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ENERGY RESEARCH

Structural Persistence and Evolution of the „Sawtooth Pattern“ in the European 15-Minute Day-Ahead Market

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15min Day Ahead auctions went live on 1 October across most European power markets, lowering the smallest trading unit

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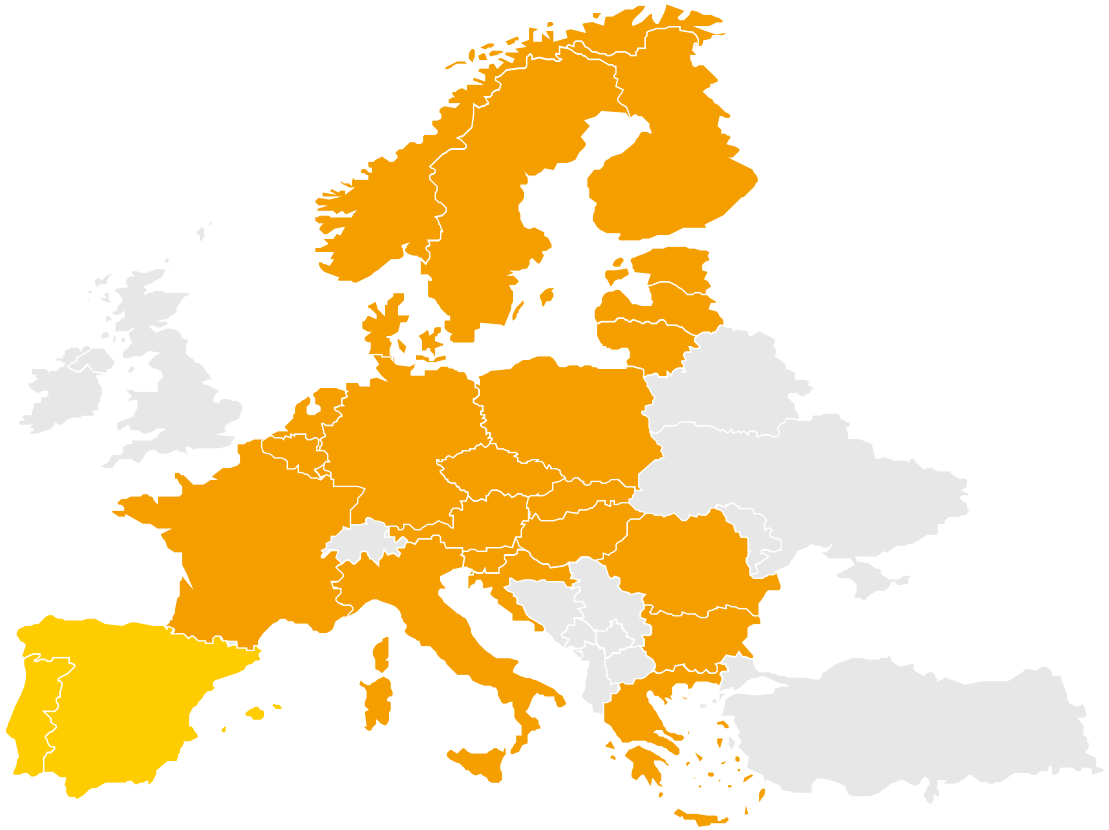
Introduction of 15min MTU[1] in October 2025



Only 15min MTU 60min MTU still possible

1) Market Time Units

In a nutshell

- For delivery on 1 October– European Day-Ahead markets switched from 60min to 15min Market Time Units (MTUs).
- 60min MTUs still exist in most markets (except Spain and Portugal).
- Hourly index prices are now calculated as averages of the underlying 15min prices.

Key observations

Focus of today's session

Price shape: An intra-hour "sawtooth" pattern has emerged in Day-Ahead prices.

Renewables: 15min Day-Ahead prices lead to a slight decrease in renewable capture rates but decrease the need for RES balancing.

