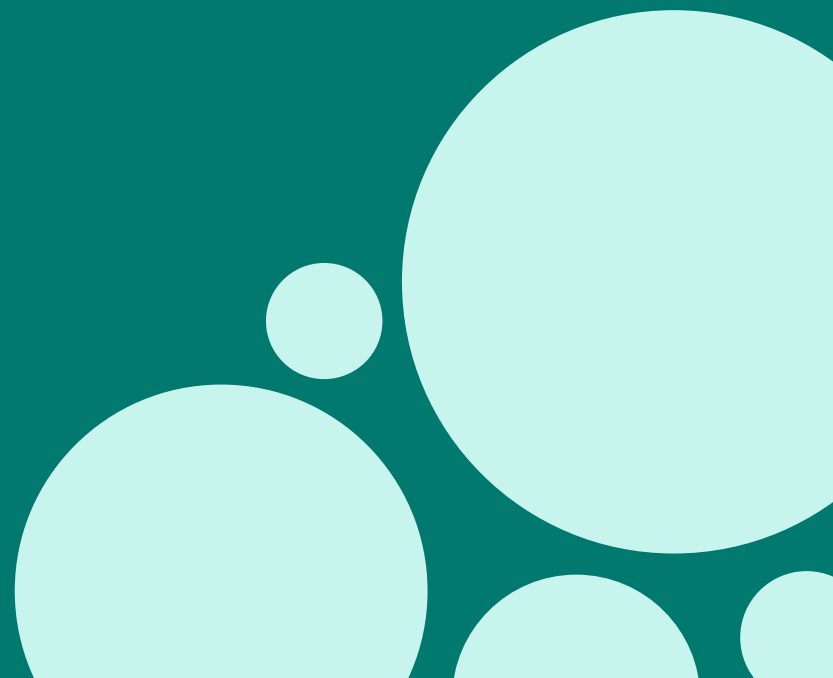




MONTEL Analysis

German Energy Day 2024

Impact of 2023 Renewables Boom on
Summer Spot Prices 2024



Agenda

*Renewable
Growth
Stats*

*What
happened at
the
neighbours?*

*Looking
back at
2023*

*Simulation
Results, 2023
with
additional
capacity*

*Derived
Assumptions,
Extrapolating
behaviour and
impact if
unchanged*

*Methods used,
data sources
and approach*

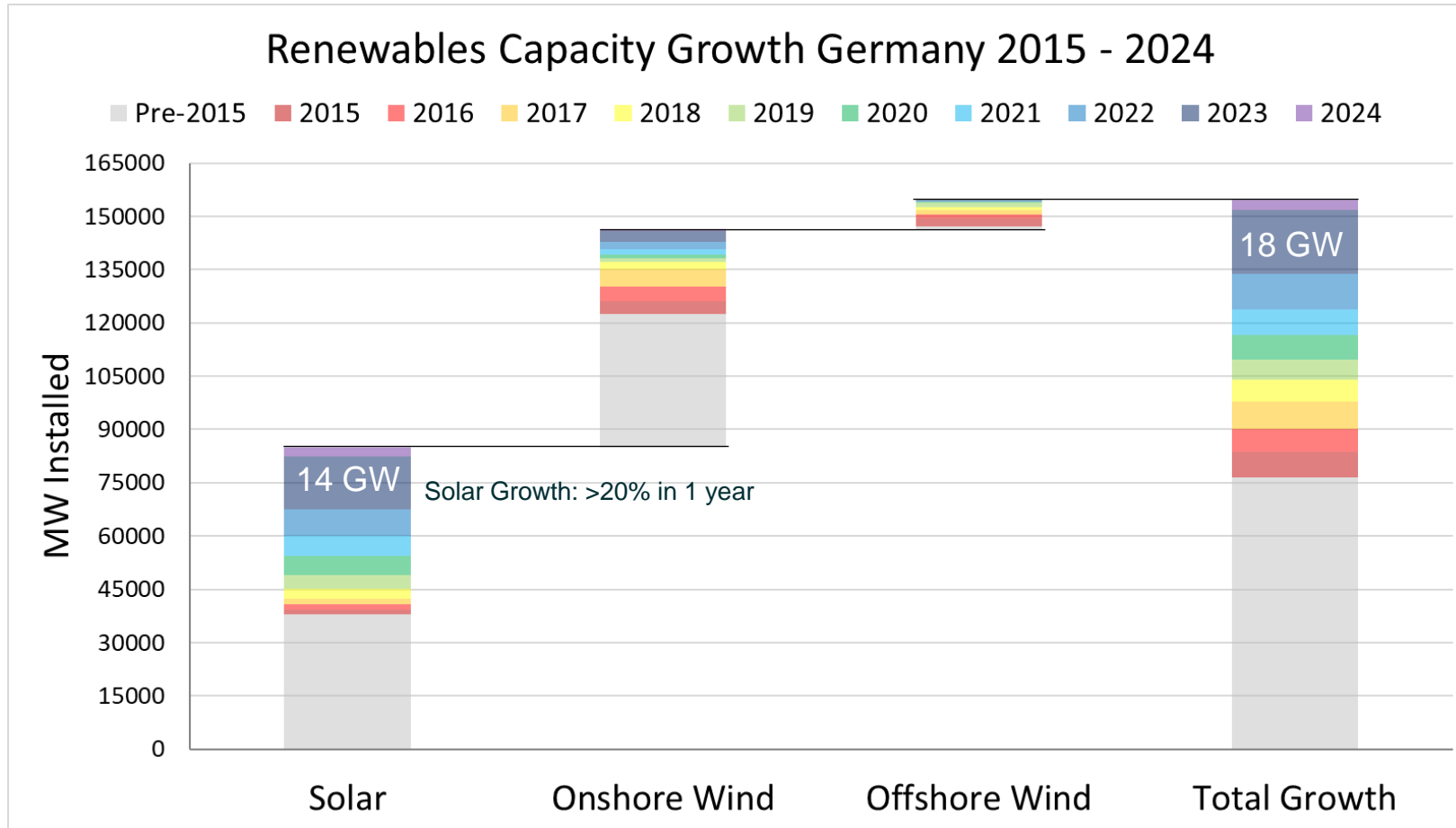
*Expectations
and
Conclusions*

Renewable Growth

Some Statistics to Set the Scene



The 2023 Renewables Boom



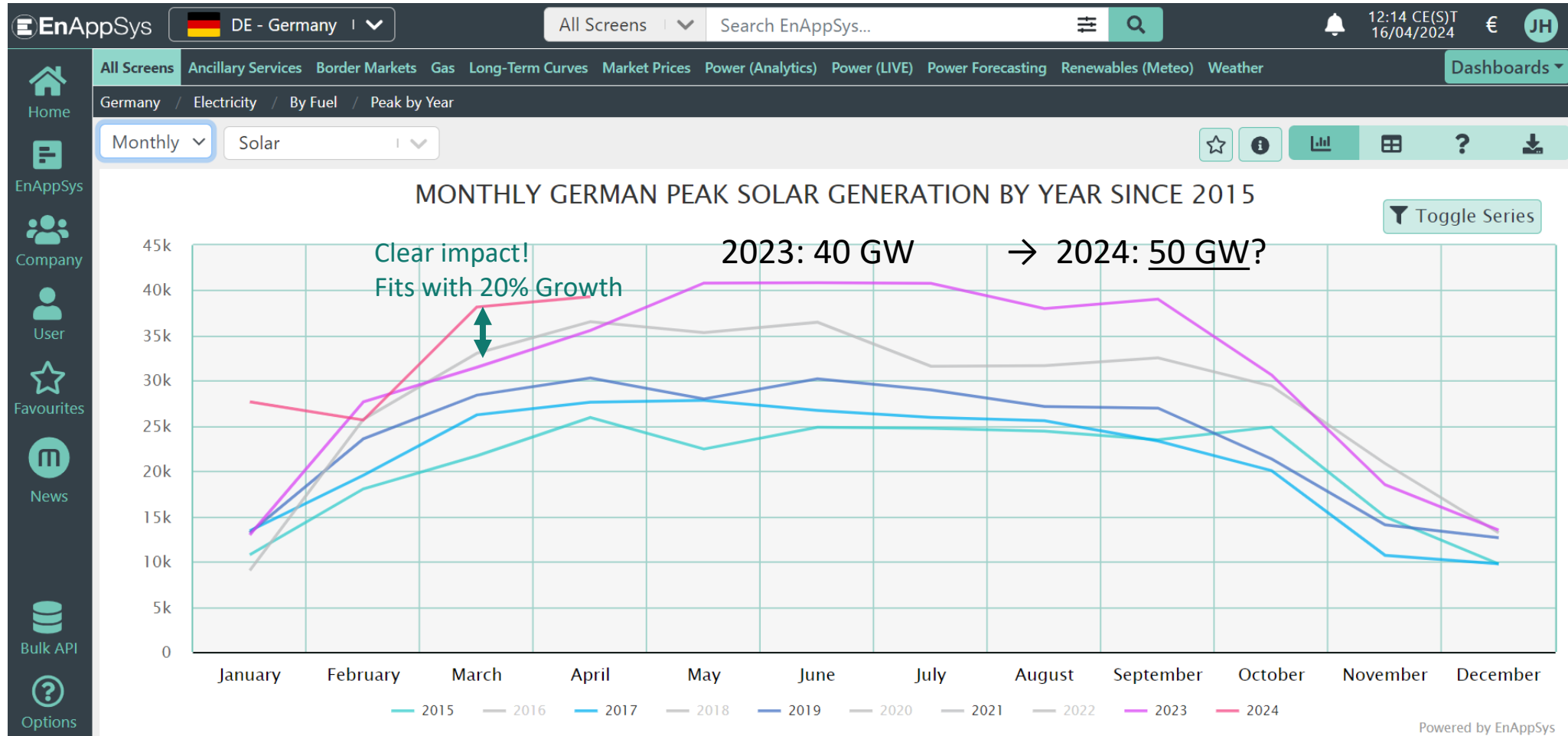
German Renewable growth has never been higher than in the past year

Renewable growth was **100% higher** than in the second fastest growth year.

