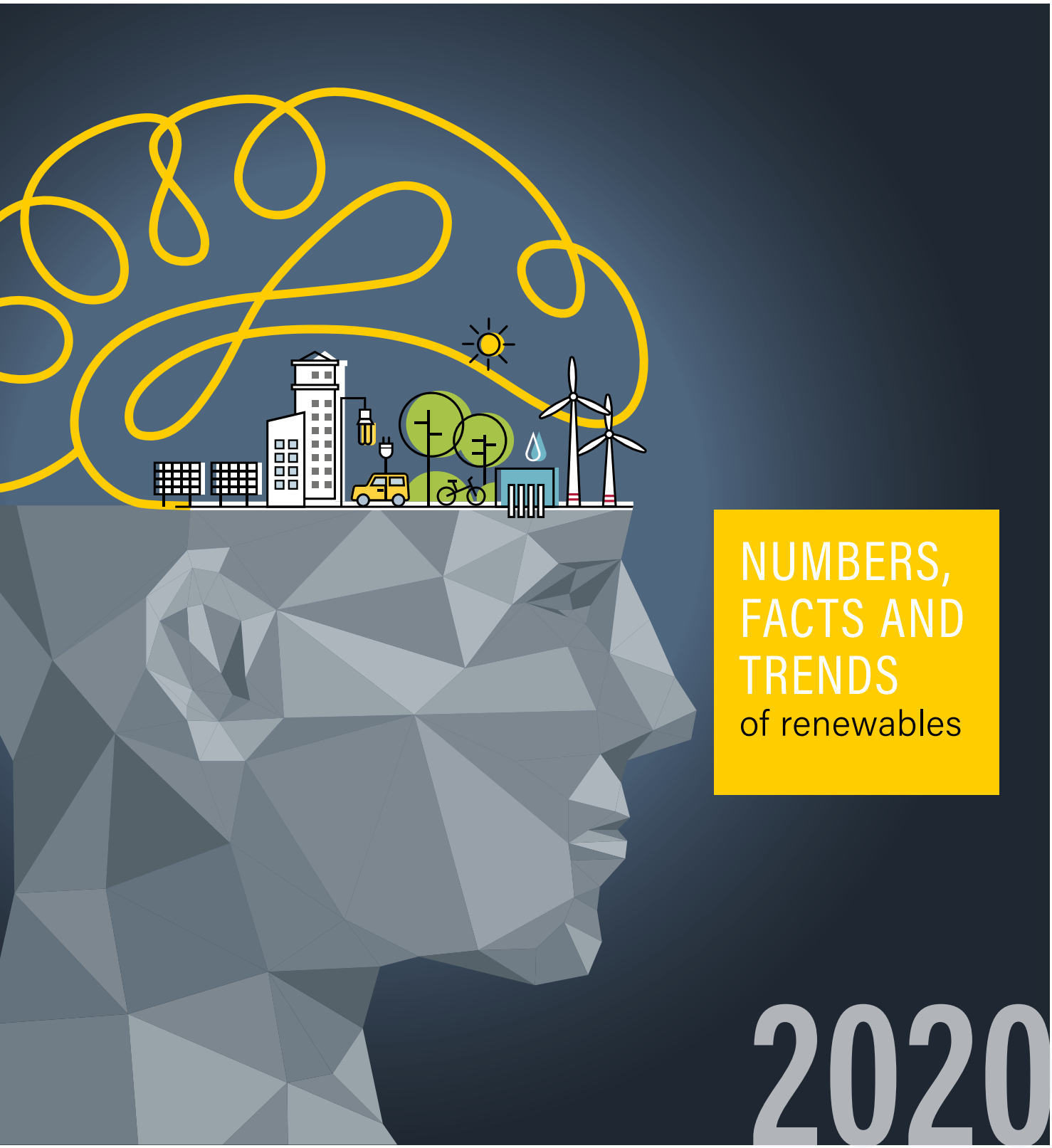
REN21
RENEWABLES NOW

KEY FINDINGS OF THE RENEWABLES 2020 GLOBAL STATUS REPORT



NUMBERS, FACTS AND TRENDS
of renewables

2020

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Alliance for Rural Electrification (ARE)
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Renewable Energy and Energy Efficiency Partnership (REEEP)
Renewable Energy Institute (REI)
SLOCAT Partnership for Sustainable Low Carbon Transport
Solar Cookers International (SCI)
World Council for Renewable Energy (WCRE)
World Future Council (WFC)
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SCIENCE AND ACADEMIA

AEE – Institute for Sustainable Technologies (AEE INTEC)
Council on Energy, Environment and Water (CEEW)
Fundación Bariloche (FB)
International Institute for Applied Systems Analysis (IIASA)
International Solar Energy Society (ISES)
National Renewable Energy Laboratory (NREL)
National Research University Higher School of Economics, Russia (HSE)
South African National Energy Development Institute (SANEDI)
The Energy and Resources Institute (TERI)

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RENEWABLE ENERGY POLICY NETWORK FOR THE 21st CENTURY

REN21 is the only **global community** of renewable energy actors from science, academia, governments, NGOs and industry. We provide up-to-date facts, figures and peer-reviewed analysis of global developments in technology, policies and markets to decision makers. Our goal: encourage and enable them to make the shift to renewable energy happen – now!

The most successful organisms, such as an octopus, have a **decentralised intelligence** and "sensing" function. This increases responsiveness to a changing environment. REN21 incarnates this approach.

Our more than **2,000 community members** guide our co-operative work. They reflect the vast array of backgrounds and perspectives in society. As REN21's eyes and ears, they collect information and share intelligence, by sending input and feedback. REN21 takes all this information to better understand the current thinking around renewables and change norms. We also use this information to connect and grow the energy debate with non-energy players.

Our annual publication, the *Renewables Global Status Report*, is probably the world's most comprehensive crowdsourced report on renewables. It is a truly collaborative process of co-authoring, data collection and peer reviewing.

EXECUTIVE SUMMARY

01 GLOBAL OVERVIEW

Renewables grew rapidly in the power sector, while far fewer advances have occurred in heating and transport.

Renewable energy had another record-breaking year in 2019[i], as installed power capacity grew more than 200 gigawatts (GW) – its largest increase ever. Capacity installations and investment continued to spread to all corners of the world, and distributed renewable energy systems provided additional households in developing and emerging countries with access to electricity and clean cooking services. Also during the year, the private sector signed power purchase agreements (PPAs) for a record amount of renewable power capacity, driven mainly by ongoing cost reductions in some technologies.

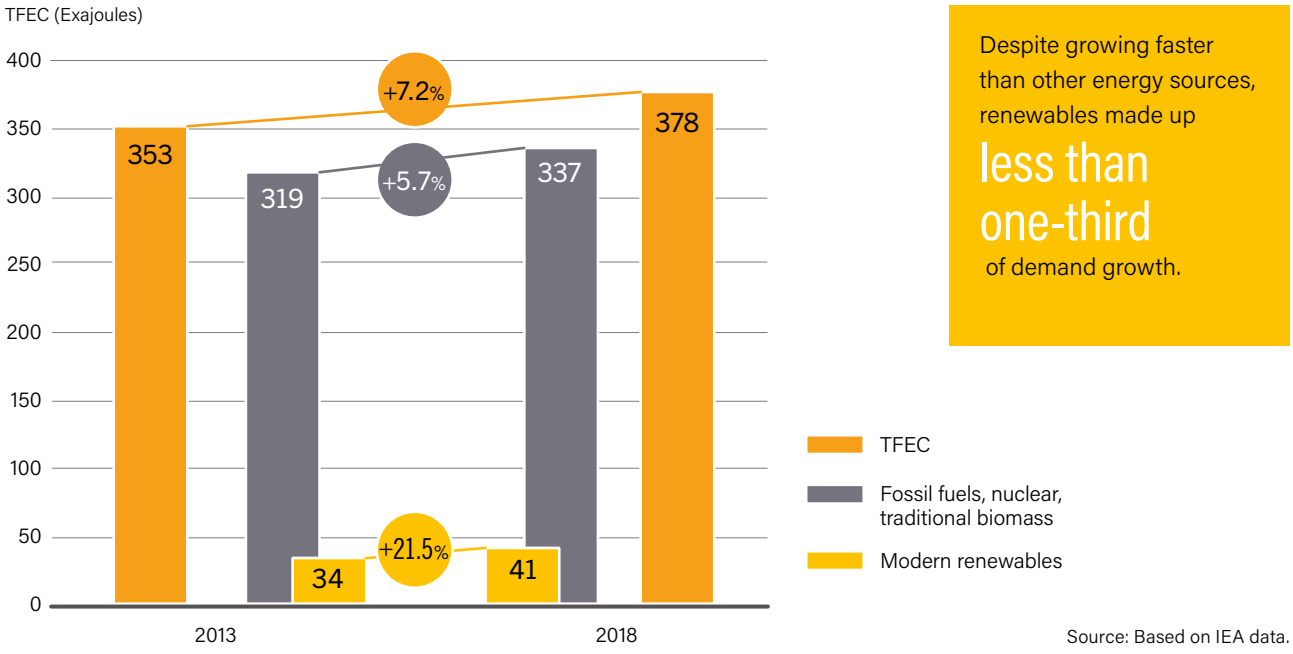
Shares of renewables in electricity generation continued to rise around the world. In some countries, the share of renewables in heating, cooling and transport also grew, although these sectors continued to lag far behind due to insufficient policy support and slow developments in new technologies. This resulted in only a moderate increase in the overall share of renewables in total final energy consumption (TFEC), despite significant progress in the power sector.

As of 2018, modern renewable energy (excluding the traditional use of biomass) accounted for an estimated 11% of TFEC, only a slight increase from 9.6% in 2013. The highest share of renewable energy use (26.4%) was in electrical uses excluding heating, cooling and transport; however, these end-uses accounted for only 17% of TFEC in 2017. Energy use for transport represented some 32% of TFEC and had a low share of renewables (3.3%), while the remaining thermal energy uses accounted for more than half of TFEC, of which 10.1% was supplied by renewables. Overall, the slow growth in the renewable energy share indicated the complementary roles of energy efficiency and renewables.

Among the general public, support for renewable energy continued to advance alongside rising awareness of the multiple benefits of renewables, including reduction of carbon dioxide (CO_2) emissions. By year's end 1,480 jurisdictions – spanning 28 countries and covering 820 million citizens – had issued "climate emergency" declarations. At the same time, while some countries were phasing out coal, others continued to invest in new coal-fired power plants, both domestically and abroad. In addition, funding from private banks for fossil fuel projects has increased, totalling USD 2.7 trillion between 2016 and 2019. Although CO_2 emissions remained stable in 2019, the world is not on track to limit global warming to well below 2 degrees Celsius (°C), let alone 1.5 °C, as stipulated in the Paris Agreement.

i The *Renewables 2020 Global Status Report* focuses on developments in renewable energy in 2019, and therefore does not reflect the impact of the COVID-19 pandemic on global energy systems. An overview of the impacts of the COVID-19 crisis on the renewable energy sector will be included in GSR 2021.

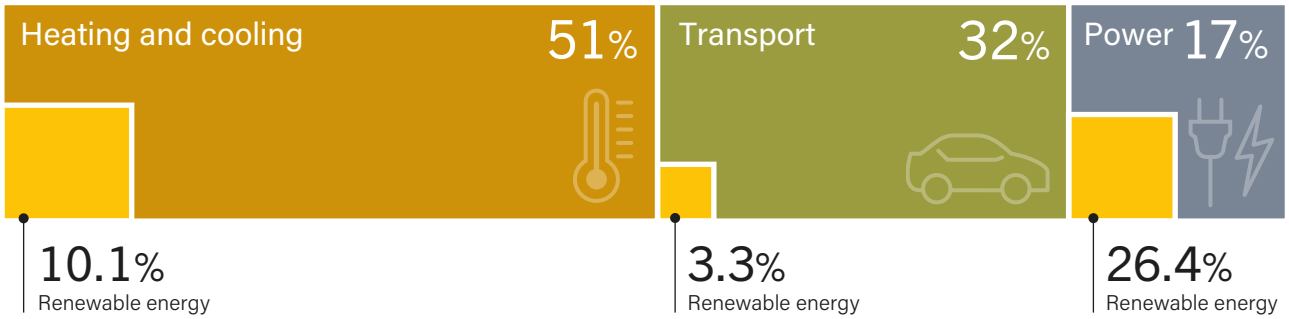
Estimated Global Growth in Renewable Energy Compared to Total Final Energy Consumption, 2013-2018



Despite growing faster than other energy sources, renewables made up **less than one-third** of demand growth.

Source: Based on IEA data.

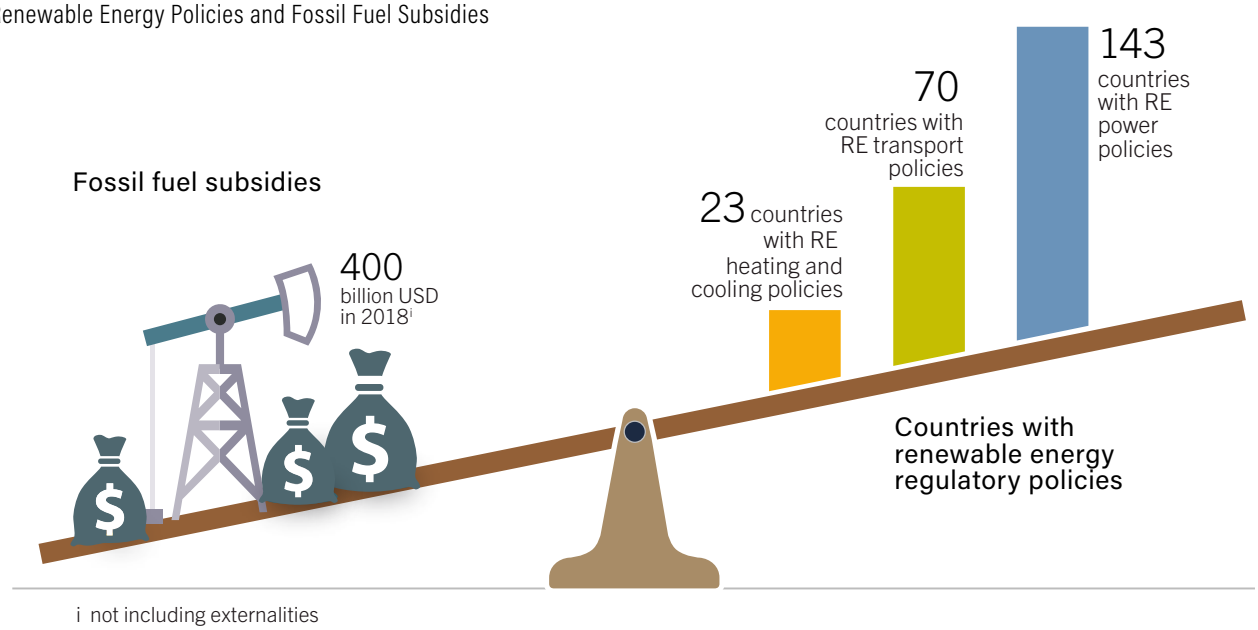
Renewable Share of Total Final Energy Consumption, by Final Energy Use, 2017



Note: Data should not be compared with previous years because of revisions due to improved or adjusted methodology.

Source: Based on IEA data.

Renewable Energy Policies and Fossil Fuel Subsidies



i not including externalities

BUILDINGS

Renewables were the fastest growing energy source in buildings, yet this increase was limited by lack of policy support.

Renewable energy met less than 14% of total energy demand in buildings in 2017. More than three-quarters of global final energy demand in buildings was for heating and cooling end-uses, which remain heavily fossil fuel-based. In 2018, renewables contributed an estimated 10.1% of heating and cooling demand in buildings; this share has barely risen from 8% in 2010. Modern bioenergy still represented the largest renewable heat source in the buildings sector, followed by renewable electricity for heat, solar thermal and geothermal heat. Most of the share increase was due to growth in renewable electricity for heat and in solar thermal, while use of modern bioenergy has remained stable. The majority of renewable electricity in buildings was provided by utility-scale, grid-connected renewables with a growing share from rooftop solar photovoltaic (PV) systems.

Direct policy action to stimulate renewable energy uptake in buildings was lacking in 2019, although more local and national governments introduced bans on fossil fuels for heating. Global efforts to decarbonise buildings through net zero carbon / net zero energy buildings are promoting the uptake of renewable energy in the sector.

INDUSTRY

The share of renewables in industrial energy use remains small, particularly in sectors that require high process temperatures.

Renewable energy met around 14.5% of industrial final energy demand, with bioenergy supplying more than half of the renewable share. Bioenergy was used primarily in sub-sectors that utilise low-temperature heat (below 100 °C), such as pulp and paper. Solar thermal and geothermal heat were used mainly for pre-heating water, drying and generating low-temperature steam in industries such as mining, food and beverage production, textiles and agriculture. Within the industrial sector, the most energy-intensive sub-sectors – those with the highest process temperatures – also use the lowest shares of renewable energy.

Renewable electricity was used to supply both electrical and thermal demands of some industrial processes. New projects were completed or announced in 2019 to use renewable electricity to produce steel and cement and to power mining operations. In addition, projects were commissioned to produce renewable hydrogen for industry, and companies announced plans and intentions to produce renewable hydrogen from offshore wind power.

TRANSPORT

Despite gains in energy efficiency and continued growth in both biofuels and electric vehicles (EVs), transport remains the sector with the lowest share of renewable energy.

Although it accounts for around one-third of TFEC, transport remained the sector with the lowest share of renewable energy, at only 3.3%. The vast majority of global transport energy needs were met by oil and petroleum products, with small shares met by biofuels and renewable electricity. Gains in energy efficiency and continued growth in both biofuels and EVs were largely offset by rising energy demand in transport. Biofuels remained by far the largest contributor of renewable energy to the transport sector in 2019.

Although rarely linked directly to renewable sources, EVs became more commonplace in more countries as a result of policies and targets adopted in prior years. With cities increasingly restricting the circulation of fossil fuel vehicles, new mobility service companies have expanded rapidly, with some committing to using renewable electricity in their EV fleets. Some regions also saw gradual increases in the use of renewable hydrogen and renewable synthetic fuels for transport, but these remained minimal overall. Many countries still lack a holistic strategy for decarbonising transport. Although positive developments occurred across transport modes, including in road freight, shipping and aviation in 2019, progress has been too slow to achieve global climate targets.

