

Renewables and Energy Efficiency: Prospects and Challenges after COP21

Plenary Session 3

Introduction

Context

- **COP 21 in Paris concluded with the most ambitious climate deal since the Kyoto Protocol was signed in 1997 and showed strong commitment to clean energy & innovation**
- **Majority of large emitting countries have set clear policies and plans to meet their climate pledges (i.e. INDCs - Intended National Determined Contributions)**
- **Renewables and Energy Efficiency are the main measures mentioned in the pledges to reduce GHG emissions**

Session objectives

- **To exchange perspectives on the future of renewables and energy efficiency, including the technologies and measures to support it**
- **To explore the impact of renewables and energy efficiency on the energy industry**
- **To discuss how the industry will adapt its investment strategy and what government policies are required to support it**

Key Question:

What role will renewables and energy efficiency play following COP21?

Agenda

Key observations on:

Where do renewables stand?

What are the most promising renewable technologies?

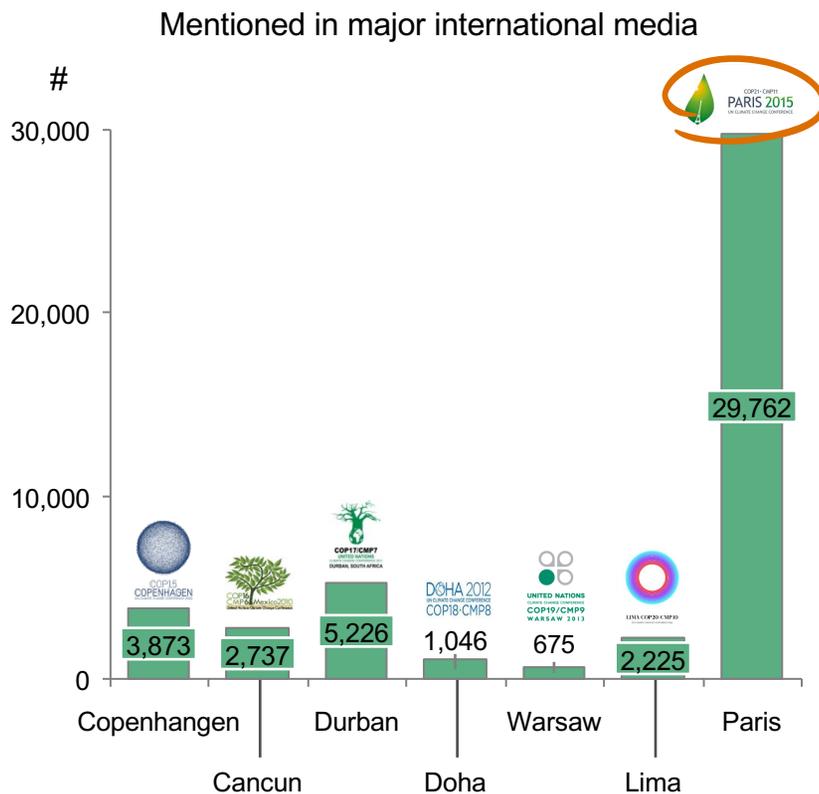
Where does energy efficiency stand?

What is the future of energy efficiency?

Key questions and discussion

COP 21 meeting represented a step forward in climate change

COP 21 received high media coverage...



... as well as crucially engaged multiple actors

- | | |
|---|---|
| For governments | <ul style="list-style-type: none"> The Paris Agreement has legal force (although not all parts are binding) Other bilateral financial agreements were also made during the Conference, including pledges to the Green Climate Fund, the Least Developed Countries Fund and others |
| For investors & companies | <ul style="list-style-type: none"> Long-term and more stable framework for investors: having reached a common agreement already provides a clear signal that the transition to a low-carbon economy is underway |
| For NGOs and civil society | <ul style="list-style-type: none"> Mention of a 1.5°C goal has been unexpected There were also mentions of food security, humanitarian concerns and "ratcheting up" |
| <p>The voice of non-state actors is functioning strongly:</p> <ul style="list-style-type: none"> The UN's non-state actor portal listed well over 10,000 climate commitments from over 2,200 cities; 150 regions; 2,000 companies; over 400 investors and over 200 civil society organizations during COP21 meeting | |

Source: Factiva, BCG Research

COP 21 in Paris concluded with the most ambitious climate deal since the Kyoto Protocol was signed in 1997

COP 21 negotiators from nearly 200 countries signed on to a legal agreement that set ambitious goals to limit temperature rises and hold governments to account for reaching those targets

Legally binding

Transparency and accountability: Submitting an emissions reduction target and regularly reviewing that goal

- Each Party shall prepare, communicate and maintain successive nationally determined contributions (INDC¹) that it intends to achieve
- Each Party shall communicate a nationally determined contribution every five years

Climate finance: Legal obligation on developed countries to continue to provide climate finance to developing countries

- Details about the mechanism have been moved out of the legally binding agreement

Non binding

Emissions reduction: Country's pledges to curb emissions

- INDCs¹ are voluntary ('nationally determined'), non-binding ('intended'), country-by-country goals for emission reductions ('contributions').
- No formal enforcement mechanism for national targets

Financing mechanism

- Countries should agree a "new collective quantified goal" from the floor of \$100bn per year

1. Intended National Determined Contributions
Source: BCG Research

Key observations

COP21 meeting is a step forward in climate change with the most ambitious target since Kyoto Protocol

Strong commitment worldwide to clear energy and innovation: Governments, Companies, Investors, Civil society and NGOs

- Majority of large emitting countries have set clear policies and plans to meet their climate pledges (i.e. INDCs - Intended National Determined Contributions)
- Private investment firms have announced climate-related investment drivers. (e.g. Allianz, BlackRock etc.)
- Mission Innovation was launched to reinvigorate and accelerate public and private global clean energy innovation with the objective to make clean energy widely affordable (COP21 Conference, December 2015) through (1) doubling governmental investment in clean energy innovation, private sector and business leadership and information sharing

However, current emissions reduction pledges still shy of goal of limiting temperature increases to 2 degrees

- Based on Paris pledges, 2.7°C of warming projected by 2100 (note: If countries do not act, 4.5°C of warming projected by 2100; following current policies, 3.6°C of warming projected by 2100)
- This could mean an estimated emissions gap of ~13GtCO₂ in 2025

Two main technologies to face this climate challenge

- Renewables: Wind and solar power playing a key role with more than 80% of the market
- Energy efficiency: New business models and entrants will compete with traditional utilities

