One Group

Two TSOs (transmission system operators) with International Activities

The Elia Group is expanding its international activities through Elia Grid International
Agenda

1. Evolution & effects of European Energy landscape
2. Roles, responsibilities & business case of unbundled TSOs
3. Challenges for TSOs due to RES
4. RES revolution: Germany leading the way
5. Key role for interconnectors
Evolution & effects of European Energy landscape
Evolution of TSOs environment in Europe...

Before 1996: Vertically integrated and Natural Monopoly (eg. no clients but rate payers)

Evolving from reliable networks designed for optimisation of generation resources and power demand requirements as a business unit ...

Electricity Directive 96/92/EC (1999)

3rd Legislative Package for the Internal Market in electricity (2009)


... towards a transmission and distribution networks implementing EU energy and climate policies and maximising welfare in a new industrial sector (Unbundling, Greening, Smartening)
... with focus on climate change and energy policies

Implementing the EU policies for

- Security of supply
- Internal electricity market
- 20% renewable energy sources

Implies

- More transmission capacities
- Smarter network operation
- Better coordination among TSOs
... in a context of market integration and coupling

2011
Undersea cable
UK & NL

Baltic market

9 November 2010
Central West & Nordic Markets

2012/2013
South-West Market

2012/2013
Central South market

Fast evolution towards regional electricity markets on a European level
... and a well functioning “market model” ...

Coordinated ATC (available transfer capacity)

Net transfer cap. or Flow based

Flow based where more efficient

Forward Market

Physical Market

Real time

Futures Y+n

Monthly Y +1

Day-ahead

Implicit auctions
Market coupling

Intraday
Implicit continuous trading

Balancing

... with an impact on operation, balancing, reserve, ...
Governance of the Energy Union
Proposal for Regulation – 30.11.’16

2020 Targets

GHG Directive 2003/87/EC (ETS)
RES Directive 2009/28/EC
Energy Efficiency Directive 2012/27

Third Energy Package

ACER Regulation: Regulation (EC) No 713/2009
Electricity Regulation: Regulation (EC) No 714/2009

SoS

Directive 2003/87/EC

Winter Package = ‘Clean energy for all European’

2030 Targets

RED II 30.11.’16 Proposal for Directive
EED II 30.11.’16 Proposal for Directive

New Electricity Market Design

ACER Regulation 30.11.’16 Proposal for Regulation
Electricity Regulation 30.11.’16 Proposal for Regulation

Risk Preparedness 30.11.’16 Proposal for Regulation
EE Buildings Proposal for Directive 30.11.’16
Eco-design Cooling and heating Proposal for Regulation 30.11.’16

Communications on – 30.11.’16:
• Eco-design working plan 2016-2019
• Accelerating clean energy innovation
• A European strategy on cooperative, intelligent transport systems

Reports on – 30.11.’16:
• Energy prices and costs in Europe
• Implementation European Energy Programme for Recovery (EEPR) and the European Energy Efficiency Fund - Funding

Future situation (start ±2019)

Actual situation

Remark: Certain provisions will be moved
Remark: Certain provisions will be moved

EC Sector Inquiry report on CRMs (DG COMP)
New targets for the 2030 framework

**GHG - Revision of the Emission Trading Scheme (ETS) and Effort Sharing Regulation**

→ 2 targets

- **A EU's target** to reduce GHG (greenhouse gas) emissions by at least 40% domestically by 2030 in line with the 2030 climate and energy policy framework and as part of its contribution to the recently adopted Paris Agreement.

- **National binding GHG emission targets** for MS from 2021-2030 for the transport, buildings, agriculture, waste, energy and land use and forestry sectors (non-ETS sectors).

**Energy efficiency**

- As an encompassing element the EC proposes a **binding EU-wide target of 30%** for energy efficiency by 2030, emphasising the EU's commitment to put energy efficiency first.

**Renewables:**

- Europe has set itself a target to collectively reach a share of at least **27% renewables** in the final energy consumption by 2030.
Roles, responsibilities and business case of unbundled TSOs
TSOs at the Heart of the Electricity System

Producers
Electricity is produced from conventional and renewable energies.

Transmission System Operators
Ensure that electricity arrives from the producer to the consumer via the distribution system operators.

