EUROPEAN ENERGY FORUM

Online Briefing Session

Wholesale energy markets: how is energy traded?

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Trading in the Wholesale Electricity Market

Presented by *Stanislav Kostka, Head of Generation and Dispatch, Trading, CEZ*

Any views or opinions presented in this presentation are solely those of the author and do not necessarily represent those of the CEZ Group

Today we'll cover

1) Stakeholders in electricity markets
2) The different times at which electricity is traded
3) Why people trade
4) The way electricity is traded in each timeframe
5) What influences price formation?
6) A quick look at each timeframe
    1) Forward Markets
    2) Day Ahead Markets
    3) Intraday Markets
    4) Balancing Markets
7) Current issues

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Stakeholders in electricity markets

- **GENERATION** – Owners of power generation assets
  - Intermittent power generation
    - Forecasting
    - Power plant dispatch
  - Conventional power generation
    - Mathematical optimization of the efficient power generation structure based on market prices
    - Power plant dispatch
- **SALES** - Sourcing of electricity for end suppliers
  - Consumption forecasting

- **FLEXIBILITY –** Providers of flexibility (generation, consumption)

- **PROP** – Speculative trading

- **REGULATION** – EU/National regulation

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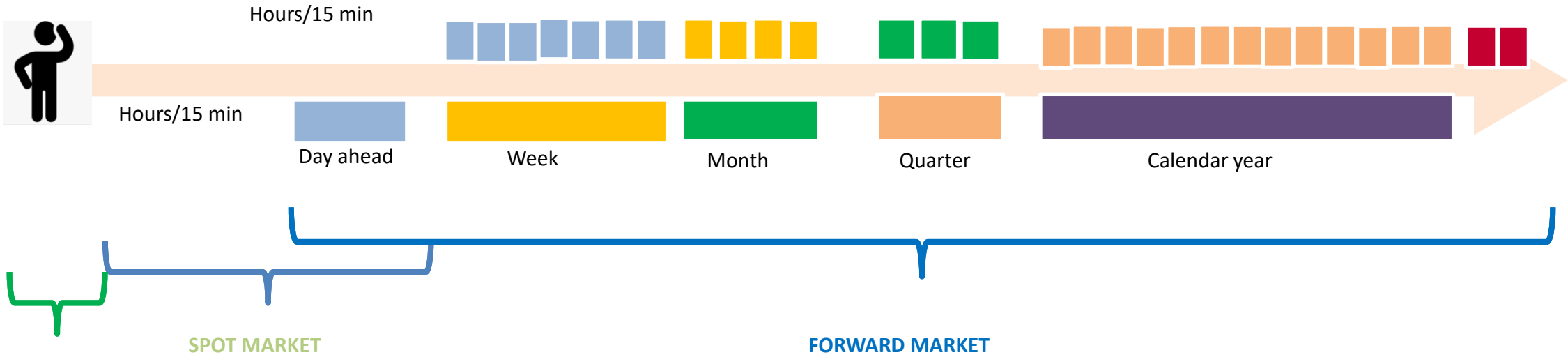
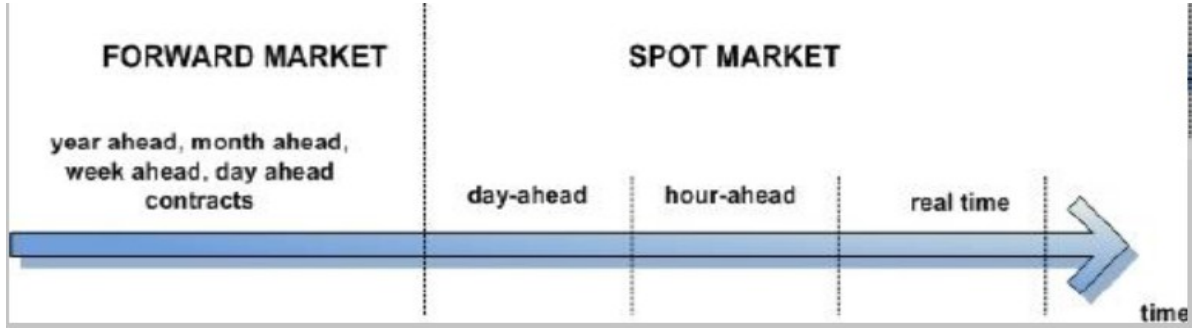
The different times at which electricity is traded



DERIVATIVES	> DAY-AHEAD	> INTRADAY	> BALANCING
Years/months/weeks before delivery	One day before delivery	<1 hour before delivery	Real-time
Price variations are HEDGED	**Optimization of GENERATION**	**Valuation of FLEXIBILITY**	**Ensuring SYSTEM SECURITY**



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Why do we trade?

- Hedging
  1. **forecast the position** of each asset and trade contract from company's portfolio
  2. **identify and classify the risk factors** to mitigate risk
  3. **perform hedging actions** to mitigate the price and volume risks

- Optimisation
  - **Electricity cannot be stored** (in large quantities) means that supply must be able to provide exactly the right quantity of electricity to meet demand.
  - **Optimisation means forecasting this demand** and constantly achieving the **most efficient balance between all the resources available** to meet it (generation, supply contracts, etc.) and the best-possible cost.

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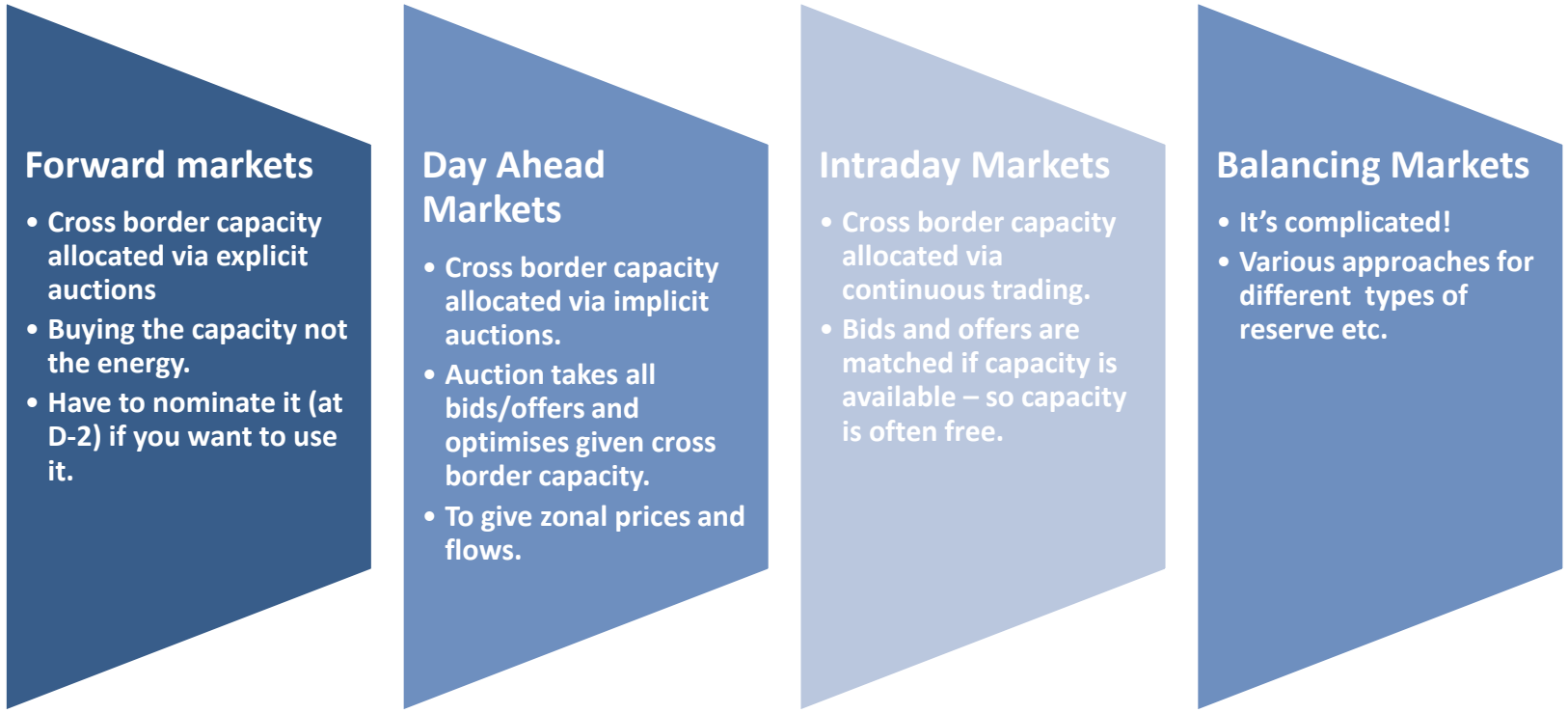
How is electricity traded in each timeframe?



Explicit Trading: Capacity & Energy are bought as 2 separate products.
Implicit Trading: Capacity & Energy are bought together.
Continuous Trading: Bids/offers are matched whenever there is capacity available (so you don't wait for an auction at a set time).

