The role of networks in the EU

Jacques de Jong
ERRA/Inogate training 16
June Istanbul
The old model: monopoly

(A) Vertical integration

Generation

Transmission

Distribution

Customer

(B) Separate retailer / distco

Generation

Transmission

Distribution Co.

Customer

Energy sales

Energy flows in same company

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Information old structure

Supplies

Producers

Transmission

Distribution

Customers

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Information & new structure

supplies

Producers

markets

Traders/Resellers

Marketing/Distribution

customers

TSO

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Agenda
• the EU network challenge in electricity
• the Dutch Case
The EU Challenge
Grid revolution

- CB-trade & interconnections
- The intermittencies
- DSM, DG, smartness

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What are the options?

- **Full OU of TSO**
  - No incentives to discriminate
  - Externalities new power plant vs new network

- **ISO**
  - Split TO and SO
  - TO can stay at VIU
  - SO: 'independent'

- **ITO**
  - "independent TSO"
  - detailed & complex relation
The outcomes

Unbundling:

► Choise between OU, ISO and ITO

► ITO:

- Independent network operator, MS appoints
- Full commercial and technical management TSO
- Conformity programme & agent
- Mgt-personnel not from commercial functions (3 years before, 4 after)

So: ITO= legal unbundling 2nd directive, specified and detailed

3rd Energy Market Package
Agreed may 2009
Integration and interconnections

Interconnection capacity (NTC) in relation to peak demand

Source: ETSO and own calculation
The RES Challenge

Biomass (620) TWh

Geothermal (380) TWh

Wind Energy (1520) TWh

Hydropower (910) TWh

Solar Energy (1730) TWh

Source: Trans-CSP 2006

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Figure 18: European Union energy-related CO₂ emissions abatement

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2030</th>
<th>Investment (2008 billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>206</td>
<td>438</td>
<td>392</td>
</tr>
<tr>
<td>End-use</td>
<td>197</td>
<td>414</td>
<td>387</td>
</tr>
<tr>
<td>Power plants</td>
<td>9</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>Renewables</td>
<td>80</td>
<td>256</td>
<td>113</td>
</tr>
<tr>
<td>Biofuels</td>
<td>1</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td>Nuclear</td>
<td>143</td>
<td>253</td>
<td>0</td>
</tr>
<tr>
<td>CCS</td>
<td>16</td>
<td>250</td>
<td>9</td>
</tr>
</tbody>
</table>

Figure 19: European Union power generation capacity in the 450 Scenario

Source: IEA-WEO 2009
MS-targets RES Directive

<table>
<thead>
<tr>
<th>Country</th>
<th>RES Share in 2005</th>
<th>RES Share in 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>2.2%</td>
<td>13%</td>
</tr>
<tr>
<td>BG</td>
<td>9.4%</td>
<td>16%</td>
</tr>
<tr>
<td>CZ</td>
<td>6.1%</td>
<td>13%</td>
</tr>
<tr>
<td>DK</td>
<td>5.8%</td>
<td>10%</td>
</tr>
<tr>
<td>DE</td>
<td>17.0%</td>
<td>25%</td>
</tr>
<tr>
<td>EE</td>
<td>18.0%</td>
<td>30%</td>
</tr>
<tr>
<td>IE</td>
<td>2.9%</td>
<td>13%</td>
</tr>
<tr>
<td>EL</td>
<td>10.3%</td>
<td>17%</td>
</tr>
<tr>
<td>ES</td>
<td>8.7%</td>
<td>20%</td>
</tr>
<tr>
<td>FR</td>
<td>18.0%</td>
<td>25%</td>
</tr>
<tr>
<td>IT</td>
<td>5.2%</td>
<td>23%</td>
</tr>
<tr>
<td>CY</td>
<td>3.1%</td>
<td>16%</td>
</tr>
<tr>
<td>LV</td>
<td>32.6%</td>
<td>40%</td>
</tr>
<tr>
<td>LT</td>
<td>0%</td>
<td>23%</td>
</tr>
<tr>
<td>LU</td>
<td>4.3%</td>
<td>13%</td>
</tr>
<tr>
<td>HU</td>
<td>11%</td>
<td>4.3%</td>
</tr>
<tr>
<td>MT</td>
<td>10%</td>
<td>13%</td>
</tr>
<tr>
<td>NL</td>
<td>14%</td>
<td>34%</td>
</tr>
<tr>
<td>AT</td>
<td>2.4%</td>
<td>23.3%</td>
</tr>
<tr>
<td>PL</td>
<td>7.2%</td>
<td>15%</td>
</tr>
<tr>
<td>PT</td>
<td>17.8%</td>
<td>24%</td>
</tr>
<tr>
<td>RO</td>
<td>1.9%</td>
<td>25%</td>
</tr>
<tr>
<td>SI</td>
<td>6.7%</td>
<td>28.5%</td>
</tr>
<tr>
<td>SK</td>
<td>14%</td>
<td>38%</td>
</tr>
<tr>
<td>FI</td>
<td>15%</td>
<td>40%</td>
</tr>
<tr>
<td>SE</td>
<td>1.3%</td>
<td>39.8%</td>
</tr>
<tr>
<td>UK</td>
<td>13%</td>
<td>49%</td>
</tr>
</tbody>
</table>
The wind challenge