Consumers
Use the electricity fed by the producer into the power transmission grids.
Addressing the EU Objectives

EU objectives

Security of supply

Competitiveness

Sustainability

1. Security of supply

2. Construction of the European market

3. Integration of renewable energies

Competition

Sustainability

Security of supply
Key Activities

Elia Group

1. Infrastructure management
   Operation, maintenance, planning and expansion of the on- and offshore high voltage infrastructure.

2. Controlling the system
   Secure operation and balancing of the whole electricity system, 24/7.

3. Developing the EU market
   Front runner in the development of the EU electricity market (NWE & CEE regions) to make the EU energy system more competitive, secure and sustainable.
Infrastructure management is about ...

Maintenance, reinforcement & development of the grid

- Integrating renewables
- Developing the European electricity market
- Safeguarding a high level of system security

1. Developing interconnections
   - Nemo (B-UK)
   - ALEGro (B-GE)
   - Hansa Power Bridge (GE)
   - Combined Grid Solution (GE-DK)

2. Optimization of grid usage
   - Smart maintenance
   - Ampacimon
   - HTLS-lines

3. Developing innovative grid solutions
   - Bestgrid
   - Bestpath
   - Ampacimon
   - Life+ project
   - …
Controlling the system is about ...

Balancing the system
- Control centers
- Security of supply
- Integration of fluctuating renewables

Integrating innovative system control solutions
- Demand response
- Operating phase shifters
- Increased grid usage

Keeping system security
- Reserve capacities
- Re-dispatching
- International dimension of system operation
Developing the EU market Is about …

Integration of the European Electricity Market
- Flow based market coupling
- NWE and CEE regions
- Cooperation with Power Exchanges

Developing methods, tools and market processes
- Capacity allocation and congestion management
- Developing network codes

Market Products and Platforms
- Developing new market products
- Auction platforms for ancillary services
Developing the EU market

Central-West and North-West Europe (CWE & NWE)
Central East Europe (CEE region)

2010
CWE
Central-West Europe:
Belgium, France, Germany, Netherlands, Luxembourg

2014
NWE
North-West Europe:
NWE + UK, Scandinavia

2015
SWE
South-West Europe:
Spain, Portugal

CSE
Central-South Europe:
Italy

MRC
Multi-Regional Coupling
Developing the EU market

The Elia Group is a frontrunner

1. in supporting close cooperation with power exchanges
   ➔ as shareholder of APX Group and EEX

2. in auctioning long-term interconnection capacity
   ➔ through CASC in NWE
   ➔ through CAO in CEE

3. in supporting the design of new market products
   ➔ closer to real-time for new types of players like flow based methodology and in the electricity system
Developing the EU market – Flow based market coupling

-9.5%

Avg price 3m before flow based
€46.00

Avg price 3m since start flow based
€41.62

Belgium

- More efficient analysis of the related commercial transactions and physical flows is enabled
- Makes it possible to increase price convergence, leading to significant economic gains.
Business case of unbundled TSOs

- Most TSOs were a profitable business unit within a vertical integrated utility although not visible

- The European unbundling allowed three options (Fully unbundling, independent transmission operator or independent system operator). Fully unbundling became the standard after a while.

- The unbundling of TSOs led to separate strong profitable companies:
  - Regulators determine return on assets (WACC times RAB) or equity
    - ROE 5% – 12% (still a wide range applicable)
  - Some were listed on European stock markets (NG, Terna, REE, REN, Elia)
    - Average EV / EBITDA 8.8
    - Average P / E 14.2
    - Average Dividend yield 5.8%
  - All of them were highly rated by the international rating agencies S&P, Moody’s, Fitch (often A-rating or higher)

- TSOs are key for the creation of a European integrated electricity market and are therefore well perceived by all stakeholders (regulators, politicians, energy market players, shareholders etc.)

- Electricity incumbent producers went through difficult times in the past 5 years but this is mainly due to increased RES development (Germany subsidizing rest of Europe by lowering electricity power prices all over Europe) and the (unexpected) closure of nuclear power plants
TSO tariffs are low in total electricity bill

Components of TSO transmission tariffs 2011 (EUR per MWh)

(1) The data of Macedonia were not available in the beginning of 2011 when the comparison was made for the expected tariffs 2011.
Challenges for TSOs due to RES
RES are driving important changes....