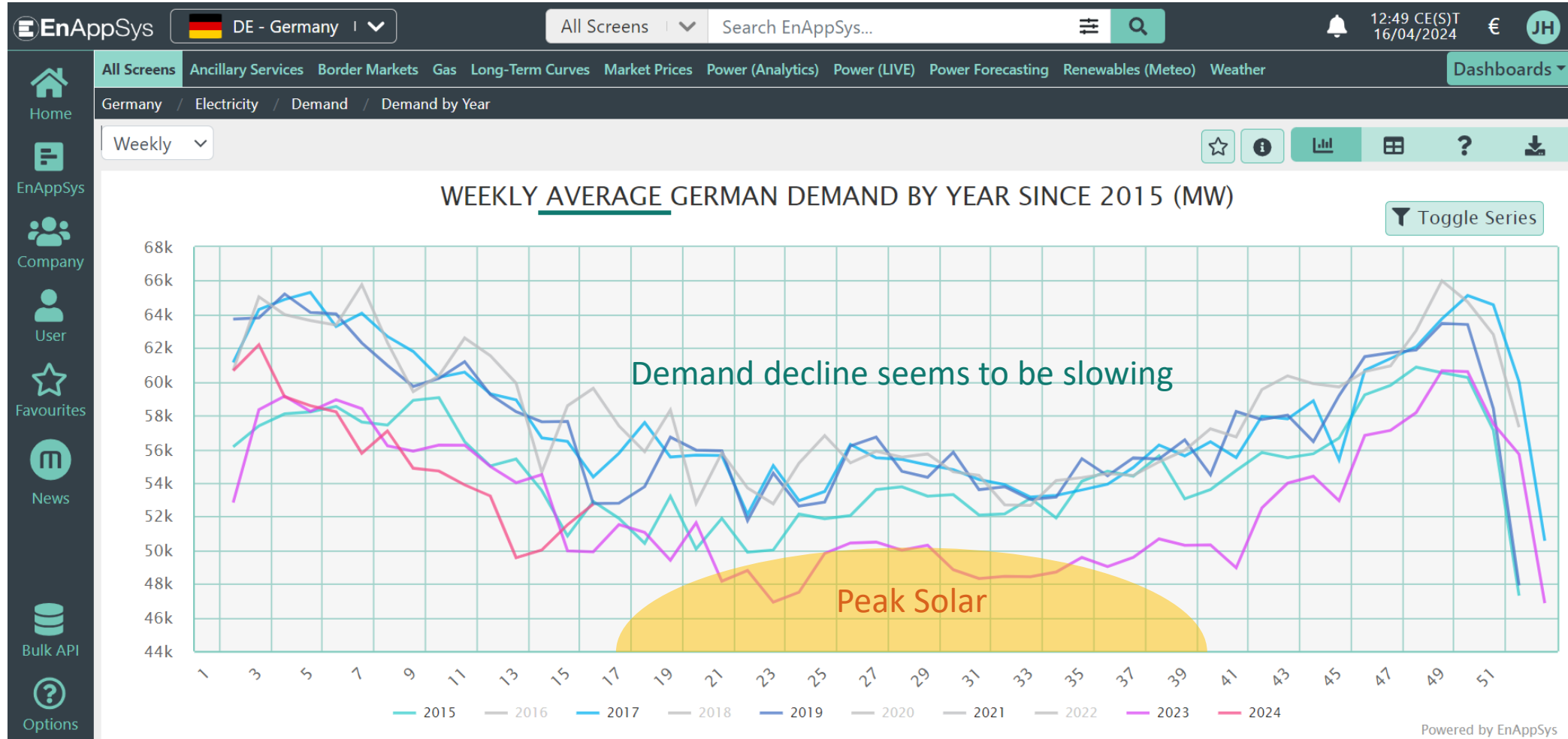




Peak Solar Evolution



Demand Evolution



Renewable Growth

Around Germany



Renewable Growth Around Germany

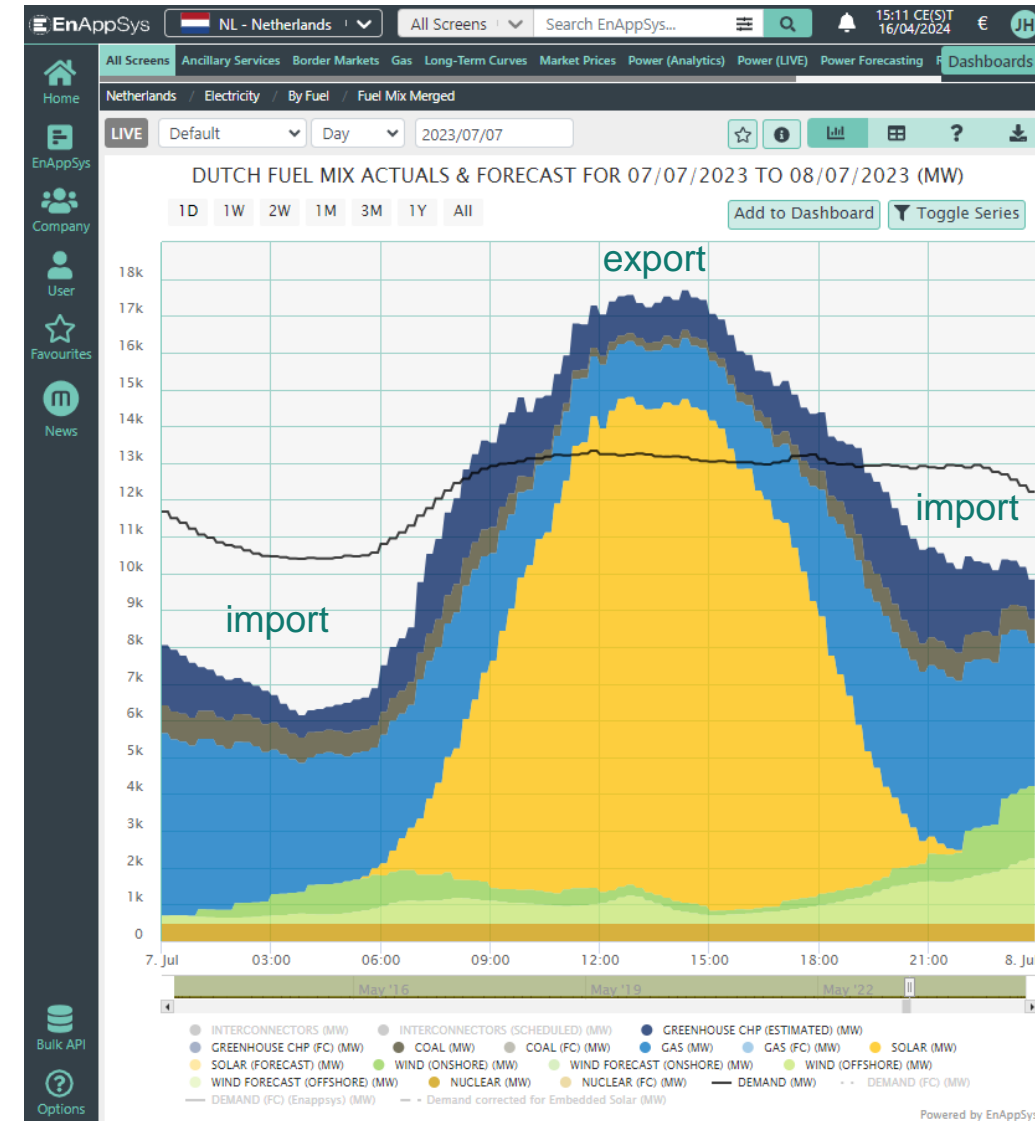
- Countries around Germany have added around:
 - 16 GW of Solar
 - 10 GW of Wind
 - Combined with Germany this adds 30 GW of Solar and 13 GW of Wind in the region around Germany
- The biggest growth in Solar is seen in Netherlands (4 GW), Poland (4 GW), France (3 GW).
- The biggest growth in Wind is seen in France (1.8 GW) and Poland (1.5 GW)
- These volumes also enter the Coupled Market, with demand being at similar levels compared to last year.





Impact of Renewables on Flexible Generation

- As renewables exceed demand during solar peak. Conventional assets run at minimum level, provide **limited flexibility** at a **high cost**.
- For the evening peak and during the night, **conventional power is still needed**.
- Sharp **ramps** and **start-stop** schedules.
- Surpluses occur in many countries at the same time, affecting capture prices and introducing a **downward scarcity component** to markets.
- The scarcity reverses for the **morning** and **evening peaks**.



2023 - Retrospective

Quick Analysis



2023 was the year of negative prices

Country GERMANY

	2018	2019	2020	2021	2022	2023	2024
Q1	70	89	128	39	14	23	35
Q2	34	53	84	66	24	79	36 *) until 24/4/2024
Q3	3	26	34	23	2	89	0
Q4	27	43	52	6	8	109	0
Full year	134	211	298	134	48	300	71 *) until 24/4/2024