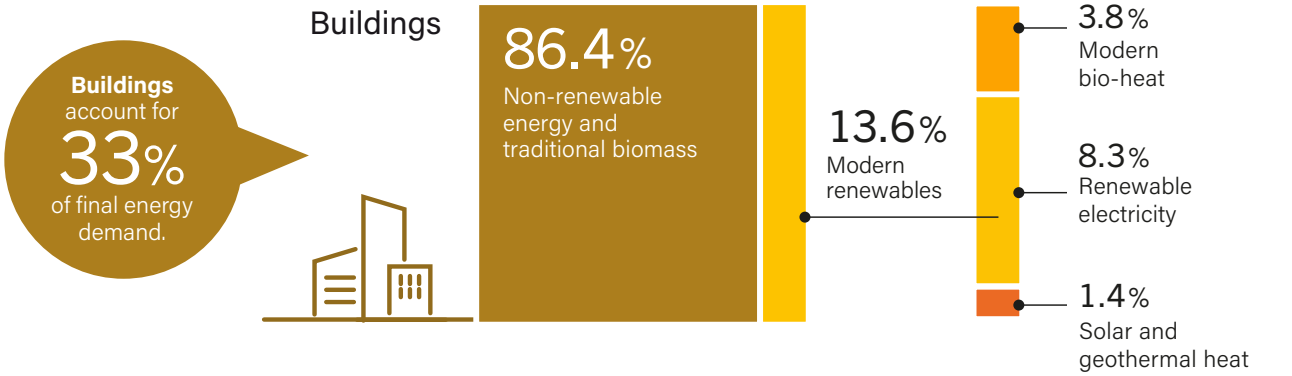
POWER

The renewable power sector experienced record-high increases in installed capacity, outpacing net installations in fossil fuel and nuclear power combined.

Installed renewable power capacity grew more than 200 GW in 2019 (mostly solar PV), the largest increase ever. For the fifth year in a row, net additions of renewable power generation capacity clearly outpaced net installations of fossil fuel and nuclear power capacity combined. Globally, 32 countries had at least 10 GW of renewable power capacity in 2019, up from only 19 countries a decade earlier. In most countries, producing electricity from wind and solar PV is now more cost effective than generating it from new coal-fired power plants. These cost declines have led to record-low bids in tendering processes, which became even more common during the year. However, competitive auctions have led to consolidation in some industries and have favoured larger multinational energy companies rather than smaller actors, including community-led groups.

Overall, installed renewable energy capacity was enough to provide an estimated 27.3% of global electricity generation by the end of 2019. Despite these advances, renewable electricity continued to face challenges in achieving a larger share of global electricity generation, due in part to persistent investment in fossil fuel (and nuclear) power capacity.

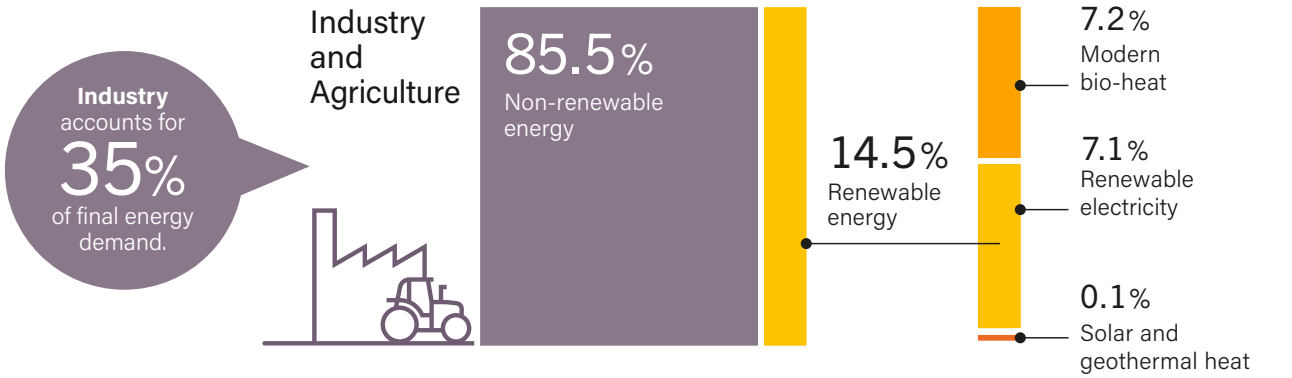
Renewable Share of Total Final Energy Consumption in Buildings, 2017



Note: Modern bio-heat includes heat supplied by district energy networks.
Totals may not add up due to rounding.

Source: Based on IEA data.

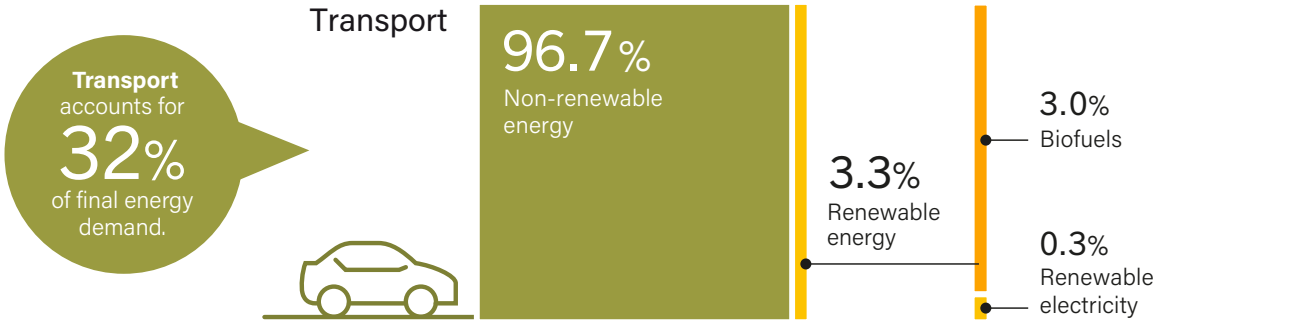
Renewable Share of Total Final Energy Consumption in Industry and Agriculture, 2017



Note: Modern bio-heat includes heat supplied by district energy networks.
Totals may not add up due to rounding.

Source: Based on IEA data.

Renewable Share of Total Final Energy Consumption in Transport, 2017



Source: Based on IEA data.

RENEWABLE ENERGY INDICATORS 2019

		2018	2019
INVESTMENT			
New investment (annual) in renewable power and fuels[1]	billion USD	296.0	**301.7**
POWER			
Renewable power capacity (including hydropower)	GW	2,387	**2,588**
Renewable power capacity (not including hydropower)	GW	1,252	**1,437**
Hydropower capacity[2]	GW	1,135	**1,150**
Wind power capacity	GW	591	**651**
Solar PV capacity[3]	GW	512	**627**
Bio-power capacity	GW	131	**139**
Geothermal power capacity	GW	13.2	**13.9**
Concentrating solar thermal power (CSP) capacity	GW	5.6	**6.2**
Ocean power capacity	GW	0.5	**0.5**
HEAT			
Modern bio-heat demand (estimated)[4]	EJ	13.9	**14.1**
Solar hot water demand (estimated)[5]	EJ	1.4	**1.4**
Geothermal direct-use heat demand (estimated)[6]	PJ	384	**421**
TRANSPORT			
Ethanol production (annual)	billion litres	111	**114**
FAME biodiesel production (annual)	billion litres	41	**47**
HVO biodiesel production (annual)	billion litres	6.0	**6.5**
POLICIES[7]			
Countries with renewable energy targets	#	169	**172**
Countries with renewable energy policies	#	158	**161**
Countries with 100% renewable energy in primary or final energy targets	#	1	**1**
Countries with 100% renewable heating and cooling targets	#	1	**1**
Countries with 100% renewable transport targets	#	1	**1**
Countries with 100% renewable electricity targets	#	57	**61**
Countries with heat regulatory policies	#	23	**23**
Countries with biofuel blend mandates[8]	#	70	**70**
Countries with feed-in policies (existing)	#	87	**87**
Countries with feed-in policies (cumulative)[9]	#	113	**113**
Countries with tendering (held during the year)	#	48	**41**
Countries with tendering (cumulative)[9]	#	98	**109**

[1] Data are from BloombergNEF and include investment in new capacity of all biomass, geothermal and wind power projects of more than 1 MW; all hydropower projects of between 1 and 50 MW; all solar power projects, with those less than 1 MW estimated separately; all ocean power projects; and all biofuel projects with an annual production capacity of 1 million litres or more. Total investment values include estimates for undisclosed deals as well as company investment (venture capital, corporate and government research and development, private equity and public market new equity).

[2] The GSR strives to exclude pure pumped storage capacity from hydropower capacity data.

[3] Solar PV data are provided in direct current (DC). See Methodological Notes for more information.

[4] Includes bio-heat supplied by district energy networks and excludes the traditional use of biomass. See Reference Table R1 and related endnote for more information.

[5] Includes glazed (flat-plate and vacuum tube) and unglazed collectors only. The number for 2019 is a preliminary estimate.

[6] The estimate of annual growth in output is based on a survey report published in early 2020. The annual growth estimate for 2019 is based on the annualised growth rate in the five-year period since 2014. See endnote 64 in Geothermal section of Market and Industry chapter.

[7] A country is counted a single time if it has at least one national or state/provincial target or policy. See Table 3 and Reference Tables R3-R12.

[8] Biofuel policies include policies listed both under the biofuel obligation/mandate column in Table 3 and in Reference Table R10.

[9] Data reflect all countries where the policy has been used at any time up through the year of focus at the national or state/provincial level. See Reference Tables R11 and R12.

Note: All values are rounded to whole numbers except for numbers <15, biofuels and investment, which are rounded to one decimal point. Totals may not add up due to rounding. FAME = fatty acid methyl esters; HVO = hydrotreated vegetable oil.

TOP FIVE COUNTRIES 2019

ANNUAL INVESTMENT / NET CAPACITY ADDITIONS / PRODUCTION IN 2019

Technologies ordered based on total capacity additions in 2019.

	1	2	3	4	5
Investment in renewable power and fuels capacity (not including hydropower over 50 MW)	**China**	United States	Japan	India	Chinese Taipei
Solar PV capacity	**China**	United States	India	Japan	Vietnam
Wind power capacity	**China**	United States	United Kingdom	India	Spain
Hydropower capacity	**Brazil**	China	Lao PDR	Bhutan	Tajikistan
Geothermal power capacity	**Turkey**	Indonesia	Kenya	Costa Rica	Japan
Concentrating solar thermal power (CSP) capacity	**Israel**	China	South Africa	Kuwait	France
Solar water heating capacity	**China**	Turkey	India	Brazil	United States
Ethanol production	**United States**	Brazil	China	India	Canada
Biodiesel production	**Indonesia**	United States	Brazil	Germany	France

TOTAL CAPACITY OR GENERATION AS OF END-2019

Countries in **bold** indicate change from 2018.

	1	2	3	4	5
POWER					
Renewable power capacity (including hydropower)	China	United States	Brazil	India	Germany
Renewable power capacity (not including hydropower)	China	United States	Germany	India	Japan
Renewable power capacity *per capita* (not including hydropower)[1]	Iceland	Denmark	**Sweden**	**Germany**	**Australia**
Bio-power capacity	China	United States	Brazil	**India**	**Germany**
Geothermal power capacity	United States	Indonesia	Philippines	Turkey	New Zealand
Hydropower capacity[2]	China	Brazil	Canada	United States	Russian Federation
Hydropower generation[2]	China	Brazil	Canada	United States	Russian Federation
Solar PV capacity	China	United States	Japan	Germany	India
Concentrating solar thermal power (CSP) capacity	Spain	United States	**Morocco**	**South Africa**	**China**
Wind power capacity	China	United States	Germany	India	Spain
HEAT					
Solar water heating collector capacity[3]	China	United States	Turkey	Germany	Brazil
Solar water heating collector capacity *per capita*	Barbados	**Cyprus**	**Israel**	**Austria**	Greece
Geothermal heat output[4]	China	Turkey	Iceland	Japan	**New Zealand**

[1] Per capita renewable power capacity (not including hydropower) ranking based on data gathered from various sources for more than 70 countries and on 2018 population data from the World Bank.

[2] Country rankings for hydropower capacity and generation can differ because some countries rely on hydropower for baseload supply whereas others use it more to follow the electric load to match peaks in demand.

[3] Solar water heating collector rankings for total capacity and per capita are for year-end 2018 and are based on capacity of water (glazed and unglazed) collectors only. Data are from International Energy Agency Solar Heating and Cooling Programme. Total capacity rankings are estimated to remain unchanged for year-end 2019.

[4] Not including heat pumps. Data are from 2015.

Note: Most rankings are based on absolute amounts of investment, power generation capacity or output, or biofuels production; if done on a basis of per capita, national GDP or other, the rankings would be different for many categories (as seen with per capita rankings for renewable power not including hydropower and solar water heating collector capacity).

SHIFTING TO RENEWABLES IN ALL SECTORS

THE REMARKABLE RISE OF RENEWABLE POWER

Momentum of renewable power continues

Renewable energy has cemented its position as the dominant source for power capacity worldwide, thanks in large part to sustained policy support and cost reductions. In 2019, a record 200 gigawatts (GW) of renewable power capacity was added, more than three times the level of fossil fuel and nuclear capacity. Over 27% of global electricity now comes from renewables, up from 19% in 2010. The share of solar photovoltaic (PV) and wind power has grown more than five times since 2009 – a remarkable rise attributed largely to continued cost declines for these technologies.

New solar PV and wind plants are now being installed at a lower cost than to run existing coal and gas power plants. An increasing number of jurisdictions have shown that variable sources of renewable electricity can be integrated into the grid at scale. Four countries – Denmark, Uruguay, Ireland and Germany – derived more than 30% of their electricity from solar PV and wind in 2019.

An increasingly global trend mobilising all actors

Renewable power is growing in all corners of the world. By the end of 2019, 47 countries across 6 continents, including several emerging economies, had at least 1 GW of solar PV and wind power in operation, compared to just 18 countries in 2009. On average, 1 GW of solar PV or wind power is enough to cover the electricity demand of nearly 150,000 European households.

A social revolution is under way: people around the world are demanding more action on climate change, and 1,480 jurisdictions in 28 countries have declared a "climate emergency". Public opinion polls worldwide have shown that people are in favour of using more renewables and are increasingly aware of the multiple benefits that renewable energy brings in terms of health, jobs, resilience and climate change mitigation.

Beyond individuals, private sector investments in renewable power and fuels reached record levels in 2019. Corporate sourcing of renewables grew more than 40%, with agreements signed in 23 countries, and some in the order of gigawatts. Membership in RE100 grew at least 27% during the year to 229 global corporations.

THE POWER SECTOR IS ONLY PART OF THE PICTURE

Momentum in renewable power hides a profound lag in the heating, cooling and transport sectors

It would be short-sighted to celebrate advances in the power sector without acknowledging the alarmingly low shares and slow uptake of renewables in the heating, cooling and transport sectors. Electricity use, such as for lighting, appliances and industrial equipment, accounts for only 17% of global final energy demand, whereas heating, cooling and transport account for as much as 83% of the energy we consume. Renewable shares in heating and cooling are low (10.1%) and struggle to increase, even as the sector accounts for more than half of total energy demand. Similarly, energy demand in transport – which accounts for a third of total energy demand – is growing the fastest by far, yet renewable shares barely exceed 3.3%.

Ongoing dependence on fossil fuels for heating, cooling and transport is related to a lack of policy support for renewables in these sectors. There is still no level playing field. Many countries continue to uphold fossil fuel subsidies, which in 2018 increased 30% from the year before. Global fossil fuel subsidies totalled USD 400 billion, more than double the amount that governments spent on renewable power. As coal plants continue to be built, public funding for these facilities is flowing to developing countries, increasing the risk for lock-in to fossil-fuelled power. The massive support for fossil fuels hinders the already difficult task of reducing emissions and must be brought to a halt.

A systemic problem requires a systemic response

Increasing the shares of renewables in all sectors is mandatory to enable the shift to a low-carbon energy system that could fulfil global climate and development goals. Unfortunately, the world is still far from being on track to meet these goals. Because of the ever-growing demand for energy, the continued support for fossil fuels and the lack of adoption of renewables in all sectors, the progress made by renewables is not fast enough to compete with rising energy demand. Demand for renewable energy grew three times faster than demand for fossil fuels and nuclear over a five-year period, but it accounted for less than a third of the total increase in final energy demand. This means that the share of renewables is only barely increasing.

SOLUTIONS EXIST FOR AN IMMEDIATE SHIFT TO EFFICIENCY AND RENEWABLE ENERGY

Much work remains to be done. On the bright side, solutions exist to switch to an efficient and renewable-based energy system. Successful policies and targets can be used as models, and minimising policy uncertainty is crucial to create stable markets. Three types of solutions must occur in parallel to make transformation of the energy system happen.

For policy makers, three actions must be taken in parallel:

Increase policies that actively support the uptake of renewables:

Governments have many options for promoting renewables, and ambitious planning, targets and policies are needed. Already, cities such as Vienna have implemented plans to boost shares of renewable heat. Feed-in tariffs and mandates for renewable heat also have been effective. Although the global electric vehicle (EV) stock has grown significantly, policies should be put in place that incentivise EVs charged with renewable electricity, and biofuel policies should be strengthened. Finally, renewable electricity generation has to ramp up; nothing is holding back governments now from channelling much more investment into renewable power.

Make energy efficiency mandatory to decrease energy demand:

Energy efficiency measures that decrease final energy demand are crucial to meet climate goals. Measures such as building retrofits, net zero energy codes, fuel efficiency standards, promoting walking, cycling and renewable-powered public transport, and new mobility services can all work towards this goal. Cities have proven particularly capable of introducing and reinforcing such changes.

Accelerate the phase-out out of fossil fuels:

Governments can take an offensive position to phase out fossil fuels and level the playing field that undermines renewable energy, especially in heating and transport, while ensuring a just transition. They should divest from fossil fuels, remove fossil fuel subsidies and implement fossil fuel bans across all sectors. Already 5 countries have plans to ban fossil fuel boilers for heating, and 14 countries have targets to ban fossil fuel vehicles. In addition, governments should implement a price on carbon emissions across all sectors that reflects the true cost of fossil fuels.

COVID-19 EXPOSED THAT SYSTEMIC CHANGE IS NEEDED

Because of the reduced energy demand during the pandemic, carbon dioxide emissions are expected to decrease between 4% and 7% for 2020. Even under these extreme circumstances, such an emissions decline is not enough to meet global goals; a decrease in emissions of at least 7% annually over the next decade would be necessary to reach the goal of limiting global temperature rise to 2° Celsius.

The pandemic's impact on carbon emissions has proven that structural shifts to overhaul our existing fossil fuel-based energy system are necessary. Now, we have an opportunity to take ambitious action during a period of uncertainty.

