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# IRENA's Inputs towards the Talanoa Dialogue under UNFCCC

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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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IRENA's Inputs towards the Talanoa Dialogue under the UNFCCC

# 1. Introduction

The International Renewable Energy Agency (IRENA) is pleased to submit herewith its inputs to the Talanoa Dialogue. As requested, the inputs attempt to respond to the three key questions, namely, "Where are we?", "Where do we want to go?" and "How do we get there?". Essence of IRENA's responses to the three questions are summarised in the designated templates, which are submitted to the UNFCCC together with this document.

Since its inception, IRENA has worked with governments around the world to promote the adoption of renewable energy and the transition to a sustainable energy future, serving as the main platform for international cooperation and a repository of policy, technology, resource and financial knowledge on renewable energy.

IRENA has been prominent in promoting the role of renewables as a key contributor to climate efforts, showing how an accelerated 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.

The Paris Agreement, which entered into force in November 2016, marked a turning point in the international climate change negotiations, as 175 Parties committed to reducing their greenhouse gas emissions to limit the increase in global average temperature to well below 2°C above preindustrial levels. Recognising the multiple benefits of renewables for both climate and development, most Parties included renewables as part of the mitigation and adaptation strategies set out in their Nationally Determined Contributions (NDCs).

In 2017, IRENA analysed renewable energy components of NDCs worldwide and compared 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 analysis highlights the need for substantially scaling up renewables investment to meet renewable energy targets in the NDC and shows that significant potential exists to strengthen renewable energy targets in the next round of NDCs. Furthermore, it shows that doing so will be cost-effective and confer significant socio-economic benefits.

The rapid deployment of renewables, coupled with energy efficiency, can achieve around 90% of the emission reductions needed in the energy sector by 2050 (IRENA, 2017a). Strengthening the renewable energy components of NDCs to match the actual potential of renewables will therefore be crucial to ensure the viability of the Paris Agreement as a means to achieve global climate objectives.

# 2. Where are we?

***'Story' to tell***

**Global renewable energy deployment in the power sector has increased rapidly in recent years and continues to grow at an unprecedented pace, contributing to the transformation towards cleaner energy future.**

**Renewable energy costs have fallen so precipitously over the past few decades that they are now the most economically-viable power option in many parts of the world.**

**Renewable energy has contributed to the increased socio-economic benefits, including in relation to job creation, gender balance, and improved health outcomes and improved energy access.**

**IRENA's analysis on renewable energy components of NDCs shows that renewable energy features prominently in most NDCs. It confirms that the transition to a renewable energy future has come to be recognised globally as central to addressing climate change.**

## 2.1 Status of global renewable energy deployment

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 2.2 TW in 2017. This transformation towards a lower-carbon and more sustainable energy future is made possible by technological innovation, rapidly falling costs and rising investment in renewable energy, backed up by committed policy frameworks.

In addition to the transformation towards cleaner energy future, renewable energy has also been contributing to the increase of socio-economic benefits. To pick up a few examples:

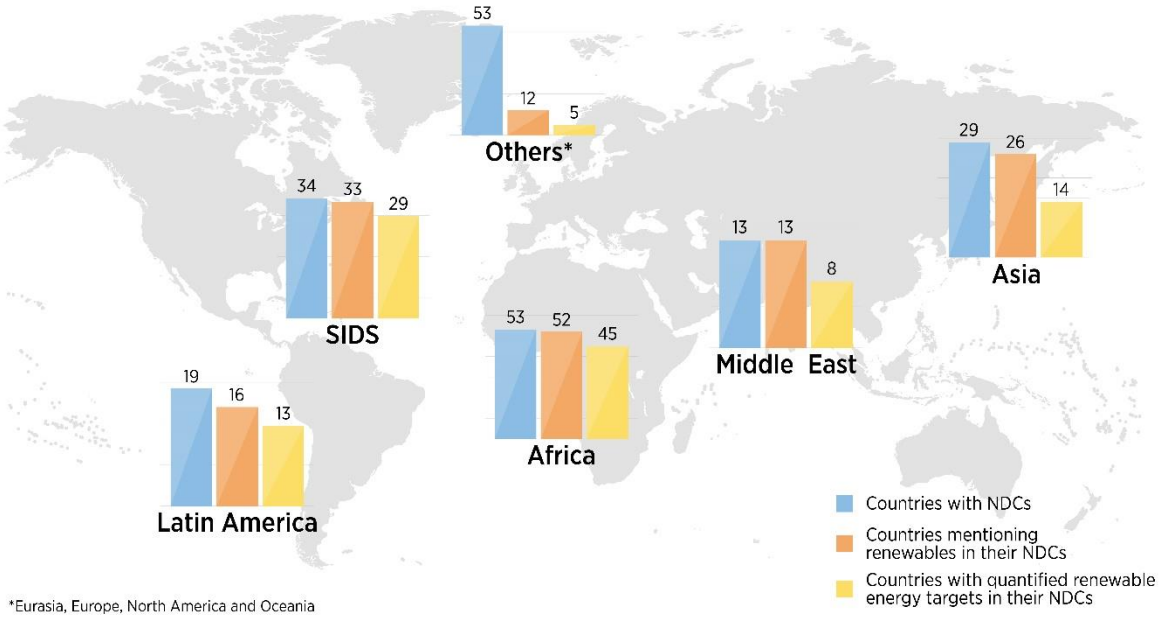
- A study by IRENA finds that direct and indirect renewable energy employment has expanded to 8.3 million people worldwide. There are an estimated 1.5 million additional jobs in large hydropower (direct only), for a combined total of 9.8 million jobs.
- The energy sector as a whole is traditionally male-dominated. Findings from an IRENA survey (IRENA, 2016a) suggest that women at present represent on average 35% of the labour force in the modern renewable energy sector – a share higher than in the conventional energy sector.
- A number of countries have pursued policies to localise portions of the renewable energy value chain to boost the domestic share of employment generation. Localisation of the value chain is increasingly recognised as a precondition of generating community benefits – ensuring that a certain percentage of revenue streams flows to areas that host wind and solar farms or that are involved in providing inputs to the sector.
- Renewable energy offers energy access in areas where grid extension is expensive or physically difficult. Energy access has been offering a range of socio-economic benefits, such as improved communications (mobile phone charging), educational environment (school lighting), health care (use of medical equipment requiring electricity) and agricultural

