Navigating Extreme Volatility in Benelux Power Markets

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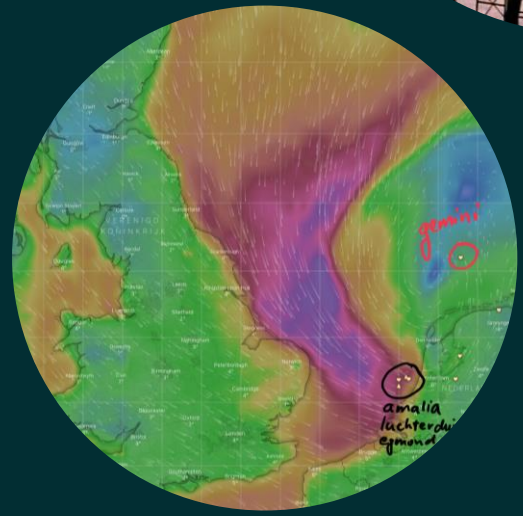
Agenda

- Setting the Scene
- Volatility
- Volatility Drivers
- Belgium Specific
- Netherlands Specific
- Navigating Volatility

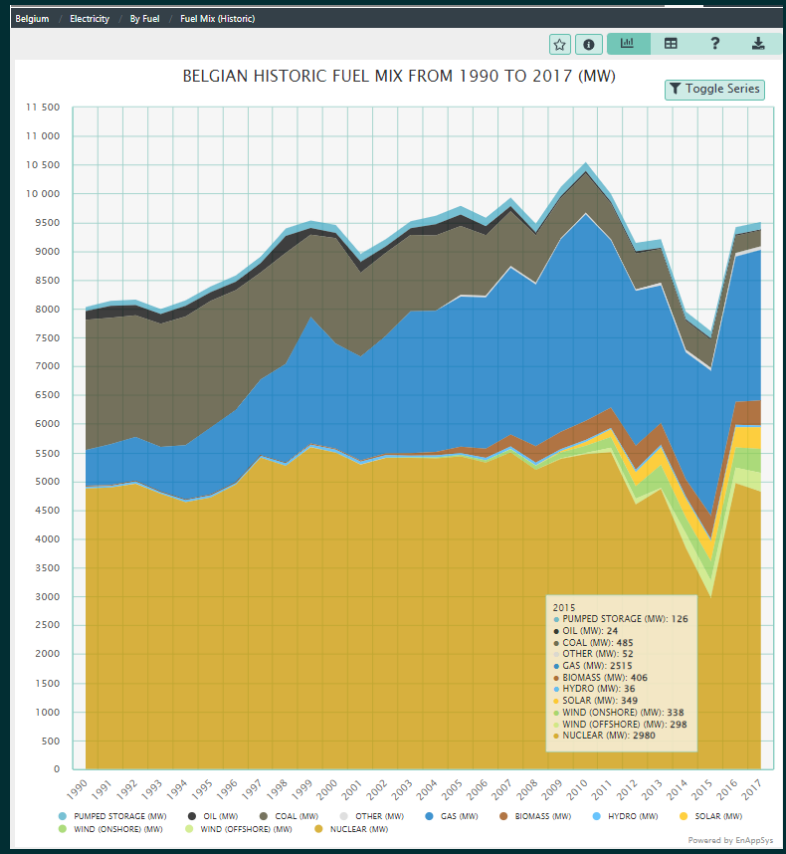


Belgium and Netherlands, similar but different

- Both highly volatile markets, but for different reasons
- Both struggling with the future of Nuclear
- Both small and linked to large and influential neighbour markets
- Share a language but not a culture

Belgium – Historic Background

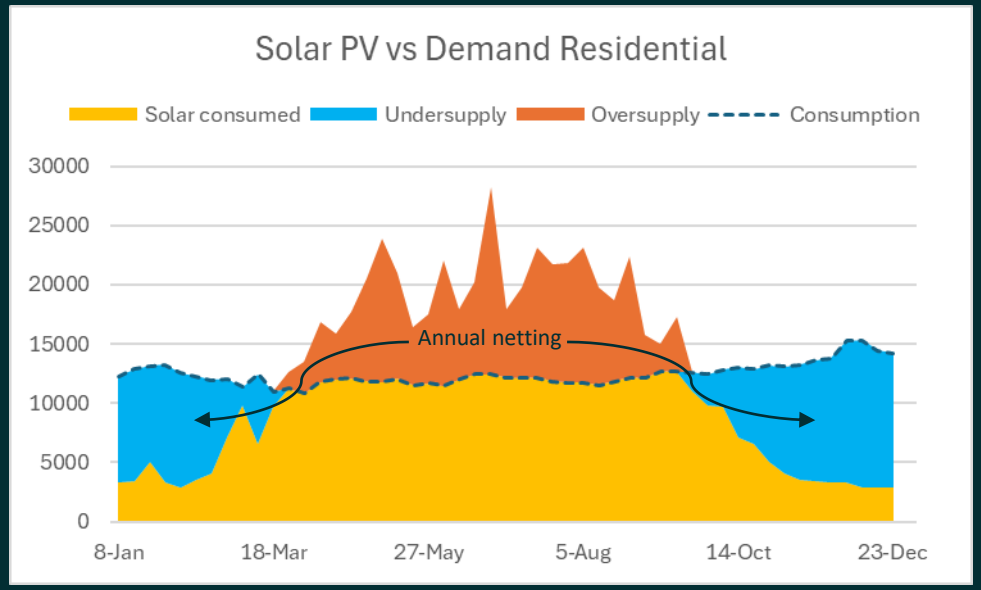
- Nuclear has been the most important source of power for many years.
- 2012-2015 first ‘cracks’ in Belgium’s nuclear reputation
- Solar build-out kicked off in 2011, 2023: 6.2 GW
- Offshore wind started in 2009, fast buildout between 2017 and 2021. Total wind capacity: 5.5 GW
- 2023: First phase of nuclear phase-out
- Demand: Between 8 and 12 GW



Source: Montel Analytics (Montel EnAppSys Platform)

Netherlands – Historic Background

- Historically power supplied by coal and gas units.
- Renewables only really picked up from 2016, massive growth since then.
- Solar capacity: 23.9 GW, roughly half is residential!
- Wind capacity: 10.7 GW
- Demand: Between 8 and 18 GW
- Net metering for solar, to end in 2027
- Radical plans: Offshore wind, nuclear?

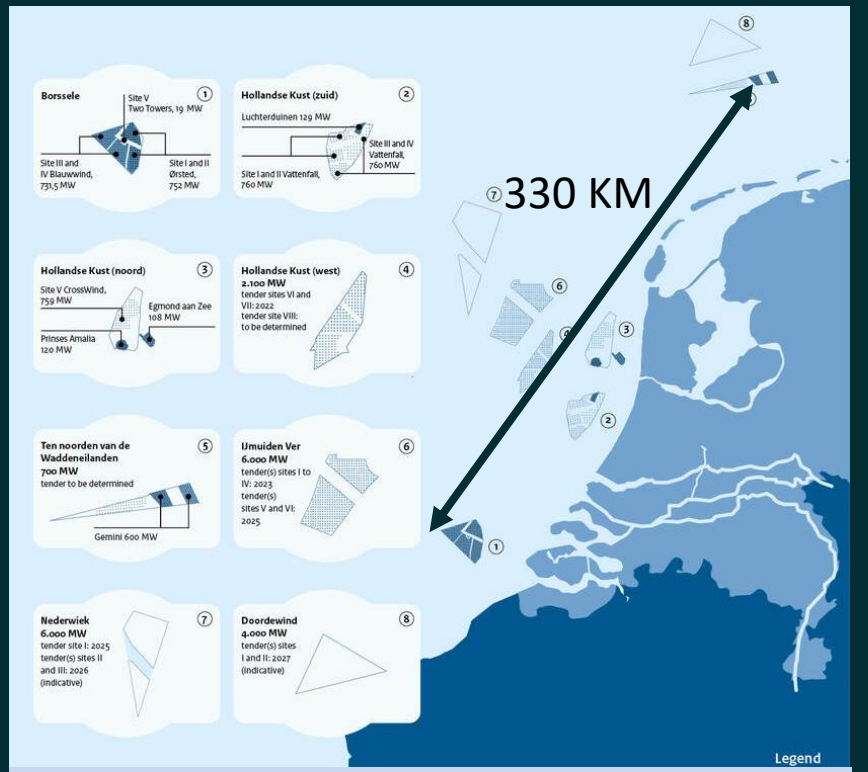


Source: Montel Analytics (Montel EnAppSys Platform)

Geography

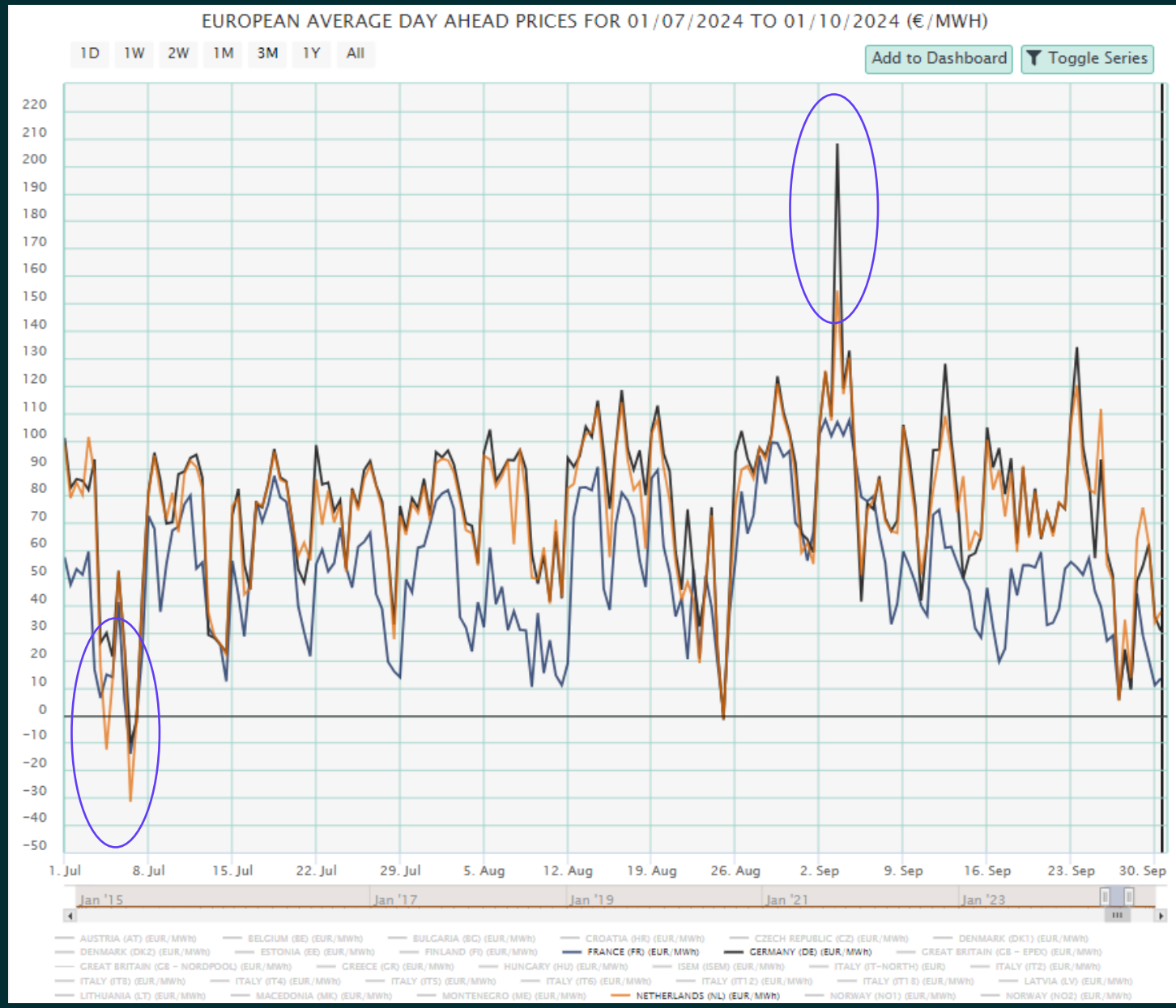
- Belgium and Netherlands are both small countries.
- Especially Belgium has few options to spread renewables and create netting effects if forecasts deviate.
- The Netherlands has several offshore wind areas, but also limited spread.

- Also… large neighbours often have similar weather.



Large Neighbours: Netherlands

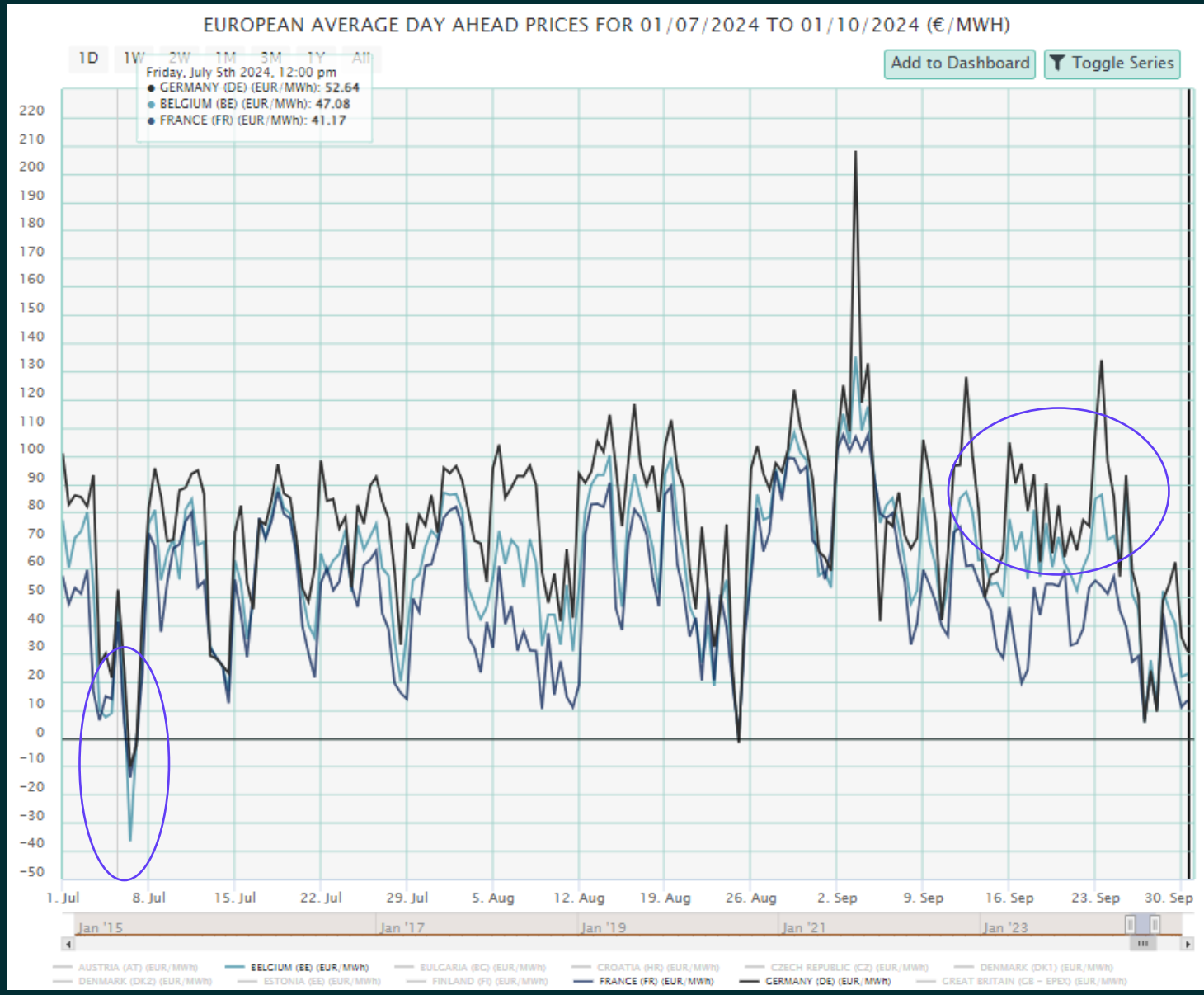
- Dutch day-ahead prices are generally closer to German prices.
- There is massive cross-border capacity.
- Netherlands has a larger portion of CCGT's providing flexibility (prices lower in evening peak) than DE.
- Higher relative penetration of solar (lower prices during solar peak) than DE.