Recovery offers a unique chance to shift to a low-carbon economy.

As governments build recovery packages, firm and unified action must be taken on emissions reduction and clean air goals. Beyond the recovery, governments also should create targets and policies to make possible the switch to an efficient and renewable-based energy system. Urgent, focused and co-ordinated policy action is crucial. And action must be taken now.

POLICY LANDSCAPE

In 2019, policy frameworks continued to evolve in response to changes in renewable energy technologies and markets.

Much of the progress in developing and deploying renewable energy technologies has been achieved thanks to effective government policies. Policy continues to be important to overcome economic, technical and institutional barriers. By the end of 2019, nearly all countries had renewable energy support policies in place, although with varying degrees of ambition, scope and comprehensiveness. Jurisdictions have adapted policies to meet their specific circumstances, including to support increasing renewable energy capacity and generation, to boost job creation, and to increase energy access and security. Trade policy also had an impact on the production, exchange and development of renewable energy products, as well as on renewable energy demand levels within specific countries.

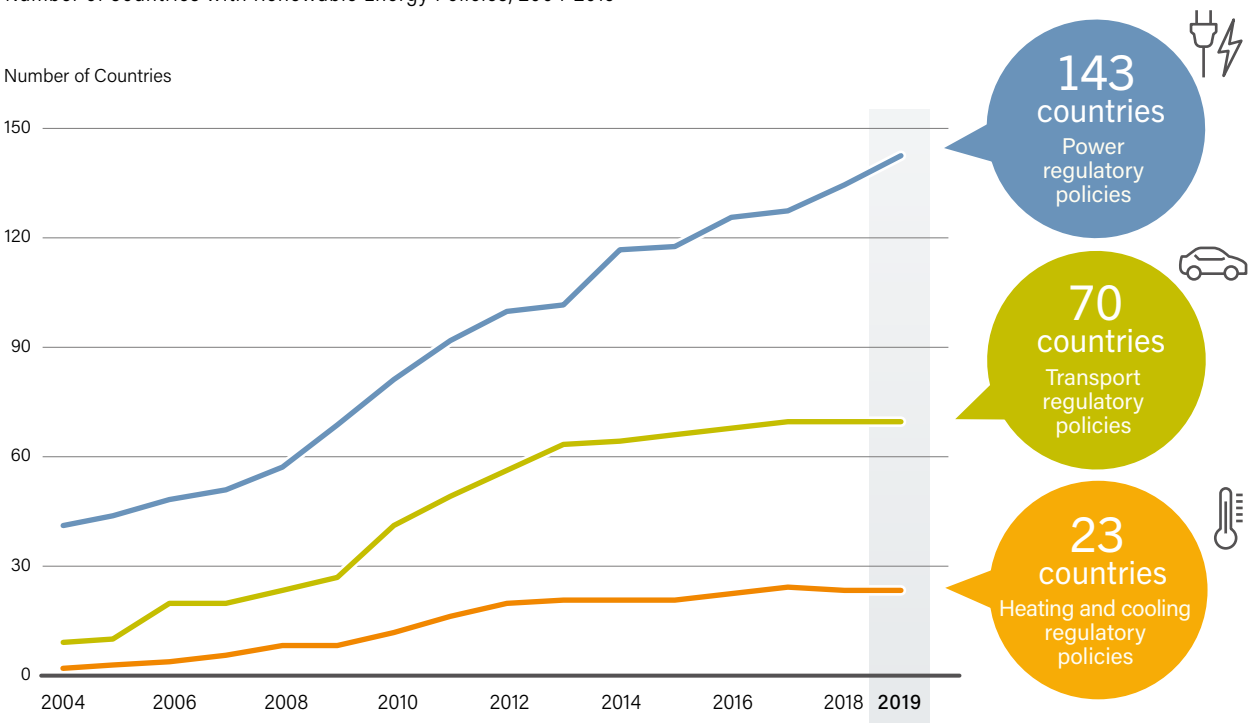
CROSS-SECTORAL TARGETS AND POLICIES

Targets that align renewable energy policy across multiple levels of governance and multiple economic sectors remained rare in 2019.

Renewable energy policies typically are enacted at a single level of governance and tend to focus on a single end-use sector, although examples of integration and co-ordination are emerging.

Targets are a primary means of expressing commitment to renewable energy and have been aimed almost exclusively at the power (electricity) sector. By the end of 2019, 166 countries had renewable power targets, compared to 49 countries for heating and cooling and 46 for transport. Only one cross-sectoral target was adopted during 2019, in Spain.

Number of Countries with Renewable Energy Policies, 2004-2019



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.

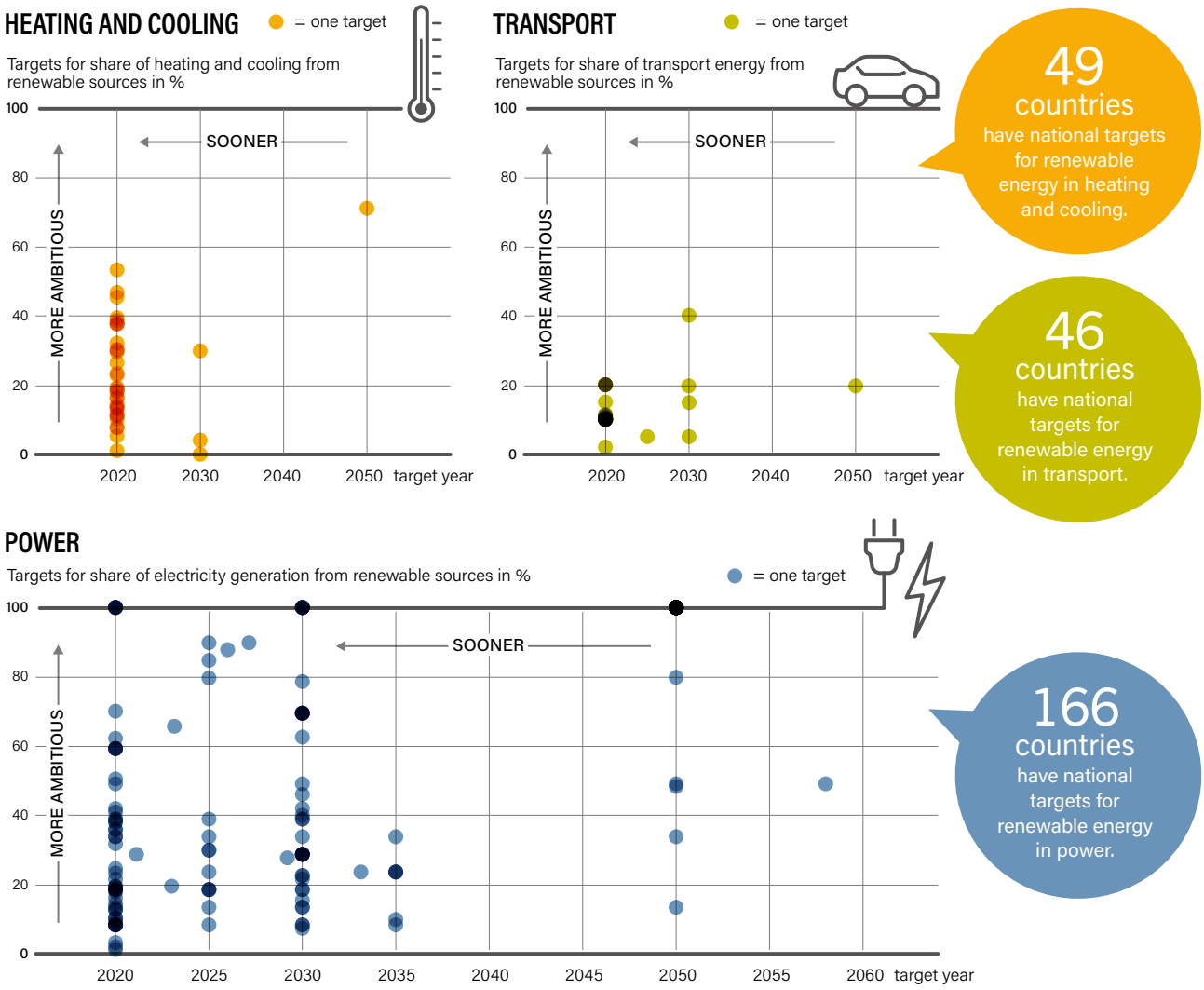
HEATING AND COOLING

Despite the enormous potential for renewable energy in heating and cooling, the number of related policies for buildings increased only slightly, while such policies for industry remained scarce.

Policies supporting renewable heating and cooling in buildings grew minimally in 2019, and include renewable heating and cooling mandates, building energy codes, support for renewable district heating and cooling, support for renewable natural gas, financial incentives, net zero emissions standards and fossil fuel bans for heating. No new countries adopted renewable heat mandates for the second year in a row, but at least four countries (Austria, Denmark, Norway and the United Kingdom) adopted targets to fully or partially ban the use of fossil fuels in heating.

Renewable energy support policies for the industrial sector are more limited, and new or revised policies in this area remained scarce in 2019. Although not always specific to the industrial sector, some policy developments related to renewable hydrogen took place in 2019, particularly in Australia, New Zealand, and Europe, while policy focus on hydrogen elsewhere occurred without a direct link to renewables.

National Sector-Specific Targets for Share of Renewable Energy by a Specific Year, by Sector, in Place at End-2019



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. 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 49 in heating and cooling, 46 in transport and 166 in power.

TRANSPORT

In the transport sector, no new countries adopted biofuel blend mandates, but some countries with existing mandates strengthened their policies. Policy attention to EVs expanded but still without a direct link to renewables.

In 2019, policies to promote renewable energy in the transport sector continued to focus primarily on road transport, which accounts for the vast majority of energy use in transport. Rail, aviation and shipping received less policy attention despite being large energy consumers.

As in previous years, biofuels were the primary focus of road transport policy frameworks. Although no new countries introduced biofuel blending mandates for the second year running (with the total remaining at 70 countries), some countries with existing mandates added new ones, and several existing mandates were strengthened. The number of countries with targets for advanced biofuels reached 24, although nearly all were targeting shares in the single digits.

Policies aimed at the electrification of transport, while not renewable energy policies in themselves, offer the potential for greater penetration of renewable electricity in the transport sector. In 2019, numerous jurisdictions implemented policies to support the increased uptake of electric road vehicles – including targets, financial incentives, public procurement and support for charging infrastructure. Targeted bans on fossil fuel vehicles were in place in at least 18 countries, up from 12 in 2018. Austria remained the only country that had a policy directly linking renewables with EVs, while only three cities had e-mobility targets that were directly linked to a renewable electricity target.

The private sector also advanced renewable energy initiatives in the transport sector, particularly for aviation, shipping and rail.

Policies and targets for
renewables in power
remain more ambitious and more numerous than those for other sectors.

POWER

Countries continued to turn to competitive auctions and tenders to support large-scale, centralised renewable power projects; however, rising attention was paid to decentralised systems.

The power sector continued to receive the bulk of renewable energy policy attention in 2019, and targets remained the most popular form of intervention. Many countries used competitive auctions and tenders in lieu of feed-in policies for large-scale, centralised projects. At least 68 renewable energy auctions or tenders were held across at least 41 countries at the national or state/provincial level, down from 48 countries in 2018. However, the total number of countries that have used this mechanism increased to 109 (up from 98 in 2018) as new countries held tenders for the first time. African countries were very active in 2019, although to a lesser degree than in 2018. Feed-in policies were in place in 113 jurisdictions by the end of 2019, with no change from 2018.

The uptake of policies targeting small-scale, distributed renewable power generation accelerated during the year. These policies include solar mandates, feed-in pricing, net metering (and virtual net metering) and public utility policy. Policies also were adopted to encourage community energy arrangements, including measures promoting community choice aggregation and shared ownership of renewables, especially in Europe and the United States.

The private sector engaged in various forms of renewable power procurement, including through PPAs, renewable energy certificates, utility-led procurement programmes and self-generation.

SYSTEMS INTEGRATION OF VARIABLE RENEWABLE ELECTRICITY

A growing number of jurisdictions directed policies towards ensuring greater integration of variable renewable electricity (VRE).

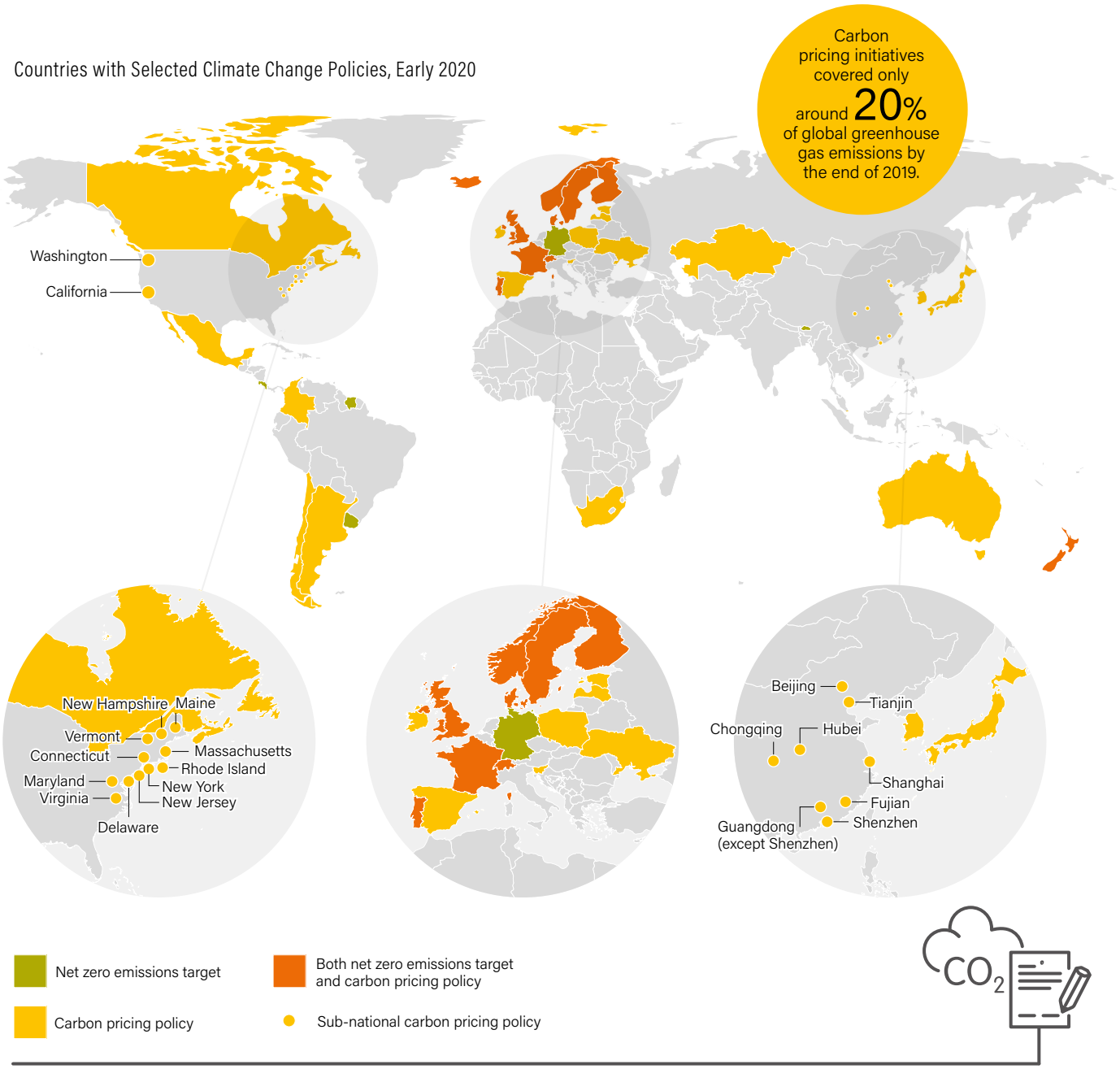
The policy push for systems integration of renewables and enabling technologies, such as energy storage, remained focused on increasing power system flexibility and control, as well as grid resilience. Policies to advance the integration of VRE in 2019 were related mainly to market design, demand-side management, transmission and distribution system enhancements, grid interconnections and support for energy storage. Much of the policy development occurred in Europe and at the state level in the United States.

RENEWABLE ENERGY AND CLIMATE CHANGE POLICY

Climate change policies that directly or indirectly stimulate interest in renewables increased in 2019, spreading to new regions and reaching new levels of ambition.

In some jurisdictions, policies directly link climate change mitigation with the increased deployment of renewables – such as Costa Rica's economy-wide roadmap launched in 2019 to achieve net zero emissions by 2050. However, other climate policies – such as fossil fuel bans and phase-outs, greenhouse gas emissions targets, and carbon pricing and emissions trading systems – stimulate the uptake of renewables indirectly. By the end of 2019, at least 56 carbon pricing initiatives in 47 countries had been implemented (up from 54 initiatives in 45 countries in 2018, with the addition of Singapore and South Africa). Fourteen countries worldwide had a legally binding target for net zero emissions (while two countries have already achieved this target), and the European Commission proposed a European Green Deal to create the first carbon-neutral continent by 2050.

Countries with Selected Climate Change Policies, Early 2020



Note: Figure does not show all climate policies but only carbon pricing policy use and net zero emissions targets. Carbon pricing policies include emissions trading systems and carbon taxes. Net zero emissions targets shown are binding and include those that are in law or policy documents, as well as those that have already been achieved.

Source: Based on World Bank and Energy and Climate Intelligence Unit.

03 MARKET AND INDUSTRY TRENDS

BIOENERGY

Modern bioenergy provided 5.1% of total global final energy demand in 2018, accounting for around half of all renewable energy in final energy consumption.

The contribution of modern bioenergy to heat in industry has grown about 2% in recent years, while its use for heating in buildings (mainly in Europe and North America) has fallen slightly. Bioenergy provides around 9% of industrial heat demand and is concentrated in bio-based industries such as paper and board. Biofuels, mostly ethanol and biodiesel, provide around 3% of transport energy, and global biofuels production increased 5% in 2019. Ethanol production grew around 2%, despite a decline in the United States, the major ethanol producer. Biodiesel production increased 13%, and Indonesia became the world's largest producer, overtaking the United States, where production declined some 7%.

In the electricity sector, bioenergy's contribution rose 9% in 2019, to 501 terawatt-hours (TWh). China extended its lead as the largest country producer, and bio-electricity growth also was strong in the EU, Japan and the Republic of Korea.

