RENEWABLES 2019
GLOBAL STATUS REPORT

REN21
RENEWABLES NOW

19 June 2019
REN21 Secretariat
gsr@ren21.net

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:

CAN-I, CCA, CLASP, Club-ER, CEEW, Energy Cities, FER, GFSE, Global 100% Renewable Energy, Greenpeace International, GWNET, ICLEI, IEC, ISEP, JVE, MFC, Power for All, REEP, REI, SCI, SLoCaT, WCRE, WFC, WRI, WWF

Inter-governmental Organisations:

ADB, APERC, ECREEE, EC, GEF, IEA, IRENA, IsDB, RCREEE, UNDP, UN Environment, UNIDO, World Bank

Industry Associations:

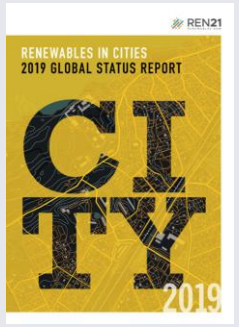
AMDA, ARE, ACORE, ALER, APREN, CREIA, CEC, EREF, GOGLA, GSC, GWEC, IREF, IGA, IHA, RES4MED, WBA, WWEA

Governments:

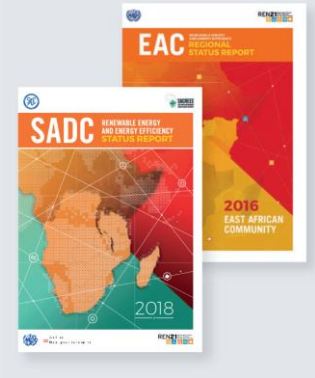
Afghanistan, Brazil, Denmark, Germany, India, Mexico, Norway, South Africa, Spain, UAE, USA

Evidence and knowledge to shape the global energy debate

Global Status Report: yearly publication since 2005

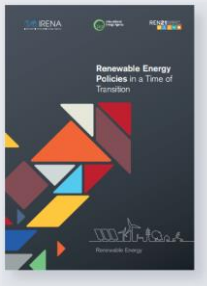


Renewables in Cities Status Report:



Regional Reports

Global Futures Reports



Thematic Reports

REN21 ACADEMY

KIREC SEOUL 2019

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.

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Another strong year for renewable energy

- **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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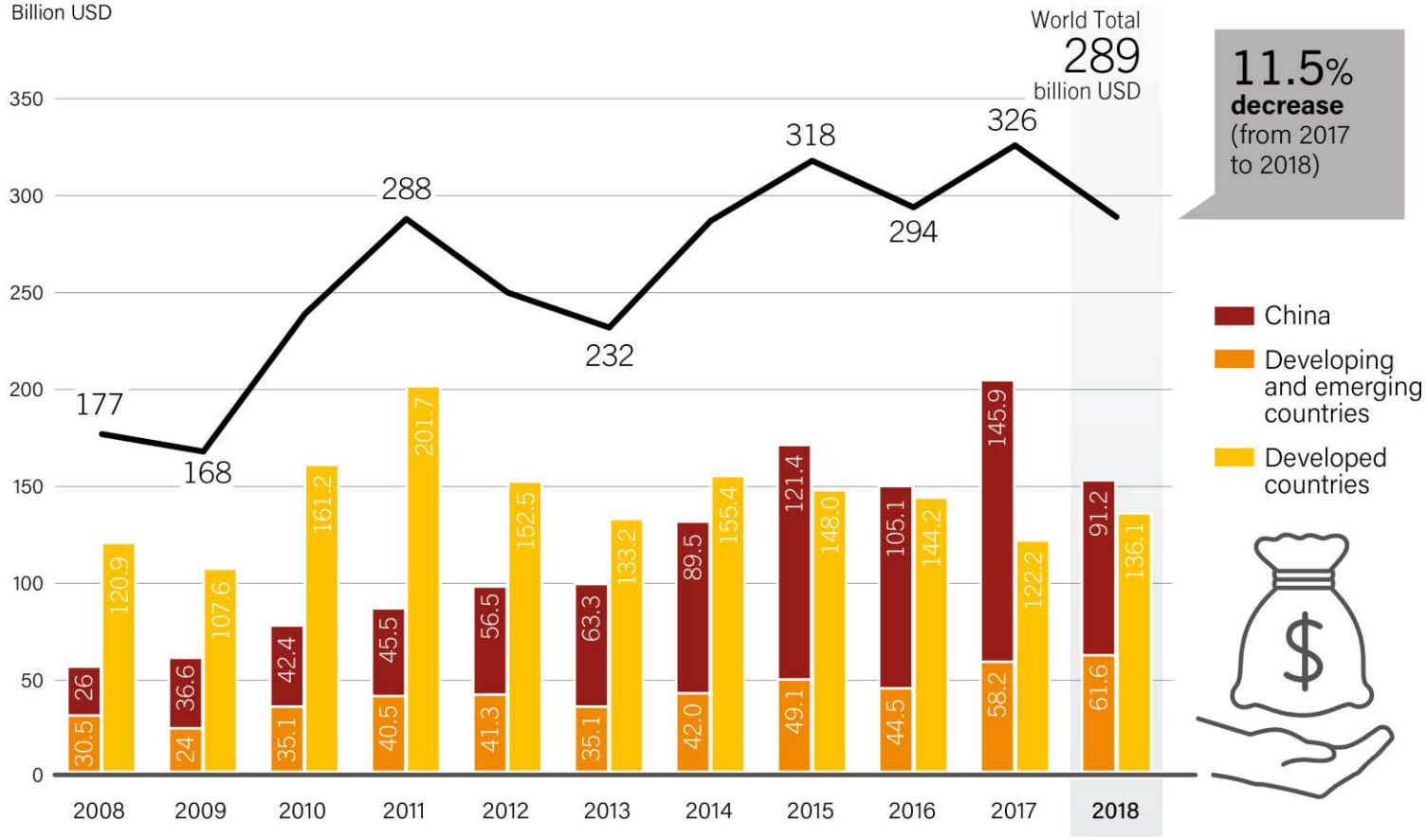
Investment in renewable energy fell in China, rose elsewhere

- Global investment in renewable power and fuels totalled **USD 288.9 billion**, a decrease of **11.5%**
  - Fall driven mainly by China
- **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



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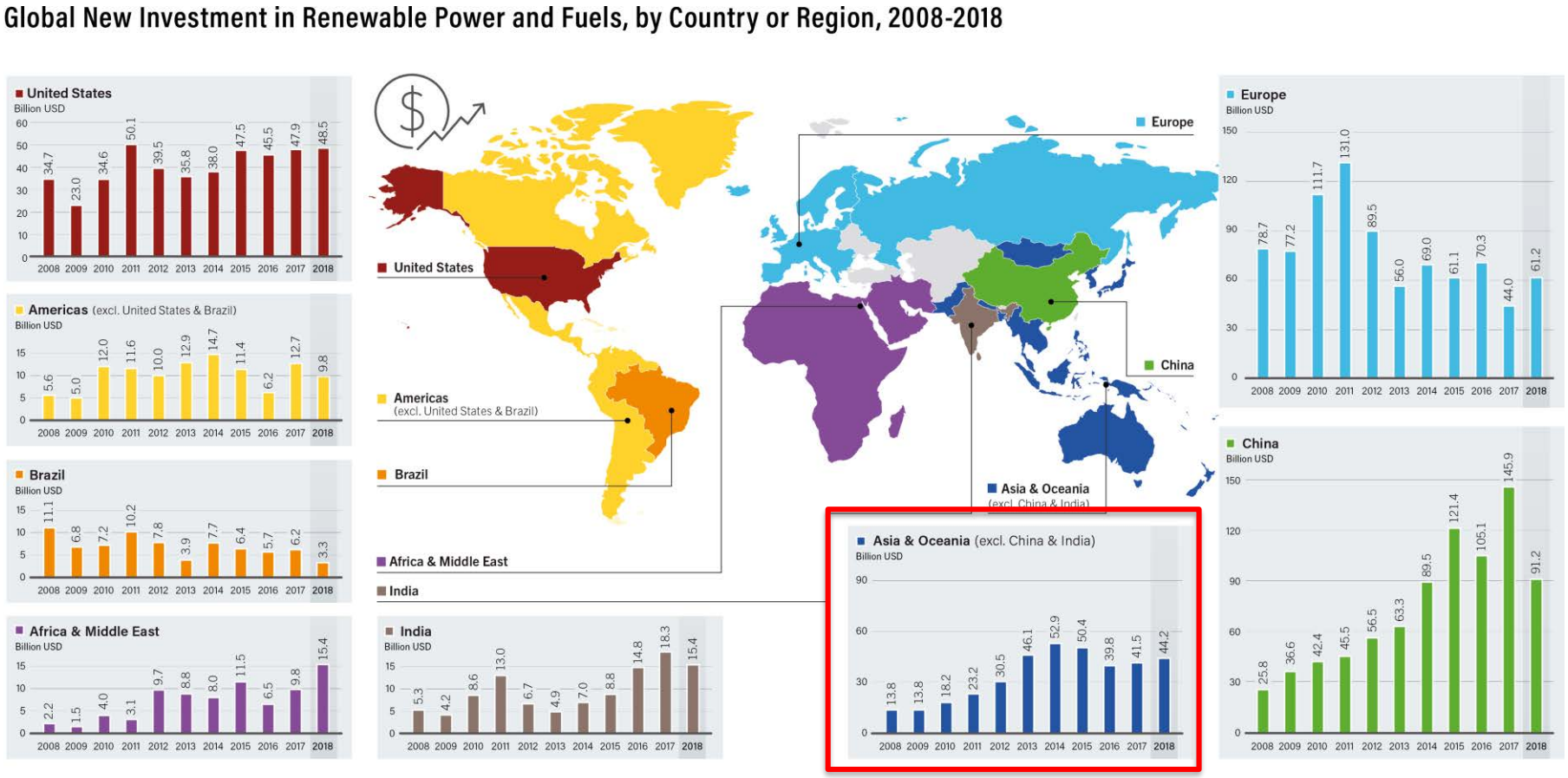
Source: BNEF.

Investment also declined in India, but rose in the rest of Asia

- Investment varied by region:
  - Rising in Asia, Europe, the Middle East and Africa, and the United States
  - Falling in the Americas, China and India
- China accounted for majority of investment despite the decline in its market (32%)



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

Source: BNEF.

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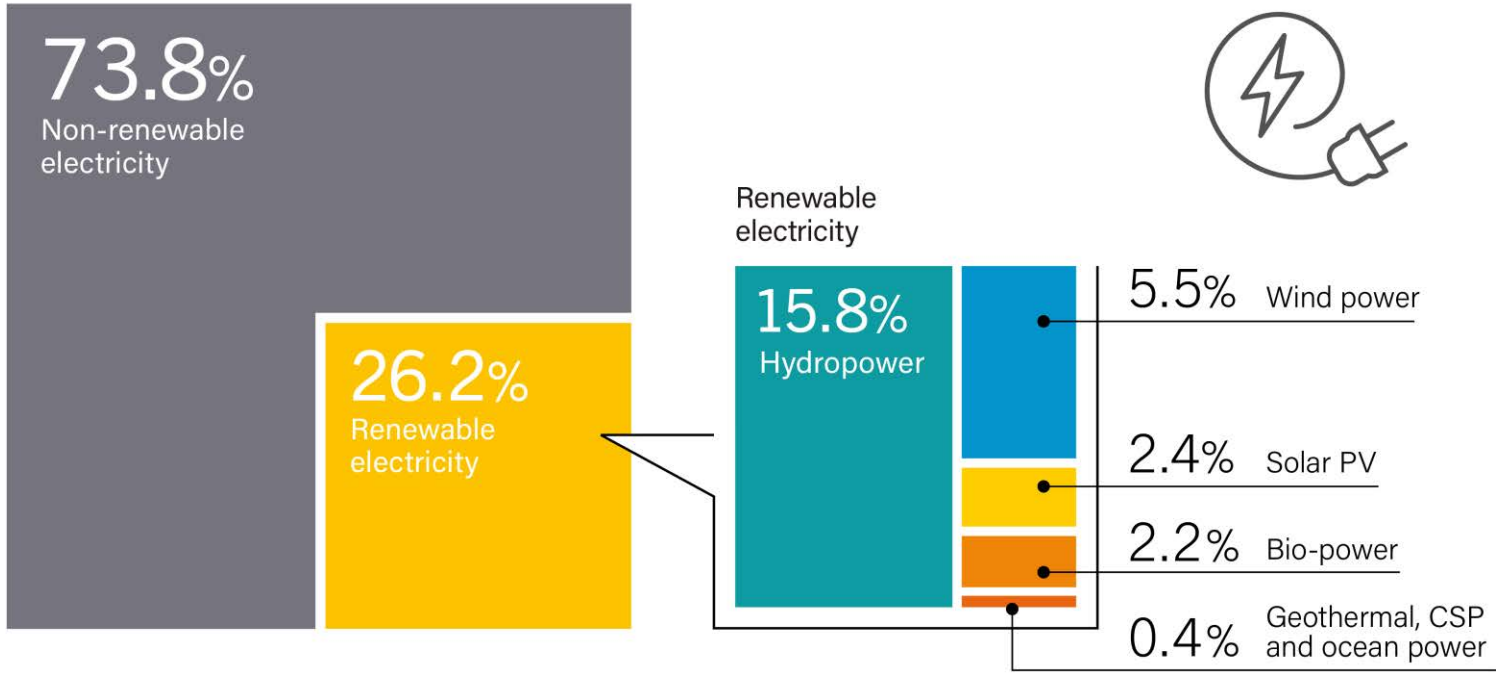
Power sector leading: Renewables supply more than 26% of global electricity

- 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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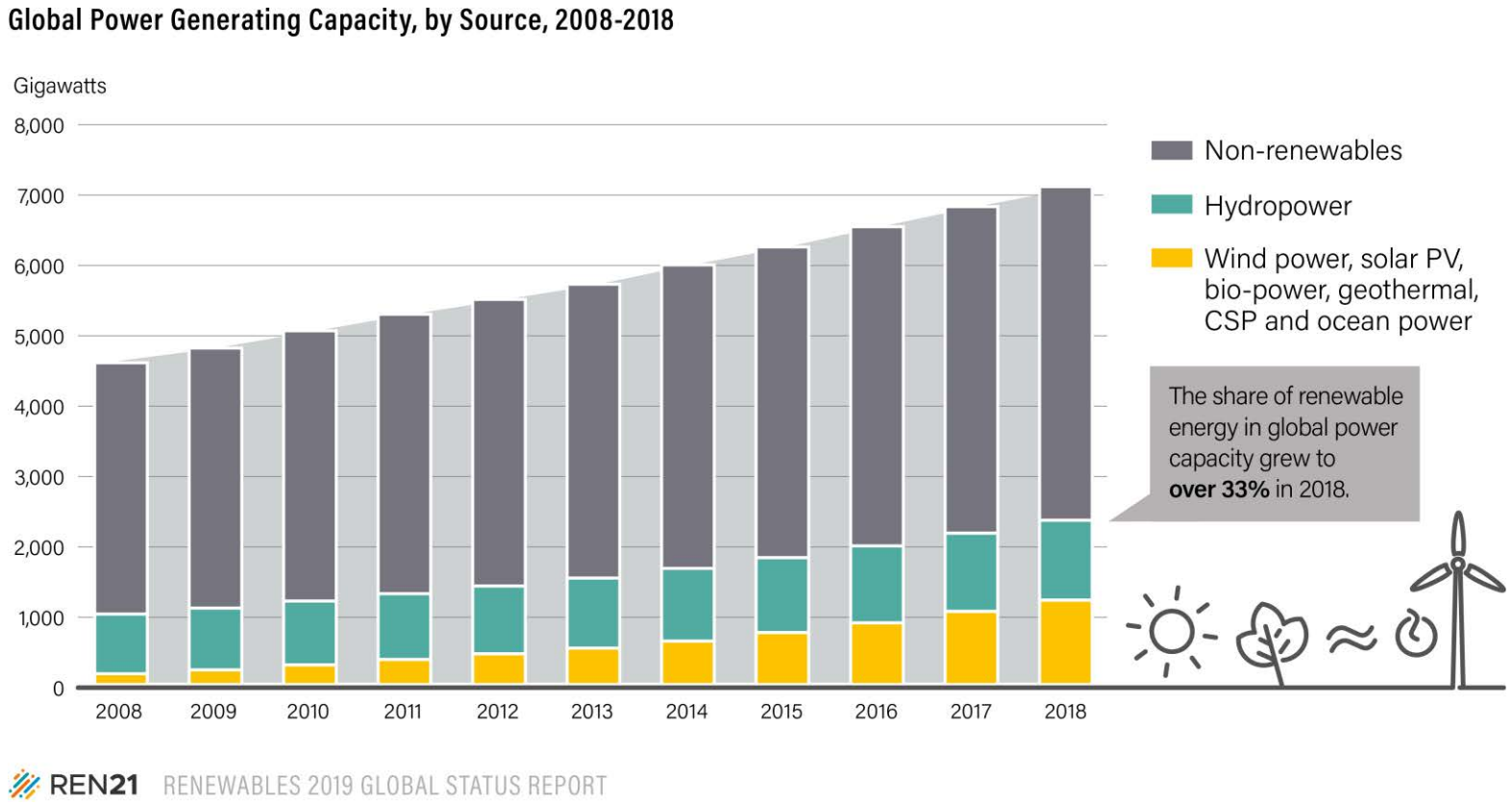
Renewable power now makes up over one-third of global capacity

