

centrica
Energy

Integrating the biofuels and electricity sectors

Lotte Holmberg Rasmussen, R&D Project Manager, M.Sc.
Centrica Energy, Aalborg, Denmark



5
th

EUROPEAN CONFERENCE

FUTURE OF BIOFUELS

24-25 October 2023, Copenhagen, Denmark



Energy
Movers
by
Nature



The Big Picture

Centrica Energy is a renewable energy trading company operating out of eight offices across all time zones to move energy from source to use.

Our mission is to drive the green transition while offering sustainable and predictable energy costs for suppliers and offtakers. In short, we call ourselves energy movers by nature.

16.5GW

Power Assets

27

Trading Markets

6.6M

Trades

432

Total Headcount
incl. students

8

Locations



Centrica Group Businesses

Our Strategic Framework

Retail

We remain relentlessly focused on providing leading customer service and experience helping them to save money and decarbonise through innovative offerings

Optimisation

We are supporting the responsible buying and selling of energy, managing risk across our business and accessing value from green generation in our trading business while continuing to build out the flexibility required for the future energy system

Infrastructure

Investing to build a low carbon, reliable energy system including power generating renewables, flexible peaking generation and energy storage through batteries and geological storage



British Gas	DYNO phJones	HIVE Bord Gáis Energy	centrica Business Solutions	centrica Energy Trading	centrica storage	SPiRiT ENERGY	Nuclear
Energy supply for residential and small business customers in England, Scotland and Wales	Services and solutions for residential customers In England, Scotland, and Wales	Energy supply services and solutions for residential and business customers in the Republic of Ireland	Energy supply and low carbon solutions for businesses, building and operating a portfolio of flexible assets	Trading and optimisation of energy globally, managing energy procurement & risk	Storing and producing gas to manage seasonal demand and energy security	Oil and gas production in existing UK assets	Minority stake in the UK's portfolio of existing nuclear power stations
British Gas Energy is transitioning onto a new digital platform to lower cost per customer and improve service	Services & Solutions is focused on fixing delivery and helping customers with the energy transition	Bord Gáis is an established business with opportunity to explore future growth	Centrica Business Solutions is refocusing on its strengths in supply and services and increasing investment in energy transition assets	Energy Marketing & Trading is an established business with proven capability ready to grow further	Centrica Storage has an opportunity to explore its role in the future of hydrogen	Spirit has an opportunity to explore its role in the future of hydrogen and carbon capture	We have a 20% minority stake in a declining portfolio, Centrica is exploring further investment in Nuclear generation

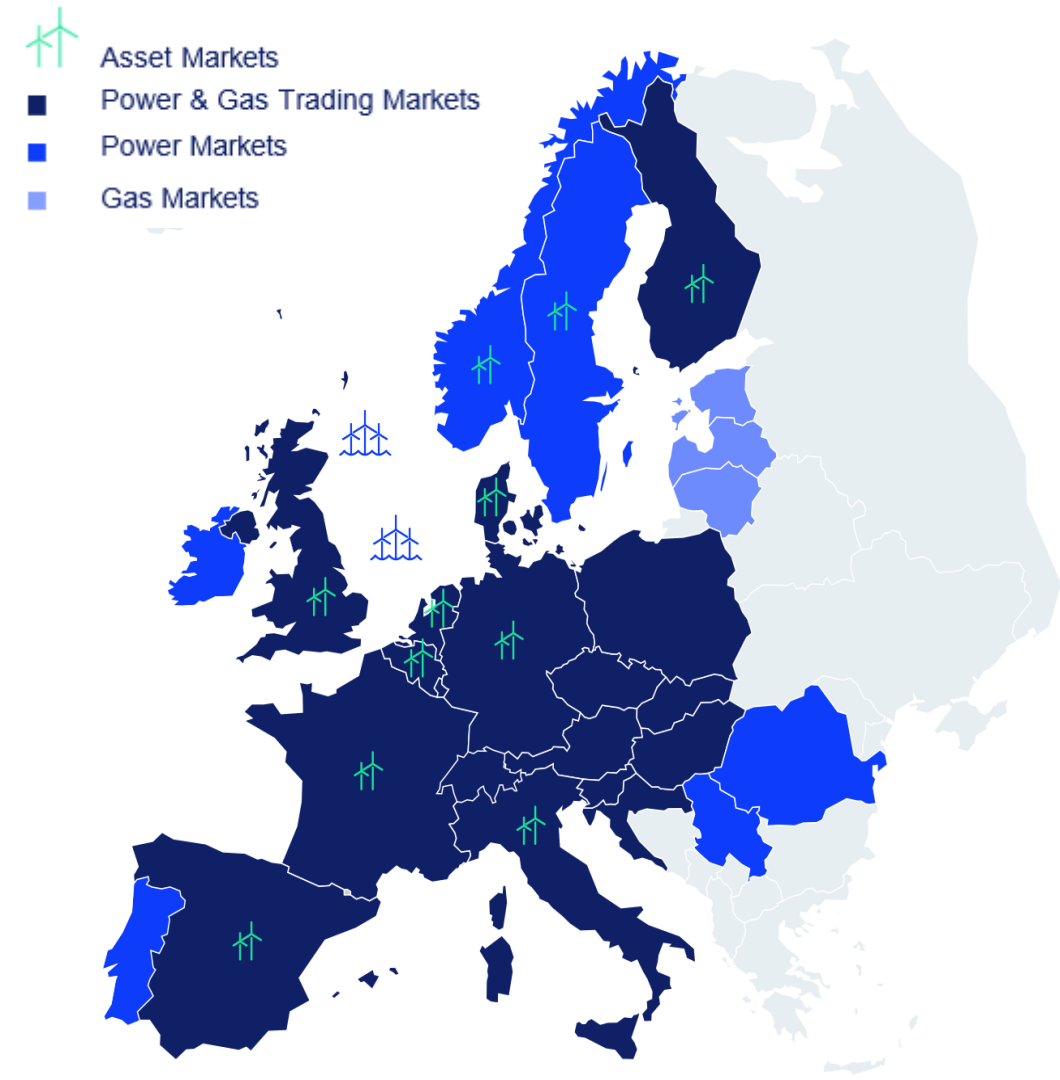


CE - Centrica Energy, Denmark

Part of Centrica PLC (UK)

