RENEWABLES 2019
GLOBAL STATUS REPORT

REN21
RENEWABLES NOW

18 June 2019
REN21 Secretariat
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2019

REN21 is an **international policy network** of passionate players dedicated to building a **sustainable renewable energy future**.

Science & Academia:
AEE INTEC, Fundacion Bariloche, IIASA, ISES, NREL, SANEDI, TERI

NGOs:
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Governments:
Afghanistan, Brazil, Denmark, Germany, India, Mexico, Norway, South Africa, Spain, UAE, USA

Renewables Global Status Report

Collaborative annual reporting since 2005 building on **international expert community.**

The report features:

01. Global Overview
02. Policy Landscape
03. Market & Industry Trends
04. Distributed Renewables for Energy Access
05. Investment Flows
06. Energy Systems Integration and Enabling Technologies
07. Energy Efficiency
08. Feature: Renewable Energy in Cities

Over **1,500** experts have contributed to the GSR since its start in 2005.

70% of these experts have participated in more than one GSR.

Over **350** experts contributed to GSR 2019, working alongside an international authoring team and the REN21 Secretariat.

45% of these were new experts.

Renewable energy continues to grow

- → **Total global capacity rose 8%** in 2018
  - 2,378 GW capacity including hydropower
- → **Non-hydro capacity grew 15%**
  - 1,246 GW by the end of 2018
- → **181 GW** of renewable power additions led by
  - Solar PV with 100 GW (55% of new additions)
  - Wind power: 51 GW (28%)
  - Hydropower: 20 GW (11%)
- → **Global reach of renewable power:**
  - over 90 countries have more than 1 GW
  - over 30 countries have more than 10 GW

RENEWABLE ENERGY INDICATORS 2018

		2017	2018
INVESTMENT			
New investment (annual) in renewable power and fuels[1]	billion USD	326	**289**
POWER			
Renewable power capacity (including hydropower)	GW	2,197	**2,378**
Renewable power capacity (not including hydropower)	GW	1,081	**1,246**
Hydropower capacity[2]	GW	1,112	**1,132**
Wind power capacity	GW	540	**591**
Solar PV capacity[3]	GW	405	**505**
Bio-power capacity	GW	121	**130**
Geothermal power capacity	GW	12.8	**13.3**
Concentrating solar thermal power (CSP) capacity	GW	4.9	**5.5**
Ocean power capacity	GW	0.5	**0.5**
Bioelectricity generation (annual)	TWh	532	**581**
HEAT			
Solar hot water capacity[4]	GW_{th}	472	**480**
TRANSPORT			
Ethanol production (annual)	billion litres	104	**112**
FAME biodiesel production (annual)	billion litres	33	**34**
HVO biodiesel production (annual)	billion litres	6.2	**7.0**

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Which countries led the way in 2018?

TOP FIVE COUNTRIES

Annual Investment / Net Capacity Additions / Production in 2018

	1	2	3	4	5
Investment in renewable power and fuels (not including hydropower over 50 MW)	**China**	United States	Japan	India	Australia
Investment in renewable power and fuels per unit GDP[1]	**Palau**	Djibouti	Morocco	Iceland/Serbia	
Geothermal power capacity	**Turkey**	Indonesia	United States	Iceland	New Zealand
Hydropower capacity	**China**	Brazil	Pakistan	Turkey	Angola
Solar PV capacity	**China**	India[2]/United States		Japan	Australia
Concentrating solar thermal power (CSP) capacity	**China/Morocco**		South Africa	Saudi Arabia	–
Wind power capacity	**China**	United States	Germany	India	Brazil
Solar water heating capacity	**China**	Turkey	India	Brazil	United States
Biodiesel production	**United States**	Brazil	Indonesia	Germany	Argentina
Ethanol production	**United States**	Brazil	China	Canada	Thailand

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Who were the renewable energy leaders at the end of 2018?

→ In major technologies, frontrunners for total capacity are major economies and historical leaders

→ In most cases, the picture changes when *per capita* capacity is considered

- Renewable power (excl. hydro) is led by Iceland
- Solar PV per capacity is led by Germany
- Wind power per capita is led by Denmark
- Solar water heating is led by Barbados

Total Capacity or Generation as of End-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)[3]	**Iceland**	Denmark	Germany/Sweden	Germany/Sweden	Finland
Bio-power generation	**China**	United States	Brazil	Germany	India
Bio-power capacity	**China**	United States	Brazil	India	Germany
Geothermal power capacity	**United States**	Indonesia	Philippines	Turkey	New Zealand
Hydropower capacity[4]	**China**	Brazil	Canada	United States	Russian Federation
Hydropower generation[4]	**China**	Canada	Brazil	United States	Russian Federation
Solar PV capacity	**China**	United States	Japan	Germany	India
Solar PV capacity *per capita*	**Germany**	Australia	Japan	Belgium	Italy
Concentrating solar thermal power (CSP) capacity	**Spain**	United States	South Africa	Morocco	India
Wind power capacity	**China**	United States	Germany	India	Spain
Wind power capacity *per capita*	**Denmark**	Ireland	Germany	Sweden	Portugal
HEAT					
Solar water heating collector capacity[5]	**China**	United States	Turkey	Germany	Brazil
Solar water heating collector capacity *per capita*	**Barbados**	Austria	Cyprus	Israel	Greece
Geothermal heat output[6]	**China**	Turkey	Iceland	Japan	Hungary

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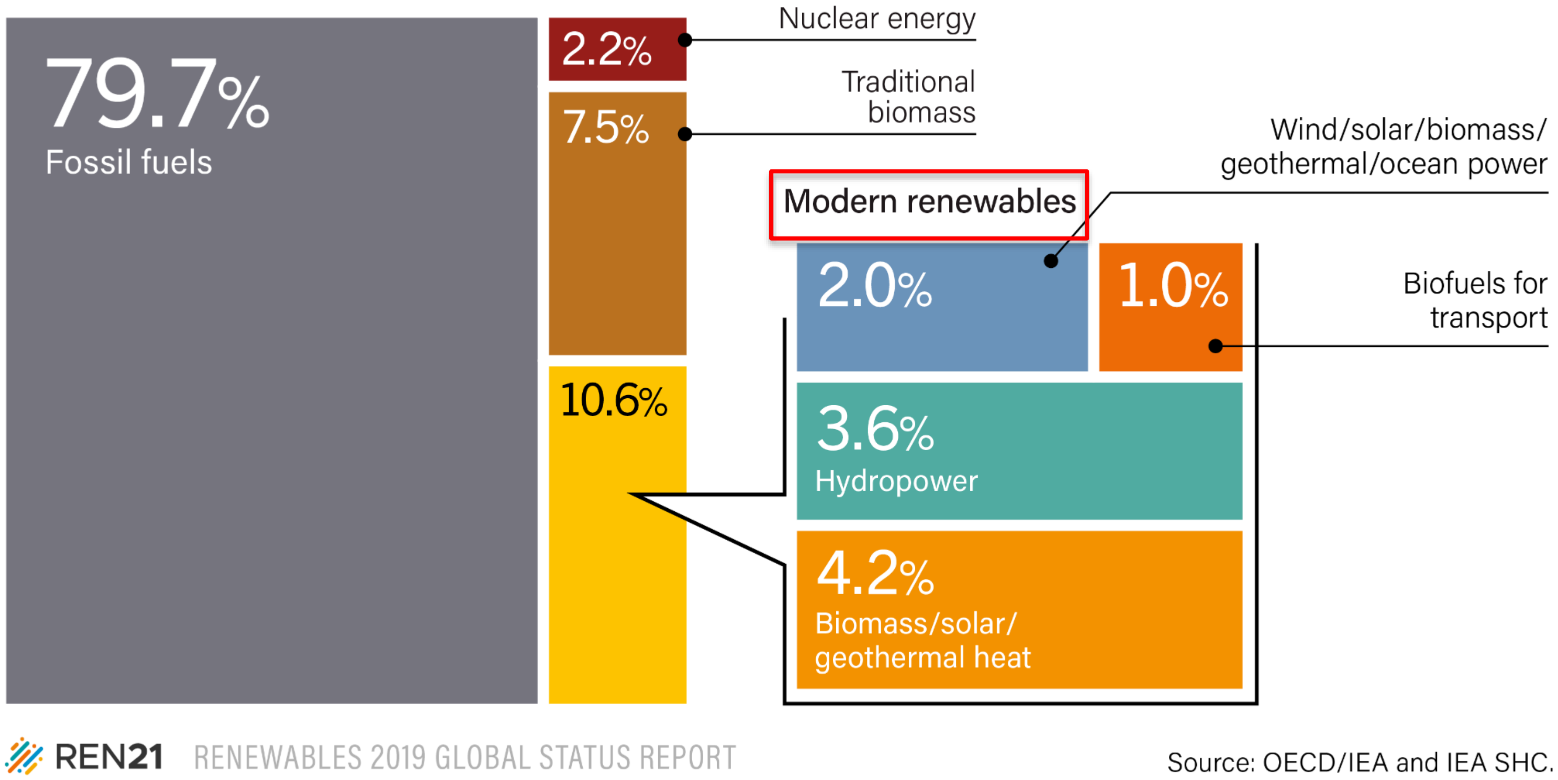
Modern renewables are gaining ground in final consumption

- **Modern renewable energy** accounted for **10.6%** of final energy demand in 2017.
  - Increase from 10.4% in 2016
- Considering traditional biomass, renewable energy covered **18.1%** of final energy demand
- Modern renewable heat covered 4.2% of demand, hydropower 3.6%, non-hydro power 2% and transport biofuels 1%.

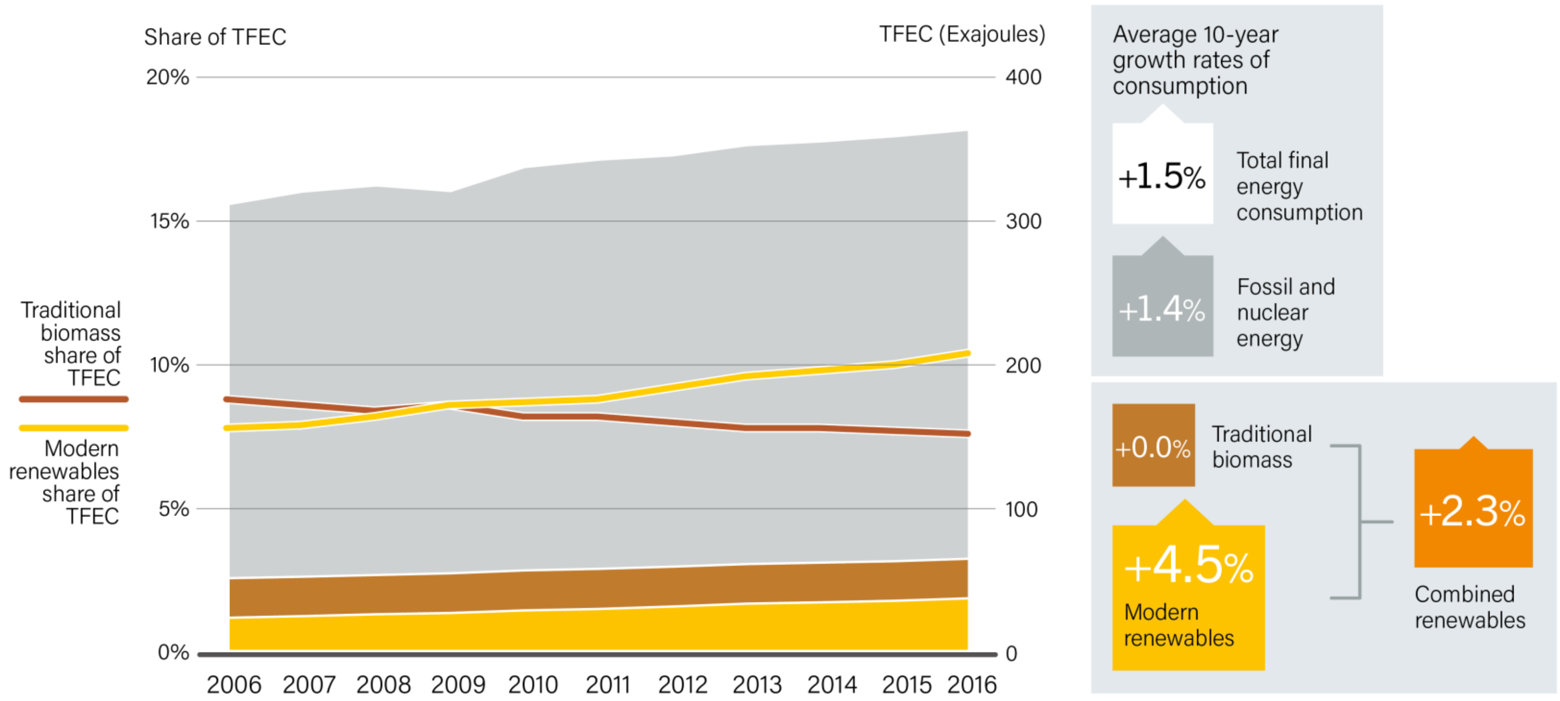


Source: OECD/IEA and IEA SHC.

Modern renewables growing faster than fossil fuel and nuclear

- → Modern renewable energy has grown **4.5% yearly since 2006**
  - Compared to annual growth of 2.3% for modern renewables along with traditional biomass
  - Still higher than fossil fuel and nuclear growth at 1.4%
- → Growth in traditional biomass use is flat
- → Energy demand has grown as well, slowing gains of renewable energy in TFEC

Growth in Global Renewable Energy Compared to Total Final Energy Consumption, 2006-2016



Source: OECD/IEA.

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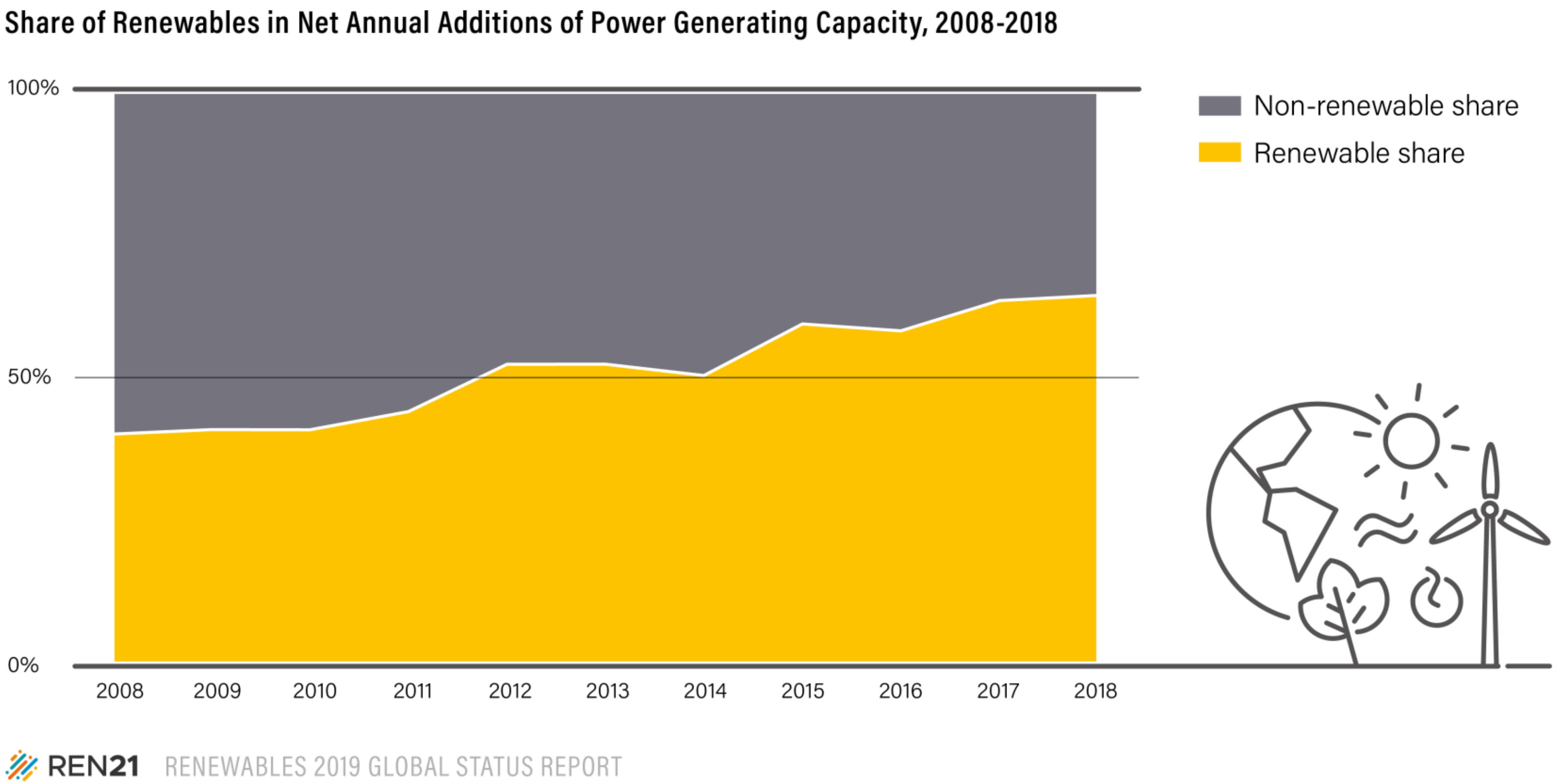
More renewable capacity added yearly than fossil fuel and nuclear

→ In 2018, nearly twice as much renewable power capacity added as all other sources, **the highest share ever**

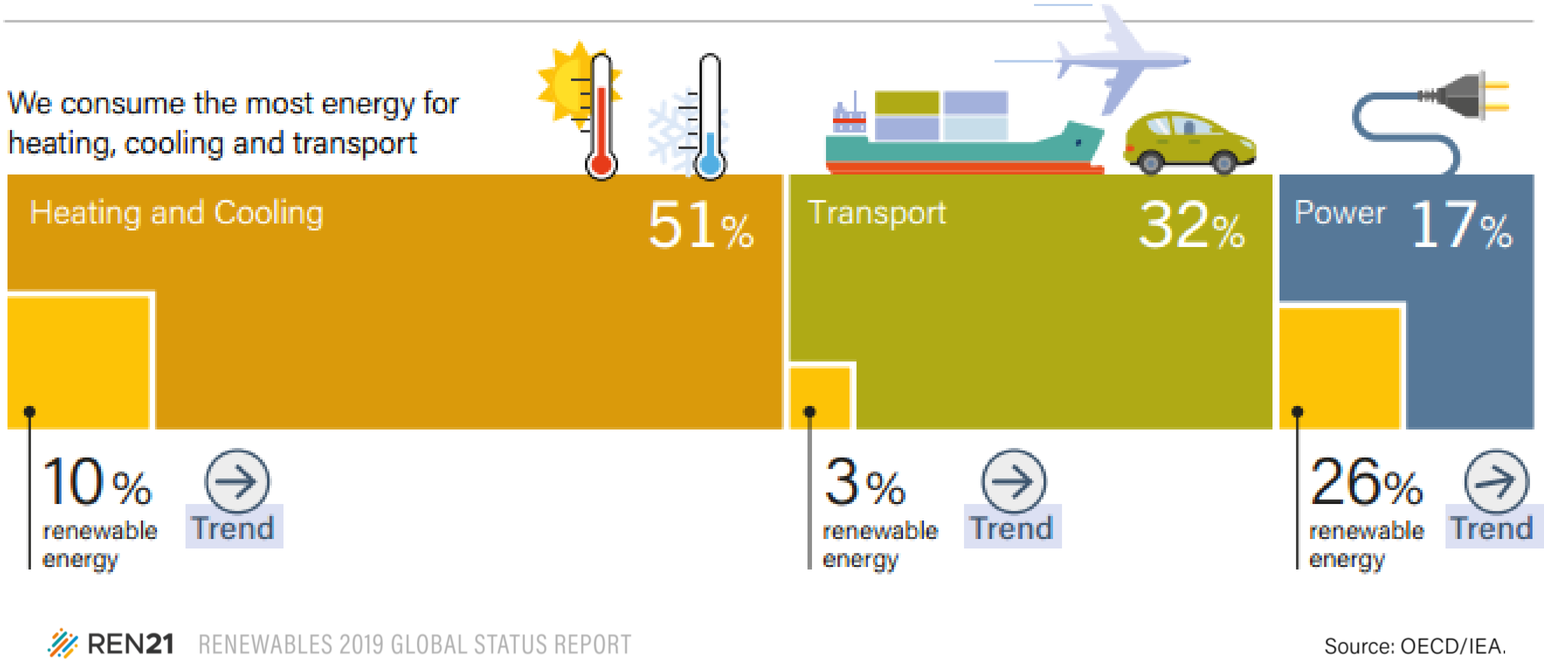
→ Fourth consecutive year that net additions of renewable power were **more than 50%**

→ 2011 was the last year that clearly more non-renewable capacity was added than renewable



More than 80% of energy demand is for heating, cooling, and transport

- **Over half** of final energy demand is from the heating and cooling sector
  - Less than 10% of this demand is supplied by renewable energy
- **32%** of final energy demand is for transport end-uses
  - Just over 3% is renewable and primarily met by biofuels
  - Renewable electricity still plays small role
- Around **26%** of electricity was renewable in 2016

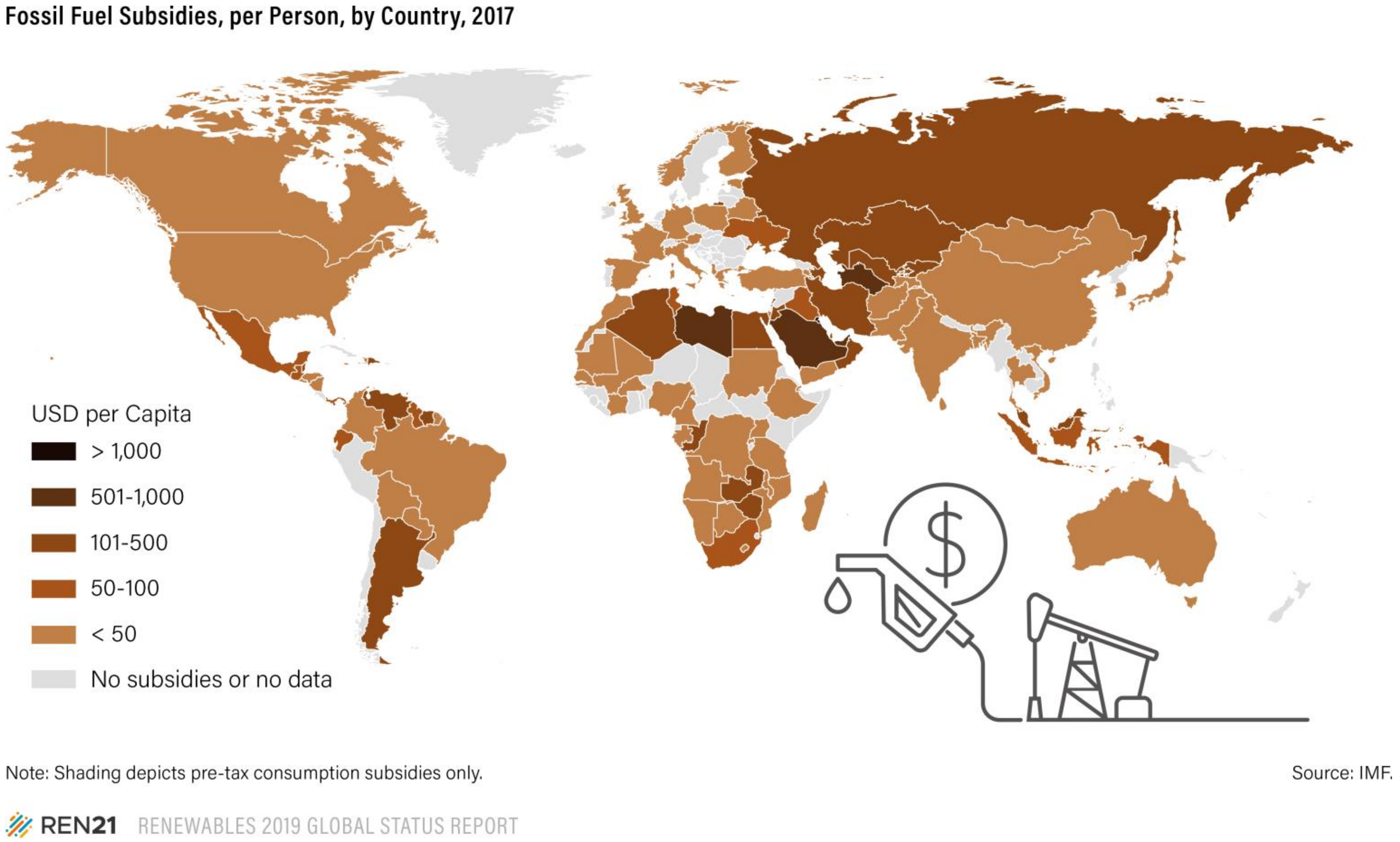


Fossil fuel subsidies are still widespread

→ Global subsidies for fossil fuel consumption reached an estimated **USD 300 billion** in 2017
  - an 11% increase from the year before
  - about double the estimated support for renewable power generation

→ Fossil fuel subsidies remained in place in at least **115 countries** in 2017

→ 73 countries provide subsidies of **more than USD 100 million** each



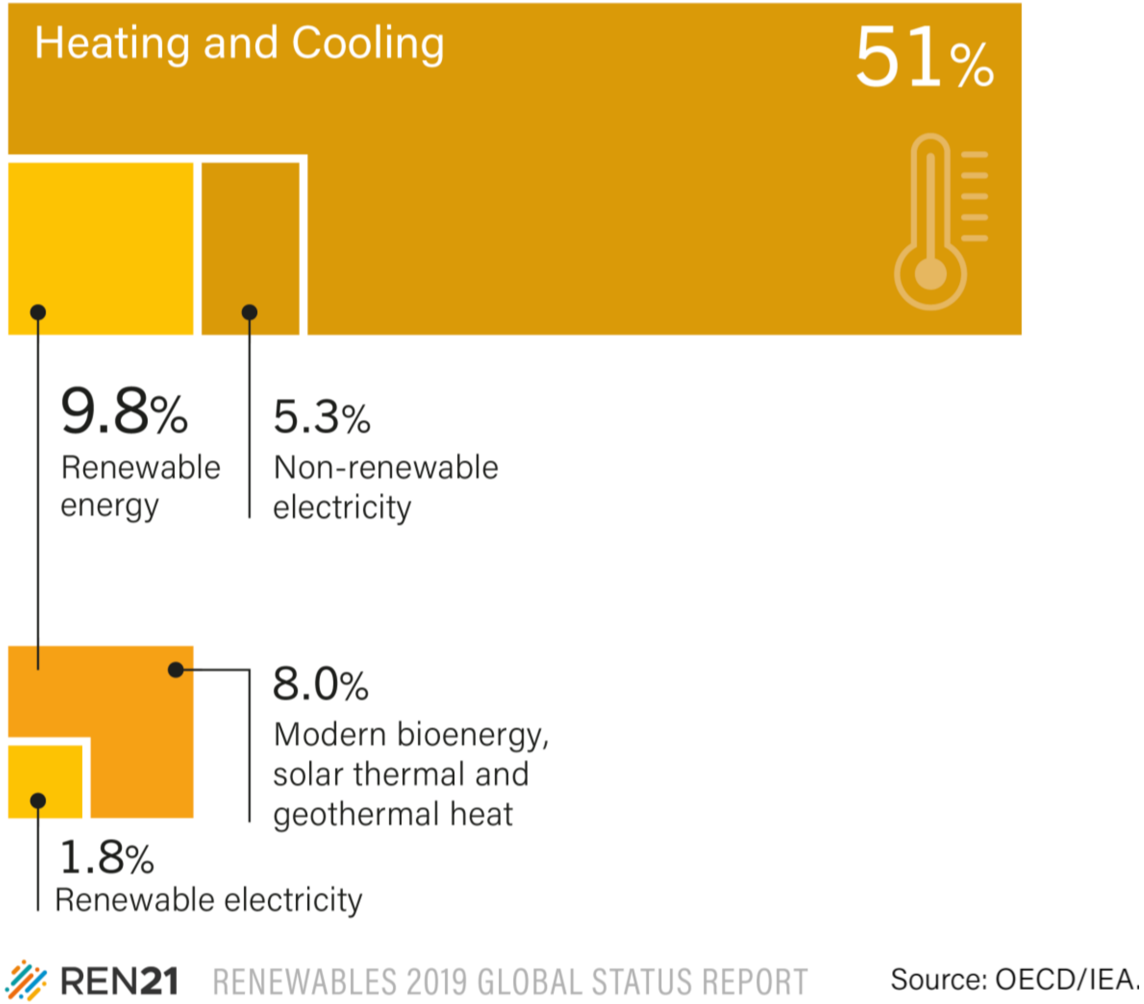
Heating and cooling makes up more than half of final energy demand

→ Modern renewables account for just **10% of heating and cooling demand**
- Demand growth is minimal (1.8%/year)

→ **Lack of policy support** in the sector
- Number of countries with regulatory policies fell from 21 to 20
- Only 47 countries had targets for RHC

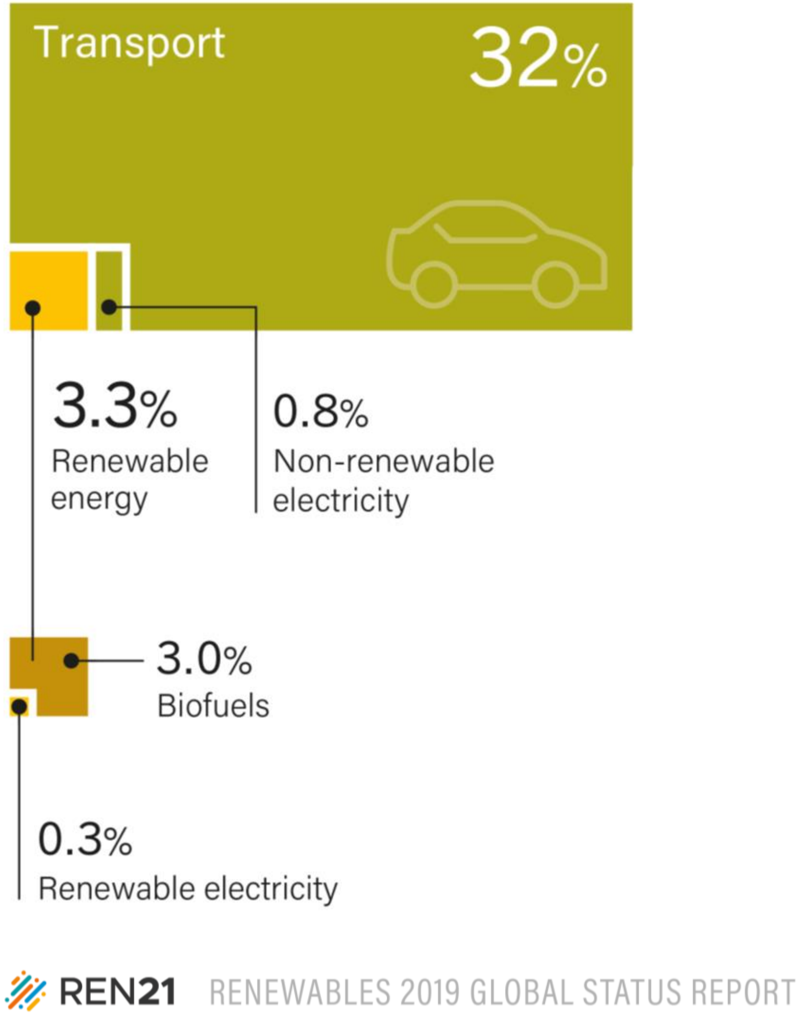
→ **Local policy action** (e.g. building codes) is most effective
- Policies integrated with energy efficiency

→ Integration with **power sector** is key



Biofuels and EVs growing but renewable share in transport remains low

- Global energy demand in transport increased **45%** since 2000
- Transport accounts for **23%** of global CO2 emissions
- The renewable share of transport grew slightly to **3.3%**
- Biofuels make up majority of renewable contribution, but sector increasingly open to electrification

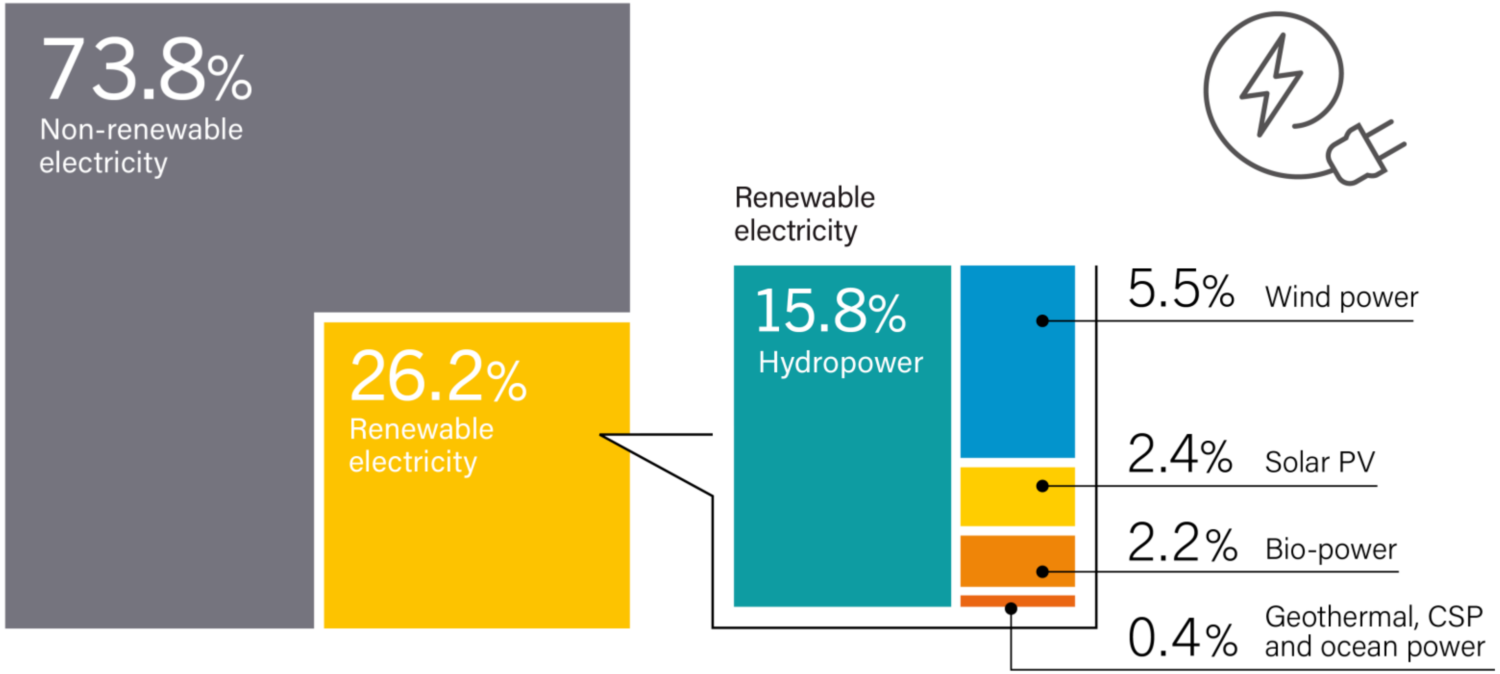


Source: OECD/IEA.

