

RENEWABLES 2016

GLOBAL STATUS REPORT

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2016

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

NGOs:

ALER, CURES, GFSE,
Gogla, Greenpeace,
ICLEI, ISEP, Renewable
Energy Institute,
RCREEE, SLoCaT,
WCRE, WFC, WRI,
WWF

Science & Academia:

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

**International
Organisations:**

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



Industry Associations:

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

**National
Governments:**

Brazil,
Denmark,
Germany, India,
Norway, Spain,
UAE, US, UK



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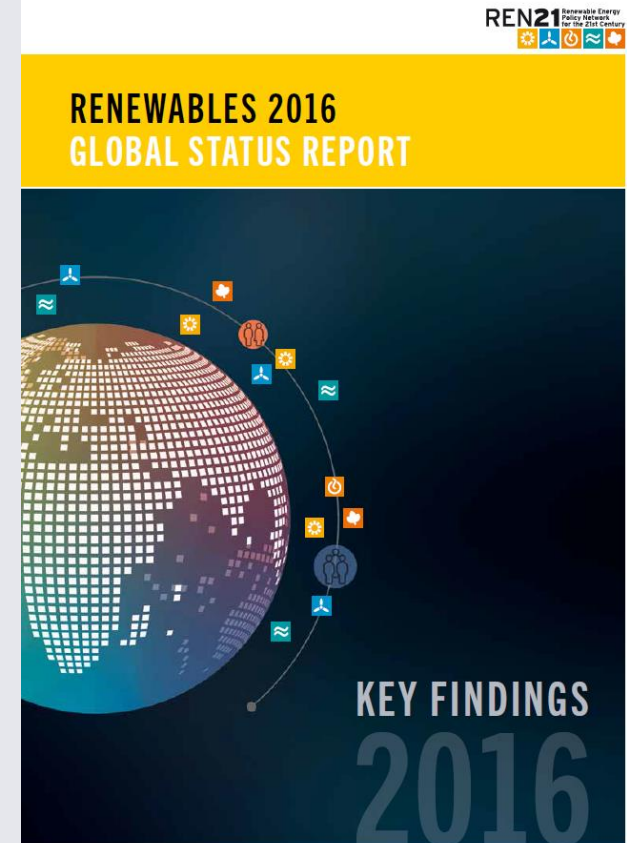
→ The report features:

- Global Overview
- Market & Industry Trends
- Distributed Renewable Energy for Energy Access
- Investment Flows
- Policy Landscape
- Energy Efficiency
- Feature: Community Energy

→ The report covers:

- All renewable energy technologies
- Power, heating & cooling, and transport sectors

→ **Country data** available on REN21 Renewables Interactive Map: www.ren21.net/map

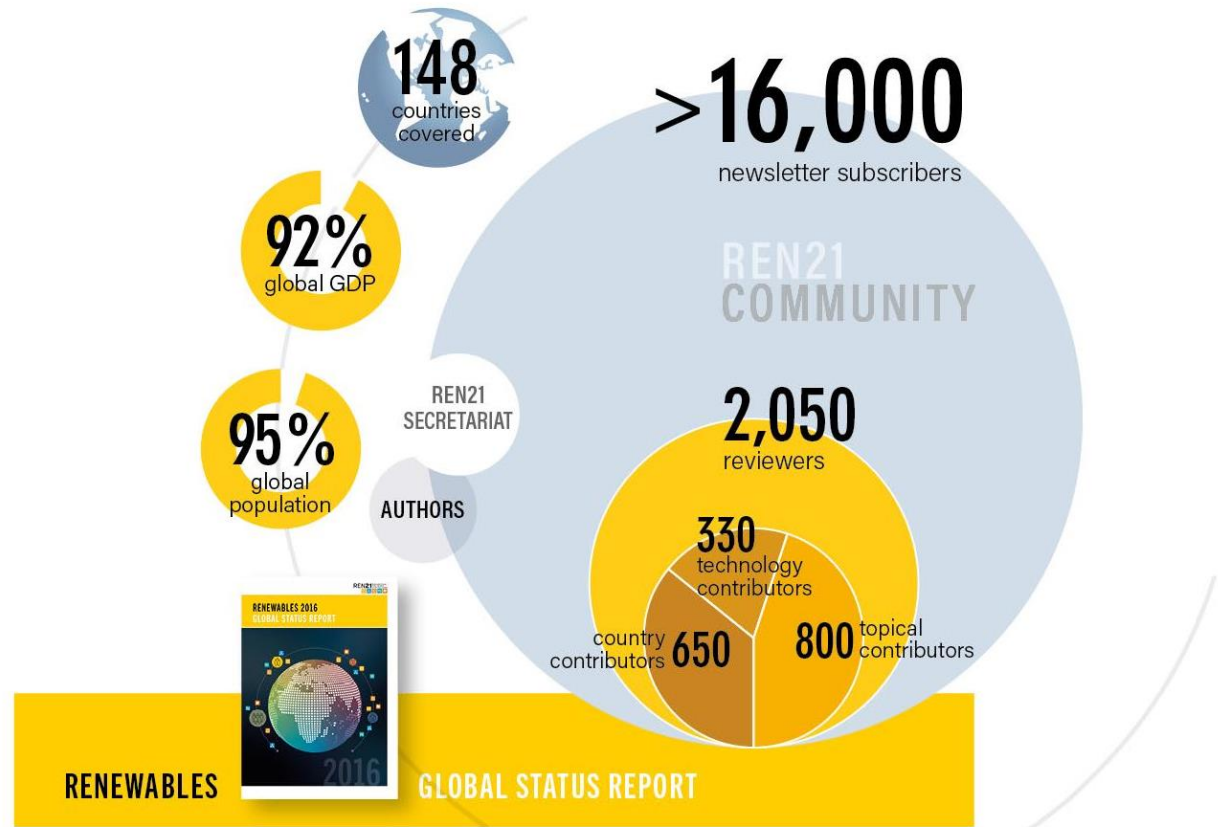


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REN21 Community

GSR Network:
700 renewable energy, energy access & energy efficiency experts

GSR 2016: **180** experts joined the report process, equivalent to the total number of GSR experts in 2012













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An extraordinary year for renewable energy

- **147 GW** of renewable power capacity added in 2015 – the largest annual increase ever
- Renewable heat capacity increased by **38 GW_{th}**
- Total biofuels production also rose

Renewable Energy Indicators 2015

		2014	2015
INVESTMENT			
New investment (annual) in renewable power and fuels ¹	billion USD	273	285.9
POWER			
Renewable power capacity (total, not including hydro)	GW	665	785
Renewable power capacity (total, including hydro)	GW	1,701	1,849
 Hydropower capacity ²	GW	1,036	1,064
 Bio-power capacity ³	GW	101	106
 Bio-power generation (annual)	TWh	429	464
 Geothermal power capacity	GW	12.9	13.2
 Solar PV capacity	GW	177	227
 Concentrating solar thermal power	GW	4.3	4.8
 Wind power capacity	GW	370	433
HEAT			
 Solar hot water capacity ⁴	GW _{th}	409	435
TRANSPORT			
 Ethanol production (annual)	billion litres	94.5	98.3
 Biodiesel production (annual)	billion litres	30.4	30.1

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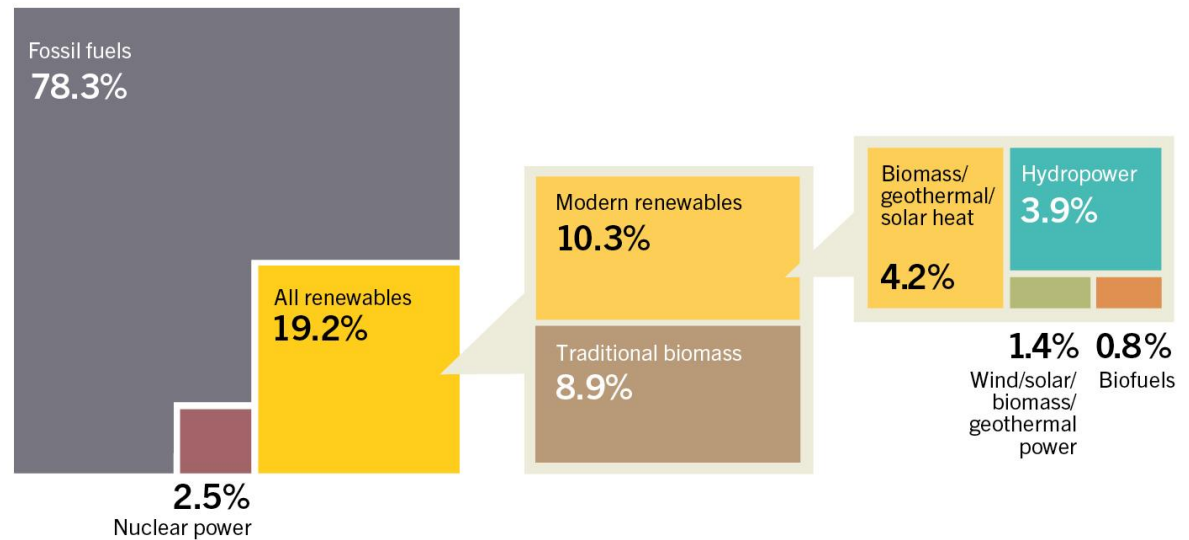