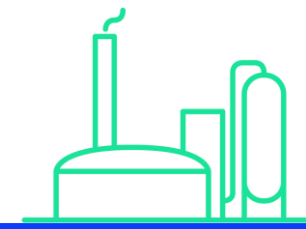
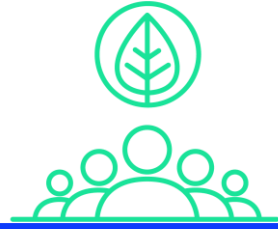
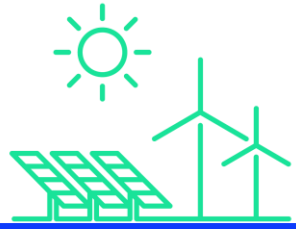
Markets and business areas

- Two main business areas:
 - Trading electricity, gas and green certificates across Europe
 - Balancing Responsible Party (BRP) for physical asset
 - Including 20 % of Europe's PPAs
- CE (BRP) customers include:
 - Approximately 150 CHPs
 - Flexible Cogeneration of Heat and Power plants – 1 - 400 MW
 - Renewables (wind, solar, hydro and biogas)
 - Flexible consumption
 - Electric boilers, heat pumps, EVs, PtX electrolyzers
 - Electricity supply companies
- We trade power across 24 European countries and gas across 16 countries. Over the next few years, we expect to further expand our presence across the European continent, as well as globally.
- To service our customers across Europe and optimise our 24/7/365 trading activities, our main office is in Aalborg, Denmark, alongside an extended office in Copenhagen. We have subsidiaries in the UK, Germany, Belgium and Singapore, and branches in Norway and Sweden.



Centrica Energy, Denmark

Our Business Areas



Asset Management

Renewable Power Purchase Agreements

Our market leading PPAs provide physical and financial optimisation of renewable energy assets to independent power producers across the continent, securing bankable revenue, transfer of merchant risks, physical balancing, and dynamic trading, alongside 24/7/365 market operations of intermittent renewable energy output.

Corporate Power Purchase Agreements

We tailor transparent and all-inclusive Corporate PPAs from source to delivery, connecting corporate energy consumption directly with sustainable sources, making any green energy procurement strategy a reality. We match, shape and trade desired energy production and associated green energy attributes to corporate off takers at stable costs.

Optimization Flexible Energy Solutions

Dynamically balancing increasing volumes of intermittent renewable generation with flexible energy production and consumption in real-time, we provide optimisation of power plants and large-scale flexible consumption assets. Our solutions include hedging structures and ancillary services with our 24/7/365 operational duty and SCADA setup.

Certificates Trading & Management

We trade and manage Guarantees of Origin and other energy attributes, covering a variety of products that provide solutions for utilities, organisations and consumers seeking to support green energy sources and offset greenhouse gas emissions from their energy utilisation.

Biomethane Sourcing

Providing long-term sourcing agreements for biomethane production, we handle nomination, transportation, and trading of green gas. Simultaneously we handle management, trading, and retirement of biogas certificates towards end-users, ensuring a transparent green gas footprint.

Why do we need a biofuels and PtX society?

- **Game changers**
 - Climate agenda: A fossil free energy system is the goal
 - Wind and solar lowest in price
 - Changing energy systems from present to future is a gigantic task
- **Challenges with very large scale wind and solar**
 - **Fluctuating** production
 - **No value** of wind and solar in some hours
 - Neighbouring countries also have wind and solar
 - **Bottlenecks** in the transmission and distribution grids
- **To utilize more wind and solar there is a need for**
 - **Higher electricity consumption**
 - **Flexible** electricity consumption (new consumption has to be flexible incl. EVs, HPs, PtX)
 - **Integration** of electricity in other sectors
 - **Seasonal storage** of electricity

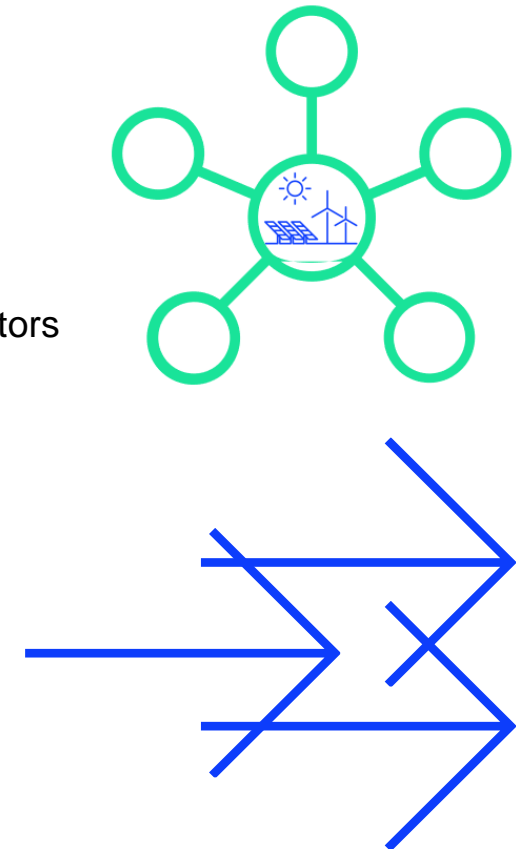
Hydrogen (PtX) is seen as the missing link between all these challenges

