IRENA QUARTERLY
Q1 2018

STRONGER NATIONAL CLIMATE PLEDGES POSSIBLE

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Much of the potential of renewable energy remains untapped in national contributions to climate action.

Nationally Determined Contributions, or 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, and ideally to 1.5°C.

Renewable energy features prominently in the first round of NDCs arising from the 2015 agreement and is increasingly recognised as a key climate solution. Of the 194 Parties to the United Nations Framework Convention on Climate Change (UNFCCC) that submitted NDCs, 145 planned to use renewables to mitigate and adapt to climate change, while 109 cited specific renewable energy targets.

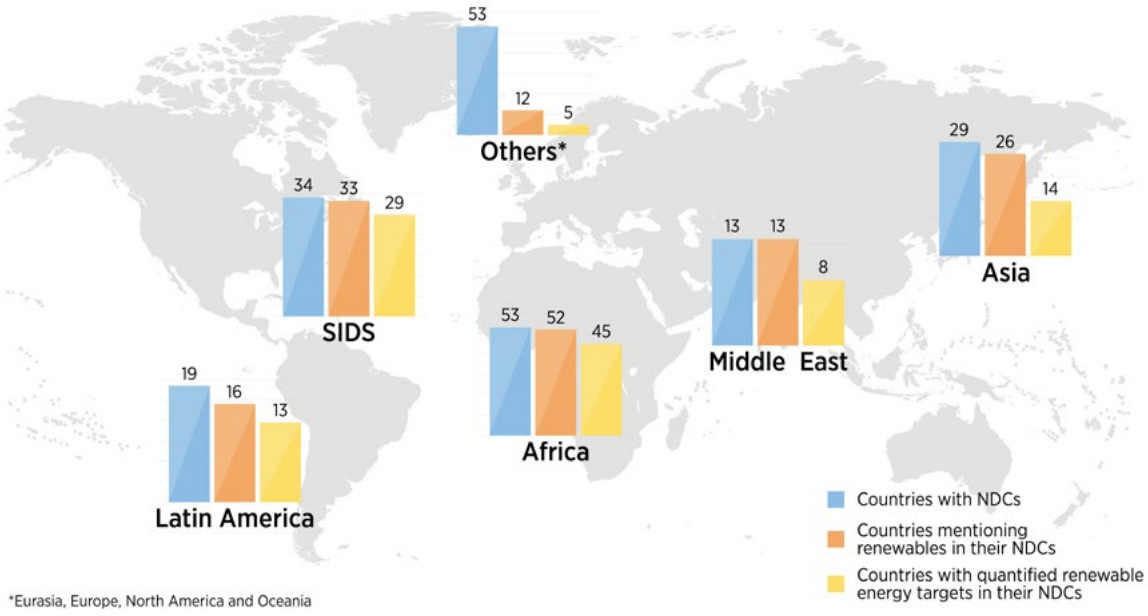
However, renewables are growing faster in reality than those captured in current NDCs. The International Renewable Energy Agency (IRENA) analysed NDCs in relation to national energy plans and actual deployment trends. This showed that NDCs have not kept up with recent, rapid growth in renewables. Furthermore, many countries that lacked targets in their NDCs had ambitious plans for renewables in the energy sector.

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, according to calculations by IRENA. This would represent a 76% increase in the world's total installed capacity compared to 2014.

Countries have an opportunity, however, to strengthen their targets for renewables in the next round of NDCs. This in turn, would increase the effectiveness of the Paris Agreement and help significantly to limit the global temperature rise. Rapid deployment of renewables, coupled with energy efficiency, could achieve around 90% of the emission reductions needed in the energy sector by 2050, while at the same time advancing economic growth and development.

"If we are serious about tackling climate change, we need to decarbonise the energy sector," Adnan Z. Amin, the Director-General of IRENA said. "We believe that energy transition is not only technically feasible but also economically attractive as it will fuel economic growth and create new employment opportunities."

