Module 3 – Intra-day and Balancing Markets

3.3 Balancing market and imbalance definition

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Passing the ball to the Transmission System Operator (TSO)

The Nordic Power Exchange
Nord Pool

Spot market
Elspot

A day-ahead market
One-hour contracts
Auction trade

Price
Demand
Supply
Spot price
MWh

Intra day market
Elbas

An hour-ahead market
One-hour contracts
Continuous electronic trade

Bid/Ask

A real time market
Supply- and demand-side bidding
Priority lists

Price
MWh

Prior to hour of operation

During hour of operation

[source: Nord Pool A/S]
The balancing market(s)

- The TSO has the **ultimate responsibility** to keep its **transmission system in balance**

- For instance in Denmark, Energinet’s transmission system covers
  - Transmission grid at the highest voltage level 400 kV
  - Regional electricity transmission grid on 132 kV east of the Great Belt and 150 kV west of the Great Belt
The balancing market(s)

- The TSO has the **ultimate responsibility** to keep its **transmission system in balance**
- For instance in Denmark, Energinet’s transmission system covers:
  - Transmission grid at the highest voltage level 400 kV
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- The balancing stage combines (though we eventually see it as a single market mechanism):
  - *regulation market*, for the TSO to obtain necessary regulating power prior to the delivery hour
  - *balancing market*, linked to the real-time operations, and yielding balancing payments based on actual metering

- This also links to some *ancillary services* (i.e., tertiary/manual reserves) that the TSO purchases

[See, e.g., Energinet’s regulation C2: *The balancing market and balance settlement*]
Who participates in these balancing market(s)?

**Regulation market:**

“A participant in the regulation market is offering to buy or sell regulating power, prior to the hour of operations”

- the TSO, aiming to purchase regulating power
- actors of the power systems, who *voluntarily* propose regulating power
- those who *committed* to provide regulating power (through the reserve provision mechanism)
- for Scandinavia, these resources are shared through the NOIS list (*Nordic Operational Information System*)

**Balancing market:**

“A participant in the balancing market is to cover the costs of his contribution to placing the system off-balance”

- the TSO, responsible for the metering and settlement
- all actors of the power system in the control area of the TSO
Is the system in imbalance?

There may be 3 possible situations, for the system as a whole:

- **Positive imbalance**: Supply > Demand → need for *downward regulation*
- **Negative imbalance**: Supply < Demand → need for *upward regulation*
- **No imbalance**: Supply ~ Demand → *no need for regulation*

Similarly, supply and demand participants may also have positive and negative imbalance:

- **Positive imbalance**: Actual generation > Scheduled generation (if supply) or ...  
- **Negative imbalance**: Actual generation < Scheduled generation (if supply) or ...
- **No imbalance**: Actual generation ~ Scheduled generation (if supply) or ...
Starting from our day-ahead market clearing...

After day-ahead market clearing, the supply and demand schedules are:

<table>
<thead>
<tr>
<th>Supply id.</th>
<th>Schedule (MWh)</th>
<th>Demand id.</th>
<th>Schedule (MWh)</th>
</tr>
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<tbody>
<tr>
<td>G₁</td>
<td>120</td>
<td>D₁</td>
<td>250</td>
</tr>
<tr>
<td>G₂</td>
<td>50</td>
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<td>300</td>
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<tr>
<td></td>
<td></td>
<td>D₁₀₋D₁₂</td>
<td>0</td>
</tr>
</tbody>
</table>
Negative imbalances

**SCHEDULE**

- 120 MWh
- \(G_1\)
- \(\vdots\)
- 55 MWh
- \(G_8\)

Total: 995 MWh

**ACTUAL**

- 100 MWh (negative imbalance)
- \(G_1\)
- \(\vdots\)
- 55 MWh
- \(G_8\)

Total: 975 MWh (negative imbalance)
Positive imbalances

SCHEDULE

120 MWh

G₁

Total: 995 MWh

G₈

55 MWh

ACTUAL

140 MWh (positive imbalance)

G₁

Total: 1015 MWh (positive imbalance)

G₈

55 MWh
Positive and negative imbalances

**SCHEDULE**

- 120 MWh
- \( G_1 \)
- \( G_8 \)
- 55 MWh

Total: 995 MWh

**ACTUAL**

- 140 MWh \( (\text{positive imbalance}) \)
- \( G_1 \)
- \( G_8 \)
- 45 MWh \( (\text{negative imbalance}) \)

Total: 1005 MWh \( (\text{positive imbalance}) \)
Use the self-assessment quizz to check your understanding!