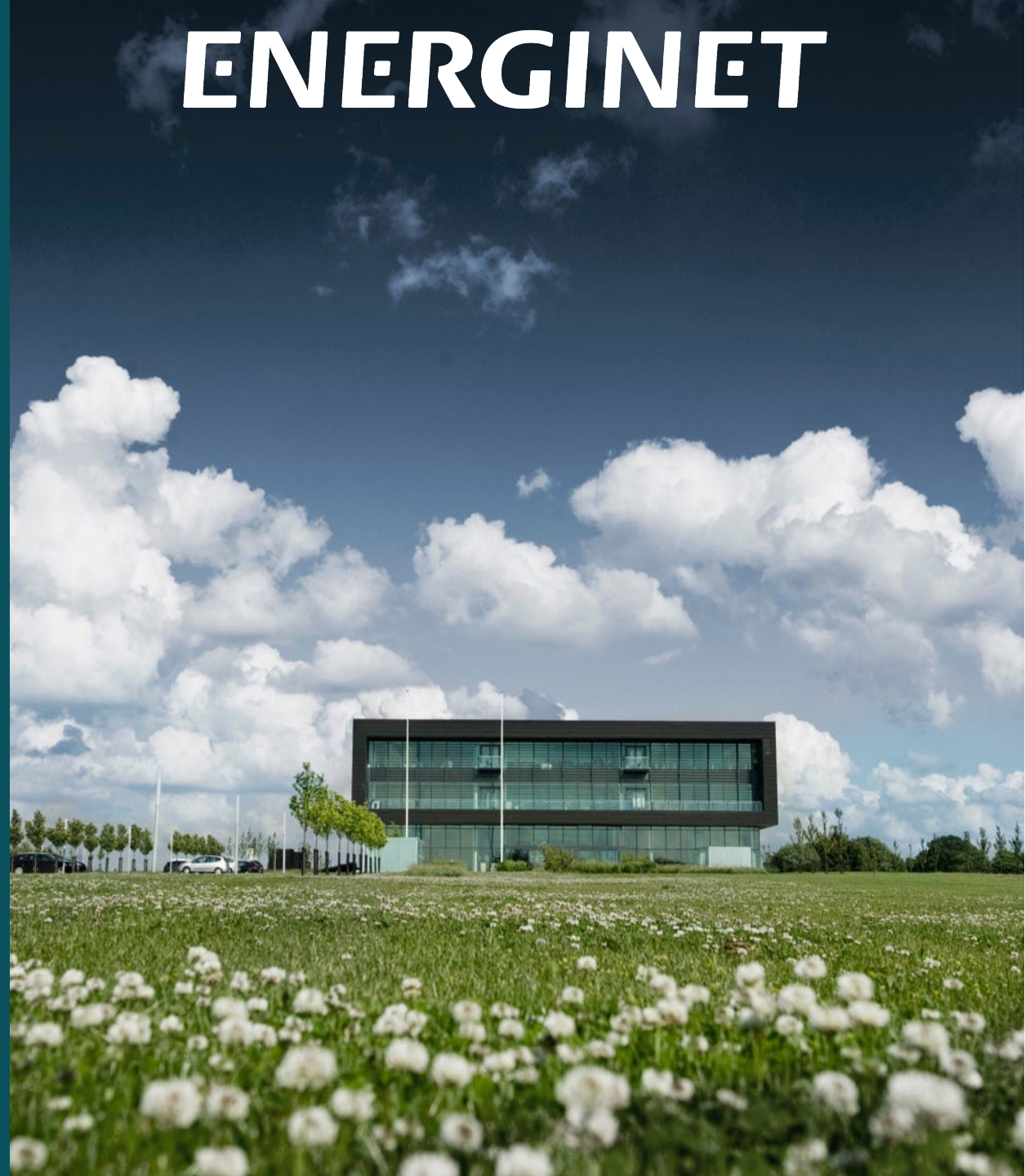


ENERGINET

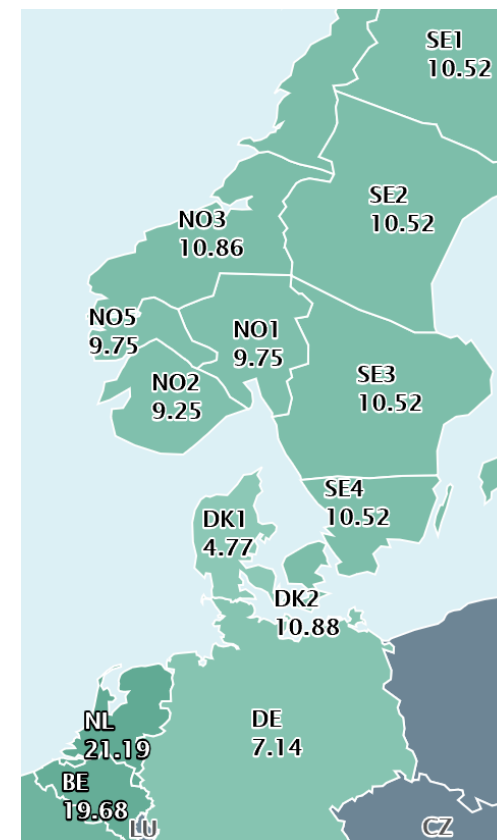
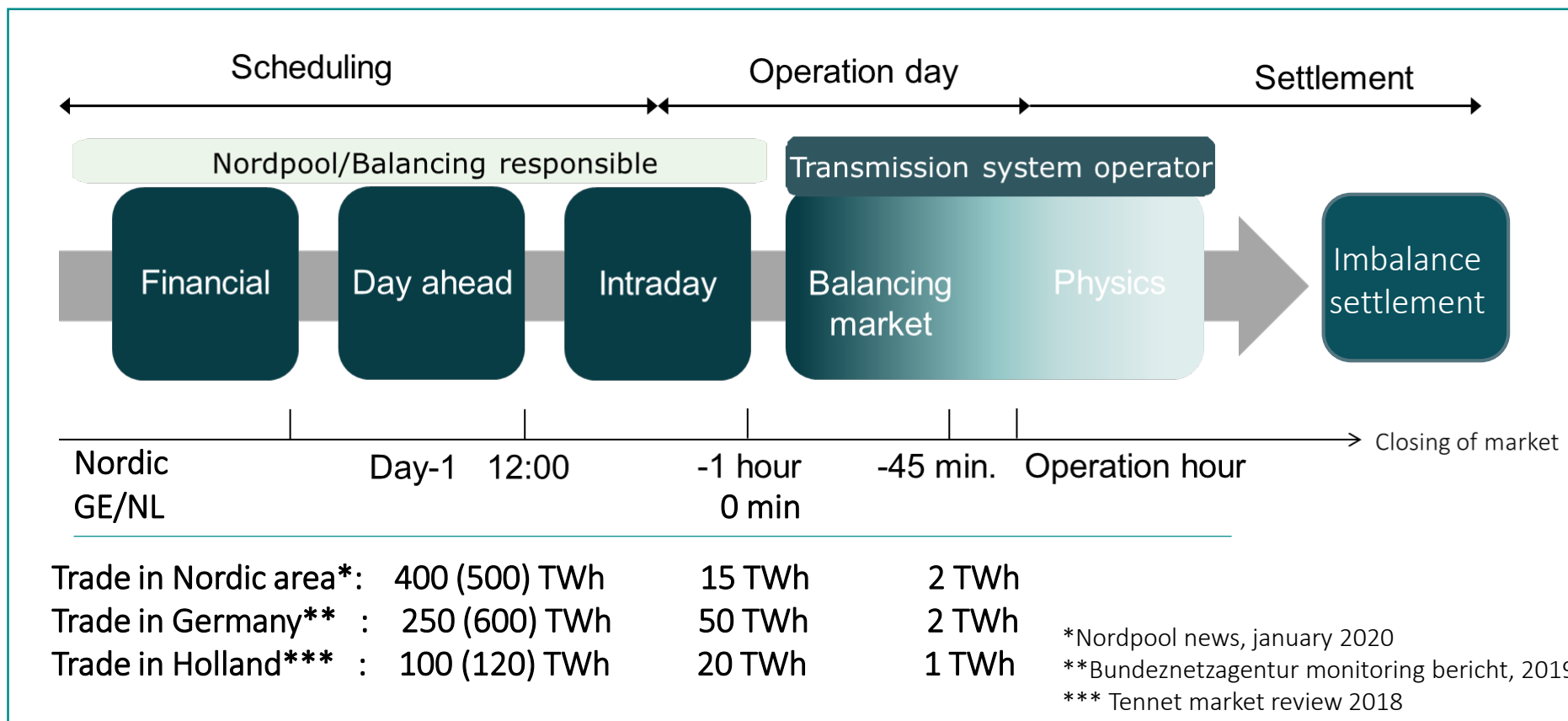
CABINET

