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

- 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 governments

- 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 investors & companies

- Mention of a 1.5°C goal has been unexpected
- There were also mentions of food security, humanitarian concerns and “ratcheting up”

For NGOs and civil society

The voice of non-state actors is functioning strongly:

- 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 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 (INDC) 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
- INDCs 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 ambitions 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
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
$300Bn Investments in Renewable Technologies per year
Solar photovoltaic and Wind make up ~80% of the total investment

Annual global investment in renewable technologies

1. Other renewables, smart grids, etc.
Technological change in power generation toward renewables has shown strong progress in recent years

Change in generation mix 2000-14

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 (%)

- Canada: 76%
- USA: 13%
- Brazil: 71%
- UK: 14%
- Spain: 37%
- Germany: 25%
- Japan: 11%
- China: 22%
- India: 6%
- Australia: 16%
- S. Africa: 2%
- No data: <5%
- 5-10%
- 11-20%
- 21-50%
- >50%

Note: Includes hydroelectric energy
Source: IEA, Bloomberg New Energy Finance, Eurostat
~150 countries have renewables generation targets

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

1. Geothermal, CSP, Marine
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
Onshore Wind and Solar Photovoltaic are the most competitive renewable technologies

- Onshore wind
- Solar photovoltaic
- Hydroelectric
- Solar CSP
- Offshore wind
- Biomass
- Geothermal energy
- Energy storage
- Tidal energy

Development status of the sector’s technology:
- Emerging
- Under development
- Mature

Production cost:
- High
- Moderate
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

The Solar PV module experience curve, 1976–2015

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
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
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

- **Rising energy demand**
  The global demand for energy is set to increase by 1.4% annually until 2035.

- **Political drive**
  Regulators around the world (but particularly in Europe) are introducing policies to improve ES, investments in public sectors increases.

- **Technology push**
  Materials and system innovation is ahead of the adaption curve, pushing down prices and increasing efficiency for new technologies.

- **Increasing transparency**
  "Smart" solutions increase the ability to monitor & benchmark energy demand data in real time, increasing the ability to intervene and measure success.

- **Positive economics**
  Driven by high energy prices, low interest rates and decreasing technology costs, many ES measures are highly NPV-positive today.

- **Industry professionalization**
  Several ES markets (esp. in EU) are starting to mature, increasing available financing and the ability of players to tap existing market potential, while decreasing customer reluctance.

- **Energy Efficiency**
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

Source: BCG research
Agenda

Key observations

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
"Integrated decentralized solutions" are the next step

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

... and can be applied across various customer segments

<table>
<thead>
<tr>
<th>Segment</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small utility</td>
<td>• IPPs, yieldcos, and / small utilities</td>
</tr>
<tr>
<td>Off-grid</td>
<td>• Mines in remote regions e.g. in Africa</td>
</tr>
<tr>
<td>Community</td>
<td>• Small cities, universities, military</td>
</tr>
<tr>
<td>Industrial</td>
<td>• Heavy industries e.g. a large steel plant</td>
</tr>
<tr>
<td>Commercial</td>
<td>• Retail stores e.g. IKEA</td>
</tr>
<tr>
<td>Residential</td>
<td>• One- or two-family homes</td>
</tr>
</tbody>
</table>
Smart Home solutions and technologies could also prove significant

- **Central control unit**
  - SmartHome controller

- **Actors & sensors**
  - Wireless thermostats
  - SmartPlugs

- **Automation rules**

- **'Local control nodes'**
  - Personal computer
  - Remote control

- **'Remote control nodes'**
  - Mobile phone

... enabling convenience, energy savings & security

... on the move

Source: BCG and BCG DV analysis
"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

<table>
<thead>
<tr>
<th>Distributed generation</th>
<th>Supply of DG systems</th>
<th>Leasing service - PPA</th>
<th>Rent-the-space model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Efficiency</strong></td>
<td>Energy services</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Energy Management Systems</strong></td>
<td>Supply of smart home solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Integrated solution</strong></td>
<td>Virtual Power Plant</td>
<td>Microgrid</td>
<td></td>
</tr>
</tbody>
</table>

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