productivity and sustainability (covering the entire value chain, from production through retailing).

## 2.2. Renewable energy targets in the NDCs

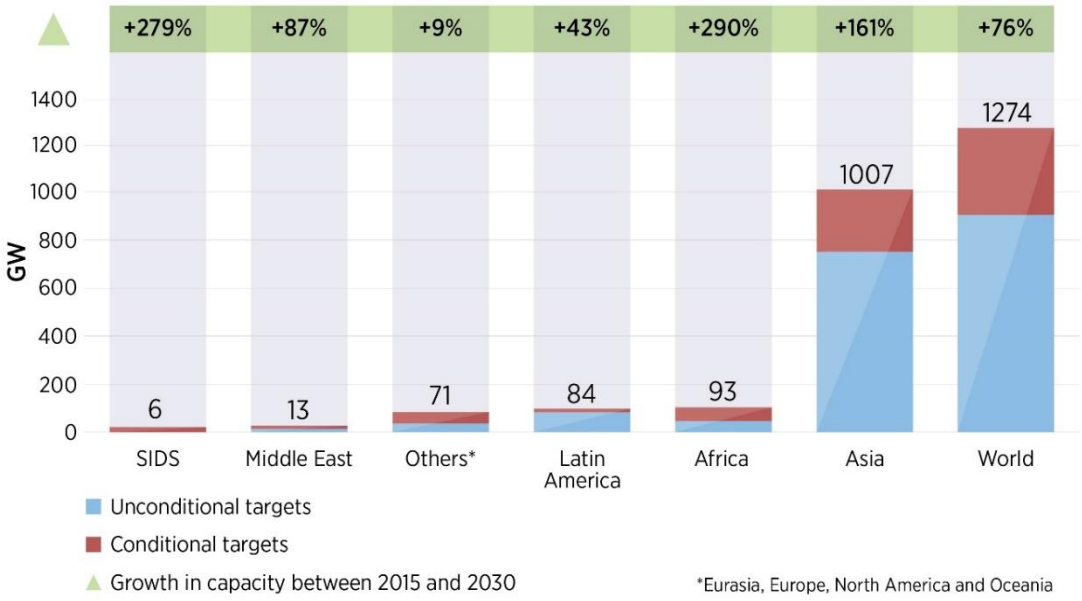
Given the key role of renewables to achieve both climate and development goals, most Parties to the Paris Agreement have included renewable energy in their NDCs. Of the 194 Parties to the UNFCCC that submitted their NDCs, 145 referred to renewable energy action to mitigate and adapt to climate change,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

*Figure 1. Renewable energy components in NDCs*



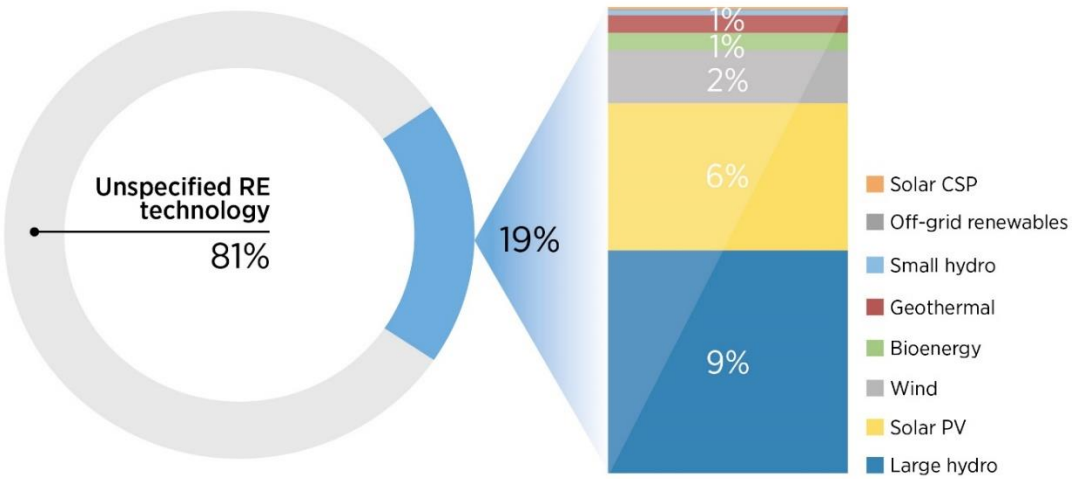

IRENA's NDC analysis shows that the full implementation of the renewable energy components of existing NDCs would add at least 1.3 terawatts (TW) of installed capacity globally between 2015 and 2030. This would represent a 76% increase in the world's total installed capacity compared to 2014 (see figure 2).

