

RENEWABLES 2017

GLOBAL STATUS REPORT



Hannah E. Murdock
Project Manager & Analyst
hannah.murdock@ren21.net

CESC Webinar
Breaking Down Silos
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2017

REN21 is the global multi stakeholder network dedicated to the rapid uptake of renewable energy worldwide.

NGOs:

CAN, CEEW, FER, GACC, GFSE, Greenpeace International, ICLEI, ISEP, MFC, SLoCaT, REI, WCRE, WFC, WRI, WWF

Industry Associations:

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

Science & Academia:

Fundacion Bariloche, IIASA, ISES, NREL, SANEDI, TERI,

International Organisations:

ADB, APERC, ECREEE, EC, GEF, IEA, IRENA, RCREEE, UNDP, UNEP, UNIDO, World Bank

National Governments:

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



REN21 Renewables 2017 Global Status Report

The report features:

- Global Overview
- Market & Industry Trends
- Distributed Renewable Energy for Energy Access
- Investment Flows
- Policy Landscape
- NEW: Enabling Technologies and Energy Systems Integration
- Energy Efficiency
- Feature: Deconstructing Baseload

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Investors Acquiring More Renewable Energy Capacity for Less Money in 2016

- 176 countries had **renewable energy targets**, and renewable energy auctions were held in 34 countries in 2016 – more than double the year before.
- **Newly installed renewable power capacity set new records** in 2016, with 161 gigawatts (GW) added, increasing the global total by almost 9% relative to 2015. Solar PV was the star performer in 2016, accounting for around 47% of the total additions, followed by wind power at 34% and hydropower at 15.5%.
- For the fifth consecutive year, **investment in new renewable power capacity** was roughly **double the investment in fossil fuel generating capacity**, reaching USD 249.8 billion.
- 2016 was the **third year in a row where global energy related CO₂ emissions** from the energy sector remained stable despite a 3% growth in the global economy and an increased demand for energy.

Another extraordinary year for renewable energy

Total global capacity was up 9% compared to 2015, to more than **2,017 GW** at year's end (**921 GW** not including hydro)

- Solar PV: **47%** of newly installed renewable power capacity in 2016
- Wind: **34%**
- Hydropower: **15.5%**

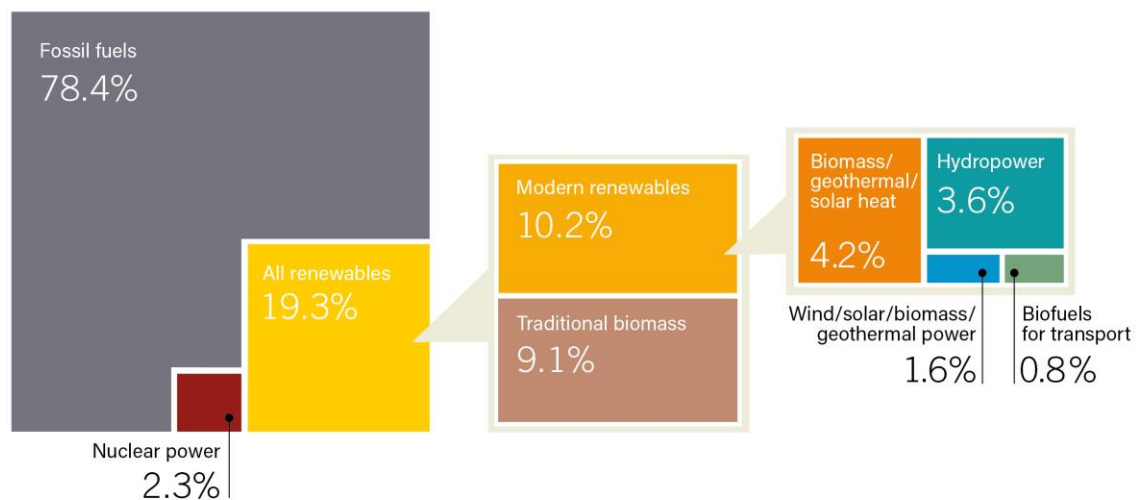
		2015	2016
INVESTMENT			
New investment (annual) in renewable power and fuels ¹	billion USD	312.2	241.6
POWER			
Renewable power capacity (total, not including hydro)	GW	785	921
Renewable power capacity (total, including hydro)	GW	1,856	2,017
 Hydropower capacity ²	GW	1,071	1,096
 Bio-power capacity	GW	106	112
 Bio-power generation (annual)	TWh	46.4	50.4
 Geothermal power capacity	GW	13	13.5
 Solar PV capacity	GW	228	303
 Concentrating solar thermal power capacity	GW	4.7	4.8
 Wind power capacity	GW	433	487
HEAT			
 Solar hot water capacity ³	GW _{th}	435	456
TRANSPORT			
 Ethanol production (annual)	billion litres	98.3	98.6
 Biodiesel production (annual)	billion litres	30.1	30.8



Renewable Energy in the World

As of 2015, renewable energy provided an estimated **19.3%** of global final energy consumption

Estimated Renewable Energy Share of Total Final Energy Consumption, 2015



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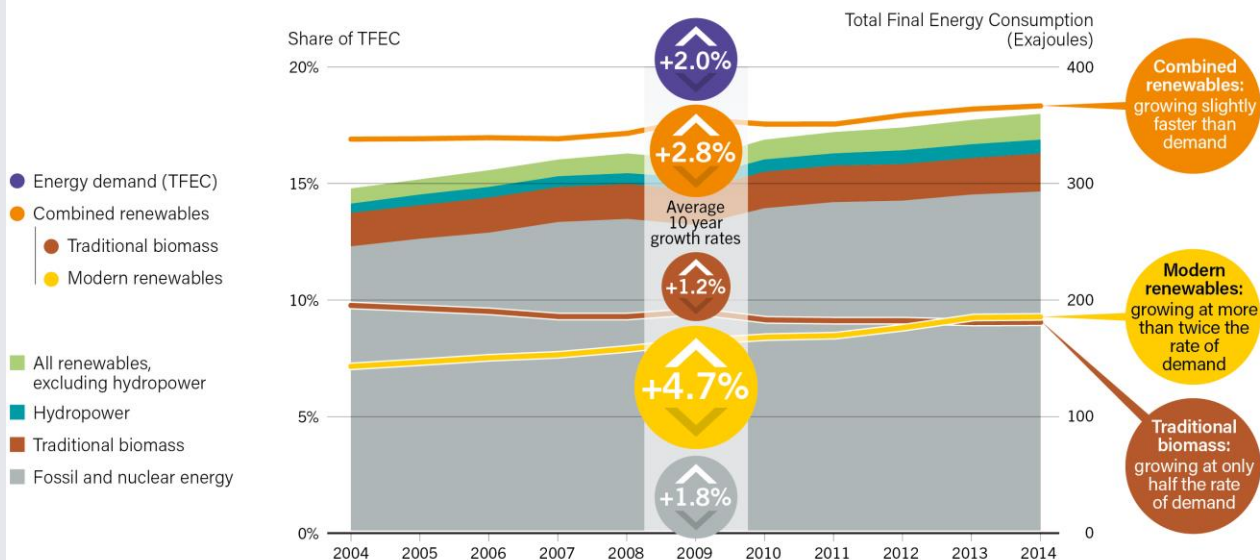
Renewable Energy in the World

Overall share of renewable energy has increased only modestly.

Reasons:

- Growth of energy demand
- Decrease of traditional biomass at a slower pace
- Increase in fossil fuel & nuclear

Growth in Global Renewable Energy Compared to Total Final Energy Consumption, 2004-2014



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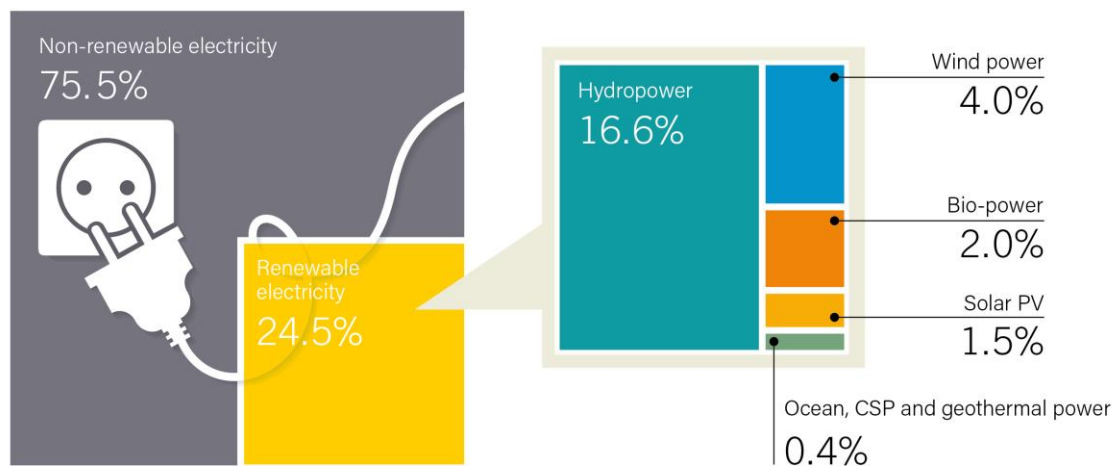


Source: based on IEA World Energy Balances, 2016.

