



Polish Electrical Energy Market (from the academic perspective)

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Sub-sectors of the Polish Electric Energy Sector

Generation:

- over 30 generating companies
- 34.000 MW installed capacity,
- 141 TW.h gross annual electricity generation
- peak load 22.821 MW (Dec. 23, 1999)

Transmission:

- PSE SA (The Polish Power Grid Company)
- transmission system operator
 - balancing market

ELECTRICITY MARKETS

Distribution:

- 33 distribution companies
- approximately 15 million customers

Supply:

suppliers, marketers, brokers,
market integrators,



Basic Markets and Contracts

Forward Energy trading: bilateral contracts and power exchanges

(POLPX, POEE) → energy trading on the „copper plate”

RMR Generation Contracts → to ensure reliability in local areas

Reserves: long-term contracts

→ to ensure adequate AGC and reserve margin

Centralized Balancing Market for adjustment bids:

→ centralized dispatching and unit commitment

→ does not enable congestion management at least cost

Flat „post stamp” System for Transmission Charges:

→ no nodal locational signals for generators

Long-term Energy Contracts (LTCs)

→ enhance environmental investments and provide financial hedges



Summary:

Real-time and Forward
Markets are not Coherent

- ◆ Physical Feasibility and Reliability
 - ◆ TSO ensures tight **centralized** resource coordination & RMR supply (day ahead gate)
 - ◆ Forward energy markets do not acquire and coordinate resources (balancing energy, reserves, transmission) needed in Real-Time (RT) market
 - ◆ Forward markets do not establish consistent prices for the scarce resources in RT operations



Summary: Polish Market Regulations

- ◆ Polish market solutions are compatible with EU regulations
- ◆ Polish producers and distributors are relatively small in comparison to typical European energy market „players”
- ◆ However, there is politically strong movement to integrate producers and distributors (horizontal and vertical integration)
 - ◆ To make them stronger in the EU competition
 - ◆ To reduce impact of „guillotine” prices on the Balancing Market by *group balancing*
 - ◆ This deteriorates the basic characteristics of the Polish energy market (efficiency, fairness, market power, incentives compatibility)
- ◆ Main Polish producers are politically sufficiently strong **to obstruct** proposals for positive changes in the market regulations that promote fair and competitive conditions to all participants



Summary: Polish Market Regulations

- ◆ Deadlock situation: no changes in the market rules are possible without acceptance of the „main players” on the market
- ◆ Very weak and inactive regulation (Regulation Office URE, Ministry)
- ◆ Privatization process has negative impact on market development
 - ◆ fragile market allows some decision makers to make arbitrary decisions
- ◆ Security of energy supply is the hottest political topic



Summary: Polish/EU Energy Market Solutions and Regulations

- ◆ Politicians and decision-makers try to solve problems at a very high abstract level without tackling real physical problems at local level and short time scale
- ◆ Market solutions implemented and promoted in the EU are not well designed:
 - ◆ Market solutions may be unfair to some participants
 - ◆ Some products and activities are subsidized
 - ◆ There are incentives to promote inefficient generation and inefficient flows in some parts of the network
 - ◆ Solutions are based on poor and incomplete theoretical trading models („copper plate”, LMP)
 - ◆ Trading aggregate commodities and services (energy, FTRs) creates „virtual reality” world at expense of global efficiency
 - ◆ Prices of aggregates are not compatible with average costs
 - ◆ No ways of revealing real costs without implementing better RT markets



Summary: Consistency of Forward Markets and Real-time Markets

- ◆ The „copper plate” trading model gives incentives to promote inefficient power generation and inefficient power flows
- ◆ The LMP model gives incentives to make use of the local power
- ◆ There are new attractive theoretical models for designing appropriate balancing market mechanisms (Intra-day and RT Balancing Markets) that provide consistency with Forward Markets and provide efficiency
- ◆ RT and Forward Market instruments must facilitate trading on heterogenic forward markets for combined commodities and services (energy, ancillary services, transmission-rights, emissions, green power certificates). For that purpose the **multi-commodity exchanges**, in addition to single-commodity exchanges and bilateral trading must be used.



