

POLICY LANDSCAPE

Renewable energy support policies and targets are now present in nearly all countries worldwide.¹ As the costs for renewable technologies fall, these measures continue to evolve and adapt, and in some places they are expanding to ease the integration of higher shares of variable renewable energy (VRE)ⁱ into electric grids. The power sector again received most of the renewable energy-focused policy attention in 2018. Similarly, targets for renewable energy continued to be more ambitious in the power sector than in the heating, cooling and transport sectors, with some countries – and many more sub-national governments – aiming for 100% renewable electricity.

Outside the power sector, policies for renewables have advanced at a slower pace, and targets for renewable heating, cooling and transport are not only far less numerous, but also often far less ambitious. This trend has continued despite the much greater contribution of the heating, cooling and transport sectors to total final energy consumption (TFEC). (→ See *Global Overview chapter*.)

Renewable energy policies and targets remain far from the ambition level required to reach international climate goals.

Overall, renewable energy policy frameworks continue to vary greatly in scope and comprehensiveness, and most remain far from the ambition level required to reach international climate goals.² (→ See *Figure 12* and **Reference Tables R3-R13**.)

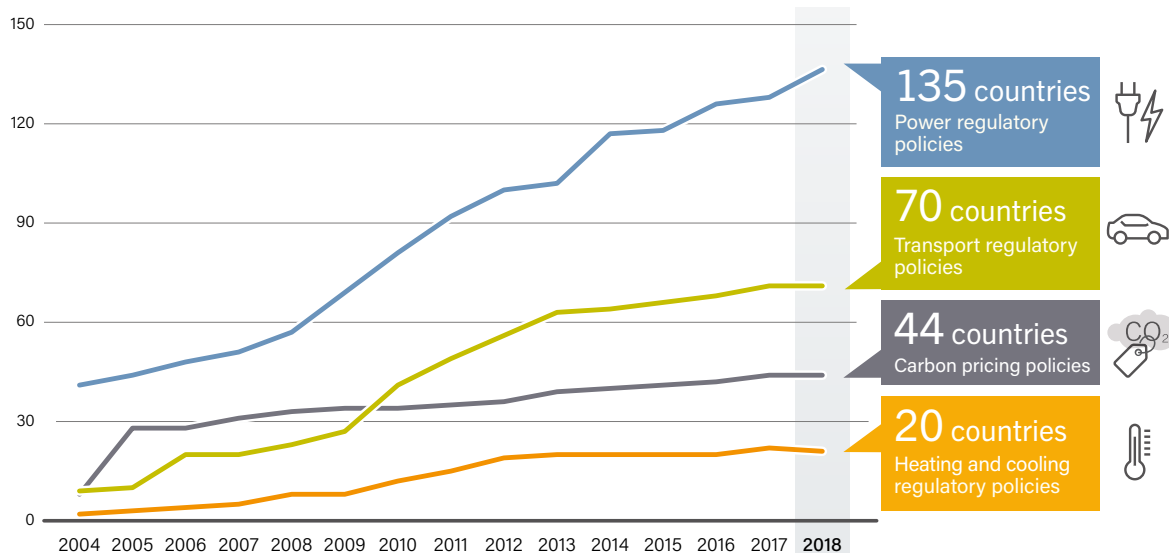
Still, the diverse benefits of renewable energy are driving policy action in countries around the world³. Policies have played a significant role in the growth of renewable energy and have helped advance technologies and reduce costs. Well-designed support mechanisms can spur deployment in nascent renewable energy markets; promote renewable energy in sectors with limited deployment, such as heating, cooling and transport; and guide the integration of technologies across different sectors of the economy. Policies also play an important role in supporting technology development that can lead to new advances, thereby



i Defined more broadly, VRE also can include some forms of ocean power and hydropower. This chapter focuses primarily on solar PV and wind power, as these represent the fastest-growing VRE markets that are having the greatest impacts on energy systems. See Glossary for an extended definition of VRE.

ii Multiple benefits of renewables include improved public health through reduced pollution, increased reliability and resilience, and job creation and other economic benefits.

FIGURE 12. Number of Countries with Renewable Energy Regulatory Policies and Carbon Pricing Policies, 2004-2018



Note: Figure does not show all policy types in use. In many cases countries have enacted additional fiscal incentives or public finance mechanisms to support renewable energy. A country is considered to have a policy (and is counted a single time) when it has at least one national or state/provincial-level policy in place. Power policies include feed-in tariffs (FITs) / feed-in premiums, tendering, net metering and renewable portfolio standards. Heating and cooling policies include solar heat obligations, technology-neutral renewable heat obligations and renewable heat FITs. Transport policies include biodiesel obligations/mandates, ethanol obligations/mandates and non-blend mandates. Carbon pricing policies include carbon taxes and emissions trading systems (ETS) and are not renewable energy policies per se. The EU ETS covers EU countries and Iceland, Liechtenstein and Norway, so the total number of EU countries covered are counted from 2005, when it was implemented. For more information, see Table 2 in this chapter and Reference Tables R9-R12.

Source: See endnote 2 for this chapter.

increasing efficiency, driving down system costs and transitioning new technologies or applications to market.

Targets, regulations, public financing and fiscal incentives supporting renewable energy development and deployment are found at the international, regional, national and sub-national levels. At each level, policy makers have the opportunity to design an effective mix of support policies tailored to their respective jurisdictions.

Although regional or national policies regularly receive the most widespread attention, provinces, states and cities are often the first movers in establishing innovative and ambitious mechanisms for renewable energy deployment. Many cities have direct control of public transport networks, building codes and, in some cases, electric utilities, allowing them to use their regulatory and purchasing authority – as well as their position as large energy users – to procure and deploy renewable technologies.⁴ (→ See *Feature chapter*.) In many developing countries, the renewable energy push comes from international agreements, which can have an impact on policy implementation at all levels of government.

Evolving energy markets and geopolitical uncertainty have moved energy security and energy infrastructure resilience to the forefront of many national energy strategies. Security of supply is a significant concern in energy markets worldwide, from the European Union (EU) and the United States to Egypt and India.⁵ Debates in this realm are often complex and can be contentious, as they may involve the introduction of new energy production sources, the emergence of decentralised renewable technologies and a departure from traditional producer-consumer dynamics.

As countries develop national energy strategies to transform their energy sectors, they continue to focus on renewable power technologies. System integration is important to ensure the long-term viability of power systems that comprise a growing range of technologies and higher shares of VRE. Policy makers increasingly are exploring opportunities to ensure that power systems have the flexibility to manage disruptions as well as fluctuations in supply. Promoting integration has included dynamic policy and market measures that provide varying levels of support based on factors such as the time or place of generation.⁶ (→ See *Integration section in this chapter, and Systems Integration chapter*.)

The following sections provide an overview of trends in renewable energy policy development worldwide in 2018ⁱ.

ⁱ The chapter highlights key trends and developments in 2018 and is not intended to be a comprehensive list of all policies enacted to date. In addition, the chapter does not assess or analyse the effectiveness of specific policy mechanisms. Further details on newly adopted policies and policy revisions are included in the Reference Tables and endnotes associated with this chapter. Policies for energy access are covered in the Distributed Renewables chapter.

TARGETS

Policy makers at all levels of governance continued to revise or adopt renewable energy targets in 2018. The spectrum of ambition ranges from vision statements to legally binding requirements.⁷ For the purposes of this chapter, only official targets are discussed.

By 2018, nearly all countries and many sub-national jurisdictions had adopted some form of renewable energy target. New and revised targets have become increasingly ambitious in scope; however, targets for economy-wide energy transformation remain rare: by year's end, fewer than 10 countries, states and provinces had economy-wide targets for at least 50% renewable energy.⁸ In contrast, at least 92 countries, states and provinces had targets specifically for the use of renewables in the power sector, a slight increase from 2017.⁹ (→ See *Figure 13* and **Reference Tables R3-R8**.) Although few countries had renewable energy targets specifically for the heating, cooling and transport sectors, Estonia, Finland, Latvia and Sweden all achieved shares of renewable heating and cooling greater than 50%.¹⁰

Several new or revised renewable energy targets were established in 2018, including the EU's goal of meeting at least 32% (revised upwards from 27%) of its final energy consumption from renewable sources by 2030.¹¹ The EU agreement also establishes a 14% minimum share of renewable fuels for transport energy, a 1.3% annual increase in renewable heating and cooling installations, and a process for individual EU member countries to develop National Energy and Climate Plans by the end of 2019 that would outline their individual commitments towards the collective goals between 2021 and 2030.¹²

The 100% renewable energy movement continued to gain traction worldwide in 2018. However, the majority of commitments apply only to the power sector.¹³ While the 100% renewables movement has taken place largely at the local and sub-national levels, a handful of countries have adopted national targets as well. (→ See **Reference Table R6**.) For example, in 2018 Lithuania approved a revised national energy strategy that commits the country to meet 80% of total energy demand with renewables by 2050.¹⁴ Denmark remains the only country globally with a target for 100% renewables in total final energy.¹⁵

At the sub-national level, US cities were particularly active in setting new 100% renewable electricity goals in 2018. By year's end, at least 100 US cities and towns had made the commitment to 100% renewables, with new goals set in Cincinnati and Cleveland (Ohio), Denver (Colorado), Minneapolis (Minnesota) and Washington, D.C.¹⁶ Targets for 100% renewable power typically are set for years ranging from 2020 to 2050, although some cities already had achieved 100% renewables by the end of 2018.¹⁷ (→ See **Reference Table R13** and *Feature chapter*.)

Many other targets focus on scaling up renewable energy in the power sector to shares below 100% – including China's new goal of achieving 35% renewable electricity consumption by 2030.¹⁸ Bahrain and France set capacity-specific targets for solar photovoltaics (PV), while several countries established targets for offshore wind power capacity.¹⁹ (→ See **Reference Table R7** and *Market and Industry chapter*.)

Denmark remains the only country with a target for 100% renewables in total final energy.



