

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,
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Brazil,
Denmark,
Germany, India,
Norway, Spain,
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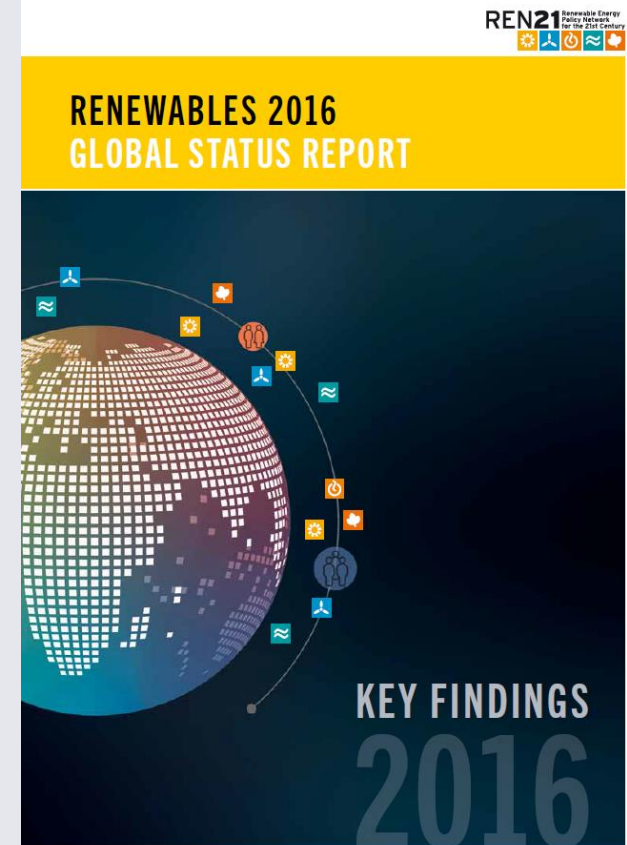
→ The report features:

- 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

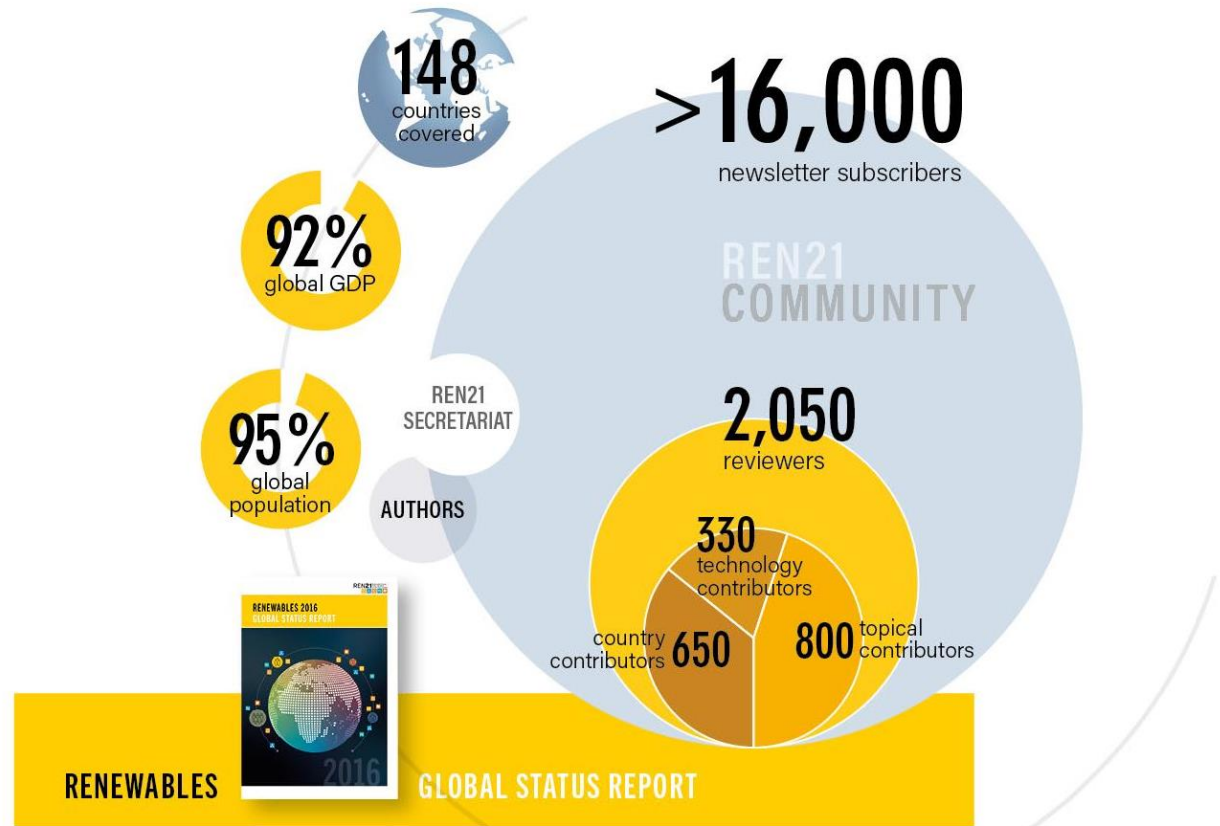


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REN21 Community

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 “Champions”

Annual investment/capacity additions/production

| | 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

| | 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 |
| ☀️ 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 heating collector capacity ⁵ | 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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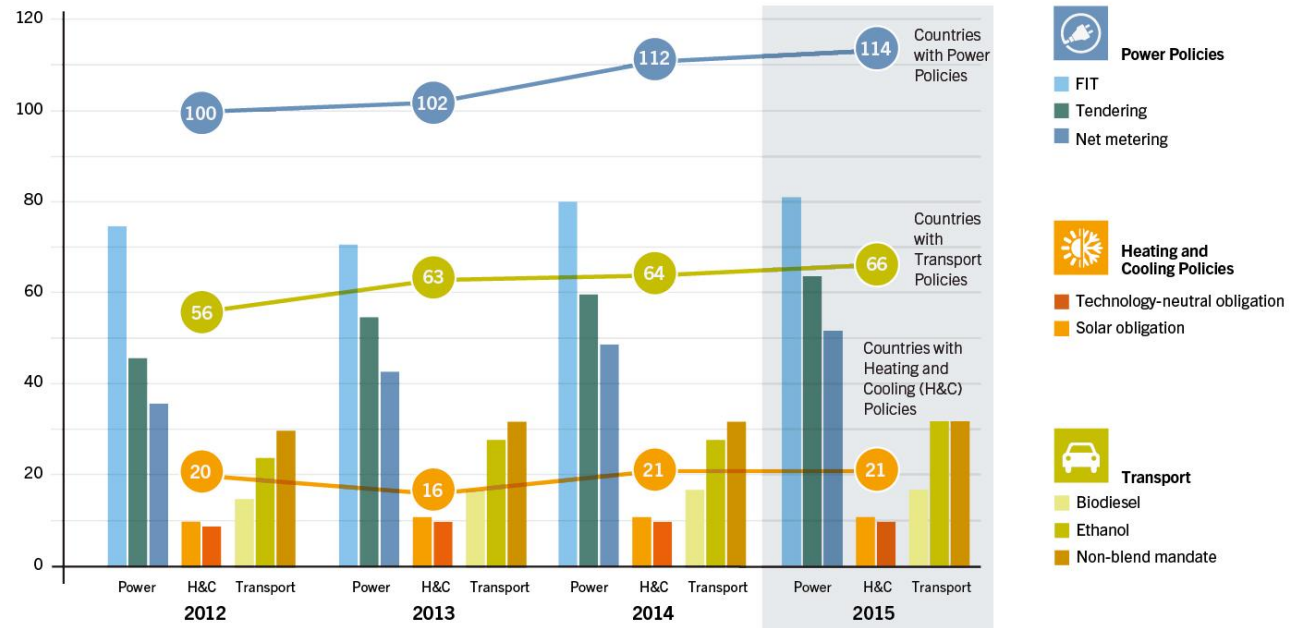