- ◆ Must-Run Generation Contracts
- ◆ Ancillary Control Services
- ◆ RT Balancing Market
- ◆ Long Term Energy Contracts



Must-Run Generation Contracts

- ◆ Network Constraints

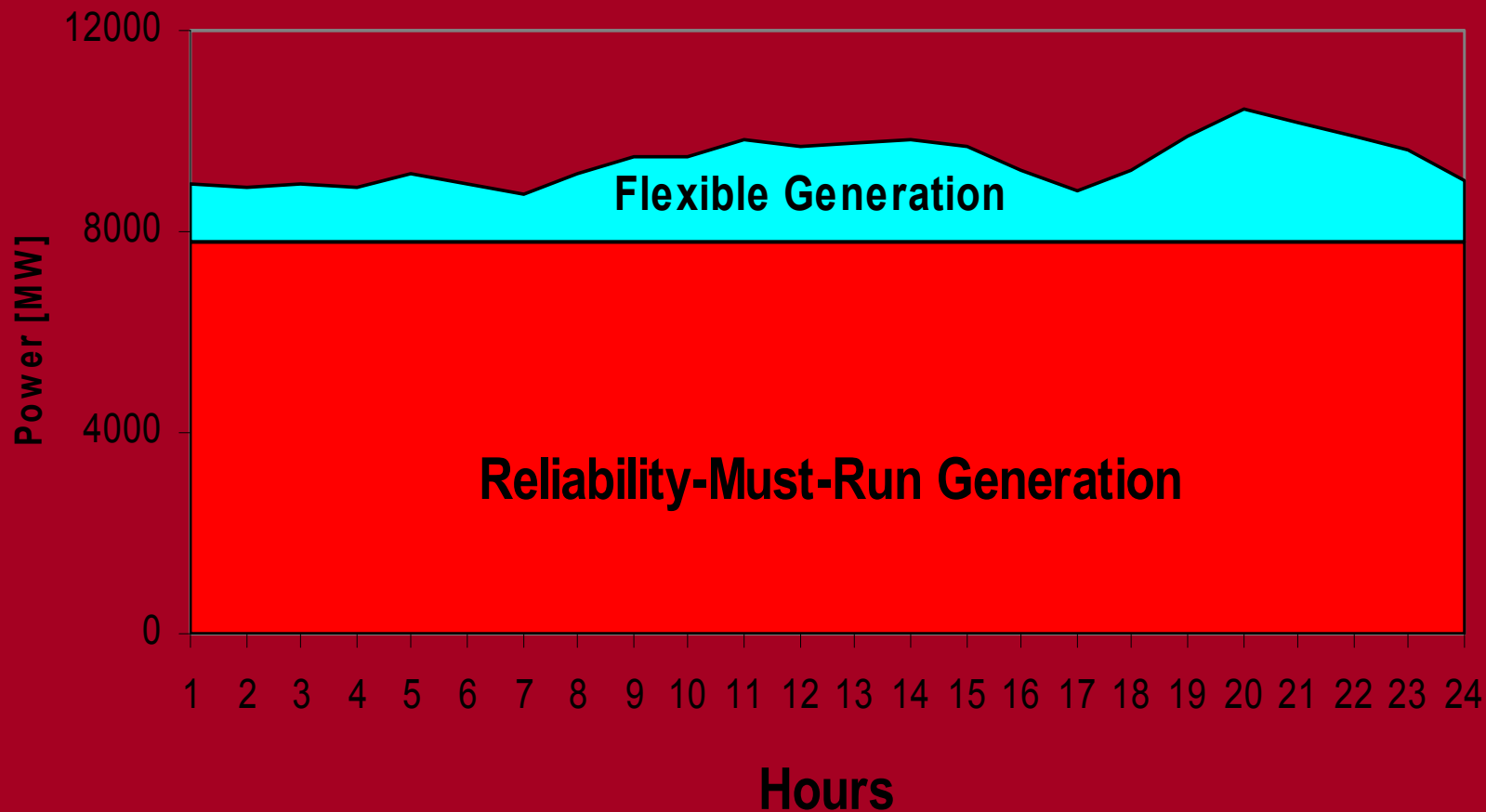
- ◆ To maintain reliability standards in the grid, generators at certain grid takeout points must keep their generation at or above minimum limits