1. Large flows all over Europe

2. Thousand small local generation units
RES share impacts security of supply & balancing methods

Which role for nuclear/fossil production units in 2020?

Marginal cost

€/MWh

0 1 6

Min. take off
(summer night)

Max. take off
(winter day)

GW

Max. available capacity

Peak units
(reserve, incidents)

Coo, ...

P.V.
(priority)

Wind
(priority)

Biomass and/or
cogeneration
(priority - must run)

P.V.

f (wind, sun)

Nuclear

CCGT

Fossil
(coal-gas-fuel)
Controlling the system: Solar eclipse – 20 March 2015

- **The market products** developed and introduced in the last years worked well
- **TSOs** properly **secured the system** via additional security measures

Megawatt (MW)

- ~ 13.7 GW
- ~ 6 GW
Raising acceptance as guideline

The Elia Group creates a better understanding of grid development needs through:

1. Participation
2. Bundling of infrastructures
3. Undergrounding
4. Use of existing powerlines

The Elia Group’s objectives in grid development = as little impact as possible on people, nature and landscape.
RES revolution : Germany leading the way
RES development in Germany

Area proportional to installed capacity

2000

~ 30,000 plants

2006

~ 221,000 plants

2014

~ 1,600,000 plants

Source: 50Hertz, Terna1, Amprion, TransnetBW, Google Earth
Germany - The *Energiewende* drives long-term opportunities

Grid extension to evacuate RES energy from Northern to Southern Germany

In the 50Hertz region 50% of the installed capacity renewable and in 2015 more than 45% of the consumed energy came from renewable energy sources

Source: 50Hertz, TenneT, Amprion, TransnetBW
RES in the 50Hertz control zone

Present situation and forecast of installed capacity

Installed capacity in MW

Current situation

Forecast

- Photovoltaics
- Wind offshore
- Wind onshore
- Biomass
- Others

Installed capacity late 2014*

Wind | 14.637 MW
Photovoltaics | 8.237 MW
Biomass | 1.792 MW
Others | 272 MW
Total | 24.938 MW

* As at July 2014; Source: 50Hertz
Energiewende

Energy transition and nuclear phase-out

- The Energiewende: energy transformation based on a set of energy policies:
  - September 2010: ambitious targets in reduction of CO2 emissions, renewable energy and energy savings
  - May 2011: announcement of nuclear energy phase-out ("Atomausstieg") in the wake of Fukushima accidents

- Energiewende brings a number of considerable challenges
  - Significant change in electricity production mix implies shift in load profile: rise in renewable and decentralised energy capacity versus phase-out large scale nuclear capacity
  - Maintenance of sufficient back-up capacity mainly through fossil fuels (coal, gas)
  - Substantial investments required for capacity extension and upgrading in transmission and distribution
  - Requirement for acceleration and simplification of permitting procedures across states and regions for new build

The Energy Concept – pathways and goals

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<tr>
<th></th>
<th>Today</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
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<tbody>
<tr>
<td>Reduction in greenhouse gas emissions (base year: 1990)</td>
<td>-27%</td>
<td>-40%</td>
<td>-55%</td>
<td>-70%</td>
<td>-80%</td>
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<tr>
<td>Share of renewable energies in electricity consumption</td>
<td>16%</td>
<td>35%</td>
<td>50%</td>
<td>65%</td>
<td>80%</td>
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<tr>
<td>Reduction of electricity consumption (base year: 2008)</td>
<td>-1%</td>
<td>-10%</td>
<td></td>
<td>-25%</td>
<td></td>
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<tr>
<td>Reduction of final energy consumption in the transport sector (base year: 2008)</td>
<td>-10%</td>
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<td>-40%</td>
</tr>
</tbody>
</table>

Germany’s changing electricity mix

Source: Bundesministerium für Wirtschaft und Technologie, Prognos, Energy Research Institute, University of Köln (EWI)
Supply and demand vs. transmission capacity

50Hertz gap between generation and consumption

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Source: 50Hertz Transmission and TenneT GmbH forecasts for 2020, Elia analysis

