to "strive to meet 100% domestic renewable energy production as rapidly as possible, while working to end energy poverty and protect water and food security, taking into consideration national circumstances".

Renewable energy can contribute to adaptation to climate change in different ways.

Diversifying power supply

When countries rely on large hydropower as their primary source of electricity production, they can be extremely vulnerable to severe and prolonged drought. The diversification of the electricity mix through the inclusion of other renewable energy sources can help these countries adapt to the effects of climate change.

For example, large hydropower accounts for a significant share of electricity generation in many countries in Latin America (100% in Paraguay, 75% in Brazil, 70% in Colombia, Costa Rica and Venezuela). Recent years have seen impressive growth in non-hydropower renewables in the region, whose installed capacity has more than quadrupled between 2006 and 2016, from 10 gigawatts (GW) to 43 GW (IRENA, 2017c), bringing down the relative share of large hydropower in total renewable capacity.

Energy security has been a key driver for energy diversification to reduce the vulnerability to changes in hydrological cycles which affect hydropower output. By diversifying the power supply, it is possible to take advantage of the long-term climate synergy between hydropower and other renewable energy technologies. While the output of some non-hydropower renewable power sources such as geothermal is generally unaffected by long-term climate events, electricity generated from wind or solar is even increased during dry periods (IRENA 2016a).

Building resilience through energy access

Access to energy is key to promoting inclusive economic development, poverty alleviation, social equity, and advances in health and education. Currently more than 1 billion people have no access to electricity; half of them live in sub-Saharan Africa. Off-grid renewables offer the most cost-effective solution to bring energy to people who are not yet connected to the grid. As such, these technologies can contribute significantly to building climate resilience in poor rural and urban areas.

The majority of people without access to electricity live in rural areas, where a large portion of households rely on agriculture and related agri-food activities for subsistence as well as for income and jobs. In such areas, the high cost of energy, vulnerability to price fluctuations and lack of access to modern energy services can exacerbate poverty and affect food security. Off-grid renewable energy technologies can be used along the different stages of the agri-food chain (including in primary production activities, post-harvesting activities, and food preparation and cooking), with multiple socio-economic benefits for rural communities. Decentralised renewables can support development by creating jobs, reducing poverty, improving health, enhancing access to water and food, improving livelihoods and promoting gender equality (IRENA, 2016b).

It should be highlighted that the benefits of an accelerated deployment of renewable energy go beyond climate mitigation and adaptation. Accelerating the transition to a renewables-based energy system represents a unique opportunity to meet climate goals while also fuelling economic growth, creating new employment opportunities and enhancing human welfare.

Renewable energy contributes directly to the achievement of the Sustainable Development Goal (SDG) 7 – universal access to affordable, reliable, sustainable and modern energy – while also reinforcing the implementation of other SDGs (see Box 2). Figure 4 shows possible linkages between SDG7 and other SDGs along the three dimensions of environmental sustainability, human development and sustainable development growth (IRENA, 2017d).

Recognising the multiple benefits of renewables for both climate and development, many developing countries included very ambitious targets in their NDCs. Particularly in Small Island Developing States (SIDS), renewable energy can improve economic development and enhance energy security as it reduces dependence on costly fossil fuel imports. Seven SIDS set out in their NDCs the ambitious target of achieving 100% of electricity generation from renewables. These include Cook Islands and Tuvalu by 2020, Cabo Verde and Samoa by 2025, and Fiji, Papua New Guinea, and Vanuatu by 2030. As SIDS are among the countries most vulnerable to the effects of climate change, renewables in these countries also can support efforts for adaptation and can help build resilience to the changing climate.

Figure 4: Linkages between renewables in SDG7 and other SDGs

(IRENA, 2017d)

Box 2 Sustainable Development Goals and the socio-economic benefits of renewables

In September 2015, the United Nations General Assembly adopted the Sustainable Development Goals (SDGs). These are 17 goals to be achieved over the next 15 years as part of the 2030 Agenda for Sustainable Development (Agenda 2030). They build on the success of the Millennium Development Goals (MDGs) and aim to go further to end poverty, protect the planet and ensure prosperity for all. As policy makers consider options to achieve both climate and development objectives, understanding the socio-economic benefits of an accelerated deployment of renewables is of vital importance.

Renewable energy contributes both directly and indirectly to the achievement of the SDGs. Together with energy efficiency, renewables are key to the goal of ensuring "access to affordable, reliable, sustainable and modern energy for all" (SDG7). Furthermore, deploying renewable energy to achieve SDG7 can reinforce the implementation of other SDGs along the other dimensions, including but not limited to, environmental sustainability, human development and sustainable development growth (IRENA, 2017d).

Environmental sustainability

Renewable energy can help mitigate the local and global environmental impacts of energy consumption, supporting other SDGs such as Climate Action (SDG13), Sustainable Cities and Communities (SDG11) and Life on Land (SDG15).

Human development

Renewable energy facilitates access to basic services (e.g., education, health, water and food) and improves the availability of income-generating activities. Together, these services contribute to poverty alleviation and to improved well-being. As such, renewables can support other SDGs such as Good Health and Well-being (SDG3), Quality Education (SDG4) and Clean Water and Sanitation (SDG6).

Sustainable economic growth

Renewable energy can fuel economic growth, improve human welfare, create new jobs and develop new industries. IRENA (2017a) quantified the macroeconomic impacts of renewable energy deployment. The analysis found that the energy transition can result in cumulative global gains in gross domestic product (GDP) of around USD 19 trillion between now and 2050. Furthermore, IRENA estimates that with the decarbonisation of the global economy, renewable energy jobs would reach 26 million by 2050; this alone would offset job losses in the fossil fuel sectors. As a consequence, renewable energy deployment can support the achievement of other SDGs such as No Poverty (SDG1) and Decent Work and Economic Growth (SDG8).

