

## Flexibility of PtX electrolyzers in the electricity system

### Key points:

- **Centrica Energy Trading**
  - Short presentation - Centrica Energy Trading including business models and range of operations
  - Our value propositions for Power-to-X
- **Coupling of electricity system with other energy sectors**
  - Electricity system – Actors – What is a BRP?
- **Electricity markets principles**
  - BRP operational setup
- **Savings from using electrolyzers as flexibility in the electricity system!**

June 14, 2023

Hydrogen & P2X 2023, Copenhagen June 14-15

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# CET - Centrica Energy Trading, Denmark

Part of Centrica PLC (UK)

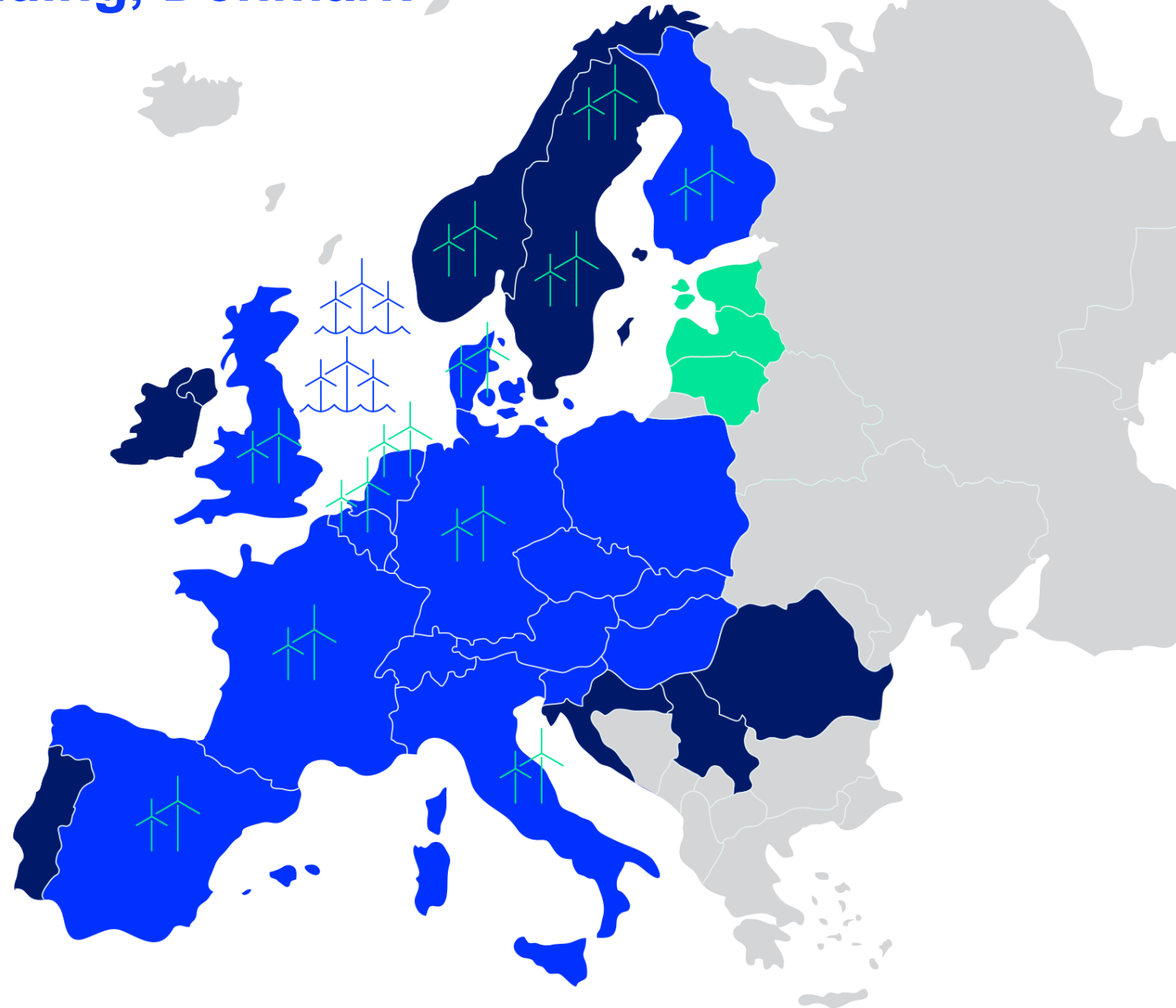
## Markets and business areas

We currently 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 and Singapore, and branches in Norway and Sweden.





# CET - Centrica Energy Trading, Denmark

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

CET (BRP) customers include:

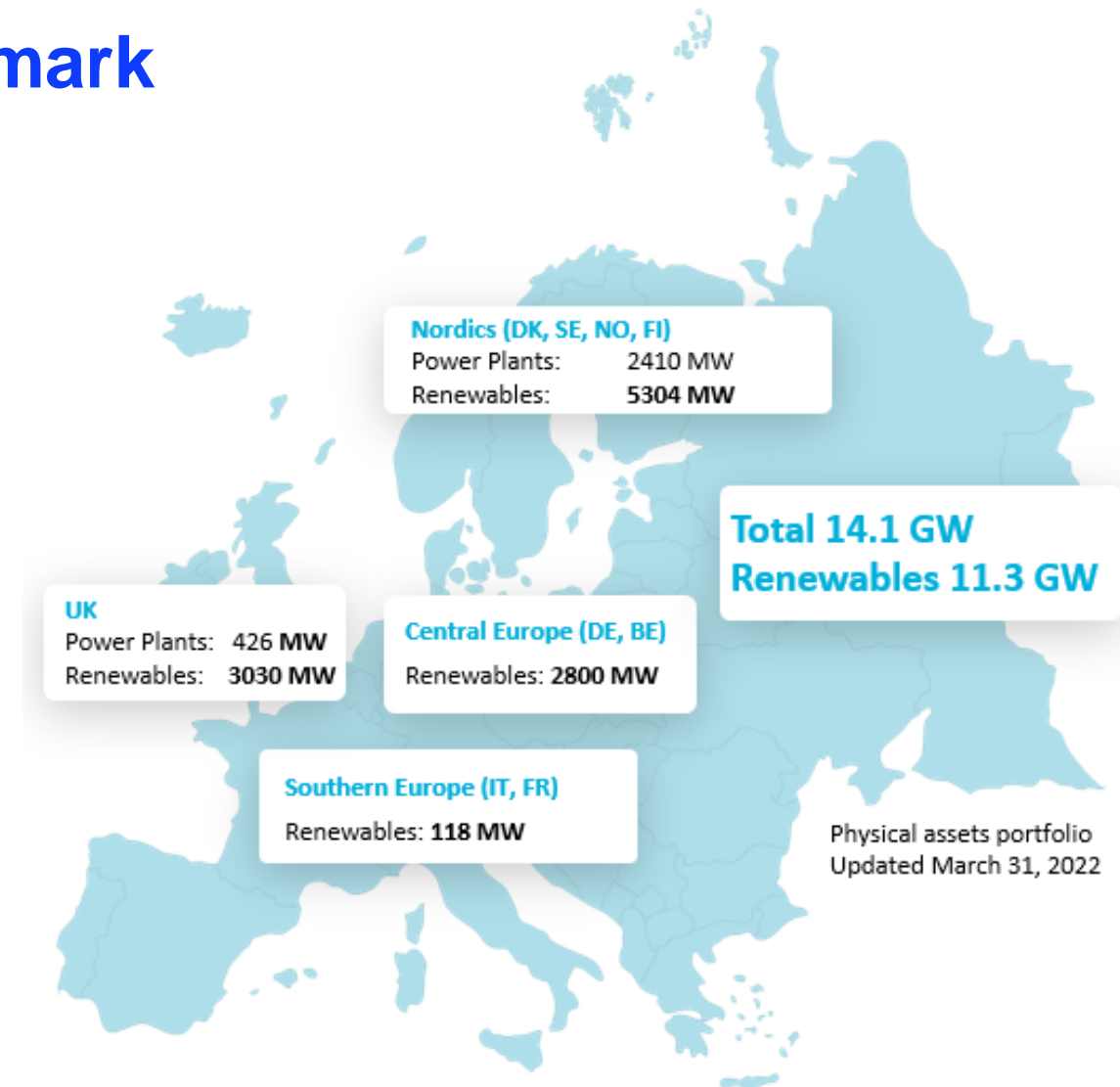
- **Approximately 150 CHP**
  - Flexible Cogeneration of Heat and Power plants – 1 - 400 MW
- **Renewables** (wind, solar, hydro and biogas)
- **Flexible consumption**
  - Electric boilers, heat pumps, EVs, PtX electrolyzers
- Electricity supply companies