Spring Storms

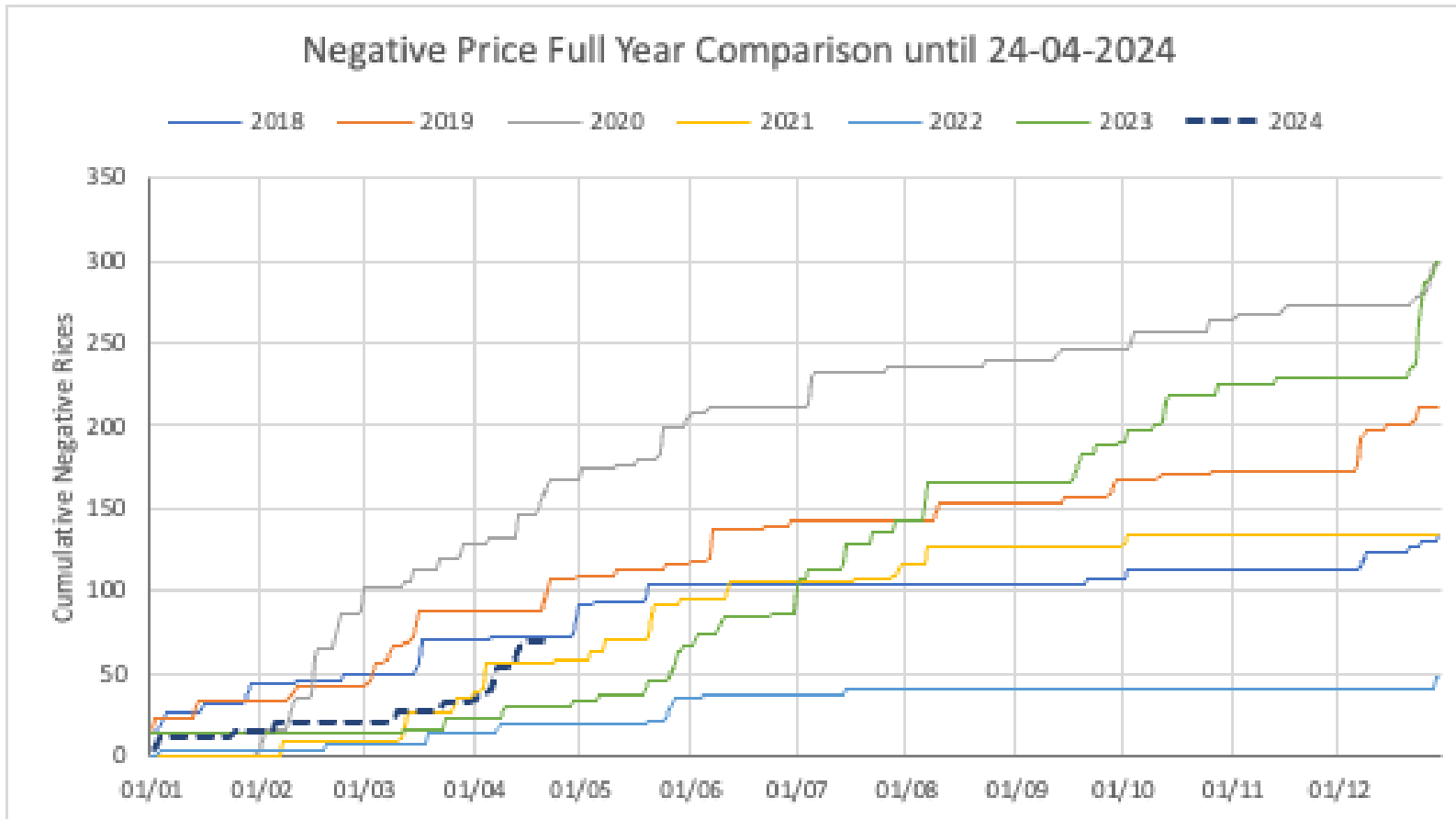
Covid:
demand + solar
and wind driven

From mainly wind driven to solar and wind driven
negative prices





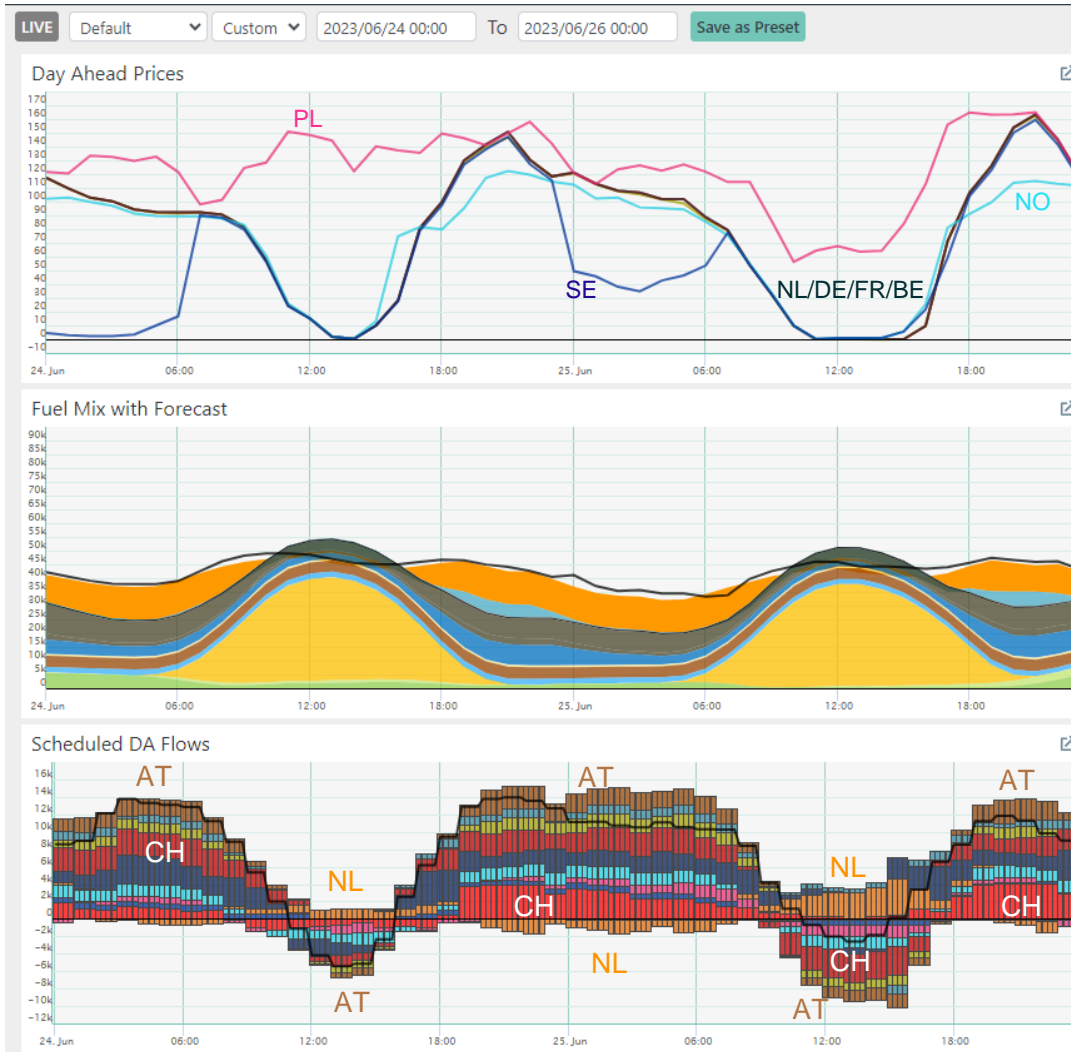
Analysing Cumulative Negative Prices over the last Years



- 2020 was exceptional
- 2018 and 2019 saw very low gas prices
- 2023 saw the fastest increase in negative prices in May and September.
- 2024 is well ahead of 2023
- Current period sees a large increase due to solar