9 March 2023

Peter Markussen, Senior director, Energinet Transmission System Operator, Denmark

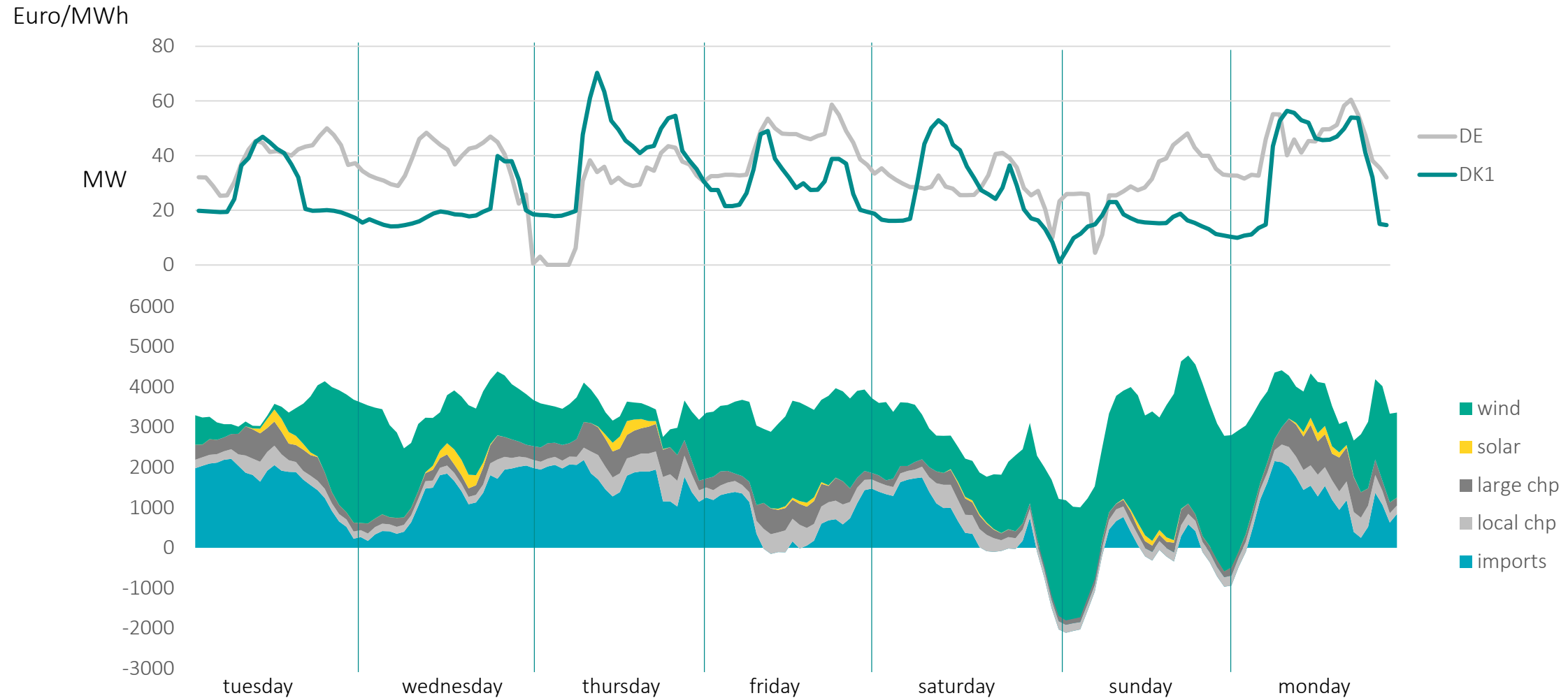


ELECTRICITY MARKETS FOR DISPATCH AND BALANCING



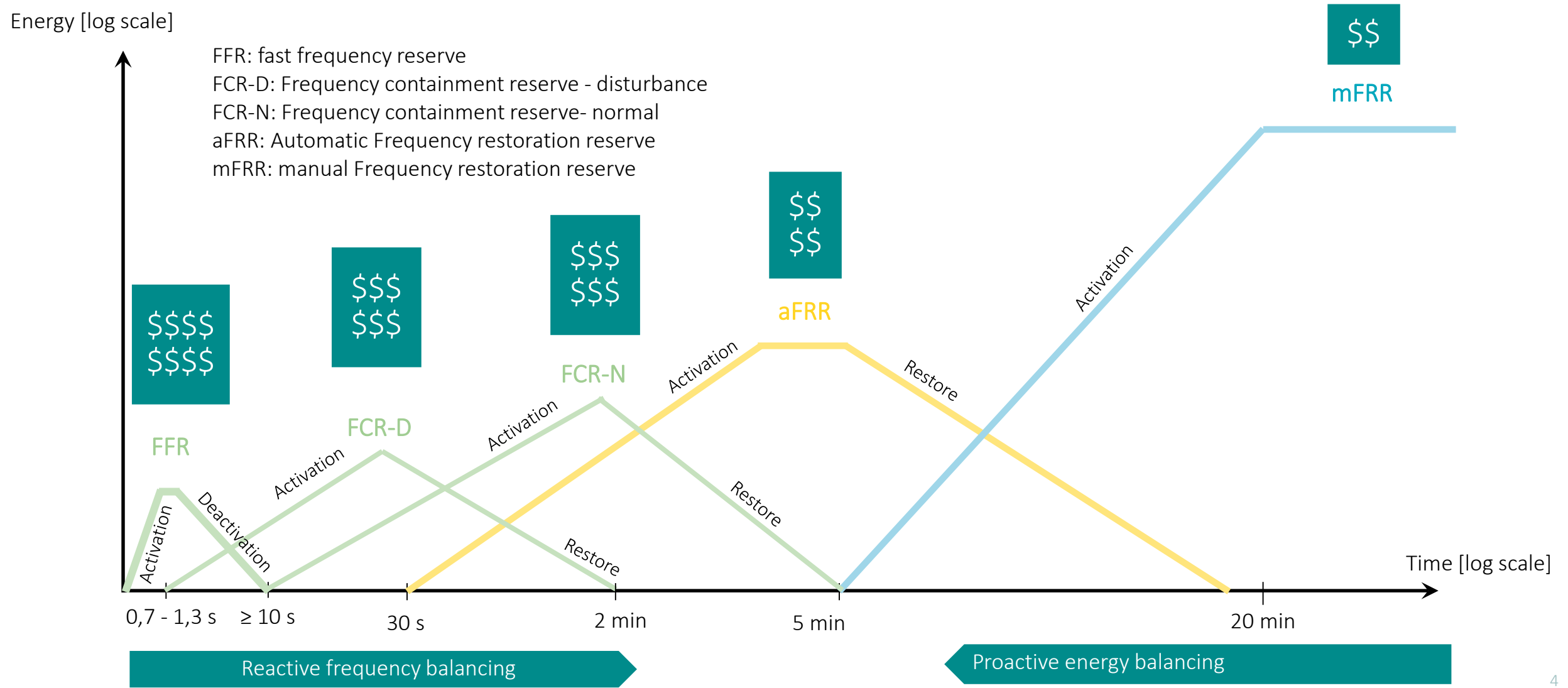
DAY AHEAD PRICE WESTERN DENMARK (DK1) AND GERMANY (DE)

European electricity market increases value of renewables – no forced curtailment



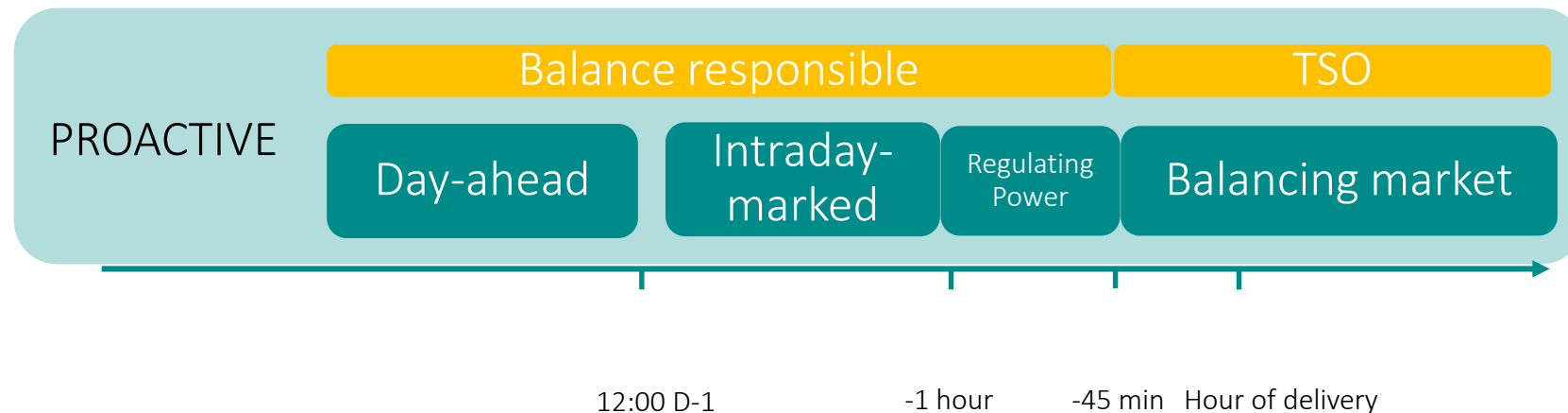
BALANCING THE SYSTEM

The reserves are a requirement in the European guidelines, except FFR. National products only where necessary. Energinet use pro-active balancing with forecasts to activate mFRR (slow and cheaper energy reserve)



DIFFERENCE IN TSO AND BRP BALANCING RESPONSIBILITY

TSO is responsible for energy and power balance from a certain time ahead of real time.



TSO is only responsible for momentary power balance



THE APPROACH TO SYSTEM OPERATION

Balancing approach (with high share of renewables)

What decisions to take in the control center

Which tools to support decisions

CRITERIA:

- Security of supply
- Reduce balancing costs
- Reduce complexity of green transition
- Grid adequacy

CHALLENGE with increasing share of renewables:

- Increased number of units
- High geographical distribution
- Variability in production

SOLUTIONS:

- Operation closer to real time
- Update of grid codes and connection requirements
- Grid enforcement
- Market development

ROLES IN THE ELECTRICITY MARKET

Balancing Responsible Party (BRP) is decisive for ensuring balancing of consumers and producers and in the center of the money and data flow

European Regulation:

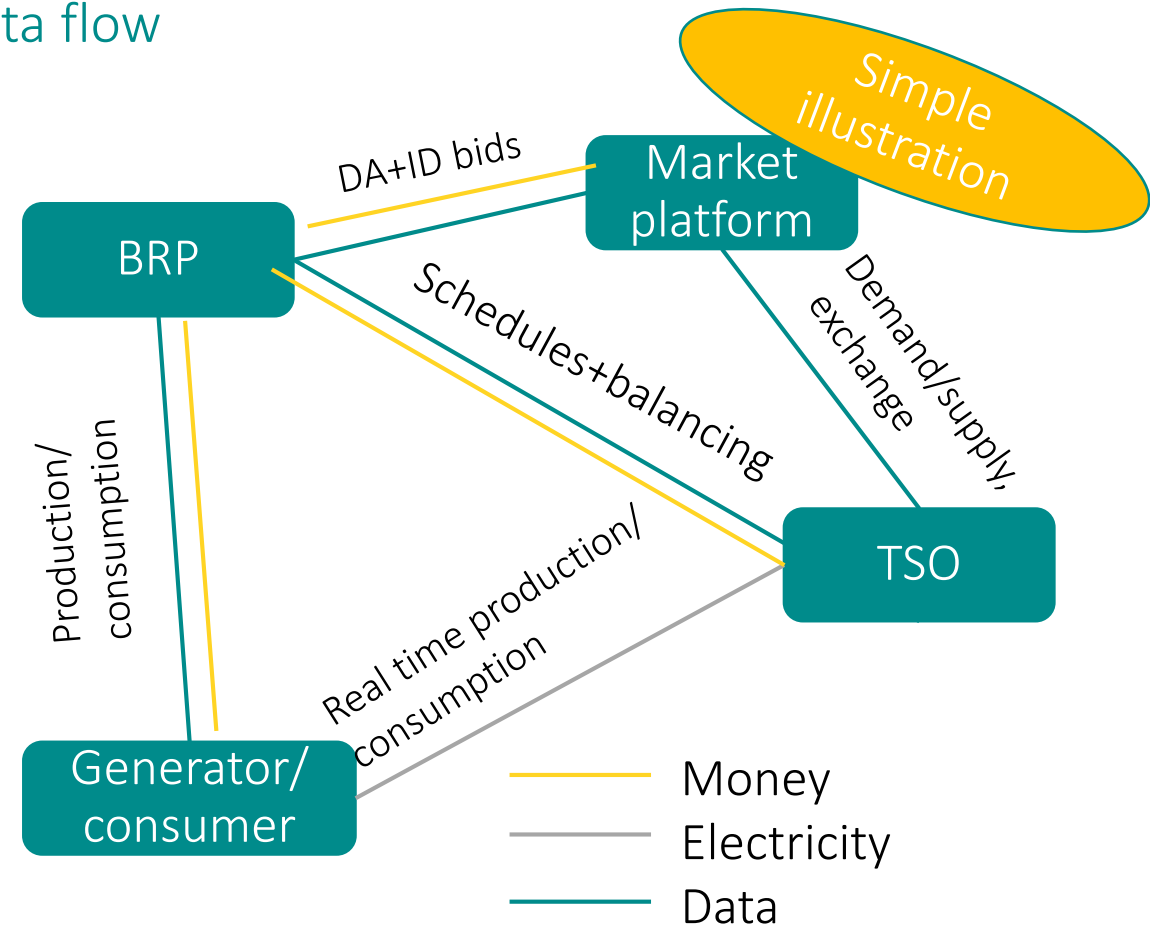
- all market participants shall be responsible for the imbalances they cause in the system ('balance responsibility').
- each market participant shall be responsible for its imbalances or contractually delegate such balance responsibility to a chosen representative.
- BRP – tasks: forecast/schedules, bidding, balancing and settlement. Can aggregate producers/consumers in one portfolio and net out each actors imbalances

Three types of BRP

- Production
- Consumption
- Trading

(+40 BRPs in Denmark)

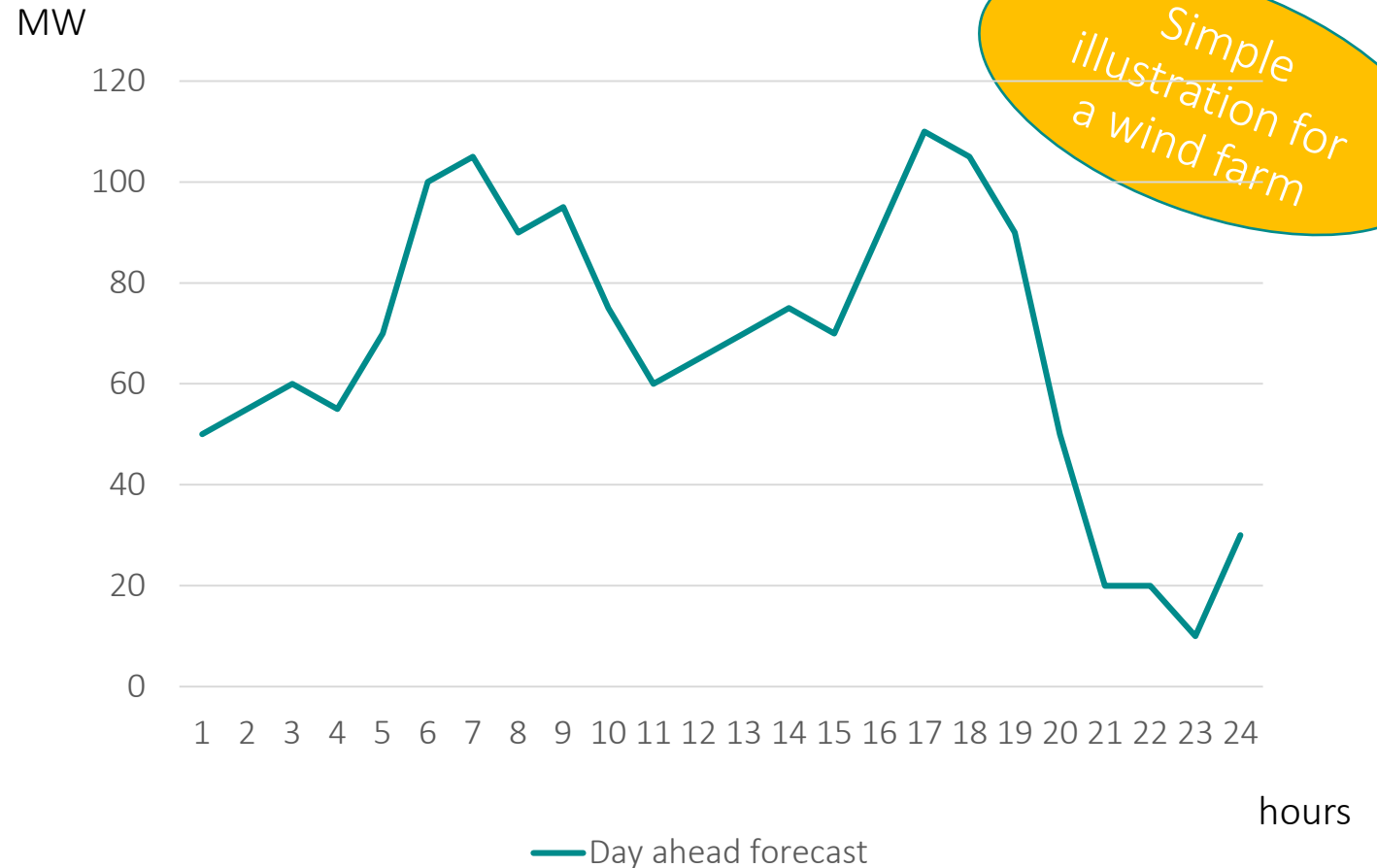
[Market Regulations Archive](#) | [Energinet](#)