Government support to Renewables and Energy Efficiency is increasing

- IEA Governments expenditure in Energy R&D increased by 74% from 2000 to 2011

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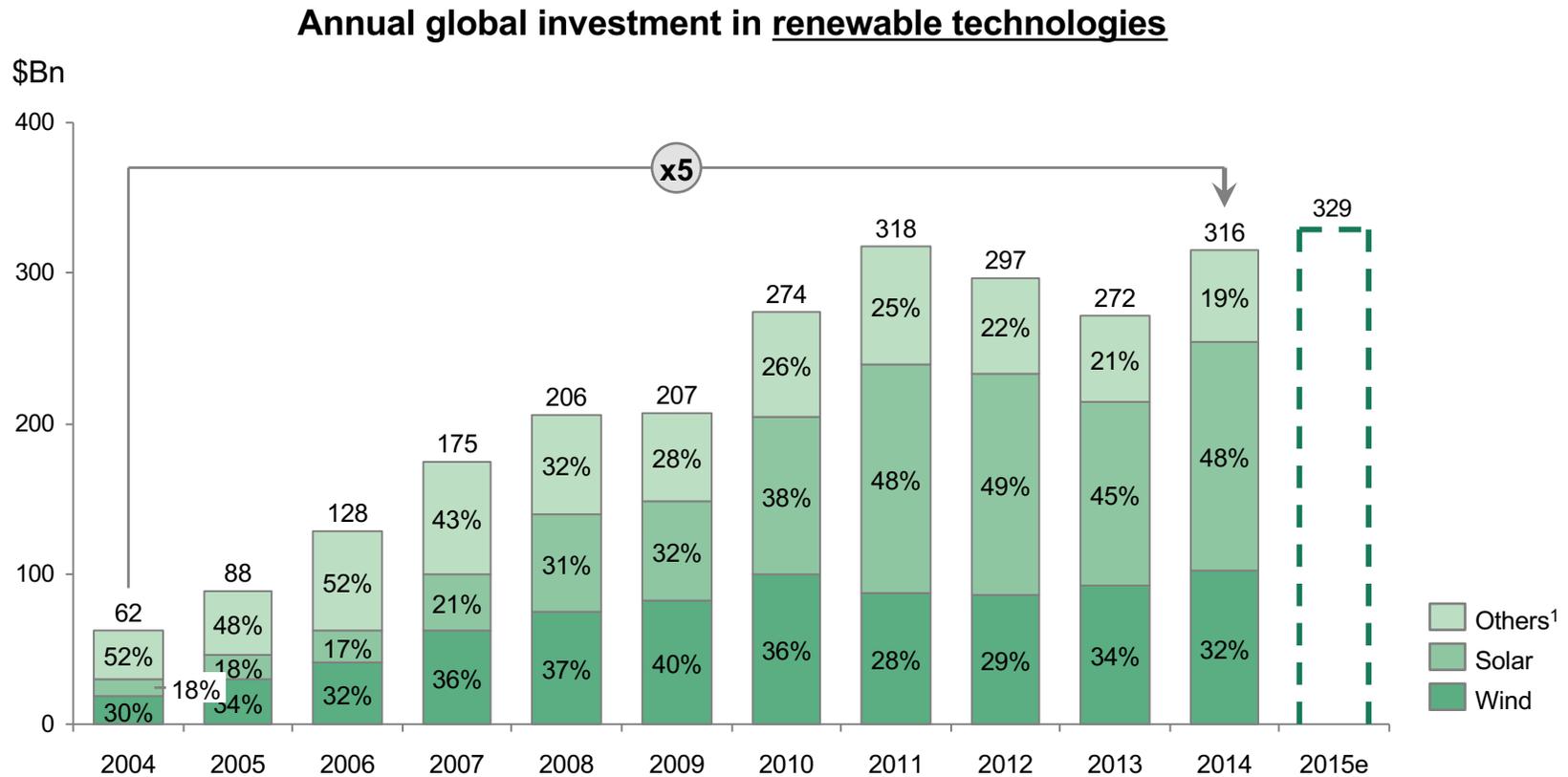
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\$300Bn Investments in Renewable Technologies per year

Solar photovoltaic and Wind make up ~80% of the total investment

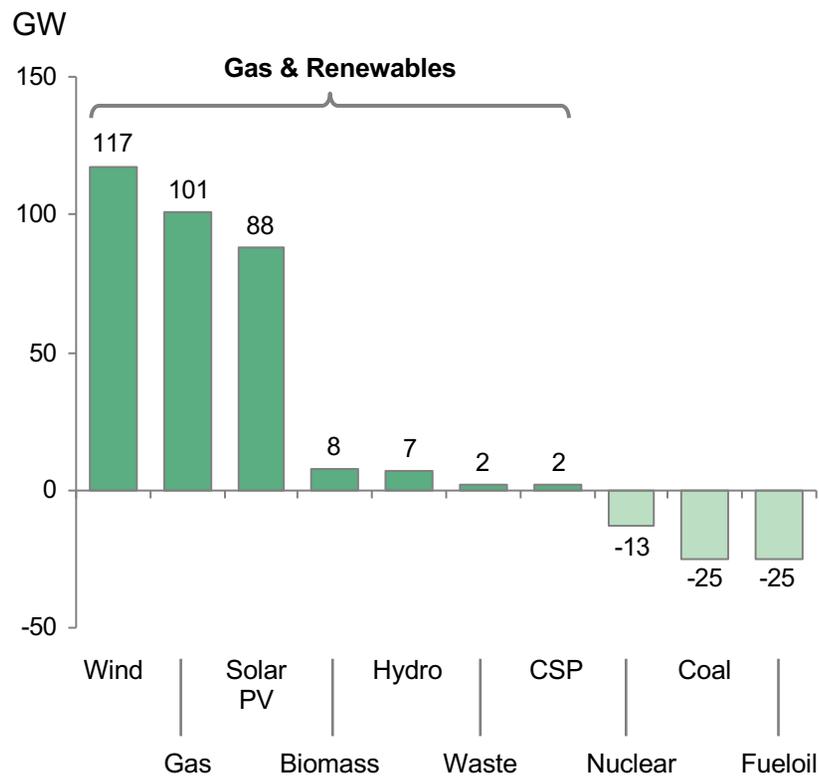


1. Other renewables, smart grids, etc.
Source: Bloomberg: New Energy Finance, 2016

Technological change in power generation toward renewables has shown strong progress in recent years

