Emerging trends in renewable power market earnings

Analysis of capture rates in Western Europe

May 2026

Introduction

- Investments in wind and solar power have grown rapidly across Europe. As their share of electricity generation increases, so does the risk of revenue “cannibalization”: concentrated output can lead to transient over-supply, lower wholesale prices, and capture prices below the market average.
- Declining capture prices (and capture rates) can weaken the investment case for renewables and, in turn, slow the green transition.
- Where developers once focused primarily on maximizing output, the timing of production is becoming increasingly important, as power markets experience more frequent and prolonged periods of very low prices.
- This creates both a system need and an economic opportunity for investment in battery storage, which can shift supply from low-price to high-price hours.
- This analysis has a dual focus. It examines historical and projected capture rates across five markets, and it develops a simple model to illustrate how battery storage can improve them on the revenue-side of the business case.
- Together, these revenue perspectives help clarify market dynamics and their implications, supporting more informed investment decisions by market participants and policymakers.

Content

Long project lifetimes require a forward-looking approach to financing

- The risk of downward pressure on electricity prices is a concern for investors and lenders since it negatively impacts the business case for energy projects. Having a forward-looking perspective on market trends is important since the financing of investments in the power sector often has long durations.
- This analysis focuses on estimating the revenue that wind and solar power producers earn (the capture price) as a share of the average market price (the capture rate) based on historical data. We relate this to the share of renewable energy in the production mix to identify any recent and emerging trends. Furthermore, we use forecast data to assess how capture rates may develop in the future.
- Many developers are currently designing new projects that include storage or integrate storage with existing assets. This analysis also attempts to model how the integration of battery storage can influence capture prices and capture rates.
- We focus on five Western European markets: Germany, Denmark, Spain, the UK, and Sweden. This group includes some of the biggest electricity markets in Europe, i.e., Germany and the UK, as well as countries that are 'extreme' in the production capacity mix of both wind power, namely SE2 and Denmark (DK1 and DK2 treated as one), and solar power (Spain) to assess how this affects our conclusions.
- The analysis is based on both historical hourly data (the ultimate source is ENTSO-E) and forecast data obtained from S&P Global. Forecasts rarely turn out to be 100% correct, but we believe that the forecasts will at least provide an indication of the general direction of the electricity markets, and that these trends reveal important takeaways for investors and lenders.

Main conclusions

- For wind power, the average capture rate has experienced a moderate decline from 94% in 2019 to 82% in 2025. This is a simple average across the five markets in this analysis, but the analysis considers each market individually. Forecasts show that capture rates are expected to continue on a slightly declining path, mostly affecting markets with strong ambitions in wind energy, especially the UK and Denmark, possibly reaching capture rates of 45–65% by 2035.
- Solar power has, on average, experienced sharply deteriorating capture rates from 98% in 2019 to 68% in 2025, especially over the last two to three years. Forecasted capture rates are naturally highly dependent on assumptions about future build-out, but S&P Global estimates that capture rates may fall to as low as 20% in Spain and 30% in Germany by 2035 (without storage), with smaller declines in less sunny markets.
- Adding battery storage to a renewable energy project generally increases capture rates, with larger storage capacity leading to greater improvements. Across the five markets included in this analysis, a wind project in 2025 with a 2:1 ratio of generation capacity to storage capacity could increase its capture rate from 82% to 99%. For a solar project, the capture rate could rise from 68% to 105%.