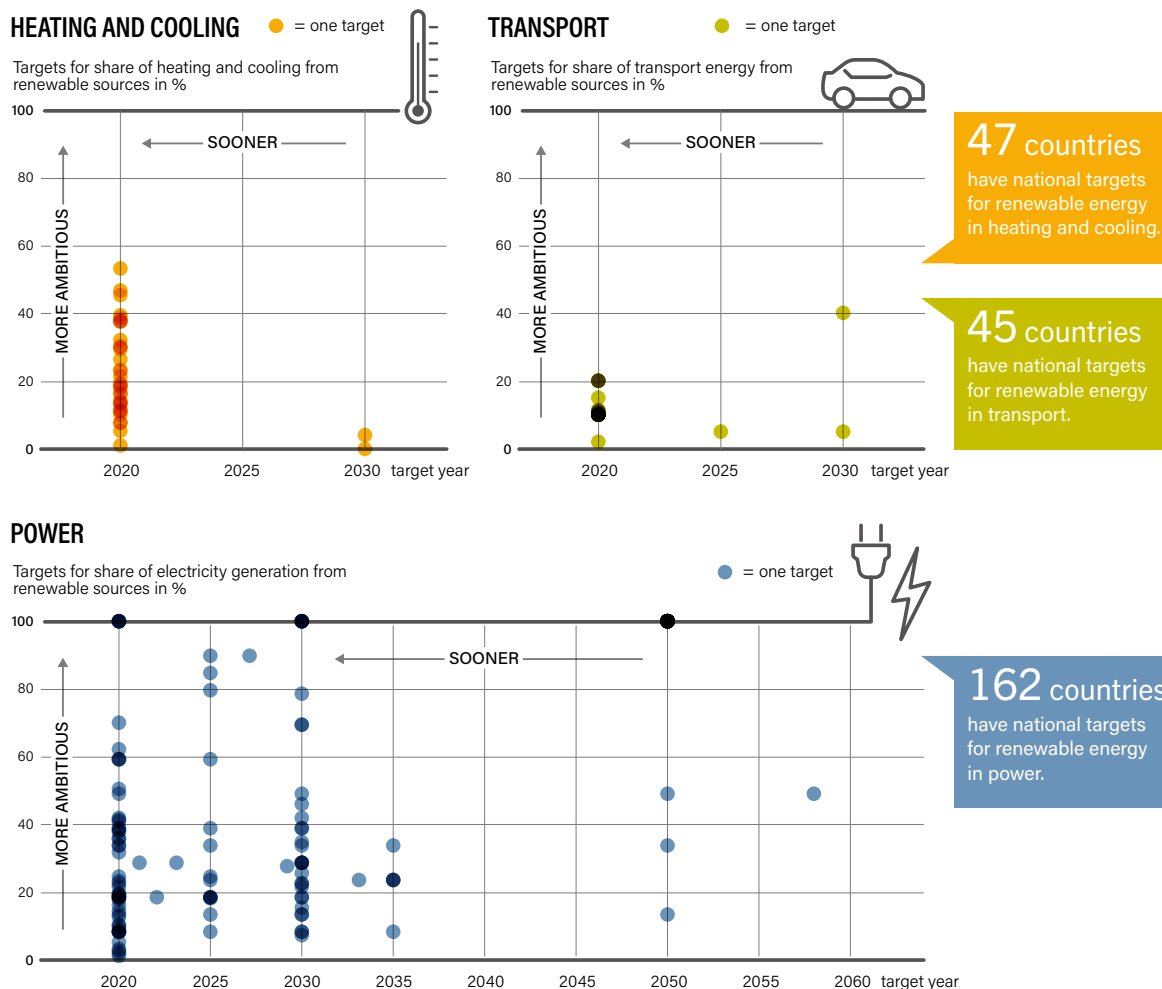
HEATING AND COOLING

Policy support for renewable energy uptake for heating and cooling in the buildings and industry sectors has been relatively flat in recent years. No new countries added regulatory incentives or mandates for renewable heating and cooling in 2018, and Kenya suspended its solar water heating regulation in August 2018.²⁰ (→ See **Reference Table R9**.)

Where they exist, policies to increase the use of renewables in buildings and industry often are implemented alongside energy efficiency policies. They include policies to promote the use of renewable heat technologies, to reduce energy consumption, to mandate the use of efficient lighting or appliances, and to require the integration of renewable energy technologies (primarily solar PV and solar thermal) in buildings. Renewable heat sources – geothermal, biomass and solar thermal energy – can help to decarbonise both the buildings and industrial sectors.

Expanding renewable energy in heating and cooling – an important energy end-use within buildings and industry – presents an opportunity for policy makers seeking to decarbonise or transform their energy sectors. In 2016, the heating and cooling sector accounted for about half of TFECE, underscoring the importance of decarbonisation of this sector.²¹ (→ See *Global Overview chapter*.)

FIGURE 13. National Sector-Specific Targets for Share of Renewable Energy by a Specific Year, by Sector, 2018



Note: Each dot can represent more than one country and is based on the highest target that a country has set at the national level. Darker shades indicate multiple countries having the same share and target year. Figure includes only countries with targets in these sectors that are for a specific share from renewable sources by a specific year, and does not include countries with other types of targets in these sectors. The total number of countries with any type of target for renewable energy (not specific to shares by a certain year) is 47 in heating and cooling, 45 in transport and 162 in power.

Source: REN21 Policy Database.

RENEWABLE ENERGY AND ENERGY EFFICIENCY IN BUILDINGS

As of the end of 2018, 135 countries had mentioned buildings in their Nationally Determined Contributions (NDCs) submitted to the United Nations under the Paris Agreement; however, only 51 countries specifically cited the use of renewable energy in buildings as a means to reduce emissions.²² Overall, as much as 60% of the total energy use in buildings that occurred in 2018 was in jurisdictions that lacked energy efficiency policies.²³

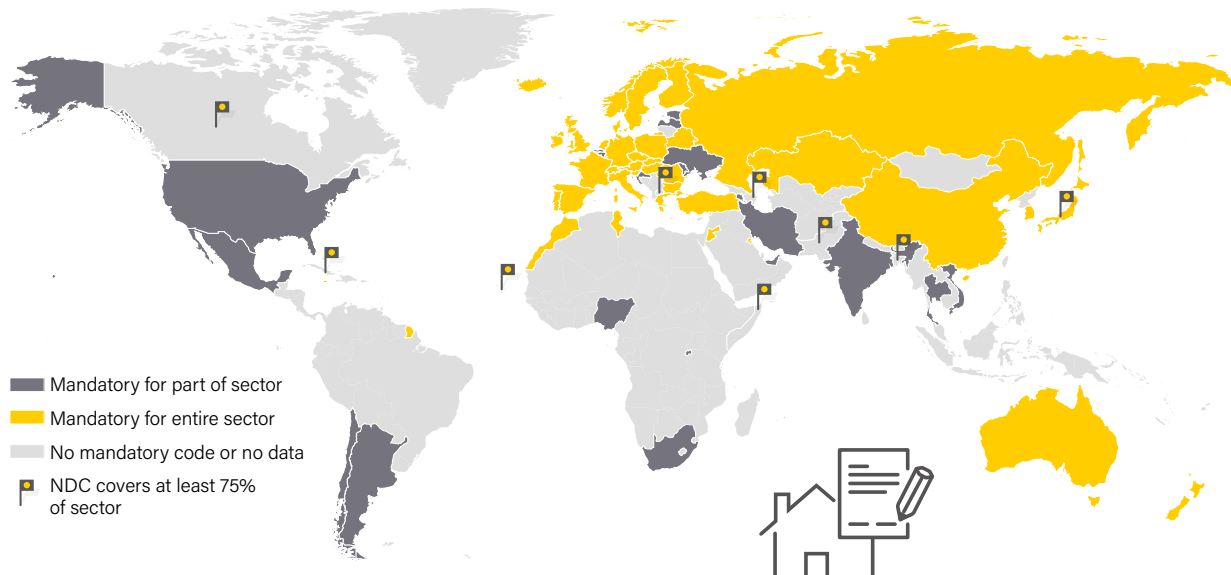
Voluntary or mandatory building energy codes are one of the primary mechanisms used to promote the deployment of both renewables and energy efficiency technologies. Building energy codes were in place in at least 69 countries as of the end of 2018, up from some 60 countries in 2017; however, only around 29% of all countries worldwide had mandatory

building energy codes in place for all or part of the sector.²⁴ (→ See Figure 14.) Building energy codes have been used to mandate the deployment of renewable generation sources and to promote standards for the efficiency of energy use. These codes usually target new construction or retrofits, although some jurisdictions also target existing buildings for renewable energy adoption.²⁵

The EU's revised Energy Performance of Buildings

60%
of the total energy used in buildings in 2018 occurred in jurisdictions that **lacked** energy efficiency policies.

FIGURE 14. Countries with Mandatory Building Energy Codes, 2018



Note: Energy codes or standards for buildings focus on decreasing energy use for specific end-uses or building components and can apply to new and/or existing buildings. Nationally Determined Contributions for the sector have focused on strengthening energy codes and standards, energy conservation and phasing out inefficient products and equipment. Coverage in Belgium, India and the United States varies by sub-national region or state. All Belgian regions have mandatory energy codes for buildings addressing part of the sector. More than half of India's states have mandatory building energy codes for part of the sector. At least 82% of US states and territories have mandatory building energy codes for the entire sector.

Source: Based on OECD/IEA. See endnote 24 for this chapter.

Directive came into force in 2018, establishing a framework for working towards the goal of decarbonising the region's buildings sector by 2050.²⁶ The strategy also establishes standards for integrating new technologies, such as electric vehicles (EVs), into building infrastructure.²⁷ At the country level in Europe, Denmark adopted new energy regulations for buildings, enacting efficiency standards as well as requirements for solar heating systems.²⁸ Malta issued its own Energy Performance of Buildings Regulations to put the EU standards into practice nationally.²⁹

In the United States, California released revised energy standards for residential and non-residential buildings in 2018, introducing requirements for both energy efficiency and renewable energy use. The measures include the first state-wide mandate for solar PV in new homes and the promotion of enabling technologies such as battery storage and heat pumps.³⁰ The state of New York also set a target of 185 trillion British thermal units (Btu) of energy reduction in residential and commercial buildings and industrial facilities by 2025.³¹

Cities and local governments are at the forefront of policy trends for energy use in buildings. (→ See *Feature chapter*.) In 2018, many of the world's largest municipalities, including London, New York and Tokyo, joined the Net Zero Carbon Buildings Commitment, pledging to reach net-zero carbonⁱ operating emissions in their buildings sector by 2050.³² By the end of 2018, 22 cities and 5 states and regions had joined the commitment.³³ In a separate

initiative, 19 city mayors from around the world, representing 130 million people, committed to ensuring that all new buildings will meet net-zero carbon standards by 2030 and that both new and old buildings will operate as zero-carbon by 2050.³⁴ In Bogotá (Colombia), a new energy-efficient construction policy aims to reduce energy use in the buildings sector by 20%.³⁵

Incentives also have been developed to simultaneously promote both renewable electricity generation and energy efficiency improvements in the residential sector, although this remains less common than promoting each individually. For example, in 2018 Canada began implementing a support scheme designed to help residents retrofit their homes in order to improve efficiency and ultimately produce as much energy (using on-site renewables) as they consume.³⁶

Although the use of renewable heat in the buildings sector has grown in recent years, the adoption of new direct policy support mechanisms for these technologies slowed in 2018.³⁷ Renewable heat technologies often benefit from indirect support, however, through policies aimed at addressing climate change or promoting energy efficiency.³⁸ (→ See *Climate Policy* section in this chapter.)