Renewable Energy in the World

Renewable energy provided an estimated **19.2% of global final energy consumption** in 2014

Share of modern renewable energy increased to **10.3%** while the share of traditional biomass was **8.9%**

Estimated Renewable Energy Share of Global Final Energy Consumption, 2014









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Renewable Energy “Champions”

Annual investment/capacity additions/production

Top Five Countries – Annual investment / net capacity additions / biofuel production in 2015

	1	2	3	4	5
Investment in renewable power and fuels (not including hydro > 50 MW)	China	United States	Japan	United Kingdom	India
Investment in renewable power and fuels per unit GDP ¹	Mauritania	Honduras	Uruguay	Morocco	Jamaica
 Geothermal power capacity	Turkey	United States	Mexico	Kenya	Germany/ Japan
 Hydropower capacity	China	Brazil	Turkey	India	Vietnam
 Solar PV capacity	China	Japan	United States	United Kingdom	India
 Concentrating solar thermal power (CSP) capacity ²	Morocco	South Africa	United States	–	–
 Wind power capacity	China	United States	Germany	Brazil	India
 Solar water heating capacity	China	Turkey	Brazil	India	United States
 Biodiesel production	United States	Brazil	Germany	Argentina	France
 Fuel ethanol production	United States	Brazil	China	Canada	Thailand

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Renewable Energy “Champions”

Total capacity

Top Five Countries – Total capacity or generation as of end-2015

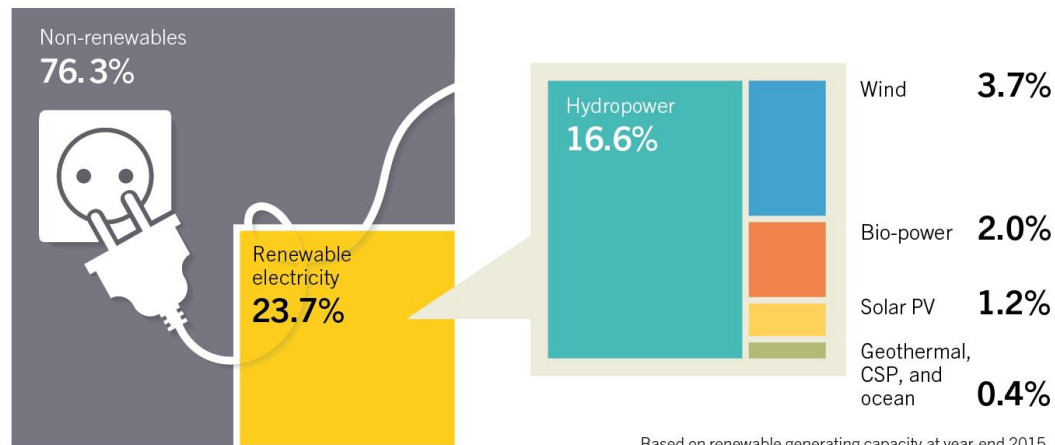
	1	2	3	4	5
POWER					
Renewable power (incl. hydro)	China	United States	Brazil	Germany	Canada
Renewable power (not incl. hydro)	China	United States	Germany	Japan	India
Renewable power capacity <i>per capita</i> (among top 20, not including hydro ³)	Denmark	Germany	Sweden	Spain	Portugal
🔌 Biopower generation	United States	China	Germany	Brazil	Japan
🔌 Geothermal power capacity	United States	Philippines	Indonesia	Mexico	New Zealand
💧 Hydropower capacity ⁴	China	Brazil	United States	Canada	Russia
💧 Hydropower generation ⁴	China	Brazil	Canada	United States	Russia
☀️ Concentrating solar thermal power (CSP)	Spain	United States	India	Morocco	South Africa
☀️ Solar PV capacity	China	Germany	Japan	United States	Italy
☀️ Solar PV capacity <i>per capita</i>	Germany	Italy	Belgium	Japan	Greece
🌬️ Wind power capacity	China	United States	Germany	India	Spain
🌬️ Wind power capacity <i>per capita</i>	Denmark	Sweden	Germany	Ireland	Spain
HEAT					
☀️ Solar water collector capacity	China	United States	Germany	Turkey	Brazil
☀️ Solar water heating collector capacity <i>per capita</i> ⁵	Austria	Cyprus	Israel	Barbados	Greece
🔌 Geothermal heat capacity ⁶	China	Turkey	Japan	Iceland	India
🔌 Geothermal heat capacity <i>per capita</i> ⁶	Iceland	New Zealand	Hungary	Turkey	Japan

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Power Sector

Estimated Renewable Energy Share of Global Electricity Production, End-2015



Based on renewable generating capacity at year-end 2015.
Percentages do not add up internally due to rounding.

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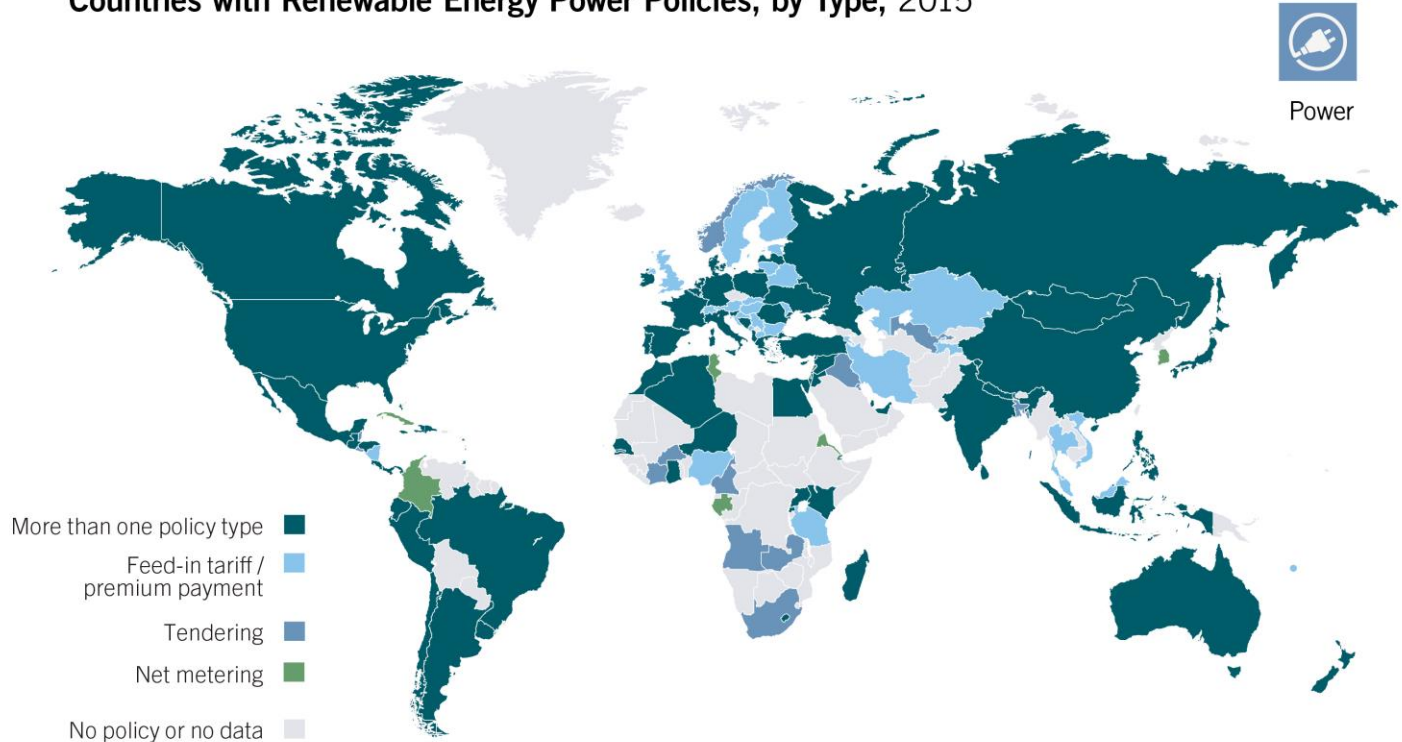


- Renewables accounted **28.9%** of global power generation capacity and **23.7%** of global electricity demand
- Renewables made up for **60%** of net additions to global power capacity
- Total RE power capacity: **1,849 GW**, an increase of almost 9% over 2014



Power Sector

Countries with Renewable Energy Power Policies, by Type, 2015



Power

Note: Countries are considered to have policies when at least one national or state/provincial-level policy is in place.