The solar challenge

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The Highways....

Road Map 2050

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Grid consequences

Grid expansion requirement example: threefold increase required for the 60% RES pathway

Grid investment needs 2010-2050
- inter-regional: 70-85B€
- offshore wind: 30B€
- back-up generation: 85-115B€

### Total net transfer capacity requirements
GW (existing + additional)

<table>
<thead>
<tr>
<th>Grid investment 2010-2050</th>
<th>Capacity additional + (existing), GW</th>
<th>Annual utilization %</th>
</tr>
</thead>
<tbody>
<tr>
<td>• UK&amp;Ireland-France</td>
<td>8 + (2)</td>
<td>75</td>
</tr>
<tr>
<td>• UK&amp;Ireland-Nordel</td>
<td>0 + (0)</td>
<td>0</td>
</tr>
<tr>
<td>• UK&amp;Ireland-Benelux &amp; Germany</td>
<td>3 + (0)</td>
<td>83</td>
</tr>
<tr>
<td>• France-Iberia</td>
<td>32 + (1)</td>
<td>83</td>
</tr>
<tr>
<td>• France-Benelux &amp; Germany</td>
<td>14 + (6)</td>
<td>78</td>
</tr>
<tr>
<td>• France-Central Europe</td>
<td>7 + (3)</td>
<td>93</td>
</tr>
<tr>
<td>• France-Italy &amp; Malta</td>
<td>0 + (3)</td>
<td>92</td>
</tr>
<tr>
<td>• Nordel, Benelux &amp; Germany</td>
<td>0 + (3)</td>
<td>75</td>
</tr>
<tr>
<td>• Nordel, Poland &amp; Baltic</td>
<td>4 + (1)</td>
<td>60</td>
</tr>
<tr>
<td>• Benelux &amp; Germany-Central-EU</td>
<td>0 + (4)</td>
<td>74</td>
</tr>
<tr>
<td>• Benelux &amp; Germany-Poland &amp; Baltic</td>
<td>9 + (1)</td>
<td>81</td>
</tr>
<tr>
<td>• Central-Europe-Poland &amp; Baltic</td>
<td>0 + (2)</td>
<td>77</td>
</tr>
<tr>
<td>• Central-South East EU</td>
<td>1 + (2)</td>
<td>80</td>
</tr>
<tr>
<td>• Central-Europe-Italy</td>
<td>0 + (5)</td>
<td>58</td>
</tr>
<tr>
<td>• South East EU-Italy</td>
<td>9 + (1)</td>
<td>79</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>87 + (34)</strong></td>
<td></td>
</tr>
</tbody>
</table>
Increased complexity... automation... capability
The new obligation..

The Ten Year Network Development Plan
- A pan-European ENTSO-E vision on the future of the grid
  - Non-binding, complementing the Regional and National Plans
  - Coordinate Transmission and Generation Investment
  - Provide a common and current reference to all stakeholders for their projects
  - Harmonise planning methodologies leading to an optimisation of resources and priorities
  - Illustrate policy options and their consequences
  - Demonstrate the TSO’s role in facilitating the implementation of European policies

- Input from national plans, not a compilation of national plans
- ACER to give an opinion
- ENTSO and ACER to monitor the implementation
- Financing of investments: only national?

TSO-obligations: Regional plans, National plans........
New infrastructures

- Needed for meeting bold RES-objectives
- Needed for enhancing further interconnections
- The Smart Grid paradigm
- But:
  - Unbundling barriers?
  - Regulatory risks
  - Low ROI’s
  - Lack of international (regulatory?) coordination
New Regulatory Agenda?