More than 26% of global electricity is renewable

- Renewables supplied an estimated **26.2%** of global electricity at the end of 2018
- For the first time, more electricity was from solar PV than bio-power
- Strong growth in renewable generation, but rising electricity demand (up 4% in 2018) makes it challenging to achieve larger share

Estimated Renewable Energy Share of Global Electricity Production, End-2018



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

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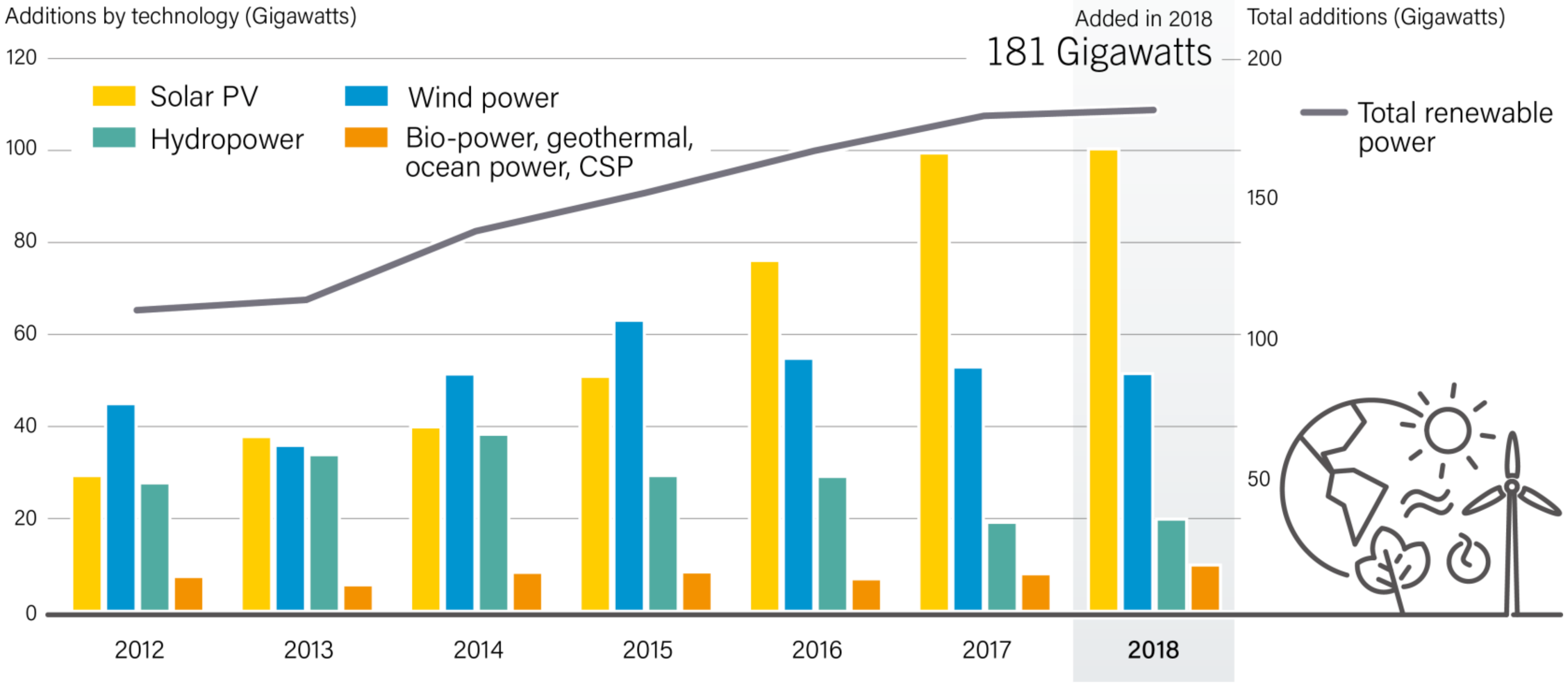
181 gigawatts of renewable power added in 2018

→ Around **55%** of these new additions were solar PV

→ Added in 2018:
- 100 GW of solar PV
- 51 GW of wind power
- 20 GW of hydropower
- 10 GW of bio-power, CSP and geothermal power

→ 2018 was the **4th** consecutive year that **more than 50 GW of wind power** was added

Annual Additions of Renewable Power Capacity, by Technology and Total, 2012-2018



Note: Solar PV capacity data are provided in direct current (DC).

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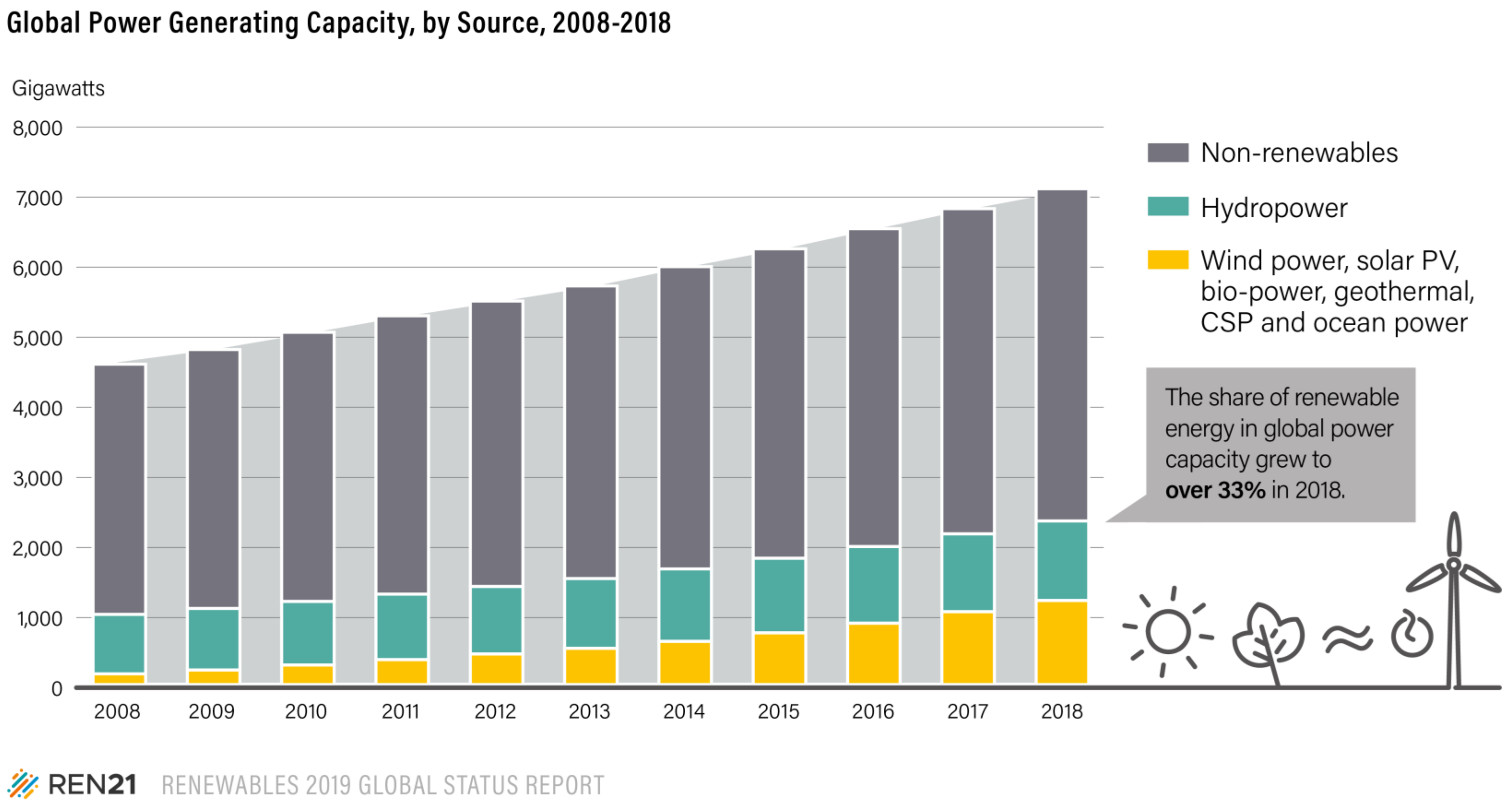
Renewable energy makes up over one-third of global capacity

- → Renewable energy is now **more than 33%** of global installed power generating capacity
- → Within renewable capacity, hydropower (1,132 GW) no longer makes up half of installed capacity
- → Wind power (592 GW) accounts for 25% and solar PV (505 GW) covers over 21%
- → Remaining 6% of bio-power, geothermal power, CSP and ocean

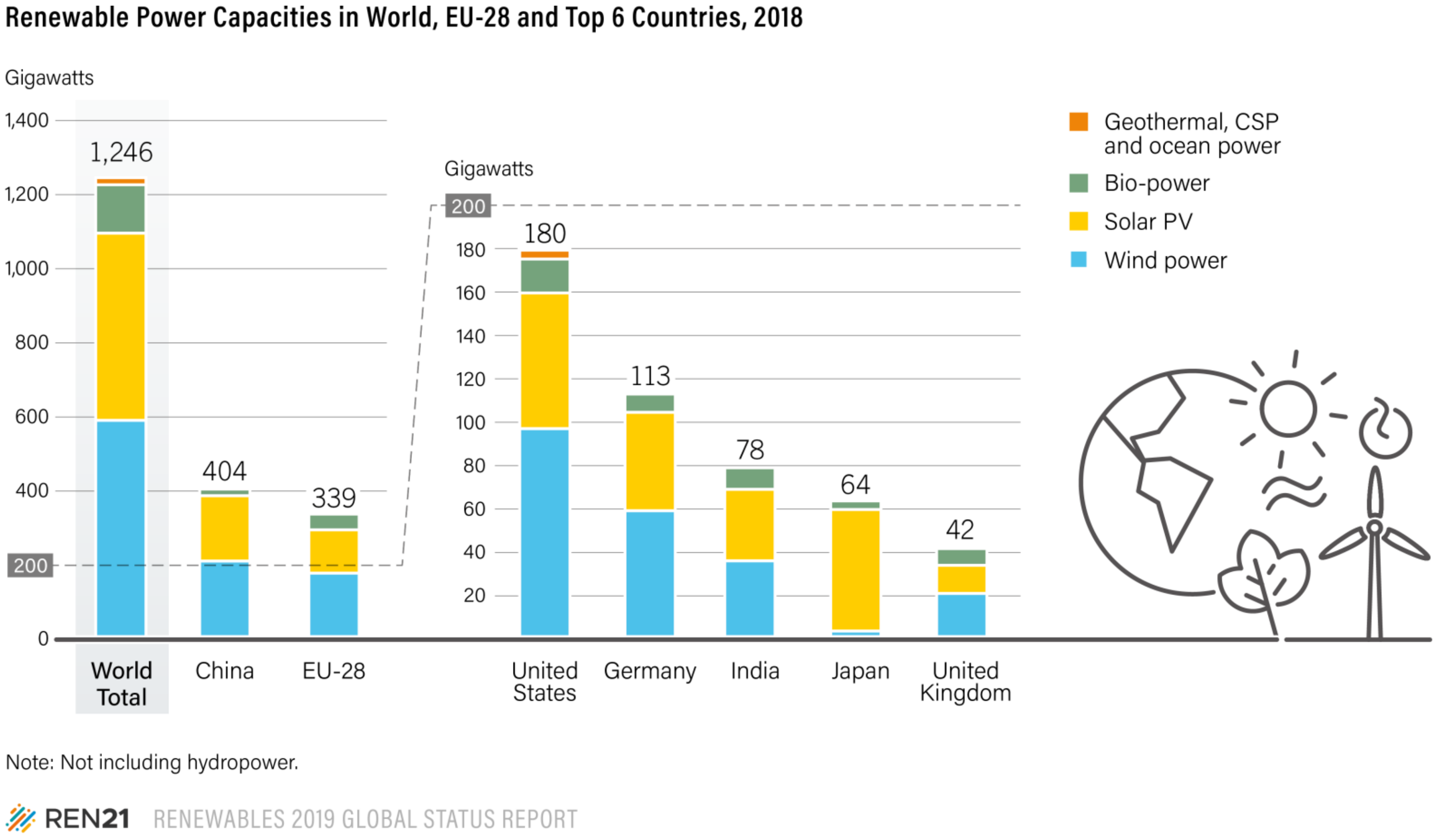


Renewable power has established itself on a global scale

→ More than **90** countries had at least **1GW** of generating capacity

→ Considering non-hydro capacity:
- 32% in China
- 27% in the European Union
- 14% in the United States

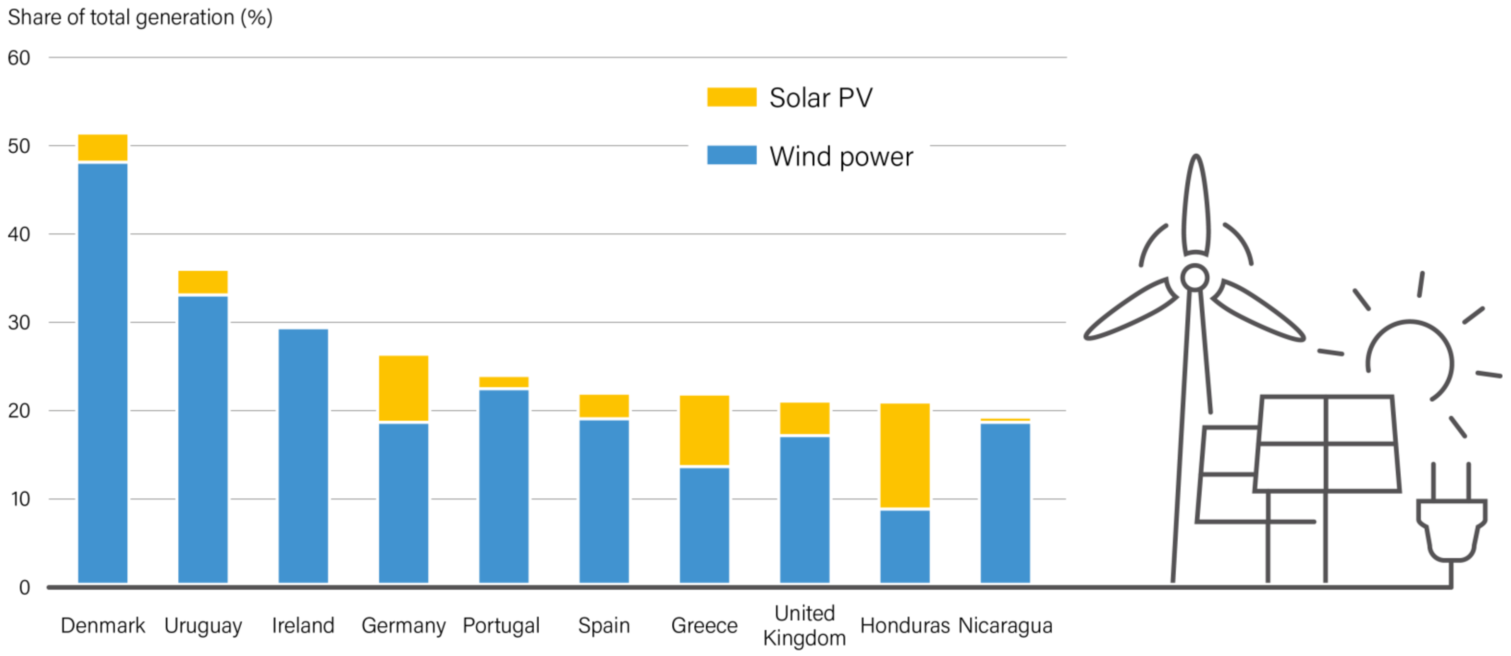
→ At least **45** countries have over **1GW** of non-hydro renewables,
- **17** countries have more than **10 GW** combined of wind power, solar PV, bio-power and geothermal power



Variable renewable energy is reaching high shares in power grids

- → Power systems around the world are adapting to higher shares of variable renewables (wind power and solar PV)
- → Shares are growing more than **10%** annually in several locations
- → At least **9 countries** generated more than **20%** of their electricity from variable wind power and solar PV

Share of Electricity Generation from Variable Renewable Energy, Top 10 Countries, 2018



Note: This figure includes the top 10 countries according to the best available data known to REN21 at the time of publication.

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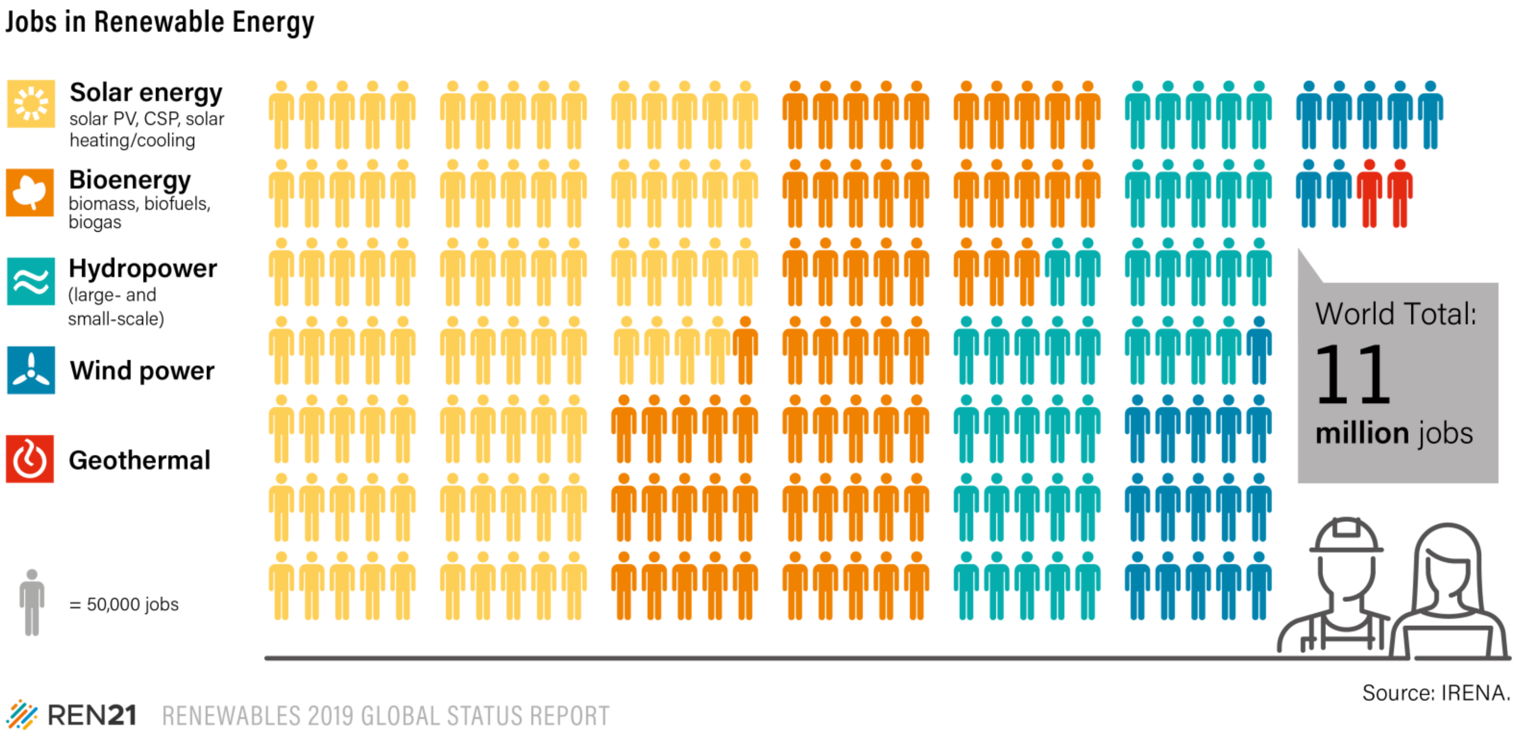
Jobs in renewable energy increase again in 2018

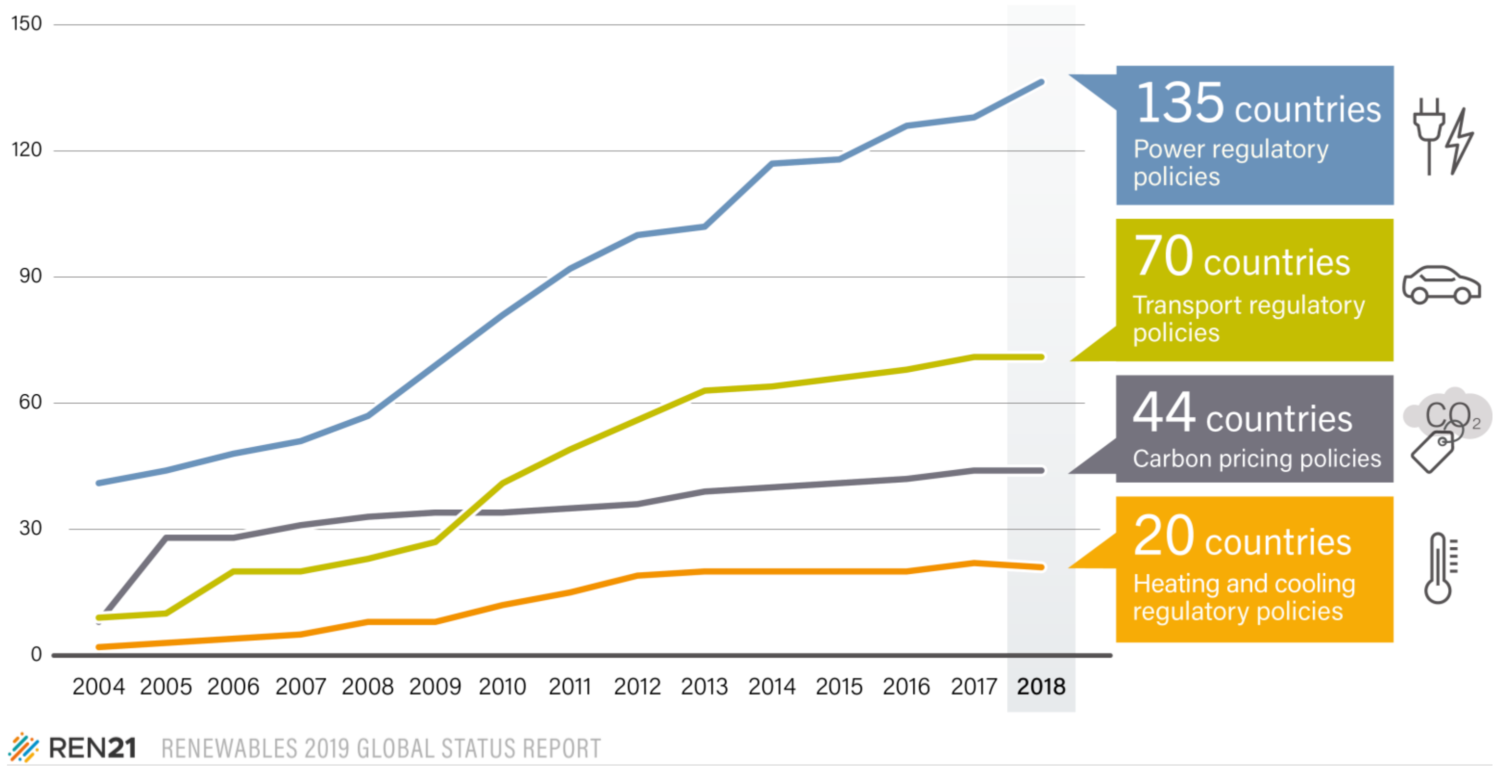
- Renewable energy sector employed around **11 million** people worldwide in 2018
- **Solar PV** was again the largest employer of all renewable energy industries
- The largest employer remained **China**, followed by the EU, Brazil, US, and India



Power sector continues to receive most policy attention

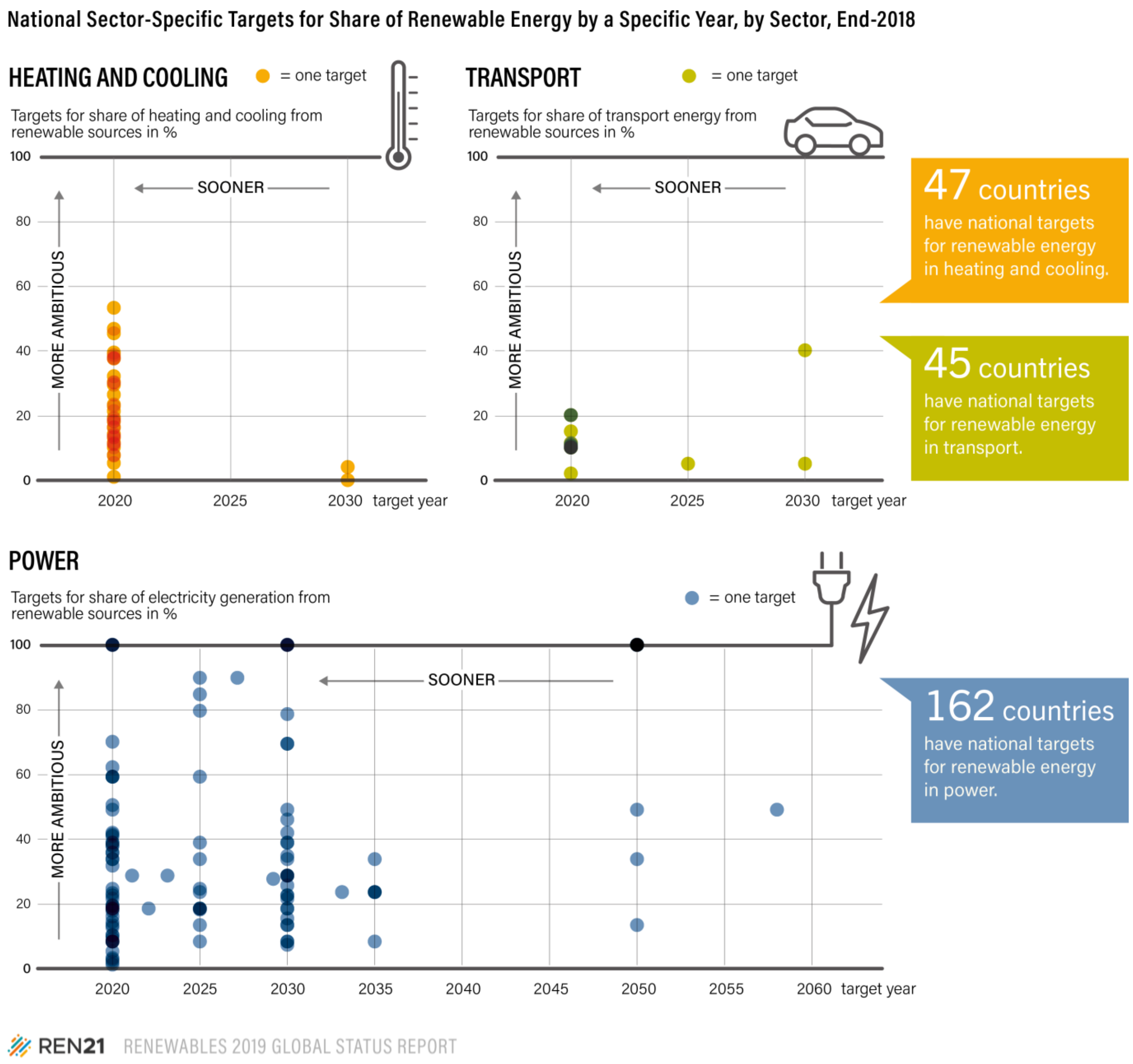
- → Renewable power **auctions** were held in at least **48** countries
- → **FITs** in place in **111** countries
- → **No new countries** adopted biofuels mandates
- → The number of countries with H&C regulatory policies **fell by 1**