2023 – Typical Summer Patterns (1)

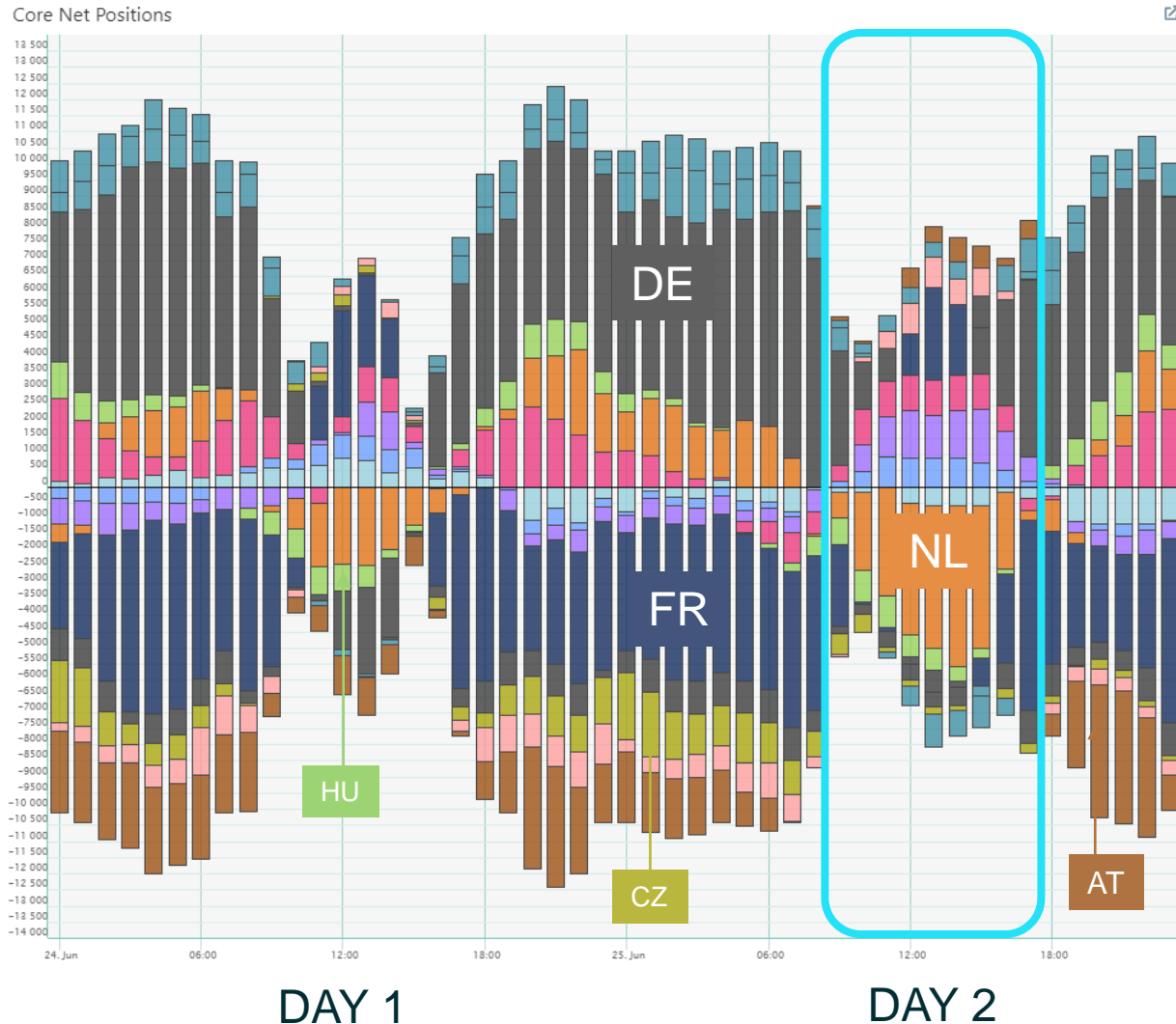


- Solar pushes conventional out-of-merit
- In the evening and night, lots of imports
- During solar peak, imports from Netherlands, feeding further into Europe
- Note the counter positions of the **Netherlands**, exporting into Germany during solar peak and importing during evening peak.
- The Alpine countries and Nordics, acting like a battery for Germany