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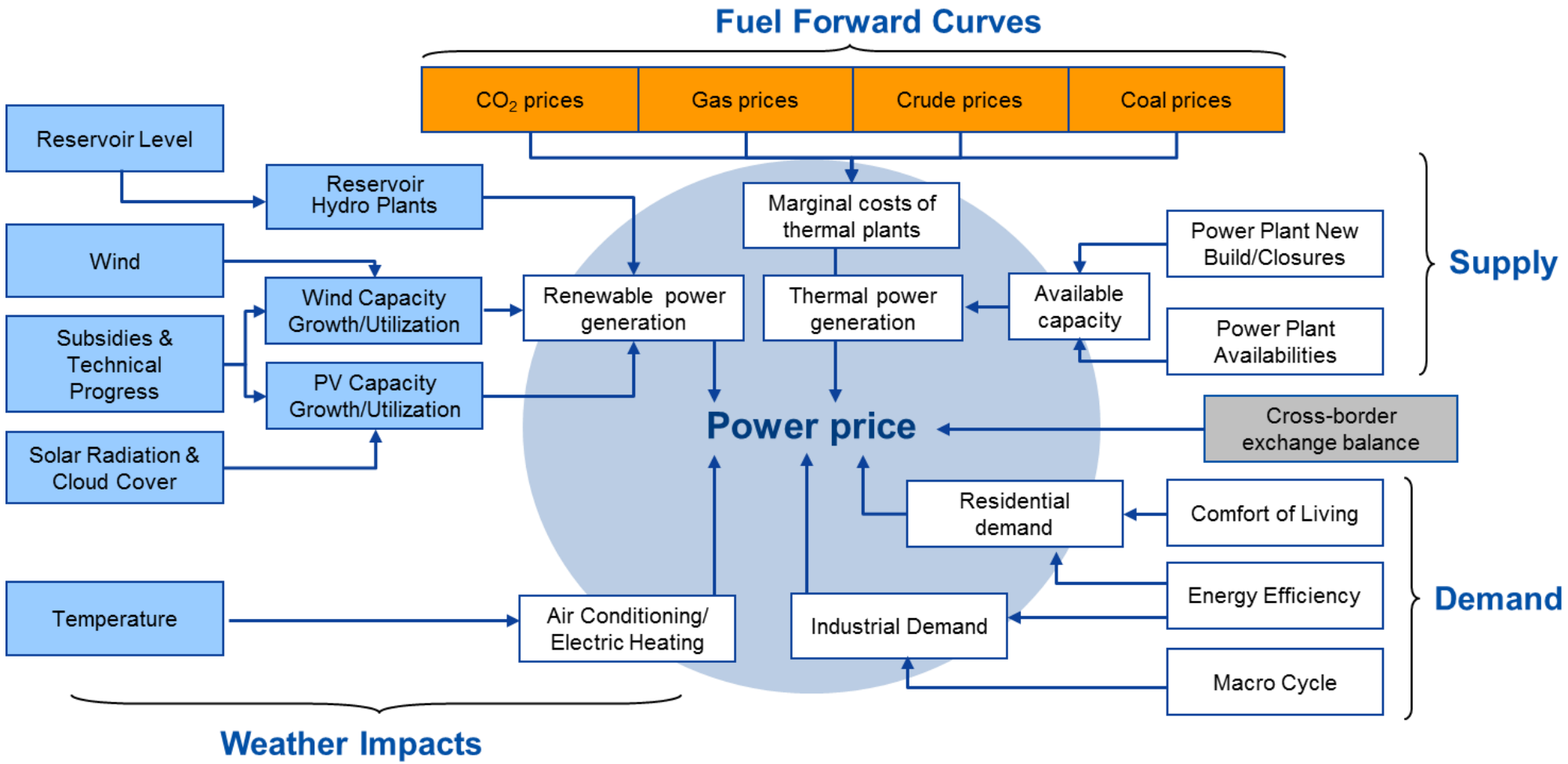
What influences price formation?



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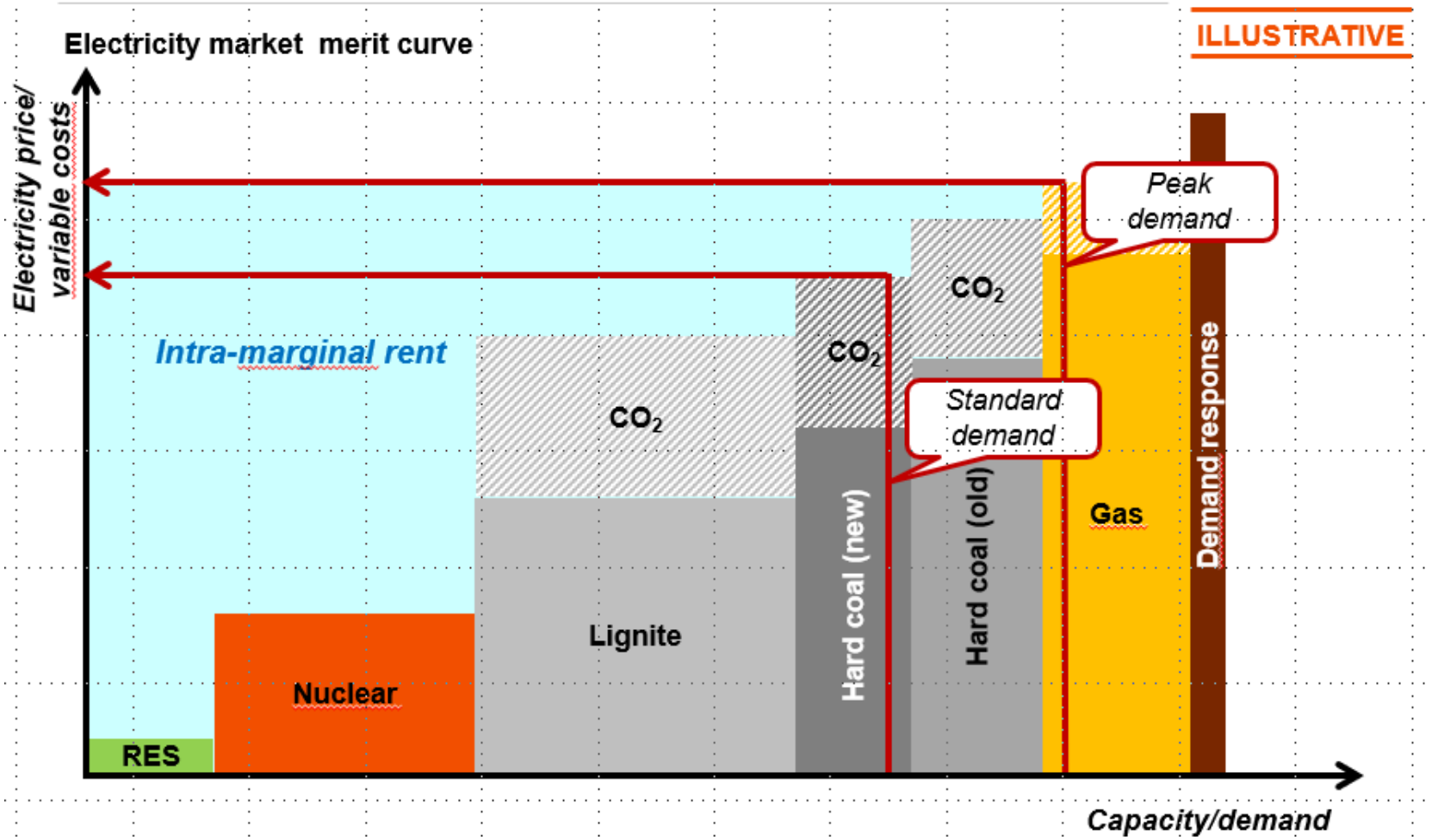
Marginal pricing in electricity markets



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Forward Trading: Where does it take place?

- **Over-the-counter trading (OTC)**
  - The deal is done directly between two parties
  - Brokers may facilitate via voice or electronic platforms
  - The contract can be less standard; so more instruments are possible
  - Both parties are exposed to *credit risk*
  - Credit, collateral and margining handled bilaterally

- **Exchange**
  - The contract is highly standardized, as defined by the exchange
  - The two parties will be anonymous
  - Settlement is via the exchange's clearing house, making use of *margining* for collateral
  - Secure and organized -> more expensive

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Forward Trading: What's Traded?