Halfway through the energy transition, market adaptation is now critical

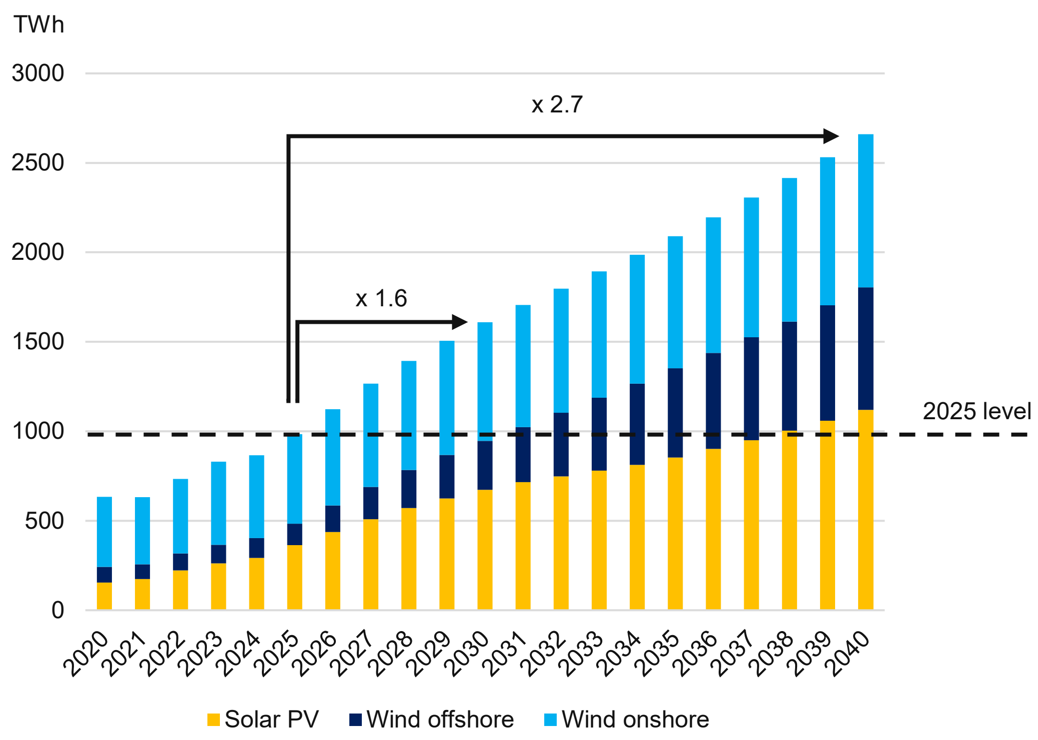
- We are only in the first half of the energy transition, yet financing risks are already becoming visible.
- Declining capture rates are directly reducing the revenues of wind and solar projects, diminishing their attractiveness relative to other investments. This is likely to make investors more hesitant to commit capital, ultimately limiting how much renewable capacity can be built on commercial terms. Our analysis suggests this effect is more pronounced for solar PV than for wind, an asset class that was previously regarded as low-risk, but where the risk profile has shifted substantially.
- The profitability of renewable investments also depends on absolute power prices. Elevated natural gas prices in recent years have supported capture prices for renewables, temporarily underpinning project economics. If and when gas prices normalize and average power prices decline further, capture prices are likely to fall with them, placing additional pressure on revenues.
- Under the current market design, there is nothing to prevent wind and solar revenues from falling to very low levels - other than a slowdown in new investments - a dynamic that risks undermining decarbonization progress.
- If investments in wind and solar are to continue over the coming years, electricity markets - including production, demand, grids, and regulation - must adjust and adapt to ensure a continuous balance between supply and demand.

- Several factors could help mitigate the negative investment effects of falling capture prices.
  - Storage is the most direct lever, as batteries can shift renewable generation away from low-price hours and improve realized revenues, particularly for solar.
  - Greater demand-side flexibility - for example through electric vehicles, heat pumps, electrolyzers and flexible industrial load - can also support prices during periods of high renewable output.
  - More interconnected markets and grid expansion can reduce local oversupply by allowing excess generation to flow to areas with higher demand, although the benefit depends on available transmission capacity and regional weather correlations.
- Other factors may support the investment case without necessarily improving capture rates directly.
  - Continued declines in project CAPEX can help preserve margins even if realized power prices fall.
  - Likewise, projects in the best locations will remain more competitive in a lower-price environment.
  - In the longer term, technologies such as green hydrogen could provide an additional source of flexible demand, but the scale and timing of this support remain uncertain.

Wind and solar production change spot market pricing dynamics

- The share of renewables in the power mix is increasing and is expected to grow more rapidly in the coming years. However, the simultaneity of wind and solar power production often leads to periods of abundant supply during favorable weather conditions.
- These periods are typically associated with low electricity prices. As a result, the price that renewable generators receive for their electricity is, on average, below the overall market average price (the baseload power price). Even modest surpluses of energy offered at very low or zero marginal cost can significantly reduce marginal prices in the spot market.
- This relative decline in the value of renewable electricity is captured by the capture rate. The capture rate measures the volume-weighted average price that a power generation asset earns compared with the overall average electricity price over a given period.
- The capture rate effect becomes more pronounced in countries where renewables already account for a substantial share of the power mix, and it is expected to intensify further as wind and solar capacity continues to expand.
- Many renewable projects rely partly or fully on revenues from the wholesale electricity market. As a result, long-term electricity price forecasts and renewable capture prices are essential for assessing project value and financing risk. While corporate PPAs can provide some income stability for the individual project, PPA prices remain closely linked to expected spot market prices.