2023 – Typical Summer Patterns (2)

CORE Flow Based Import/Export

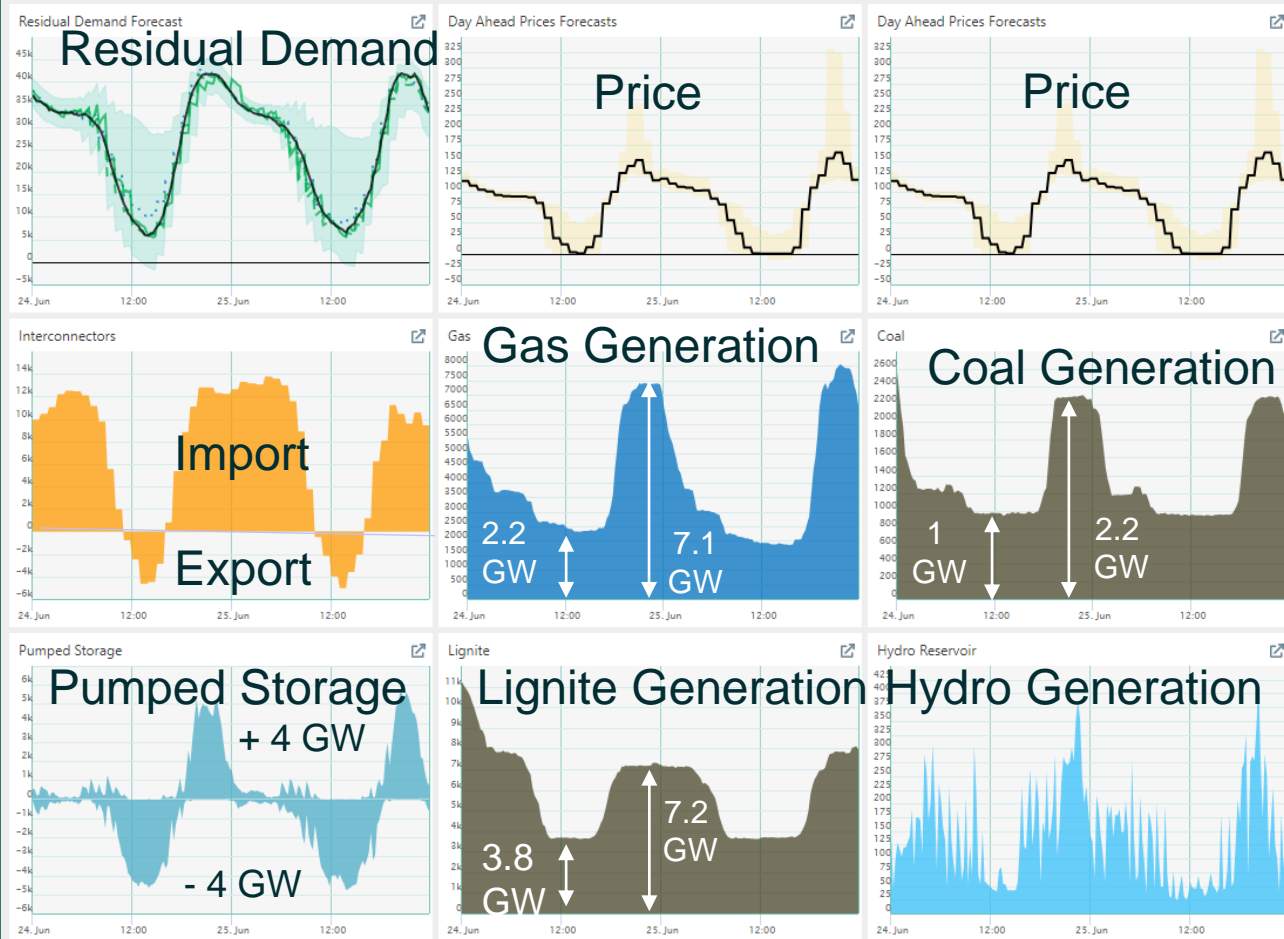


- Germany, Netherlands and Hungary see the largest solar-driven exports
- France, Austria and Czech Republic providing the most support to the continent during evening peak and night.
- Note on Day 2, when Netherlands exports more, Germany's net position is nearly "flat".





2023 – Typical Summer Patterns (3)



- **Flexibility** comes from import/export, pumped storage, gas, coal, lignite and hydro.
- **Must-run** conventional seems to be around **7 GW** of fossil fuels.
- The flexibility to satisfy evening peak is around **10.5 GW** of fossil fuels.
- **Pumped storage** provides another massive **4 GW** of flex in both directions.
- The down ramp before solar peak is gradual, but for the evening peak nearly **15 GW** of flex is ramping in the space of roughly 3 hours.

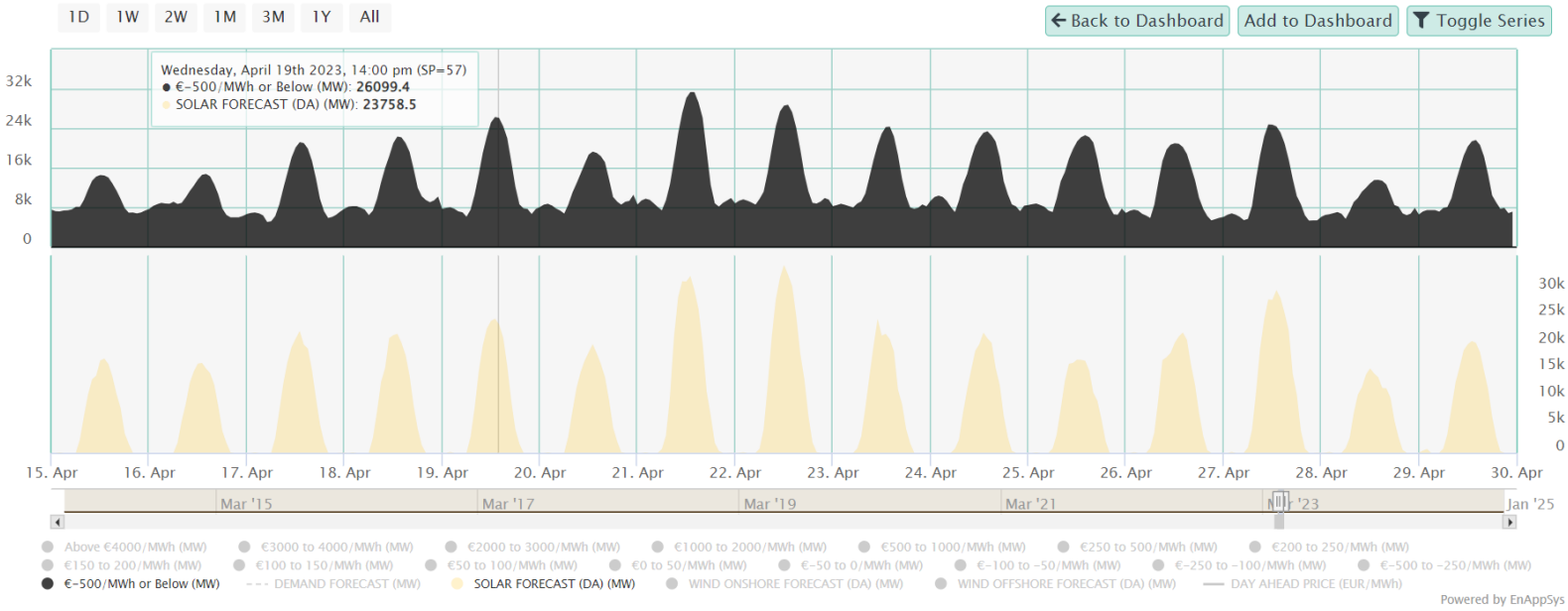
Simulating 2023 – What if?