Notable trends in the bioenergy industry included the continuing rise in wood pellet production, especially to serve growing markets in Japan and the Republic of Korea, and increasing investment in hydrotreated vegetable oil (HVO) production. Production of HVO/HEFA (hydroprocessed esters and fatty acids) increased 12% in 2019, and investments in numerous additional plants were announced.

Global biofuels production

increased

5%

in 2019.

HYDROPOWER

The global hydropower market, as measured in annual capacity installations, contracted in 2019, continuing a multi-year trend of deceleration.

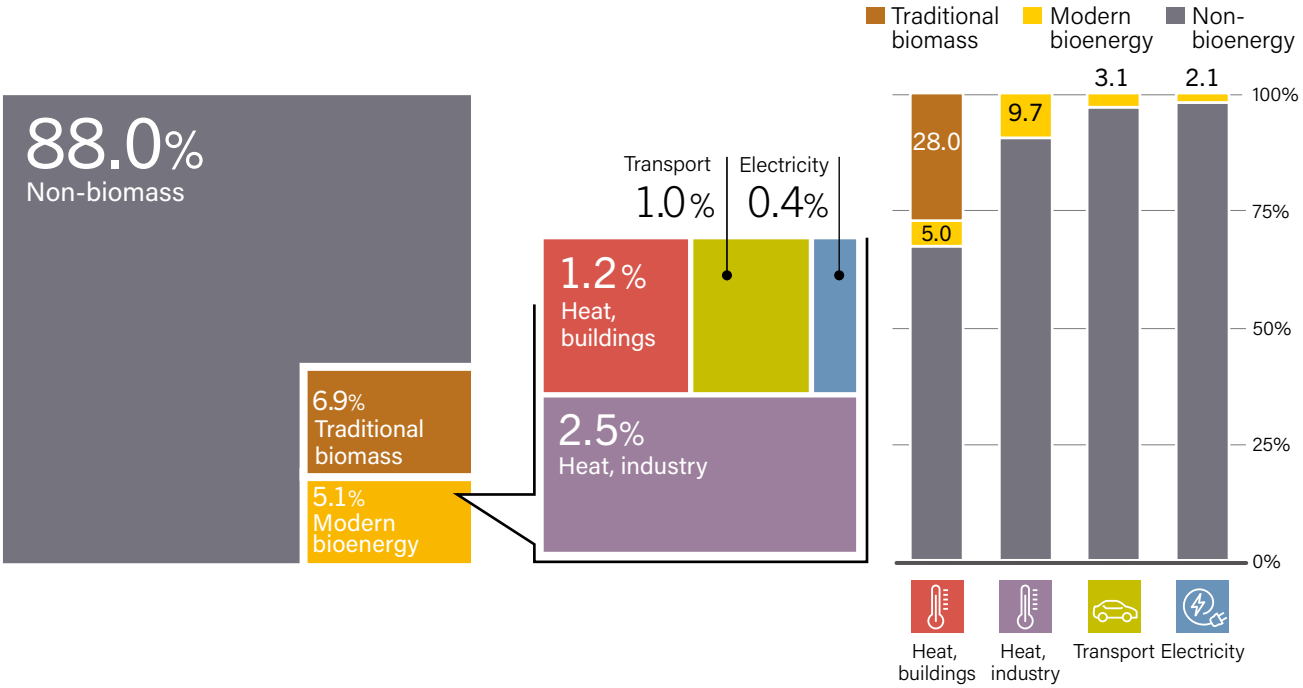
New capacity totalled an estimated 15.6 GW, raising the global installed capacity to around 1,150 GW in 2019. Hydropower generation increased 2.3% during the year 2019 to an estimated 4,306 TWh, reflecting not only increased capacity but also significant localised variability from shifting weather patterns and other operational conditions.

Brazil led in commissioning new hydropower capacity in 2019, followed by four Asian countries: China, Lao PDR, Bhutan and Tajikistan. This marked the first year since at least 2004 that China did not maintain a wide-margin lead over all other countries for new hydropower completions.

Pumped storage capacity grew minimally in 2019 (0.2%), with most of the increase being a single 300 megawatt (MW) facility completed in China. Total installed capacity at year's end was 158 GW. However, significant new capacity was being planned or under construction, in part to support growth in VRE from solar PV and wind power.

The hydropower industry continued to face a wide, interconnected, and evolving web of challenges and opportunities in a world of changing energy systems and priorities. Some are specific to the technical workings and economic considerations of the industry itself (such as the need for modernisation and climate resilience), while others pertain to hydropower's relationship with other renewable energy sources (such as integration of VRE), as well as other environmental, social, climate and sustainability imperatives.

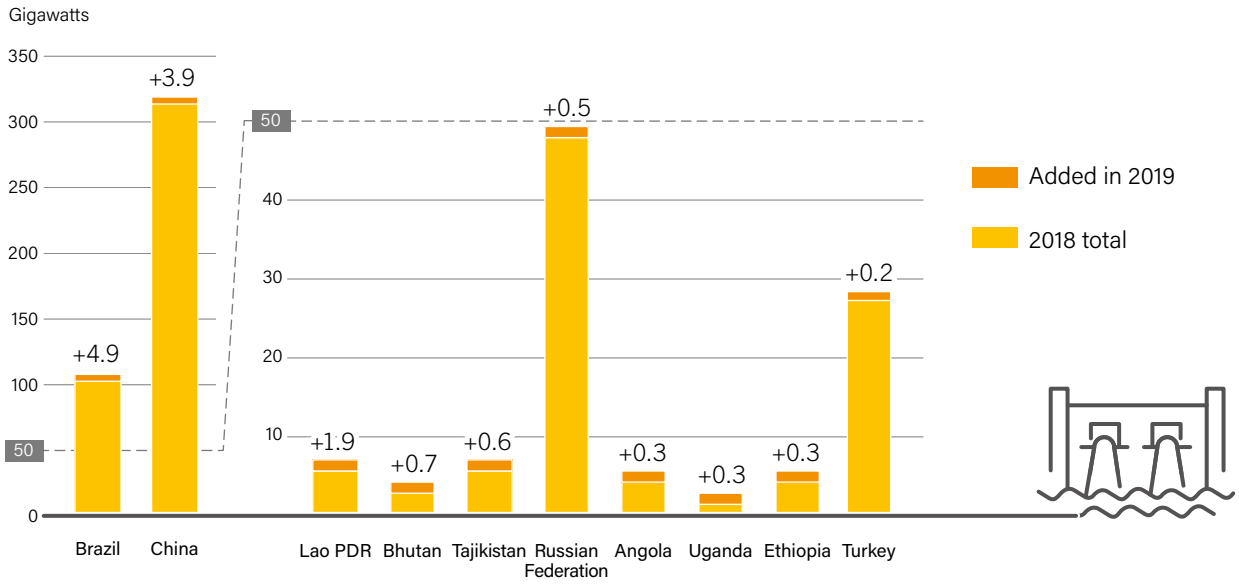
Estimated Shares of Bioenergy in Total Final Energy Consumption, Overall and by End-Use Sector, 2018



Note: Data should not be compared with previous years because of revisions due to improved or adjusted data or methodology. Buildings and industry categories include bioenergy supplied by district energy networks. Totals may not add up due to rounding.

Source: Based on IEA.

Hydropower Capacity and Additions, Top 10 Countries for Capacity Added, 2019



SOLAR PHOTOVOLTAICS (PV)

Following a year of stable demand, the solar PV market increased 12% in 2019 to a record 115 GW (direct current), for a total of 627 GW.

The decade ended with strong demand in Europe, the United States and emerging markets around the world, more than making up for a substantial decline in China. Not including China, the global market grew around 44%. China continued to dominate the world market as well as manufacturing, having a significant influence on both.

In most countries, the need still exists for support schemes for solar PV, as well as for adequate regulatory frameworks and policies governing grid connections. Even so, interest in purely competitive large-scale systems is growing quickly, with a number of projects under construction. Corporate purchasing expanded considerably in 2019, and self-consumption (increasingly with battery storage) was an important driver for new distributed systems in several countries, including Australia and Germany.

The industry continued to face relentless competition that, coupled with policy vagaries and uncertainty, prompted cut-throat bids at some auctions and resulted in thin margins for some developers and manufacturers, contributing to ongoing consolidation. At the same time, competition drove declining prices, opening new markets, while the pressure of lower prices and expectations of rising global demand encouraged expanded and more efficient manufacturing, the entry of new companies into the sector and ongoing pursuit of innovation.

During the year, solar PV accounted for around 10.7% of total generation in Honduras and substantial shares also in Italy (8.6%), Greece (8.3%), Germany (8.2%), Chile (8.1%) and elsewhere. By year's end, enough capacity was in operation worldwide to produce an estimated 2.8% of global electricity generation.

CONCENTRATING SOLAR THERMAL POWER (CSP)

Global CSP capacity in operation grew exclusively in emerging markets.

Global CSP capacity grew 11% in 2019 to 6.2 GW, with 600 MW of capacity coming online. Although this was well below the average annual increase (24%) of the past decade, CSP continued to spread to new markets, including France, Israel and Kuwait. China and South Africa also brought new plants into service. For the first time, as much tower capacity as parabolic trough capacity was completed during 2019.

At year's end, an estimated 21 GWh of thermal energy storage (TES) was operating in conjunction with CSP plants across five continents. Nearly all commercial CSP under construction – located in Asia, the Middle East and Latin America – will include TES.

The CSP industry has become more geographically diverse, both in the locations of commercial plants and in the origins of developers, investors and contractors. Levelised costs of energy from CSP continued to decline during 2018 and 2019, with CSP increasingly being built alongside both solar PV and wind power to lower costs and increase capacity value. R&D activities during the year focused on further improving CSP economics and on addressing environmental impacts.

SOLAR THERMAL HEATING AND COOLING

Solar thermal capacity reached 479 gigawatts-thermal in 2019, with China accounting for 69% of the total.

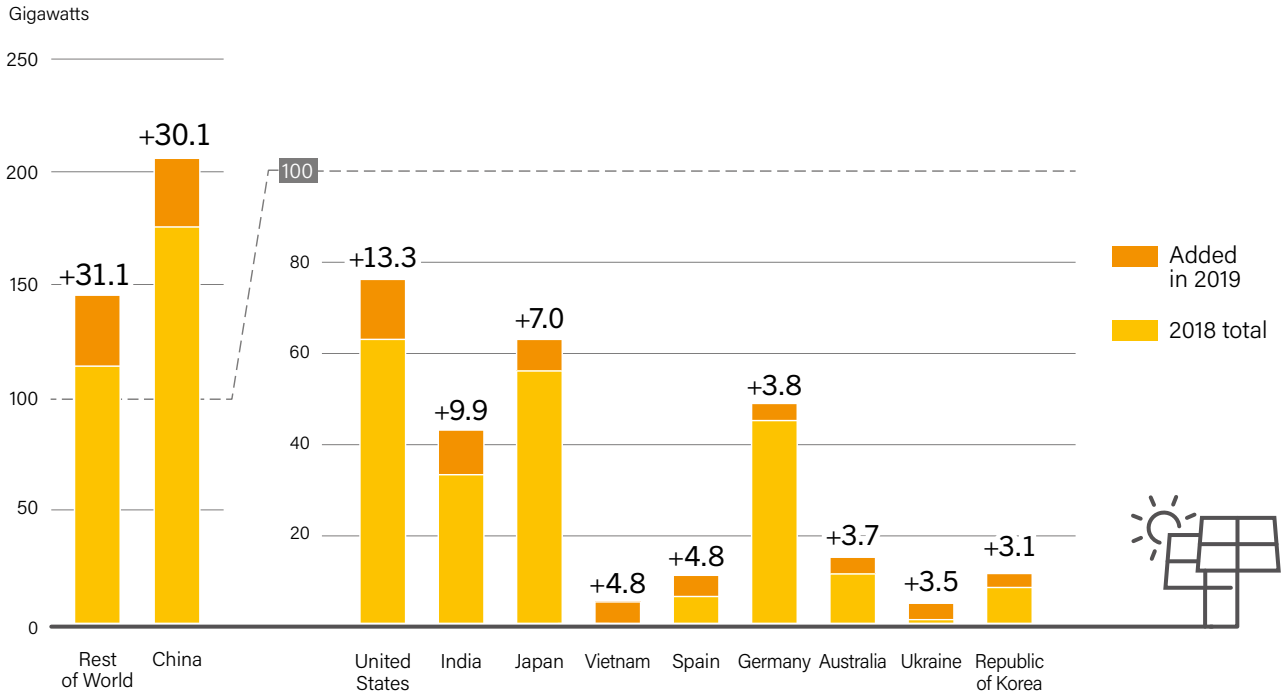
For the first time, cumulative global capacity declined (1%) compared with the previous year, because installations in China did not cover the country's need for replacements. Additions in the other largest markets for solar heating and cooling remained stable, with noteworthy growth in Brazil, Cyprus, Denmark, Greece, South Africa and Tunisia balancing declines in Australia, Austria, Germany, Israel, Italy, Poland and Switzerland.

The year was bright for solar district heating in Denmark, China and Germany, with 24 systems (totalling 196 megawatts-thermal, MW_{th}) newly commissioned. Successful development also generated interest elsewhere in Europe.

Record-high capacity additions of solar heat for industrial processes (SHIP), totalling 251 MW_{th}, also occurred during the year, led by Oman, China and Mexico. Parabolic trough collectors dominated new installations, and by year's end at least 817 SHIP systems (a cumulative total of more than 700 MW_{th}) were supplying process heat to factories worldwide. To reduce project development times and costs, system suppliers created mutually beneficial partnerships with conventional energy technology providers and with third-party financers.

The ongoing transition from small residential systems to large commercial and industrial plants resulted in consolidation among collector manufacturers, as large players gained market share through contracts for large fields or high numbers of systems.

Solar PV Capacity and Additions, Top 10 Countries for Capacity Added, 2019

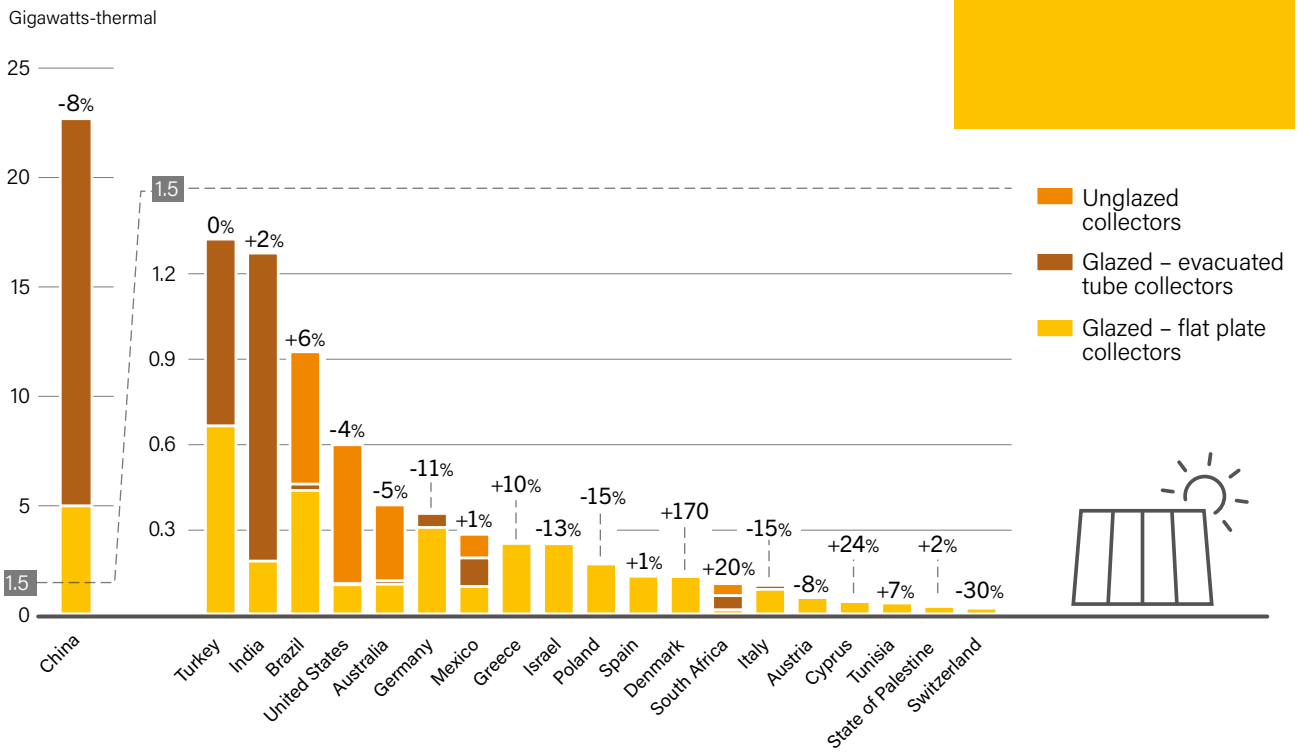


Note: Data are provided in direct current (DC).

New CSP capacity

was added exclusively in emerging markets.

Solar Water Heating Collector Additions, Top 20 Countries for Capacity Added, 2019



Note: Additions represent gross capacity added. New additions in China were based on produced collector area, and included export volumes in the national statistics for 2019 and earlier years.

GEOTHERMAL POWER AND HEAT

Geothermal electricity generation in 2019 totalled around 95 TWh, while direct useful thermal output reached around 117 TWh (421 petajoules).

An estimated 0.7 GW of new geothermal power generating capacity came online in 2019, bringing the global total to around 13.9 GW. As in 2018, Turkey and Indonesia led for new installations, followed closely by Kenya; together the three countries represented three-quarters of new installations globally. Other countries that added new geothermal power facilities (or added capacity at existing facilities) were Costa Rica, Japan, Mexico, the United States and Germany.

Direct use of geothermal energy for thermal applications has grown nearly 8% on average in recent years, with the fastest growing segment being space heating (around 13% annual growth). Among the most active markets are regions of Europe and China, the latter showing the fastest expansion. Just four countries – China, Turkey, Iceland and Japan – represented roughly 75% of all geothermal direct use in 2019.

As in many previous years, the global geothermal industry had mixed results. Construction activity and anticipation of further development remained intact in some key markets, but was largely predicated on government support. Elsewhere, the industry was inhibited by industry-specific challenges of high project costs and front-loaded project risks and by the corresponding lack of adequate funding and risk mitigation.

Continued research into new technologies and innovative processes and techniques, often supported by government programmes, helped fuel optimism for a path forward.

OCEAN POWER

Ocean power represented the smallest portion of the renewable energy market, and most deployments to date have been small-scale demonstration and pilot projects.

