

Nodal Pricing project in Poland

Tomasz Sikorski

34th IAEE International Conference
Institutions, Efficiency and Evolving Energy Technologies

Stockholm, 21 June 2011

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!