Decarbonization on Supply & Demand Sides

G20 CSWG Session 6: The Role of Renewable Energy in Addressing Climate Change

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February 15, 2019
Sharing global and local knowledge

250
BNEF professionals in 17 locations*

* Part of the Bloomberg LP with 19,000 employees in 176 locations.
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Decarbonization on the supply side

Technology, economics and policy
Decarbonization on the supply side

**Wind and solar are at terawatt scale**

**Global wind and solar installations**

Cumulative GW

Source: BloombergNEF
Decarbonization on the supply side

Storage is also accelerating

Global energy storage installations
Cumulative GW

Source: BloombergNEF
Decarbonization on the supply side

Transitions driven by technology

Solar PV module prices

Onshore wind turbine prices

Lithium-ion battery prices

Source: BloombergNEF.
Decarbonization on the supply side

... thanks to a rapid scale-up in manufacturing capacity...

Annual manufacturing capacity

Solar PV Cells
- GW per year
- 2010: 50
- 2018: 150
- +415%

Wind Turbines
- GW per year
- 2010: 50
- 2018: 150
- +42%

Li Battery Cells
- GWh per year
- 2010: 50
- 2018: 150
- +390%
Decarbonization on the supply side

Transitions characterized by tipping points

**Solar costs vs. coal & gas**

- **Utility PV**
- **Coal**
- **CCGT**

**Wind costs vs. coal & gas**

- **Offshore wind**
- **Onshore wind**
- **Coal**
- **CCGT**

Source: BloombergNEF  Note: Levelized cost of electricity (solar, wind, gas, coal) calculations are for utility-scale assets in the U.S. and exclude incentives such as the ITC and the PTC. Utility PV assumes tracking. EV price is for a medium segment vehicle in the U.S.
Decarbonization on the supply side

50% wind and solar generation by 2050

Source: BloombergNEF, IEA
Decarbonization on the demand side

Corporations and customers
Decarbonization on the demand side

Power is decentralizing – consumer choice

Source: BloombergNEF
Decarbonization on the demand side

Large companies have country-sized electricity demand

The world’s largest corporations have country-sized electricity demand. A good strategy on how to procure reliable, low-cost and low-carbon electricity is critical to their business operations and profitability.

Annual electricity consumption

1. **Rio Tinto**: 60 TWh  
2. **PetroChina**: 43 TWh  
3. **Walmart**: 29 TWh  
4. **Glencore**: 25 TWh  
5. **GM**: 9 TWh

- **Romania**: 58 TWh  
- **Hong Kong**: 42 TWh  
- **Ireland**: 26 TWh  
- **Slovakia**: 27 TWh  
- **Kenya**: 10 TWh

Source: BloombergNEF, Bloomberg Terminal  Note: 2016 for all companies
Decarbonization on the demand side

The RE100: pledging for 100% renewable energy use

The world’s most influential companies, committed to 100% renewable power.

Source: The Climage Group
Decarbonization on the demand side

Projected renewables shortfall for the RE100

Source: BloombergNEF, Bloomberg Terminal, The Climate Group, company sustainability reports. Note: Charts are for RE100 members that have disclosed electricity demand. Certificate purchases includes non-U.S. green tariff programs, and are assumed to step down 10% each year. Onsite generation and contracted wind and solar purchases are assumed to remain flat through 2030. Regional breakdown of shortfall estimated based on each company’s share of revenue by region. See this report’s accompanying excel for company-level data on the RE100.
Decarbonization on the demand side

Supply chains will multiply corporate procurement effect

In addition to greening their own electricity consumption, many corporations are asking their suppliers to do the same. This will multiply and spread the impact of corporate renewable energy purchasing to new markets.

### Supplier List

February 2017

This list is our top 200 suppliers, including component providers and others representing at least 97% of procurement expenditures for materials, manufacturing, and assembly of our products worldwide in 2016.

<table>
<thead>
<tr>
<th>Supplier Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M Company</td>
<td>No. 235, Zhongyuan Road, Suzhou, Jiangsu, China</td>
</tr>
<tr>
<td>3M Company</td>
<td>5500 Oaza Daini, Hagihime, Yamaega, Japan</td>
</tr>
<tr>
<td>3M Company</td>
<td>577 Keumseong-won, Janggun-myeon, Hoecheon, Gyeonggi-Do, South Korea</td>
</tr>
<tr>
<td>3M Company</td>
<td>No. 312, Section 1, Huan Dong Road, Sinshin Township, Taichung, Taiwan</td>
</tr>
<tr>
<td>3M Company</td>
<td>1400 State Dock Road, Decatur, Alabama, United States</td>
</tr>
<tr>
<td>3M Company</td>
<td>1400 Perimeter Road, Greenville, South Carolina, United States</td>
</tr>
<tr>
<td>3M Company</td>
<td>South Building, 915 Adams Street, Hutchinson, Minnesota, United States</td>
</tr>
<tr>
<td>3M Company</td>
<td>3405 East Pleasant Street, Knoxville, Iowa, United States</td>
</tr>
<tr>
<td>3M Company</td>
<td>1030 Lake Road, Medina, Ohio, United States</td>
</tr>
<tr>
<td>3M Company</td>
<td>1425 Stell Parkway, Monomoy, Wisconsin, United States</td>
</tr>
<tr>
<td>AAC Technologies Holdings Inc.</td>
<td>No. 68, Yanghui Road, Wuji District, Changzhou, Jiangsu, China</td>
</tr>
<tr>
<td>AAC Technologies Holdings Inc.</td>
<td>No. 8, Fengyi Road, High Tech. Industry Development Area, Wuji District, Changzhou, Jiangsu, China</td>
</tr>
<tr>
<td>AAC Technologies Holdings Inc.</td>
<td>Building 5, 6th floor, Nanyou Tianan Industry Park, Denglong Road, Nanshan District, Shenzhen, Guangdong, China</td>
</tr>
</tbody>
</table>

Source: Apple
Decarbonization on the demand side

**Grids are less reliable in emerging markets**

<table>
<thead>
<tr>
<th>Country</th>
<th>Outages in a typical month</th>
<th>Electricity from a generator (%)</th>
<th>Losses due to electrical outages (% of sales)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakistan</td>
<td>75</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>65</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Nigeria</td>
<td>33</td>
<td>41</td>
<td>11</td>
</tr>
<tr>
<td>Egypt, Arab Rep.</td>
<td>16</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>India</td>
<td>14</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Tanzania</td>
<td>9</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

*Source: World Bank*
Decarbonization on the demand side

Fossil fuels capacity added in non-OECD countries

Source: Bloomberg New Energy Finance, PGS Consulting. * Diesel capacity is estimated based on customs data
Decarbonization on the demand side

Many emerging markets still rely heavily on diesel generators

Source: Bloomberg New Energy Finance, PGS Consulting
Countries with C&I solar projects in Sub-Saharan Africa

Source: BloombergNEF. Note: Countries colored in yellow indicate that there are known C&I solar projects plus installed capacity that developers reported to BNEF.
Decarbonization on the demand side

Economics of solar vs commercial grid electricity tariffs

Source: BloombergNEF, Climatescope. Note: Tariffs for Ghana are as of April 2018. The others are as of 2017. The range of C&I solar cost estimates for Kenya, Ghana and Nigeria, and assumes a project starts operation in 2019.
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