- ◆ MRG Contracts

- ◆ Generators that are needed to be at a certain minimum level for reliability may have relatively higher than competitive costs
- ◆ To provide partial compensation of these higher costs, the generator signs a Must-Run Generation Contract



Must Run Generation





Ancillary Control Services

Objectives

- ◆ Ensure reliable and secure operations
- ◆ Support efficient operation in energy markets

◆ Operating reserves

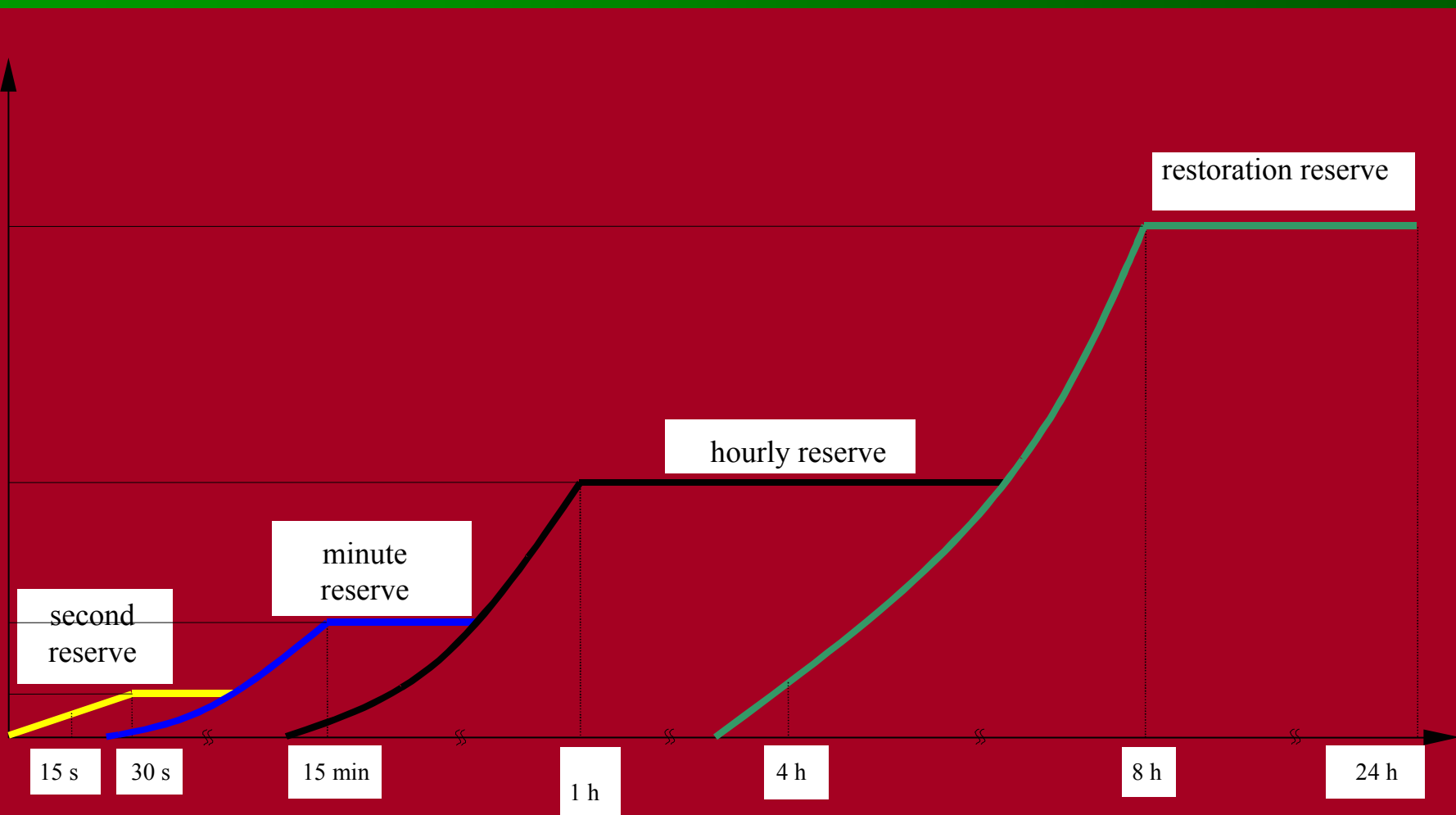
- ◆ Thermal power stations and hydro power stations
- ◆ TSO procures through negotiation long-term contracts for reserve capacity with different qualities