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



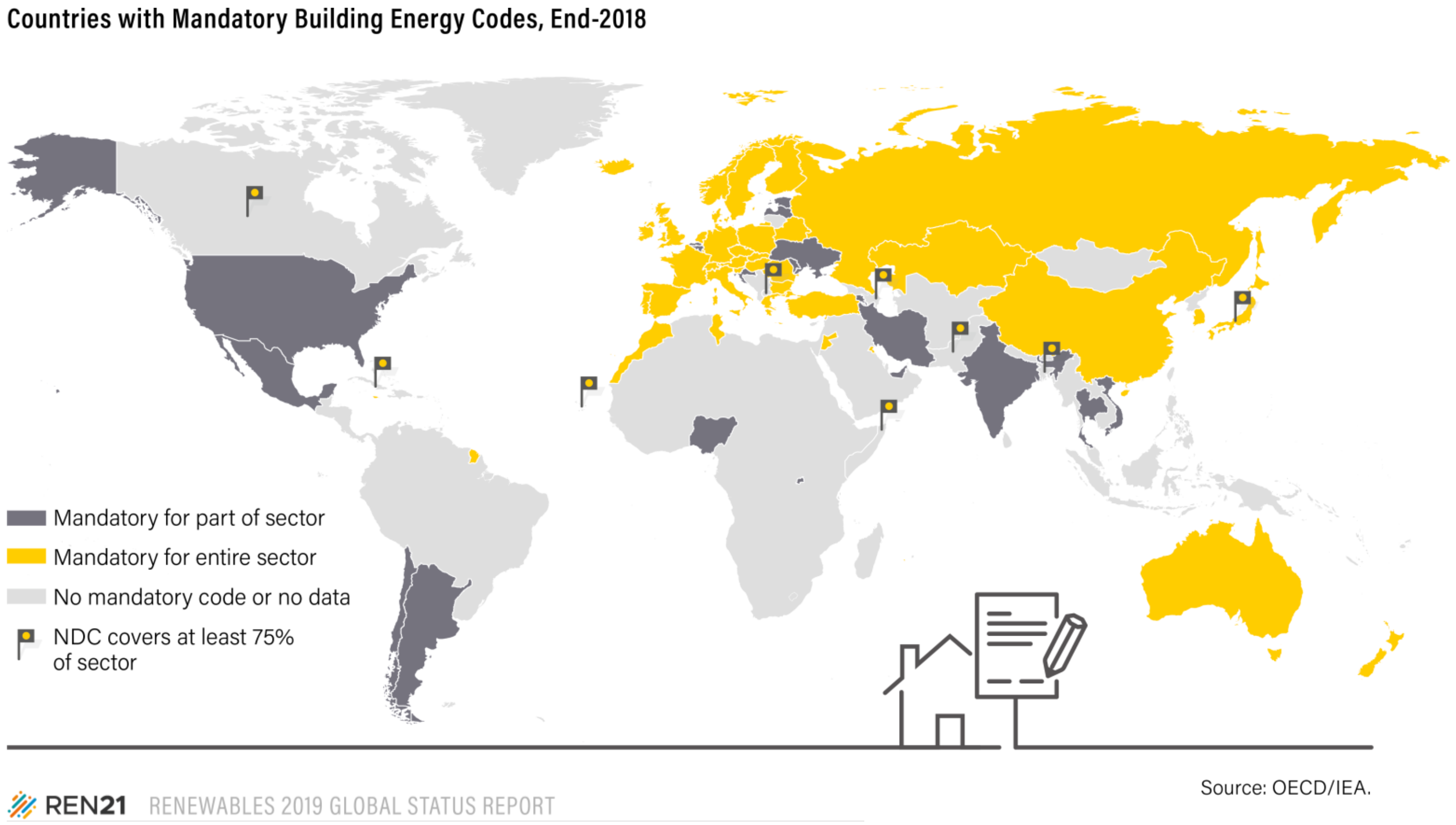
Ambition uneven across sectors

- Targets in the **power sector** remain more ambitious, more numerous than in heating and cooling and transport
- Fewer than **10** countries and states/provinces had economy-wide targets for at least **50%** renewable energy
- Still **only 1** country with a target for 100% renewables in total final energy



Policy coverage lacking in buildings and industry

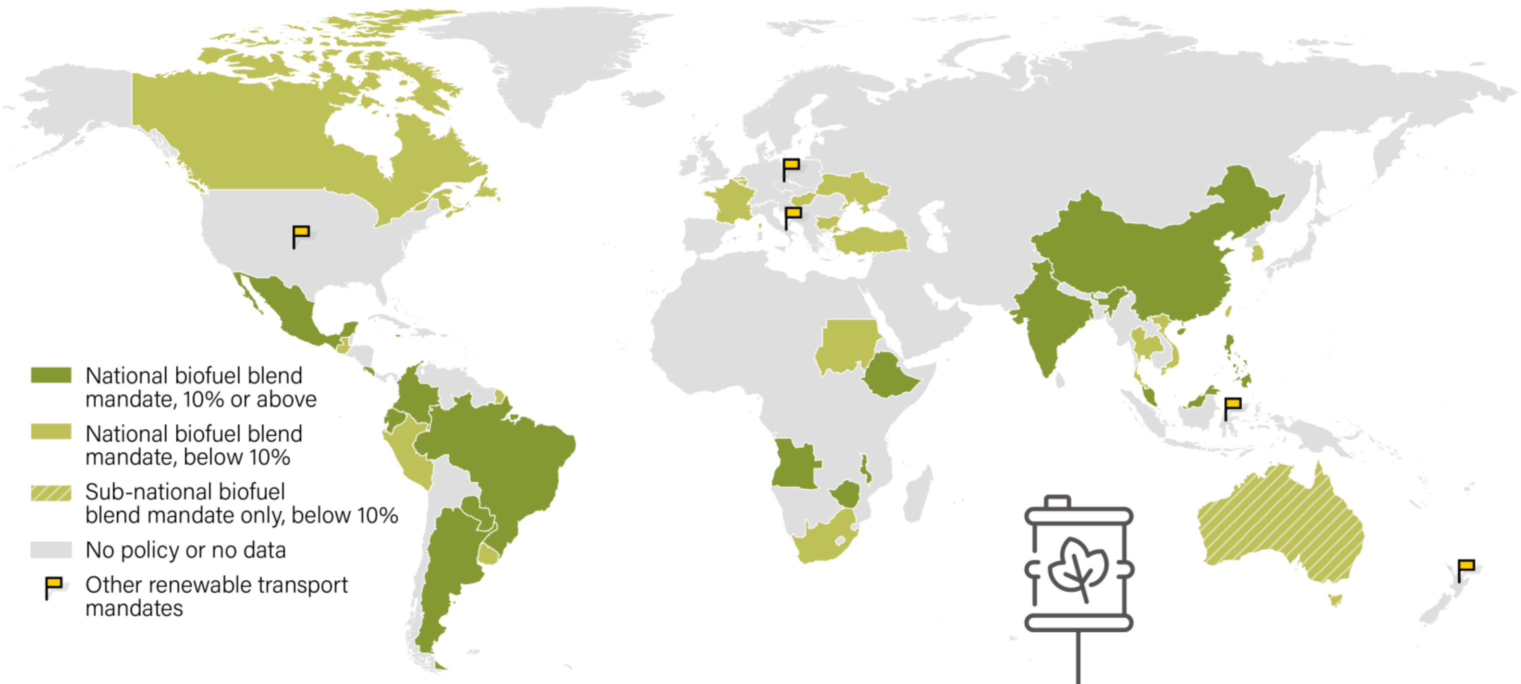
- **135** countries mentioned buildings in NDCs, only 51 cited renewables
- Only **29%** of countries had mandatory building energy codes
- **60%** of energy used in buildings in jurisdictions without any energy efficiency policies
- Only **25%** of industrial energy use covered by standards/targets for energy efficiency



Policy support remains static for transport

- → Only **36%** of countries have biofuel blend mandates
- → Some expanded support for ethanol, biodiesel, and advanced biofuels in 2018
- → Only **40** countries have fuel economy policies for LDVs
  - Just 5 countries have fuel economy standards for trucks

National and Sub-National Renewable Transport Mandates, End-2018



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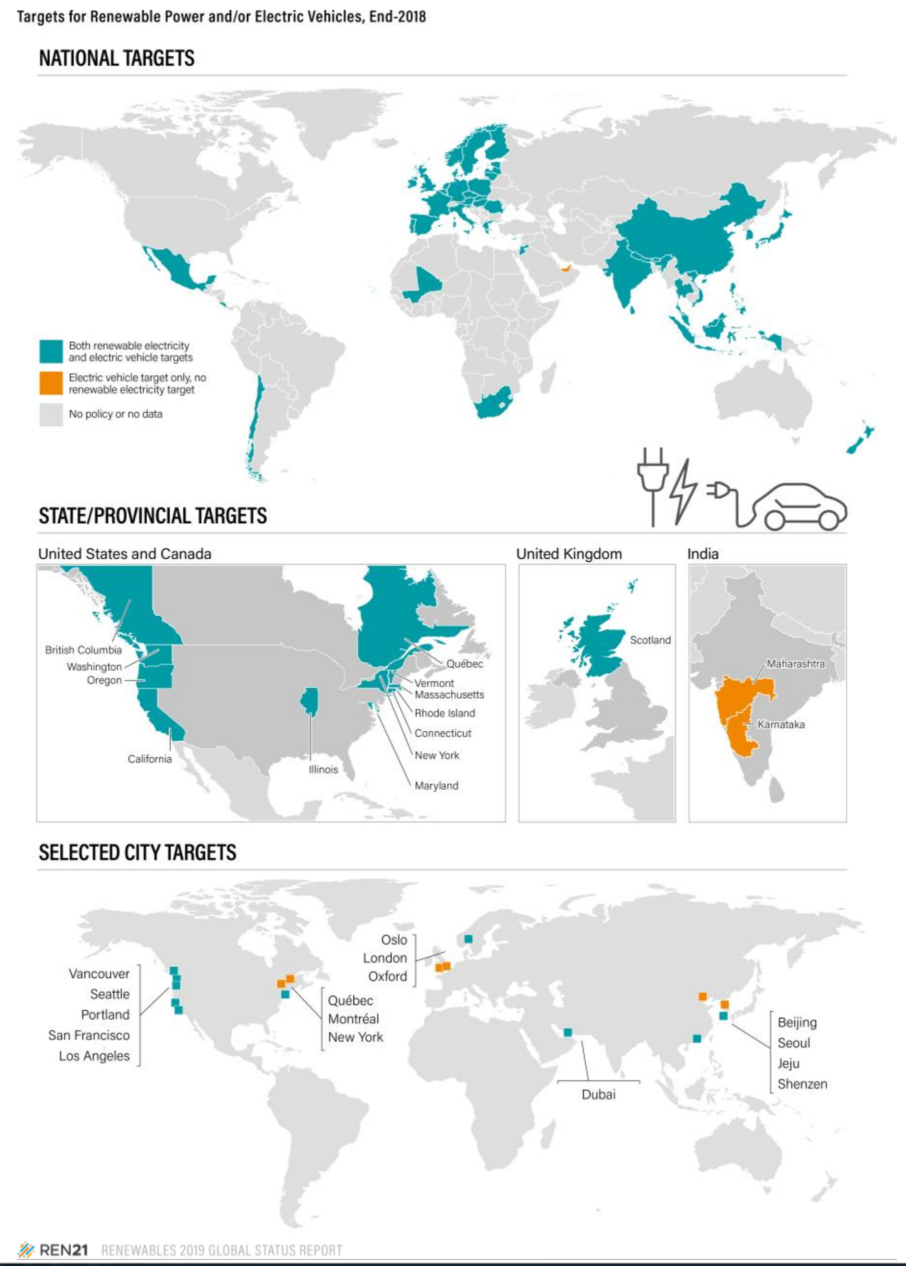
Source: REN21 Policy Database.

Little direct linking of EVs and renewables

→ EVs can play a role in increasing renewables in transport **when powered by renewable electricity**

→ Only **1** country with policy support **directly linking** renewables and EVs

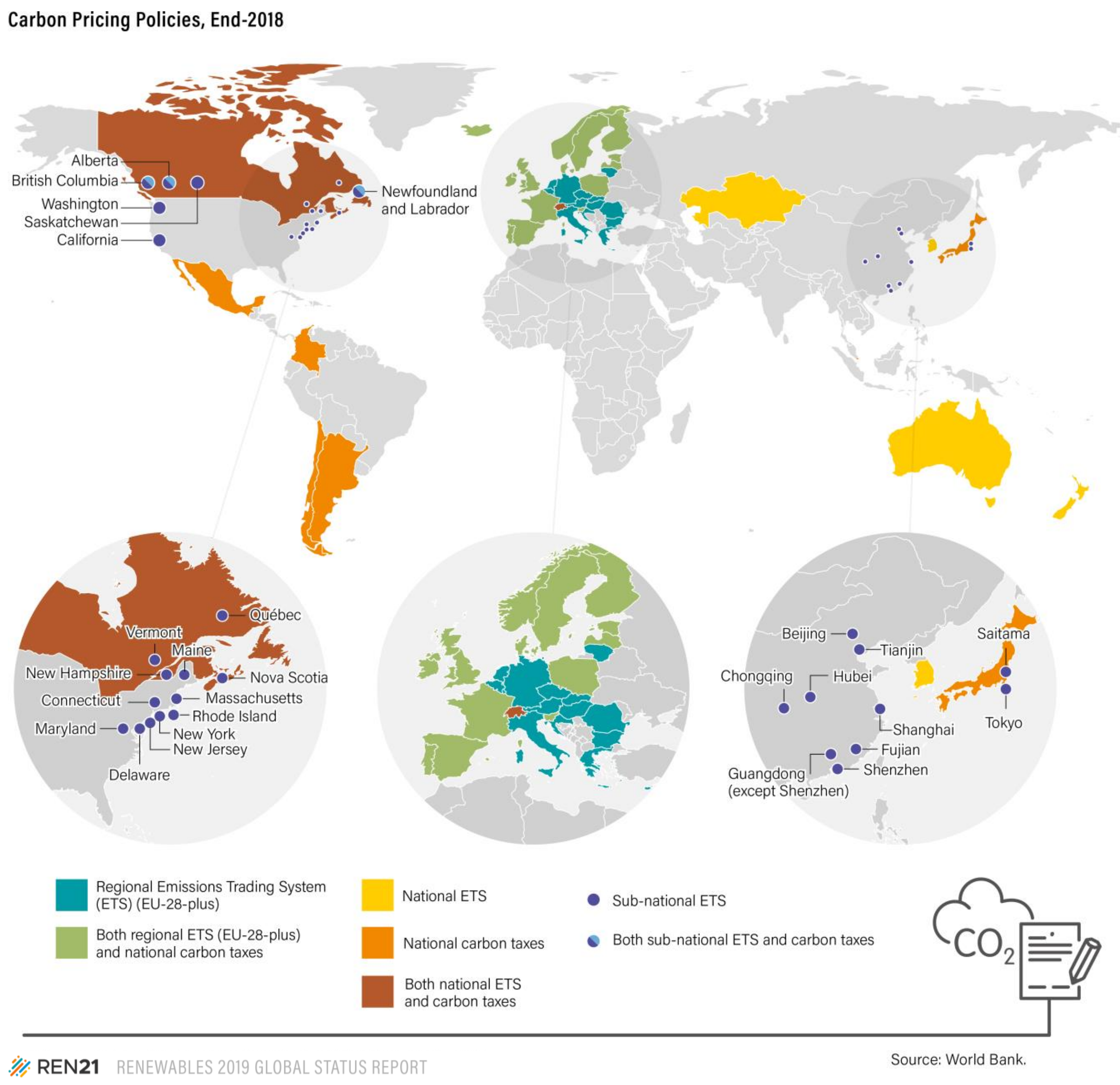
→ At least **49** countries have **independent targets** for renewable electricity and EVs



Carbon pricing slowly expanding

→ At least **54** carbon pricing initiatives implemented by end-2018
- 27 emission trading systems
- 27 carbon taxes
- Covering 44 countries

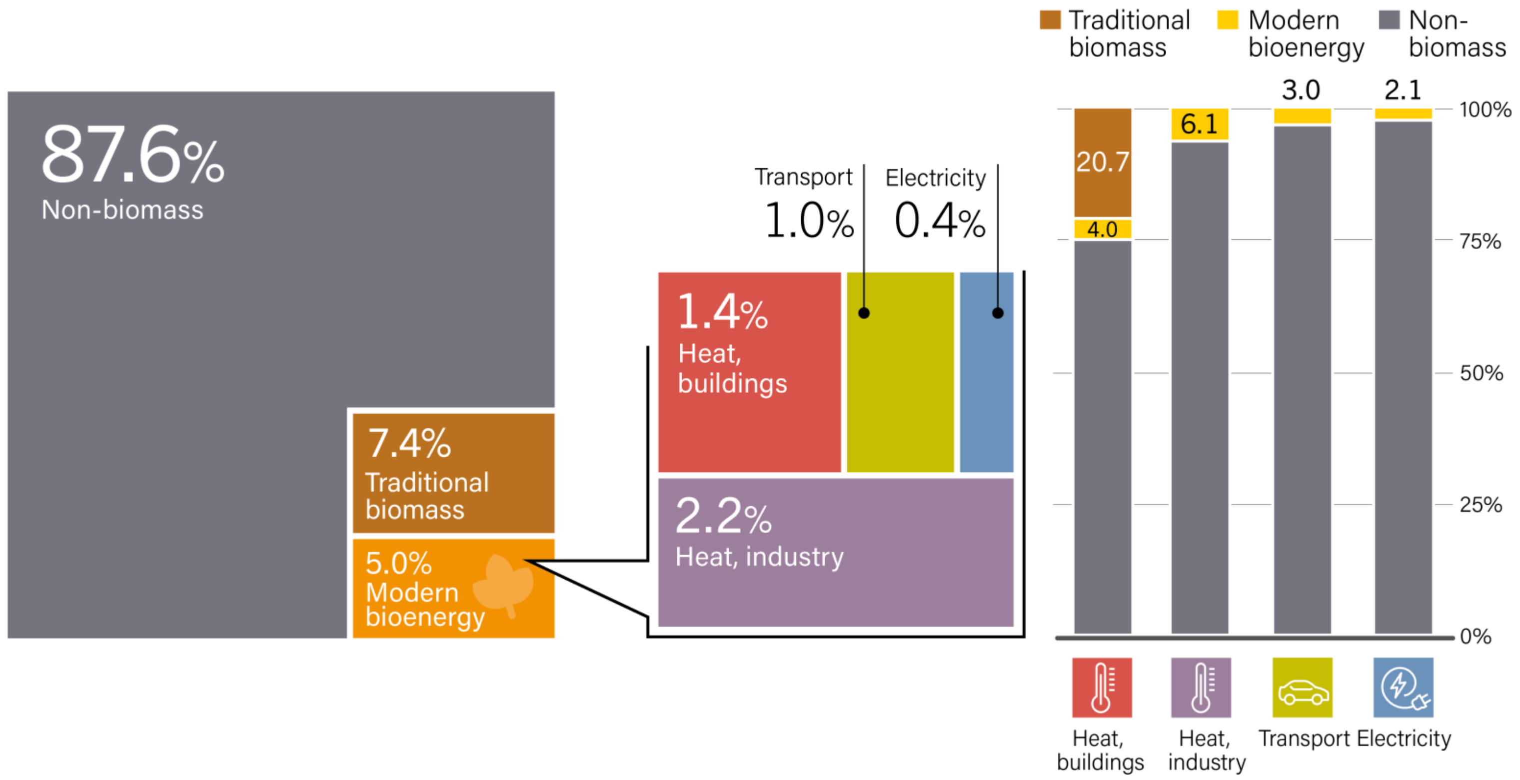
→ Covering only **13%** of global greenhouse gas emissions



Bioenergy remains largest contributor to global renewable energy supply

- → Modern bioenergy contributed **5%** to total final energy consumption
- → Growing at a rate of **9% per year** in electricity sector, 7% in transport, 1.8% in heat
- → Contribution by sector
  - 13.3 EJ in global supply of heat
  - 3.5 EJ in transport
  - 1.6 EJ in electricity

Estimated Shares of Bioenergy in Total Final Energy Consumption, Overall and by End-Use Sector, 2017



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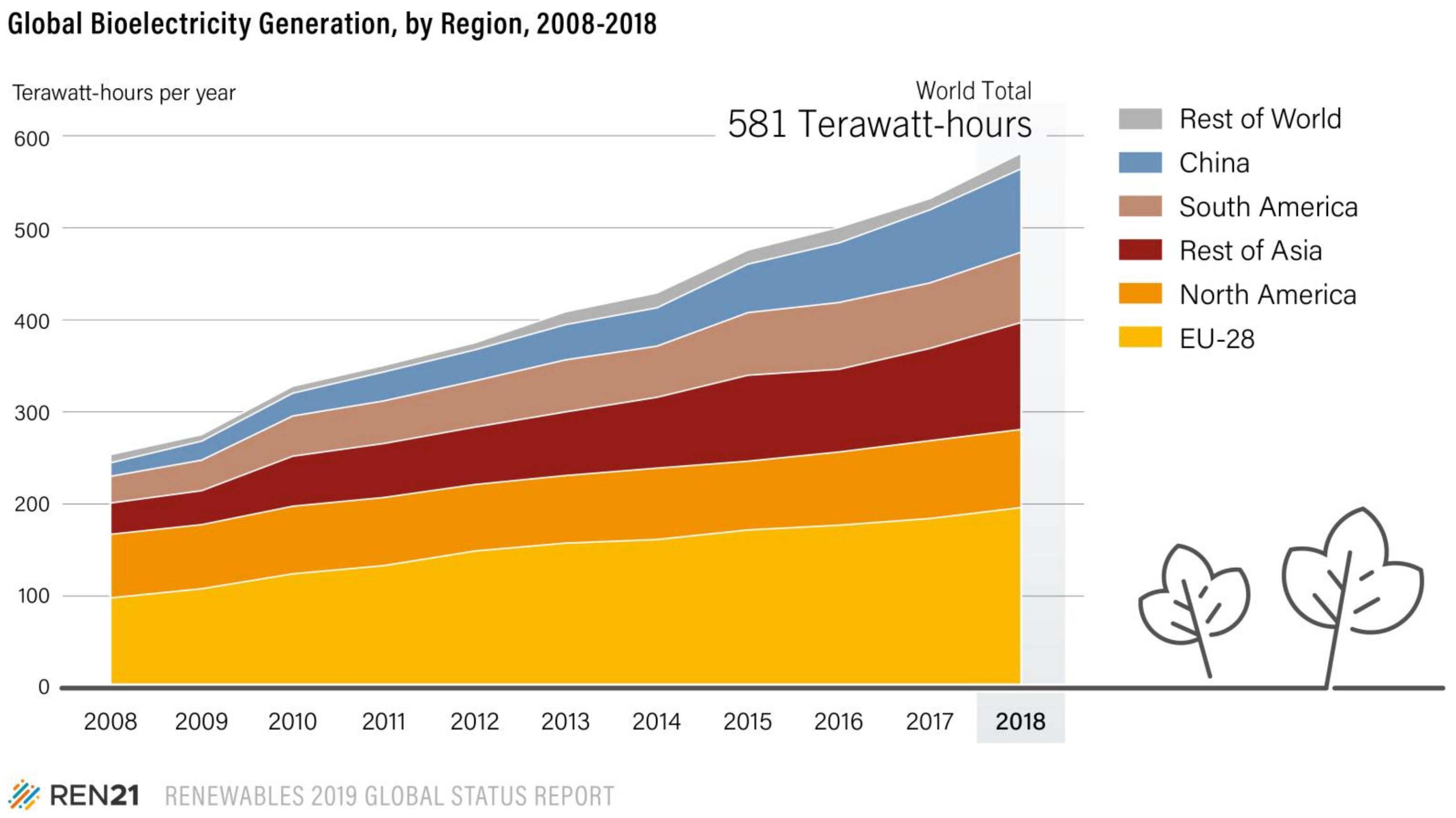
Source: OECD/IEA.

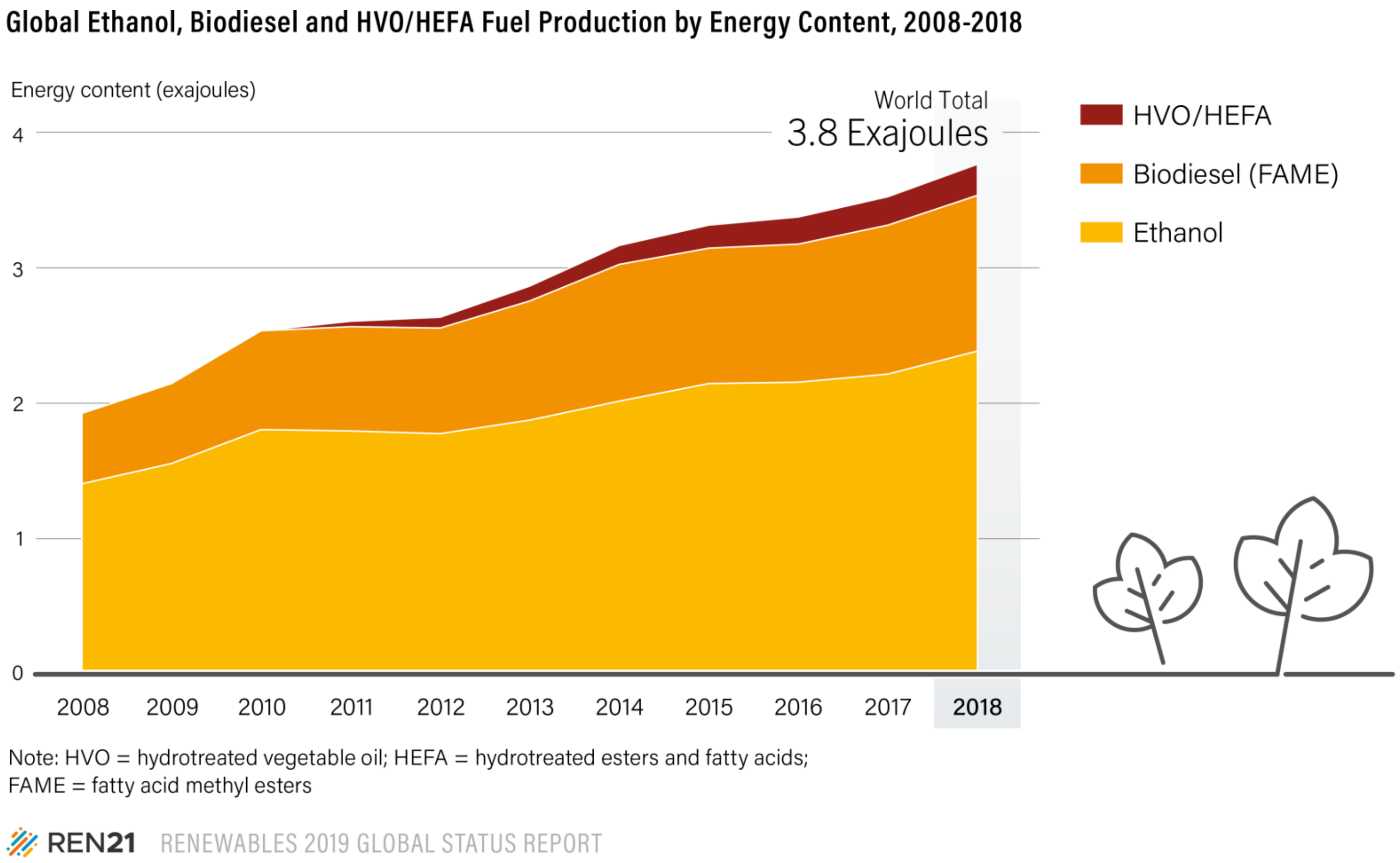
Bio-power continues trends from previous years

- Bio-power capacity increased **6.5%** in 2018
- Bioelectricity generation increased **9%**, most rapidly in China
- EU remains largest generator by region
- Top countries were China, Brazil, Germany, India, UK, and Japan



Biofuels production increases, dominated by US and Brazil

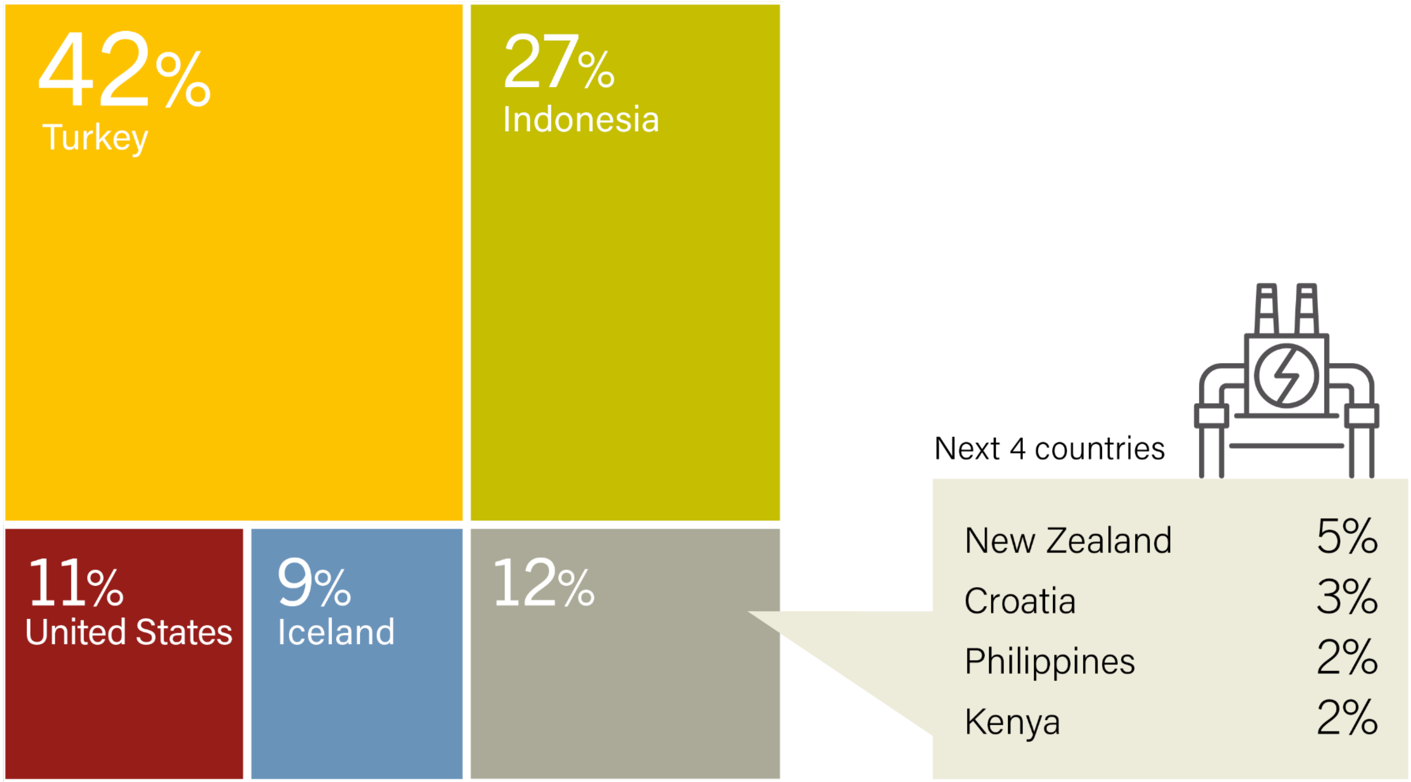
- Biofuels production increased nearly **7%** in 2018
  - US and Brazil together produced 69% of all biofuels
- Ethanol accounted to **63%** of biofuel production, FAME 31%, HVO/HEFA 6%
- Biomethane and advanced biofuels represent still small shares, though biomethane is growing rapidly in some countries