- **Standardised forward contracts**
  - Forwards: An agreement to buy or sell a fixed quantity of electricity at a fixed price for delivery at a future time
  - Options: The right, but not the obligation, to buy or sell a fixed quantity of electricity at a fixed price for delivery at a future time

- **Bespoke forward contracts**
  - Individual time periods or locations (eg, station gate)
  - Full-requirements contracts
  - Long-term power purchase agreements or renewable "Contracts for Difference"

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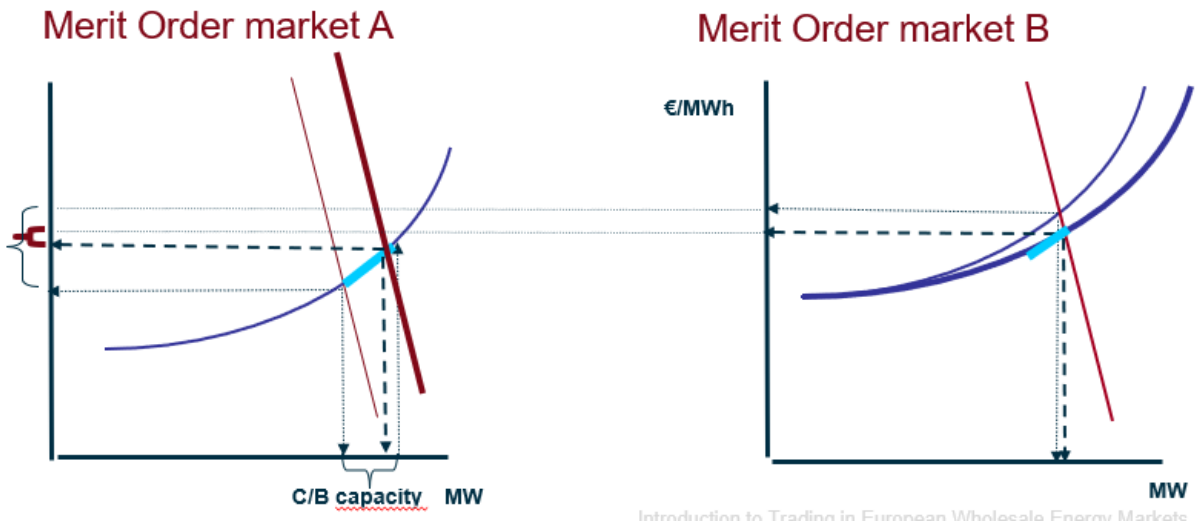
Day Ahead Market Coupling

- Essentially a big auction to make sure cross-border capacity in Europe is used efficiently.
- The market supplies bids/offer, the TSOs supply cross border capacity, the NEMOs run the auctions.
- The result is a set of zonal prices and cross border flows.



Why?

- Allows for a more optimal use of resources (generation, demand and network assets).
- Pools liquidity and creates more robust reference prices.
- Sends signals about where energy is needed most.
- Enhances **overall social welfare**

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Intraday market price volatility

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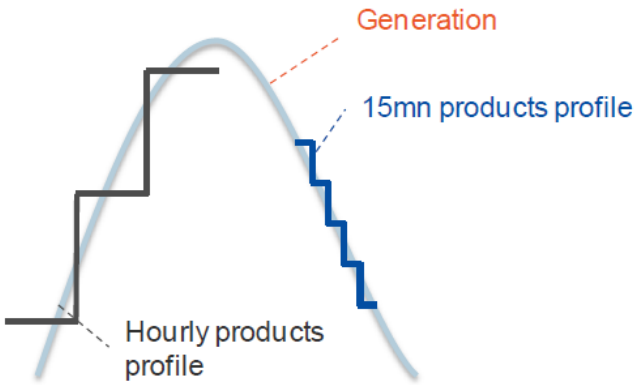
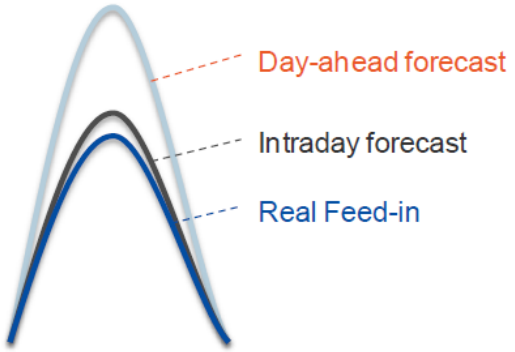
Flexibility challenges and intraday trading

GENERATION RAMPS



FORECAST DEVIATIONS



1. Adjust purchase and sale based on the results of the day-ahead auction
2. Run and plan power generation closer to delivery
3. Manage unforeseen events such as power plant outage or renewable forecast errors
4. Enable arbitrage between neighboring countries, provide opportunities for cross-border trading
5. Offer flexibility to manage ramping constraints or intra-hour variation, adjust from hourly to sub-hourly positions

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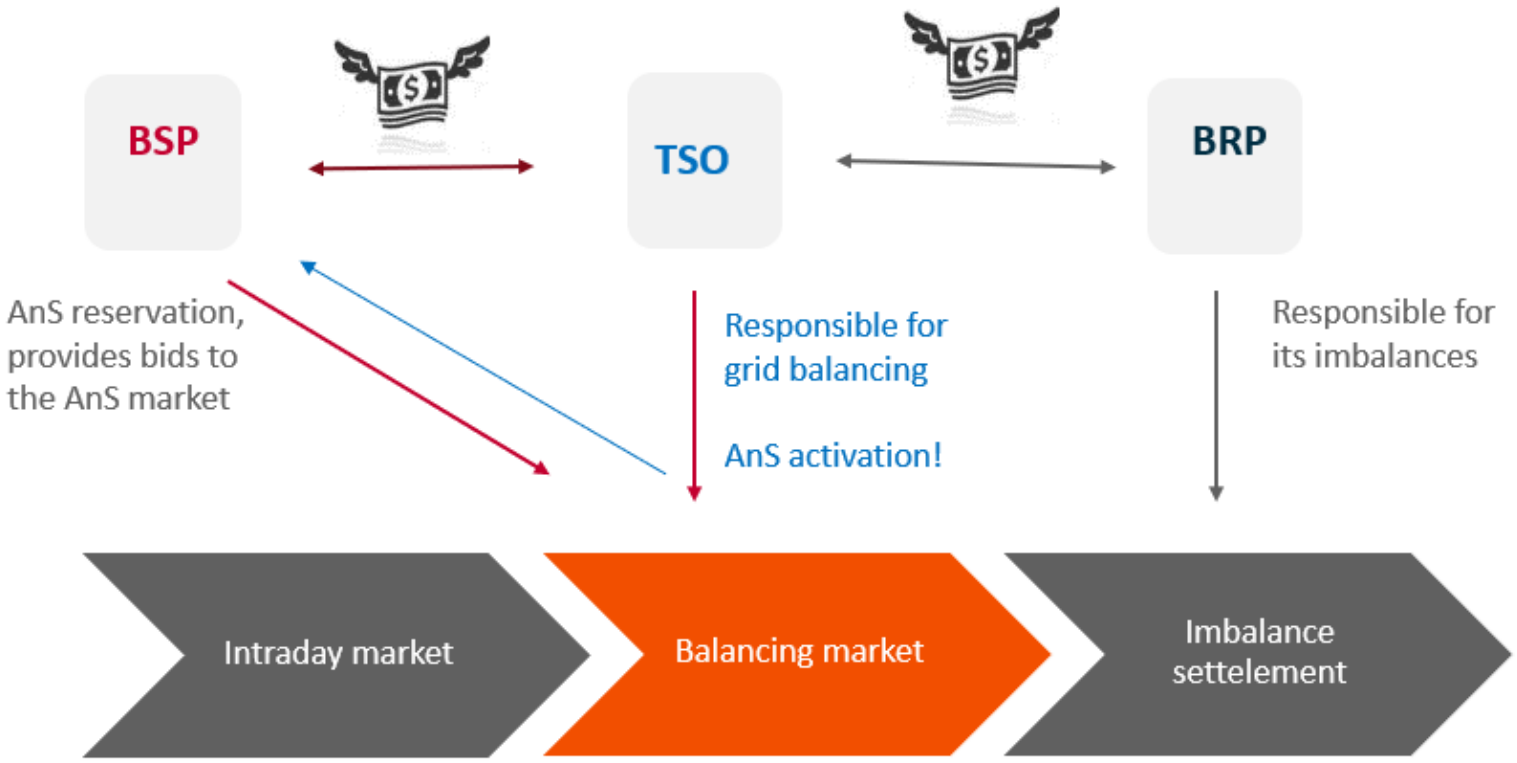
Balancing Markets