Sector coupling

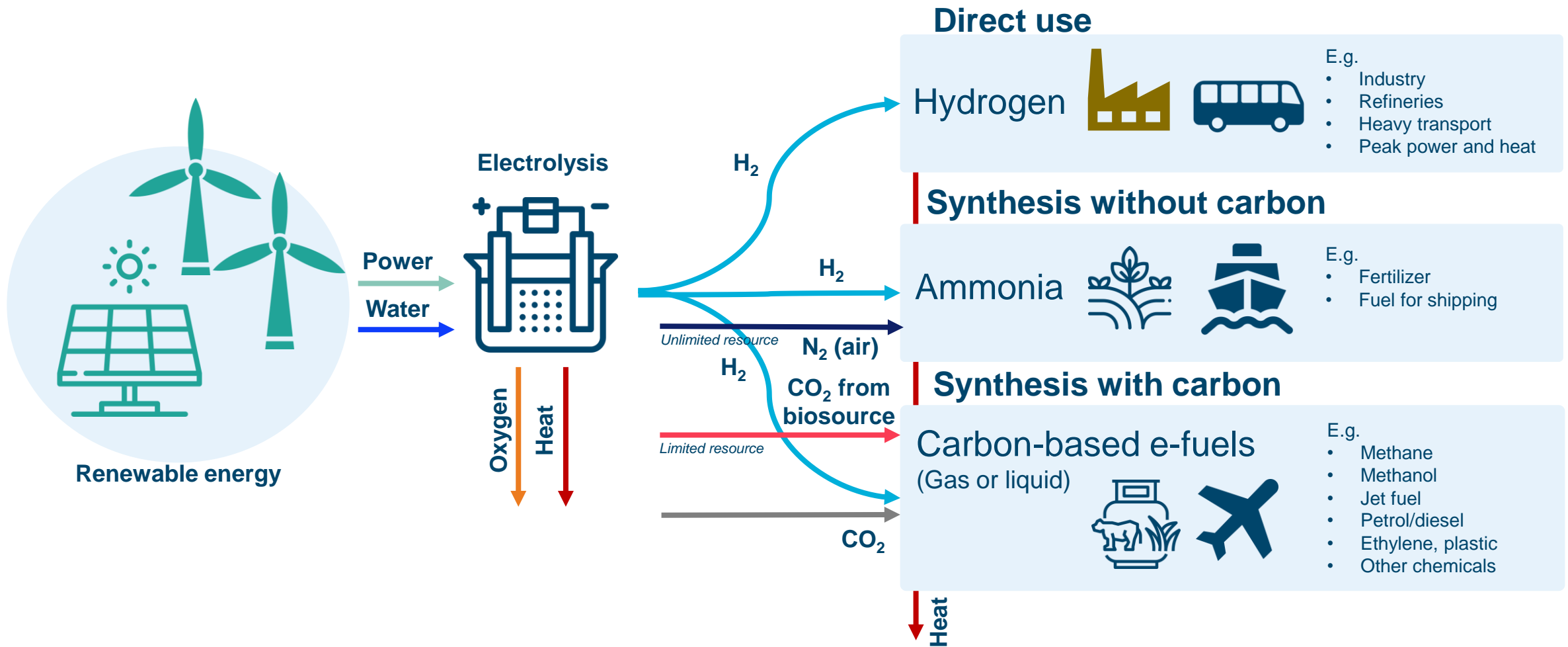
Different sectors are to be much more integrated

- Electricity
- Transport
- Gas
- Heat
- Wastewater
- Agriculture

PtX can be a part of all sectors



What is PtX?



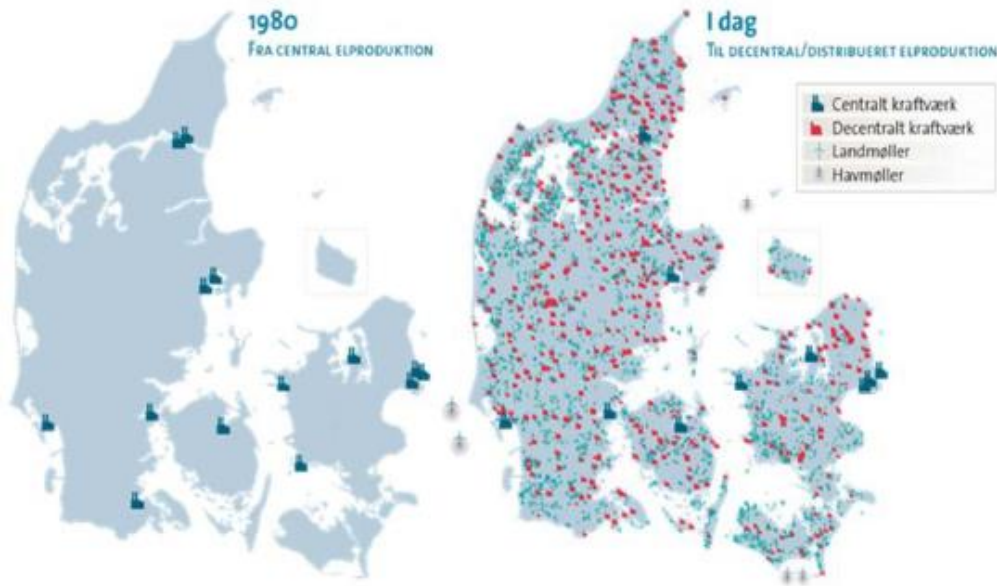
How does the electricity system work?

Denmark:

Now app. wind 50 % of electricity consumption.