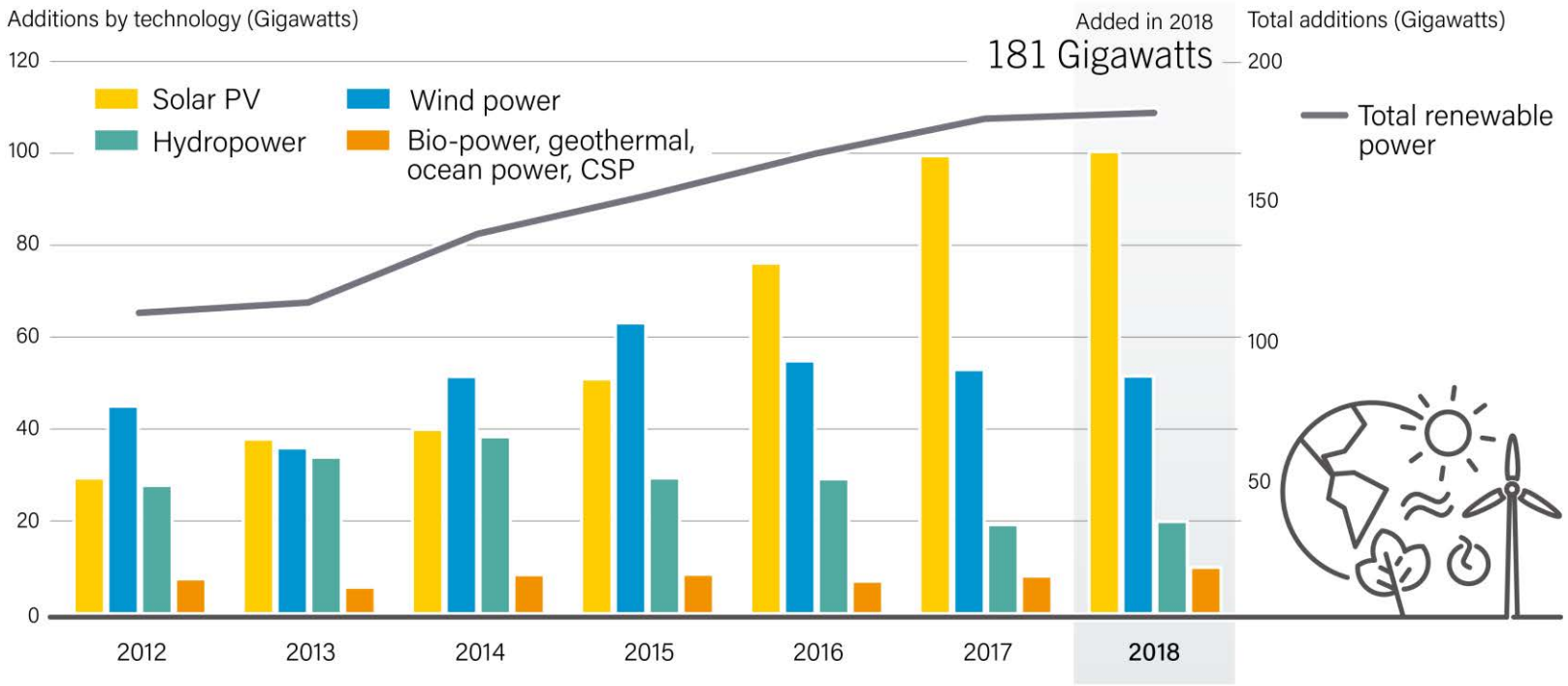
- Renewable energy is now **more than 33%** of global installed power generating capacity
- Within renewable capacity, hydropower (1,132 GW) no longer makes up half of installed capacity
- Wind power (592 GW) accounts for 25% and solar PV (505 GW) covers over 21%
- Remaining 6% of bio-power, geothermal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



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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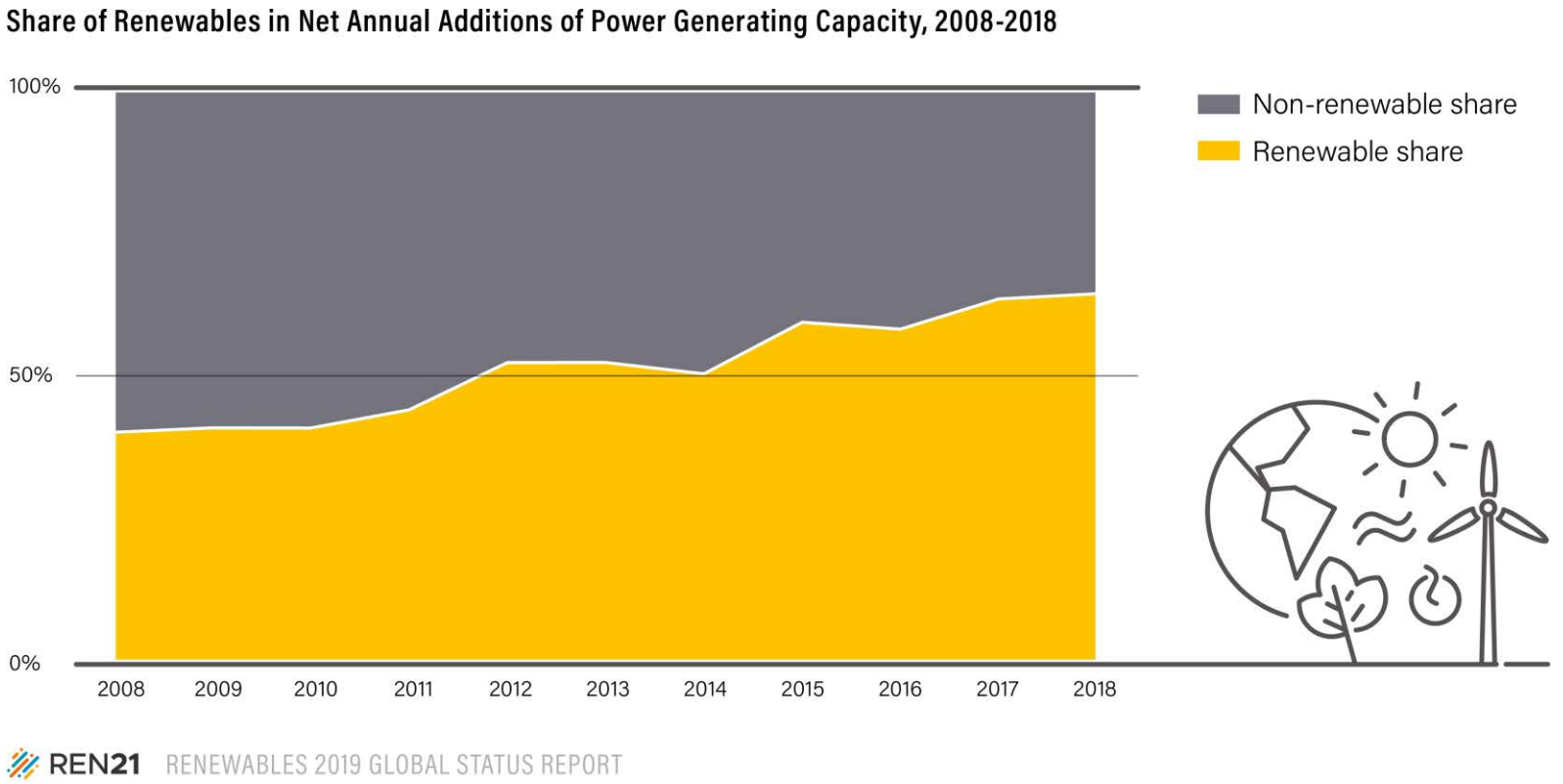
More renewable power capacity added than fossil fuel and nuclear power

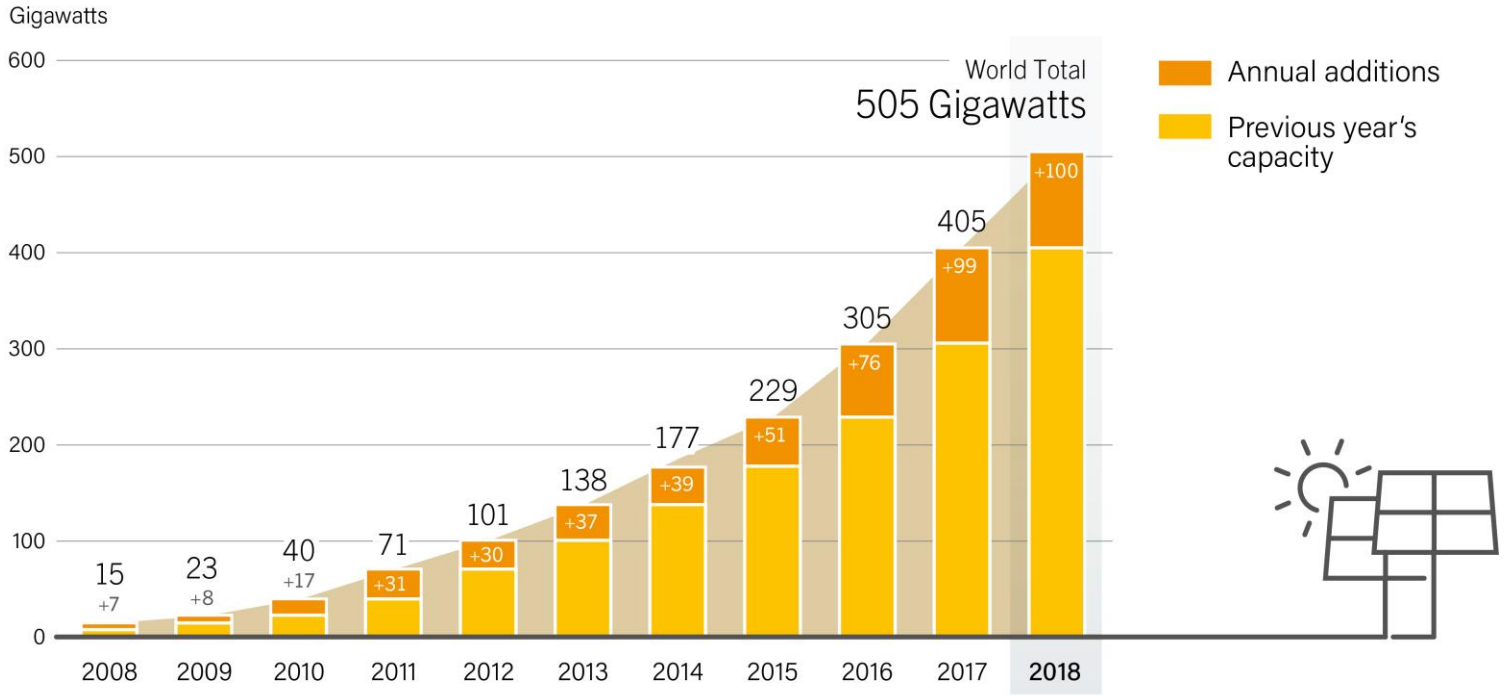
- In 2018, nearly twice as much renewable power capacity added as all other sources, **the highest share ever**
- Fourth consecutive year that net additions of renewable power were **more than 50%**
- 2011 was the last year that clearly more non-renewable capacity was added than renewable



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

Solar PV Global Capacity and Annual Additions, 2008-2018



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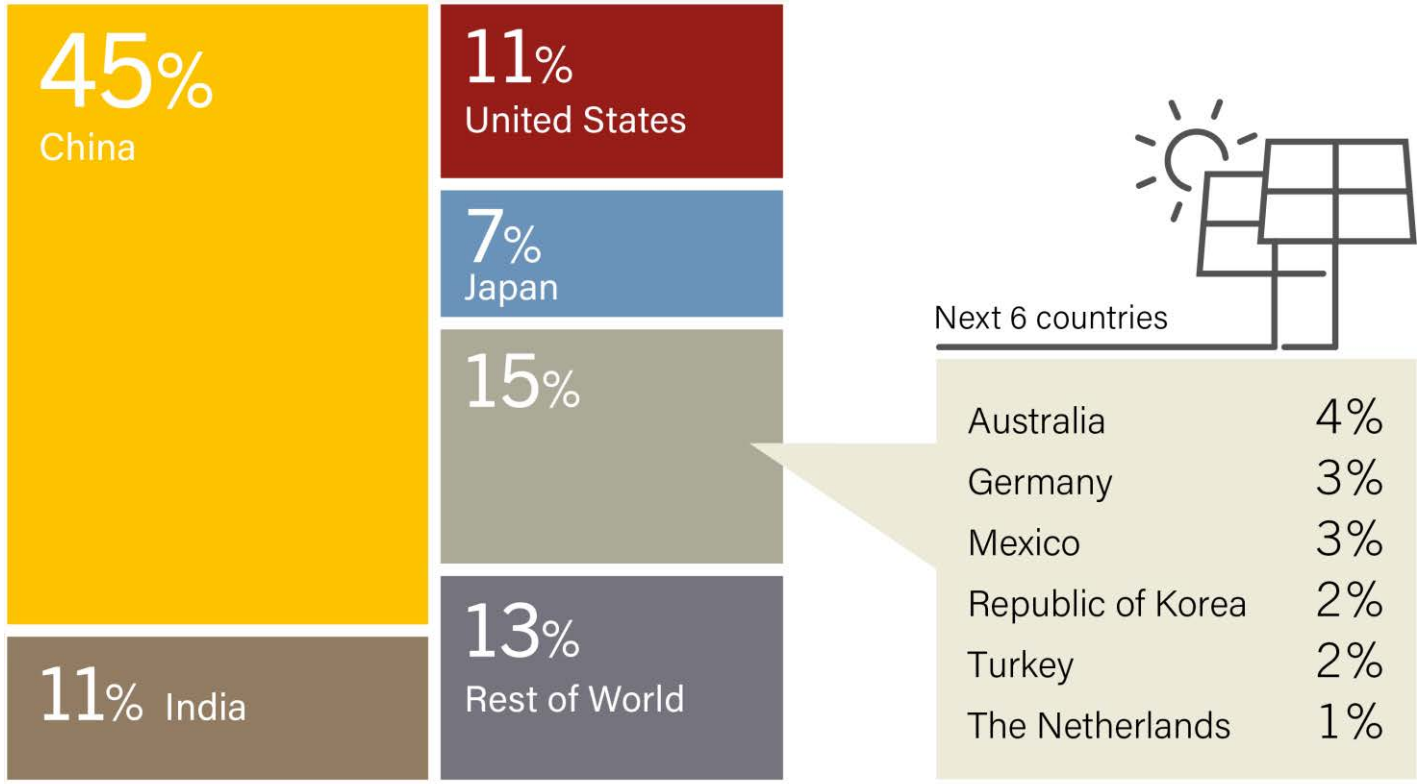
Asia the main world market for solar PV for sixth consecutive year

- 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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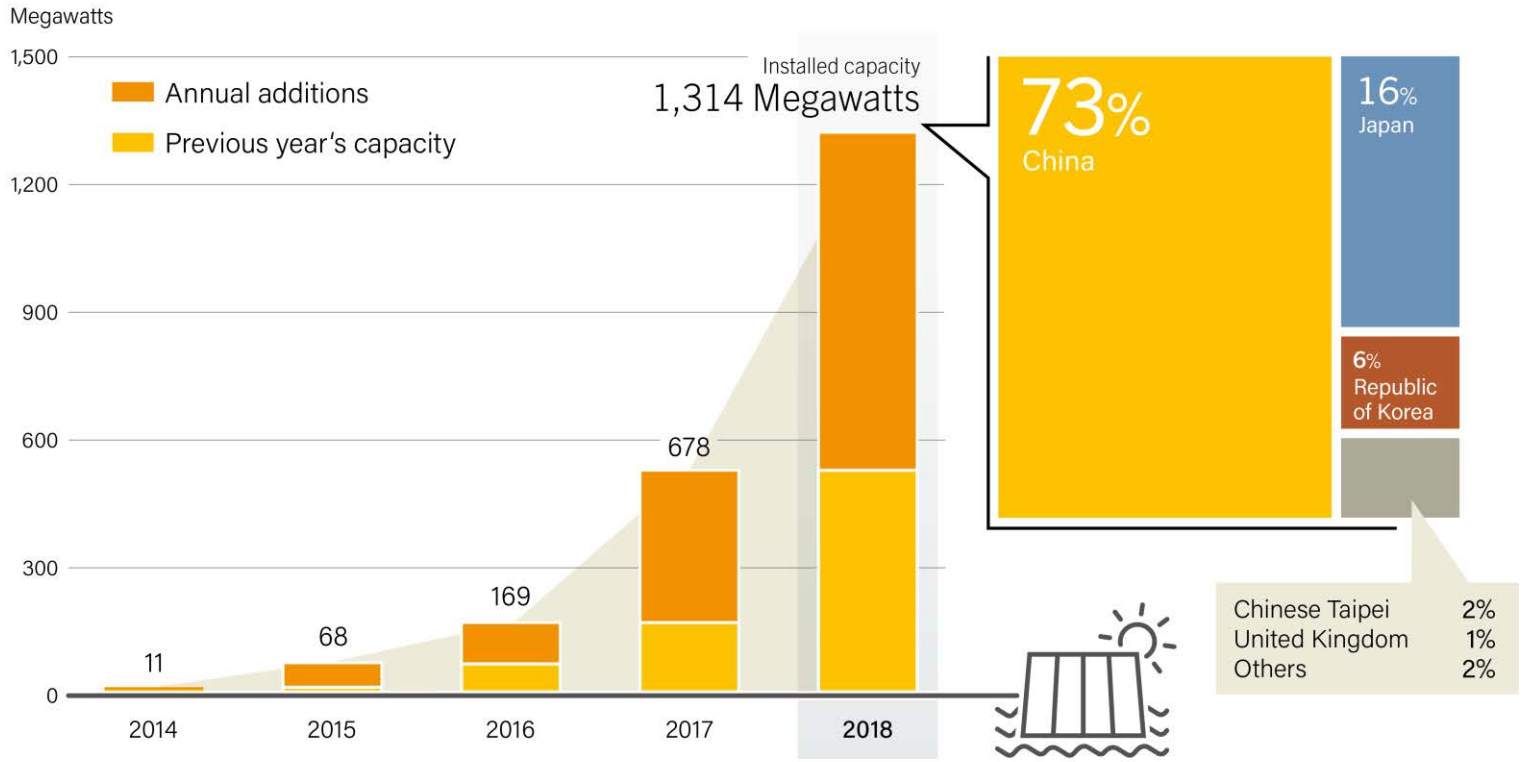
Floating solar PV cumulative capacity passes 1 GW mark