Renewable Energy Policy Landscape

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



Renewable Energy Policy Landscape

| | | 2014 | 2015 |
|--|---|------|------|
| POLICIES | | | |
| Countries with policy targets | # | 164 | 173 |
| States/provinces/countries with feed-in policies | # | 108 | 110 |
| States/provinces/countries with RPS/quota policies | # | 98 | 100 |
| Countries with tendering / public competitive bidding ⁵ | # | 60 | 64 |
| Countries with heat obligation/mandate | # | 21 | 21 |
| Countries with biofuel mandates ⁶ | # | 64 | 66 |

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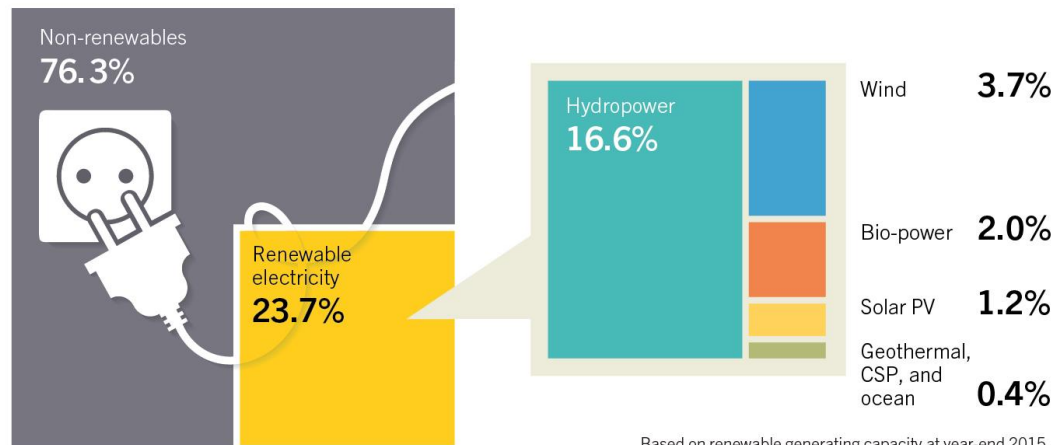


- At least **173** countries had renewable energy targets
- At least **146** countries had renewable energy policies in place
- Most policies focus on power: Mainly FIT and RPS



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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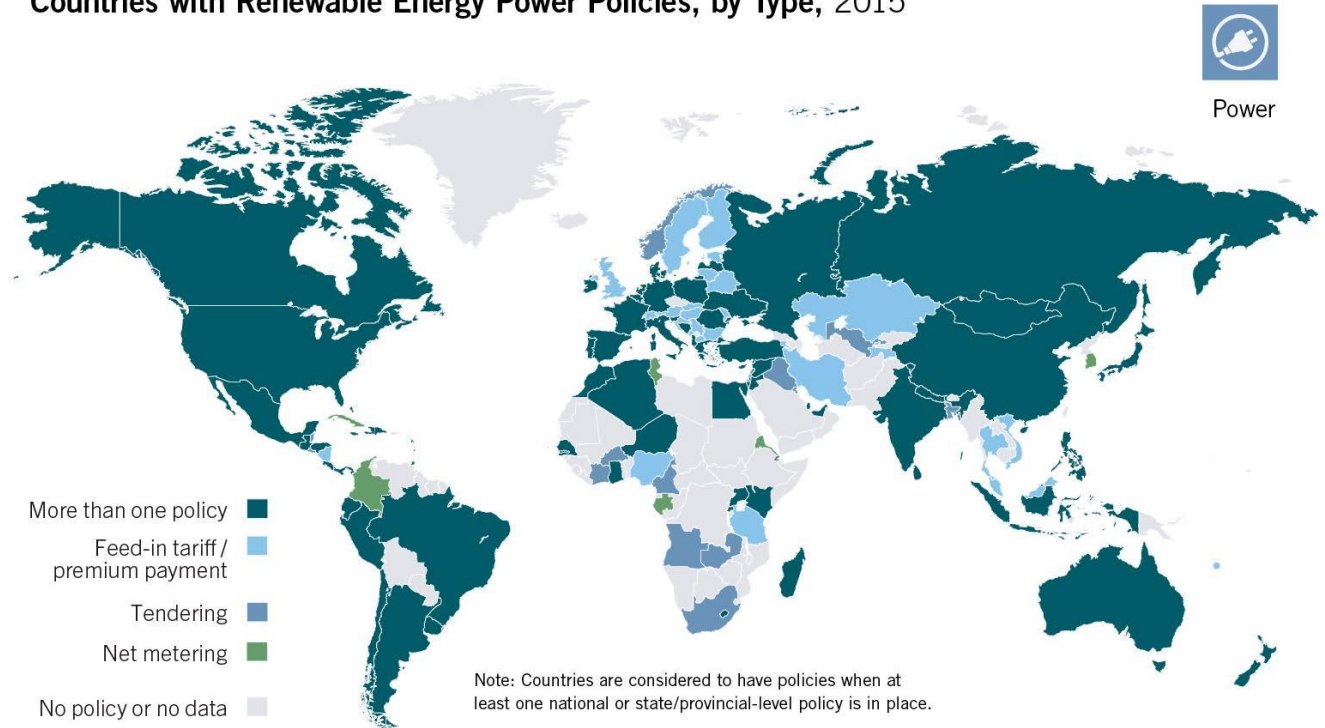


- Renewables accounted **28.9%** of global power generation capacity and **23.7%** of global electricity demand
- Renewables made up for **60%** of net additions to global power capacity
- Total RE power capacity: **1,849 GW**, an increase of almost 9% over 2014

Power Sector

Electricity continues to dominate policy makers' focus

Countries with Renewable Energy Power Policies, by Type, 2015



Power

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Source: REN21 Policy Database