Geothermal power capacity growing gradually

- **0.5 GW** of new geothermal power capacity came online in 2018
- Global total reached **13.3 GW**
- Turkey and Indonesia added **two-thirds** of new capacity

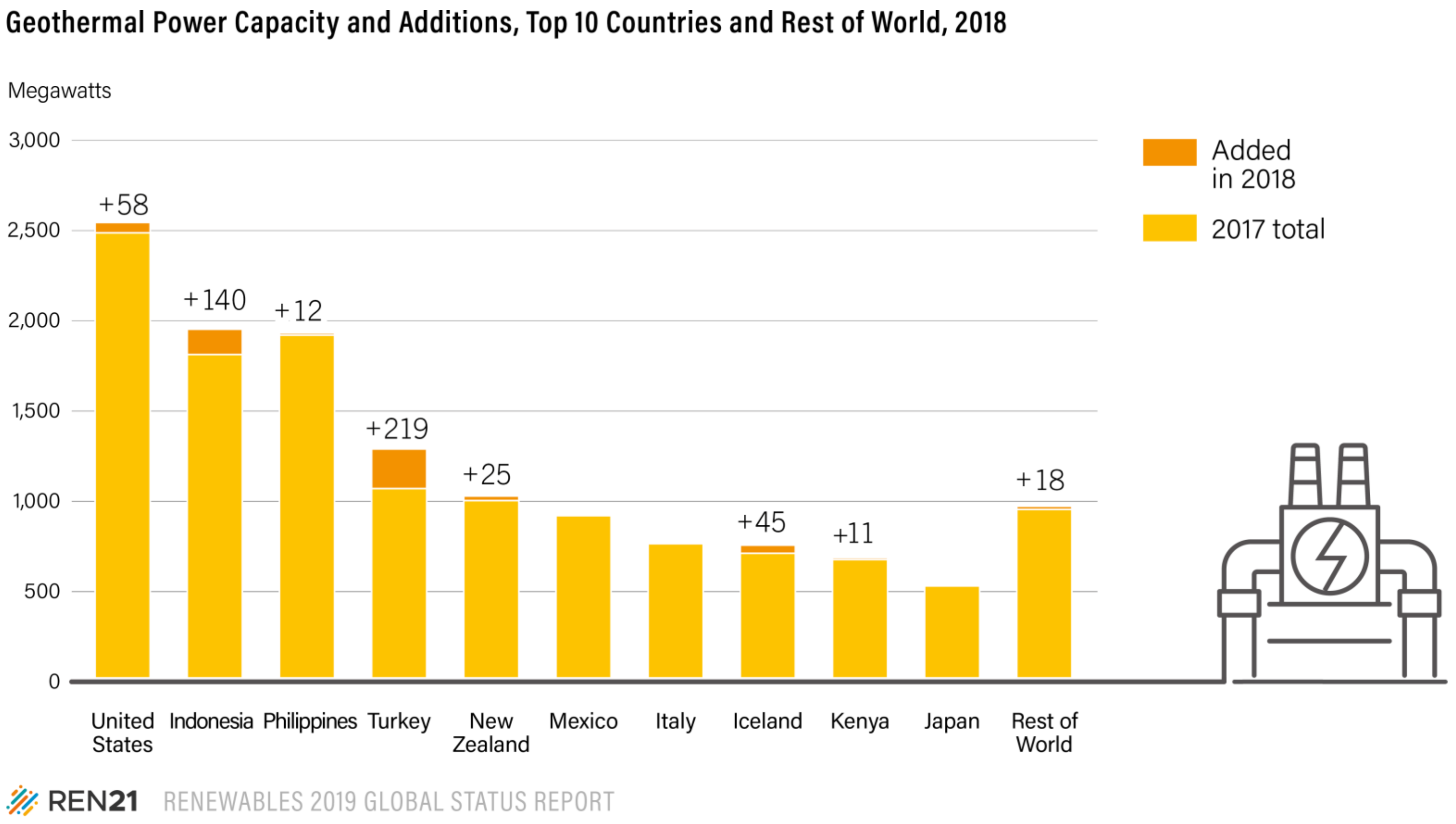
Geothermal Power Capacity Global Additions, Share by Country, 2018



Note: Total may not add up due to rounding.

Half of geothermal output as electricity, half as heat

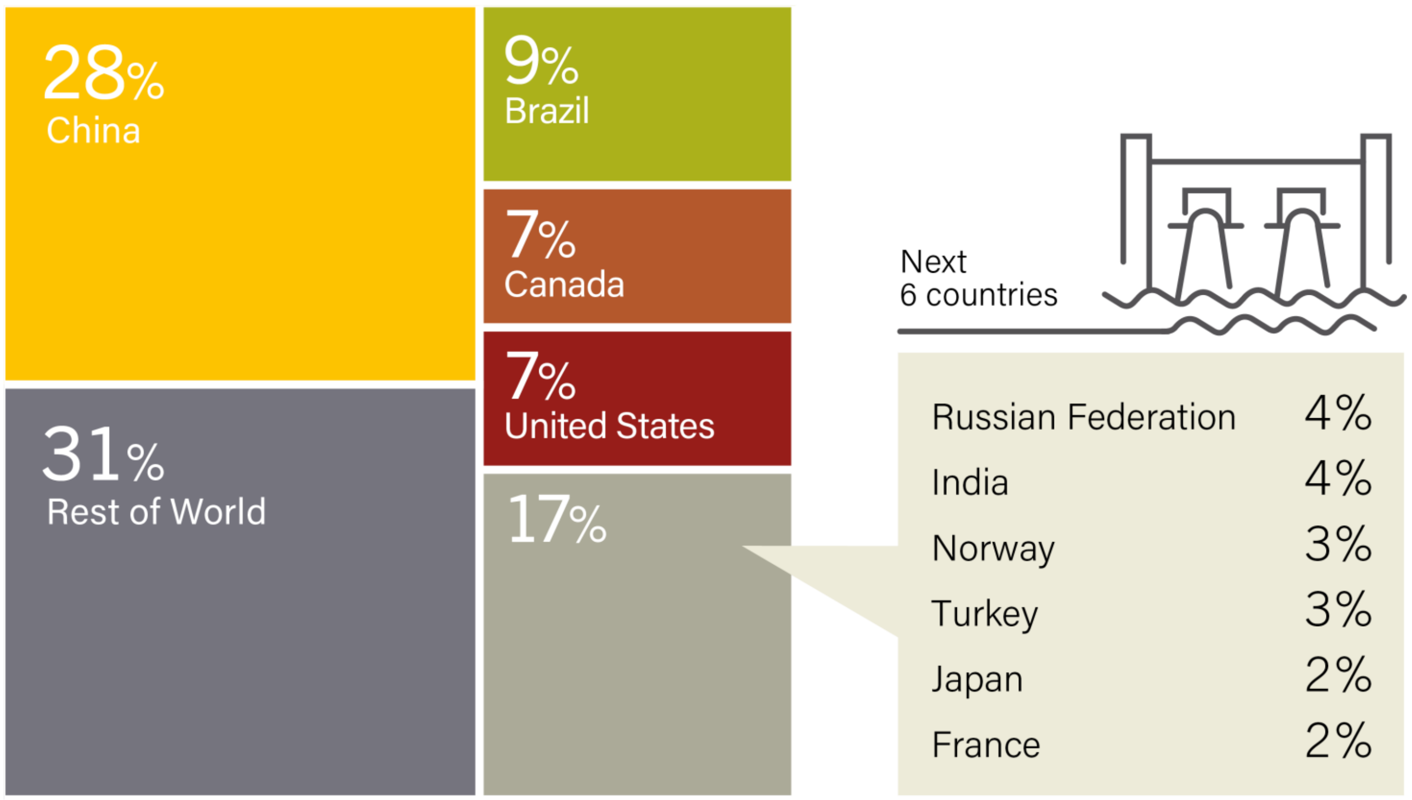
- Top countries with the largest amounts of geothermal power generating capacity were the US, Indonesia, and the Philippines
- Half of total geothermal energy output in 2018 was in the form of **electricity**, half as **heat**
- Direct use grew especially for space heating, with most activity in Europe and China



Hydropower characterised by market stability

- **20 GW** were added to reach a total of **1,132 GW** by end-2018
- China continues to lead the market, followed by Brazil, Canada, and the US
- Generation estimated at **4,210 TWh** in 2018

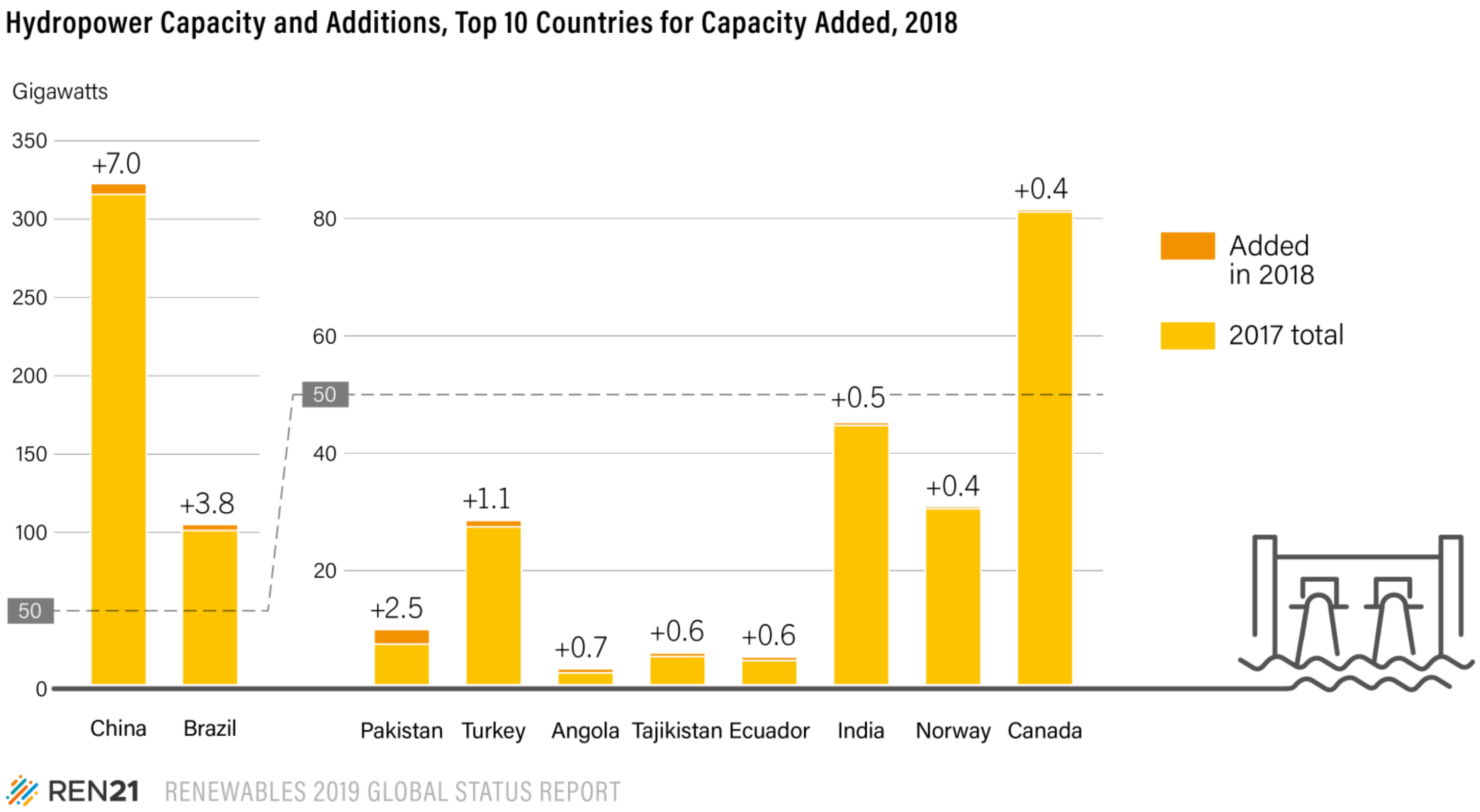
Hydropower Global Capacity, Shares of Top 10 Countries and Rest of World, 2018



Note: Total may not add up due to rounding.

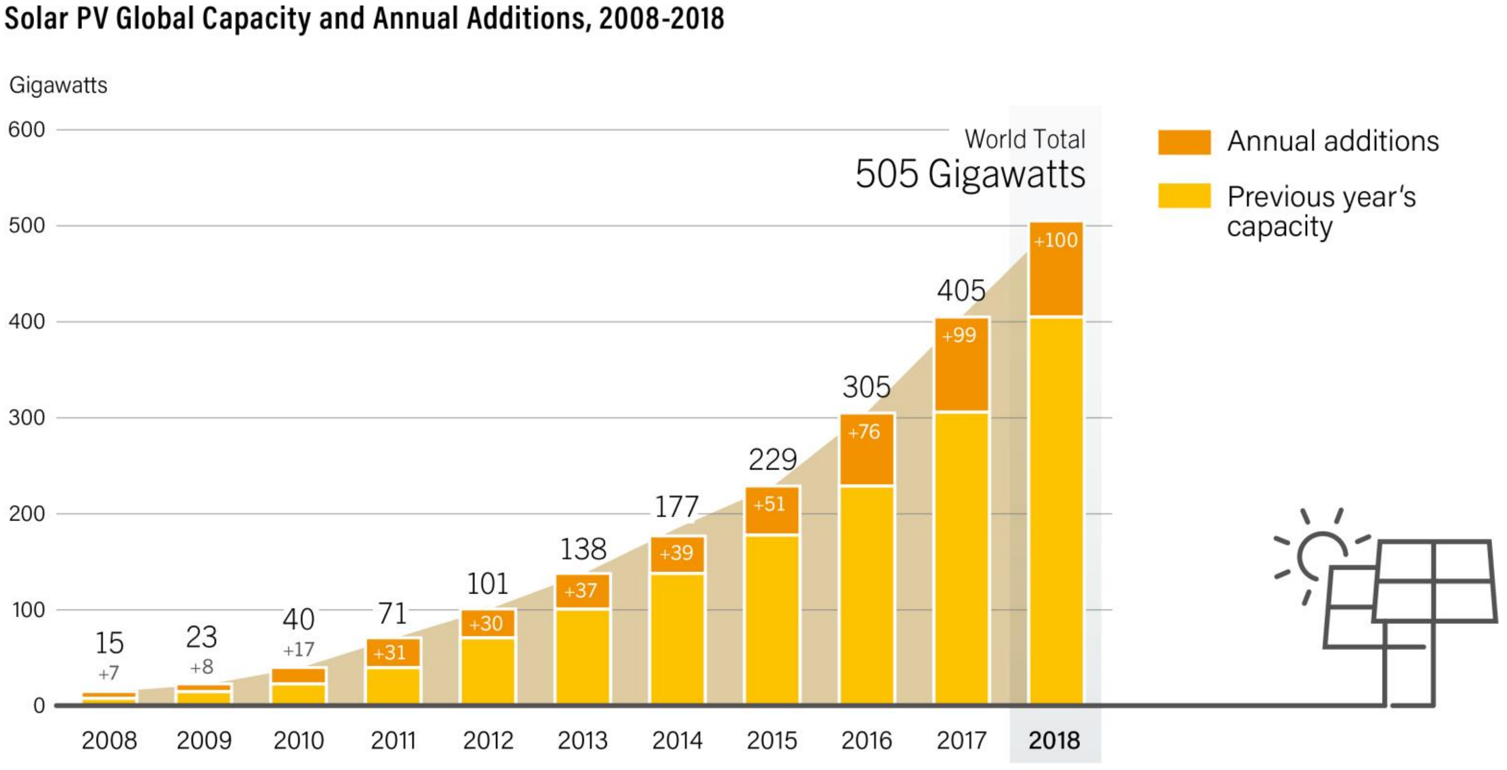
Hydropower capacity added in nearly every region

- China represented more than **35%** of new installations, followed by Brazil, Pakistan, and Turkey
- Pumped storage capacity grew **1%**, mostly in China



Solar PV capacity additions pass 100 GW mark in 2018

- Solar PV capacity additions were **more than 100 GW** for the first time
- Cumulative capacity reached **505 GW**, an increase of **25%** from 2017



Note: Data are provided in direct current (DC).
Totals may not add up due to rounding.

Source: Becquerel Institute and IEA PVPS.

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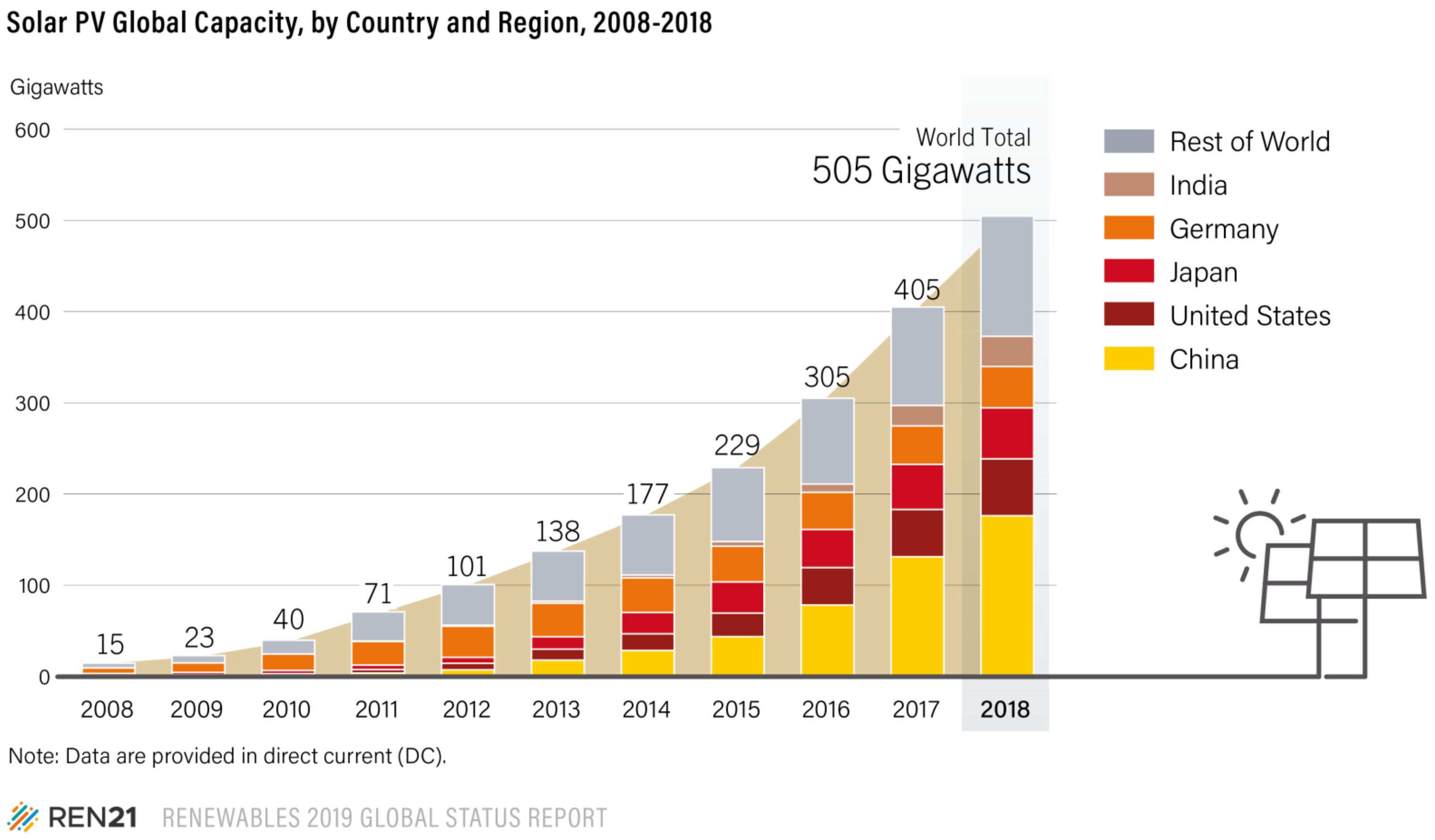
Solar PV now fastest growing energy technology worldwide

→ Solar PV is the fastest growing energy technology, and in an increasing number of countries

→ **11** countries added more than 1GW in 2018

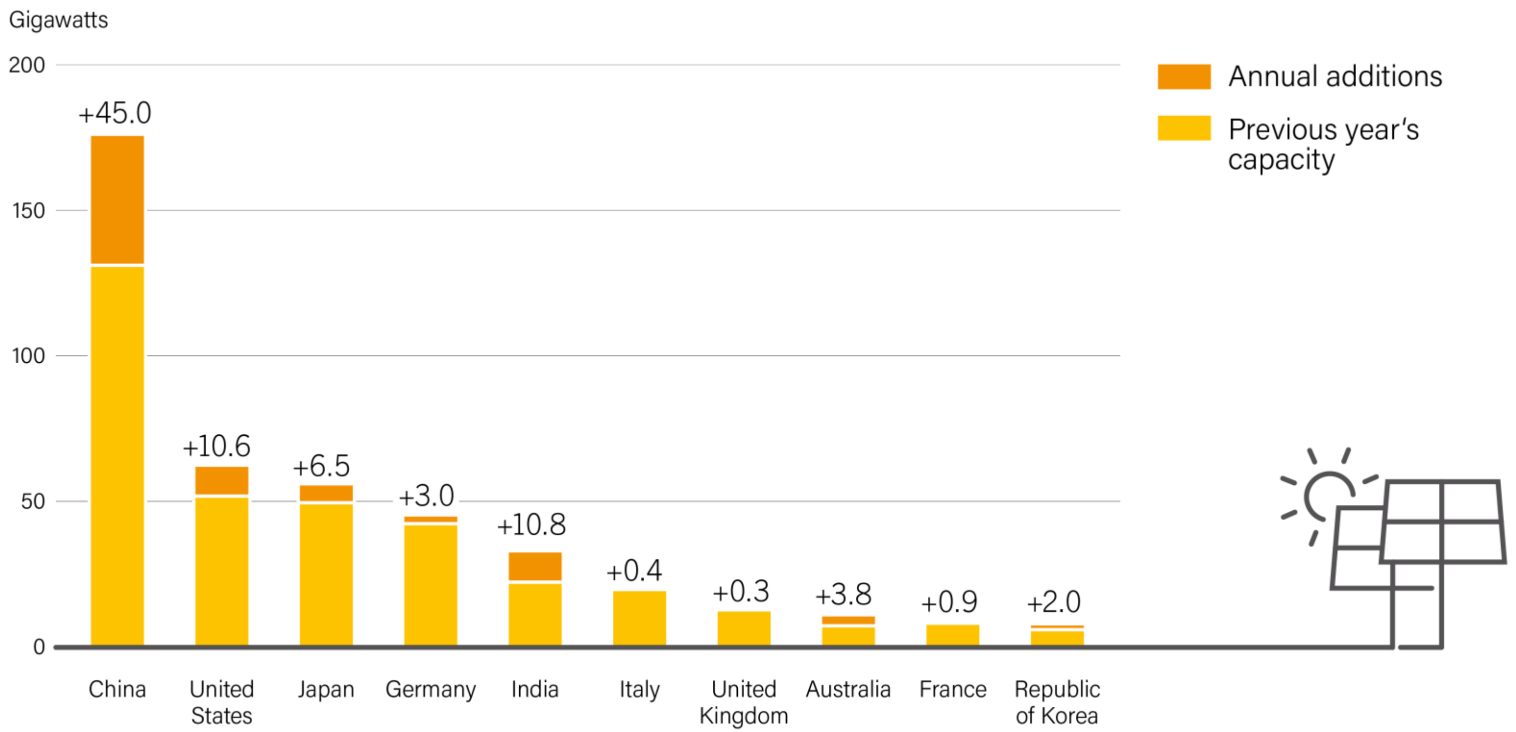
→ **32** countries had cumulative capacity of at least 1GW



China remains leader in solar PV despite decline in market

- China's market declined for the first time since 2014
- Still, its additions were more than **4 times** the next largest market
- China's cumulative capacity reached **176.1 GW**, well beyond its 2020 target

Solar PV Capacity and Additions, Top 10 Countries, 2018



Note: Data are provided in direct current (DC).
Data for India are highly uncertain.

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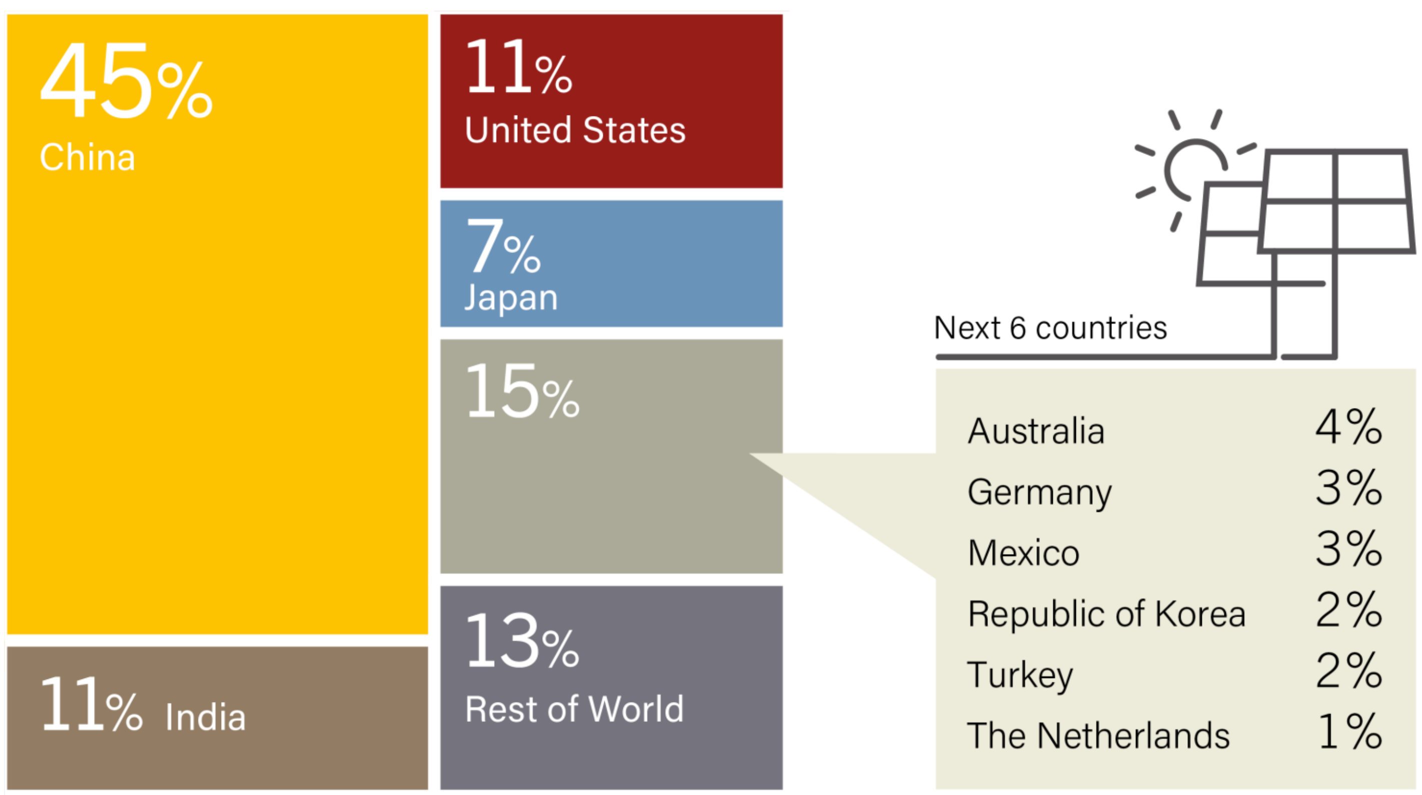
Asia the main world market for solar PV for sixth consecutive year

- Asia added the most capacity for the **6th** year in a row, followed by the Americas
- China accounted for **45%** of global additions
- The top 5 markets accounted for **three-quarters** of newly installed capacity

Solar PV Global Capacity Additions, Shares of Top 10 Countries and Rest of World, 2018



Note: Totals do not add up due to rounding.

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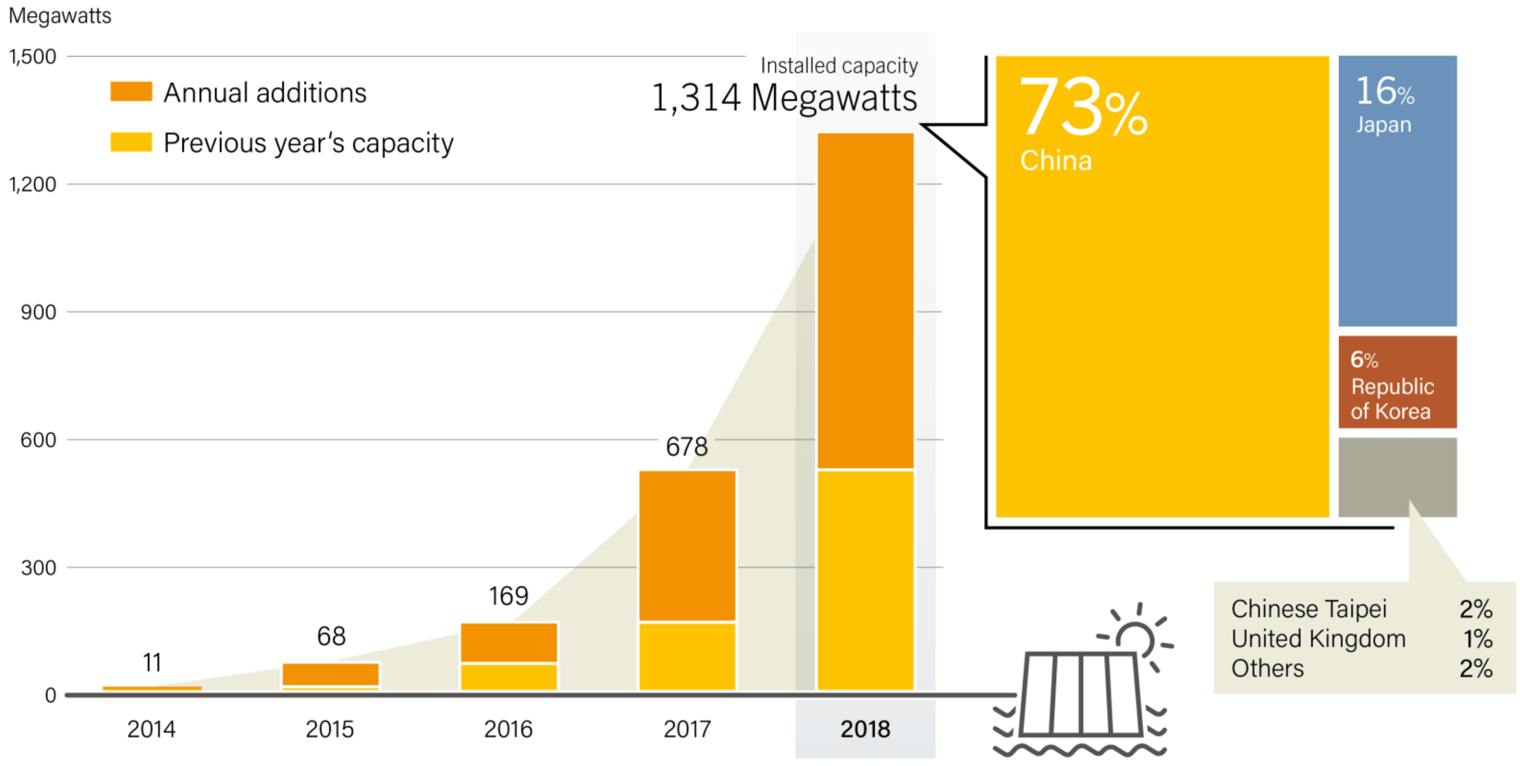
Floating solar PV cumulative capacity passes 1 GW mark

- In 2018, installed capacity of Floating PV crossed the **1 GW** mark
- Floating PV systems exist in at least **29** countries in nearly every world region
- Top markets include China, Japan, Republic of Korea, Chinese Taipei, and UK

Floating Solar PV Global Capacity and Annual Additions, 2008-2018, and Top Countries, End-2018



Source: World Bank Group, ESMAP and SERIS.