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Source: REN21 Policy Database

Electricity continues to dominate policy makers' focus

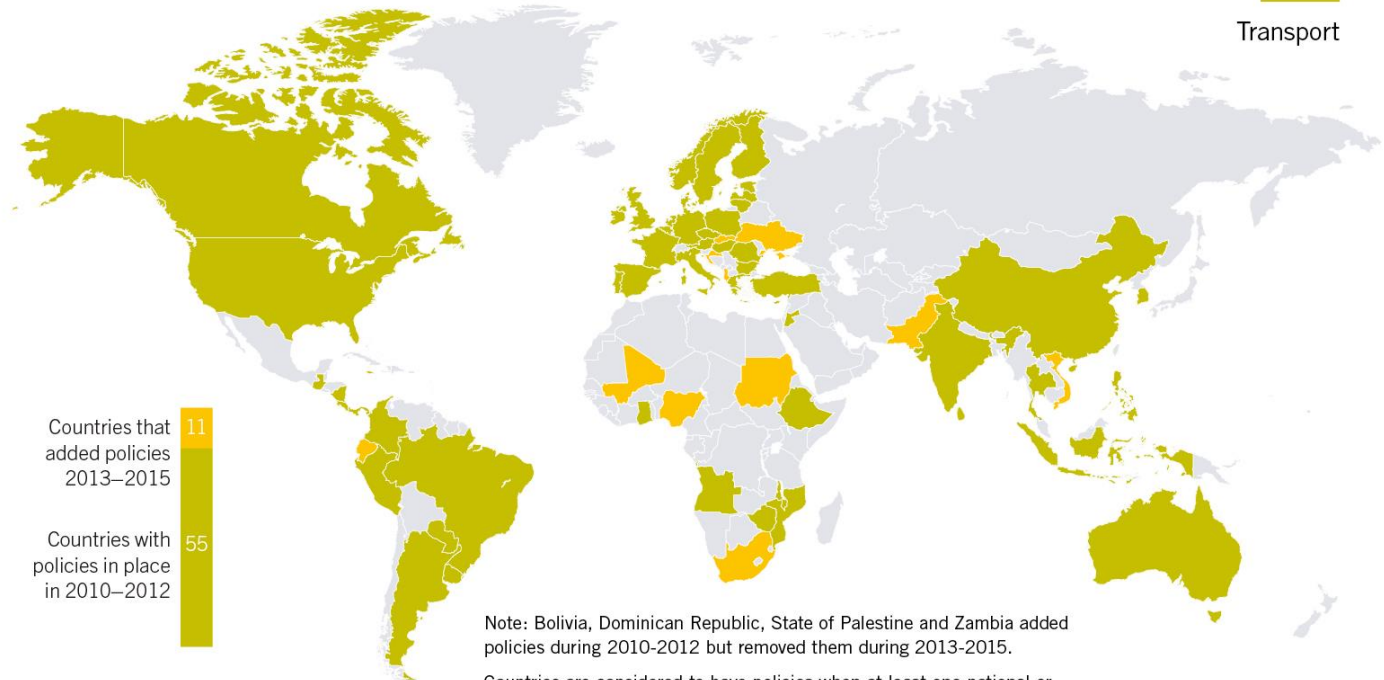


Transport Sector

Countries with Renewable Energy Transport Obligations, 2010–2015



Transport



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Source: REN21 Policy Database

Renewable energy accounted for an estimated **4%** of global energy demand for road transport in 2013, up from **2%** in 2007

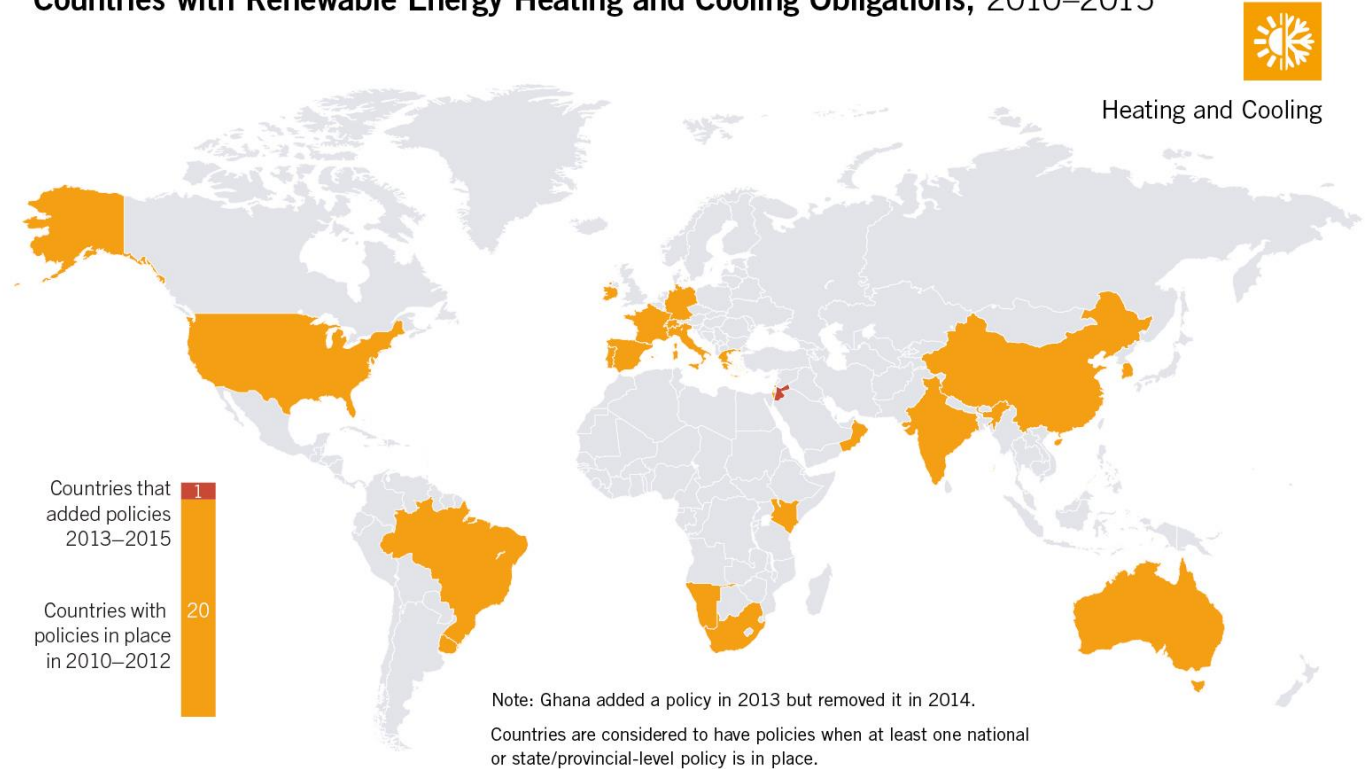


Heating & Cooling Sector

Energy use for heat accounts for about **half** of total world final energy consumption

RE share of final global heat demand: **approx. 8%**

Countries with Renewable Energy Heating and Cooling Obligations, 2010–2015



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Source: REN21 Policy Database