Source: Montel Analytics (Montel EnAppSys Platform)

Large Neighbours: Belgium

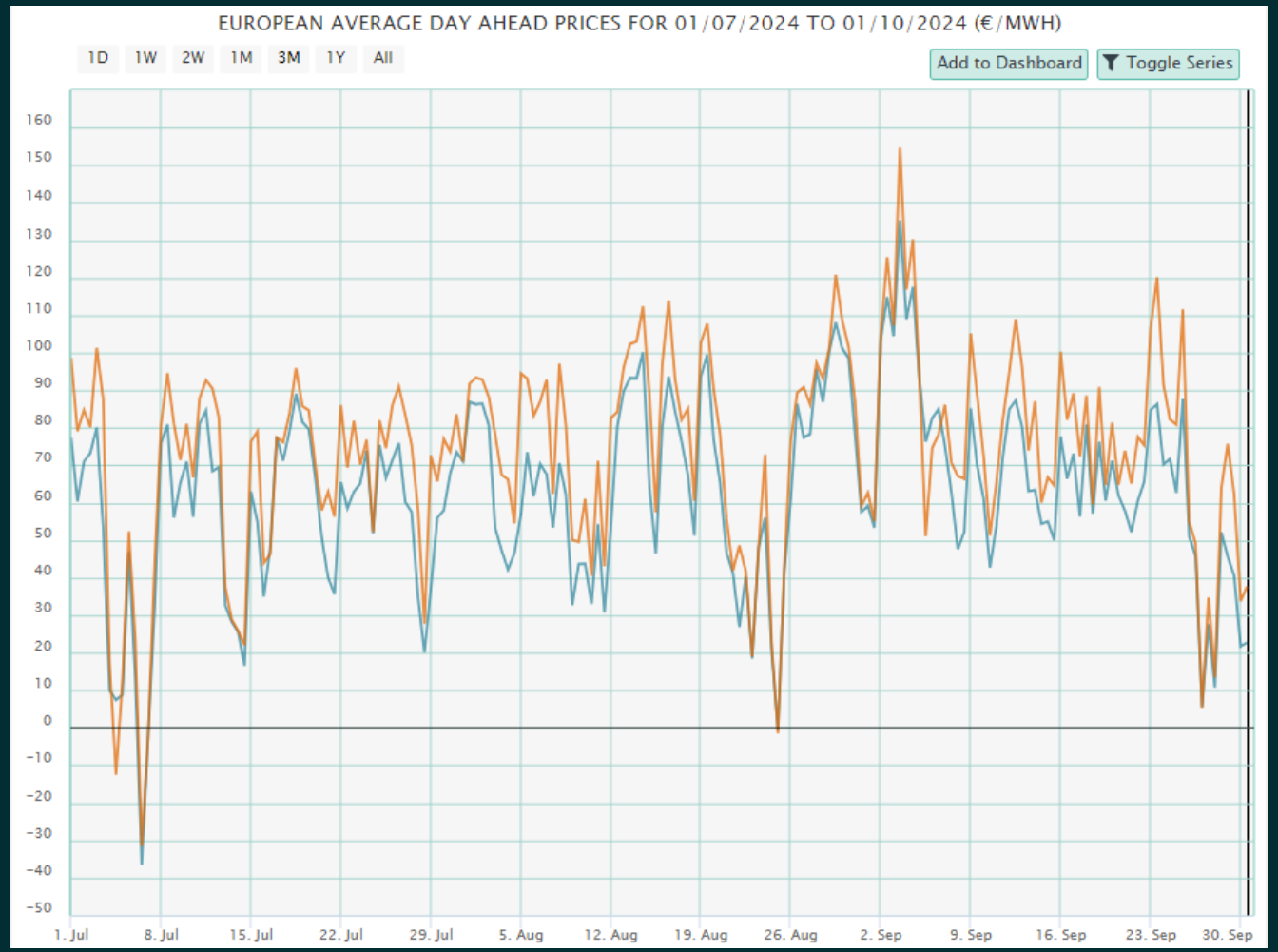
- Belgium is generally between DE and FR for prices.
- As it depends on imports, capacity runs out frequently.
- Evening peak prices can go as high as NL and DE, due to limited CCGT's online.
- Solar surplus sometimes also feeds in from NL.



Source: Montel Analytics (Montel EnAppSys Platform)

Similar but Different

- We see similar price shapes, between Netherlands and Belgium.
- Dutch price deviate more upward, whereas Belgian prices deviate more down.
- The influence of France as a ‘shock absorber’ (this year!!!) and Germany as a ‘scarcity component’ is clear and very clearly linked to the amount of interconnection with each country.



Source: Montel Analytics (Montel EnAppSys Platform)

Volatility

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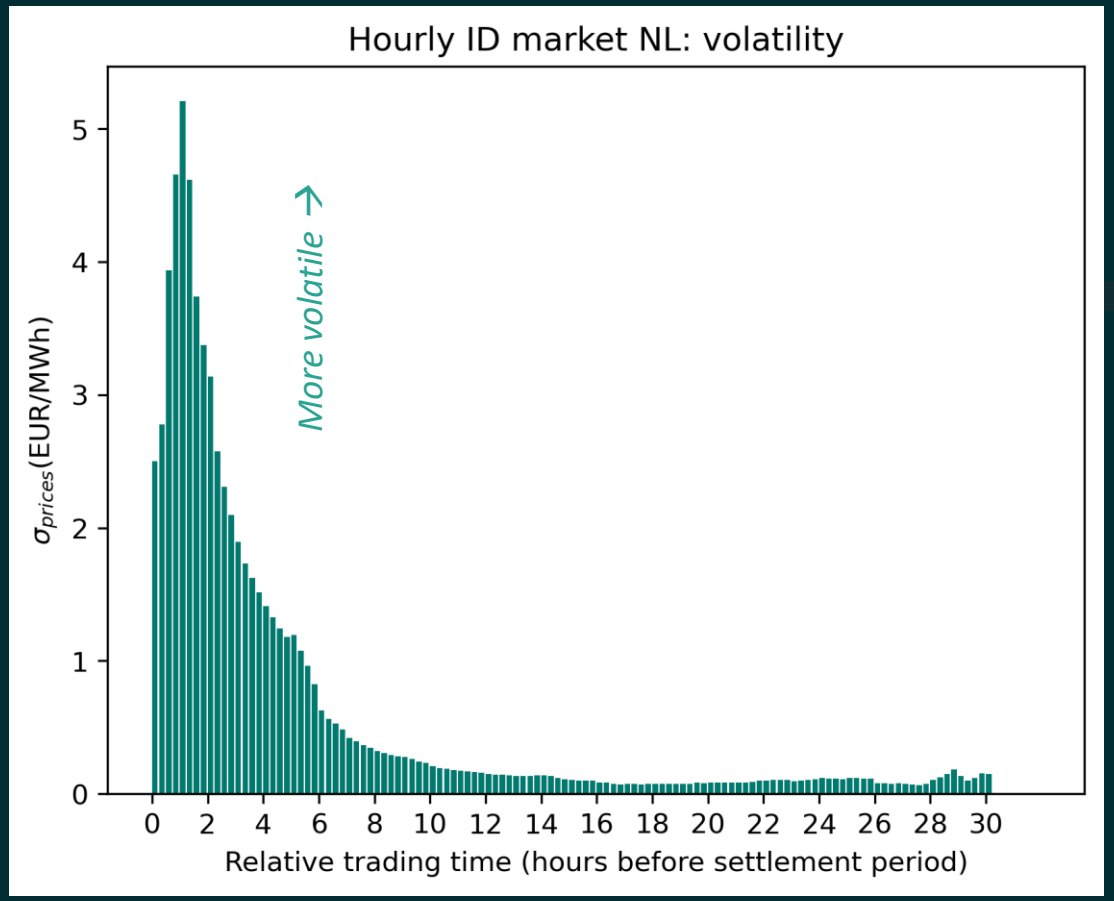
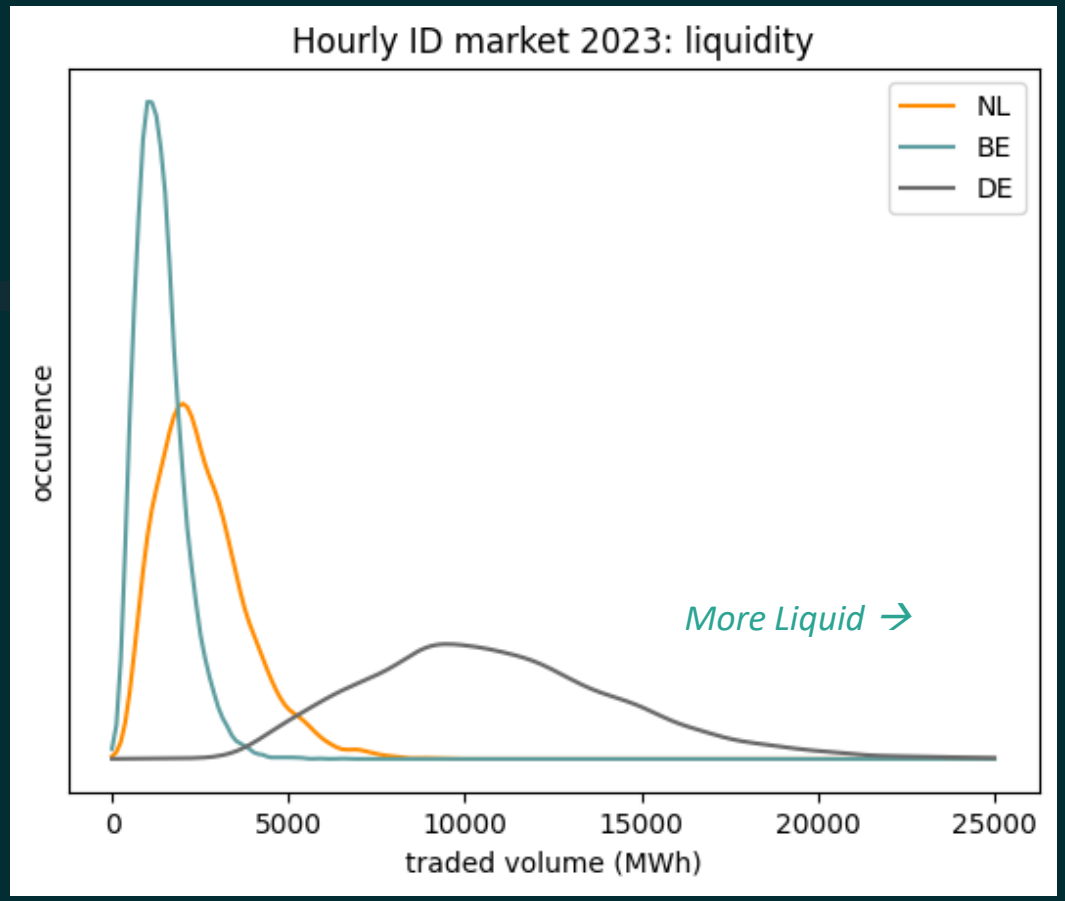
Example: NL Volatility vs Liquidity Intraday Continuous Market

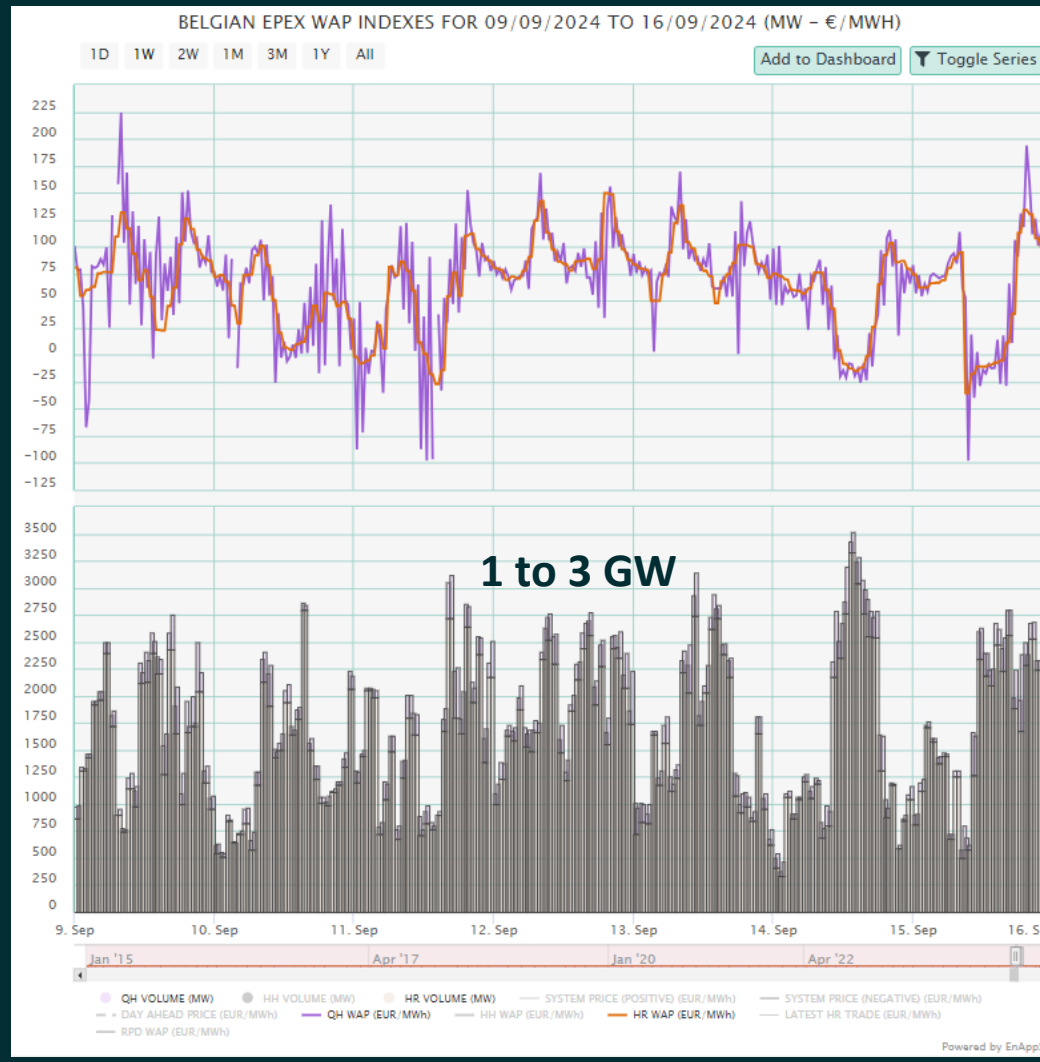




Source: Montel Analytics (Montel EnAppSys Platform)