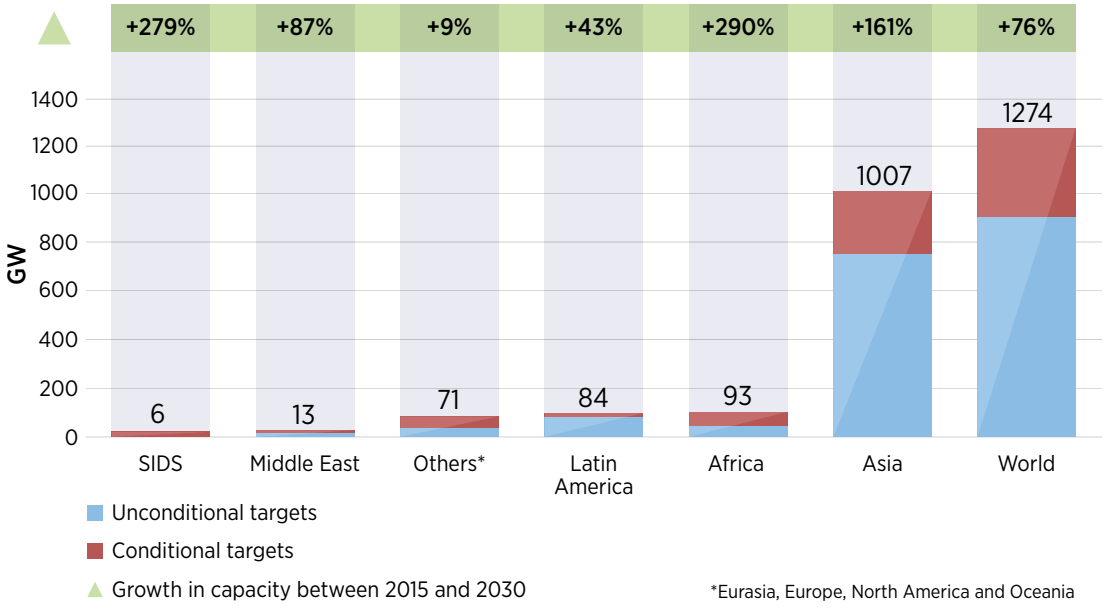
2.1 NDC targets for renewable power generation

The full implementation of the renewable energy components of existing NDCs would add at least 1.3 terawatts (TW) of installed capacity globally between 2015 and 2030. This would represent a 76% increase in the world's total installed capacity compared to 2014.[5]

As depicted in Figure 5, the majority of this new capacity would be installed in Asia (1 TW), with China, India and Japan accounting for 66%, 21% and 6% of the total in the region, respectively. Africa would account for approximately 95 GW, followed by Latin America with almost 85 GW.

The highest growth would occur in Africa and in Small Island Developing States (SIDS), both nearly quadrupling their total renewable power installed capacity between 2015 and 2030.

Figure 5: NDC-driven increases in renewable power installed capacity up to 2030 by region and target



Global totals differ from the sum of regional totals, as seven SIDS are included simultaneously in other regions

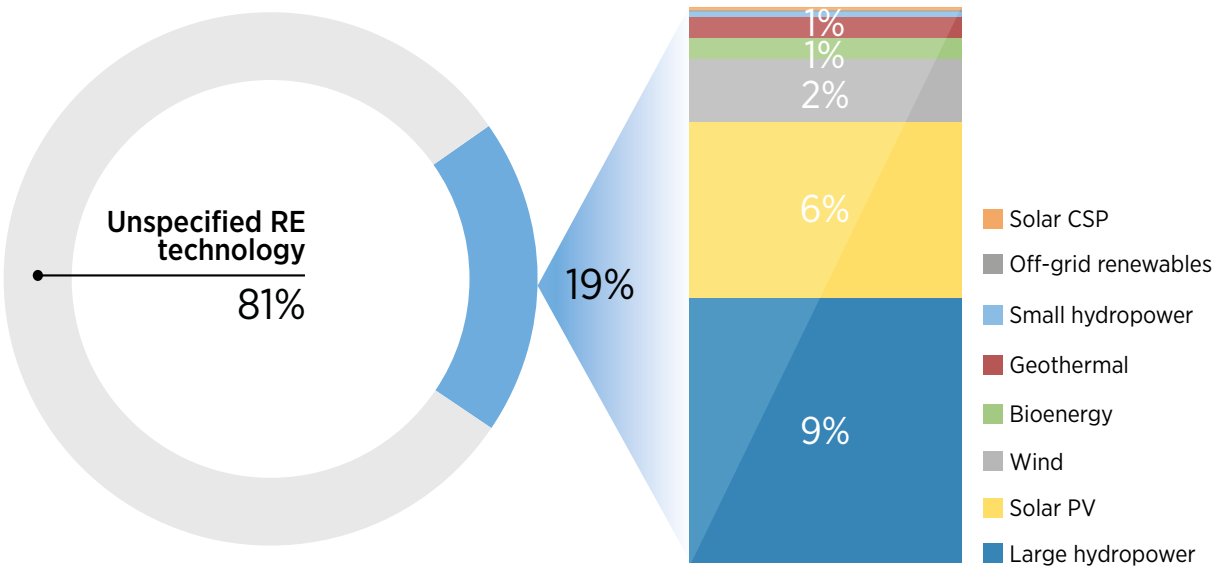
Most NDCs provide only aggregated renewable energy targets for the power sector, but some include details about the technology breakdown (see Figure 6). Of the 1.3 TW of additional renewable power installed capacity that would result from the implementation of NDCs, 240 GW (about 19% of the total) would come from technology-specific targets. Of this, more than 110 GW would be for large hydropower, almost 80 GW for solar photovoltaics (PV) and almost 30 GW for onshore wind.

NDC targets for off-grid renewables – including solar home systems (SHS), solar lanterns, biodigesters and mini-grids – would result in an additional 1.3 GW of installed power capacity by 2030, most of it in Africa (1.2 GW), and are estimated to provide access to electricity to roughly 140 million people.

[5] *As most countries prepared their intended NDCs in the lead-up to the Paris Climate Conference in 2015, the analysis presented in this report uses 2014 as the baseline year.*

These figures suggest that the potential for accelerating the renewable energy transition by fully implementing the current NDCs is considerable. From a climate policy perspective, the reverse is equally true: accelerating renewable energy deployment will help countries fulfil their NDC commitments, and ultimately contribute to achieving their climate action ambitions. It is a win-win situation.

Figure 6: NDC-driven increases in renewable power installed capacity up to 2030 by technology



Comparison with current deployment trends

But so much more could actually be "won". Global renewable energy deployment in the power sector has increased rapidly in recent years and continues to grow at an unprecedented pace. Global renewable power capacity more than doubled in the last decade and reached 2 TW in 2016. Figure 7 shows the average level of annual renewable energy deployment in the power sector during the period 2010-2016, as compared to the level of deployment during the period of NDC implementation (i.e., 2015-2030). In other words, for each region it compares the impact of existing commitments under the Paris Agreement with the recent historical deployment trend. At the global level, the capacity added annually (on average) as a result of NDC implementation is actually lower than the recent historical trend.

