

GLOBAL RENEWABLE ENERGY STATUS

AND FUTURE OUTLOOK

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

Science & Academia:

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

NGOs:

CURES, GFSE, Greenpeace,
ICLEI, ISEP, JREF, RCREEE,
WCRE, WFC, WRI, WWF

Industry Associations:

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



International Organisations:

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

National Governments:

Brazil, Denmark, Germany,
India, Norway, South Africa,
Spain, UAE, United States of
America

REN21 Renewables 2015 Global Status Report



RENEWABLES 2015 GLOBAL STATUS REPORT

Launched at Vienna Energy Forum on 18 June 2015

Network of over 500 contributors, researchers & reviewers worldwide

The report features:

- Global Overview
- Market & Industry Trends
- Investment Flows
- Policy Landscape
- Distributed Renewable Energy for Energy Access
- Feature: Using Renewables for Climate Change Adaptation

The report covers:

- All renewable energy technologies
- The power, heating & cooling, and transport sector
- Energy Efficiency

Country data available under new REN21 Renewables Interactive Map www.ren21.net/map

www.ren21.net/gsr


A Decade Of Renewable Energy Growth Surpassing Expectations

The evolution of renewable energy has surpassed all expectations.

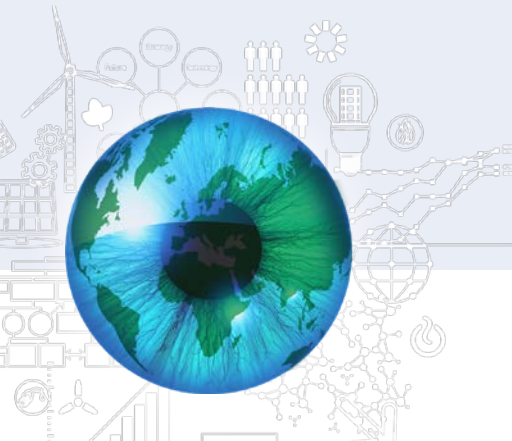
Global installed capacity and production from all renewable technologies have increased substantially.

Significant cost reductions for most technologies.

Supporting policies spread throughout the world.

		START 2004	2013	2014
INVESTMENT				
New investment (annual) in renewable power and fuels	billion USD	45	232	270
POWER				
Renewable power capacity (total, not including hydro)	GW	85	560	657
Renewable power capacity (total, including hydro)	GW	800	1,578	1,712
 Hydropower capacity (total)	GW	715	1,018	1,055
 Bio-power capacity	GW	<36	88	93
 Bio-power generation	TWh	227	396	433
 Geothermal power capacity	GW	8.9	12.1	12.8
 Solar PV capacity (total)	GW	2.6	138	177
 Concentrating solar thermal power (total)	GW	0.4	3.4	4.4
 Wind power capacity (total)	GW	48	319	370
HEAT				
 Solar hot water capacity (total)	GW _m	86	373	406
TRANSPORT				
 Ethanol production (annual)	billion litres	28.5	87.8	94
 Biodiesel production (annual)	billion litres	2.4	26.3	29.7

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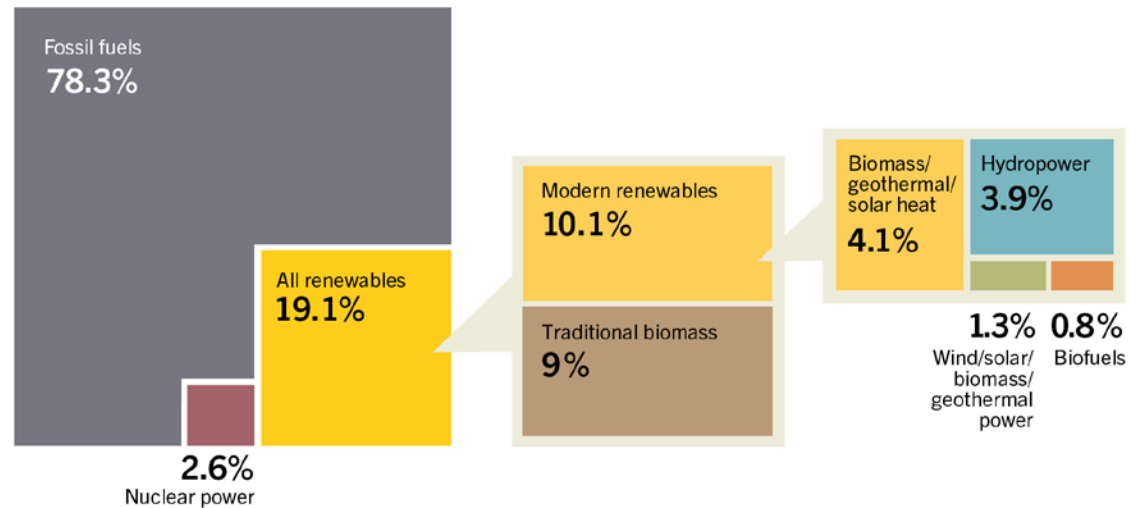
Renewable Energy in the World

Renewable energy provided an estimated **19.1%** of global final energy consumption in 2013.

The share of **modern renewable energy** increased to 10.1%.

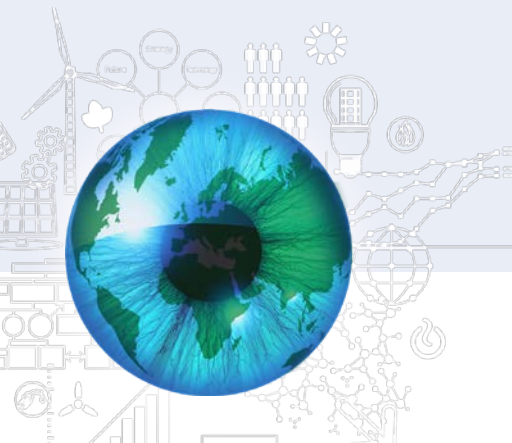
The share of **traditional biomass** was of 9%, same as in 2012.