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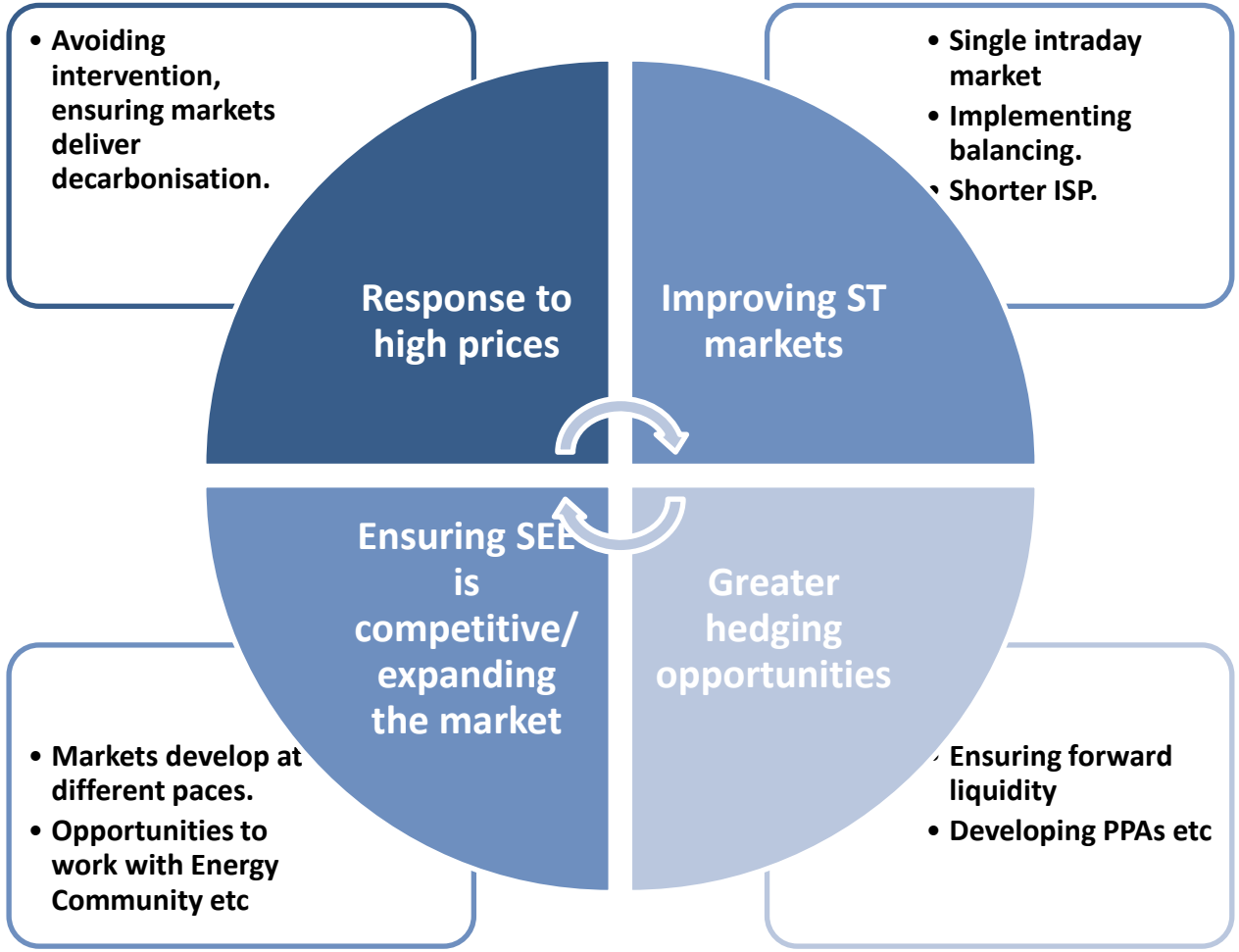
Current issues/ challenges



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Trading in the wholesale gas market

Presented by Cristiano Campi, Portfolio and Trading Gas - Northern Europe, Eni Global Energy Markets

Content

- Trading strategy and compliance;
- Price formation in the gas market;
- What lies behind the trader;
- Information availability and use;
- Liquid vs. illiquid markets;
- Q&A.

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Gas Trading: A cog in a complex and big machine

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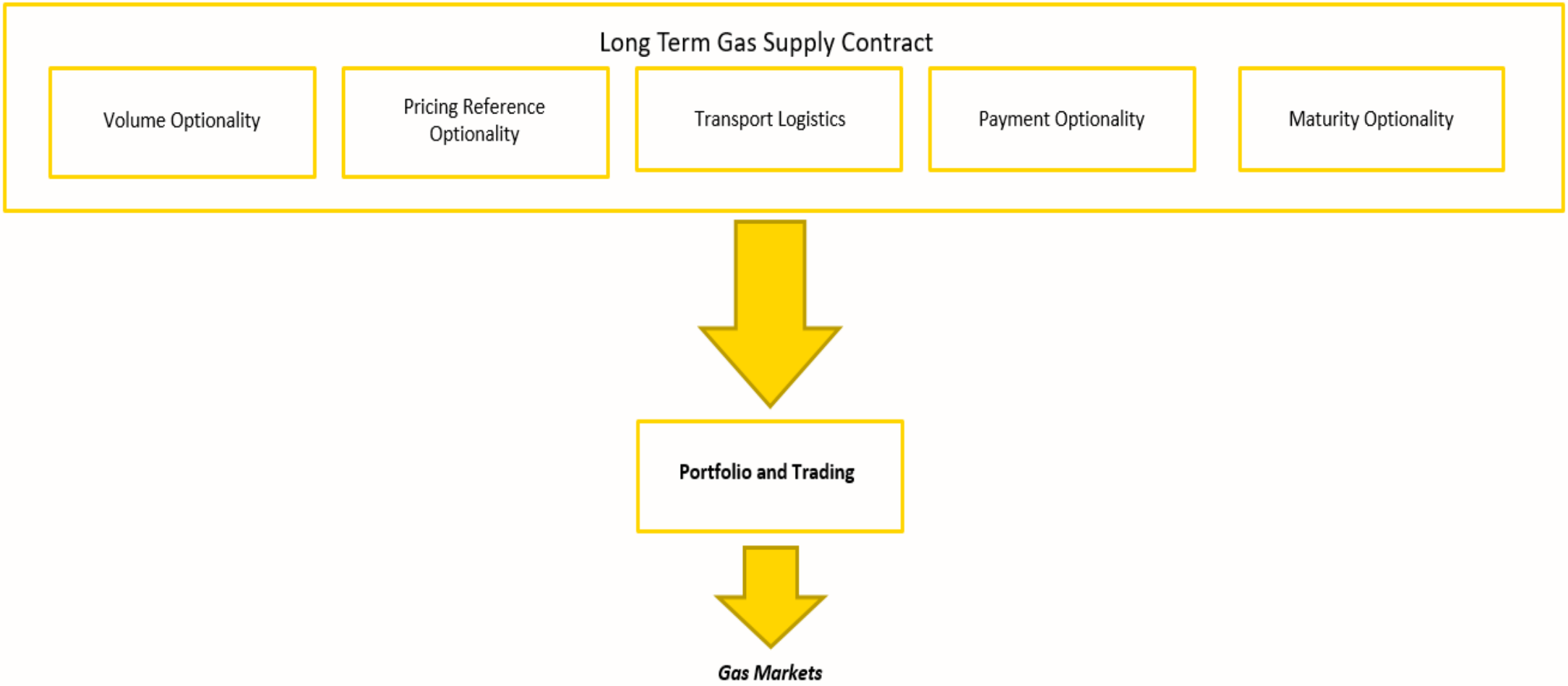
Deep dive: Long Term Contracts



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Not a Single Model or a Single Approach to Trading

- E&P – mainly interested to sell volumes, cover maintenance and outages
- Utilities – portfolio (end customers, power production, industrials) – integrated, classic energy value chain
- Supply Companies – serving energy to consumers, but not interested in assets, instead focused on lean IT, marketing, etc.
- Speculative – various approaches to harness market inefficiencies – statistical, fundamental, market making, etc.
- Merchant – commonly positioned in the physical space, interest in assets, risk premia approach – no natural position
- And many more

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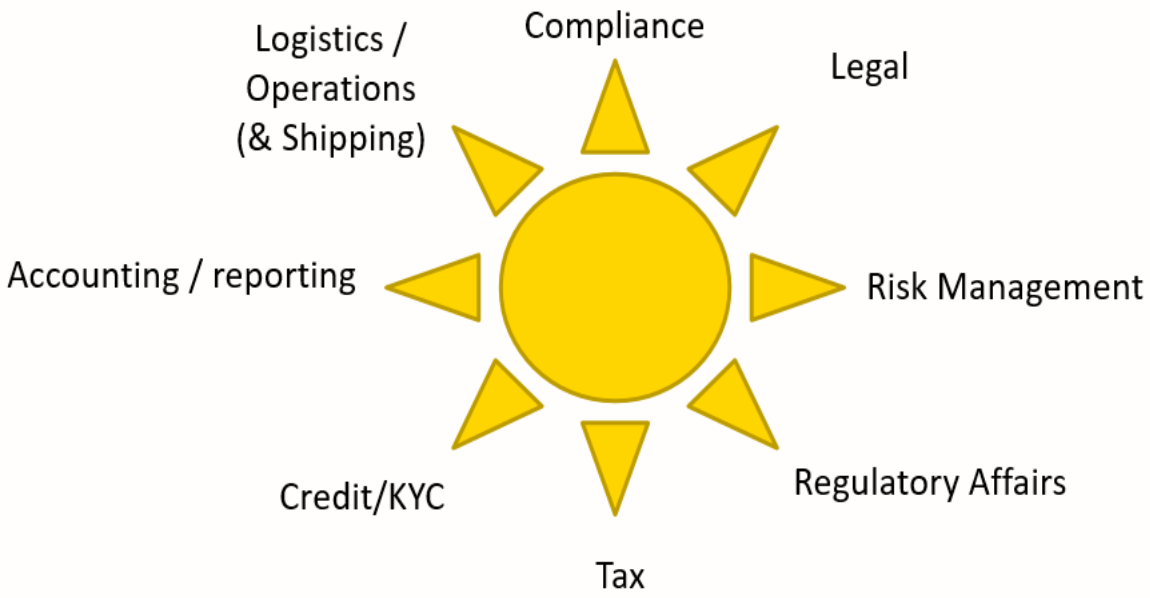
Set up of Trading Activity goes beyond just hiring a team of traders.