Analysing market results with additional capacity



Analysing Bidding Behaviour

GERMANY DAY AHEAD SELL CURVE VOLUMES BY PRICE CLASS FOR 15/04/2023 TO 30/04/2023 (MW)



- Solar forecasts show a massive correlation with must-sell bids (*sell at € -500*) on the day-ahead market.

EnAppSys - Energy Insight
20,955 followers
2d • 🌐

What was the average % of solar generation forecast being bid into the day ahead auction at a must-sell price of €-500 in the year 2023?

Jean-Paul Harreman - Director, Montel EnAppSys will be presenting the topic, Impact of 2023 renewables boom on summer spot prices 2024 at **Montel Group's** German Energy Day on the 24th of April.

During his session he will reveal the answer to this poll question.

What was the average % of solar generation forecast being bid into the day ahead auction at a must-sell price of €-500 in the year 2023?

You can see how people vote. [Learn more](#)

10%

40%

70%

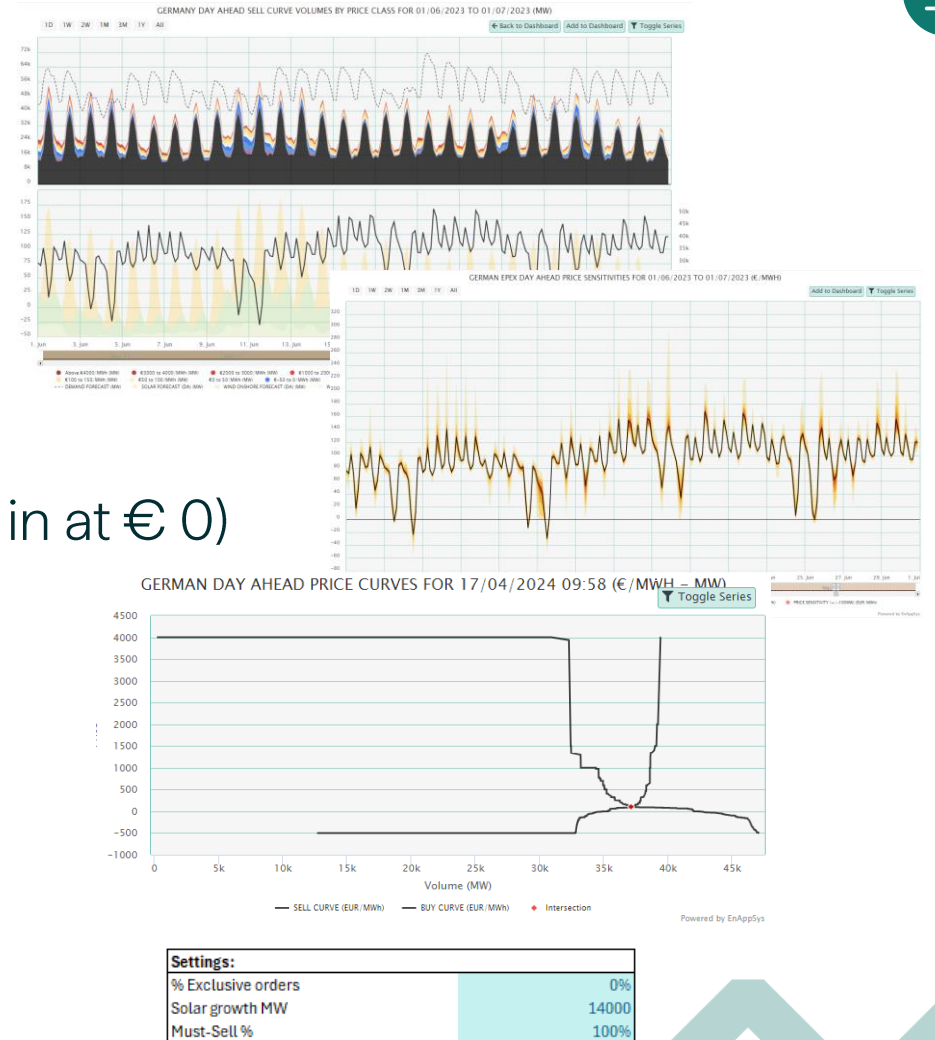
87.2%





Methodology

- Working with different assumptions for:
 - Bidding behaviour for additional solar
 - Smart-orders (if 6 hours of negative prices, bid in at € 0)
 - New capacity (4-hour rule)
- And by using:
 - Historic bidding behaviour (2023)
 - 2023 weather and demand
 - 2023 supply and demand curves
- We were able to simulate the impact of solar on must-buy volumes.

