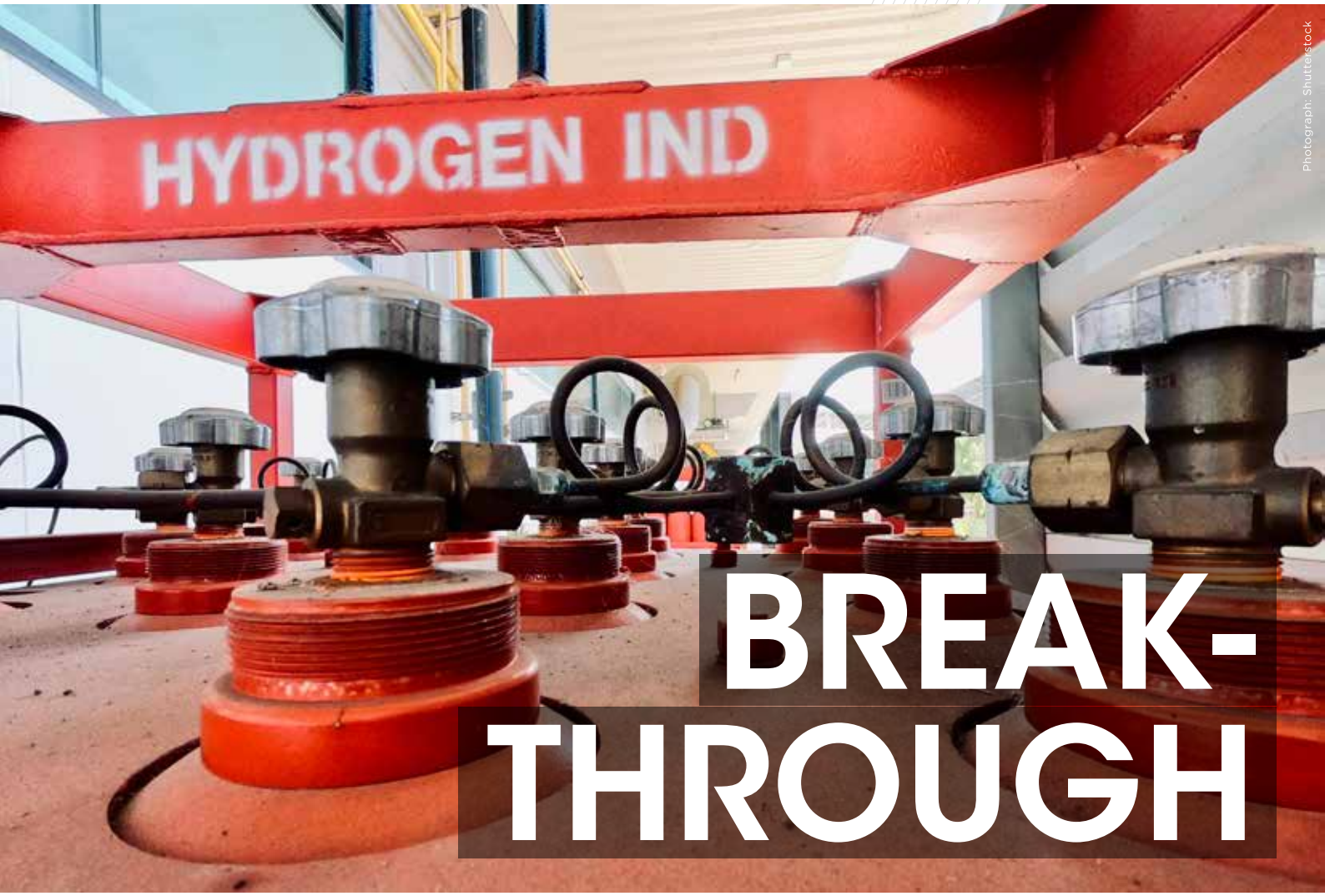
IRENA QUARTERLY
Q1 2021



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BREAK-THROUGH

As global economies strive for carbon neutrality, cost-competitive renewable hydrogen is possible within the decade.

Green hydrogen, produced by renewable power, can help eliminate carbon dioxide (CO_2) emissions in challenging sectors like steel, chemicals, long-haul transport, shipping and aviation. Thanks to the decline in renewable power costs, hydrogen could become a cost-competitive clean energy carrier worldwide by 2030.