Estimated Renewable Energy Share of Global Final Energy Consumption, 2013



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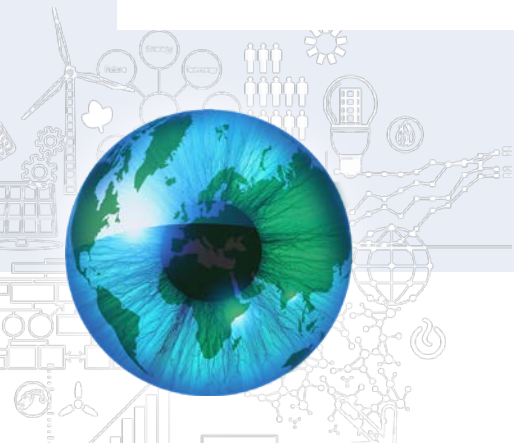


Renewable Energy “Champions” - annual investment/capacity additions

ANNUAL INVESTMENT / NET CAPACITY ADDITIONS / PRODUCTION IN 2014

	1	2	3	4	5
Investment in renewable power and fuels (not including hydro > 50 MW)	China	United States	Japan	United Kingdom	Germany
Investment relative to annual GDP ¹	Burundi	Kenya	Honduras	Jordan	Uruguay
 Geothermal power capacity	Kenya	Turkey	Indonesia	Philippines	Italy
 Hydropower capacity	China	Brazil	Canada	Turkey	India
 Solar PV capacity	China	Japan	United States	United Kingdom	Germany
 CSP capacity	United States	India	—	—	—
 Wind power capacity	China	Germany	United States	Brazil	India
 Solar water heating capacity ²	China	Turkey	Brazil	India	Germany
 Biodiesel production	United States	Brazil	Germany	Indonesia	Argentina
 Fuel ethanol production	United States	Brazil	China	Canada	Thailand

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Renewable Energy “Champions” – total capacity

TOTAL CAPACITY OR GENERATION AS OF END-2014

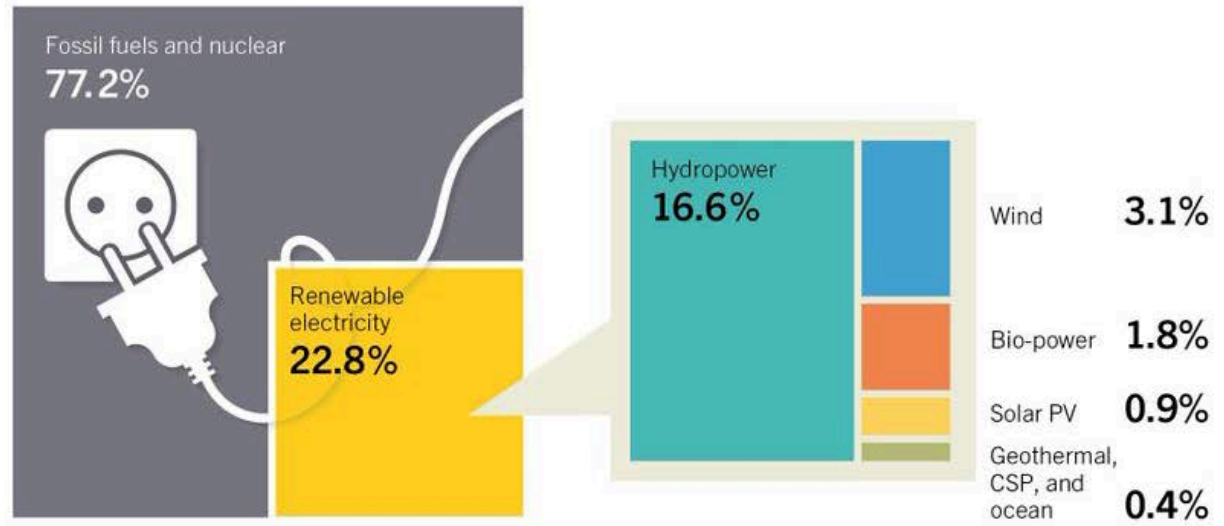
	1	2	3	4	5
POWER					
Renewable power (incl. hydro)	China	United States	Brazil	Germany	Canada
Renewable power (not incl. hydro)	China	United States	Germany	Spain / Italy	Japan / India
Renewable power capacity per capita (not incl. hydro)	Denmark	Germany	Sweden	Spain	Portugal
Biopower generation	United States	Germany	China	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	United Arab Emirates	Algeria
Solar PV capacity	Germany	China	Japan	Italy	United States
Solar PV capacity per capita	Germany	Italy	Belgium	Greece	Czech Republic
Wind power capacity	China	United States	Germany	Spain	India
Wind power capacity per capita	Denmark	Sweden	Germany	Spain	Ireland
HEAT					
Solar water collector capacity ²	China	United States	Germany	Turkey	Brazil
Solar water heating collector capacity per capita ²	Cyprus	Austria	Israel	Barbados	Greece
Geothermal heat capacity ³	China	Turkey	Japan	Iceland	India
Geothermal heat capacity per capita ³	Iceland	New Zealand	Hungary	Turkey	Japan

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Power Sector

Estimated Renewable Energy Share of Global Electricity Production, End-2014



Based on renewable generating capacity in operation at year-end 2014.

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- Renewables accounted **27.7%** of global power generation capacity and **22.8%** of global electricity demand.
- Renewables made up for **59%** of net additions to global power capacity.
- Total RE power capacity: **1712 GW**, an increase of more than 8.5% over 2013.



Heating & Cooling

Energy use for heat accounted for about half of total world final energy consumption in 2014.

Small but growing modern renewable energy share of final global heat demand: **approx. 8%.**

Asia uses the largest amount of modern renewable energy in the heating sector overall, driven primarily by the amount of industrial bio-heat used in India and other Asian countries.

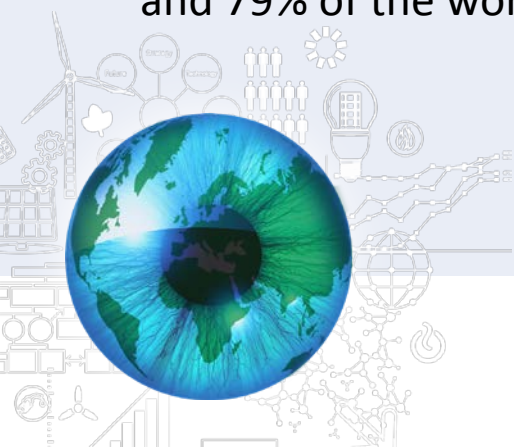


Transport

Renewable energy accounted for an estimated **3.5%** of global energy demand for road transport in 2013, up from **2%** in 2007.

Trends in the development of **gaseous fuels** and electricity continued to create pathways for the integration of renewables into transportation.

As of early 2015, China was home to 97% of the world's 235 million electric two wheelers and 79% of the world's 46,000 electric buses.