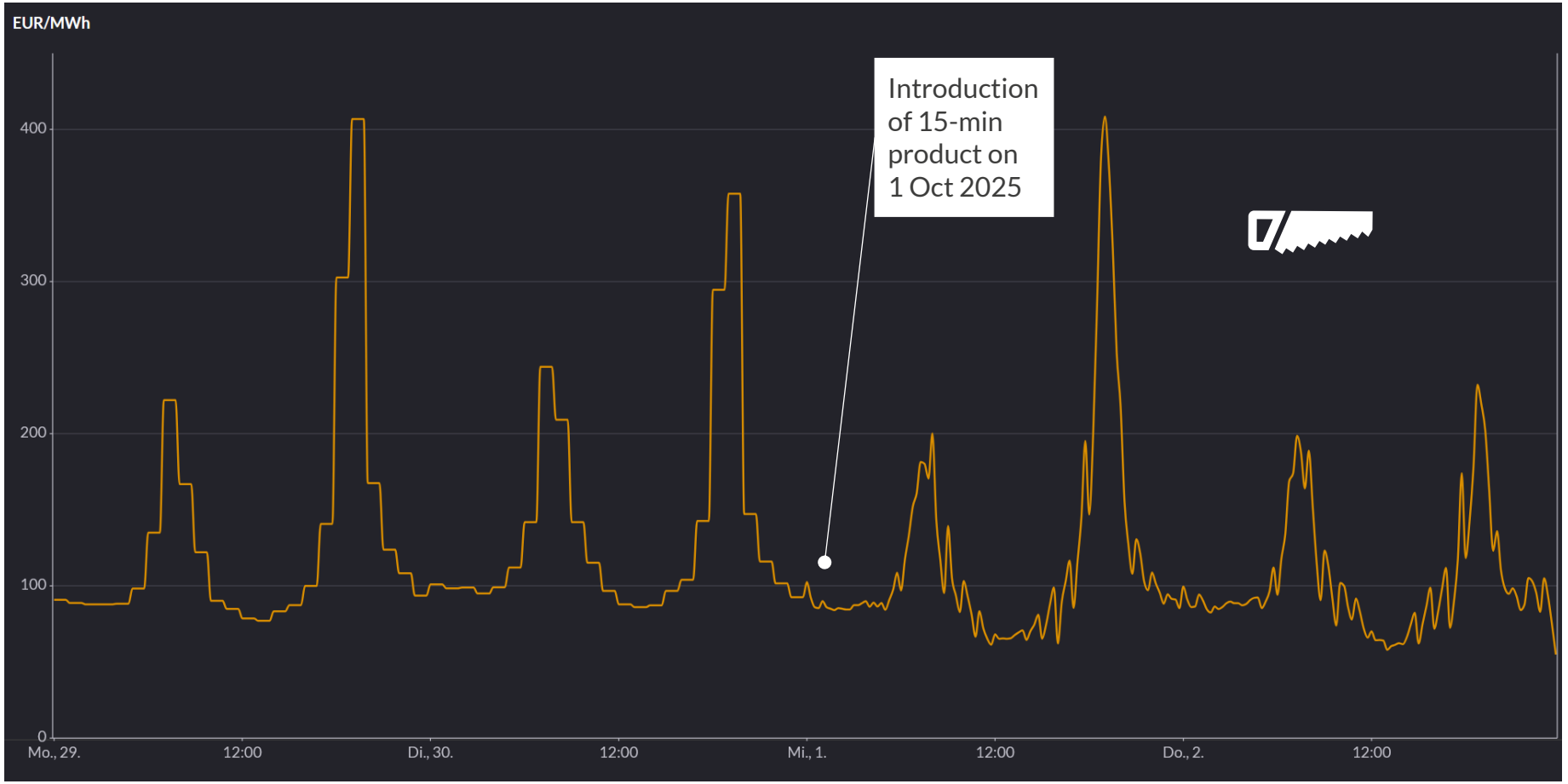
Daily spreads: Day-Ahead price spreads have risen with the 15min prices, though much of the increase comes from a "sawtooth" pattern.

Batteries: The sawtooth pattern offers additional arbitrage opportunities on the Day-Ahead market.