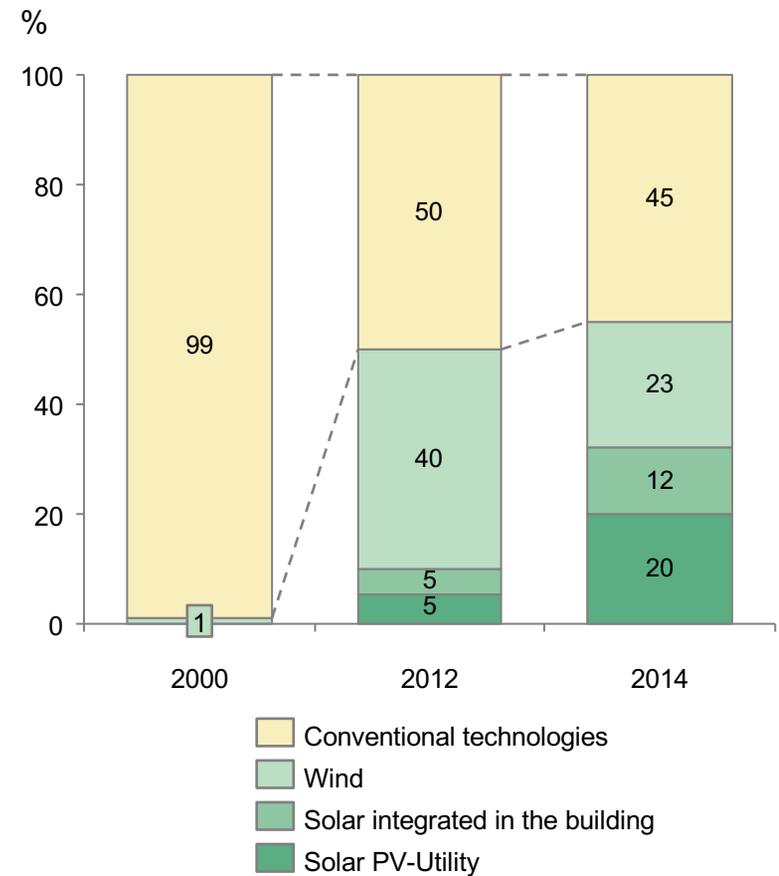
EU-27

Change in generation mix 2000-14



USA

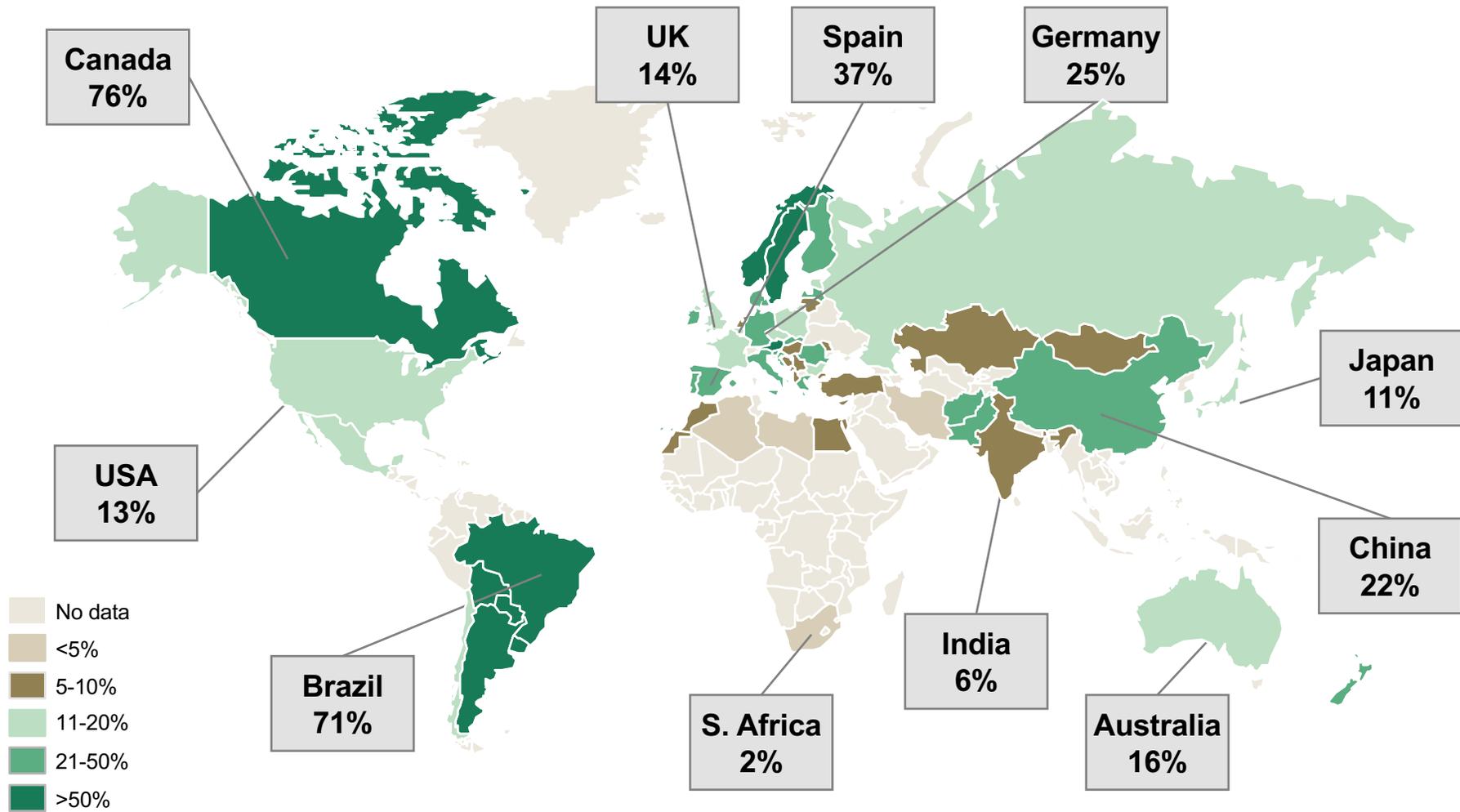
New installed capacity 2012-14



Source: EWEA, EIA (DOE, US), BCG analysis

The weight of renewable energies is becoming increasingly relevant around the world

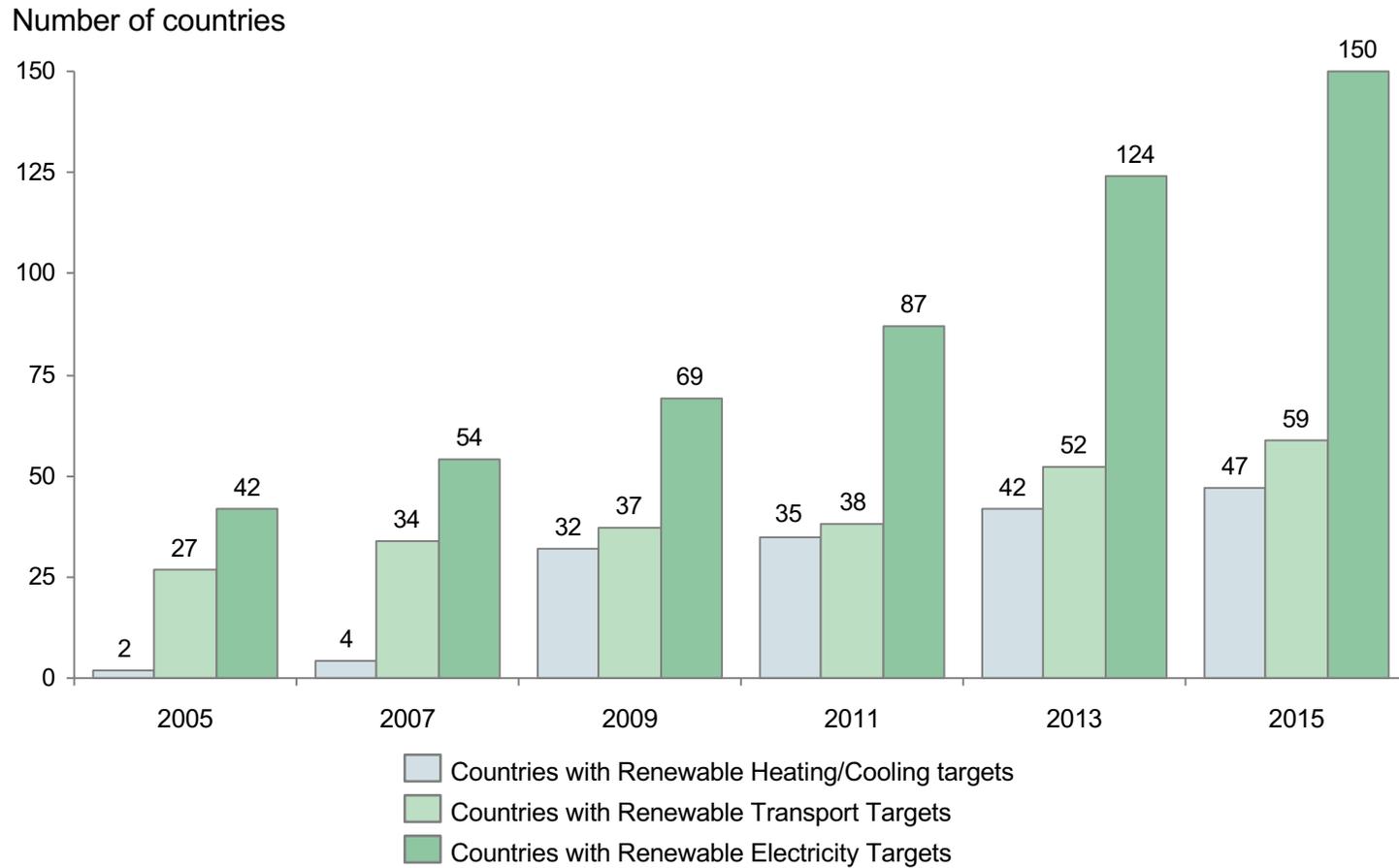
Renewable electricity production out of the total in 2013 (%)