Despite the slow developments in the sector, the ocean power industry began moving towards semi-permanent installations and arrays of devices. The resource potential of ocean energy is enormous, but the development trajectory of ocean power technologies has been volatile, and these resources remain largely untapped.

Following a turbulent 2018, the ocean power industry regrouped in 2019 and continued its gradual advance towards commercialisation. Net additions in 2019 were around 3 MW, with an estimated 535 MW of operating capacity at year's end. Significant investments and deployments were planned for 2020 and beyond.

Ocean power development has been concentrated mainly in Europe, where tidal stream devices generated 15 gigawatt-hours (GWh) in 2019 (up 50% from 2018). However, ocean power was gaining momentum in Canada, the United States and China, which offer generous revenue support and ambitious research and development (R&D) programmes.

WIND POWER

The global wind power market saw its second largest annual increase, with offshore wind accounting for a record 10% of new installations.

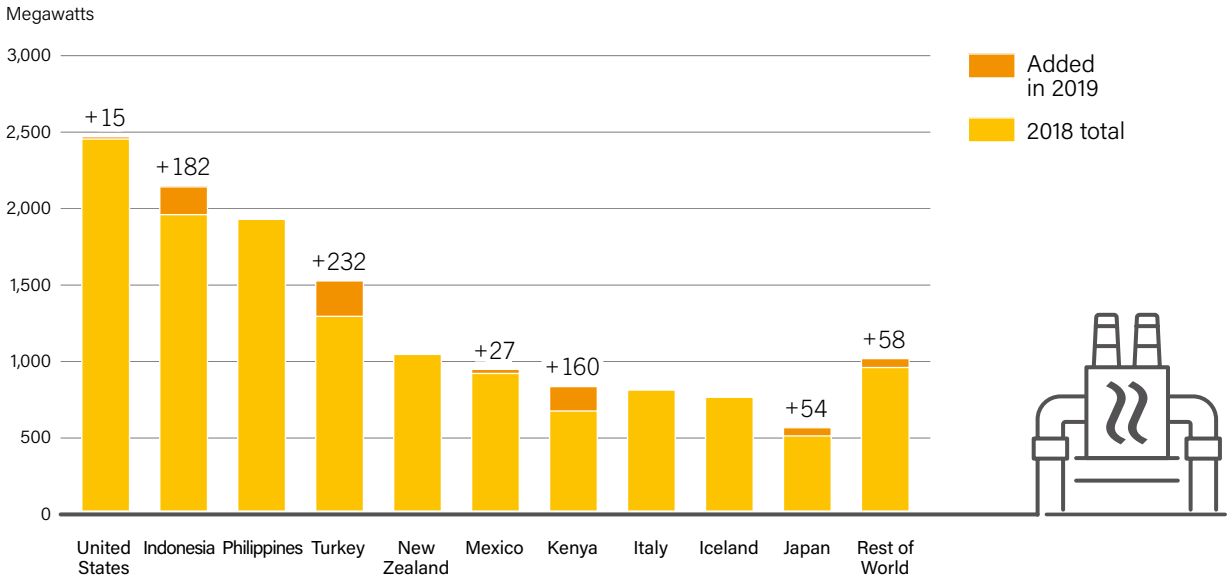
The global wind power market expanded 19% in 2019 to 60 GW, the second largest annual increase, for a total of 650 GW (621 GW onshore and the rest offshore). The rapid growth was due largely to surges in China and the United States in advance of policy changes and to a significant increase in Europe, despite continued market contraction in Germany. New wind farms reached full operation in at least 55 countries, and by year's end at least 102 countries had some level of commercial wind power capacity.

While falling prices are opening new markets, the global transition to auctions and tenders has resulted in intense price competition. Poorly designed tenders, permitting delays and lack of available land and grid access are challenging wind developers in many countries and causing attrition among turbine manufacturers. The industry is working to meet new challenges with improved technologies and other advances to further reduce costs and better integrate wind energy into existing energy systems.

Offshore wind power is playing an increasingly important role and accounted for a record 10% of 2019 installations. Interest in hybrid projects, combining wind power with solar and/or energy storage, is increasing to reduce energy prices while mitigating impacts of variability and expanding revenue opportunities.

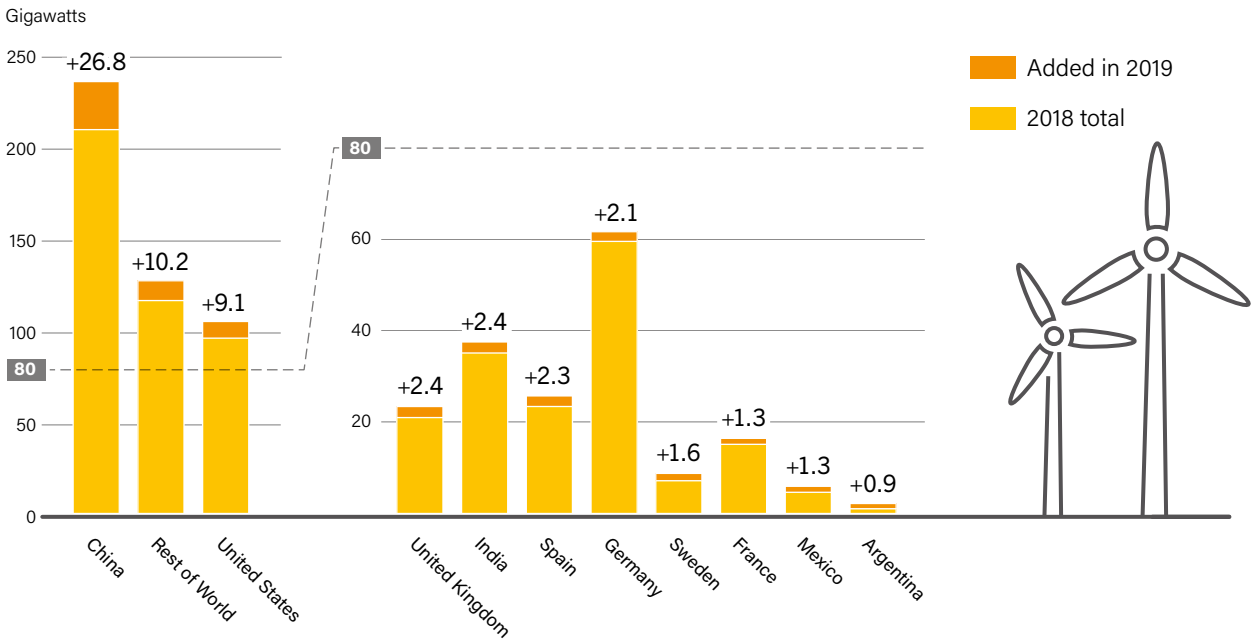
Wind energy accounted for an estimated 57% of Denmark's electricity generation in 2019, with high shares also in Ireland (32%), Uruguay (29.5%), Portugal (26.4%) and several other countries. Capacity in operation worldwide at year's end was enough to provide an estimated 5.9% of global generation.

Geothermal Power Capacity and Additions, Top 10 Countries for Capacity Added and Rest of World, 2019



Offshore wind power additions accounted for **10%** of all newly installed capacity, up from 5% in 2015.

Wind Power Capacity and Additions, Top 10 Countries, 2019



Note: Additions are net of decommissioning.

04 DISTRIBUTED RENEWABLES FOR ENERGY ACCESS (DREA)

DREA systems have become an effective, established solution for providing energy access, and benefited some 150 million people around the world in 2019.

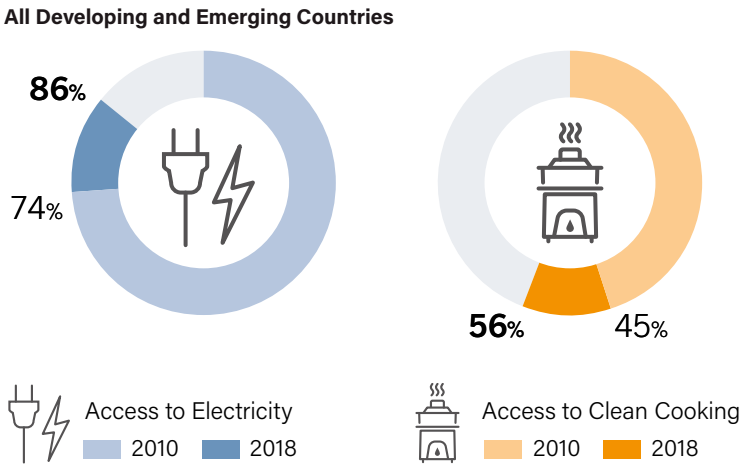
Worldwide, the number of people lacking access to electricity dropped to 860 million (11% of the global population) in 2018, and an estimated 2.65 billion people (35% of the global population) were living without clean cooking facilities that year. DREA systems are present in both urban and rural areas of the developing world and provide a wide range of services, including for lighting, appliances, cooking, space heating and cooling, and productive uses. They represent a key solution for fulfilling modern energy needs and enabling the livelihoods of hundreds of millions of people who still lack access to electricity or clean cooking solutions.

Since 2010, more than 180 million off-grid solar systems have been sold, including 150 million pico solar products and 30 million solar home systems. The market for off-grid solar systems grew 13% in 2019 – the highest growth of the past five years – with sales totalling some 35 million units, up from 31 million units in 2018. In addition, renewable energy (mostly hydropower) supplied, either entirely or partially, around half of the 19,000 mini-grids installed worldwide by the end of 2019. Solar PV and solar hybrid mini-grids continued to gain momentum as more projects were developed across Africa and Asia.

Biomass cook stoves, biogas and solar cookers, and electric stoves were being deployed and piloted in many developing countries. An estimated 125 million people worldwide used biogas for cooking in 2018, and by the end of 2019 more than 3.9 million solar cookers were estimated to have been distributed, providing clean cooking solutions to around 14 million people.

Corporate-level investments in the DREA sector totalled around USD 468 million in 2019, down 8.5% from 2018. At the same time, capital flows in mini-grid start-ups surged 126% to a record USD 113 million. Development finance institutions, international organisations, philanthropic foundations and non-state actors provided significant support to the DREA sector in many countries by addressing policy barriers, enhancing the enabling framework, and offering technical assistance and financing to governments and companies.

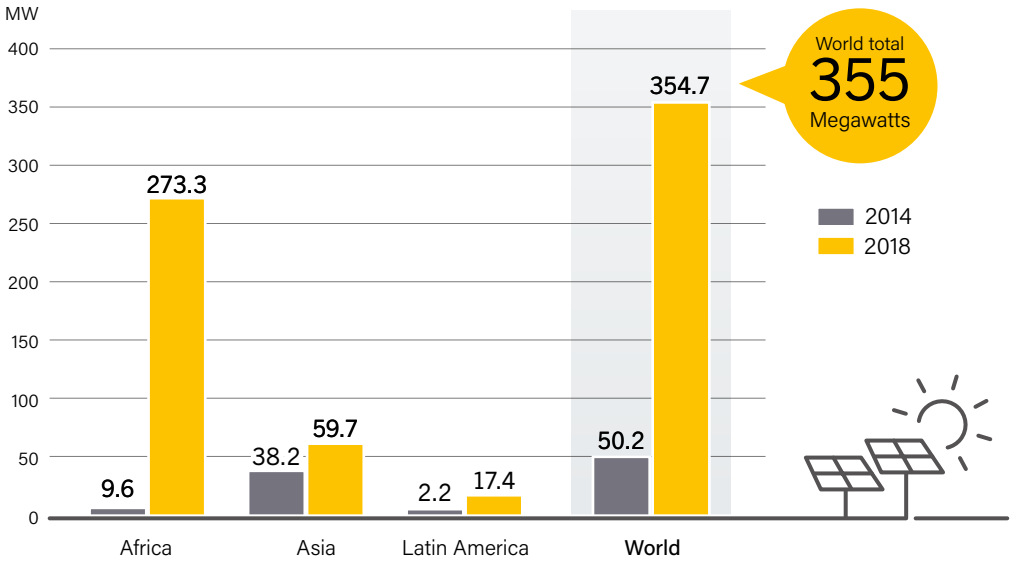
Access to Electricity and Clean Cooking by Region, 2010 and 2018



Source: IEA.

Clean cooking attracted **less than 1%** of the USD 4.4 billion investment required annually to achieve universal access in the sector.

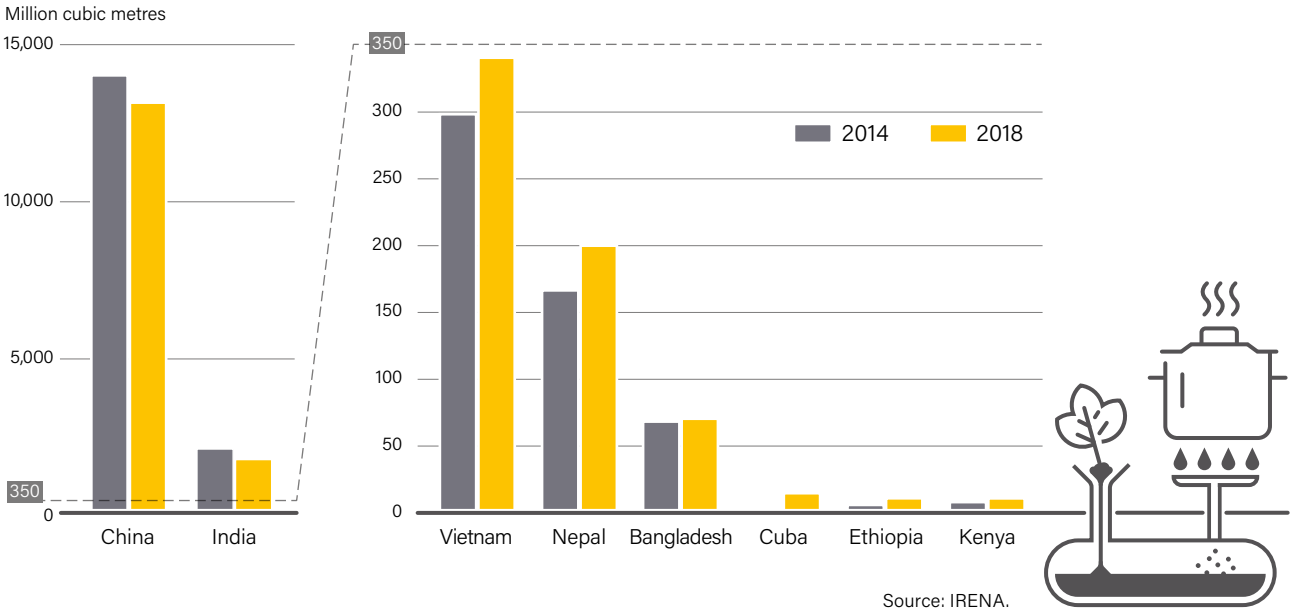
Installed Capacity of Solar PV Mini-Grids, Selected Regions and World, 2014 and 2018



Note: World total may not add up due to rounding.

Source: IRENA.

Production of Biogas for Cooking in Selected Countries, 2014 and 2018



Source: IRENA.

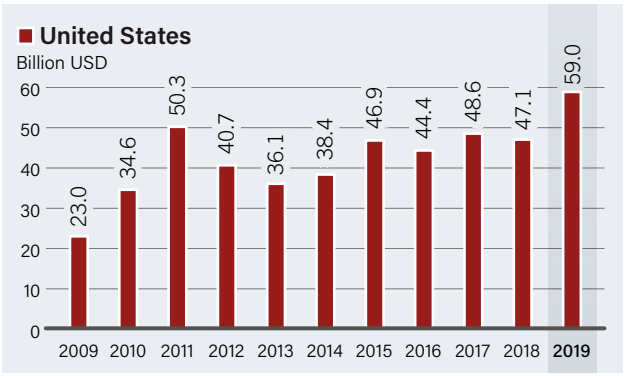
05 INVESTMENT FLOWS

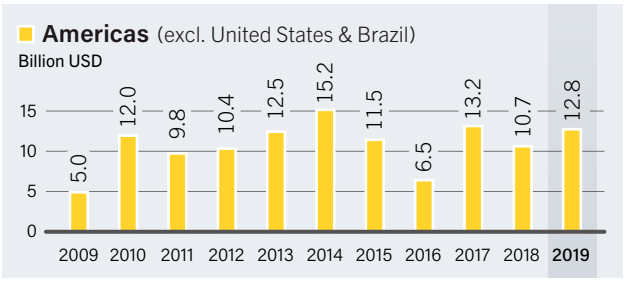
Global investment in renewable energy capacity remained nearly flat in 2019, although more capacity was financed due to continuous falling capital costs.

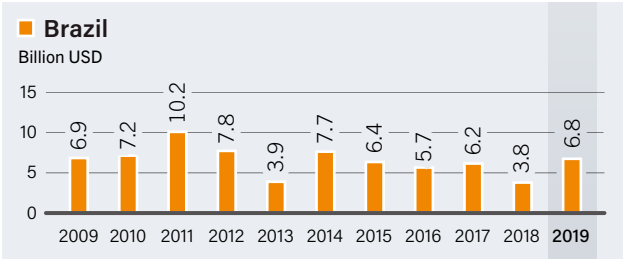
Global new investment in renewable power and fuels (not including hydropower projects larger than 50 MW) totalled USD 301.7 billion in 2019, up 5% from 2018. Including investments in hydropower projects larger than 50 MW, total new investment in renewable power and fuels was at least USD 316.7 billion. Global investment in renewable energy capacity has exceeded the USD 200 billion mark every year since 2010, reaching USD 282 billion in 2019.

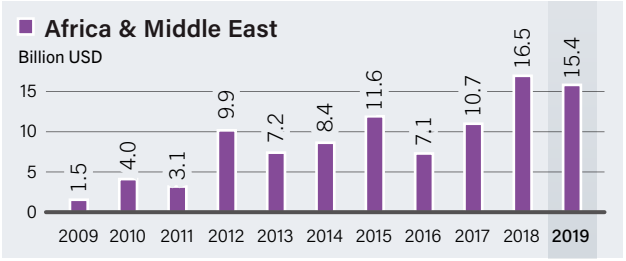
Dollar investment in new renewable power capacity (including all hydropower) again far exceeded investment in coal, natural gas and nuclear power capacity in 2019, accounting for 75% of the total committed to new power generating capacity. Investment in renewables continued to focus on wind and solar power, with wind power outweighing solar PV for the first time since 2010. Asset finance of utility-scale projects, such as wind farms and solar parks, secured USD 230.1 billion during 2019. Investment in small-scale solar PV installations (less than 1 MW) increased 43.5% to USD 52.1 billion worldwide.