Comparing Liquidity: BE

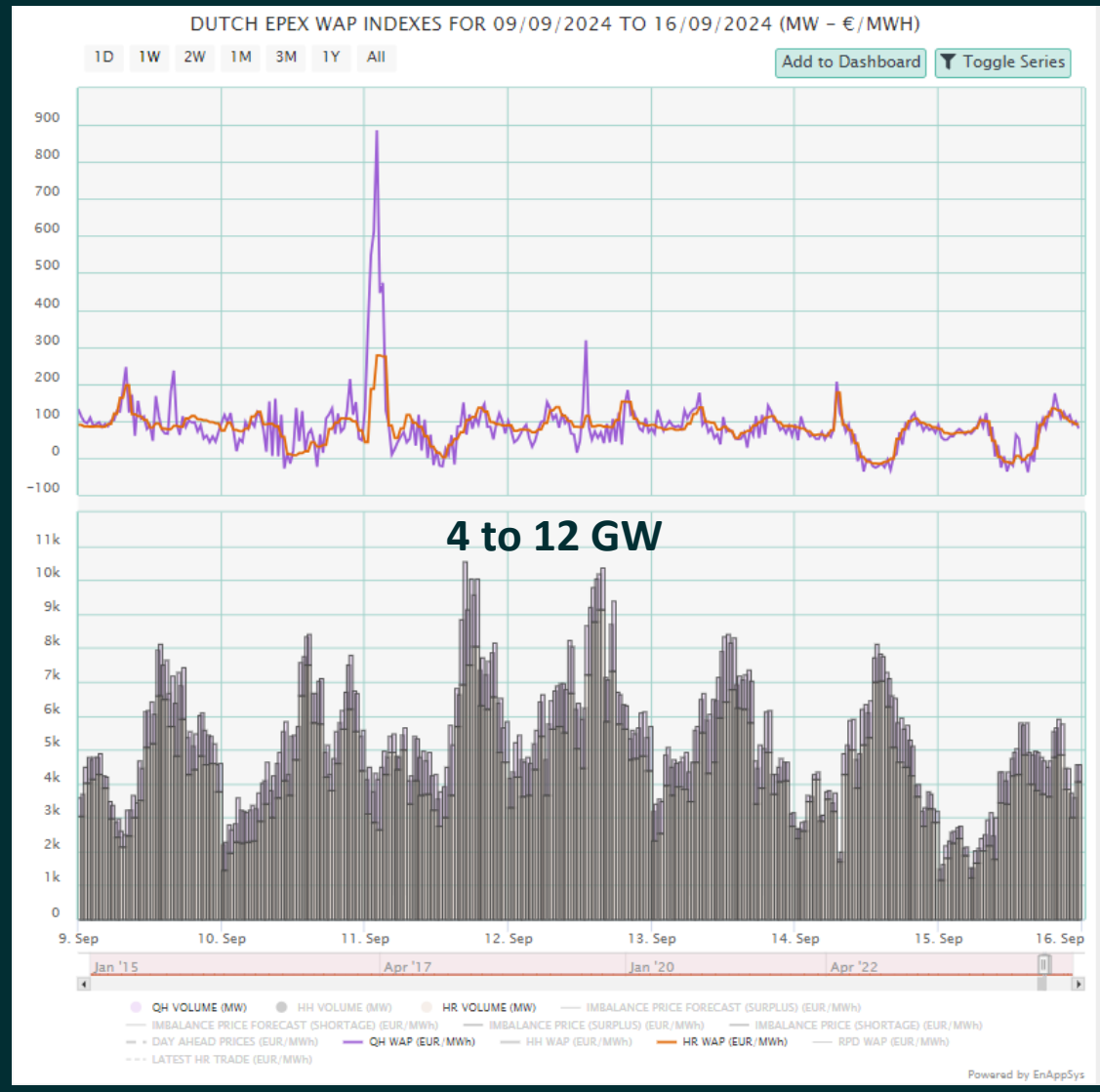
- Belgium sees much lower liquidity, why?
  - Fewer market participants
    - Domestic market
    - Non-physical players
  - Low cross-border capacity left for trading
  - Only 1000 MW connection with Germany
  - Little local flexibility online
  - Hourly products see much better liquidity



Source: Montel Analytics (Montel EnAppSys Platform)

Comparing Liquidity: NL

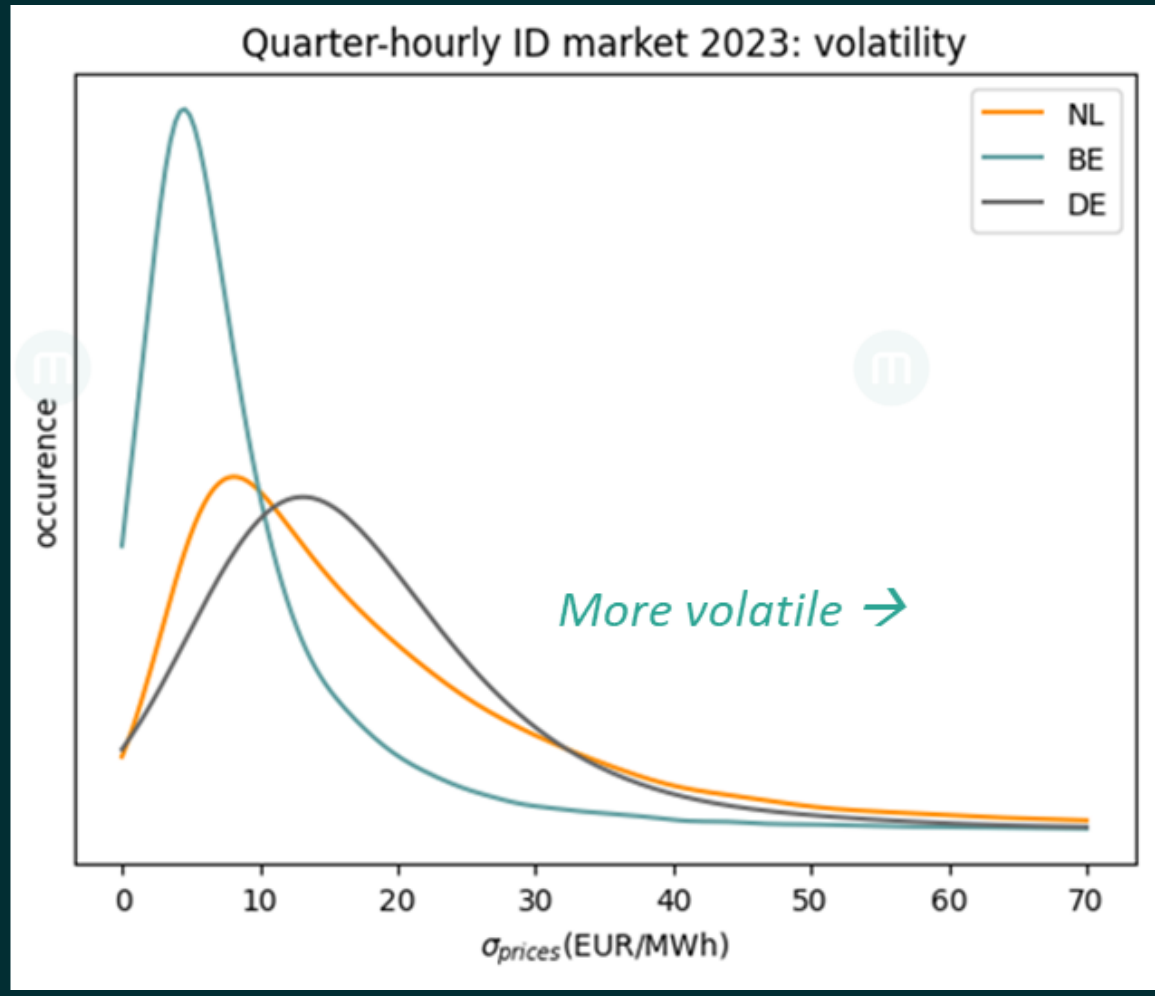
- NL typical sees at least 4x the volume we see in Belgium, why?
  - Much more players in the market:
    - Non-Physical
    - More diversity in power generators
  - More often cross-border capacity left, with Germany (liquid market), less import dependent
  - Flexible assets online when needed



Source: Montel Analytics (Montel EnAppSys Platform)

Lower volatility on QH Trading

- Germany sees higher volatility on QH trading than NL and BE.
  - Reserve activation prices (the price of doing nothing) less extreme than in DE.
  - Belgium generally sees less extreme upward activation prices.
  - Potential balancing prices feed into the intraday continuous
- Parties can therefore trade themselves ‘out of trouble’ at less extreme prices than in Germany.
- Periods with no volume in Belgium



Source: Montel Analytics (MontelEnAppSys Platform)

Drivers of Volatility

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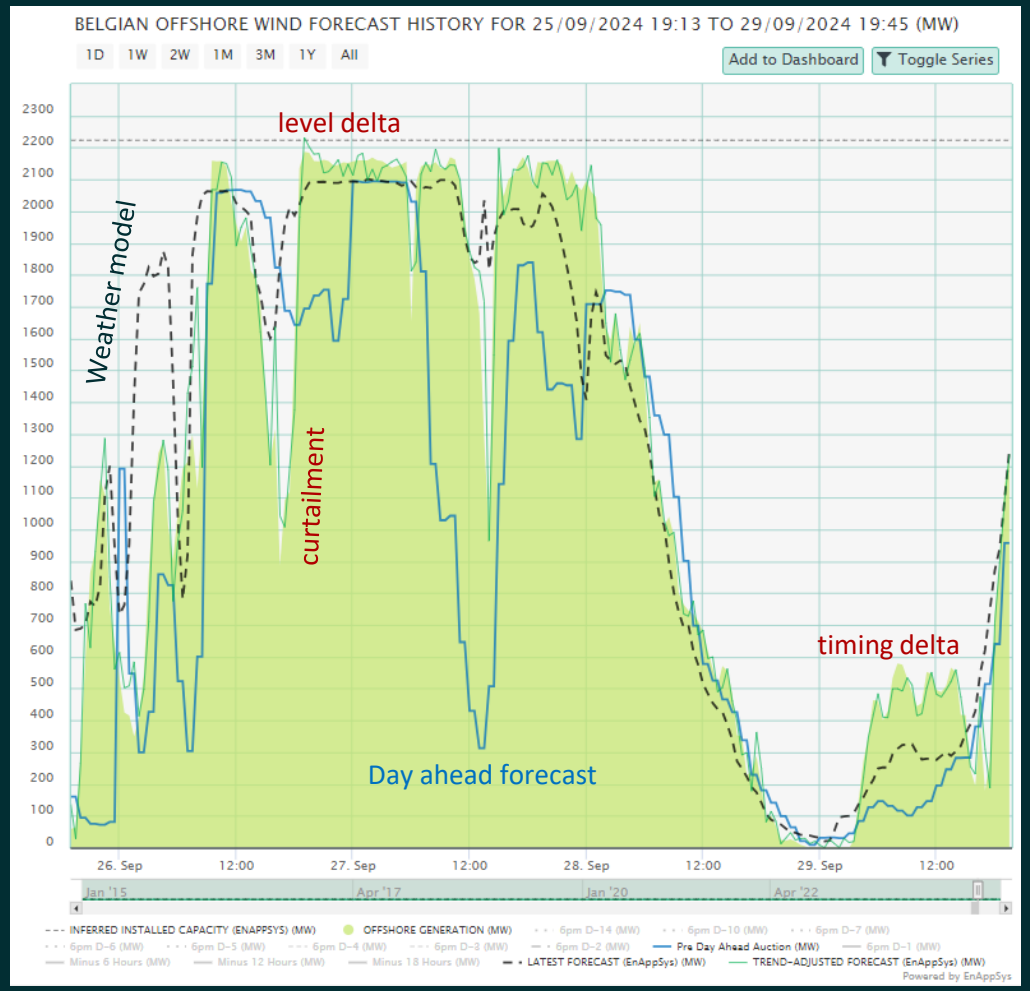
Some Volatility Drivers are Generic

- Forecast deviations: Demand & renewables
- Outages
- Cross border capacity for trading
- Depth of the intraday market
- Depth of the balancing market
- Amount of spinning reserve
- Ramping speed of conventional power
- Direction changes of interconnectors

Forecast Deviations – Delta Tracking

Demand, Wind, Solar

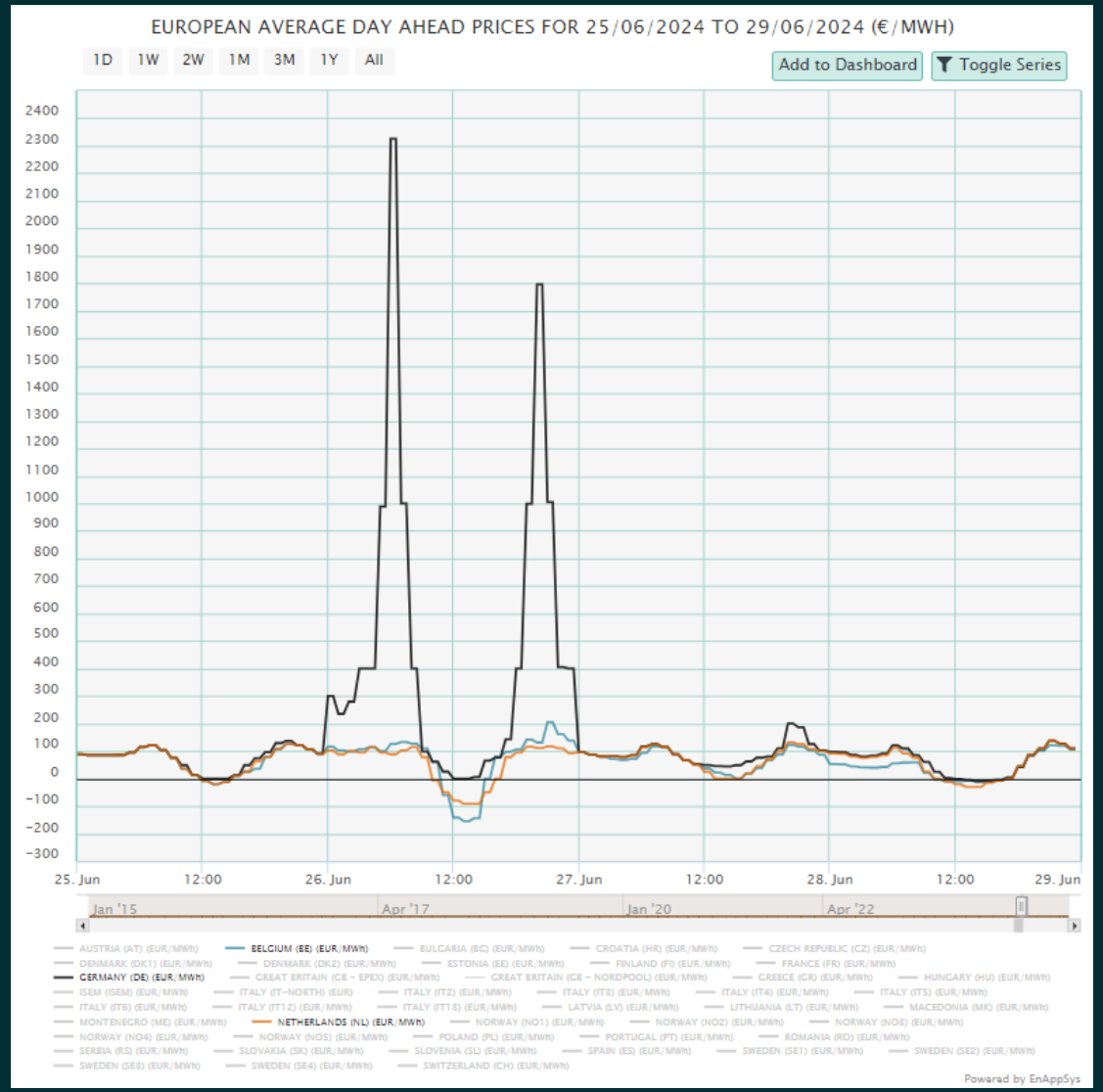
- Weather or congestion issues can cause demand, solar or wind generation to deviate dramatically. Temperature can also affect the performance of assets.
- While weather models update fundamentally only every 6-hours, having a feedback loop in forecasts can really help to identify additional deltas.
- Using machine learning forecasts can tell you if a deviation is a result of a change in ‘level’ or ‘timing’.
- In this example, the green line further improves the weather-model forecast, adding significant value.



Source: Montel Analytics (Montel EnAppSys Platform)

Outages

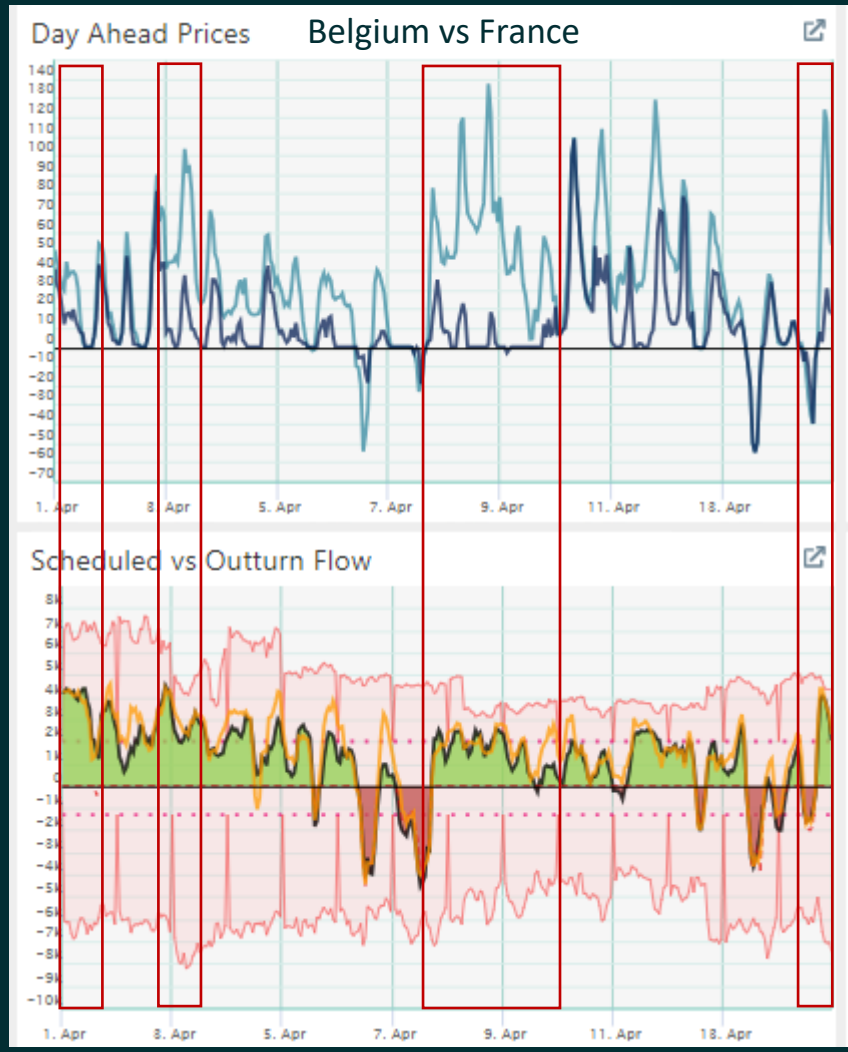
- Power plants and interconnectors break.
- With continuous intraday trading, a power plant outage seldom has a major impact on market prices, unless only the local market can be used and there is a shortage in the market already.
- Interconnectors are becoming more and more important. If a DC interconnector breaks, this causes major imbalances of up to 1000 MW on either side of the cable.
- Outages at power exchanges and market coupling, are IT issues that can distort the market massively.