*Figure 2. NDC-driven increase in renewable power installed capacity up to 2030*




Most NDCs provide only aggregated renewable energy targets for the power sector, but some include details about the technology breakdown (see Figure 3). 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.

*Figure 3. NDC-driven increase in renewable power installed capacity up to 2030 by technology*



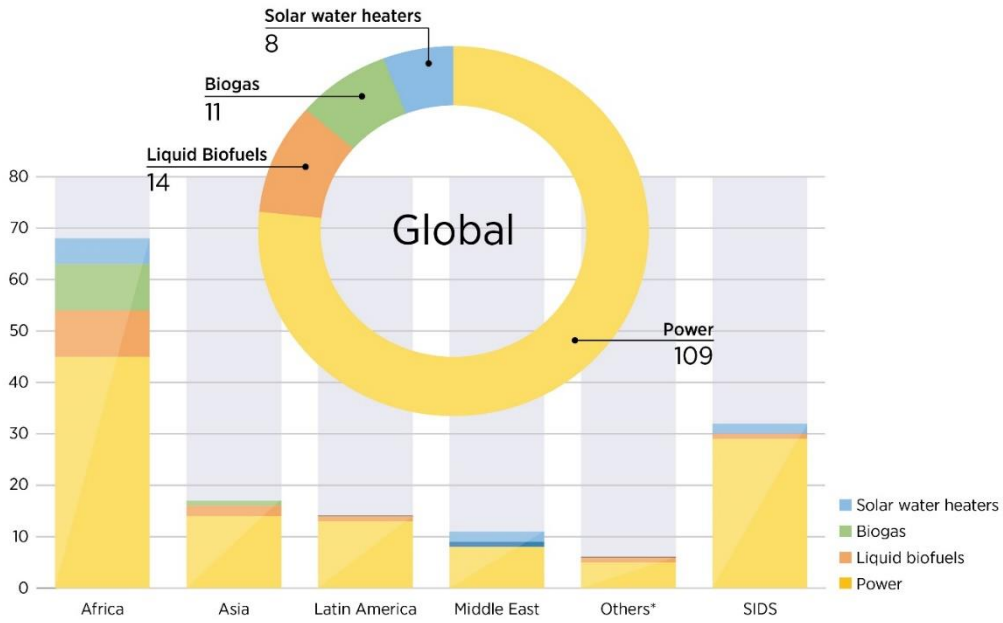

NDC targets for off-grid renewables – including solar home systems (SHS), solar lanterns, biodigesters and mini-grids – would result in an additional 1.3 GW of installed power capacity by 2030, most of it in Africa (1.2 GW), and would provide access to electricity to roughly 140 million people.

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.

As 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 by only a few countries. Figure 4 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.

*Figure 4. Renewable energy targets in NDCs by end-use application*

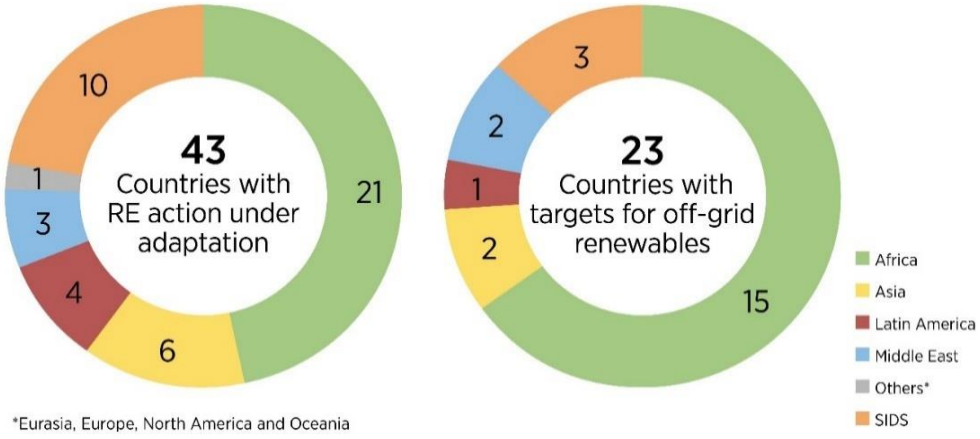



While most NDCs treat renewable energy deployment primarily as a mitigation measure, many countries, in particular those most vulnerable to climate change –SIDS and developing countries in Africa, Asia and Latin America – generally take a more comprehensive approach in developing their NDCs: mitigating 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. As depicted in Figure 5.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 5.b). Decentralised renewables are of particular importance in countries where a large share of the population still lacks access to modern energy services.

