Key Challenges for the German Energy Transition and its Market Design

US-System-Operator Study-Tour

Andreas Jahn
Senior Associate
The Regulatory Assistance Project (RAP)®

Anna-Louisa-Karsch-Straße 2
D-10178 Berlin
Germany

+49 30 700 1435 421
ajahn@raponline.org
raponline.org
Agenda

Challenges for today’s market design

• EOM 2.0
• Coal phase out
• EEG reform/auctions
• Tariff design
• Electrification of transport and heat
German/EU market design
Power market configuration along national borders – without LMP

Source: CEREG (Belgium Regulator 2016)
Transmission: Ownership and operation in one hand

25% owned by RWE-utility

100% owned by EnBW-utility

TSO doing jointly
- network planning
- auctions on balancing resources/ancillary services

Source: KWH-Netz
System resiliency

Increased share of underground cables

- 89% low voltage
- 79% mid-voltage
Decentralized dispatch

• „Balancing responsible parties“ are private enterprises (generators, suppliers, retailers)

• Central dispatch by system operators after gate closure, only
2 Challenges
German power market design

• EOM 2.0 provides price incentives (shortage pricing) for investments into peak generation, DR and storage, without capacity payments.
• Backup by out-of-market “strategic reserves”
• Flexibility has time value only, no locational value in today’s market design.
• Consumer benefit from Internal European Energy Market, but policies and operation mostly national…
Interconnectional power flows

2016 in TWh

Germany, the EU power hub

Source: BNetzA Monitoring /Agora Energiewende

Regulatory Assistance Project (RAP)®
Capacity surplus – how to get rid of the wrong resources, best?

- RES has been added successful
- Emission prices (EU-ETS) are relatively low
- Existing (high emission) resources still generating (lignite is cheaper than gas)

⇒ Gov. installed “coal commission”, should determine coal (lignite) phase out and required support for mining regions until Dec. 2018
Transmission network investment plans and costs

Investment in and expenditure on TSO network infrastructure € million

Source: BNetzA
Development of redispatch costs

Source: Agora Energiewende
RE support: From FiT to auctions

Auction results are lower than Feed-in-Tariff:

- Price increase is screenshot
- Investors revenue streams are wholesale markets or auction results as backup
- Offshore grid costs are socialized

<table>
<thead>
<tr>
<th>Technologie</th>
<th>Gebotstermine 2018</th>
<th>Zuschlagswert* (ct/kWh)</th>
<th>letzte Zuschlagsliste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>1. Februar 1. Juni 1. Oktober</td>
<td>4,33 4,59</td>
<td>06/2018</td>
</tr>
<tr>
<td>Onshore</td>
<td>1. Februar 1. Mai 1. August 1. Oktober</td>
<td>4,73 5,73</td>
<td>05/2018</td>
</tr>
<tr>
<td>KWK</td>
<td>1. Juni 1. Dezember</td>
<td>4,31</td>
<td>06/2018</td>
</tr>
<tr>
<td>innovative KWK-Systeme</td>
<td>1. Juni 1. Dezember</td>
<td>10,27</td>
<td>06/2018</td>
</tr>
<tr>
<td>Biomasse</td>
<td>1. September</td>
<td>-</td>
<td>09/2017</td>
</tr>
<tr>
<td>Offshore</td>
<td>1. April</td>
<td>4,66</td>
<td>04/2018</td>
</tr>
<tr>
<td>Technologie-übergreifend</td>
<td>1. April 1. November</td>
<td>4,67</td>
<td>04/2018</td>
</tr>
</tbody>
</table>

Source: BNetzA
Increasing Price Differences

Distribution network fees for household in 2016 (at 3500 kWh)

⇒ Rural networks with high RE-penetration and low demand becoming more and more expensive
⇒ Demand in cites, far from supply is less effected and cheaper

Source: BNetzA
Regional transmission fees become harmonized until 2023

States (Länder): „Differences in transmission fees are an unfair (dis-)advantage to local economy“

Source: 50Hertz, Vereinigung sächsische Wirtschaft
Increasing fixed charges

Due to missing regulation, distribution networks increased fix charges over the last couple of years.

Fixed Charges for Consumers below 100,000 kWh/year (SLP) in Germany

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2016</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Fixed charge</strong></td>
<td>14.16</td>
<td>16.44</td>
<td>20.71</td>
<td>60.5</td>
</tr>
<tr>
<td><strong>Max. Fixed charge</strong></td>
<td>33.96</td>
<td>36.50</td>
<td>50</td>
<td>96</td>
</tr>
<tr>
<td><strong>Networks without fixed charge</strong></td>
<td>29</td>
<td>24</td>
<td>15</td>
<td>(?)</td>
</tr>
</tbody>
</table>

Source: BNetzA Netzentgeltsystematik 2015, Spiegel-Background/Verivox

⇒ Up to 50% of network costs are paid fix by low demand customers (e.g. in apartments) in some networks
New demand is flexible

To achieve 2030 German decarbonization target, fossil assets need to be replaced by
• 2 to 4 million heat pumps
• 5 million EV

Network infrastructure is good/underutilized. Smart electrification will be beneficial, but network owners are keen about investments…

Source: RAP
About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org