2030: 100 % renewables power production

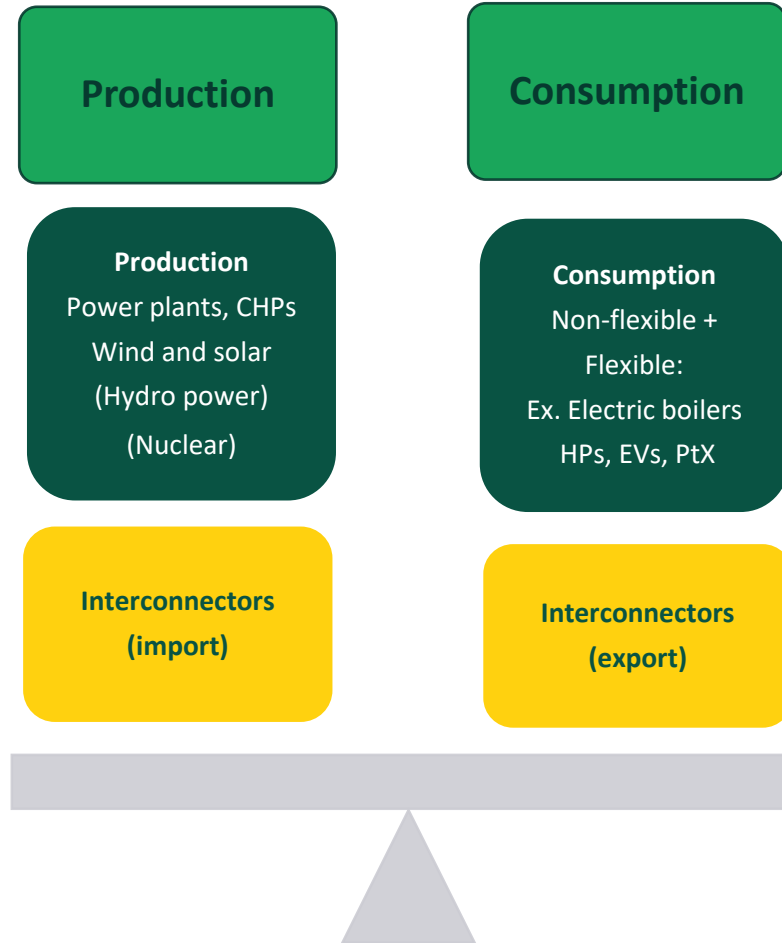
How utilize so much wind/solar?



The Danish power system. Dominated by central power stations in the 1980s and today changed into a de-centralised power system with large amount of wind and solar power

Reference: Ea, Energinet, Danish Energy Agency. Integration of Wind Energy in Power Systems.

The electricity system has to be in balance at all times



Denmark has one of the most intelligent electricity systems and it is all controlled by electricity markets

- Much more flexibility needed in the future
- Including flexibility from PtX and aggregators

Role of the Balance Responsible Parties

Communication links between market actors to handle (physical) electricity markets

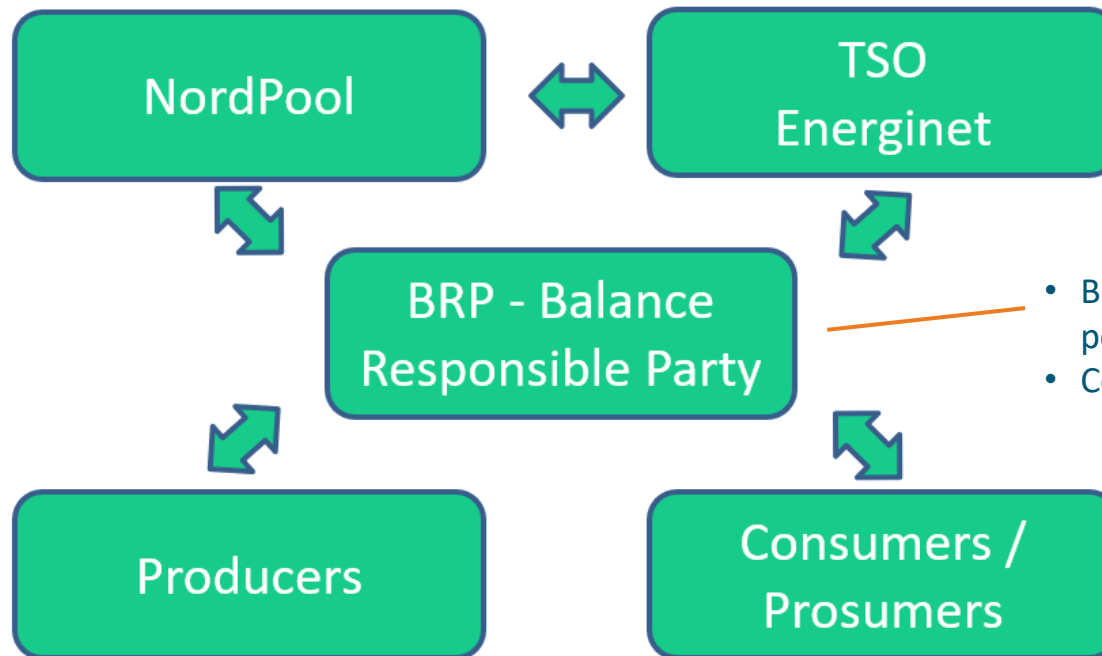
All trading in Scandinavia in all markets: Day ahead markets (spot), intraday markets and ancillary services goes through the Balance Responsible Parties

The TSO (in Denmark Energinet) is responsible for the physical system balance
The Balance Responsible Parties have the economic and legal responsibilities for their own balance between:

Production **sold** and actually **produced**

Consumption **bought** and actually **consumed**

- Spot market
- Financial contracts
- Intraday market



- Transmission System Operator, TSO is responsible for the system balance
- TSO orders ancillary services from the BRPs

- BRPs: Responsible for production and consumption of own BRP portfolio
- Centrica Energy Trading is a BRP