Note: Includes hydroelectric energy
Source: IEA, Bloomberg New Energy Finance. Eurostat

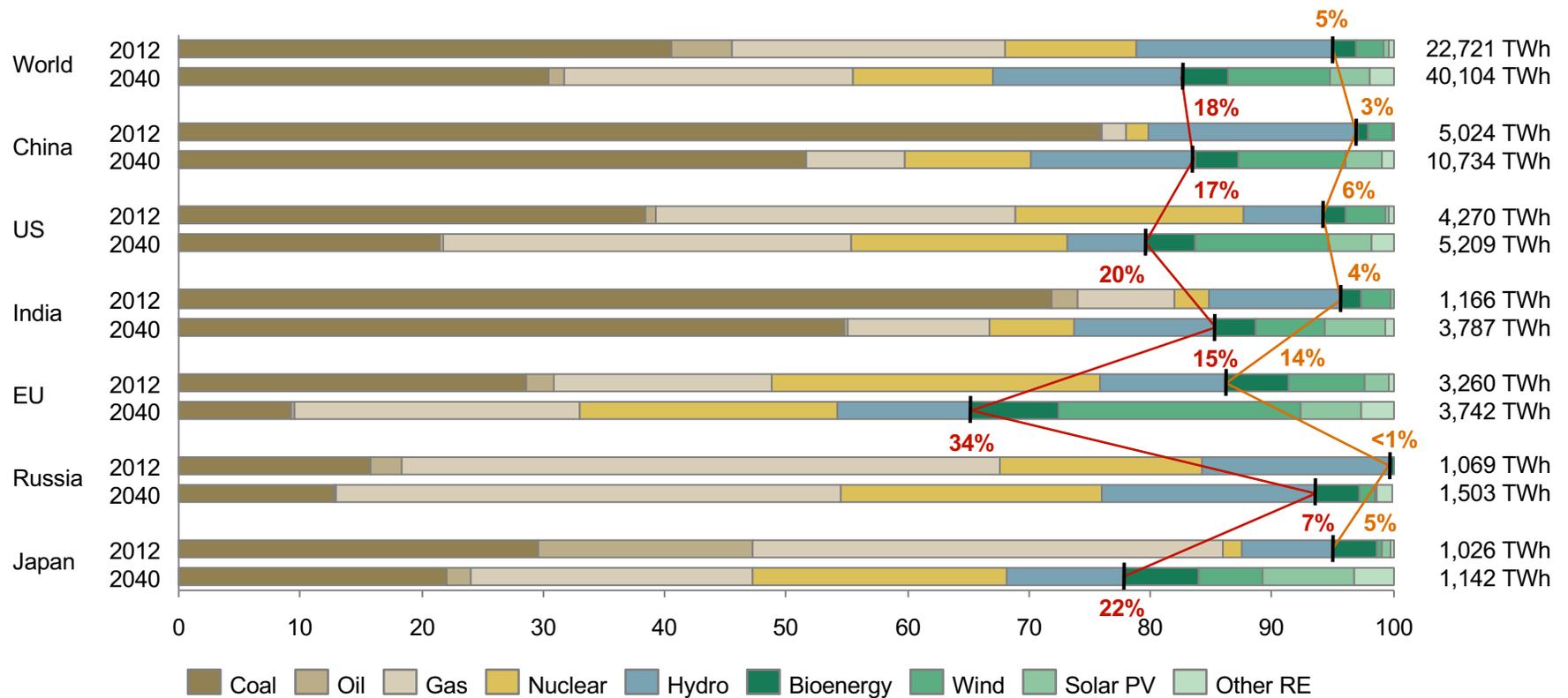
~150 countries have renewables generation targets

Number of countries with renewable regulation



Source: IRENA

Renewables predicted to increase share in global energy mix from 5% in 2012 to 18% in 2040



1. Geothermal, CSP, Marine
 Source: IEA (2015) World Energy Outlook (IEA New Policies Scenario), BCG analysis

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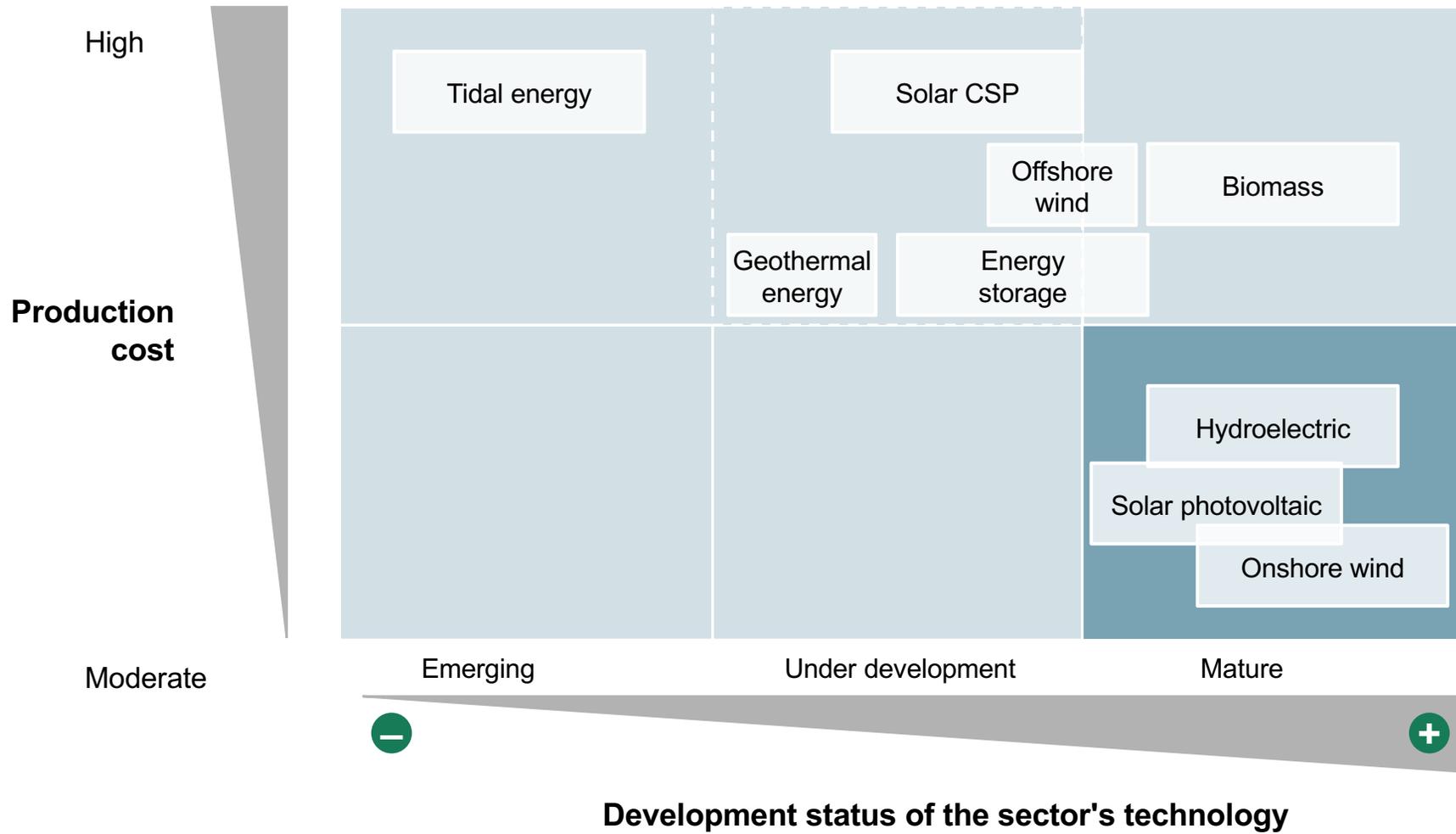
What are the most promising renewable technologies?