Hydropower - global capacity

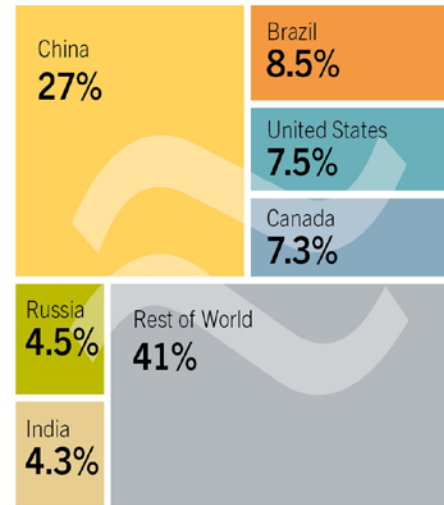
Total global hydropower capacity:
1,055 GW

37GW of new capacity were commissioned in 2014, presenting a **3.6%** increase (out of which 22 GW in China)

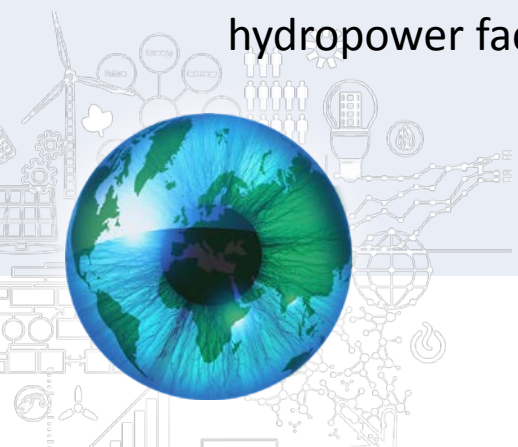
Steady industry growth, driven by:

- China's expansion
- modernisation of ageing hydropower facilities

Hydropower Global Capacity, Shares of Top Six Countries and Rest of World, 2014



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Solar Photovoltaics (PV) – total global capacity

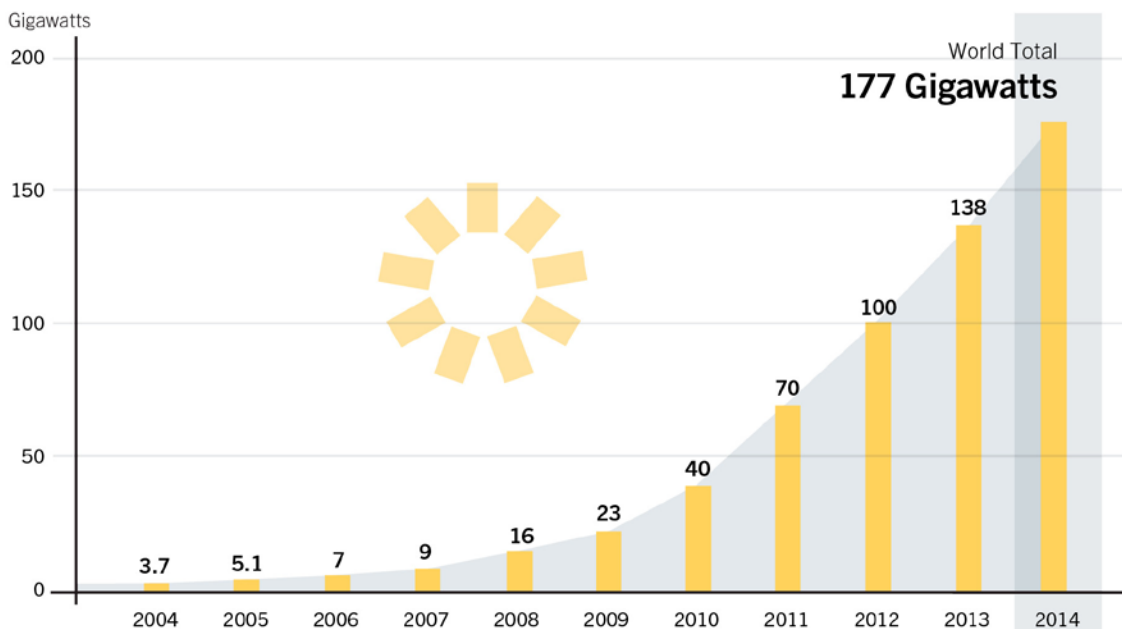
Solar PV:

- **+40 GW** added (10.6 GW in China)
- Total capacity: **177 GW**

More than 60% of all PV capacity in operation worldwide at the end of 2014 was **added over the past three years**.

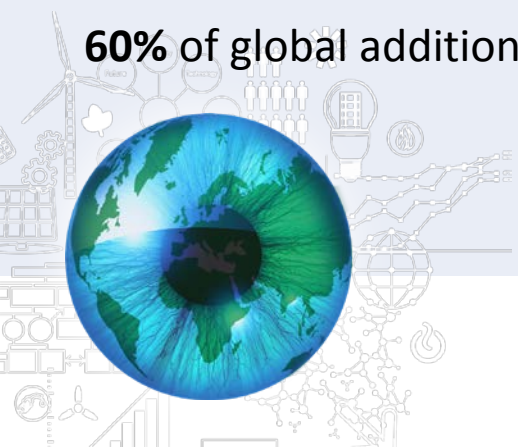
Asia accounted for almost **60% of global additions**.

Solar PV Global Capacity, 2004–2014



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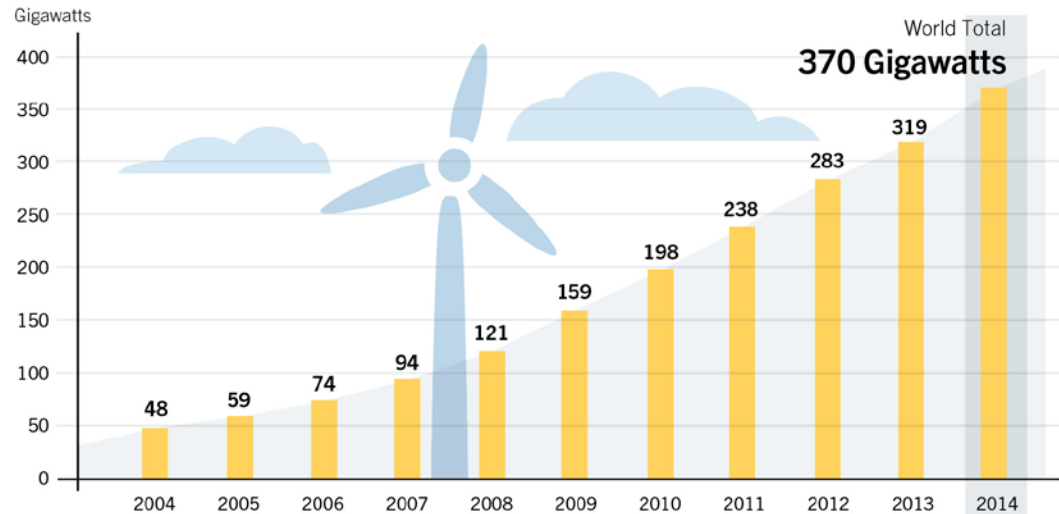
Wind Power – total world capacity