- Before being able to transact in the market, many prerequisites need to be in place:
- Besides internal support services, many external relationships need to be established (platform access, subscriptions, trading software, ETRM, credit lines, bank clearing lines)
- Systems need to work seamlessly across the organization and with the market
- Trading Gas in Europe is “still” a very physical business - molecules physically change hands vs. financial settlement of contracts



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Navigating the Market : Information Flow

- Some information is generated through internal systems, models etc. other can be accessed through 3rd party systems
- Regulation changes to standardize TSO information have been a big game changer
- ENTSO-G transparency has improved over the years
- With a maturing market, better information systems are being offered, as more parties have the money to pay for it

KPLER

THOMSON REUTERS

ICIS Independent Commodity Intelligence Services

Bloomberg Markets

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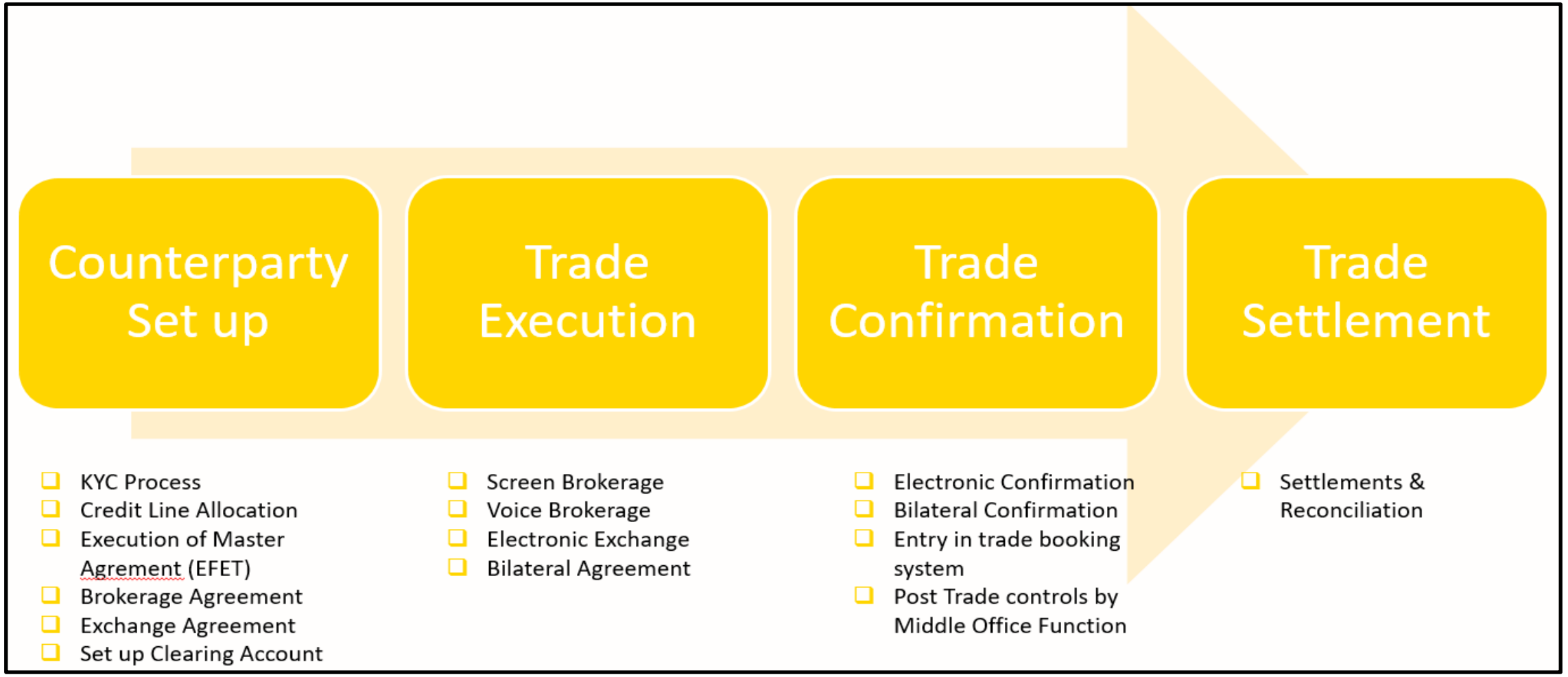
What are the different steps during a trade?



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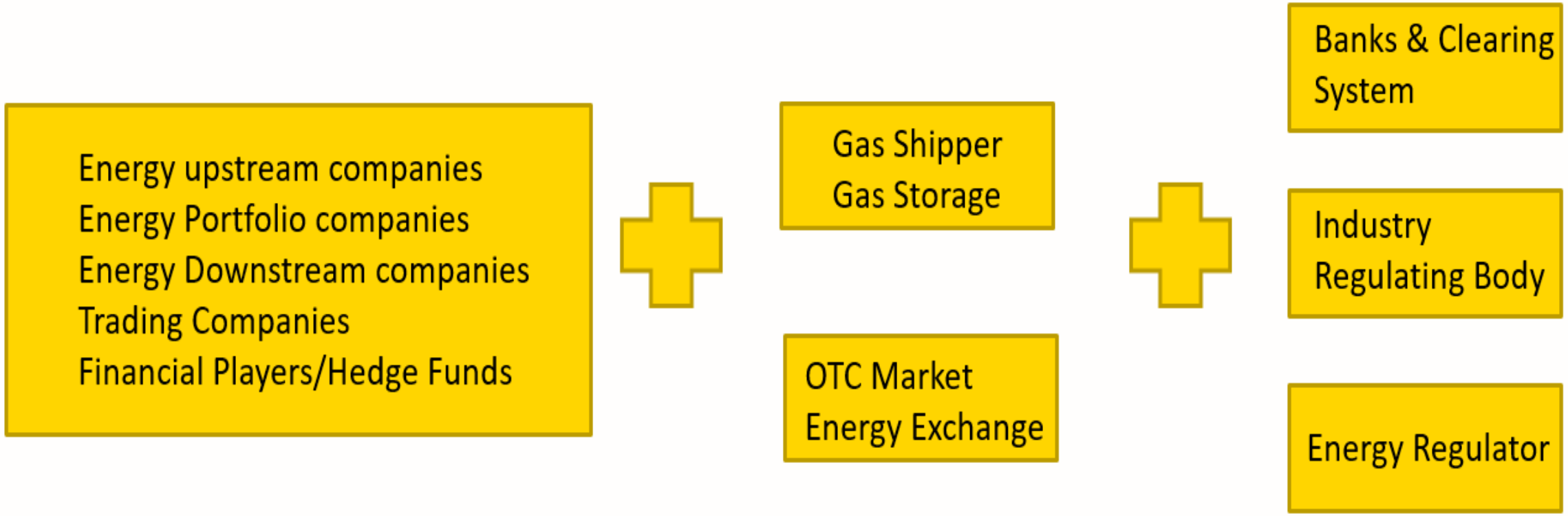
Traders are only one part of the market

The main players in a well functioning gas markets are:



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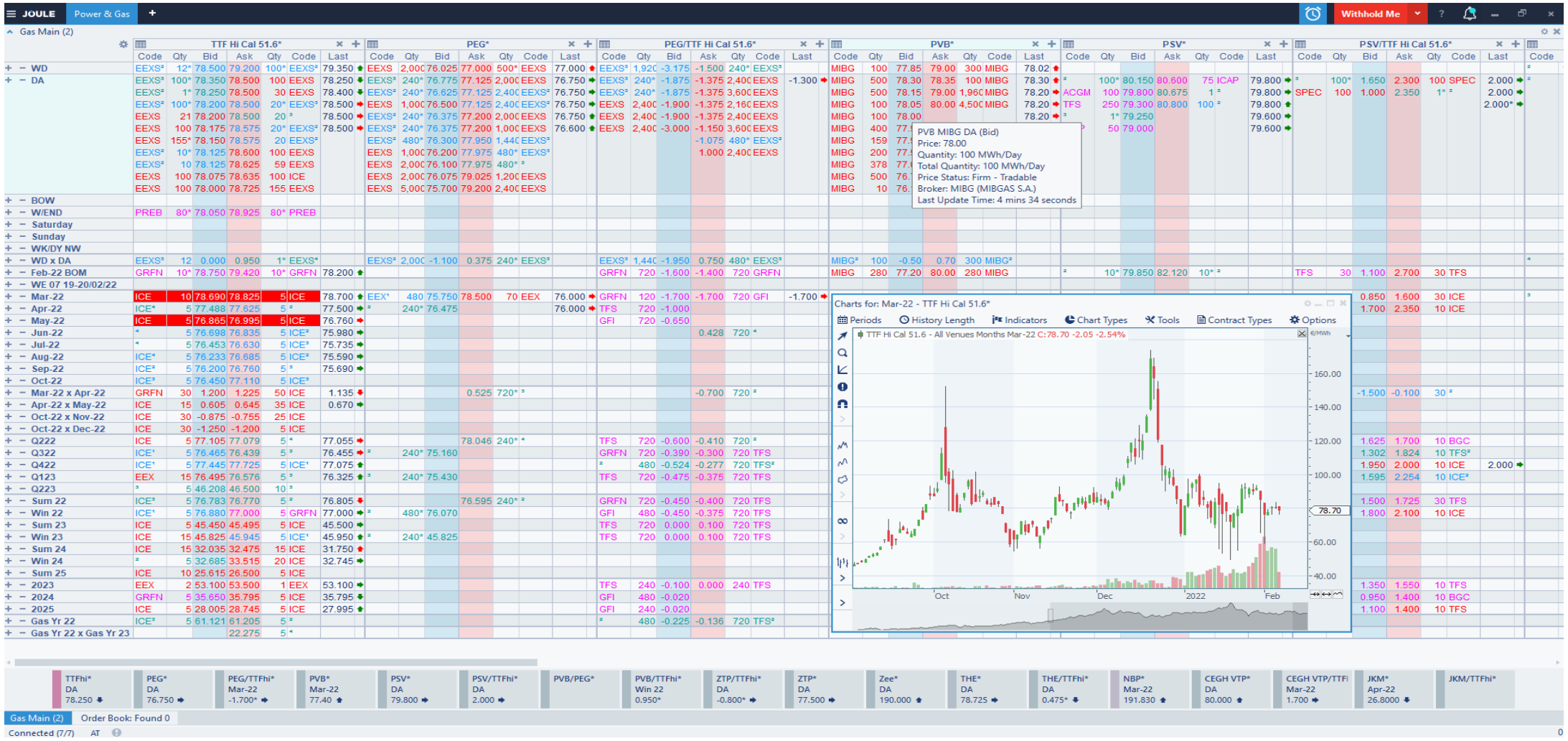
Which Products are Traded/1 ?



Source: Trayport as of 08/02/2022

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The key elements of a well functioning gas market

- The key factors for assessing the trading potential of a gas market are :
  - Number of Active Participants;
  - Number of Traded Products;
  - Volume Traded;
  - Churn Rate.

2020	5 KEY ELEMENTS					
HUB	Active Market Participants*	Traded Products**	Traded Volumes	Tradability Index (Q4)	Churn Rate***	Score /15****
TTF	225	49	46690	20	60.0	15
NBP	166	39	10060	17	11.2	13
PSV	112	24	1455	16	1.9	10
NCG	126	23	1965	15	2.1	9
VTP	110	19	1010	14	2.0	9
GPL	99	21	1350	16	1.6	9
TRF	46	19	890	15	1.6	7
PVB	55	13	145	0	0.2	6
ZEE	45	12	235	5	0.5	6
ZTP	32	10	235	7	0.5	5
VOB	41	11	95	6	0.4	5

* Hub Score in the OTC Active Traders table.
** Score /56 derived from the OTC and Exchange product categories in the Traded Products Table.
*** Gross churn basis.
**** Score based on each of the Key Elements scoring zero for Grey; 1 point for Red; 2 points for Amber; 3 points for Green.

Source: Oxford Energy Institute

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OTC and Exchange in the European Gas Markets

- The liquid hubs in Europe (TTF and NBP) offer liquidity across all the OTC and Exchange products across the curve.
- The liquid and emerging hubs have a healthy competition among the main organised exchanges and OTC platforms for market shares.

2020 Product evaluation based on absolute volumes*		OTC	SCORE / 28	CLEARING	WD DA	BOW W/E WDNW BOM	MA MONTHS	QUARTERS	SEASONS	YEARS (CAL + GAS)	EXCHANGE	(% SHARE)	SCORE / 28	BALANCING TRADES	SPOT PROMPT	FUTURES MONTHS	FUTURES QUARTERS	FUTURES SEASONS	FUTURES YEARS	OPTIONS MONTHS
TTF	49	Y	25	Y	Y	Y	Y	Y	Y	Y	ICE PGS CME	93 5 1	24	N	Y	Y	Y	Y	Y	Y
NBP	39	Y	20	Y	Y	Y	Y	Y	Y	Y	ICE PGS CME	99 <1 <1	19	Y	Y	Y	Y	Y	Y	Y
PSV	24	Y	17	Y	Y	Y	Y	Y	Y	Y	GME PGS ICE	74 13 13	7	Y	Y	Y	Y	Y	Y	N
NCG	23	Y	16	Y	Y	Y	Y	Y	Y	Y	PGS ICE	97 3	7	N	Y	Y	Y	Y	Y	Y
GPL	21	Y	14	Y	Y	Y	Y	Y	Y	Y	PGS ICE	99 <1	7	N	Y	Y	Y	Y	Y	N
TRF	19	Y	12	Y	Y	Y	Y	Y	Y	Y	PGS	100	7	N	Y	Y	Y	Y	Y	N
VTP	19	Y	12	Y	Y	Y	Y	Y	Y	Y	PGS ICE	97 3	7	N	Y	Y	Y	Y	Y	N
PVB	13	Y	7	Y	Y	Y	Y	Y	Y	Y	MIB PGS	91 9	6	N	Y	Y	Y	Y	Y	N
ZEE	12	Y	10	Y	Y	Y	Y	Y	Y	Y	PGS	100	2	Y	Y	Y	Y	Y	Y	N
VOB	11	Y	6	Y	Y	Y	Y	Y	Y	Y	PGS	100	5	N	Y	Y	Y	Y	Y	N
ZTP	10	Y	6	Y	Y	Y	Y	Y	Y	Y	PGS	100	4	N	Y	Y	Y	Y	Y	N
*KEY:		GREEN: =/>600TWh			AMBER: <600TWh		BLUE: <250TWh		RED: <50TWh		GREEN: =/>500TWh			AMBER: <500TWh		BLUE= <100TWh		RED: <30TWh		
GREY: No volumes		Hubs column based on OTC + Exchange 'score'/56; OTC column based on 'score'/28; Exchange column based on 'score'/28																		
		ICE=ICE/Endex			PGS=PEGAS		CME=CME Europe				MIB=MIBGAS			Y=AVAILABLE				N=NOT AVAILABLE		

Source: Oxford Energy Institute

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Trading carbon emission allowances and green attributes of renewable electricity, renewable and low carbon gases

Presented by Nora Topor-Kalinskij, Regulatory and Policy Advisor, EDF Trading

EU ETS & Green Certificates

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Introduction to the EU ETS

- **The EU ETS is a market mechanism to price CO2 emissions through a cap and trade system**
- Launched in 2005, the EU ETS is now in its fourth trading phase (2021-2030) - covers emissions from a number of sectors:
  - (1) power generation
  - (2) energy-intensive production (e.g. steel, iron, aluminium, cement)
  - (3) civil aviation between and within countries in the EU and European Economic Area
- Companies must obtain European Emission Allowances (EUAs) to cover yearly CO2 emission (measured in tonnes)
- **Auctioning of allowances**
- The number of allowances issued per year depends on the yearly cap of GHG emissions set by the EU - decreases by a set factor every year – constraining the supply side
- EU member states auction allowances typically on the European Energy Exchange (EEX)
  - Set number of allowances allocated for free to export-heavy industries
- Companies face a fine if they emit more CO2 than their emission allowances - compliance tracked through an EU-wide compliance registry - allowances have to be ‘surrendered’ against verified emission levels
- Companies can buy and sell allowances on a secondary market (primarily on exchange)

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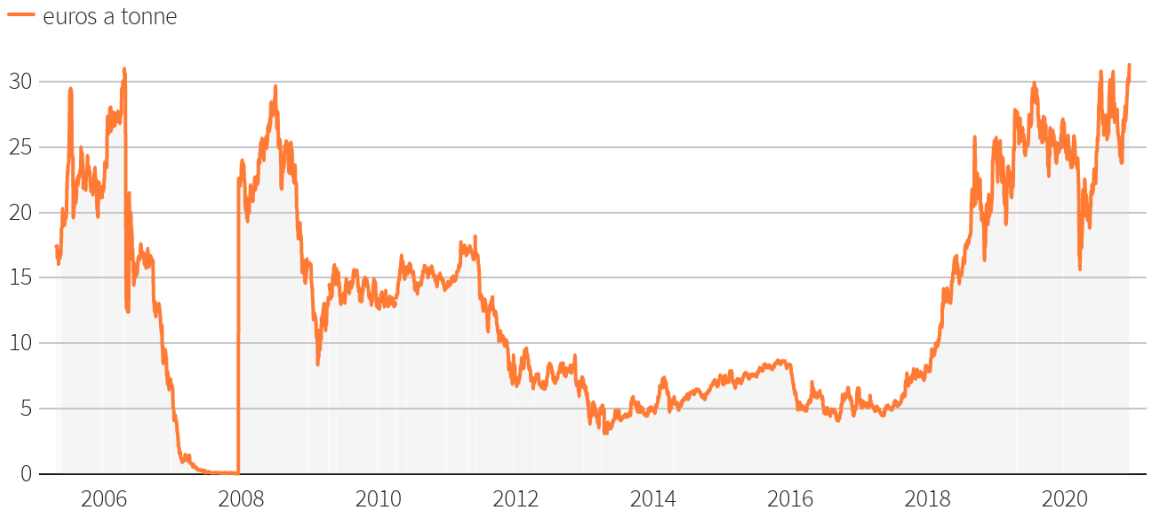
An initial price collapse

- Price collapse post-2008 = EU ETS relevance questioned
- As a result, the auctioning of 900 million allowances were back-loaded in 2014-2016 to support price
- They were transferred into the **Market Stability Reserve (MSR)** that began its operation in 2019.