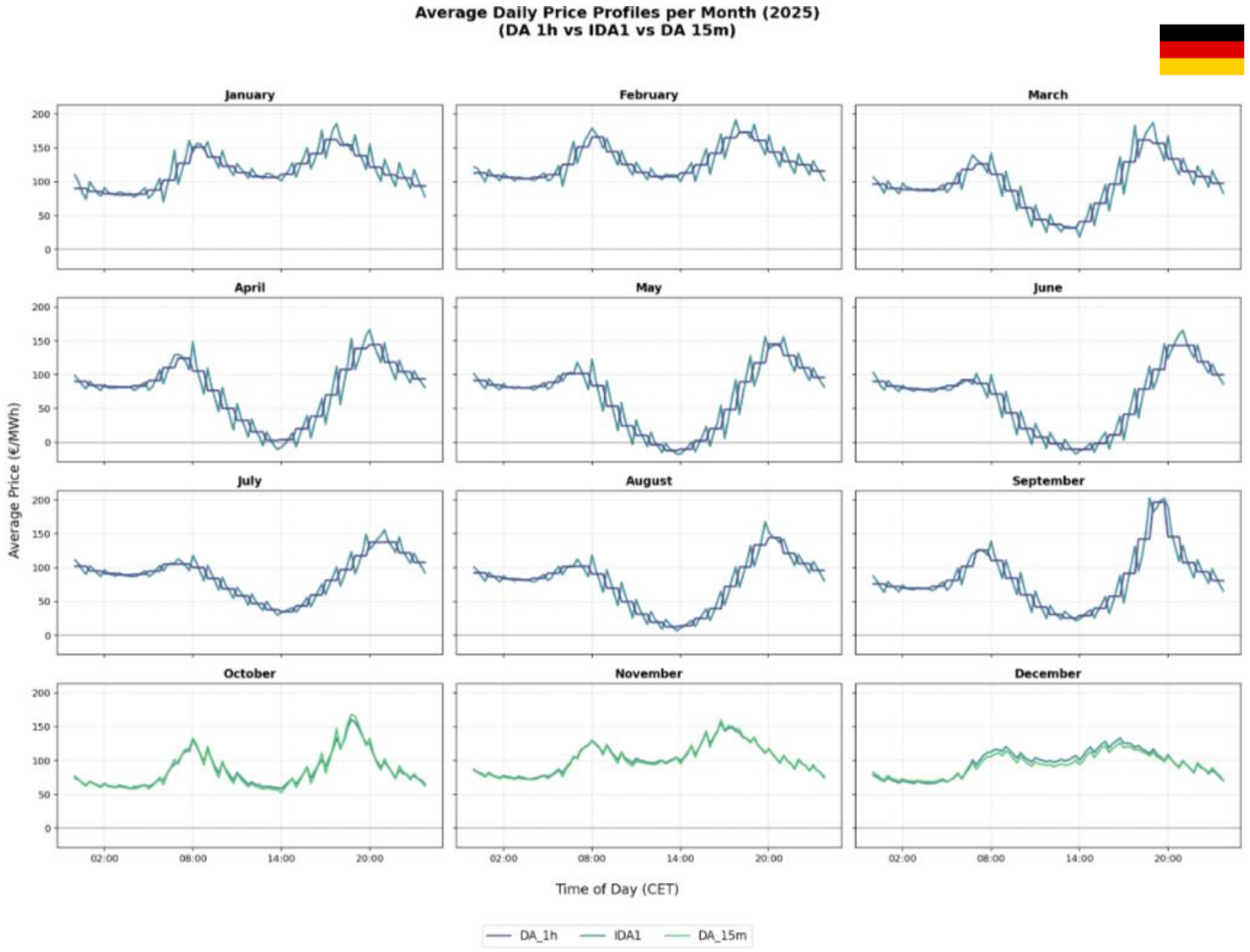
Sources: Aurora Energy Research, NEMO Committee

A “sawtooth” price pattern has emerged with the 15-minute market time unit in European day-ahead markets

Day-ahead power prices from 29/09/25 – 02/10/26
€/MWh



The „sawtooth“ pattern, previously only observed in the Intraday Auction 1 (IDA1), has become a feature of the day-ahead market



The size of the sawtooth varies across markets, depending on domestic and interconnection constraints

1 Drivers of the sawtooth pattern

These are the underlying drivers of the sawtooth pattern. In markets where they co-occur, the sawtooth is strongest.