Green hydrogen can cut emissions from heavy industry and transport

The costs of green hydrogen reflect renewable electricity prices, investment costs for electrolysers and operating hours. All these factors currently make it between two and three times more expensive than blue hydrogen, the kind produced with fossil fuels in combination with carbon capture and storage (CCS).

Continuous innovation and policy attention will be essential to make green hydrogen viable as part of a sustainable energy mix. Regulations, market design, and the costs of power and electrolyser production will all come into play.

Green hydrogen to join climate mitigation arsenal

As the world strives to cut greenhouse gas emissions and reach carbon neutrality by 2050, energy-intensive industries and transport present a major challenge. Emissions are especially hard to abate in sectors such as steelmaking and cement, aviation and long-haul shipping.

Hydrogen based on renewables, also known as "green" hydrogen has emerged as a vital clean energy carrier, the only hydrogen type ultimately compatible with net-zero emission targets and sustainable, climate-safe energy use. "Grey" and hybrid "blue" hydrogen can also boost energy supply and power system flexibility, but without eliminating fossil-fuel use.

Energy planning has recently started to include green hydrogen for several reasons:

- It results in no residual greenhouse gas emissions.
- It can increase system flexibility, particularly through seasonal storage, helping to integrate higher shares of solar and wind power.
- Although currently expensive, it will become more competitive due to rapidly falling costs for electricity from renewables. Solar photovoltaic (PV) and wind power costs have already declined 80% and 40%, respectively, in the last decade, with these trends expected to continue.

Green hydrogen now costs USD 4-6/kilogram (kg), 2-3 times more than grey hydrogen. The largest single cost driver is renewable electricity, which is becoming cheaper every year. But electricity itself is not the only factor to consider.

Electrolysers – which split water into hydrogen and oxygen – must also be scaled-up and improved to make green hydrogen cost-competitive. Their costs, having fallen 60% since 2010, could fall another 40% in the short term and 80% in the longer term, the latest IRENA analysis indicates. Achieving these reductions hinges on innovation to improve electrolyser performance, scaling up manufacturing capacity, standardisation, and growing economies of scale.

This could bring green hydrogen cost below USD 2 /kg – a crucial milestone for cost competitiveness – before 2030.

While renewable power keeps getting cheaper, electrolyser costs must also be reduced

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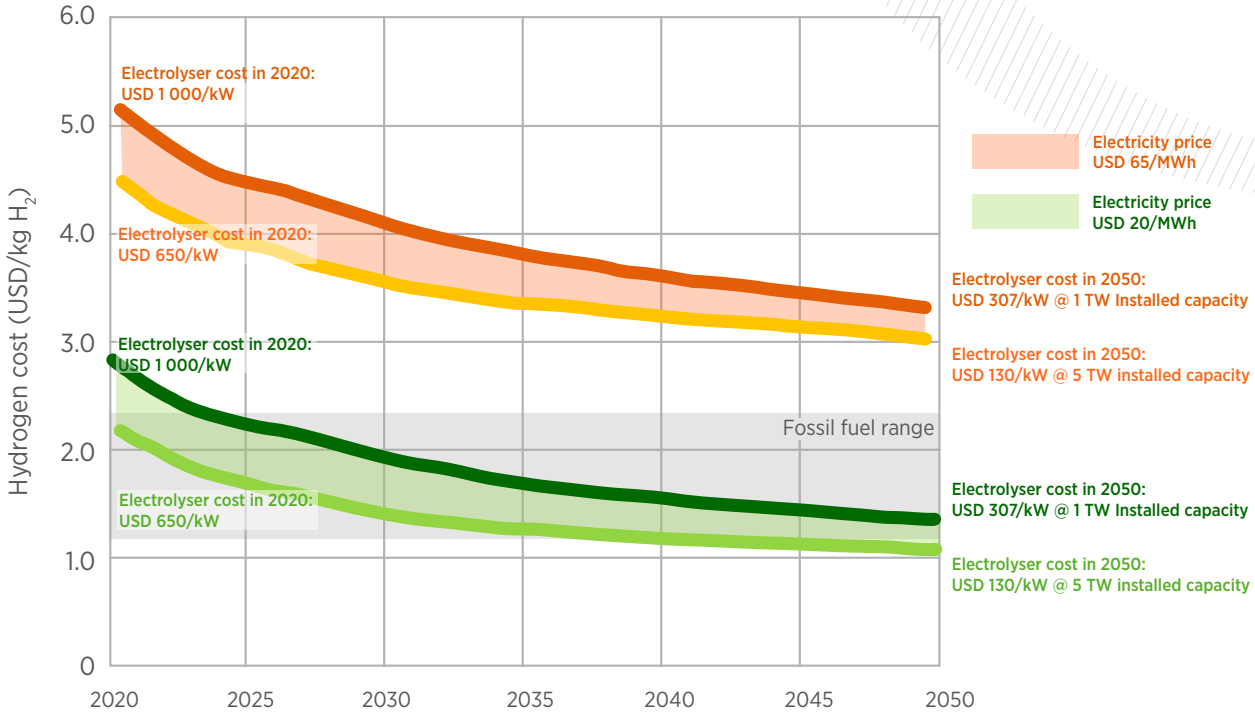
How electrolyser scale-up drives down costs