51 GW of capacity were added (out of which 23.2 GW in China)

Total capacity: **370 GW** (out of which 115 GW in China generating 2.8 % of China's total electricity consumption)

Offshore, an estimated **1.7 GW** of grid-connected capacity was added in 2014, for a world total exceeding **8.5 GW**

Wind Power Global Capacity, 2004–2014



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Concentrating Solar Power (CSP) – global capacity

Total CSP capacity: **4.4 GW**

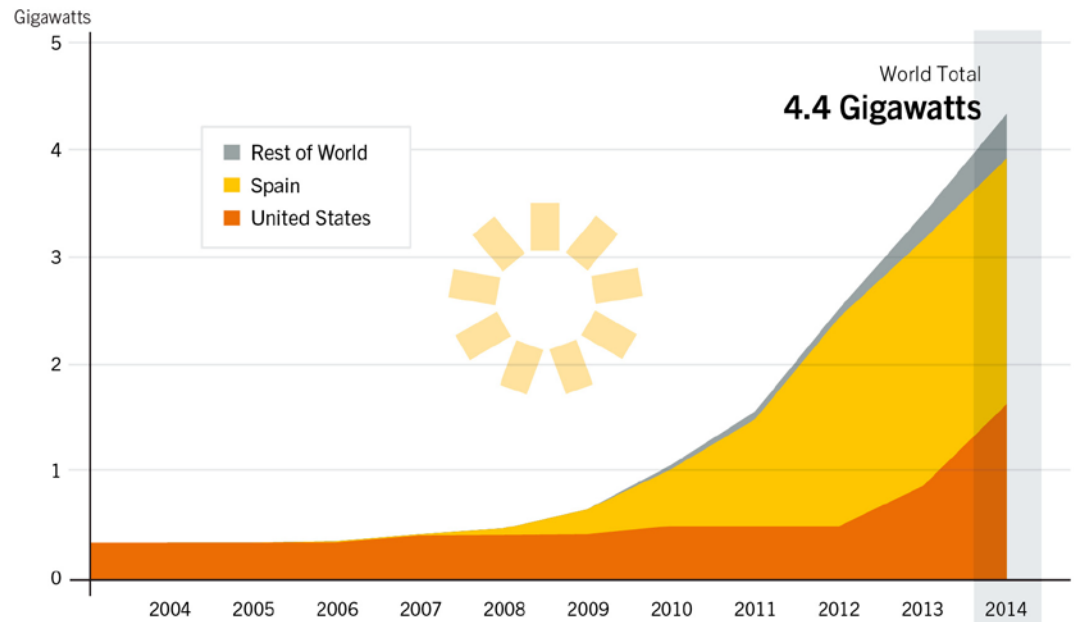
With **+0.9 GW** added, this represents an increase of **27%**.

Trends:

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

China started construction on its first commercial CSP project: the 50 MW Qinghai Delingha plant

Concentrating Solar Thermal Power Global Capacity, by Country or Region, 2004–2014



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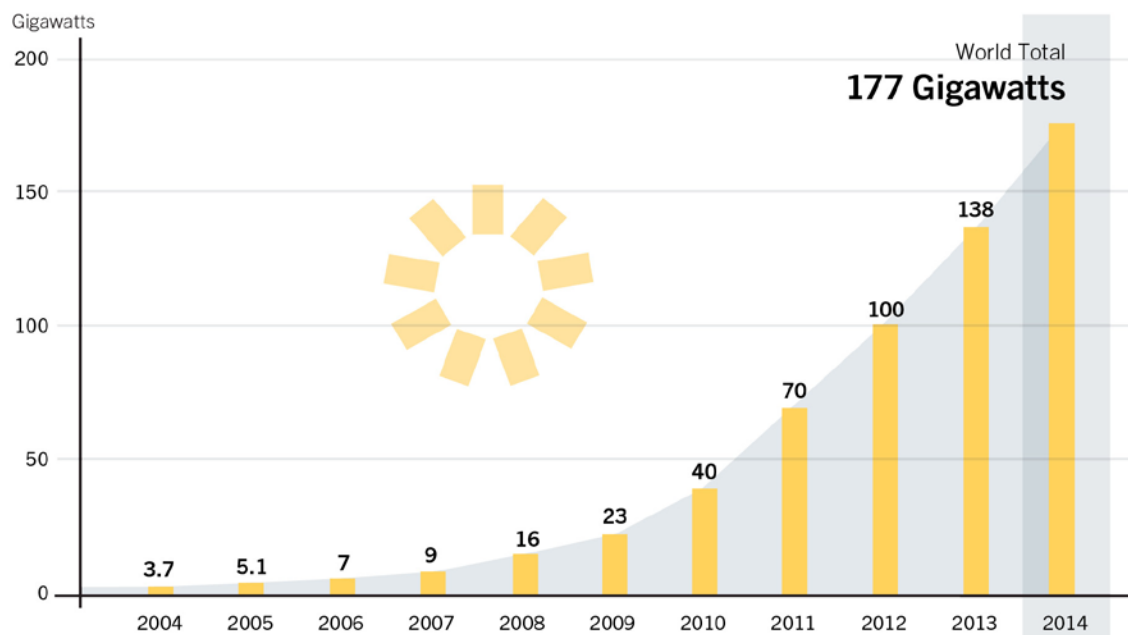
Solar Thermal Heating & Cooling

Cumulative capacity of all collector types in operation rose by a net **44 GWth** for a year-end total of **374.7 GWth**

China again accounted for about 80% of the world market for solar water collectors.

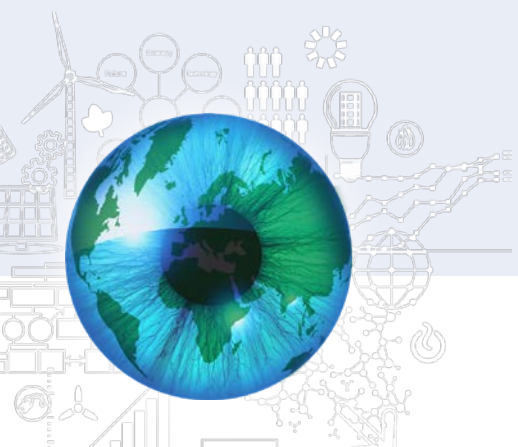
The slowdown in market growth continued in 2014.