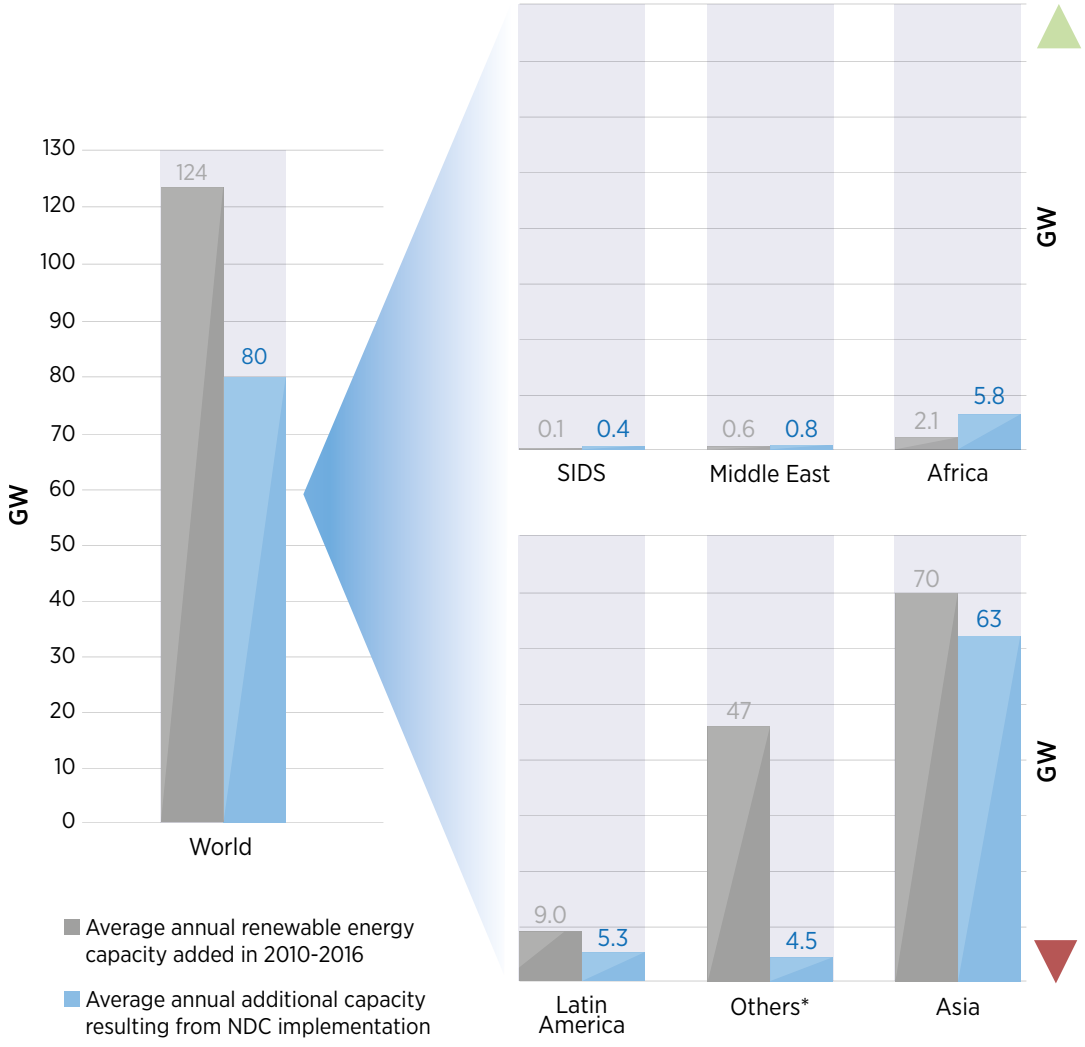
Looking ahead to 2030, implementing current NDCs would lead to an estimated 80 GW of additional capacity globally on average on an annual basis (2015 to 2030). Again, this is far less than the 124 GW that was installed globally on average every year between 2010 and 2016 (IRENA, 2017c). In terms of growth rates, renewable energy deployment resulting from NDC implementation would increase at an annual 3.6% over 2015-2030, significantly slowing down recent uptake since global renewable power installed capacity grew at a pace of 8.5% between 2010 and 2016. This may be a case of "under promising and over delivering", suggesting that there is substantial scope for the next round of NDCs to be more ambitious if they are to serve as tools for driving accelerated action. And given the dramatic reduction in technology costs over the last few years, this should be increasingly easy in the coming years.

It should be noted that there are significant regional differences in the scale of renewable

energy deployment expressed in NDCs. Accelerated deployment (compared to recent trends) is expected in SIDS, Africa and the Middle East, reflecting the multiple benefits that renewables offer for economic development. Specifically, annual new capacity in SIDS would grow from 83 MW (over the period 2010-2016) to an estimated 400 MW between 2015 and 2030 as a result of NDC implementation – a four-fold increase. In Africa the level of annual renewable energy deployment would triple, from 2.1 GW to 5.8 GW, and in the Middle East the implementation of NDCs would bring online on average more than 800 MW every year, up from 640 MW over the period 2010-2016.

In all other regions, including in most of the world's richest countries, there is substantial scope for increasing renewable energy ambition in the next round of NDCs. Particularly in Eurasia, Europe, North America and Oceania, the anticipated annual renewable energy deployment in NDCs accounts for only 10% of the growth levels that actually occurred in 2010-2016. This is mainly because the majority of these countries do not include quantified renewable energy targets in their NDCs.

Figure 7: Average annual renewable energy deployment in NDCs as compared to annual capacity additions over 2010-2016



*Eurasia, Europe, North America and Oceania

Global totals differ from the sum of regional totals, as seven SIDS are included simultaneously in other regions

Alignment with existing national targets and plans

Not only does the ambition reflected in NDCs lag behind recent historical trends, it falls short of the effort expressed in national energy plans and policies. While 109 Signatories include quantified targets for renewable electricity generation in their NDCs, 150 countries have ambitious national power sector plans in place (REN21, 2017). Many Signatories have chosen not to explicitly include their existing national renewable energy policies as part of their international climate commitments. Moreover, many countries have not fully reflected the ambition of national policies in the targets they have set for the renewable energy power sector in their NDCs.

By way of example, Boxes 3 and 4 detail the results of the analysis for two groups of countries: the G20 countries and Africa.