Power Sector

By year's end, renewables comprised an estimated **30%** of the world's power generating capacity and **24.5%** of global electricity demand

Estimated Renewable Energy Share of Global Electricity Production, End-2016



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Heating and Cooling

Modern renewable energy supplies approx. **9%** of total global heat demand.

In 2016, the vast majority of renewable heat continued to be supplied by **biomass**, with smaller contributions from **solar thermal** and **geothermal** energy.

Deployment of renewable technologies in this market continued to be constrained by factors such as comparatively **low fossil fuel prices** and a relative **lack of policy support**.



Transport

In 2016, **liquid biofuels** provided around **4%** of world road transport fuels, which account for the majority of transport energy use.

Biogas use in transport grew substantially in the **United States** and continued to gain shares of the transport fuel mix in Europe.

Further **electrification** of the transport sector has the potential to create a **new market** for renewable energy and to facilitate the integration of **variable renewable energy**.



Renewable Energy Policy Landscape

- **176** countries had renewable energy **targets**
- **126** countries had power policies
- **68** countries had transport policies
- **21** countries had heating and cooling policies

Number of Renewable Energy Regulatory Incentives and Mandates, by Type, 2014-2016



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. Heating and cooling policies do not include renewable heat FITs (i.e., in the United Kingdom). Countries are considered to have policies when at least one national or state/provincial-level policy is in place. A country is counted a single time if it has one or more national and/or state/provincial-level policies. Some transport policies include both biodiesel and ethanol; in this case, the policy is counted once in each category (biodiesel and ethanol). Tendering policies are presented in a given year if a jurisdiction has held at least one tender during that year.

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Source: REN21 Policy Database.

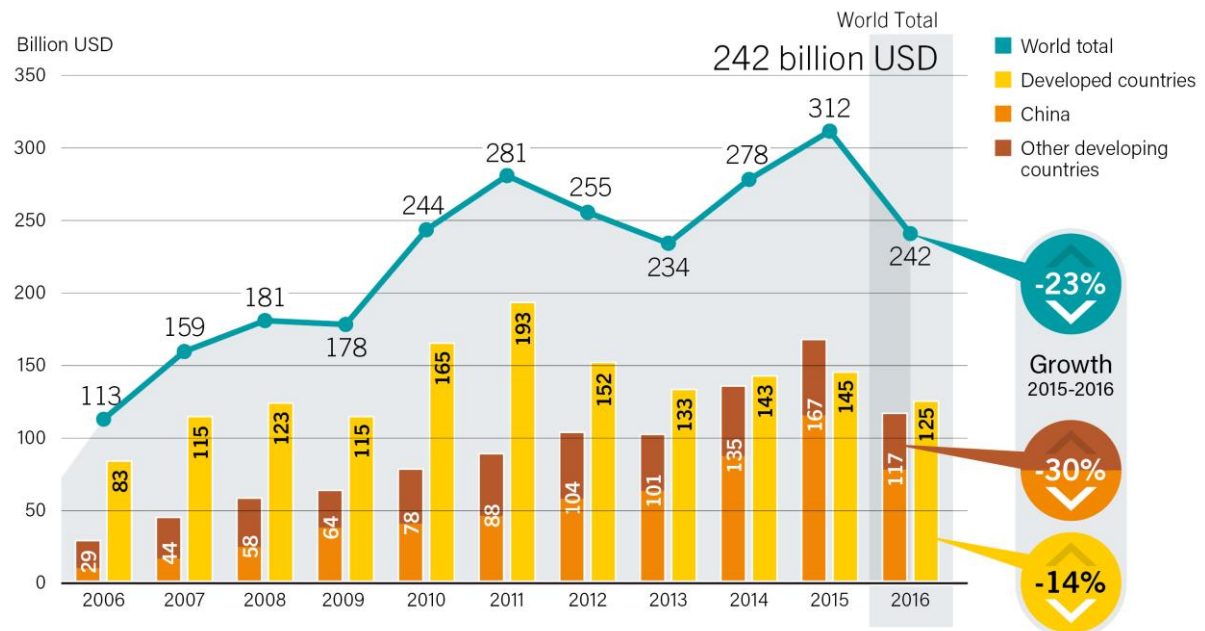


Global Investment in Renewable Energy

Global new investment in renewables was **USD 241.6 billion** in 2016 (-23% compared to 2015)

For the fifth consecutive year, investment in new renewable power capacity was roughly **double that in fossil fuel** capacity.

Global New Investment in Renewable Power and Fuels, Developed, Emerging and Developing Countries, 2006-2016



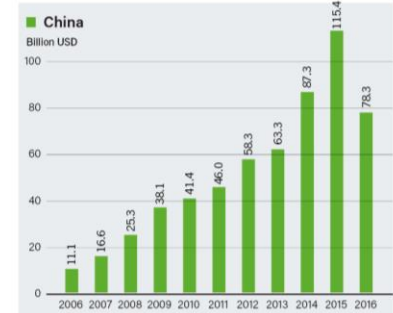
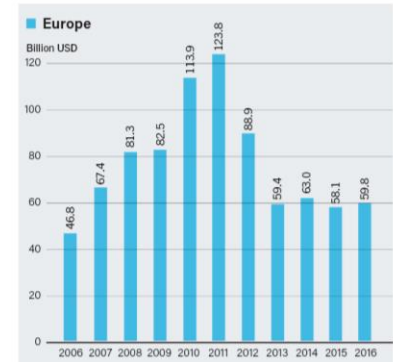
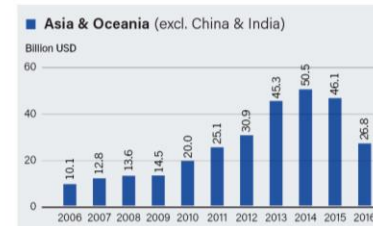
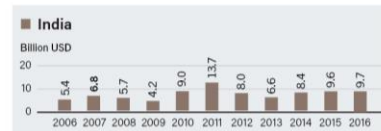
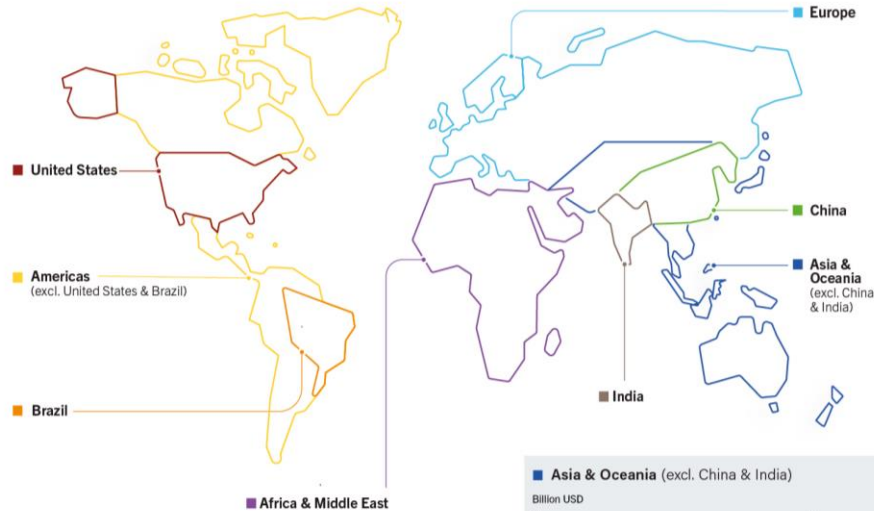
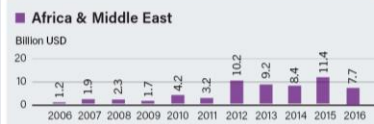
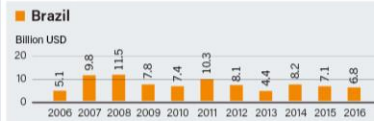
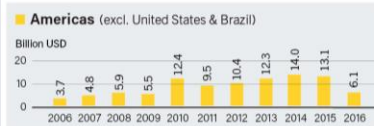
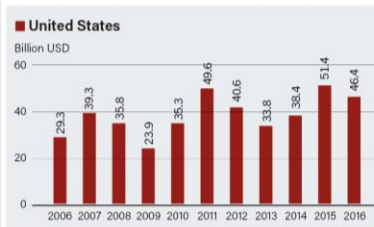
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Source: BNEF.