Four policy pillars would help move green hydrogen from niche to mainstream:

- Developing national hydrogen strategies. These define each country's level of ambition and can provide a valuable reference for private investment and project finance.
- Setting priorities. Along with use as a fuel or re-conversion to electricity, hydrogen can support a wide range of end-uses for industry and transport. Policy makers must identify the applications that provide the highest value. Industrial uses, for example, could be prioritised over low-grade heat or fuel blending.
- Guarantees of origin. Clear labels are needed to reflect carbon emissions over the whole life cycle of hydrogen. This would increase consumer awareness and allow incentives for green hydrogen use.
- Enabling policies. With the right overall policy framework, green hydrogen can create significant industrial, economic and social value, including new jobs.

Green hydrogen costs could fall below USD 2/kg before 2030

Green hydrogen promises to become a game changer for energy efficiency and decarbonisation. To achieve its potential, it needs to be widely affordable, including for developing economies seeking affordable ways to build sustainable future energy systems. With the right policies put in place now, it could soon become a cornerstone of the world's shift away from fossil fuels.

For more see: **Green hydrogen cost reduction: Scaling up electrolysers to meet the 1.5°C climate goal** *and* **Green hydrogen: A guide to policy making**

Lower technology costs give renewables more purchase

Global renewable energy investments have increased steadily in recent years, peaking at USD 351 billion in 2017. Even the dip in 2018 reflected declining technology costs, with more capacity being added despite lower investment totals. To meet global climate goals, however, investments in renewables must triple over the next three decades.

Between 2013 and 2018, solar photovoltaics (PV) and onshore wind attracted 75% of global renewable energy investments, followed by offshore wind (7%), solar thermal (6%) and hydropower (4%).

Renewable energy investments, however, remained concentrated in a few regions. East Asia and the Pacific, led by China, attracted the largest share (32%) over 2013-2018. Western Europe and developed economies in the Americas (Canada, Chile, Mexico, US) followed, with 19% and 18%, respectively. Developing and emerging economies remained consistently under-represented, attracting only 15% of global investments in renewables in 2013-2018.

The private sector remains the main capital provider for renewables, accounting for 86% of investments in 2013-2018. Project developers provided 46% of this private finance, followed by commercial financial institutions (22%).

Development finance remains crucial to reduce risks, attract private investors and bring new markets to maturity.

Renewables are needed to extend electricity access to hundreds of millions of people. Annual financial commitments to off-grid renewables in developing and emerging countries reached USD 460 million in 2019, up from just USD 250 000 in 2007. Still, this is just 1% of finance to expand energy access.

Renewable energy assets have proven resilient amid the COVID-19 crisis. But the past year's modest investment recovery is insufficient to fulfill the Paris Agreement. To put the world on a climate-safe path, average annual investments in renewables must reach USD 800 billion between now and 2050 — or three times their current level.