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New CSP additions installed exclusively in emerging markets

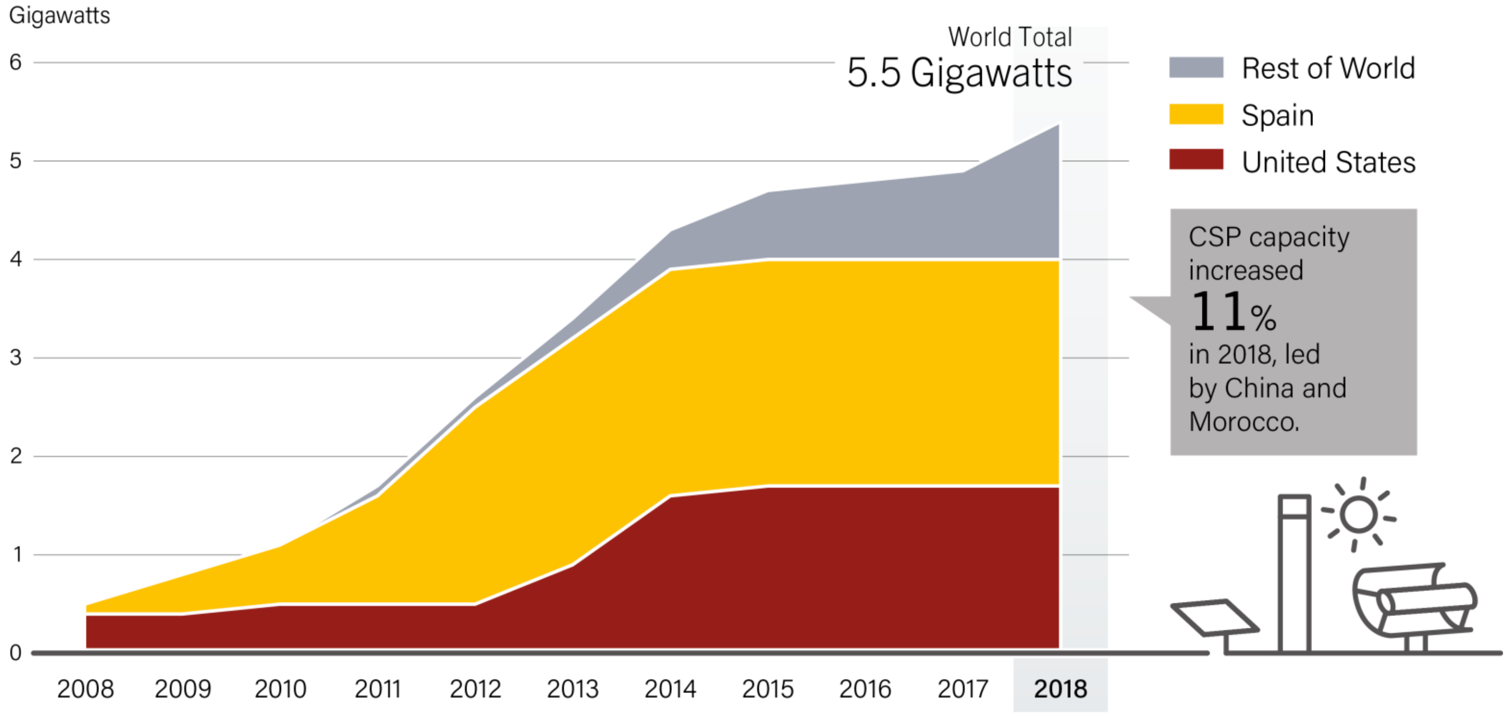
→ An estimated **550 MW** of CSP came online in 2018,

- 11% increase in cumulative global capacity
- Total reached just under 5.5 GW

→ **4 GW** of total installed capacity is located in Spain and the United States

→ For the **third consecutive year**, new capacity came online only in **emerging markets**

Concentrating Solar Thermal Power Global Capacity, by Country and Region, 2008-2018



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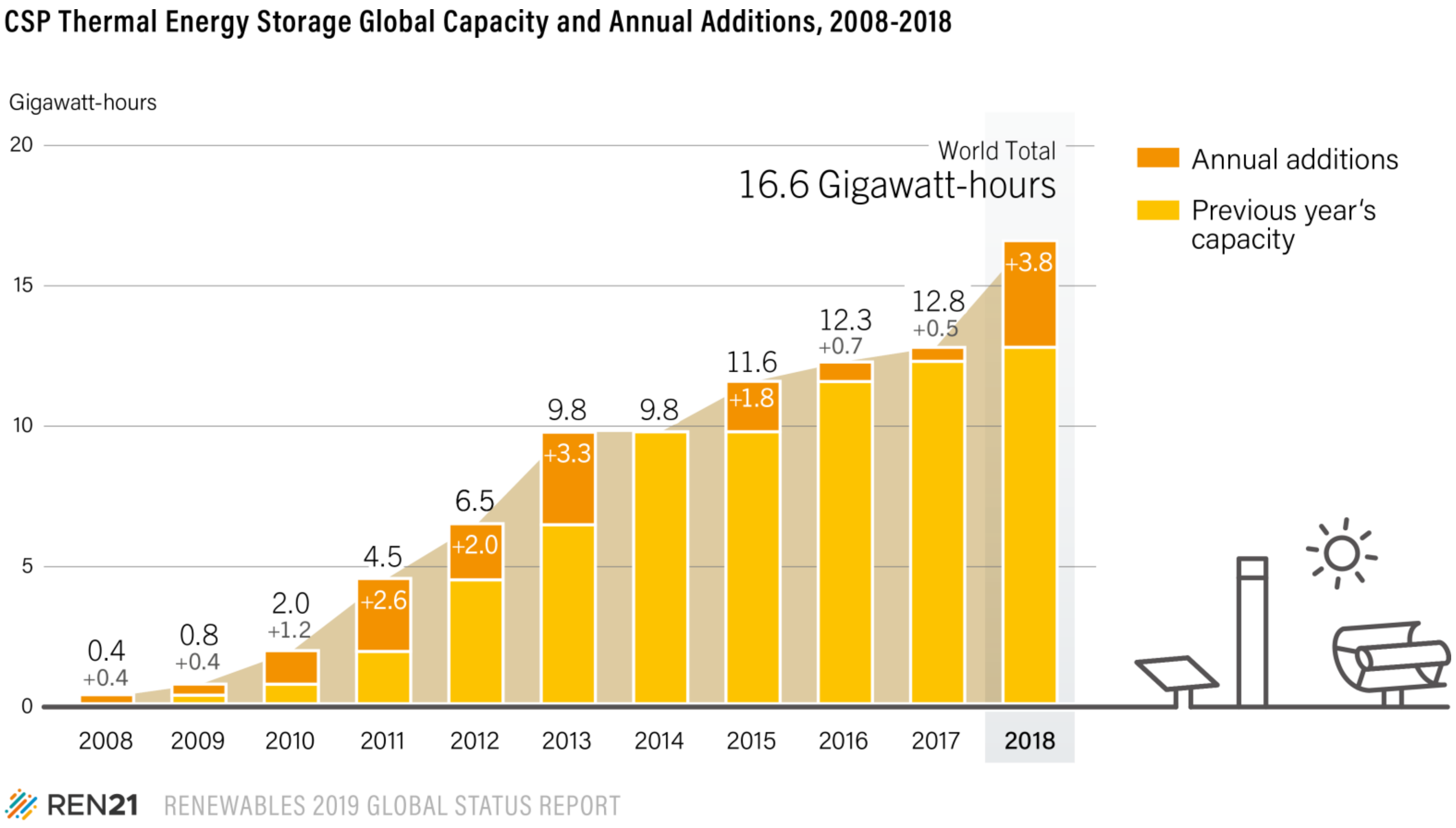
Record year for thermal energy storage

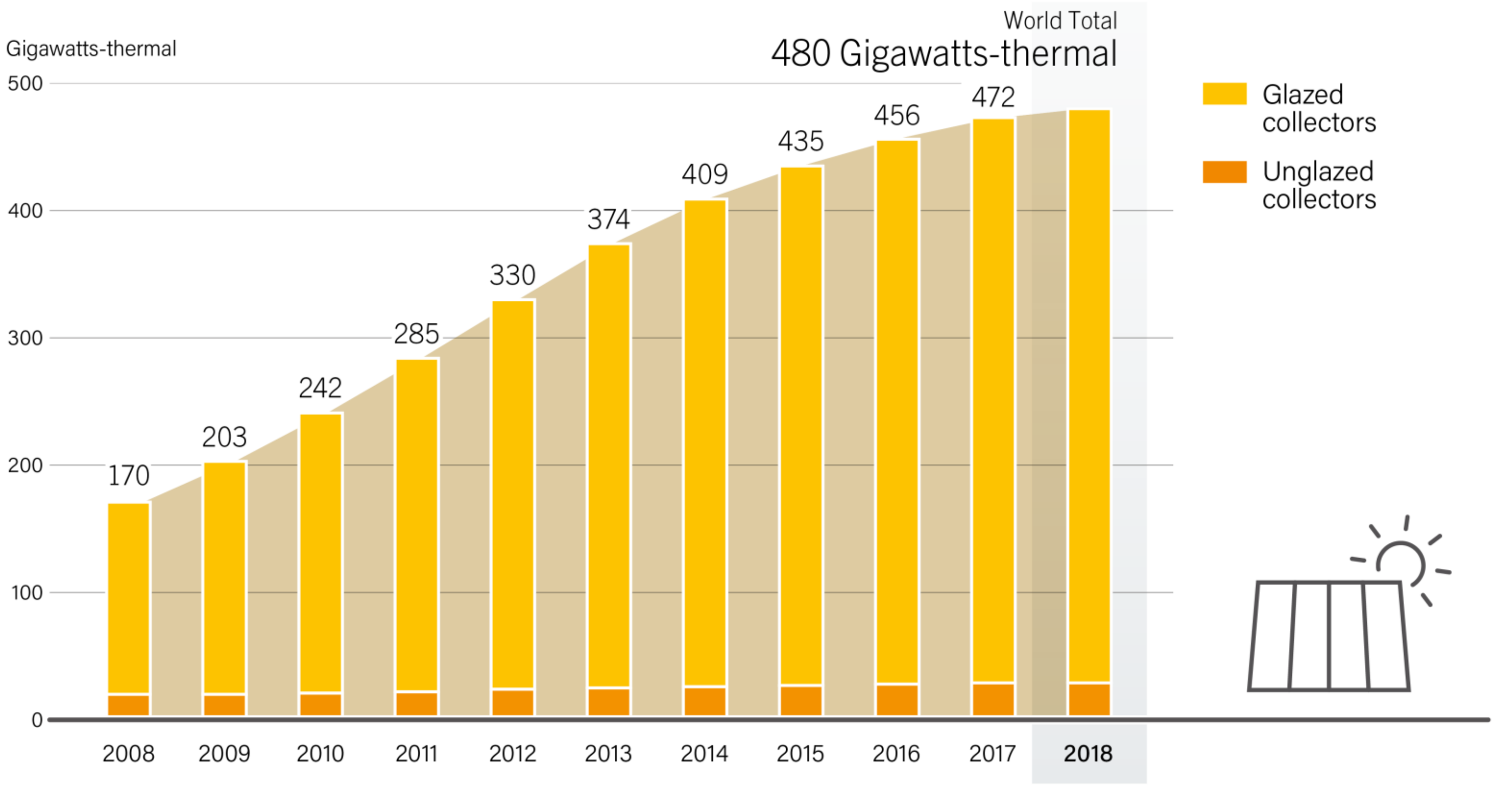
- Almost **17 GWh** of thermal energy storage was operational in conjunction with CSP plants by the end of 2018
  - Based almost entirely on molten salts
- 2018 was a record year for additions with **3.8 GWh** being brought online



Growth rate slows for solar water heating capacity additions

- Cumulative global operating capacity for solar water heating collectors increased **2%** to reach **480 GWth**
- The majority of this capacity is glazed collectors
- The 2018 increase of **8 GWth** is the smallest in the last ten years

Solar Water Heating Collectors Global Capacity, 2008-2018



Note: Data are for glazed and unglazed solar water collectors and do not include concentrating and air collectors.

Source: IEA SHC.

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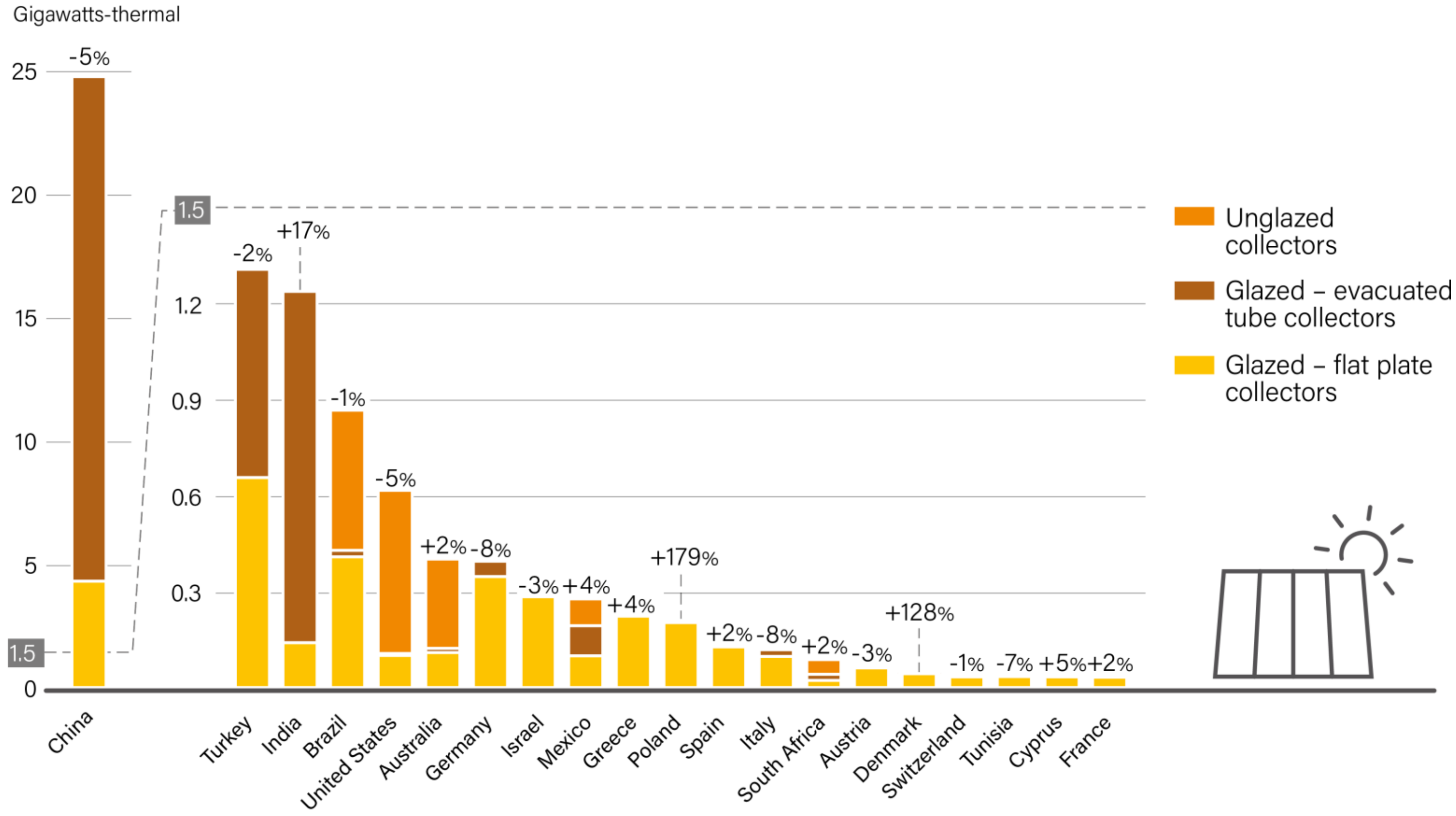
More markets report solar thermal sales increases in 2018

- Globally, **33.3 GWth** of solar thermal capacity was added in 2018
  - Down **4%** from the 34.6 GWth newly installed in 2017
- China accounted for **74%** of gross additions, with **24.8 GWth**
- Annual installations rose in 10 of the world's 20 largest markets

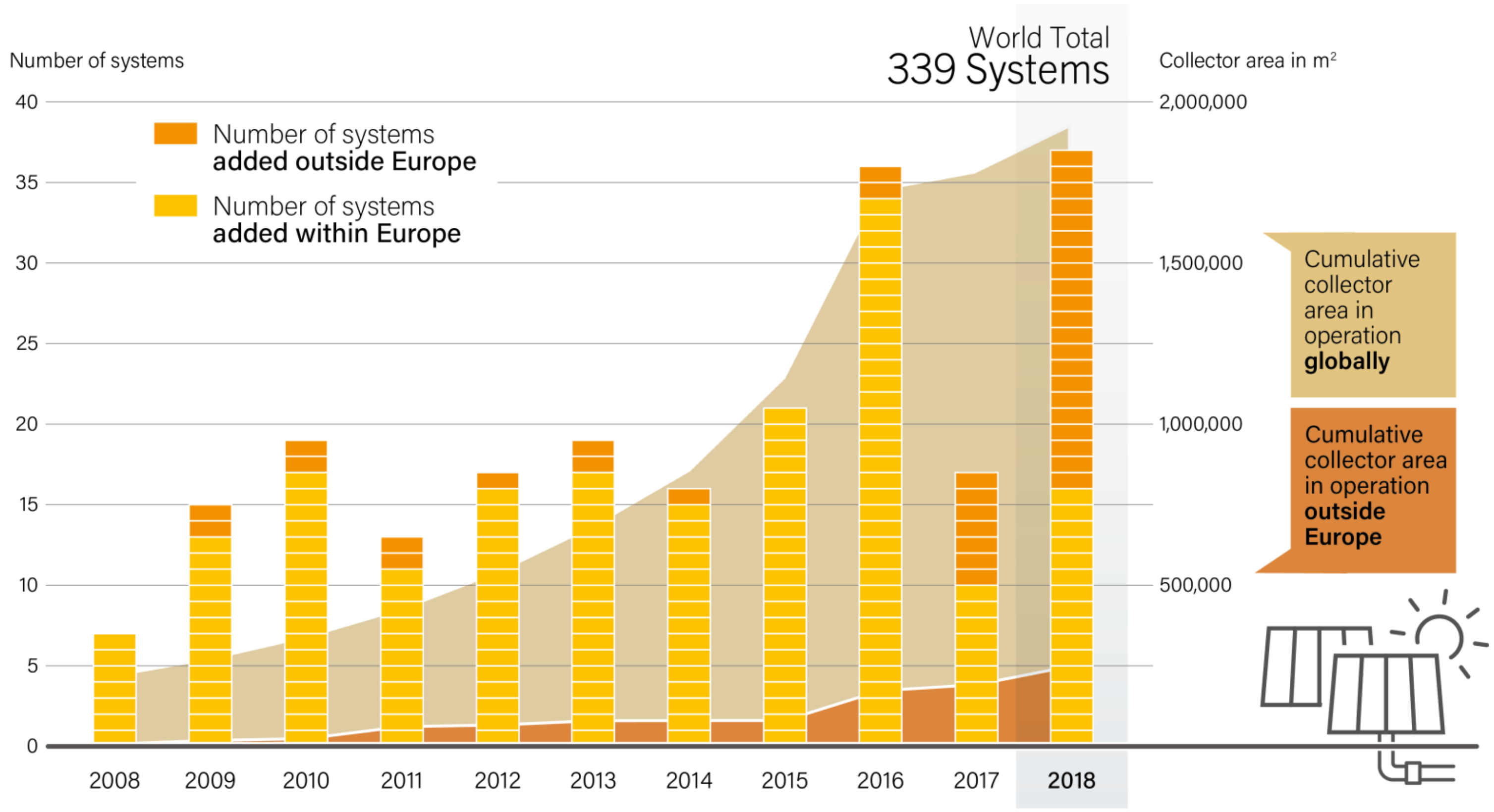
Solar Water Heating Collector Additions, Top 20 Countries for Capacity Added, 2018



Note: Additions represent gross capacity added.

Significant increase in solar district heating additions outside Europe

- **37** new large-scale solar thermal systems were commissioned in 2018
  - Significant increase compared to 17 systems reported in 2017
- Globally, at least **339** large-scale solar thermal systems were in operation by the end of 2018, for a total of **1.35 GWth**



Note: Includes large-scale solar thermal installations for residential, commercial and public buildings. Data are for solar water collectors and concentrating collectors.

Source: IEA SHC.

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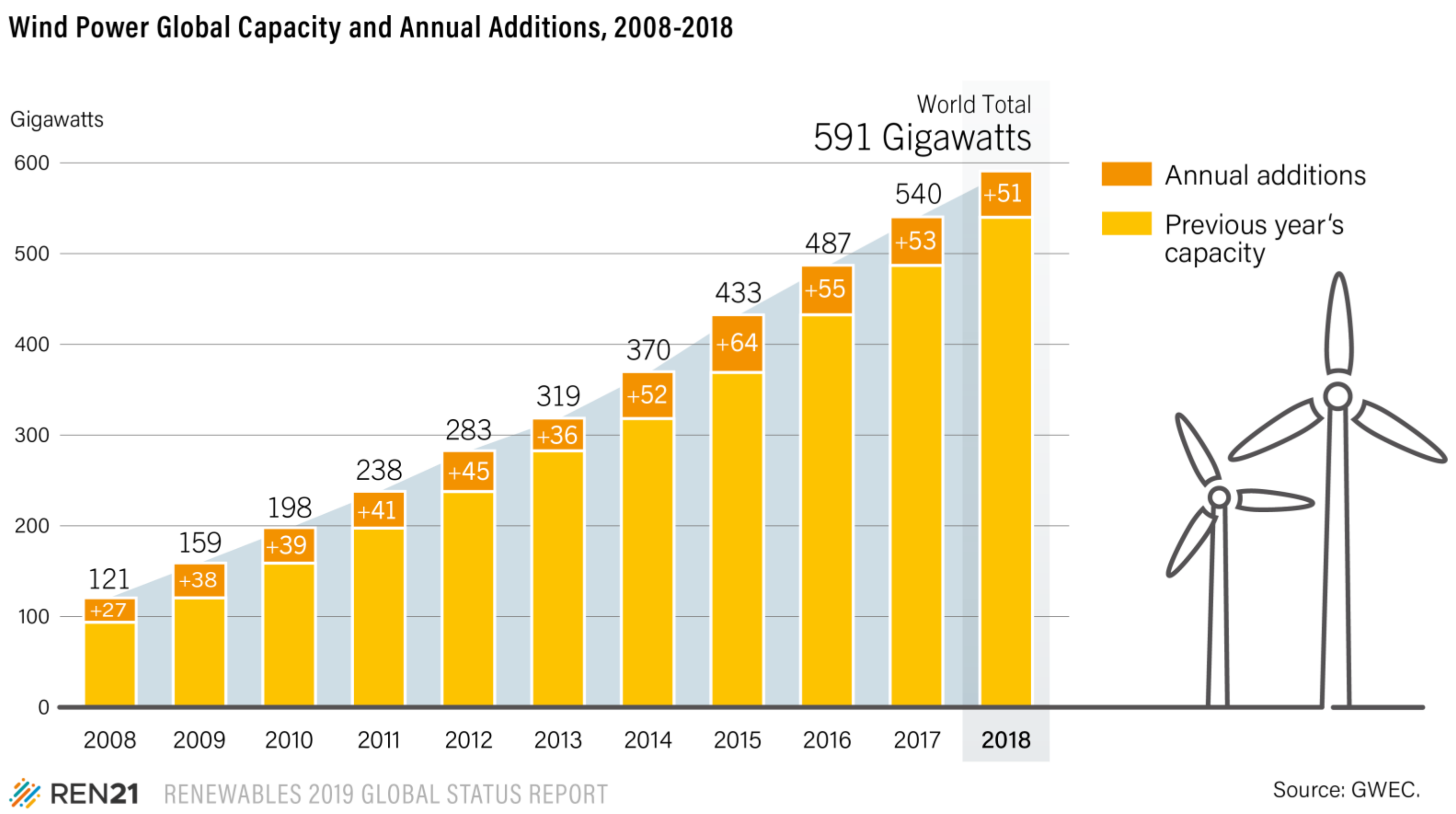
Wind power capacity continues to increase steadily year-on-year

→ The additions in 2018 pushed cumulative capacity up **9%** to **591 GW**

→ Of the **51 GW added**, nearly 47 GW was onshore and 4.5 GW was offshore

→ This was the fifth consecutive year with annual additions **exceeding 50 GW**, but also the third year of decline following the peak in 2015



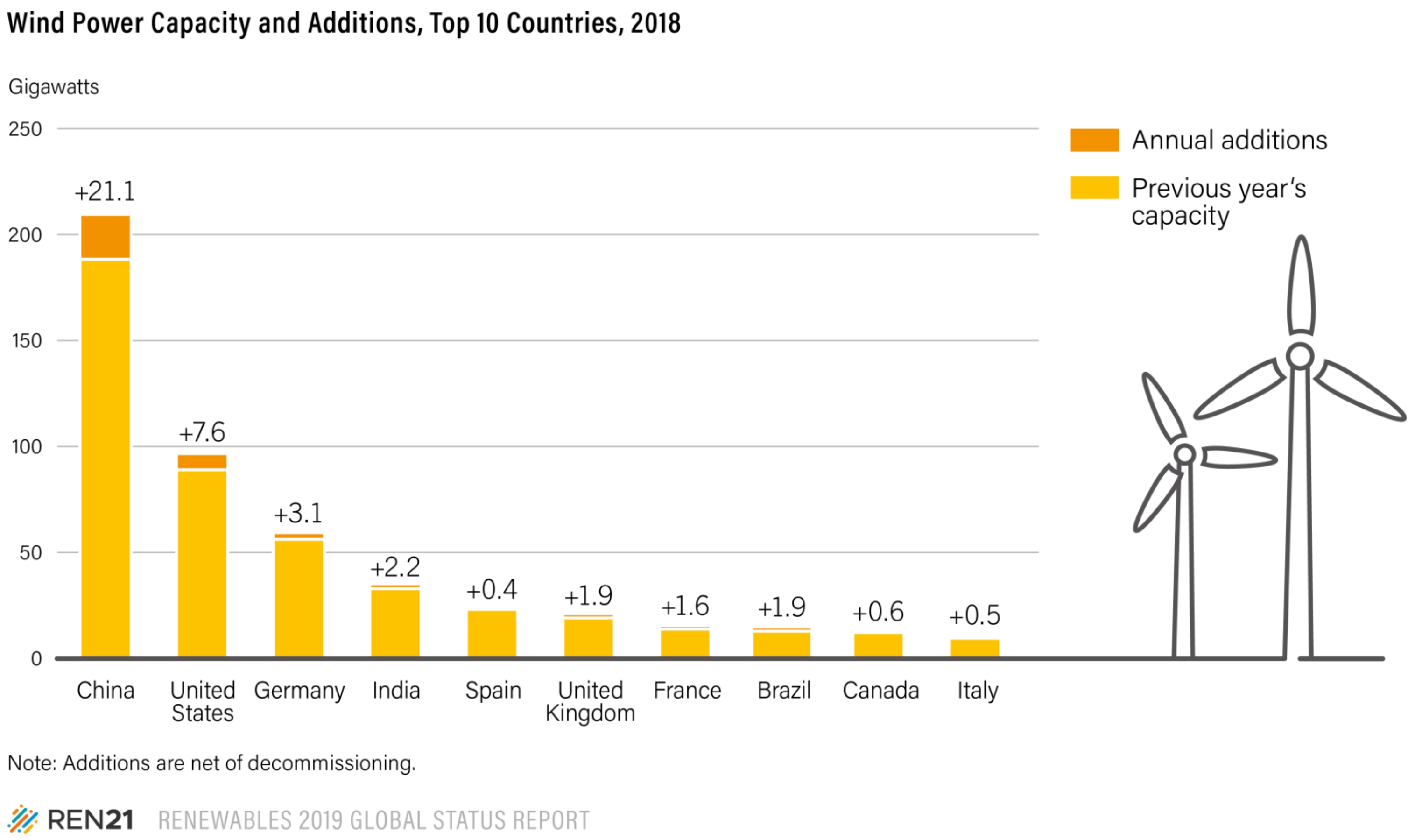
Commercial wind power projects becoming more widespread

→ For cumulative capacity, the top 10 countries remained unchanged from 2017

→ China became the **first country to exceed 200 GW** of capacity and saw an increase in new installations after two years of decline