Global Investment in Renewable Energy

Global New Investment in Renewable Power and Fuels, by Country and Region, 2006-2016



Note: Data include government and corporate R&D.

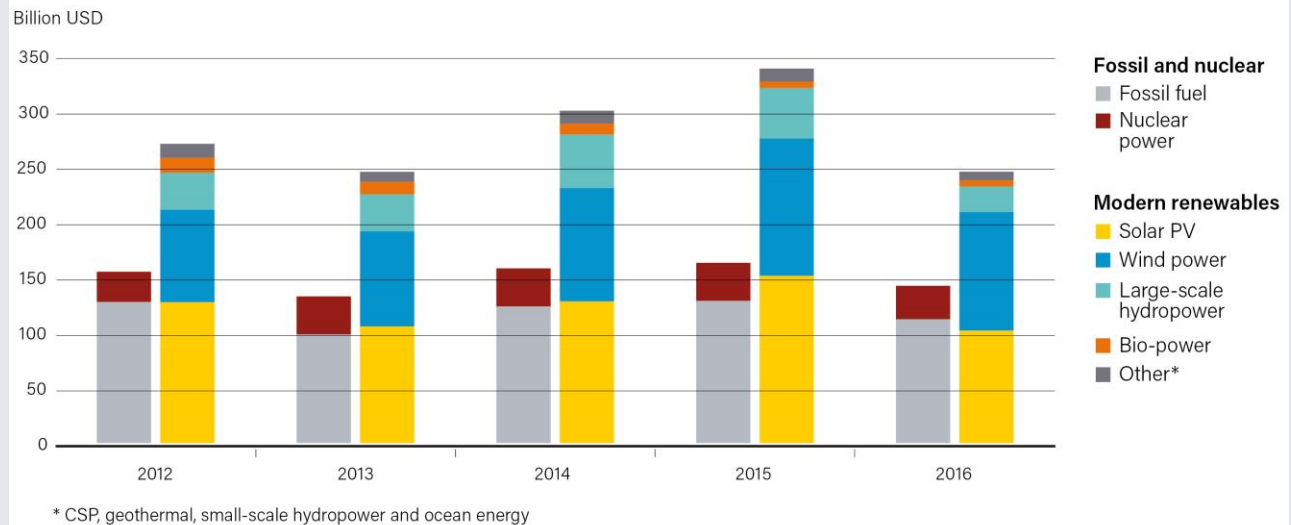
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Source: BNEF.



Global Investment in Renewable Energy

Global Investment in Power Capacity, by Type (Renewable, Fossil Fuel and Nuclear Power), 2012-2016



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Source: BNEF.



An estimated **USD 249.8 billion** (63.5%) was committed to constructing new renewable power plants, compared to:

- Fossil fuel capacity: USD 113.8 billion
- Nuclear capacity: USD 30 billion



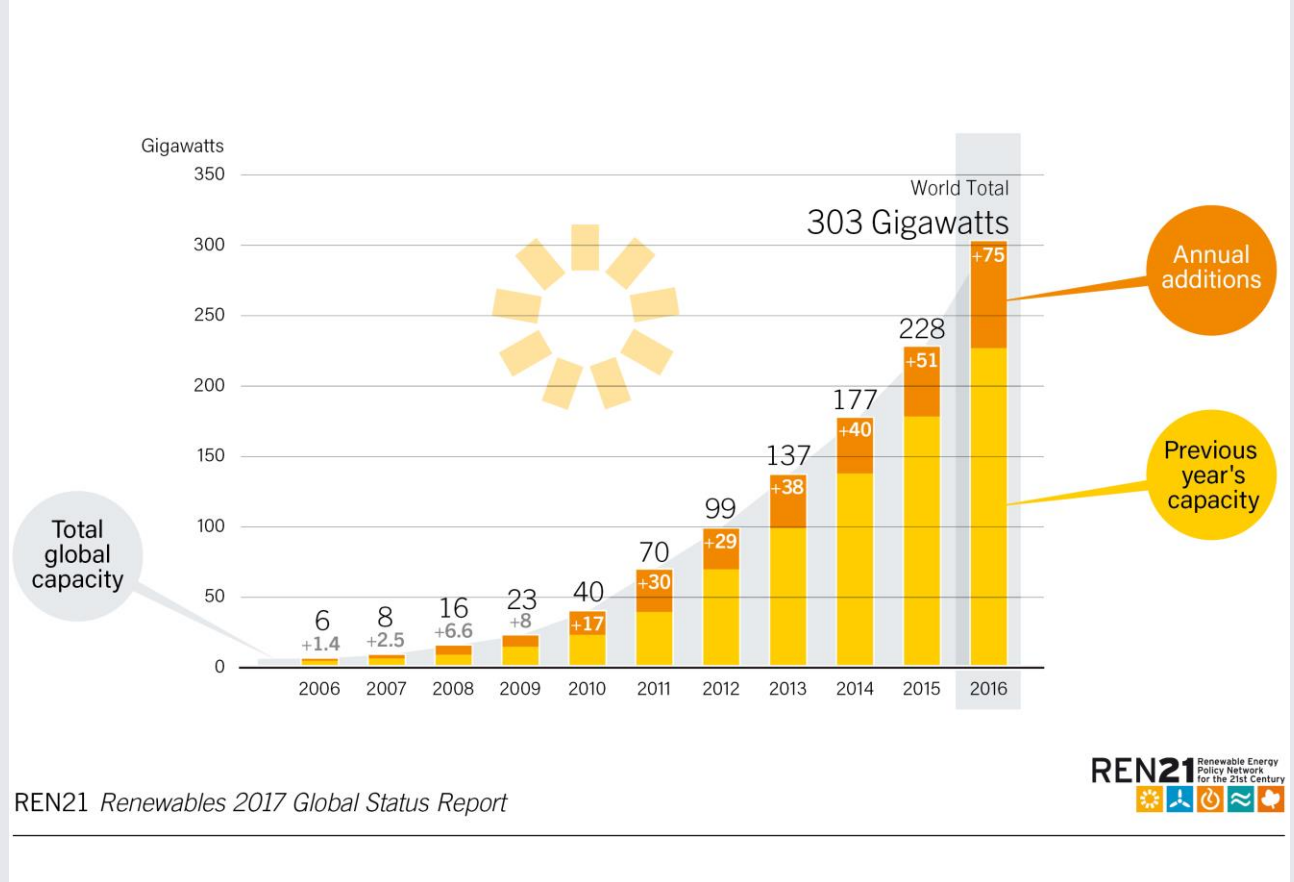
Solar PV

Global solar PV capacity totaled **303 GW**
(31,000 PV panels every hour)

By end-2016:

- Every continent had installed > **1 GW**
- At least 24 countries had **1 GW** or more of capacity
- At least 114 countries had more than **10 MW**