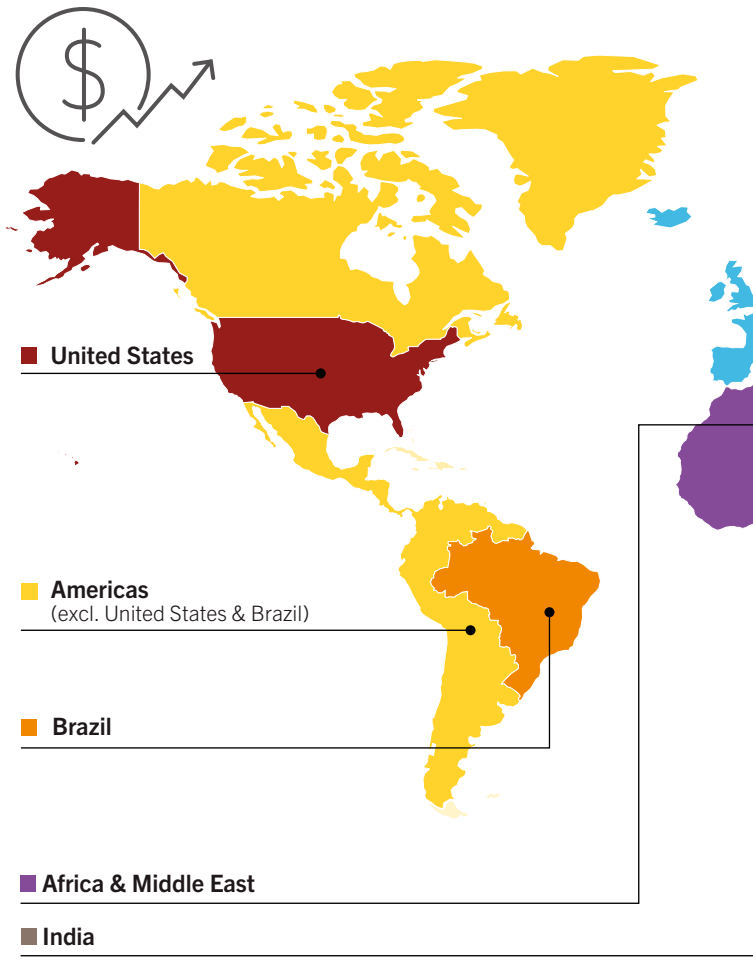
Global Investment in Renewable Power and Fuels, by Country and Region, 2009-2019

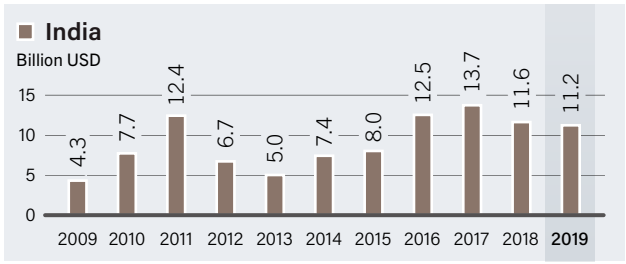












Note: Investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals.

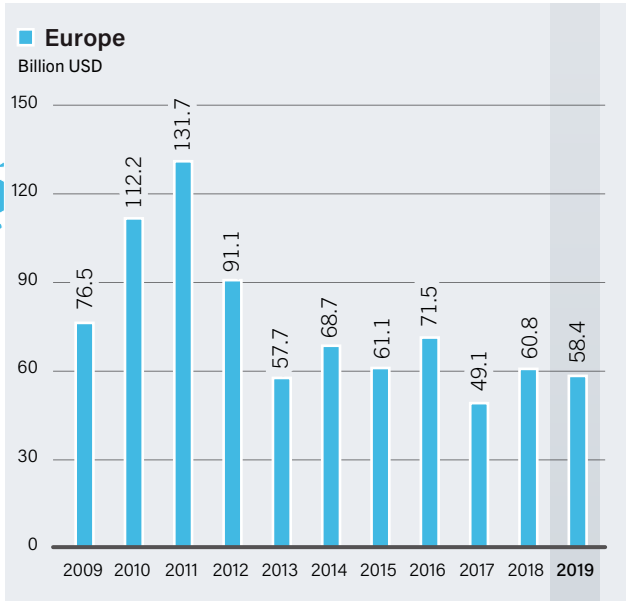
Developing and emerging economies outweighed developed countries in renewable energy capacity investment for the fifth year running, reaching USD 152 billion. Although capacity investment declined in both China and India, outside these two countries it rose 17% in developing countries to a record USD 59.5 billion. In parallel, renewable energy capacity investments in developed countries increased 2% to USD 130 billion.

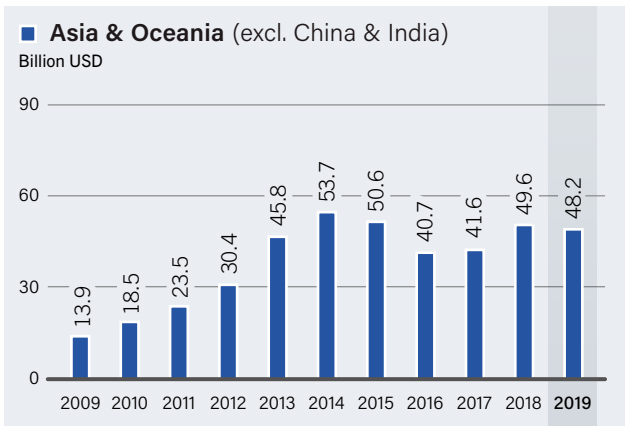
Renewable energy investment varied by region, rising in the Americas, including the United States and Brazil, but falling in all other world regions including China, Europe, India, and the Middle East and Africa. Considering all financing of renewable energy capacity (but excluding hydropower larger than 50 MW), China again had the largest share (30%), followed by the United States (20%), Europe (19%) and Asia-Oceania (16%; excluding China and India). Smaller shares were seen in Africa and the Middle East (5%), the Americas (excluding Brazil and the United States, 4%), India (3%) and Brazil (2%).

Investments in renewable power and fuel capacity accounted for USD 282.2 billion in 2019,

up only 1%

from 2018.





Source: BloombergNEF.

06 ENERGY SYSTEMS INTEGRATION AND ENABLING TECHNOLOGIES

Countries integrated more solar PV and wind power than ever through a range of measures, supported by expanding markets for heat pumps, EVs and energy storage.

Growth in renewable energy is transforming energy systems around the world. In the power sector in particular, rapid growth in the installed capacity and penetration of variable renewable electricity sources – such as solar PV and wind power – has occurred in many countries. In 2019, VRE produced an estimated 8.7% of global electricity, while all renewables met 27.3% of global generation.

Improving power system flexibility is central to advancing the integration of VRE. Power system flexibility is being enhanced through: strategic market design that rewards or promotes flexibility; direct procurement of flexibility services from sources of generation, demand and energy storage; improved forecasting of electricity demand and of VRE generation and demand; and the improvement of grid infrastructure to support VRE uptake.

Several technologies are supporting the integration of renewables by enabling greater flexibility in energy systems or by promoting the linking of energy supply and demand across electricity, thermal and transport applications. These include mature or commercialised technologies such as heat pumps, EVs and certain types of energy storage, and emerging energy storage technologies including renewable hydrogen.

The heat pump market has grown rapidly in recent years, driven largely by rising demand for cooling in emerging economies and by strong sales of reversible air conditioning units used for both cooling and heating. Notable activity in 2019 included investments by large technology companies in specialised heat pump firms, a focus on incremental cost and efficiency improvements, and the integration of heat pumps alongside renewables and energy storage using digital technologies.

The global stock of electric cars (passenger EVs) grew more than 40% in 2019, up more than 2 million from 2018. However, growth was lower than in 2018, when the global stock jumped 63% from the previous year. The global stock of two- and three-wheeled EVs reached some 251 million in 2019, while sales of electric buses declined for the fourth consecutive year. The EV industry in 2019 was characterised by diverse commitments and investments from both dedicated EV manufacturers and traditional automakers. VRE was increasingly available on EV charging networks.

The global market for energy storage of all types reached 183 GW in 2019. Around 0.3 GW of pumped (hydropower) storage was added in 2019, while the leading markets for battery storage had mixed results. Renewables-plus-storage has emerged as a major driver of battery market growth. The energy storage industry saw significant cost improvements, increased manufacturing capacity, large investments and ongoing R&D during 2019, with many of these activities focused on short-duration storage applications and battery technologies.

07 ENERGY EFFICIENCY AND RENEWABLES

Global energy intensity has continued to fall in recent years, and an integrated approach for advancing both renewables and energy efficiency remains crucial.

International efforts to meet energy demand in a safe and reliable manner generally acknowledge the complementary nature of renewable energy deployment and energy efficiency measures. Both renewables and efficiency can contribute significant benefits including lower energy costs on a national, corporate or household level, increased grid reliability, reduced environmental and climate impacts, improved air quality and public health, and increased jobs and economic growth. Coalitions of governments, corporations, institutions and non-governmental organisations have boosted global energy efficiency efforts, recognising the potential to greatly reduce greenhouse gas emissions.

Global primary energy intensity – the amount of energy used per unit of GDP – fell more than 10% between 2013 and 2018, although the annual improvement slowed over the period. The decline in energy intensity has been facilitated in part by the uptake of renewables, as the use of some sources of renewable power – particularly hydropower, solar PV and wind power technologies – lessens the amount of primary energy needed to meet final energy needs by reducing the overall transformation losses in generation. Meanwhile, improvements in final energy intensity reduce overall energy demand, and can enable the same renewable energy sources to supply a larger share of the world's final energy needs.

In member countries of the Organisation for Economic Co-operation and Development (OECD), final energy intensity improved 14% between 2007 and 2017; during this same period, consumption of renewable energy increased around 42%, while the share of modern renewables in TFEC rose 44%. In non-OECD countries, the improvement in final energy intensity was even greater during the decade (25%), but these countries also saw large increases in energy demand driven by rapid economic growth and improved energy access. As a result, while the absolute amount of renewable energy in TFEC grew at a higher rate in non-OECD countries than in OECD countries (68%), the share of renewables in TFEC in these countries increased to a lesser extent (29%).

In buildings, total energy demand continued to increase steadily despite energy efficiency improvements, due primarily to increasing population and incomes. Energy demand for transport also surged during 2000-2018 and has far exceeded the effect of greater vehicle efficiency. Energy demand in industry has grown only slightly in recent years, mitigated by structural changes as well as by greater energy efficiency.

Renewables and energy efficiency maximise their **emissions mitigation potential** when pursued together.

08 FEATURE: PUBLIC SUPPORT FOR RENEWABLES

Public support for renewables has expanded in general, although some individual projects have faced opposition. Governments are using a diverse range of levers to increase support for renewables.

The views of local communities are a key factor in the uptake of renewables but are only one part of the broader social acceptance of renewables. A number of complex factors can influence the public's reactions towards local or regional renewable energy projects, including perceptions of health and environmental impacts; perceptions of the distribution of economic costs and benefits; and the perceived fairness of the consenting process.

Opinion polls have consistently indicated strong public support for the expansion of renewables, due in part to the multiple benefits that these technologies provide. However, some individual renewable energy projects have faced opposition from local host communities. This creates an apparent "social gap" between strong overall support for renewables at the societal level and disapproval with specific proposed projects at the local level.

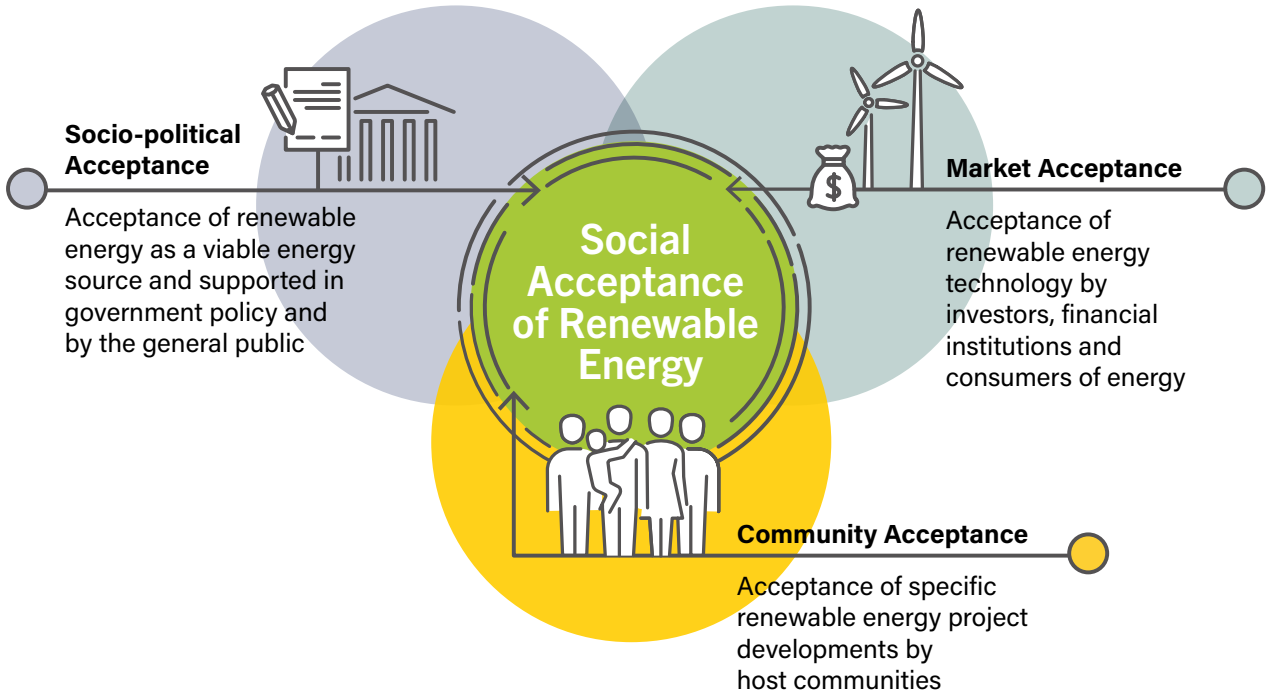
At a societal level, climate protests and litigation often are aligned with implicit support for renewable energy – such as the strikes and protests during 2019 involving millions of people across 150 countries demanding political action on climate change. On the other hand, perceptions of unfairness or a lack of transparency can lead the public to oppose policies intended to support an energy transition, such as in France, where protests emerged in late 2018 against government energy policies that disproportionately impacted lower-income households.

At the local level, movements for energy sufficiency and conservation have spread around the world, and the numbers of both community renewable energy projects and prosumers continue to increase. At the same time, host communities may oppose certain forms of infrastructure development including renewables because of the perceived impacts on the character of a neighbourhood or landscape.

Governments have sought to build public support through a wide range of measures, including public awareness campaigns, such as Mauritius' campaign to increase the presence of women in the renewable energy sector. Other popular measures include improving public participation in the development and procurement of renewable energy, which often is encouraged through the development of feed-in tariff schemes, peer-to-peer models and prosumer community groups.

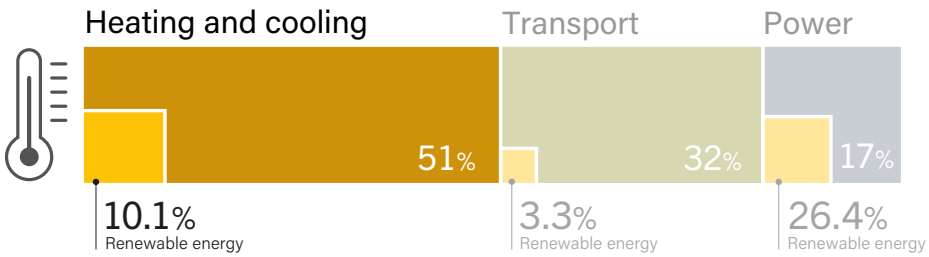
Many governments have looked to share the economic benefits of renewables with host communities by establishing Just Transition Funds and by developing more "passive" forms of financial participation, such as community benefits packages and option-to-purchase share schemes. Some governments also have started to engage with the concept of energy democracy by requiring greater public participation in the project planning process for renewables. For example, developers of solar and hydropower plants in Kazakhstan and Tajikistan were required to consult with communities as part of their Stakeholder Engagement Plans.

Dimensions of Social Acceptance of Renewable Energy



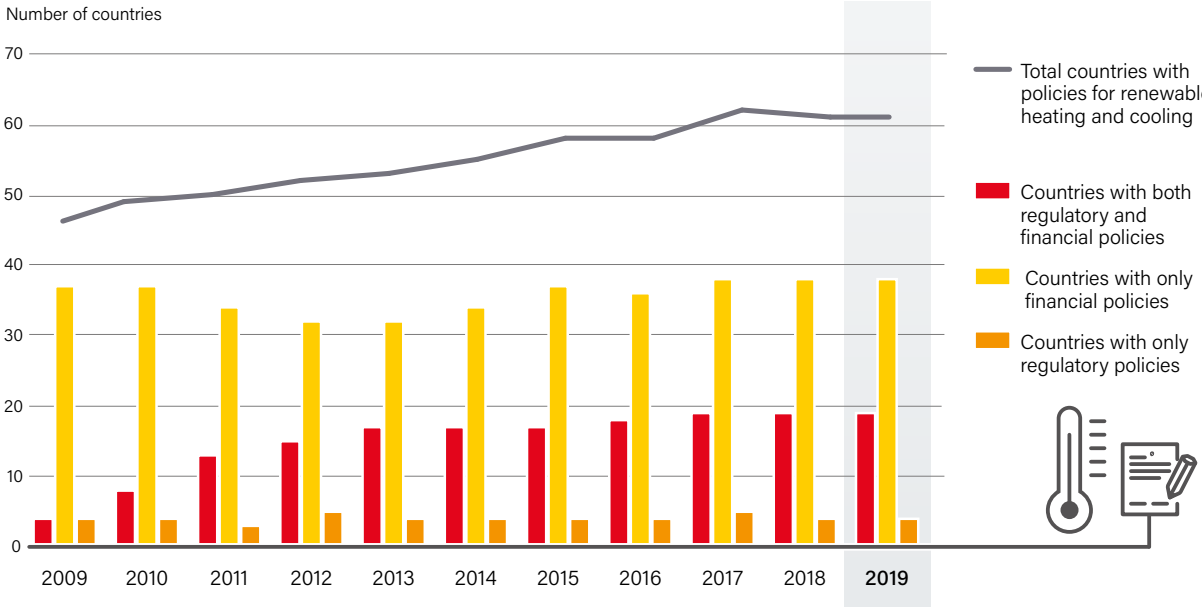
HEATING & COOLING IN NUMBERS

Renewable Share of Total Final Energy Consumption, 2017



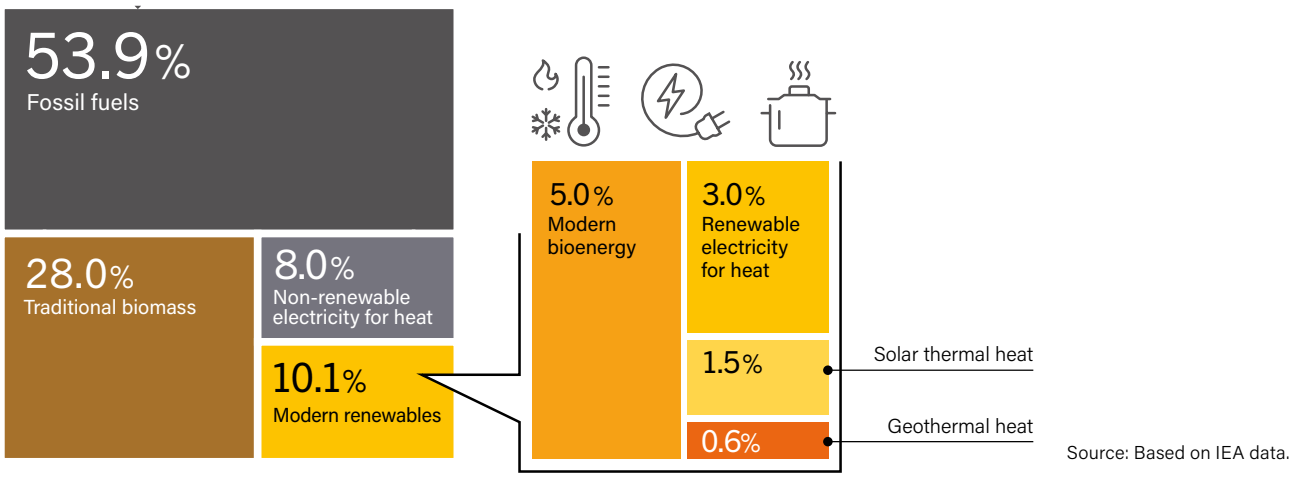
No new countries have adopted renewable energy financial support policies for heating and cooling since 2017.

