IRENA QUARTERLY
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EMPLOYED IN THE ENERGY TRANSITION

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Renewable energy employed 11.5 million people worldwide last year.

The coronavirus (COVID-19) pandemic has brought to the fore the close connection between the natural environment, our economies and patterns of living. A clean, reliable energy supply and durable, healthy, low-carbon job creation are viewed as essential components to the transformation our societies need to undertake to limit further degradation of the planet's natural systems.

Countries must align their COVID-19 response with the energy transition

Building the skills base necessary to support this ongoing global energy transition from fossil fuels to renewables requires more vocational training, stronger curricula, more teacher training and expanded use of information and communications technology for remote learning.

Worldwide, most renewable energy jobs are still held by men. The share of women in the renewables workforce is about 32%, compared to 22% in the energy sector overall, surveys indicate.

The post-COVID agenda put forward by the International Renewable Energy Agency (IRENA) could bring renewables jobs to nearly 30 million globally by 2030 and pave the way for longer-term resilience, development and equality.

Renewable energy fuels job growth

The renewable energy sector employed at least 11.5 million people, directly and indirectly, in 2019. Solar photovoltaic (PV), bioenergy, hydropower and wind power industries are the biggest employers. Increasingly, decentralised PV serves communities that previously lacked access, creating new jobs in the process.

Today, solar PV employs 33% of the global renewable energy workforce. Last year, 91% of PV employment was concentrated in ten countries.

China is the clear leader in renewable energy jobs with 4.4 million, or 38% of the global total. Prior to COVID-19, the country's solar PV and solar water heating workforce became more export oriented amid slowing domestic installations.

Wind power employs 1.2 million people, an estimated 21% of whom are women. This is considerably lower than the 32% average for all renewables and closer to the gender balance in the oil and gas industry. Onshore wind continues dominate, but offshore wind jobs are growing fast. Eighteen countries host offshore wind farms, up from ten a decade ago.

Germany's wind energy segment employed 122 000 people, more than 40% of the country's renewable energy workforce, Europe's largest.

Jobs in biofuel meanwhile reached 2.5 million worldwide, driven by output growth of 2% for ethanol and 13% for biodiesel. Production expanded robustly in Brazil, Colombia, Malaysia, the Philippines and Thailand, all with labour-intensive supply chains, whereas biofuel output fell in the United States and the European Union.

Latin America has 43% of global biofuel jobs with Brazil holding the largest share and Colombia the fourth largest. Mexico, Chile, Argentina are also key markets, while other Latin American countries similarly aim to scale up renewables.

Hydropower retains the largest installed capacity of all renewable power generation sources. Its growth, however, is slowing. The segment employs close to 2 million people directly, many in operations and maintenance. It accounts for 342 000 jobs in Latin America, making this the region's second largest renewable energy employer after biofuels.

Renewable energy use in Africa is still comparatively low, with 4% of the global jobs in solar PV and 3% of those in hydropower. Encouragingly, off-grid solar has created more than 100 000 full-time-equivalent jobs in Sub-Saharan Africa, a number that is set to increase in coming years.

For more see the new **Renewable energy and jobs: Annual review 2020**

Global renewable energy employment by technology, 2012-2019

Source: IRENA jobs database.

Note: Except for hydropower, where a revised methodology led to revisions of job estimates, numbers shown in this figure reflect those reported in past editions of the Annual Review.

a. Includes liquid biofuels, solid biomass and biogas.

b. "Others" includes geothermal energy, concentrated solar power, heat pumps (ground based), municipal and industrial waste, and ocean energy.

The path to zero CO_2 emissions

Limiting the global average temperature rise to 1.5°C will require all sectors of the economy to reach zero carbon dioxide (CO_2) emissions early in the second half of this century.

The Paris Agreement, in calling for rapid decarbonisation, has focused attention on the energy sector as a major source of global emissions. The latest studies from the Intergovernmental Panel on Climate Change (IPCC) show that the window of opportunity closing fast for meaningful action to counter the global climate threat.