Source: Montel Analytics (Montel EnAppSys Platform)

Cross Border Capacity

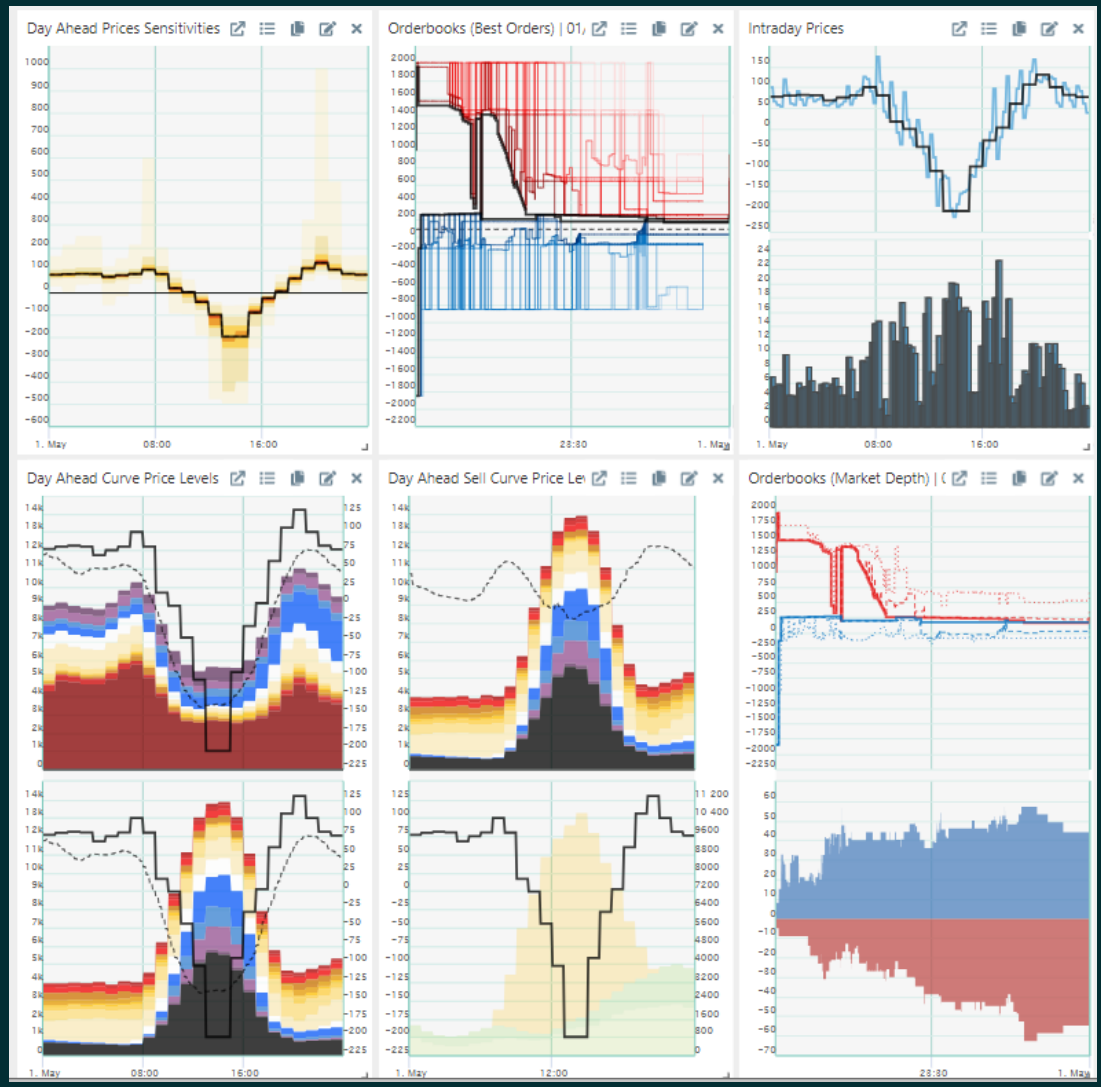
- Cross-border capacity is important for an efficient distribution of welfare across the Core flow-based market coupling zone.
- Interconnection is in most cases still dimensioned to facilitate a centralized power generation system that follows set patterns.
- The market has changed significantly since 2015.
- More volatile generation profiles (renewables, less conventional power) and a different distribution of assets, have resulted in borders ‘running out of spare capacity’.
- One of the symptoms is a difference in day-ahead prices. Even though intraday trading results in capacity recalculation, liquidity can be very low if cross border capacity runs out.



Source: Montel Analytics (Montel EnAppSys Platform)

Intraday Market Depth

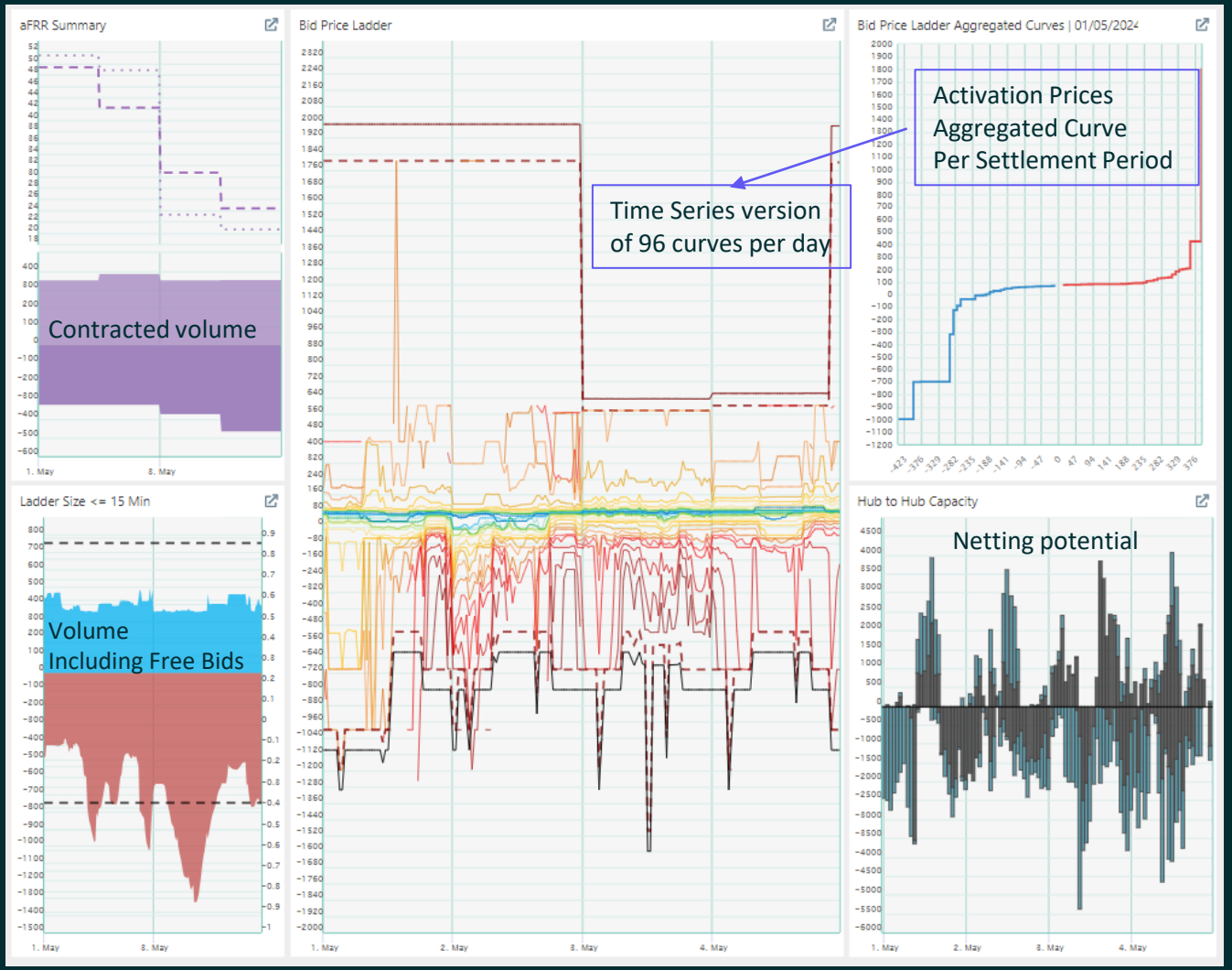
- After the day ahead market has cleared, the aggregated supply and demand curves provide background info.
- The orderbooks further expand the information.
- Analysing buy and sell orders allow you to analyse the bidding behavior of various asset classes.
- As most likely the carbon and fuel costs are similar within day, you can assess how much volume will be in the market at which levels.



Source: Montel Analytics (MontelEnAppSys Platform)

Balancing Market Depth

- How much capacity is contracted by the TSO?
- How much capacity is available as free bids?
- What do the aggregated curves look like?
- Is cross-border capacity available for imbalance netting?
- How much voluntary balancing volume is available?



Source: Montel Analytics (Montel EnAppSys Platform)

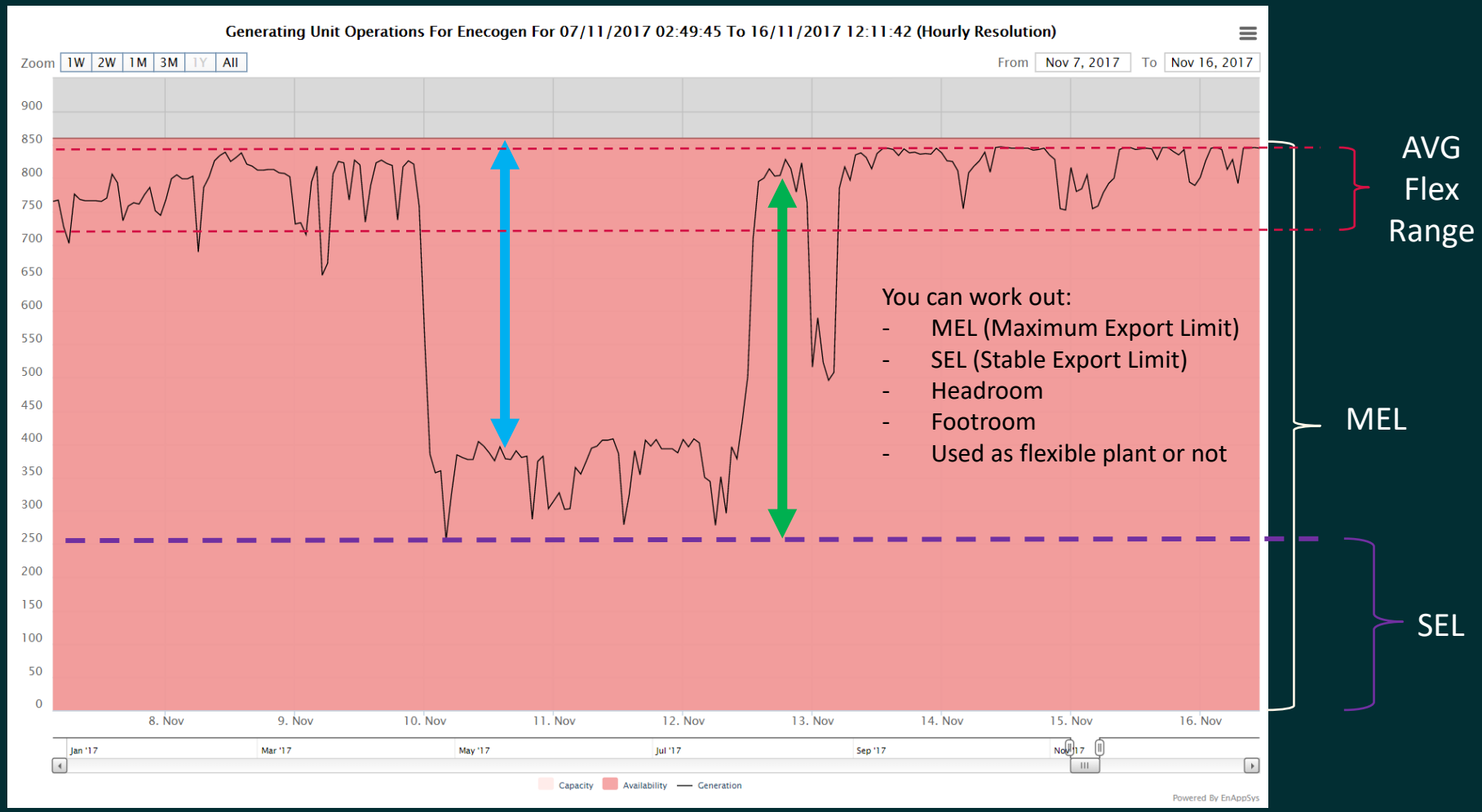
Spinning Reserve

- Spinning Reserve is the volume of upward and downward flexibility, available in online assets.
  - How much can an asset ramp up until it reaches max utilization
  - How much can an asset ramp down, before having to switch off
  - All within the limits of reserve obligations and commitments to the TSO
- Spinning reserve in a power system with only conventional power is usually abundant, unless all assets run at maximum output.
- In a system with a high renewable penetration, flexible assets get pushed out of the merit order, due to low marginal cost of renewables.
- Assets then alternate between run ‘as low as possible’ and ramping up to max-output to fill the gap left by renewables.

Headroom and Footroom Explained

By analyzing behaviour, you can collect power plant details and use this to calculate headroom and footroom.

