"The perspectives of the future European Electricity Grid"

2011 Elcom Forum
University of Fribourg
Daniel Dobbeni
• ENTSO-E: role, membership, structure, ...

• What will it look like in 10 years?

• Priorities ...
• ENTSO-E: role, membership, structure, …

• What will it look like in 10 years?

• Priorities …
**ENTSO-E role**

**41** TSO members from **34** countries

**Major responsibilities**

- Network codes
- 10 year network plans
- Adequacy Forecasts
- Tools and processes for **market integration**
- R&D Plan

Through its members deliver **infrastructure** and **market tools**
• ENTSO-E: role, membership, structure, …

• What will it look like in 10 years?
  – Hardware

• Priorities …
1. Major shift: EU Power Capacity Mix from 2000 to 2010

- **2000** = 575.5 GW
- **2010** = 887.9 GW

### Breakdown of Energy Sources in 2010

- **Gas** 212,131 (24%)
- **Coal** 231,050 (26%)
- **Nuclear** 127,383 (15%)
- **Fuel oil** 54,735 (6%)
- **Large Hydro** 120,578 (14%)
- **Wind** 84,324 (10%)
- **PV** 28,943 (3%)
- **Biomass** 5,851 (1%)
- **Small Hydro** 4,843 (1%)
- **Waste** 3,703 (0%)
- **Geothermal** 1,466 (0%)
- **CSP** 635 (0%)
- **Tidal & Wave** 250 (0%)

Source: EWEA, EPIA, Estela, EU-OEA and Platts Powervision
Moving higher towards 2030 and later...

Wind share of demand: 2010 = 5.3% → 2020 = 23% → 2030 = 36%

Source: EWEA 2011
2. A Grid for all kind of Power flows

a. Large **varying flows** all over EU

b. **Thousands of (small) power plants**
3. Which role for conventional power plants?

- Min. demand (summer night)
- Max. demand (winter day)

Peak Unit (reserve, incidents)
Hydro Storage

Marginal cost

F.V. (priority)
Wind (priority)
Biomass units and/or cogeneration (priority - must run)
Nuclear
CCGT
Fossil (coal-gas-fuel)

eg. Merit Order in 2020

Daniel Dobbeni | 18.11.2011 | Page 9
4. Who will deliver flexible reserve energy for balancing?

Denmark 2008

20% wind power

Wind power covers total demand in ~200 hours (West DK)

Tomorrow (2025)

50% wind power

In 2025 wind power will exceed total demand in more than 1,000 hours
An important issue today?

7000 MW export to 4000 MW import in less than 24h

the interconnected systems implicitly have to deliver a flexibility equivalent to

18 CCGT plants of 400 MW reducing from 100% output to 0%

followed later on with 18+10 CCGT plants of 400 MW increasing from 0% to 100%
And tomorrow?

Solar & Wind capacity share = 2010 * ~2.25

More than 60 CCGT of 400MW whose outputs depend on weather conditions in Germany

Who will invest in these plants, running full power a few hundred hours per year?

- What incentives for plant investment if marginal cost becomes RES-driven?
- How to manage T/DSO interventions on RES if support schemes are “output” driven?
From vision to field reality: some “hardware” issues!

From CREG study

1. Planning of the first nuclear power plants; exit planned by 2034
2. Based on average annual generation

Source: BCG analysis

- Go green faster
- Go green slower
- Careful rethinking
- Still bullish about nuclear

Age of operational electricity generation capacity in EU-37

Source: PricewaterhouseCoopers

Nuclear power generation

-140 TWh/p.a.

Reality: TYNDP chases a moving target ... 2012 ... 2014 ...
• ENTSO-E: role, membership, structure, …

• What will it look like in 10 years?
  – Software

• Priorities …
Coordinated ATC

NTC or Flow based

Flow based where more efficient

Day-ahead
- Implicit auctions
- Market coupling

Intraday
- Implicit continuous trading

Balancing
- DSM & DER

Forward Market

Physical Market

But ... for the software to work ... a well functioning hardware is a prerequisite!

Daniel Dobbeni | 18.11.2011 | Page 16
A competitive wholesale market with a fast increasing RES share?

Since the Moratorium, Be-Fr lower prices than De-NL especially night & w-e

Excess wind in Germany

Baseload market clearing prices CWE region
Outline

• ENTSO-E: role, membership, structure, …

• What will it look like in 10 years?

• Priorities …
1. At EU level: reinforce ASAP bulk transmission capacity

Main investment projects in line with EIP:

- North-South power flows
  - RES: North Seas, South to EU
  - Load in Italy, South Germany
- Better integration
  - Baltic states,
  - British islands,
  - Iberian peninsula
- East-West flows in S-E Europe
.. At EU level: cross-border AND within the member states
.. at EU & MS level: create context ... OR ... change targets!

+14% compared to EU grid

500 projects (all needed)

Roughly € 100 billion
without grids in sea & E-highways

on top of investments for slightly growing demand and aging assets!