Complete decarbonisation presents a daunting challenge, particularly in the most energy-intensive industry and transport sectors. Options that deliver only partial emission reductions will not be sufficient; policy makers and investors must pursue specific options that are consistent with reaching zero. Most of those options use renewable energy in combination with various cutting-edge technologies.

Four of the most energy-intensive industries and three key transport sectors stand out as the hardest to decarbonise. Together, those seven sectors could account for 38% of energy and process emissions, and 43% of final energy use by 2050 unless major policy changes are pursued now.

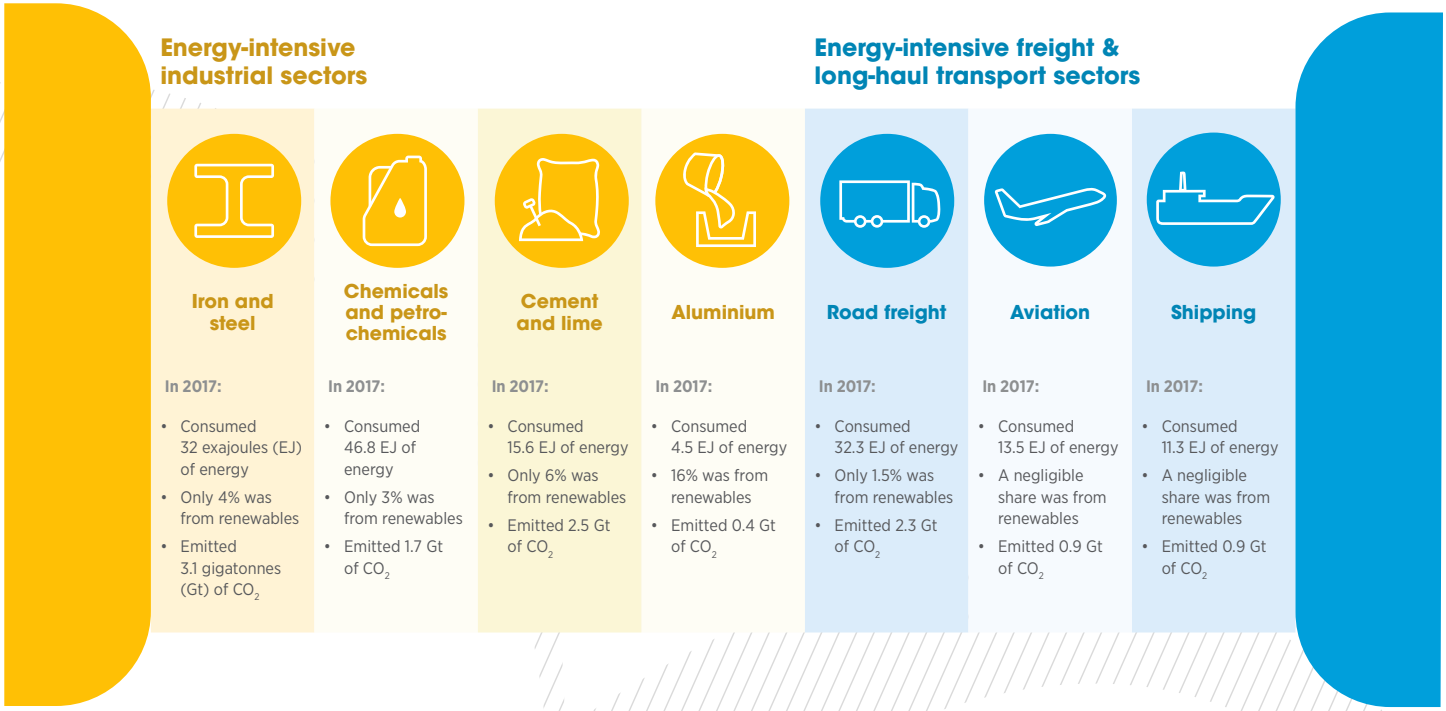
Analysis of the options available for heavy industry and transport suggests that these key sectors warrant increased and immediate attention, particularly on how to make much greater use of renewables, which could provide over half of the emissions reduction needed to meet the 1.5°C climate goal. With the right plans and sufficient support now, zero emissions can be reached by the 2050s, in time to contain the worst effects of climate change.

