Effect of the German *Energiewende* on the Dutch electricity market

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The German *Energiewende*

Source: German transmission system operators Amprion, 50 Hertz, Tennet and Transnet BW and the Royal Dutch Meteorological Institute. Data is freely accessible on their websites.
Wind electricity in Germany: highest level of production increased to 26 GW, average level to 5.4

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean</th>
<th>St.dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>3.4</td>
<td>3.2</td>
<td>0.5</td>
<td>15.9</td>
</tr>
<tr>
<td>2013</td>
<td>5.4</td>
<td>4.9</td>
<td>0.1</td>
<td>26.0</td>
</tr>
</tbody>
</table>

Source: German transmission system operators Amprion, 50 Hertz, Tennet and Transnet BW. Data is freely accessible on their websites.
Solar electricity in Germany:
installed capacity exceeds wind capacity, but
average and highest level of production is lower
than for wind

Feed in by solar cells in Germany

Supply of solar electricity in Germany per year

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean</th>
<th>St. Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1.7</td>
<td>2.7</td>
<td>0</td>
<td>11.0</td>
</tr>
<tr>
<td>2013</td>
<td>2.8</td>
<td>4.2</td>
<td>0</td>
<td>18.8</td>
</tr>
</tbody>
</table>

Source: German transmission system operators Amprion, 50 Hertz, Tennet and Transnet BW. Data is freely accessible on their websites.
Impact of German events on Dutch market

Cross-border capacity
Dutch-German markets
is about 3.5 GW
(20% of installed Dutch capacity)
What happened in the Dutch market?
Since 2011 a strong decrease in the utilisation of power plants

Source: ACM; see my paper in the The Energy Journal, 36(2), for a description of data and methodology.
Merit order has changed strongly in Dutch market in 2013 much steeper than in previous years.

Source: ACM; see my paper in the The Energy Journal, 36(2), for a description of data and methodology.
Changes in fuel prices have changed relative positions of plants in the merit order.

many gas-fired plants are not in the money anymore

Source: Bloomberg

Source: ACM; see my paper in the The Energy Journal, 36(2) for a description of data and methodology.
Explaining Dutch power price
- gas price remains to be the main price driver in the Dutch power market
- coal price has become a price driver as well
- in 2013 no influence anymore of German wind and solar production

Regression analysis on hourly data

<table>
<thead>
<tr>
<th>Log.Dutch day-ahead price (APX)</th>
<th>2011+2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>log.Demand</td>
<td>0.17***</td>
<td>0.24***</td>
</tr>
<tr>
<td>log.RSI</td>
<td>-0.07***</td>
<td>-0.06***</td>
</tr>
<tr>
<td>log.gasprice</td>
<td>0.72***</td>
<td>0.81***</td>
</tr>
<tr>
<td>log.coalprice</td>
<td>-0.0004</td>
<td>0.75***</td>
</tr>
<tr>
<td>Log.CO2price</td>
<td>0.21***</td>
<td>-0.03</td>
</tr>
<tr>
<td>Log.windspeedNeth</td>
<td>-0.01***</td>
<td>-0.02***</td>
</tr>
<tr>
<td>Log.windsupplyGer</td>
<td>-0.03***</td>
<td>0.004</td>
</tr>
<tr>
<td>Log.solarsupplyGer</td>
<td>-0.03***</td>
<td>0.0007</td>
</tr>
<tr>
<td>Time dummies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR-terms</td>
<td></td>
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</tr>
</tbody>
</table>
Conclusions

• The influence of German *Energiewende* on the Dutch electricity market has reduced because of the full utilisation of the cross-border capacity
  – supply of German wind and solar do less influence Dutch power prices

• The dramatic changes in the Dutch market are more related to changes in fuel prices
  – the high gas price compared to the low coal price has made many gas-fired power plants uneconomic

• When the Dutch-German cross-border capacity will be extended in the near future, the Dutch market will become more affected by the *Energiewende*
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