

# Danske Commodities

*Introductions to markets that are available to DH companies in Denmark. How DH units in Denmark are gradually becoming more active in the electricity markets for day-ahead and ancillary services. The role of Balance Responsible Party (BRP) and other actors.*

## Jakob Krogshave Laursen

### Manager, Head of Flexible Asset Solutions & UK Origination

Trained Mechanical Engineer

Holds an HD1 degree (Graduate Diploma in Business Administration)

14 years of experience in the power and energy sector

Specialized in Combined Heat and Power (CHP) across Nordics, Europe and the UK

Represents district heating, flexibility and cogeneration at Danske Commodities



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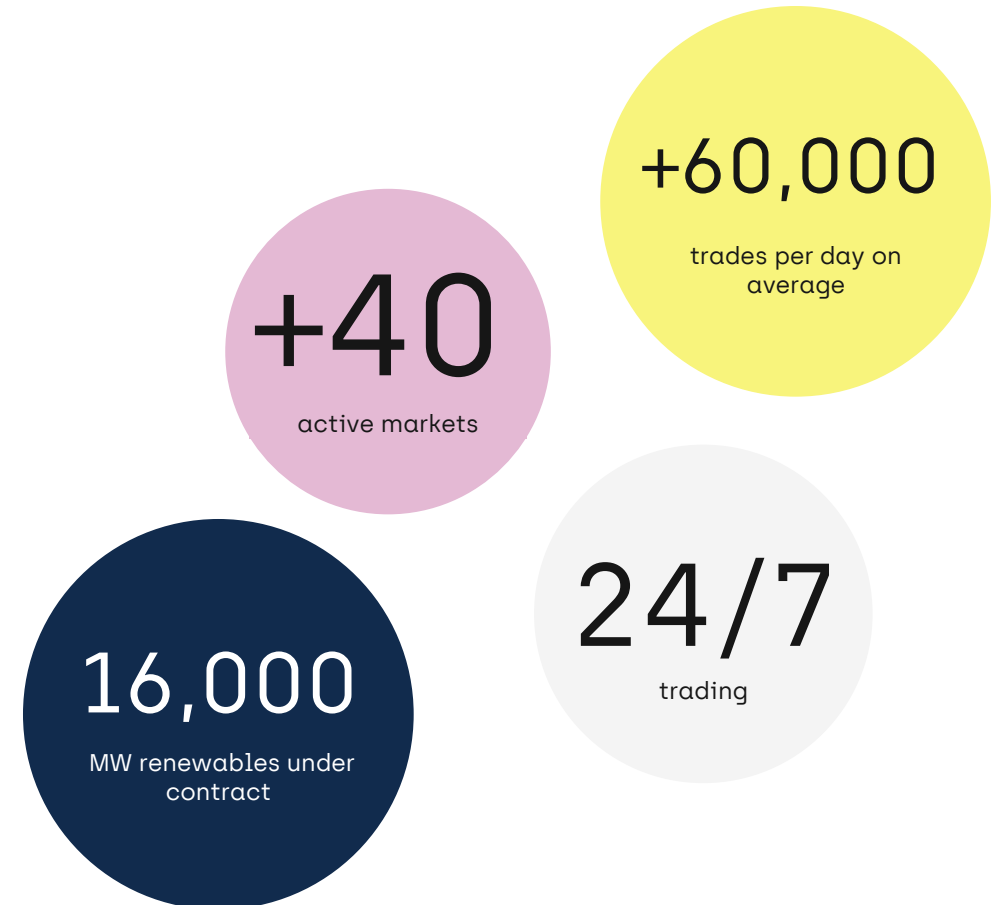
Jakob krogshave Laursen

[jku@danskecommodities.com](mailto:jku@danskecommodities.com)

+45 6060 2245

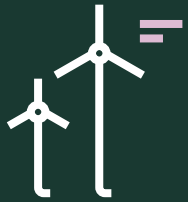
# Danske Commodities is a leading energy trading company, specialising in power and gas trading

- Founded in 2004
- Headquartered in Aarhus
- 600 dedicated employees
- Trading in power, gas and certificates
- Customer business and services (BRP) for producers, suppliers and large-scale consumers
- Owned by international energy major Equinor



IN SHORT

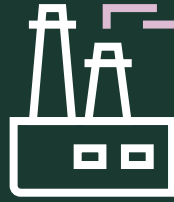
# Danske Commodities has 16 GW assets under contract