Zero emissions are reachable by 2050 with the right plans and support

Progress has thus far been limited. However, steeply falling renewable energy costs and the growing political and social consensus on climate action allow for more ambitious investments to cut emissions.

While renewable power capacity has grown rapidly over the last decade, end use sectors remain stuck burning vast quantities of fossil fuels.

For a comprehensive study of deep decarbonisation options, see: **Reaching Zero with Renewables**



Utilities target 100% renewable energy

Governments and companies are setting their sights more and more on the exclusive use of renewable electricity. Recent years have witnessed steep reductions in the costs of renewable energy technologies as well as continuing technological innovation. These factors make the vision of a renewables-only power system more achievable than ever before.

In the power sector, where renewables already account for over half of new capacity additions each year, the prospect of going entirely renewable could soon be within reach for many countries.

The focus on renewables by many public and private companies has shaped new roles and responsibilities for traditional electricity providers. At the same time, long-term government policies increasingly aim to promote the transition to 100% renewable power.

As the entities traditionally responsible for delivering power to consumers, utilities retain a crucial role, both in maintaining large-scale generation hubs and as more flexible grid operators enabling distributed generation. Both national and local utilities must adjust to the new and growing demand specifically for renewable power.

"The transition to 100% variable renewable energy is not simply the substitution of one generation source with another," says Dr Bryn Williams, future network strategy manager at SA Power Networks in South Australia. "It entails an unprecedented transition from centralised, top-down, to decentralised, bottom-up, generation."

Big power utilities helped create the current energy system. Traditionally, they have delivered power to communities and industries from large, centralised generation facilities. Dr Williams says the next wave of transformation is going to be led by customers.

Currently, SA Power Networks distributes power to around 860 000 homes and businesses and is expected to reach 73% variable renewable energy in electricity generation by 2021 and 100% in 2025. Government subsidies and incentives help to steer the market towards sustainable options, he adds.

Denmark's largest energy firm, Ørsted, generates and distributes electricity and heat to businesses and households around the country.

The Danish government aims for 99% renewable power by 2025 and a complete phase-out of coal-fired power generation by 2023.

"The dynamic [between policy makers and industry] is key to developing a world run entirely on green energy," said Magnus Hornø Gottlieb, Ørsted's senior global public affairs advisor. "Industrial players are ready to invest, innovate and industrialise new, renewable solutions, but policy makers must provide the political ambition and a clear pipeline of upcoming projects to speed up the process as well."

Transforming the power system requires firm commitments at national and also sub-national levels. Shannon Tangonan, corporate communications manager at Hawaiian Electric Companies (US), recommends starting with transparent stakeholder engagement.

"Setting expectations for stakeholders, customers and regulators will become more challenging as the Hawaiian Electric Companies makes the transition to 100% renewables," she says.

Reaching 100% renewables is not just a case of substituting generation sources

"The stakeholder engagement process had an important and positive influence on the formulation of the final strategic plan currently being implemented by the utility."

Under a decisive transformation plan, Hawaiian Electric Companies went from 9.5% renewable electricity generation in 2009 to over 25% in the past decade.

Close collaboration between utilities and decision makers is essential. Another US power utility, Aspen Electric, reached 100% renewables for its customers in the Colorado ski-resort town by 2015.

"A major lesson was not to listen to those who were opposed to the idea and keep a long-term frame of reference when approaching these goals," emphasises Phil Overeynder, retired utility director for Aspen Utilities. "Teamwork is very important," he adds. "For example, Aspen Electric made MEAN (Municipal Energy Agency of Nebraska – the wholesale energy provider for Aspen) part of the team, and therefore developed positive collaboration and effective compromises."