In Europe, Ireland announced a long-awaited support scheme to help commercial heat users replace fossil fuel heating systems with renewable energy systems.³⁹ The United Kingdom launched a scheme providing grants and loans for renewable

i A net-zero carbon building is a building that is highly energy efficient and fully powered from on-site and/or off-site renewable energy sources, from World Green Building Council, "What is Net Zero?", <https://www.worldgbc.org/advancing-netzero/what-net-zero>, viewed 10 May 2019.

heat networks that serve two or more buildings in the public or private sectors, including residences, hospitals, schools and council buildings.⁴⁰ In addition, changes to the UK Renewable Heat Incentive included higher tariffs for biogas and biomethane to benefit those industries, as well as proposed restrictions on new biomass heating installations in urban areas to reduce air quality impacts.⁴¹ In France, the budget for the Fonds Chaleur renewable heat incentive programme was increased 14% to EUR 245 million (USD 273 million), and in Germany biomass and deep geothermal installations became eligible for funding under the country's Market Incentive Programme for renewable heat.⁴²

RENEWABLE ENERGY AND ENERGY EFFICIENCY IN INDUSTRY

Renewable energy can be used to meet thermal energy (heat) demands of industrial processes, which are supplied by direct renewables (bioenergy, solar thermal and geothermal heat) and electricity.⁴³ (→ See Box 1 in *Global Overview chapter*.) However, renewable energy support policies focusing on the industrial sector are limited, and new or revised policies in the sector were scarce in 2018.⁴⁴ Meanwhile, as of 2016, standards and targets for energy efficiency for industrial processes covered only around 25% of total industrial energy use worldwide.⁴⁵ Monitoring and enforcement of such standards is far less common than their overall adoption.⁴⁶

Existing policy mechanisms in the industry sector include Vietnam's feed-in tariff for co-generation projects, and targets in Lao People's Democratic Republic for biomass, biogas and solar energy (although not exclusively for industry).⁴⁷ In 2018, Germany continued to offer low-interest loans for solar thermal, heat pump and biomass systems, with the stipulation that applicants use at least half of the generated heat for industrial processes such as production, processing or refining.⁴⁸

Standards and targets for energy efficiency of industrial processes covered only

25%

of total industrial energy use in 2016.



TRANSPORT

The transport sector accounts for about one-third of TFEC, and reducing fossil fuel use in the sector is critical for improving fuel security, reducing air pollution and reaching international emissions reduction goals.⁴⁹ However, policy support for increasing the share of renewables in transport remains relatively static. Policy makers in some countries have enacted measures to increase the use of renewable energy sources and to improve fuel efficiency in specific sectors, including road, rail, aviation and maritime transport. Existing policies support technologies ranging from first-generation biofuels to EVs and more advanced fuels, as well as strategies to reduce transport demand or encourage a shift to less energy-intensive transport modes.⁵⁰

Policy developments in the transport sector are focused largely on road transport. However, the growing use of electricity and advanced biofuels in road transport has, to a limited degree, encouraged policy makers to support renewable energy use in rail, aviation and shipping as well. Although some policies are aimed at fuel use across the transport sector, most focus on specific modes of transport.⁵¹ (→ See Reference Table R10.)

ROAD TRANSPORT

In the road transport sector, the use of fuel-efficient vehicles as well as vehicles powered by alternative fuelsⁱ or electricity continues to grow. Policies supporting these technologies and fuels include consumer-focused grants and rebates; tax incentives, deployment quotas and mandates; and research and development (R&D) support. Policy makers also have used their purchasing and regulatory oversight to ensure that public transport networks and public fleets use alternative or fuel-efficient vehicles.

Only
36%
of countries have
biofuel blend mandates
globally.



i Alternative fuels refer to alternative propulsion systems to the traditional diesel (or petrol) internal combustion engine, including biofuels, synfuels or low-carbon liquid fuels produced from agriculture crops or waste, liquified natural gas (LNG) or compressed natural gas (CNG), and biomethane. Other propulsion systems that are reaching commercial viability include hydrogen fuel cells, electric and hybrid vehicles, and electric roads (electric-powered vehicles where the energy source is external, for example through overhead wires).

Some regions, such as Scandinavia, have been particularly active in adopting measures to spur transformation of their road transport sectors.⁵² (→ See Box 1.) Globally, however, fuel economy policies for light-duty vehicles existed in only 40 countries as of the end of 2018 and have been largely offset by trends towards larger vehicles.⁵³ Meanwhile, only five countries – Canada, China, India, Japan and the United States – had fuel economy standards for trucks.⁵⁴

Biofuels remain a central component of national renewable transport policy frameworks. By the end of 2018, biofuel blend mandates existed at the national and/or sub-national level in at least 70 countries, or 36% of countries globally.⁵⁵ (→ See Figure 15.) No additional countries adopted biofuel mandates in 2018, but some countries that had mandates in place added new ones, and several existing mandates were strengthened.

BOX 1. Policy Spotlight: Transformation of Road Transport in Scandinavia

Scandinavia has taken a central role in the burgeoning transition to renewable or alternative fuel vehicles. Both Sweden (in 2011) and Finland (in 2013) have already met the EU-wide target for a 10% renewable energy share in transport final energy by 2020, well ahead of schedule, and as of 2016 Norway was slightly below the 10% benchmark.

Scandinavia has a long history of promoting the deployment of alternative transport fuels (including advanced biofuels) – and the vehicles that use them – through policy mandates and incentives at both the national and sub-national levels. Denmark is still the only country in the world with a target for 100% renewables in total final energy, with a strategy to dramatically increase electricity and biomass use in the transport sector.

Sweden's capital, Stockholm, has set a goal to phase out fossil fuel use by 2040. Mechanisms to reduce emissions in the city's transport sector include the promotion of renewable fuels, the use of digital monitoring to increase the efficiency of bus lanes, and reserved parking for "green" vehicles. The city has taken a novel approach to public procurement of transport services, progressively strengthening environmental standards – first set in the 1990s – to help achieve its goals. The requirements vary by contract area and are flexible in design: companies may

adopt the technologies they prefer, stimulating competition while meeting environmental goals in multiple ways. This has resulted in a diverse mix of vehicles in the city's fleet, with about 96% qualifying as "clean" under the city's definition. Following Stockholm's success, many other Scandinavian cities have adopted similar policies.

At the national level, both Norway and Sweden have demonstrated strong growth both in the overall share of EVs in their vehicle fleets (39%) and in the share of new cars that are EVs (6%), ranking first and third in the world, respectively, in 2017. Both countries have ambitious renewable energy targets and support policies, meaning that the EVs effectively are being powered by growing shares of renewable power, although not linked directly.

Financial incentives for EV purchases have been a central component of national efforts to increase adoption of the vehicles, along with the development of public charging infrastructure and deterrents for purchasing higher-carbon emitting cars. EV adopters receive additional benefits including the ability to use high-occupancy vehicle or bus lanes, toll-free roads and ferries, free charging or free parking in some public spaces.

Source: see endnote 52 for this chapter.



Ethanol received expanded support in at least three countries: Colombia increased its blend mandate from E8 to E10, Zimbabwe increased its mandate from E15 to E20, and China expanded its ethanol promotion from 11 regions to 15 regions.⁵⁶ For biodiesel, new policy support included Ireland's announcement of a 10% biodiesel blending mandate to take effect in 2019, and Brazil's increase in the voluntary mixture of biodiesel allowed in fuel blending.⁵⁷ At the sub-national level, the US state of Minnesota implemented a B20 mandate originally passed in 2008, and Vancouver (Canada) announced plans to transition its city-owned diesel vehicle fleet to 100% renewable dieselⁱ by the end of 2019.⁵⁸

Few new measures promoting advanced biofuels or other fuel sources were adopted in 2018. However, the EU provisionally agreed on an advanced biofuels and biogas mandate of 1% by 2025 and 3.5% by 2030, as part of its goal to have at least 14% of transport fuels come from renewable sources by 2030.⁵⁹ The EU also placed a 7% cap on the share of first-generation biofuels in final transport energy consumption.⁶⁰ At the national level, Croatia enacted a 0.1% second-generation biofuel mandate, Denmark adopted a 0.9% advanced biofuel blend mandate effective by 2020, and Italy introduced a support scheme for the production and distribution of advanced biofuels and biomethane for use in the transport sector.⁶¹ The United States announced an increase in its advanced biofuels mandate starting in 2019.⁶²

Electric vehicles can play an important role in increasing the use of renewables in the transport sector and in reducing global carbon emissions, particularly when powered with rising shares of renewable electricity. Although numerous measures have been adopted in recent

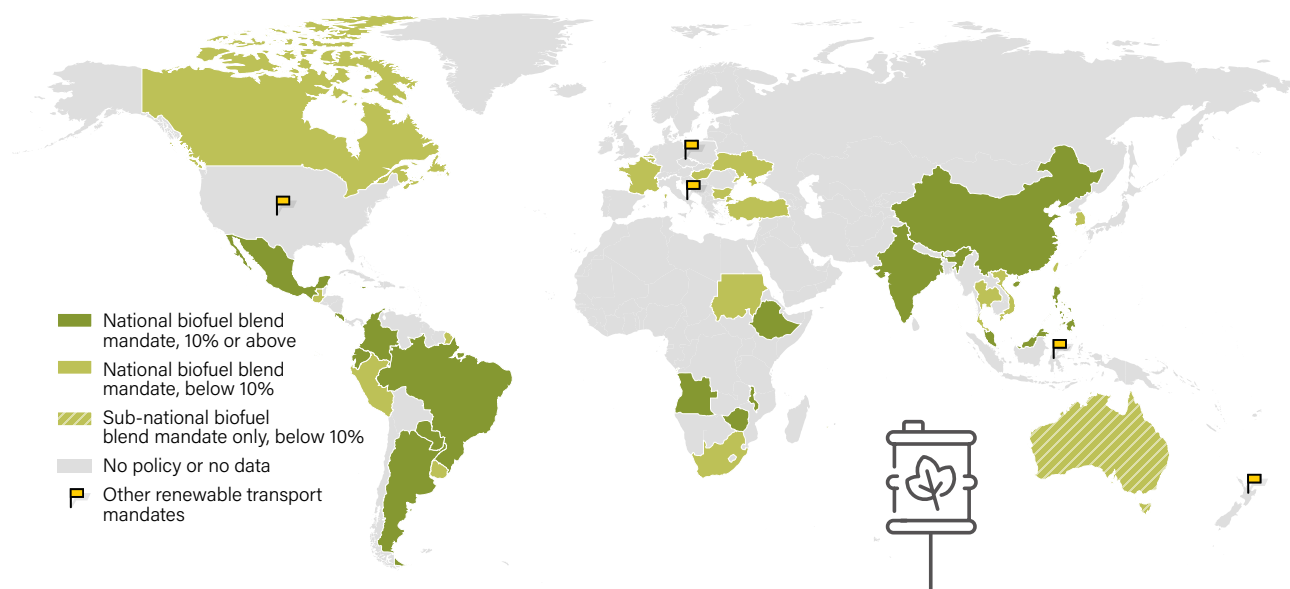
years to scale up EV use, few efforts have been made to link renewable electricity production directly with this use, or to ensure that EVs support the integration of renewable energy into energy supplies.⁶³ At the national level, only Austria had a policy directly linking renewables with EVs as of the end of 2018.⁶⁴

Nevertheless, EVs are becoming an important component of national energy development strategies in the transport sector.⁶⁵ (→ See Figure 16 and Sidebar 2 in this chapter.) Similarly, some initiatives are emerging for hydrogen fuel cell vehicles, but the vast majority of hydrogen continues to be produced using non-renewable sources. (→ See Systems Integration chapter.)