The MSR allows authorities to increase or decrease the number of CO2-permits in the market, following pre-defined rules, in order to adjust supply (e.g. due to macro issues)

- If the total number of allowances in circulation surpasses 833 million (audit every May), 24% of the surplus is withdrawn from future auctions and placed into the reserve over a period of 12 months
- Allowances will be released if the number of pollution permits falls below 400 million



Note:
Source: Refinitiv

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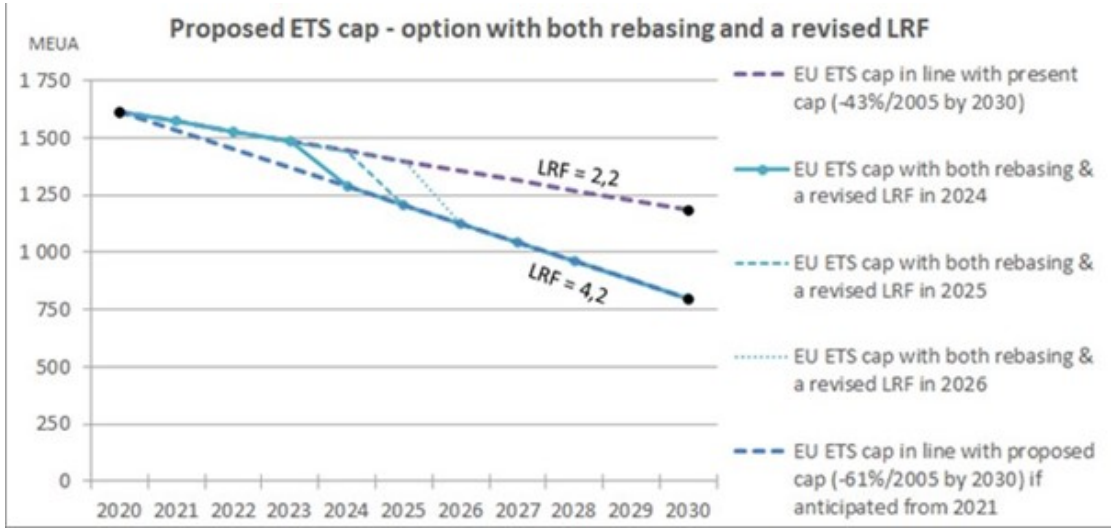
EU ETS – 2021 reform proposals

EU ETS is now the centre-piece of the EU's decarbonisation drive and its Green Deal agenda.

New measures building on ETS scheme are under review:

- Between 2019 and 2023, the amount of allowances put in the **MSR** was doubled to 24% of the allowances in circulation. The 2021 reform proposes to maintain this **withdrawal rate** until 2030.
- **Linear reduction factor** – steepened from 2.2% to 4.2%. One off reduction of allowance quantities in order to ensure effective backdating to 2021, regardless of when becomes law
- **Expansion to maritime** – to be gradually phased **in from 2023** (20% of verified emissions) to 2026 (100% verified emissions). To apply to ships coming into EU ports (including from non-EU locations), and ships berthing in EU ports
- **Adjacent Road Transport + Buildings ETS** – 2025 launch date, with regulated entities being subjected to compliance obligations from **2026 onwards**. No date for integration into wider ETS set.



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Carbon Border Adjustment Mechanism (CBAM)

The Carbon Border Adjustment Mechanism (CBAM) is a proposed system to price imports into the EU, based on carbon content.

Based on the Commission's proposal, the CBAM would apply to electricity, steel, iron, cement, refining, organic chemicals and fertiliser industries.

Certificates would be pegged in price to the weekly average auction price of the EU ETS.

Manufacturers in these heavy industries currently receive free CO2 allowances. The Commission has proposed to phase these out along with the introduction of CBAM. This would happen over a 10-year period by 10% each year, starting in 2026. Under CBAM, there will also be no export rebates.

Exemptions

- Countries integrated into the EU ETS or linked to EU ETS will be exempted.
- Derogation for goods originating from countries where carbon price is "effectively charged"
  - In practice a carbon price paid in a country of origin will be recognised by the EU through a reduction in the number of CBAM certificates required for surrender.

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Guarantees of Origin & Sustainability Certificates

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The Backdrop: Energy System Integration

The EU strategy on Energy System Integration from July 2020 has **a core focus on electrification**, based on renewable energy sources.

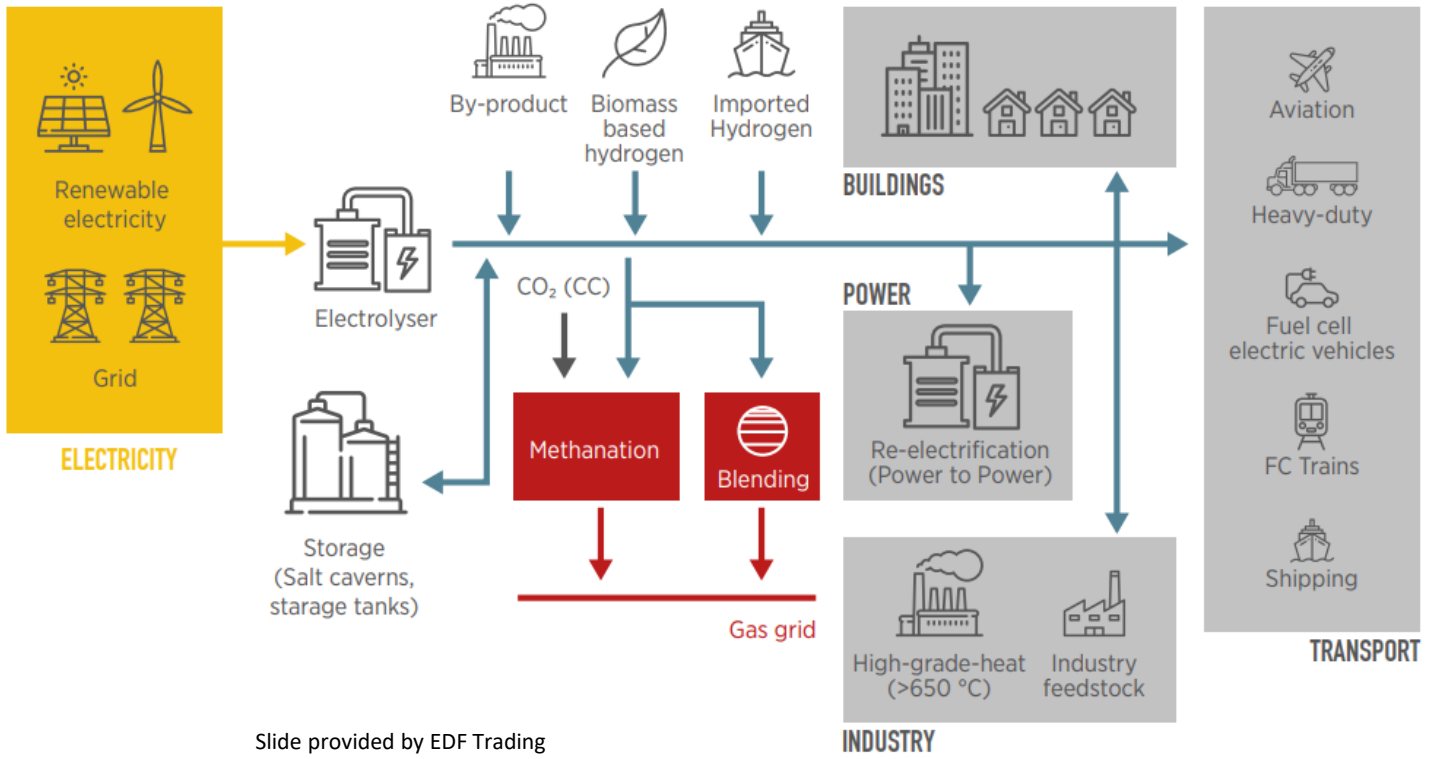
Renewable and low-carbon fuels (incl. hydrogen) **in hard-to-abate sectors are also key.**

As a result, infrastructure integration (mainly gas, electricity, heating and transport) will play a big role in the future energy system.