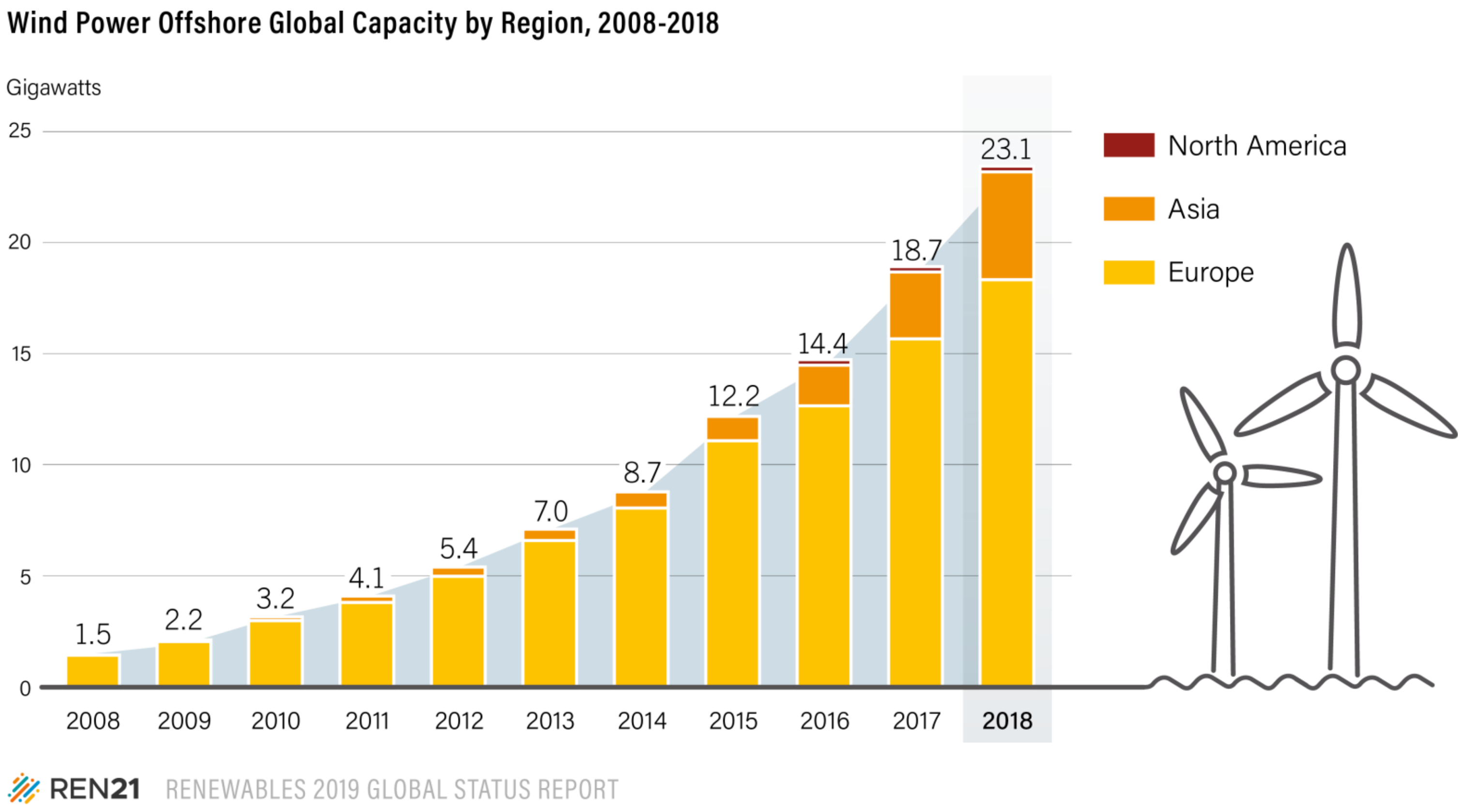
→ At least **103** countries have commercial wind power capacity

- **33** countries have **more than 1 GW** in operation



Success of offshore wind in Europe has sparked interest elsewhere

- By the end of 2018, **17** countries had offshore wind capacity
- The United Kingdom leads with **8 GW** of installed capacity
- In 2018, seven countries in Europe and two in Asia connected **4.5 GW**, increasing global cumulative capacity **24%**
- Europe accounts for about **79%** of global capacity



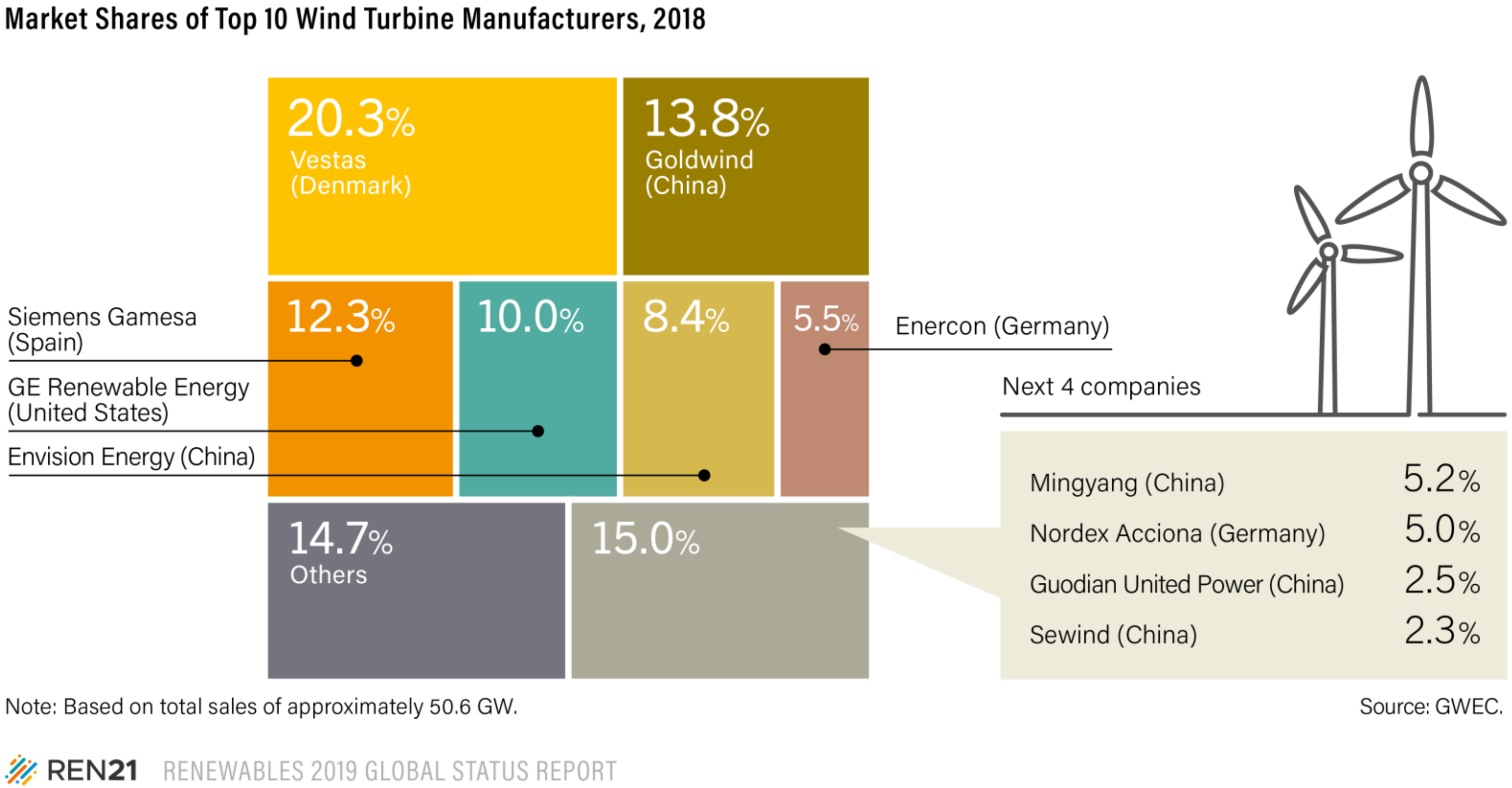
Competition causing consolidation among wind turbine manufacturers

→ **7** small turbine equipment manufacturers forced out of the market in 2018

→ The top 10 companies captured an **85%** market share

- Up from 80% in 2017 and 75% in 2016

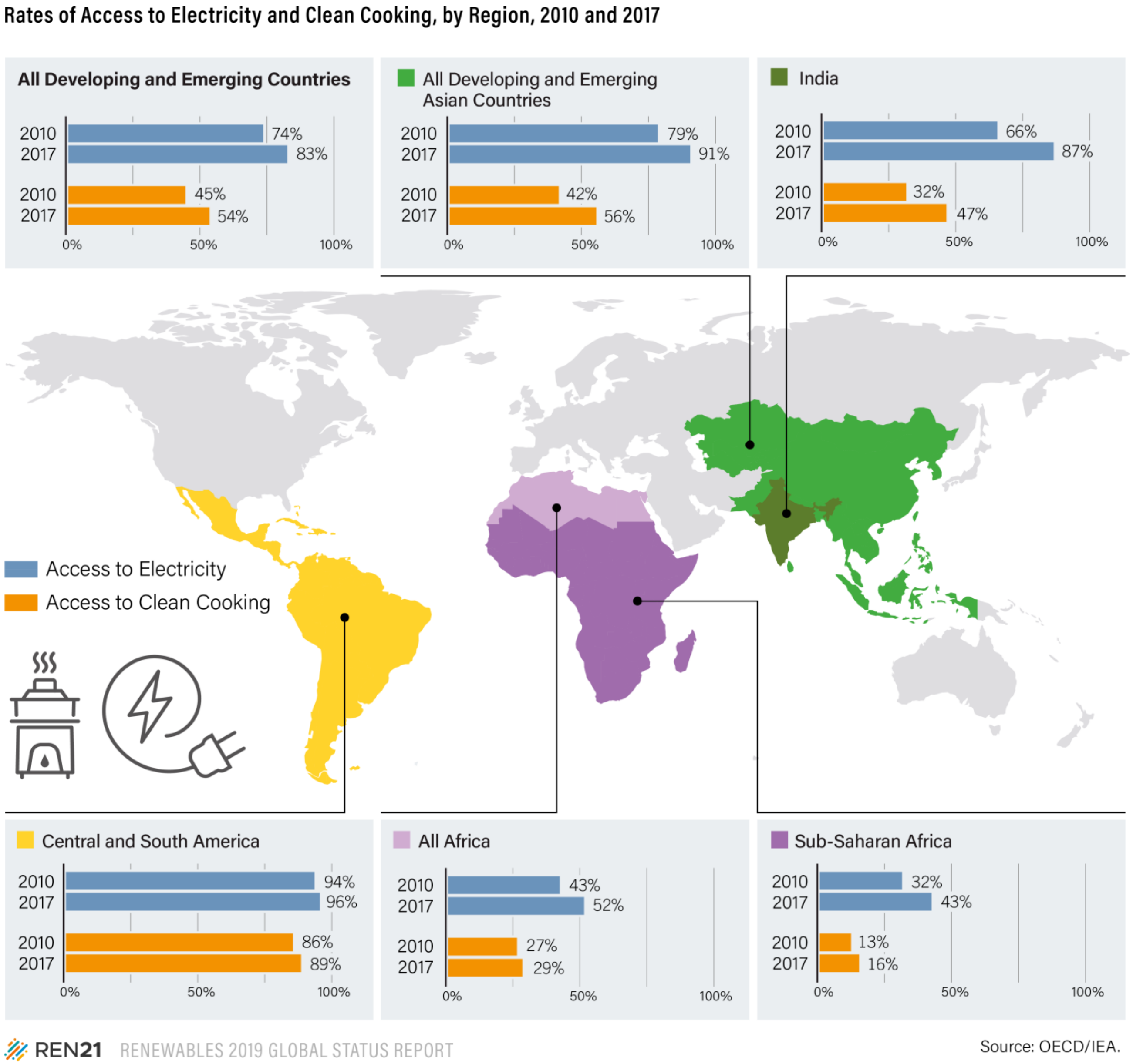
→ Top 5 manufacturers accounted for nearly **two-thirds** of turbines delivered



Access to energy expands

→ In 2017:

- **13%** of the global population lived **without electricity** – approx. 992 million people
- **36%** of the global population lived **without clean cooking** – approx. 2.7 billion people
- A majority live in rural areas of sub-Saharan Africa and Asia-Pacific regions

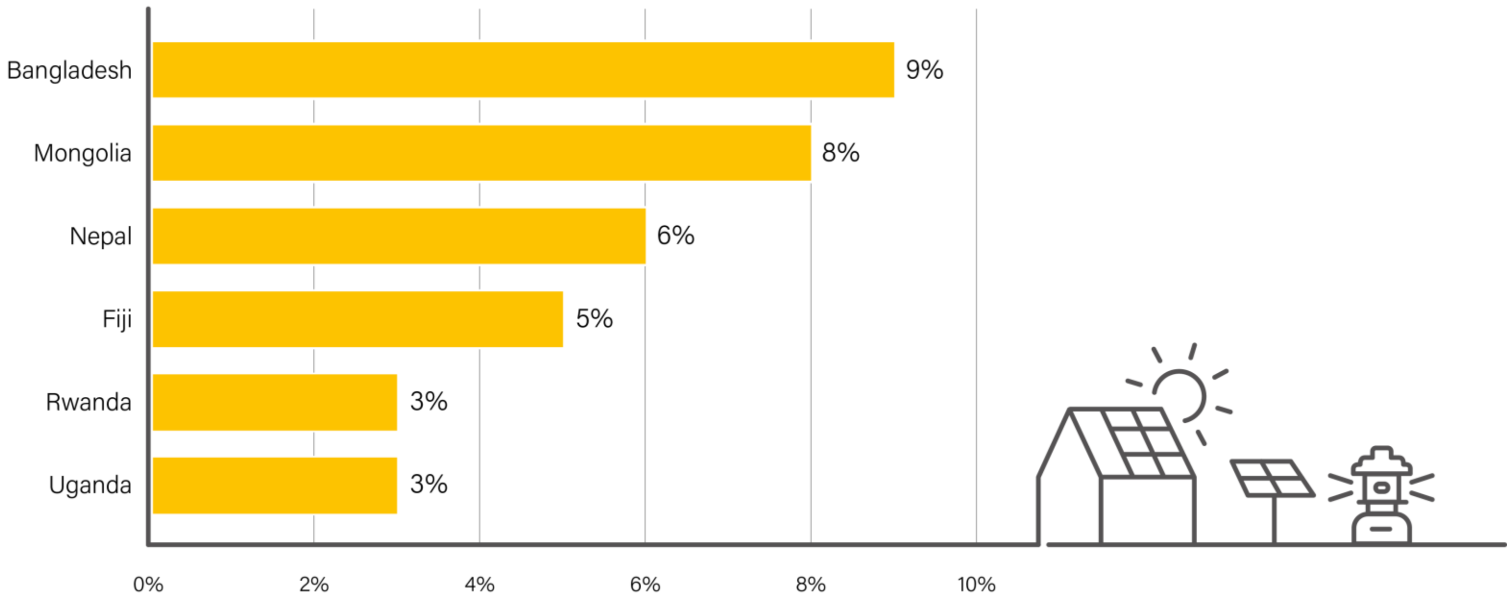


Off-grid solar PV is increasingly widespread

→ **150 million** people across Africa and Asia benefit from energy access through **off-grid solar systems**

- 5% of the population in Africa
- 2% of the population in Asia

Top 6 Countries with Highest Off-Grid Solar PV Access Rate (Tier 1 and Above), 2016



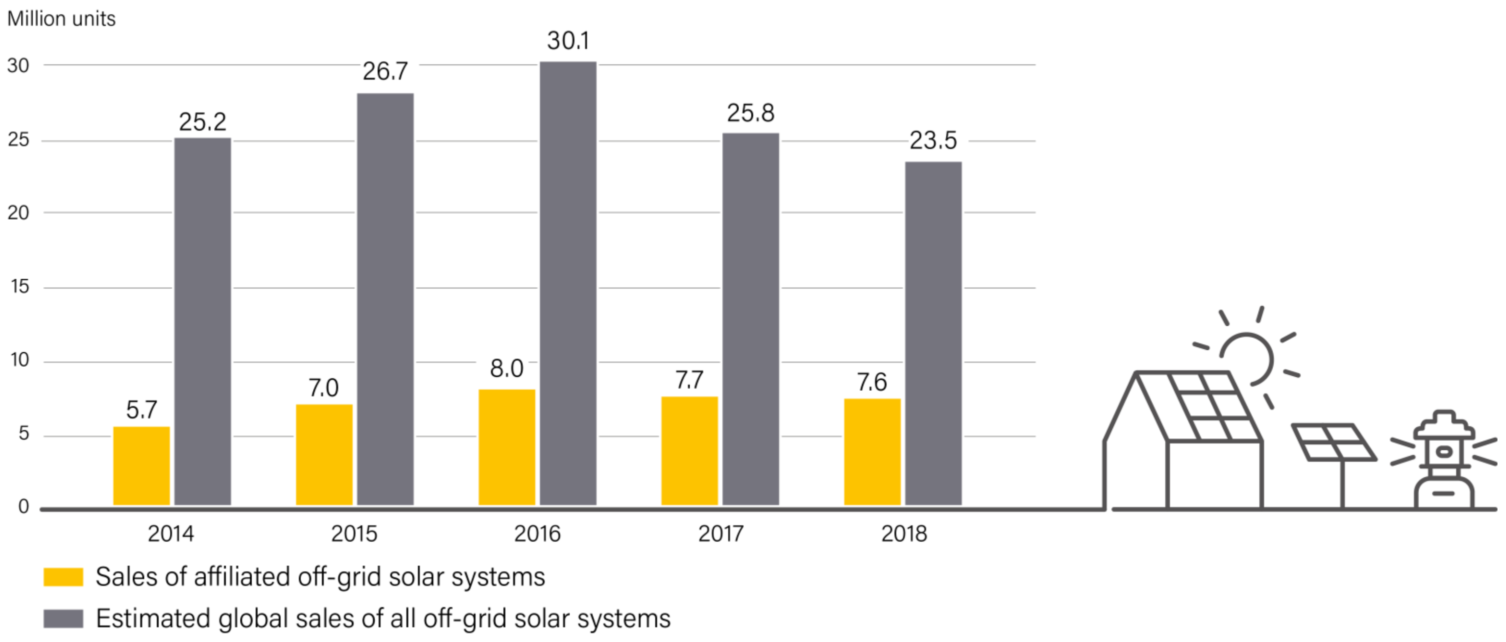
Note: Tier 1 access, as defined in the Multi-tier Framework for measuring access to household electricity supply, equals a minimum of 3 watts or 12 watt-hours per day of peak capacity, lighting of 1,000 lumen hours per day, and a minimum four hours per day or one hour per evening of electricity supply.

Source: World Bank.

Global sales of off-grid solar systems sees strong growth rates

- Off-grid solar devices (solar lanterns and solar home systems): **50% annual growth** rates between 2010 and 2018
- In 2018:
  - Total sales of off-grid solar products: 23.5 million units
  - Sales of affiliated off-grid solar products: 7.6 million units
- Installed capacity of **affiliated off-grid solar products increased 45%**
- Change in the dynamics of the market:
  - Pico-solar sales decreased 9%
  - Larger solar home systems increased 77%

Annual Global Sales of Off-Grid Solar Systems, 2014-2018



Source: GOGLA/Lighting Global.

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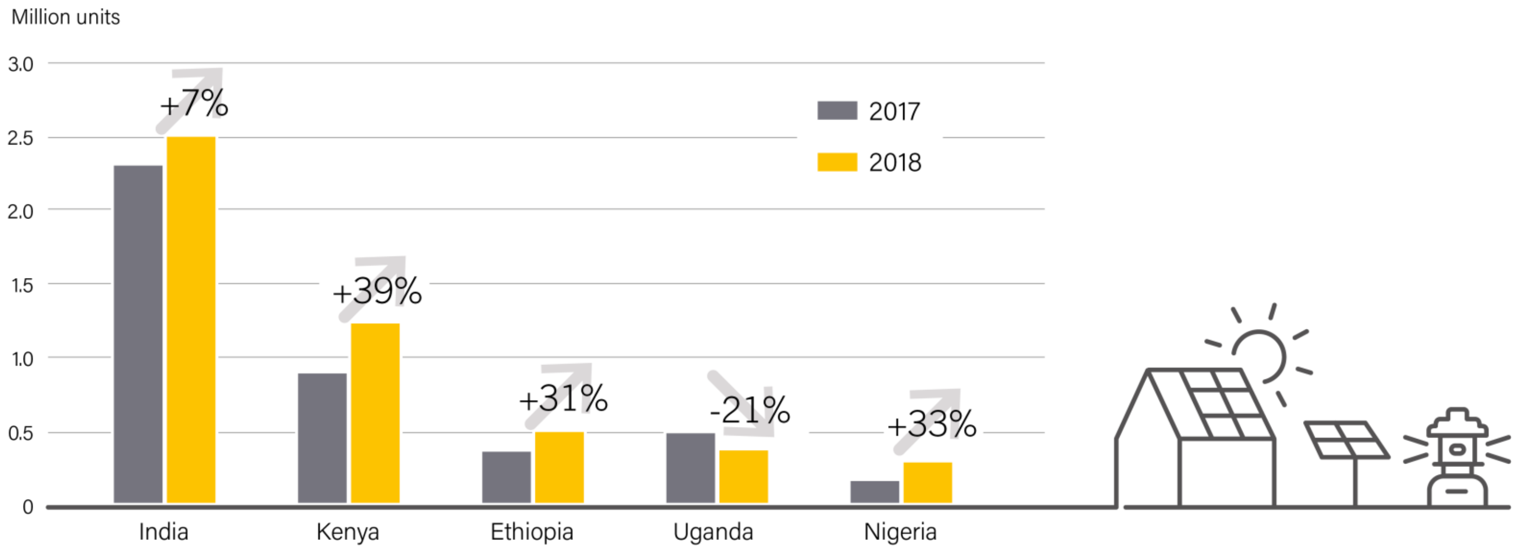
Markets for off-grid solar systems evolving

→ Regional markets evolutions:

- East Africa: +16%
- South Asia: +9%
- East Asia and the Pacific: +32%
- Central Africa: -43%
- West Africa: -21%

→ Across the top 5 markets, sales increased in India, Kenya, Ethiopia and Nigeria, whereas sales decreased in Uganda

Number of Affiliated Off-Grid Solar Systems Sold in Top 5 Countries, 2017 and 2018



Note: Figure drawn from dataset in which only countries where more than three companies have provided data are included.

Source: GOGLA/Lighting Global.

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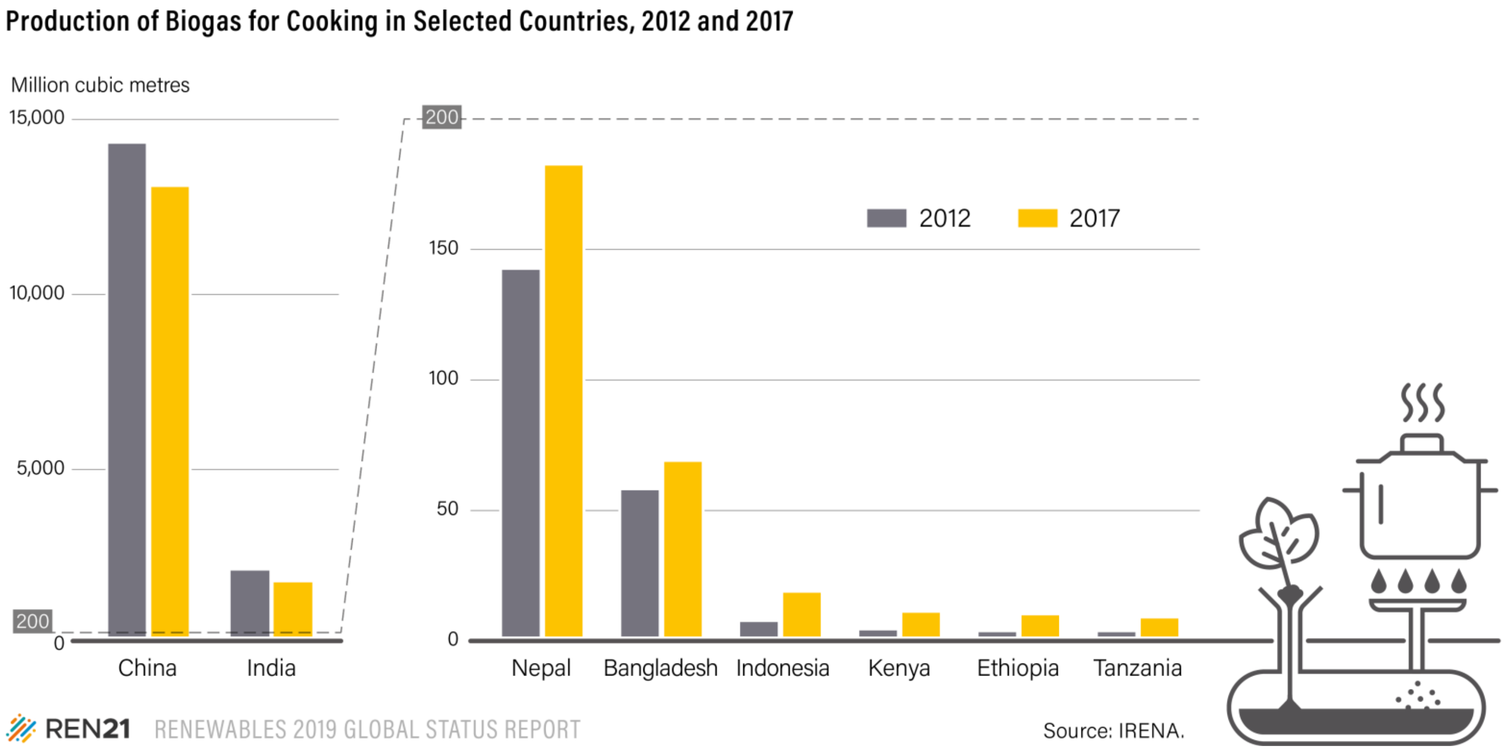
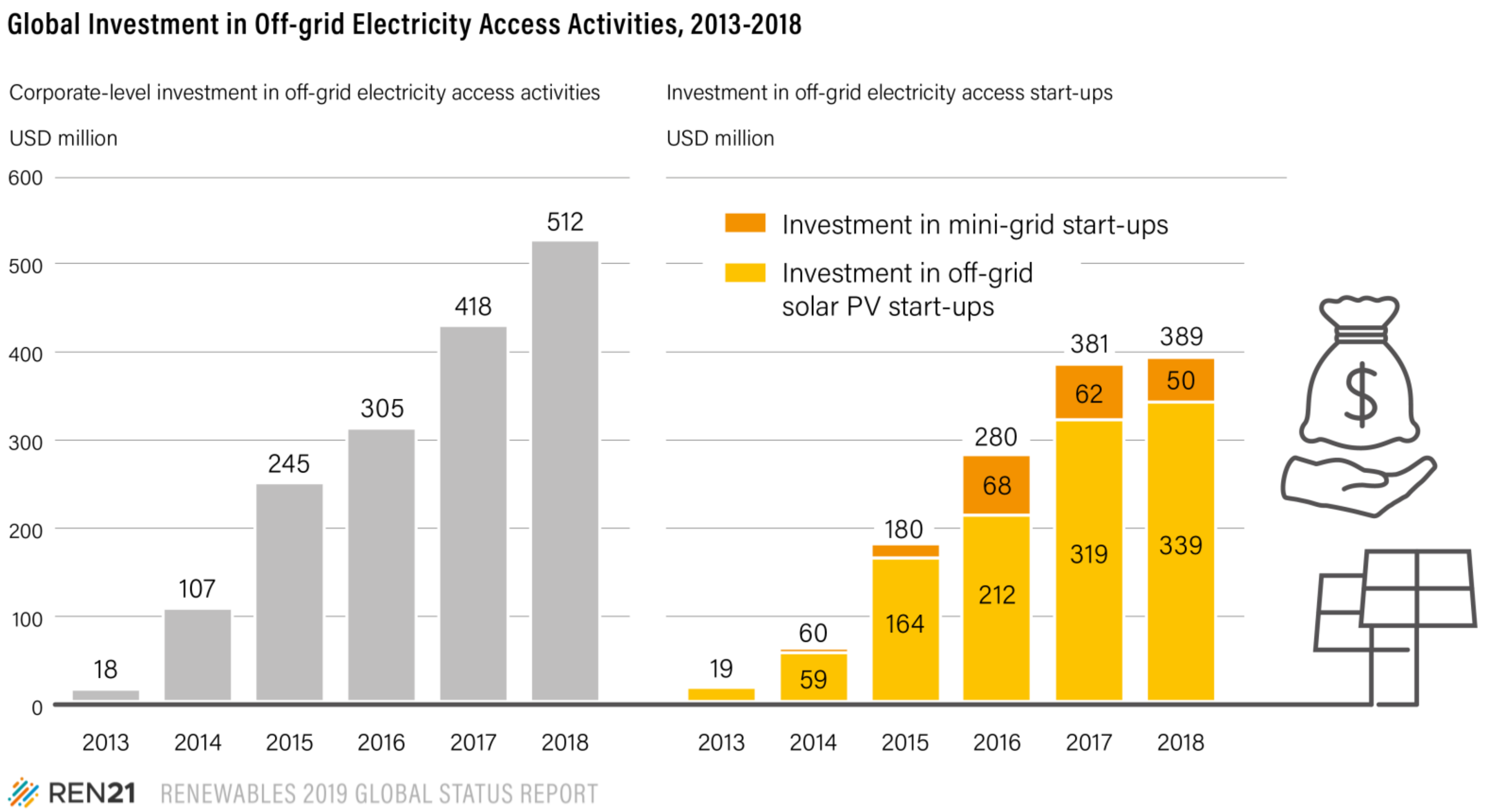
Production of biogas for cooking expands in new markets

- **125 million people using biogas for cooking** (111 million in China and 9 million in India)
- **China**: 13.1 billion m^3 of biogas produced for cooking; **India**: 1.7 million m^3
- Use of biogas for cooking grew over the past five years in Asia (Bangladesh, Cambodia, Indonesia, Nepal) and sub-Saharan Africa (Burkina Faso, Ethiopia, Kenya, Tanzania and Uganda)



Investment in off-grid electricity access continues to grow

- In 2018, **USD 512 million** of corporate-level investment into **off-grid electricity access** companies, +22% than 2017
- Off-grid solar systems in 2018:
  - Most of the investments flowed to PAYG solar home system companies: **USD 339 million**
  - East Africa remained the main recipient of capital inflows
- Mini-grids are gaining momentum
  - From 2010 to 2018: **USD 289 million**