Wind



Solar



CHP's



BESS

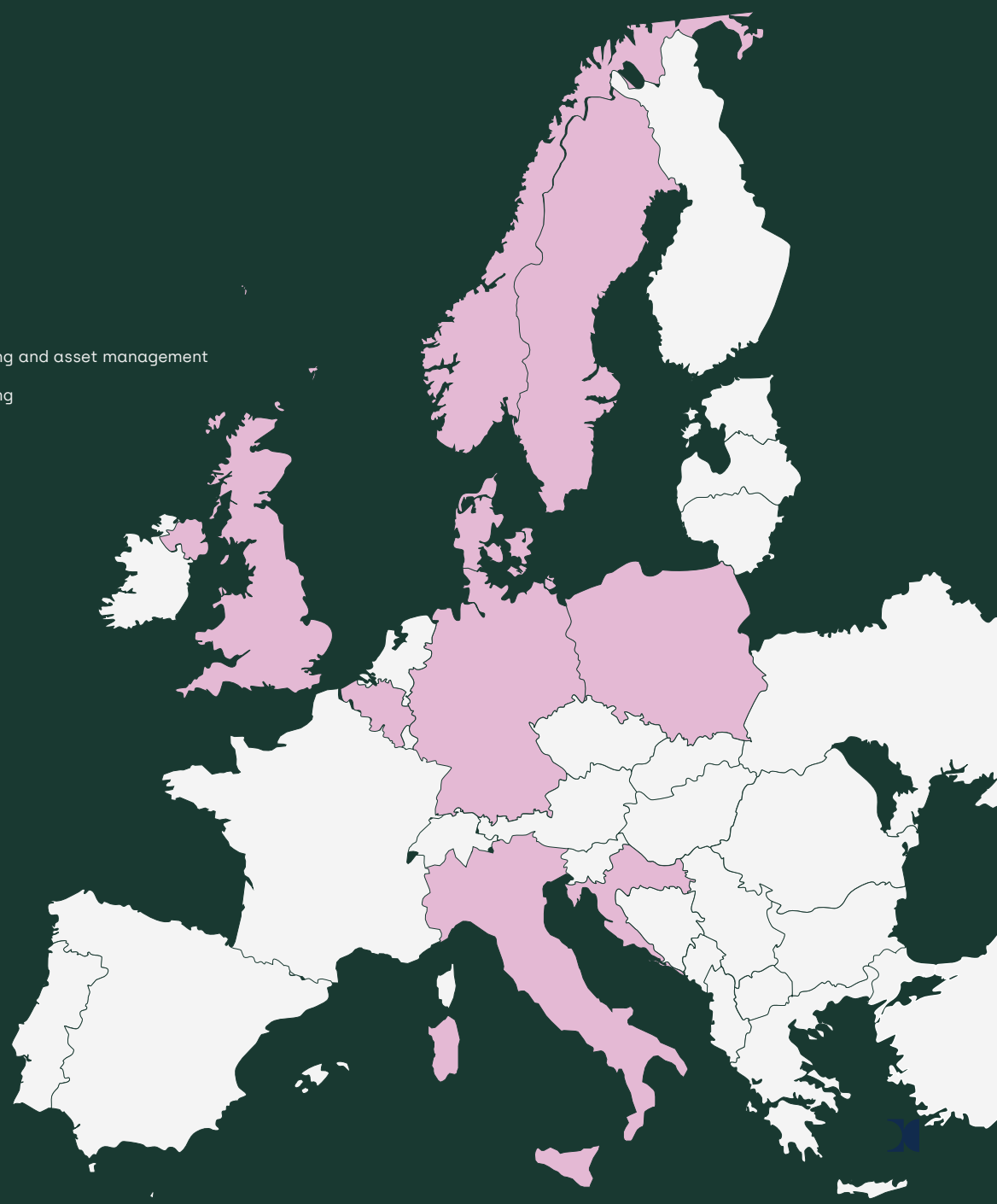


Hydro

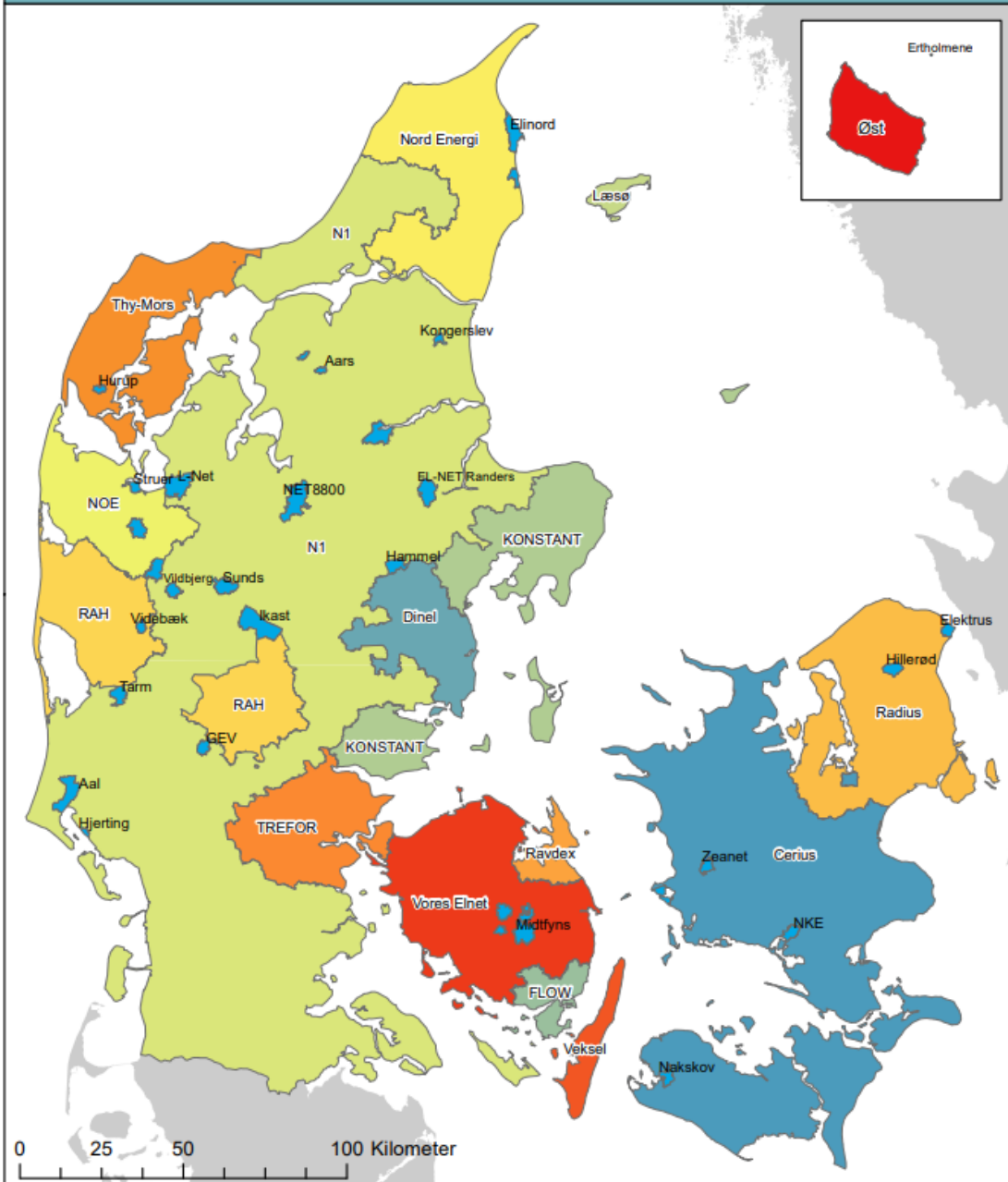


Power-to-X

- Trading and asset management
- Trading



# Elnetselskaber



## Distribution system operators [DSO]

- 37 DSO companies in Denmark
- 16 larger DSO companies
- Approximately 21 smaller local DSO companies

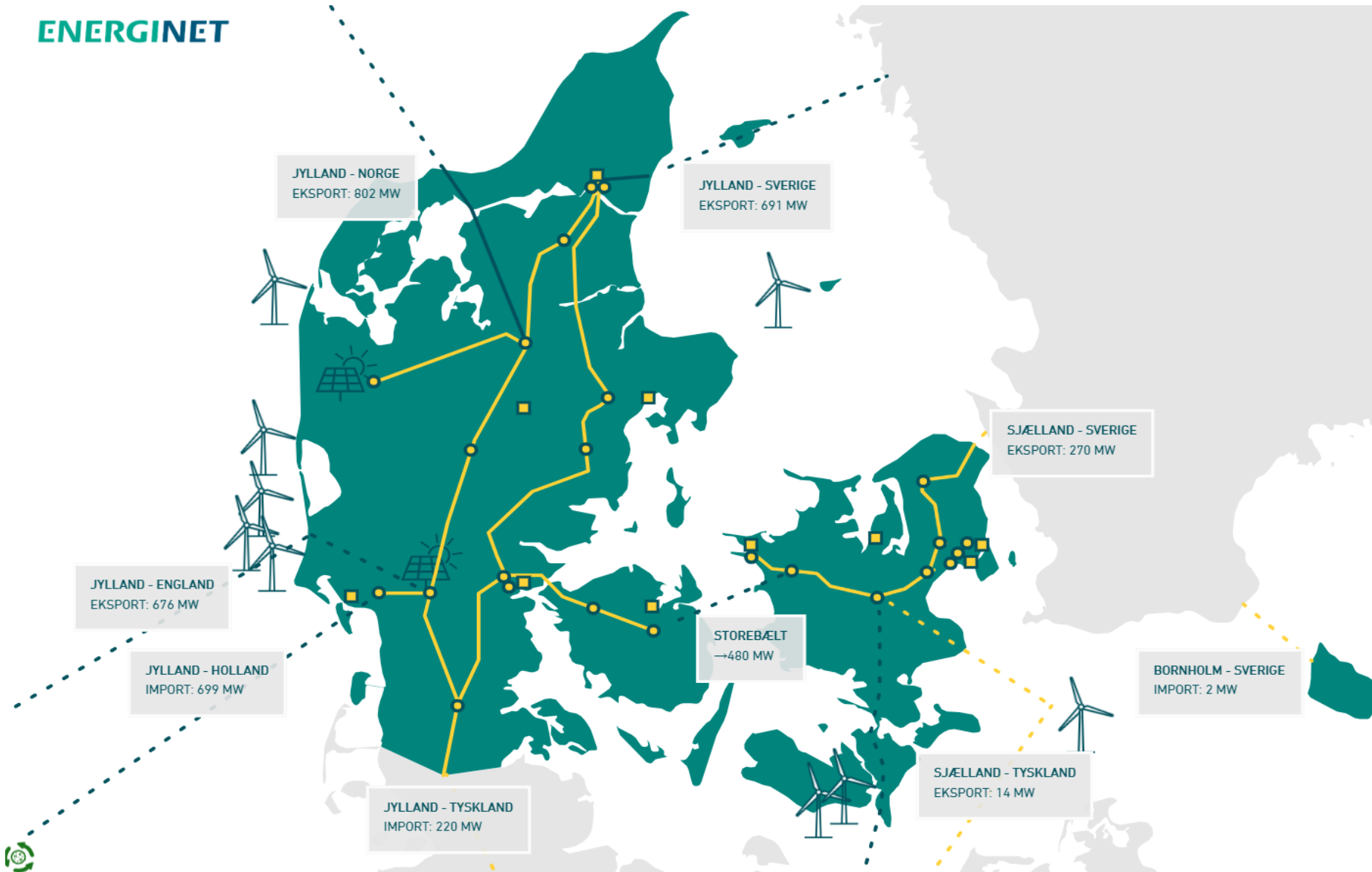


Elnetselskabernes grænser,  
Kortet er opdateret december 2020



# The transmission grid in Denmark (TSO)

**ENERGINET**



## ELSYSTEMET LIGE NU

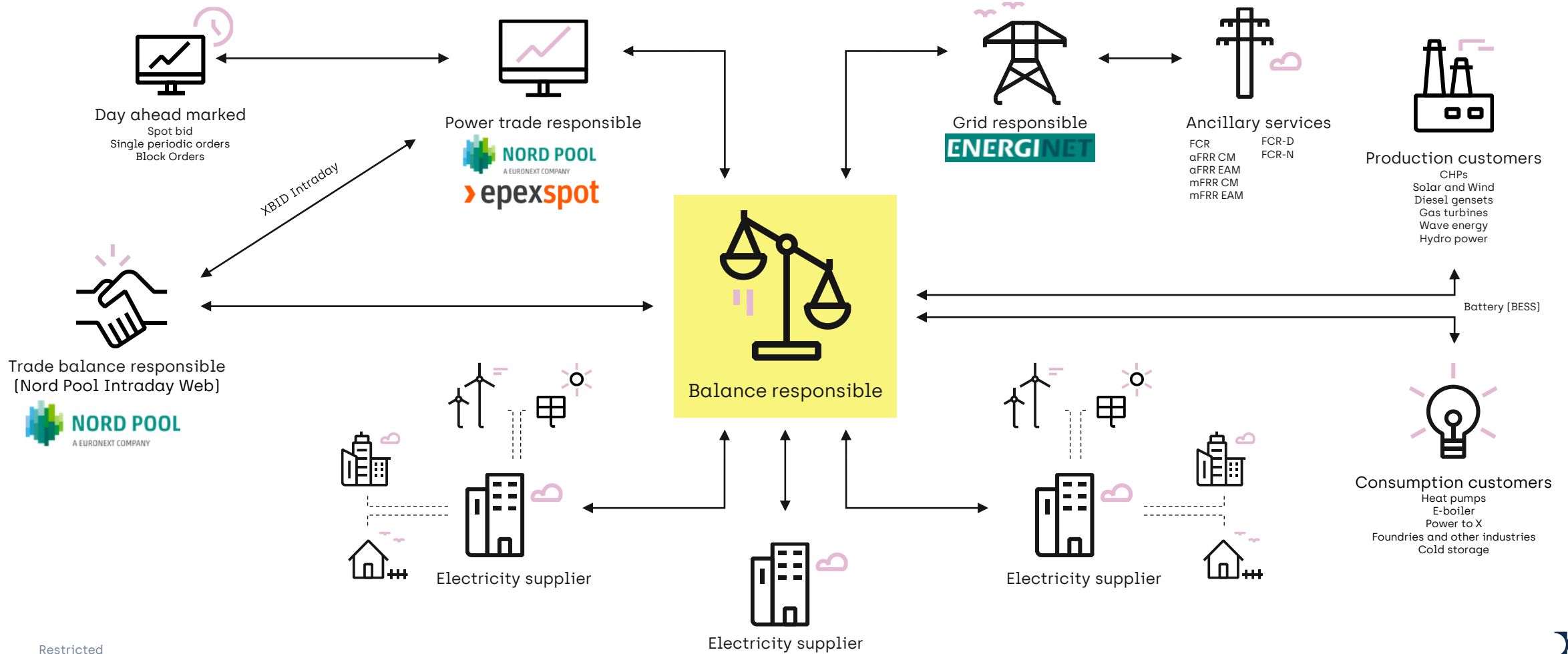
|                            |           |
|----------------------------|-----------|
| STØRRE VÆRKER OVER 100 MW  | 1.065 MW  |
| MINDRE ANLÆG UNDER 100 MW  | 591 MW    |
| VINDMØLLER                 | 6.153 MW  |
| SOLCELLER                  | 3 MW      |
| FØRBRUG I DK               | 6.281 MW  |
| NETTOUDVEKSLING IMPORT     | -1.532 MW |
| CO <sub>2</sub> -UDLEDNING | 56 g/kWh  |

## IKONFORKLARING

|                          |  |
|--------------------------|--|
| VÆRK OVER 100 MW         |  |
| HAVVINDMØLLEPARK         |  |
| TRANSFORMERSTATION       |  |
| LUFTLEDNING, VEKSELSTRØM |  |
| KABEL, VEKSELSTRØM       |  |
| LUFTLEDNING, JÆVNSTRØM   |  |
| KABEL, JÆVNSTRØM         |  |