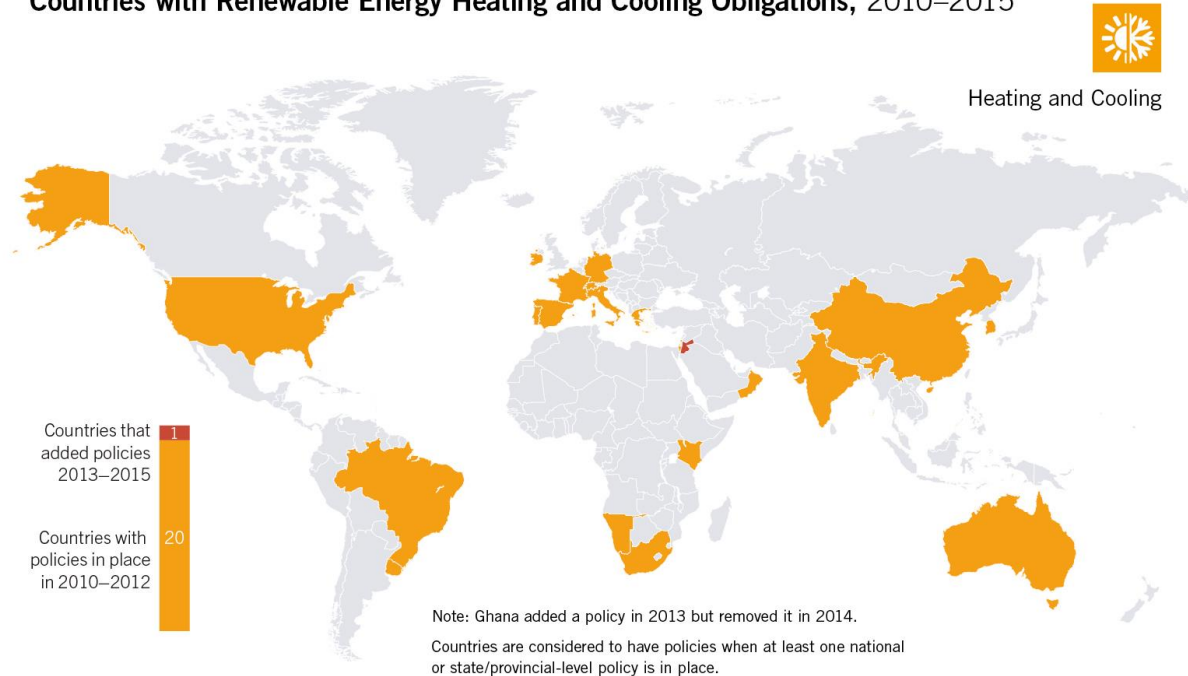


Heating & Cooling Sector

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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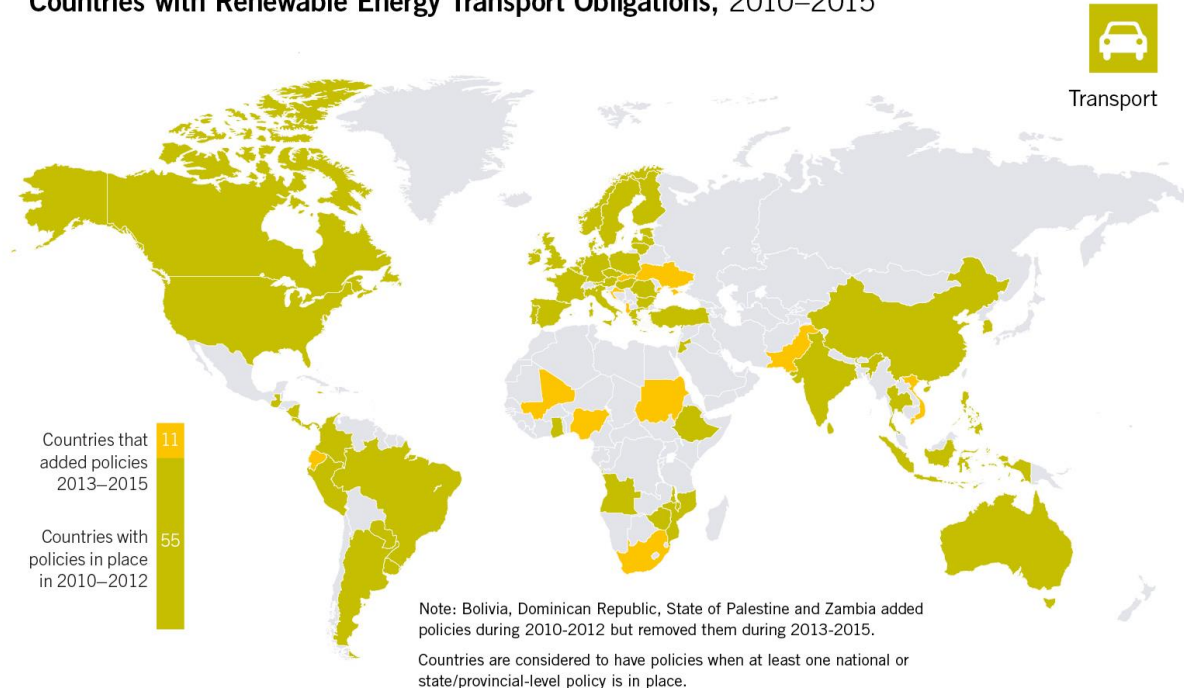
Source: REN21 Policy Database



Transport Sector

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

Countries with Renewable Energy Transport Obligations, 2010–2015



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Source: REN21 Policy Database



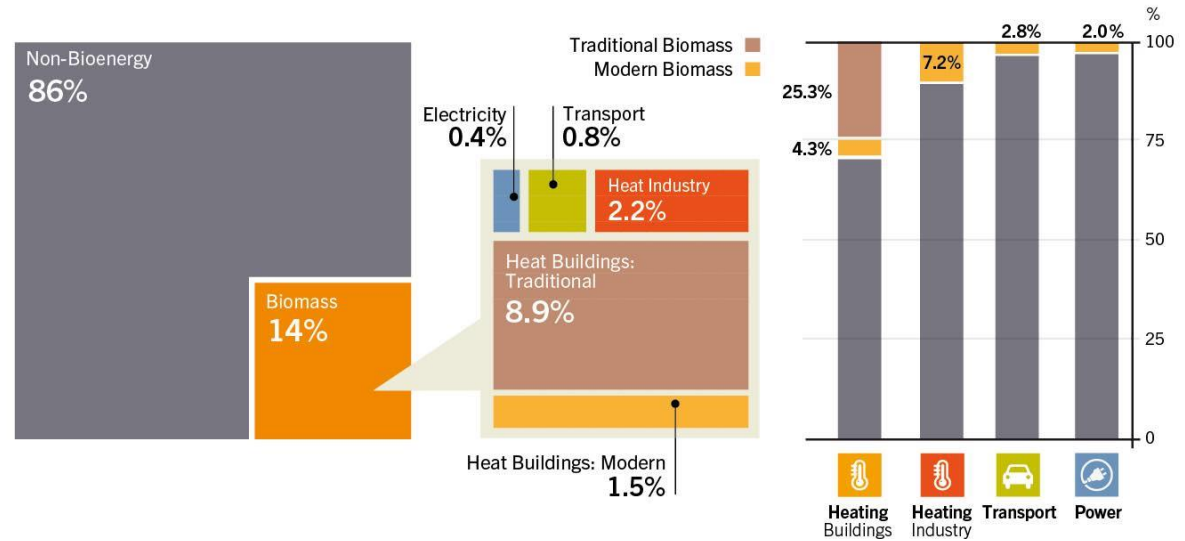
Biomass Energy

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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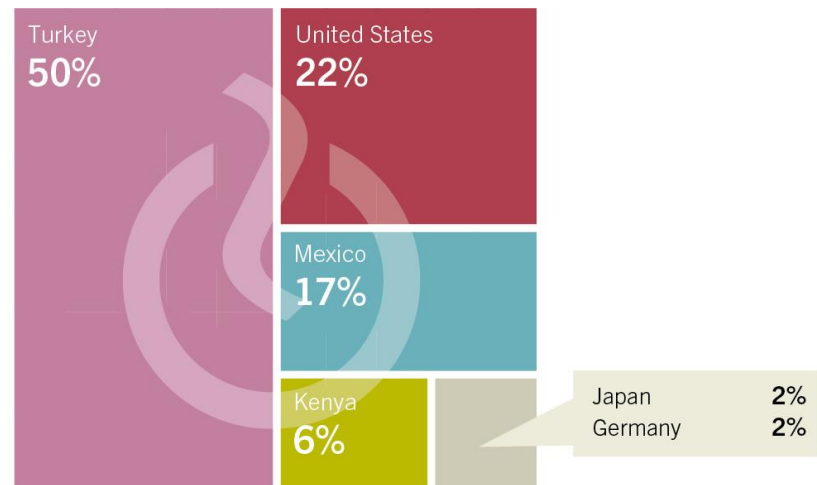
Geothermal Power and Heat