- 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



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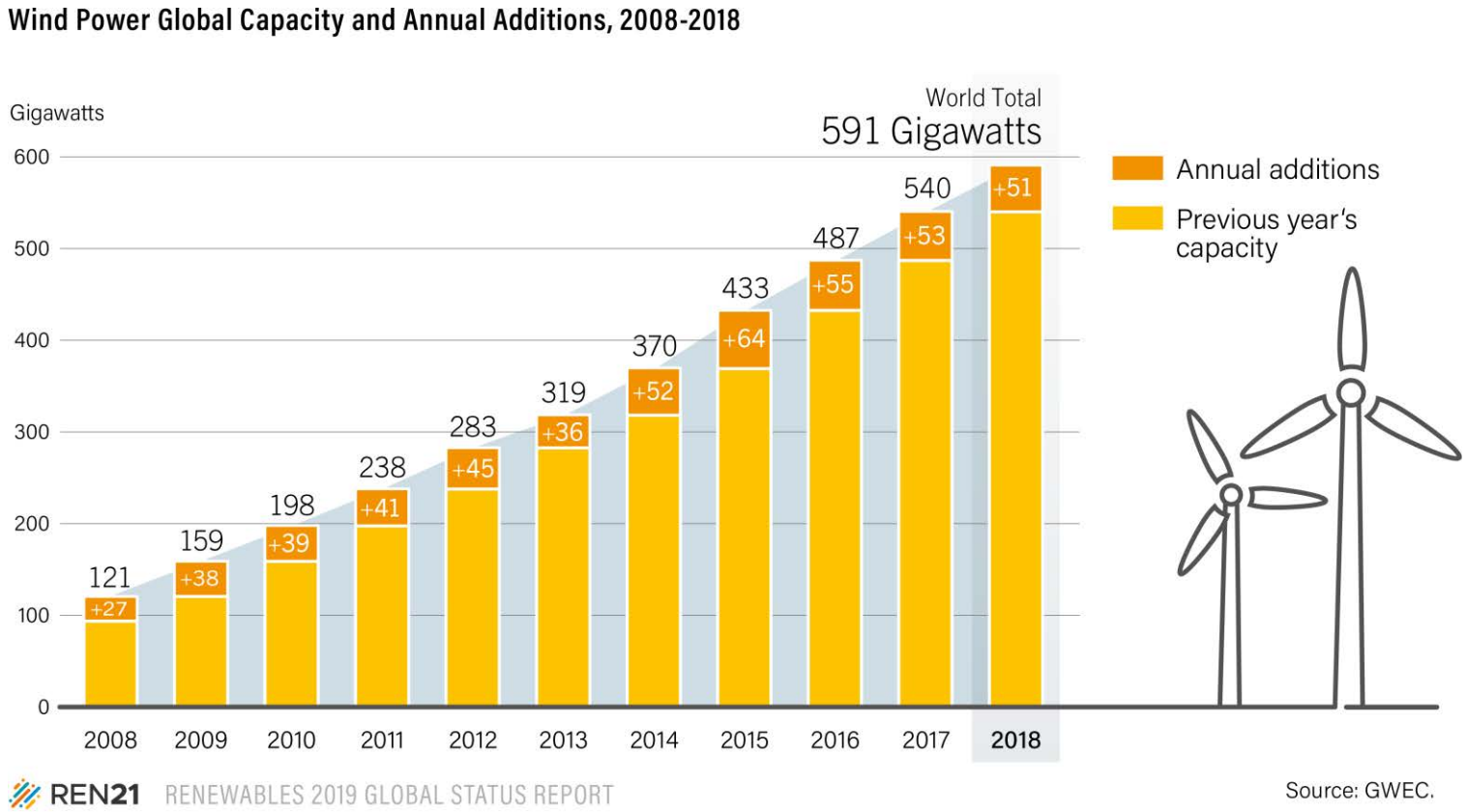
Source: World Bank Group, ESMAP and SERIS.

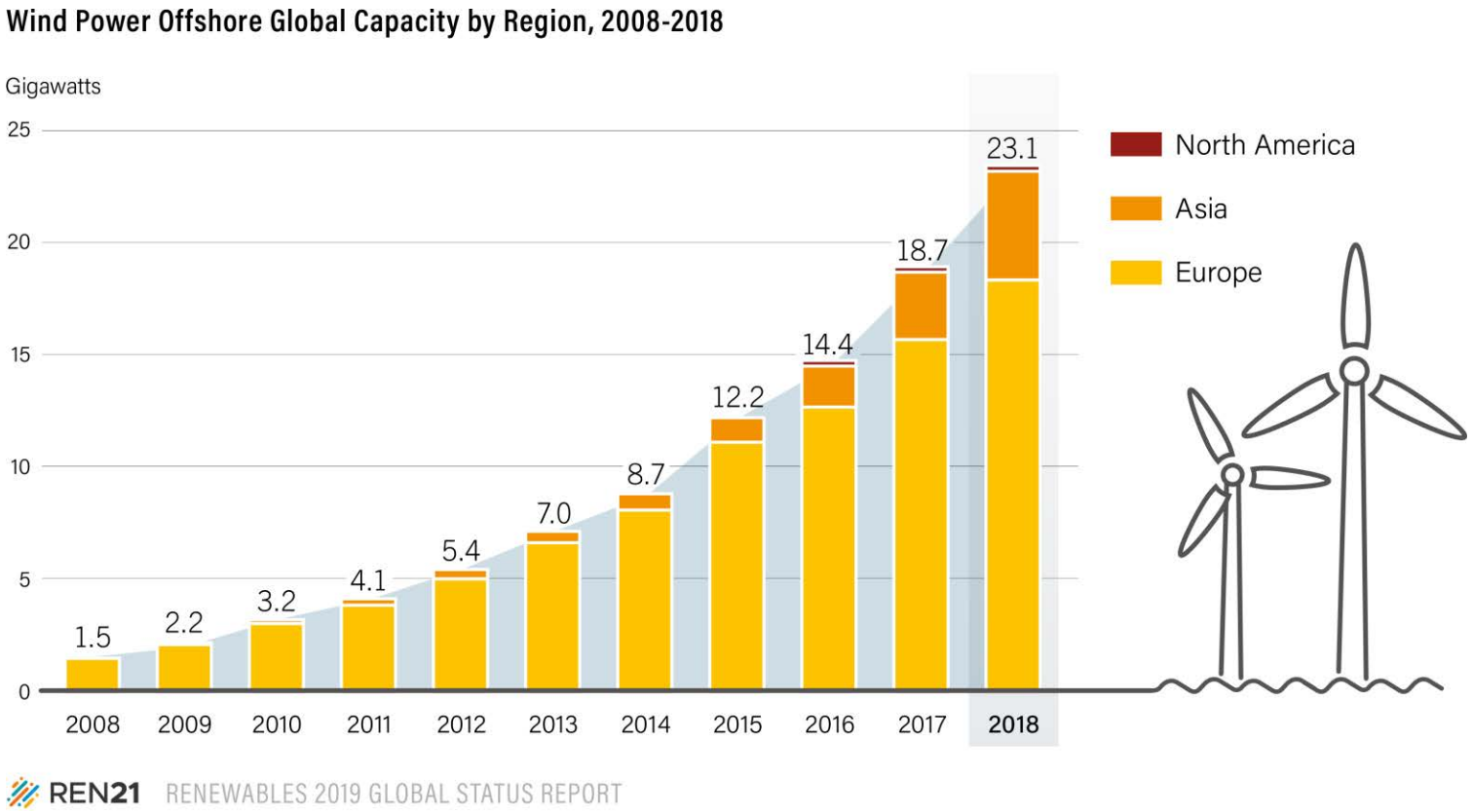
Wind power capacity continues to increase steadily year-on-year

- 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



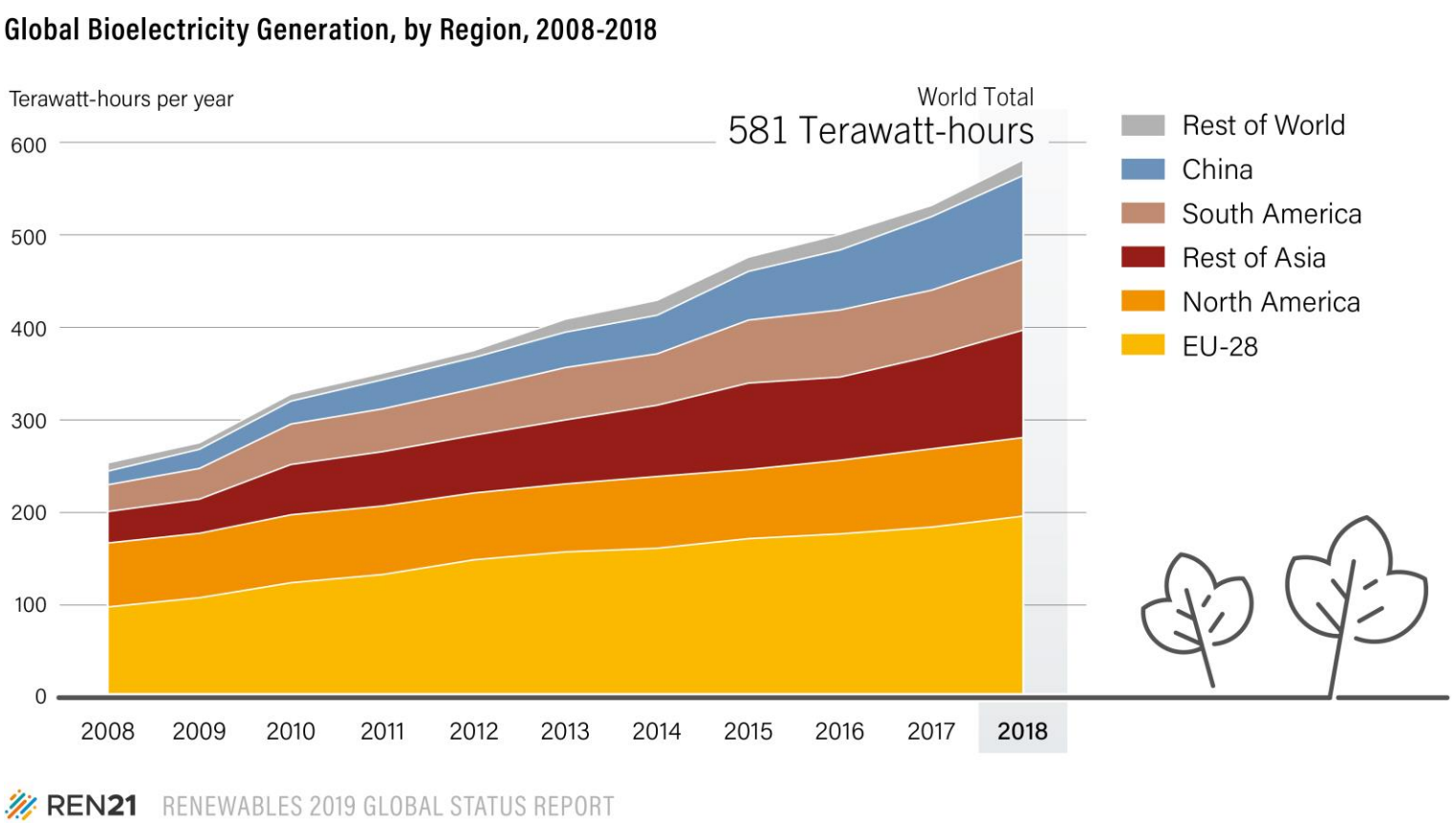
Success of offshore wind in Europe has sparked interest elsewhere

- 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



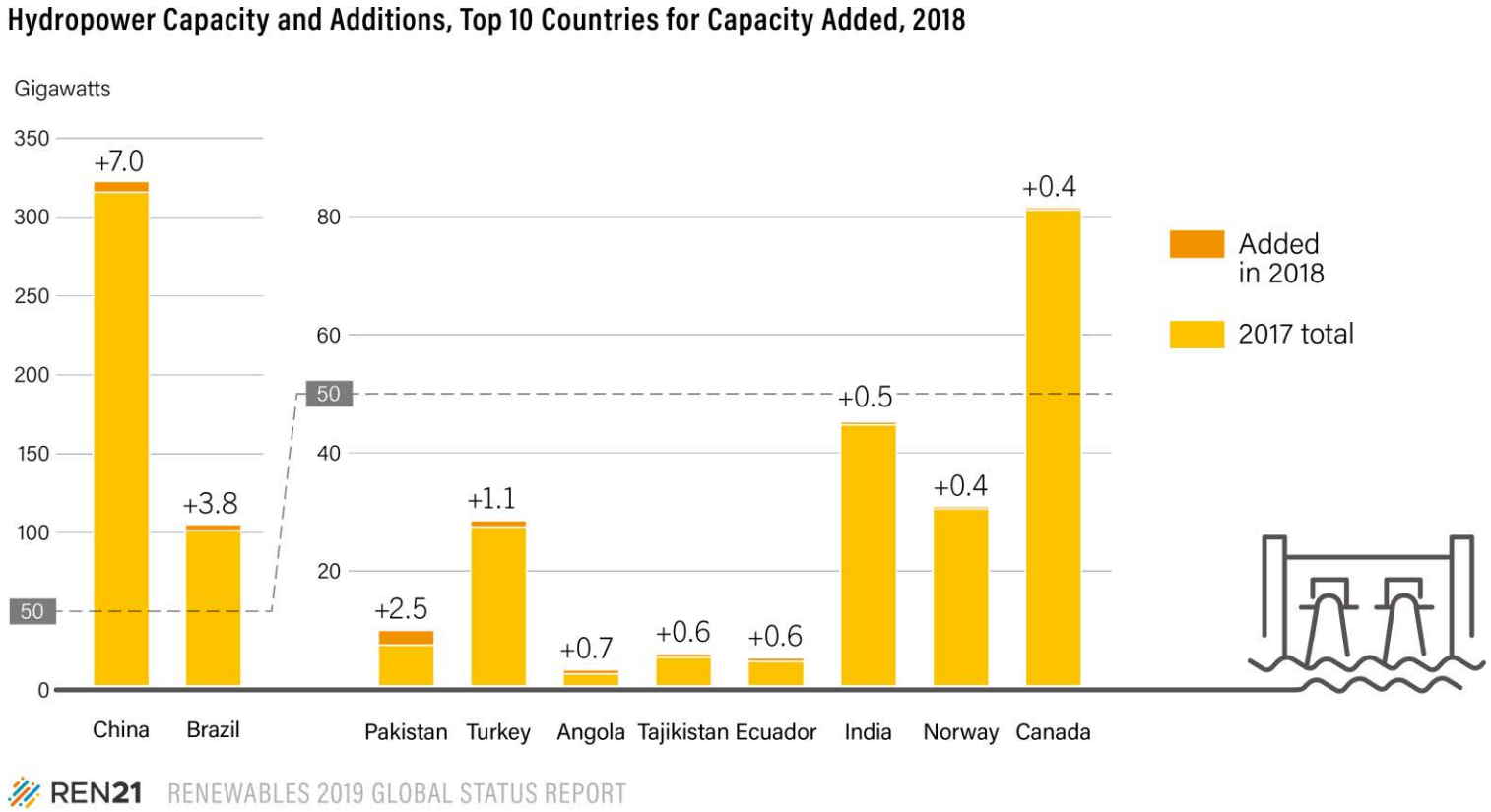
Bio-power continues trends from previous years