Block bids

- Some market participants have not moved to the 15-minute MTU (yet). They are bidding in hourly fractions or longer block-bids. This concerns both, supply and demand-side bids.

Calculation of available cross-border NTC[1] on hourly granularity

- While the trading has transitioned to 15-minute granularity, hourly capacity calculations introduce some constraints to flexbility of power im-/exports.

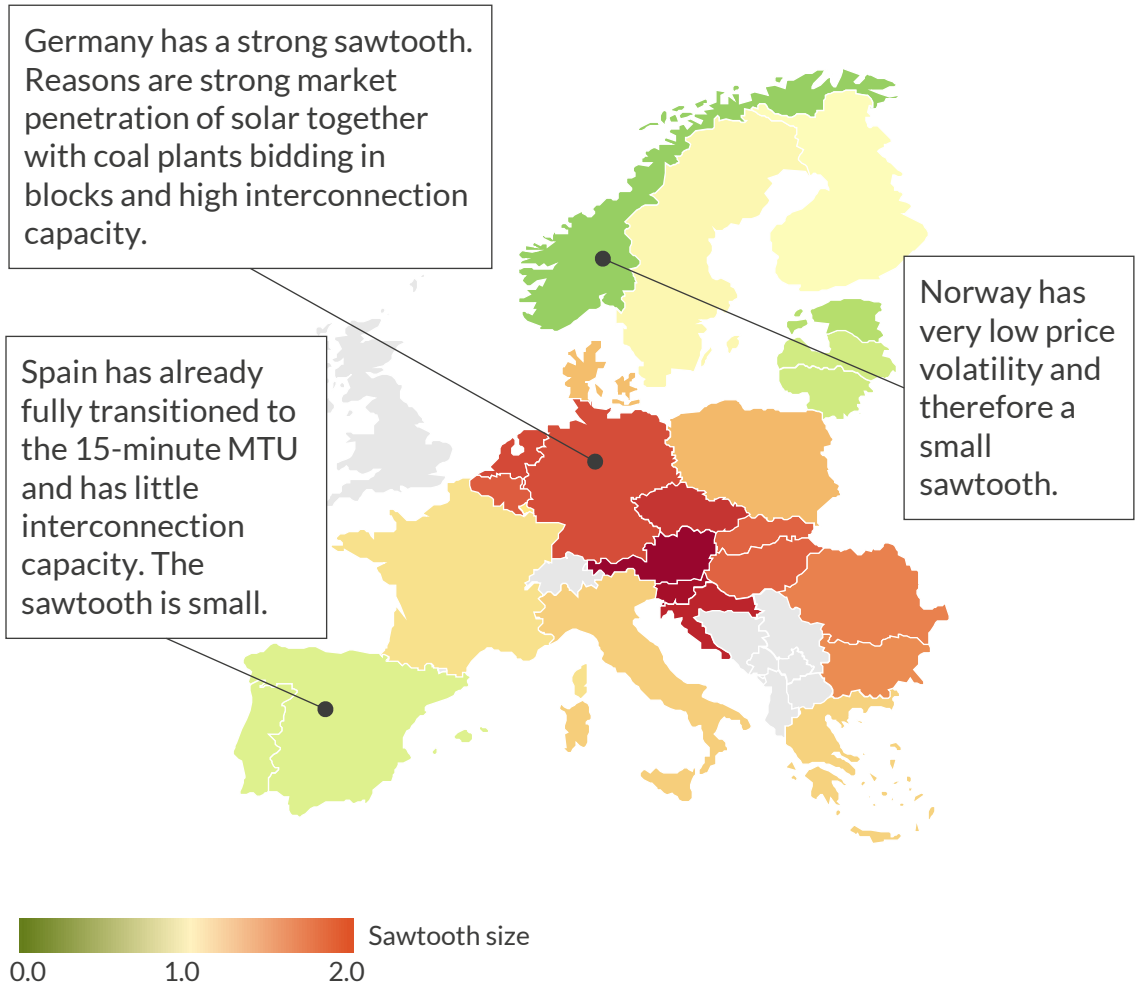
(Steep) gradients in demand and supply

- Supply gradients drive the size of the sawtooth. E.g. during solar ramps in summer, we see a higher sawtooth compared to winter.
- Demand gradients have a similar effect. E.g. the sawtooth becomes higher when demand ramps up in the evening.