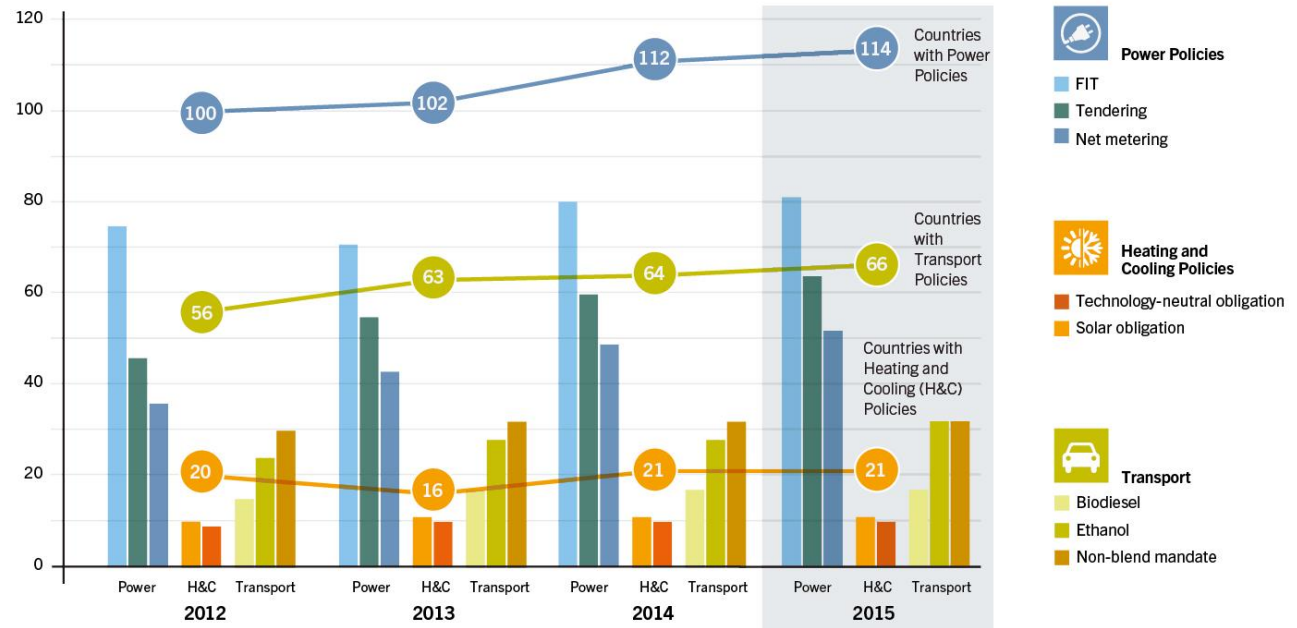


Renewable Energy Policy Landscape

173 countries had renewable energy **targets**, and an estimated **146** countries had renewable energy support **policies**:

- **114** countries with **power** policies
- **66** countries with **transport** policies
- **21** countries with **H&C** policies

Number of Renewable Energy Policies and Number of Countries with Policies, by Type, 2012–15



Note: Figure does not show all policy types in use. Countries are considered to have policies when at least one national or state/provincial-level policy is in place. Some transport policies include both biodiesel and ethanol; in this case, the policy is counted once in each category (biodiesel and ethanol).

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Source: REN21 Policy Database



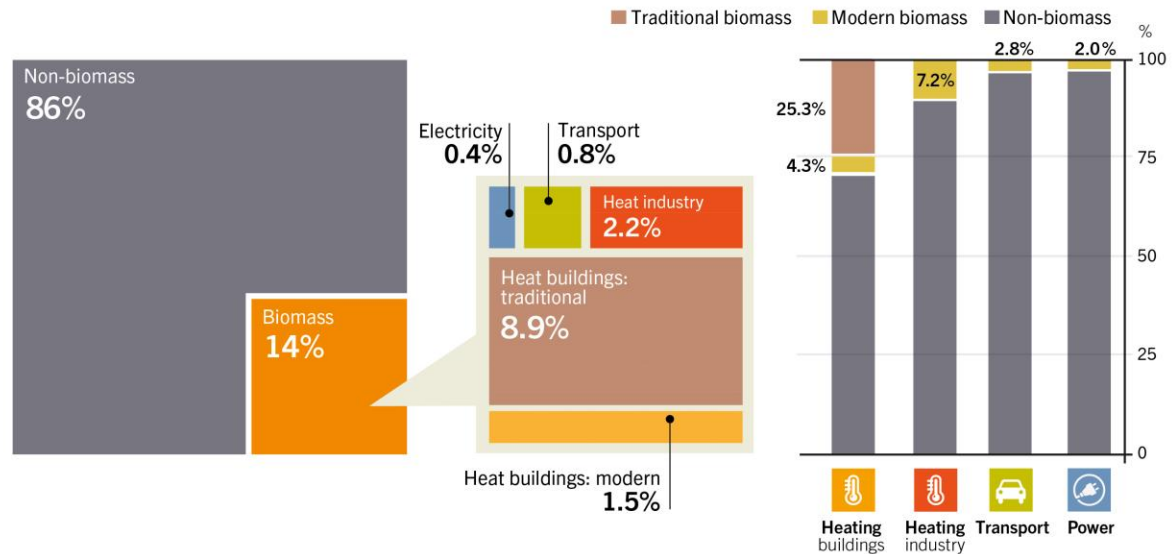
Biomass Energy

Biomass makes up **14%** of total final energy consumption

By end-use sector:

- **28.6%** of heating in buildings
- **7.2%** of heating in industry
- **2.8%** of transport
- **2.0%** of power

Shares of Biomass in Total Final Energy Consumption and in Final Energy Consumption, by End-use Sector, 2014

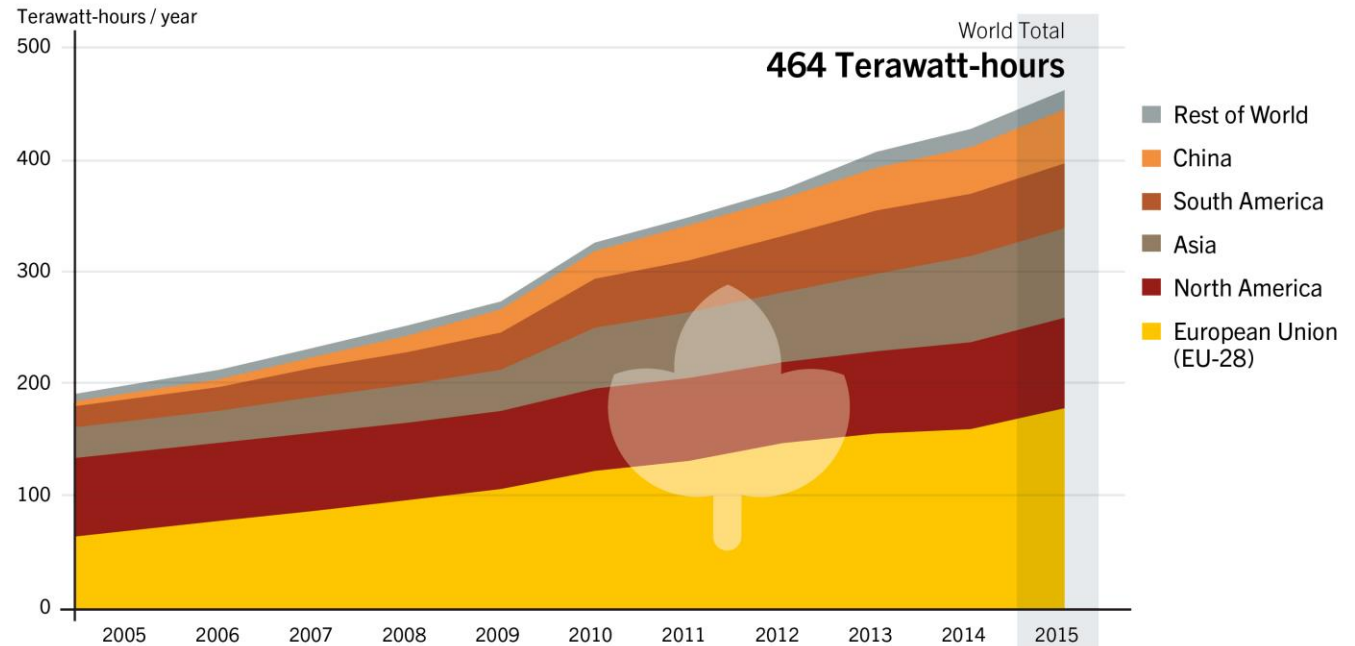


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Biomass Energy

Bio-power Global Generation, by Country/Region, 2005–2015



Bio-power has grown to **464 TWh**

Most rapid growth occurring in China, Japan, Germany, and the UK

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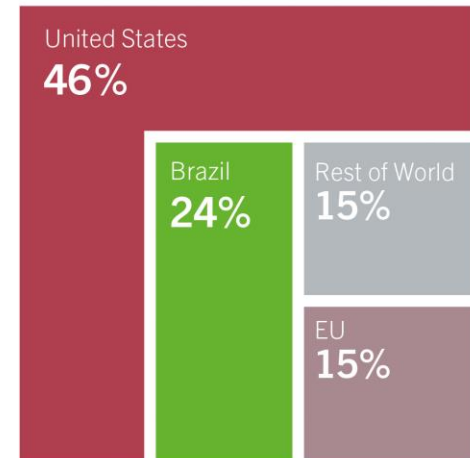
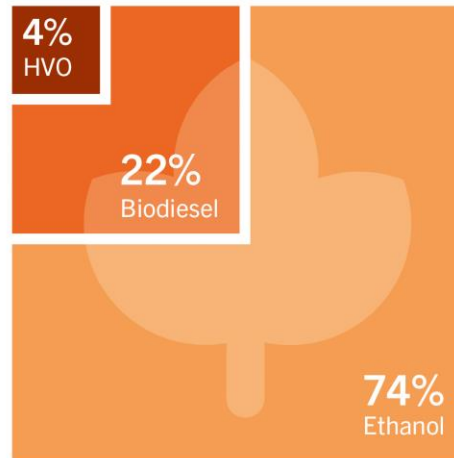