*Figure 5. NDCs with renewable energy action for adaptation (5.a) and targets for off-grid renewables (5.b)*



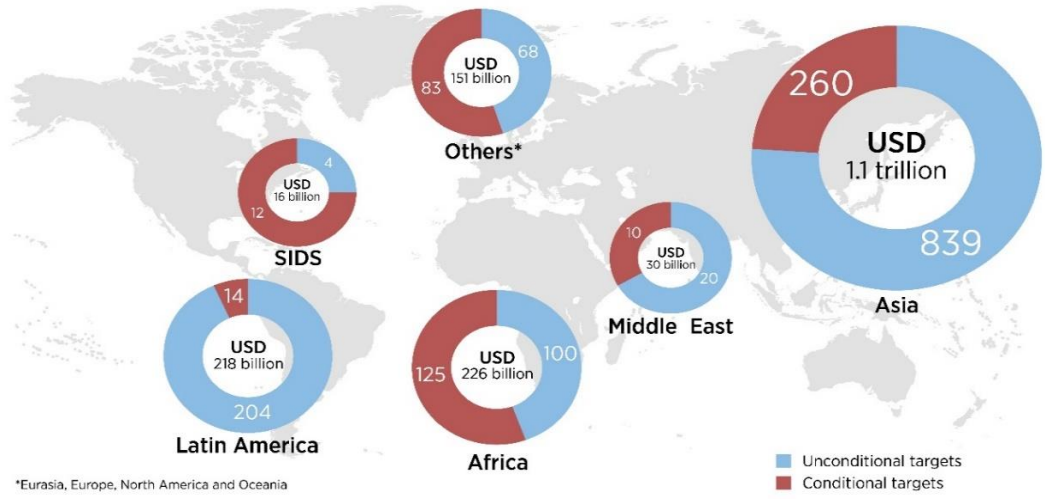

Global totals differ from the sum of regional totals, as seven SIDS are included simultaneously in other regions

## 2.3 Investment needs

IRENA estimates show that to implement the renewable energy targets of the NDCs, 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 6, 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.

*Figure 6. Total investment needed by 2030 for the implementation of renewable energy targets in NDCs (USD billion)*




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. 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 the scale required. 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.

# 3. Where do we want to go?

***'Story' to tell***

**The "well below 2°C" objectives under the Paris Agreement can be achieved for the energy sector through enhanced energy efficiency and renewable energy deployment. IRENA's analysis suggests that the energy transition is not only technically possible but also economically beneficial.**

**NDCs can play a critical role to make this happen. There is significant untapped potential in strengthening renewable energy targets in NDCs.**

## 3.1 Decarbonising the energy sector to reach the objectives of the Paris agreement

### 3.1.1 IRENA's roadmap for long-term energy transition

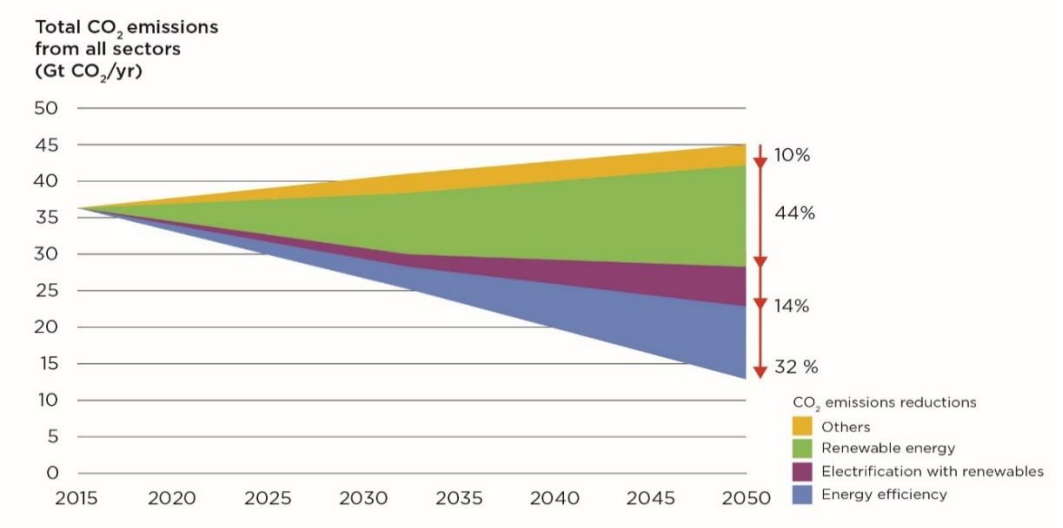
The Paris Agreement has set out a long-term goal to limit the rise in global mean temperature to well below 2°C and to pursue efforts to limit the temperature increase to 1.5°C. This is a core of "where we want to go". In order to achieve these goals, our society needs to be 'decarbonised' in the second half of the 21st Century. Given that approximately two-thirds of GHG emissions stem from energy production and use, the energy sector is put at the centre stage of efforts to combat climate change.

IRENA's roadmap for an energy sector transition would be consistent with limiting the rise in global mean temperature to well below 2°C by 2100 with a probability of 66%. The roadmap therefore can be characterised as a reflection of "where we want to go". IRENA analysed which technologies are required for an energy transition or a decarbonisation of the energy sector in line with the climate goal.

### 3.1.2 Energy transition: a key role for renewable energy

IRENA analyses show that achieving a global energy transition that limits global temperature change to less than 2°C is technically feasible. It would be achieved largely by the accelerated deployment of renewable energy and energy efficiency measures (see Figure 7).