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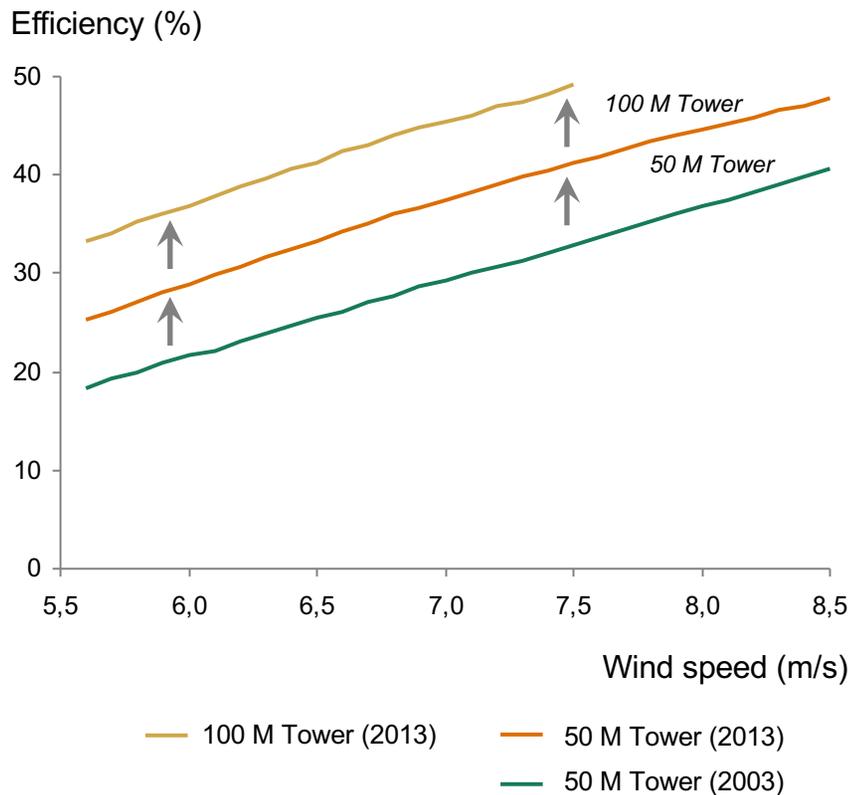
Key questions and discussion

Onshore Wind and Solar Photovoltaic are the most competitive renewable technologies

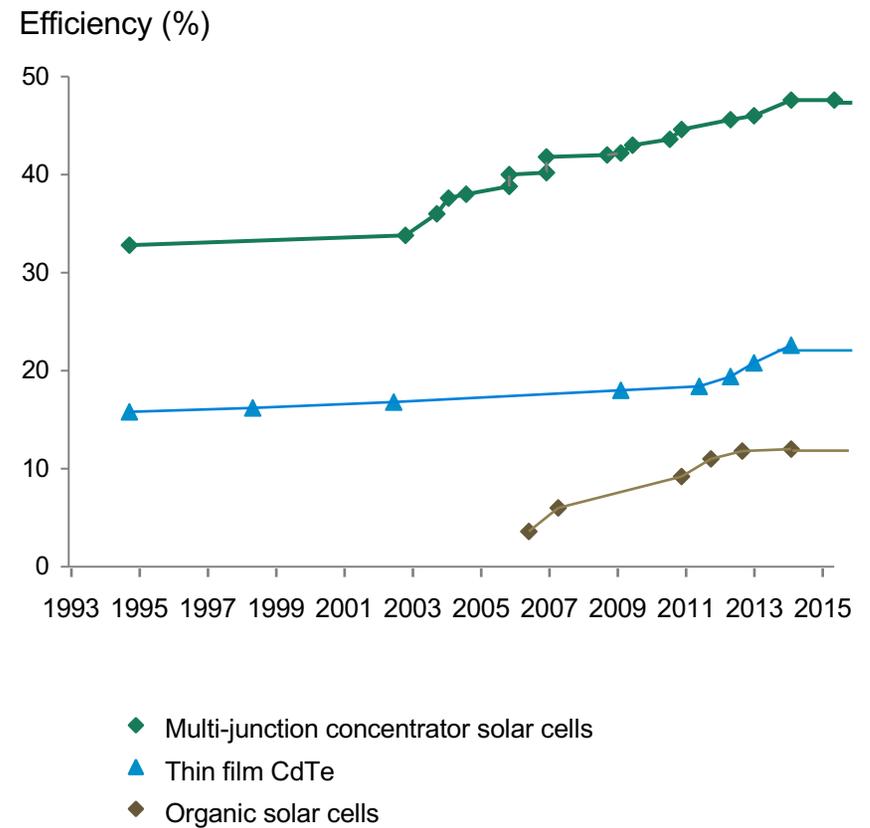


Innovation is driving efficiency and cost reduction in wind and solar technologies