Renewable electricity production from wind- and solar

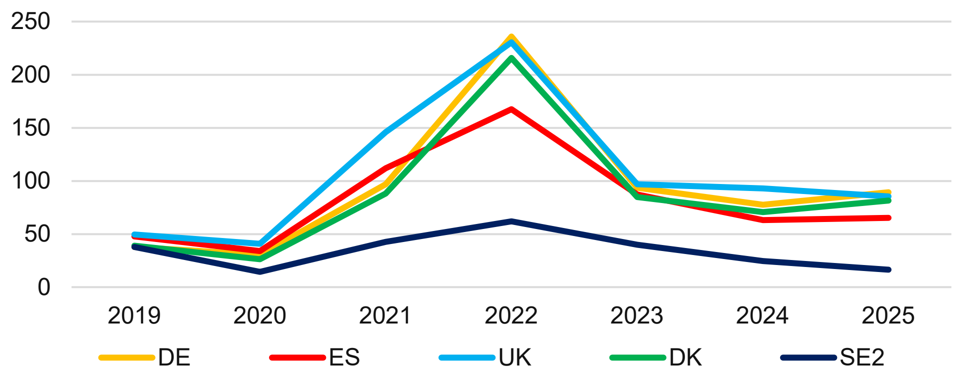


Note: *Data covers EU, UK, Norway, and Switzerland.*
Source: *EIFO analysis based on data from S&P Global's 'Planning scenario' December 2025.*

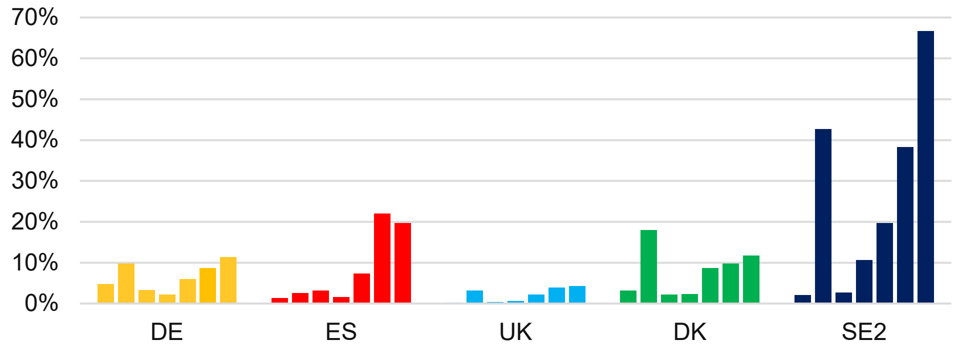
More renewables cause more frequent and longer periods of low market prices

- The wholesale market price is the starting point for evaluating the long-term financial viability of renewable generation assets. A rising wholesale average lifts the absolute value of capture prices even when the capture rate (capture price as a percentage of the wholesale average price) is declining. This makes capture rates only meaningful in the context of absolute price levels. A solar asset achieving a 70% capture rate in a EUR 100/MWh market earns EUR 70/MWh, materially more than a 90% capture rate in a EUR 50/MWh market.
- European wholesale prices have structurally reset to a higher level post-2022 and have provided a (likely temporary) boost to the profitability of renewable projects, offsetting ongoing technology-specific capture rate dynamics.
- Floor prices are the primary driver of capture price deterioration. Since renewables generate disproportionately during high-supply, low-price hours, near-zero price periods drag capture prices significantly below the wholesale average, making floor price frequency and depth central to forecasting future capture prices. We define floor prices as hours below EUR 10/MWh, a level at which producers cannot cover operational costs and any imbalance settlement costs.
- Floor prices signal structural cannibalization and long-term revenue risk. Growing renewable oversupply during peak generation periods will intensify cannibalization, compress capture prices, and increase revenue unpredictability. The number of floor price hours has increased across all five markets over the last seven years. In 2025, the share of hours below EUR 10/MWh exceeded 10% in Germany and Denmark, with Spain approaching 20%, and more than 65% in the Swedish price zone SE2. Only the UK still retains a limited number of low-price hours.
- Likewise, the displacement of conventional capacity reduces market depth during scarcity, driving peak prices higher.