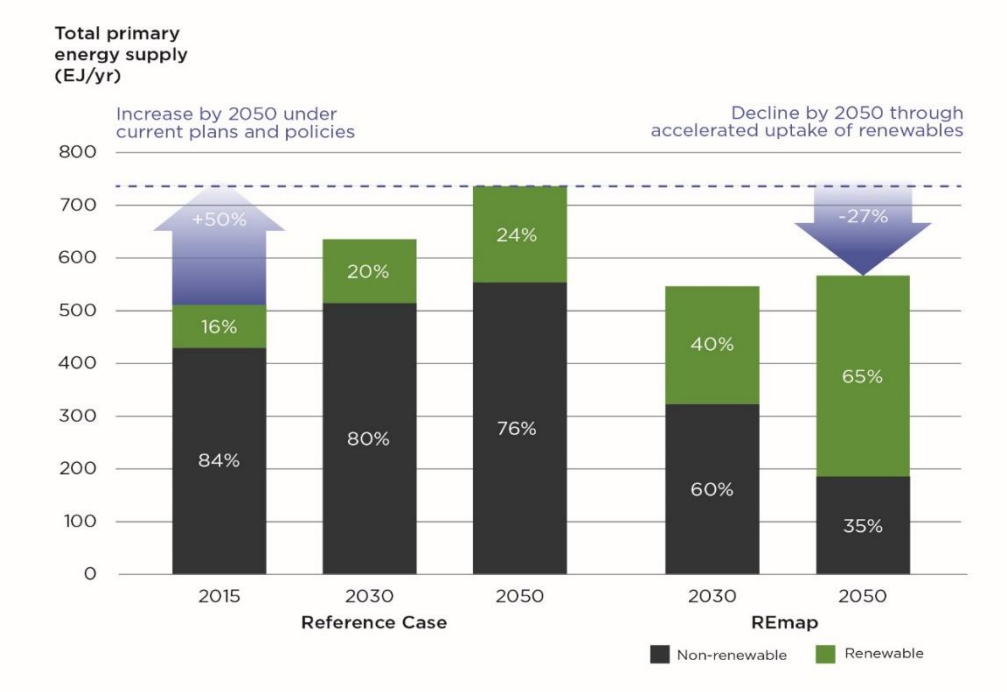
*Figure 7. Primary CO2 emission reduction potential by technology from the 'Reference Case'*



Under the roadmap, while the total energy demand in 2050 would be similar to today's level, the supply mix would change substantially.

The total global primary energy supply in 2050 would reach 635 EJ per year, only marginally higher than today's level and 26% less than in the Reference Case. Total non-renewable energy use would be reduced by 67%. The share of renewable energy in the total primary energy supply would grow to about 65% by 2050 from the today's share of 16% (Figure 8).

*Figure 8. Global total primary energy supply in the 'Reference Cas'e and REmap (roadmap), 2015-2050*



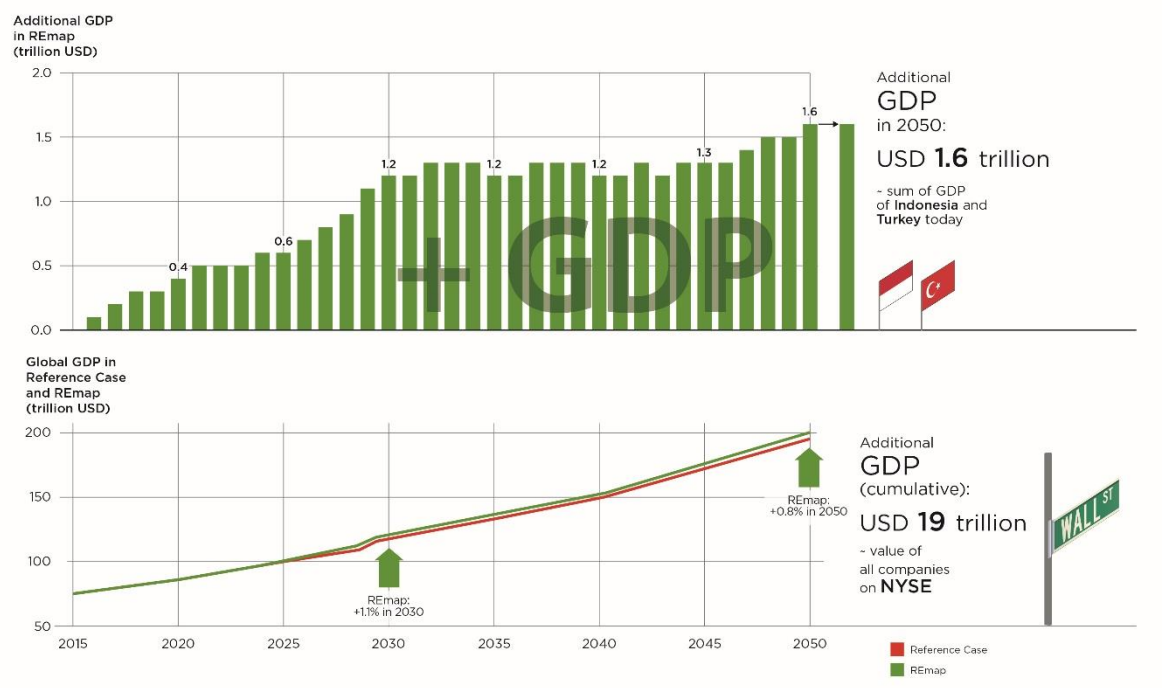

## 3.2 The economic case for the energy transition

### 3.2.1 Decarbonisation fuels economic growth

While the traditional view has been that there is a trade-off between economic growth and decarbonisation, recent rapid technological advancements and dramatic cost reductions in renewables are forcing a rethinking of the traditional view. There is growing evidence that mitigating climate change through renewable energy could actually bring positive economic impacts, stimulating growth and employment worldwide.

