PPAs and renewables

What is the impact on actor diversity?

Dario Traum

June 19, 2019 - Paris
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Strategies for a cleaner, more competitive future

**Commodities**
- Carbon
- Power markets
- Oil & products
- Gas & LNG
- Chemicals
- Metals

**Clean energy**
- Solar
- Wind
- Storage
- Decentralized energy
- Frontier power
- Heat
- Impact on power & utilities

**Advanced transport**
- Electrified transport
- Mobility services
- Connected & autonomous vehicles
- Impact on transport
- Impact on oil & power

**Digital industry**
- IoT technologies & platforms
- Advanced analytics & automation
- Digital business model evolution
- Digitalization of energy, industry & supply chains

**Advanced materials**
- 3D printing & green manufacturing
- Sustainable materials & circular economy
- Composites, bioplastics & new materials
- Impact on industrials, utilities & manufacturing

**Policy, Economics & forecasts**
- Sustainability
- Innovation & tech
- Finance

**Impact on**
- power & utilities
- transport
- oil & power
- energy
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London
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New Delhi
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Automotive Energy Technology
Energy Finance Technology
Energy Technology
Technology Manufacturing Materials
Energy Transport Government
Energy Industry Transport
Supporting leading organizations

**Energy, Utilities & Resources**

- ExxonMobil
- e.on
- Total
- CLP
- bp
- Chevron
- Engie
- Shell
- Exelon
- Repsol

**Transportation, Industrials & Technology**

- BYD
- Mitsubishi Corporation
- IBM
- Siemens
- Daimler
- GM
- Nissan
- ABB
- Schneider Electric
- Jaguar
- Goldwind

The logos listed do not represent a full client list. They are illustrative of the organizations BNEF has worked with in the past.
### Financial Institutions

- BlackRock
- Credit Suisse
- Macquarie
- Munich Re
- J.P. Morgan
- Norghes Bank
- HSBC
- Lazard
- Bank of America
- Morgan Stanley
- Sumitomo Mitsui Banking Corporation
- Riverstone

### Public Sector

- ADB
- Asian Development Bank
- IEA
- International Energy Agency
- European Investment Bank
- Australian Government
- UNDP
- United Nations Development Programme
- UN
- United Nations
- UKAid
- From the British People
- Norwegian Ministry of the Environment

The logos listed do not represent a full client list. They are illustrative of the organizations BNEF has worked with in the past.
Corporate PPA market

An overview
Most of the corporate PPAs in Europe happened in wind
Most of the corporate PPAs in Europe happened in wind.
Concentrated in countries with the right resources, regulation
These trends are reflected in the composure of market participants

Top offtakers by capacity (MW),

- Norsk Hydro ASA: 1,563 MW
- Google LLC: 901 MW
- Alcoa Corp: 805 MW
- Facebook: 454 MW
- Microsoft Corp: 307 MW
- Vivens: 258 MW
- Deutsche Bahn: 205 MW
- Amazon: 202 MW
- BT Group Plc: 154 MW
- Novozymes: 123 MW
- Northumbrian Water: 111 MW
- Novo Nordisk: 102 MW

Source: BloombergNEF
These trends are reflected in the composure of market participants

Top developers by capacity (MW)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Eolus Vind AB</td>
<td>559</td>
</tr>
<tr>
<td>2</td>
<td>Vattenfall</td>
<td>503</td>
</tr>
<tr>
<td>3</td>
<td>General Electric Co, Green Inv.</td>
<td>483</td>
</tr>
<tr>
<td>4</td>
<td>Statkraft</td>
<td>452</td>
</tr>
<tr>
<td>5</td>
<td>Norsk Vind Energi AS</td>
<td>374</td>
</tr>
<tr>
<td>6</td>
<td>Norsk Miljokraft AS</td>
<td>281</td>
</tr>
<tr>
<td>7</td>
<td>Zephyr AS</td>
<td>274</td>
</tr>
<tr>
<td>8</td>
<td>Innogy Renewables UK Ltd</td>
<td>270</td>
</tr>
<tr>
<td>9</td>
<td>Eneco NV</td>
<td>257</td>
</tr>
<tr>
<td>10</td>
<td>Havvol Nordic</td>
<td>208</td>
</tr>
</tbody>
</table>

Source: BloombergNEF
Corporate PPA market

Outlook for Europe
The world’s biggest companies are major, committed buyers of renewable energy.

Source: BloombergNEF, Bloomberg, RE100
Companies are as big as countries – in electricity terms

<table>
<thead>
<tr>
<th>Company</th>
<th>Annual electricity consumption (TWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYDRO</td>
<td>53.8</td>
</tr>
<tr>
<td>Alcoa</td>
<td>42.4</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>20.2</td>
</tr>
<tr>
<td>Google</td>
<td>8.0</td>
</tr>
<tr>
<td>Microsoft</td>
<td>6.3</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>55.5</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>42</td>
</tr>
<tr>
<td>Hungary</td>
<td>21.5</td>
</tr>
<tr>
<td>Estonia</td>
<td>8.2</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>6.9</td>
</tr>
</tbody>
</table>

Source: Companies, CIA World Factbook
Rooftop PV is increasingly attractive for households...

Residential PV socket parity with 35% onsite consumption, 2018

Residential PV socket parity with 35% onsite consumption, 2035
...but for businesses it looks even better

Commercial PV socket parity with 70% onsite consumption, 2018

Commercial PV socket parity with 70% onsite consumption, 2035

Source: BloombergNEF
Projects in Europe are small
Projects in Europe are small
European generation mix, 2012

Overview
European generation mix, 2018
European generation mix, 2030
Overview

European generation mix, 2040
Overview

European generation mix, 2050

- Devices
- Homes
- Communities
- Towns
- Cities
- Countries

- Small scale solar
- Utility scale solar
- Hydro
- Nuclear
- Onshore wind
- Gas
- Biomass
- Coal
- Offshore wind
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