Important aspects of short term balancing and congestion management on electricity market with larger shares of intermittent RES

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Utilization of the transmission grid should be cost-effective while meeting all the transmission system constraints:

- Thermal limits
- Voltage limits
- Stability limits

When the transactions that parties wish to schedule would result in the violation of constraints, the system is congested and the TSO must take action to relieve the constraints violations - this is congestion management.

The options the TSO has:

Option 1: solve constraints outside the markets and socialize related cost
Option 2: solve these scarce resources through market mechanisms
Option 1: Market/System operation based on two-step approach - Market Clearing & Redispatching

- **Main advantages**
  - Easy to understand and analyse
  - Simple solution algorithms

- **Main challenges**
  - Market processes run in parallel compete for the same resources (valid also for non market based redispatching)
  - A large part of the energy delivery cost is socialized (tariff charges)
  - Timing conflicts (between trading and redispatching processes)
Challenges with current market design

- **Economic Efficiency** – ensure comprehensive maximization of total social welfare by including all energy supply cost components in the market clearing processes (costs of energy, reserves, congestions and losses)

- **System Security** – ensure secure operation of the power system by including detailed representation of both transmission and generation unit constraints directly in the market clearing process

- **Incentive Compatibility** – ensure coherency between market participants behaviours/strategies and secure and costs effective use of the grid by applying correct price signals (dispatch based pricing)
Why zonal model is not the first best solution

• Problems with Zonal Markets
  – Intra-zonal congestion must be infrequent, inexpensive and non-predictable, to avoid:
    • Infeasible market schedules
    • Excessive need for real-time dispatch corrections
    • Gaming (i.e. DEC game)
  – Zone definition requires studies and constant monitoring
  – Challenging in highly meshed grids
  – Difficulties with Zonal PTDF calculation
  – Inefficient transmission loss allocation (losses are ignored)
  – Different treatment of intra-zonal and inter-zonal transactions

• Market consequences
  – Risk of infeasible schedules
  – Market prices not reflecting the real costs of electricity delivery
  – Lower social welfare
Option 2: Market/System operation based on Integrated Process

- **Main advantages**
  - Co-optimization of all resources and transmission capacity utilization (e.g. reserves and energy schedules can compete for transmission capacity)
  - System security requirements are reflected in energy prices (e.g. scarce resources and services are priced)
  - There is no timing conflict

- **Main challenges**
  - Full Network Model
  - Greater data requirements
  - More sophisticated algorithms/less intuitive market outcome
The role of the BM is strongly determined by the BRP model

1. BRP is required to be balanced after intraday market, or
2. BRP is incentivized to be balanced but may have open position on BM

**Balanced BRP model**
- BM Prices act as penalties (penalised for deviations)
- TSO procures and dispatches fast reserves to cover deviations
- Commonly used in self-dispatch systems

**Open position BRP model**
- BM Prices act as value of a commodity
- TSO performs Security Constrained Dispatch to cover imbalances (integrated balancing and congestion management)
- Commonly used in central-dispatch systems
• BM Prices coordinate the behaviour of generators (consumers) in real-time regardless of the results of previous markets and therefore directly affect both the market efficiency and system security.

• Given the role of BM Prices they shall properly reflect:
  • the costs of energy delivery (efficiency dimension)
  • the system security conditions (security dimension)

In order to ensure:
  • coherency between market participants behaviours
  • secure and costs effective use of the grid
  • full remuneration of value provided by generation capacity to the system.
Thank you for your attention