For more on the evolving role of power utilities, see IRENA Coalition for Action White Paper: **Towards 100% Renewable Energy: Utilities in Transition**

Sweden explores innovative solutions

The largest of the Nordic countries, with over 10 million inhabitants, has set out to meet 100% of its electricity needs from renewable sources by 2040. With a highly decarbonised power system already in place, Sweden is well positioned to meet ambitious energy and climate goals. Still, it needs innovative solutions to achieve 100% renewable power use within just two decades.

A recent study, produced in consultation with the Swedish Energy Agency (Energimyndigheten), proposes four main ways for the Swedish power system to integrate the highest possible shares of renewables:

- Providing innovative ancillary services based on both conventional and variable renewable energy sources;
- Gaining power system flexibility from the Pan-European market through collaboration among system operators;
- Ensuring system-friendly integration of distributed energy resources;
- Renewable-based electrification to decarbonise end uses like heat and transport.

Sweden's case also offers insights applicable to other countries in the quest for 100% renewable power. In a series of workshops last year, IRENA convened stakeholders for further discussions on ramping renewable power up to very high shares. Similar case studies are soon to be conducted elsewhere.

See **Innovative solutions for 100% renewable power in Sweden**

MEMBER BULLETIN

Photograph: Shutterstock

Islands aim to phase out fossil fuels

From the Atlantic Ocean and the Caribbean to the farthest reaches of the Indian and Pacific oceans, island communities face common and increasingly daunting energy challenges.

On top of their vulnerability to climate change, Small Island Developing States (SIDS) tend to have limited primary energy resources, leaving them dependent on imported fossil fuels. This means severe price volatility, along with climate damage.

Small system size, however, makes island grids good candidates to demonstrate the shift in power generation from fossil fuels to local renewable sources.

In one instance, in **Vanuatu**, the power utility of **Espiritu Santo** undertook a grid assessment study that estimated 87% of electricity demand could be met with renewables by 2030. New operational procedures and enabling measures could boost solar photovoltaic (PV) power in the system as well as adding more hydropower.

How islands can scale up renewables:

Grid assessment	Technical Challenges	Recommendations
Dominican Republic	• Response to contingencies • Loss of synchronism during faults • Lack of inertia • Frequency stability • Voltage regulation • Automatic load shedding • System security • Over loading, under voltages and over voltages in lines and transformers	• Installation of battery for frequency support • Must run generators for inertial support • New lines and upgrades to existing lines for evacuation of variable power • Corrective actions such as generation redispatch and grid reconfiguration • Application of shunt devices or static synchronous compensators (STATCOMs) for voltage correction
Fiji	• Effect of roof top PV on feeder voltage profile • Reverse power flow • Thermal limits of lines • Over-loading of lines	• Follow heuristic rules defined by the study for implementing PV on feeders • Upgrade on load tap changing equipment • Implement voltage regulation support, reactive power support, fault ride through and dynamic frequency support from PV inverters • Improve protection settings • Modify grid codes • Feasible generation dispatch to cover net load
Vanuatu	• Frequency constraints • Voltage regulation • Fault current and protection settings	• Improved control system • Grid code modifications • Upgrade transmission assets at specific locations • Batteries and diesel UPS (uninterruptible power supply) for inertial provision and siting them to improve voltage profile • Grid modernisation

Moving from predominantly thermal, fossil-based power generation to a system rich in wind and solar energy is not without challenges for SIDS. The variable nature of those sources – the sun must shine and the wind must blow – requires careful integration with existing power systems. The transition must be approached in a structured manner, with studies undertaken at key stages.

In **Viti Levu**, an island in the **Republic of Fiji**, grid assessments showed that the share of PV could increase as much as 65 megawatts (MW) with infrastructure upgrades and grid code changes to reduce constraints in the power system.

After a thorough evaluation by power engineering experts, effective grid codes can be adopted and adapted from other countries with similar demand and generation profiles.

In the **Dominican Republic**, assessments have showed ways to integrate variable renewables into the existing power system.