- 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



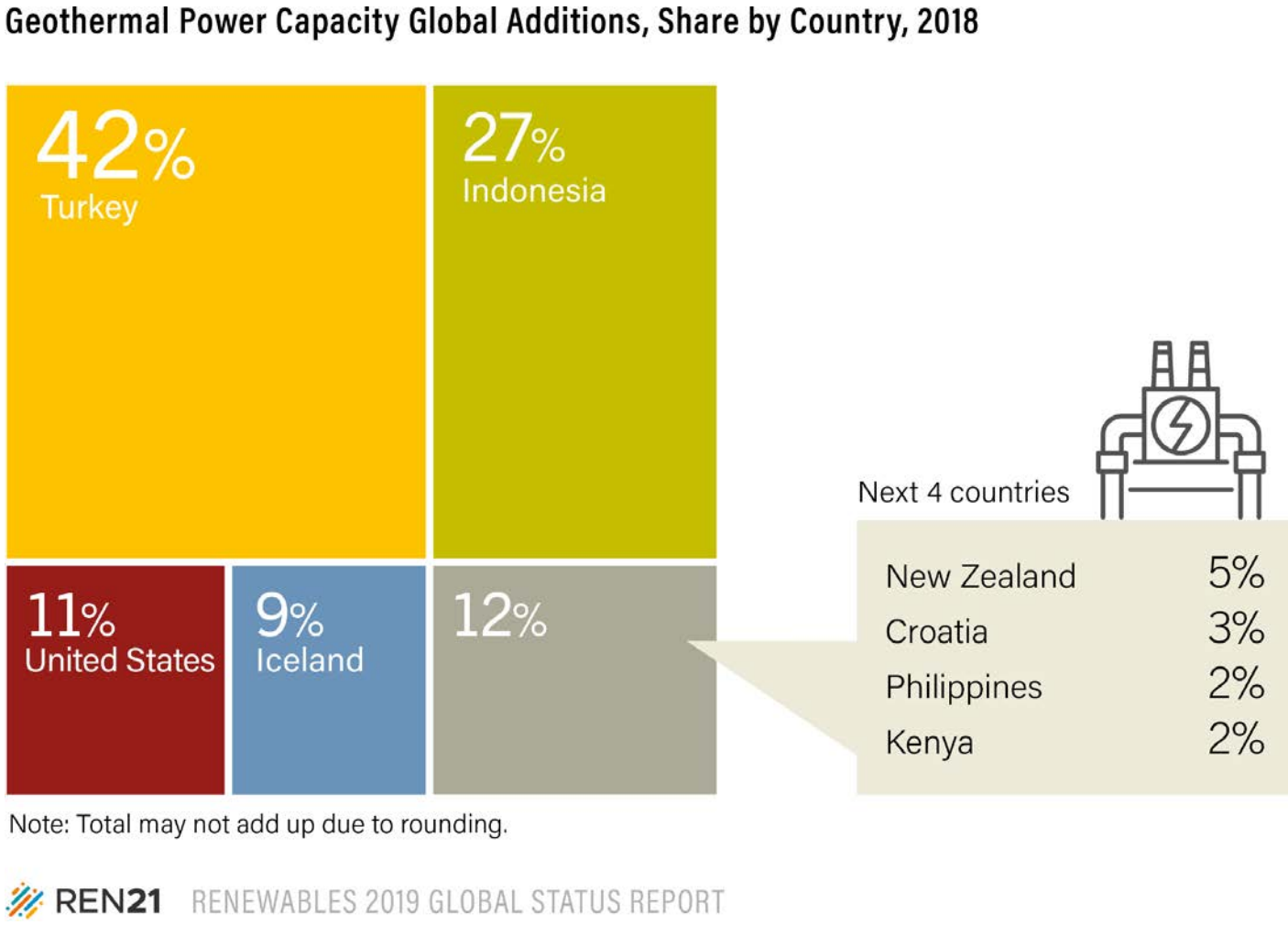
Hydropower characterised by market stability

- **20 GW** were added to reach a total of **1,132 GW** by end-2018
- China represented more than **35%** of new installations, followed by Brazil, Pakistan, and Turkey
- Generation estimated at **4,210 TWh** in 2018



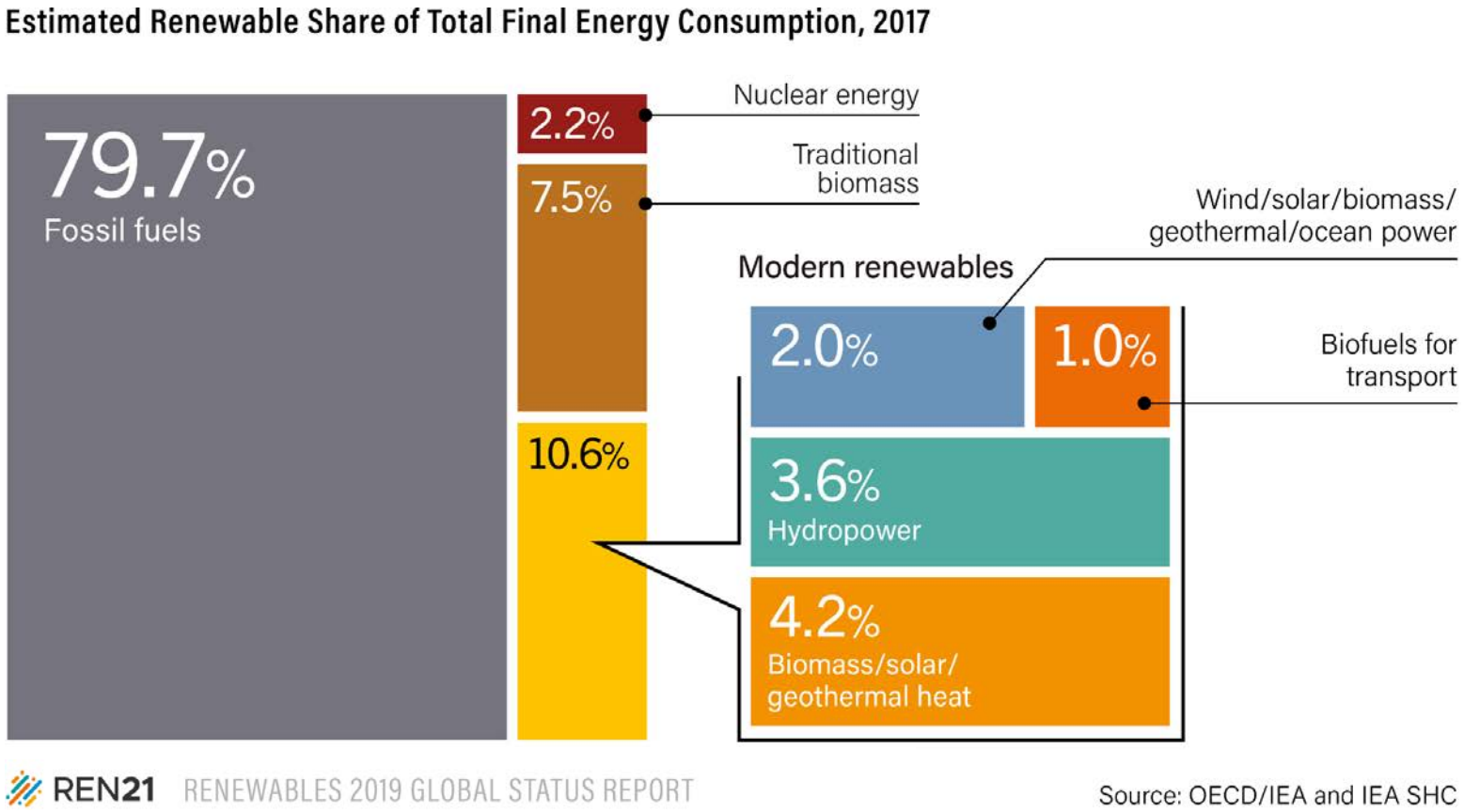
Geothermal power capacity growing gradually

- **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



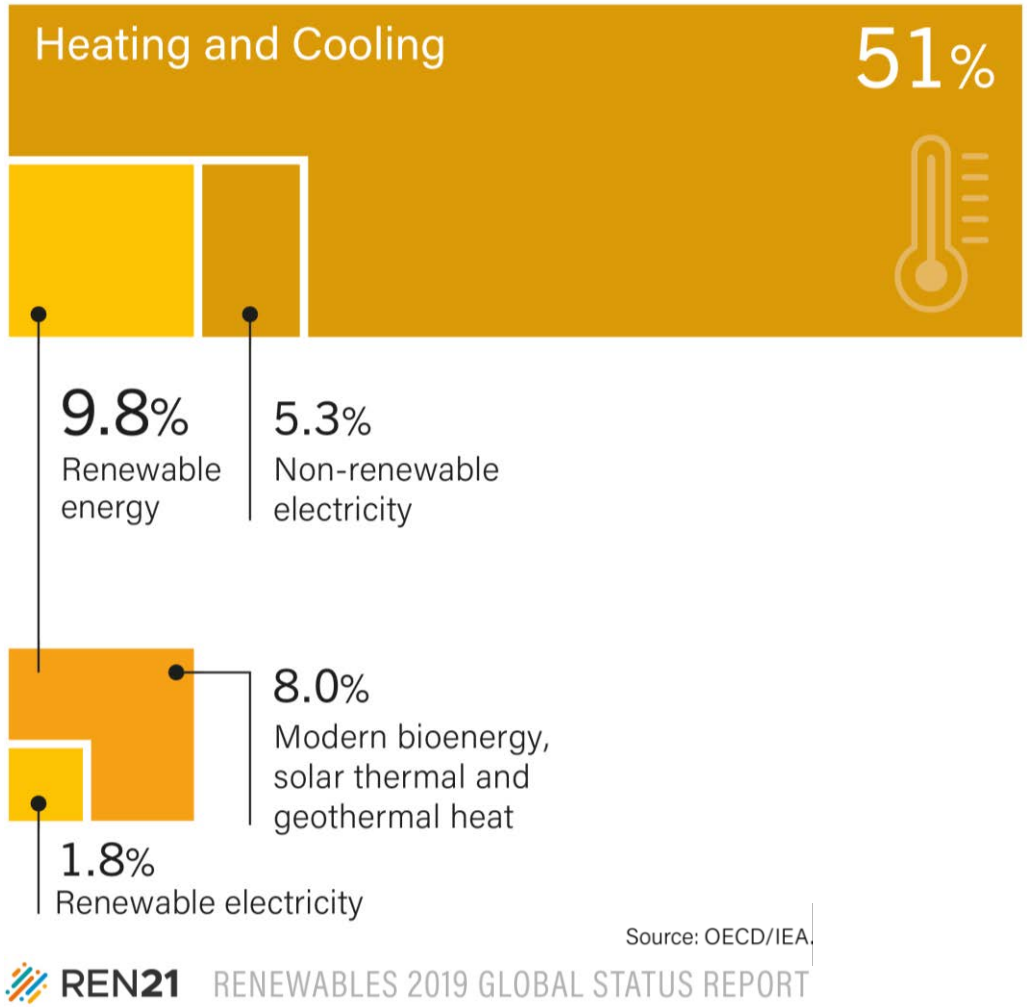
Modern renewables slowly gaining ground in final energy demand

- **Modern renewable energy** accounted for **10.6%** of final energy demand in 2017.
- Considering traditional biomass, renewable energy covered **18.1%** of final energy demand
- 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



Renewables in heating and cooling increasing very slowly

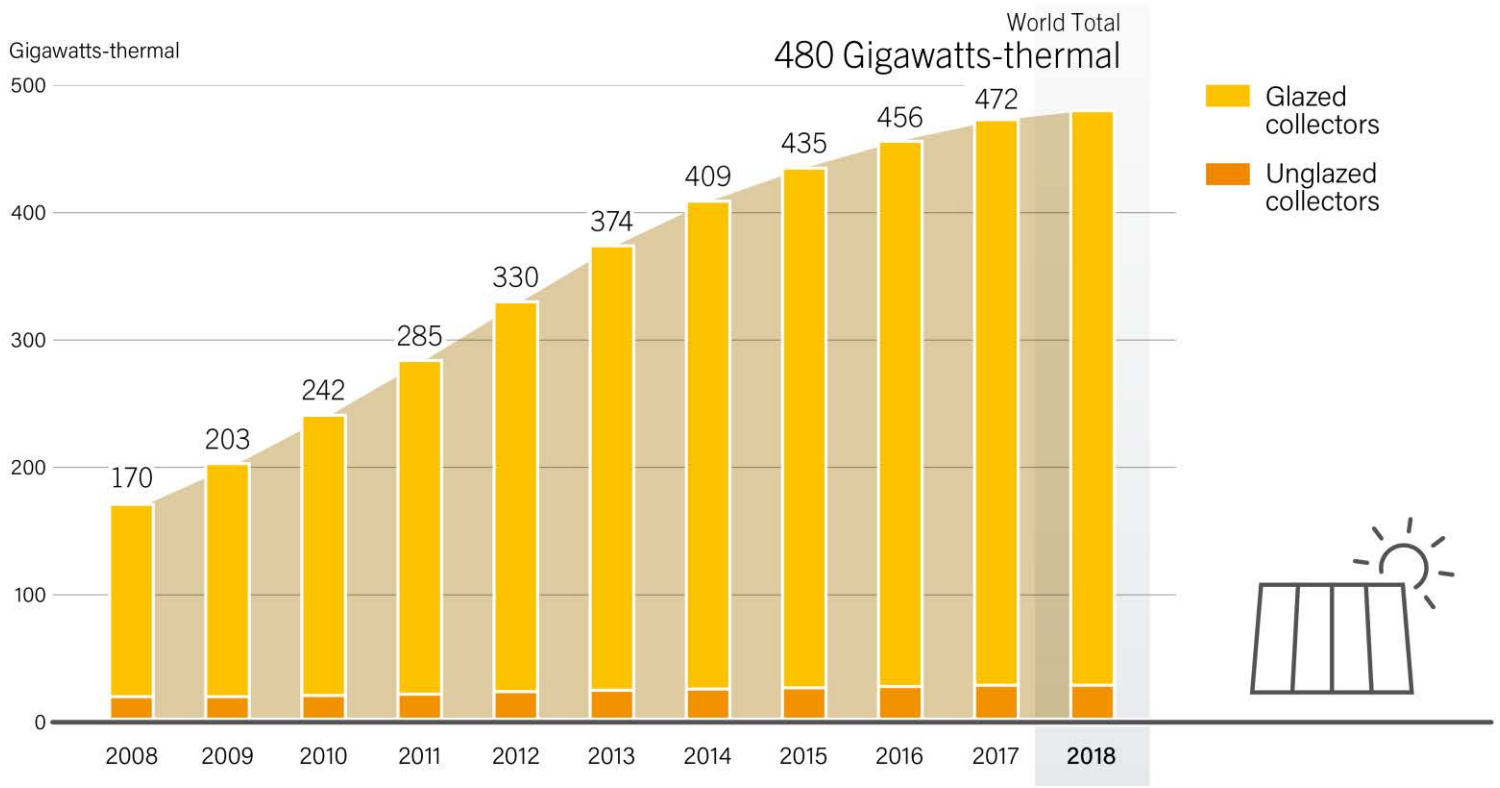
- Modern renewables account for just **10% of heating and cooling demand**
  - Demand growth is minimal (1.8%/year)
- **Lack of policy support** in the sector
  - Number of countries with regulatory policies fell from 21 to 20
  - Only 47 countries had targets for RHC
- Bio-heat provides majority but integration with **power sector** is key