## Business model

- Our BRP business is built on an integration of energy trading and software services to fulfil opportunities for customers with assets in energy markets

Headquarter in Aalborg, Denmark with offices in the UK, Germany, Belgium, Sweden, Norway and Singapore.

**Revenue 2021: 21 bn € / 23 bn USD**



Both flexible production and consumption customers already aggregated – both internally by CET or from external consumption aggregators

# CET - The big picture

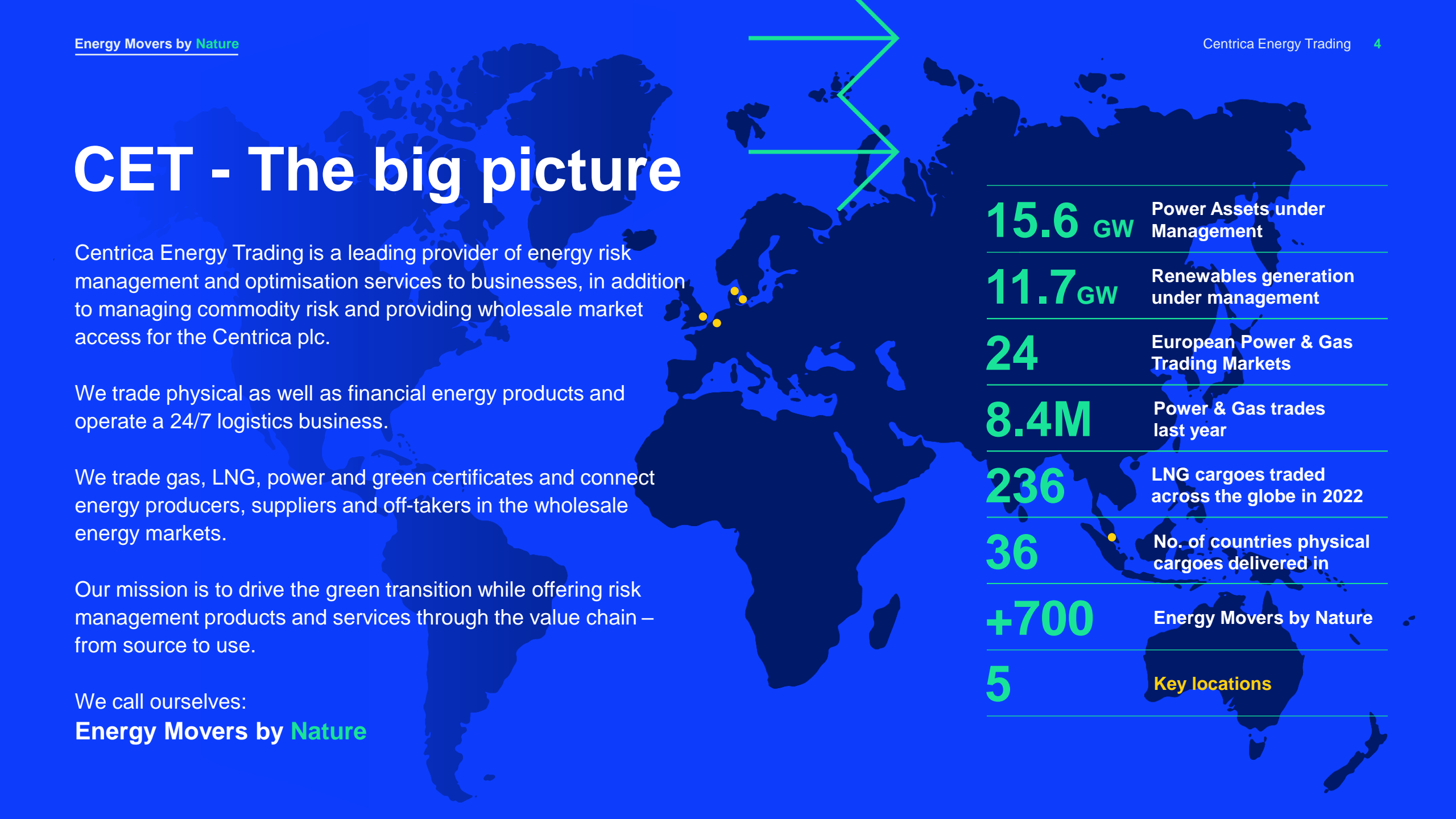
Centrica Energy Trading is a leading provider of energy risk management and optimisation services to businesses, in addition to managing commodity risk and providing wholesale market access for the Centrica plc.

We trade physical as well as financial energy products and operate a 24/7 logistics business.

We trade gas, LNG, power and green certificates and connect energy producers, suppliers and off-takers in the wholesale energy markets.

Our mission is to drive the green transition while offering risk management products and services through the value chain – from source to use.