Biomass Energy

Biofuels Global Production, Shares by Type and by Country/Region, 2015

Ethanol production increased by **4%** globally

Record production levels in the US and Brazil



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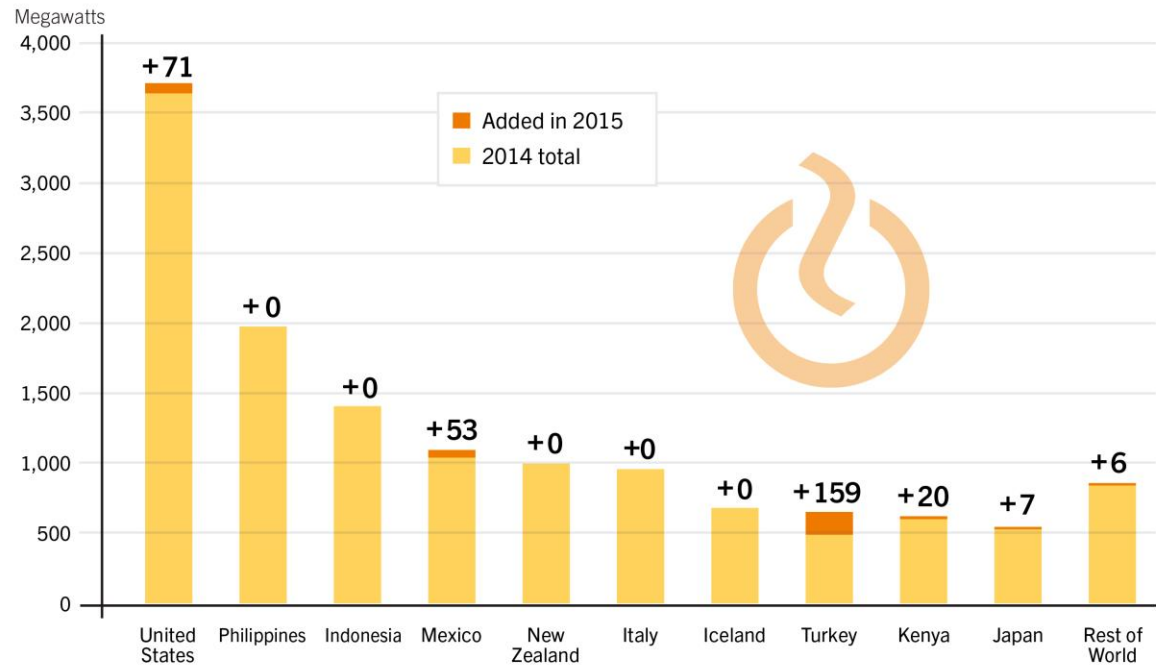


Geothermal Power and Heat

315 MW of new geothermal power capacity came online in 2015

Geothermal power generated an estimated **75 TWh** during 2015

Geothermal Power Capacity and Additions, Top 10 Countries and Rest of World, 2015



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Hydropower

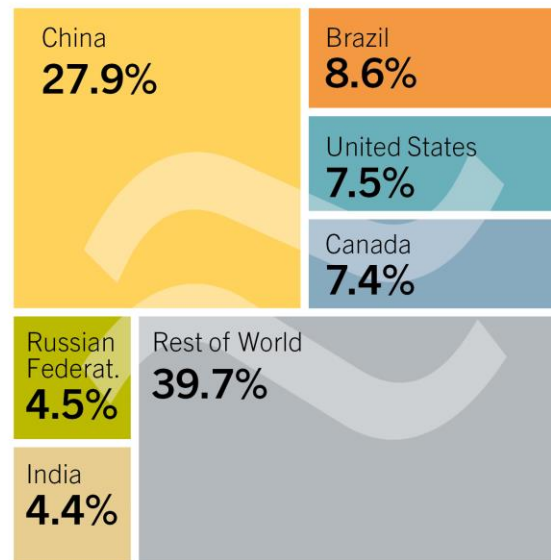
Total global
hydropower
capacity:

1,064 GW

Global
hydropower
generation: **3,940
TWh**

28 GW of new
capacity were
commissioned in
2015

Hydropower Global Capacity, Shares of Top Six Countries and Rest of World, 2015



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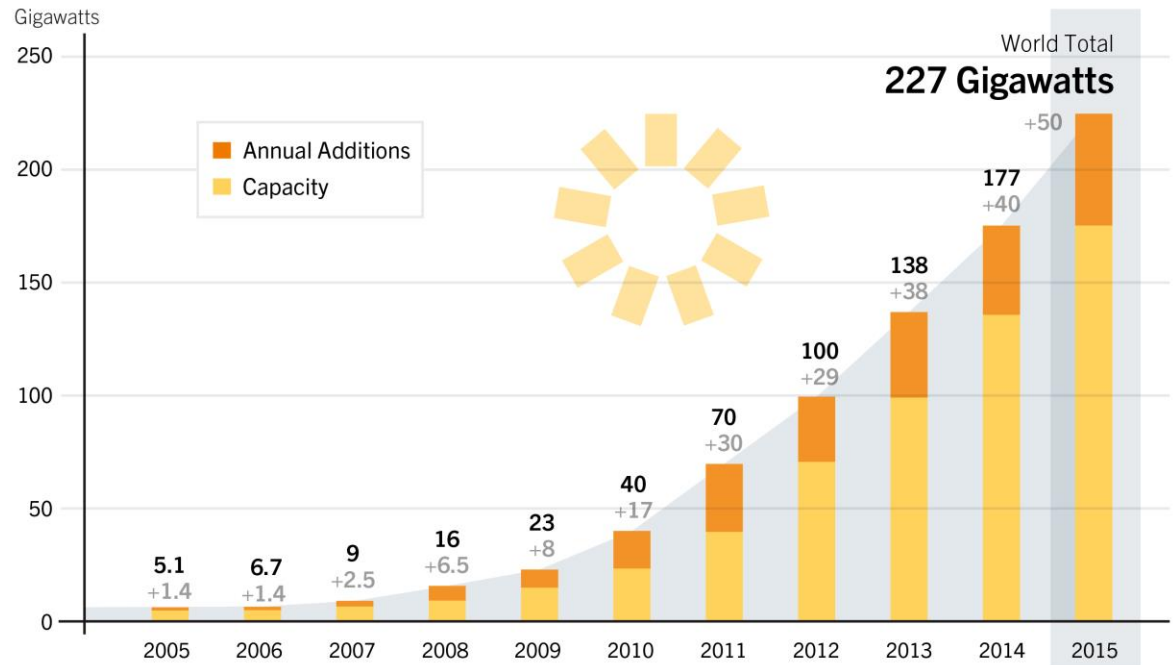
Solar PV

Capacity added:
+50 GW

Total capacity:
227 GW

Annual PV market in 2015 was nearly **10 times** the world's cumulative solar PV capacity of a decade earlier

Solar PV Global Capacity and Annual Additions, 2005–2015



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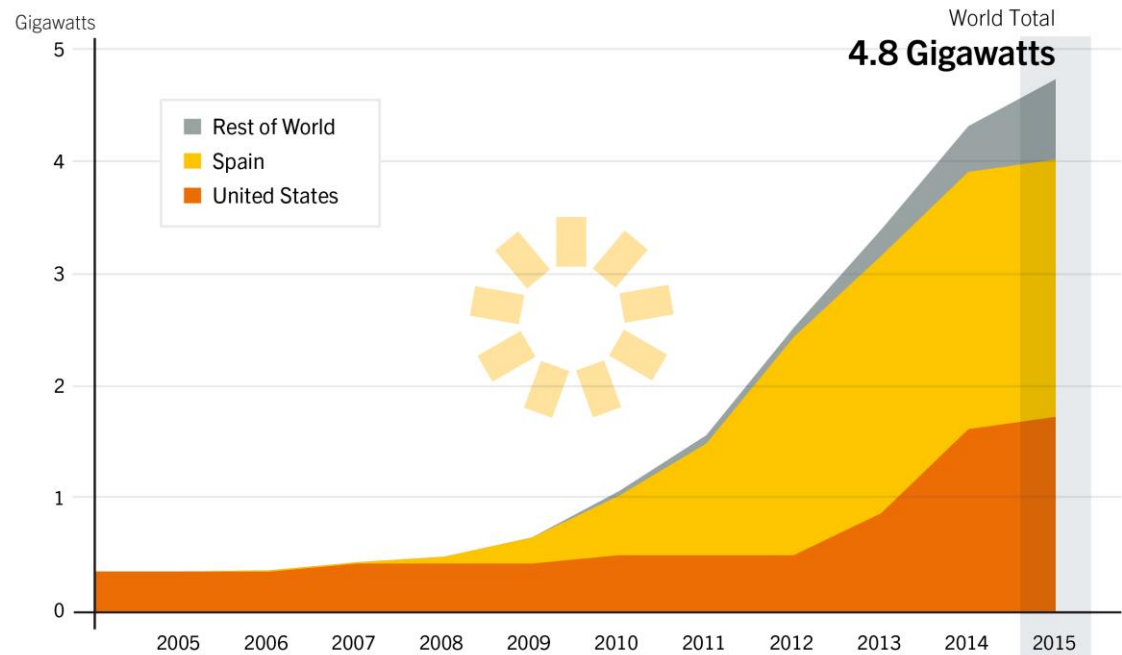
Concentrating Solar Thermal Power (CSP)

Total capacity: **4.8 GW**

With **+0.4 GW** added, this represents an increase of 10%.