Only ten G20 countries explicitly include quantified renewable energy targets for the power sector in their NDCs, while all of them have set targets as part of their national energy plans and strategies. IRENA estimates that renewable power installed capacity in the G20 would reach almost 2.3 TW in 2030 as a result of the implementation of unconditional contributions set out in NDCs. This falls below the targets set out in national energy plans, which are estimated to bring renewable power installed capacity to almost 2.8 TW in 2030.

Similarly, unconditional contributions in African countries foresee the installation of about 40 GW of additional renewable power installed capacity by 2030. Although their implementation would result in a doubling of the renewable power installed capacity on the continent, these contributions are actually less ambitious than the targets set in national energy plans, which envisage over 110 GW by 2030.

Alignment with cost-effective potential[6]

There is a third element to consider when analysing the ambition of renewable energy components of NDCs. As IRENA's analysis shows, renewable energy targets for the power sector in both national policies and current NDCs could, in many cases, be increased significantly before reaching the available potential for cost-effective deployment. This cost-effective potential for increasing renewable energy capacity has been estimated in previous IRENA reports (2015; 2016c). The evidence suggests that there is a significant opportunity to adopt more ambitious targets, both in NDCs and in other national plans, including for increased shares of renewables in the total energy supply.

For instance, IRENA estimates that renewable power installed capacity in the G20 could reach 4.6 TW by 2030; this is double the amount that would be achieved though the implementation of unconditional renewable energy targets in NDCs, meaning that there is approximately 2.3 TW of untapped potential. Similarly, implementing other existing national targets would bring total renewable power capacity to only 2.8 TW (see Box 3).

More ambitious targets also would be feasible in Africa. IRENA estimates that the cost-effective potential for renewables on the continent is around 310 GW by 2030, while total renewable power installed capacity would reach only 70 GW based on the implementation of unconditional contributions, and 150 GW if other national targets are implemented (see Box 4). To fully exploit the significant renewable energy potential in Africa, IRENA estimates that USD 32 billion will be needed on average every year during 2015-2030. This is significantly higher than the current level of investment on the continent, estimated to have fluctuated between

[6] *This part of the analysis has been conducted so far only for Africa and the G20, due to limited availability of data on cost-effective potential.*

USD 2 billion and USD 9 billion during 2010-2016 (BNEF, 2017). On average almost 60% of total annual investment was provided by the public sector, and growth in private finance has been slow given that investors perceive risks as high. The implementation of increasingly ambitious renewable energy targets up to tapping the full potential will depend on the ability of countries to overcome the investment challenge and address these risk perceptions.

Box 3: Comparing the renewable energy components of NDCs with other national targets and cost-effective potential in the G20 countries

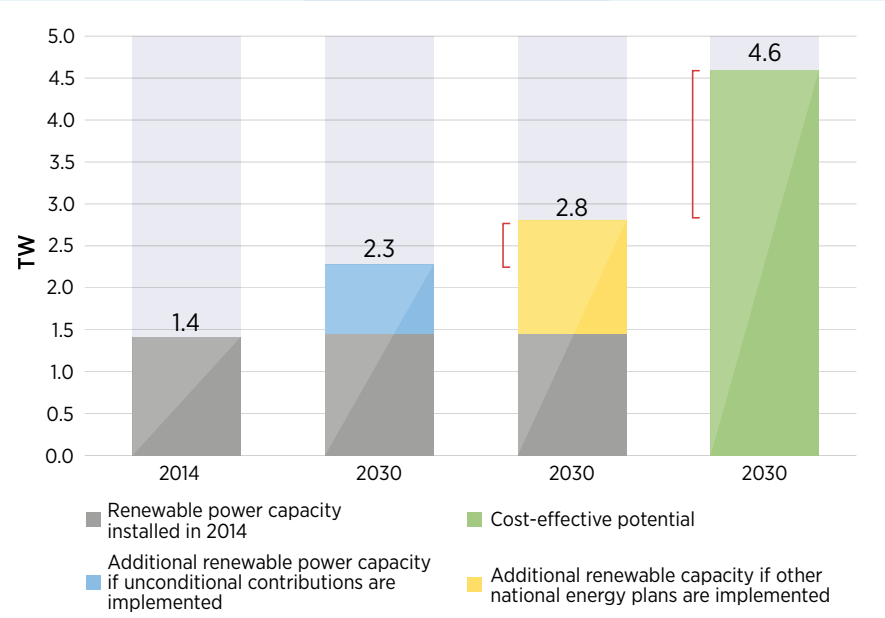
The G20 countries have a key role to play in the energy transition, as they are responsible for 80% of the global energy-related carbon dioxide emissions reductions projected for 2050 which are needed to reach the goals of the Paris Agreement (IRENA, 2017a). Previous IRENA analysis has shown that G20 countries account for 75% of the global renewable energy potential and that significant opportunities remain beyond today's policy plans.

IRENA estimates that renewable power installed capacity in the G20 would reach almost 2.3 TW in 2030 as a result of the implementation of unconditional contributions set out in NDCs (see Figure 8). This represents a 60% increase over 2014 levels, most of which would occur in South Africa (+480%), Indonesia (+300%), China (+160%) and Japan (+120%). However, only 8 G20 countries include quantified unconditional renewable energy targets in their NDCs, and two limit renewable energy deployment to conditional targets.

In aggregate, unconditional renewable energy components in the NDCs of G20 countries actually fall below the targets in national energy plans, which are estimated to bring total installed capacity to almost 2.8 TW in 2030 (IRENA, 2016b). For Argentina, India, Saudi Arabia and Turkey, in particular, the renewable energy targets in NDCs could at least triple if they were aligned with national targets.

Moreover, renewable energy deployment in the G20 resulting from the implementation of both NDCs and national energy plans would be only about 60% of the cost-effective potential, which IRENA (2016c) estimates to be around 4.6 TW. For Argentina, Australia, India, Indonesia, Mexico, the Republic of Korea, Saudi Arabia, South Africa, Turkey and the United States, in particular, the renewable energy targets in NDCs could be increased significantly if countries decided to aim for closer to their cost-effective potential; in these countries in fact the implementation of current NDCs would leave more than 65% of this potential untapped.