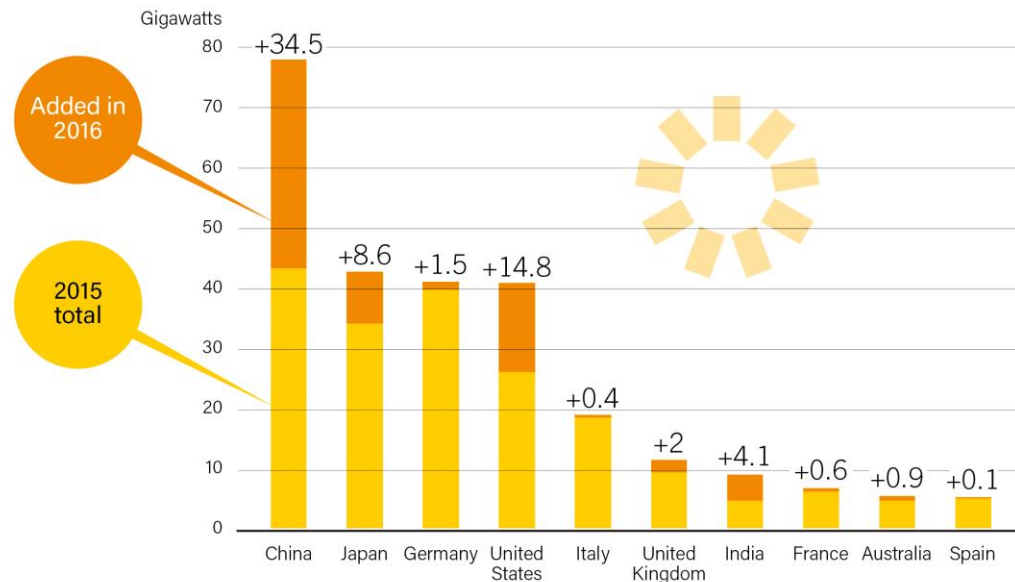
Solar PV Global Capacity and Annual Additions, 2006-2016



Solar PV

China added **34.5 GW** (up 126% over 2015), increasing its total solar PV capacity 45% to **77.4 GW**, far more than that of any other country

Solar PV Capacity and Additions, Top 10 Countries, 2016

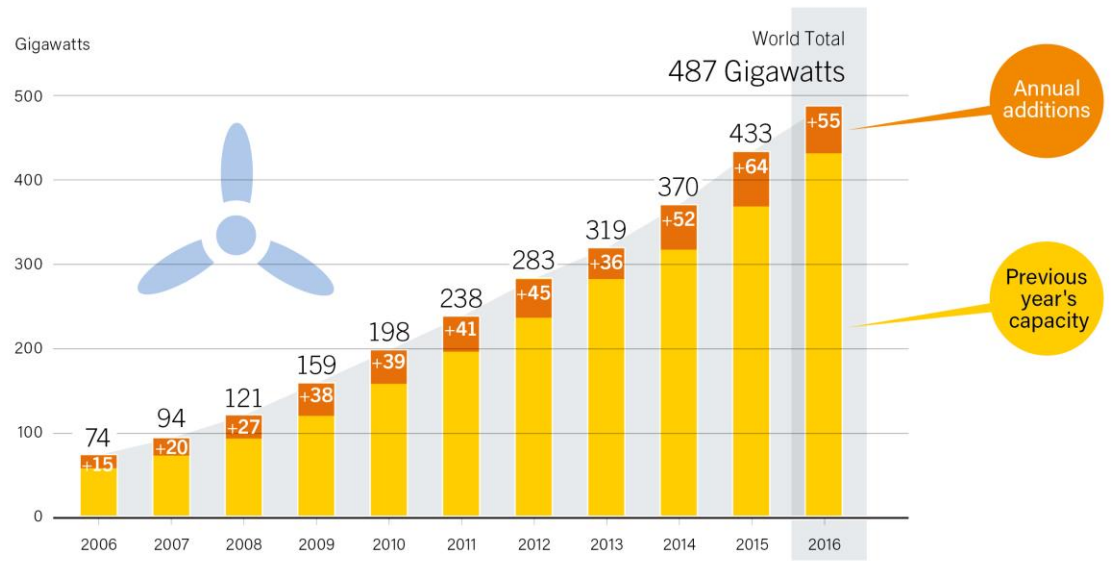


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Wind Power

Wind Power Global Capacity and Annual Additions, 2006-2016



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55 GW of wind power capacity added

Global total increased 12% to **487 GW**

Over 90 countries with commercial wind power activity; 29 countries > 1GW

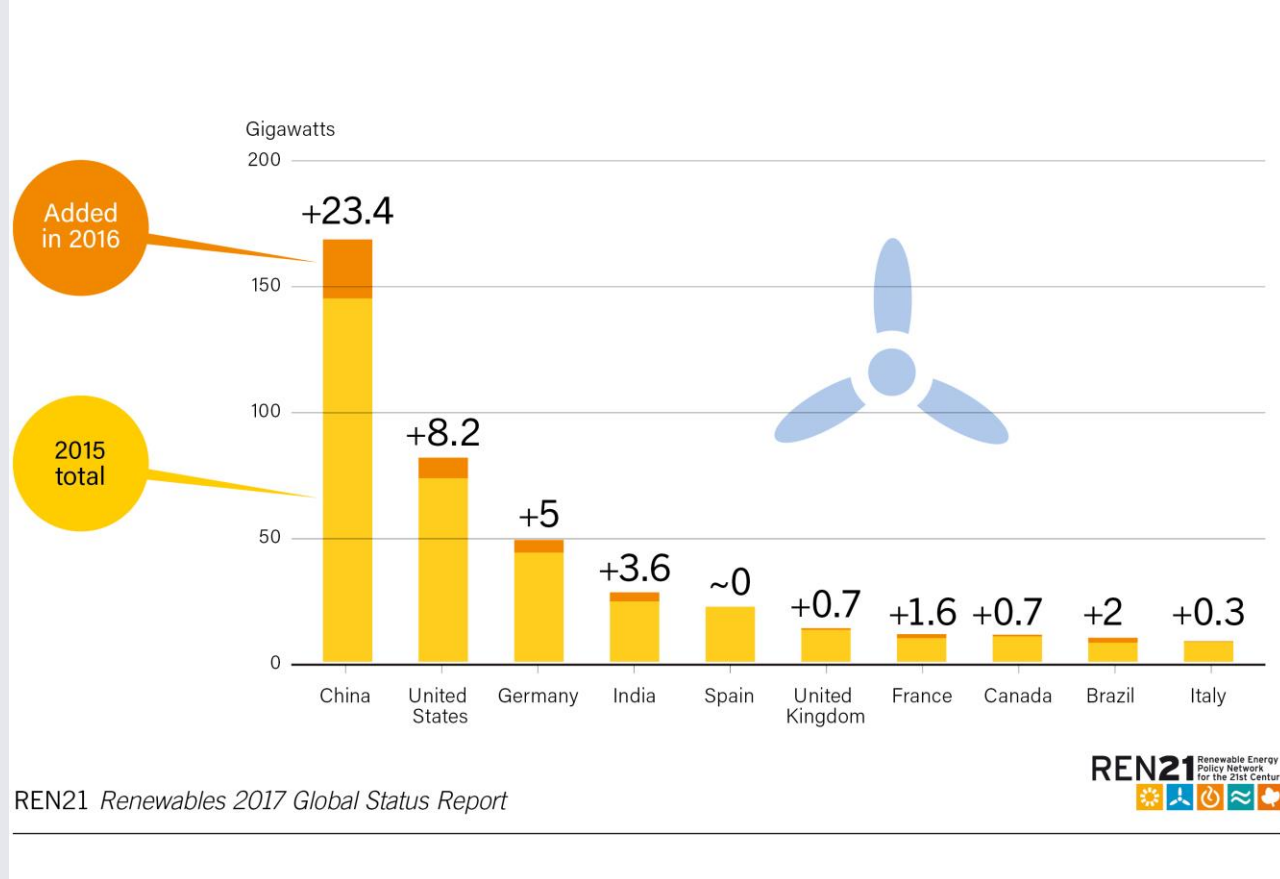


Wind Power

The global wind power market contracted in 2016

China added most new installations: **23.4 GW** (significant decline compared to 2015)

