Market Design for Germany's Power Station Strategy

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Background and motivation

• Decarbonization brings change
  • Expansion of intermittent renewable energy
  • Phase-out of coal
  • Growing demand

• Market implication
  • Flexible climate-friendly generation must be built
  • Existing market failures prevent investment without regulatory response

• Regulatory response
  • Procure essential flexible generation consistent with immediate needs
  • Fix market failures (incomplete markets, market power, uncertainty, lumpiness)
    • For the long run, an efficient, reliability, and resilience electricity market
    • For the near term, a lower-cost, forward-looking procurement of immediate needs
Key insights

- Procure 10 GW of hydrogen-ready generation with best-practice methods
- Use prices to encourage efficient operation and investment of critical infrastructure as we transition to net-zero
- Address market failures and immediate needs with a consistent and proven approach that is simple, responsive, and sustainable
  - Incomplete markets: allow products to be defined with any desired time and location granularity (e.g., Bonn energy, weekday, 8-9am, February 2029)
  - Market power: allow generators to sell (or buy) forward products gradually with persistent piecewise-linear supply curves (e.g. auctions every hour)
  - Uncertainty: Gradual trade of forward products allows participants to follow simple trade-to-target strategies that respond as uncertainties are resolved
  - Regulator's commitment to purchase coordinates trade
Market design

Goal: maximize social welfare subject to physical constraints

What potential market failures arise, and how to mitigate?
Prisoner's dilemma
Incomplete markets
Market power
Adverse selection and moral hazard
Product design

Financial energy option
- Obligation to deliver energy when day-ahead price is above strike price of about 1000 euros

Physically backed
- Hydrogen-ready gas units to be converted on a future date specified in 2032

Hydrogen price risk borne by the government
- Supplier receives green hydrogen price – natural gas price – carbon price
Traditional best-practice procurement

• Uniform-price auction better than pay-as-bid
  – All are paid the clearing price
  – Less strategic behavior, more truthful bidding, improved efficiency
  – More competitive market structure, market power is self-correcting
  – Easier participation and improved privacy, more competitive

• Sequence of smaller auctions is better
  – Less market power, improved efficiency
  – Less risk, "don't put all your eggs in one basket"
  – Meaningful outcome discovery helps regulator and participants manage demand curve and offers to best achieve goals

• Slight advantage to descending clock if few auctions
  – Outcome discovery helps bidders manage bids as market information is revealed
  – But advantage is reduced or vanishes if many auctions

• Easy prequalification
• Regulator specifies reserve price and downward-sloping demand
• Aggregate Q and P at end of round or auction revealed
## Market structure
(Shares based on energy volume 2023)

<table>
<thead>
<tr>
<th>Generation Company</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWE</td>
<td>9%</td>
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<tr>
<td>LEAG</td>
<td>9%</td>
</tr>
<tr>
<td>EnBW</td>
<td>5%</td>
</tr>
<tr>
<td>Uniper</td>
<td>3%</td>
</tr>
<tr>
<td>Vattenfall</td>
<td>2%</td>
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<tr>
<td>Others</td>
<td>71%</td>
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<table>
<thead>
<tr>
<th>Retail service provider Company</th>
<th>Share</th>
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<tbody>
<tr>
<td>Eon</td>
<td>18%</td>
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<tr>
<td>EnBW</td>
<td>16%</td>
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<tr>
<td>Vattenfall</td>
<td>11%</td>
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<td>Stadtwerke München</td>
<td>4%</td>
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<tr>
<td>MVV</td>
<td>4%</td>
</tr>
<tr>
<td>Others</td>
<td>46%</td>
</tr>
</tbody>
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Source: Generation from BNetzA and company reports; Retail service provider from company reports.

*Procurement auction should be competitive*