Learning rates for investment costs



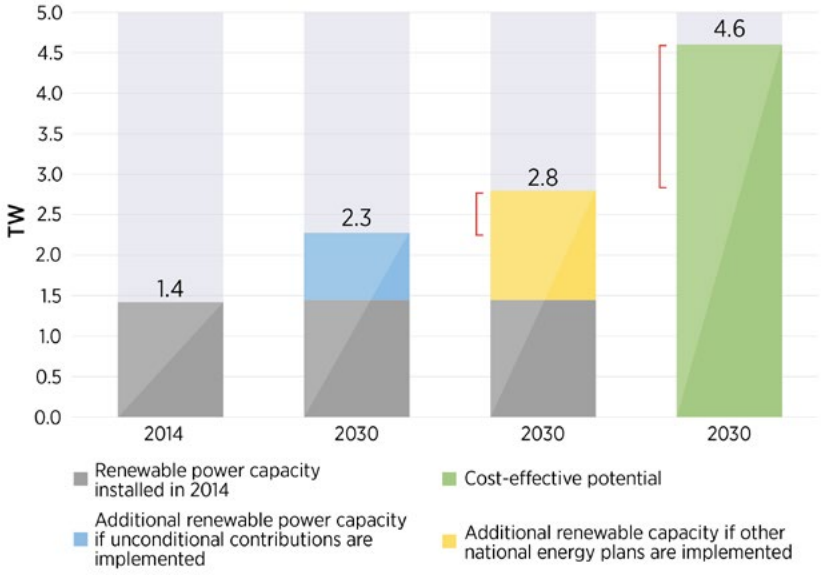
Upgraded NDCs could build on recent growth rates, pick up targets from national energy plans, and more closely reflect cost-effective potential for renewables, as well as significantly advancing the energy transition.

For example, the implementation of unconditional contributions would bring the total installed capacity of renewable power to some 2.3 TW in the G20 alone. This could be raised to at least 2.8 TW, just by ensuring the alignment of NDCs with existing national energy plans and strategies. Furthermore, installed renewable power capacity in the G20 could reach 4.6 TW by 2030 if the full potential for renewables were tapped.

Over USD 1.7 trillion would be needed by 2030 to meet renewable energy targets contained in current NDCs. Increasing renewable energy targets to match national energy plans would send a strong signal to investors.

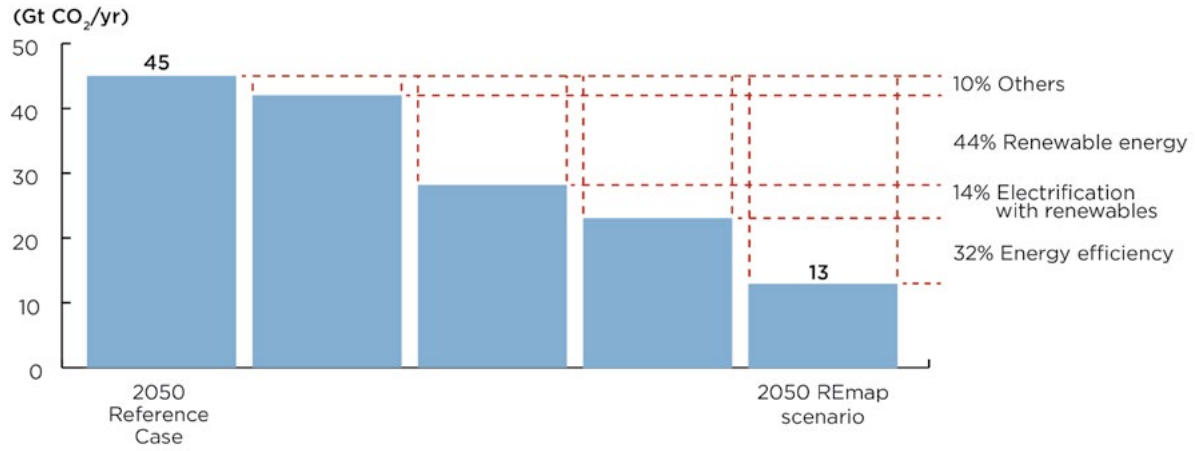
In mobilising finance, countries need to develop appropriate investment plans. This also means creating the enabling framework, adopting policies to scale up renewables, NDCs could help greatly to attract investment at the levels required to meet international climate goals and use public finance to effectively mobilise private investment.