Figure 8: Renewable energy components in G20 NDCs, national targets and cost-effective potential



Box 4 Comparing the renewable energy components of NDCs with other national targets and cost-effective potential in African countries

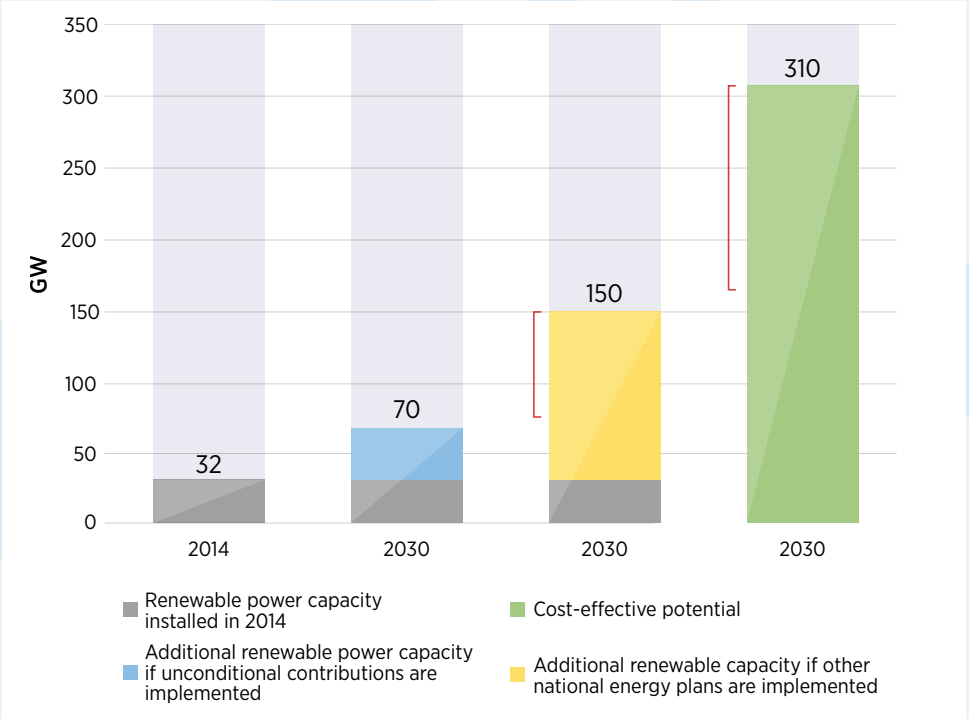
As economic progress and population growth advance at unprecedented speed in Africa, the continent is faced with the significant challenge of meeting rising demand for power, transport and other energy uses in a way that is economically sustainable and that safeguards livelihoods. Accelerated use of modern renewable energy provides a unique opportunity to tackle current energy challenges and pursue sustainable development.

African NDCs foresee the installation of about 95 GW of additional renewable power generation capacity by 2030, of which almost 40 GW is an unconditional contribution to the global effort on climate change. With 32 GW of renewables installed at the end of 2014 (IRENA, 2017c), the implementation of such contributions would more than double installed renewable energy capacity on the continent (see Figure 9). Although ambitious on the face of it, these contributions are in fact less ambitious than the targets set in national energy plans, which envisage over 110 GW by 2030.

Moreover, renewable energy targets, both in NDCs and in national plans, do not fully account for the cost-effective potential for renewables in Africa. IRENA (2015) estimates this potential to be 310 GW by 2030, provided that the African economy continues to grow at an average annual rate of 5%. This shows a significant potential for more ambitious targets and increased shares of renewables on the continent.

This ambition is captured in the objectives of the African Renewable Energy Initiative (AREI), an Africa-owned and Africa-led effort aimed at accelerating the deployment of renewables by harnessing the significant renewable energy potential on the continent. The Initiative aims to add at least 10 GW of new renewable energy generation capacity by 2020, and at least 300 GW by 2030. IRENA supports this objective through Clean Energy Corridor initiatives that promote regional development and deployment of renewable energy.

Figure 9: Renewable energy components in African NDCs, national targets and cost-effective potential



2.2 NDC targets for renewable heating, cooling and transport

The majority of NDCs focus on renewable energy targets for electricity generation. Opportunities for accelerated renewable energy deployment in end-use sectors, such as heating, cooling and transport, were included only by a few countries. Yet, as of year-end 2016, 47 countries had set national targets for renewable energy for heating and cooling and 41 for transport (REN21, 2017).

IRENA (2017a) has shown that the decarbonisation of the energy sector cannot be achieved through electricity generation alone. Significant carbon dioxide emission reductions also will be needed in end-use sectors, including heating and cooling in buildings (-73% compared to a business-as-usual scenario), energy use in transport (-70%) and energy use in industry (-56%).

For instance, heating and cooling represents 80% of the total energy demand in buildings. Coupled with energy efficiency measures, renewable energy including solar PV panels and solar water heaters, geothermal energy and electrification can have a significant impact in reducing emissions.

Important benefits in terms of climate change mitigation can be achieved, for example, through the accelerated use of renewables for district heating and cooling (DHC[7]). Significant potential exists to upgrade existing fossil fuel-based systems to include renewable energy, including biofuels, solar and geothermal. Such measures can help countries meet rising urban energy needs, improve efficiency, reduce emissions and provide cost-effective temperature control (IRENA, 2017e).

Renewables also can help to cut emissions in the transport sector coming from both passenger and freight vehicles. Although switching to electric vehicles (EVs) will have a key role to play [8] (especially in passenger transport), when electrification is not possible, CO_2 emissions can be cut by replacing oil with liquid or gaseous biofuels or renewables-based hydrogen (IRENA, 2017a).

Opportunities to accelerate the deployment of renewables and to realise their full potential in the overall energy system also can be created by linking electricity generation with end-use sectors. This is referred to as sector coupling and can ensure that the surplus renewable electricity is stored and transformed for use in industry, for managing thermal loads in buildings and for transport. Besides being economically more efficient, sector coupling can improve the flexibility of the power system and can help accommodate higher shares of variable renewables such as solar and wind (IRENA, 2017d).

[7] DHC is defined as the centralised heating or cooling of water, which is then distributed to multiple buildings through a pipe network.

[8] Electric vehicles (EV) provide zero-vehicle-emissions driving, and, when increasingly fuelled by renewable power, they can help significantly cut overall well-to-wheel emissions. Furthermore, EVs can be used to enable a higher share of variable renewable energy in the power system by making use of EV batteries to store excess electricity and to provide ancillary services to the grid, such as frequency regulation, shaving peak demand, power support to enhance the operation, and reserve capacity to secure the grid.

3 INVESTMENT NEEDS FOR IMPLEMENTATION OF THE RENEWABLE ENERGY COMPONENTS IN NDCs

Setting aside the opportunities for increasing ambition in NDCs, the first priority has to be to advance rapidly on implementing the NDC-based renewable energy components in place already. This requires above all a scaling-up of investment. Doing so will help to accelerate the energy transition and advance progress towards achieving climate objectives. Experience has shown that once initial investment hurdles have been overcome and a track record is building up, further growth in renewables becomes much easier.

