Nodal Pricing project in Poland

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Lessons learned from the operation of the current (zonal) electricity market

- **Difficulties in the incorporation of the transmission grid constrains into commercial trading**
  - Infeasible forward market schedules
  - Large scale of redispatching and related costs

- **Inaccurate price signals**
  - For generation
  - For consumers
  - For network development

- **Non-optimal market outcome**
  - Dispatch efficiency, including domestic network utilization
  - Separate reserves and balancing energy procurement

No possibility to mitigate the existing imperfections by improving the current zonal model
Market redesign Project

- Project is managed by the Ministry of Economy
- Specific tasks are carried out by:
  - Project Teams: PSE Operator, Regulator, Ministry of Economy
  - Working Groups: Created by Steering Committee to support Project Teams
- Results obtained so far:
  - Agreed directions of the Reform and Project schedule
    - Phase 1 – Reform Preparation (2010-2011)
    - Phase 2 – Reform Implementation (2011-2014)
    - Phase 3 – Reform Monitoring (2015)
  - Agreed market design concept, i.e. Nodal Pricing based electricity market

Stakeholders, including Market Participants, support the implementation of Nodal Pricing based electricity market in Poland
Redesign of Polish electricity market

• **Main objectives:**
  – Ensuring consistency between the commercial model and the physical reality
  – Accurate price signals for generation and demand response
  – Improvement of system reliability and increase in operation efficiency
  – Ensuring proper conditions for integration with EU internal energy market

• **Basic solutions:**
  – Bid-based organized spot markets for energy and reserves with the possibility of
    ▪ Self-scheduling of energy
    ▪ Self-providing of reserves
  – Integration of spot markets with the efficient allocation of scarce domestic transmission capacity
  – Locational pricing of energy reflecting the marginal cost of production and delivery
  – Active demand side that can respond to locational spot price signals
  – Capacity market ensuring long term generation adequacy
New Electricity Market Architecture

- Markets

• Energy and Ancillary Services Markets
  • Real-Time Market
  • Intra-Day Market
  • Day-Ahead Market

with the following pricing mechanism:
  • Nodal Locational Marginal Pricing for generation
  • Zonal Locational Marginal Pricing for consumers

• Financial Transmission Rights Markets
  • FTR allocation
  • FTR auction

• Capacity Markets
  • Decentralized bilateral market
  • Centralized market run by TSO
New Electricity Market Architecture
- Commodities

- Market Commodities
  - Energy
  - Ancillary Services
    - Regulation UP
    - Regulation Down
    - Spinning Reserve (15-min reserve)
    - Non-Spinning Reserve (60-min reserve)
  - Financial Transmission Rights (FTRs)
  - Forward Capacity

- Non-Market Commodities
  - System Voltage Support
  - Black Start
  - Primary Reserve
Simulation results

- Lower energy supply costs to end users (the gain in marginal costs of energy supply ranges from 1.2% to 1.9%, which amounts to some 75 mln EUR per year)
- Maintaining the prices in Poland at a similar level to the current one, ranging from some 48 EUR/MWh to 55 EUR/MWh
- Only limited differentiation of locational prices throughout the different demand aggregation areas in Poland
- Significant variation of the hourly energy prices in particular nodes in case of congestions
- Increase of transmission capacity available for commercial transactions thanks to more detailed modeling, and less needs for approximations and the entailed reliability margins
Combining nodal with European zonal market
- Important features of the integrated models

- Both models belong to the same market design category
  - Locational pricing
  - Flow-based capacity allocation

- However, some important differences exist, e.g.
  - Size of locations
  - Transmission network model

- Additional challenges arise from the different scheduling schemes
  - Self unit commitment-based Zonal model (most common European approach)
  - Central unit commitment-based Nodal model (Polish approach)
Combining nodal with European zonal market
- Consequences of the differences

• Only two components of energy delivery cost may be reflected in the energy prices
  – Marginal Energy Component
  – Marginal Congestion Component
  (i.e. the Loss Component must be neglected)

• Unit Commitment problem must be included in the Market Clearing Problem (i.e. European Price Coupling algorithm)
  – Commitment costs
  – Generation unit constraints
Combining nodal with European zonal market
- Integration models

- **Model 1:** Single Market Coupling (First best solution)
  - One-step market clearing
  - Single market clearing algorithm which clears Zonal market simultaneously with Nodal market (Nodal market is cleared for all nodes taking into account all resource and transmission constraints)

- **Model 2:** Sequential Market Coupling (Second best solution)
  - Two-step market clearing: EU Zonal -> Domestic Nodal
  - Simplified representation of Nodal market in Zonal market clearing (nodes aggregated into zones; only main resource and transmission constraints reflected)
  - Separate Nodal market clearing that includes results from Zonal market clearing (energy exchange between zones)
Thank you for your attention!