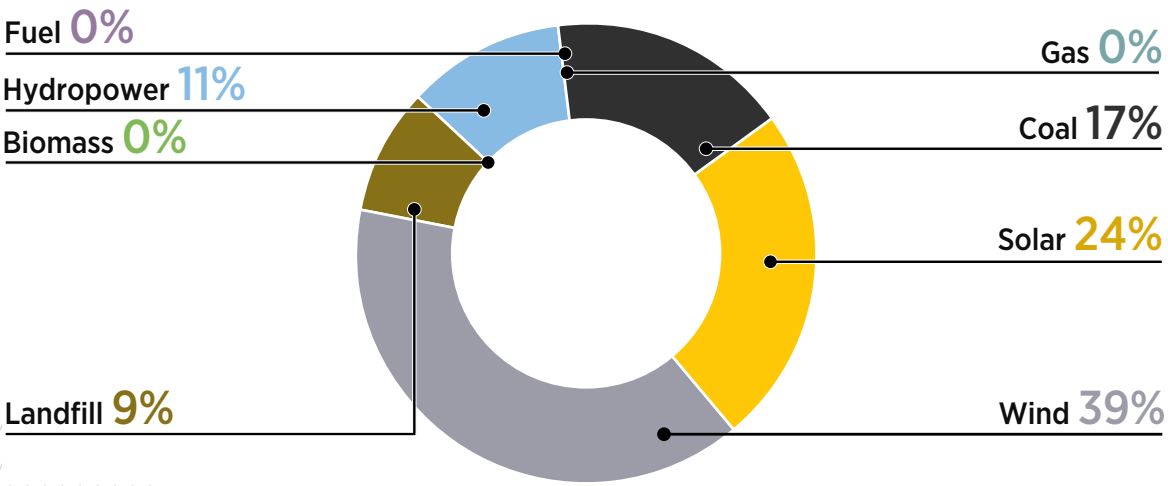
By 2030, some 63% of real-time demand could be met by wind and solar energy. This means over a third more wind and nearly a quarter more solar than in recent years, while slashing the use of natural gas and oil-based fuels by more than a quarter. This could cut system operating costs as well as carbon-dioxide (CO_2) emissions.

After an island state sets its policies and targets for renewables, grid assessment studies can indicate feasible shares for the existing power system, as well as future investment needs. Such studies can also offer valuable recommendations on solar and wind integration.

While SIDS contribute only to a very small percentage of global emissions, they are taking decisive steps to scale up renewable energy and fulfil their own international climate pledges.

For more, see **Transforming small-island power systems**

Optimal generation mix 2030 for the Dominican Republic



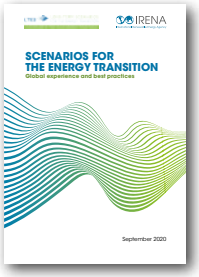
Nurturing island economic health

Island states, like other countries, are suffering economic fallout from COVID-19. But clean domestic energy supplies could help to limit the impact.

Large scale investments in renewables can enhance energy, food, water and health security in the island context. Development partners aim to help SIDS use a range of financing options, such as blended finance, de-risked investments. Island states can also pursue grants through the new Climate Investment Platform and funds mobilised through planned IRENA Investment Forums.

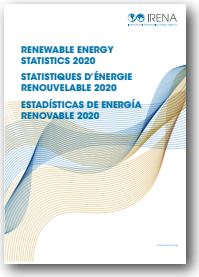
The SIDS Lighthouses Initiative, facilitated by the International Renewable Energy Agency (IRENA), supports SIDS in their energy transformation. The initiative, consisting of 36 SIDS and 28 development partners, aims to reach a total installed capacity of 5 gigawatts (GW) by 2023.

Recent publications



Scenarios for the Energy Transition: Global experience and best practices

Energy transitions involve complex and varying challenges for different countries and regions. This report presents a collection of over 50 practices from over 20 governments and technical institutions worldwide, dedicated to improving the use and development of long-term energy scenarios to guide the clean energy transition.



Renewable Energy Statistics 2020

This yearbook contains comprehensive, reliable data sets on renewable energy capacity and use worldwide. It covers data sets on power-generation capacity for 2010-2019, actual power generation for 2010-2018 and renewable energy balances for over 130 countries and areas for 2017-2018.

www.irena.org/publications

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.