Wind Power Capacity and Additions, Top 10 Countries, 2016



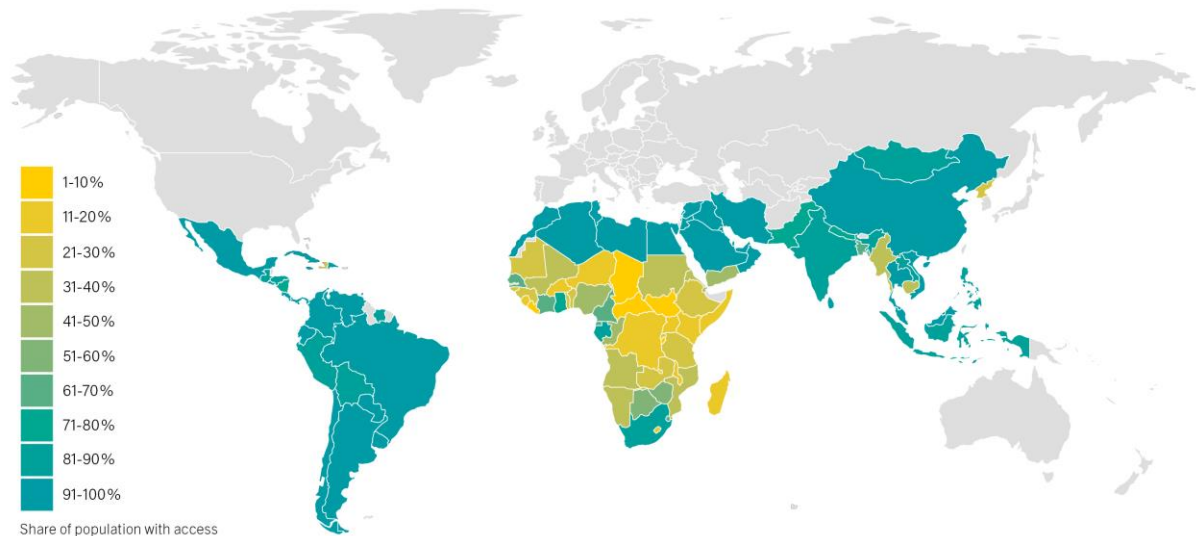
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Distributed Renewable Energy for Energy Access

16% of the global population lived **without electricity** - approx. 1.19 billion people

Electricity Access in Developing Countries, 2014



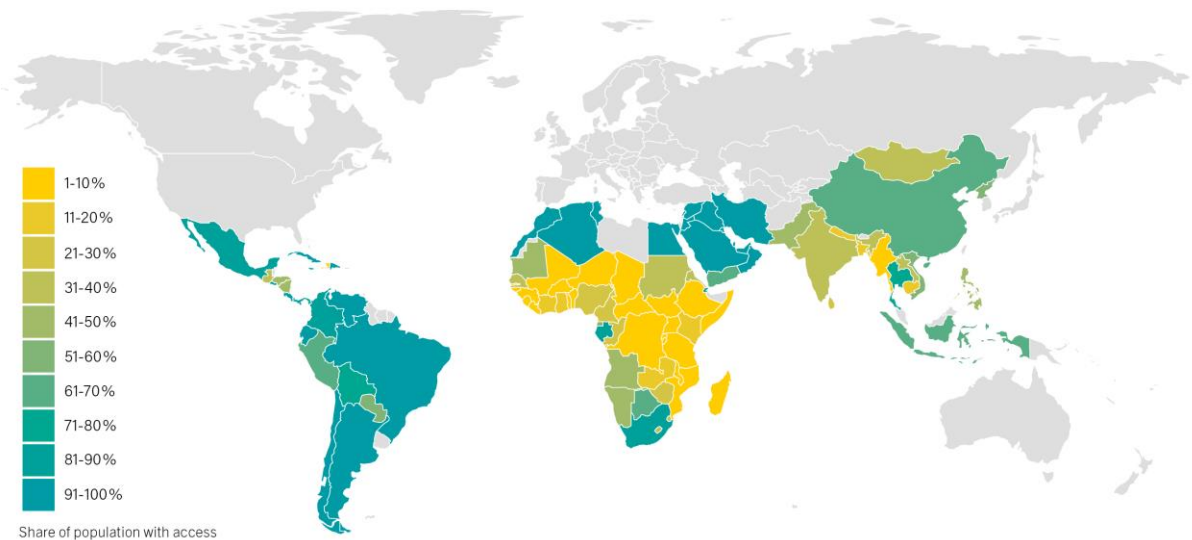
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Distributed Renewable Energy for Energy Access

38% of global population are **without clean cooking facilities** - approx. 2.7 billion people

Access to Clean Cooking Facilities in Developing Countries, 2014



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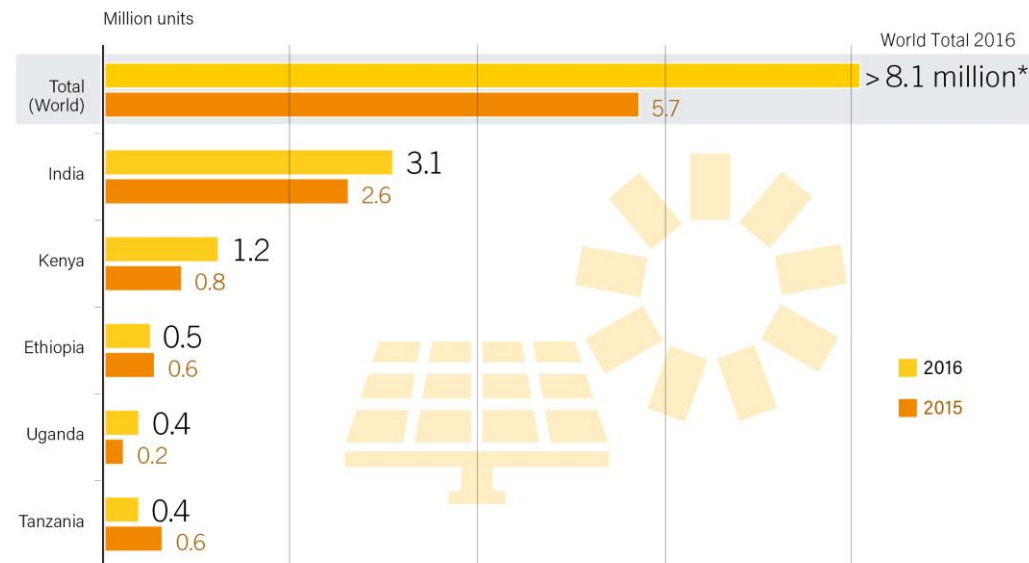


Distributed Renewable Energy for Energy Access

Sales of off-grid solar systems reach **8.1 million** units worldwide

Sales were highest in sub-Saharan Africa, in particular in East Africa

Sales of Off-Grid Solar Systems in Top 5 Countries, 2015-2016



*Data reported for global sales represent approximately 50% of all sales of off-grid products.

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Source: GOGLA/IFC.



Distributed Renewable Energy for Energy Access

Deployment of mini-grids accelerated in 2016

Market now exceeds **USD 200 billion** annually

Status of Renewable Energy Mini/Micro-grid Markets, by Region

- Limited
- Pilots
- Emerging
- Mature

Region	Autonomous Basic	Autonomous Full	Interconnected Community
Central America and the Caribbean	■	■	■
South America	■	■	■
Northern Africa	■	■	■
Sub-Saharan Africa	■ ■	■	■
Central and North Asia	□ ■	■	■
East and South Asia	■	□ ■ ■	■
Middle East	■	□	■
Oceania	■	■ ■	□

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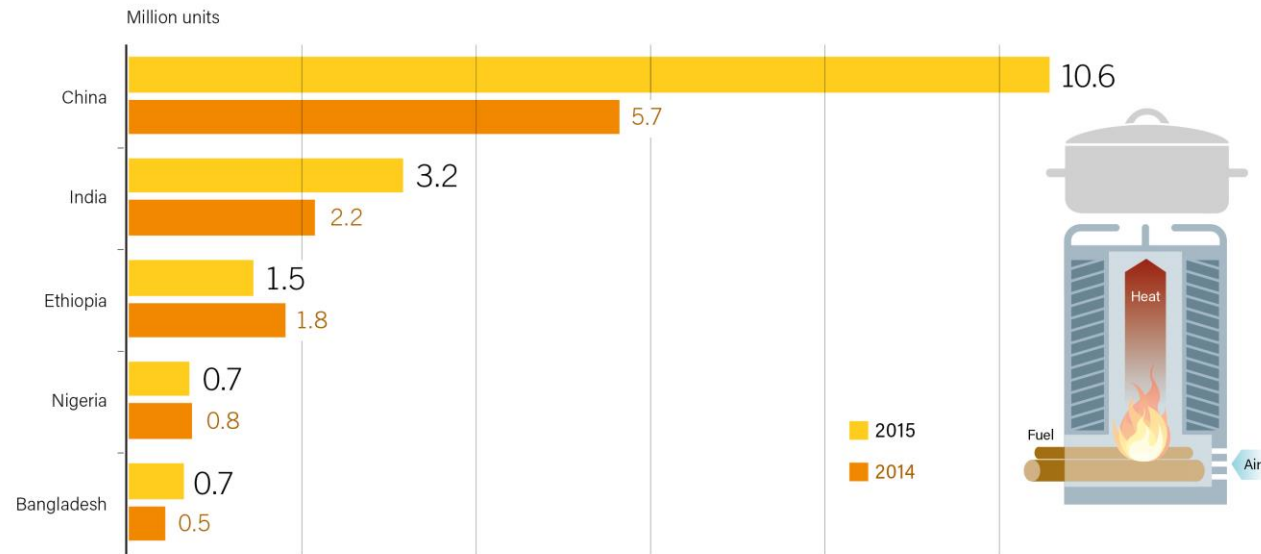