BALANCING PROCES AND IMBALANCE SETTLEMENT

The Day-1 for BRP

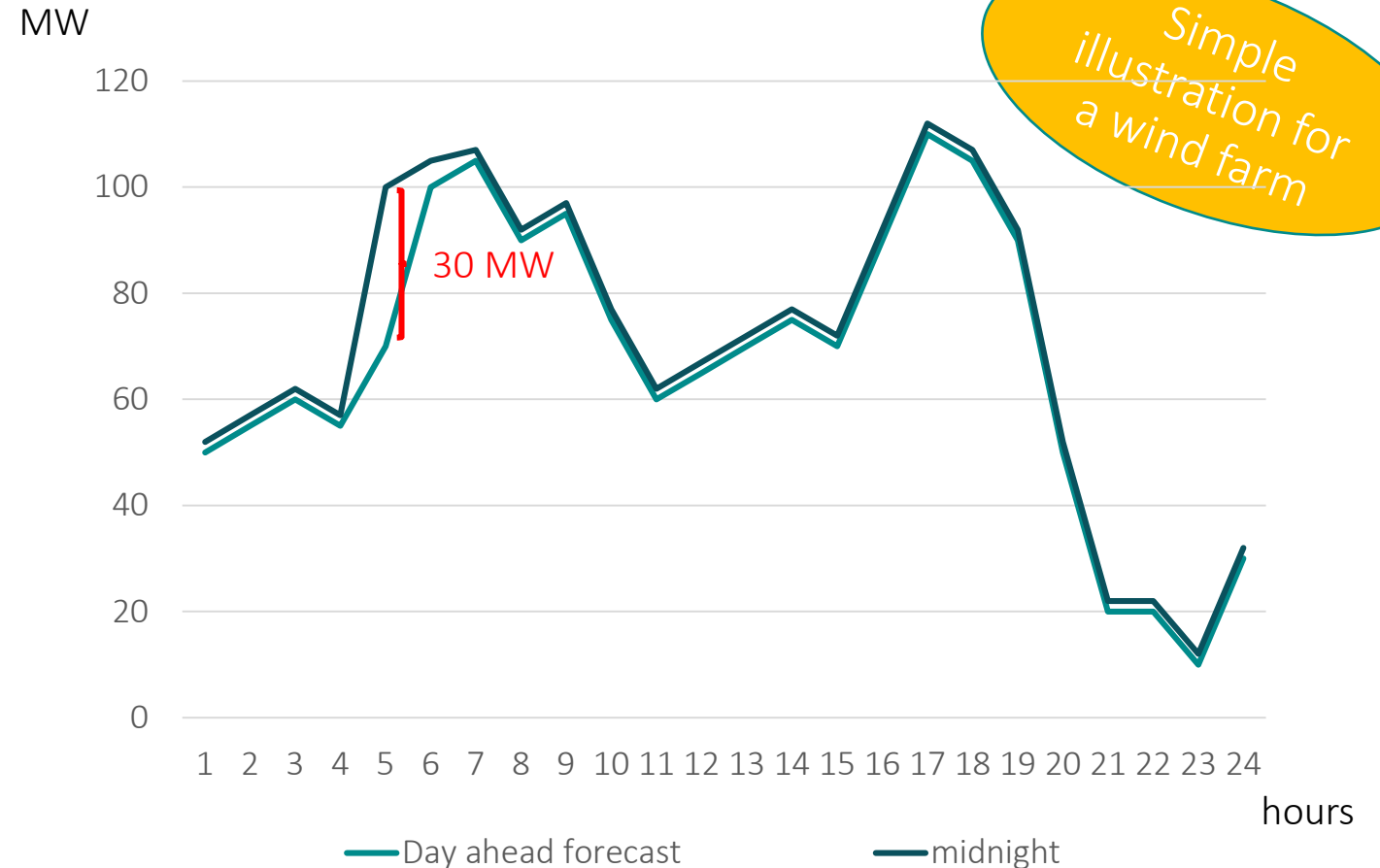
- Windturbine owner informs BRP on availability for next day
- BRP makes production forecast for each hour in upcoming day
- BRP gives bid to power exchange to day ahead based on contract between BRP and wind turbine owner
- BRP receives results at 15.00 from power exchange with marginal price and sold volume
- BRP sends schedules to TSO and informs windturbine owner on expected production



BALANCING PROCES AND IMBALANCE SETTLEMENT

At midnight for BRP

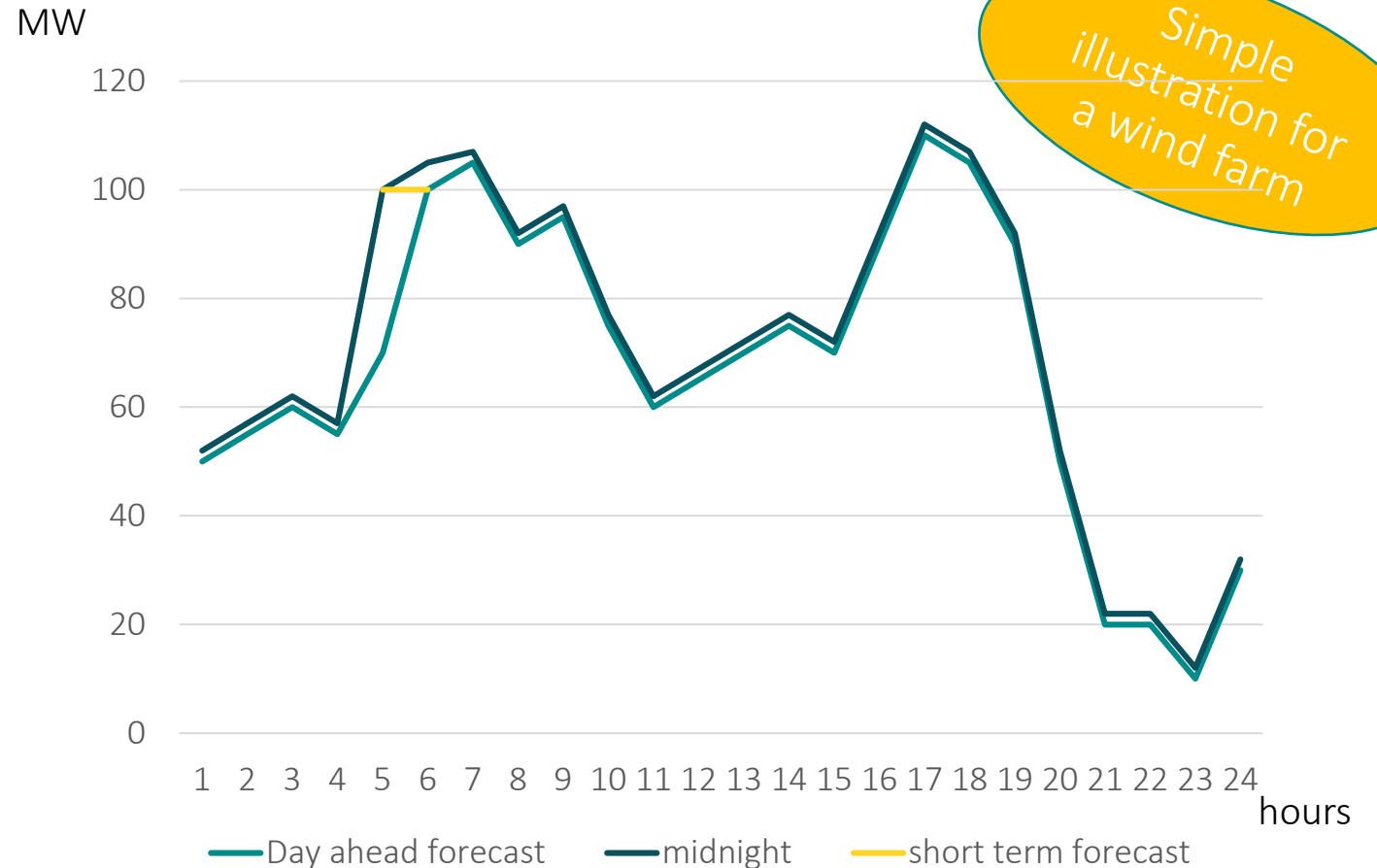
- BRP makes update of forecast for production
- BRP forecasts an increase in expected production of 30 MW in hour 5 (from 70 MW to 100 MW)
- BRP sells extra 30 MW in the intraday market
- Intraday is a continuous market, where BRP is matched directly with buyer – and often at lower price than day-ahead
- Schedule is updated and send to TSO