Source: Montel Analytics (Montel EnAppSys Platform)

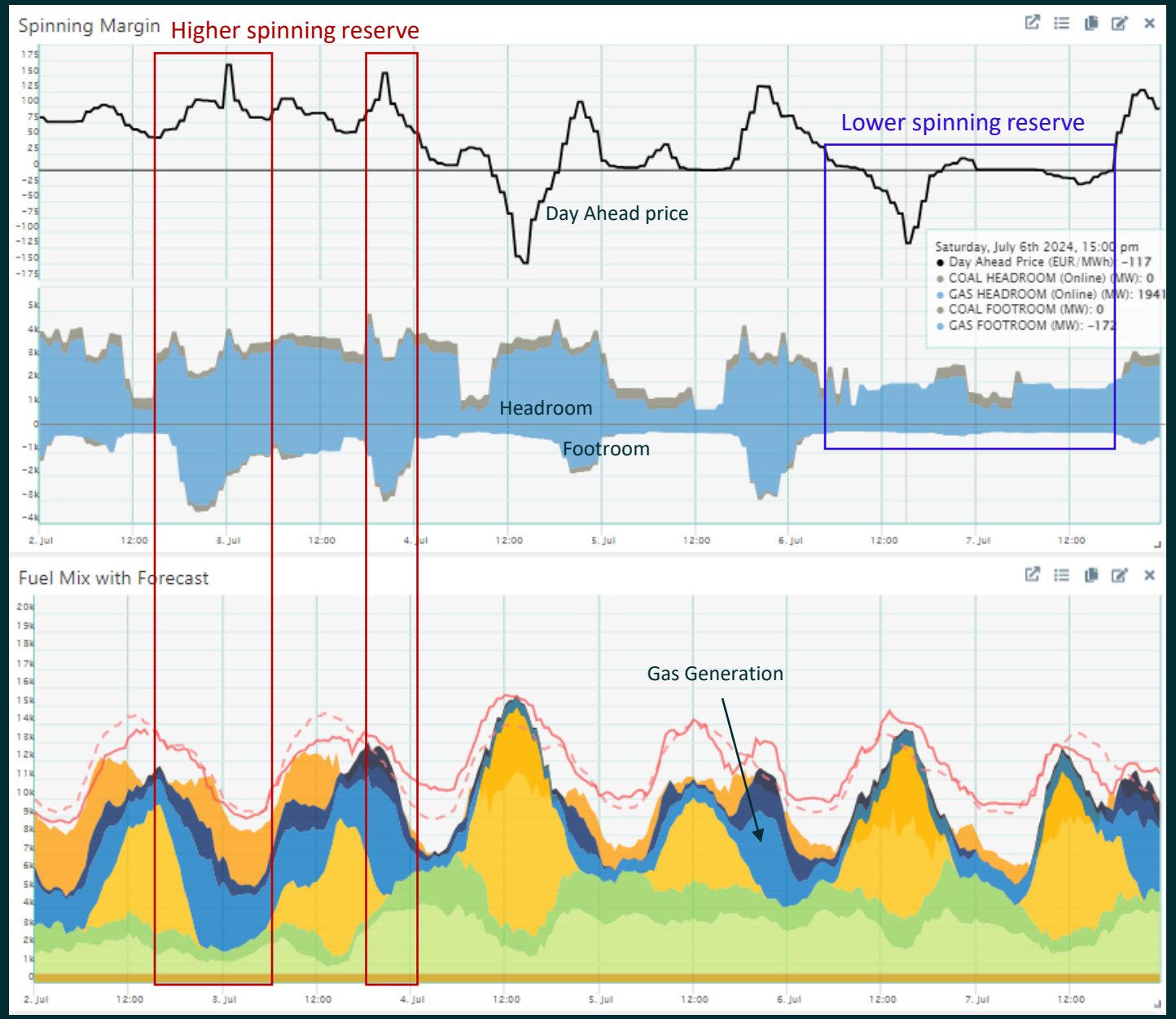


Headroom: Difference between running level and max capacity, also UPWARD MARGIN

Footroom: Difference between running level and min stable run-level, also DOWNWARD MARGIN

Spinning Reserve

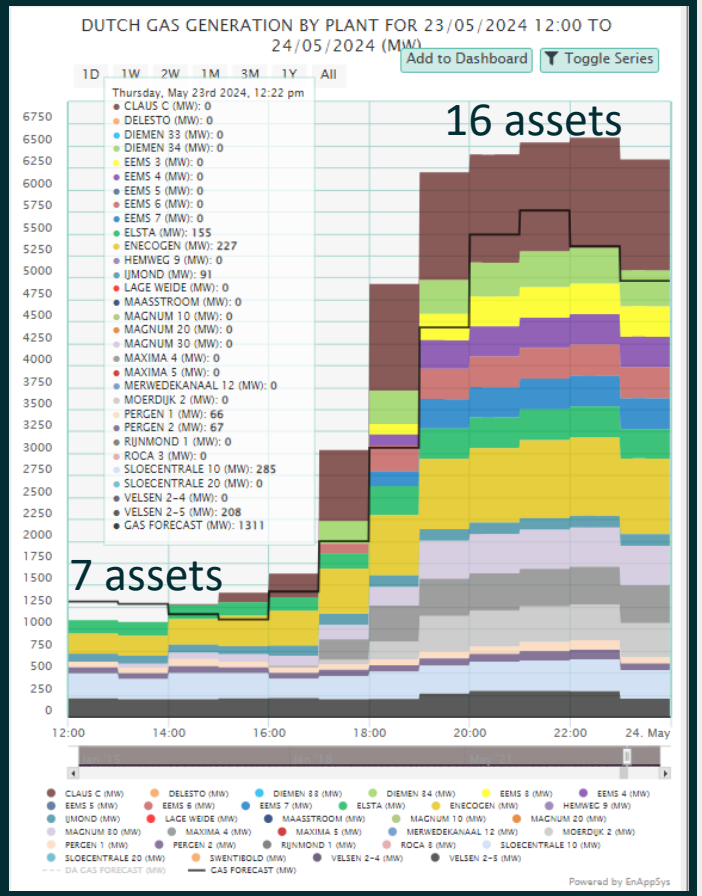
- When prices are low, gas assets still run (at low levels), to provide reserves. They compensate this with capacity income from FCR, aFRR markets.
  - Many assets will be offline.
- When prices are higher, and more gas is online, spinning reserve is higher. Gas assets make money by running.
  - Assets will spread their activity over Day Ahead, intraday, balancing markets, including ‘passive balancing’.

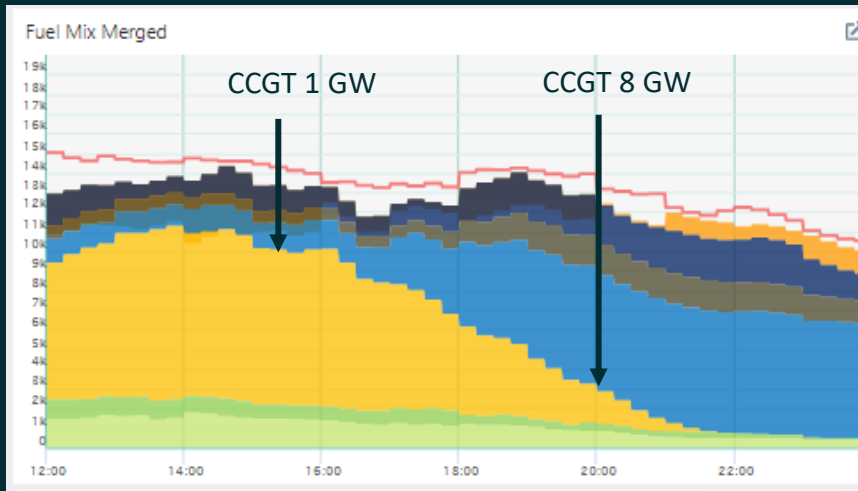


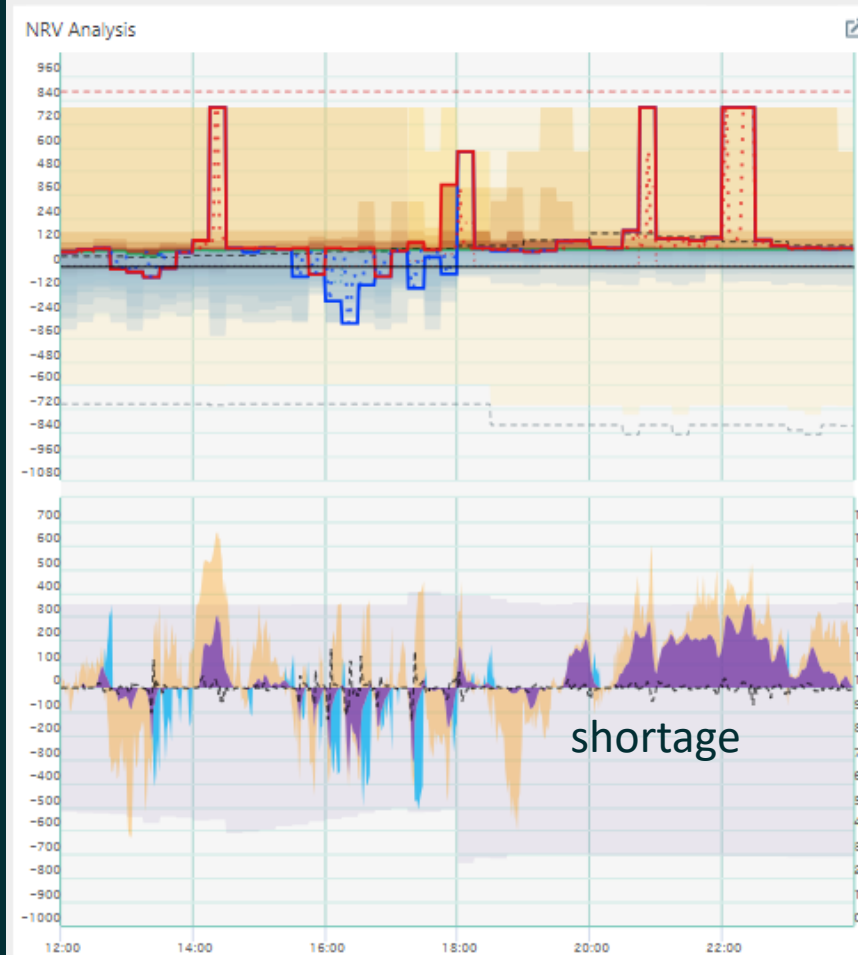
Source: Montel Analytics (Montel EnAppSys Platform)

Ramping Speed

- Especially on days with low conventional generation, ramping speed can create challenges for the market.
- In this example solar and wind ramp down by 8 GW in 4 hours.
- CCGT's go from 7 spinning assets to 16 spinning assets.
- Ramping of solar vs CCGT's results in mismatches 'along the curve'







Source: Montel Analytics (Montel EnAppSys Platform)

Interconnector Flips

- By far, the most extreme balancing prices occur in the first quarter hour of the hour.
- This is the time where the hourly profiles based on day ahead prices change in volume or direction.
- Physical assets on both sides of the interconnector must ramp to match the profile, which introduces a slight latency, visible in minutely activation data.
- As the volumes tend to be large, TSO's need speed to mitigate the impact and therefore activate more balancing reserves than visible.

Source: Montel Analytics (Montel EnAppSys Platform)

Belgium Specific Drivers

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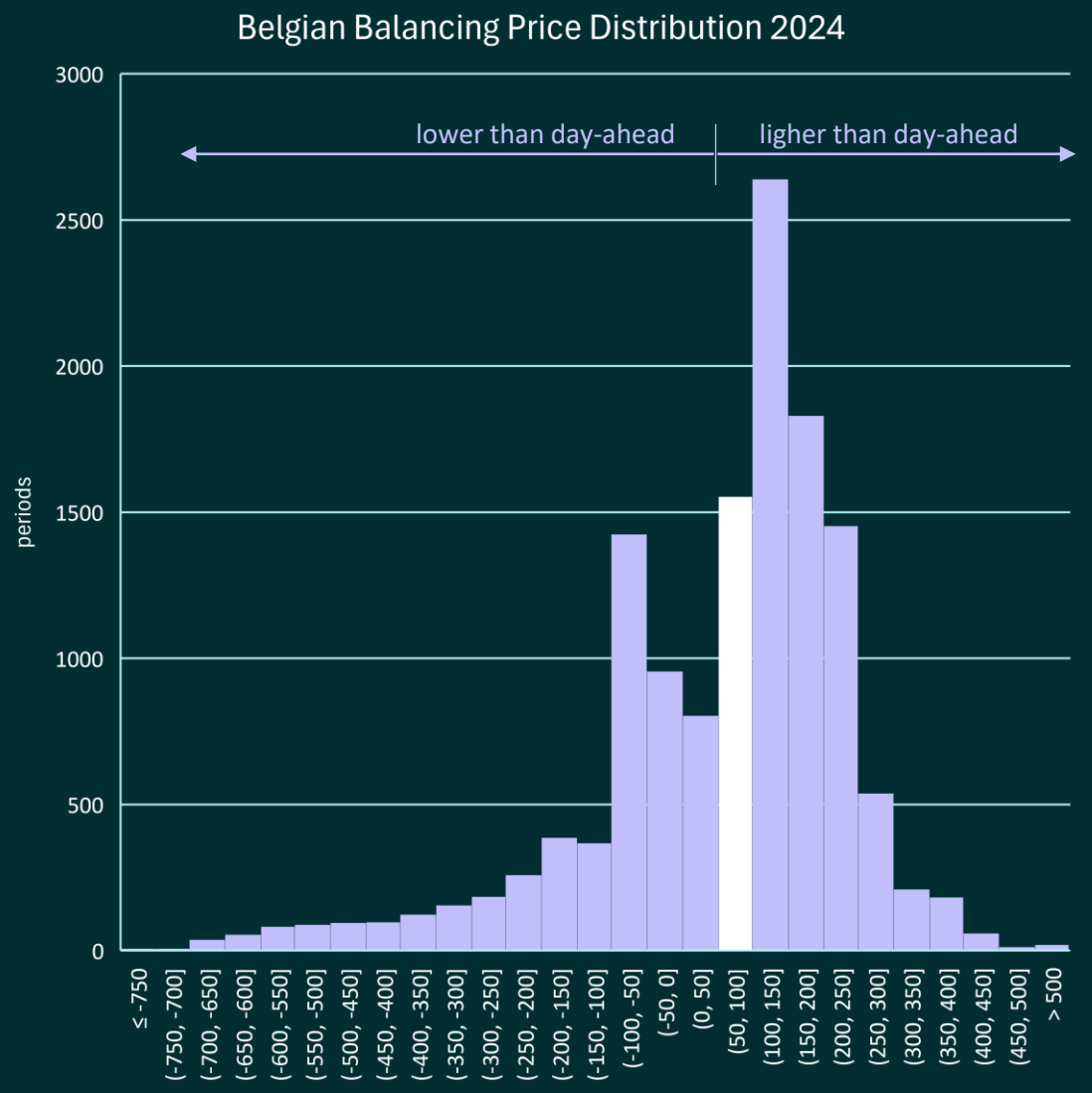
Belgian Peculiarities

- Low volumes of aFRR contracted
- Price distribution of balancing prices
- (Temporary) disappearance of gas flexibility
- Limited downward flex
- Import dependence

Belgian Volatility Drivers

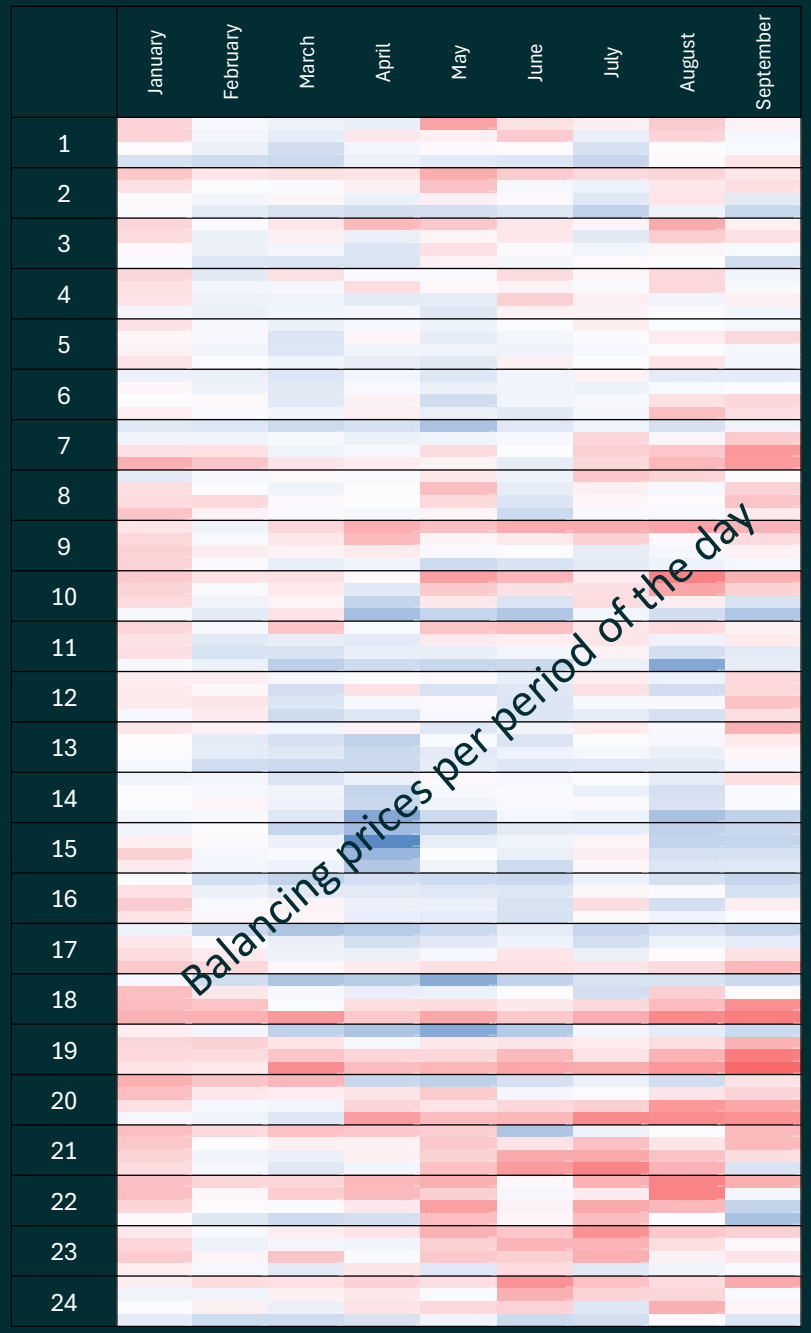
- Very little room for conventional power
  - Renewables
  - Nuclear baseload
  - French imports
- Downward prices go more extreme than upward (in 2024)