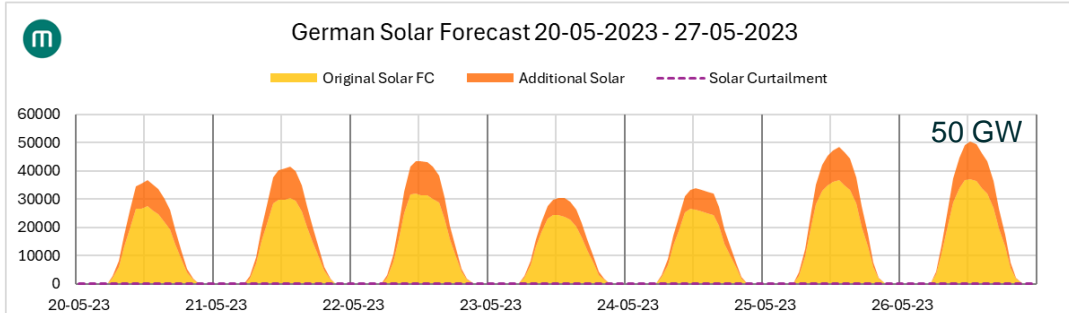
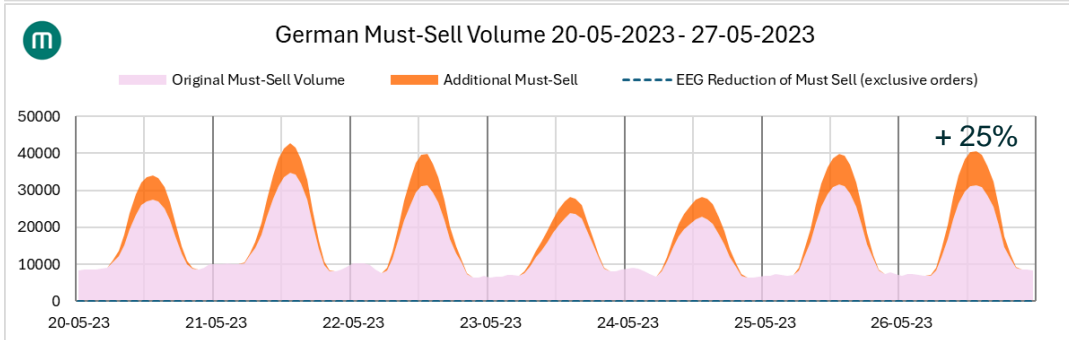
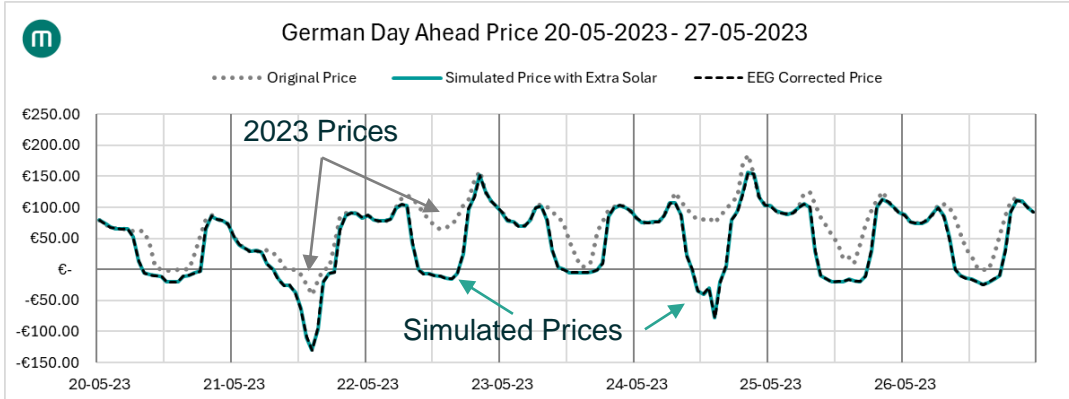




What would a random week look like?

Case 1. No change in behaviour

Number of negative prices:
 2023 – 301 hours
 2023 – 1600 hours (simulated)



If behaviour would be the same, prices would be:

- Lower Prices across the year
- Low Price periods last longer per day
- Must-sell volumes would peak up to 25% higher

Month	2023 Price	Simulated Price
January	€ 117.83	€ 108.93
February	€ 128.32	€ 113.00
March	€ 102.51	€ 80.67
April	€ 100.74	€ 70.08
May	€ 81.71	€ 41.71
June	€ 94.77	€ 39.00
July	€ 77.60	€ 38.30
August	€ 94.34	€ 56.28
September	€ 100.72	€ 62.58
October	€ 87.60	€ 68.59
November	€ 91.10	€ 79.89
December	€ 68.52	€ 63.63
All	€ 95.20	€ 68.25
Selected Week	€ 71.33	€ 40.37



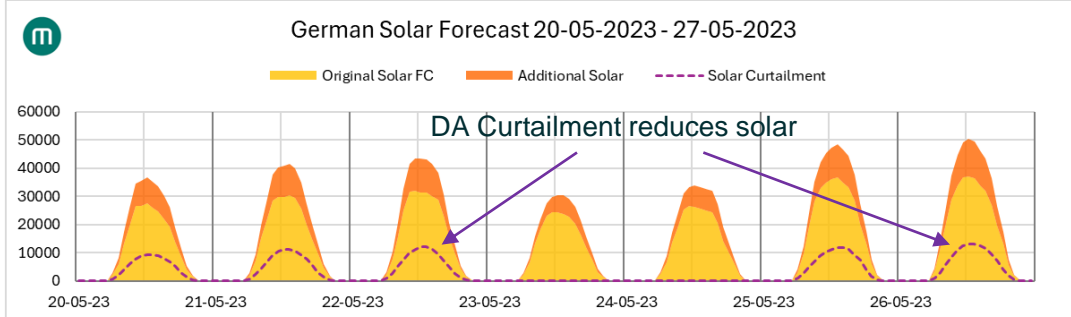
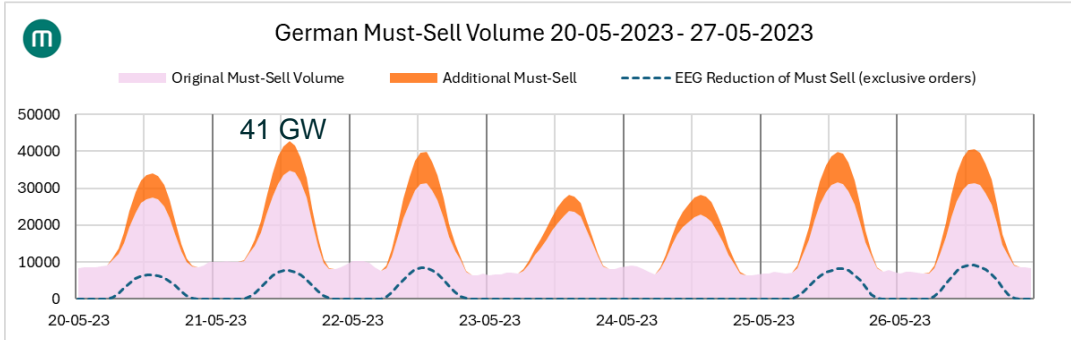
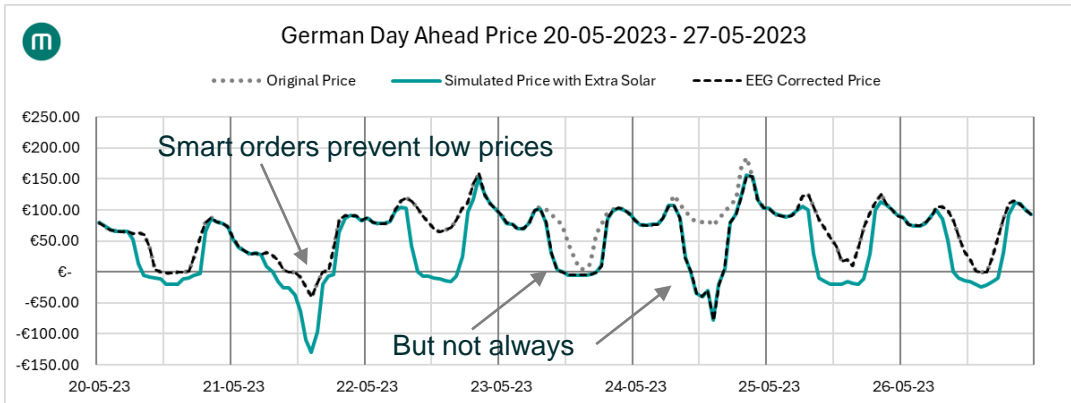
Settings:
 100% Smart Orders
 14 GW Solar Growth
 70% Must-sell



What would this week look like?