Global investment in renewable energy increased steadily between 2004 and 2011 and has fluctuated since then at around USD 300 billion per year (Buchner et al., 2017; Frankfurt School-UNEP Centre / BNEF, 2017).

IRENA analysis (2017a) has shown that to cost-effectively raise the share of renewables in the global energy mix, in line with the target of staying below 2°C[9], renewable energy investment needs to be scaled up significantly above current levels. The decarbonisation of the energy sector would require a total of USD 25 trillion to be invested in renewables up to 2050, or on average more than USD 700 billion per year.

In contrast, to implement the renewable energy targets of the NDCs discussed in section 3 above, more than USD 1.7 trillion would be needed between 2015 and 2030, or on average almost USD 110 billion per year. More than 70% of this total investment needed (or USD 1.2 trillion) would have to be mobilised to implement the unconditional targets. A further USD 500 billion would be required in developing countries in the form of international finance to support the conditional targets.

As depicted in Figure 10, the largest investment will be needed for the implementation of renewable energy components of NDCs in Asia (USD 1.1 trillion), followed by Africa (just above USD 225 billion) and Latin America (almost USD 220 billion). International support is expected to play a major role in SIDS and in Africa, where the majority of targets for renewables are conditional. Conversely, 95% of investment needs in Latin America, more than 75% in Asia and more than 65% in the Middle East would be mobilised domestically.

The USD 1.2 trillion needed for the implementation of unconditional renewable energy targets will have to be mobilised by the Parties that made the commitments. The implementation of unconditional contributions presents such countries with the opportunity to mobilise capital for renewable energy domestically and, thereby, build capacity of local finance institutions and local capital markets to engage in the renewable energy sector.

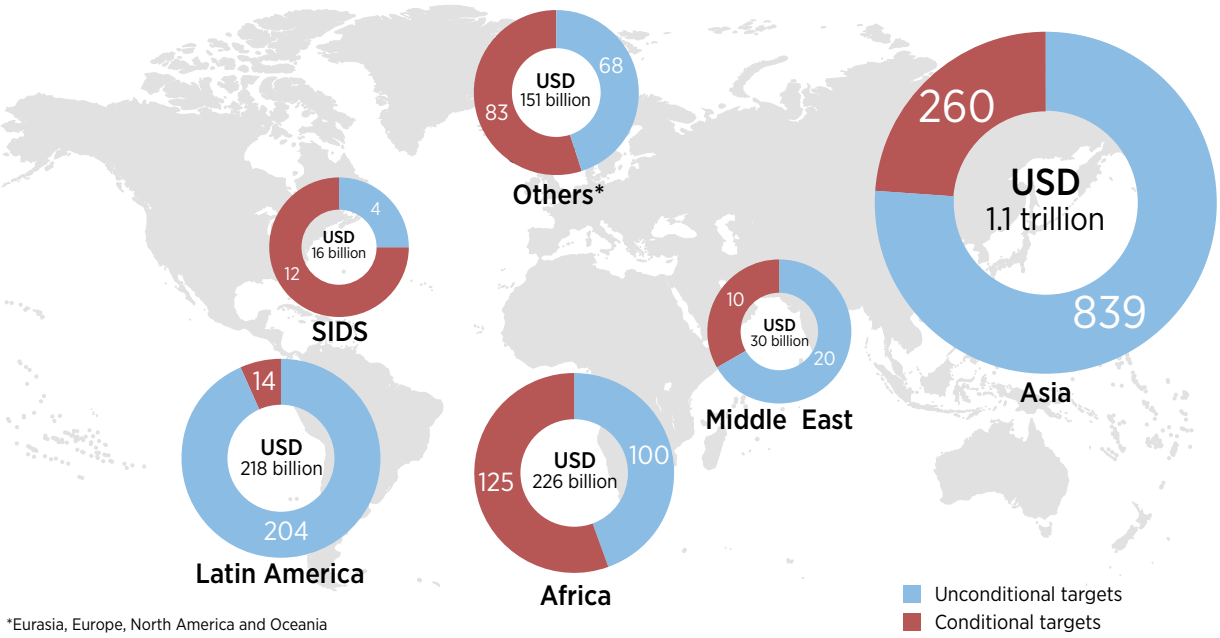
One option to advance this is through the establishment of Green Investment Banks (Kerr et al., 2017). These are dedicated green investment entities created with the purpose of catalysing public funds to overcome investment barriers and facilitate private investment in low-carbon and climate-resilient infrastructure. Furthermore, Parties to the Paris Agreement can mobilise the investment needed for the implementation of unconditional contributions from international capital markets. This could provide an opportunity to increase South-South investment flows as well.[10]

Under the framework of the Paris Agreement, developed-country Parties extended the

[9] IRENA analysis shows that moving from an 18% share in 2014 to 36% in 2030 can help to significantly advance towards international climate and development goals.

[10] That is, investment flows from emerging markets into other emerging markets.

Figure 10: Total investment needed by 2030 for the implementation of renewable energy targets in NDCs (USD billion)



*Eurasia, Europe, North America and Oceania

commitment taken on at the United Nations Climate Change Conference in Copenhagen and pledged to jointly mobilise USD 100 billion a year in climate finance between 2020 and 2025 to assist developing countries in enhancing their climate action and adapting to climate impacts.

Since a total of USD 500 billion will be needed for the implementation of conditional renewable energy targets in NDCs, about USD 31 billion (on average) would have to flow into the renewable energy sector every year (2015 to 2030) in the form of international climate finance.

Hence a large portion (almost one-third) of the USD 100 billion pledged would already be required for the implementation of existing renewable energy targets contained in NDCs, which are, however, not yet sufficient to meet the objective of limiting the rise in global mean temperature to 2°C, let alone 1.5° C. And this is only one mitigation sector and does not address other adaptation needs. International climate finance will need to be scaled up significantly over time, in order to finance increasingly ambitious renewable energy targets as well as other climate needs included in NDCs.

As public resources are generally limited, the bulk of investment needed for the implementation of NDC-based renewable energy targets will have to come from the private sector. 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. Estimates are based on leverage ratios actually recorded for renewable energy investment deals. These can differ significantly[11], leading to a very wide range of estimated public finance required. The leverage ratios observed apply to very different realities and would, for most renewable energy projects, fall somewhere in the middle of the range. 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.