Increasing capacity factors in wind



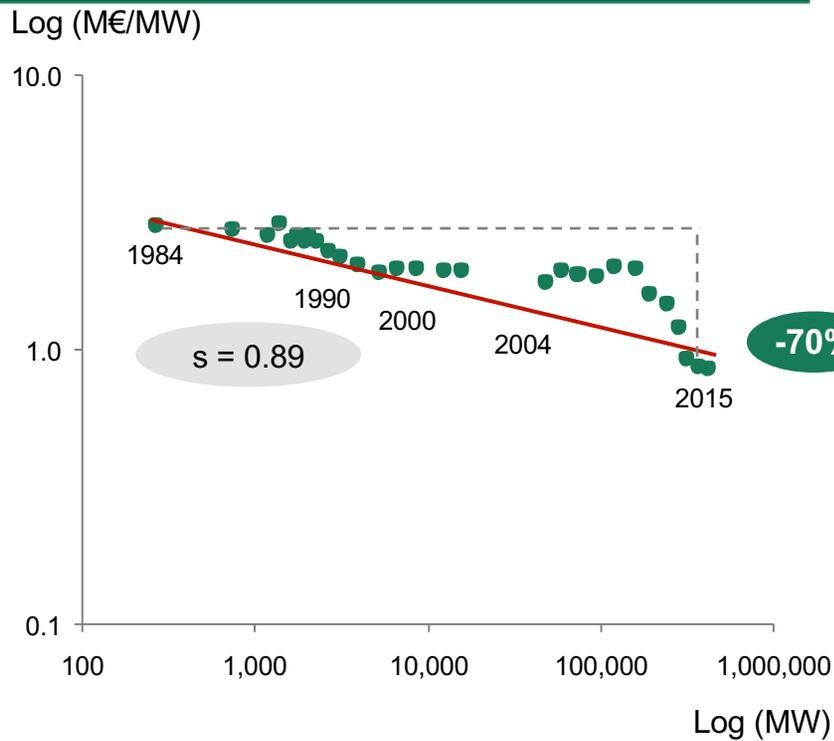
Improving solar PV cell efficiencies



Source: IBA, Fraunhofer

Wind and solar costs are moving down the experience curve

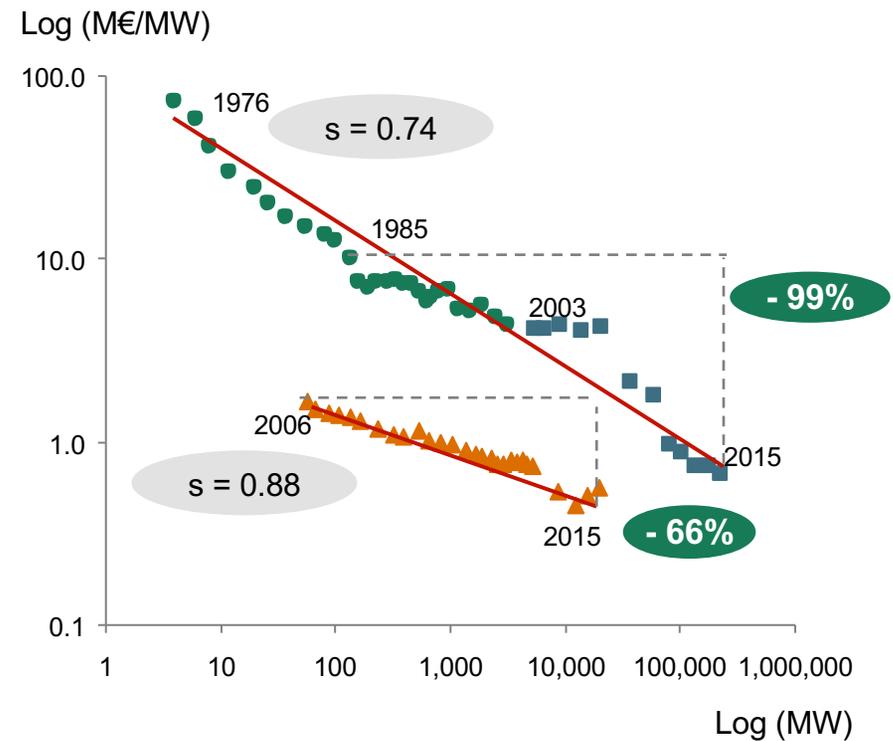
Wind turbine price index,
1984–2015



● Historic prices — Experience curve

s= price index as cumulative volume doubles¹

The Solar PV module experience curve,
1976–2015



● Historic prices

■ Chinese c-Si module prices

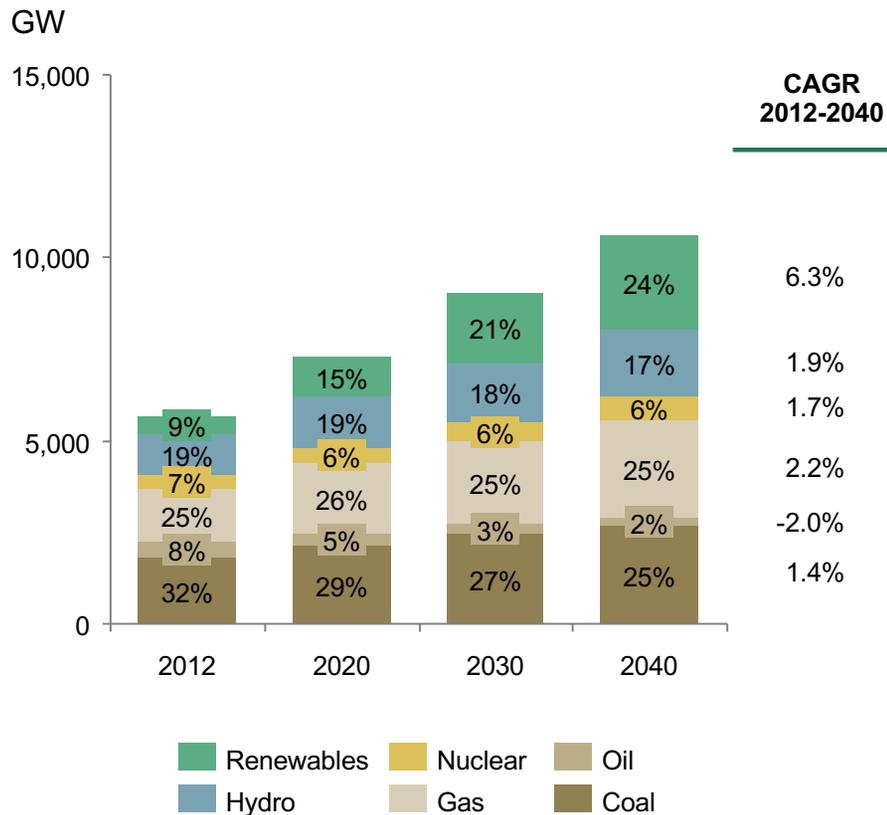
▲ Thin-Film module price

— Experience curve

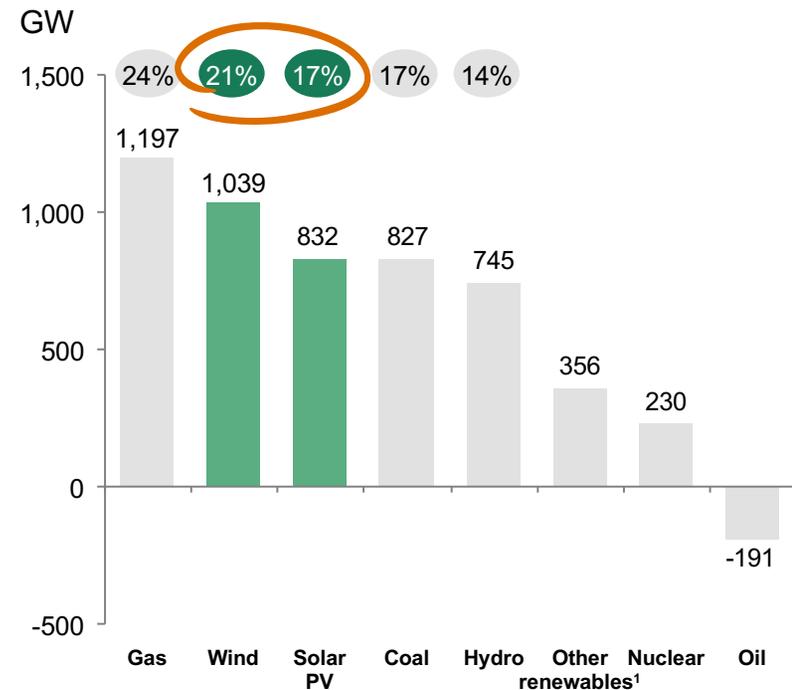
1. S: price index as cumulative volume doubles; S= 0.95 means as cumulative volume doubles, price drops to 95% of before
Source: Bloomberg new energy finance; Lawrence Berkeley laboratory

Wind and solar photovoltaic could account for 40% of capacity additions from 2012 to 2040

Worldwide installed power generation capacity 2012-2040



Net capacity additions 2012-2040



1. Bioenergy, Geothermal, CSP, Marine
Source: IEA (2015) World Energy Outlook (IEA New Policies Scenario), BCG analysis

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6 key technologies to improve Energy Efficiency