Wholesale price (EUR/MWh)



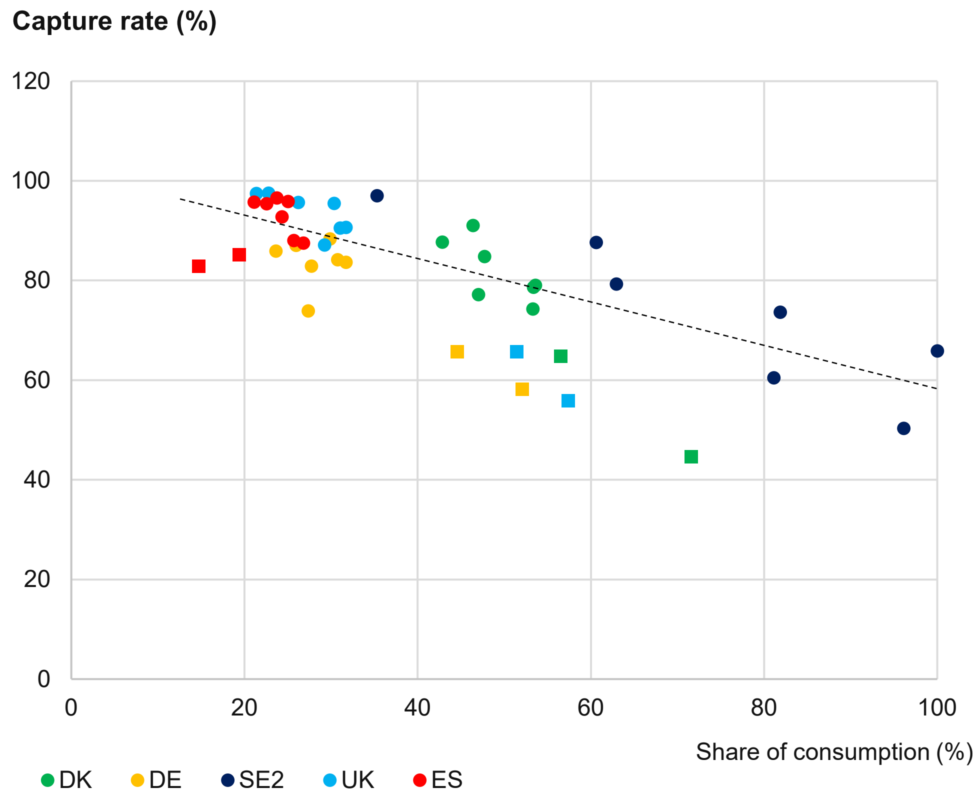
Share of floor prices (less than EUR 10/MWh), 2019-2025



Note: *UK prices in these charts are converted from GBP to EUR assuming 1 EUR = 0.865 GBP (average across the period).*
Source: *EIFO analysis based in data from ENTSOE via Electricity Maps.*