Based on initial calculations, it is estimated that public finance ranging from USD 65 billion to USD 580 billion would be needed over the period 2015-2030 to mobilise private investment at scale. Of this, more than USD 45 billion to USD 410 billion would be required to leverage the investment needed for the implementation of unconditional contributions; a further USD 20 billion to USD 170 billion would be needed to mobilise conditional investments. Table 3 illustrates the regional differences.

[11] *From as low as 1:3 to as high as 1:26.*

Table 3: Estimated public finance needed by 2030 for the implementation of renewable energy targets in NDCs (USD billion)

	Global	Africa	Asia	Latin America	Middle East	Others*	SIDS
Estimated public finance needed	**65-580**	10-75	40-370	5-75	1-10	5-50	0.5-5
• for unconditional targets	**45-410**	5-35	30-280	5-70	0.5-10	1-25	0.1-1.5
• for conditional targets	**20-170**	5-45	10-70	0.5-5	0.5-5	1-30	0.5-5

*Eurasia, Europe, North America and Oceania

Global totals differ from the sum of regional totals, as seven SIDS are included simultaneously in other regions

4 CONCLUSIONS AND RECOMMENDATIONS

NDCs are poised to play a central role in achieving the climate objectives set out in the Paris Agreement. While a remarkable transition to a renewable energy future is currently ongoing, fuelled by decreasing costs and improving technologies, it is not happening fast enough to prevent dangerous climate change. Accelerating action is critical to limit the global temperature rise, maximise the benefits of the energy transition and reduce the risk of stranded assets (IRENA, 2017a).

IRENA's analysis shows that the renewable energy targets are central to the mitigation strategies set out in the vast majority of current NDCs. Taken together, however, NDCs as they are do not appear to be driving an accelerated global energy transition. Overall, renewable energy targets contained in NDCs add up to less than what countries have committed to do in national plans and strategies; are less ambitious than recent deployment levels observed in practice; and do not fully take advantage of the untapped, cost-effective potential for renewables. In other words, in submitting their NDCs, Signatories seemed to have adopted a strategy of "under promising and over delivering".

Advancing the implementation of existing NDCs, however, has to be a priority. This will require sound policy frameworks and mobilising the investment needed to meet targets, which could unleash a positive dynamic in many countries. Still, there is much potential for increasing ambition in the next round of NDCs, in order to accelerate the energy transition in a time frame consistent with achieving the global climate goals.

Setting higher targets would clearly be in line with the "ratcheting mechanism" contained in the Paris Agreement, whereby subsequent NDCs are expected to be more ambitious than the previous ones. And the good news is that this can be done in a cost-effective way, with net benefits to society.

In order to advance the implementation of renewable energy targets outlined in NDCs worldwide and progressively strengthen such targets in future NDCs, IRENA has identified several crucial actions:

Facilitate the quick implementation of renewable energy targets in current NDCs

As early action is critical, there is a need to advance the implementation of renewable energy components in NDCs without delay, focusing on attracting the necessary investment. A track record of successful projects in developing countries will help to unleash market dynamics that will make further growth much easier.

- ***Set up the enabling framework and policies to scale up renewables.*** In mobilising private investment, significant attention should be paid to creating a stable, consistent and transparent enabling framework for renewables to provide a sound basis for deployment and a long-term perspective for investors.
- ***Develop appropriate investment plans.*** Renewable energy targets contained in NDCs should be translated into effective investment plans, in close co-ordination with overall energy planning. NDCs can be an enabler of dialogue across sectors, including the financial sector, on how to scale up renewable energy investments to levels required to meet climate goals. Translating NDCs into investment plans can facilitate this dialogue by providing increased transparency regarding the resources needed to advance towards national renewable energy targets.
- ***Use public finance to effectively mobilise private investment.*** As public resources are limited and renewables are cost-competitive, the focus of public finance institutions should be on crowding in additional private capital to scale up investment in renewables. This can be achieved by extending the use of public finance beyond direct financing, i.e., grants and loans, to focus on risk mitigation instruments and structured finance mechanisms , which can help address some of the risks and barriers faced by private investors (IRENA, 2016d).

Raise the ambition of renewable energy targets in the next round of NDCs

The analysis has shown that there is significant potential for increased ambition of renewable energy targets in NDCs. Countries can use the opportunity presented by the 2020 NDC update to examine whether renewable energy components can be strengthened, or if such components can be added for those countries that have not done so yet.

- ***Reflect current levels of renewable energy deployment in NDCs.*** Growth in renewables has been very rapid across the globe, but in most regions the renewable energy targets in NDCs do not reflect this growth. As global renewable energy capacity additions continue to increase at an unprecedented pace, the ambition of updated NDC-based targets for renewables should at least reflect the actual pace of deployment.
- ***Consider alignment with, and inclusion of, other, more ambitious, national targets.*** NDC-based renewable energy targets are often less ambitious than those set in other national energy plans. Moreover, 85 Signatories do not include renewable energy components in their NDCs yet, although the majority of these have established other national targets for renewables. Given the importance of renewables to achieve the objectives of the Paris Agreement, countries should consider reflecting their national renewable energy targets in their NDCs, when the former are more ambitious.
- ***Take into account the cost-effective potential for renewables***. Setting new renewable energy targets based on the national cost-effective potential can help to ensure that these are realistic while also ambitious. Cost-effective potential can provide a benchmark for countries to self-assess the ambition of renewable energy targets set out both in NDCs and in other national plans and strategies.

Broaden the scope of renewable energy components in NDCs

The analysis has shown that most renewable energy components outlined in NDCs focus on mitigation and on the power sector. In the next round of NDCs, Parties have the opportunity to explore the potential role of renewables more systematically and to incorporate renewables in end-use sectors as well as for adaptation.

- ***Include renewable energy targets for end-use sectors (transport, heating and cooling).*** Significant reductions in the end-use sectors are needed to meet the objectives of the Paris Agreement. Biofuels, solar thermal and in many locations geothermal solutions have the potential to be scaled up, especially for transport and for heating and cooling in buildings. Countries can explore the opportunities for scaling up renewables in such sectors and increasingly reflect such efforts in their NDCs. When setting renewable energy targets for the end-use sectors, increasing attention should be paid to synergies between electricity generation and end-use sectors, i.e., sector coupling, as well as to the use of renewable energy for district heating and cooling (DHC).
- ***Include renewable energy targets for adaptation, including for energy access through off-grid renewables where applicable.*** With the increase in frequency and severity of storms and drought conditions and other climate impacts, there is an opportunity for countries to pro-actively adapt their energy systems to better insulate themselves against climate impacts and, beyond that, to use renewables to increase the resilience of their economies. There is a need to raise awareness of the role that renewable energy can play in adapting to climate change impacts and to support the inclusion of renewable energy in future NDC updates.