Renewable power in the G20: Potential beyond current NDCs



For further reading, see **Untapped Potential for Climate Action: Renewable Energy in Nationally Determined Contributions**

Carbon dioxide emissions reduction potential from all sectors: 2050 Reference Case vs. REmap scenario



Energy decarbonisation hinges on renewables and efficiency

The year 2016 was the world's hottest on record, surpassing 2015 and marking the third consecutive year of record average temperatures. In fact, of the 17 hottest years on record, 16 have occurred in the 21st century.

Energy decarbonisation is vital to "holding the increase in the global average temperature to well below 2°C above pre-industrial levels", as per the Paris Agreement. This requires raising the share of renewables considerably.

For now, the world is on track to massively miss the agreed climate goals. Temperatures have already increased nearly 1°C since the 19th century — leaving only 1.1°C or less to stay within the agreed boundaries.

Current country pledges, or NDCs, could initiate an emission decline, but are not sufficient. Efforts must be strengthened. Around two-thirds of greenhouse gas emissions stem from energy production and use, which puts this sector at the core of efforts to combat climate change.

Power generation and industry together are responsible for about 65% of energy-related carbon dioxide (CO_2) emissions today. The remaining 35% comes from transport, buildings and district heating.

The energy sector needs to transform from fossil-based to zero-carbon energy production by the second half of this century. Today, more than four-fifths of energy use comes from fossil fuels, with most of the rest derived from renewables. Renewables represent about 25% of electricity generation. To keep climate objectives in sight, renewables would have to cover two-thirds of the world's energy use and four-fifths of its power generation by 2050.

Renewables and energy efficiency together would provide 90% of the reductions needed by 2050 to be able to fulfil the Paris agreement.

The transformation to a sustainable energy system with high shares of renewables would also pay for itself. It would lead to trillions of US dollars in economic growth between now and 2050, and the health, environmental and climate benefits would save up to six times more than the additional costs associated with transforming the energy sector, IRENA's analysis shows.

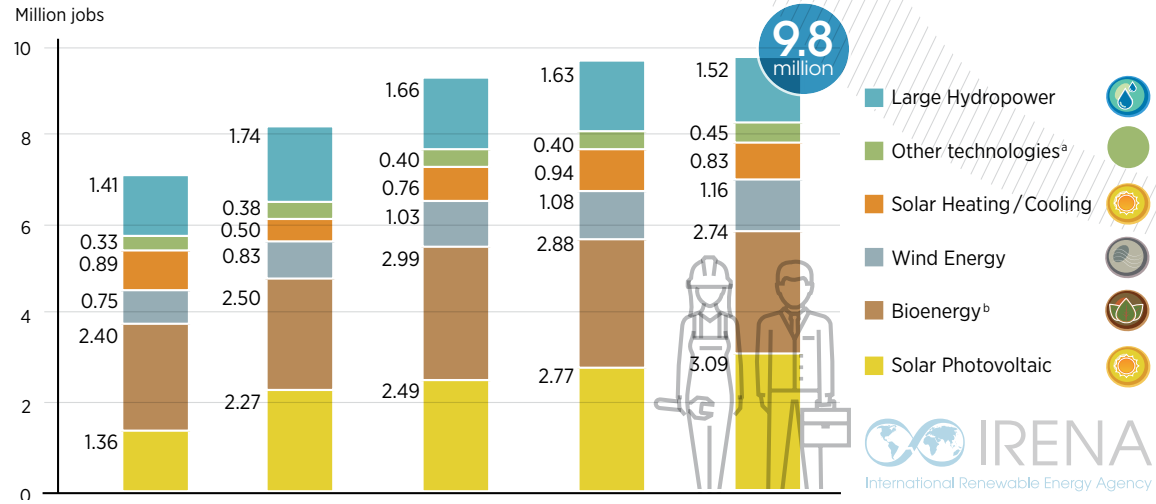
The energy transition is technically and economically feasible. Early action, however, is essential to capitalise on the economic opportunities available while avoiding the future costs of stranded assets.