We call ourselves:  
**Energy Movers by Nature**



15.6 GW	Power Assets under Management
11.7 GW	Renewables generation under management
24	European Power & Gas Trading Markets
8.4M	Power & Gas trades last year
236	LNG cargoes traded across the globe in 2022
36	No. of countries physical cargoes delivered in
+700	Energy Movers by Nature
5	Key locations

# Our value propositions for Power-to-X

## Green PPAs and Hedges

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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

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

## Tradefloor

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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**

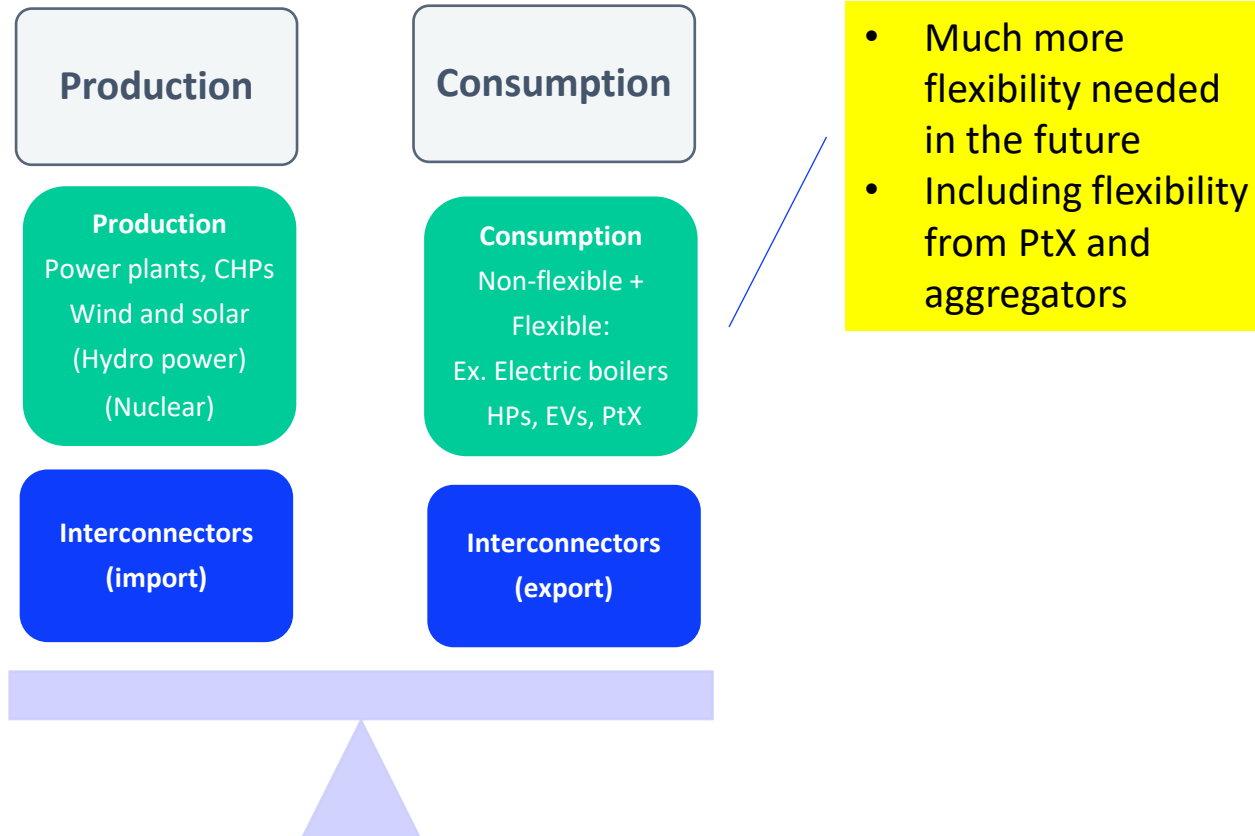
In the making: RFNBO compliance



# How does the electricity system work?

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

The electricity system has to be in balance at all times

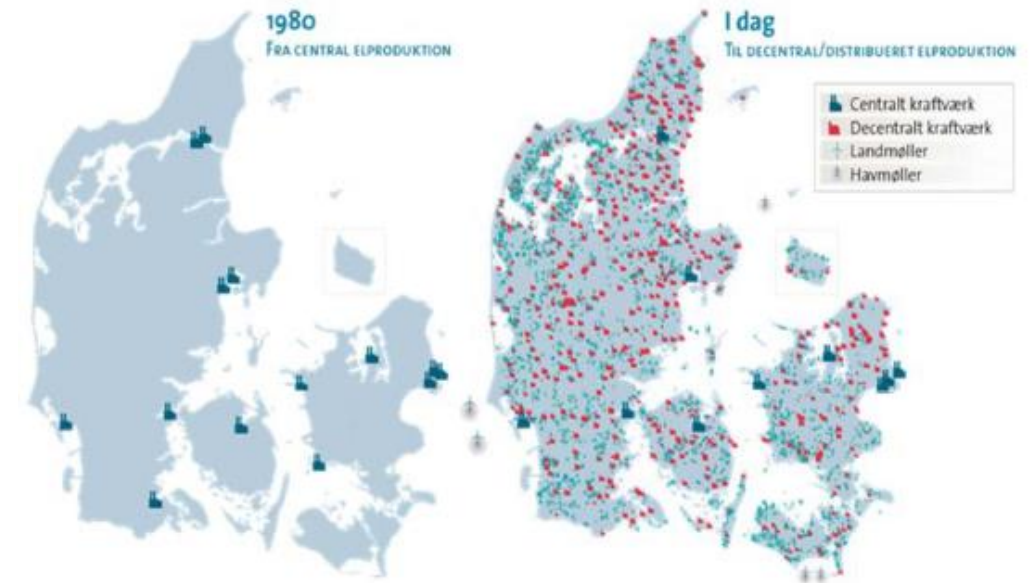


Denmark:

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.

# Why do we need the hydrogen society with PtX?

## 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

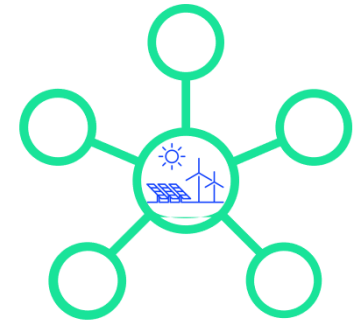
- **Higher electricity consumption**
- **Flexible** electricity consumption (new consumption has to be flexible incl. EVs, HPs, PtX)
- **Integration** of electricity in other sectors
- **Seasonal storage** of electricity

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

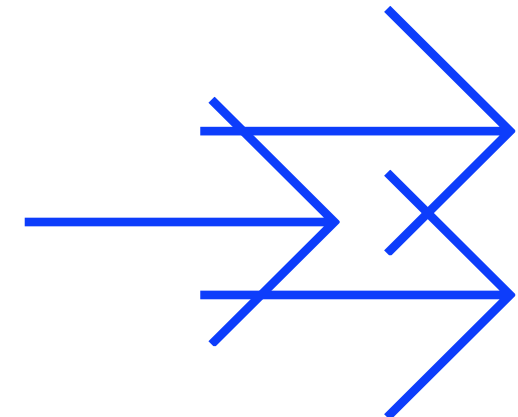
### Sector coupling

Different sectors are to be much more integrated

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



PtX can be a part of all sectors



# Actors in the Danish electricity system

- TSO – Transmission System Operator
  - In Denmark Energinet. Also called system responsible
- DSOs - grid companies
  - Responsible for the local distribution grids and the meters at the consumers and producers. Monopolies.
- Nord Pool – The Nordic Energy exchange
- BRPs - Balance Responsible Parties
  - Production, consumption, trading
- Wholesale trading companies
- Electricity Suppliers
  - Sell electricity nation wide to end consumers (private and industry)
- Producers / generators (power plants and CHP, wind and solar power)
- Consumers - including aggregators of consumption