Distributed Renewable Energy for Energy Access

20 million clean cook stoves distributed in 2015, an **18%** increase

China leads in installations

Number of Clean Cook Stoves Added in Top 5 Countries, 2014 and 2015



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REN21 Renewable Energy Policy Network for the 21st Century

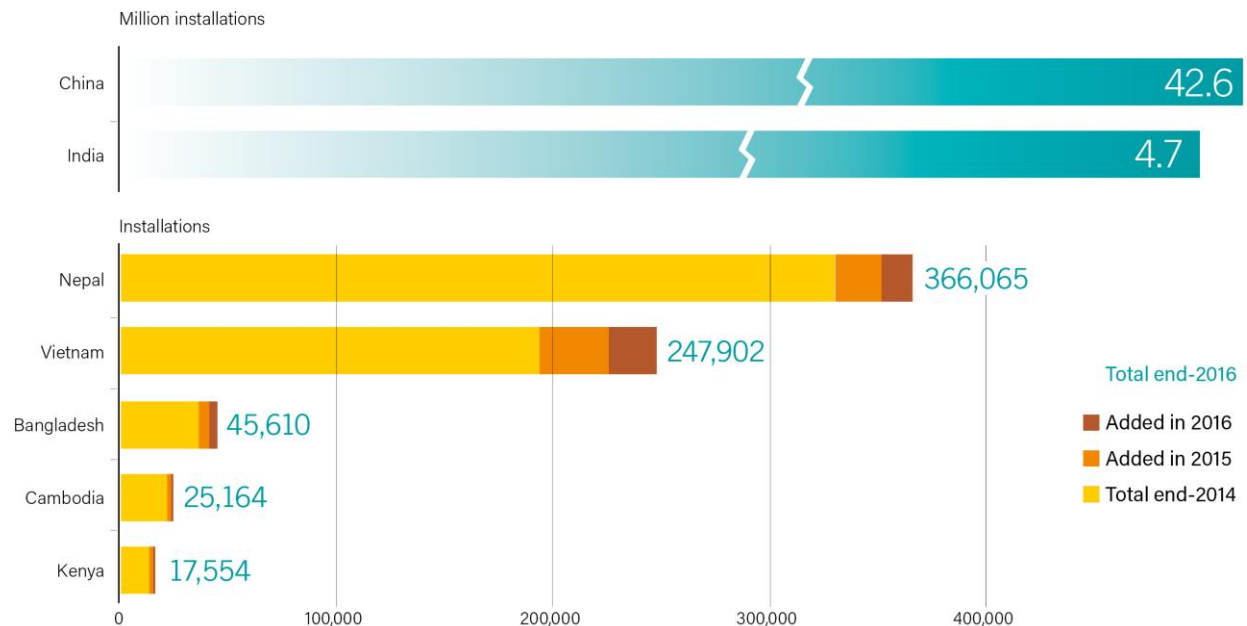


Distributed Renewable Energy for Energy Access

Asia leads in total installations of domestic biogas plants

Most are in **China** (42.6 million units at the end of 2016), and **India** (4.7 million units)

Number of Domestic Biogas Plants Installed in Top 5 Countries, Total and Annual Additions, 2014-2016



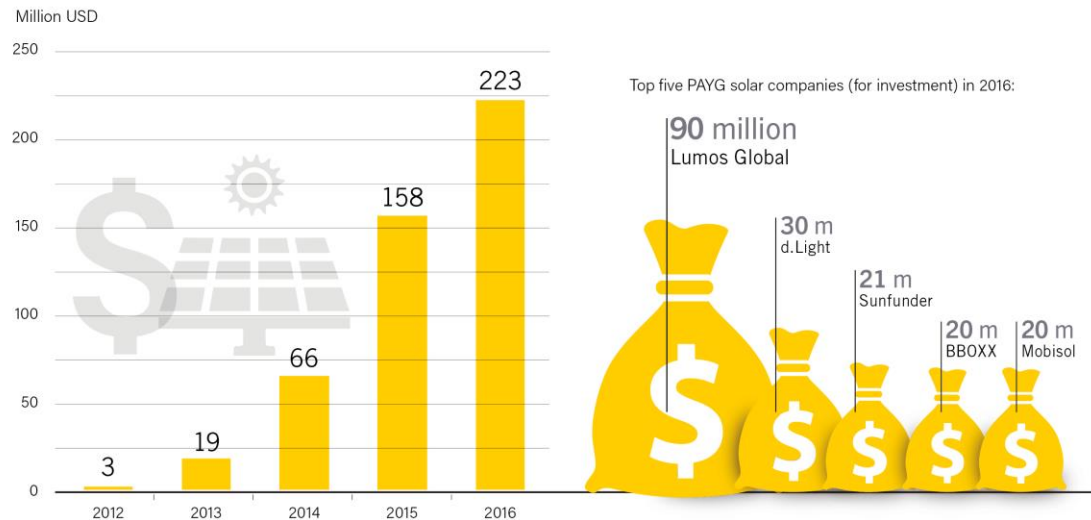
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Distributed Renewable Energy for Energy Access

USD 223 million raised by PAYG solar PV companies, an increase of about **40%** from 2015

Investment in Pay-As-You-Go Solar Companies, 2012-2016



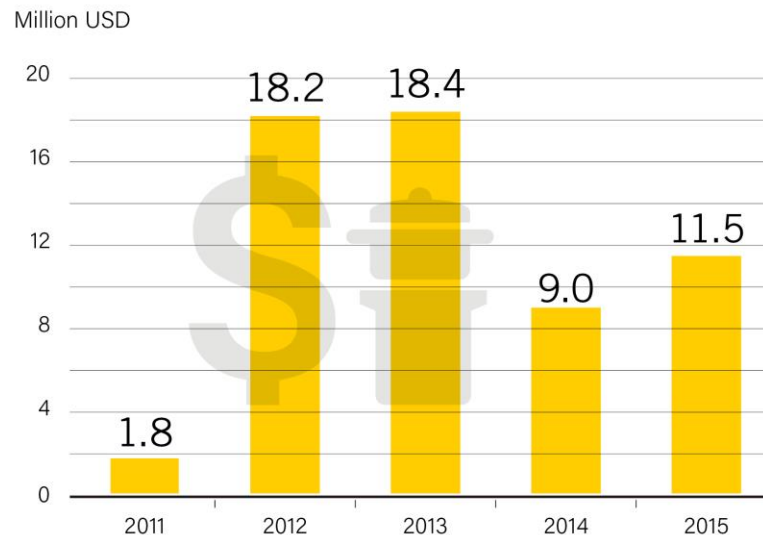
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Distributed Renewable Energy for Energy Access

Investment in clean cook stoves increased **28%** (to **USD 11.5 million**) in 2015