Delaying decarbonisation of the energy sector would make higher levels of investment necessary to achieve the same objectives.

Cumulative assets stranded in the transition would total USD 10 trillion by 2030. But this would double to USD 20 trillion given just a decade if delay in adopting effective mitigation policies.

See **Perspectives for the energy transition: Investment needs for a low-carbon system**

Growth in global renewable energy employment by technology, 2012-2016



Understanding the socio-economics of renewables

Sustainable energy solutions have sometimes been perceived as coming with too many trade-offs, at the expense of overall socio-economic development. Undoubtedly, as governments around the world strive to put the 2015 Paris climate agreement into practice, they need to balance the urgency of the energy transition against numerous other considerations that affect people's welfare.

Fortunately, renewable energy provides climate-safe solutions that also support a wide range of socio-economic benefits, including job creation.

In the US during 2016, the solar PV sector added workers almost 17 times as fast as the overall economy

As the energy transition accelerates, growth in renewable energy employment appears set to remain strong. IRENA's analysis finds that the sector could employ around 25 million people worldwide by 2050.

New job creation in renewables and energy efficiency would more than offset the job losses in the conventional energy sector. In recent years, the renewable energy sector has continued to create jobs, whereas the conventional energy sector has struggled to retain them.

The global oil and gas industry, for example, is confronting job losses due to low oil prices and oversupply, with at least 440 000 people laid off in 2015 and 2016.

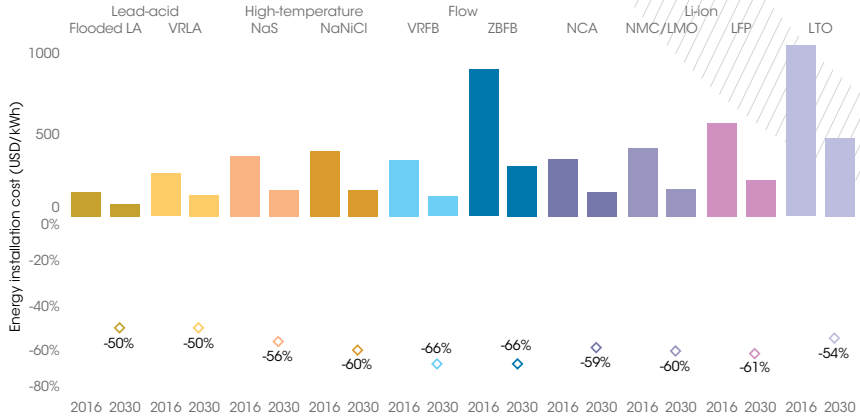
Whereas at 3.1 million jobs, solar photovoltaic (PV) employment grew by 12% in 2016 and has more than tripled since 2011 (see Figure). The industry is followed by the liquid biofuels sector (growing at a slower rate of 3% to 1.7 million jobs), and by the wind industry, growing by 7% to 1.2 million jobs.

Jobs are created in all segments of the renewable energy value chain. For example, a 50 megawatt (MW) onshore wind project creates job opportunities equivalent to 144 000 person-days. Operation and maintenance uses 43%, and manufacturing 17%, of the labour needed throughout the project lifetime.

For a 50 MW PV plant, the estimate is even higher, at 230 000 person-days across the value chain. Jobs in operation and maintenance, account for 56% of all labour requirements, while manufacturing jobs represent 22%.

IRENA has analysed the socio-economic benefits of renewable energy since 2011. For more on this, see ***Renewable energy benefits: Understanding the socio-economics****. See also the executive summaries of IRENA's* **Leveraging Local Capacity** studies for **onshore wind** and **solar PV**

Battery electricity storage systems: Installed energy cost reduction potential, 2016-2030



Renewables ready to compete

For almost every commercially available renewable power technology, the cost of electricity to the customer has become low enough to compete head-on with fossil fuels.