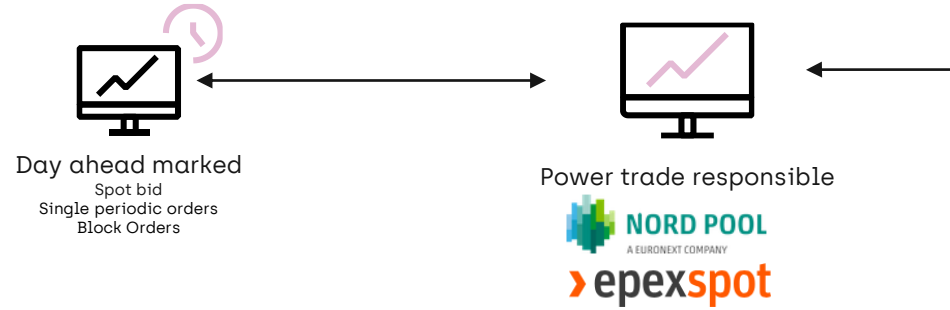
# The modern electricity market is complex with multiple stakeholders with different responsibilities



# The Dayahead / Spot Market

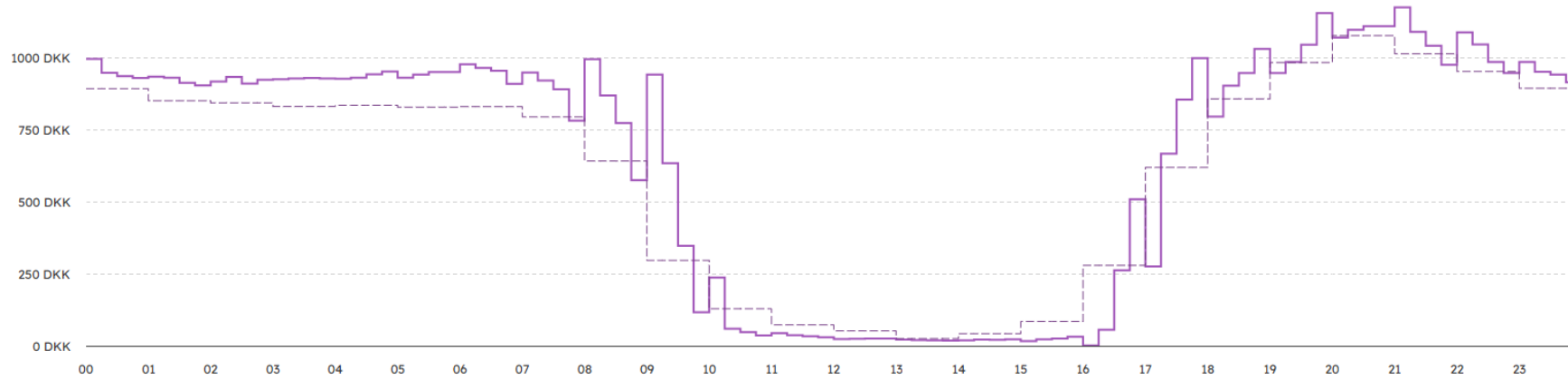
## Day-ahead submission by 12:00

- Spot bid:  
On price – accepts the spot price
- Block bid:  
Minimum of 3 consecutive bids
- Single periodic orders:  
One pooled price per 15-minute interval



## Electricity

— Spotprices — Spotprices forecast



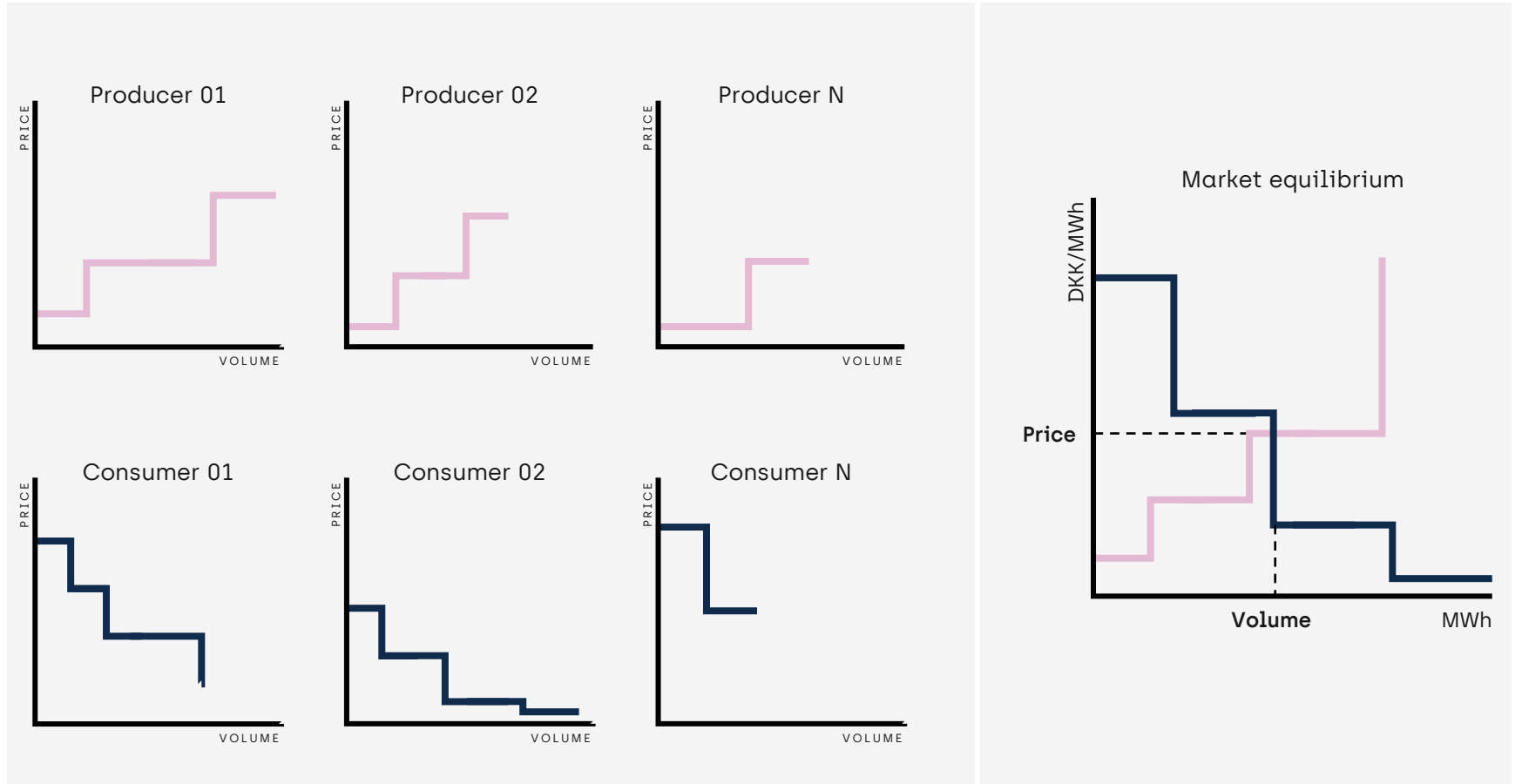
| Month      | Average Spot Price [DKK] |
|------------|--------------------------|
| 01-01-2025 | 730,93                   |
| 01-02-2025 | 841,82                   |
| 01-03-2025 | 628,80                   |
| 01-04-2025 | 561,09                   |
| 01-05-2025 | 479,23                   |
| 01-06-2025 | 438,52                   |
| 01-07-2025 | 617,92                   |
| 01-08-2025 | 548,40                   |
| 01-09-2025 | 540,44                   |
| 01-10-2025 | 584,13                   |
| 01-11-2025 | 693,59                   |
| 01-12-2025 | 615,77                   |



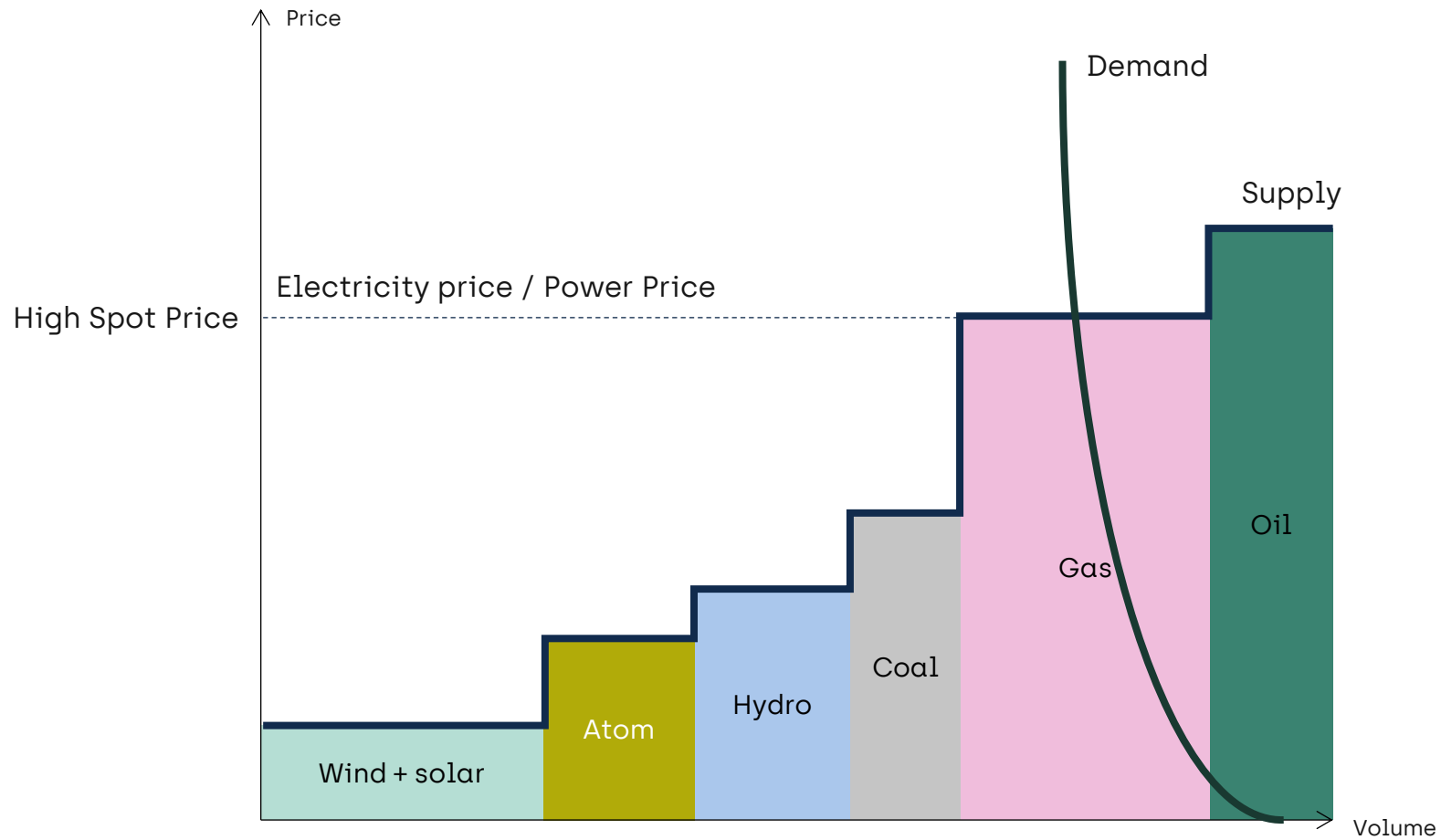
# Introduction to regulations on the electricity markets – pricing on the spot market

Electricity producers (suppliers) and consumers (buyers) send their forecasted volumes to the spot exchange before 12.00.