Growth rate slows for solar water heating capacity additions

- Cumulative global operating capacity for solar water heating collectors increased **2%** to reach **480 GW$_{th}$**
- The majority of this capacity is glazed collectors
- The 2018 increase of **8 GW$_{th}$** 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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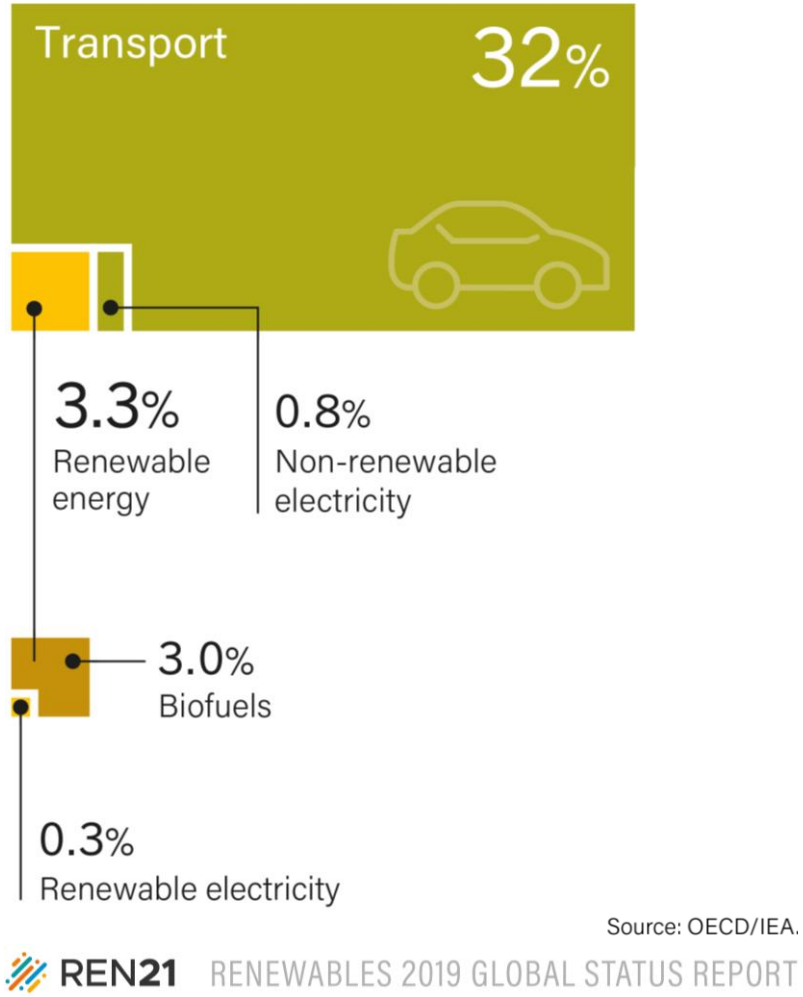
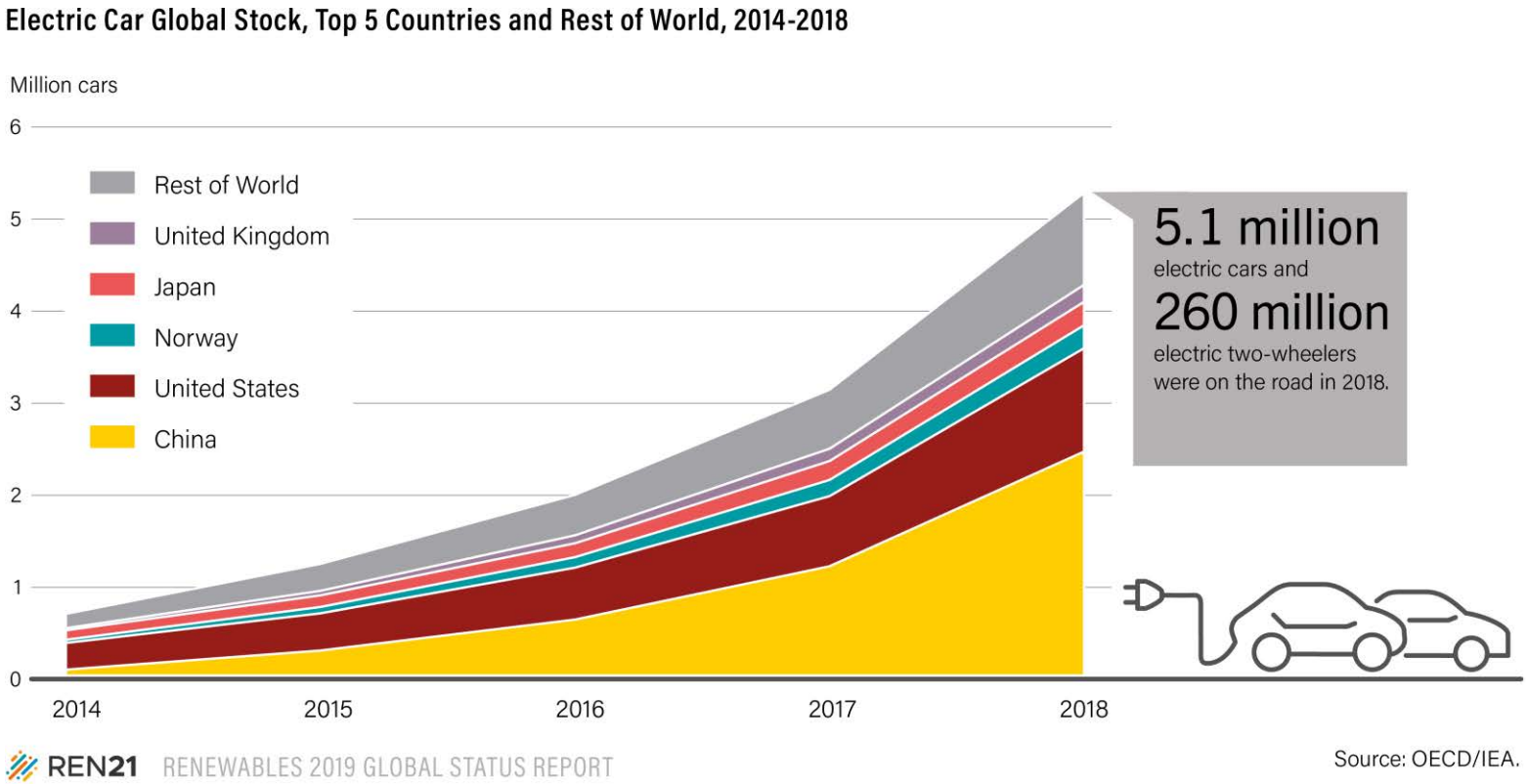
Biofuels and EVs growing but renewable share in transport remains low

- Global energy demand in transport increased **45%** since 2000
- Transport accounts for **23%** of global CO_2 emissions
- The renewable share of transport grew slightly to **3.3%**
- Biofuels make up majority of renewable contribution, but sector increasingly open to electrification



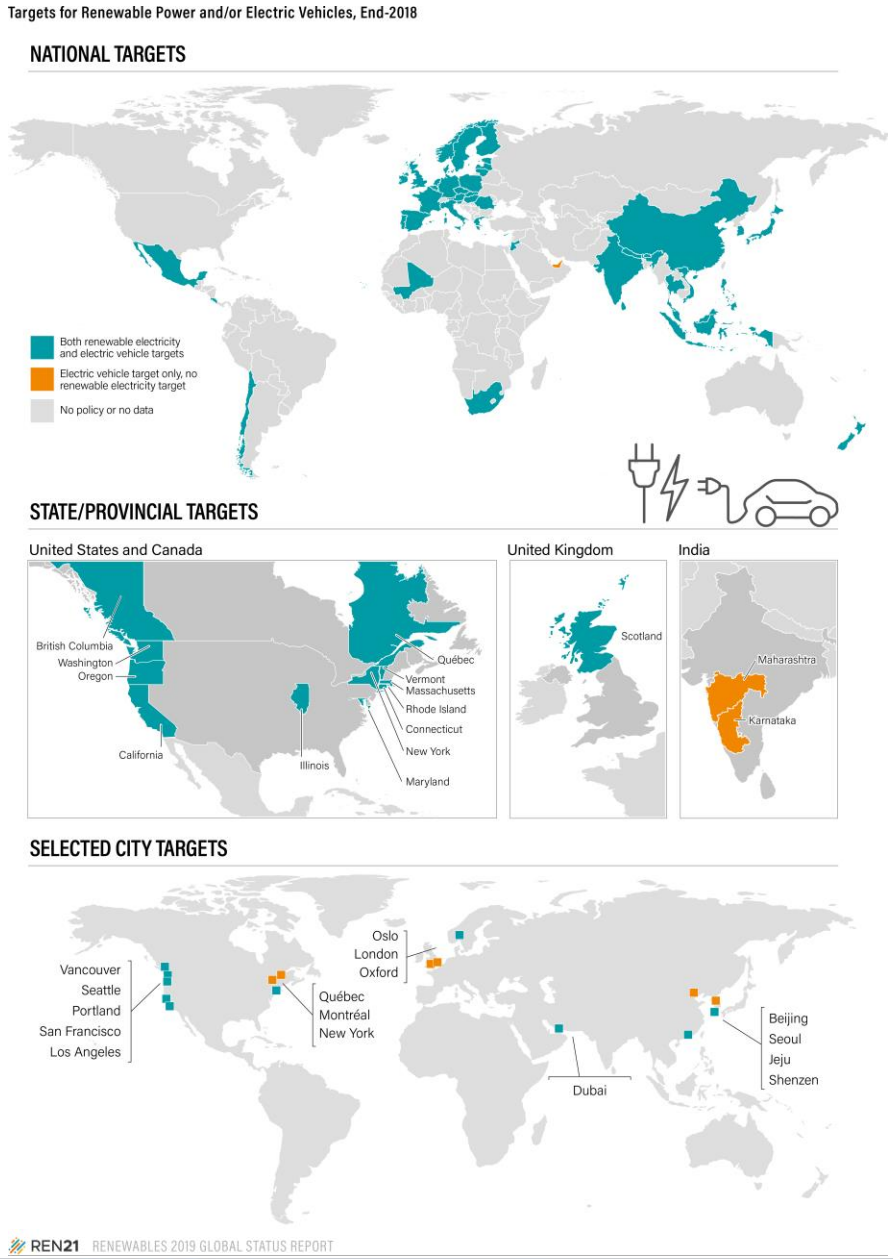
Electric passenger vehicle stock grew over 60%

- 260 million electric two-wheelers and 40 million electric three-wheelers
- More than **2 million** electric cars (inc. battery EV and plug-in hybrid EV) were sold in 2018 (+68%)
- China had **nearly 50%** of global stock, followed by US at 22%
- EV markets **highly concentrated**: 40% of all EVs were in just 20 cities
- Share of RE power: around **25%**



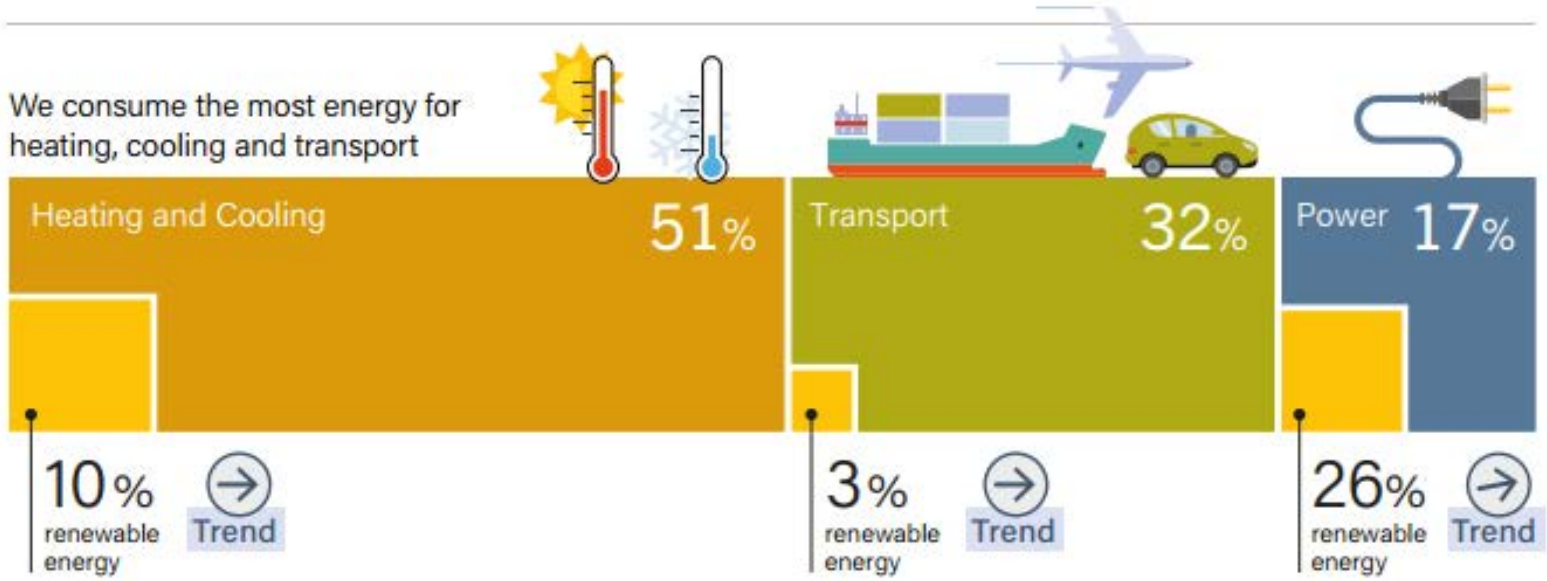
Little direct linking of EVs and renewables

- 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



Beyond Power: Over 80% of demand 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



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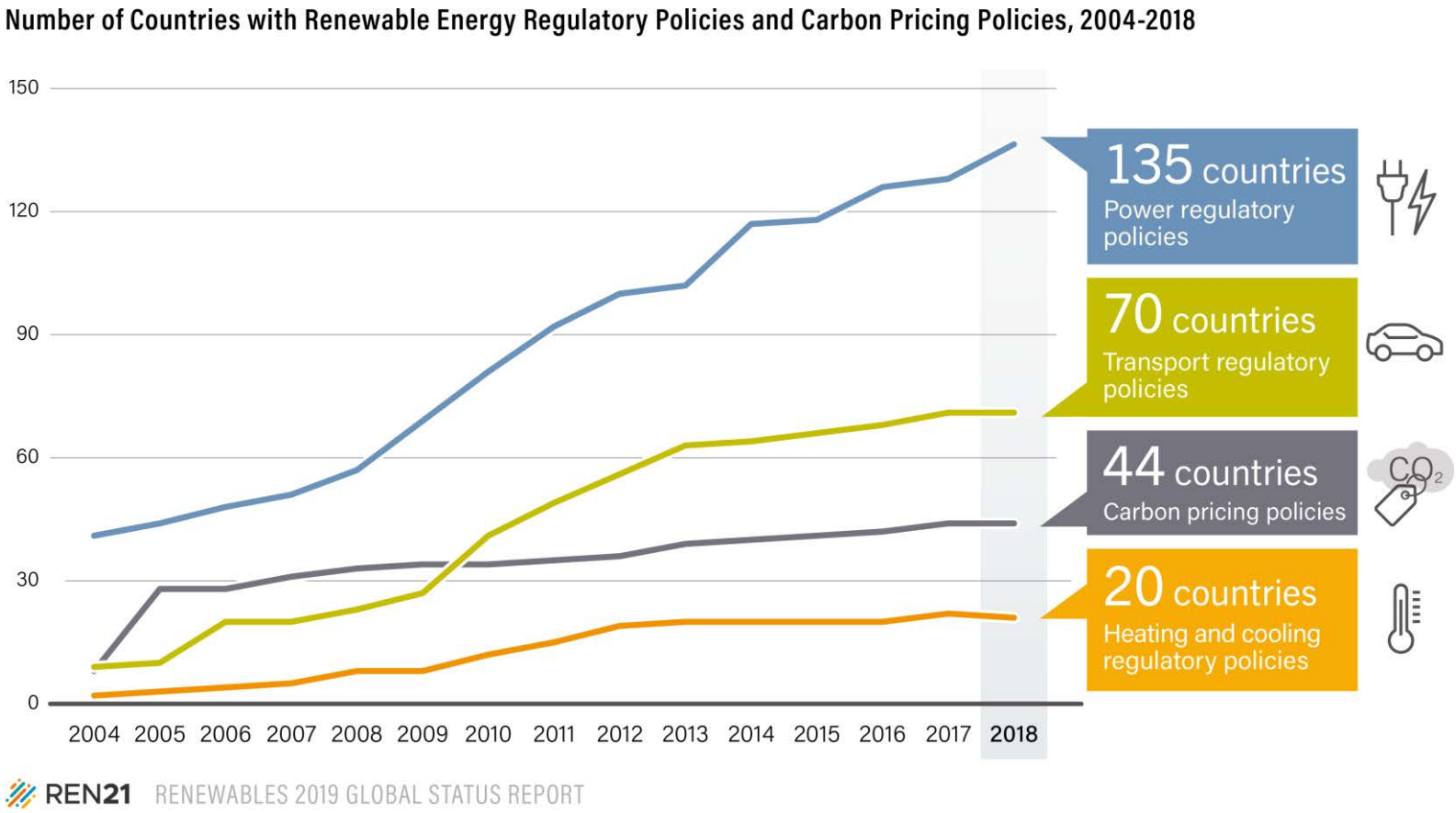
Source: OECD/IEA.

