REGULATORY FRAMEWORK AND CHALLENGES FROM THE EUROPEAN PERSPECTIVE

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Honorary Chairman Elia System Operator NV
Overview

1. European Energy Policy

2. The European Regulatory Framework

3. Regulatory Challenges

4. Smart Grids - Regulatory Barriers
Liberalisation

• European liberalisation process since 1990s
  ➔ Towards a competitive internal energy market (IEM)
    – Almost simultaneous for electricity and gas sector
    – Competition and trade = welfare increasing
      • cost-efficiency
      • price reductions
      • service improvements

• 3 legislative packages:
  – 1\textsuperscript{st} ➔ Directive 96/92/EC and 98/30/EC
  – 2\textsuperscript{nd} ➔ Directive 2003/54/EC and 2003/55/EC
  – 3\textsuperscript{rd} ➔ Directive 2009/72/EC and 2009/73/EC

set common rules for electricity sector:

– Consumers’ right to choose their supplier
– Unbundling TSO and DSO from production and supply
– Third party access transmission and distribution
– Independent national regulators
Liberalisation: unbundling

- **GenCo**
- **TransCo**
- **DistCo**
- **Retailer**

**Competition**
- **Regulated Monopolies**
Renewable Energy Targets
2020 Package

• RES Target
  – EU2005: 8.5%
  – EU2010: 12.7%
  – NREAP2020: 20.7%

• GHG Target
  – Projections2020: -24%

• Efficiency
  – Projections2020: ???
  – New Directive 2012/27/EU
  – Framework of additional measures
Renewable Energy Targets Beyond 2020

• 2030 Framework
  – GHG: 40% cut compared to 1990 levels
  – RES: 27% of total energy consumption
  – EFFICIENCY: no specific target yet

• 2050 Roadmap

<table>
<thead>
<tr>
<th>GHG reductions compared to 1990</th>
<th>2005</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>-7%</td>
<td>-40 to -44%</td>
<td>-79 to -82%</td>
</tr>
<tr>
<td>Sectors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power (CO2)</td>
<td>-7%</td>
<td>-54 to -68%</td>
<td>-93 to -99%</td>
</tr>
<tr>
<td>Industry (CO2)</td>
<td>-20%</td>
<td>-34 to -40%</td>
<td>-83 to -87%</td>
</tr>
<tr>
<td>Transport (incl. CO2 aviation, excl. maritime)</td>
<td>+30%</td>
<td>+20 to -9%</td>
<td>-54 to -67%</td>
</tr>
<tr>
<td>Residential and services (CO2)</td>
<td>-12%</td>
<td>-37 to -53%</td>
<td>-88 to -91%</td>
</tr>
<tr>
<td>Agriculture (Non-CO2)</td>
<td>-20%</td>
<td>-36 to -37%</td>
<td>-42 to -49%</td>
</tr>
<tr>
<td>Other Non-CO2 emissions</td>
<td>-30%</td>
<td>-72 to -73%</td>
<td>-70 to -78%</td>
</tr>
</tbody>
</table>

April 10, 2014 Rio de Janeiro
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European Energy Regulators

- **Council of European Energy Regulators (CEER)**
  - March 2000, HQ Brussels
  - Facilitate EU internal market for electricity and gas
  - Cooperation, information exchange & assistance between national regulators

- **Agency for Cooperation among Energy Regulators (ACER)**
  - 3 March 2011, HQ Ljubljana, Slovenia
  - Integration EU market electricity and gas
    - Framework Guidelines Network Codes
    - Decisions access and operation cross-border investments
    - Advise to European institutions
European Energy Regulators

• National Energy Regulators
  – Part of 3rd Energy Package
  – Enhanced independence
    • Legally distinct
    • Functionally independent
  – Enhanced duties and powers
    • Advises government towards organization and functioning and of the electricity market
    • Controls compliance with rules and legislation
      – Examples of responsibilities:
        » Monitor compliance with unbundling and liberalization
        » Appoint DSOs and TSOs
        » Approve network tariffs
        » Approve defense plan (black-out)
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Main Regulatory Challenges

• Transmission Systems
  – Network and Market Integration ‘Super Grids’
    • Pan-European transmission grid
    • Market coupling

• Distribution Systems
  – Active Distribution Systems “Smart Grids”
    • Uptake of new distributed energy resources
    • Roll-out ICT infrastructure
    • Demand flexibility integration

• Generation Adequacy
  – Ensuring the security of supply
    • Capacity mechanisms and profitability of conventional “back-up” power
    • Market differentiation conventionals and renewables
Stretching the current AC system or developing a new overlay grid?

**GOVERNANCE**
*Planning e.g. projects of common interest*

*Ownership e.g. merchant transmission lines*

*Cost Allocation e.g. locational price signals*

*Financing e.g. public-private financing*

*Operation e.g. network guidelines*
Smart Grids

Multi-directional ‘flows’

Central & dispersed sources

End user real time
Information & participation

Seamless integration
of new applications

Central & dispersed intelligence

Smart materials and power electronics
Security of Supply

• High Renewable power with low variable cost
  – Impact electricity prices
  – Profitability thermal power plants
  – Adequacy

Capacity Remuneration Mechanisms?
Future of the Energy-Only Market?
Overview

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Context Distribution Systems

• Large-scale integration of Distributed Energy Resources (DER):
  
  – Distributed and Renewable Generation (DG & RES)
    • PV, wind, biomass, CHP, back-up generating units ➔ prosumers
    • Local generation exceeding consumption (cfr. Germany)
  
  – Distributed Storage (DS)
    • R&D efforts needed to improve technology
    • Expectations to reduce future cost of small-scale, local energy storage
  