BALANCING PROCES AND IMBALANCE SETTLEMENT

At 04.00 for BRP

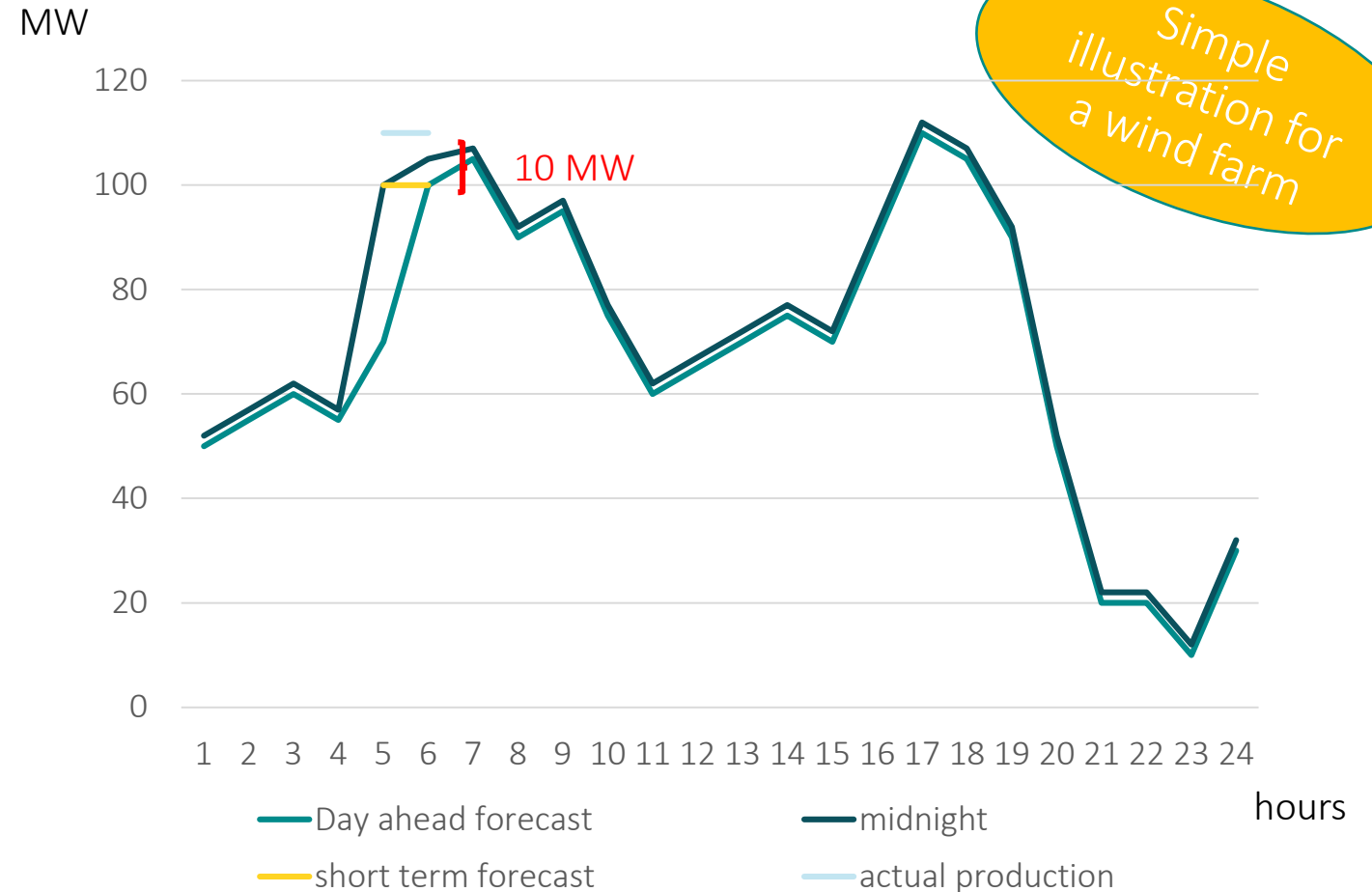
- BRP makes update of forecast for production 1 hour before production and last chance for use of intraday
- Forecasts is correct and no trading or updating of schedule is done
- BRP gives bid to TSO to sell down regulation of up to 100 MW at 05.00 in the balancing market (bid price for down regulation is negative and BRP will receive money for not producing)



BALANCING PROCES AND IMBALANCE SETTLEMENT

At real time for BRP (hour 05:00)