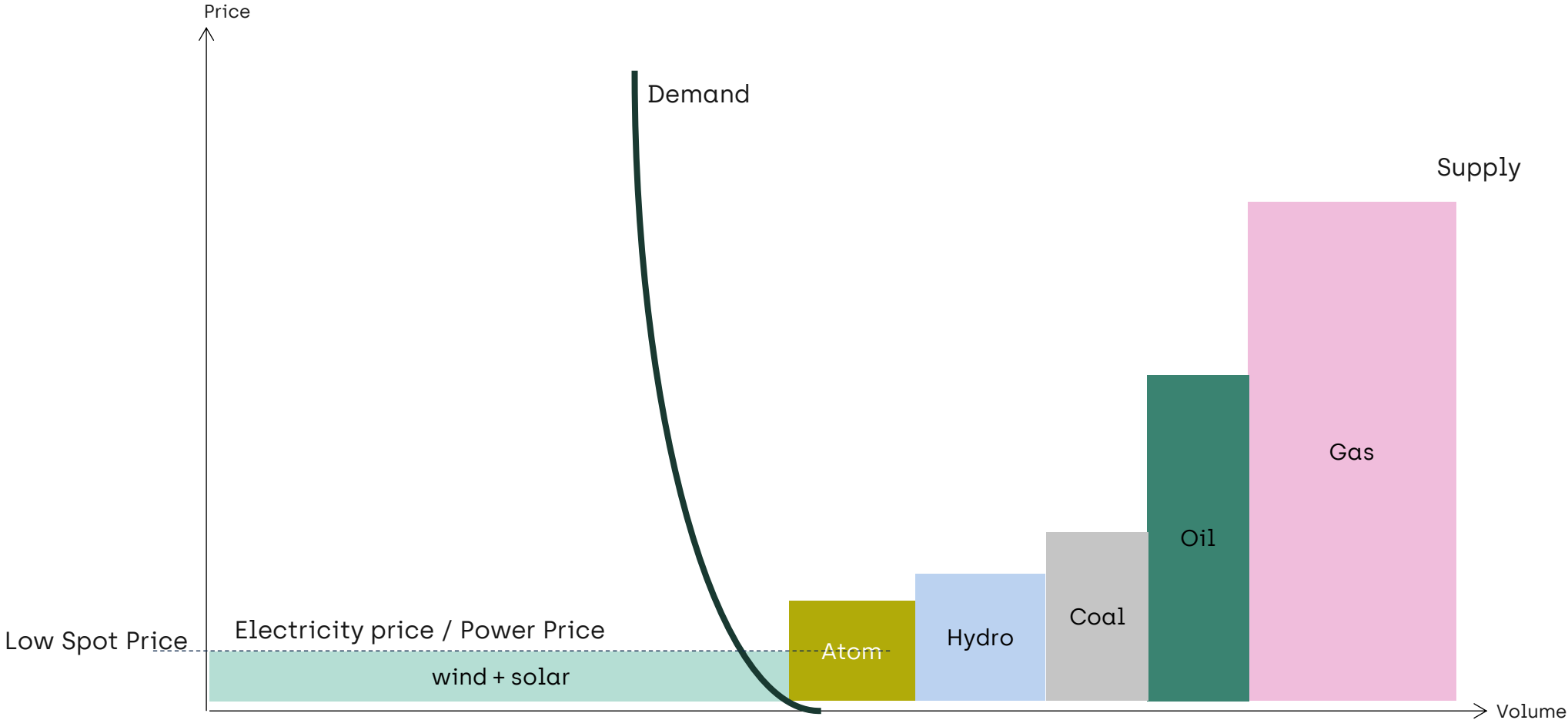
Based on this the following day's electricity mix is decided.



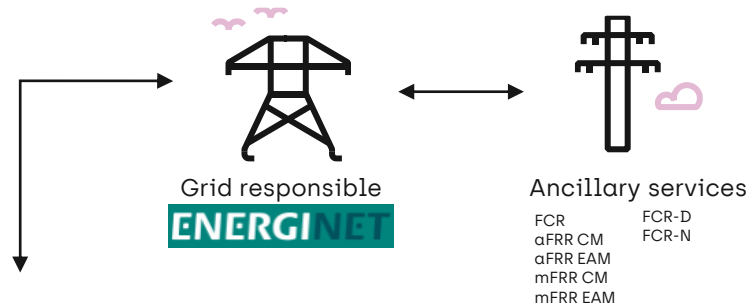
# No wind or solar generation can result in high electricity prices



# Wind and solar power can result in low electricity prices.

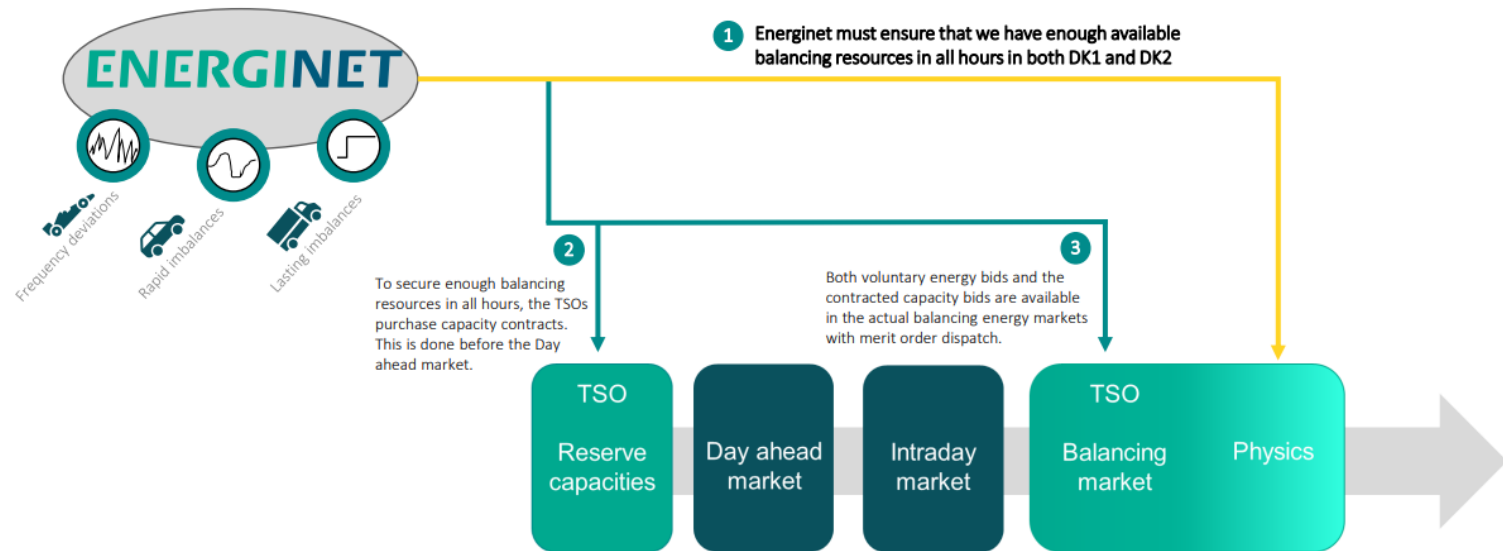
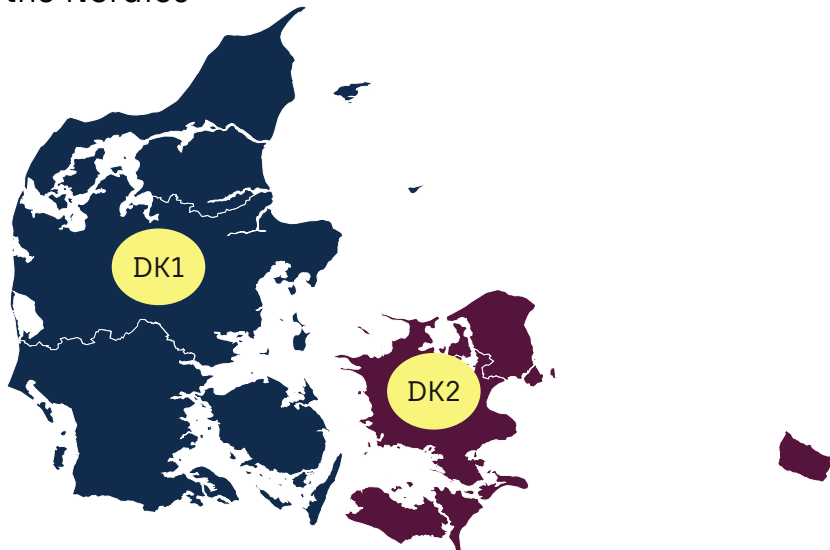


# Introduction to regulations on the electricity markets – Ancillary Services



## HOW DO WE ENSURE RESOURCES?

The Danish electricity grid is divided into two bid-zones. DK1 is connected to CWE and DK2 is connected to the Nordics