Wind power capture rates declines moderately with market share

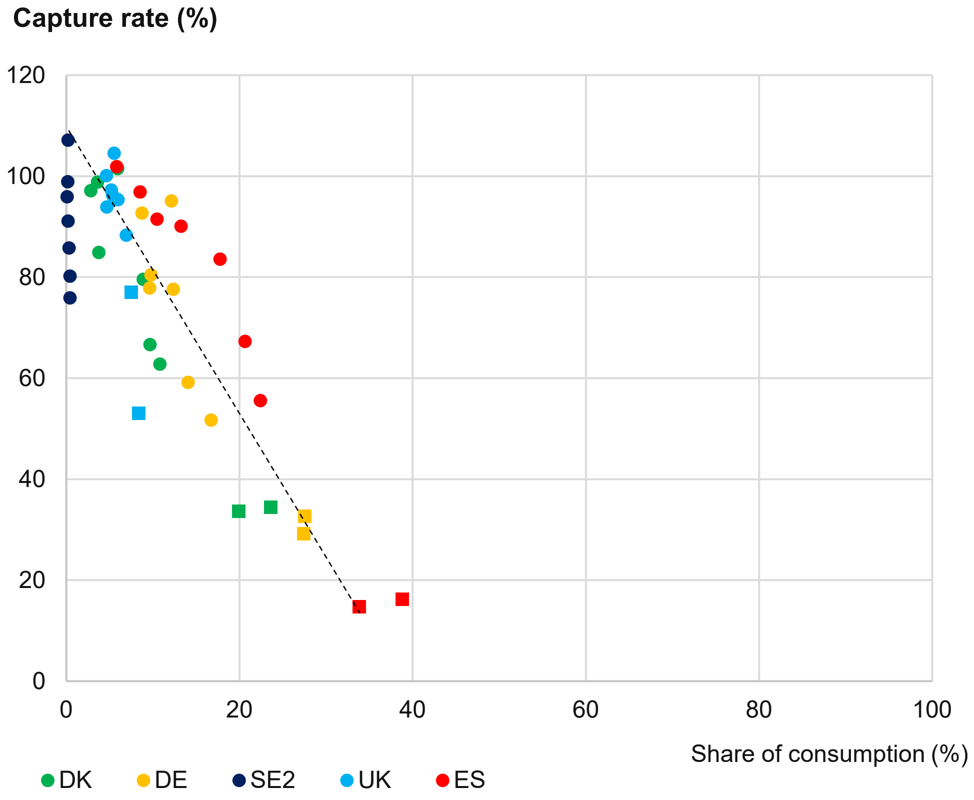
- Historical price data show a moderate negative correlation between capture rates for wind power and its share of electricity consumption across the five countries in this analysis, despite differences in production mixes, interconnection rates, weather, and load profiles.
- On average across the five markets in the analysis, wind power capture rates have decreased from 94% in 2019 to 82% in 2025 as wind production has increased as a share of electricity load from 30% of demand in 2019 to 46% in 2025 (all numbers are simple averages across the five markets). SE2 stands out, and to a lesser degree Denmark (DK1+DK2), with low capture rates and high wind production relative to electrical load. We analyze each market in greater detail later in this report.
- Due to limitations in the available data, wind includes both onshore and offshore generation.
- Forecast data show that most markets are expected to continue expanding wind power. This expansion leads to a moderate decline in capture rates towards a level of 45% to 65% by 2035. The decline in capture rates predicted by the forecast appears to be a continuation of the effect already seen today: more wind power capacity leads to greater supply during windy conditions, which results in lower prices. The opportunities to trade away production surpluses to neighboring countries become more limited, reinforcing low prices and low capture rates.
- SE2 and, to a lesser extent, the Danish markets stand out with an exceptionally high share of wind power and correspondingly lower capture rates. Looking towards 2035, political ambitions for offshore wind in Denmark point to a continuation of the current trend.



Note: *Round markers = historical data. Square markers = Forecast data (S&P Global). No forecast available for SE2.*
Source: *EIFO analysis based in data from ENTSOE via Electricity Maps. Forecasts from S&P Global.*

Solar power capture rates declines strongly with market share

- Historical data show a strong correlation between the penetration rate of solar power and capture rates. At very low penetration levels, capture rates for solar power are sometimes above 100%, indicating that it earns an average (volume-weighted) price that is above the market average. This is related to power prices historically being highest during the day, when demand and prices were highest.
- Capture rates for solar have decreased strongly over the 2019-2025 period, and in particular over the last three years. A simple average across the five markets covered shows a decline in capture rates from 98% in 2019 to 68% in 2025, as solar has increased its market share from 4.4% in 2019 to 11.4% in 2025.
- Forecast data from S&P Global suggest that capture rates may fall below 40% by 2030 in Denmark and Germany, and below 20% in Spain. These estimates rely on the consultants' prognosis for solar build-out in these markets. One reason why sun-rich Spanish investors can accept a lower capture rate per unit of electricity produced is the higher production volume, which helps offset the business case.
- Capture rates for solar power show a stronger correlation with deployment compared to wind power. One major reason for this is the localized nature of wind conditions versus sunlight. Abundant wind power production in one market can - to a certain degree - be exported to neighboring markets with less wind production at that time. Since the sun shines everywhere at once in Europe, there is less opportunity to trade away surpluses to neighboring markets, making grid expansion less of an opportunity for solar than for wind.
- There is also much greater seasonality in solar production compared to wind production, leading to very strong cannibalization during the summer and low overall capture rates.