Source: Montel Analytics (Montel EnAppSys Platform)

Belgian Price Biases

- When solar peak is high, balancing prices go very low, often negative.
  - Low downward flexibility
- Morning and evening ramps see more upward risk
  - Ramping assets have little additional flex
  - When replacing renewables, there can be ramping speed issues



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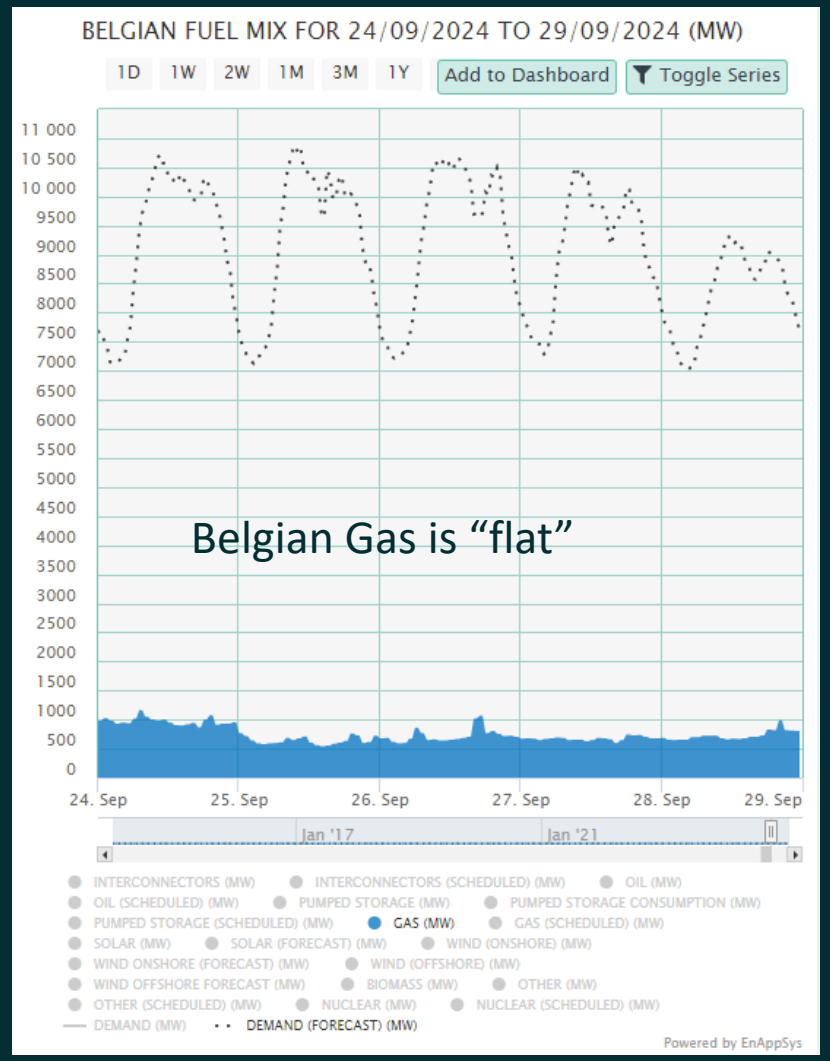
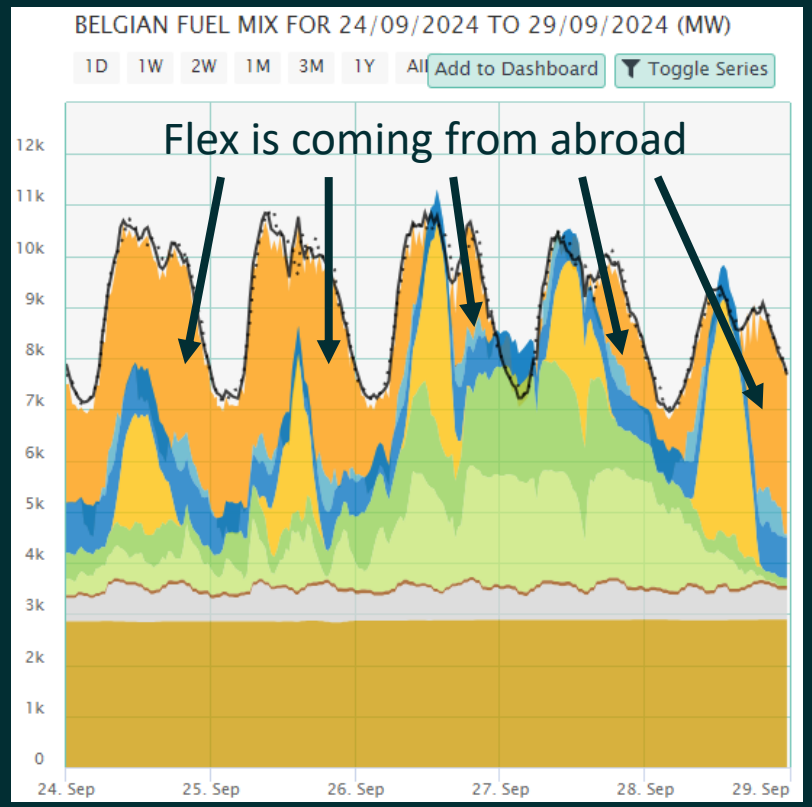
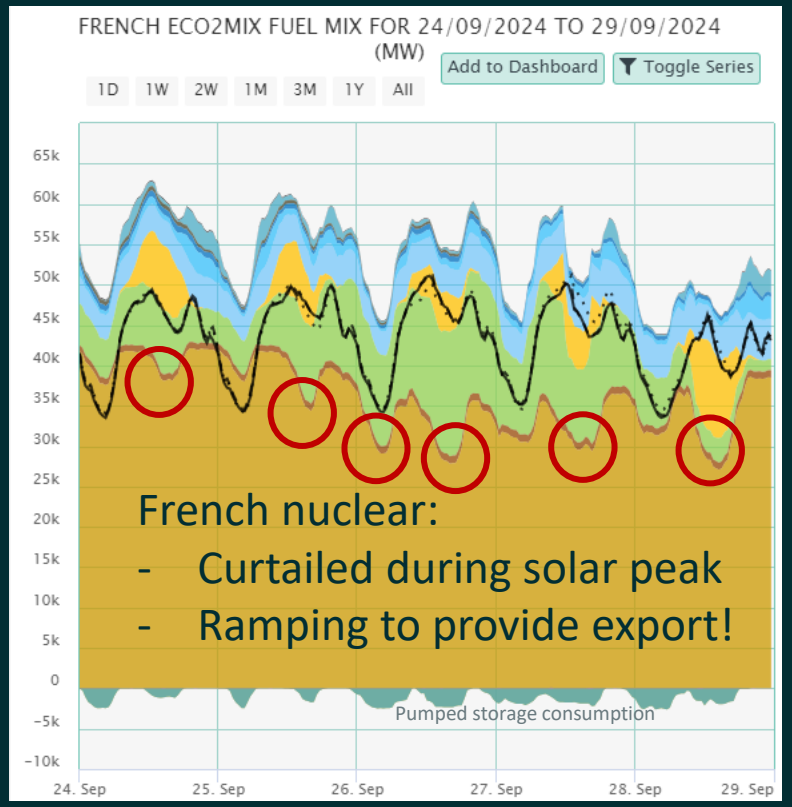
New Phenomenon!





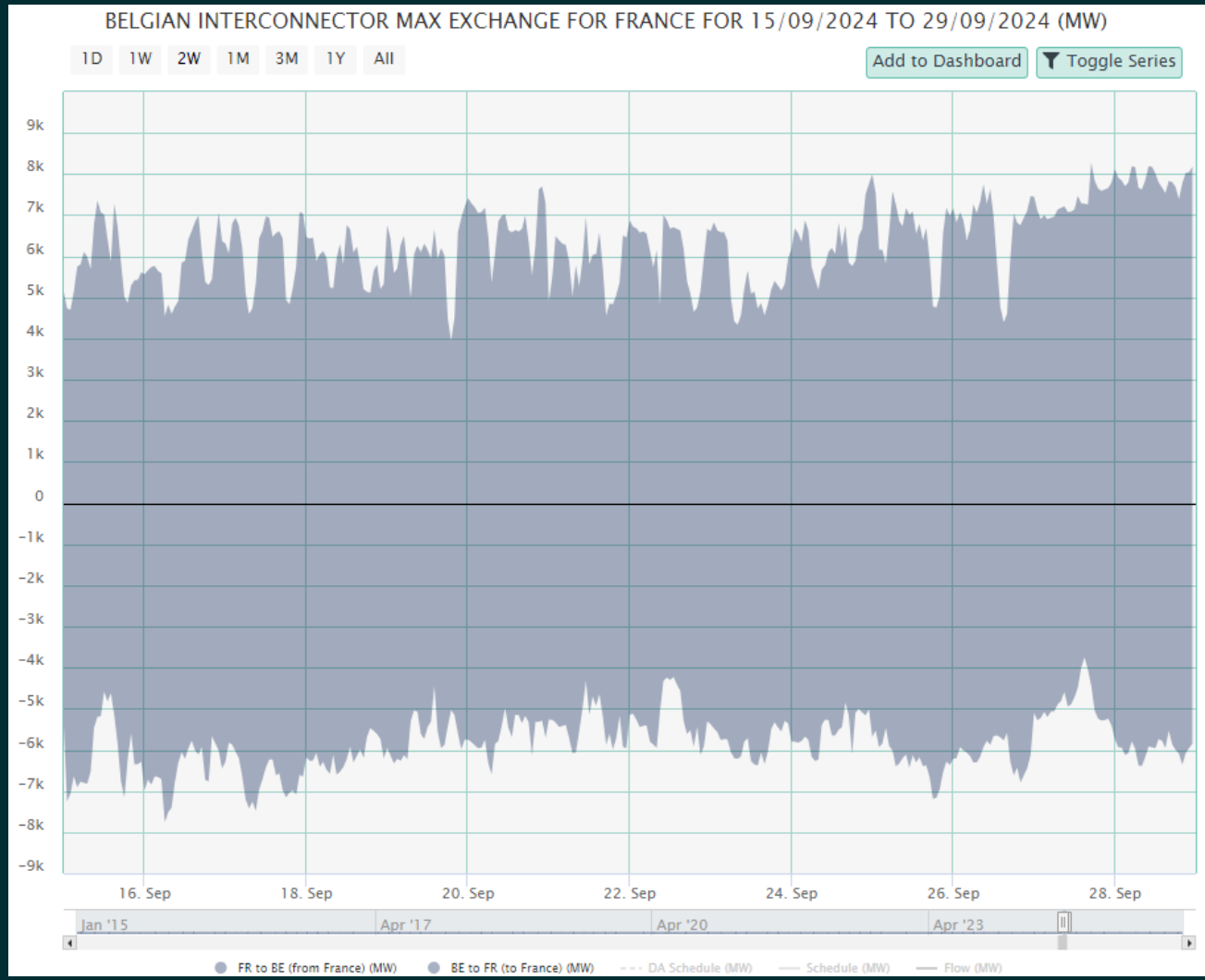


- As long as cross-border capacity is available, France can provide the flex that is needed.
- This keeps spinning reserve, and potential for voluntary balancing low.

Source: Montel Analytics (Montel EnAppSys Platform)

Cross-Border Limitations

- Capacity limitations on the border are a new insight into what can drive peak prices for morning and evening ramp.
- Strong limitations can decrease the volume of imports left for intraday and therefore drive volatility.
- Note that these are Max-Exchange numbers, which are an indication of shape, rather than volume limitations.



Source: Montel Analytics (Montel EnAppSys Platform)

Netherlands Specific Drivers

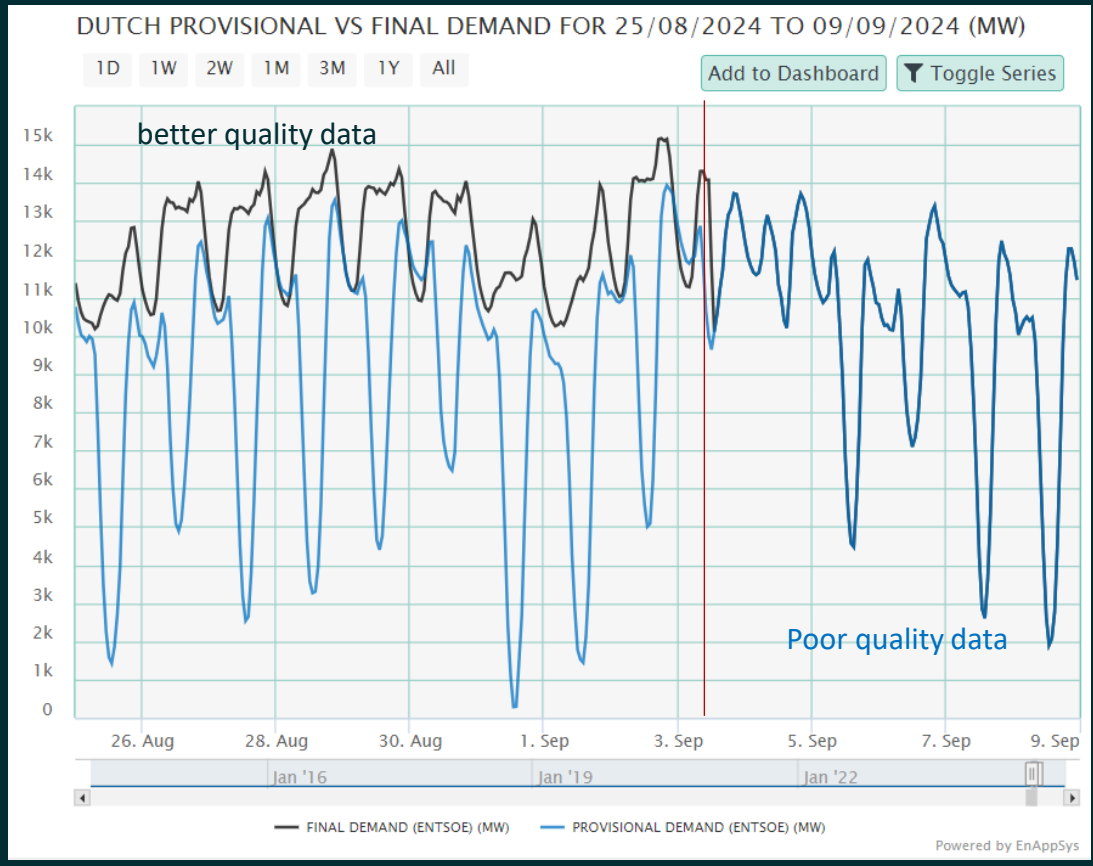
Dutch Peculiarities

- Data quality issues on public sources
  - Demand
  - Renewables

- Dual pricing in balancing markets
- High volumes of voluntary balancing (passive balancing)
- Speed requirements driving prices to end of merit-order
- Net metering rule (not in this webinar!!)