Only Austria
has a national policy
directly linking renewable
electricity with EVs.

i Both renewable diesel and biodiesel are made from organic biomass, but differences can be seen, for example, in their production process, cleanliness and quality. (→ See Bioenergy section in Market and Industry chapter.)

FIGURE 15. National and Sub-National Renewable Transport Mandates, 2018

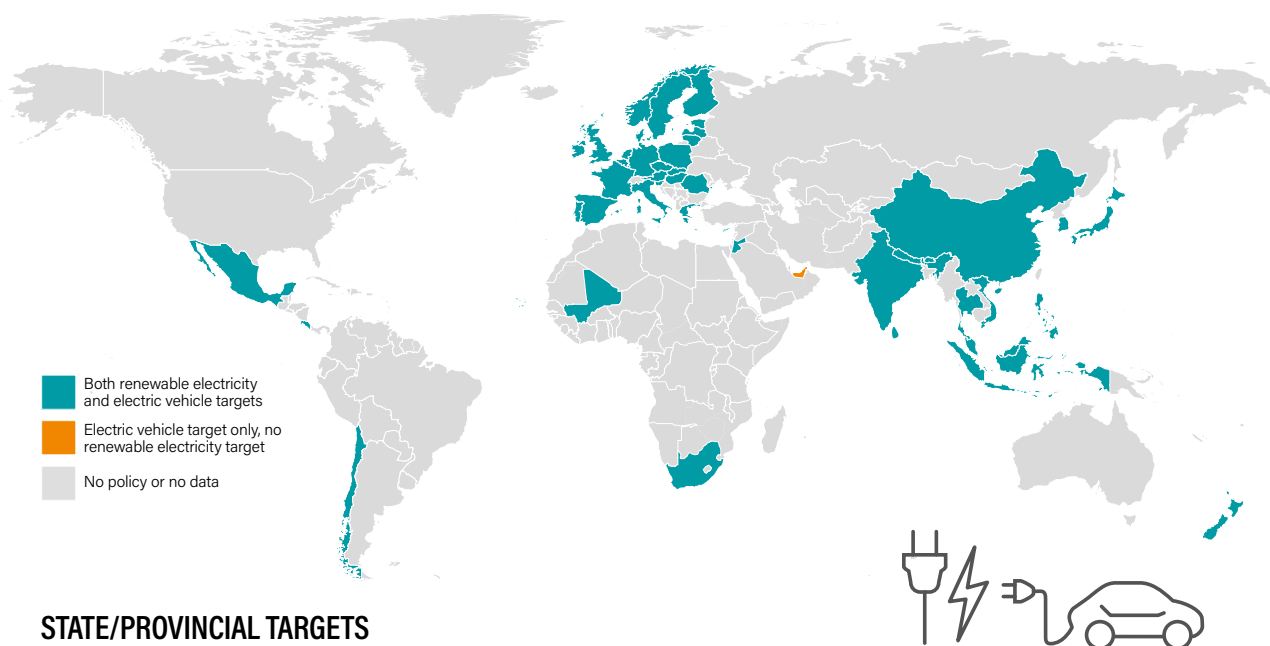


Note: Shading shows countries and states/provinces with mandates for either biodiesel, ethanol or both. Other renewable transport mandates include mandates for advanced biofuels and for sectors other than road transport, among others. See Reference Table R10.

Source: REN21 Policy Database.

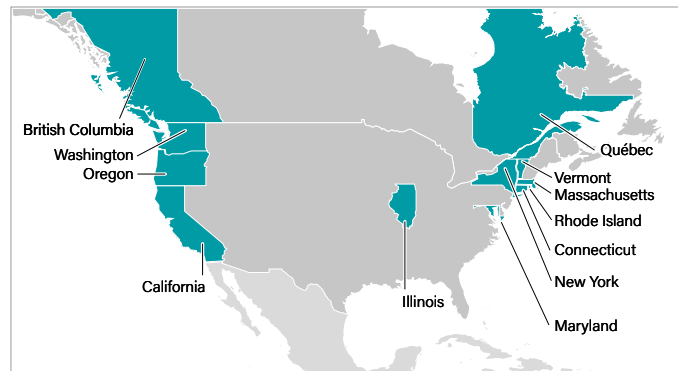
FIGURE 16. Targets for Renewable Power and/or Electric Vehicles, 2018

NATIONAL TARGETS



STATE/PROVINCIAL TARGETS

United States and Canada



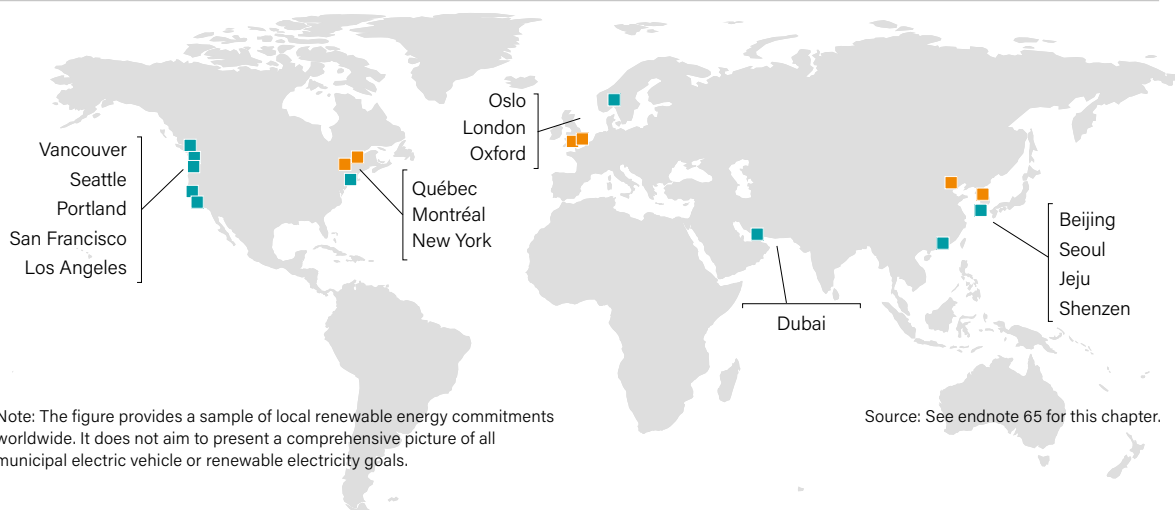
United Kingdom



India



SELECTED CITY TARGETS



Note: The figure provides a sample of local renewable energy commitments worldwide. It does not aim to present a comprehensive picture of all municipal electric vehicle or renewable electricity goals.

Source: See endnote 65 for this chapter.

SIDEBAR 2. Policies Potentially Enabling Renewable Energy Penetration in Transport

Policies and targets for electric and hydrogen fuel cell vehicles are not renewable energy policies and targets by themselves. Similarly, “zero-emission vehicles” typically refer to vehicles that produce no atmospheric pollutants during operation but are not necessarily fuelled by renewable sources. In most cases, the term refers to EVs, albeit without reference to the source of the electricity. However, while EVs and hydrogen fuel cell vehicles do not necessarily increase the renewable energy share in transport, they do offer the potential for greater penetration of renewables and lower emissions.

Many governments are providing financial incentives for EVs. In 2018, Costa Rica, Germany, the Kyrgyz Republic and Ukraine all reduced various taxes for EVs. India allocated INR 87.3 billion (USD 1.3 billion) to incentives for EVs, electric buses and other electrified vehicles such as scooters, and Scotland instituted GBP 1.3 million (USD 1.7 million) in grants and loans to encourage electric bike purchases. In Sweden, the government introduced a new tax system, increasing taxes on light-duty petrol and diesel vehicles and providing a tax incentive for EVs. Beyond EVs, the Republic of Korea eased regulations on the production and transport of hydrogen fuel cell buses as part of an effort to reach 1,000 such buses on the road by 2022.

At least 19 countries aim to replace or phase out internal combustion engine (ICE) vehicles and “non zero-emission vehicles” to stimulate EV uptake. In 2018, Cabo Verde announced a plan to gradually replace ICE vehicles with EVs by 2050. Nepal announced plans to replace all ICE vehicles with EVs by 2030, while Israel pledged to sell only electric passenger cars by the same year. Also in 2018, China set a target of 2 million EV sales annually by 2020, and India launched a national E-Mobility Programme with a goal of having more than 30% of new car sales come from EVs by 2030. By the end of 2018, China was considering a

ban on inefficient ICE vehicles and, in the meantime, was implementing production quotas for “new energy vehicles”ⁱ.

In Europe, Denmark pledged to sell only electric passenger cars by 2030. Ireland and Portugal pledged that by 2030 and 2040, respectively, no new “non zero-emission vehicles” will be sold within their jurisdictions. Ireland’s National Development Plan for 2018-2027 also targets the sale of 500,000 EVs. The United Kingdom released its Road to Zero strategy in 2018, which sets targets for 50% to 70% of new car sales and 40% of van sales to be ultra-low emission by 2030, 100% of cars to be zero-emission by 2040 and 25% of the government fleet to be ultra-low emission by 2022.

At the sub-national level, Brussels (Belgium) agreed to ban diesel cars from the city starting in 2030, and British Columbia (Canada) and California (United States) adopted 2040 phase-out targets for ICE vehicles. California also called for 5 million zero-emission vehicles on the road by 2030. Madrid (Spain) banned the majority of non-zero-emissions vehicles from its city centre, and Rome (Italy) announced its intention to ban all diesel cars from its roads by 2024.

Countries also are pledging to develop supporting infrastructure to encourage EV adoption. For example, in 2018 Germany established a target of 100,000 public EV charging stations installed by 2020, which it supported with a EUR 70 million (USD 78 million) scheme for charging stations and electric buses. California set a target to commission 250,000 vehicle charging stations by 2025 and a goal to have 200 hydrogen refuelling stations in place state-wide by 2025.

ⁱ In China, “new energy vehicles” include plug-in hybrid electric vehicles, battery electric vehicles and hydrogen fuel cell vehicles. Source: see endnote 65 for this chapter.