Solar PV Global Capacity, 2004–2014



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Jobs in Renewable Energy

Global employment continued to increase

An estimated **7.7 million** direct or indirect jobs in the renewable energy industry

Solar PV: 2.5 million jobs, global wind 1 million jobs in 2014

Jobs in Renewable Energy, 2014



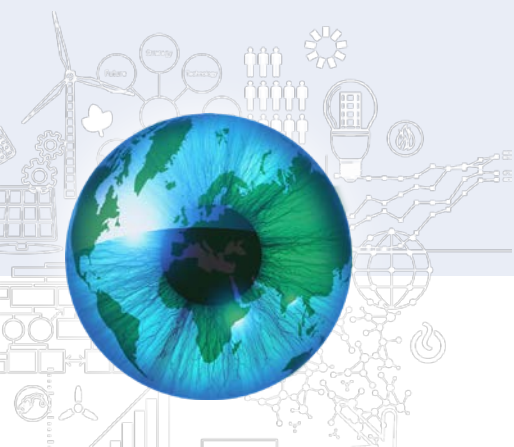
i - Employment information for large-scale hydropower not included.

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Source: IRENA

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Global Investment in Renewable Energy

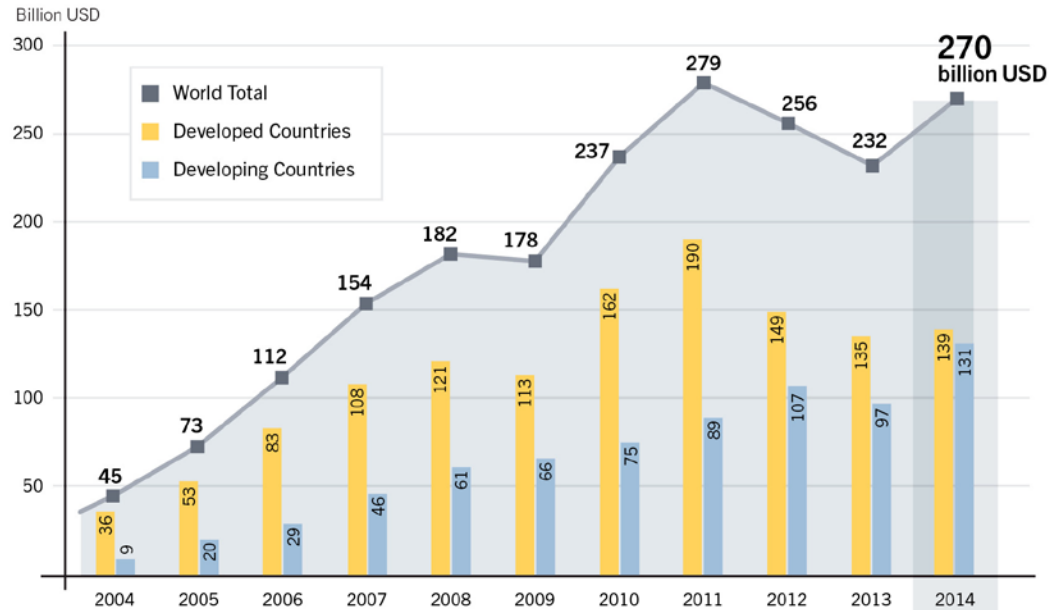
Global new investment estimated **USD 270.2 billion in 2014**

(including hydropower USD 301 billion)

Reasons for the increase:

- Increase in solar power installations in China and Japan
- Investment in solar power up **25%**
- Record investment in offshore wind projects in Europe

Global New Investment in Renewable Power and Fuels, Developed and Developing Countries, 2004–2014



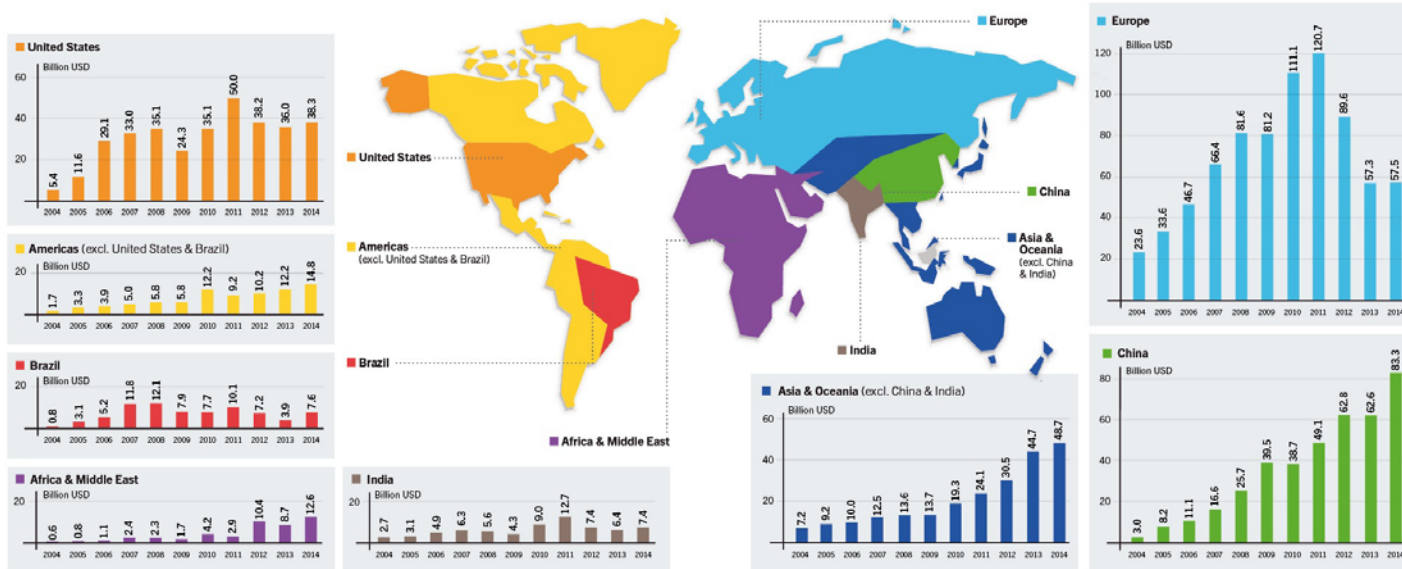
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Source: Frankfurt School–UNEP and BNEF



Global New Investment in Renewable Power and Fuels, by Region, 2004–2014



Data include government and corporate R&D.