Achieving the energy transition in the G20 as outlined by IRENA's roadmap would increase global GDP by 1.1% in 2030 and by 0.8% in 2050 compared to the most likely scenario with the existing and planned policies (Figure 9). The additional economic activity generated between now and 2050 would be an estimated USD 19 trillion. In 2050 alone, the additional output would be USD 1.6 trillion, similar to the combined GDP of Indonesia and Turkey today (IRENA, forthcoming a).

*Figure 9. Global economic impact of energy transition under REmap: additional and absolute GDP values, 2015-2050*




Notes: The top graph illustrates the additional real global GDP in each year (USD 2015 trillion, undiscounted) and is equivalent to the area between the two GDP lines in the bottom graph. The figure of the additional cumulated GDP sums these yearly figures, discounted at a social discount rate of 3%. The bottom graph represents the global GDP in real terms (2015 USD) in each of the two cases. All GDP figures are expressed in market exchange rates.

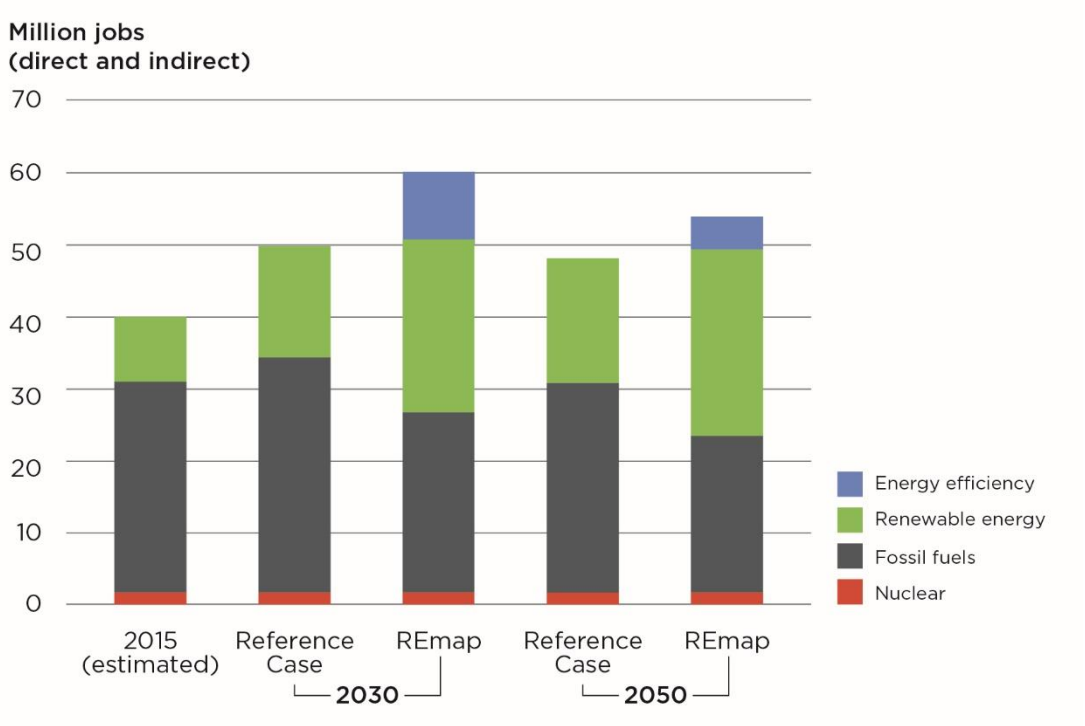
The main driver of the global economic surge is the investment boost from the high capital requirements of renewables and energy efficiency. Upfront investment is, for both, a larger share of total lifetime cost than it is for fossil fuel-based technologies.

Overall, this analysis suggests that it is possible to carry out a fundamental transition in the energy sector without slowing GDP growth. In fact, the rates of GDP growth may increase. However, important changes in the sectoral contributions to GDP can be expected.

### 3.2.2 Increased employment across energy sector and in the economy as a whole

The decarbonisation of the energy sector will bring higher employment levels in energy, since the number of new jobs created in renewables and energy efficiency more than offsets job losses in fossil fuels. Global energy sector employment today stands at around 40 million jobs (direct and indirect). Of these, IRENA estimates 9.4 million jobs to be in renewables, a number that has grown consistently in recent years (IRENA, 2016a). IRENA's roadmap estimates that global renewable energy jobs (direct and indirect) would reach 15 million by 2030 and 17 million by 2050. The increased employment from renewables alone would offset job losses in the fossil fuel sectors (which would be around 7 million in 2030 and 8 million in 2050). Furthermore, when jobs related to the increased rates of energy efficiency are considered (9 million in 2030 and around 5 million in 2050), the overall energy sector (including efficiency) employs significantly more people (Figure 10).

*Figure 10. Overall employment in the overall energy sector – 2015, 2030 and 2050*




Note: Due to methodological limitations, energy efficiency jobs are only computed for the REmap case based on the additional investments needed in energy efficiency (in REmap vs Reference Case).