Countries with Policies for Renewable Heating and Cooling, 2009-2019



Note: Regulatory policies include solar heat obligations, technology-neutral renewable heat obligations, renewable heat FITs, and fossil fuel bans for heating and cooling at the national or state/provincial level. Financial policies include investment subsidies, grants, rebates, tax credits, tax deductions and exemptions, and loans.

Estimated Renewable Share of Heating and Cooling in Buildings, 2018



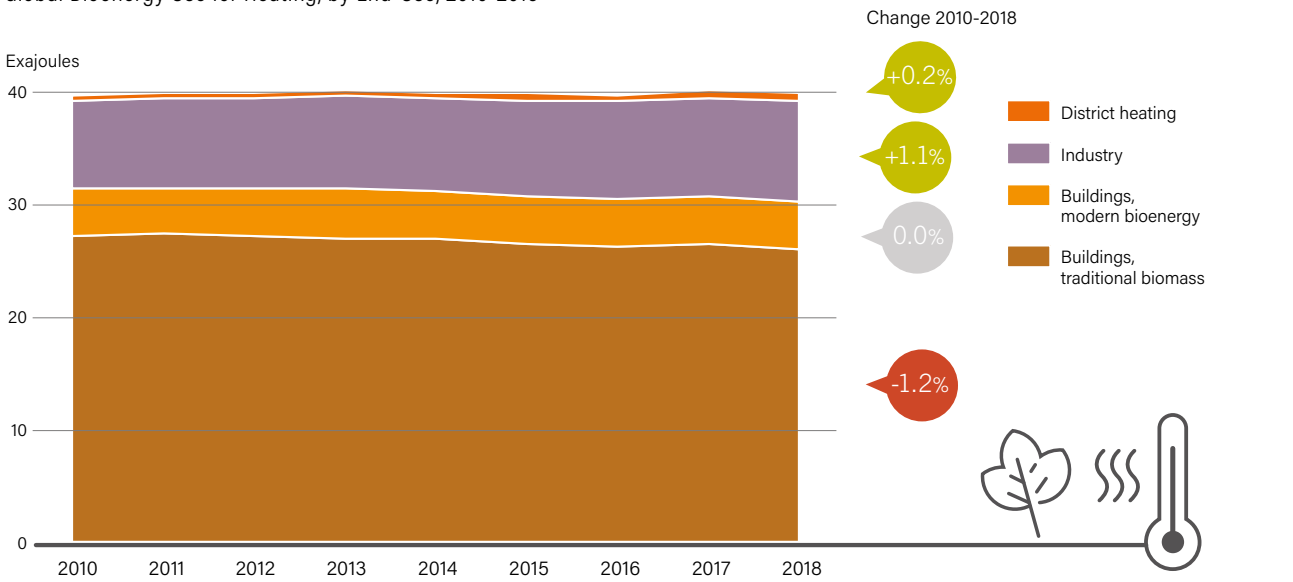
Source: Based on IEA data.

Note: Includes space heating, space cooling, water heating and cooking. Modern bioenergy includes heat supplied by district energy networks.

Geothermal

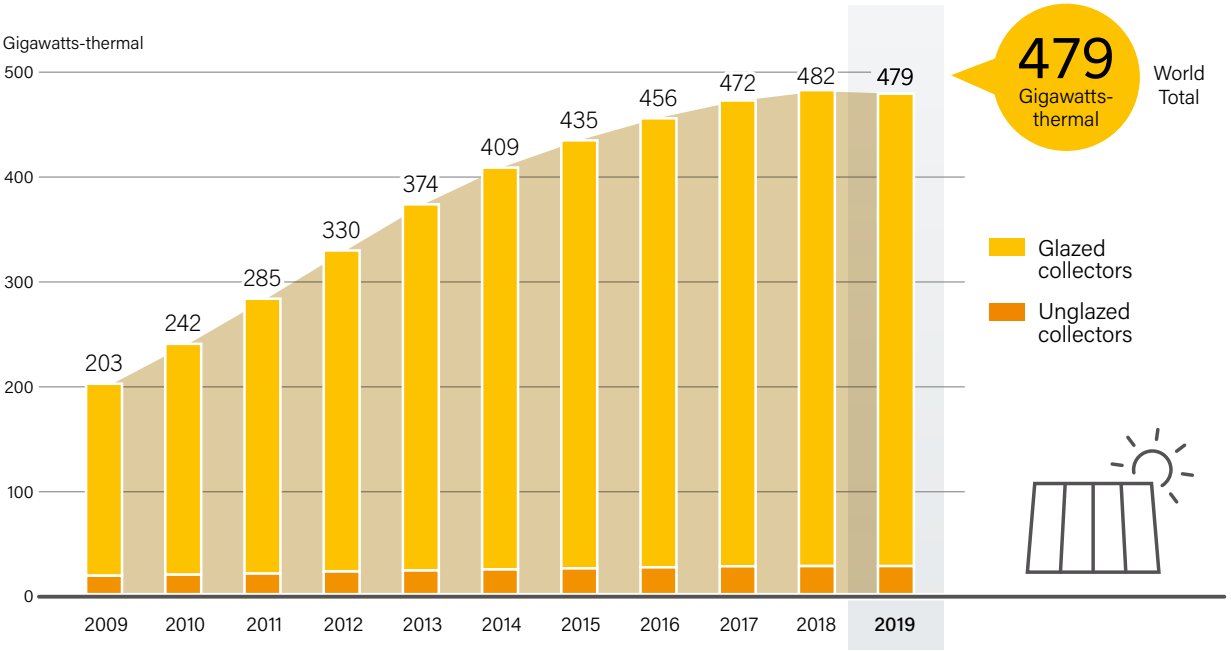
direct use grew 9% in 2019, most rapidly in space heating.

Global Bioenergy Use for Heating, by End-Use, 2010-2018



Source: Based on IEA.

Solar Water Heating Collectors Global Capacity, 2009-2019

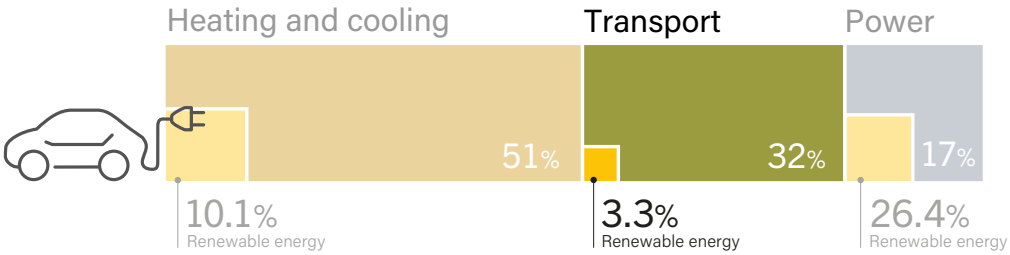


Note: Data are for glazed and unglazed solar water collectors and do not include concentrating, air or hybrid collectors. New additions in China were based on produced collector area, and included export volumes in the national statistics for 2019 and earlier years.

Source: IEA SHC.

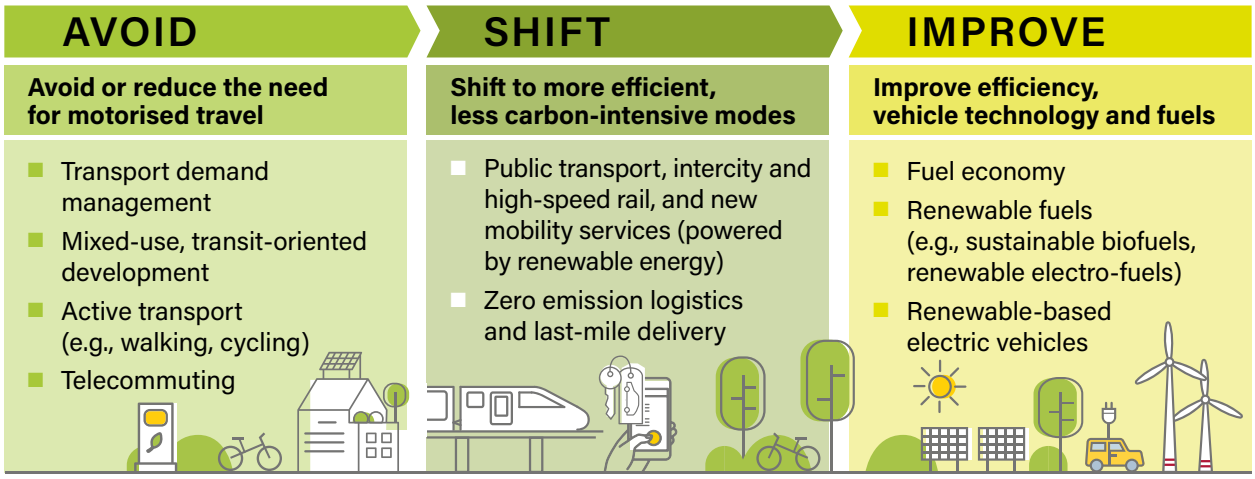
TRANSPORT IN NUMBERS

Renewable Share of Total Final Energy Consumption, 2017



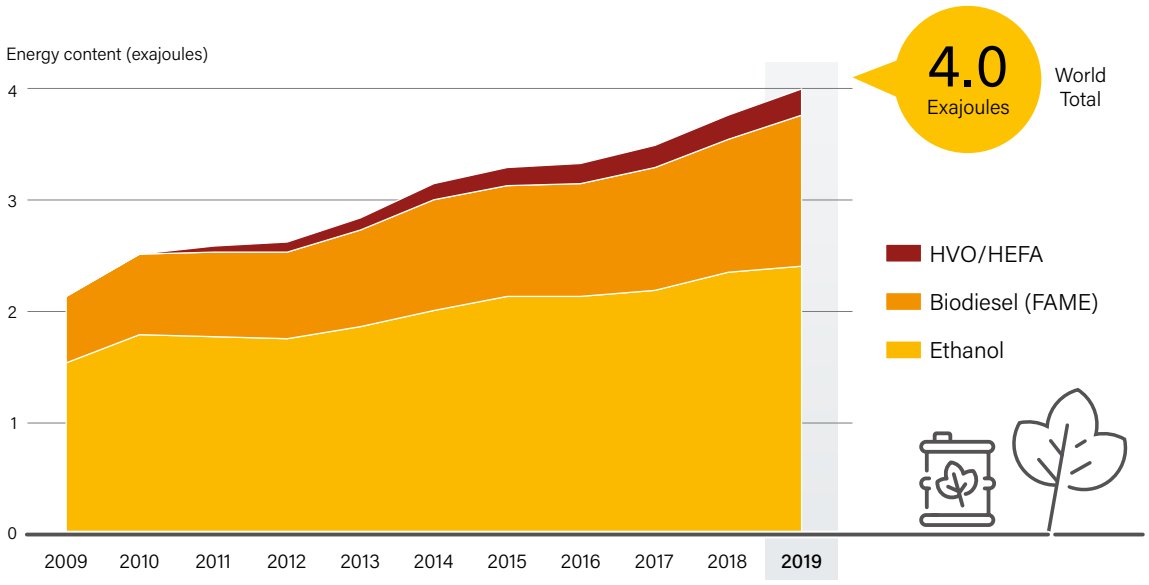
Biofuel blending mandates
remain the most widely adopted renewable energy support policy in the transport sector.

Avoid-Shift-Improve Framework in the Transport Sector



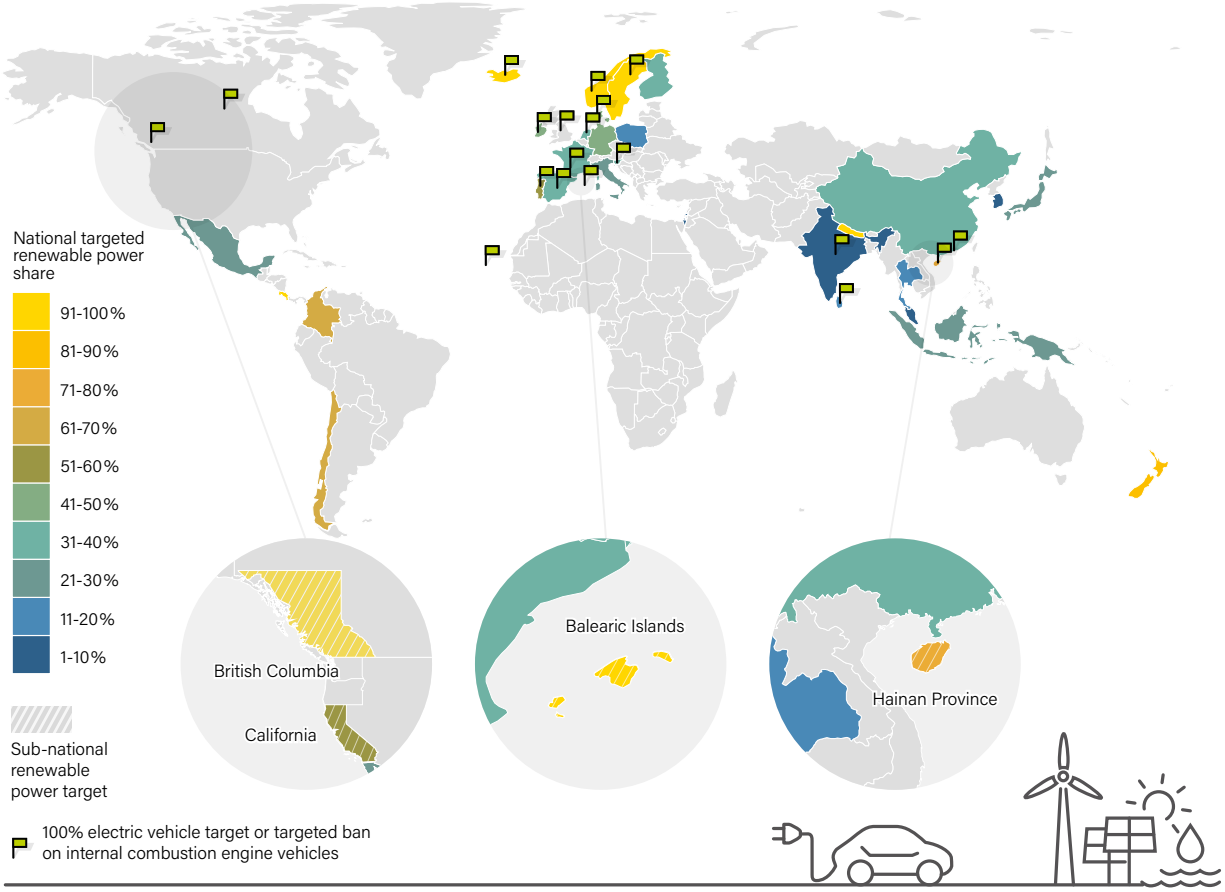
Note: Transport demand management refers to encouraging travelers to avoid trips or shift to more resource-efficient options to limit vehicle traffic. Mixed-use development refers to having more than one use or purpose within a building or development area, ranging from housing on upper floors of a building and office or commercial space on the ground floor, to comprehensive developments with multiple buildings having separate but compatible uses. Transit-oriented development refers to mixed urban development around or near a transit station to reduce the need for motorised trips.