RAIL, AVIATION AND MARITIME TRANSPORT

The use of renewable fuels and electricity to power rail, aviation and maritime transport has developed more slowly than it has for road transport. Several barriers to commercialisation and deployment – such as the cost of advanced biofuels as well as challenges related to battery weight and range – have limited the applicability of many of the technologies used in road transport to other transport sectors.⁶⁶ Aviation and maritime transport also face jurisdictional challenges associated with regulating cross-border industries. Policy support has been limited in these sectors, despite their large overall contribution to global fuel use. (→ See *Transport section in Global Overview chapter*.)

In recent years, some jurisdictions and companies have attempted to link renewable power generation with rail transport.⁶⁷ In 2018, Toronto (Canada) began to develop a new light rail line using solar PV-plus-storage systems to reduce peak energy demand and to add backup capacity as part of a CAD 190 billion (USD 150 billion) public infrastructure plan.⁶⁸ Indonesia expanded the country's B20 biofuel blending mandate from the road transport sector to cover fuel used by railroads and power plants.⁶⁹

National governments, as well as the aviation industryⁱ, have taken initial steps towards increasing the use of alternative fuels in aviation – including issuing either mandates for use of these fuels or incentives for their development. In 2018, Norway established a quota for 0.5% advanced biofuel use in aviation starting in 2020, and the Indian Air Force announced plans to begin using ethanol-blended fuel in its aircraft.⁷⁰ Canada established the Sky's the Limit Challenge with the goal of supporting R&D in the renewable aviation fuel supply chain.⁷¹ The programme offers a prize of CAD 1 million (USD 740,000) for the first cross-Canada commercial flight fuelled by a minimum 10% blend of Canadian-made biojet fuel.⁷²

For the maritime shipping sector, few policies were directly promoting the use of renewable energy sources as of the end of 2018, although some indirect policy support existedⁱⁱ. The Port of Rotterdam Authority in the Netherlands announced an incentive to support vessel owners that use low-carbon or zero-carbon fuels, as well as a commitment to reduce emissions from the port (Europe's largest) starting in 2030.⁷³ Alternative measures – such as funding for shore-side renewable electricity for ports – also can help reduce fossil fuel use in the sector.

Renewables in aviation, rail and maritime transport continue to receive less policy attention than those in road transport.

POWER

Worldwide, governments have focused their renewable energy policy attention primarily on promoting the development and deployment of renewable power generation technologies. Countries at all levels of economic development have turned to renewable power sources to meet goals ranging from decarbonising electricity generation to expanding energy access. (→ See *Distributed Renewables chapter*.) These policies have evolved in response to technology advances and cost reductions, rapidly increasing shares of renewables in the power mix in some countries, and advances in the development and use of energy storage and other enabling technologies. (→ See *Systems Integration chapter*.)

The increasing electrification of end-use sectors – such as heating, cooling and transport – combined with decarbonisation of the electricity supply has begun to play an important role in the global energy transformation. When paired with renewable power development, the electrification of these sectors means that the impact of renewable power policies can be felt across a larger segment of the economy.⁷⁴

Regulatory policies – including feed-in policies and renewable portfolio standards – have been instrumental in guaranteeing market access for renewable power suppliers, in setting power prices for grid-connected renewable systems and in establishing mechanisms for achieving new lower prices for technology delivery. Although different policies have been adopted to support large- and small-scale, as well as centralised and distributed, projects, many of the same price-reduction or technology maturation trends are prevalent in each of these market segments.



i The International Air Transport Association (IATA), a trade association representing 290 airlines, set a goal of having 1 billion passengers fly on flights fuelled by sustainable aviation fuel by 2025. IATA, "Aim for 1 billion passengers to fly on sustainable fuel flights by 2025", 26 February 2018, <https://www.iata.org/press-room/pr/Pages/2018-02-26-01.aspx>.

ii In 2018, the International Maritime Organization adopted energy efficiency standards targeting a 40% reduction in total carbon intensity from shipping by 2030 and a 50% reduction in greenhouse gas emissions by 2050. Dale Hall, Nikita Pavlenko and Nic Lutsey, *Beyond Road Vehicles: Survey of Zero-emission Technology Options Across the Transport Sector* (International Council on Clean Transport, 18 July 2018), https://www.theicct.org/sites/default/files/publications/Beyond_Road_ZEV_Working_Paper_20180718.pdf.

Renewable power auctions
were held in at least

48 countries

worldwide in 2018, up
from 29 the year before.

Accurately accounting for system costs and benefits in renewable power support mechanisms remains an important challenge for policy makers looking to promote the deployment of renewable power projects. Adjustments – such as updating long-standing fixed-price policies by introducing pricing measures such as

automatic rate reductions tied to specific deployment levels – have been implemented to keep up with declining technology costs. To better match declining costs, manage capacity levels and steer deployment to specific areas or technologies, policy makers have continued to turn to competitive auctions in lieu of traditional fixed-price policies.⁷⁵ These objectives also can be achieved through feed-in tariffs and other policies, depending on policy design.

Renewable power auctions were held in at least 48 countries worldwideⁱ in 2018, up from 29 countries in 2017.⁷⁶ At least one of the auctions in 2018 was technology-neutral (in Brazil), while six were neutral for renewable technologies.⁷⁷ (→ **See Reference Table R12.**) Both Ireland and Kenya announced that they would employ auctions to support renewable energy project development in future years.⁷⁸ Auctions were delayed in several countries, and some contracts were annulled (especially in India), resulting in significant impacts on industry.⁷⁹

Policy makers have used the flexibility of auction mechanisms to design tenders to meet various national goals beyond awarding contracts at minimum prices.⁸⁰ This includes the use of domestic content requirements to promote domestic manufacturing – such as in India, which mandated that all future solar power bids include at least 50% locally manufactured components.⁸¹ Auctions also can be designed to overcome unintended consequences that have been overlooked previously in power sector development, such as the exclusion of local communities and small actors, or the concentration of projects in specific areas.⁸²

Likely the biggest auction-related policy development in 2018, and perhaps in all recent years, occurred in China. As part of broad changes to its national solar power policy, Chinese officials halted all financial support for utility-scale and distributed solar projects in favour of project support through auctions.⁸³ Wind energy projects in China also will be supported through auctions in the coming years.⁸⁴

Other notable developments worldwide included the first renewable energy auction ever held in Benin, for a 25 megawatt (MW) solar PV project; a contract awarded in the Netherlands for up

to 750 MW of grid-connected offshore capacity; and a series of power purchase agreements signed in South Africa for 2.3 gigawatts (GW) of long-delayed renewable power capacity, awarded under its national auction scheme.⁸⁵

Policy makers in some countries used auctions for more specialised renewable energy projects. Bahrain announced plans to develop 150 MW of solar PV through tenders on a landfill site, and Jordan auctioned 30 MW of solar PV capacity to support water pumping stations throughout the country.⁸⁶ At the sub-national level, the Indian states of Maharashtra and Uttar Pradesh auctioned projects for floating solar PV to generate electricity on dam reservoirs.⁸⁷ (→ *See Sidebar 3 in Market and Industry chapter.*)

Several offshore wind power auctions were held in Europe in 2018, and in the United States both Rhode Island and Massachusetts used competitive bidding through auctions to select offshore wind projects for development.⁸⁸ The US Bureau of Ocean Energy Management continued to hold auctions to allocate leases for offshore wind power projects, bringing the total number of active leases nationwide to 15 by the end of 2018.⁸⁹

Despite the shift to auctions in many countries, feed-in tariff (FIT) policies continue to play a role in national and sub-national policy schemes and were in place in 111 countries by year's end.⁹⁰ FIT support for utility-scale renewable projects is often now limited to countries with nascent renewable energy markets. FITs also are used to support less-established technologies, or technologies with relatively high project development costs that often are not included in auctions. (→ **See Reference Table R11.**)

In 2018, Zambia's FIT-based renewable energy support scheme – modelled on an existing programme in Uganda – entered its first round after officially launching in 2017.⁹¹ Japan postponed to September 2019 its deadline for planned cuts to FIT solar projects larger than 2 MW, and Serbia extended its existing FIT scheme – which was set to expire at the end of 2018 – for an additional year.⁹² Serbia ultimately plans to replace the scheme with new mechanisms including feed-in premiums and tenders.⁹³ Also in 2018, Switzerland increased its geothermal power FIT, and Vietnam raised its FIT for onshore and offshore wind power.⁹⁴

Some countries reduced their FIT rates in 2018. Although the roll-back of feed-in policies has tended to focus primarily on large-scale installations, even smaller-scale systems have seen reductions in rates. For example, in 2018 the United Kingdom

111 countries,
states or provinces
had feed-in tariff policies
in place by the end of 2018.

i African nations were particularly active in 2018, with auctions held in Algeria, Benin, Egypt, Eswatini, Ethiopia, Madagascar, Malawi, Niger, Senegal, Seychelles, South Africa, Tanzania, Tunisia and Zambia. Auctions were also held in Asia and Oceania (Australia, Bangladesh, China, India at both the national and sub-national level, Japan, Kazakhstan, Singapore, Sri Lanka and Tonga); in Europe (Albania, Armenia, Denmark, Finland, France, Germany, Greece, Malta, Montenegro, the Netherlands, Poland, the Russian Federation); in the Middle East (Afghanistan, Bahrain, Jordan, Kuwait, Lebanon, Oman, State of Palestine, Qatar, Saudi Arabia and Turkey); and in North America, Latin America and the Caribbean (Argentina, Brazil, Canada and the United States).

ii The specific design of individual auction mechanisms – including rules governing critical features such as permitting, grid connection or local content requirements – can impact the ability of auctions to attract developer interest or result in successful project development. Auction design varies widely: while some are technology-specific calls for individual projects, others are technology-neutral tenders where renewable, nuclear and fossil fuel generation options all compete to provide new power capacity, or are neutral for renewable technologies only.

confirmed its plans to eliminate the FIT for new household solar PV systems, starting in 2019.⁹⁵ In Japan, 2018 marked the final full year of the 10-year FIT contracts for household solar PV systems under the FIT implemented in 2009.⁹⁶ At the sub-national level, New South Wales (Australia) approved a 44% reduction in its FIT rate for solar PV.⁹⁷

Renewable obligations, often in the form of renewable portfolio standards (RPSs), remained in place in many jurisdictions, typically at the sub-national level. In the United States, five states and the District of Columbia increased RPS levels in 2018, and the District of Columbia also passed a new mandate for 100% renewable power by 2032.⁹⁸ California, the world's fifth largest economy, committed to 100% clean powerⁱ by 2045 as part of its RPS.⁹⁹ New Jersey established an RPS for 50% renewable electricity by 2030, and Connecticut set a new requirement of 40% by the same year.¹⁰⁰ Massachusetts increased its RPS, while voters in Nevada passed a ballot measure supporting a 50% RPS by 2030.¹⁰¹