Turkey added about **half** of new global capacity

Lead countries for cumulative geothermal power generating capacity:

- The United States (3.6 GW)
- The Philippines (1.9 GW)
- Indonesia (1.4 GW)
- Mexico (1.1 GW)
- New Zealand (1.0 GW)

Geothermal Power Capacity Additions, Share by Country, 2015



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Hydropower

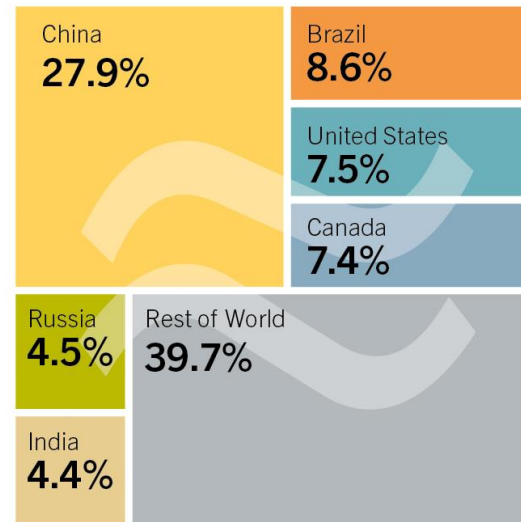
Total global
hydropower
capacity:

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, 2015



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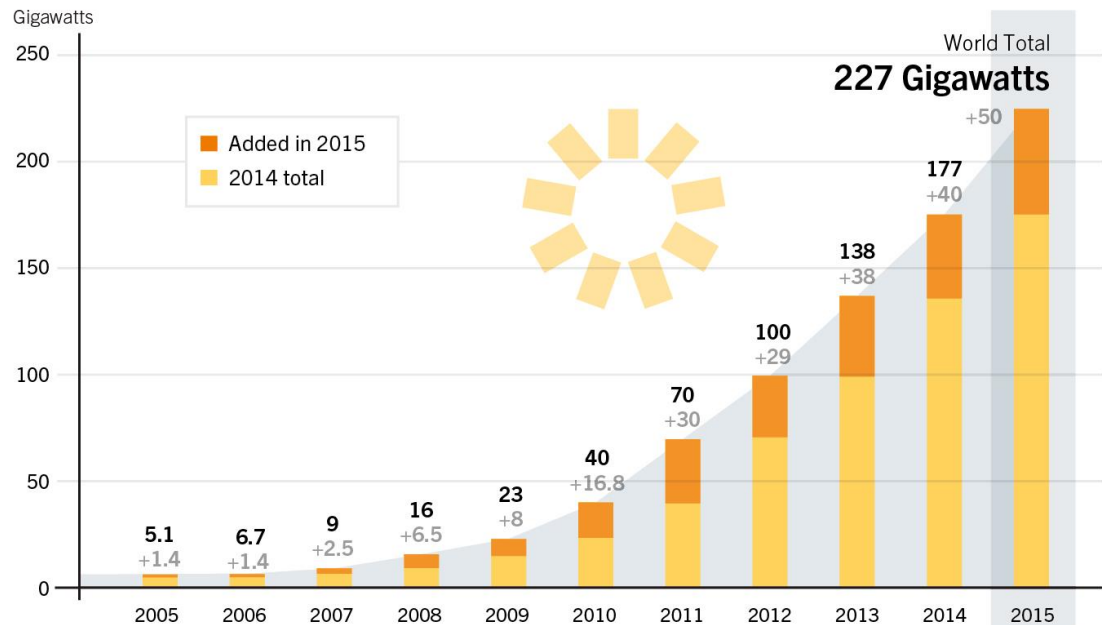
Solar PV

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 Total Global Capacity Annual Additions and Capacity, 2005–2015



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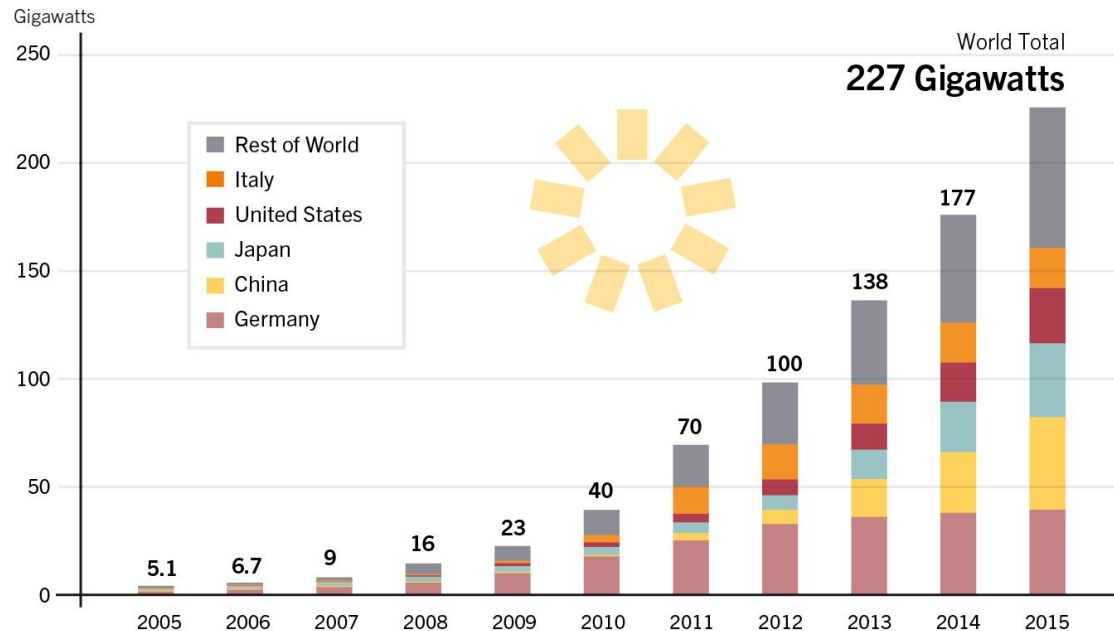


Solar PV

22 countries had enough PV capacity at end-2015 to meet more than 1% of their electricity demand, with far higher shares in some countries

- Italy 7.8%
- Greece 6.5%
- Germany 6.4%

Solar PV Global Capacity, by Country or Region, 2005–2015



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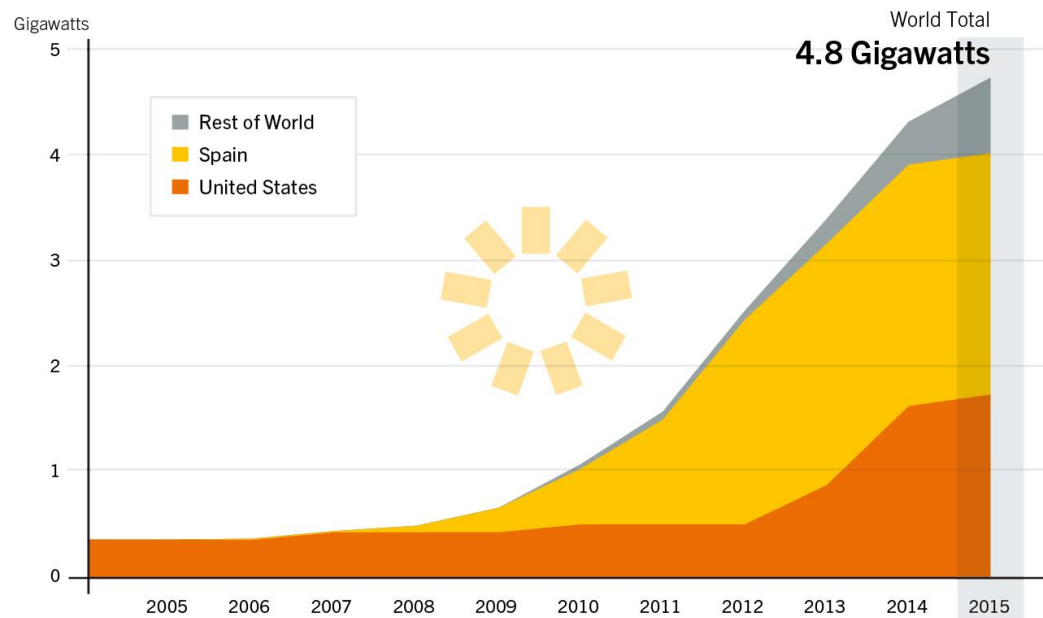
Concentrating Solar Thermal Power (CSP)