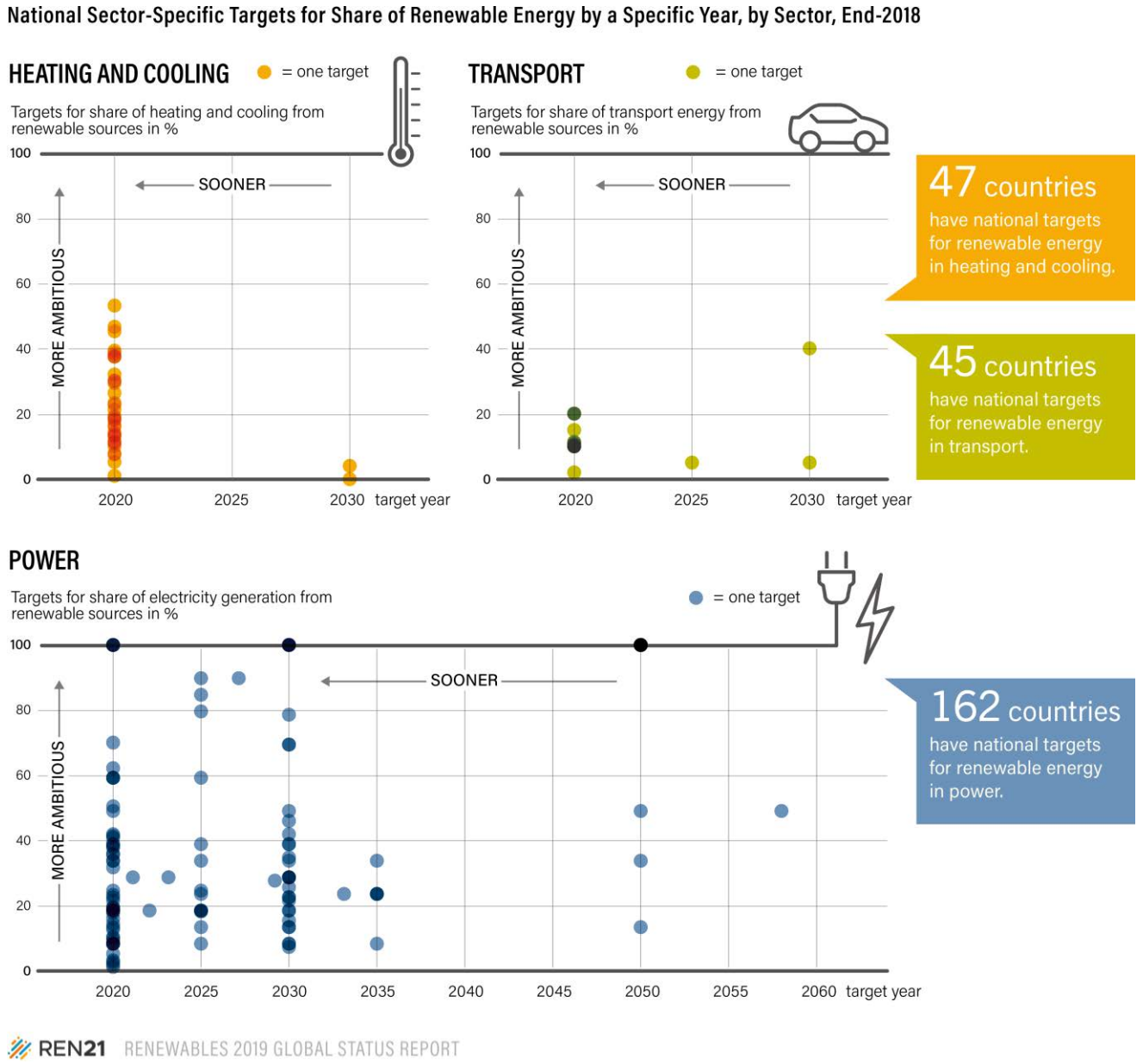
Advances in power made possible by policy support, other sectors lacking

- 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**



Targets uneven across sectors

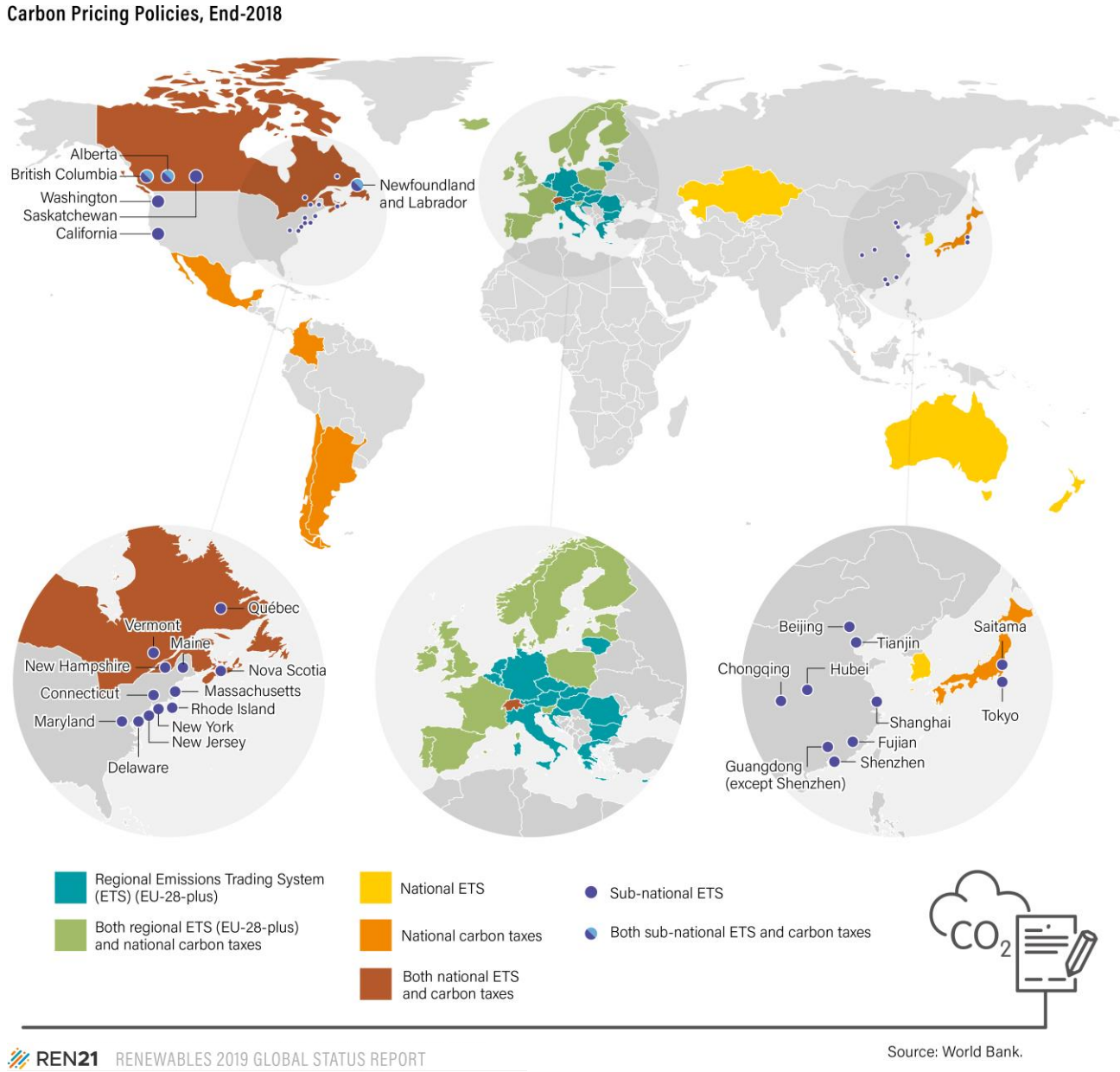
- Targets in the **power sector** remain more ambitious, more numerous than in heating and cooling and transport
- Fewer than **10** countries and states/provinces had economy-wide targets for at least **50%** renewable energy
- Still **only 1** country with a target for 100% renewables in total final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



Carbon pricing slowly expanding

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

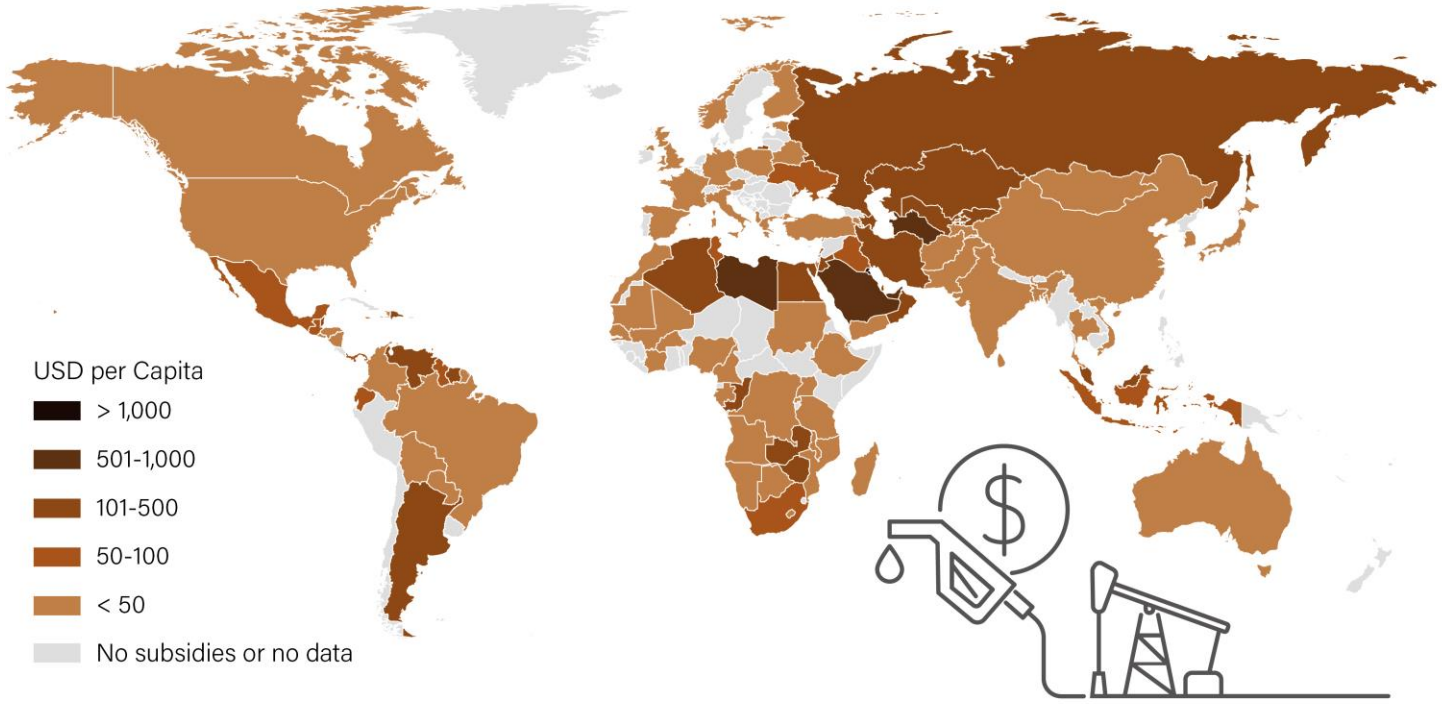
- Covering only **13%** of global greenhouse gas emissions



Not a level playing field: 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

Fossil Fuel Subsidies, per Person, by Country, 2017



Note: Shading depicts pre-tax consumption subsidies only.

Source: IMF.

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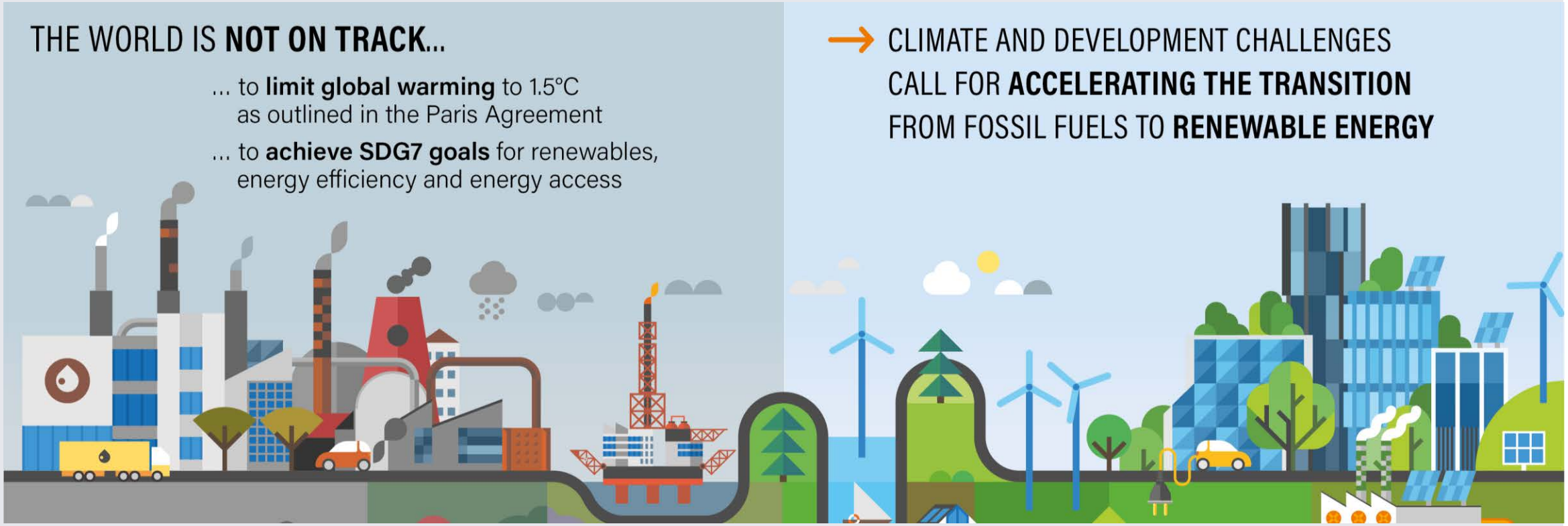
A sustainable energy future requires stronger policy action now



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?

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		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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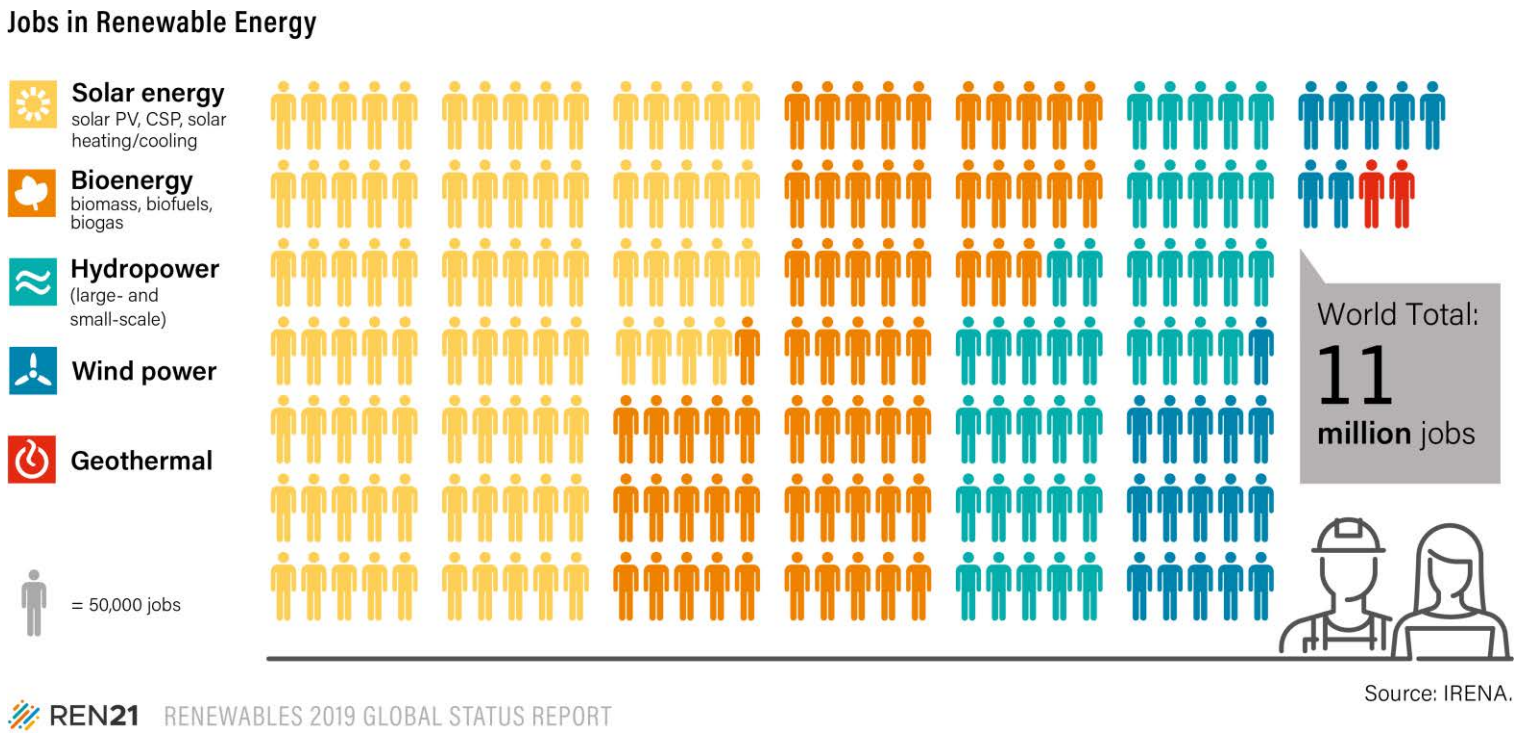
Jobs in renewable energy increase again in 2018

- 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



Where is Asia leading?