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Source: Frankfurt School–UNEP and BNEF

Developed Countries: Annual investment in 2014: **USD 138.9 billion**
(increase of 3 % compared to 2013)

Developing Countries: annual investment in 2014: **USD 131.3 billion**
(increase of 36% compared to 2013)

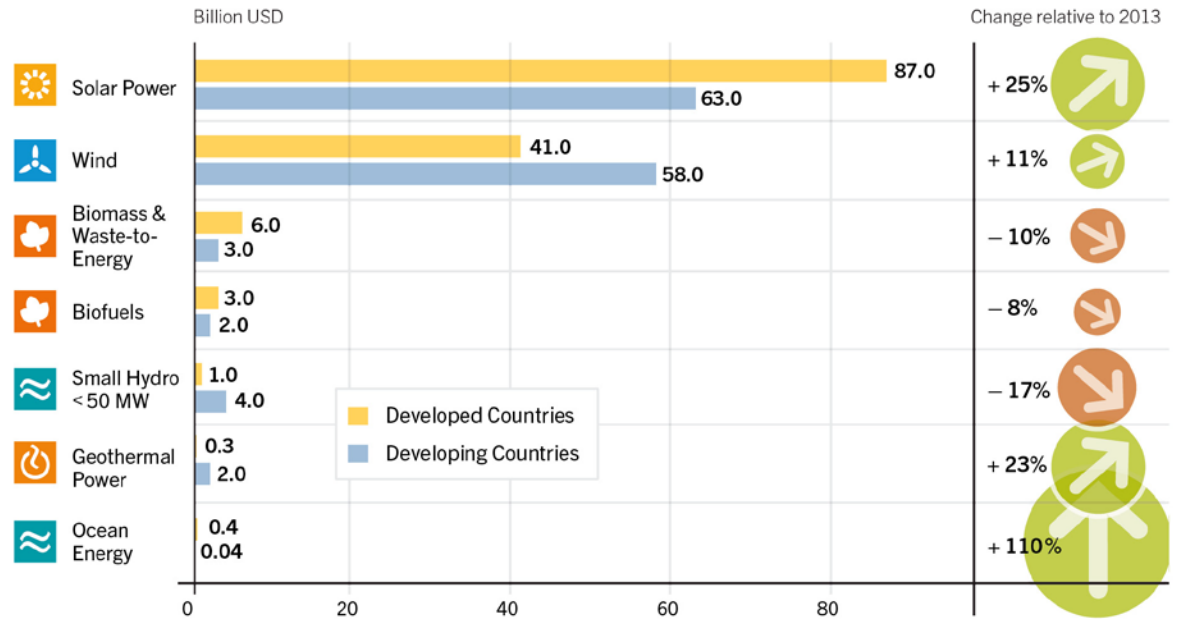


Global Investment in Renewable Energy by Technology

Solar power - leading sector for money committed during 2014, receiving more than **55%** (USD 149.6 billion) of total new investment in renewable power and fuels

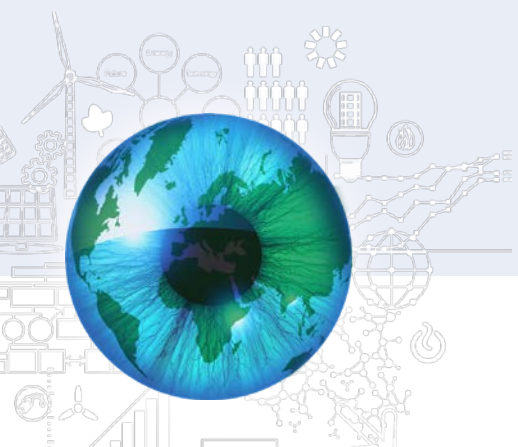
Wind power followed with **USD 99.5 billion**

Global New Investment in Renewable Energy by Technology, Developed and Developing Countries, 2014



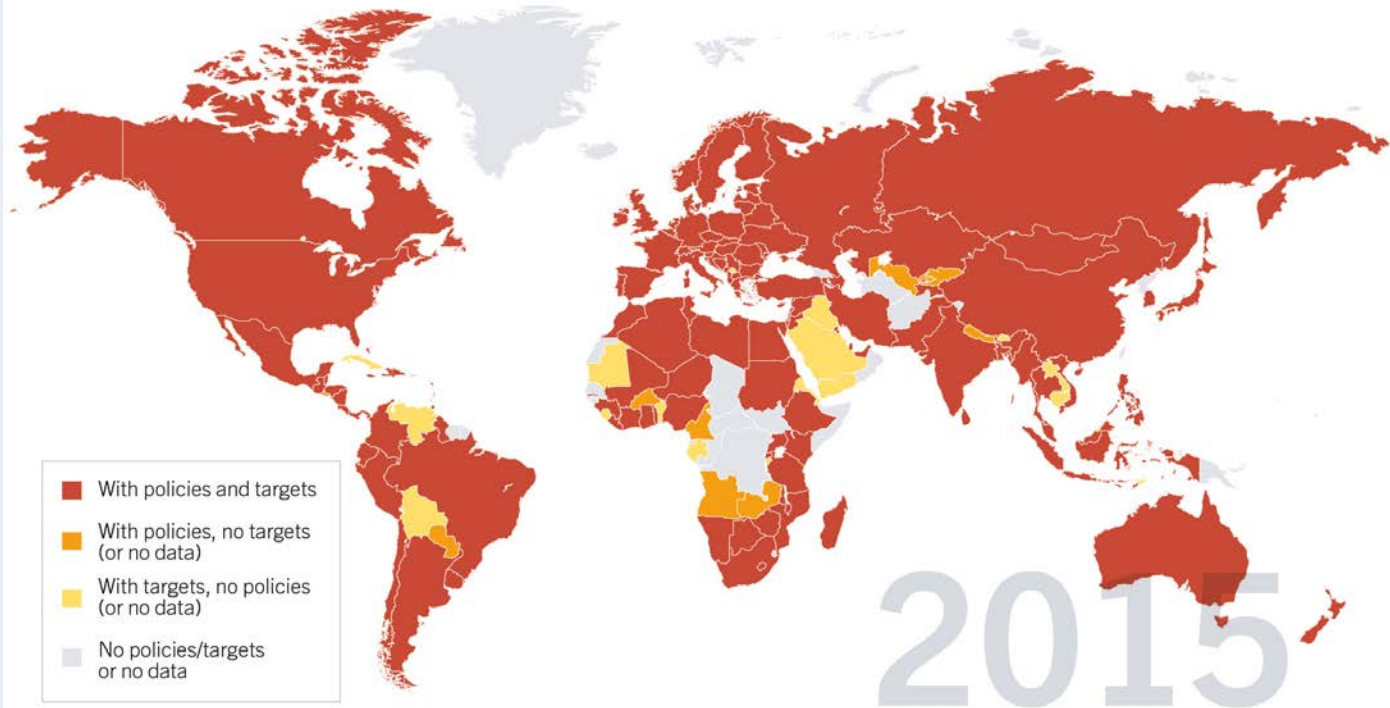
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Source: Frankfurt School-UNEP and BNEF



Renewable Energy Policy Landscape

Countries with Renewable Energy Policies and Targets, Early 2015



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

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Renewable Energy Policy Landscape