Markets continue to shift to **developing countries**.

Concentrating Solar Thermal Power Global Capacity, by Country/Region, 2005–2015



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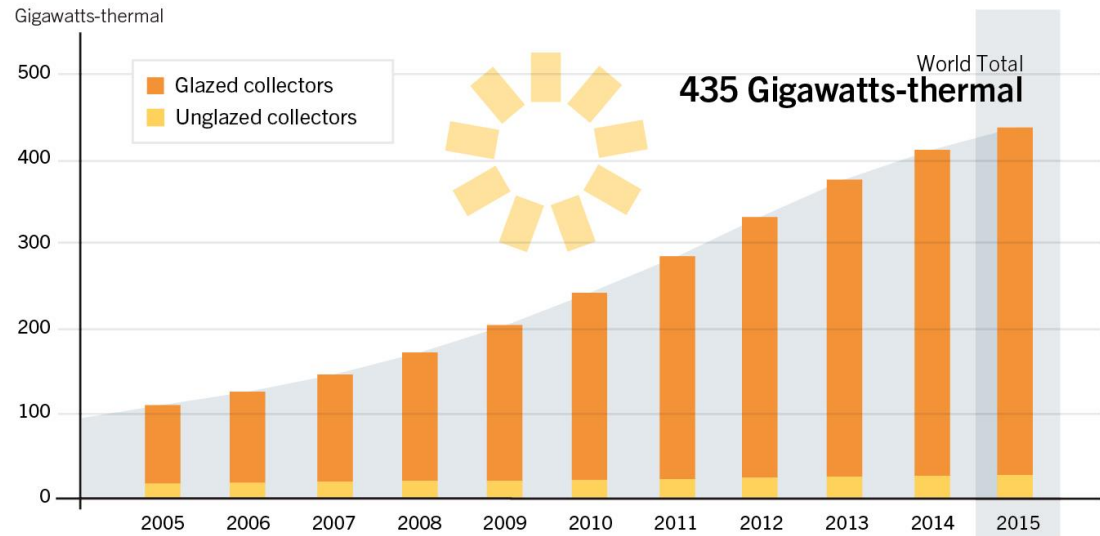


Solar Thermal Heating and Cooling

Total capacity of water collectors increased by more than 6% in 2015, bringing operating global solar thermal capacity to about **435 GW_{th}**

The slowdown in market growth continued in 2015.

Solar Water Heating Collectors Global Capacity, 2005–2015



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Source: IEA SHC.



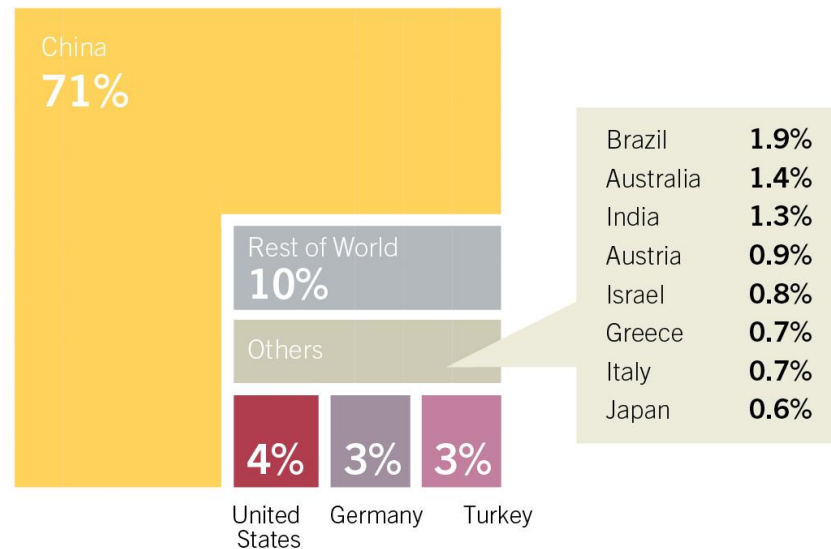
Solar Thermal Heating and Cooling

China accounts for **71%** of cumulative solar water heating collectors capacity

Total solar water heating capacity per capita:

1. Austria
2. Cyprus
3. Israel
4. Barbados
5. Greece

Solar Water Heating Collectors Global Capacity, Shares of Top 12 Countries and Rest of World, 2014



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Source: IEA SHC.



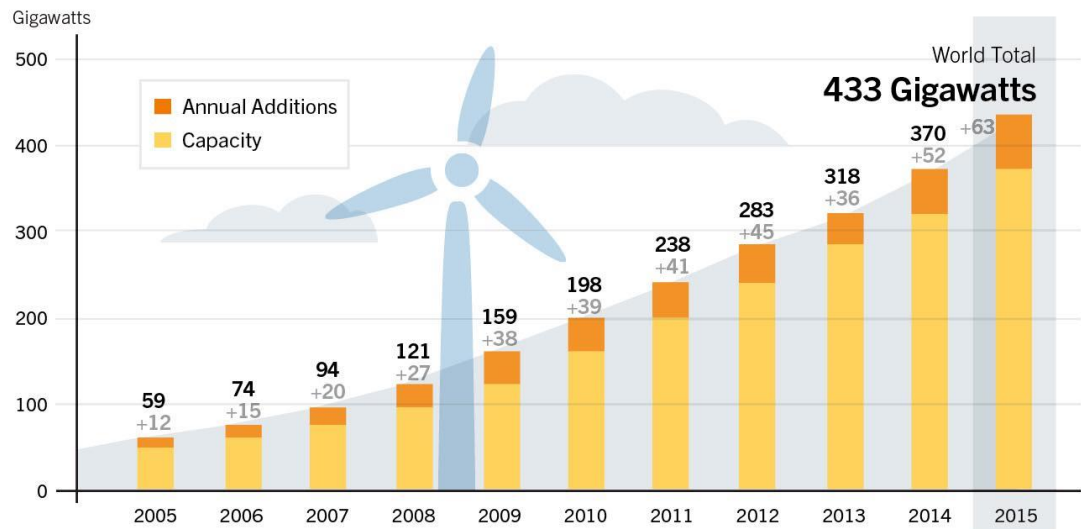
Wind Power

63 GW of capacity were added

Total capacity: **433 GW**

Offshore, an estimated **3.4 GW** of grid-connected capacity was added in 2015, for a world total exceeding **12 GW**

Wind Power Global Annual Additions and Capacity, 2005–2015



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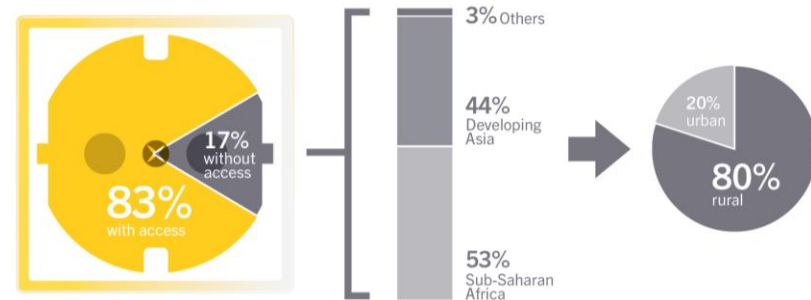
Distributed Renewable Energy for Energy Access

17% of the global population still lack electricity access – approx. **1.2 billion people**

38% of the global population lack access to clean cooking

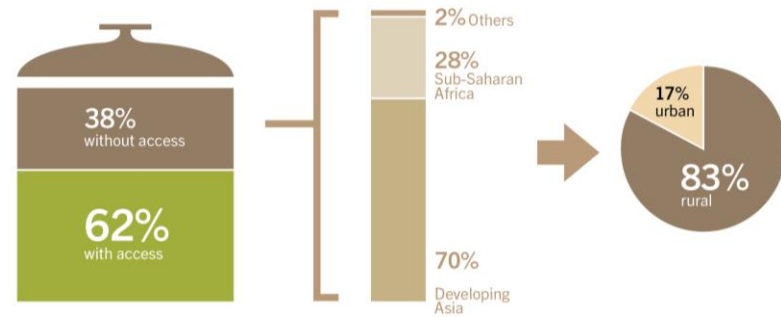
By year's end, approx. **28 million** households worldwide were using clean cook stoves