Example: Demand data

- Poor quality data gets published
- After 30 days, this data gets overwritten by better quality estimates
- Solution: Model data to align with the better quality data



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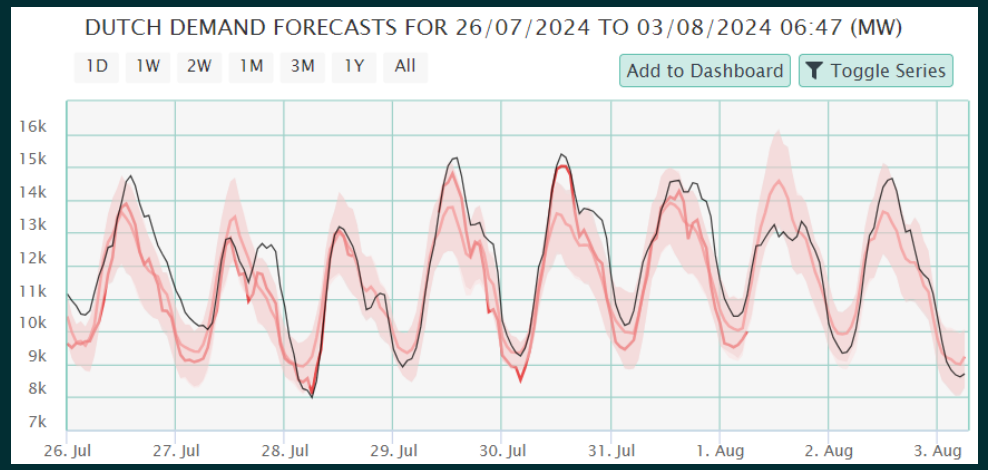
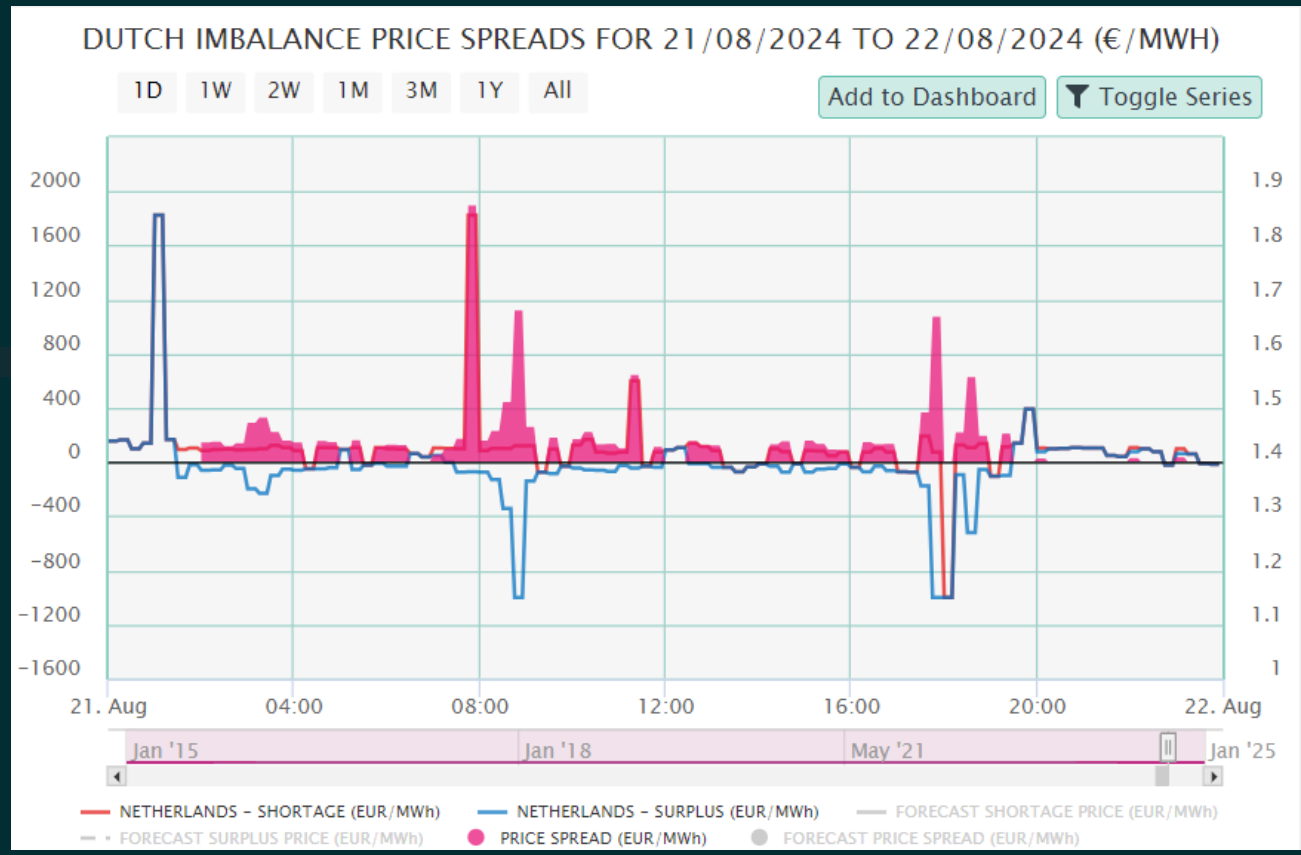


Despite feedback lagging 30 days, the model produces better data than TSO publication.
Crucial for monitoring deltas.

Dual Pricing

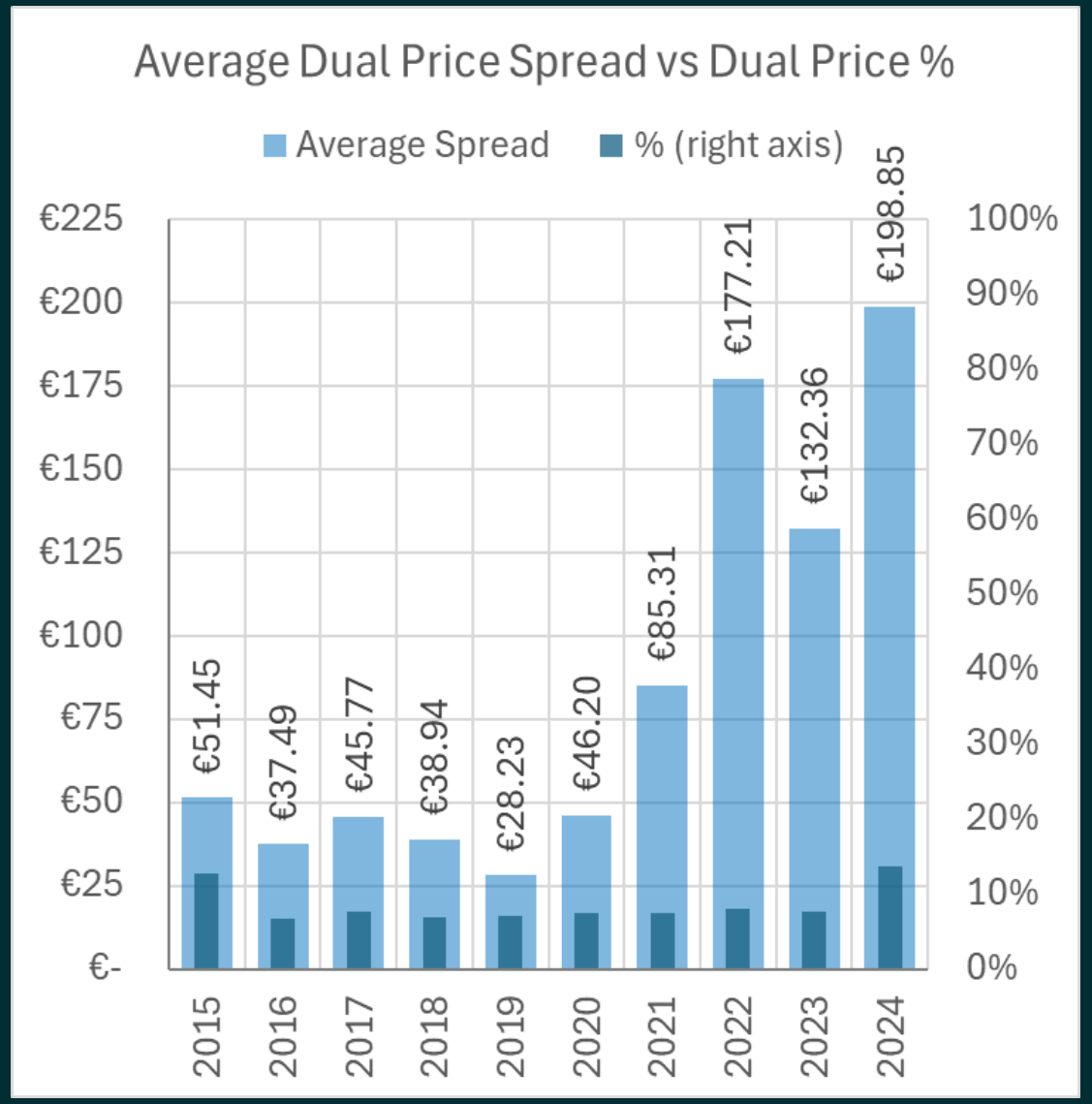
- Dual pricing is a feature of the Dutch balancing market
  - Designed to limit ‘overshoot’ in voluntary response to price incentives
  - With low conventional power and high wind, wind assets provide voluntary down volume.
- Dual pricing increases balancing risk.
- Market seems to respond badly to dual pricing as a disincentive to overshoot.
- As a market party you need to be on top of this.

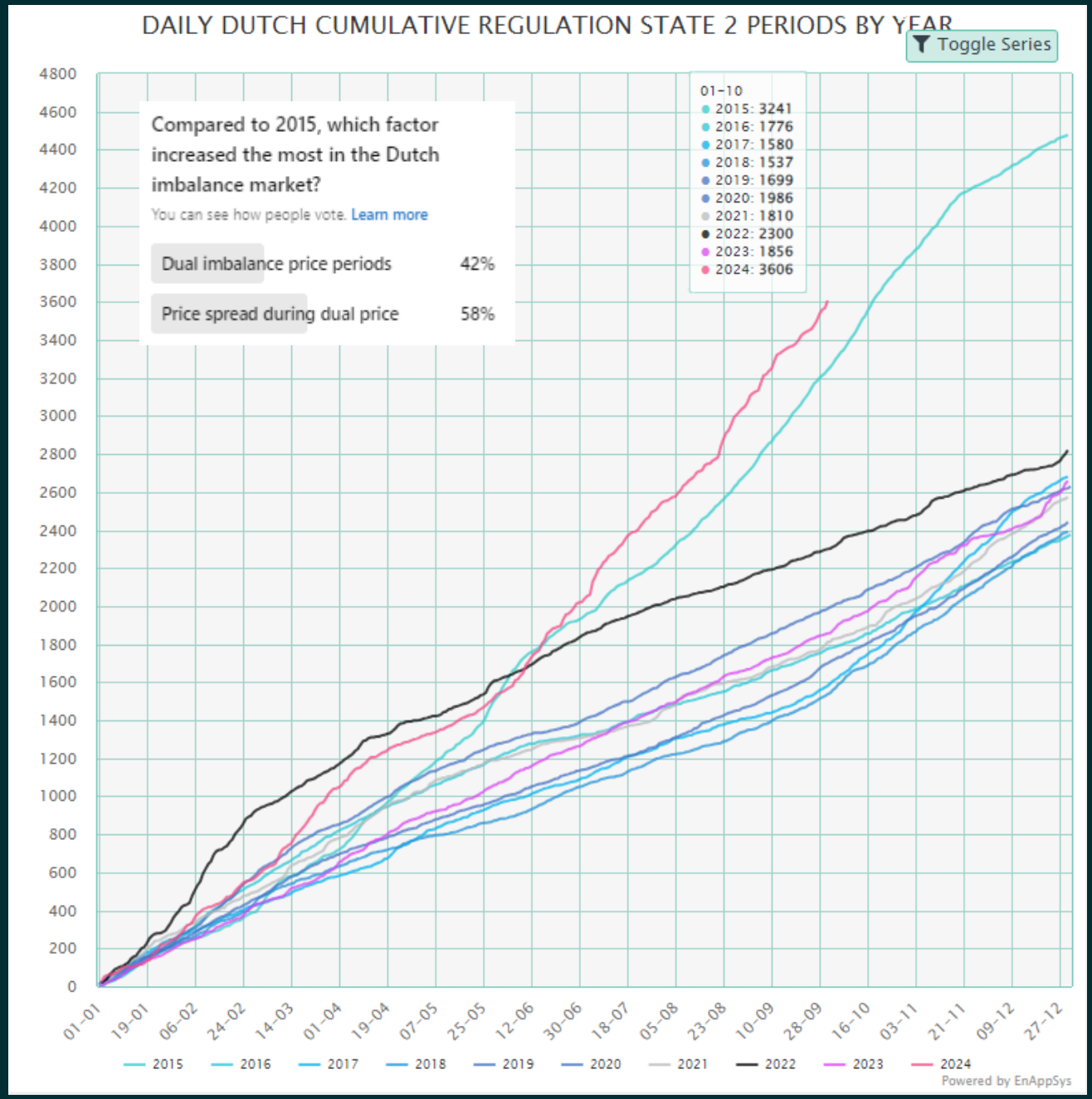


Source: Montel Analytics (Montel EnAppSys Platform)

Netherlands Specific

Dual Pricing History

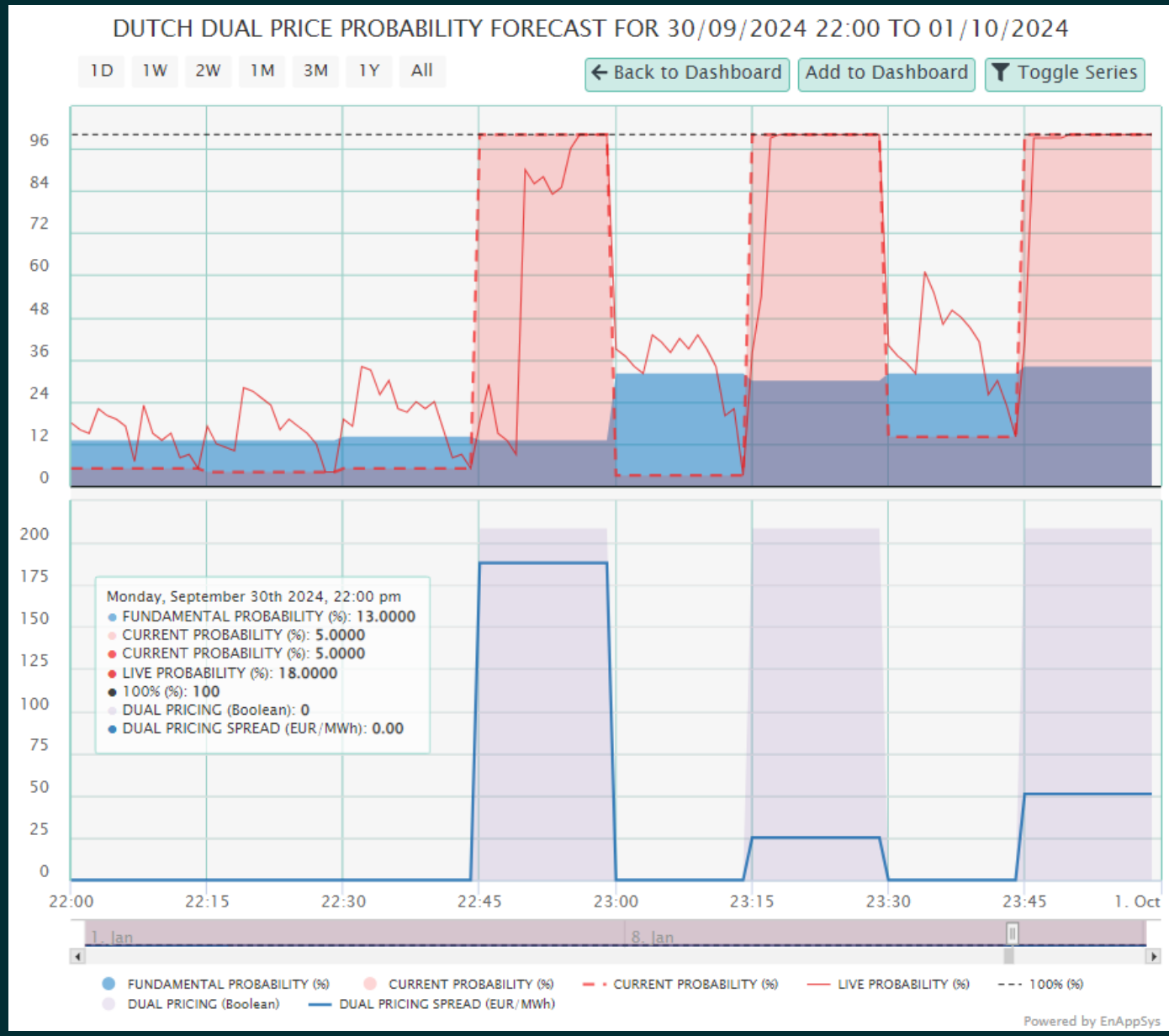




Source: Montel Analytics (Montel EnAppSys Platform)

Dual Pricing Risk

- Live calculation of balancing price and estimating the balancing risk, based on real-time data.
- Fundamental risk modelling, to deal with the conditions under which dual pricing is more frequent.
- Fundamental risk supports trading decisions.
- Live risk support dispatch decisions