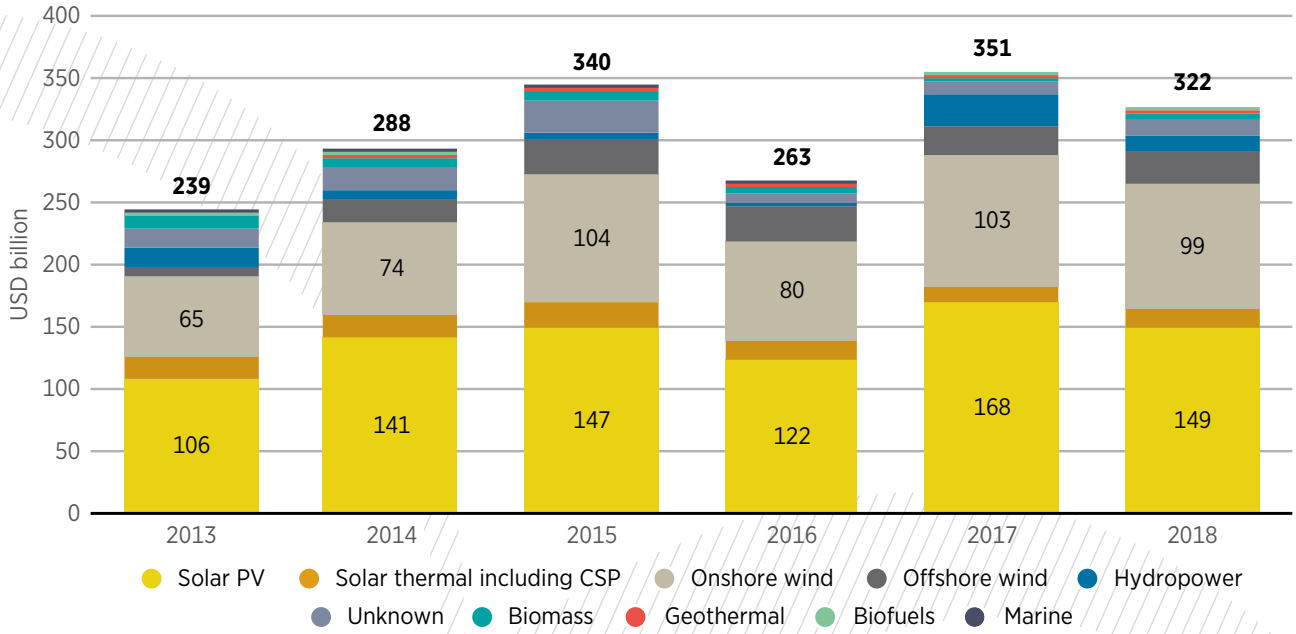
This requires governments, capital market regulators, finance issuers and investors to work together to shift assets away from fossil fuels.

To make this happen, policy makers are advised to:

- Use public finance to attract private capital;
- Mobilise institutional investment in renewables;
- Promote greater use of green bonds for renewables;
- Enhance the participation of corporate investors;
- Scale up financing for off-grid renewables.

For more, see **Global Landscape of Renewable Energy Finance**

Annual financial commitments to renewable energy technologies, 2013-2018



National climate pledges: How well are we doing?

Reducing carbon dioxide (CO_2) and other greenhouse gas emissions is key to a long-term, low-carbon, climate resilient future. Just over five years ago, on 12 December 2015, countries around the world signed the Paris Agreement, aiming to slow down global warming and avert catastrophic climate change.

Each Party – or signatory that has ratified the agreement – effectively pledges to reduce emissions through Nationally Determined Contributions (NDCs). Such pledges increasingly include targets to boost renewable energy use.

To date, 190 Parties have ratified the Paris Agreement and 188 have submitted NDCs to the United Nations Framework Convention on Climate Change (UNFCCC). Of these, 170 Parties (or 90% of the total) mention renewables in their NDCs, while 134 (or 71%) include quantified renewable energy targets. A further eight have recently submitted second NDCs.

In line with the initial expectations to ratchet up ambitions over a five-year review cycle, formal NDC updates began in 2020. It was meant to be the year for revising and increasing climate ambitions. By the fifth anniversary of the Paris Agreement in mid-December, 18 countries had submitted new NDCs.

Of those ten included quantified renewable energy targets, but only five of those targets look more ambitious than in the last round of NDCs.

Amid the COVID-19 pandemic, many missed the year-end deadline. However, by the end of 2020 a further 22 parties had submitted either their first NDCs, updates or a second NDC.