World Electricity Access and Lack of Access by Region, 2013



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World Clean Cooking Access and Lack of Access by Region, 2013



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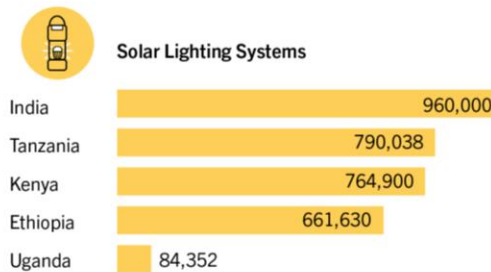
Distributed Renewable Energy for Energy Access

Little quantitative information exists on **DRE markets**, but information available indicates that markets are significant

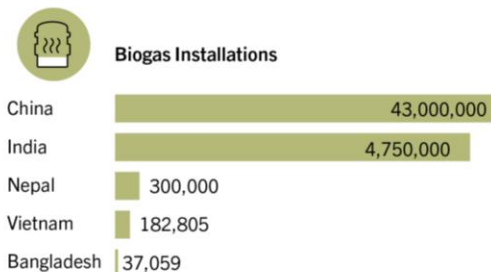
DRE solar PV markets continue to flourish:

- **44 million** off-grid pico-solar products sold
- Represents annual market of **USD 300 million**
- **70 countries** had off-grid PV capacity or programmes to support off-grid PV

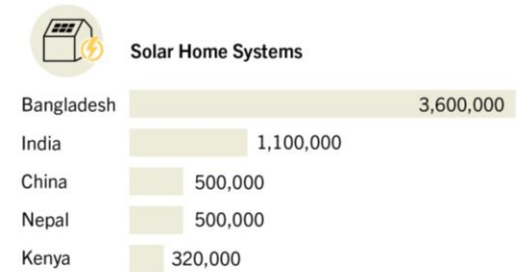
Number of Solar Lighting Systems in Top Five Countries, End-2014



Number of Biogas Installations in Top Five Countries, End-2014



Number of Solar Home Systems in Top Five Countries, End-2014



Number of Installed Clean Cook Stoves in Top Five Countries, 2012-2014



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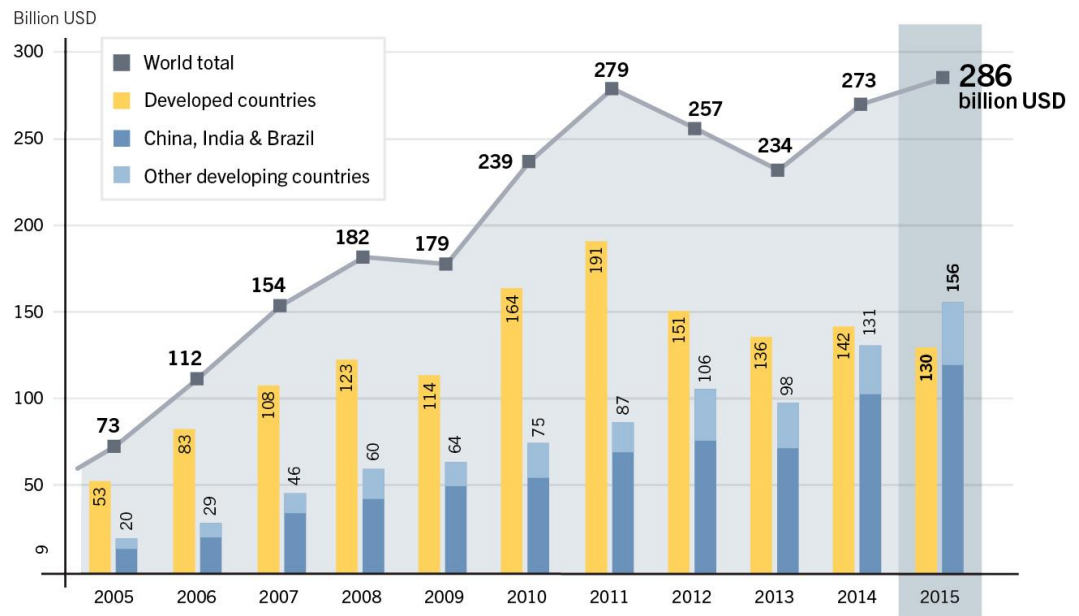


Global Investment in Renewable Energy

Global new investment in renewables estimated at **USD 286 billion** in 2015

- ➔ A new **record high**
- ➔ Increase of **5%** from 2014
- ➔ Including hydropower: **USD 328.9 billion**

Global New Investment in Renewable Power and Fuels, Developed, Emerging and Developing Countries, 2005–2015



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Global Investment in Renewable Energy

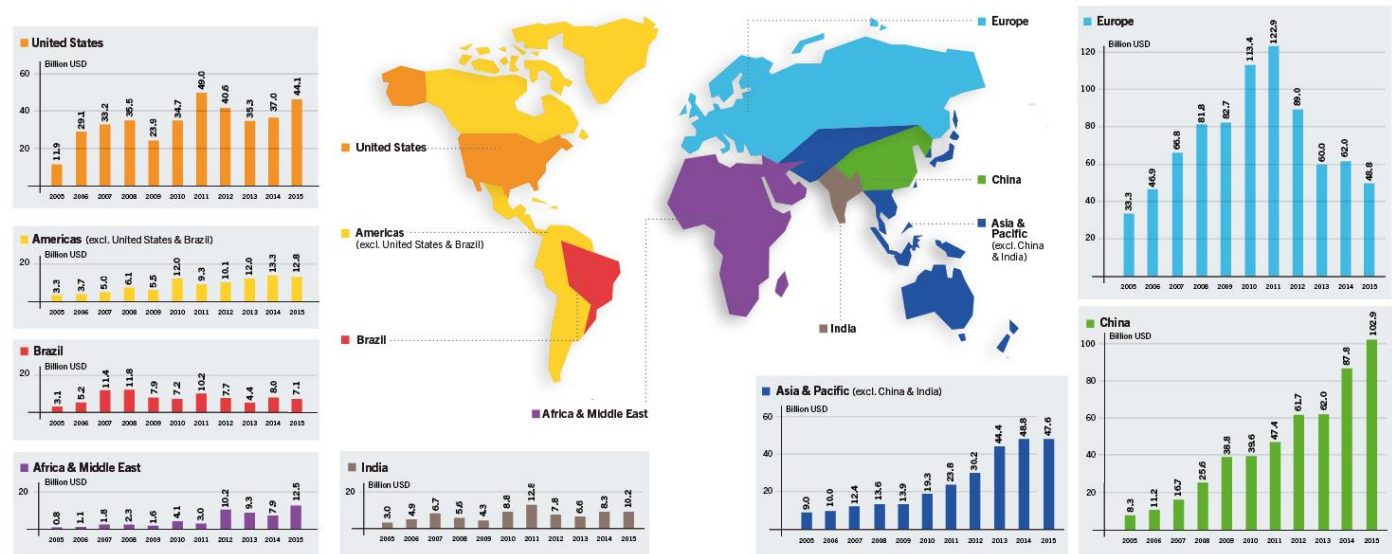
Developing & emerging countries:

- USD 156 billion
- Increase of 19% compared to 2014

Developed countries:

- USD 130 billion
- Decrease of 8% compared to 2014

Global New Investment in Renewable Power and Fuels, by Country and Region, 2005–2015



Data include government and corporate R&D.