		START 2004 ¹	2013	2014
POLICIES				
Countries with policy targets	#	48	144	164
States/provinces/countries with feed-in policies	#	34	106	108
States/provinces/countries with RPS/quota policies	#	11	99	99
Countries with tendering/ public competitive bidding ⁵	#	n/a	55	60
Countries with heat obligation/mandate	#	n/a	19	21
States/provinces/countries with biofuels mandates ⁶	#	10	63	64

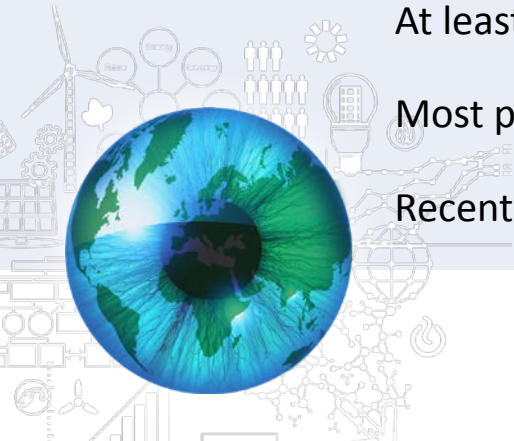
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At least **164 countries** had **renewable energy targets**.

At least **145 countries** had **renewable energy policies** in place.

Most policies focus on power: mainly feed-in-tariffs and renewable portfolio standards.

Recent trends: Merging of components from different policy mechanisms.



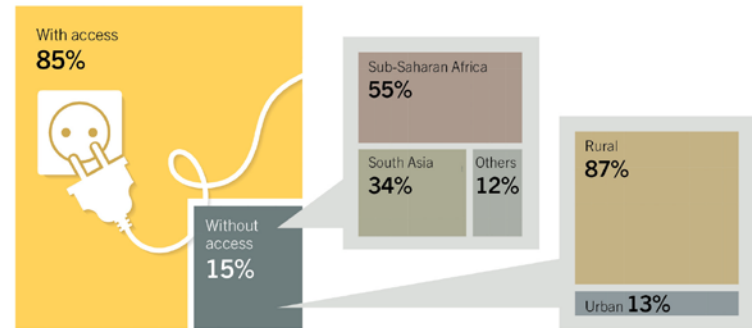
Distributed Renewable Energy in Developing Countries

15% of the global population still lack electricity access

In developing Asia, the share of population with access is 83% and the number of people without access to electricity in 2012 was 620 million.

Little quantitative information on DRE markets, but information available indicates that **markets are significant**, e.g. **off-grid solar PV** attracted approx. **USD 64 billion of investment in 2014**.

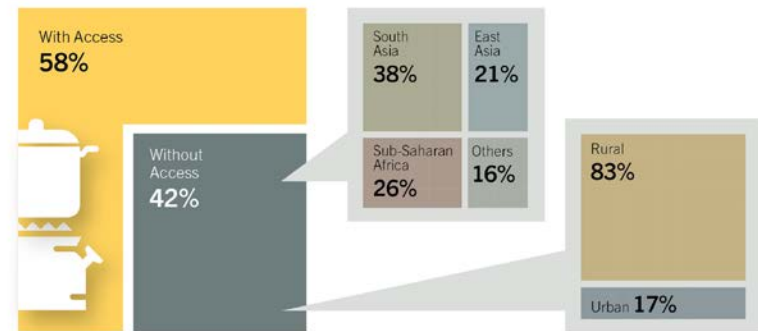
World Electricity Access and Lack of Access by Region, 2012



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World Clean Cooking Access and Lack of Access by Region, 2012



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The future of renewable energy – what is in the cards?



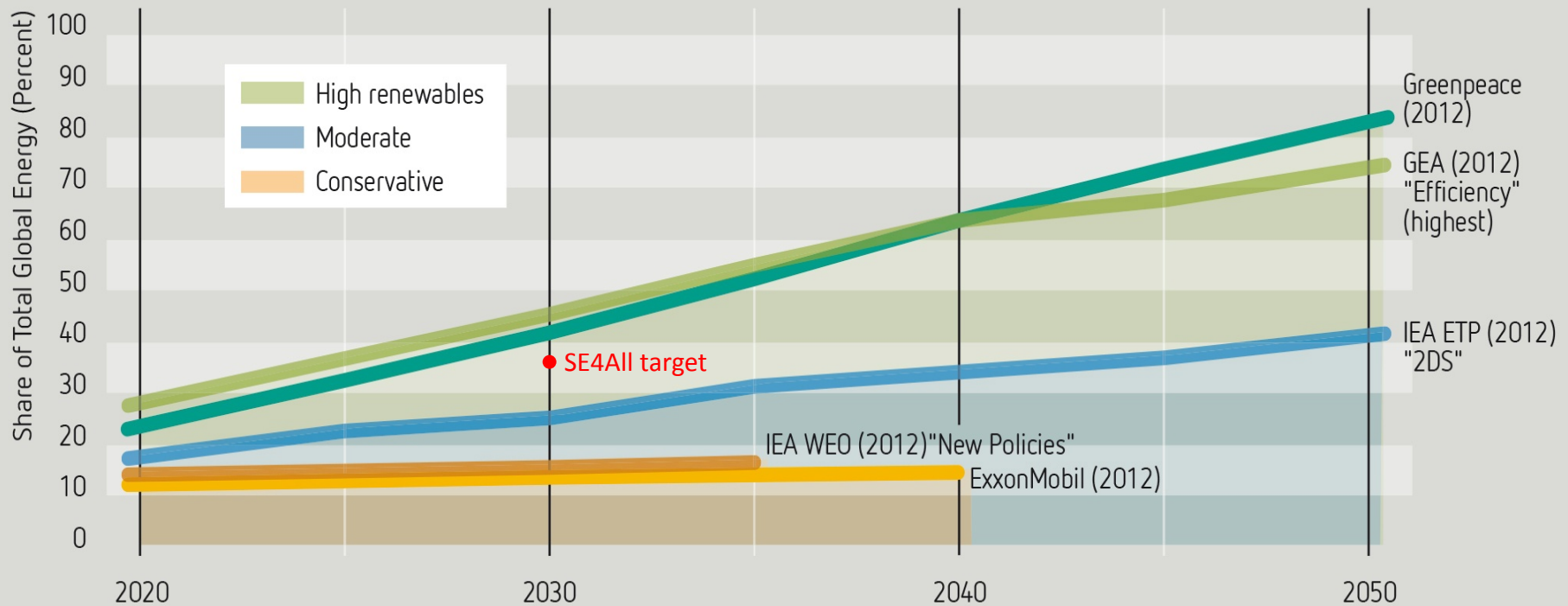
“The future of renewable energy is fundamentally a choice, not a foregone conclusion given technology and economic trends.”