In China, quotas were established for grid utilities and power purchasers, setting rules for the use of renewable power.¹⁰² The move was driven by growing curtailment rates for wind and solar power, which were in turn the result of China's rapid expansion of new variable renewable power generation capacity. Under the new regulations, curtailment of wind power is capped at 10% in 2019 and 5% by 2020, and solar power is capped at 5% from 2018 to 2020.¹⁰³

Smaller-scale renewable energy projects often find support through policies that provide access to grid networks as well as remuneration for surplus electricity that is fed into the grid. Net metering or net billingⁱⁱ is a primary mechanism used at the residential and commercial levels. These policies often are adopted to spur the development of small-scale rooftop solar PV systems or, less commonly, small-scale wind turbines. By the



end of 2018, net metering policies existed in at least 66 countries at the national or sub-national level; in the United States alone, they had been adopted in 45 states and territories.¹⁰⁴

In 2018, Indonesia adopted a new metering policy opening grid access for the first time to residential, commercial and industrial rooftop solar PV systems.¹⁰⁵ Romania approved new rules for net metering of renewable installations up to 100 kilowatts (kW) and will also support these installations via a new rebate scheme.¹⁰⁶ Malaysia revised its existing net metering policy to strengthen incentives for energy producers, increasing payments for surplus electricity fed into the grid.¹⁰⁷ Spain revised its net metering policy for solar PV to simplify registration procedures and to remove the charge on self-consumption adopted in 2015.¹⁰⁸

The increased deployment of grid-connected systems under net metering policies has led to political and legal challenges, and policy makers often have had to revise policies in response. In some cases, rate adjustments have been enacted to keep pace with falling technology costs, and revisions have resulted in the adoption or elimination of fees that utilities charge to connect to the grid. The EU reached an agreement in 2018 to ensure that all prosumersⁱⁱⁱ with systems of 25 kW or smaller be allowed to connect to grid networks without being subject to connection fees.¹⁰⁹ Meanwhile, the US state of Michigan rolled back net metering incentives, reducing payments for surplus generation fed to the grid.¹¹⁰

Community power projects also increase local renewable energy generation. In 2018, the European Commission guaranteed energy communities the right to operate within the EU by ensuring that they can own, rent or purchase their own electricity distribution networks.¹¹¹ In the United States, the newly approved Massachusetts SMART programme promotes solar development (including community solar) across the state.¹¹²

Fiscal incentives – grants, rebates, tax credits, etc. – also play an important role in overcoming fiscal and financial barriers to renewable energy development and deployment.¹¹³ Non-regulatory policies can be used to promote technologies ranging from large-scale commercial installations to small-scale residential renewable energy systems. For example, in 2018 the United States reinstated the Residential Renewable Energy Tax Credit, which provides homeowners with a 30% credit for the cost of installing a small-scale wind turbine at their residence; the federal government also launched a USD 133.5 million initiative for energy-resilient infrastructure upgrades at military bases, including solar PV and energy storage (as well as natural gas).¹¹⁴

i California's policy calls for all retail electricity sales by 2045 to come from renewable energy resources and zero-carbon resources.

ii See Glossary for definition.

iii See Glossary for definition.

POLICIES TO INTEGRATE VARIABLE RENEWABLE ENERGY

As the transformation of energy systems continues in many countries, policy makers have focused on the development and deployment of enabling technologies to facilitate the integration of renewable energy technologies. (→ See *Systems Integration chapter*.) Policies to integrate VRE can address both supply and demand to increase the flexibility of the overall energy system. Traditional fiscal and regulatory mechanisms have been used to advance the deployment of enabling technologies, and new mechanisms also have emerged.

Sector integrationⁱ offers the potential to overcome challenges associated with higher shares of VRE or to maximise the value of renewable energy investments. Policy makers can directly link sectors, as in the case where renewable electricity is used for charging EVs. This leads to numerous benefits: for example, renewable electricity can help to decarbonise transport or other sectors, while the batteries found in EVs offer electricity storage capacity, which can help integrate VRE into the wider energy system. To date, however, few countries have implemented policies to advance sector integration specifically with renewables.

Increasingly, policy makers are promoting the ancillary grid servicesⁱⁱ offered by enabling technologies and, to a lesser extent, by renewable energy. The design of appropriate power market rules is an important lever for increased participation of VRE and other enabling technologies in electricity markets and trade. In China, the 13th Five-Year Plan (2016–2020) and related initiatives aim in part to create new wholesale electricity markets that work for renewables.¹¹⁵ In the EU, the Clean Energy for Europeans Package, finalised in late 2018, further opens markets to renewable electricity, energy storage and demand response; it will allow energy consumers to be exposed to wholesale electricity pricing, increasing opportunities for arbitrage and for higher levels of distributed renewables.¹¹⁶

In 2018, Australia's Renewable Energy Agency and the government of the state of Victoria jointly funded battery storage at a transmission terminal to help stabilise the grid by drawing power at peak times.¹¹⁷ At the transmission level, in a major development in the United States, the Federal Energy Regulatory Commission issued orders to grid operators to develop rules for energy storage to participate in wholesale, capacity and ancillary services markets.¹¹⁸

The ongoing maturation of battery storage technologies – driven largely by the rapidly expanding EV sector – has created opportunities for the deployment of battery and other storage solutions alongside more traditional technologies such as pumped (hydropower) storage. This has led to a push for mandates and incentives promoting the deployment of energy storage capacity both in front of the meter (for example, utility-scale, centralised) and behind the meter (for example, residential

and commercial). These storage mandates have focused increasingly on battery storage technologies, and some, such as California's, explicitly exempt pumped storage.¹¹⁹

Among new policies in 2018, Jordan issued a tender for a new energy storage project that aims to put 30 MW of storage capacity online by early 2019.¹²⁰ Ireland established new rules that accelerate the process for approving connections for more than 370 MW of energy storage projects.¹²¹ For household systems, the state of South Australia launched an AUD 100 million (USD 70.5 million) subsidy scheme for the installation of home battery systems, particularly to facilitate rooftop solar PV, and the Australian Capital Territory began a household energy storage rebate programme.¹²²

Another emerging trend is policies that encourage the joint installation of renewables (primarily solar PV) and energy storage systems. Both Lebanon and Madagascar held solar PV-plus-storage auctions in 2018, and India solicited bids for a 160 MW solar PV-wind-storage hybrid project.¹²³ Multiple jurisdictions also offered incentives for the development or deployment of solar PV-plus-storage, including Ireland, which began providing household grants in 2018, and Thailand.¹²⁴ At the sub-national level, the US states of California, Massachusetts and New York introduced new incentives for solar PV-plus-storage projects.¹²⁵

Governments continued to invest in R&D to further advances in battery storage technology. In 2018, the UK government invested GBP 246 million (USD 312 million) in battery R&D; the US Department of Energy provided USD 27.7 million for long-duration energy storage; and the US state of Iowa began supporting battery technology research.¹²⁶

Targets focused on enabling and integrating technologies – such as energy storage and EVs – also have gained prominence in recent years. For example, in 2018 the US state of New York established an initial target of 1.5 GW of energy storage by 2025 and later doubled this target to 3 GW by 2030.¹²⁷ In addition, many countries have set targets for specific shares or volumes of EVs, which can enable increasing shares of renewable electricity in the transport sector. (→ See *Sidebar 2 in this chapter*, and *Systems Integration chapter*.)

To date,
few countries
have implemented
policies to advance
sector integration
specifically with
renewables.

i Sector integration refers to the interconnection of the power, heating and cooling, and transport sectors to facilitate the integration of higher shares of renewable energy.

ii Ancillary grid services support the transmission and distribution of electric power so that supply will continually meet demand.

CLIMATE POLICY AND RENEWABLES

Energy production and consumption remains a key focal point in global efforts to address climate change. Renewable energy technologies have received both direct and indirect support through policies targeting mitigation as well as adaptation. Direct mechanisms include renewable-specific targets set through national emissions reduction strategies, such as the NDCs submitted by 181 countries under the United Nations Framework Convention on Climate Change.¹²⁸ (→ See *Policy Landscape chapter in GSR 2018*.) Approximately three-quarters of NDCs specifically reference renewables as tools for mitigating climate change, and more than half establish renewable energy targets.¹²⁹

Climate strategies that set targets for partial or complete decarbonisation can establish indirect mechanisms for scaling growth in the renewable energy sector. These goals often necessitate a shift away from fossil fuels in many sectors of the economy. For example, in 2018 the European Commission outlined its strategy for reaching a zero-carbon economy across the region by 2050, and individual EU member countries were required to establish national energy and climate plans to meet EU-wide 2030 targets.¹³⁰

In 2018, Costa Rica announced its plan to ban fossil fuels and become the first decarbonised country in the world.¹³¹ Israel pledged to eliminate the use of coal, gasoline and diesel for energy production and transport by 2030, in favour of natural gas and renewable fuels.¹³² At the sub-national level, California established a state-wide goal to achieve carbon neutrality no later than 2045, and London outlined its strategy for zero carbon by 2050.¹³³ Municipal initiatives continued to be advanced through partnerships such as the Global Covenant of Mayors for Climate & Energy, which by the end of 2018 included over 9,200 cities committed to combatting climate change.¹³⁴

The ongoing transformation of power systems – spurred by factors such as the closure of coal and nuclear power plants – has led to an increased focus on ensuring the reliability of electricity supply using new generation mixes. This has resulted in opportunities for renewable energy and enabling technologies that offer ancillary grid services.¹³⁵ (→ See *Integration section in this chapter, and Systems Integration chapter*.) New developments in 2018 included a commitment to phase out coal power in Hungary by 2030.¹³⁶

Carbon taxes and emissions trading systems are among the policy mechanisms that can stimulate interest in low-carbon, renewable energy technologies to meet climate mitigation goals. At least 54 carbon pricing initiatives had been implemented by the end of 2018 (up from 46 in 2017), including 27 emissions trading systems and 27 carbon taxes.¹³⁷ (→ See *Figure 17*.) Carbon pricing initiatives that were being implemented by the end of 2018 covered around 13% of global greenhouse gas emissions, while those that were scheduled for implementation would cover an additional 7%.¹³⁸