◆ Other auxiliary control services

- ◆ Operation of the condensing thermal power stations in underload/overload
- ◆ Self-startup ability, Isolated operation ability
- ◆ Voltage and reactive capacity control (ARNE)
- ◆ Compensator operation of hydro units



Classification of Reserves





Ancillary Control Services Required Market Instruments

Trading of reserves in forward markets (incentive compatible multi-commodity auctions) that recognizes multi-dimensional attributes of reserves

Refined reserve products:

- ◆ decremental reserves, ramping capacity, fast starts

Auctions should allow TSO

- ◆ to substitute fast-response reserves for slow-response reserves
- ◆ Ensure adequate rewards to fast-response units (hydro pumped-storage)

Methods for improved coordination between reserves, energy markets and transmission through joint dispatch/optimization on the balancing market should be implemented



Balancing Market Coordination and Operational Scheduling

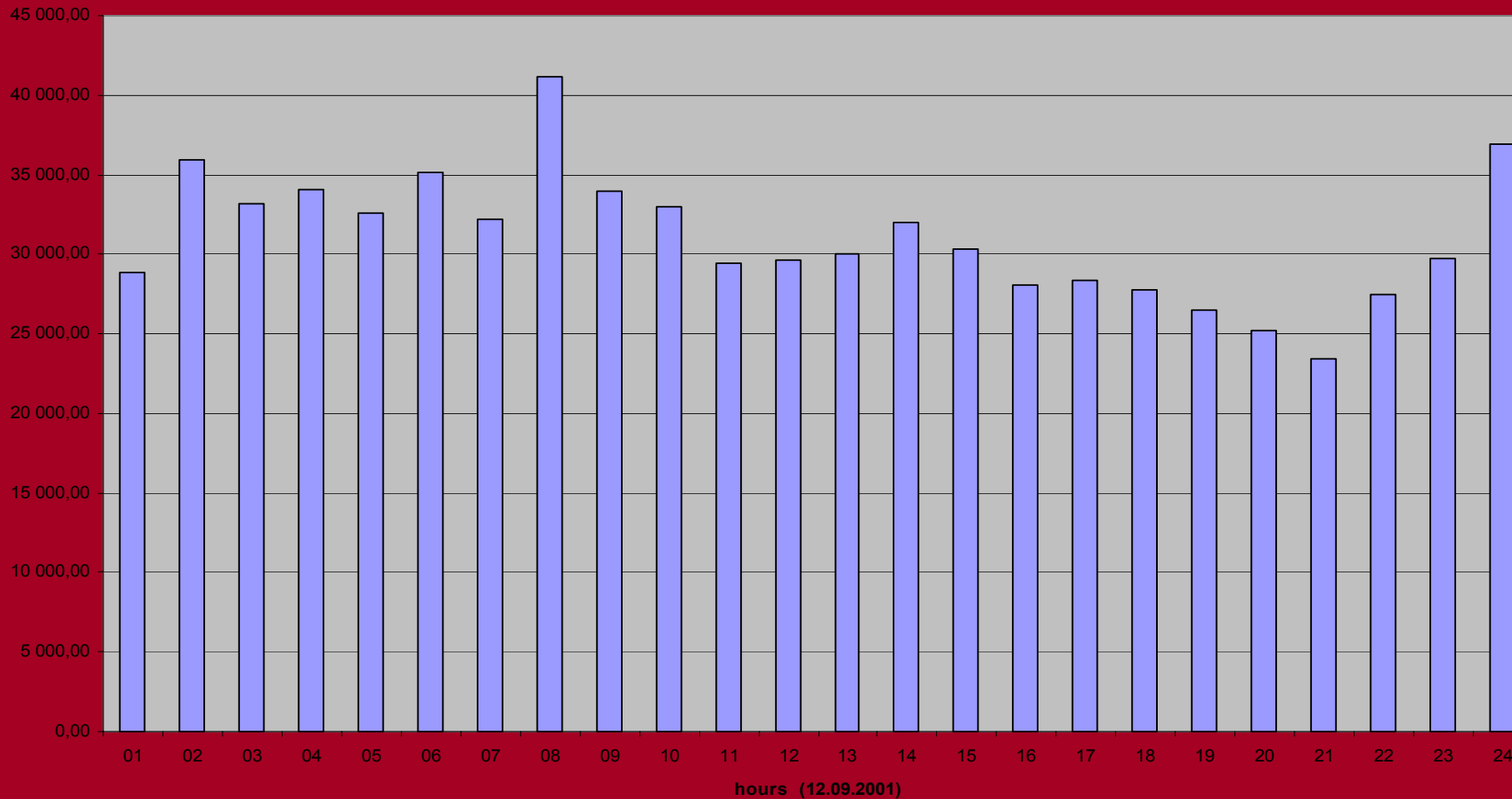
- ◆ PKD on day n-1
 - ◆ Producers and distributors first submit Electricity Sales Contracts, Balancing Bids and other related data
 - ◆ TSO runs Linear Programming Dispatch (LPD) algorithm
 - ◆ Input to LPD → *declared energy schedules, forecasted demand, inter-area exchange, balancing bids, network constraints (incl. minimum must-run energy needs), reserve constraints, network facility outages*
 - ◆ Output to market participants
 - Revised energy schedules based on dispatch algorithm
- ◆ BPKD on day n
 - ◆ Similar to PKD, but on day n and published every 15 minutes
 - ◆ LPD runs with and without constraints and determines final revised (planned) schedule