# Capacity and Energy Markets

**Purpose:** security of available balancing energy



Ensures that enough balancing capacity will be offered into the energy market

CAPACITY MARKET  
"Reserves"

**Purpose:** activation of actual balancing energy



Activation of energy bids balancing the high voltage electricity system

ENERGY MARKET

Bid

\$

Stakeholder receives payment

**Stakeholder**



Stakeholder receives payment

\$

Bid

- Stakeholders can place bids in the capacity market to provide reserves
- If a capacity market bid is accepted, the stakeholder receives a payment for having balancing energy available and committing to bid in the energy market

- Stakeholders with obligation from the capacity market **must** bid in the energy market  
*NB: The bid price delivered to the capacity market is irrelevant.*
- Stakeholders without obligation from the capacity market **can** bid in the energy market with voluntary bids



# ASSETS AND PRODUCTS

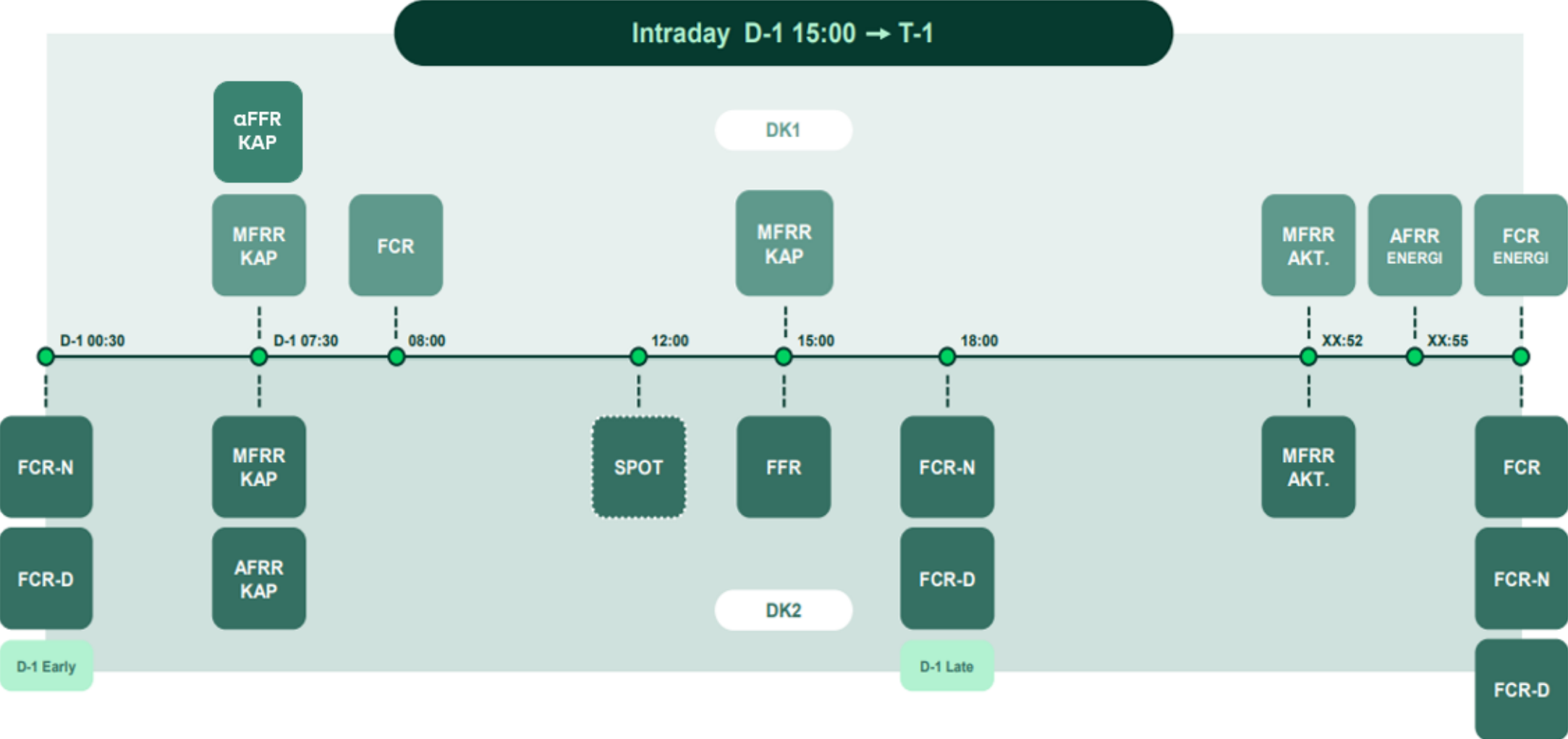
Besides being active in all common spot-marked products, hourly-block-bids etc. DC is also active in all ancillary marked depending on the Asset's pre-qualification to participate

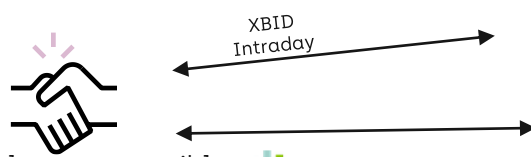
| Activation time |           |             |           |             |                |                |
|-----------------|-----------|-------------|-----------|-------------|----------------|----------------|
| Marked          | FFR [DK2] | FCR-D [DK2] | FCR [DK1] | FCR-N [DK2] | aFRR [DK1/DK2] | mFRR [DK1/DK2] |
|                 | 1 sec.    | 5-30 sec.   |           | 2,5 min     | 5 min          | 12,5 min       |

| Asset/product      | FFR | FCR-D | FCR [DK1] | FCR-N | aFRR | mFRR |
|--------------------|-----|-------|-----------|-------|------|------|
| CCGT plant         |     | x     |           | x     | ☒    | ☒    |
| Steam turbines     |     |       | ☒         | x     | ☒    | ☒    |
| Gas- engines       |     | x     | ☒         | x     | ☒    | ☒    |
| Electrical boilers | ☒   | ☒     | ☒         | ☒     | ☒    | ☒    |
| Heat pumps         |     |       | [x]       | [x]   | [x]  | ☒    |
| Batteries          | ☒   | ☒     | ☒         | ☒     | ☒    | ☒    |

☒ = bids submitted daily to the TSO from DC

# Ancillary services: deadlines and activation

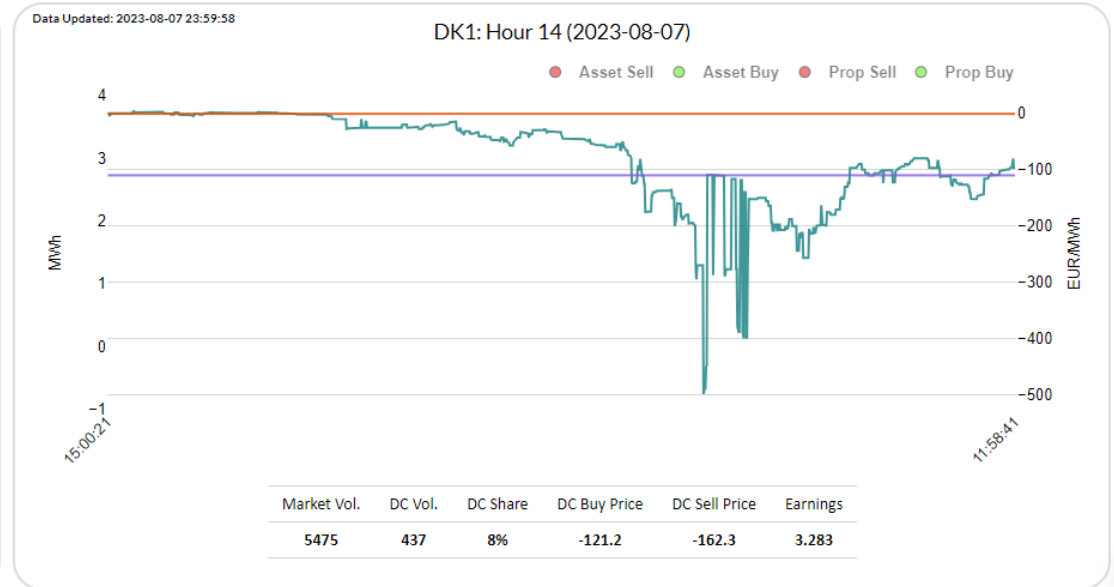
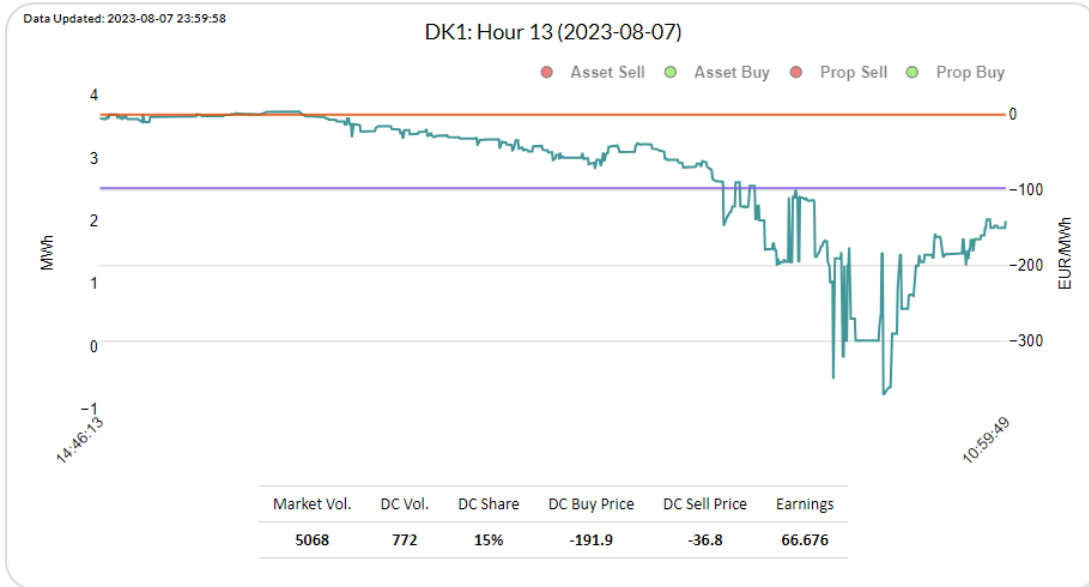