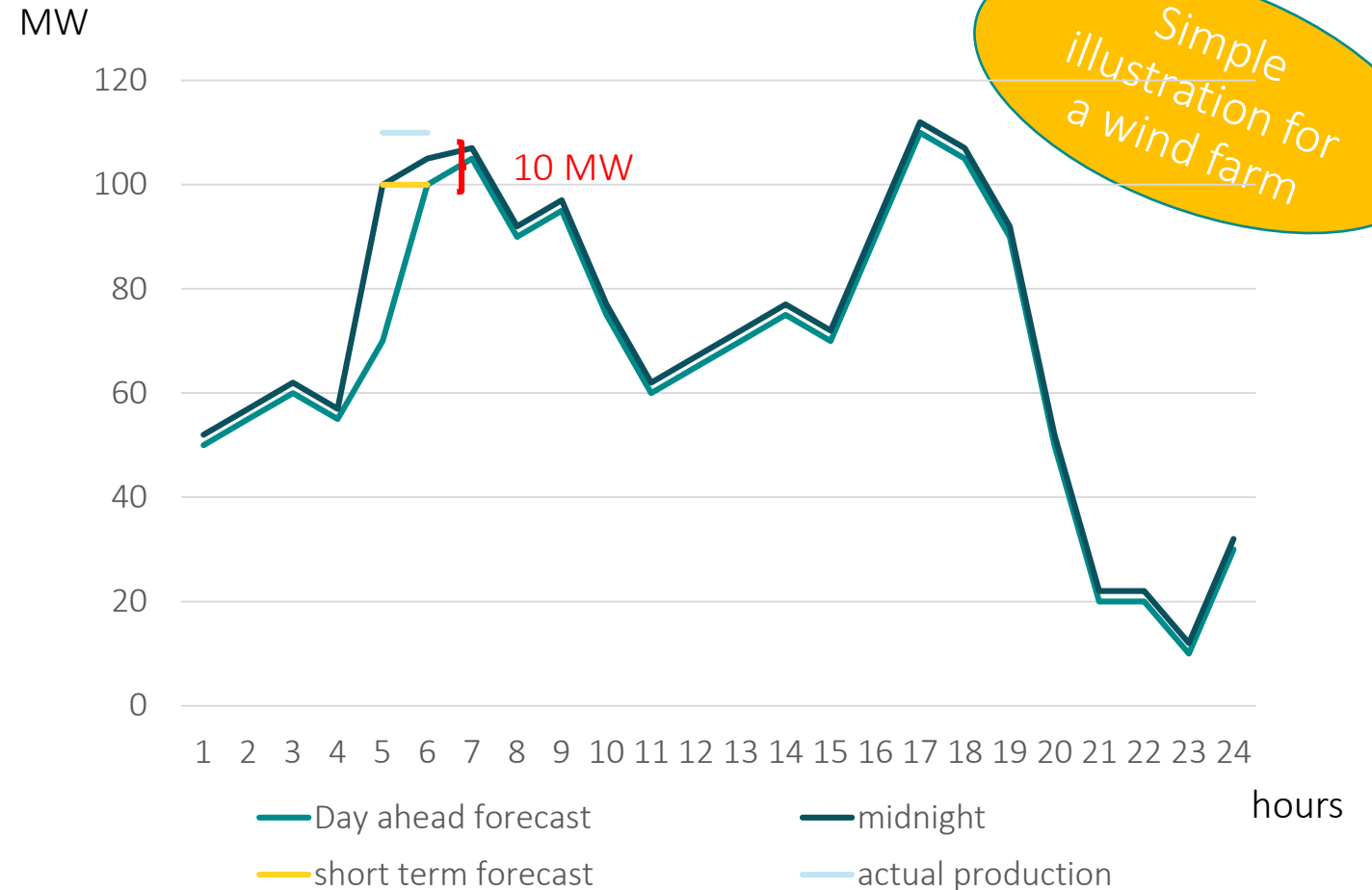
- BRP can see on scada system, that production is 10 MW higher than expected (110MW)
- Bid for down regulation is not taken by TSO
- This means that BRP has an imbalance of 10 MW



BALANCING PROCES AND IMBALANCE SETTLEMENT

Imbalance settlement for BRP

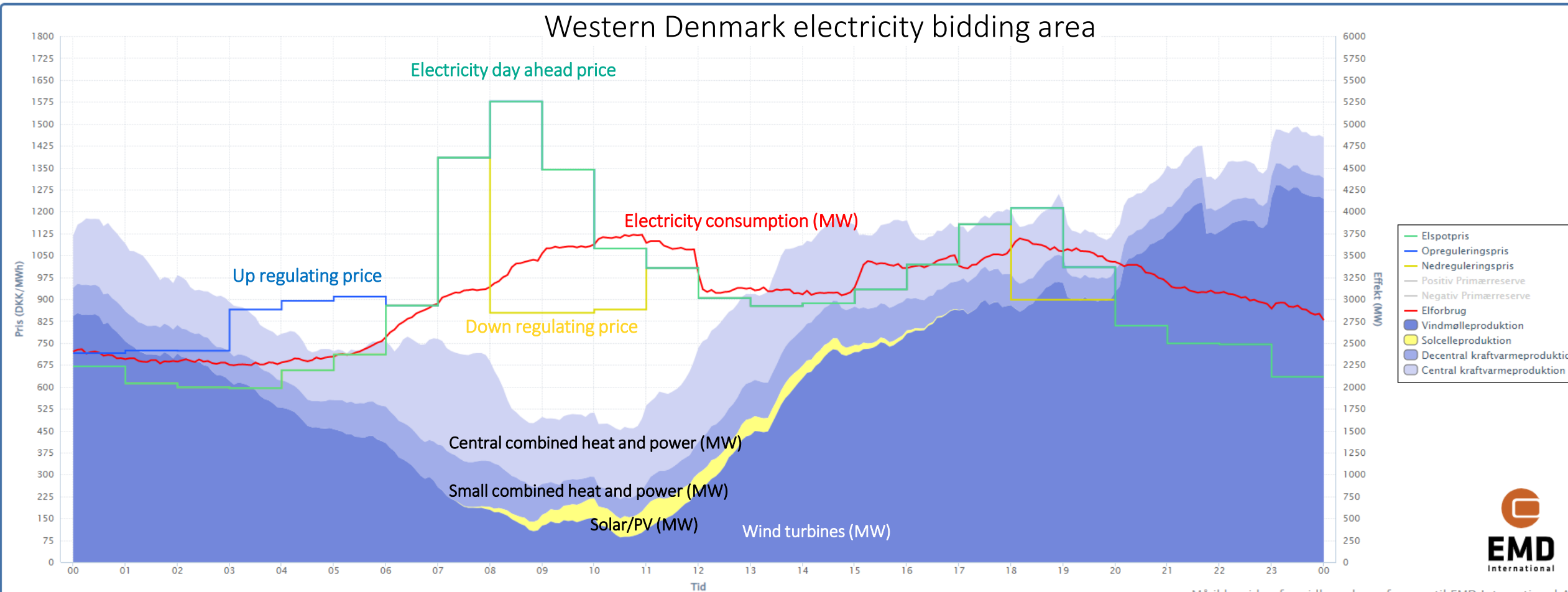
- Price for imbalance depends on system balance:
 - Imbalance in opposite direction of system: receive day ahead price (helping system balance)
 - Imbalance in same direction of system: receive down regulation price (causing system imbalance)
- BRP will have to pay/receive accordingly for the 10 MW.



EXAMPLE, 22 FEBRUARY 2022 (1/2)