1 Heating
(e.g. CHP)



2 Lighting
(e.g. LED)



3 Ventilation
& cooling



4 Industrial
processes
(e.g. heat recovery)

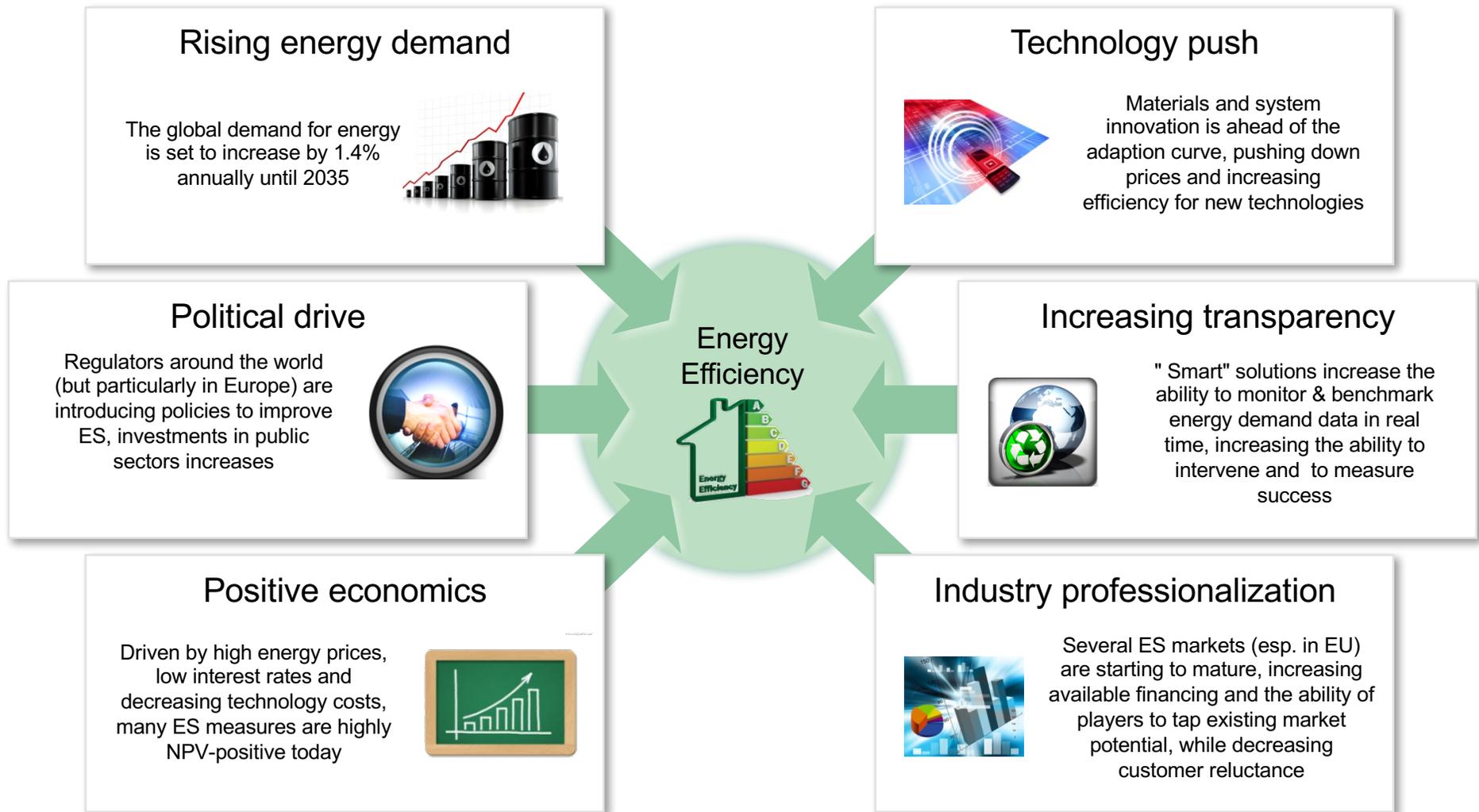


5 Refrigeration



6 Other
(e.g. energy
management)

Strong drivers push the energy efficiency opportunity globally



Governments around the world are including Energy Efficiency within regulation

Energy efficiency related goals



- Increase 20% energy efficiency in 2020 vs. business as usual scenario
- Increase 30% energy efficiency in 2030 vs. business as usual scenario



- Doubling energy productivity by 2030



- 17% savings in electricity supply by 2030



- 15% improvement in energy efficiency by 2020



- 10% increase in energy efficiency by 2030

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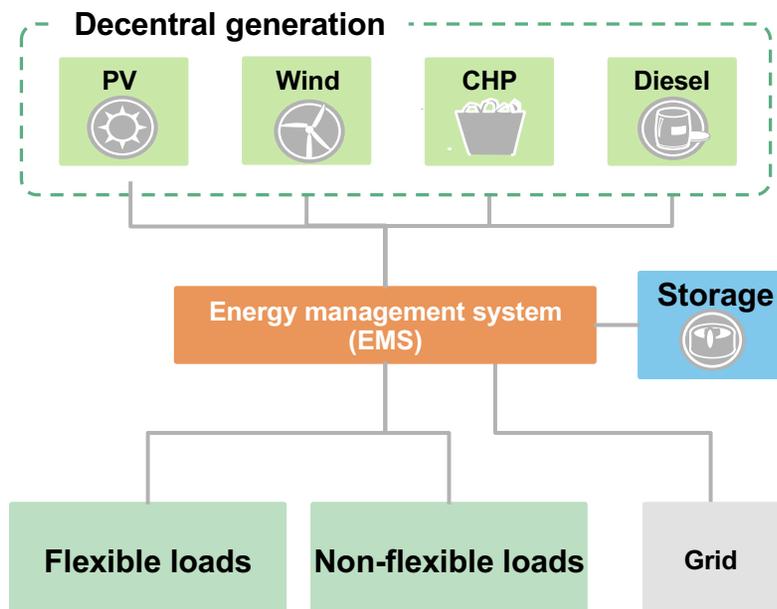
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"Integrated decentralized solutions" are the next step

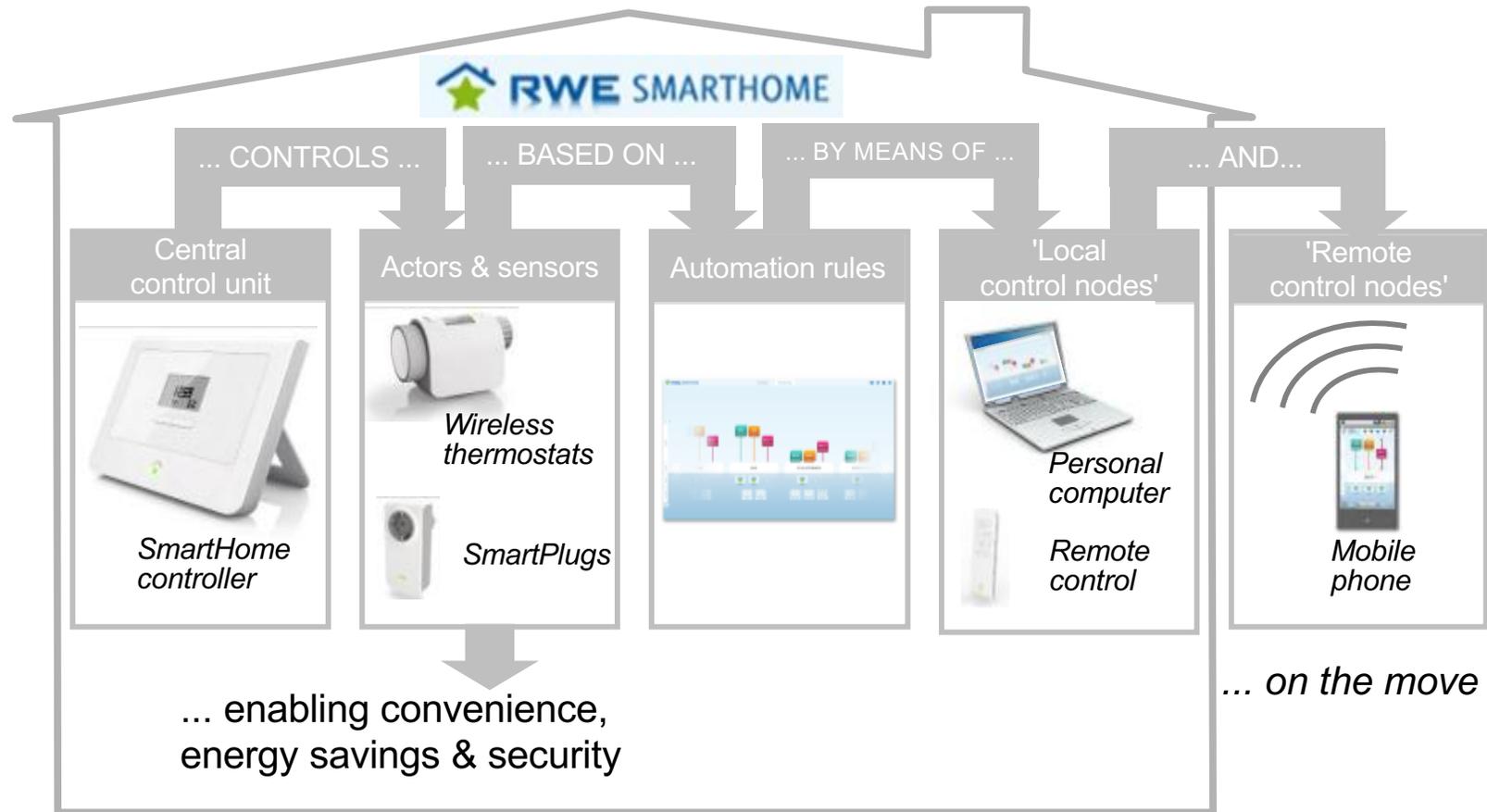
Decentralized technologies consist of generation, storage, and load ...