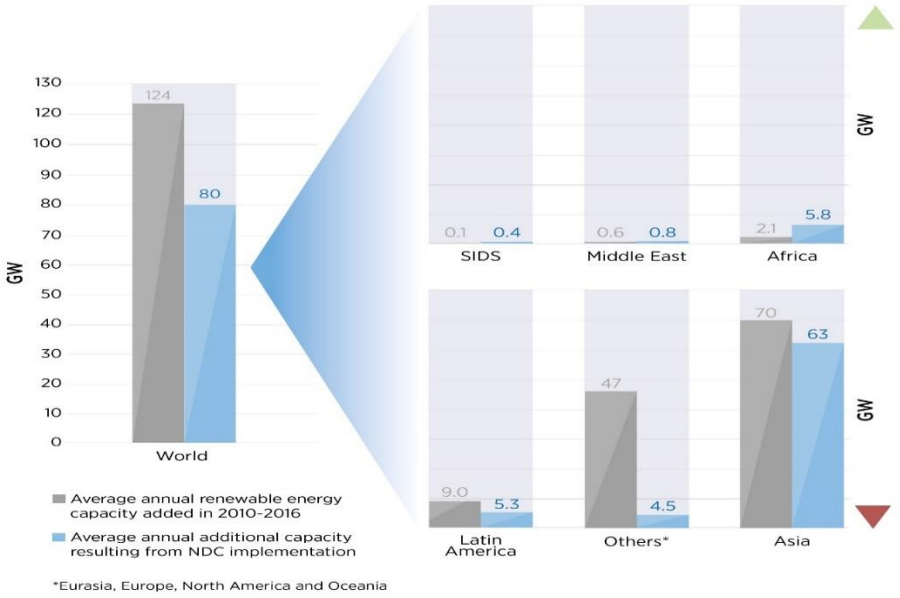
## 3.3 Strengthening renewable energy targets in NDCs

### 3.3.1 Comparison with current deployment trends

Figure 11 compares the impact of existing commitments under the Paris Agreement with the recent historical deployment trend for each region. 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, 2017b). 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.

*Figure 11. Average annual renewable energy deployment in NDCs as compared to annual capacity additions over 2010-2016*




### 3.3.2 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.

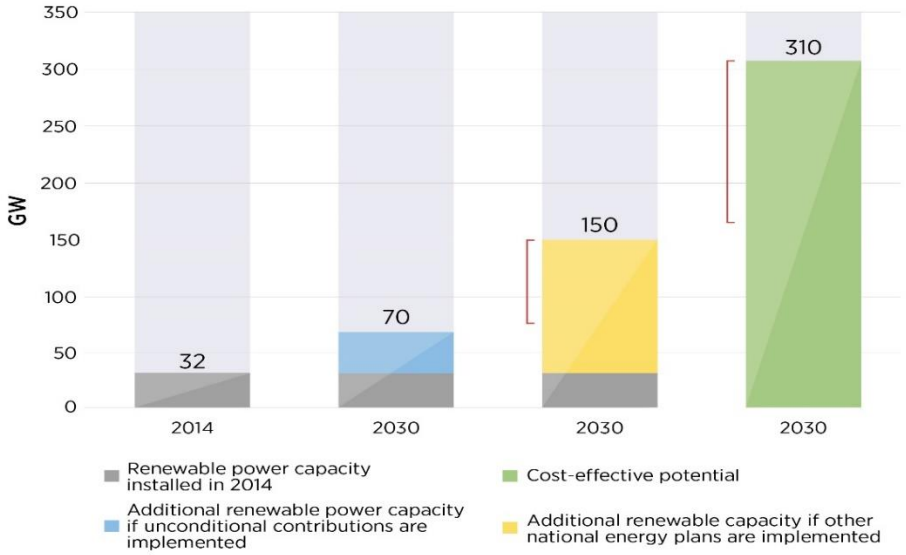
### 3.3.3 Alignment with cost-effective potential

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 the cost-effective potential for renewables in Africa 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 Figure 12). 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 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 its full potential will depend on the ability of countries to overcome the investment challenge and address these risk perceptions.

*Figure 12. Renewable energy components in African NDCs, national targets and cost-effective potential*




### 3.3.4 Broadening the scope of renewable energy components of NDCs

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).

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.

# 4. How do we get there?

***'Story' to tell***

**There are several crucial actions to be taken to achieve the energy transition required for the climate objectives under the Paris Agreement, as follows:**

- **Quickly implementing renewable energy targets in current NDCs**
- **Reviewing the untapped potential for strengthening renewable energy targets in the NDCs**
- **Broadening the scope of renewable energy components in NDCs**
- **Ensuring the quality of and a sounds basis for implementation of the renewable energy components in the NDCs**
- **Promoting the participation of all stakeholders**