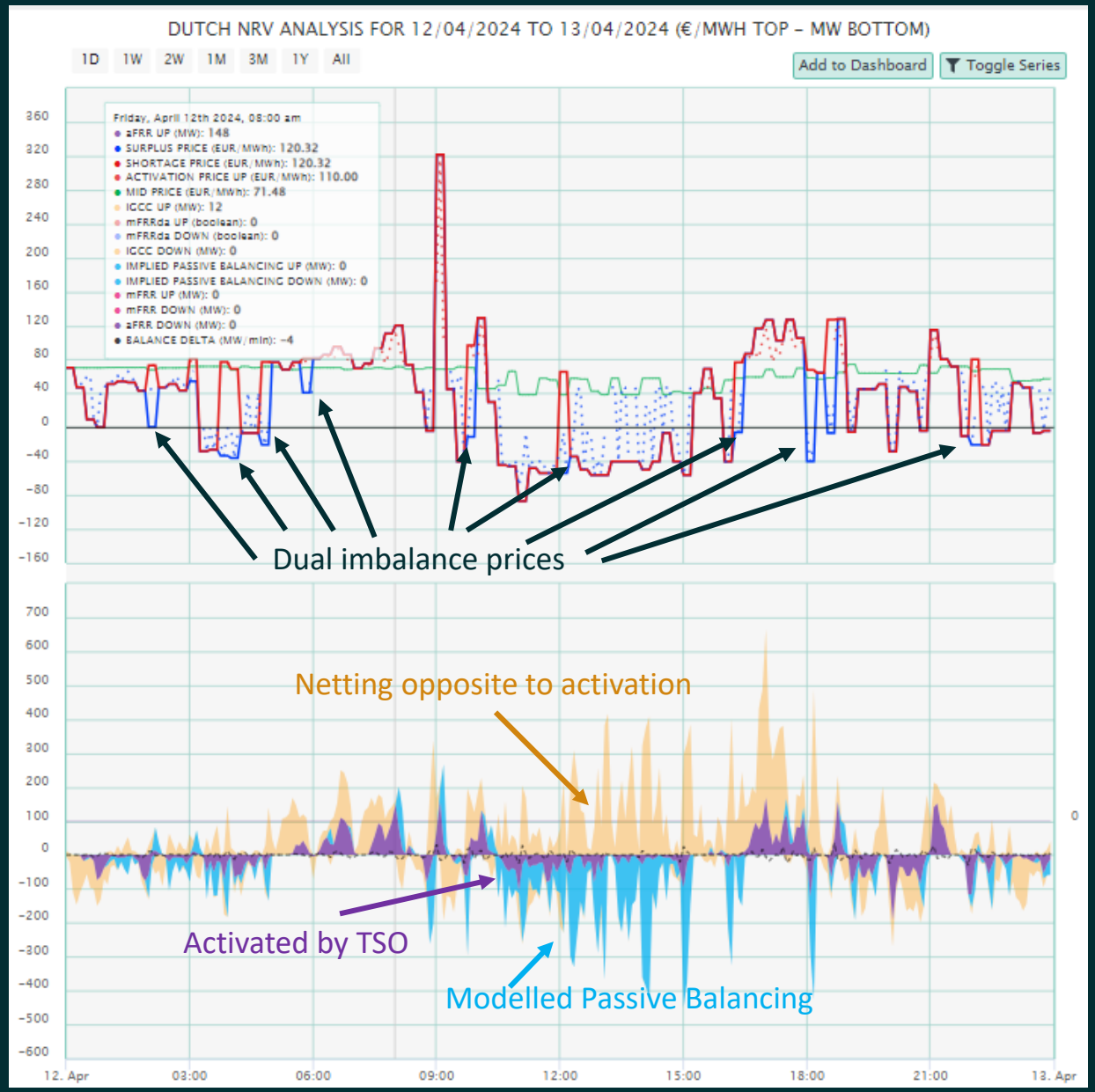


Source: Montel Analytics (Montel EnAppSys Platform)

Passive Balancing

- Thanks to strong price incentives, the Dutch balancing market traditionally sees a high volume of ‘passive balancing’.
- This volume is now so great that it adds to the dual pricing risk.
- This means you will need a way to follow, how this evolves.
- The current non-responsiveness to dual pricing is remarkable!

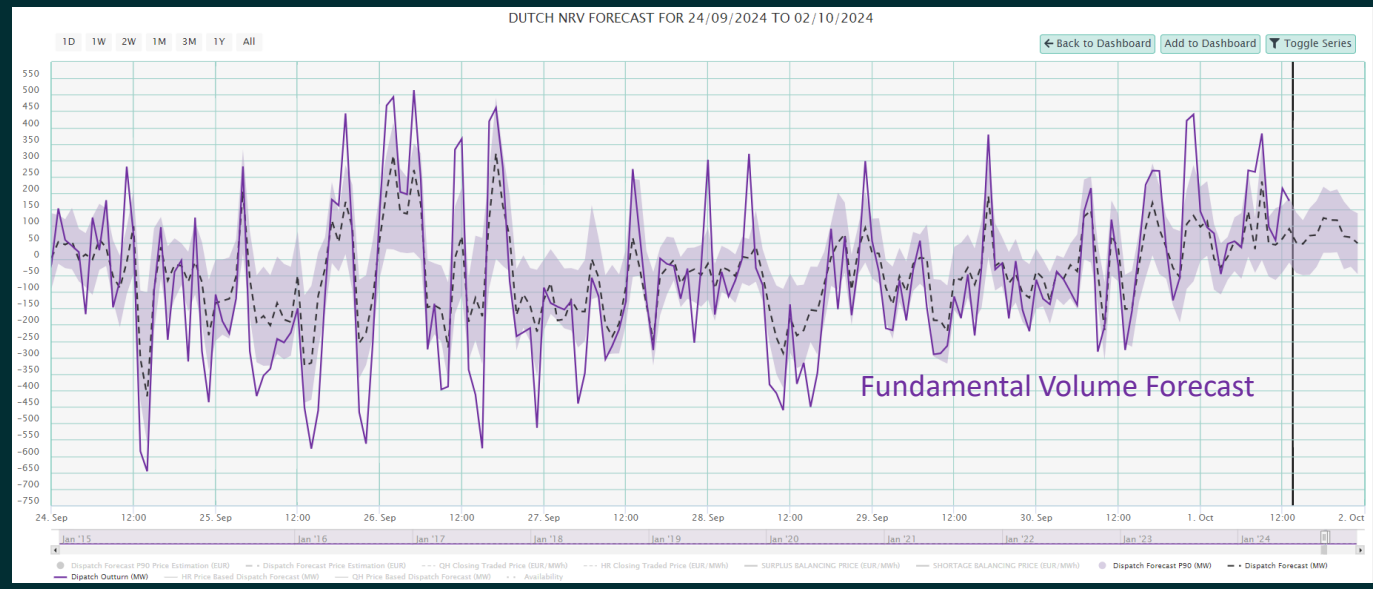
- Balancing risk is increasing

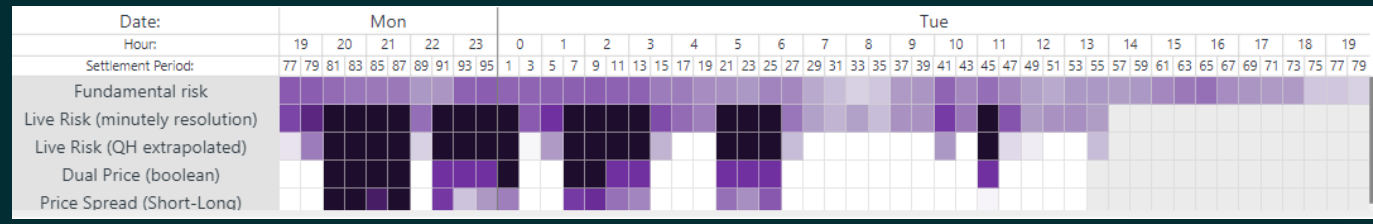


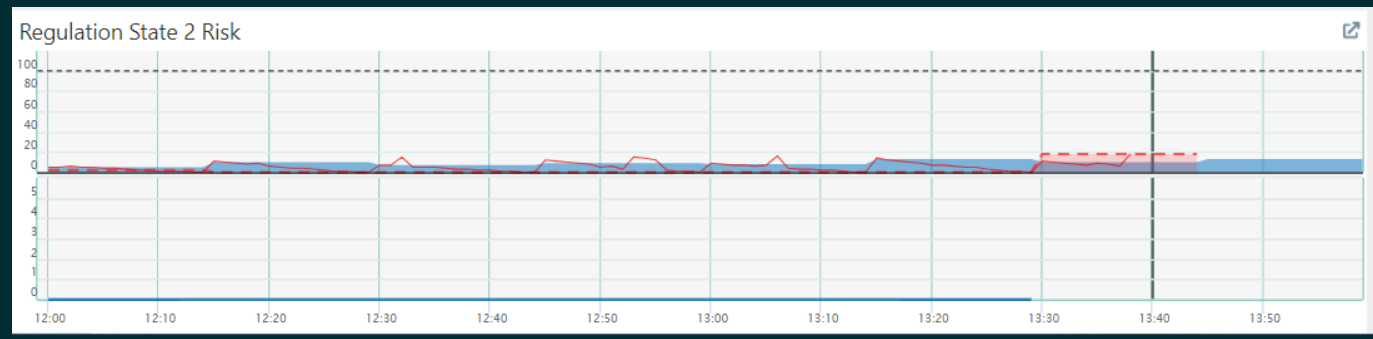
Source: Montel Analytics (Montel EnAppSys Platform)

Balancing Risk

- Fundamental balancing forecasts are possible in many markets.
- The Dutch market is no exception, however…
- Balancing prices can be extremely volatile, depending on **speed requirements** and the availability of voluntary balancing volume.
- The combination of a volume forecast and a dual pricing risk indicator, with real-time continuous market information, provides input for trading and asset dispatch strategies.



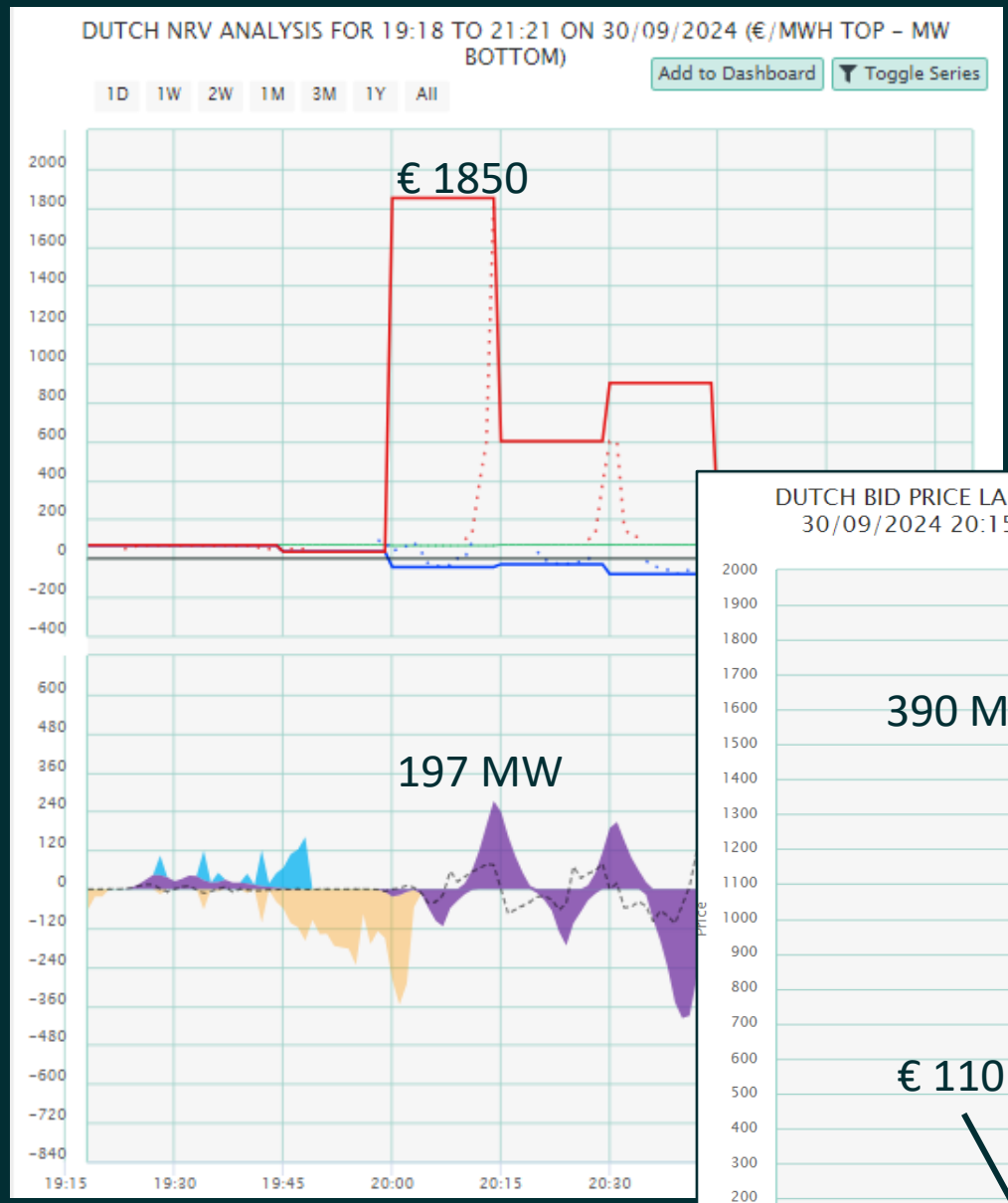


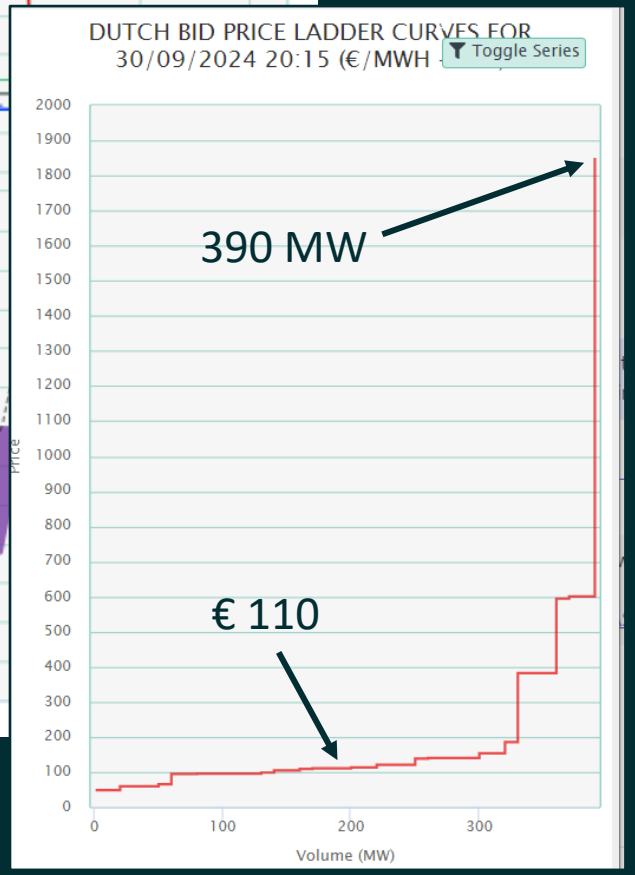


Source: Montel Analytics (Montel EnAppSys Platform)

Need for Speed

- If the TSO sees a disturbance in the grid, that may have a large effect on grid stability, it needs to respond quickly.
- In this case it can activate the whole stack.
- If the disturbance is solved, it may deactivate reserves, before they reach full output, making it look like the activation price does not match the visibly activated volume.





Example:

Actual: 390 MW activated @ € 1850

Visible: 197 MW, stack price would be € 110

Source: Montel Analytics (Montel EnAppSys Platform)

Navigating Volatility

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Predicting Volatility

Volatility announces itself through a sequence of forecasts and feedback loops.

If you are able to read the signs, you will be able to navigate successfully.

There is a lot to watch out for, but setting up the right ‘trading cockpit’ will allow you to make the right decisions more easily.

Road Signs

- Weather forecasts
- Demand & Generation forecasts
  - Ramps
  - Spinning reserve
  - Residual load
- First feedback loop: Ancillary Services Auctions
  - Prices highlight scarcity or abundance in each direction
- Second feedback loop: Day Ahead Auctions
  - Sensitivity analysis tells you about symmetric or asymmetric risk
- Third feedback loop: Intraday Auctions (too illiquid for now)
- Fourth feedback loop: Aggregated balancing curves
- Finally: Continuous intraday trading

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THANK YOU!

Contact us for more...