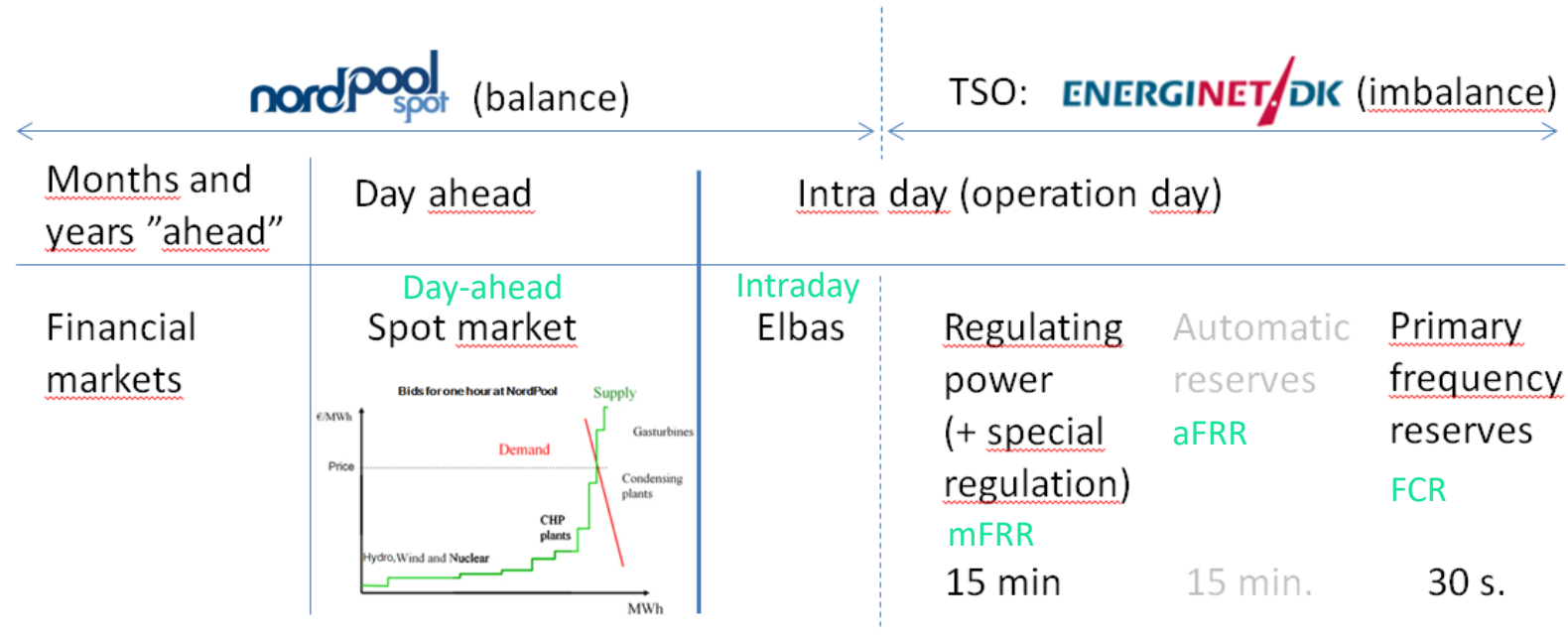
- Powerplants
- CHPs
- Wind
- Solar (PVs)

- Through suppliers (and aggregators):
- Flexible consumers (fx PtX electrolysers, EVs, electric boilers, heat pumps)
- Non-flexible consumers (no communication)

Principles of electricity markets

Example: West Denmark - DK1

Both production and consumption can participate



The day before operation day there is a perfect balance between production and consumption for every hour tomorrow

In the day of operation there will be imbalances because of:

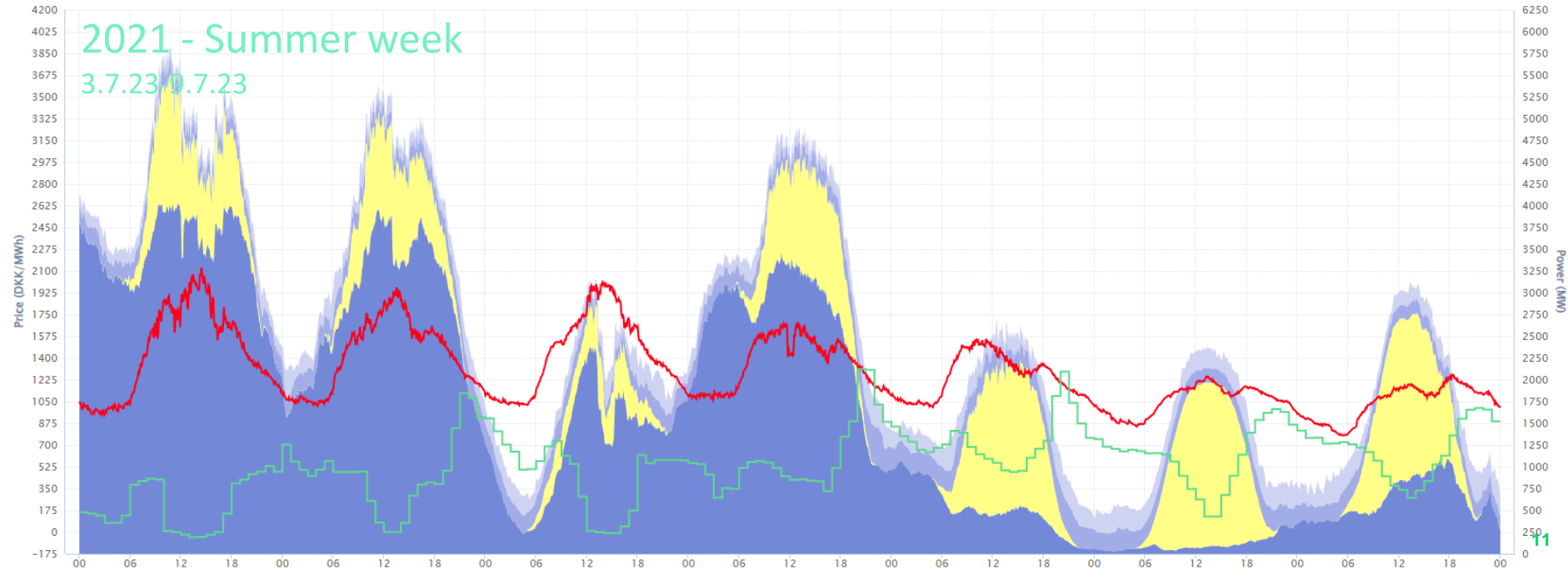
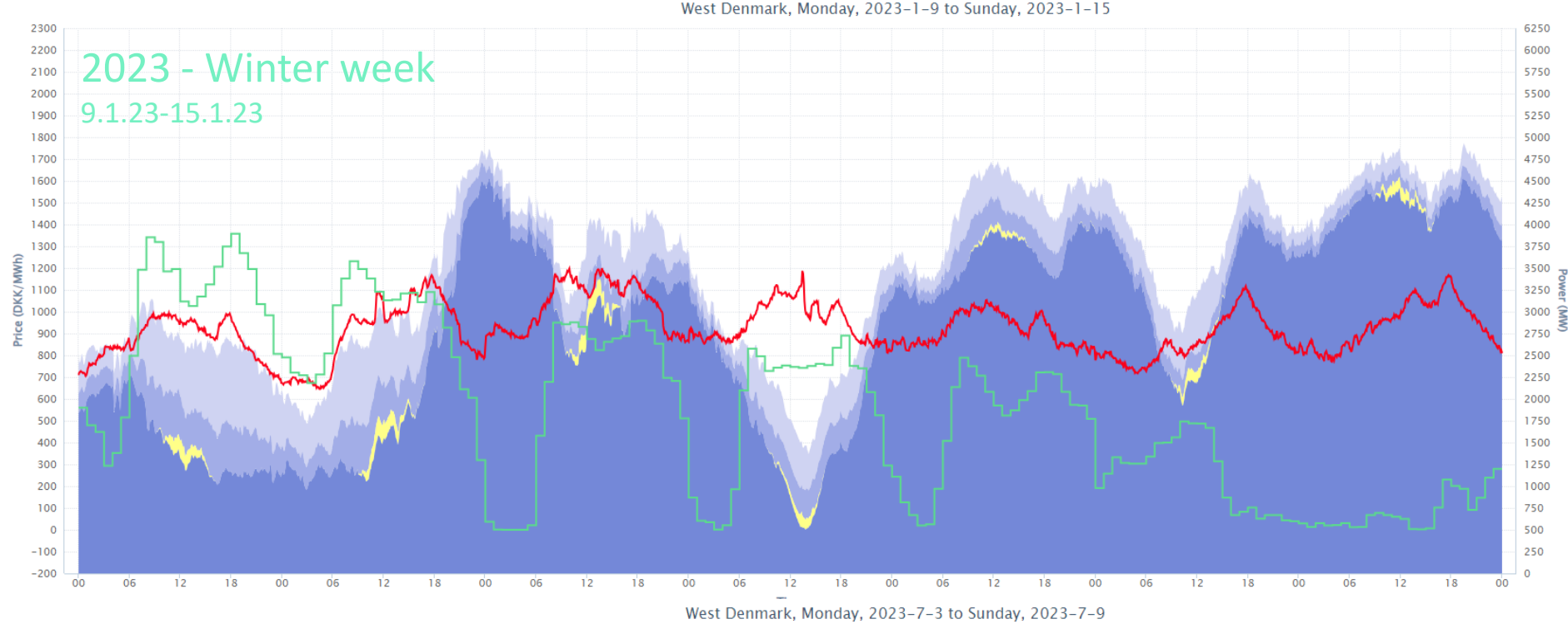
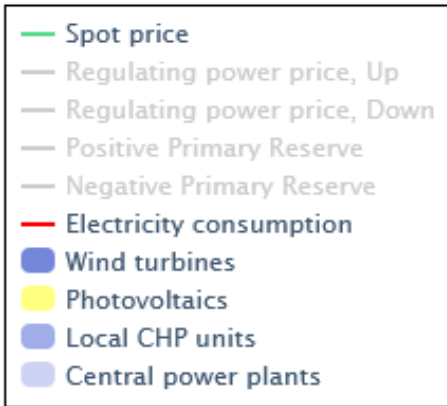
- Errors in wind forecasts, errors in consumption forecasts, errors in planning
- Unexpected down time at production plants, unexpected down time on interconnectors between countries

Energinet maintains balance in the day of operation through different system services (ancillary)

- Until now mostly by production
- From now also by consumption ex. PtX, EV's and heat pumps