Investment in Clean Cook Stoves, 2011-2015



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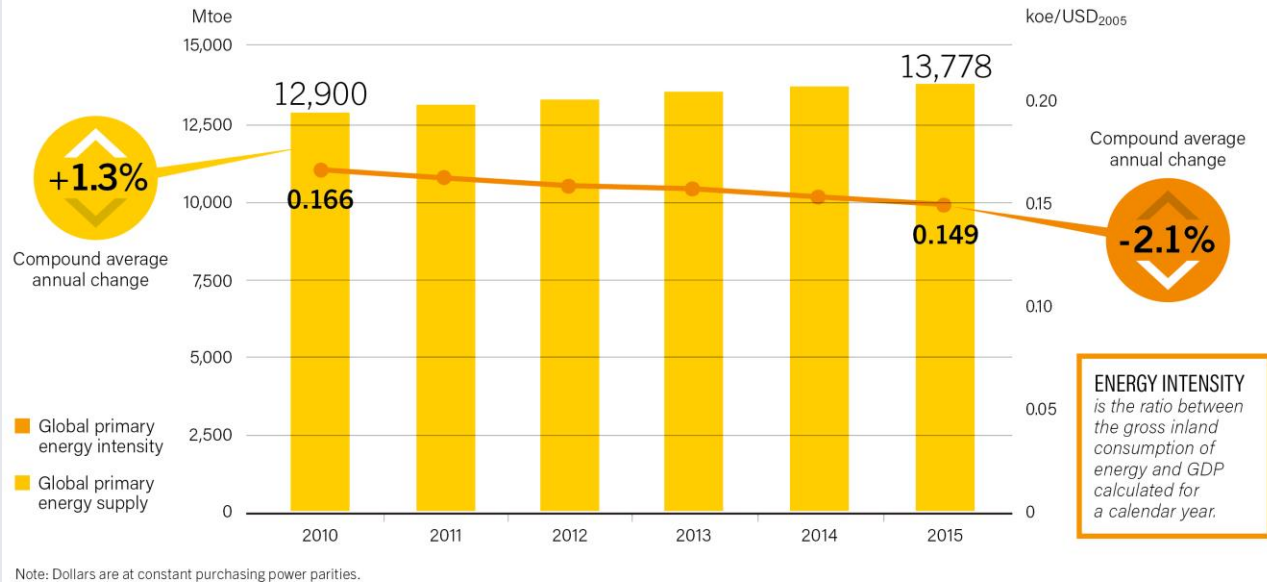


Energy Efficiency

Global primary energy intensity improved by **2.6%**

From 2010 to 2015, energy intensity declined by an average annual rate of **2.1%**

Global Primary Energy Intensity and Total Primary Energy Supply, 2010-2015



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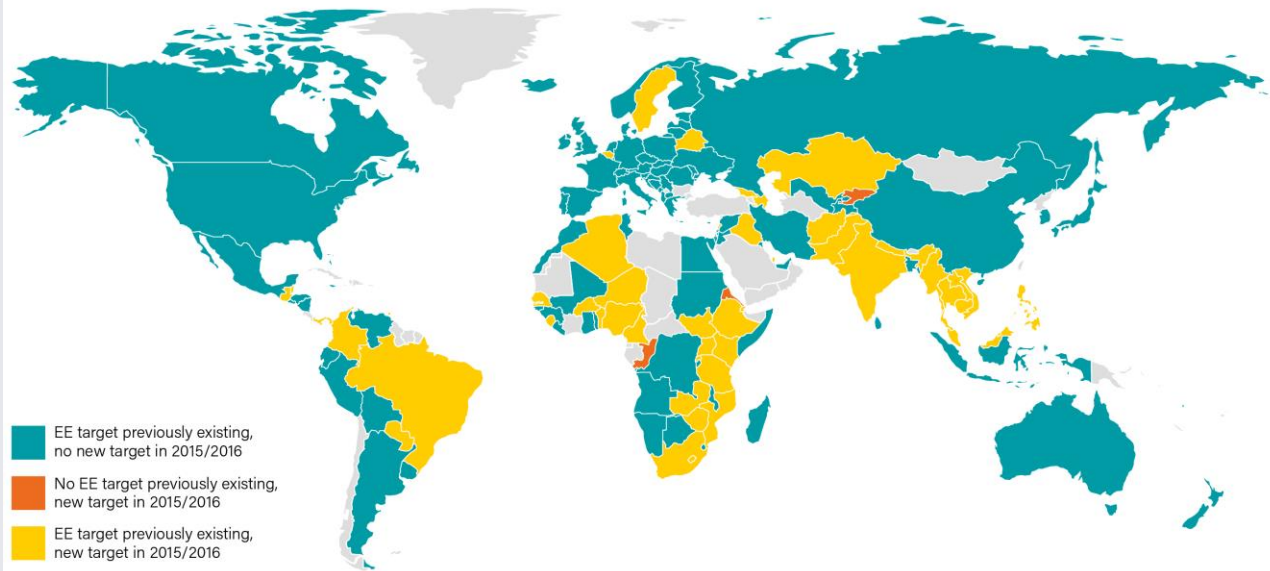


Energy Efficiency

By end-2016, at least **149** countries had enacted one or more energy efficiency targets.

Of these countries, **56** adopted a new target in 2015 or 2016

Countries with Energy Efficiency Targets, 2016



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Source: REN21 Policy Database.

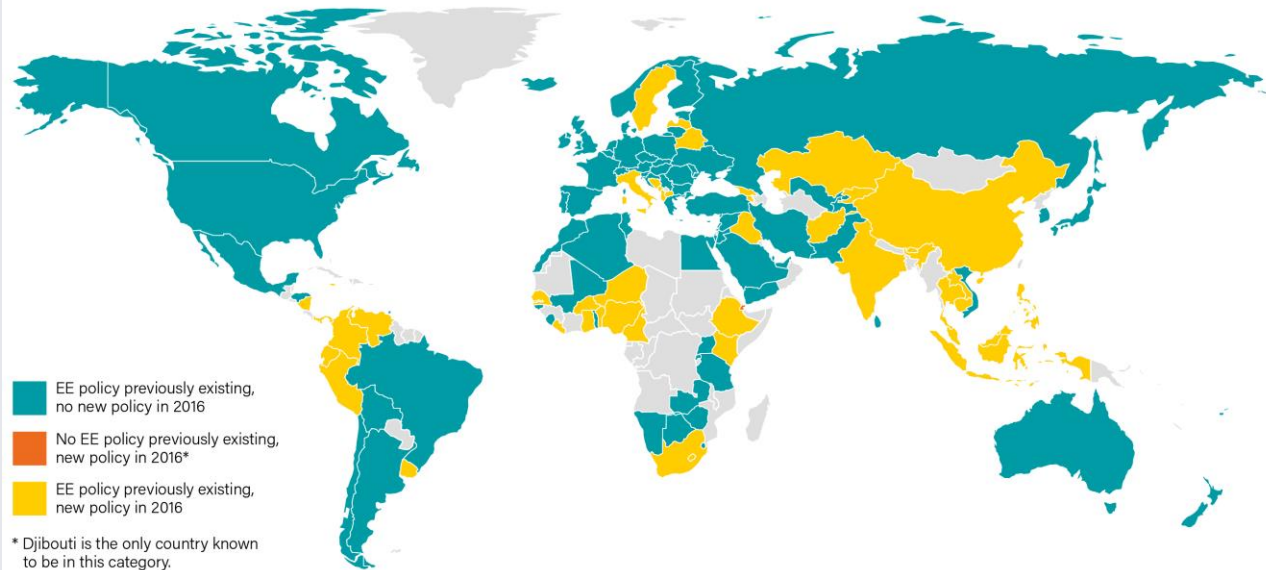


Energy Efficiency

By end-2016, at least **137** countries had enacted some kind of energy efficiency policy.

Of these countries, **48** adopted a new or revised policy in 2016

Countries with Energy Efficiency Policies, 2016



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Source: REN21 Policy Database.