... and can be applied across various customer segments

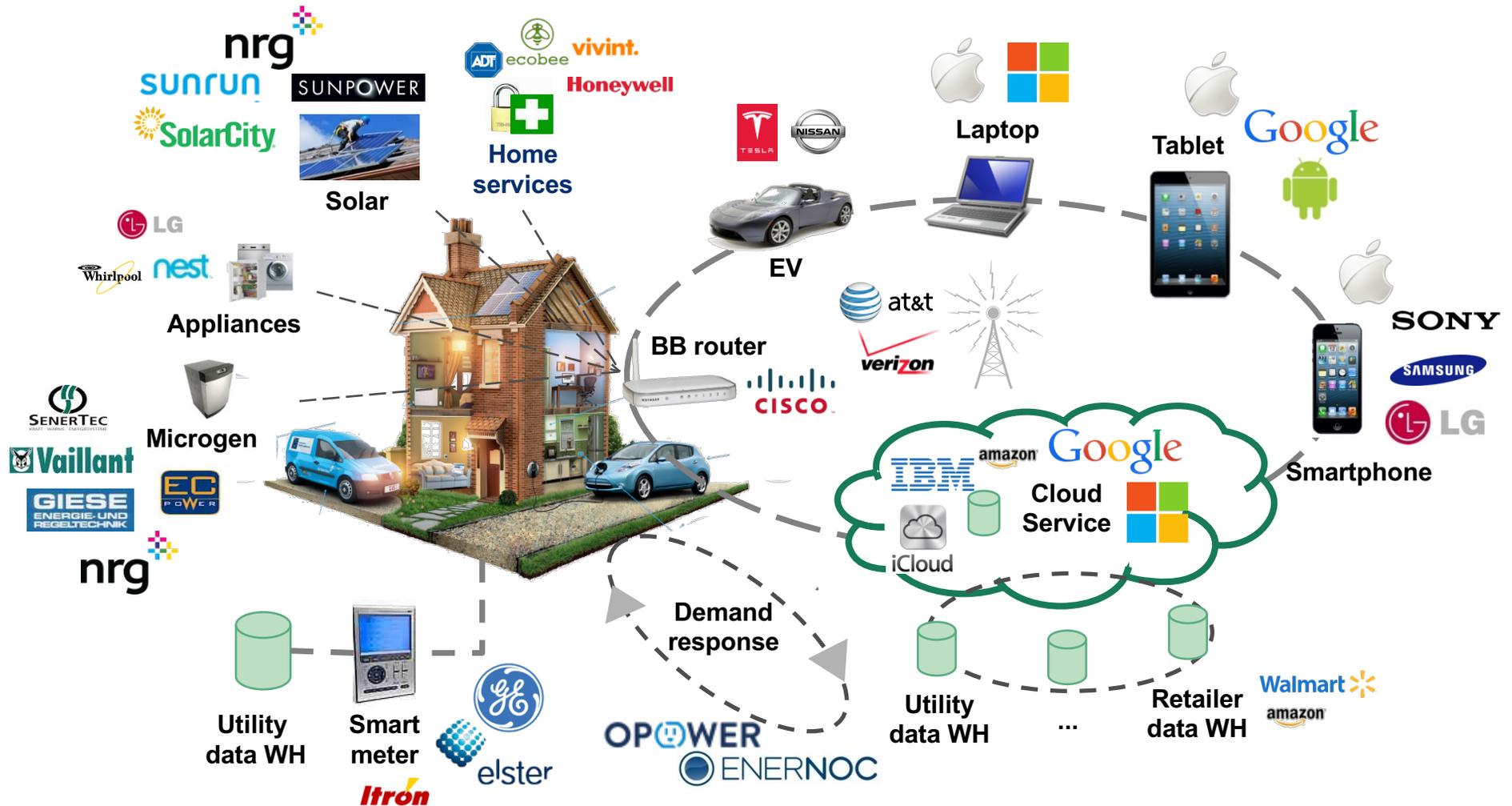
Segment		Example
Small utility		• IPPs , yieldcos, and / small utilities
Off-grid		• Mines in remote regions e.g. in Africa
Community		• Small cities, universities, military
Industrial		• Heavy industries e.g. a large steel plant
Commercial		• Retail stores e.g. IKEA
Residential		• One- or two-family homes

Smart Home solutions and technologies could also prove significant



New technologies mean new incumbents and new products

Example: Distributed Generation and Demand Management



"Utilities are crazy if they don't start offering customers innovative financing packages for solar and distributed generation...because others will."—Honda Executive

High diversity of companies and business models will emerge

		USA	UK	Germany
Distributed generation	Supply of DG systems			
	Leasing service - PPA			
	Rent-the-space model			
Energy Efficiency	Energy services			
Energy Management Systems	Supply of smart home solutions			
	Demand response service			
Integrated solution	Virtual Power Plant			
	Microgrid		<p>Non-commercial pilot projects</p>	

Note: map of examples, not exhaustive
Source: BCG analysis

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Key questions

- 1 How do governments attract investment to grow Renewables and Energy Efficiency technologies and accelerate adoption?**
- 2 How do governments and the industry as a whole promote efficient consumption habits (e.g. along energy supply chains and across sectors)?**
- 3 What needs to be done in order to achieve emission reduction pledges from COP 21 and limit temperature increases to 2 degrees?**
- 4 How will the oil price fall and/or carbon pricing mechanisms improve the Energy Mix and impact Renewables and Energy Efficiency?**
- 5 What concerted government and industry actions could improve data transparency and Energy Efficiency gains in the short-, longer-term?**

Disclaimer

The observations presented herein are meant as background for the dialogue at the 15th International Energy Forum Ministerial Meeting. They have been prepared in collaboration with the Boston Consulting Group, and should not be interpreted as the opinion of the International Energy Forum or the Boston Consulting Group on any given subject.



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