Lessons from FERC:
- Interstate trade only
- Promote infrastructures,
- Support competitive markets
- Prevent market manipulation

ACER-II?
- Promote pan-EU infrastructure, set cb-tariffs and coordinate licensing
- Promote competitive market, remove barriers and harmonise regulatory arrangements
- Use the CESR-la Rosiere approach, including binding mediation NRA’s

ACER (Ljubljana)
27-Regulatory Board
Director
The Dutch case:
- the networks
- the regulator
Liberalization in Dutch energy markets

- **Generation & production**
  - Free market, full competition
  - Ex post correction; ex ante merger control
  - Complicated markets, structure and behaviour

- **Supply, step-by-step**
  - Full & non-discriminatory TPA
  - Independent from supply and production
  - All networks (high & low voltage)
  - Regulated access conditions
  - Specified TSO-function

- **Networks: key**
  - Free market, full competition
  - Competition law
  - Household market:
    - Price monitoring DTe, ex post correction if needed
    - Supplier last resort
Market model Dutch electricity market

TSO: TenneT

CONSUMERS: free market as of 01.07.2004

Supply

Nuon/Vattenfall, Essent/RWE, Eneco, others

Transmission

Alliander, Enexis, Stedin, Others

Distribution

IMPORT EXPORT

GdF/Suez, Eon, Essent/RWE, Nuon/Vattenfall, Others (Co-gen)

Generation

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The Network Sector

TSO TenneT; state owned

DSO’s:
- 8 regional DSO’s
- ownership unbundled
- owned by regional govt’s
Electricity TSO’s are key to the market functioning at about 5% of total revenues.
Producers plan to build another 15 GW in production capacity, mainly coal, until 2015.

Source: TenneT
Between 2008 and 2015, large investments are planned for the 380 kV network

Estimate of needed investments in 380 kV infrastructure [EUR, billion]

Reasons for new investment

• Closing ring structure in Randstad (most densely populated area)
• Increasing wind power on sea (6000 MW in 2020)
• Investment plans for large new coal power plants
• Increased consumption

Source: TenneT
Dutch NMa/ER active along the whole value chain

Wholesale ➔ Transmission Distribution ➔ Retail

- Monitoring market developments
- Promoting transparency
- Promoting regional market integration

- Ensuring TPA
- Regulating transportation tariffs
- Regulating quality of network

- Licensing
- Monitoring market developments & supervising tariffs
- Promoting transparency & ensuring level playing field

Board of the NMa

DM
Competition Department

JD
Legal Department

DREV
Office of Energy and Transport Regulation

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Competition vs. regulation

**Ex post**
- General oversight
- Prohibition of cartels and abuse of dominant position
- Merger control
- Rest: freedom for companies

**Ex ante**
- Sector specific
- Monopoly tariffs based on efficient cost
- Licenses, monitoring, ...
- Frequent interaction with sector
Electricity Codes

System Code
- balancing
- back-up/black-start
- system reliability
- access conditions for generators
- balancing responsible companies

Net Code
- connection to the grid
- operation of the grid
- quality of the grid
- switching procedures

Metering Code
- meter location
- meter quality
- conditions for data collection
- rules for data use
Tarification Principles Electricity

Principles for setting transportation tariffs:

- costs (incl. Tariffs should be cost-oriented and based on historical reasonable ROI)
- fixed costs in a fixed tariff-element: variable costs in a variable element
- Causality: every customer pays for his cost
- Non-discrimination
- Apply RPI-X methodology for efficiency; fixed baseperiod
- Apply RPI-Q methodology for quality regulation
Every period for which an x-factor had to be set, proved to be a specific experience

<table>
<thead>
<tr>
<th>X-factor for Dutch TSO</th>
<th>Key aspects of period</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001,2,3</td>
<td>First time, lacking information base</td>
</tr>
<tr>
<td>2004,5,6</td>
<td>Reduction in WACC</td>
</tr>
<tr>
<td></td>
<td>Regulation of revenues</td>
</tr>
<tr>
<td>2007</td>
<td>Period cut short by transfer of 150 kV assets</td>
</tr>
<tr>
<td>2008,9,10</td>
<td>In preparation (delayed)</td>
</tr>
<tr>
<td></td>
<td>Large investment portfolio</td>
</tr>
</tbody>
</table>
Dutch customer’s transmission bill is relatively low.

Comparison of transmission invoices: producer and consumer connected at EHV, for a utilisation time of 5,000 h

Application of transmission tariffs for producer + consumer both connected at EHV (220 kV - 400 kV), for a utilisation time of 5,000 h

Source: ETSO

See appendix, for countries using a zonal tariff system: Norway, Sweden, England. Finland: tariff includes also costs concerning 110 kV network, estimated price for a connection EHV is 1.6 Euro/MWh. Germany: preliminary estimation due to major changes in the German power control market. Denmark: tariffs include only costs concerning 400 kV network.