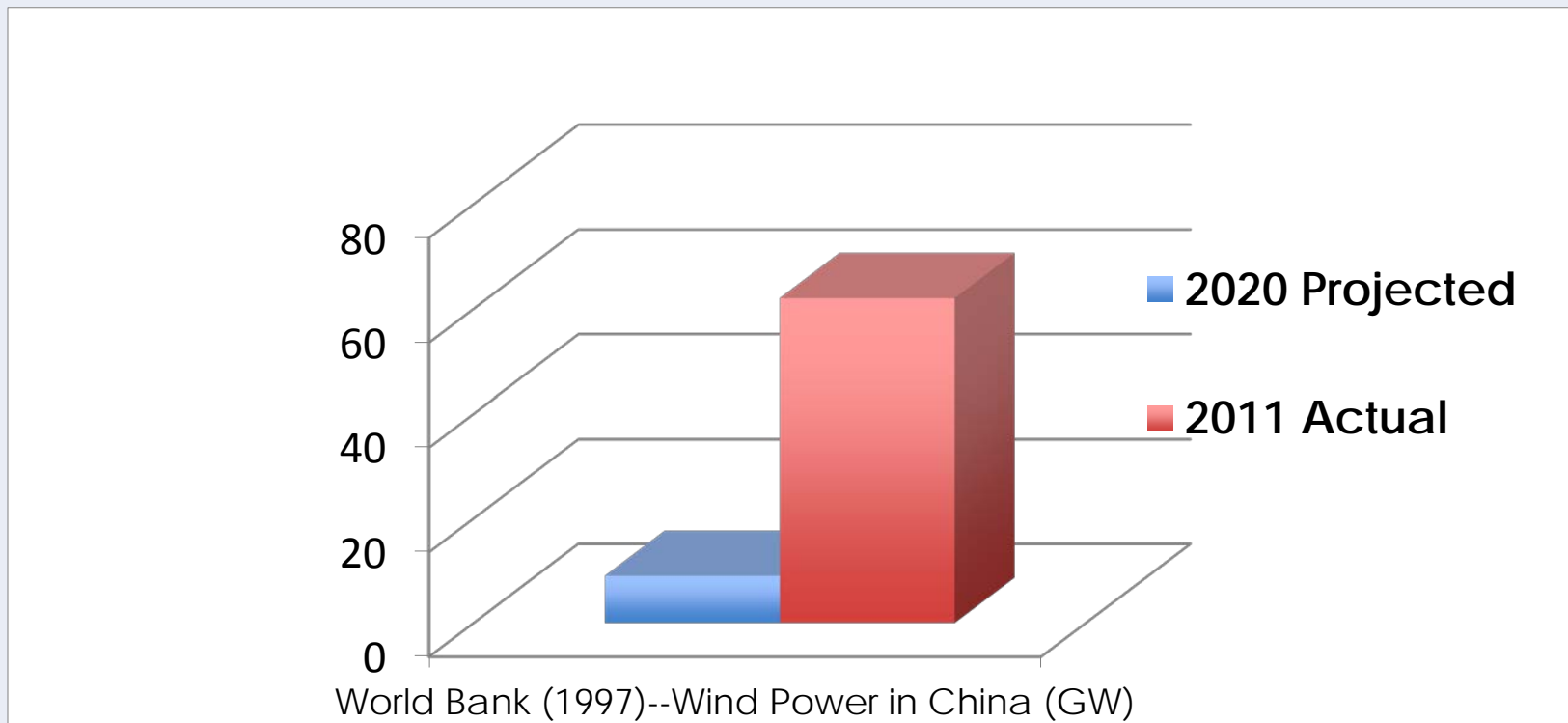
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Future outlook – what is in the cards?

Figure 1: Conservative, Moderate, and High-Renewables Scenarios to 2050



Historic Projections Fall Short...



In 1997, the World Bank predicted about 6 GW of wind in China for 2020, nearly ten times of this amount was reached nearly a decade earlier with close to 60 GW installed wind capacity in China in 2011.



Global Renewable Power Capacity by 2030

Table 4: Global Renewable Power Capacity by 2030 in Recent Scenarios

	Hydro	Wind	Solar PV	CSP	Biomass	Geothermal	Ocean
	GW						
Actual 2006 Capacity for Comparison	–	74	8	0.4	45	9.5	0.3
Actual 2011 Capacity for Comparison	970	238	70	1.8	72	11	0.5
IEA WEO (2012) "New Policies"	1,580	920	490	40	210	40	10
IEA WEO (2012) "450"	1,740	1,340	720	110	260	50	10
IEA ETP (2012) "2DS"	1,640	1,400	700	140	340	50	20
BNEF GREMO (2011)	—	1,350	1,200	—	260	30	—
IEA RETD (2010) "ACES"	1,300	2,700	1,000	120	340	—	—
Greenpeace (2012)	1,350	2,900	1,750	700	60	170	180

Sources: See Annex 2. Actual 2006 and 2011 from REN21 (2008, 2012).

Notes: CSP stands for solar thermal power. Figures for 2030 are rounded to nearest 10 GW or 50 GW from original sources. Hydropower figure for 2011 excludes pure pumped hydro capacity; a comparable figure for 2006 is not available, see REN21 (2012), notes to Table R2, and note on hydropower on page 168.



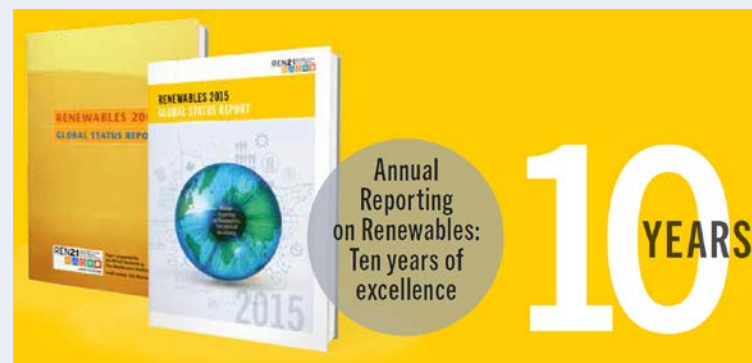
Conclusions

Renewable energy continued to grow in 2014 against the backdrop of increasing global energy consumption, and a dramatic decline in oil prices during the second half of the year.

For the first time in 40 years, economic and CO₂ growth has “decoupled” – marking a record year for renewables.

The past decade has set the wheels in motion for a global transition to renewables, but a concerted and sustained effort is needed to achieve it:

- Long-term and stable policy frameworks, which can adapt to changing environment, to sustain and increase investment levels
- Greater attention to the heating and cooling and the transport sector and “energy system thinking”
- Improve information on distributed renewable energy markets in developing countries and improve access to up-front finance



RENEWABLE ENERGY POLICY NETWORK FOR THE 21st CENTURY



*Global Status Report:
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