In the case of power plants commissioned in 2016, the global weighted average cost of electricity from renewable-based technologies, except for concentrated solar power and offshore wind, now falls within the range of fossil fuels (USD 0.045 per kilowatt-hour [/kWh] to USD 0.14/kWh).

Solar photovoltaics (PV) and onshore wind have seen very rapid cost reductions in recent decades. Between 2010 and 2016, the global weighted average cost of electricity from new, utility scale solar PV plants fell 69%, to as low as USD 0.11/kWh.

Recent auction and tender results suggest that the range could fall further, to just USD 0.04/kWh by 2019. Especially in the sunbelt – territories receiving strong, steady sunshine – and where low-cost financing is available, competitive costs can be achieved. Auction results in Abu Dhabi, Chile, Dubai, Mexico and Saudi Arabia all suggest that a new low in power generation costs, USD 0.03/kWh, will be achievable from 2019 and beyond.

Bioenergy, hydropower and onshore wind all offer low-cost power generation where untapped and economical resources exist. Offshore wind and concentrated solar power too, could offer competitive electricity in the next few years.

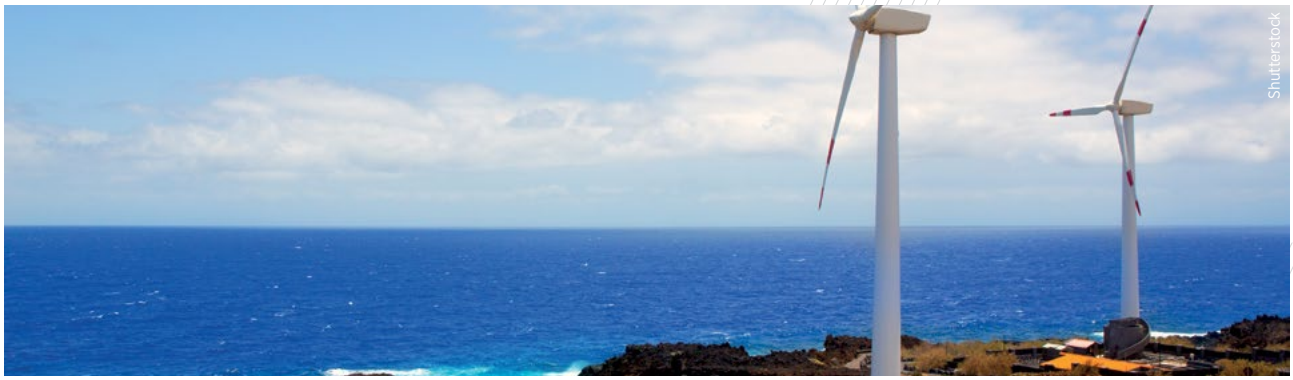
Onshore wind now represents one of the least-cost sources of new electricity generation capacity. The decline has been driven in part by falling wind turbine costs since 2009, as well as by increasing hub heights and larger swept areas. Auctions in 2016-2017 for offshore wind delivery in Denmark, Germany, the Netherlands and the United Kingdom saw the cost of electricity fall to the range of USD 0.06 to USD 0.10/kWh, which is highly competitive for new generation capacity in Europe.

Although solar and wind power technologies are commercially mature, they still have significant potential for cost reduction. By 2025 the global weighted average cost of electricity from solar PV could fall by as much as 59%, and from concentrated solar power up to 43%. Onshore and offshore wind could see cost declines of 26% and 35%, respectively. But more has to be done to integrate renewables in heating and transport.

Electricity storage based on rapidly improving batteries and other technologies will permit greater system flexibility, a key asset as the share of variable renewables – meaning solar and wind energy – increases.

Electricity storage technologies offer good cost-reduction potential and could see further reductions in costs and increases in performance. Depending on the battery storage technology, installed costs could fall by half to two-thirds by 2030 (see figure), with improvements in performance in terms of depth of discharge, calendar life and cycle life, which will all contribute to dramatically lower the cost of services from battery electricity storage technologies.

See **Electricity storage and renewables: Costs and markets to 2030**



A renewable future for islands

As small island developing states (SIDS) brace for the impact of climate change, about three-quarters of them have made renewable energy a key part of their energy planning. Most SIDS have the political will for a transition to renewable energy. About half of the 20 SIDS considered in a recent assessment see renewables as crucial to meet key energy targets.