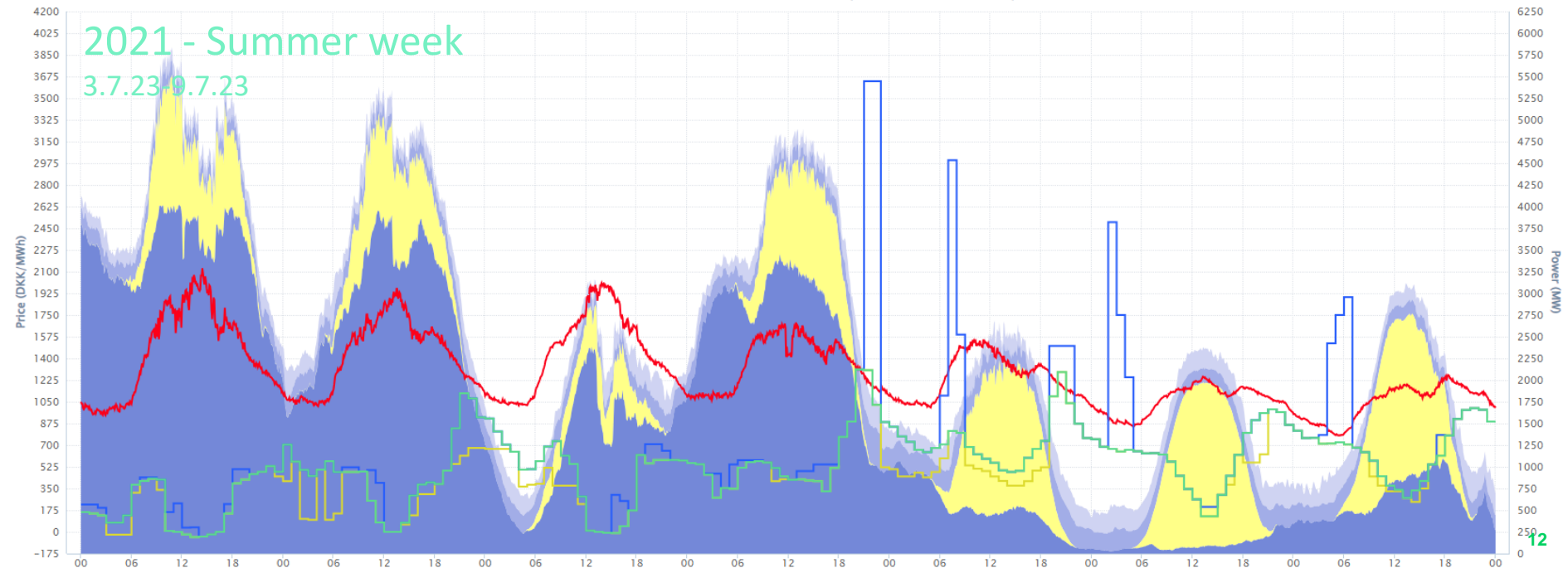
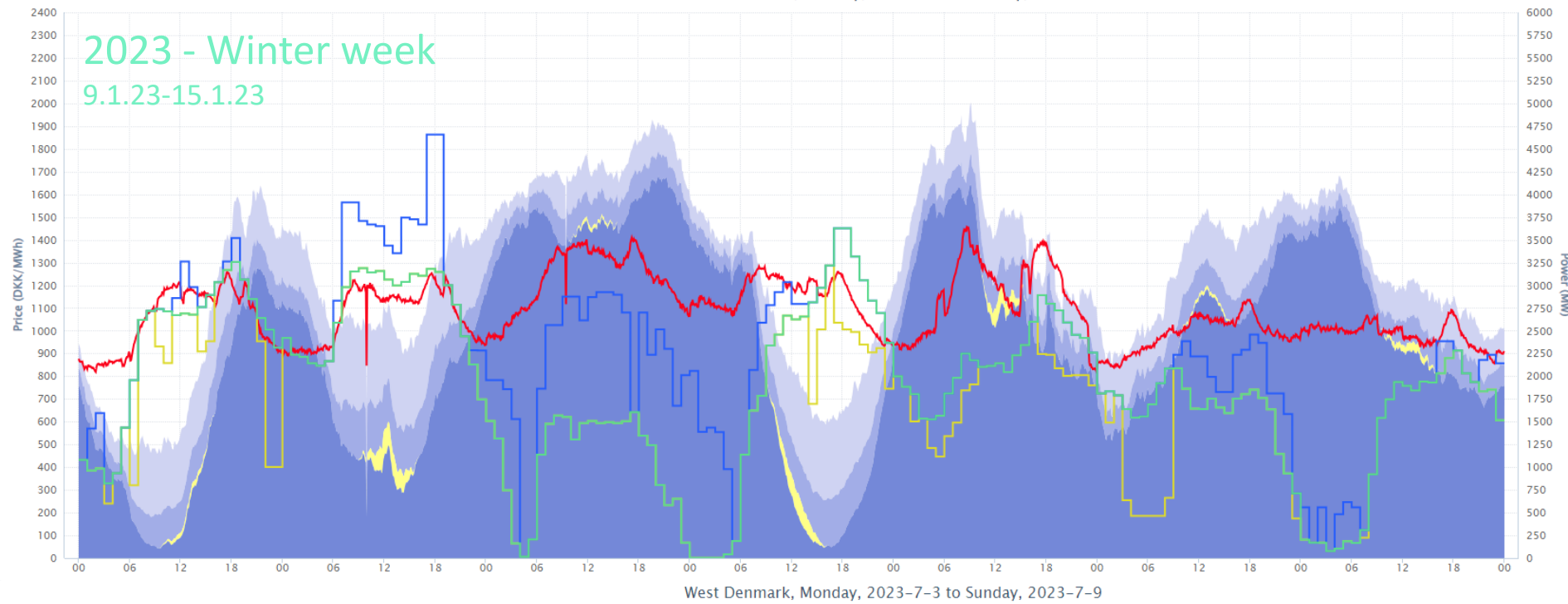
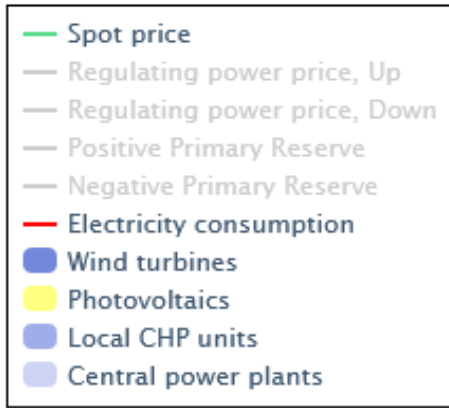
Examples of varying prices in spot market

West Denmark (DK1)



Examples of varying prices in spot market and mFRR

West Denmark (DK1)



Source: www.emd.dk/el

Different possibilities for biofuels and biogas plants

Centrica Energy products

Buying/selling biomethane

Buying/selling electricity

Buying/selling GOs from biomethane + green hydrogen and other e-fuels (when markets emerge)

Power supply (for example for electrolyser)

- Supplying electricity
- Long-term financial contracts – PPAs (Power Purchase Agreements)
- Corporate PPAs (matched with appointed renewable production)

Balancing responsible (BRP) services (monthly fee) for electricity

- Customers bid through CET BRP tool Direct - in all electricity markets (parallel to existing CHP customers)
- CET forwards bids to all electricity markets
- CET offers remote control of assets