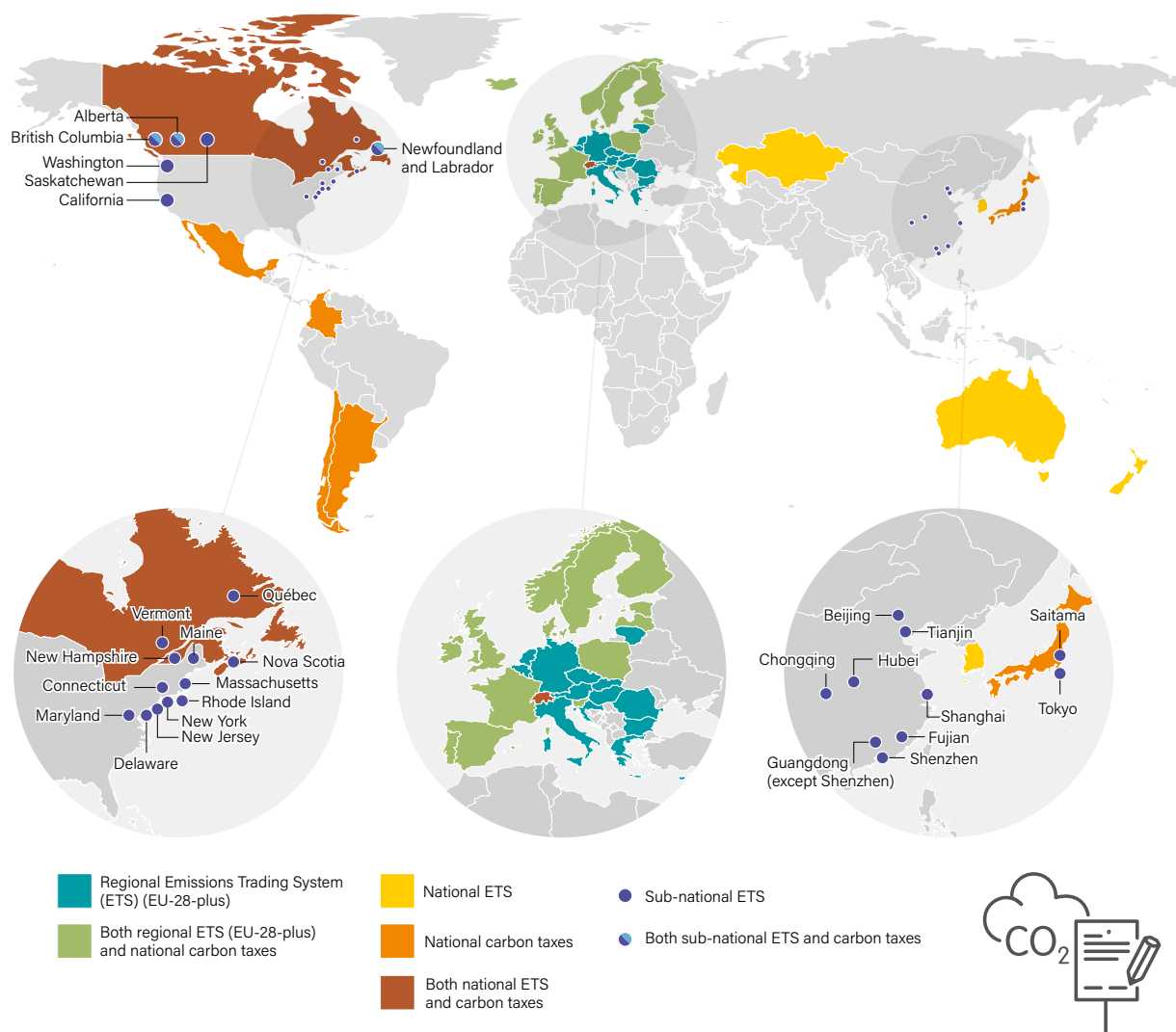


At least

54

carbon pricing initiatives
had been implemented by
the end of 2018.

FIGURE 17. Carbon Pricing Policies, 2018



Note: The Regional Greenhouse Gas Initiative (RGGI) includes the US states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont.

Source: World Bank. See endnote 137 for this chapter.

If well-designed, carbon pricing policies can incentivise the deployment of renewable energy technologies by internalising at least some externalities of fossil fuels, thereby increasing the relative cost of these fuels. However, some uncertainty exists as to whether these mechanisms are sufficient to drive deployment of renewable energy, particularly in the power sector, as many other factors are at play, including the structure of power markets and regulations governing market access.

The impacts of carbon pricing policies on renewable energy vary by technology and sector, and according to factors such as market prices within trading systems. Revenue accrued through these systems can be used to fund new renewable energy projects

– as demonstrated in the European Commission's New Entrants' Reserve mechanisms – or can be returned to residents through carbon dividends (→ see Box 2 in this chapter).¹³⁹

In 2018, the European Commission established new rules for phase IV (2021-2030) of the EU Emissions Trading System, with adjustments designed to accelerate the deployment of low-carbon technologies.¹⁴⁰ At the national level, Canada established a revenue-neutral carbon tax that was scheduled to be implemented in 2019.¹⁴¹ Finland increased its carbon tax rate for coal and for heavy and light fuel oil, and Kazakhstan restarted its emissions trading system following a two-year hiatus.¹⁴²

BOX 2. Policy Spotlight: Carbon Dividends

Carbon dividends – also known as a carbon fee-and-dividend policy or a revenue-neutral carbon tax – place a gradually increasing fee or tax on fossil fuel use, with the resulting revenue redistributed to taxpayers via “dividends”: through rebates, reductions on other taxes or fixed payments. The dividend is key to ensuring that the policy is consistent with the notion of a “just transition” away from fossil fuels because it counterbalances the financial impact that a fee on fossil fuel consumption might have on households and businesses.

Such a policy can encourage changes in consumption habits – for both individuals and large consumers – either through more-efficient energy use or through the replacement of fossil fuels with lower-emission alternatives such as renewable energy sources. In turn, as consumption decreases, the predictably increasing fee is intended to send a strong price signal to fossil fuel producers, spurring them to shift investment to innovative and renewables-based solutions. This type of policy tends to be popular with voters and often receives support across political divides.

In early 2019, the Canadian government applied a carbon fee-and-dividend policy in provinces that did not already

have a carbon pricing plan – whether a carbon dividend or otherwise – that met federal thresholds. For 70% of affected Canadian households, the annual dividends are expected to exceed any increase in energy costs that might result from the carbon fee, with lower-income households benefiting most. The federal policy builds on a similar policy that has been in place since 2008 in the Canadian province of British Columbia.

More than 10 years on, British Columbia’s policy has maintained support of more than half of the province’s population. It has reduced per capita fossil fuel consumption – even as British Columbia has maintained the strongest economic growth of any Canadian province – and has seen positive effects on the overall labour market.

Between 2007 and 2016, British Columbia’s per capita fossil fuel consumption decreased by at least 10%, while annual emissions declined an estimated 2.2%. However, the policy coverage has narrowed over time, and the possibility of “leakage” remains, with emissions reductions in the province potentially associated with increases elsewhere.

Source: see endnote 139 for this chapter.

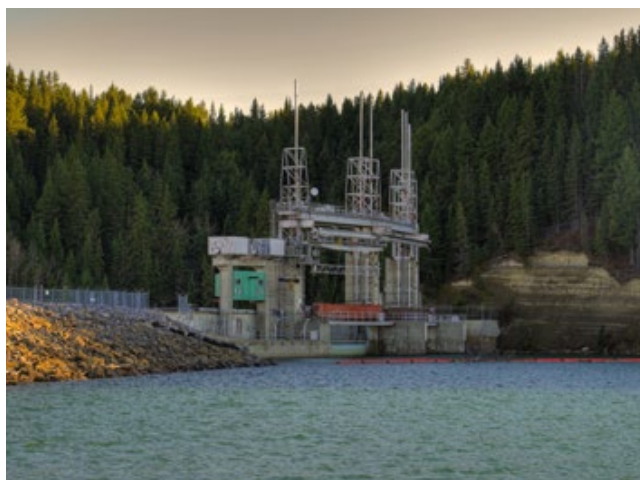


Table 2. Renewable Energy Targets and Policies, 2018

Country	Renewable energy targets ⁷	Renewable energy in INDC or NDC	Regulatory Policies							Fiscal Incentives and Public Financing				
			Feed-in tariff/ premium payment	Electric utility quota obligation/RPS	Net metering/ bidding	Biofuel blend obligation/mandate	Renewable heat obligation/mandate	Tradable REC	Tendering	Tax incentives	Investment or production tax credits	Reductions in sales, energy, CO ₂ , VAT or other taxes	Energy production payment	Public investment, loans, grants, capital subsidies or rebates
High Income Countries														
Andorra			●										●	
Antigua and Barbuda	P								○		●	●		●
Argentina	P	●			●	●			○		●	●	●	●
Australia	P	●	★	●	●	●	●	●	○					●, ★*
Austria	E, P, HC, T		●			●		●		●	●			●, ★*
Bahamas, The	P													
Bahrain	P(R)	●			●				○					●
Barbados ¹	P	●			●					●		●		●
Belgium	E, P, HC, T			●	●	●		●	●	●	●	●		●
Brunei Darussalam	E, P													
Canada	P*	●	●	●	●	●			○	●	●	●		●, ★ ⁷
Chile	P	●		●	●			●	●	●	● ⁶	●		
Croatia	E, P, HC, T		●			★								● ⁶
Cyprus	E, P, HC, T		●		●	●			●					●
Czech Republic	E, P, HC, T		●			●		●		●	●	●		● ⁶
Denmark	E, P, HC, T		●		●	★		●	○	●	●	●		● ⁶
Estonia	E, P, HC, T		●			●							●	●
Finland	E, P, HC, T		●			●		●	○	●	●	●	●	●
France	E, P(R), HC, T		●			●	●	●	○	● ⁶	● ⁶	●		★ ⁶
Germany	E, P, HC, T		●			●	●	●	○	●	●	●		● ⁶
Greece	E, P, HC, T		●	●	●	●	●	●	○	●	●	●		●
Hungary	E, P, HC, T		●			●			● ⁶	●		●		
Iceland	E, T					●								
Ireland	E, P, HC, T	●	●			●	●	●	●					★ ⁶
Israel	E, P, T	●	●	●	●	●	●	●	●	●		●		●
Italy	E, P, HC, T		●		●	●			●	●	●	●		★ ⁶
Japan	E, P	●	★					●	○	●	●	●		
Korea, Republic of	E, R(P)			●	●	●	●	●		●	●	●	●	● ⁶
Kuwait	P	●							○					
Latvia	E, P, HC, T		●		●	●			●	●		●		
Liechtenstein			●											
Lithuania	E, P(R), HC(R), T		●	●	●	●				●		●		●
Luxembourg	E, P, HC, T		●			●								●
Malta	E, P, HC, T		●		●	●			○	●		●		● ⁶
Monaco														
Netherlands	E, P, HC, T		● ⁶		●	●		●	○	● ⁶	● ⁶		●	● ⁶
New Zealand	P	●			●	★ ⁷	●	●	●					●
Norway	E, T, P	●		●		●		●	○	●		●		● ⁶
Oman														
Palau	E, P	●		●					○					
Panama	E	●	●		●	●			●	●	●	●	●	
Poland	E, P, HC, T		●	●		●	●	●	○	●		●		● ⁶
Portugal ²	E, P, HC, T		●	●		●	●	●		●		●		●
Qatar	P, T	●							○					
San Marino		●	●											
Saudi Arabia	P	●			●				○					
Seychelles	P	●			●				○	●	●	●		●
Singapore	P	●			●				○					●
Slovak Republic	E, P, HC, T		●			●		●		●	●	●		● ⁶
Slovenia	E, P, HC, T		●		●	●		●	●	●	●	●		● ⁶
Spain ³	E, P(R), HC, T				★	●	●		●	●	●		●	● ⁶
St. Kitts and Nevis														
Sweden	E, P, HC, T		●	●		●		●		●	●	●		●
Switzerland	E, P		★					●		●		●		● ⁶
Trinidad and Tobago	P	●		●	●					●	●	●		
United Arab Emirates	E, P	●		●	●		●		●	●		●	●	●
United Kingdom	E, P, T, HC		★ ⁶	●	●	●	●	●	●	●		●	●	★ ⁶
United States ⁴	P*(R)		●	★	★	●, ★	●, ★*	●	○	★	★	●	●	★ ⁶
Uruguay		●			●	●	●		●			●	●	● ⁶

Note: Please see key on last page of table.