Transmission capacity cannot follow the pace

- Existing north-south routes already at full capacity during strong winds
- Approximately 50 GW - 60 GW new production capacity until 2020, vs. 12 GW new transport capacity

The necessary network expansion is slower than the increase of renewable energies

Demand centers
Generation of renewables
Current construction projects

Increase of congestion cannot be avoided with currently implemented projects

Source: 50Hertz Transmission and TenneT GmbH forecasts for 2020, Elia analysis
System Security: 50Hertz grid is highly reliable, despite very high share of renewables

2011 highlights for system security

- Secure grid operations in Hamburg, despite exceptional circumstances
- On 45 days EEG power had to be lowered
- Redispatch costs at over EUR 100m (thereof EUR 41m in 12/2011)

Very low failure rate at 50Hertz

50Hertz redispach costs and quantity

Increasing curtailment of RES production required
Key role for interconnectors
German ten year grid development plan

- Cooperation 4 German TSO’s for one grid development plan for Germany, accepted by BNetzA & Bundesrat
- Measures to optimize existing routes
- Grid expansion in new routes, including DC corridors
- Total investment value foreseen at € 16.5 billion, of which € 4.6 billion is relating to DC corridors (A,C & D)
Interconnection between offshore wind in Germany & Denmark (later also potentially Sweden)

Unique in the world
Hansa Power Bridge

➔ First subsea interconnection between Germany and Sweden to balance German wind and Swedish hydro

➔ Essential for the integration of renewable, system security and the further development of the European market
ALEGrO

- First HVDC-interconnection between Belgium (Elia) and Germany (Amprion)

- 100 km underground cable

- Transmission capacity of 1000 MW

- Operational 2019
→ HVDC connection between Bruges (BE) and Richborough (UK)
→ 140 km of undersea & underground cables
→ Electricity transport capacity of 1000 MW
→ Investment: 660 million EUR (50% for Elia)
→ Operational 2019
Geography
Some of the Risks and Challenges

Seabed Conditions

The offshore weather challenge

Unexploded Ordnances (UXOs)

Permits/authorizations
Regulatory Framework written by 2 national regulators

- Mainly congestion revenue income resulting from market price difference and interconnector capacity used;
- 2 regulators: OFGEM (UK) and CREG (Belgium);
- Joint ‘Cap and Floor’ regulatory regime for 25 years;
- ‘Below Floor’ revenues: \(\rightarrow\) exceptional support from consumers; reduces the financial risk;
- ‘Above Cap’ revenues: \(\rightarrow\) surplus flows back to consumers;
- Regulatory assessment periods of 5 years.
CAP AND FLOOR PROCESS

• IPA and FPA create a Preliminary Cap and Floor
• At the 85-95% stage of construction completion we create a PCR adjustment to those initial values
• We have potentially two further adjustments:
  • Opex related - ORA
  • Decommissioning related - DC

Regulatory reporting

IPA
Submission
Challenge & Review
Consultation & Decision

FPA
Submission
Challenge & Review
Consultation & Decision

PCR
Submission
Challenge & Review
Consultation & Decision

ORA
Submission
Challenge & Review

+10y
Submission
Challenge & Review
Consultation & Decision

PCR
Submission
Challenge & Review
Consultation & Decision

DC
Submission
Challenge and Review
Decision

85% - 95% of construction

Legislative requirements

IPA = Initial Project Assessment;  FPA = Final Project Assessment;  PCR = Post Completion Review;  ORA = Opex Reassessment Adjustment;  DC = Decommissioning Cost Adjustment
CAP AND FLOOR CALCULATION AND ANNUITISATION

<table>
<thead>
<tr>
<th>Real post tax allowed returns</th>
<th>GB</th>
<th>Belgium</th>
<th>Nemo (Average)</th>
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<tbody>
<tr>
<td>Cap</td>
<td>8.10%</td>
<td>6.58%</td>
<td>7.34%</td>
</tr>
<tr>
<td>Floor</td>
<td>0.92%</td>
<td>-0.07%</td>
<td>0.42%</td>
</tr>
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Cap / Floor level annuitised

Cap / Floor level pre annuity

€ Millions

Years

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

- Tax allowance
- RAV return
- Opex
- Depreciation