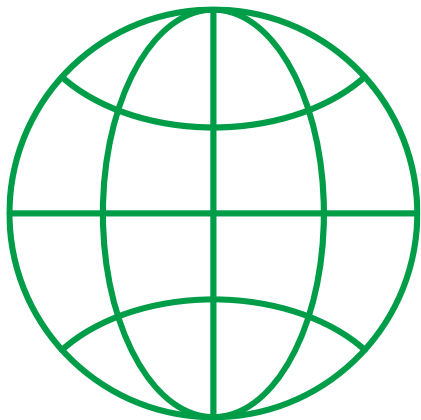
Daily assets optimization

- CET can optimize electricity production and consumption in all relevant electricity markets: Spot, intraday, ancillary services: Regulating power including special regulation, frequency regulation etc.
- Optimization of assets behind-the-meter

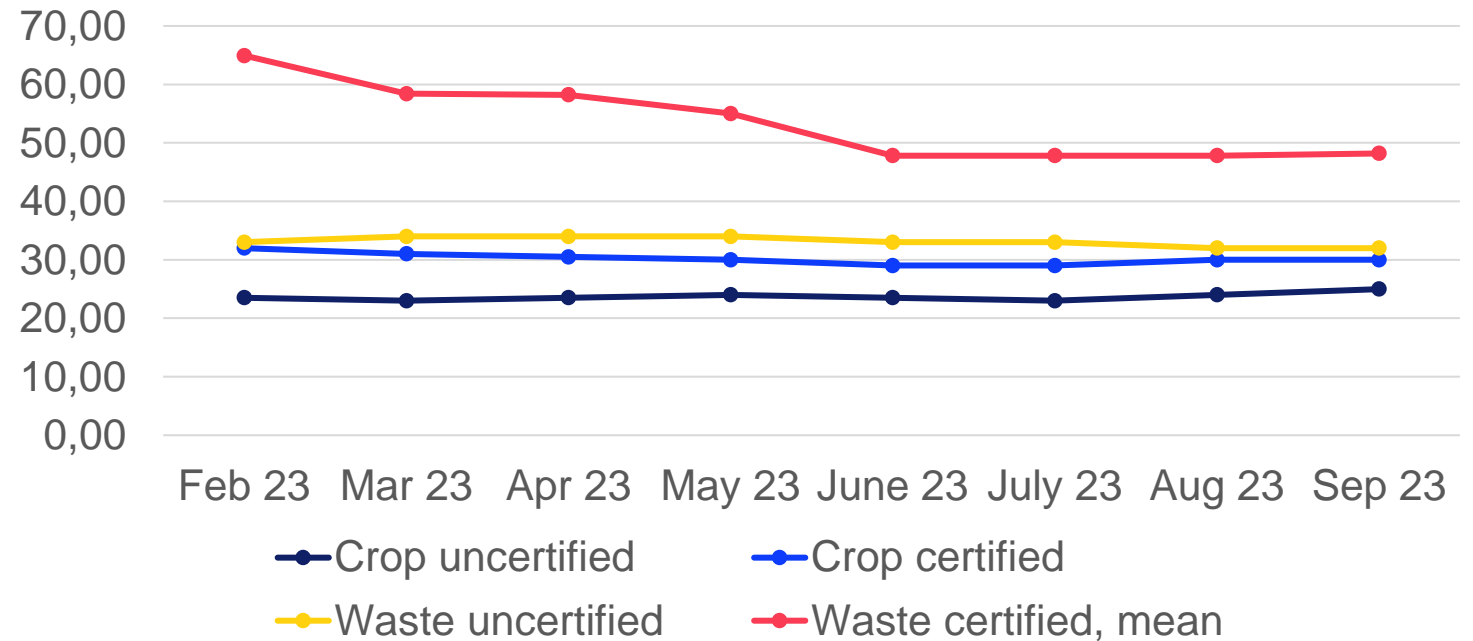
Price development of biomethane guarantees of origin

We buy and sell biomethane certificates

Price depending on origin of biomethane



European biomethane certificate pricing [€/MWh]



Our value propositions for PtX and other flexible consumers

Green PPAs and Hedges

We offer multiple products, including balancing, hedging and green certificates, for a variety of tenors, at **competitive prices**, thanks to the scale and diversification of our portfolio

Power Cost Optimisation

Our unparalleled experience and technology platform in markets for ancillary services and day ahead/intraday provides significant **power cost savings**

Tradefloor

Through our in-house technology platform Centrica Direct, the customer is given **full transparency** into the operation of the facility in the markets. We act as the customer's own **tradefloor** and provide **market access**

Savings: Min 20 - 40 % on the electricity bill by participating in the electricity markets
Highly depends on the flexibility of the PtX plant



Lotte Holmberg Rasmussen
R&D Project Manager, MSc Eng
lotte.rasmussen@centrica.com



Disclaimer

This presentation is intended solely for the meeting, event, presentation, or other function you are attending. This presentation may not be disseminated, distributed, duplicated or in other ways used for other purposes than the meeting, event, presentation, or other function you are attending.

Centrica Energy Trading A/S and its affiliates (“Centrica”) is not responsible for any errors or omissions, or for the results obtained from the use of this information. All information in this presentation is provided "as is", with no guarantee of completeness, accuracy, timeliness or of the results obtained from the use of this information, with no guarantee of any kind, express or implied.

The information contained in this presentation is a general description of markets or services only and do not replace independent professional judgment or advice. Before acting on any information, you should consider the appropriateness of it having regard to your particular objectives, financial situation and needs and seek advice. No information set out in this presentation constitutes advice, an endorsement, an advertisement, an invitation, a confirmation, an offer, or a solicitation, to buy or sell any product or service from or to Centrica or any other persons presenting at the same meeting, event, presentation, or other function you are attending.

To the extent this presentation contains forward looking statements, these forward-looking statements are subject to risk and uncertainties because they relate to, and may be impacted by, events and circumstances that will occur in the future which are beyond Centrica’s ability to control or estimate precisely.

All information in this presentation – the text, photographs, video, audio, graphics, data, information, and the overall look and feel and all protectable intellectual property – is the property of Centrica.