- **Largest regional wind power market**, with a total added capacity exceeding 262 GW, for 10th consecutive year

- Increasing number of people are **employed in off-grid solar and biofuels**

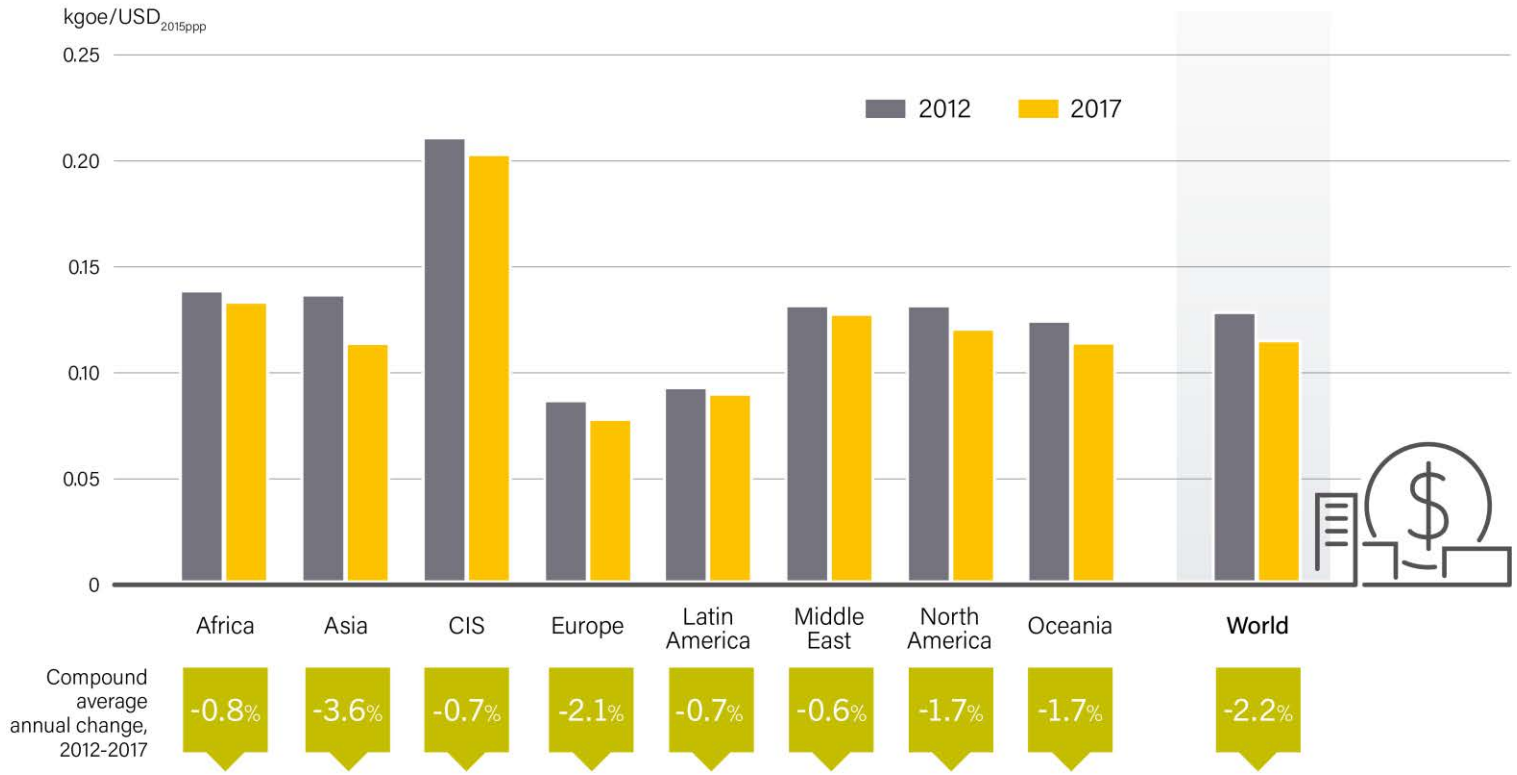
- Asia-Oceania (excluding China and India):
  - accounted for 15% of total renewables investment globally
  - investment increased 6% to USD 44.2 billion, the highest in 3 years
  - largest percentage increase in R&D

- **91% of population** in developing Asia have access to electricity

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

Primary Energy Intensity of Gross Domestic Product, Selected Regions and World, 2012 and 2017

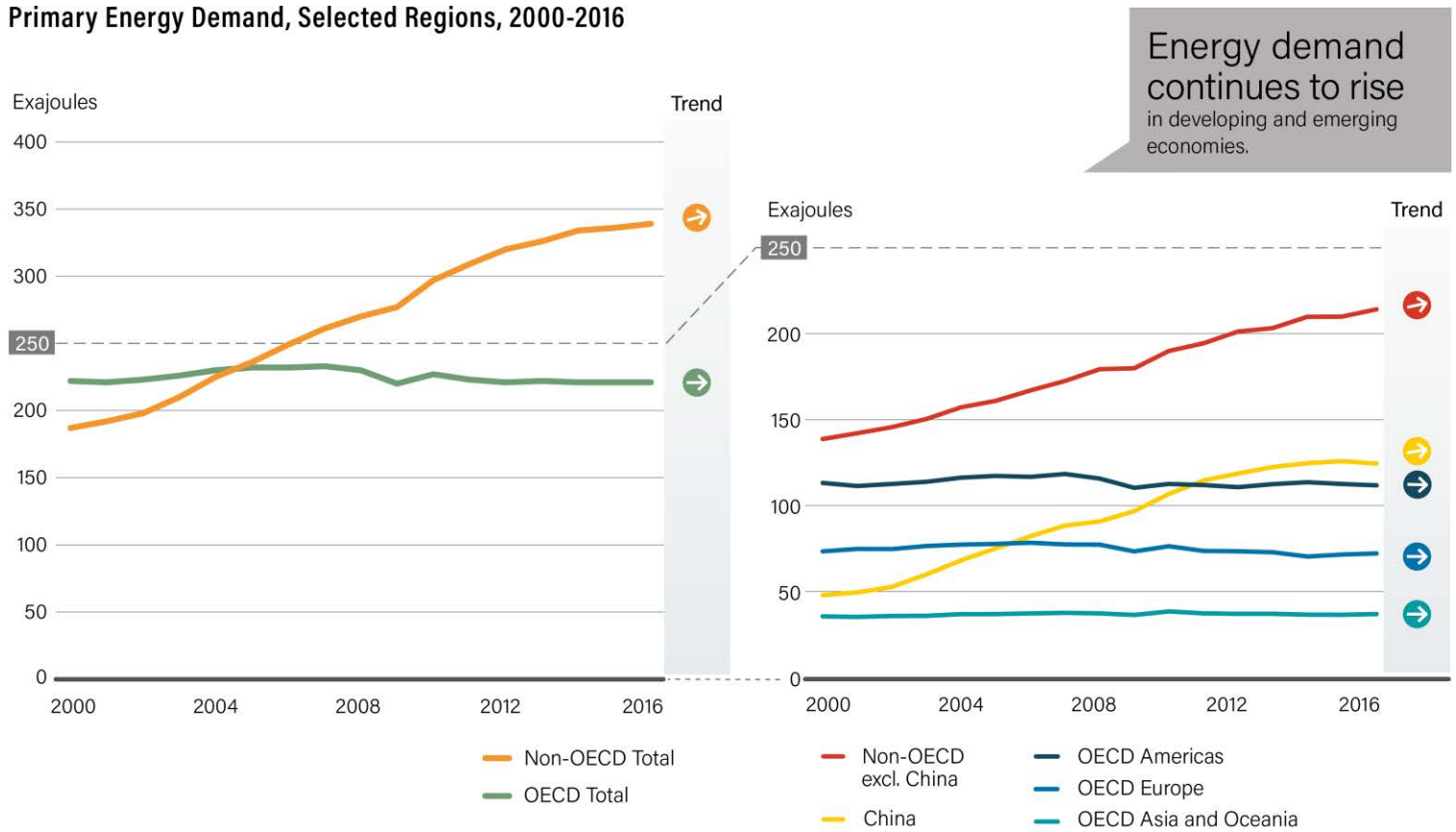


Note: Dollars are at constant purchasing power parities.
CIS = Commonwealth of Independent States.

Source: Enerdata.

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



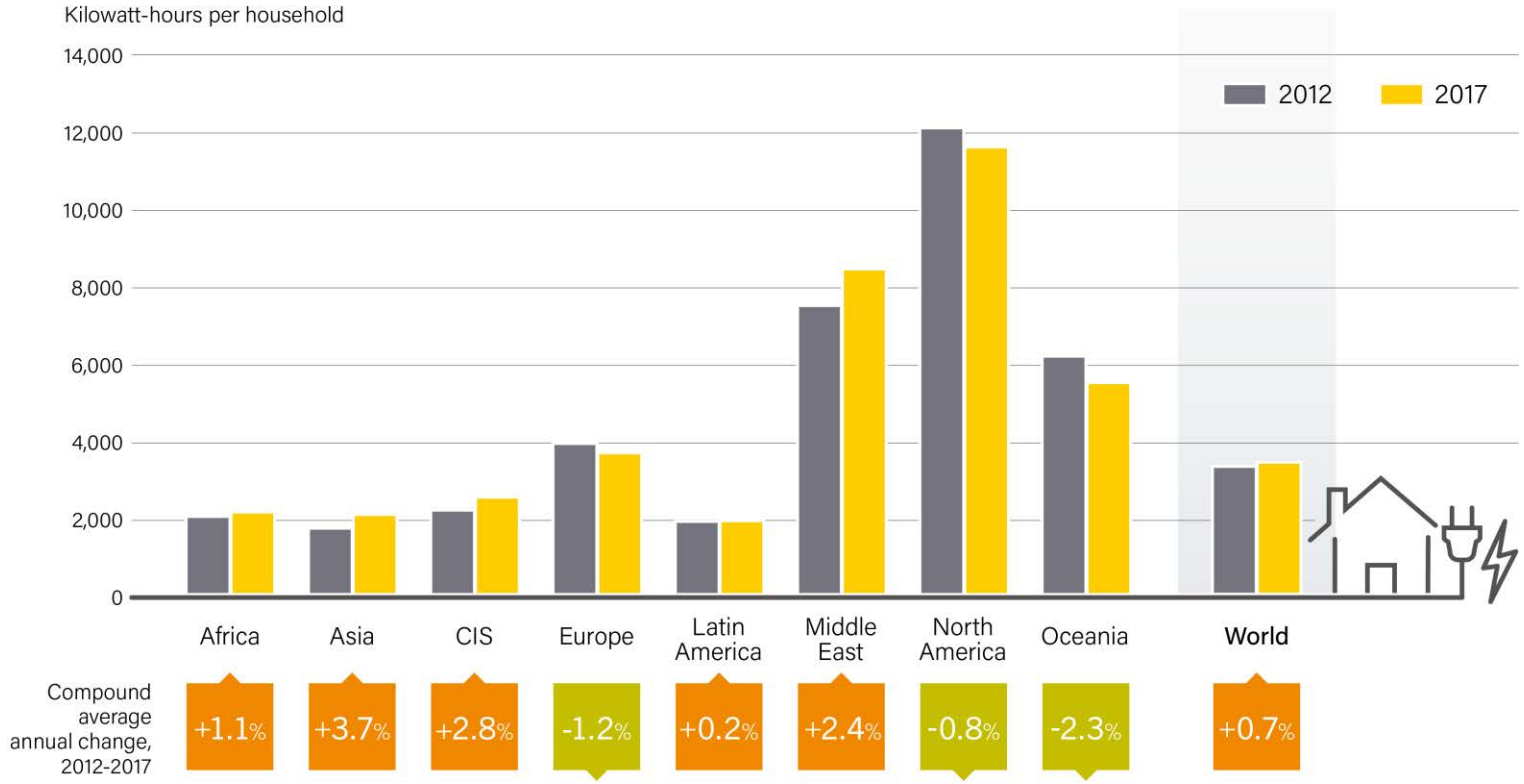
Note: Trend is based on a compound annual average growth rate from 2010 to 2016 for each indicated region.

Source: OECD/IEA.

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

Average Electricity Consumption per Electrified Household, Selected Regions and World, 2012 and 2017

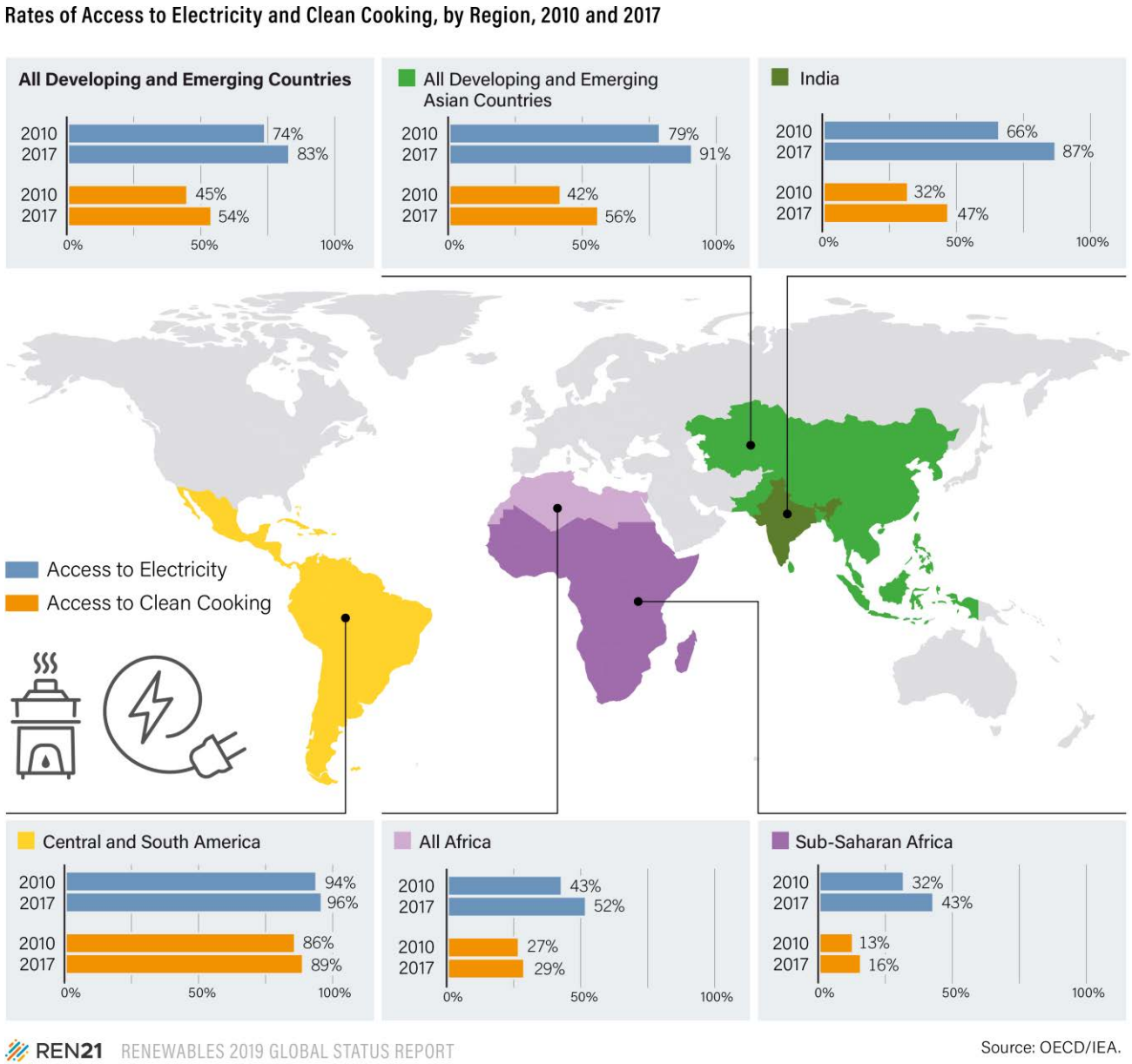


Note: CIS = Commonwealth of Independent States.

Source: Enerdata.

Access to energy expands

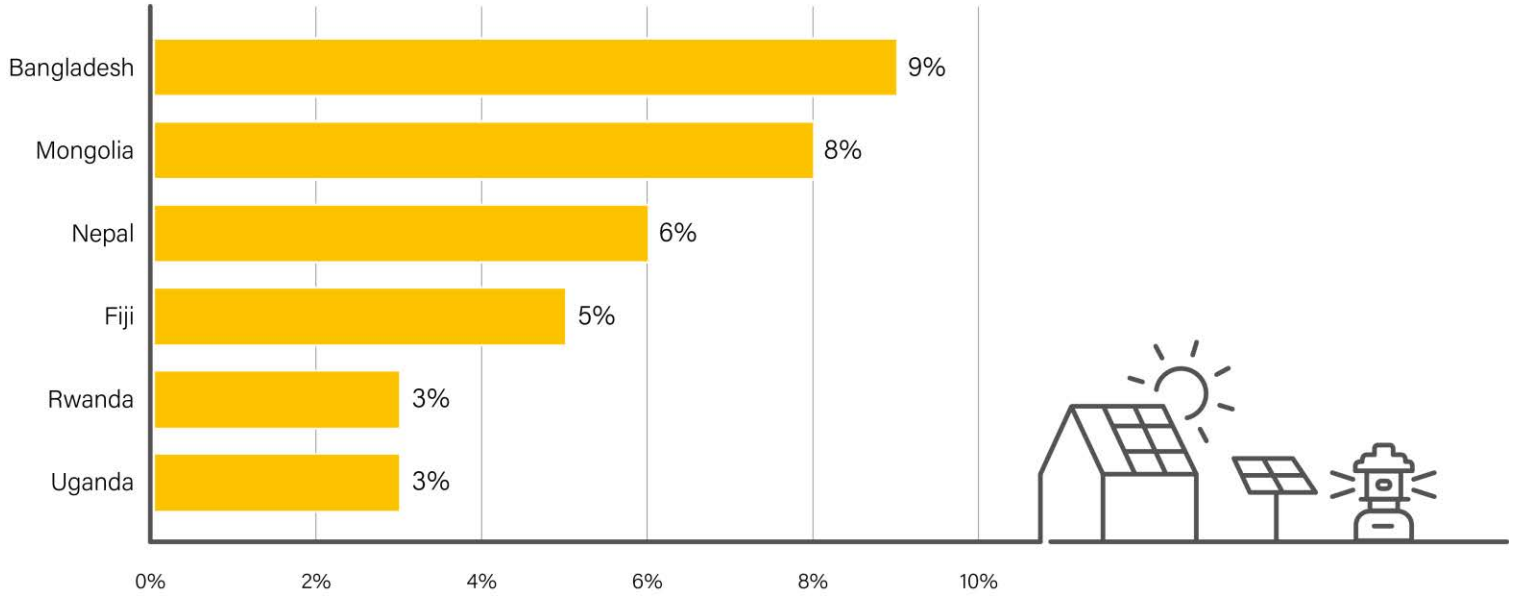
- In 2017:
  - **13%** of the global population lived **without electricity** – approx. 992 million people
  - **36%** of the global population lived **without clean cooking** – approx. 2.7 billion people
  - A majority live in rural areas of sub-Saharan Africa and Asia-Pacific regions



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.