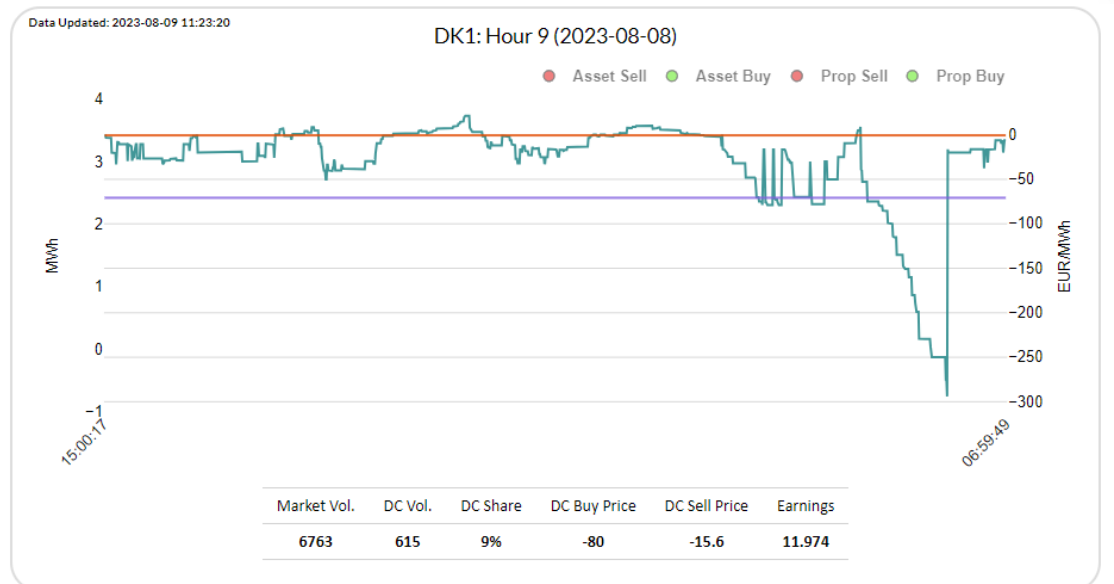
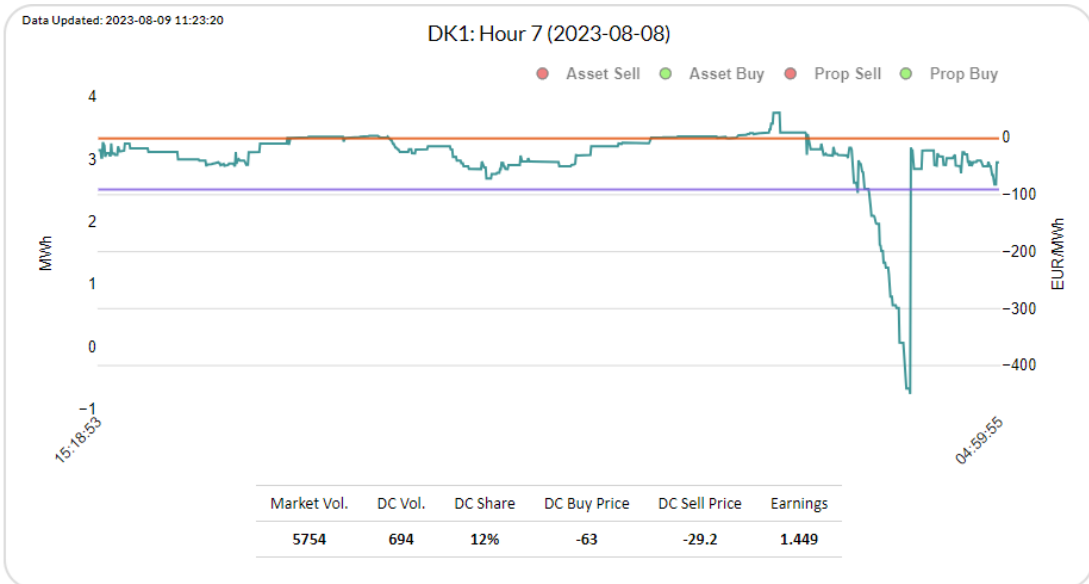
# Intraday Market

Trade balance responsible  
(Nord Pool Intraday Web)

7/8/2023



8/8/2023



# COSTUMERS AND ASSETS TYPES

- Costumers are mostly district heating companies (A.m.b.a companies)
- DC has also some industrial costumers (refineries, offshore facilities etc.)
- We do see more private investors, investing in Battery setup for frequency based ancillary services

- **Assets types**

- **Production**

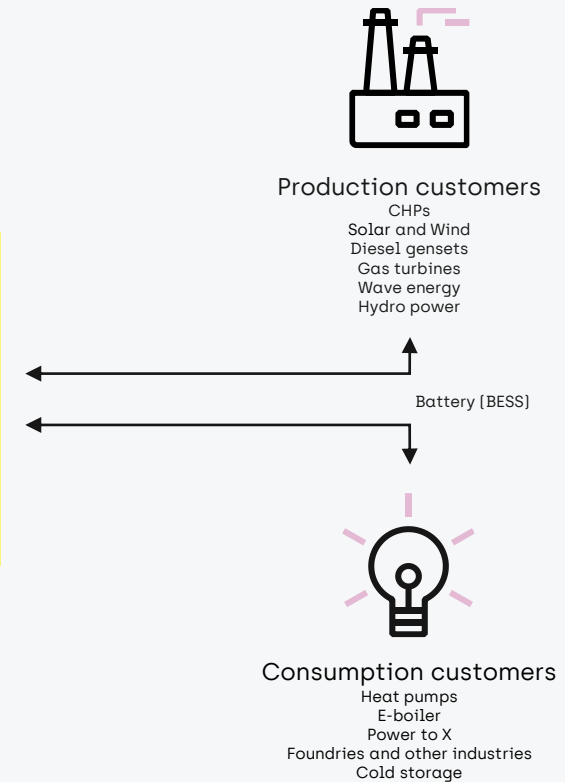
- Gas turbines CCGT plants
- Waste-to-energy - steam-turbines
- Biomass plants – steam-turbines
- Gas engines

- **Consumption**

- Electrical boilers
- Heat pumps (air – liquid)