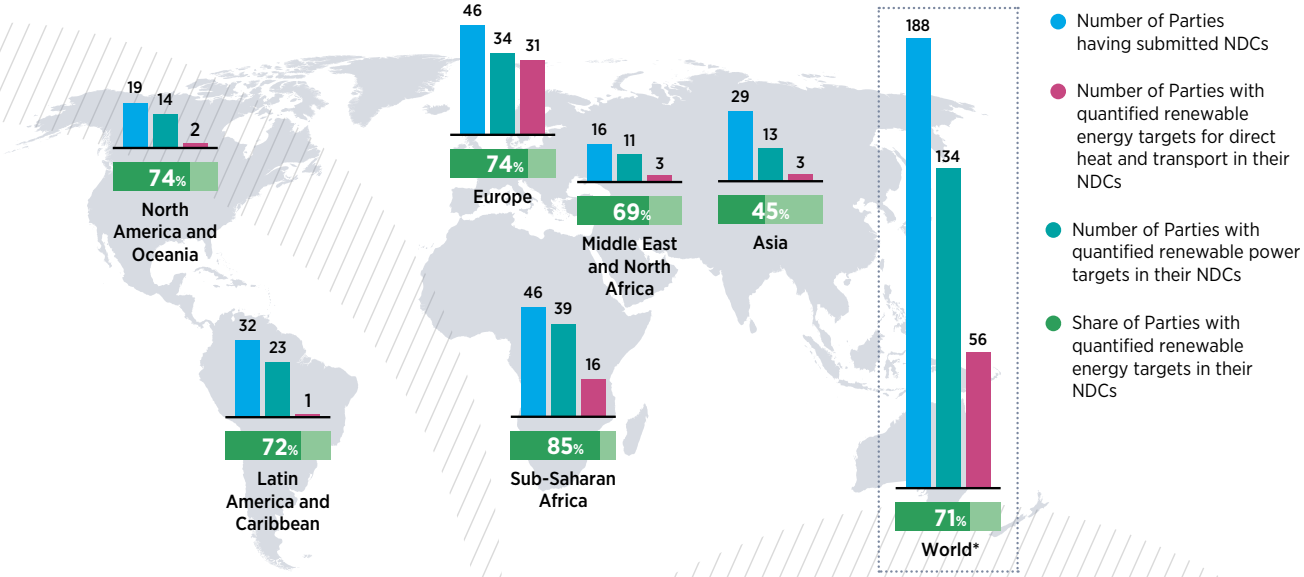
In theory, if all renewable power targets included in prior NDC plans were implemented, an additional 1 041 gigawatts (GW) of renewables would be added by 2030. Global renewable power capacity would consequently grow almost 42%, from 2 523 GW in 2019 to an estimated 3 564 GW in 2030.

Energy uses outside the power sector remain comparatively neglected in current NDCs. The sweeping decarbonisation called for by the Paris Agreement must embrace transport, buildings and industry, not just electricity generation. Nevertheless, only 56 Parties have included renewable energy targets for transport or direct heat in their NDCs, as compared to 134 which included targets for renewable power generation.

IRENA is engaged directly with 66 countries, including 17 of the world's least developed countries and 20 small island developing states, to scale up renewables in their climate action plans.

For more see: **Renewable energy and climate pledges: Five years after the Paris Agreement**

Renewable energy components in current NDCs



Note: Figures from 9 December 2020

Climate-safe future hinges on city-level renewables

Cities are engines of the global economy, generating as much as 80% of gross domestic product for some countries. They also emit three-quarters of the world's energy-related carbon dioxide (CO_2) emissions.

With cities on course to hold two-thirds of the world's population by 2050, they are central to climate change solutions. Measures to scale up renewable energy at the municipal level offer enormous potential to reduce emissions and will be essential to achieve a carbon-neutral future.

Urban renewable energy targets, combined with a range of policy tools, can help to provide policy signal and assure potential investors and project developers of consistency in future development plans.

> Renewables at the city level could cut emissions from buildings, transport and industry

Renewables can enable developing countries to avoid lock-in to the fossil energy trap. Among world regions, Asia and Africa are projected to grow fastest, in terms of both urban populations and energy demand.

These two continents are falling behind in renewable energy target setting and renewable-based power plant deployment, despite great renewable energy resource potential. For example, Africa, which boasts high solar irradiance, is home to only 1% of solar power plants located near cities.