Elpriser og estimeret elproduktion

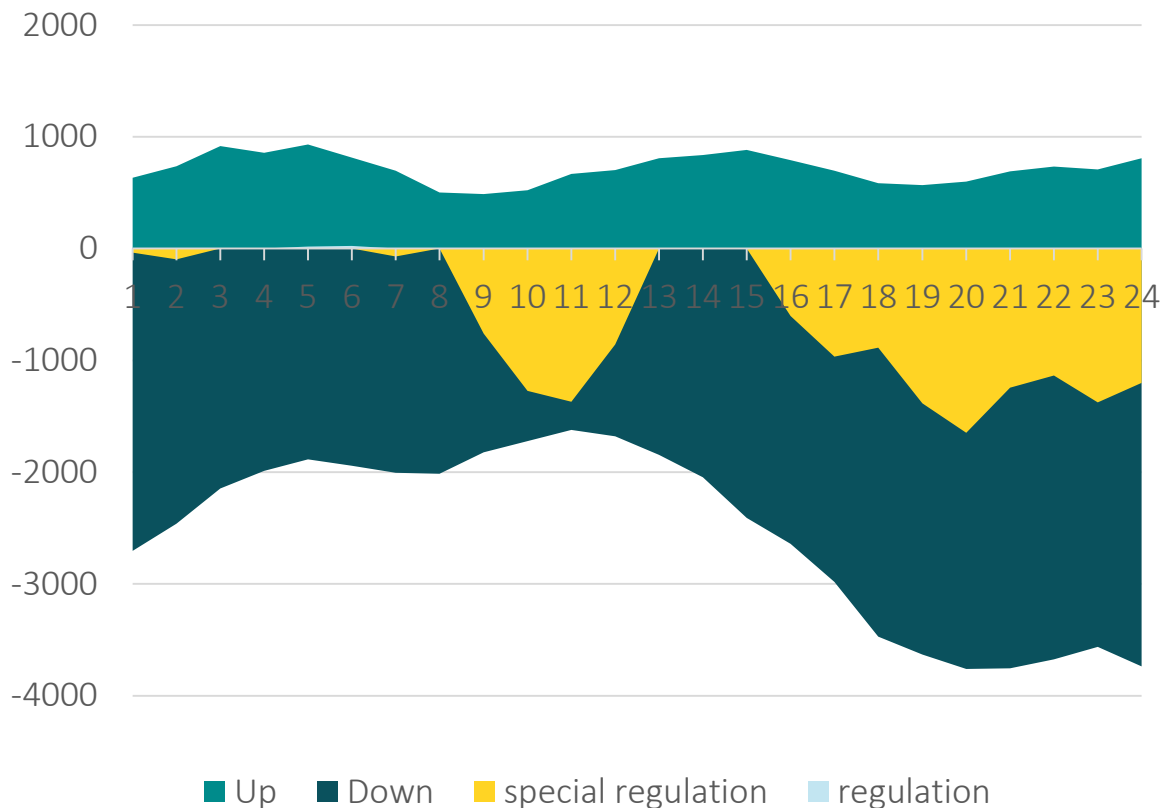
1 dag 22-02-2022



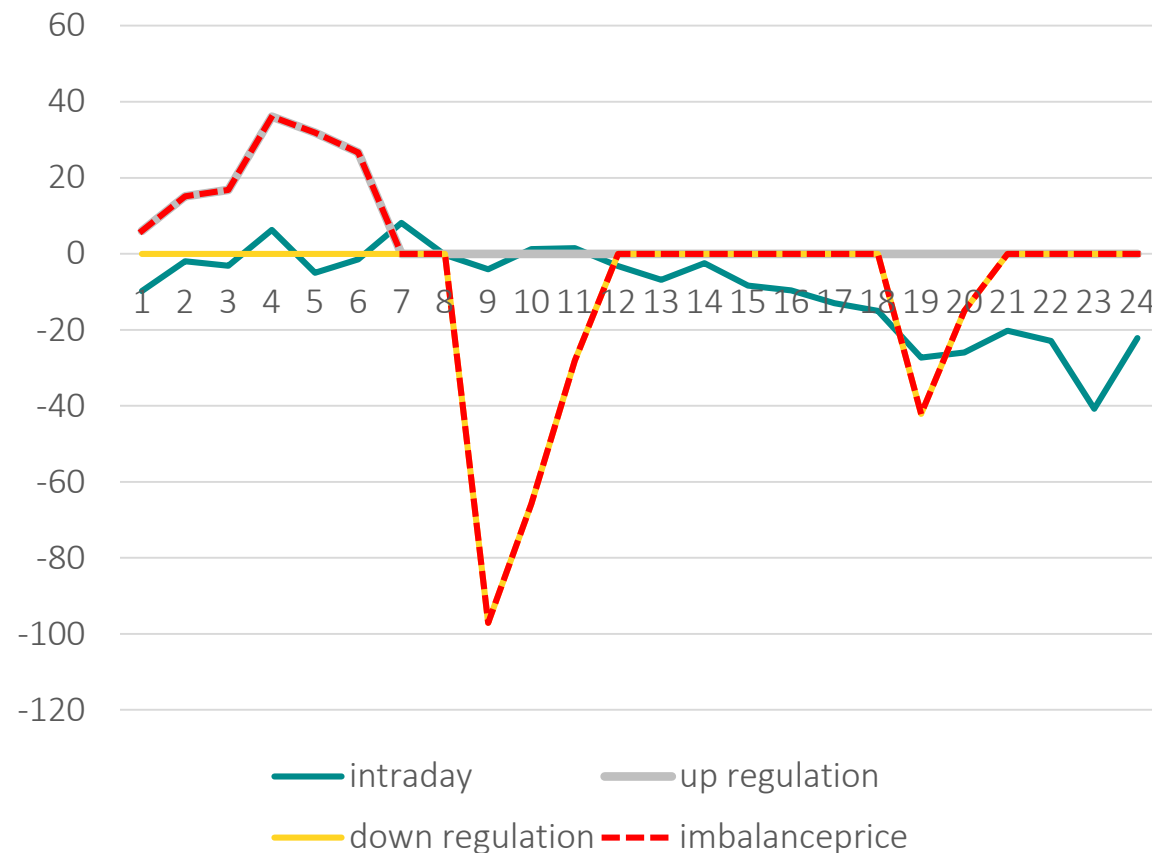
Elpriser og estimeret elproduktion og forbrug i vest-Danmark (Jylland/Fyn). (emd.dk)

EXAMPLE, 22 FEBRUARY 2022 (2/2)

Bids and activated balancing bids, DK West, MW



Difference to DK-West Day ahead price, Euro/MWh



IMBALANCE SETTLEMENT – REGULATORY CONSIDERATIONS

- European regulation: Fair, transparent and objective imbalance pricing
- Where does imbalances come from?
- What are possibilities for BRPs to reduce imbalances?
- Possibilities arbitrage between day ahead-imbalance pricing?
- How to calculate the imbalance price?
- What are costs for TSO's? (reserves, imbalance netting, IT-systems, settlement costs)

[Single-Price Common-Market-Design.pdf \(nordicbalancingmodel.net\)](#)

	Denmark	Rest of Nordic	EU harmonisation (2021)
Legal obligation to be in balance	No	Yes	no
Imbalance settlement period	1 hour	1 hour	15 min
Schedule period	5/15 min (>25 MW offshore/thermal)	5/15 min	No harmonization
Single position	no	no	Yes
Single/two price	Two price	Two price	Single price
Fee/penalty	No (socialize in tariff)	Fee (cover costs reserves)	No harmonization
TSO imbalance netting	yes	yes	yes

PRIORITY PRODUCTION

In principle concept of priority production removed in 2012

Priority production compensated with 20 DKK/MWh compensation (costs for balancing) (1 Yen/kWh)

Incentive for wind to participate in balancing and provide down regulation

Units below 0,1 MW handled by Energinet and outsourced to third party

Costs for imbalances and compensation