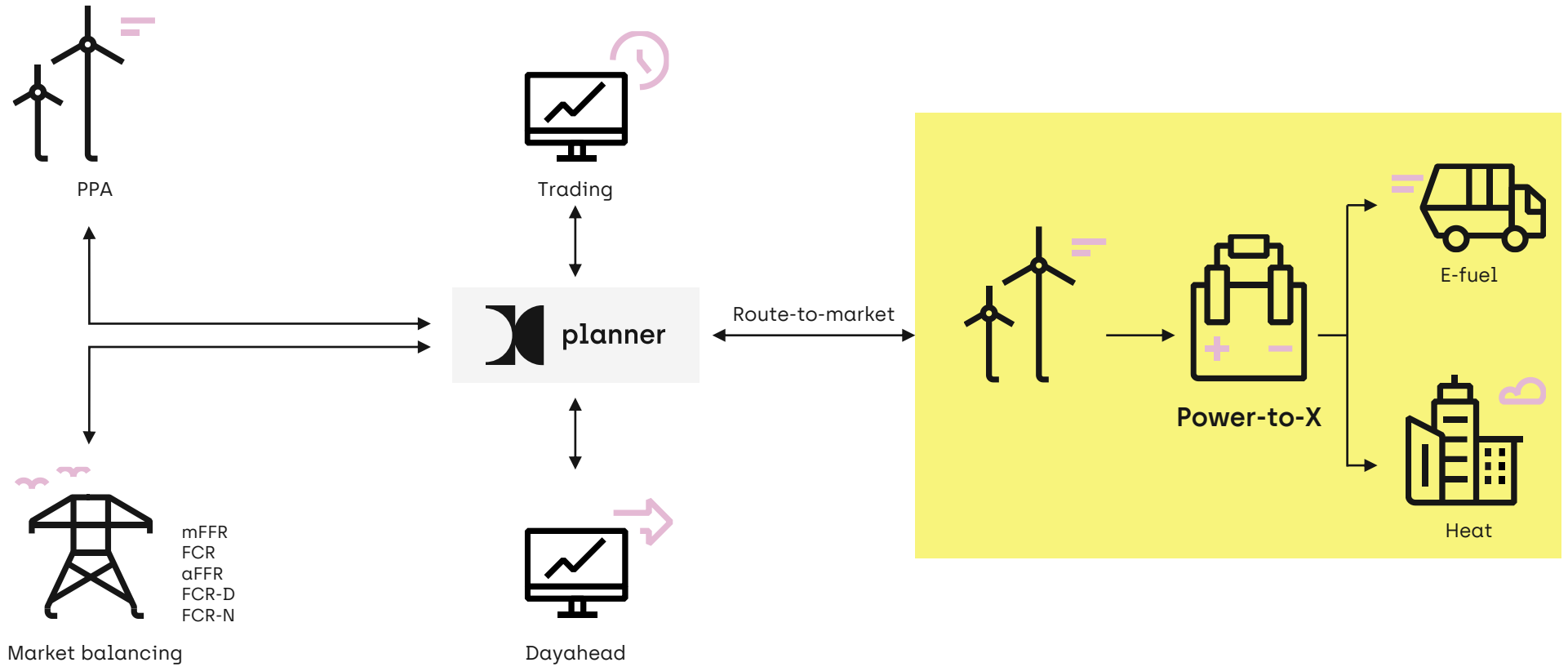
- **Flex – storage (as is now)**

- Batteries storage-production-consumption
- Heat-storage tanks



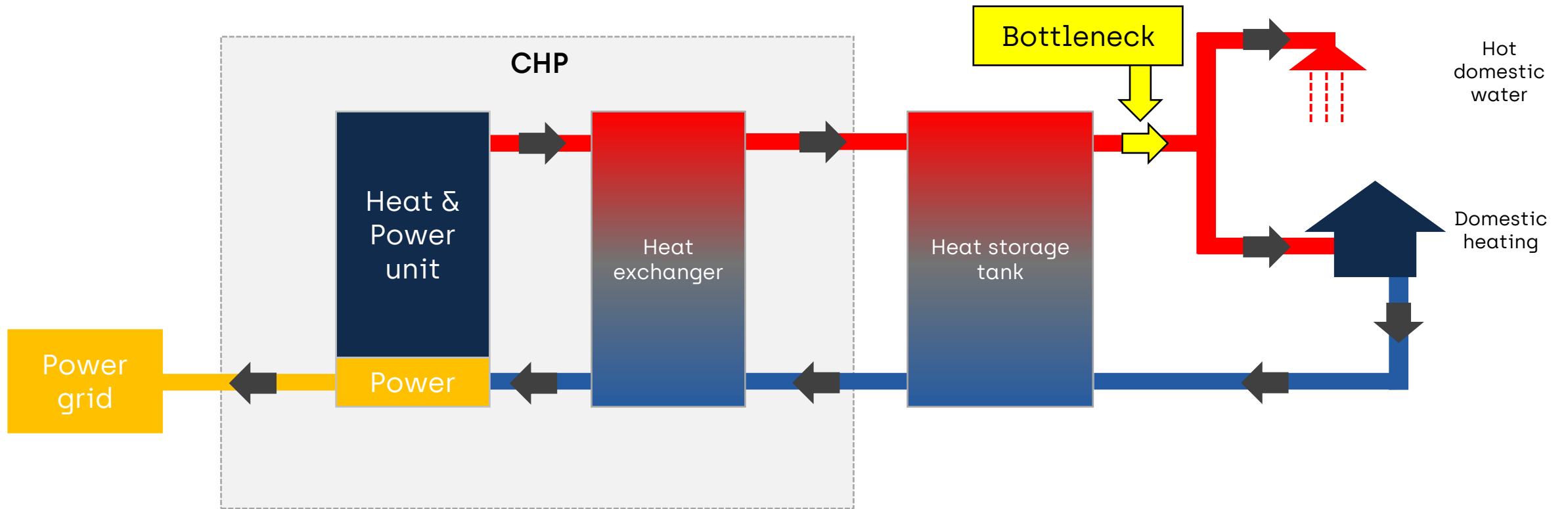
# BRP system setup - Route to marked access placing bids

1. DC -Planner
2. Bidding in the day ahead market
3. Bidding in ancillary services
4. Bidding in intraday market
5. DC planner can apply API interface to third party systems

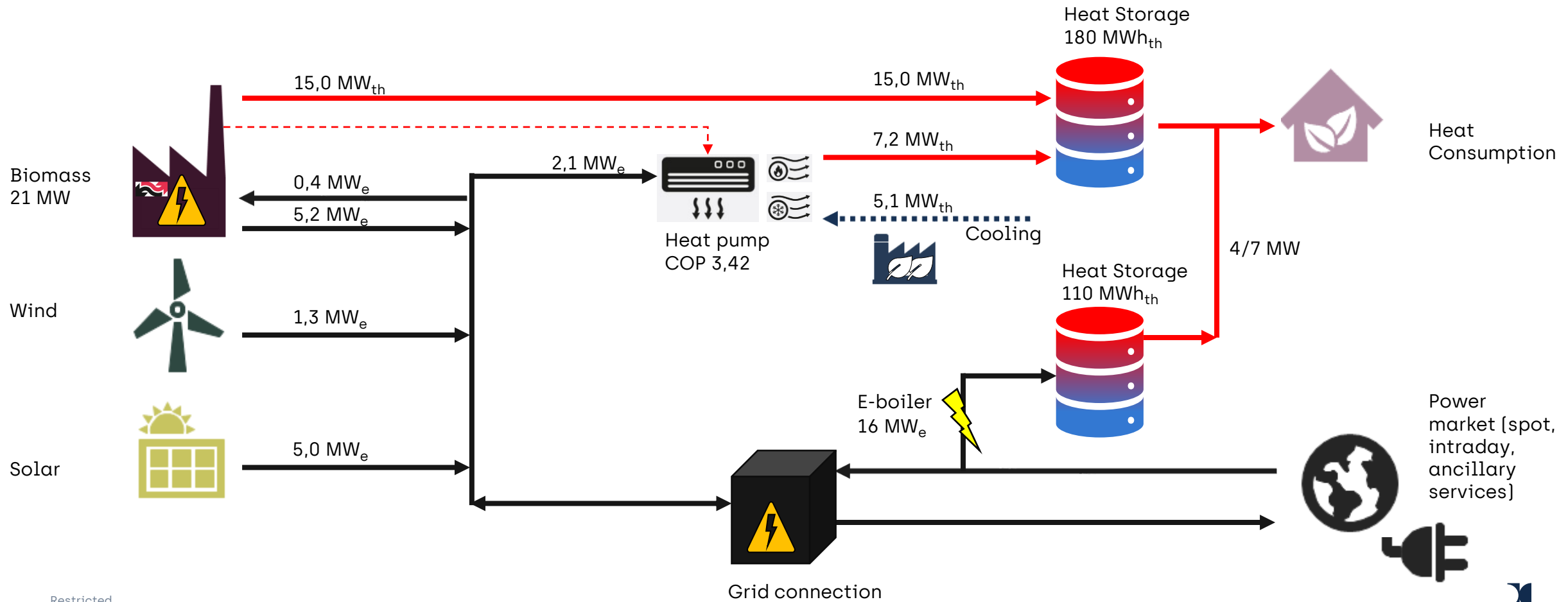


# Illustration of CHP

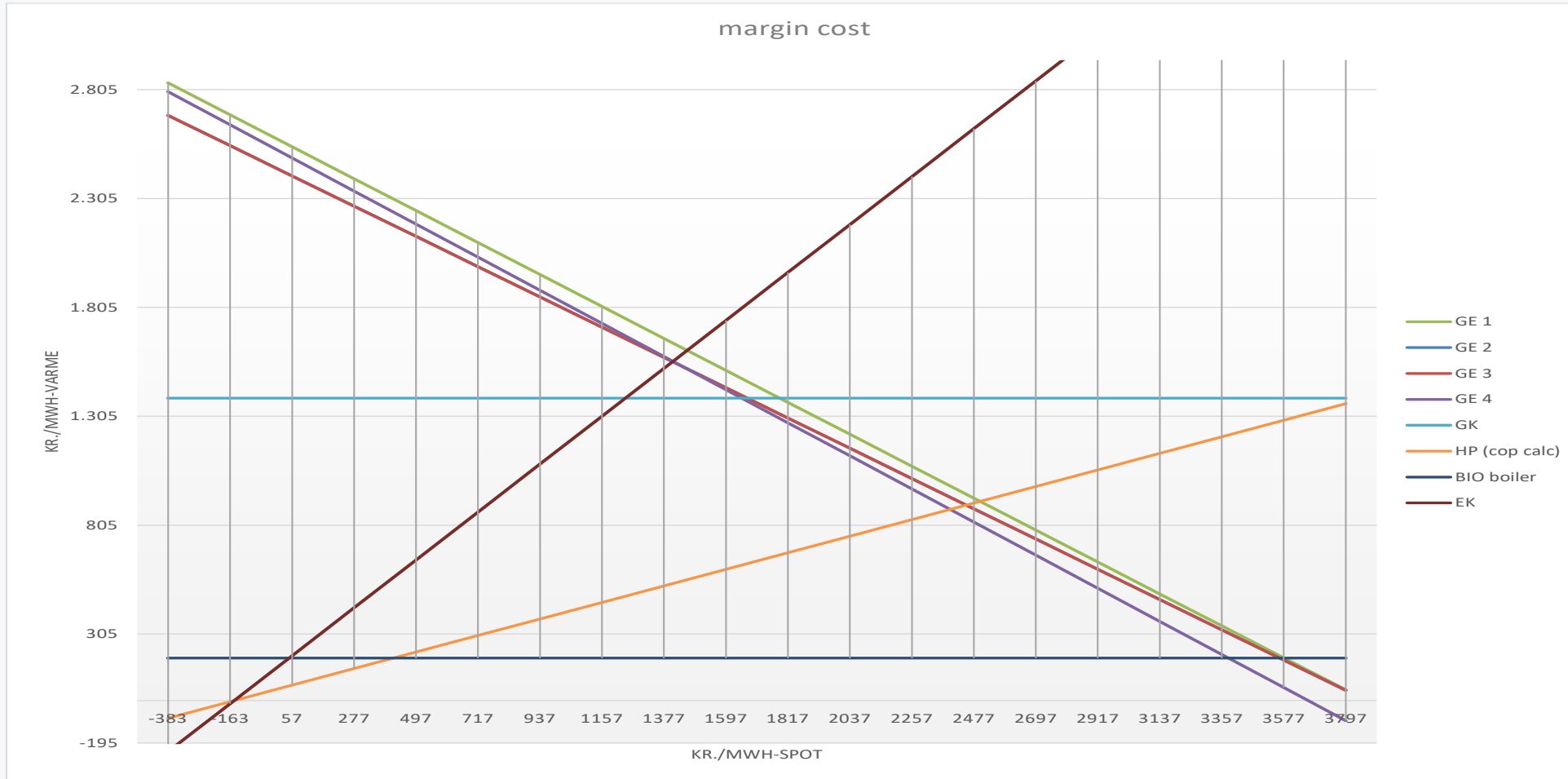
- CHP power production is driven by heat demand



# A typical Danish combined heat and power (CHP) plant



# MARGIN COST AND BID CALCULATIONS



Heat-producer = lowest price => depending on value from power markets [spot-marked, intraday, ancillary services]

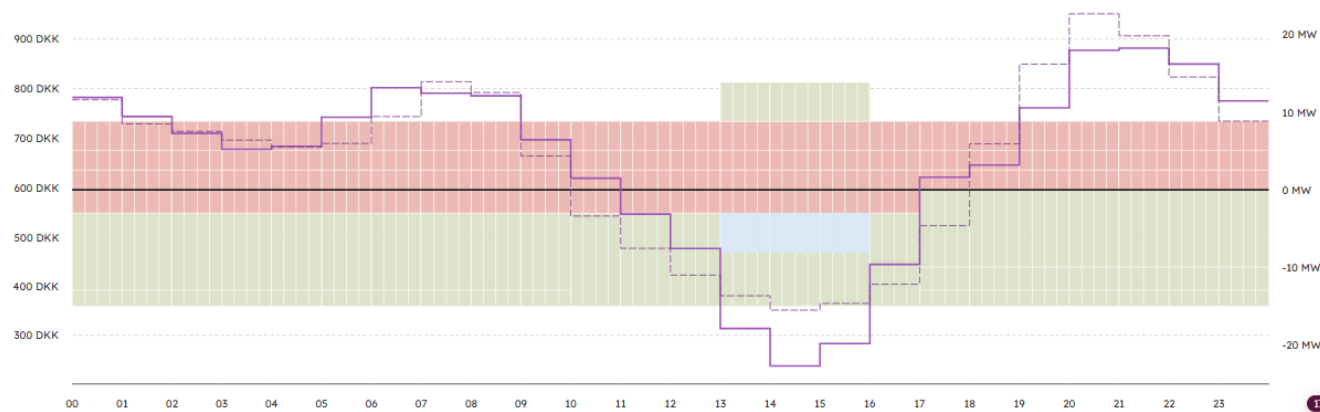
Bids volumes are depending on the available flex [available storage capacity combined with underlying off-take of heat]



