Securing Power during the Transition to Low Carbon Electricity Systems

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Outline

- Electricity security
- Climate policies
- Flexibility
- Capacity markets
Electricity security

- **Fuel Security**
  - Ensure continued fuel supply of gas, coal and uranium

- **Adequacy**
  - Generation capacity
  - Network infrastructure

- **System Security**
  - Network operations
  - Emergency protocols
Low-carbon policies have engendered uncertainties

- Carbon price (in)stability
- Energy efficiency policies
- Pace of renewable deployment
- Carbon emission standards
- Global climate negotiations
Renewable energy variability

Germany, wind and solar power generation, 10-16 September 2012

Quick deployment of wind and solar power raises new challenges
Controlling power flows

Phase-shifting transformers installed in the EU at a selection of borders

Source: Data provided by NRAs through the ERI (2012) and information from CEE NRAs (presentation at the ACER Workshop on Unplanned Flows, June 2012).

National TSOs install equipments to control flows at borders
What kind of flexibility is needed?

Overview of operating challenges with high shares of variable renewable energy

- **Peak load adequacy**
  - Load
  - Flexible
  - Rigid
  - VRE
  - Unused VRE capacity

- **Minimum load balancing**
  - Load
  - Margin
  - Flexible
  - Rigid
  - VRE
  - Lost Prod

- **Ramp rates of residual demand**
  - Load
  - Margin
  - Flexible
  - Rigid
  - VRE
  - Wind forecast uncertainty

- **Predictability of renewables**
  - Wind forecast
  - Hours before real time
  - Real time
Wind and solar power plants will need to provide flexibility in order to secure system operations.

A market platform for flexible services can create a level playing field for all technologies, including renewables.

Source: Potomac Economics, ERCOT SOM report 2011
Does Europe need new investments?

Electricity supplied in OECD Europe (2000-2011)

In Europe, ‘residual’ electricity supply (i.e. net of non-hydro renewables) decreased by 6% between 2008 and 2011.
Power plant revenues (US markets)

Figure 34: Comparison of Net Revenue of Gas-Fired Generation between Markets

Source: Potomac Economics
## Options to address generation investment and operations issues

### Basic package

<table>
<thead>
<tr>
<th>A</th>
<th>Improved climate and low-carbon policies</th>
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<tbody>
<tr>
<td></td>
<td>• Improve certainty/credibility of energy policies</td>
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<td>• Design of low carbon support instruments</td>
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<td>Ex:</td>
<td>- UK carbon price floor</td>
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<td>- US Clean Energy Standards</td>
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<td>- Renewable premium in Germany</td>
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<tr>
<th>B</th>
<th>Better energy markets</th>
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<td>• Remove restrictions on electricity prices</td>
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<td>• Locational Marginal Pricing (LMP)</td>
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<td>• Develop missing markets</td>
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<td>• Integrate day ahead, intraday, balancing and reserve markets</td>
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<td>Ex:</td>
<td>- ERCOT, ISO-NE, Australia</td>
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<th>Standards &amp; Procedures</th>
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<td></td>
<td>• Reliability criteria</td>
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<td>• Generation adequacy forecasts (planning)</td>
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<td>• Technical flexibility and controllability requirements</td>
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### Possible optional measures

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<th>Targeted contracting</th>
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<td>Contracts to:</td>
<td>• avoid mothballing of existing assets</td>
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<td>• trigger new investments</td>
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<td>• relieve congestions</td>
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<td>• promote demand side response</td>
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<td>Ex:</td>
<td>Strategic reserve</td>
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<th>Market-wide capacity mechanism</th>
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<td>• Capacity payments</td>
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<tr>
<td></td>
<td>• Central buyer of capacity</td>
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<td>• Decentralised capacity market</td>
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<td>• Combined capacity and flexibility market</td>
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**Ex:** PJM, ISO-NE, Spain, France
Concluding comments

- Stable and predictable climate policies would solve some of the power investment problems.
- Increasing shares of wind and solar power exacerbate the investment issues.
- Capacity arrangements can create a safety net to cope with uncertainties caused by climate policies.
Back-up
Capacity remuneration mechanisms across Europe

- **SE&FI**: capacity reserves for spot market deficits only, SE reserves to be gradually phased out by 2020
- **GB**: developing full-scale capacity auctions, legislation to be ready in 2013
- **IE&NI**: capacity payments since 2005
- **FR**: capacity purchase obligations planned to be implemented by 2016, but new government could change the NOME law
- **PT**: same as Spain for new units. Payments reduced in 2012
- **ES**: capacity payments for new units and to existing coal, gas, oil and hydro capacity. In 2012 proposals to stop/reduce payments
- **IB**: minor payments. New capacity market mechanism to be implemented by 2017
- **RU**: capacity market with price restrictions. Long-term capacity supply agreements for obligatory investments
- **LT**: condensing units as reserve
- **EE**: household market opening January 2013
- **PL**: nodal pricing and capacity market discussed, but no final decisions
- **BE**: tendering for new gas plants proposed + additional rules for grid stability reserves
- **GR**: capacity obligation mechanism since 2005

*No capacity payments to power plants in the day-ahead and intraday market, but balancing market reserve capacity is contracted in advance*

Source: Eurelectric

Inexistent coordination of capacity mechanisms