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 or Region, 2005–2015



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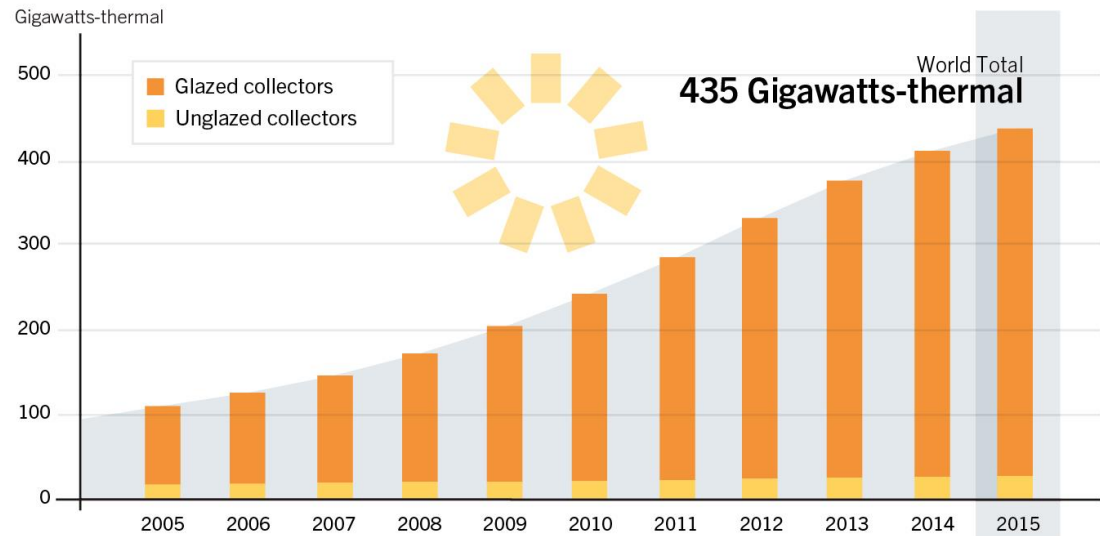


Solar Thermal Heating and Cooling

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.



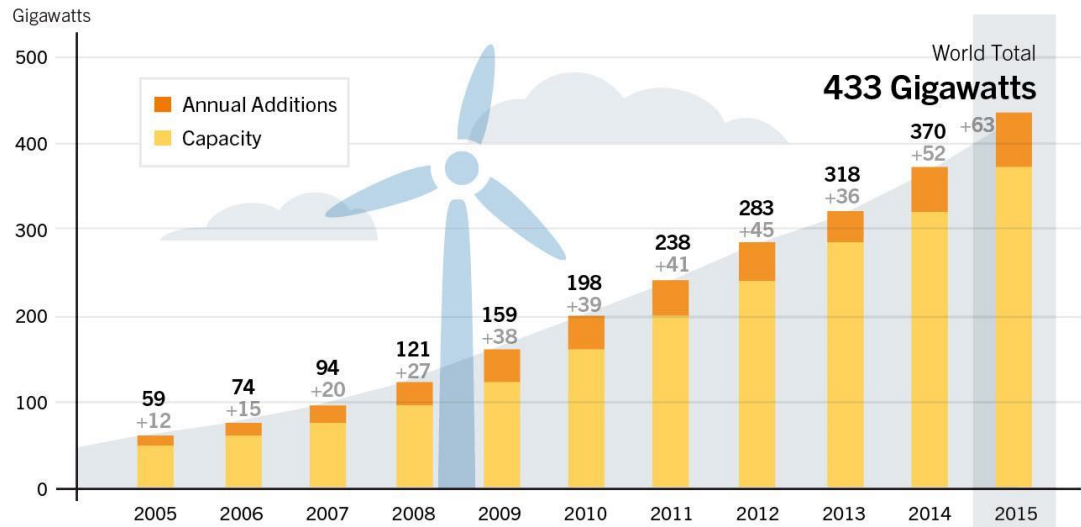
Wind Power

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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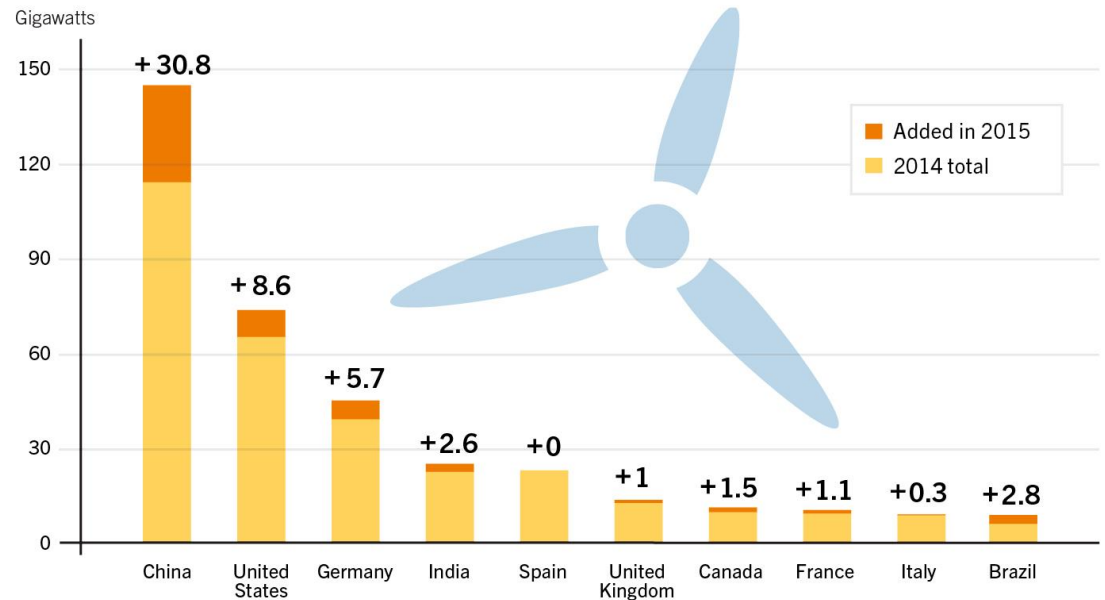
Wind Power

Wind power was the **leading source of new power generating capacity** in Europe and the United States in 2015, and the second largest in China

Wind power is playing a major role in meeting electricity demand in an increasing number of countries, e.g.:

- Denmark: **42%** of demand
- Uruguay: **15.5%**

Wind Power Capacity and Additions, Top 10 Countries, 2015



Additions are net of repowering/decommissioning.