Case 2. Smart orders for all new capacity

Number of negative prices:
 2023 – 301 hours
 2023 – 1426 hours (simulated)
 2023 – 654 hours (EEG corrected)



Smart orders for all 14 GW of new solar:

- Regular curtailment of up to 10 GW
- Must-Sell order reduction
- Still drastically lower prices on DA
- Effect of smart orders driven by EEG rules, reduces negative prices dramatically

Month	2023 Price	Simulated Price	EEG Corrected
January	€ 117.83	€ 111.40	€ 111.45
February	€ 128.32	€ 116.05	€ 116.05
March	€ 102.51	€ 84.08	€ 84.20
April	€ 100.74	€ 74.08	€ 80.91
May	€ 81.71	€ 45.09	€ 69.44
June	€ 94.77	€ 42.66	€ 84.71
July	€ 77.60	€ 41.77	€ 71.80
August	€ 94.34	€ 60.26	€ 80.15
September	€ 100.72	€ 65.55	€ 85.27
October	€ 87.60	€ 72.23	€ 73.44
November	€ 91.10	€ 82.79	€ 82.79
December	€ 68.52	€ 64.97	€ 65.02
All	€ 95.20	€ 71.44	€ 83.50
Selected Week	€ 71.33	€ 43.11	€ 62.19

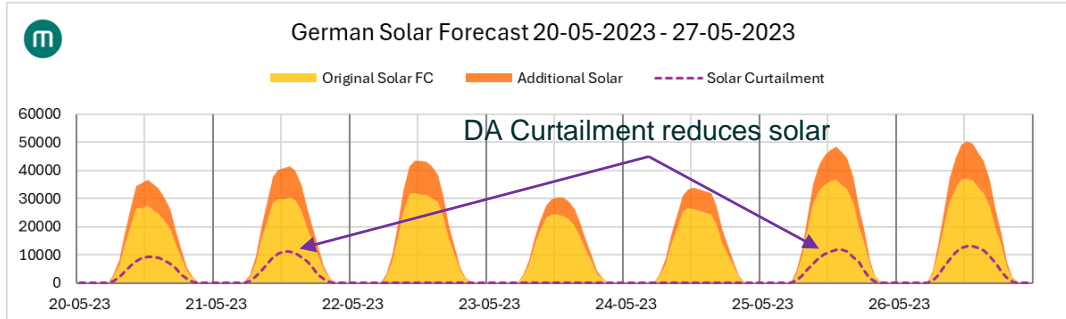
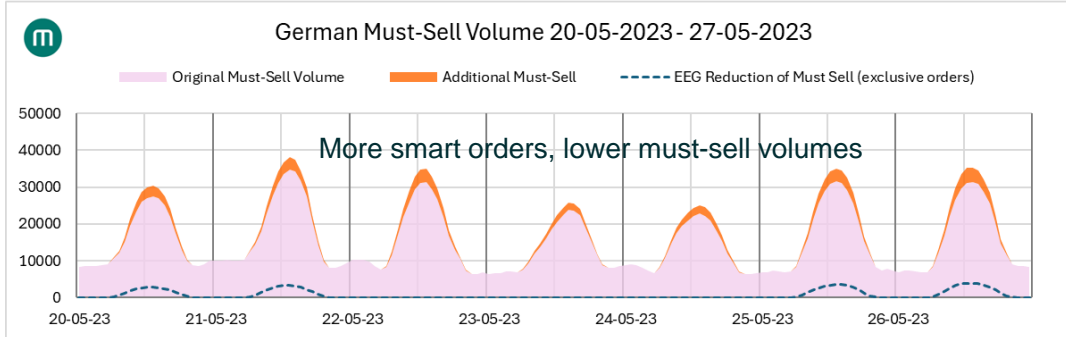
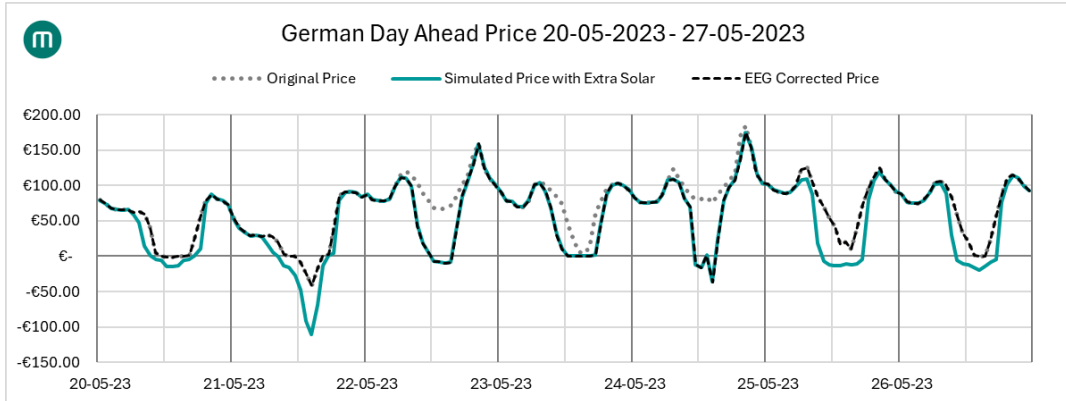


What would this week look like?

Case 3. Behave like NL-market

Number of negative prices:
 2023 – 301 hours
 2023 – 916 hours (simulated)
 2023 – 677 hours (EEG corrected)

- EEG driven Smart orders for 70% of new solar
- Must Sell Volume only 30%
- More realistic scenario than assuming 100% smart orders (Dispatchability)



Month	2023 Price	Simulated Price	EEG Corrected
January	€ 117.83	€ 114.69	€ 114.71
February	€ 128.32	€ 121.81	€ 121.81
March	€ 102.51	€ 93.10	€ 93.16
April	€ 100.74	€ 86.69	€ 88.31
May	€ 81.71	€ 58.60	€ 68.97
June	€ 94.77	€ 61.89	€ 75.98
July	€ 77.60	€ 55.34	€ 63.12
August	€ 94.34	€ 74.65	€ 79.09
September	€ 100.72	€ 78.49	€ 83.22
October	€ 87.60	€ 79.61	€ 79.79
November	€ 91.10	€ 87.42	€ 87.42
December	€ 68.52	€ 66.96	€ 66.98
All	€ 95.20	€ 81.30	€ 84.93
Selected Week	€ 71.33	€ 52.81	€ 62.11



What does all this mean for Capture Prices for Solar?

Actual Historic Data

2023 Actual		
WAP EPEX	€	94.16
WAP Capture Price	€	75.07
Discount	€	19.09
Discount %		20.3%
YTD		
WAP EPEX	€	109.33
WAP Capture Price	€	99.42
Discount	€	9.91
Discount %		9.1%

Additional Solar – Intelligent Bids Same weather more capacity

2023 +14 GW + intelligent bidding		
WAP EPEX	€	81.02
WAP Capture Price	€	42.95
Discount	€	38.07
Discount %		47.0%
YTD		
WAP EPEX	€	100.04
WAP Capture Price	€	73.60
Discount	€	26.44
Discount %		26.4%

Outturn Data 2024 Different weather

2024 Actual		
WAP EPEX	€	62.94
WAP Capture Price	€	48.82
Discount	€	14.12
Discount %		22.4%

2024

- Lower power prices in general (gas prices).
- Profile discount solar, similar to simulation.

Conclusions



Conclusions

- Day Ahead Prices will result in curtailments on renewables in general and should affect solar in particular, especially when EEG thresholds are hit.
- Solar will need to bid in more intelligently than in previous years, to avoid very negative prices. Best case: existing and new capacity.
- With maximum smart bidding, only for new capacity, we still expect over 600 negative prices in Germany, disregarding the influence of its neighbours.
- Prices may go lower as countries compete to export, see NL market in 2023.
- The € -500 clearing prices of 2023 were all driven by IT-issues and bidding errors, we may get to the end of summer without a change in minimum price, unless...

NOTE:

Intraday and balancing risks go up as more flexible generation is pushed out-of-merit, we show you the indicators and sensitivities.

Contact us, for demo or free trial.



Backup Slides