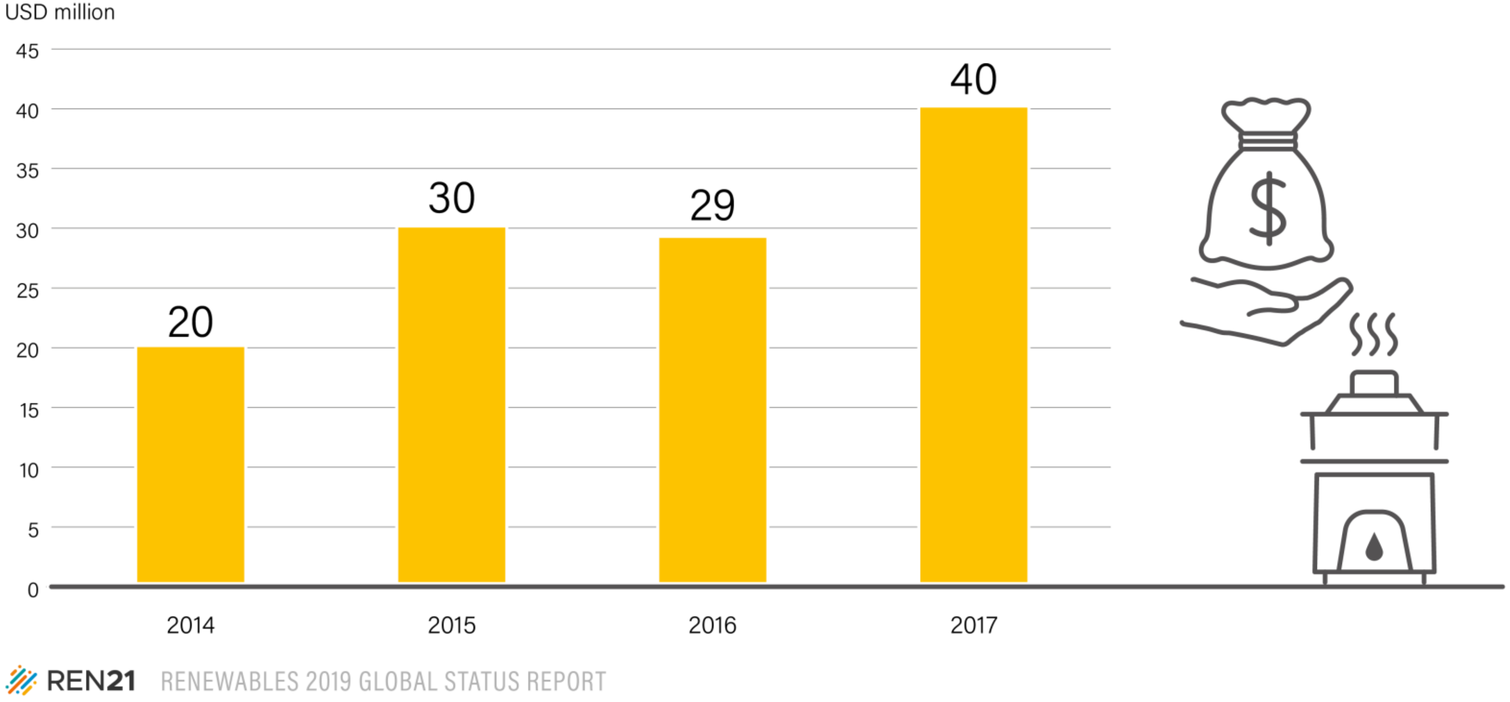


Investment in clean cooking companies sees steady growth

- In 2018, **USD 40 million** of invested into **clean cooking** companies, +36% than 2017
- Nearly **70%** flowed to companies with **integrated business models,** deploying both clean cookstoves and fuels

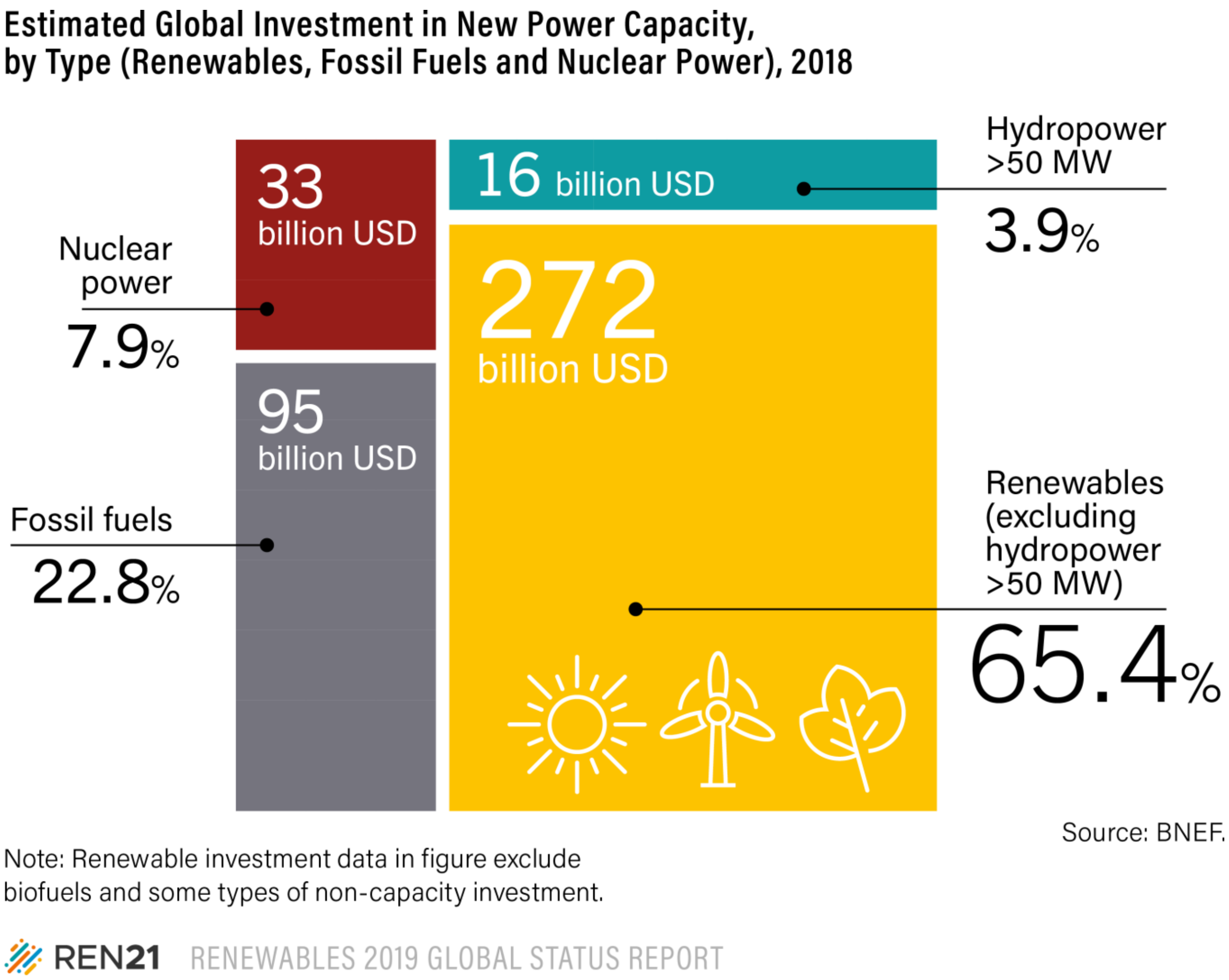

© Charlotte Pert / Hivos

Global Investment in Clean Cooking Companies, 2014-2017



Renewable energy-based stoves attract increased investment

- Companies commercialising renewable energy-based stoves and/or fuels attracted 90% of the sector's investment in 2017
- Less capital for LPG stoves, though these still make up the majority of the clean cookstoves market



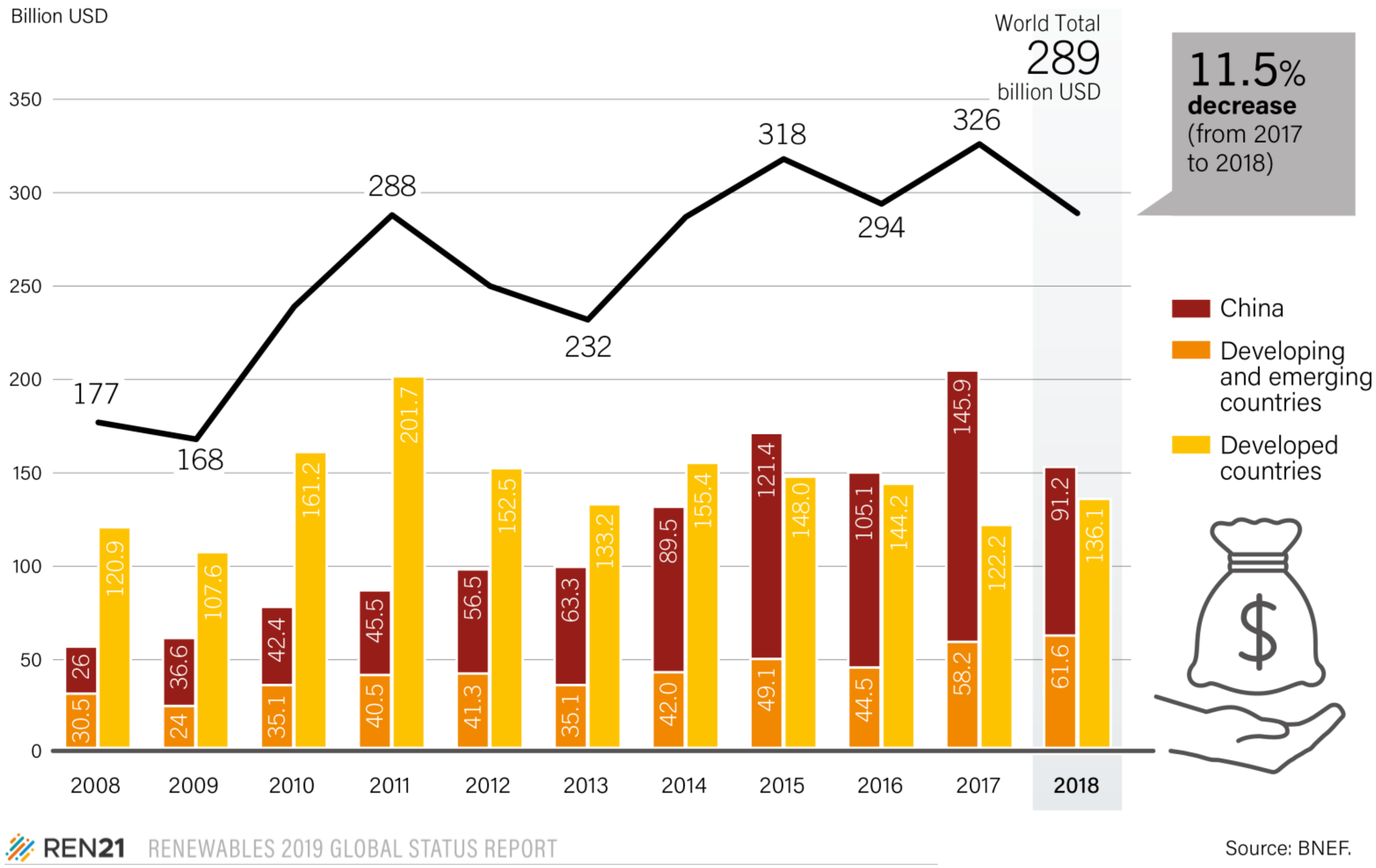
Investment in renewable power and fuels declined in 2018

→ Global investment in renewable power and fuels totalled **USD 288.9 billion**, a decrease of **11.5%**
- Fall driven mainly by China, following policy changes for solar PV

→ **Fifth consecutive year** in which investment topped USD 280 billion

→ Investment in developing and emerging countries exceeded that in developed countries for the **fourth consecutive year**

Global New Investment in Renewable Power and Fuels in Developed, Emerging and Developing Countries, 2008-2018



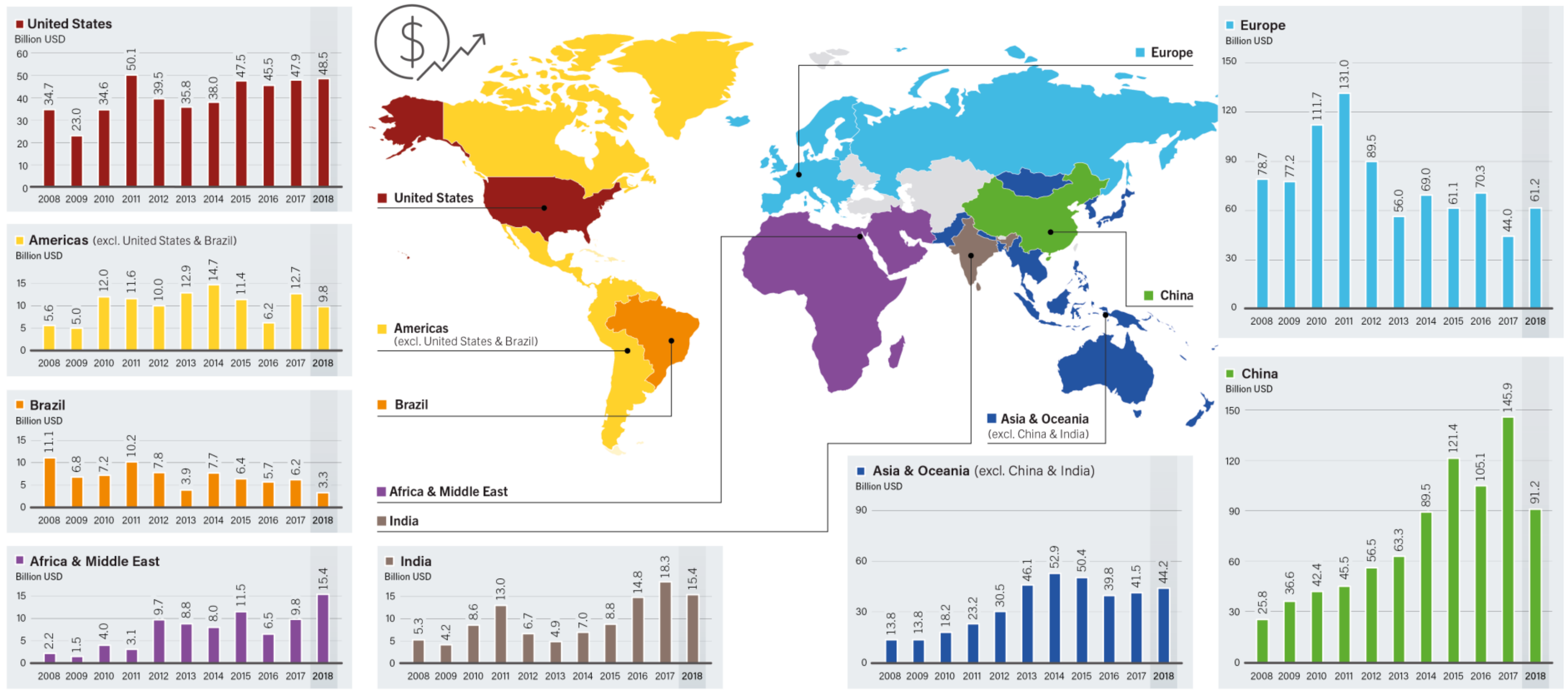
Source: BNEF.

Investment fell sharply in China after record high in 2017

- Investment varied by region:
  - Rising in Europe, the Middle East and Africa, Asia and the United States
  - Falling in the Americas, China and India

- China accounted for majority of investment despite the decline in its market

Global New Investment in Renewable Power and Fuels, by Country or Region, 2008-2018

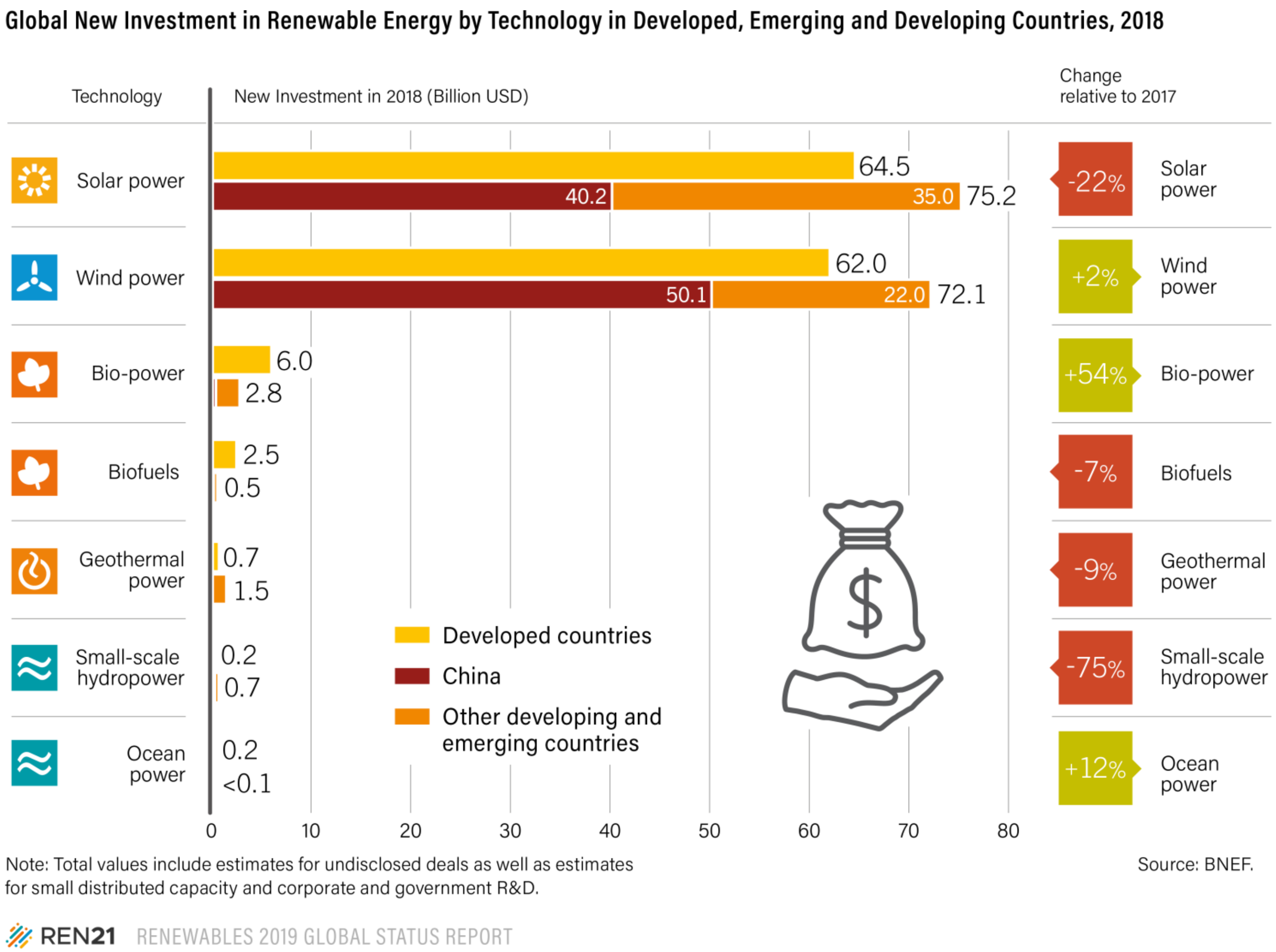


Note: Data are in current USD and include government and corporate research and development (R&D).

Source: BNEF.

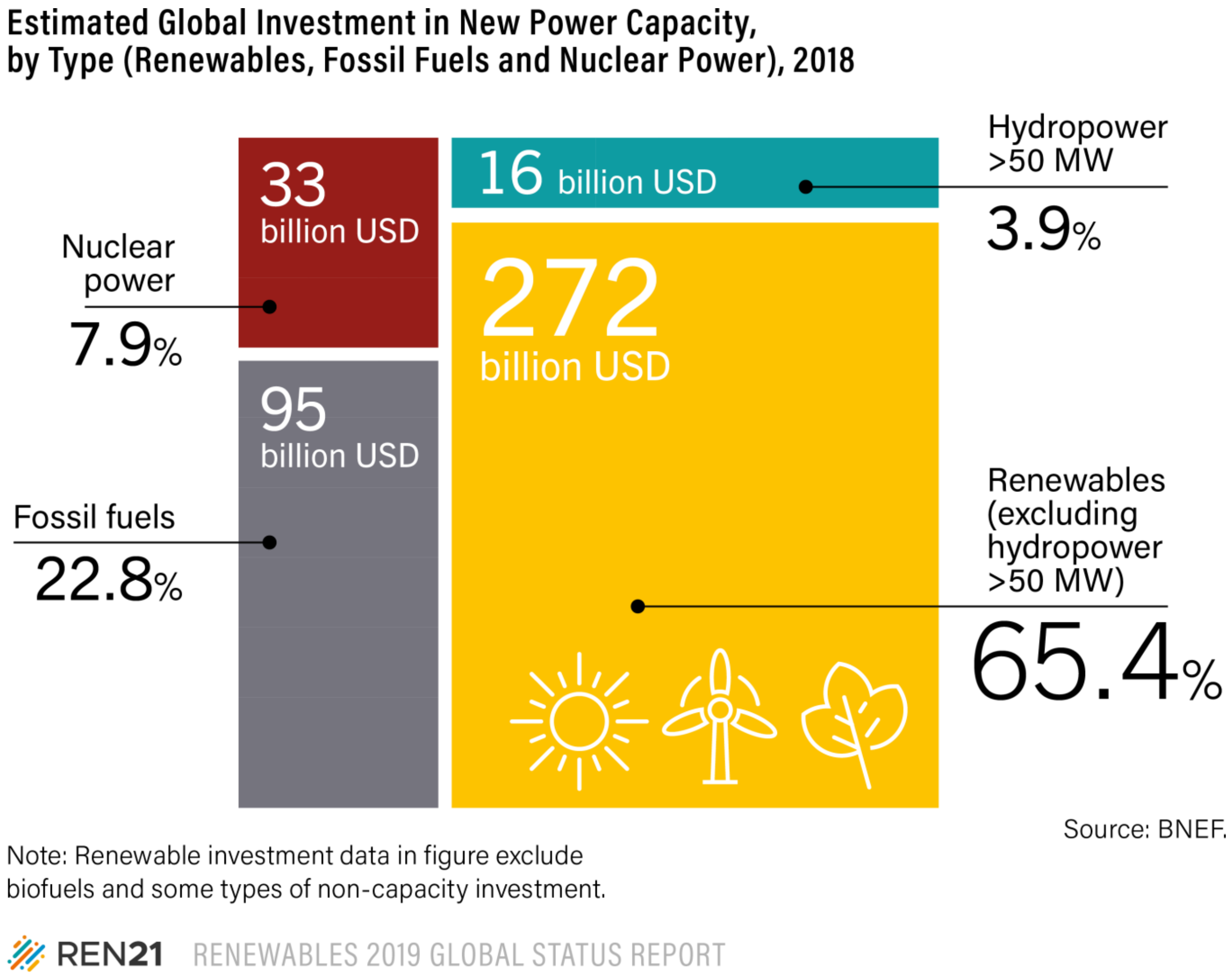
Investment in solar PV and wind power continue to lead

- Solar PV and wind power continued to dominate new investment in renewable energy in 2018
- The gap narrowed between the two
  - Solar accounted for 48%
  - Wind power for 46%
- Investment in biomass was comparatively small, but was up **54%** in 2018, to USD 8.7 billion



Investment in renewable power far exceeds that in fossil and nuclear

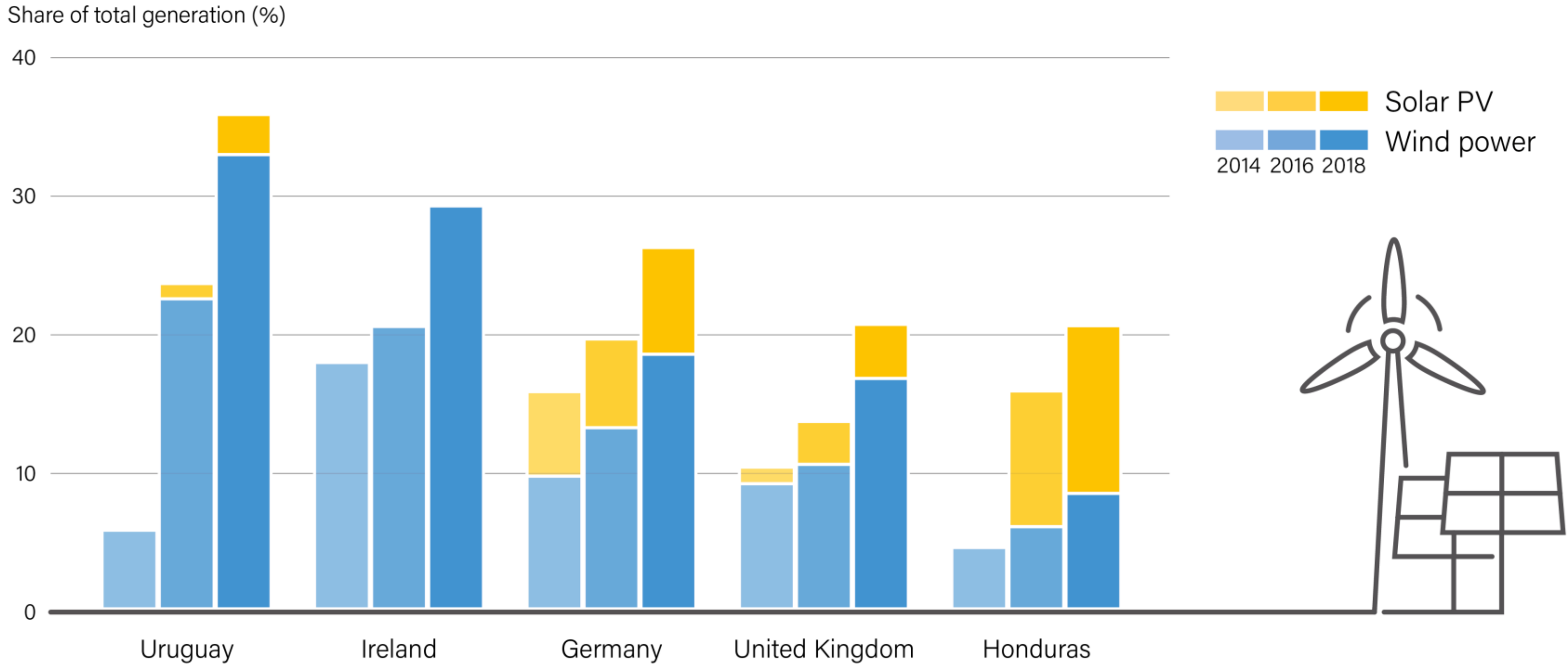
- Investment in new renewable power capacity (including all hydropower) once again far exceeded that invested in fossil and nuclear power capacity in 2018
- Investment in renewable power technologies accounted for **65%** of the total of all new generating capacity



Variable renewable shares have grown dramatically in some countries

- → The power sector is transforming rapidly in some countries
- → Variable renewables have seen penetration rates **above 20%** in at least nine countries in 2018
- → Average annual growth rates of **more than 10%** in five countries

Share of Electricity Generation from Variable Renewable Energy, Selected Countries, 2014, 2016, 2018



Note: This figure includes selected countries with high shares of variable renewable energy according to the best available data at the time of publication. Factors including annual weather variations may significantly impact generation from VRE in a particular year. Trends shown are not meant to imply assumed future growth of generation shares.

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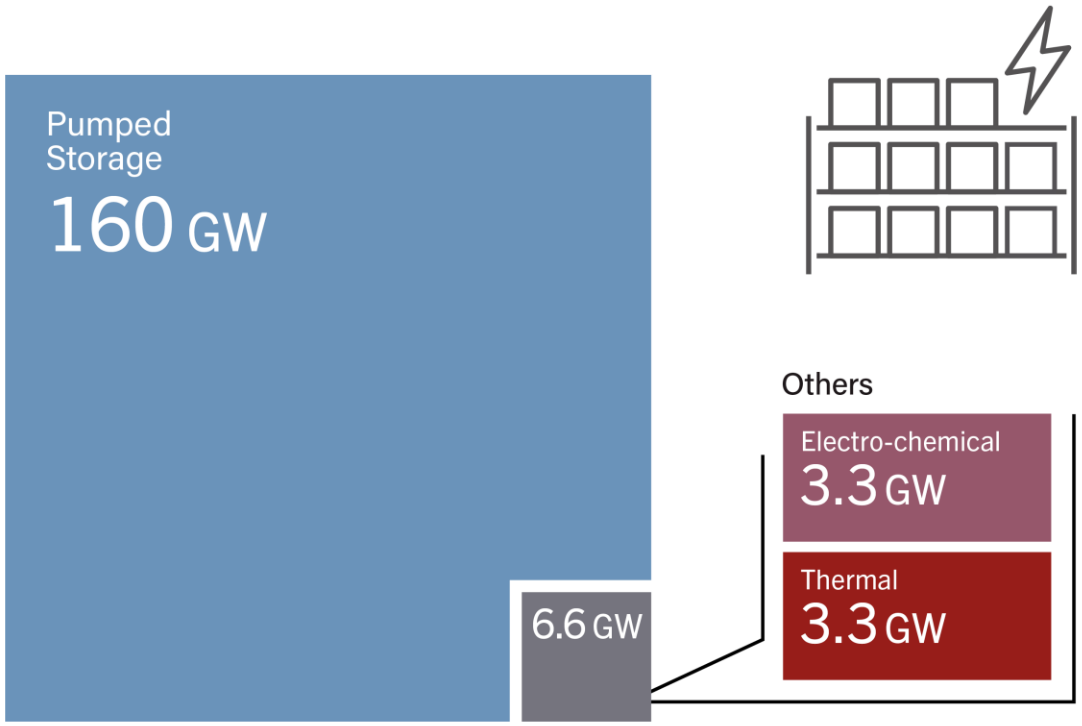
Pumped storage dominant for utility-scale energy storage

→ Global stationary and grid-connected energy storage capacity: **167 GW**
- Estimated value and excluding electro-mechanical storage beyond pumped storage.

→ **1.9 GW** of pumped storage added
- Less than 3 GW commissioned in 2017

→ Grid-connected battery storage capacity totalled over **3 GW**
- More than 80% of systems located in Australia, China, Republic of Korea, United Kingdom and United States

Utility-Scale Energy Storage Capacity, Selected Technologies, 2018



Note: Numbers should not be compared with prior versions of this figure to obtain year-by-year increases, as some adjustments are due to improved or revised data. The category of electro-mechanical storage has been excluded due to limited global data availability.