Ensure the quality of the renewable energy components in the next round of NDCs

Setting consistent renewable energy targets based on accurate national and regional data and assumptions can help to ensure the quality of NDCs and is crucial to provide the right signal to investors.

- ***Take into account all relevant national targets, strategies and plans.*** It is important to ensure consistency among different sets of renewable energy targets at the country level in order to provide clear and reliable signals to investors. When setting new NDC-based targets for renewables attention should be paid to ensure that these are consistent with national energy strategies and plans, and that they are properly aligned with strategies to meet the Sustainable Development Goals (SDGs).
- ***Base targets on sound data and projections.*** When setting renewable energy targets, the impact of such targets should be assessed properly, in terms of the level of both renewable energy deployment and investment need. Targets should be as specific as possible to ensure clarity, and they should be set based on sound data and projections across the energy sector and on other economic variables. Some developing countries may require technical assistance and other support to ensure that this analysis is conducted properly.

Promote the participation of all stakeholders

Broad stakeholder engagement, including energy, finance and climate sectors and public and private actors, is crucial throughout the implementation and planned revision of NDCs. Policy coherence across sectors will strengthen credibility of targets and effectiveness of action. Using a multi-stakeholder approach can help to ensure the quality of both processes and increase ownership and acceptance.

- ***Enhance the integration of climate change and energy policies***. In order to actually achieve targets, NDCs have to build on strategies and plans developed in the energy sector. Just as importantly, climate change considerations must be progressively integrated into national energy policy planning. Such integration can accelerate the energy transformation with NDCs as an additional driver.
- ***Involve stakeholders in the implementation of NDCs.*** Broad engagement is needed to develop the policy framework and investment plans that need to guide the deployment of programmes and projects and mobilise the investment needed to realise the renewable energy targets in NDCs. This has to include all stakeholders involved in or associated with implementing renewable energy projects, including government (all relevant ministries), industry, the financial sector, utilities and civil society.
- ***Involve stakeholders in the revision of NDCs.*** While the process to update NDCs may be led by the climate or environment ministry, it is important to involve all relevant ministries – including climate, energy and finance – to ensure whole-of-government acceptance and ownership of the resulting targets, investment plans and implementation measures. Broad consultation of private sector stakeholders will further help to solidify targets.

Several countries have demonstrated increased ambition in their NDC renewable energy targets, both in terms of aiming for high share of renewables in the power mix and in setting targets for renewables in transport and heating and cooling. Other countries, especially where renewables are still viewed as a novelty, need to start this transition, which will become easier as experience is built and as technology costs decline further.

Significant potential exists to strengthen renewable energy targets in the next round of NDCs. This can build on the strong current growth rates for renewables, it can pick up ambitious targets in national energy plans and strategies, and it can be informed by an assessment of the cost-effective potential of renewables in all sectors.

Given the cost-competitiveness of renewables, governments today have remarkable opportunities to utilise renewable energy targets in NDCs to accelerate the global energy transition and increase climate-resilience. Advancing NDCs to match the actual potential of renewables will be crucial to ensure the viability of the Paris Agreement as a means to achieve global climate objectives.

5 REFERENCES

BNEF (2017), Market sizing tool (database), Bloomberg New Energy Finance (subscription required – accessed 15 October 2017).

Buchner B. K. et al. (2017), Global Landscape of Climate Finance 2017, Climate Policy Initiative.

Frankfurt School-UNEP Centre / BNEF (2017). Global Trends in Renewable Energy Investment 2017, Frankfurt School-UNEP Collaborating Centre for Climate & Sustainable Energy Finance / Bloomberg New Energy Finance, Frankfurt am Main.

IRENA (forthcoming), Assessment of the Renewable Energy Components in Nationally Determined Contributions: The Methodology. International Renewable Energy Agency, Abu Dhabi.

IRENA (2017a), "Chapter 3: Global Energy Transition Prospects and the Role of Renewables", in Perspectives for the Energy Transition – Investment Needs for a Low-carbon Energy System, International Renewable Energy Agency, Abu Dhabi.

IRENA (2017b), "Renewable Energy in the NDCs", IRENA Data & Statistics (database) (accessed 15 October 2017).

IRENA (2017c), Renewable Energy Statistics 2017, International Renewable Energy Agency, Abu Dhabi.

IRENA (2017d), REthinking Energy 2017: Accelerating the Global Energy Transformation, International Renewable Energy Agency, Abu Dhabi.

IRENA (2017e), Renewable Energy in District Heating and Cooling: A Sector Roadmap for REmap, International Renewable Energy Agency, Abu Dhabi.

IRENA (2016a), Renewable Energy Market Analysis: Latin America, International Renewable Energy Agency, Abu Dhabi.

IRENA (2016b), Renewable Energy benefits: Decentralised Solutions in the Agri-food Chain, International Renewable Energy Agency, Abu Dhabi.

IRENA (2016c), G20 Toolkit for Renewable Energy Deployment: Country Options for Sustainable Growth Based on REmap, International Renewable Energy Agency, Abu Dhabi.

IRENA (2016d), Unlocking Renewable Energy Investment: The Role of Risk Mitigation and Structured Finance, International Renewable Energy Agency, Abu Dhabi.

IRENA (2015), Africa 2030: Roadmap for a Renewable Energy Future, International Renewable Energy Agency, Abu Dhabi.

Kerr T. et al. (2017), Creating Markets for Climate Business, International Finance Corporation, Washington, D.C.

Olsson, L. et al. (2014), "Livelihoods and Poverty", in Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, USA.

REN21 (2017), Renewables 2017 Global Status Report, REN21 Secretariat, Paris.

UNFCCC (2017a), INDC Platform (database), United Nations Framework Convention on Climate Change, http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx (accessed 15 October 2017).

UNFCCC (2017b), NDC Interim Registry (database), United Nations Framework Convention on Climate Change, http://www4.unfccc.int/ndcregistry/Pages/All.aspx (accessed 15 October 2017).

World Bank (2017), "Access to electricity (% of population)", World Bank Open Data (database) https://data.worldbank.org/ (accessed 15 October 2017).

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