Renewable-based distributed energy generation increasingly allows countries and cities to harness local resources, as well as pursue trade in commodities, including electricity, with neighbours. This can cut investment costs, reduce energy losses from long-haul transmission, spur economies create job opportunities and enhance climate resilience.

Enhanced knowledge of urban renewable energy applications would help cities to improve their future energy use. Hydropower, bioenergy and waste-to-energy already help many cities meet renewable energy targets and reduce emissions. Solar and geothermal use in cities is rising while advancing technologies could soon allow widespread wind power generation in and near cities.

Modelling tools can help to optimise the urban energy mix using local renewables. A variety of approaches can be followed, from early planning to later system design (e.g. sizing and operation) and long-term municipal strategy development. Dramatic declines in renewable power generation costs and the strategic adoption of disruptive technologies increasingly allow cities to scale up decentralised renewables.

A recent study by the International Renewable Energy Agency (IRENA), supported by Germany's Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU), through the International Climate Initiative (IKI), finds that renewables could reshape urban energy systems and cut energy-related CO_2 emissions from buildings, transport, and industry.

To learn more, see: **Rise of renewables in cities: Energy solutions for the urban future**

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MEMBER BULLETIN


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El Salvador intensifies energy transformation drive

El Salvador depends heavily on imported fossil fuels to meet its energy needs for industry, transport and, to some extent, power generation. As domestic demand grows, the country has turned to electricity imports from its Central American neighbours. However, indigenous renewable energy, including hydropower and geothermal sources, could be scaled up to meet growing energy demand.

In the past decade, the country has achieved significant progress in the promotion of renewable energy, in line with its National Energy Policy and climate targets. El Salvador has added no fossil-based power generation since 2013, diversifying its energy mix with new renewable generation.

Since 2015, solar photovoltaic (PV) capacity alone has grown nearly tenfold, reaching 273 megawatts (MW) in 2019. Geothermal energy, in contrast, remains vastly underutilised, in part because current regulatory frameworks only cover geothermal electricity.

"El Salvador might be the smallest country in Central America, but its renewable energy potential is vast," said Francesco La Camera, Director-General of the International Renewable Energy Agency (IRENA). "By unlocking indigenous renewables, El Salvador can boost health capacity, build climate resilience and substantially boost its post-COVID recovery."

163rd Member: Austria has completed the accession process to become an IRENA member state. The agency now encompasses 163 members (162 states plus the European Union) and 21 signatories or states in accession.

Competitive tendering processes have helped to scale up renewable power generation, with various fiscal incentives also contributing to the rise in renewable capacity.

El Salvador's implementation of a net-metering scheme in 2017 further promoted distributed solar PV generation. Now, regulatory frameworks need to be updated to encourage distributed PV use, provide flexible energy management and empower end users.

El Salvador became a member of the International Renewable Energy Agency (IRENA) in June 2017 and recently concluded a *Renewables Readiness Assessment* with IRENA's support. The process involved broad national stakeholder consultations, which identified challenges and outlined key recommendations.

The country-led process highlighted 14 concrete short- and medium-term actions to accelerate uptake of renewables and help meet climate goals.

Broadly, the assessment advises El Salvador to enhance long-term planning and policy for the renewable energy sector; create enabling conditions for geothermal energy development; establish clear institutional frameworks and co-ordination; assess the implementation of distributed power generation; and foster project development and financing for renewables.

To learn more, see: **Renewables Readiness Assessement: El Salvador**

Recent publications

Innovation Outlook: Ocean Energy Technologies

Oceans contain vast renewable energy potential. The report examines the status and prospects of ocean energy – including wave, tidal, salinity gradient and ocean thermal energy conversion technologies.

Renewable Energy Policies in a Time of Transition: Heating and Cooling

Heating and cooling accounts for almost half of global energy consumption. This joint report from IRENA, the IEA and REN21 outlines the infrastructure and policies needed with each transition pathway.

IRENA/ADFD Project Facility: Lessons from the selection process

IRENA's partnership with the Abu Dhabi Fund for Development (ADFD) has helped to channel low-cost capital to innovative renewable energy projects in developing countries. The report outlines lessons to inform future financing initiatives.

Geothermal development in Eastern Africa: Recommendations for power and direct use

Countries of the East African Rift hold significant geothermal potential, giving them valuable options for sustainable electricity and direct use.

www.irena.org/publications