  – Electric Vehicles (EV)
    • Flexible charging
    • V2G: grid services
  
  – Demand Response (DR)
    • Initially for large consumers
    • Increasing potential towards small-scale residential consumers

• Evolution towards Smart Distribution Grids (SG):
  
  – Roll-out smart metering systems
  
  – Improved grid monitoring and control
1. Local electricity generation will result in low, zero or negative local net energy consumption
   1. Monitor and control peak injection and off-takes
   2. Adapt remuneration schemes of DSOs
   3. Plan appropriate asset investments

2. This while taking into account developments in other energy distribution systems
   1. Gas distribution systems
   2. District heating distribution systems
Context Distribution Systems

- **Strong DSO differences among EU countries**
  - **Voltage level**
    - max 200 kV (IT) – 20 kV (FR)
  - **Number**
    - > 800 (DE) – 1 (SL)
  - **Scope**
    - e.g. public services

- **Increasing impact on electricity cost!**

Network costs went up by 30% for industrial consumers and by 18.5% for households. While this increase is smaller than in the case of taxes and levies, network charges constitute a much more important element of final prices, reaching 50% in the case of households (CZ) and 56% in the case of industrial consumers (LT).

Source: EC 2014
Market Framework

• Unclear roles & responsibilities
  – Investment in new infrastructure
    • ICT, metering, EV, ...
  – Roll-out of new equipment
    • Smart Meters, charging infrastructure,...
  – Ownership of infrastructure
  – Data handling (privacy and security)
Remuneration Schemes

• Focus on cost-efficiency
  – Based on historical expenses, benchmarking,...
  – Focus on cost-efficiency
  – Lack of innovation incentives!
  – No emphasis on long-term, market-wide benefits
  – Time-delay before new investments are recognized

Source: Think 2013
Tariff Regulation

• Flat and volume-based grid tariffs
  – Limited cost-reflectiveness & cost-causality
  – Socialization of costs
  – Ignores true cost drivers

- geographical location
- connected capacity
- contribution to peaks
- contribution to system losses

Source: Think 2013
Market entry barriers

• Limited unbundling (>50% of EU DSOs not unbundled)

• Minimum market requirements
  – Participation fees in power exchange
  – Minimum capacity e.g. reserve market
  – ...

Table 1: Unbundling of electricity TSOs and DSOs of selected Member States (2010 data)

<table>
<thead>
<tr>
<th>Country</th>
<th>Total number TSOs</th>
<th>Ownership unbundled</th>
<th>Total number DSOs</th>
<th>Ownership unbundled</th>
<th>Legally unbundled</th>
<th>Less than 100,000 cust.</th>
<th>Exemption</th>
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<td>6</td>
<td>5</td>
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</tr>
</tbody>
</table>

Source: EC (2012c) Rio de Janeiro

Source: Think 2013
Standardization

- Lack of (inter)national smart grid standards & minimum requirements
  - Interoperability
  - Reduced market liquidity
  - Slower roll-outs
  - Difficult integration in existing infrastructure

- Currently being developed by CEN, CENELEC and ETSI
Privacy and consumer protection

• Smart grids requires increased data processing (frequency, granularity,..)

• Who has access to which data?

• How to keep data secure?
Market Integration of Domestic Active Demand

➡️ Development of Business Cases
➡️ Development of Market and Regulatory Framework

Automated active demand

DSO

- LV transformer load
- LV feeder voltage profile

BRP/retailer

- Trading wholesale market
- Portfolio management (wind)

Dynamic tariffs
Overview

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5. Ongoing Research Activities
Energyville Business Affiliation Program
Smart Limburg (NER300)

Demonstration Project of Virtual Power Plant Concept

- Develop New Market Design (Local Energy Market)
- Resolve Regulatory Barriers for Implementation
DSO Think Tank

• Multi-disciplinary team of researchers
  – 3 PhD researchers
  – Focusing on long-term future of distribution systems
  – Economic, technical and regulatory aspects

• Tackle future distribution system challenges
  – Research questions put forward by financing partners, in cooperation with EnergyVille
  – Output: periodical reports
    • Supervision EV experts
    • Guarantee for independent research
### 1. Impact DER on peak and net energy flows?

<table>
<thead>
<tr>
<th>Technical</th>
<th>Economic</th>
<th>Regulatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact of EU policy goals on distribution systems?</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Measure impact DER on peak demand, injections and net energy consumption?</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Distribution system adequacy to cope with peak energy flows?</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Impact current tariff structures on electricity price?</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

### 2. How to induce cost-reflective consumer behaviour?

<table>
<thead>
<tr>
<th>Technical</th>
<th>Economic</th>
<th>Regulatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential contribution of DER in system support?</td>
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<td></td>
</tr>
<tr>
<td>Development of cost-reflective grid tariffs?</td>
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</tr>
<tr>
<td>Integration with other other electricity tariff components?</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

### 3. How to facilitate local DER in providing system services?

<table>
<thead>
<tr>
<th>Technical</th>
<th>Economic</th>
<th>Regulatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which potential services can be provided with which technology?</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>What is the value of this services?</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>What is the required market framework for participation?</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

### 4. Impact of distribution system on transmission system?

<table>
<thead>
<tr>
<th>Technical</th>
<th>Economic</th>
<th>Regulatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact of new distribution tariffs on stakeholders (supplier, TSO,...)?</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Impact of new distribution tariffs on system (CO2, import,...)?</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Interaction with other energy distribution systems (gas, heat,...)?</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>
Further questions...

Ronnie.Belmans@energyville.be
International Workshop
Sharing Energy Regulatory Practices and Perspectives.

LatAm-Europe: National Experiences, Common Languages and Future Trends.

Rio de Janeiro | 10th April 2014