In particular, note the concept of **"Power-to-gas" – using renewable or low-carbon power to produce hydrogen that can be used in hard-to-abate sectors or for storage.**

- Many P2G technologies are still in development, seeking to decrease energy loss and increase commercial viability

European legislation is currently being reformed in order to implement energy system integration.



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Guarantees of Origin

- Nowadays, more and more customers would like to consume power produced from renewables.
- We cannot prove the origin of electricity in the same way we do it for some other goods, by packaging and labelling it.
- Instead, **renewable energy generators (under RED II) receive guarantees of origins** = an electronic certificate for every MWh produced (can also be issued for renewable gases including H2).
- **At any given point, there are as many guarantees of origin as there was renewable energy produced.**
- **The certificates are traded separately from the physical electricity – this is called "book & claim".** Electrons take the shortest available path from producer to user – we cannot control the flow of green electricity.

- **GO sales may not affect physical flows, but they affect cash flow**: regardless of where the certificate was bought, it is the relevant renewable power producer that receives revenue = by purchasing GOs, customers, wherever they are located, support investment in renewable generation.

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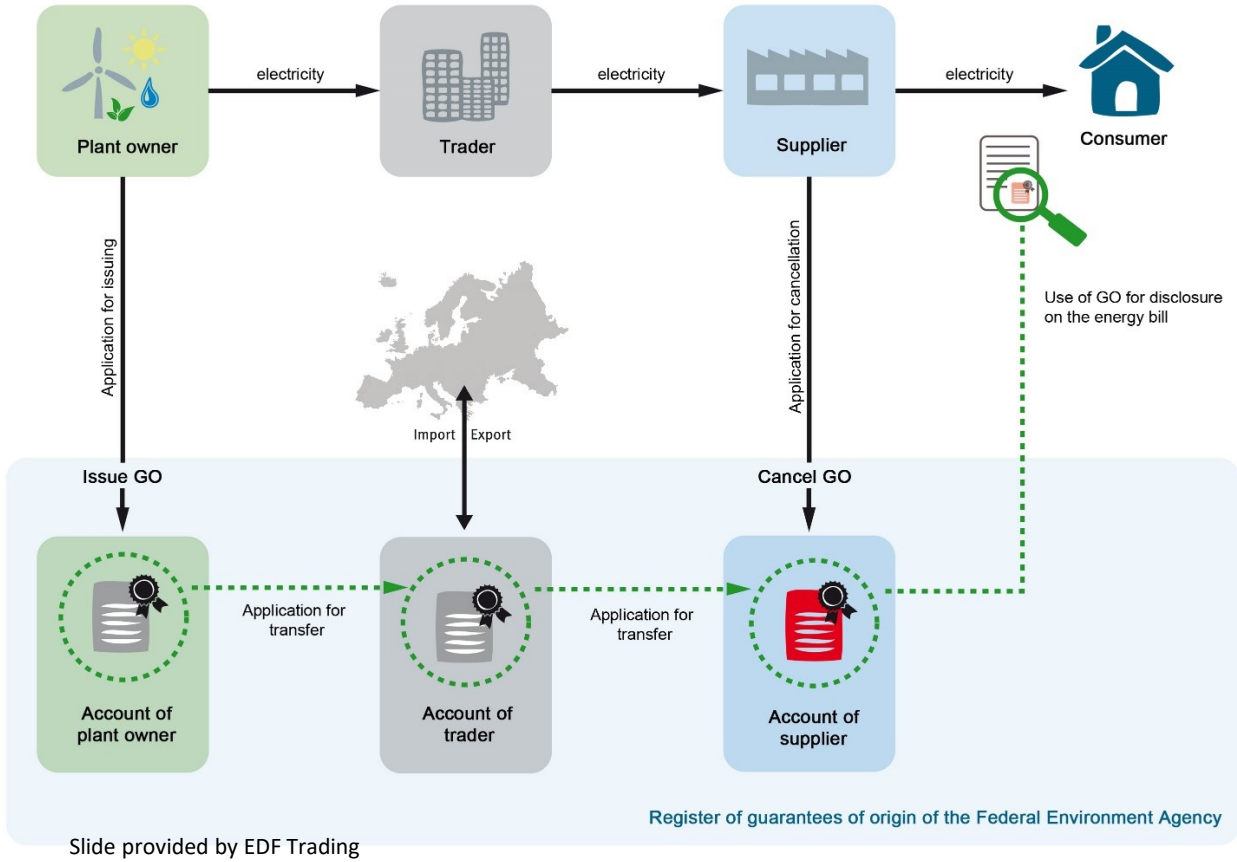
Guarantees of Origin

Once a GO is used by an end customer or retail supplier to demonstrate that a certain volume of electricity came from a renewable source, it is cancelled, to avoid double-counting.

- There is no fixed price for a GOs: their value depends on market dynamics
- **GOs are issued at the national level**, but there is an authority in Europe, AIB, whose role is to facilitate the transfer of GOs between registries. Most member states have a registered body with AIB.
- There are harmonised time limits for validity, disclosure and expiration.



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Sustainability Certificates for RES gases

- In order to **count towards RED II targets, producers of eligible RES gases** (biofuels, bioliquids and biomass fuels) **use sustainability certificates** to count towards the renewable targets set in RED II.
- Eligible RES gases must meet sustainability requirements set out in RED II – i.e. land bases criteria and/or minimum GHG savings.
- These schemes are voluntary and only specially recognised bodies can issue certificates.
- **When transactions in eligible RES gases occur, a mass balance principle is applied to the certificates**
  - This means sustainability certificates and physical product are coupled when they are traded between parties (unlike for GOs)

ERGaR was established by national renewable gas registries to enable cross- border transfer of renewable gas certificates among the member state registries

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Sustainability Certificates for RES gases

- In the mass balance system, the actors within the supply chain keep track of the amount of each consignment they are handling.
- This way they ensure that the amount of certified material exiting the supply chain equals the amount of certified material that has entered it, taking into account the conversion factors.
- Implementing a mass balance system requires elaborate documentation of the physical fuel transport, capacity booking in the grid, sustainability of the feedstock, and more.

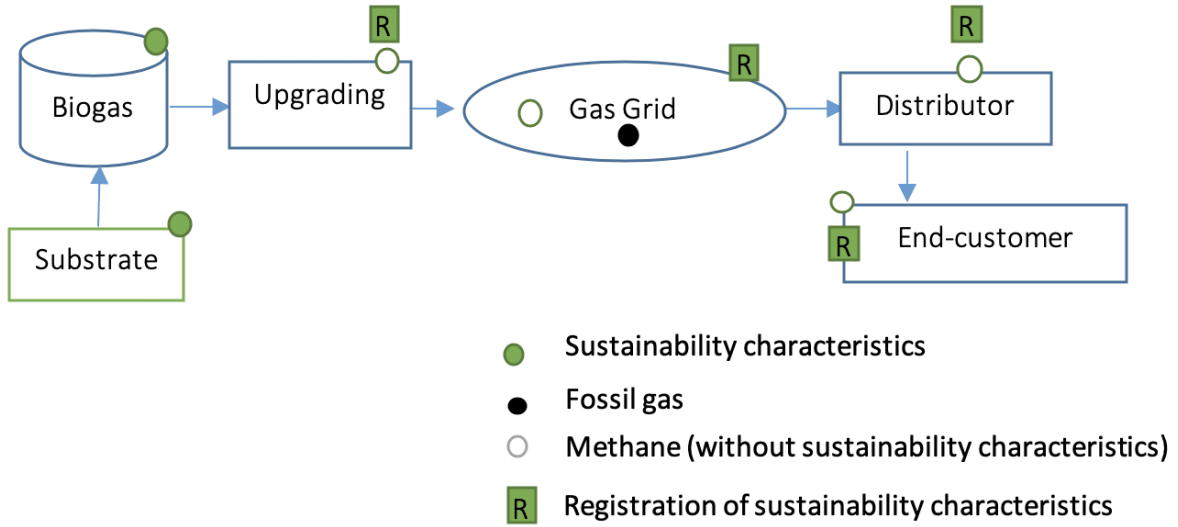

Figure 3: Mass balance system

Slide provided by EDF Trading

Current reform proposals – RED III & Gas Directive

Slide provided by EDF Trading

RED III & Decarbonised Gas Package

1. Including low carbon fuels as a general category in RED III combined with a requirement for their certification (based on a specific threshold for GHG emission savings)

2. Introduction of the union database for a centralized tracking of fuels, including decarbonised gases

- The proposal is for a mass balance system on EU level (as is currently for eligible fuel certificates)
- Still a number of points to clarify, including how to address:
  - Operational complexity
  - Impact on liquidity and competition in the internal gas market
  - Interaction with the Guarantee of Origin scheme

3. Updates to GO regulation

- Obligation for MS to issue GOs for all RES producers (currently some countries do not issue GOs for renewables that receive subsidies)
- Possibility to transfer GOs to buyers of renewable power under PPAs

GOs and Sustainability certificates remain different tools pursuing different objectives:
✓ GOs = disclosing the energy source to customers
✓ Sustainability certificates = general accounting eg to meet renewable energy targets.

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