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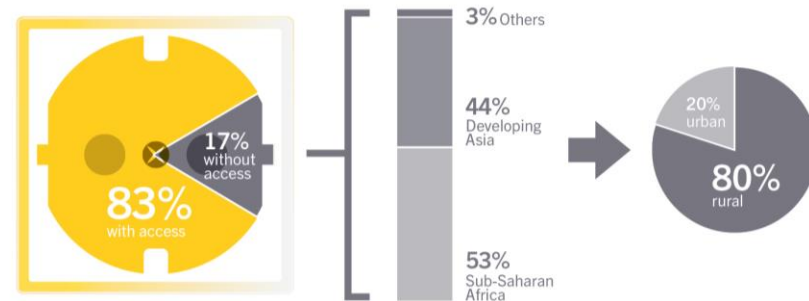
Distributed Renewable Energy for Energy Access

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

38% of the global population lack access to clean cooking

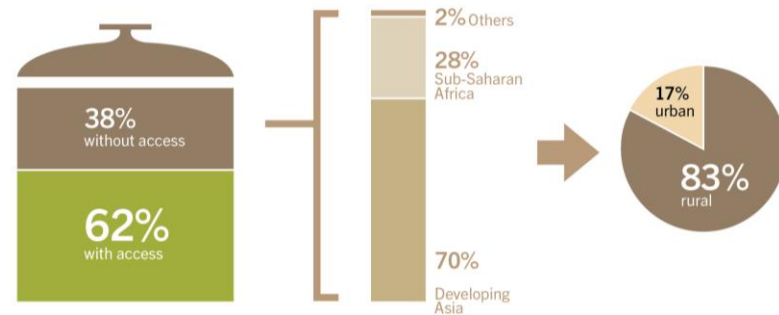
By year's end, approx. **28 million** households worldwide were using clean cook stoves

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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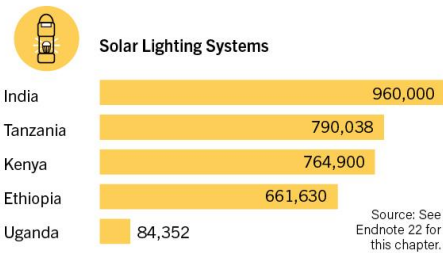
Distributed Renewable Energy for Energy Access

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

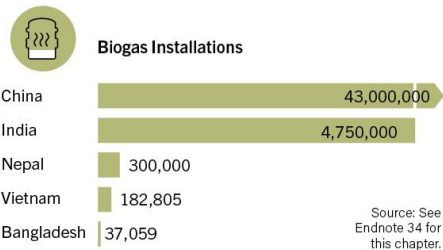
DRE solar PV markets continue to flourish:

- **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

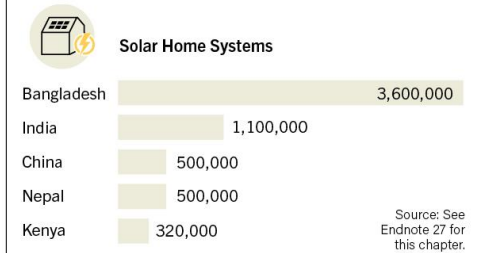
Total Solar Lighting Systems in Top Five Countries, End-2014



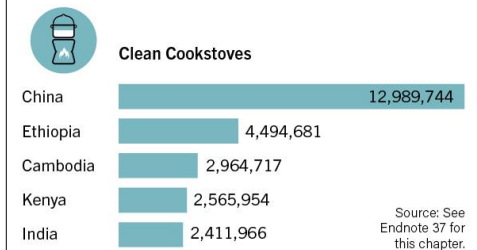
Total Biogas Installations in Top Five Countries, End-2014



Total Solar Home Systems in Top Five Countries, End-2014



Total Installed Clean Cookstoves in Top Five Countries, 2012–2014



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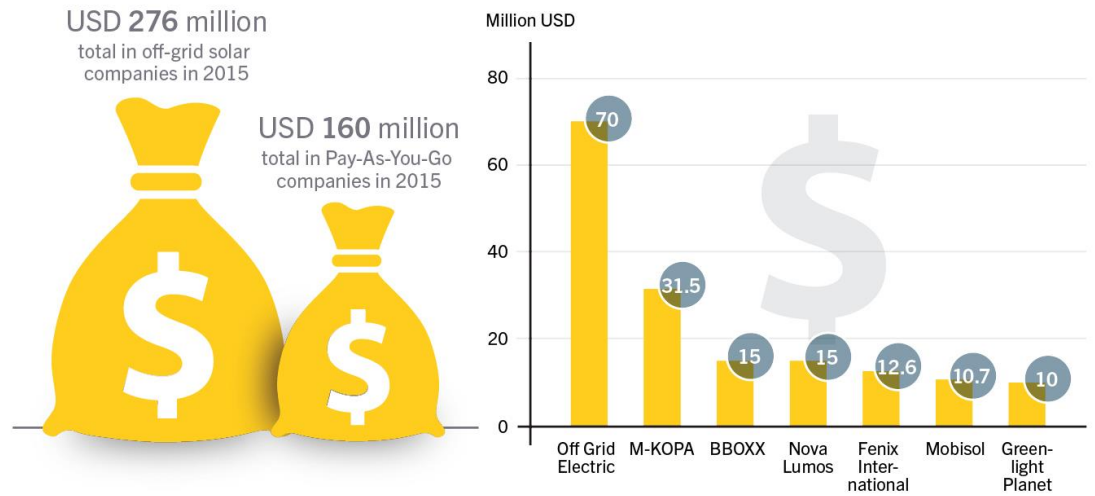
Distributed Renewable Energy for Energy Access

2015 saw **positive market trends** and **increased investment** in DRE

Innovative business models continued to mature and expand

DRE deployment in 2015 received **policy support** through a variety of policy types and incentives

Capital Raised by Distributed Renewable Energy Companies in 2015, 2015



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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