**centrica**  
Energy Trading



# Role of the Balance Responsible Parties

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

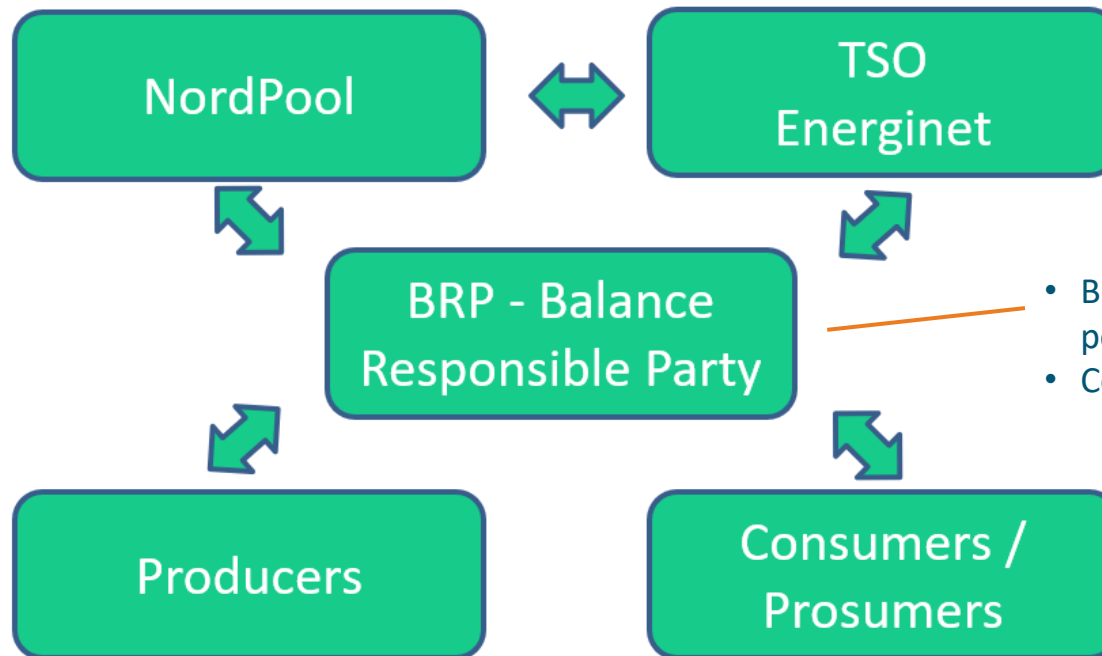
**All trading in Scandinavia in all markets: Day ahead markets (spot), intraday markets and ancillary services goes through the Balance Responsible Parties**

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

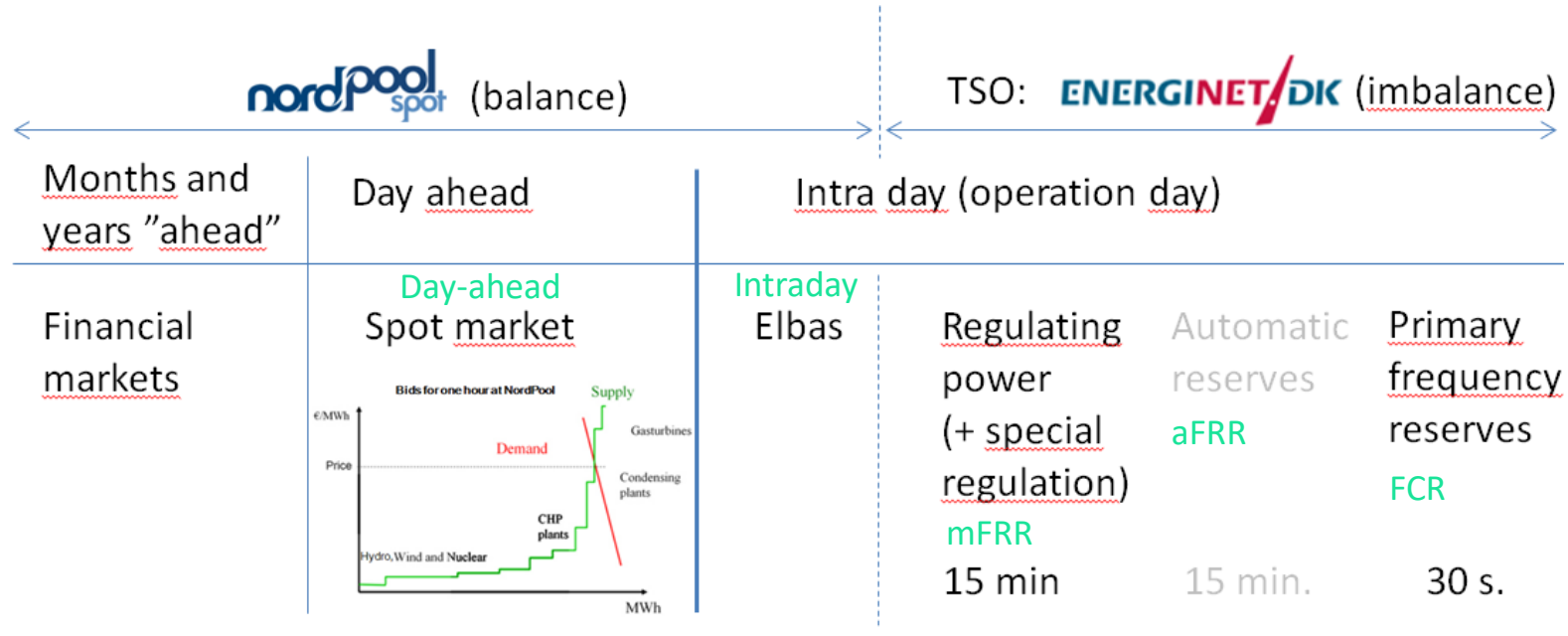
- Powerplants
- CHPs
- Wind
- Solar (PVs)

- Through suppliers (and aggregators):
- Flexible consumers (fx PtX electrolyzers, 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:

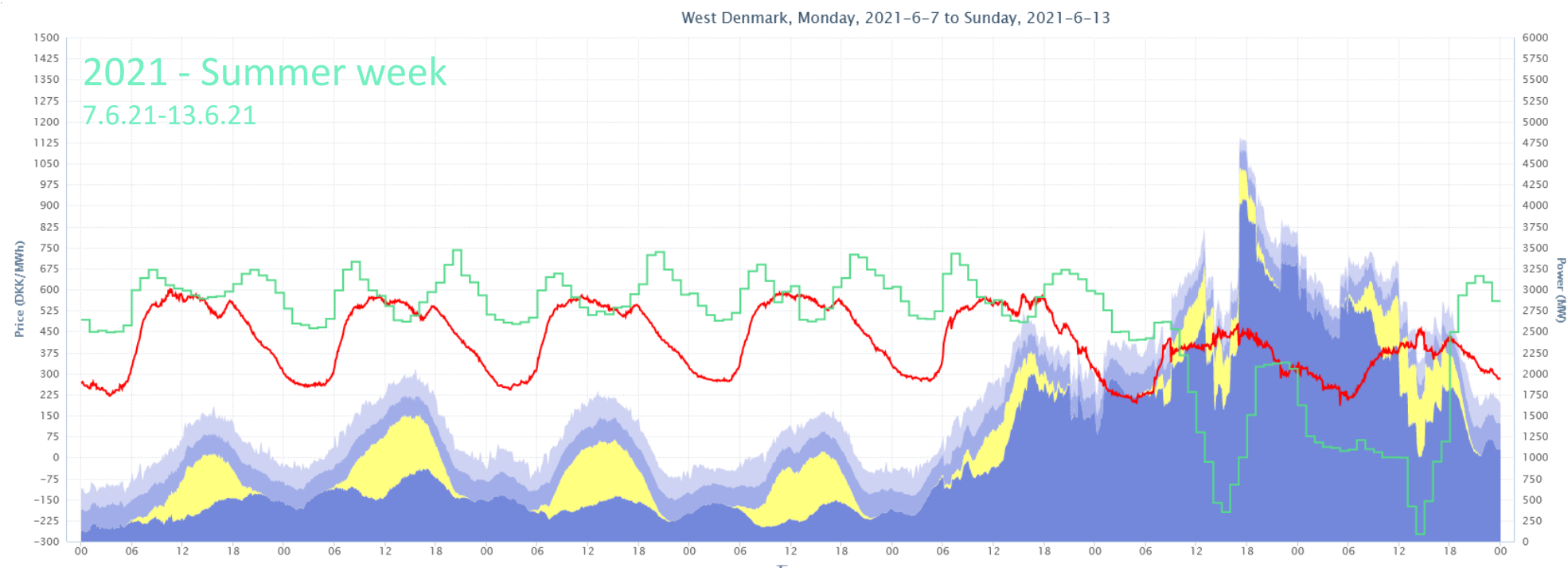
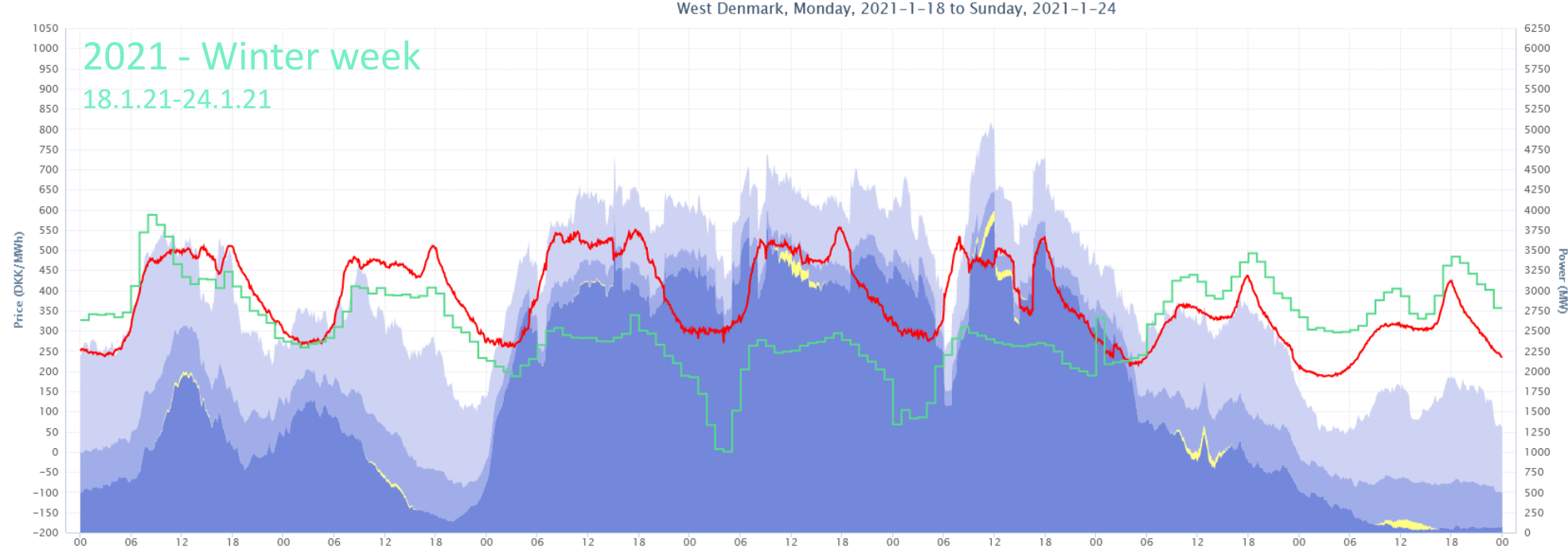
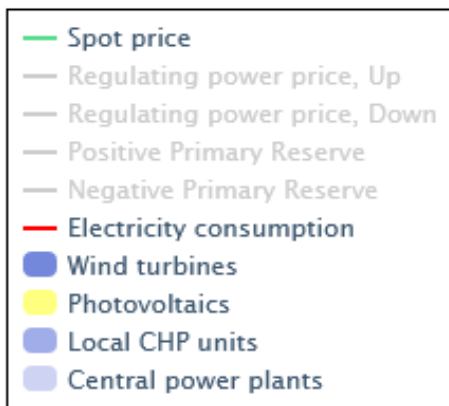
- Errors in wind forecasts, errors in consumption forecasts, errors in planning
- Unexpected down time at production plants, unexpected down time on interconnectors between countries

