BARRIERS AND IMPLICATIONS OF ELECTRIFICATION FOR THE ELECTRIC INDUSTRY

IEA/EPRI workshop on decarbonisation

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Offshore wind energy is becoming competitive with conventional technologies

**Levelised costs for society of electricity, incl. transmission costs**

New built capacity, EUR/MWh, 2016-prices

<table>
<thead>
<tr>
<th>Project</th>
<th>Tender year</th>
<th>Expected commercial operation year</th>
<th>Walney Extension</th>
<th>East Anglia</th>
<th>Borkum Riffgrund 2</th>
<th>Horns Rev III</th>
<th>Borssele I &amp; II</th>
<th>Kriegers Flak</th>
<th>Borssele III &amp; IV</th>
<th>Hornsea 2</th>
<th>Cluster 1</th>
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<td>Conventional technologies (Commercial Operation Date, 2025)</td>
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Sources: BNEF, BEIS; Danish Energy Agency; NEV (Dutch Energy Scenarios); Bundesnetzagentur

1. Levelised revenue (price) of electricity over lifetime of the project used as proxy for the levelised cost to society. Consists of subsidy and market price element for the first years and market income for remaining 25 yrs lifetime. Societal discount rate of 3.5%. Based on country specific public power price projections at the time of contracting where available, else an average of 5 analytics is used. For comparability across projects and because there is no transparency round the TSO costs of transmission a generic scope adjustment (incl. transmission and extra project development costs) have been applied. Due to specific DC transmission set up in Germany cost estimates from the ‘Offshore Netzentwicklungsplan’ 2017 have been applied.

2. LCOE data from BNEF, H1 2017. Average cost projection from Germany and the UK in average cost scenario with capacity factors of between 50 and 80% for gas, and 45 and 70% for coal. CO₂ price trend reaching 20 €/t in 2025 and 34 €/t in 2035.

3. Same approach as for offshore wind. Strike price is 92,5 £/MWh in real2012-prices hence indexed to inflation each year. Lifetime of 60 years and 91% capacity factor.
The North Sea is “made” for offshore wind energy

Accumulated economically attractive offshore wind production potential in Northern Seas (TWh)\(^1\)

WindEurope og BVG-associates

Decarbonizing through electrification

- 65% emission reductions in the electricity sector and decreasing

- Transport emissions continue to grow

- Heating has reduced emissions through fuel switching
  - Limited scope for further reduction through fuel switching
  - High share of district heating allows for fast scalability of new solutions

- Reduced emissions in industry
  - Efficiency measures
  - Reduced activity

Example: Danish electricity sector on track to full decarbonisation, while transport and heating are lagging behind

Danish CO2 emissions, by sector, 1990-2015

Source: Danish Energy Agency – 2015 energy statistics
RES expansion and stagnating electricity consumption has reduced the value of electricity

**Wind and PV production, Nordic countries, 2004-2015**

- **+25 TWh**

**Final electricity consumption, Nordic countries, 2004-2015**

- **-10 TWh**

**Nord Pool power prices, €/MWh, real**

**Value of electricity under pressure**

- Electricity *generation* on track to decarbonize from reduced costs of RES
- Electricity *consumption* reduced from efficiency and reduced economic activity
- Value of electricity in the market *decrease* at a time when value of electricity as tool for efficient decarbonization *increase*

Source: Eurostat (consumption and production), Nordpoolspot (electricity prices and CO2-prices).
Consumer choice is key to electrification
Are utilities able to excite consumers?

Electrifying and decarbonizing the transport sector will only succeed if the electrical alternatives are competitive on all parameters.

The believers

The enthusiastic few

The rational many

Source: OECD/IEA – Global EV outlook 2017
Taxes, tariffs, and regulatory framework is key
Example: Danish district heating

- Large heat pumps could contribute significantly to electrification of Danish heat supply, but needs commercialisation
- District heating suppliers are municipally and cooperatively owned, with unclear commercial governance
- High taxes on electricity compared to alternative sources of heating
- Regulation of district heating is based on not-for-profit

Danish district heating is a fantastic opportunity with a 64% market share, but...