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Source: BNEF

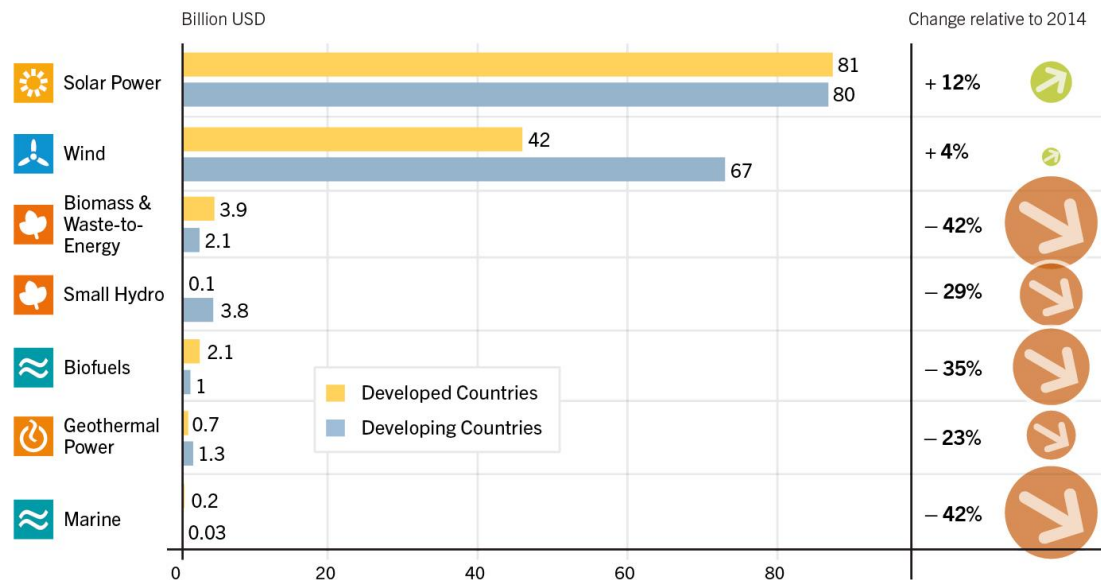


Global Investment in Renewable Energy

Solar power leading sector for money committed during 2015, receiving more than 56% (USD 161 billion) of total new investment in RE

Wind power followed with USD 109.6 billion (38.3% of total, up 4%)

Global New Investment in Renewable Energy by Technology, Developed and Developing Countries, 2015



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Source: BNEF



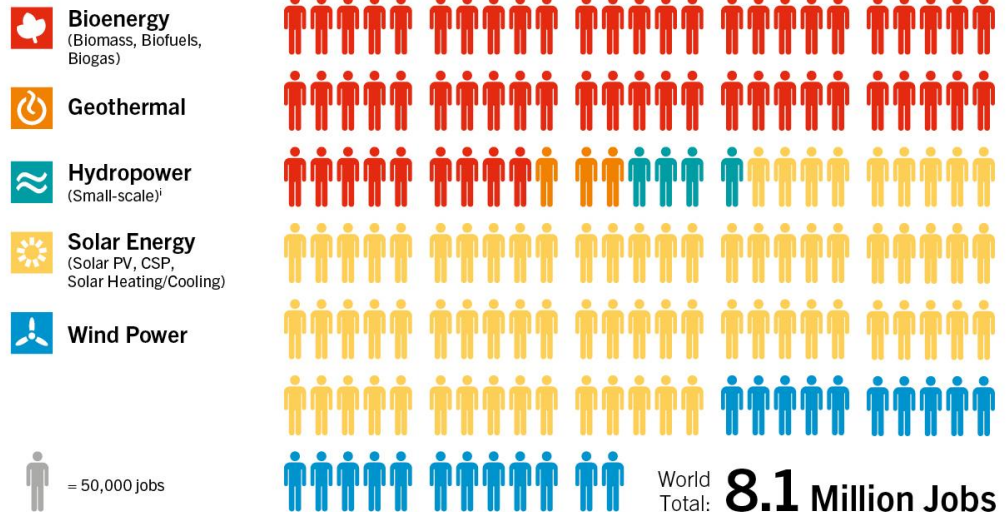
Jobs in Renewable Energy

Global employment continued to increase by **5%** in 2015

An estimated **8.1 million direct and indirect jobs** in the renewable energy industry

Leading employers in 2015 were China, Brazil, the United States, and India

Jobs in Renewable Energy



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Source: IRENA

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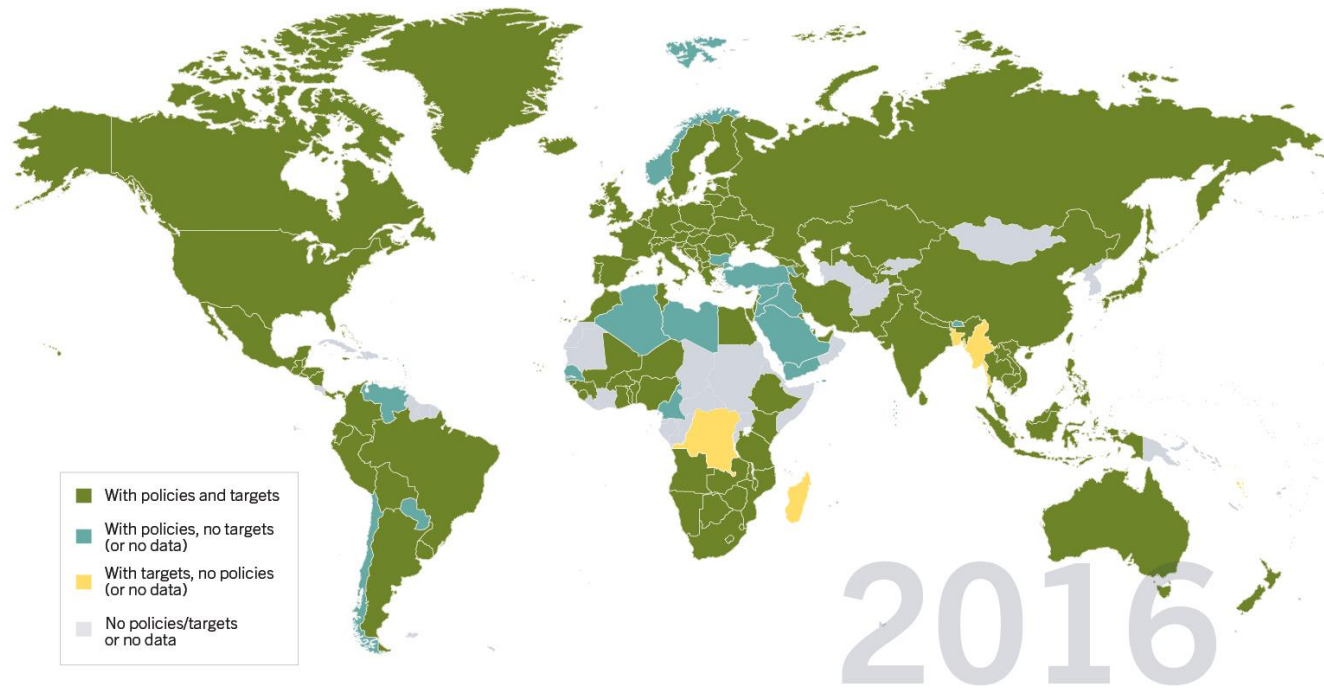


Energy Efficiency

Increased emphasis on activities to improve energy efficiency in all sectors

- 146 countries with policies
- 128 countries with targets

Countries with Energy Efficiency Policies and Targets, 2015



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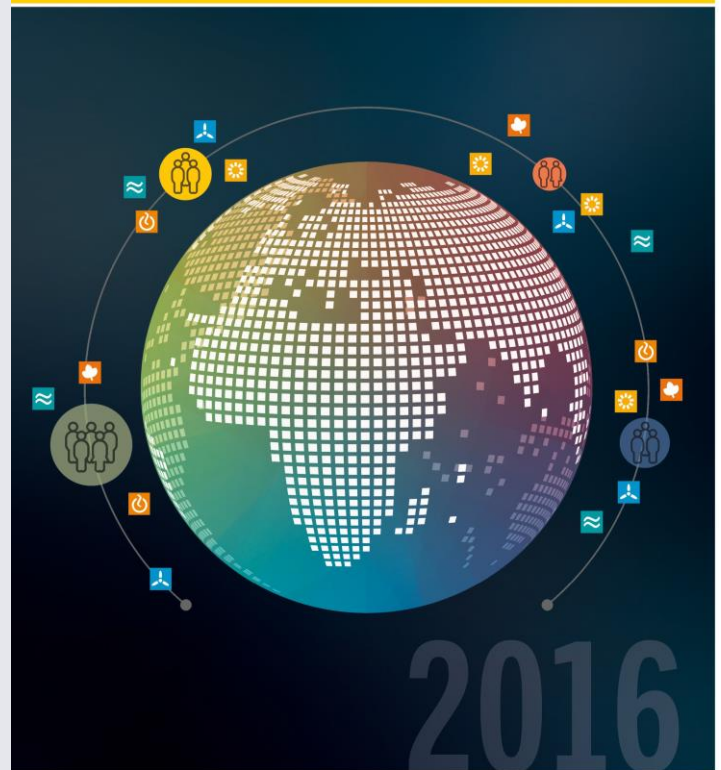
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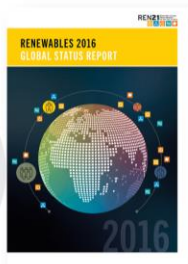
Conclusions

- **Largest global capacity additions** from renewables to date
- Majority of remaining **fossil fuel reserves will have to be kept in the ground**, and both **renewable energy and energy efficiency will have to be scaled up** dramatically in order to reach 2° climate target
- More emphasis on renewable energy in the **heating and cooling as well as transport sectors** and on **sector-coupling**
- Need to build a **smarter, more flexible system** that accommodates both **centralised and decentralised** as well as **community-based** generation

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