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

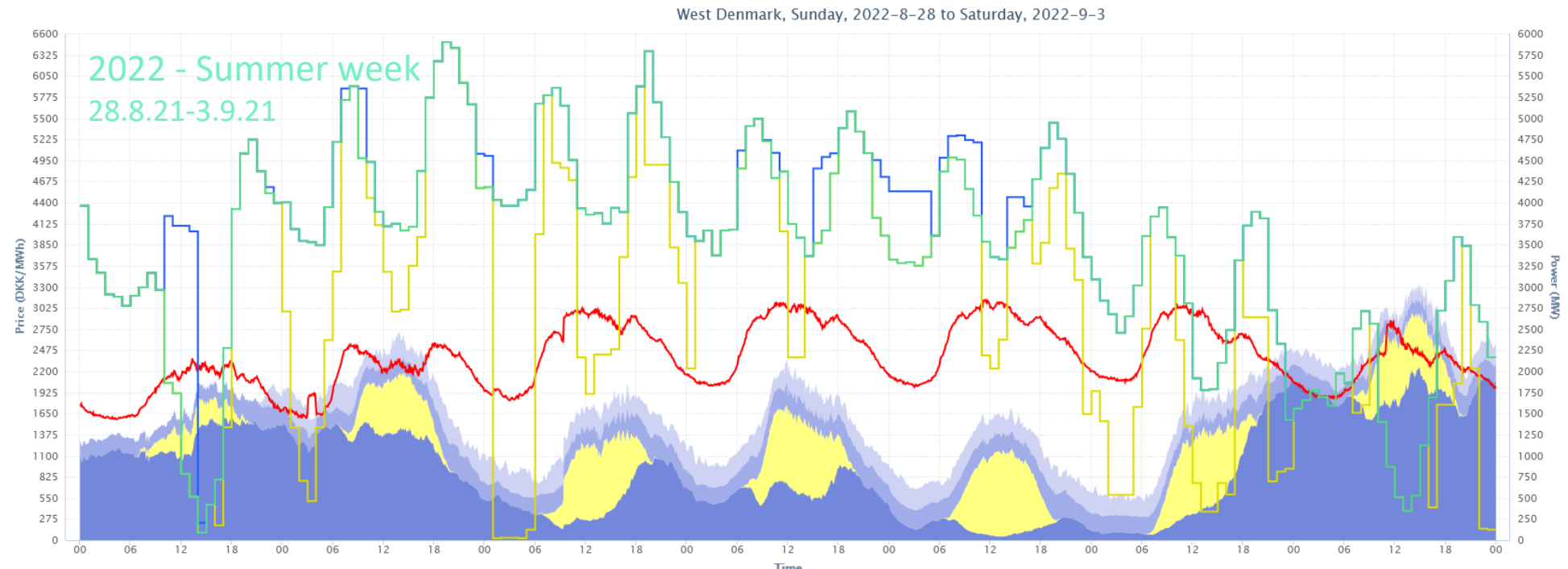
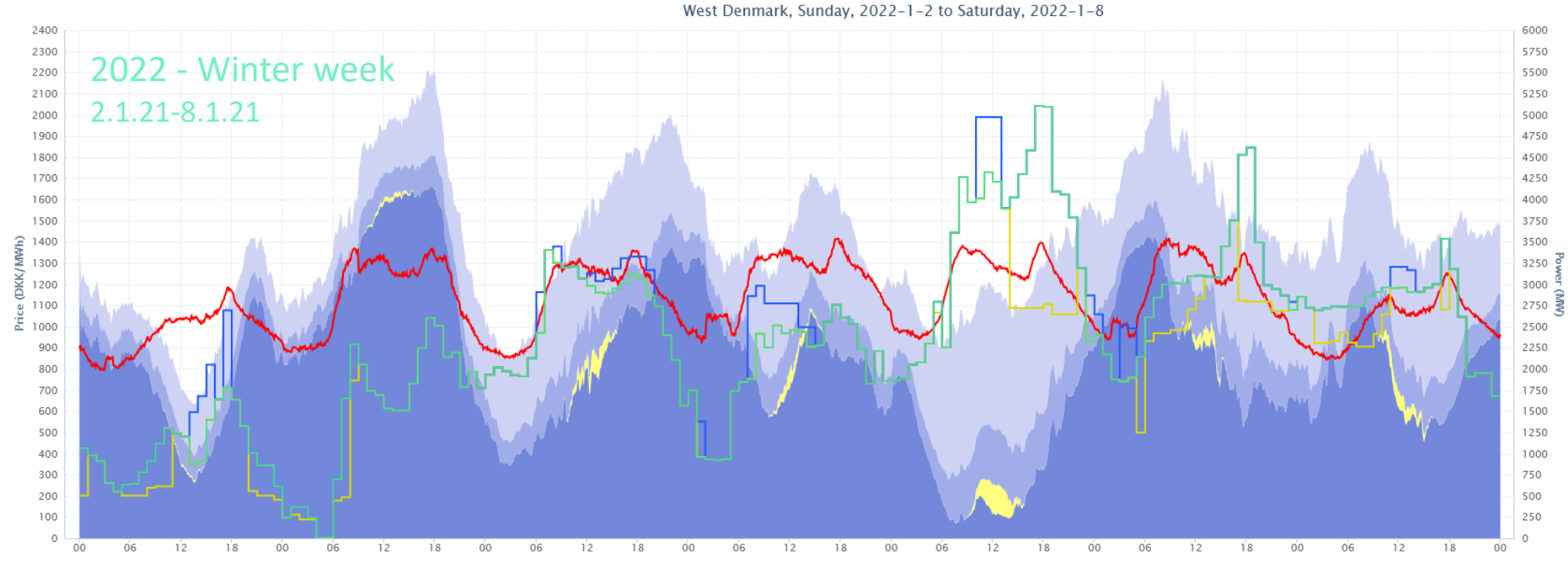
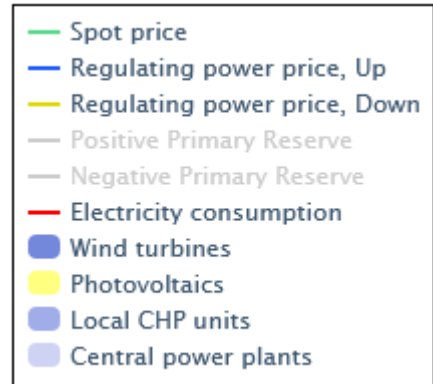
West Denmark (DK1)





# Examples of varying prices in spot and mFRR

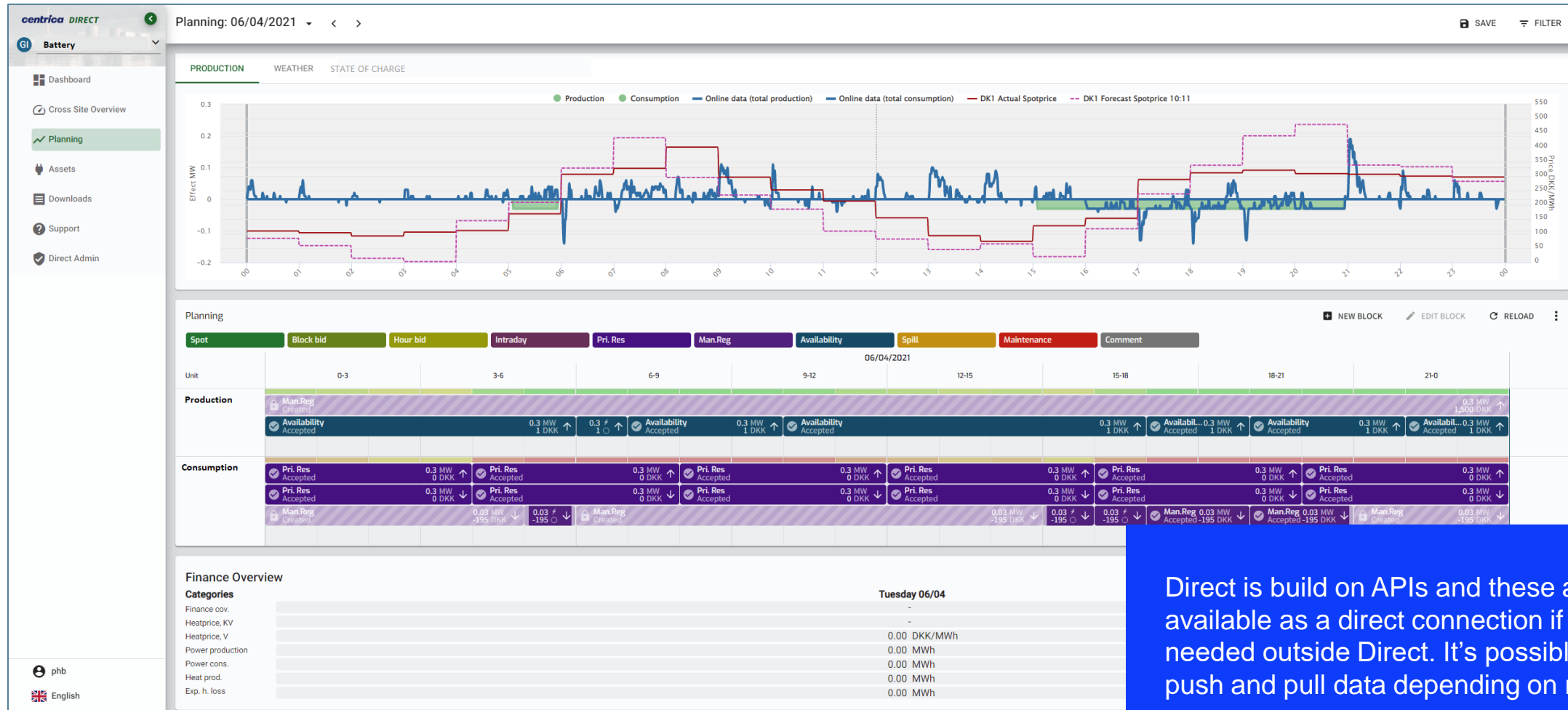
West Denmark (DK1)