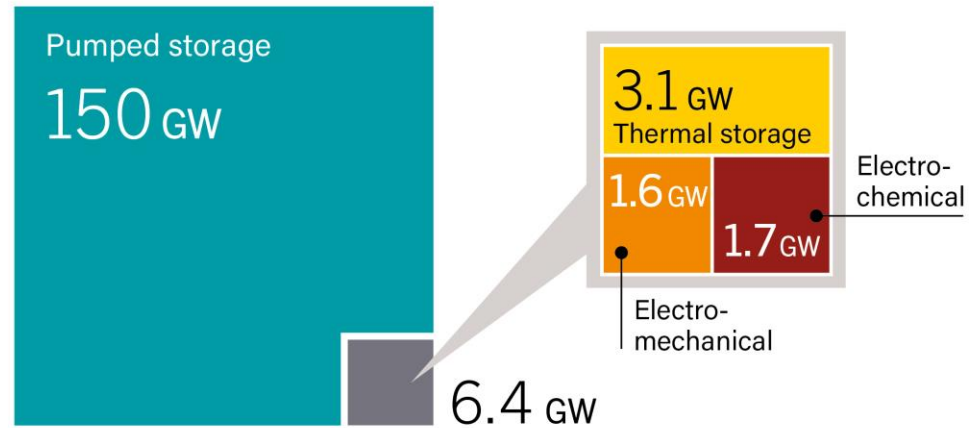
Enabling Technologies and Energy Systems Integration

Storage can provide **system benefits** and **flexibility** to customers, system managers and utilities

Can be applied from the **household level** to **utility-scale**

- Global grid-connected storage capacity in 2016 : **156 GW**
- Grid-connected **battery** storage grew by **50%**

Global Grid-Connected Energy Storage Capacity, by Technology, 2016



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REN21 Renewable Energy Policy Network for the 21st Century

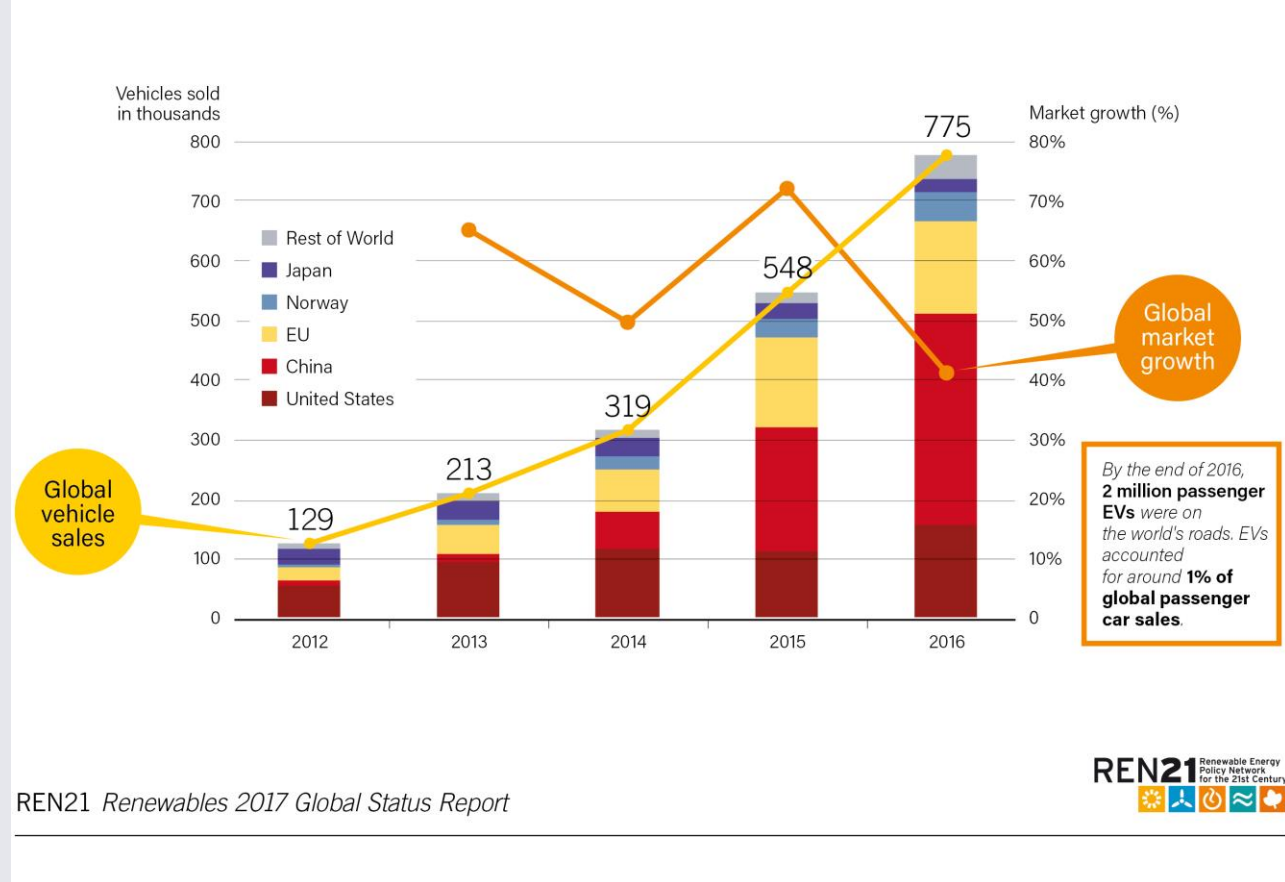
Enabling Technologies and Energy Systems Integration

Global sales of EVs reached **775,000 units**

More than **2 million passenger EVs** were on the world's roads by year's end (1% of the light vehicle market)

So far, little linking of renewable energy and electric mobility

Global Passenger Electric Vehicle Market (Including PHEVs), 2012-2016



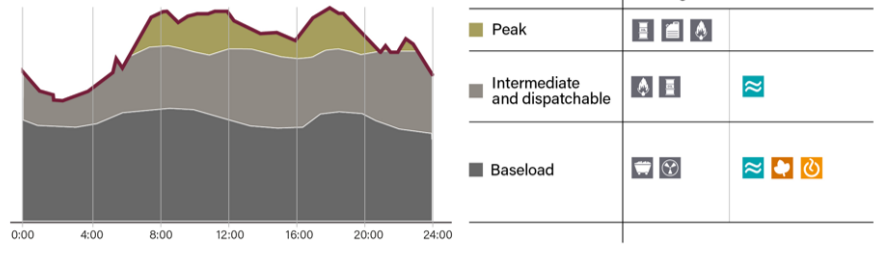
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Feature: Deconstructing Baseload

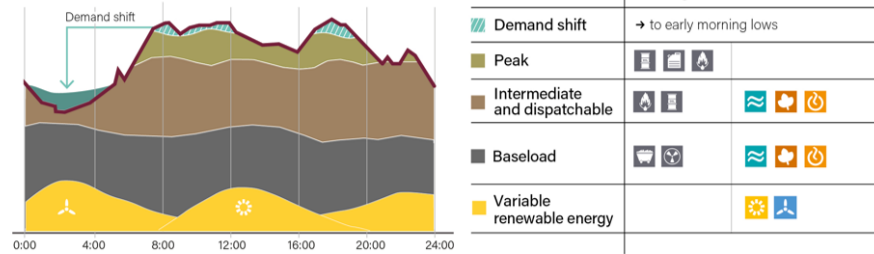
- Traditional baseload generators such as coal and nuclear are beginning to lose their economic advantage and may no longer be the first to dispatch energy.
- A number of countries and regions – including **Denmark, Germany, Uruguay and Cabo Verde** – have integrated high shares (from **20-40%**) of variable renewable energy.

Conceptual Progression from the Baseload Paradigm to a New Paradigm of 100% Renewable Electricity

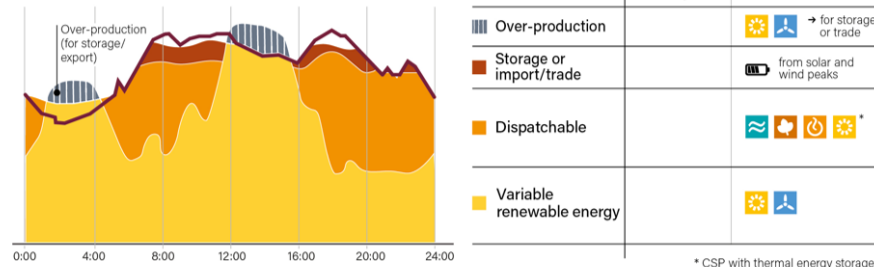
A) The Baseload Paradigm



B) The Early Transition



C) A New Paradigm



* CSP with thermal energy storage

Coal-fired
 Oil-fired
 Diesel generator
 Nuclear
 Natural gas-fired
 Hydro-power
 Bio-power
 Solar PV and CSP
 Geothermal power
 Wind power

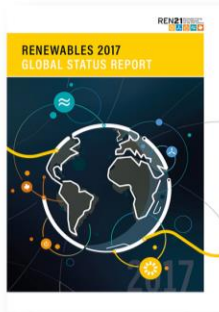
Conclusions

- Global renewable energy transition advancing with record capacity additions and rapidly falling costs – more capacity for less money
- 2016 was the third year in a row where decoupling of economic growth and energy-related CO₂ emissions occurred
- **However, progress not fast enough to reach Paris Agreement goals**
- Better-integrated sectoral planning
- Smarter, more flexible systems integrating variable renewables
- Systems approach: energy efficiency, more use of enabling technologies

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Renewable Energy Policy Network for the 21st Century



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