Future development of sawtooth

- Due to wider adoption of the 15-min products by market participants, we expect a decline of the sawtooth size in the coming years
- One important driver will be the coal exit in certain countries

2 Overview of estimated[2] sawtooth size[3] in 2026



1) Net Transfer Capacity. 2) The initial sawtooth magnitude is applied in the first modelled year (2026) and then gradually phased out. 3) We define the size of the sawtooth to be the multiplier of the quarter-hour 1- vs. quarter-hour 4-spread of the smoothed 15min price so that the anticipated sawtooth is reached. The forecasted sawtooth is a result of the historically observed 15-minute day-ahead prices and the intraday auction 1 prices, as proxy for missing historical spring and summer day-ahead prices.

The introduction of 15-minute day-ahead products leads to slightly lower solar capture prices and higher daily price spreads in our forecast

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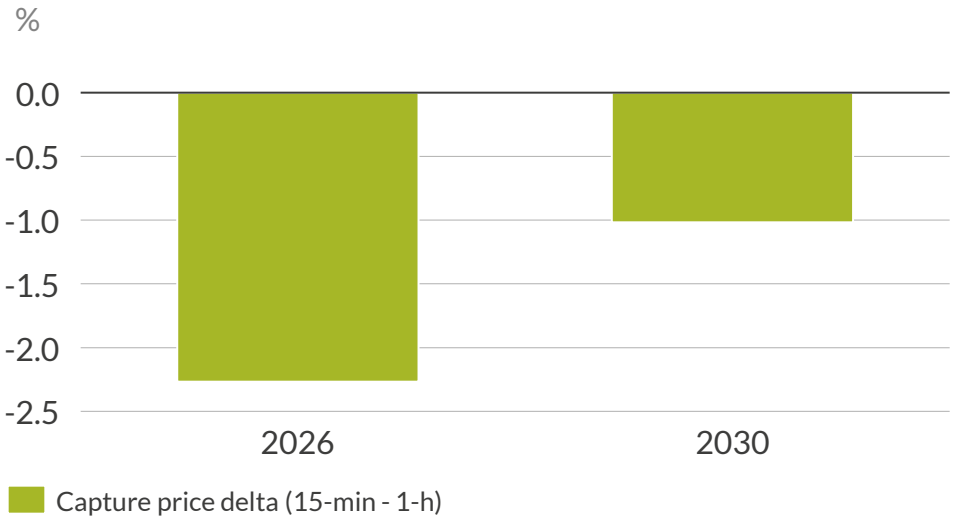
➢ **The order of magnitude of the impacts below is strongly dependent on the size of the sawtooth pattern.**

I Lower solar capture prices

- As prices generally decrease with higher solar generation, the reduced price granularity leads to a decrease in solar capture prices
- The delta is higher in the early forecast years, when the sawtooth is still stronger

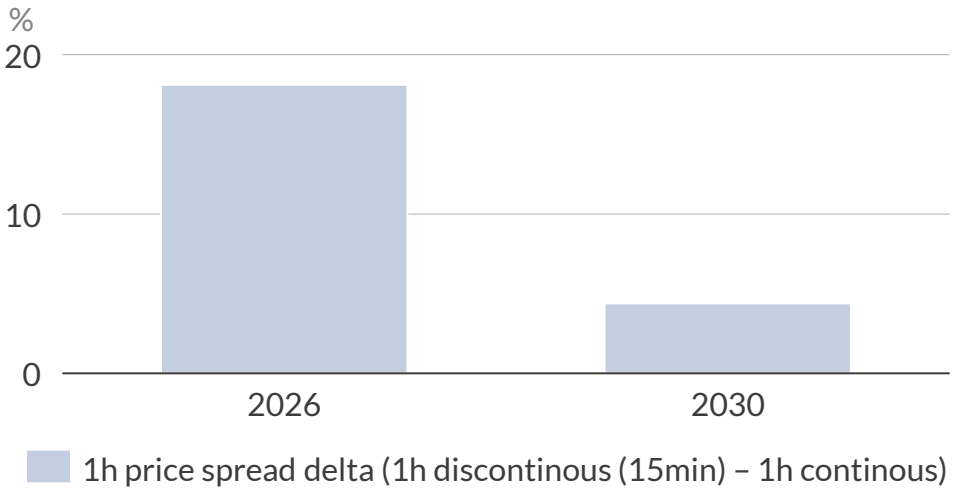
Forecasted delta in solar capture prices 15min - 1h