Source: [www.emd.dk/el](http://www.emd.dk/el)

# centrica acts as the customer's tradefloor

Energy Trading



Direct is build on APIs and these are also available as a direct connection if the data is needed outside Direct. It's possible to both push and pull data depending on needs.

# Bidding in the electricity markets

## Direct – our BRP platform for bidding

Managing production and consumption in Direct allows access to advanced tools and data to plan and operate generation and consumption on optimal conditions for maximum value with a minimum of risk and uncertainty.

The software gives access to Centrica Energy Trading's 24/7 operation and trading services:

### Forecasting

- Power prices
- Gas prices
- Weather forecasts

### Operation

- Scheduling
- Planning
- Remote control
- Reporting

### Optimisation

- Production plans
- Day-ahead
- Intraday
- Ancillary services





# We power PtX facilities

## BALANCING

- CENTRICA assumes the Balancing Responsible Party (BRP) role for production and consumption.
- Price of balancing services:
  - Fixed balancing price for the renewable asset (based on child meter point)
  - Actual balancing costs for renewable asset and electrolyser + a fixed fee

## HEDGING

- CENTRICA offers different types of hedging of production and consumption for up to 10 years. The services include:
  - Pay-as-produced for renewable assets – the same price for every MWh produced – physical settlement on actual production
  - Monthly profile weighted baseload for all assets – different volumes per month according to the production/consumption profile
  - Baseload market price – the same price as the exchange – settlement as above

## CORPORATE PPA

- CENTRICA offers to try and find a renewable asset to match the whole or some of the consumption of the electrolyser
- The offer include GOs (Green certificates) from the asset
- The price can be a fixed price or spot price
- The period can be short term or long term

## GOOs (GREEN CERTIFICATES)

- CENTRICA offers GOs to match the consumption of the electrolyser
- The price can be a fixed price or spot price
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## Tradefloor

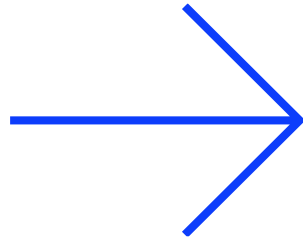
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Through our in-house technology platform Centrica Direct, the customer is given full transparency into the operation of the facility in the markets. We act as the customer's own tradefloor and provide market access

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

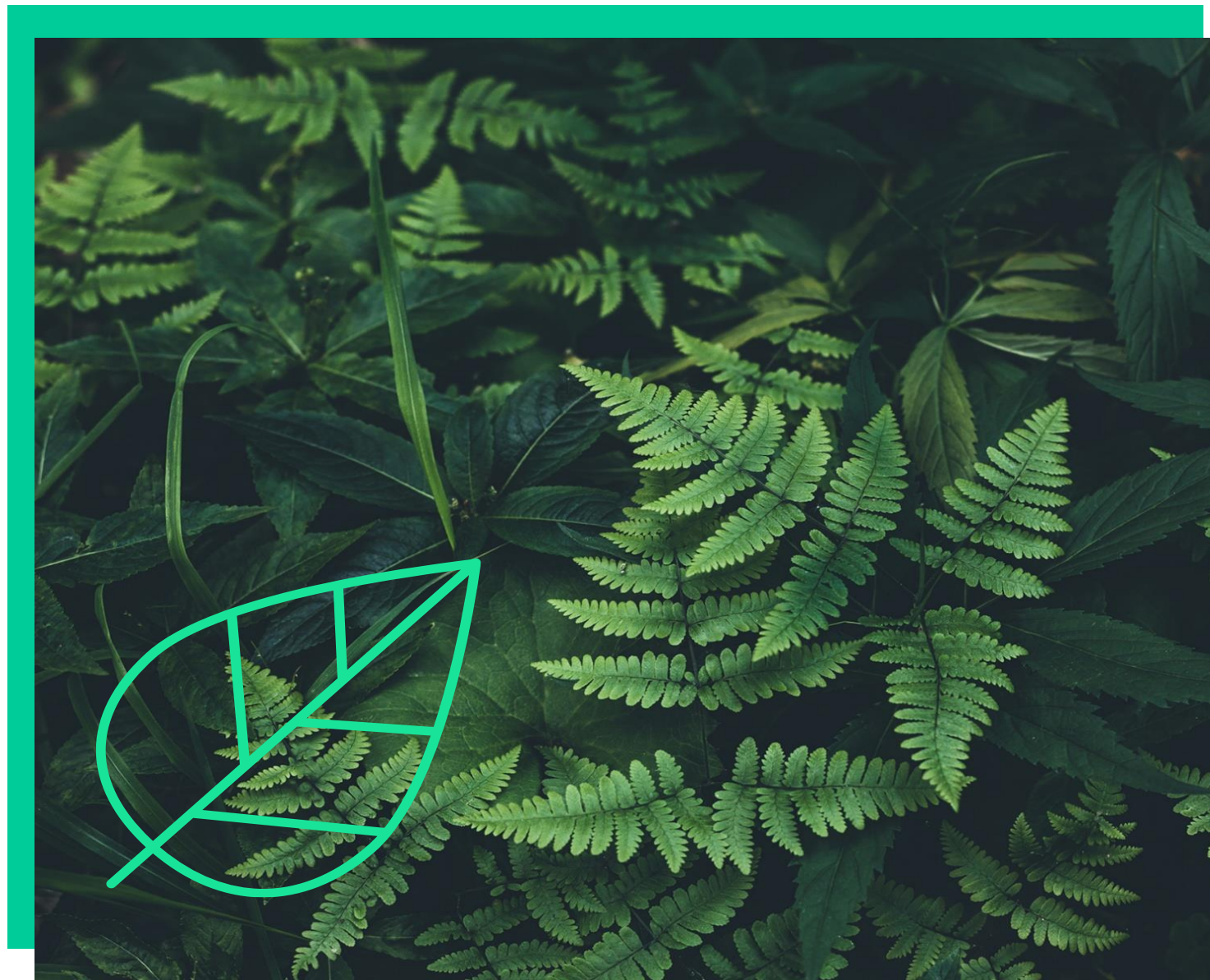
**Thank you  
for your attention**

**Lotte Holmberg Rasmussen  
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# Extra slides for back ground



# Centrica Group Businesses

Centrica operates with five customer-facing businesses focusing on the areas in which Centrica has distinctive capabilities – energy supply, services and solutions, energy trading and optimisation.