 **Bioenergy**
(Biomass, Biofuels, Biogas)

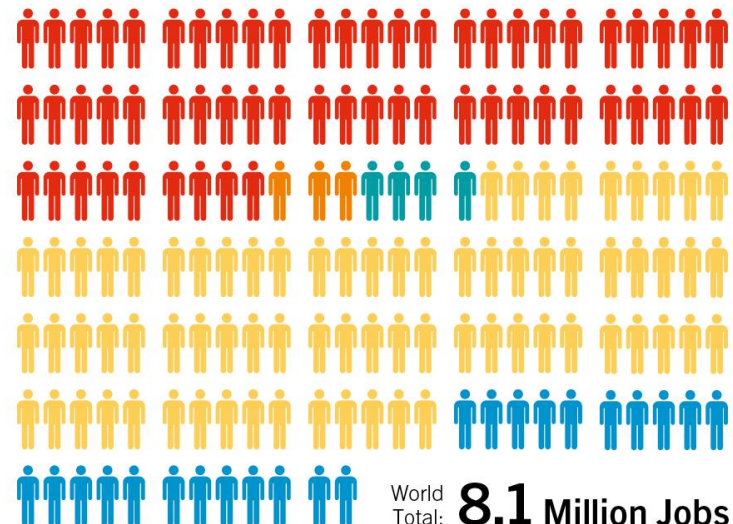
 **Geothermal**

 **Hydropower**
(Small-scale)¹

 **Solar Energy**
(Solar PV, CSP, Solar Heating/Cooling)

 **Wind Power**

 = 50,000 jobs



World Total: **8.1 Million Jobs**

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Source: IRENA

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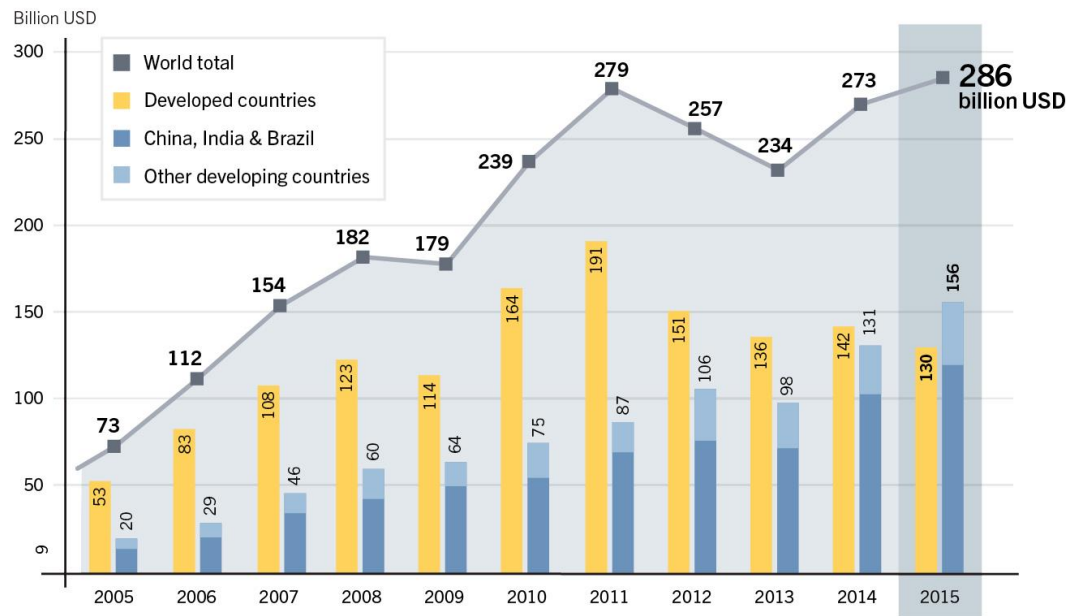
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Global Investment in Renewable Energy

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

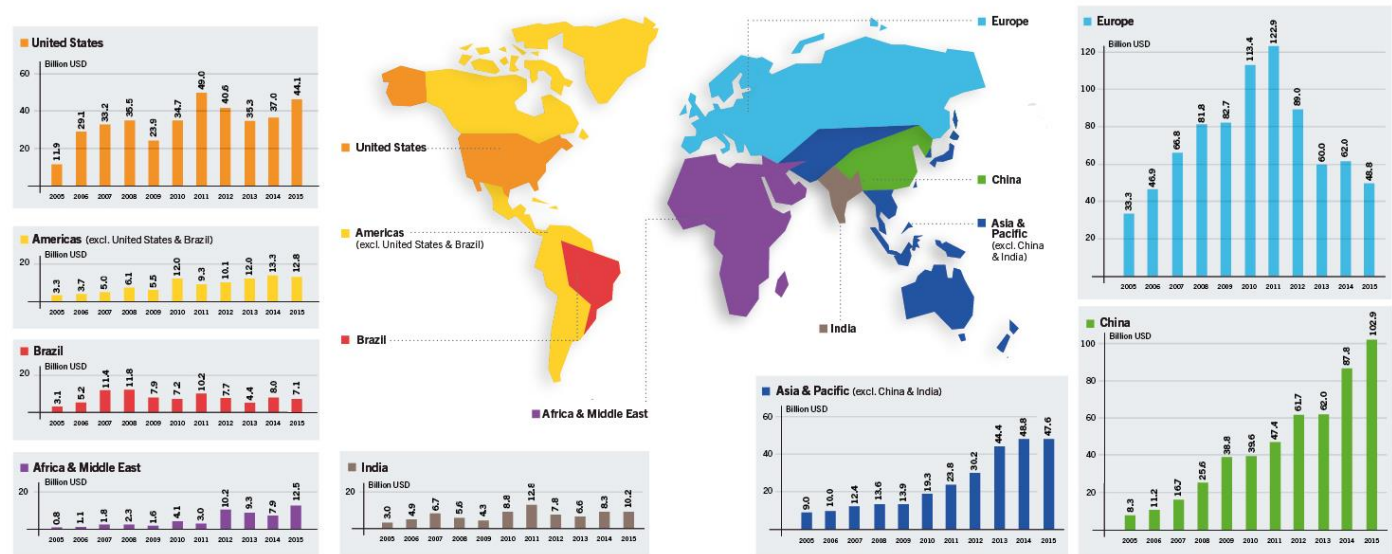
Developing & emerging countries:

- 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

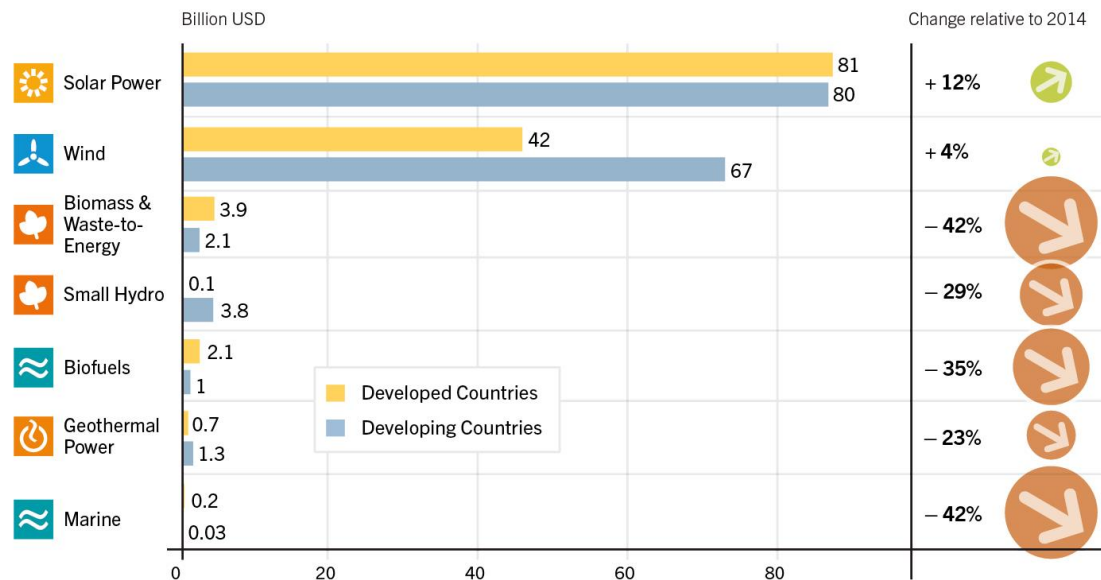


Global Investment in Renewable Energy

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

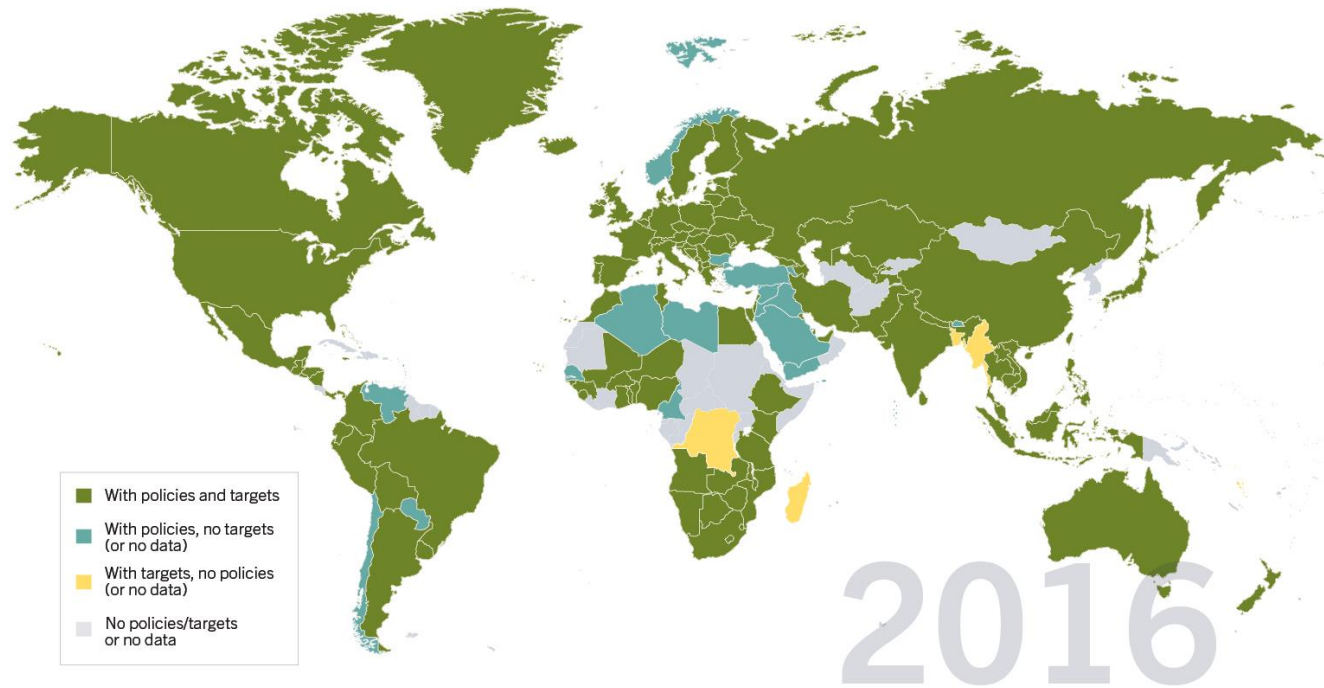


Energy Efficiency

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



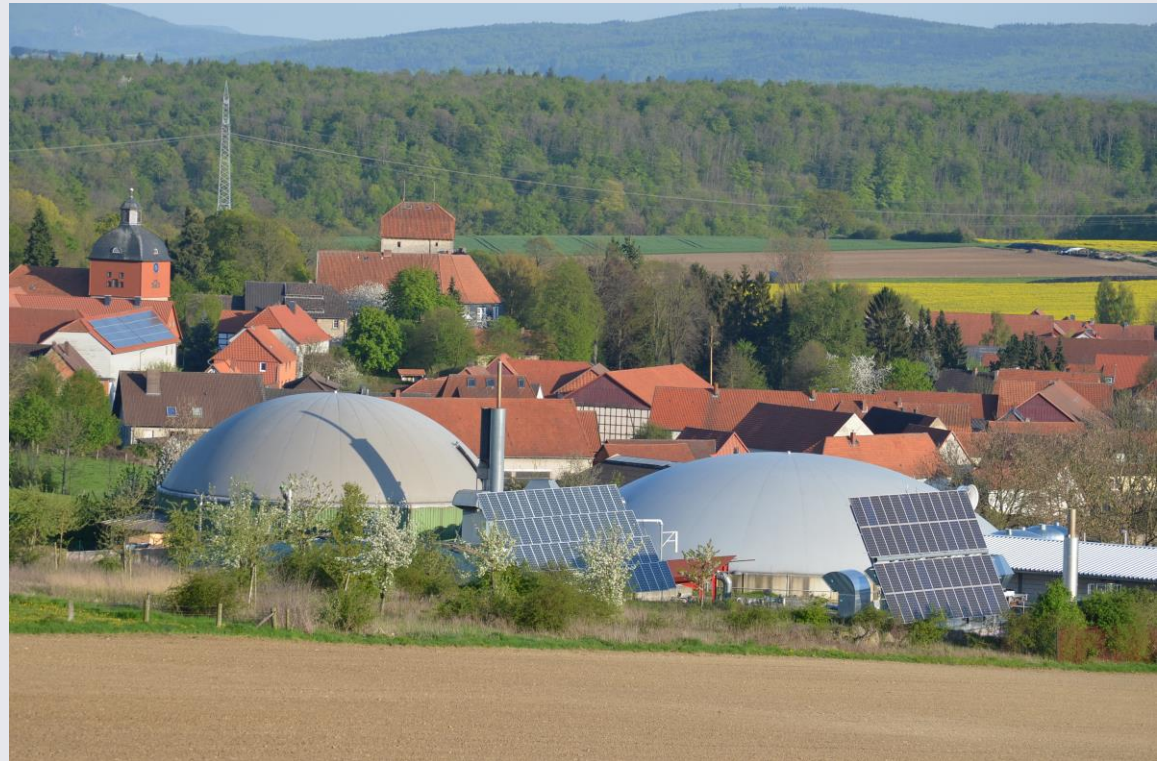
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City and Local Government Renewable Energy Policies

100% Renewable Energy movement expanded in 2015:

- Byron Shire, Coffs Harbour, and Uralla in Australia
- Oxford County and Vancouver in Canada
- US cities of Rochester (Minnesota) and San Diego (California)



Feature: Community Renewable Energy

Consolidated data on community initiatives are very limited

Since 2008, there has been a marked rise in initiatives focused on community renewable energy, especially in **Europe**:

- Europe: more than **2800** energy co-operatives
- Germany: **772**
- The Netherlands: **500**

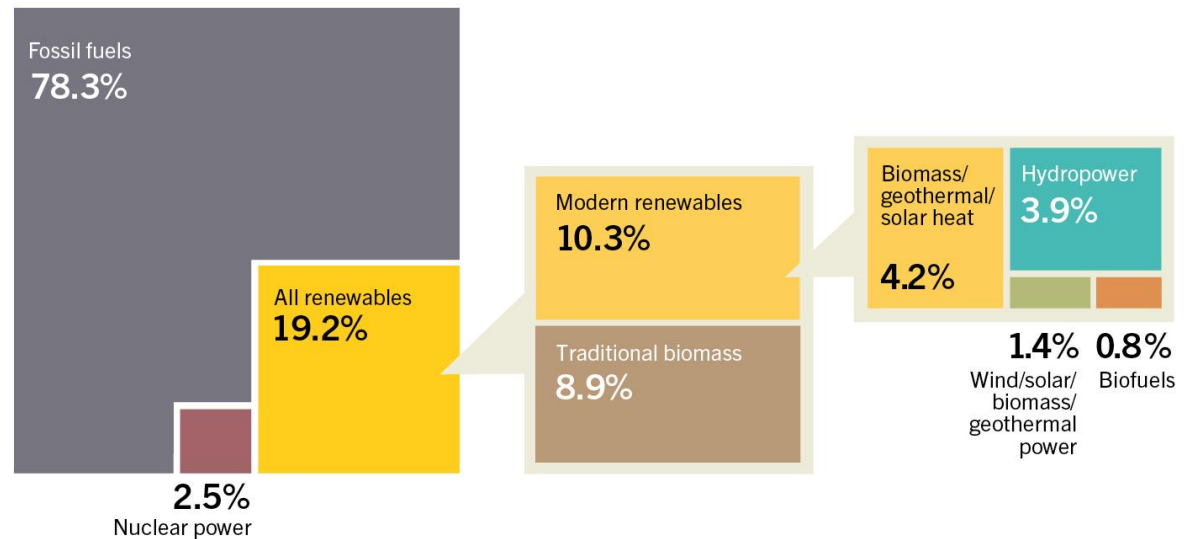


Renewable Energy in the World

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 of 8.9%

Estimated Renewable Energy Share of Global Final Energy Consumption, 2014



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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 as well as decentralised and community-based generation



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