Global Production of Ethanol, Biodiesel and HVO/HEFA Fuel, by Energy Content, 2009-2019



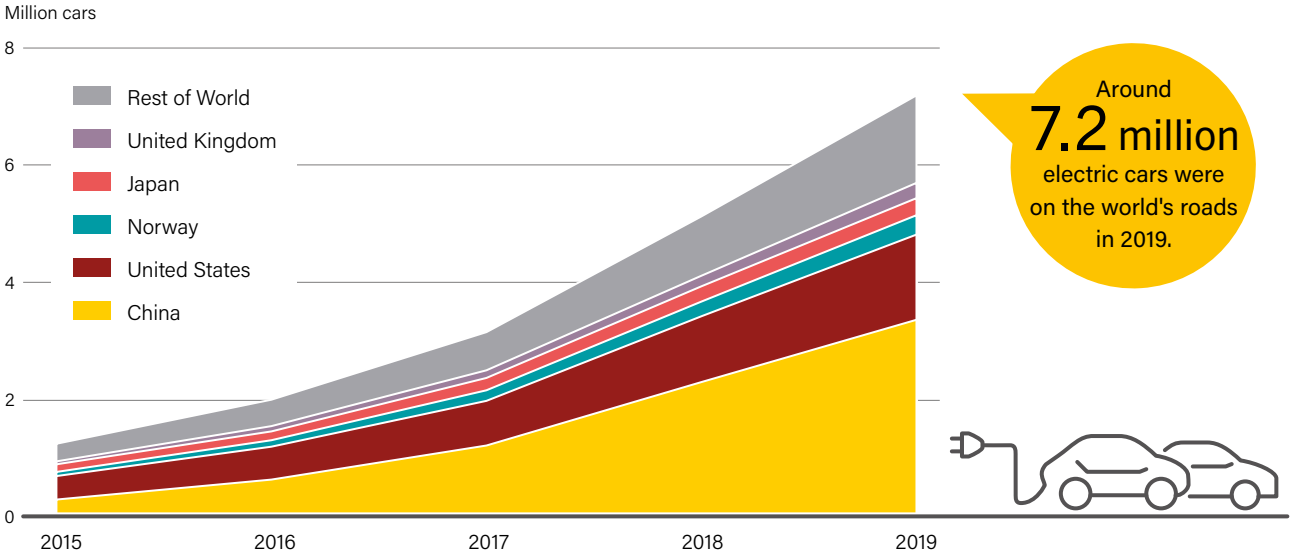
Note: HVO = hydrotreated vegetable oil; HEFA = hydrotreated esters and fatty acids; FAME = fatty acid methyl esters

Targets for Renewable Power and Electric Vehicles, as of End-2019



Note: Renewable power targets include only targets for a specific share of electricity generation by a future year. Where a jurisdiction has multiple targets, the highest target is shown. Electric vehicle targets vary.

Electric Car Global Stock, Top Countries and Rest of World, 2015-2019

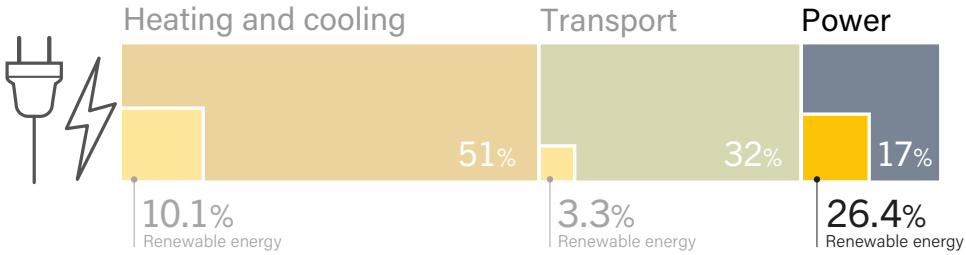


Note: Includes battery electric vehicles and plug-in hybrid electric vehicles. Shows countries among the top 5 according to the best available data at the time of publication.

Source: IEA.

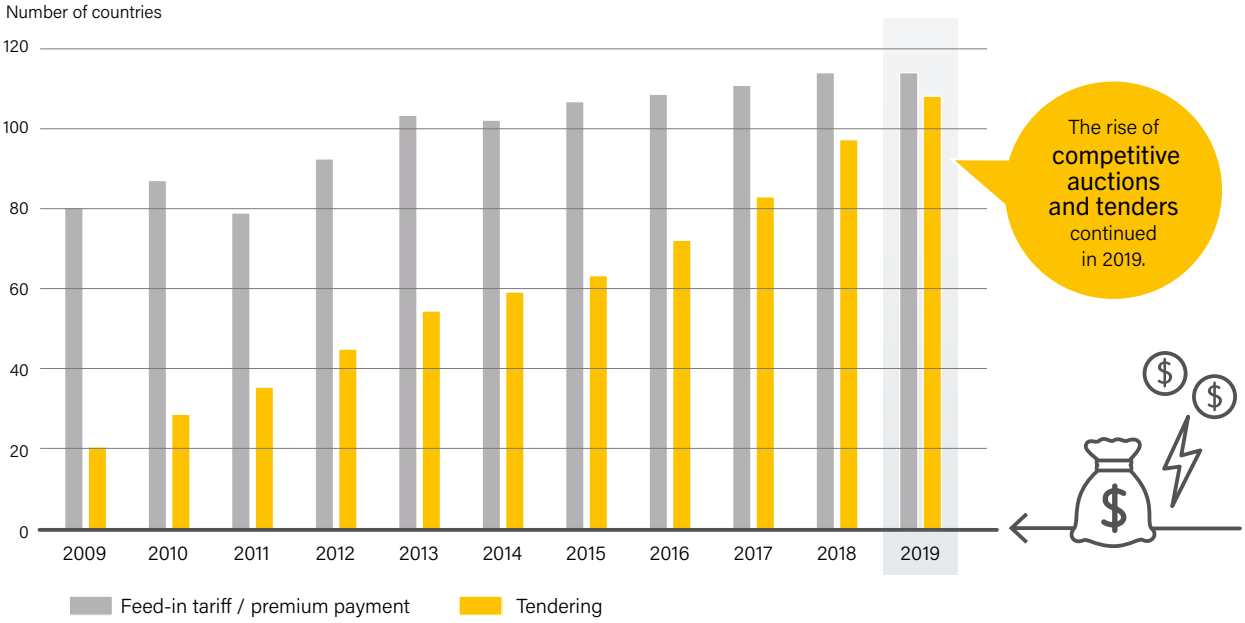
POWER IN NUMBERS

Renewable Share of Total Final Energy Consumption, 2017



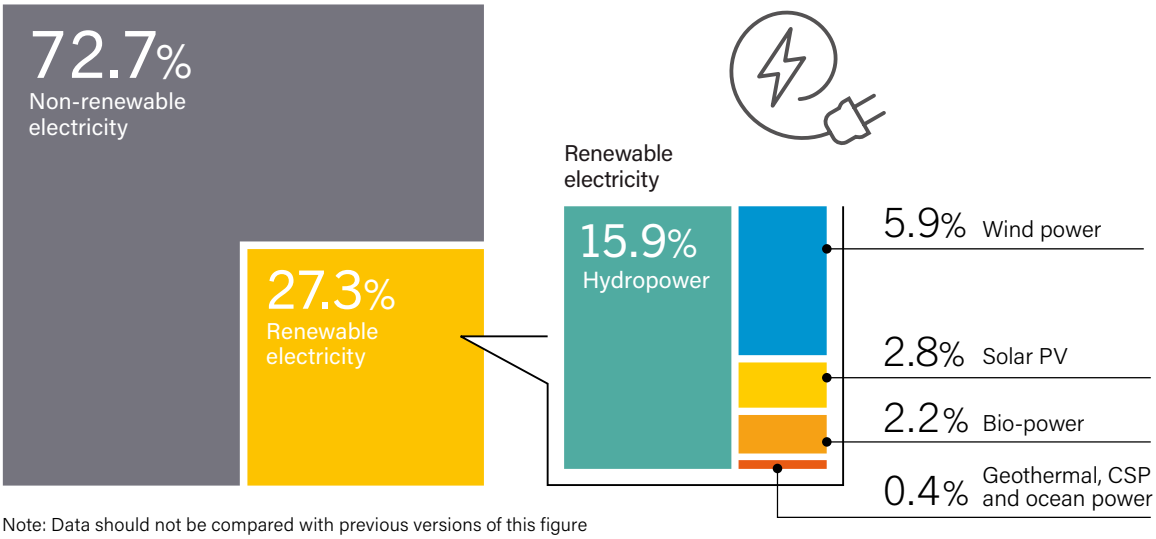
Use of electricity (other than for heating, cooling or transport) accounts for the **lowest share** of final energy demand.

Cumulative Number of Countries with Feed-in and/or Tendering Policies, 2009-2019



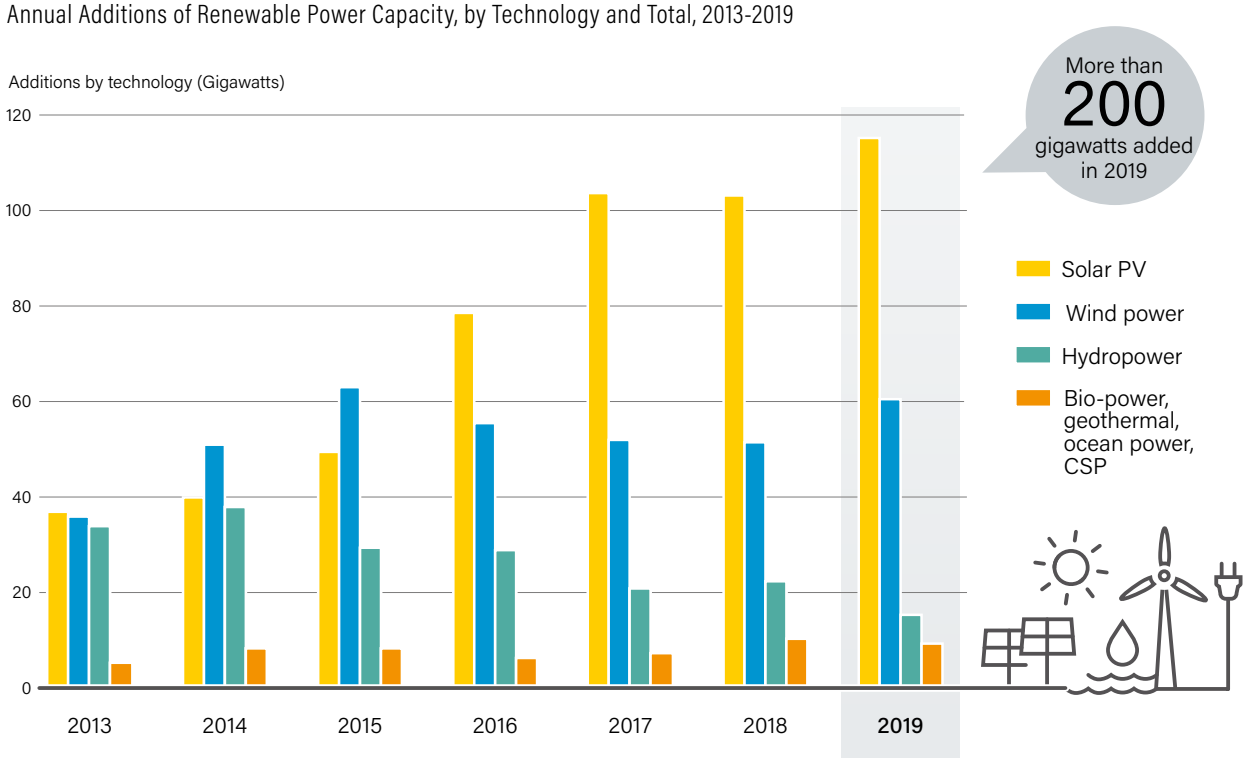
Note: A country is considered to have a policy (and is counted a single time) when it has at least one national or state/provincial-level policy. Some countries have used both policies.

Estimated Renewable Energy Share of Global Electricity Production, End-2019



Note: Data should not be compared with previous versions of this figure due to revisions in data and methodology.

Annual Additions of Renewable Power Capacity, by Technology and Total, 2013-2019

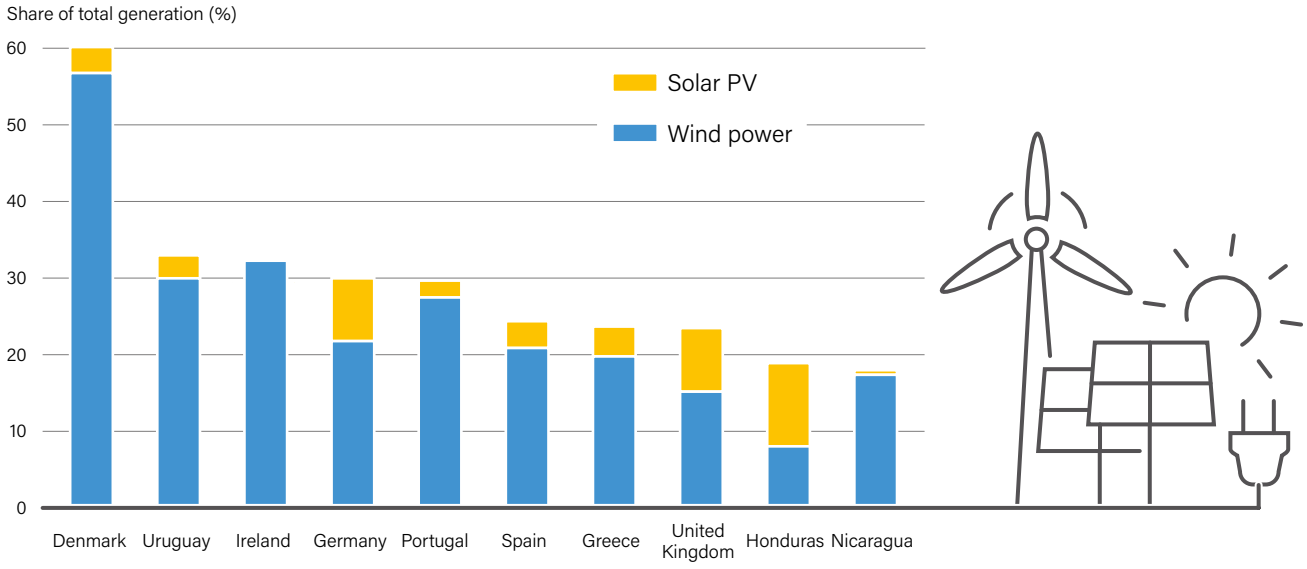


Note: Solar PV capacity data are provided in direct current (DC). Data are not comparable against technology contributions to electricity generation.

Solar PV mini-grids

are increasingly the preferred technology for providing electricity access across Africa and Asia.

Share of Electricity Generation from Variable Renewable Energy, Top Countries, 2019



Note: Figure shows countries among the top 10 according to the best available data at the time of publication. However, several small-island countries with low total generation may be excluded from this list.

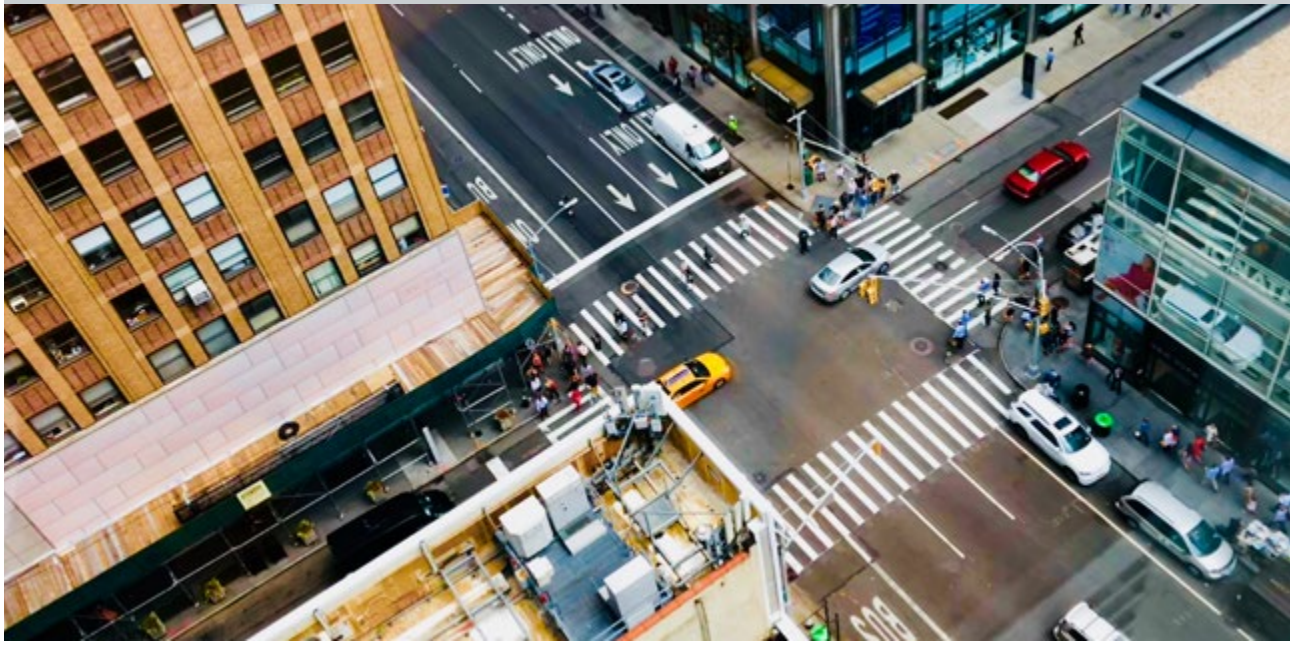
Renewable Energy in Cities

Cities play an important role in the effort to address climate, energy and sustainable development issues. They account for around two-thirds of global final energy use and some three-quarters of global CO_2 emissions. At the same time, local governments have a direct impact on the daily lives of their citizens, such as through urban planning decisions or providing urban services, including public housing, waste and wastewater management, and public transport. They are well positioned not only to grow the use of renewable energy in municipal operations, but also to encourage and support the deployment and use of renewables in cities more broadly. Thus, cities can play a major role in advancing the transition towards renewable energy in the heating and cooling and transport sectors, to accelerate deployment in the power sector, and to foster the integrated approaches needed to decarbonise energy use in all sectors.

Globally, thousands of cities have adopted renewable energy-specific targets and action plans, and by mid-2019 more than 250 cities worldwide had targets for 100% renewable energy, not only for the power sector, but also covering heating and cooling, and transport. To achieve these targets, many cities have adopted renewable energy (and energy efficiency) measures for buildings, for example through financial and fiscal incentives for the installation of solar PV or geothermal systems. Cities also can link the development of renewables with other urban services, such as by using waste and wastewater to produce biogas and biomethane, simultaneously improving waste management and supporting the local production and use of renewables. As the electrification of transport gains momentum, some cities are facilitating the integration of EVs and renewable power supply, installing EV charging stations or public transport infrastructure that relies on renewable electricity.

Renewable energy deployment in cities is often part of wider urban strategies to develop infrastructure, while at the same time achieving local objectives such as reducing air pollution to improve public health, mitigating climate change, creating jobs, supporting the local economy and building resilient infrastructure.

REN21's *Renewables in Cities Global Status Report* series is establishing continuous and reliable data on urban renewable energy developments in order to create a clearer and more comprehensive picture of renewables in cities around the world. (→ *See https://www.ren21.net/cities.*)



The REN21 Secretariat has produced this document to highlight important trends in renewable energy that occurred in 2019 and to put them in perspective of the global energy transition. It draws on elements from REN21's *Renewables 2020 Global Status Report.*

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For further details and access to the report and references, visit **www.ren21.net/GSR**

See Endnotes and Methodological Notes in the full GSR for further details on the information presented in this document.

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