## British Gas Energy

Supplies energy to residential and small business customers in England, Scotland and Wales.



## British Gas Services

Provides services and solutions to residential customers in England, Scotland and Wales.



## Bord Gáis

Provides energy supply, services and solutions to residential and business customers in the Republic of Ireland.



## Centrica Business Solutions

Provides energy supply to UK business customers and low-carbon solutions for customers internationally.



## Centrica Energy Trading

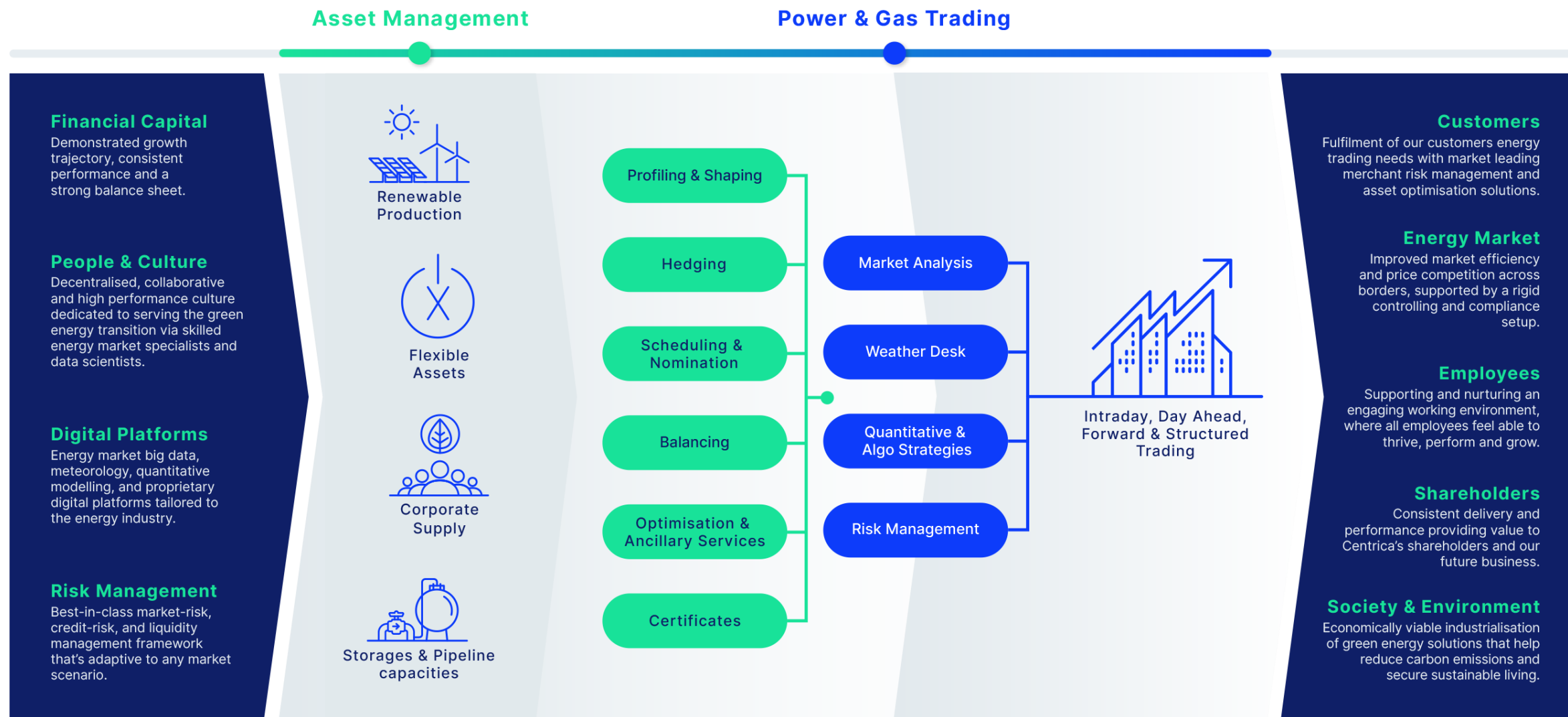
Is the trading and optimisation arm of Centrica, responsible for managing commodity risk and sourcing energy.



## Upstream

Includes our oil and gas E&P assets, our 20% interest in the UK's nuclear power generation fleet and the rough field.

# Our Business Model



# CET 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.

### 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

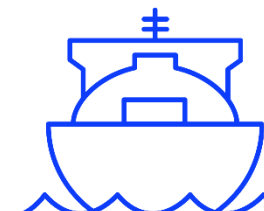
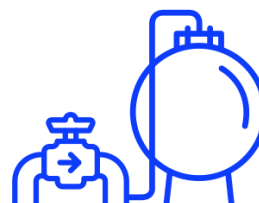
We trade and manage Guarantees of Origin and other energy attributes, covering a variety of products that provide solutions for utilities, organisations and consumers seeking to support green energy sources and offset greenhouse gas emissions from their energy utilisation.

### 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.



# CET Business Areas



## Power & Gas Trading

### Power Trading - From Intraday to Curve

We're commodity market pioneers with 2022 marking our 20-year anniversary in Power Trading. During that period, we've developed a pan-European footprint and today we actively trade in 24 different power markets. We trade on all major exchanges and in the OTC market, covering all horizons from Intraday through Day-Ahead to weekly, monthly and yearly contracts including structured products. Current and future growth is centred around an ambitious strategy for automation and algorithmic trading, which is heavily supported by our best-in-class risk framework. As traders we're making energy grids more stable, whilst helping ensure market efficiency and transparent competition.

### Gas Trading & Asset Optimisation

Established in 2012, our gas trading activities have a pan-European presence in 19 different markets where we're active in wholesale trading, asset optimisation and cross-border trading. Current activities include trading standard products on OTC markets and exchanges alongside trading gas transport and storages in secondary markets. Providing energy balancing to the largest gas networks in Europe, we contribute to the security of supply for European gas markets. Growth in our asset optimisation activities is underpinned by a robust risk framework and state-of-the-art hedging strategies. Supporting our ability to handle trades and data at ever-increasing speeds and scales, we're developing and refining our inhouse algorithmic operation platforms, improving operational robustness and bringing increased efficiency to energy markets.

### LNG Trading - Global Reach

With over 15 years of experience, our LNG business makes our value proposition truly global, with cargoes delivered almost anywhere in the world. Our commercial business consists of both traders and originators that close complex deals, operators and marine assurance with extensive industry experience, and analysts that help structure and value agreements in the market. Through our trading operations in both London and Singapore, we've transacted hundreds of trades, concluded many charterers, and manage over a hundred active master sales and purchase agreements.