Public acceptance!
2. Testing ASAP new technologies in the EU grid

Innovation, field testing: eg. **DC Grids**… imply… **DC switchgears**
3. A stable and attractive regulation looking forward!

Conclusions of the European Council
4 February 2011

“It is important to streamline and improve authorisation procedures, while respecting national competences and procedures, for the building of new infrastructure;”

“...The bulk of the important financing costs for infrastructure investments will have to be delivered by the market, with costs recovered through tariffs. It is vital to promote a regulatory framework attractive to investment.”
### Deliverables

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>ACER PG draft</th>
<th>ENTSO-E code</th>
<th>ACER evaluation</th>
<th>Consultology</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start</td>
<td>End</td>
<td>Start</td>
<td>End</td>
<td>Start</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>NC on capacity allocation and congestion management</td>
<td>Q2/11</td>
<td>Q3/11</td>
<td>Q3/13</td>
<td>Q4/13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NC on forward markets</td>
<td>Q4/12</td>
<td>Q3/13</td>
<td>Q4/13</td>
<td>Q3/14</td>
<td>Q1/14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional progress, setup and testing (incl. AESA process and Regional Initiatives Work Program)</td>
<td>Q3/13</td>
<td>Q3/13</td>
<td>Q4/13</td>
<td>Q3/14</td>
<td>Q1/14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC consultory guideline on governance</td>
<td>Q4/11</td>
<td>Q4/11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FG on network connection</td>
<td>Q3/11</td>
<td>Q4/11</td>
<td>Q4/11</td>
<td>Q1/12</td>
<td>Q2/12</td>
<td>Q3/13</td>
<td>Q4/13</td>
<td></td>
</tr>
<tr>
<td>NC on generation connection</td>
<td>Q4/13</td>
<td>Q4/13</td>
<td>Q3/14</td>
<td>Q3/14</td>
<td>Q1/14</td>
<td>Q2/14</td>
<td>Q3/14</td>
<td>Q4/14</td>
</tr>
<tr>
<td>NC on DSO and Industrial lead connection</td>
<td>Q3/13</td>
<td>Q4/13</td>
<td>Q3/13</td>
<td>Q4/13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FG on system operation</td>
<td>Q4/11</td>
<td>Q4/11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NC on operational security</td>
<td>Q2/11</td>
<td>Q3/12</td>
<td>Q3/13</td>
<td>Q3/13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NC on operational planning and scheduling</td>
<td>Q2/13</td>
<td>Q3/13</td>
<td>Q3/13</td>
<td>Q4/13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NC on load-frequency control and reserves</td>
<td>Q3/13</td>
<td>Q3/13</td>
<td>Q4/13</td>
<td>Q4/13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FG on balancing</td>
<td>Q4/11</td>
<td>Q4/11</td>
<td>Q3/12</td>
<td>Q3/12</td>
<td>Q4/12</td>
<td>Q3/12</td>
<td>Q4/12</td>
<td>Q1/14</td>
</tr>
<tr>
<td>EC consultory guideline on transparency</td>
<td>Q4/12</td>
<td>Q4/12</td>
<td>Q3/12</td>
<td>Q4/12</td>
<td>Q1/14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible Guidelines / FG on incentives to TSOs to increase cross-border trade</td>
<td>Q4/11</td>
<td>Q4/11</td>
<td>Q4/11</td>
<td>Q4/11</td>
<td>Q1/12</td>
<td>Q2/12</td>
<td>Q3/12</td>
<td>Q4/12</td>
</tr>
<tr>
<td>Possible Guidelines on investment incentives to TSOs</td>
<td>Q1/12</td>
<td>Q2/12</td>
<td>Q3/12</td>
<td>Q4/12</td>
<td>Q1/12</td>
<td>Q2/12</td>
<td>Q3/12</td>
<td>Q4/12</td>
</tr>
<tr>
<td>EC Consultory Guideline on tariffs</td>
<td>Q1/12</td>
<td>Q2/12</td>
<td>Q3/12</td>
<td>Q4/12</td>
<td>Q1/12</td>
<td>Q2/12</td>
<td>Q3/12</td>
<td>Q4/12</td>
</tr>
</tbody>
</table>

### Comments

1. CADC NC includes Capacity Calculation, Intraday Platforms and Day Ahead issues; beginning of formal 12 months NC period started with Q3/11
2. NC might start already in the end of Q3/2012 and end in the beginning of Q3/2013
3. Possible Guidelines will be available on the end of Q3/13
4. Preparatory work including codes consistency work

### Legend

- **PG**: Framework Guidelines
- **NC**: Network Code

### Adequate timing given available resources: eg ENTSO-E

... ~90 groups requiring ~19500 mandays/y from TSOs experts!
"The perspectives of the future European Electricity Grid"
ENTSO-E structure: tackling EU and Power systems complexity!!

1- Research & Development Plan
2- Monitoring and Knowledge Sharing