But many SIDS governments are concerned about long-term operation and maintenance. Just five of the 20 SIDS reviewed have adequate plans and budgets in place to successfully operate and maintain public- or donor-funded renewable energy systems. Critically, more capacity is needed to plan and operate power grids with high shares of solar and wind power.

Access to finance is also a major issue. Local equity and government funding are insufficient to achieve the deployment envisioned, while the framework to attract foreign investments into renewables is not in place or is not effective.

Quickscan is a tool to help SIDS in their transition to renewable energy. Developed by IRENA as part of the SIDS Lighthouses Initiative, Quickscan helps to assess deployment conditions, monitor progress and identify areas where targeted assistance could accelerate the transition to renewables.

Quickscans provide a rapid, country-owned, qualitative assessment of existing conditions. To achieve this, government-appointed local energy experts complete a questionnaire covering seven key elements of the transition to renewable energy: Institutional Framework, Knowledge Base, Planning, Financing, Deployment, Capacity Building and Co-operation. Questionnaire responses are analysed by IRENA and other Lighthouses partners to determine key barriers and highlight opportunities for renewable energy deployment.

Quickscan participation

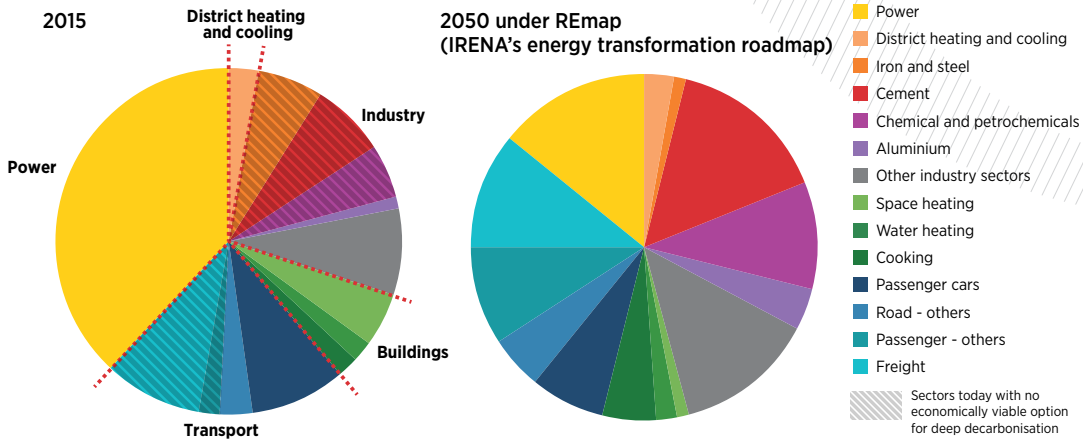
IRENA and a Lighthouses partner, the Overseas Countries and Territories Association (OCTA) of the European Union (EU), have assisted 28 island partners in the SIDS Lighthouses Initiative in completing quickscans. These partners included:

- **EU overseas countries and territories:** Anguilla, Aruba, Bermuda, British Virgin Islands, French Polynesia, Montserrat, New Caledonia, Sint Maarten, Turks and Caicos;
- **Other SIDS:** Antigua and Barbuda, Bahamas, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Maldives, Mauritius, Nauru, Niue, Palau, Republic of the Marshall Islands, Samoa, Seychelles, Solomon Islands, Tonga, Trinidad and Tobago, Tuvalu, Vanuatu.

Ten **other island countries and territories** also completed quickscans with OCTA assistance: Bonaire, Falkland Islands, French Southern and Antarctic Lands: TAAF, Pitcairn Islands, Saba, Saint Barthélemy, Saint Helena, Saint Pierre et Miquelon, Sint Eustatius and Wallis et Futuna.