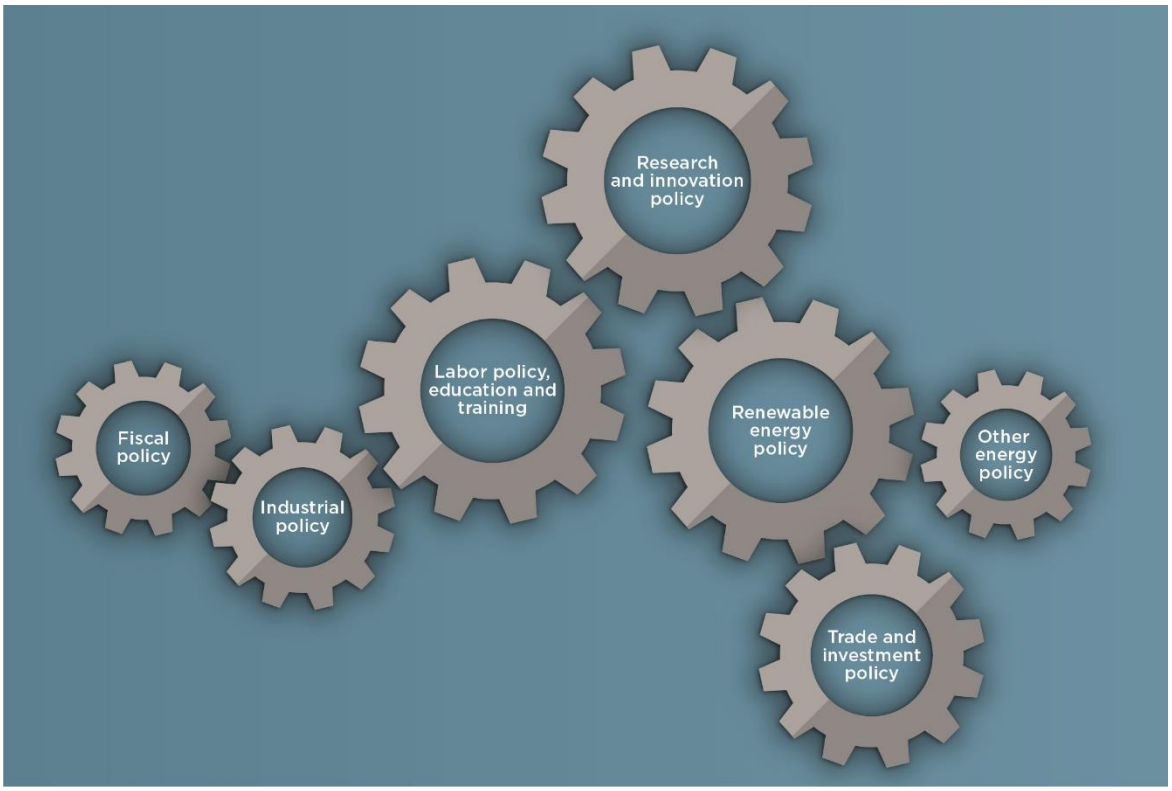
## 4.1 Need for the implementation of coherent energy and economic policies

The analysis in this section shows that the energy transition can fuel economic growth and create new employment opportunities. Thanks to the growing business case for renewable energy, climate change mitigation and economic growth are no longer an "either-or" choice. This is a significant conclusion in the current context of sluggish economic growth.

Job creation in renewables and energy efficiency, for instance, would more than offset job losses in fossil fuel sectors. Millions of new jobs will exist in activities related to deployment and maintenance of renewables, construction, implementation of energy efficiency measures, manufacturing of required equipment and bioenergy supply. Many of these labour requirements could be met with workers from fossil fuel industries, as in many cases the skills are complementary. Active labour and retraining policies will need to underpin such shifts. This highlights the importance of looking beyond energy policy.

Macroeconomic benefits will only be realised if countries implement a coherent mix of economic policies to complement the energy policies underpinning decarbonisation (Figure 13). Therefore, policy makers should place renewable energy policy in the broader context of the energy sector while also considering a range of cross-cutting policies beyond energy, such as industrial, fiscal, trade and labour policies (IRENA, 2016c, 2013, forthcoming b; IRENA and CEM, 2014).

*Figure 13. A broad and coherent mix of policies*




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. Based on this, countries can consider strengthened renewable energy targets 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. 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 suggests several steps:

### (1) Ensure 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. This could entail, among others, the following actions:

- *Set up the enabling framework and policies to scale-up renewables*
- *Develop an appropriate investment plan*
- *Use public finance to effectively mobilise private investment*

### (2) Consider options for strengthening renewable energy targets in 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 which have not done so yet. To this end, countries would need to:

- *Reflect current level of renewable energy deployment in NDCs*
- *Consider alignment with, and inclusion of, other, more ambitious, national targets*
- *Take into account the cost-effective potential for renewables.*

### (3) 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 (such as transport, heating and cooling) as well as for adaptation (including improvement of energy access through off-grid renewables) and a diversification of energy supply.

### (4) Ensure the quality of and a sounds basis for implementation for the renewable energy components in the 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. To this end, countries would need to take into account all relevant national targets, strategies and plans, as well as base targets on sound data and projections.

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 investors. It is also required that appropriate investment plan be developed. Renewable energy targets in NDCs should be translated into effective investment plans, in close coordination 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.

IRENA can support countries by offering methodologies to evaluate the cost-effective potential of renewables and assess the readiness for implementing the targets, including the policy framework and the steps needed to mobilize investment at the scale required.

### (5) 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. To this end, countries would need to:

- *Enhance the integration of climate change and energy policies*
- *Involve stakeholders in the Implementation of NDCs*
- *Involve stakeholders in the revision of NDCs.*

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