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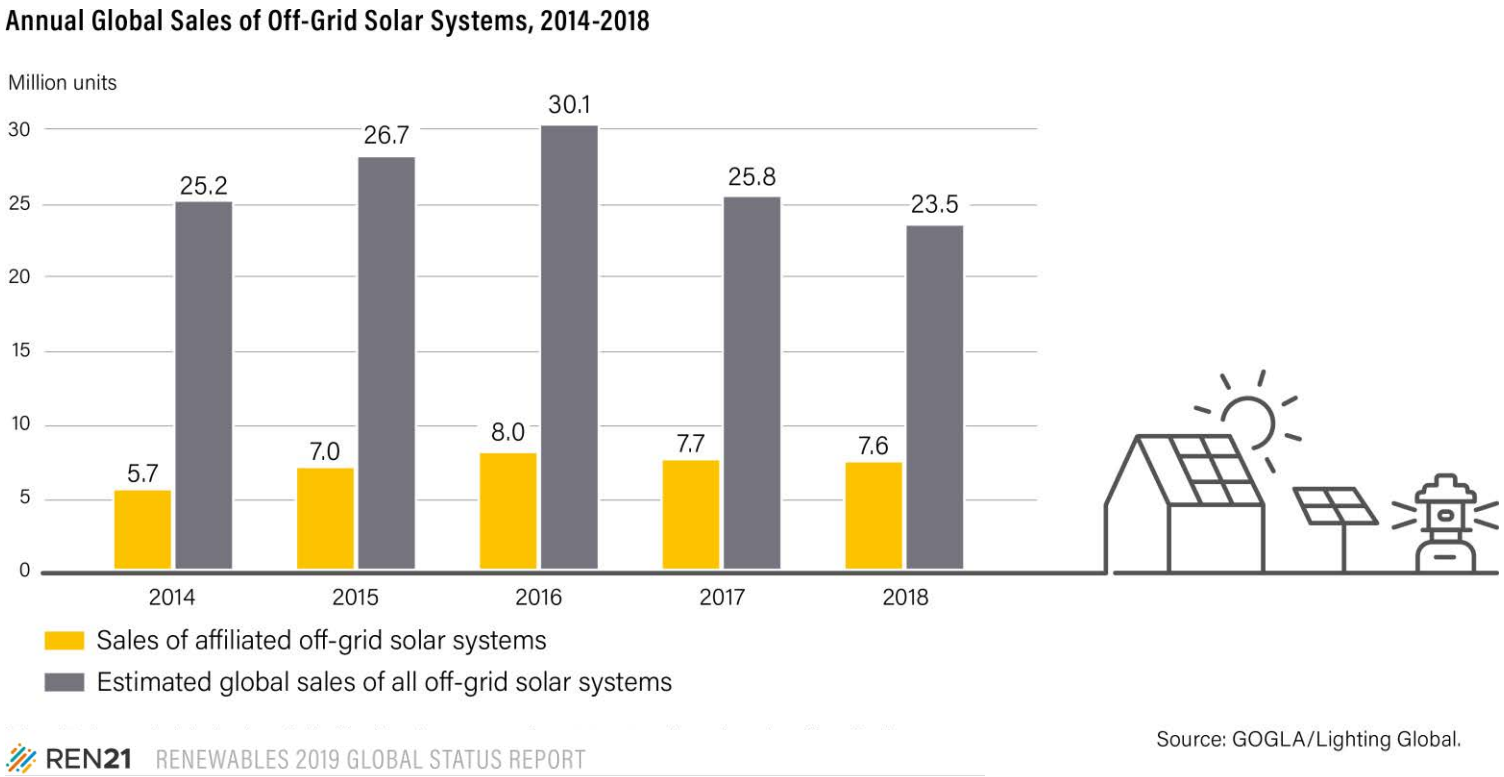
Global sales of off-grid solar systems sees strong growth rates

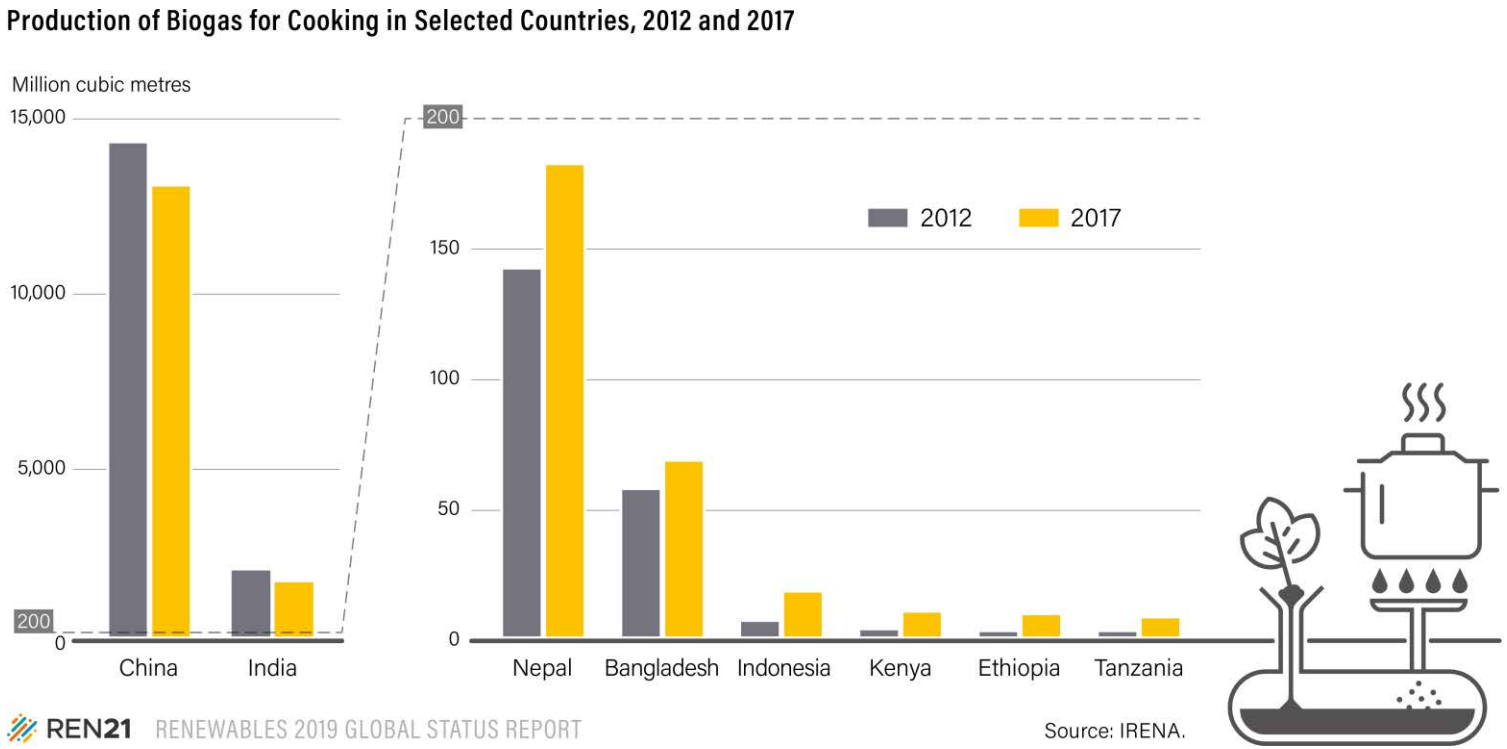
- Off-grid solar devices (solar lanterns and solar home systems): **50% annual growth** rates between 2010 and 2018
- In 2018:
  - Total sales of off-grid solar products: 23.5 million units
  - Sales of affiliated off-grid solar products: 7.6 million units
- Installed capacity of **affiliated off-grid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



Source: GOGLA/Lighting Global.

Production of biogas for cooking expands in new markets

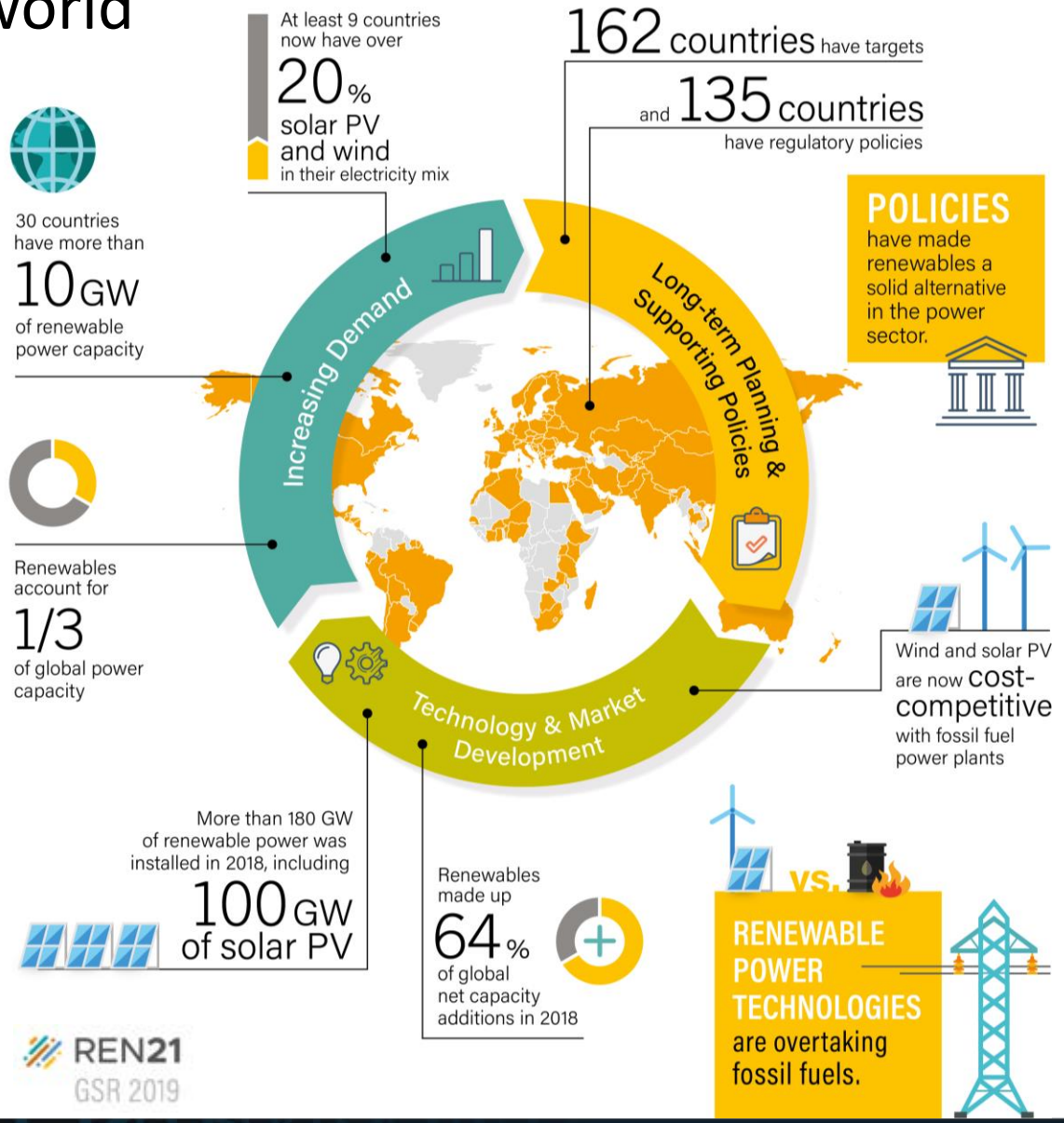
- **125 million people using biogas for cooking** (111 million in China and 9 million in India)
- **China**: 13.1 billion m^3 of biogas produced for cooking; **India**: 1.7 million m^3
- Use of biogas for cooking grew over the past five years in Asia (Bangladesh, Cambodia, Indonesia, Nepal) and sub-Saharan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



Renewable energy is powering the world

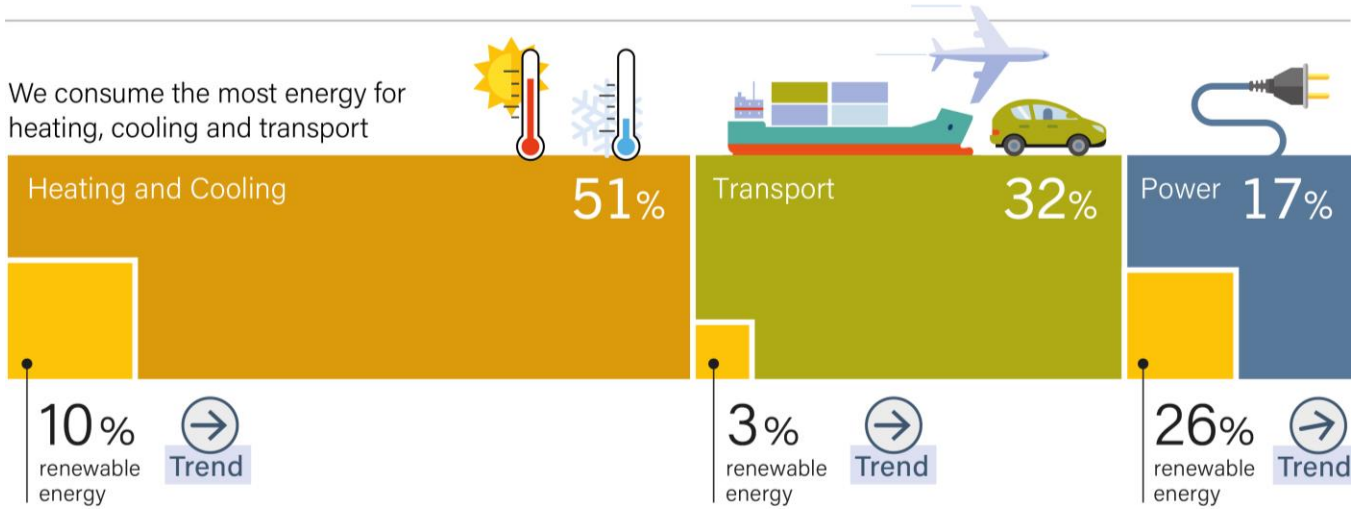
Reliable and Mainstream:

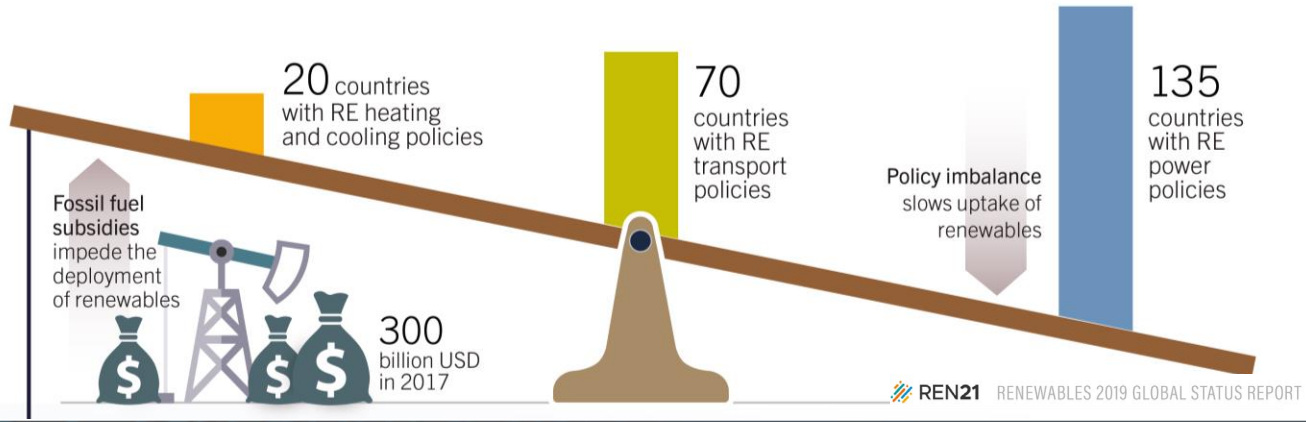
Renewable power is here to stay!



From an electricity transition to an energy system transformation

- **Create a level playing field** by removing fossil fuel subsidies and adopting carbon pricing
- **Encourage sector integration** among power, heating and cooling, and transport
- **Align policies** across the national, sub-national and local levels
- **Link to energy efficiency** in renewable energy policy initiatives





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

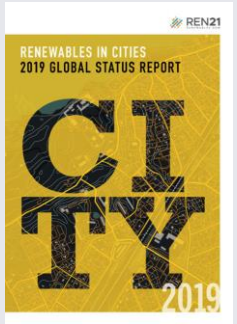
- **Leadership from national governments** is paving the way towards 100% renewables in countries.
- **Cities and sub-national governments** are setting more ambitious policies than their national governments.
- **1000+ organisations**, totaling USD 8 trillion of managed assets, have committed to divesting 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

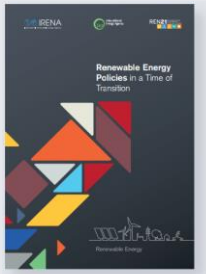
Global Status Report: yearly publication since 2005



Renewables in Cities Status Report:

Regional Reports

Global Futures Reports



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