# Flexible production and consumption – electric boilers (district heating plant)

## Electricity

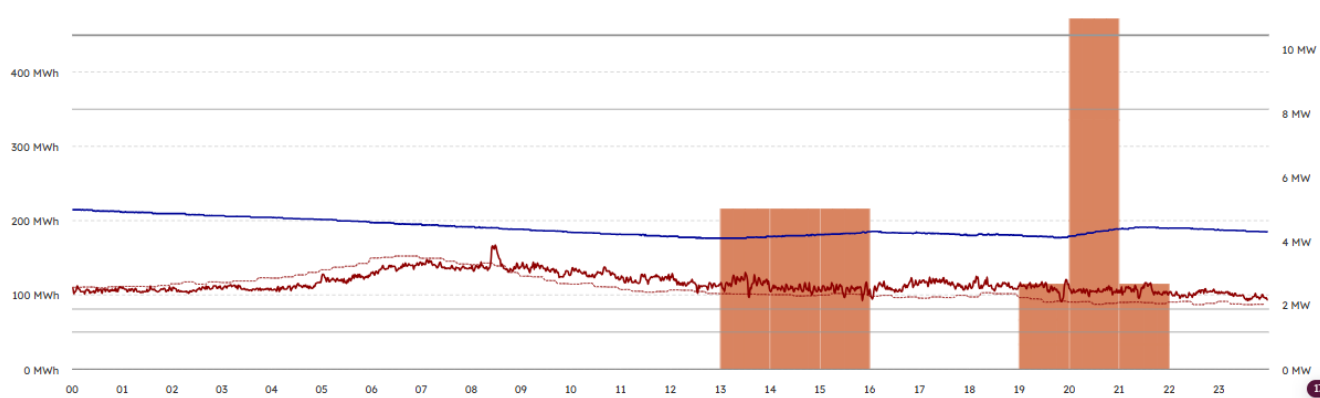
■ aFRR Energy 
 ■ Hour limitation 
 ■ mFRR Energy 
 ■ Spotprices 
 ● Spotprices forecast



Show Marginal Prices

## Heat overview

■ Accumulation tank 
 ● Accumulation tank forecast 
 ■ Accumulation tank simulation 
 ■ Heat demand 
 ● Heat demand forecast 
 ■ Derived heat production



5/5 Dashboard Planning

|                                   | Power                               | Heat            | Price                  | Won price     |
|-----------------------------------|-------------------------------------|-----------------|------------------------|---------------|
| <b>HOURLY LIMITATION</b> Closed ^ |                                     |                 |                        |               |
| <b>Elkedel</b>                    | ↓ 35<br>7 bids   3   4<br>MWh       | ↑ 35<br>MWh     | 400<br>DKK             | --            |
| <b>MFRR CAPACITY</b> Closed ^     |                                     |                 |                        |               |
| <b>M1</b>                         | ↑ 61.20<br>24 bids   24<br>MWh      | ↑ 75.60<br>MWh  | 2<br>DKK               | 441.96<br>DKK |
| <b>M2</b>                         | ↑ 61.20<br>24 bids   24<br>MWh      | ↑ 75.60<br>MWh  | 2<br>DKK               | 441.96<br>DKK |
| <b>M3</b>                         | ↑ 90<br>24 bids   24<br>MWh         | ↑ 111.36<br>MWh | 2<br>DKK               | 649.94<br>DKK |
| <b>MFRR ENERGY</b> (21:30) ^      |                                     |                 |                        |               |
| <b>Elkedel</b>                    | ↓ 51<br>17 bids   17<br>MWh         | ↑ 51<br>MWh     | 49 ... 89<br>DKK       | --            |
| <b>M1</b>                         | ↑ 61.20<br>24 bids   21   3<br>MWh  | ↑ 75.60<br>MWh  | 3,999 ... 6,999<br>DKK | --            |
| <b>M2</b>                         | ↑ 61.20<br>24 bids   21   3<br>MWh  | ↑ 75.60<br>MWh  | 3,998<br>DKK           | --            |
| <b>M3</b>                         | ↑ 90<br>24 bids   21   3<br>MWh     | ↑ 111.36<br>MWh | 3,998 ... 4,998<br>DKK | --            |
| <b>AFRR ENERGY</b> Closed ^       |                                     |                 |                        |               |
| <b>Elkedel</b>                    | ↓ 279<br>204 bids   182   22<br>MWh | ↑ 279<br>MWh    | 0 ... 300<br>DKK       | --            |
| <b>AFRR CAPACITY</b> Closed ^     |                                     |                 |                        |               |
| <b>Elkedel</b>                    | ↓ 50<br>41 bids   17   24<br>MWh    | ↑ 50<br>MWh     | 2 ... 7,001<br>DKK     | 507.28<br>DKK |

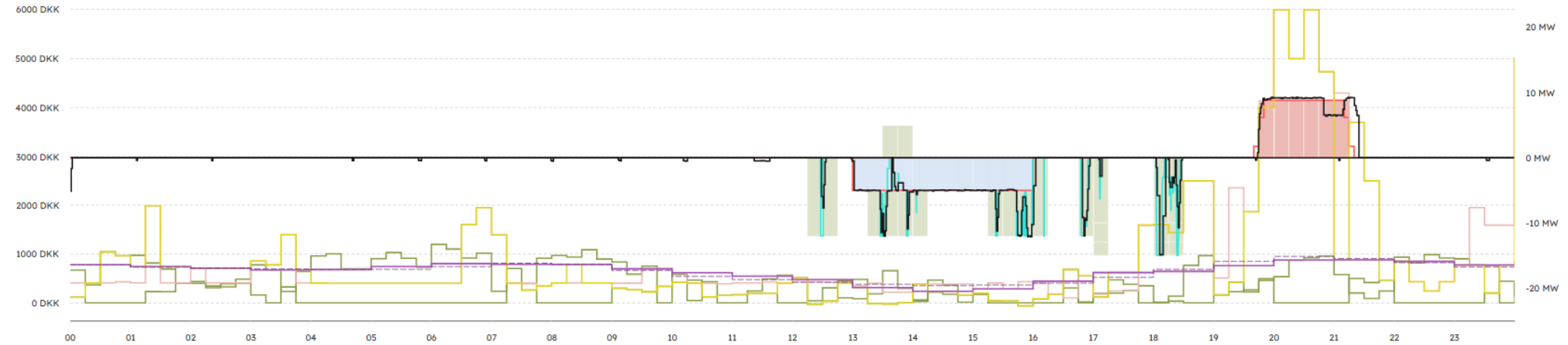


# Flexible production and consumption – electric boilers (district heating plant)

## Electricity

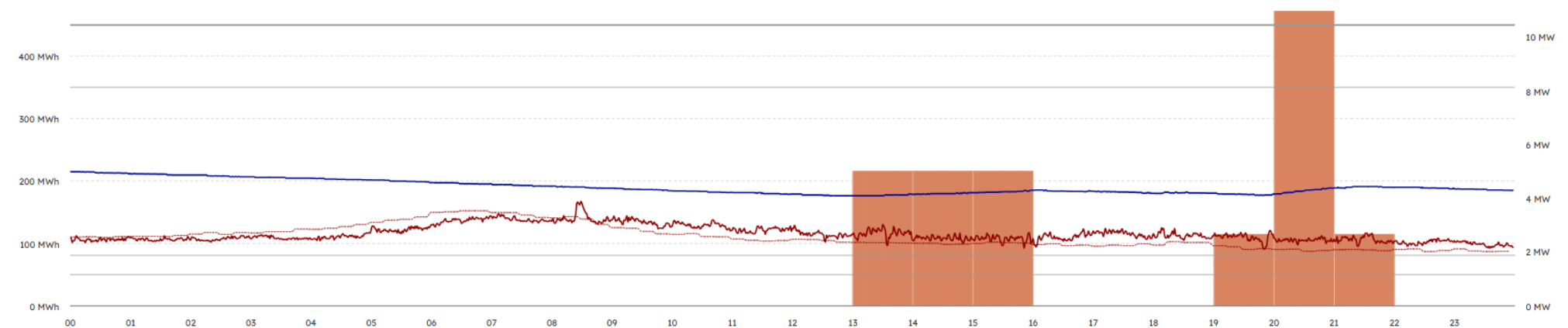
aFRR Energy aFRR price Imbalance price Hour limitation Activations mFRR price Realtime measurement Spotprices Spotprices forecast

11/11 Dashboard Planning

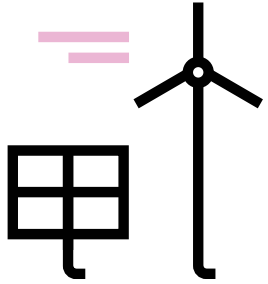


## Heat overview

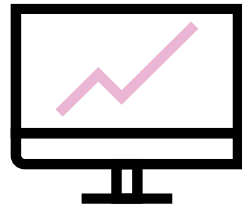
Accumulation tank Accumulation tank forecast Accumulation tank simulation Heat demand Heat demand forecast Derived heat production



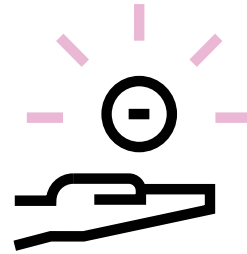
We bring renewables and CHP to the market at scale, paving the way for a more sustainable future



We control the assets



We optimise the assets



We guarantee earnings



We operate across markets





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