See the **interim report** *released at COP23, the 23rd Conference of the Parties of the UNFCCC*

Changing breakdown of energy sector carbon dioxide emissions with accelerated uptake of renewables



No economically viable solutions yet exist for one-third of carbon dioxide emissions - mainly heavy industry, long-haul trucking, aviation and shipping. By 2060 the world needs zero emissions. The emissions left in 2050 represent a real challenge, mainly in industry and transport.

Innovation and research have to pick up the pace

Today's existing technologies are sufficient for about two-thirds of the massive decarbonisation required in the global energy sector in the coming 25 years. The next step is to integrate far higher shares of solar and wind power in large-scale energy systems.

This calls for rapid innovation, aimed at upgrading today's control systems, smart grids and storage, and other infrastructure. Innovation also has to focus on new ways to operate energy systems and to improve business models for mass commercialisation.

For the other third of the world's anticipated energy use, particularly in industry, buildings and transport, no commercial solutions exist today. Research and development (R&D) needs to speed up to lay the foundations for climate-safe energy systems.

Past energy transformations have been driven primarily by economic opportunity and technological development, not fuel resource scarcity. The current transformation is evolving in the same vein, with innovation making renewables competitive and mainstream in the power sector.

Decarbonisation requires global carbon intensity, the measure of an economy's carbon emissions, to be reduced by 85% over the next 35 years. Two out of three units of primary energy supplied must come from renewables by 2050. This requires renewables' share of total primary energy supply to increase at a rate of about 1.2% per year, an eightfold acceleration compared to the trend seen in recent years.

This major increase of renewables in the global energy mix, calls for both faster deployment of available technologies and the development of new technologies.

IRENA estimates that by 2050, the accelerated deployment of renewables and energy efficiency can achieve 90% of the emissions reductions needed to achieve Paris Agreement climate goals.

Innovation is needed to accelerate deployment, drive cost reduction and improve performance, as well as to discover and develop new technologies. Incremental improvements will continue to foster significant progress. Yet game-changing technologies and approaches are needed as well, in order to fully overhall energy use.

Despite the promising progress observed in the power sector, policy makers need to encourage both incremental R&D and crucial breakthroughs. This means nurturing all phases of the technology life cycle from early-stage research to commercialisation.

For analysis of the deployment rates for each technology and sector, see **Renewable Energy Innovation Accelerating research for a low-carbon future**. *See also* **Accelerating the Energy Transition through Innovation**

IRENA Events during Abu Dhabi Sustainability Week

15 – 18 January 2018

Event	Time	Venue
IRENA Booth at the Abu Dhabi National Exhibition Center	All Day	A500 and A510
	MONDAY, 15 JANUARY 2018	
The Role of Regions in the Global Energy Transition	13.30 – 17.00	Capital Suite 5
Global Standardisation Initiative	13.30 – 15.30	Capital Suite 7
Renewable Energy Industry Advisory Board (RIAB) of the IEA	15.30 – 18.00	Capital Suite 7
Project Funding – IRENA/ADFD Project Facility	14.00 – 15.00	Pavilion, A500-A510
Member Presentation: Germany *Achievements and Potential in Renewable Energy*	16.00 – 16.30	Pavilion, A500-A510
	TUESDAY, 16 JANUARY 2018	
MENA Renewable Energy Manufacturing Developments and Future Prospects	10.00 – 12.30	Capital Suite 5
Renewable Energy in the Water-Energy Nexus	10.00 – 12.30	Capital Suite 7
Member Presentation: Dominican Republic *Achievements and Potential in Renewable Energy*	10.00 – 10.30	Pavilion, A500-A510
Member Presentation: European Commission *Achievements and Potential in Renewable Energy*	11.00 – 11.30	Pavilion, A500-A510
Member Presentation: France *Achievements and Potential in Renewable Energy*	12.00 – 12.30	Pavilion, A500-A510
Renewable Energy Investment in Southeast Asia	14.30 – 16.00	Capital Suite 5
Sector Coupling: Heat Pumps Facilitating High Shares of Solar and Wind	14.00 – 17.30	Capital Suite 7
Member Presentation: United Arab Emirates *Achievements and Potential in Renewable Energy*	14.00 – 14.30	Pavilion, A500-A510

Times may be subject to change.