II Higher daily price spreads

- Daily price spreads increase as the higher granularity comes with increased price volatility
- As a result, the day-ahead market becomes more attractive for short-term trading

Forecasted average daily 1h spread delta (1h discontinous (15min) – 1h continous)



Due to the introduction of the 15-minute day-ahead product, solar capture prices are facing a discount compared to 1-hour prices

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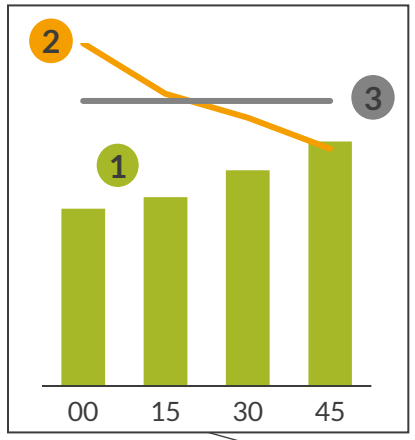
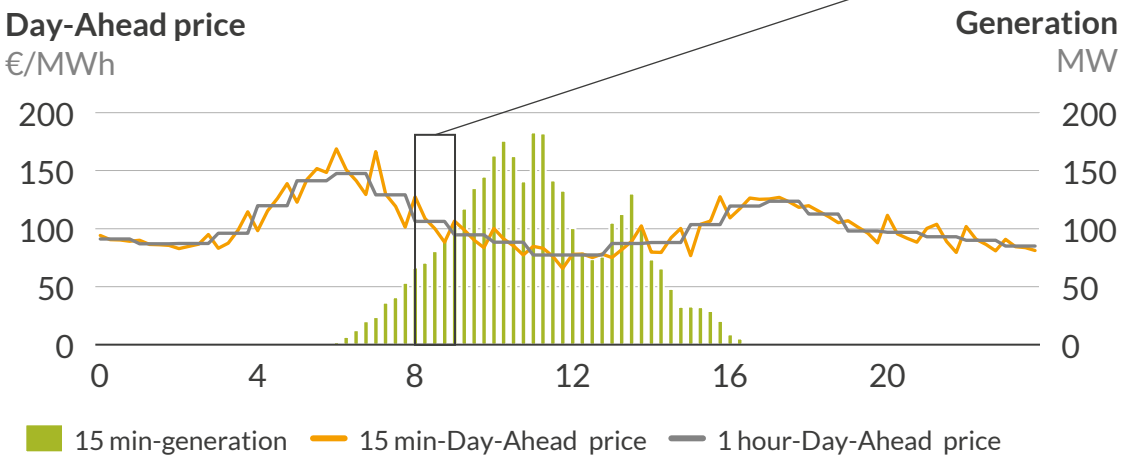
Higher solar generation correlates with lower prices



Hourly solar PV generation and day-ahead price



1) Generation-weighted uncurtailed capture price. 2) Excluding rooftop solar PV.

Source: Aurora Energy Research

1. Intra-hour solar generation is increasing, as solar output ramps up.
2. With less solar generation, prices are higher in the first quarter-hour and lower in the last, when generation is higher. The sawtooth pattern additionally amplifies this effect.
3. Hourly prices would renumerate all generation at a single flat price.

→ **We expect the discount to be stronger in the short-term and then weaken, in line with the reduction of sawtooth.**

→ **In the mid-to-long term, imbalance cost potentially decrease slightly due to the more granular MTU, partially counterbalancing the downward impact on the solar business case.**

Details and disclaimer

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