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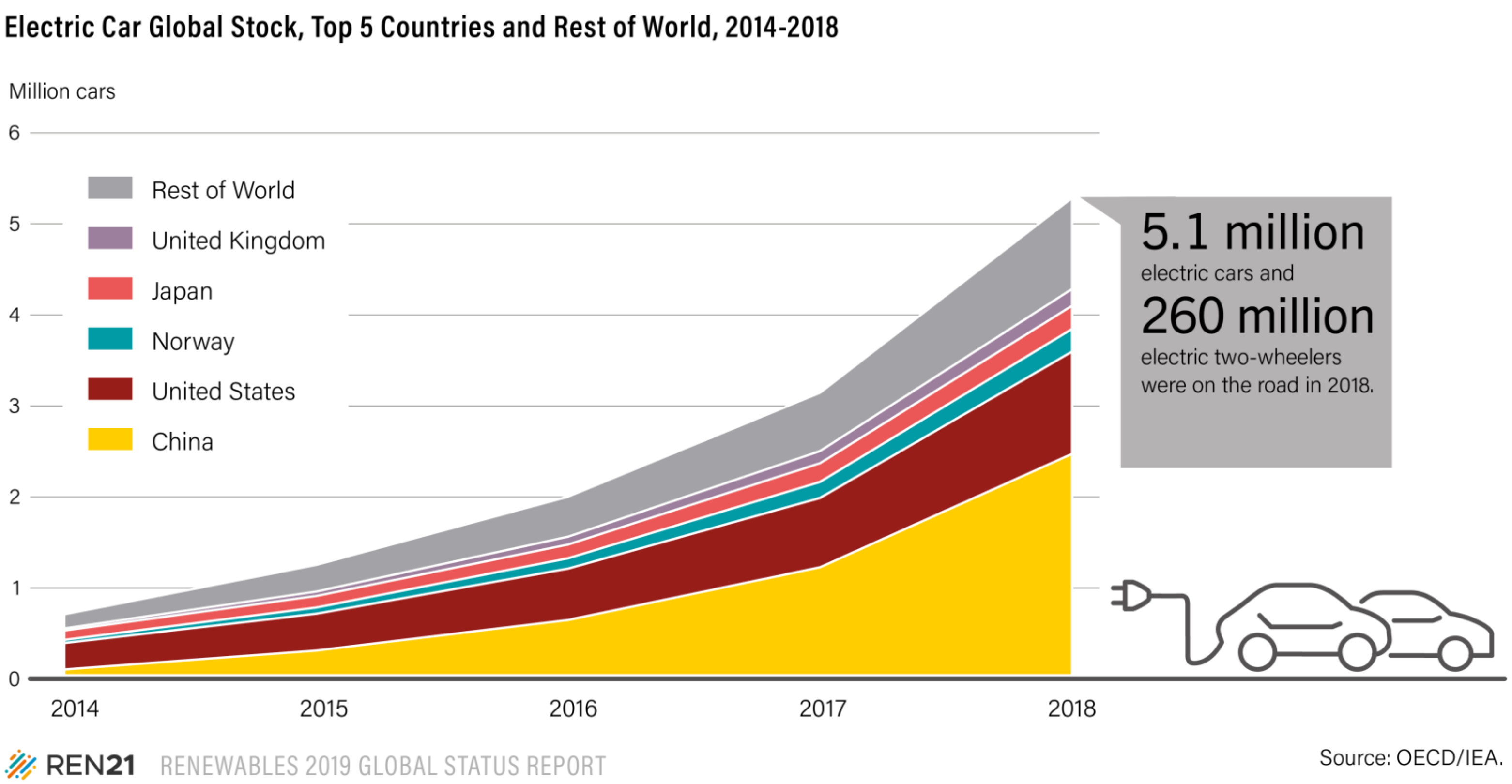
Electric passenger vehicle stock grew over 60%

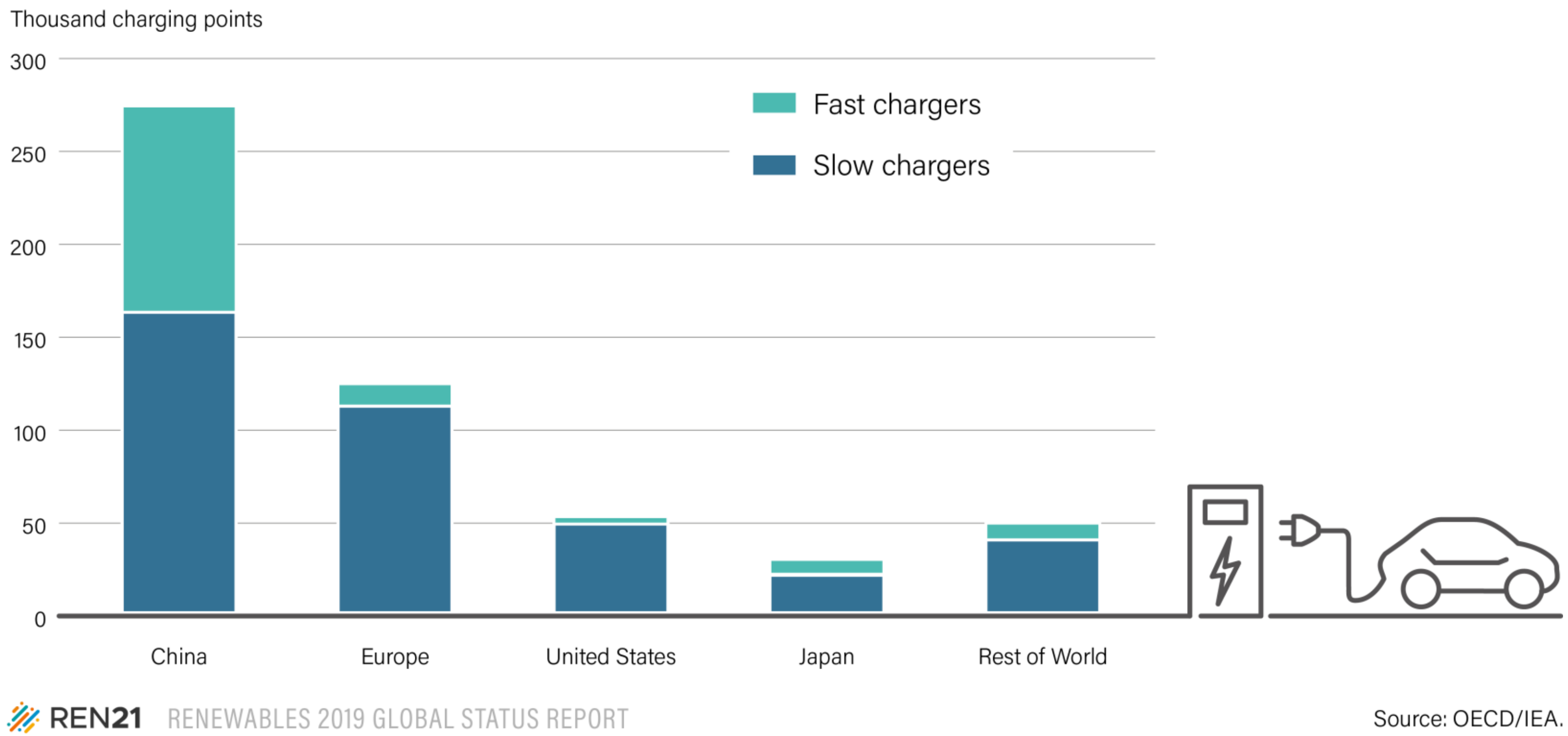
- More than **2 million** electric cars (including battery EV and plug-in hybrid EV) were sold in 2018
- China had **nearly 50%** of global stock, followed by US at 22%
- EV markets **highly concentrated**: 40% of all EVs were in use in just 20 cities
- 260 million electric two-wheelers and 40 million electric three-wheelers



More than 100,000 public EV charging points installed in 2018

- Global total reached around **540,000** and grew 23% from 2017 levels
- Around 72% are slow charging points
- China has more than half of all public EV charging points, and the vast majority of the fast chargers
- Public charging points still dominated by private chargers (numbering over 5 million)

Public EV Charging Points by Country or Region, Fast and Slow Charging, End-2018



Source: OECD/IEA.

Note: Europe comprises the Netherlands, Germany, France, the United Kingdom, Norway, Sweden, Portugal and Finland.

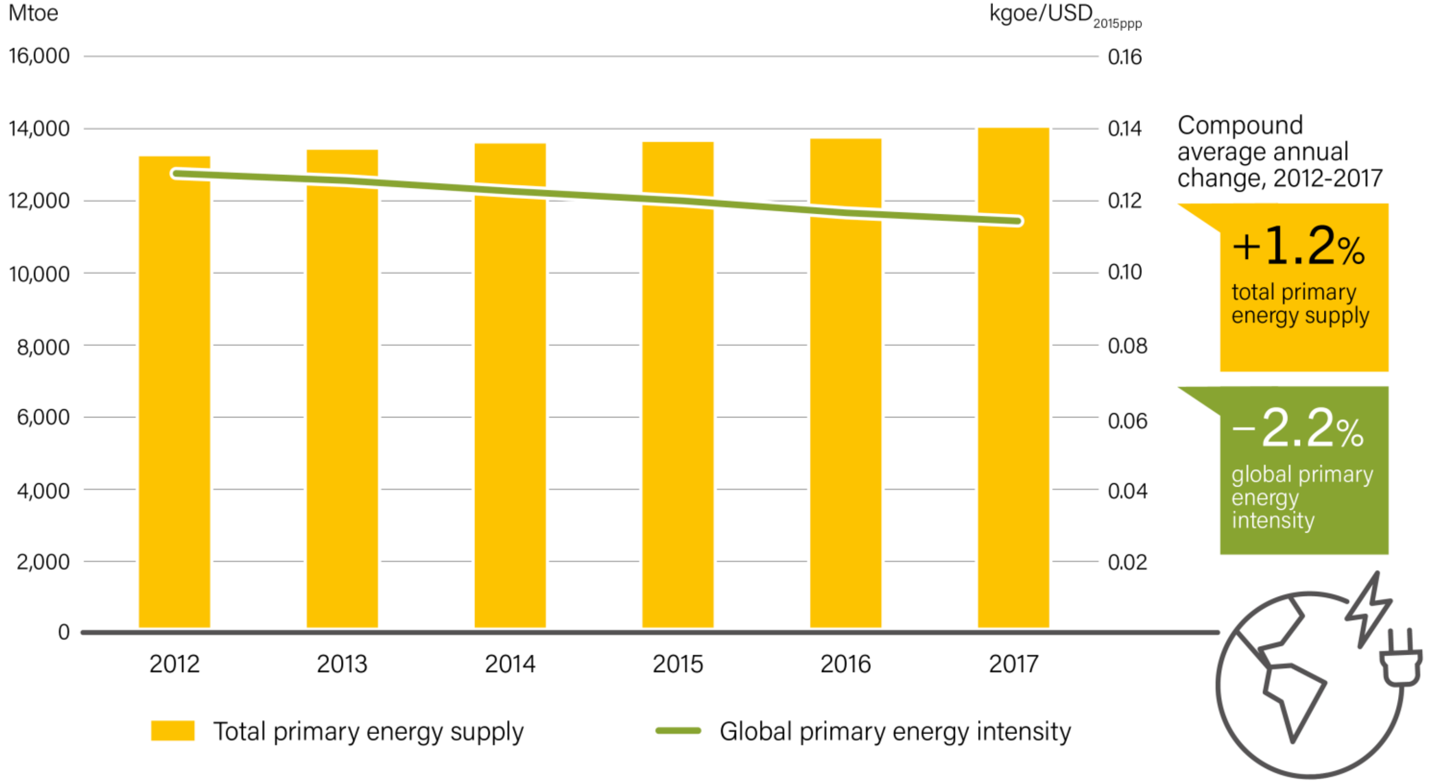
Global primary energy intensity continues to fall

→ Global primary energy intensity decreased more than 10% between 2012 and 2017, at an average annual rate of 2.2%

→ The total primary energy supply grew 5.9% over the same period, at an average annual rate of 1.2%

→ Only 34% of global energy use falls under the reach of energy efficiency policies and mandates

Global Primary Energy Intensity and Total Primary Energy Supply, 2012-2017



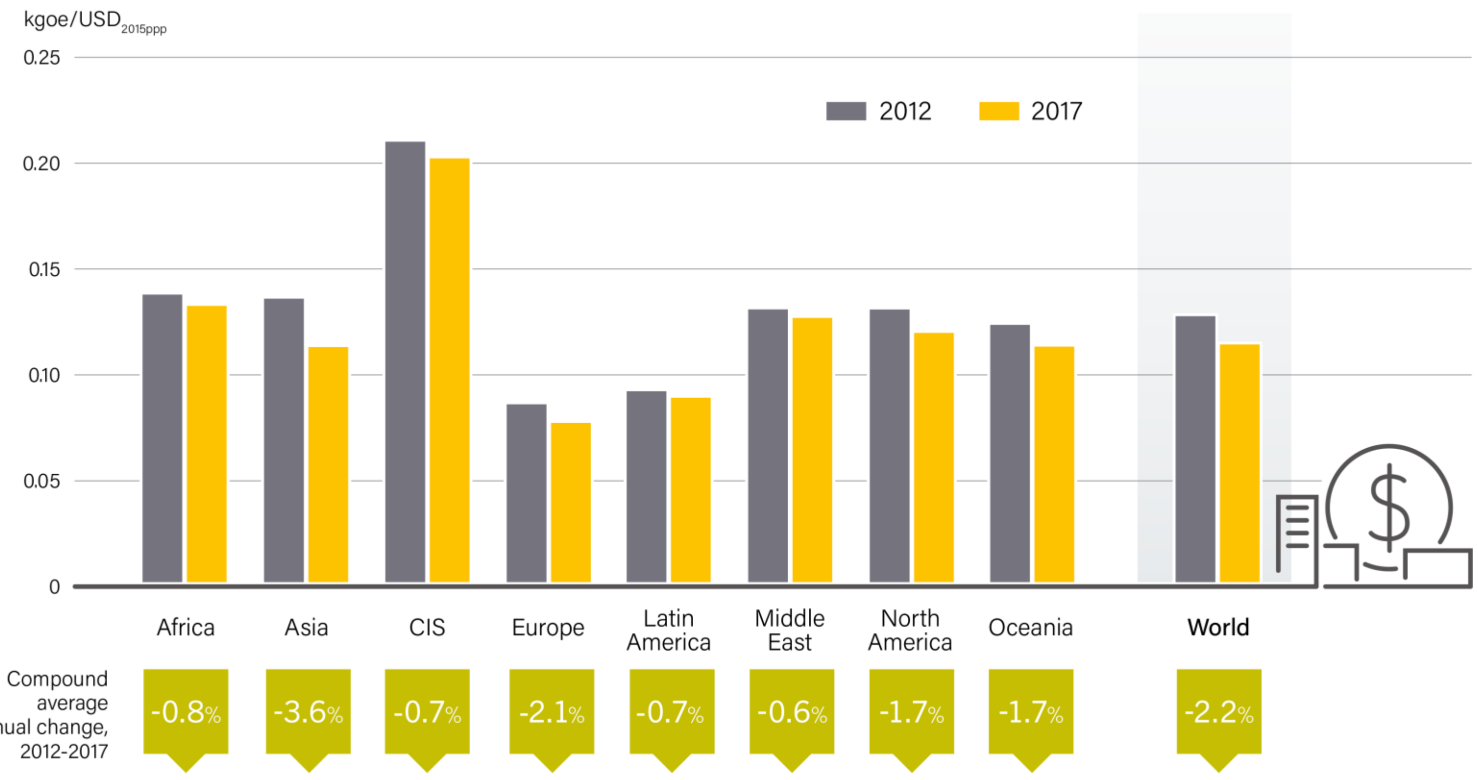
Note: Dollars are at constant purchasing power parities.

Source: Enerdata.

Mtoe = million tonnes of oil equivalent;
kgoe = kilograms of oil equivalent.

Asia is leading the global decrease in primary energy intensity

- All regions of the world showed some improvement in the energy intensity of their economic activities between 2012 and 2017
- Asia (led by China) had the most marked decline in energy intensity during the period – an annual average drop of 3.6%
- Global primary energy intensity decreased more than 10% between 2012 and 2017



Note: Dollars are at constant purchasing power parities.
CIS = Commonwealth of Independent States.

Source: Enerdata.

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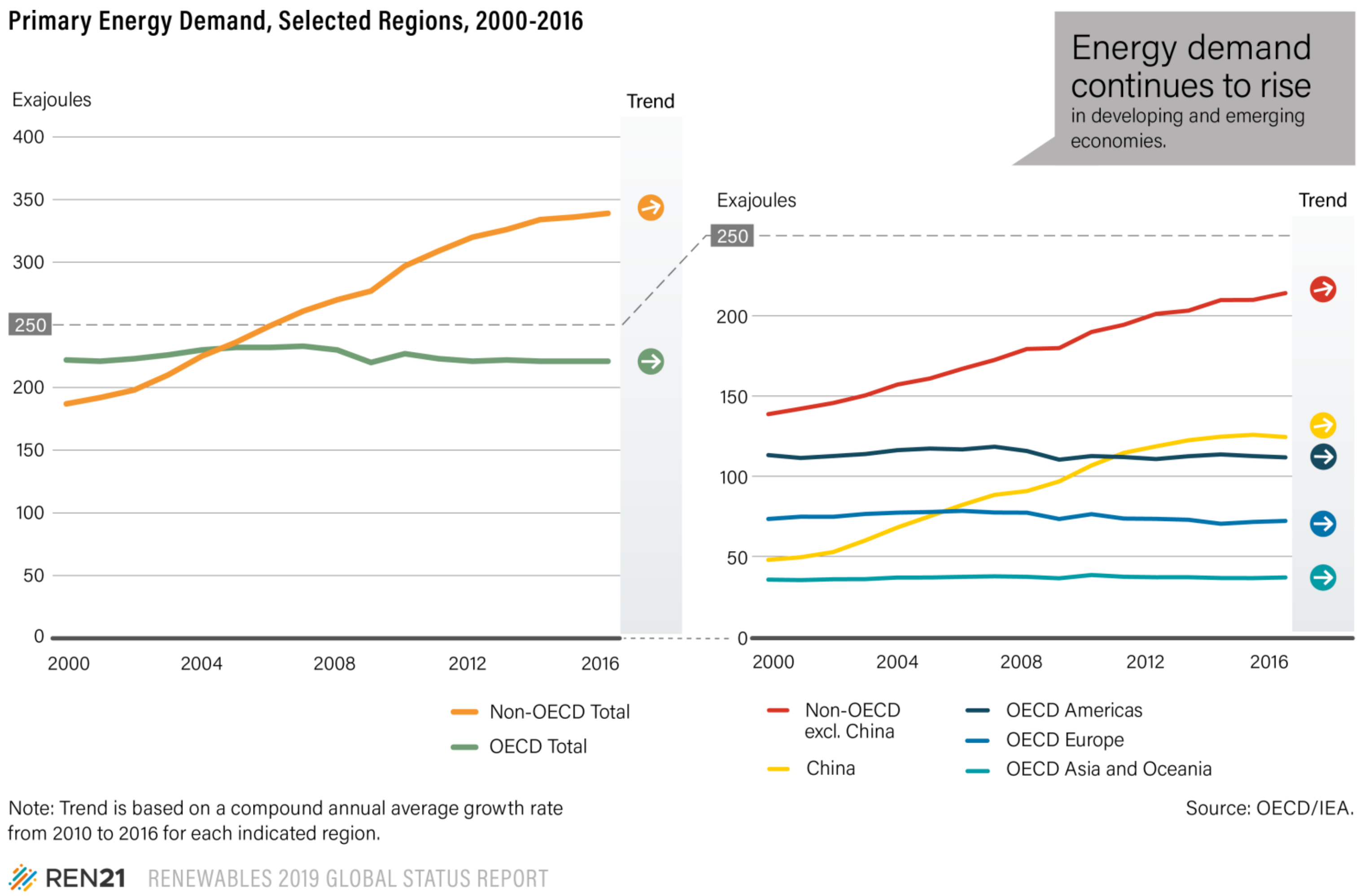
Energy demand in non-OECD countries continues to rise

- Collectively, energy demand in member countries of the OECD reached a historical peak in 2007
- In China, energy demand fell slightly in 2016 – its first decline since 1997 – before reaching a new high in 2017

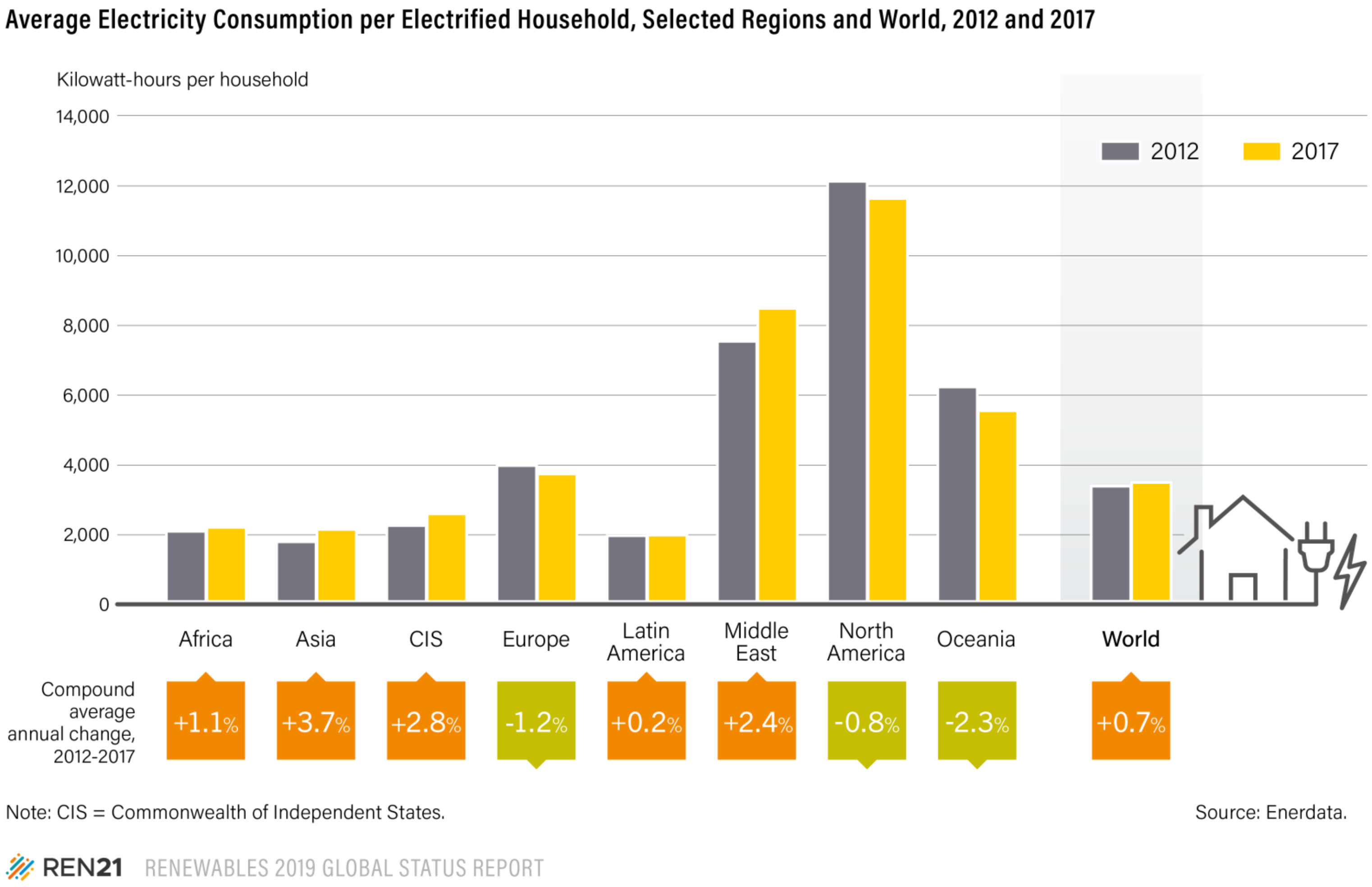


Global household electricity consumption increases in 2017

→ Between 2012 and 2017, global average electricity consumption per household grew 0.7% annually, but this growth varied widely by region

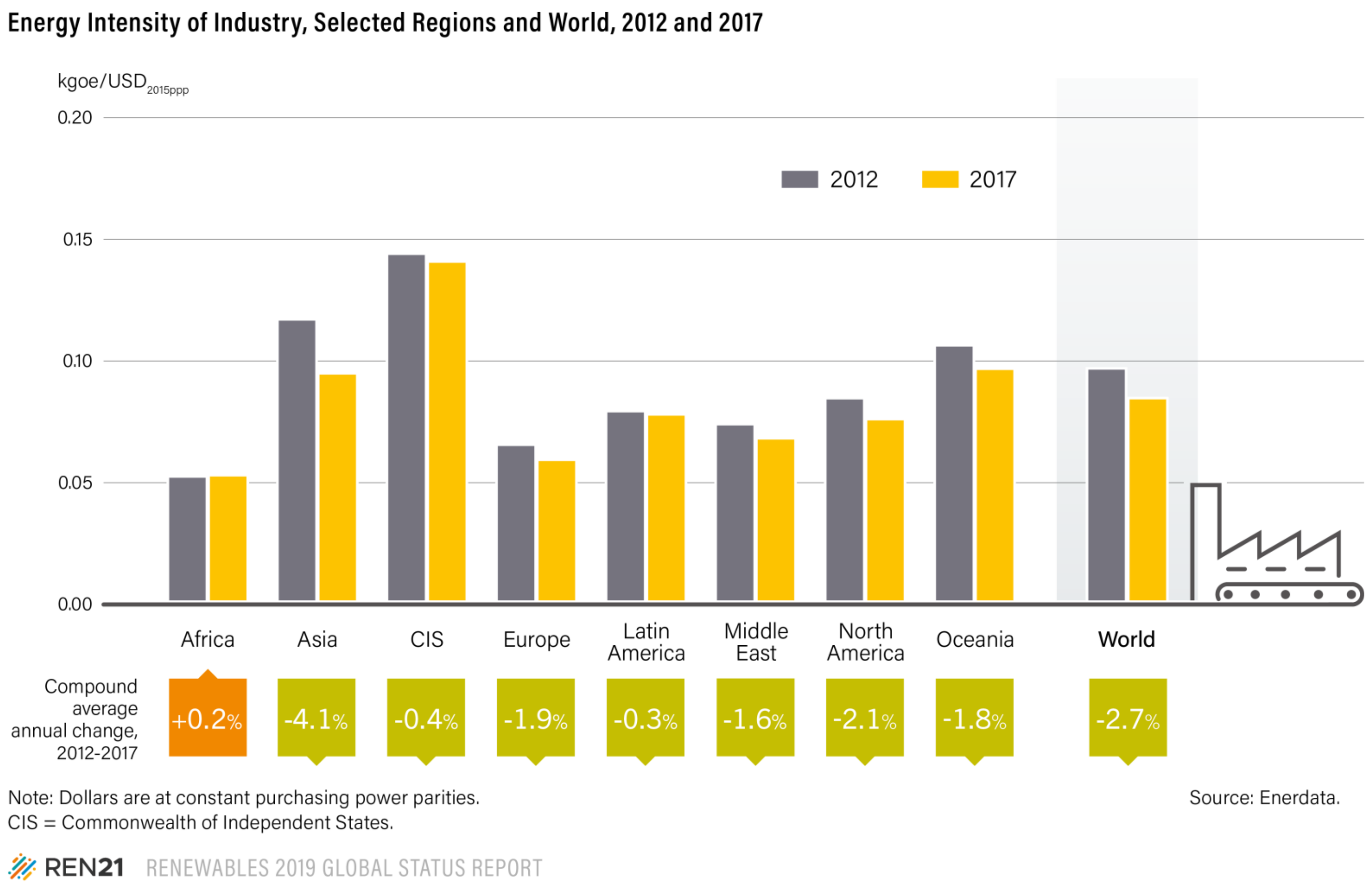
→ Household electricity demand rose most rapidly in Asia (average annual growth of 3.7%)

→ Oceania, Europe and North America saw a decrease in demand



Despite growing energy demand, energy intensity of industry decreases

- Globally, the average energy intensity of the industrial sector decreased between 2012 and 2017, at an average annual rate of 2.7%
- Asia's industrial energy intensity improved at a relatively higher rate, with Europe and North America showing consistent improvement
- Africa was the only region where energy intensity increased

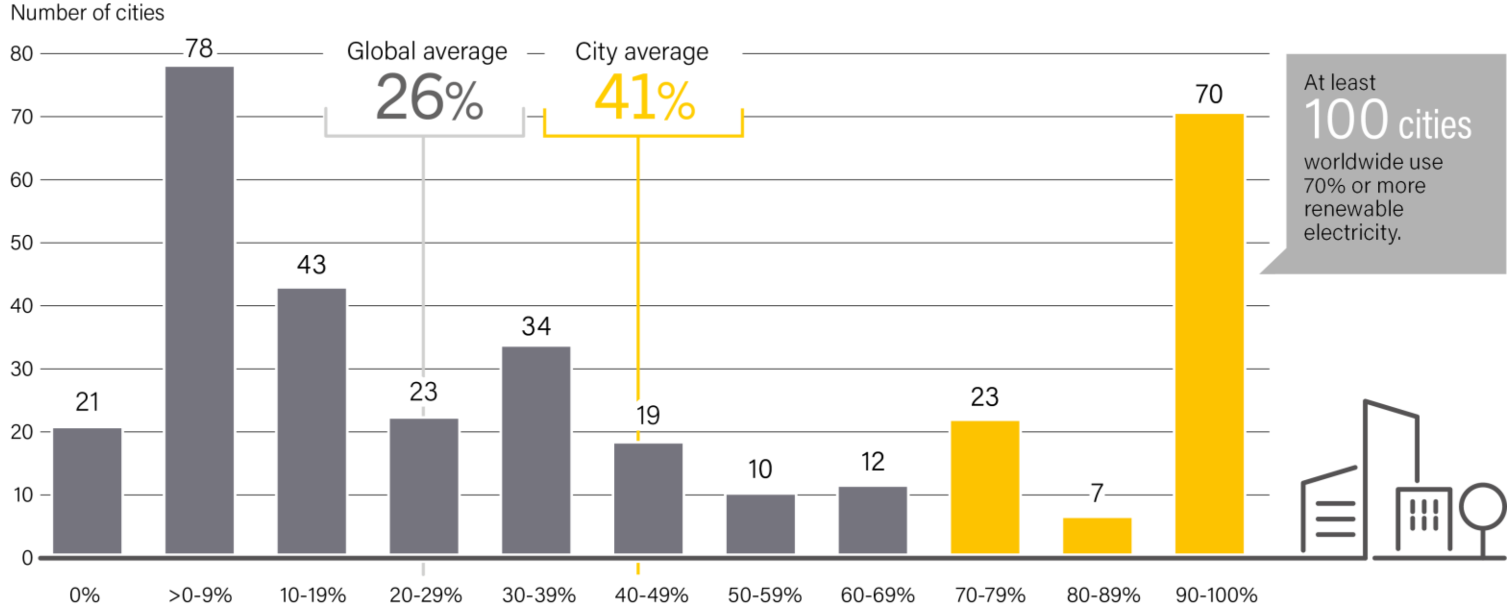


Cities are advancing renewables to achieve diverse goals

- Cities account for **65%** of global energy demand

- Some cities able to accomplish more ambitious renewables goals than national and state/provincial bodies
  - At least **100** cities sourcing **70% or more** of their electricity from renewables
  - More than **40 cities** were already powered by **100%** renewables

Renewable Power in Cities*, by Number of Cities and Renewable Share, 2017



* The figure shows shares of renewables in the electricity consumption of 340 cities that self-reported to CDP.

Source: CDP.

Note: City average is calculated based on the 340 cities shown.
Categories include all values below the lower limit of adjacent category.

The transition is possible – positive examples are showing the way!

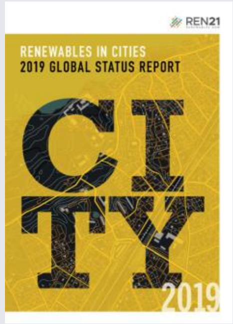
- **Leadership from national governments** is paving the way towards 100% renewables in countries.
- **Cities and sub-national governments** are setting more ambitious policies than their national governments.
- **1000+ organisations**, totaling USD 8 trillion of managed assets, have committed to divesting from fossil fuels.
- The **private sector** has doubled its investment in sourcing renewable power.

Conclusions – what is needed to advance the energy transition?

- → **Set ambitious targets** globally, across regions, countries and sectors
- → Create the right, sustainable **market conditions**
- → **Accelerate investment** in renewable power, while also establishing new (and strengthening existing) policies for renewables in heating, cooling and transport
- → Encourage **sector integration** among the power, heating and cooling, and transport sectors
- → **Align** regional, national and sub-national policies, and **support cities** in their actions
- → Enact integrated policies that enforce **energy efficiency** measures while promoting the uptake of renewable energy
- → Support local job creation and a **just transition**
- → **Build social acceptance** and increase public buy-in

Renewable Energy Policy Network for the 21st Century

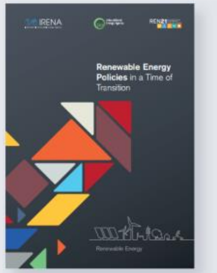
Global Status Report:
yearly publication since 2005



Renewables in Cities
Status Report:

Regional Reports

Global Futures
Reports



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