Balancing Market (version 2001)

High Local Market Power Costs

Cost of the Systems Constraints





Balancing Market (version 2002+)

Energy Deviation Settlements for Distribution

- ▶ Pay-as-bid settlement for planned generation
- ▶ Two-price settlement for distribution
- ▶ Uninstructed deviations priced at
 - » Positive deviation: Incremental Market Clearing Price
 - » Negative deviation: Decremental Market Clearing Price
- ▶ Reduction of TSO costs is insured by „*guillotine*” prices
 - » Incremental MCP ~200 PLZ
 - » Decremental MCP ~ 70 PLZ
- ▶ *Unfair* treatment of distribution and some generation



Long Term Energy Contracts

- ▶ Unsuccessful efforts to abolish the Long Term Contracts (LTC) between generators and PSE (physical supply)
- ▶ The objectives of a proper abolition are:
 - ◆ Terminate the status of PSE as a *de facto* single buyer
 - ◆ Enabling LTC holders to sell their output through market channels: bilateral contracts, balancing market, power exchange
 - ◆ Achieve ratification by the banks that accepted the LTCs as security for loans granted to the generators
 - ◆ Incentivize production decisions to be consistent with the environmental objectives that motivated the LTCs
- ▶ Environmental objectives should be pursued with market-based approaches (However, emission trading and green power certificates trading are still under preparation)



Summary:

Real-time and Forward Markets are not Coherent

- ◆ Reliability of Grid and Power Delivery is ensured by TSO at high cost (in a traditional way)
- ◆ Incentives of Market Participants are wrong
 - ◆ charge for usage of transmission, reserves and other resources are not compatible with real costs
- ◆ Market pricing is unfair and unclear
 - ◆ does not allow competitive offers of each resource used by TSO: reserves, transmission



Summary: Markets and Resource Adequacy

◆ Generation Capacity

- ◆ Energy market prices are too low to promote investments
- ◆ Sufficient operational capacity is achieved through centralized scheduling and unit commitment (but not through market mechanisms, i.e. -call options)
- ◆ Price-responsive, dispatchable loads are not promoted

◆ Transmission Capacity

- ◆ Locational price signals (RMR charges, adjustment bids) are not sufficient to encourage efficient location of new investments in generation and transmission
- ◆ TSO's Congestion Management through centralized scheduling and unit commitment