■ Table 2. Renewable Energy Targets and Policies, 2018 (continued)

Country	Renewable energy targets ⁷	Renewable energy in INDC or NDC	Regulatory Policies							Fiscal Incentives and Public Financing				
			Feed-in tariff/ premium payment	Electric utility quota obligation/RPS	Net metering/ bidding	Biofuel blend obligation/mandate	Renewable heat obligation/mandate	Tradable REC	Tendering	Tax incentives	Investment or production tax credits	Reductions in sales, energy, CO ₂ , VAT or other taxes	Energy production payment	Public investment, loans, grants, capital subsidies or rebates
Upper-Middle Income Countries														
Albania	E, T	●	●	●	●	●		●	○		●	●	●	●
Algeria	E, P	●	●						○				●	●
Armenia	P	●	●		●				○					● ⁶
Azerbaijan	P	●												●
Belarus	E, P	●	●	●							●			●
Belize	P	●							●					
Bosnia and Herzegovina	E, P	●	●						●					
Botswana										●		●		●
Brazil	E, P	●			●	★			○	●	●	●		●
Bulgaria	E, P, HC, T	●	●			●					●			● ⁶
China	E, P(R), HC, T	●	★	★		●	●		○	●	●	●	●	●
Colombia	P	●				★				●	●	●		●
Costa Rica	P	●	●		●	●			●	●		●		
Cuba	P													
Dominica	P													
Dominican Republic	P		●		●				●	●	●	●		●
Ecuador		●	●			●			●	●		●		●
Equatorial Guinea														
Fiji	E, P	●								●	●	●		
Gabon	E, P										●			
Grenada	E, P	●			●					●		●		
Guatemala	E, P	●			●	●			●	●	●	●		
Guyana	E, P	●								●		●		
Iran	P	●	●							●	●		●	●
Iraq	P	●							●					
Jamaica	E, P	●			●	●			●	●	●	●		
Jordan	E, P, HC	●	●		●		●		○	●	●	●		●
Kazakhstan	P	●	●					●	○					●
Lebanon	E, P, HC	●			●				○	●		●		● ⁶
Libya	E, P, HC									●		●		
Macedonia, FYR	E, P, HC, T		●							● ⁶		● ⁶		● ⁶
Malaysia	P	●	●	●	★	●			●	●		●		●
Maldives	P	●	●						●					
Marshall Islands	P	●								●		●		
Mauritius	P	●			●				●	●		●		● ⁶
Mexico	P, HC	●			●	●			●	●	●			●
Montenegro	E, P, HC, T	●	●			●			○					
Namibia	P	●					●							
Nauru														
Paraguay	P	●				●				●		●		
Peru	E, P	●	●	●	●	●			●	●		●		●
Romania	E, P, HC, T	●		●	★	●		●						★, ● ⁶
Russian Federation	P	●	●						○					●
Samoa	E, P													
Serbia	E, P, HC, T		★			●								●
South Africa	P(R)	●		●		●	●		○	●		●		●
St. Lucia	P	●			●					●		●		
St. Vincent and the Grenadines ¹	P	●			●									
Suriname		●			●				●					
Thailand	E, P(R), HC, T	●	●			●				●		●	●	●
Tonga	P								○					
Turkey	P	●	●			●			○					●
Turkmenistan														
Tuvalu	P													
Venezuela	P													

Note: Please see key on last page of table.

■ Table 2. Renewable Energy Targets and Policies, 2018 (continued)

Country	Renewable energy targets ⁷	Renewable energy in INDC or NDC	Regulatory Policies							Fiscal Incentives and Public Financing				
			Feed-in tariff/ premium payment	Electric utility quota obligation/RPS	Net metering/ bidding	Biofuel blend obligation/mandate	Renewable heat obligation/mandate	Tradable REC	Tendering	Tax incentives	Investment or production tax credits	Reductions in sales, energy, CO ₂ , VAT or other taxes	Energy production payment	Public investment, loans, grants, capital subsidies or rebates
Lower-Middle Income Countries														
Angola	E	●				●				●				●
Bangladesh	E, P	●							●	●		●		●
Bhutan	P, HC	●												
Bolivia	P	●	●	●	●				●	●		●	●	●
Cabo Verde	(P)	●			●				●	●	●		●	
Cambodia	P	●												
Cameroon	P	●								●		●		
Congo, Republic of	P	●												
Côte d'Ivoire	E, P	●							●	●		●		
Djibouti	E, P	●												
Egypt	E, P	●	●		●				○	●		●		●
El Salvador		●							○	●	●	●	●	●
Eswatini														
Georgia														● ⁶
Ghana	E, P	●	●	●	●	●		●		●		●		●
Honduras	P	●	●		●			●	○	●	●	●	●	● ⁶
India	P, HC, T	●	●	●	●	●				●	●	●	●	● ⁶
Indonesia	E, P	●	●	●	★	★ ⁷			●	●	●	●	●	●
Kenya	P, HC	●	●		●		●		●	●		●	●	●
Kiribati	P	●												
Kosovo	E, P, HC	●												
Kyrgyz Republic				●						●		●		●
Lao PDR	E													
Lesotho	P	●			●				●	●	●		●	●
Mauritania	E													
Micronesia, Federated States of	P	●			●									
Moldova	E, P, HC, T	●	●		●	●			●	●				●
Mongolia	E, P	●	●						●	●		●		
Morocco	P, HC	●			●				●					●
Myanmar	P	●								●		●		
Nicaragua	P	●	●						●	●	●	●		●
Nigeria	P	●	●	●					●	●		●		●
Pakistan			●		●			●		●		●		●
Palestine, State of	E, P		●		●				○	●		●		
Papua New Guinea	P													
Philippines	P	●	●	●	●	●			●	●	●	●	●	●
São Tomé and Príncipe	P													
Solomon Islands	P													
Sri Lanka	P, T	●	●	●	●	●			○	●		●	●	●
Sudan	E, P	●				●								
Timor-Leste	P													
Tunisia	P	●			●				○	●		●		● ⁶
Ukraine	E, P, HC, T	●	●		●	●			●	●		●		● ⁶
Uzbekistan	P								●					
Vanuatu	E, P	●	●							●		●		
Vietnam	E, P, T	●	★ ⁶	●	●	●		●		●	●	●		●
Zambia		●	★						○	●		●		●

Note: Please see key on last page of table.

■ Table 2. Renewable Energy Targets and Policies, 2018 (continued)

Country	Renewable energy targets ¹	Renewable energy in INDC or NDC	Regulatory Policies							Fiscal Incentives and Public Financing				
			Feed-in tariff/ premium payment	Electric utility quota obligation/RPS	Net metering/ bidding	Biofuel blend obligation/mandate	Renewable heat obligation/mandate	Tradable REC	Tendering	Tax incentives	Investment or production tax credits	Reductions in sales, energy, CO ₂ , VAT or other taxes	Energy production payment	Public investment, loans, grants, capital subsidies or rebates
Low Income Countries														
Afghanistan	E, P								○					
Benin	E, P								○					
Burkina Faso	P	●							●	●	●	●		
Burundi	E, P													
Central African Republic														
Chad														
Comoros	P													
Congo, Democratic Republic of the	P													
Eritrea	P													
Ethiopia	P					●			○					
Gambia	P	●								●		●		
Guinea	E, P	●								●		●		
Guinea-Bissau	P													
Haiti	P	●												●
Korea, Democratic People's Republic														
Liberia	E, P, T	●				●				●		●		
Madagascar	E, P	●							○	●		●		
Malawi	E, P, HC	●				●	●		○	●		●		●
Mali	E, P	●								●		●		●
Mozambique	P, HC	●				●				●		●		●
Nepal	E, P, T	●	●					●	●	●	●	●		●
Niger	E, P	●							○	●		●		
Rwanda		●	●						●	●	●	●		●
Senegal	P	●	●	●	●				○	●		●		
Sierra Leone	P, HC													
Somalia														
South Sudan	P													
Syria	E, P		●		●				●	●	●			
Tajikistan	E, P	●	●							●		●		●
Tanzania	E, P	●	●		●				○	●		●	●	●
Togo	E, P	●								●		●		
Uganda		●	●						●	●		●		●
Yemen	P	●												
Zimbabwe		●				☆				●		●		●

Targets

E Energy (final or primary)

P Power

HC Heating or cooling

T Transport

* Indicates sub-national target

☆ New

★ Revised

● Removed

Policies

● Existing national policy or tender framework (could include sub-national)

◐ Existing sub-national policy or tender framework (but no national)

○ National tender held in 2018

◑ Sub-national tender held in 2018

¹ Certain Caribbean countries have adopted hybrid net metering and feed-in policies whereby residential consumers can offset power while commercial consumers are obligated to feed 100% of the power generated into the grid. These policies are defined as net metering for the purposes of the GSR.

² FIT support removed for large-scale power plants.

³ Spain removed FIT support for new projects in 2012. Support for projects is based on the "reasonable return" concept meant to ensure a fixed return on investment over the lifetime of a plant. Incentives for projects that previously had qualified for FIT support continue to be revised.

⁴ State-level targets in the United States include RPS policies.

⁵ The area of the State of Palestine is included in the World Bank country classification as "West Bank and Gaza".

⁶ Includes renewable heating and/or cooling technologies.

⁷ Aviation, maritime, or rail transport.

Note: Countries are organised according to annual gross national income (GNI) per capita levels as follows: "high" is USD 12,056 or more, "upper-middle" is USD 3,896 to USD 12,055, "lower-middle" is USD 996 to USD 3,895, and "low" is USD 955 or less. Per capita income levels and group classifications from World Bank, "Country and Lending Groups", <http://data.worldbank.org/about/country-and-lending-groups>, viewed May 2019. Only enacted policies are included in the table; however, for some policies shown, implementing regulations may not yet be developed or effective, leading to lack of implementation or impacts. Policies known to be discontinued have been omitted or marked as removed or expired. Many feed-in policies are limited in scope of technology.

Source: See endnote 1 for this chapter.