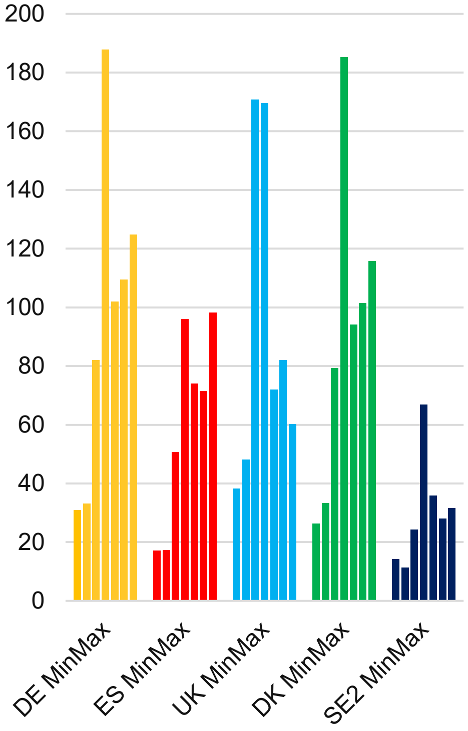


Note: *Round markers = historical data. Square markers = Forecast data (S&P Global). No forecast available for SE2.*
Source: *EIFO analysis based in data from ENTSOE via Electricity Maps. Forecasts from S&P Global.*

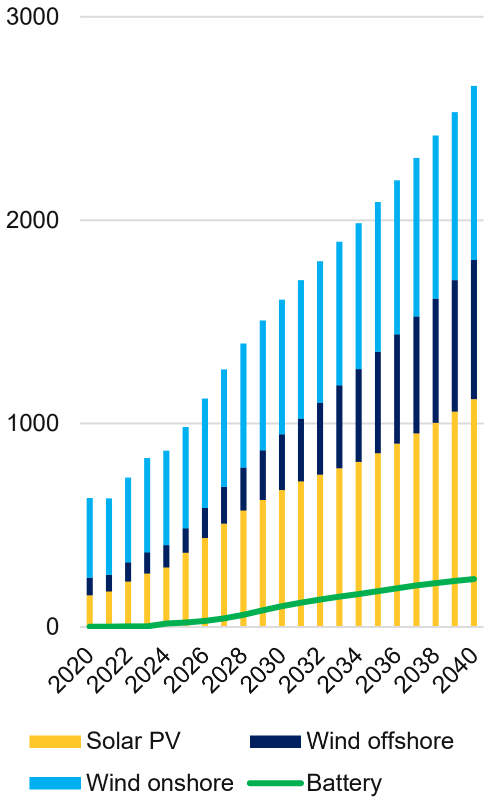
Higher within-day price spreads improve the business case for batteries

- As low prices become lower and more frequent, and high scarcity prices become higher (but not necessarily more frequent), new opportunities open up. Integrating battery storage allows projects to shift electricity sales from low-price hours to high-price hours, improving their ability to capture higher market prices.
- The figure to the right shows the average daily difference between the highest and lowest hourly price. The within-day Min-Max spread provides an indication of the price volatility, which is the foundation for the business case for a battery. This spread is also called the TB1-spread (Top-bottom, 1 hour). During the seven years from 2019 to 2025, Germany, Denmark, and Spain have experienced at least a 300% increase in price spreads, while SE2 has doubled and the UK spread has increased by 50%.
- The Min-Max spread in nominal values varies significantly across countries, with Germany and Denmark showing the highest spreads recently, both sitting around EUR 120/MWh in 2025. Spain and the UK generally have somewhat smaller spreads, while SE2 remains consistently lower, suggesting a more stable pricing environment, which is related to its production mix of nuclear and hydro.
- In this analysis, we model the value of battery storage for a project with a 2:1 ratio of electricity production capacity to storage. This could be a 200 MW wind park coupled with a 100 MW battery. We use this setup to arrive at updated capture rates and capture prices per MWh per unit of energy produced. One could think of many relevant alternative project designs.
- We consider three storage capacities: 0 MWh (no storage), 2 MWh (medium storage), and 4 MWh (high storage). This project configuration is broadly representative of common project configurations. Our aim is to provide a ballpark figure of how battery storage influences the capture rates of wind and solar projects.

Average daily MinMax price difference 2019-2025, (EUR/MWh)



Renewable electricity production (TWh)



Source: *Left: EIFO analysis based in data from ENTSOE via Electricity Maps. Right: Data from EU+UK+CH+NO from S&P Global.*

Storage help stabilize revenues and improves investment case

› The generation profile for each project follows the average production pattern of its price area (e.g., wind for wind assets). The battery is modelled as an independent add-on, decoupled from generation and optimized for price arbitrage. It charges during the lowest-price hours and discharges during the highest-price hours, always using full capacity. This maximizes arbitrage value rather than restricting operation to on-site production, which would reduce margins. If grid fees were included, battery operation would shift toward alignment with project generation.

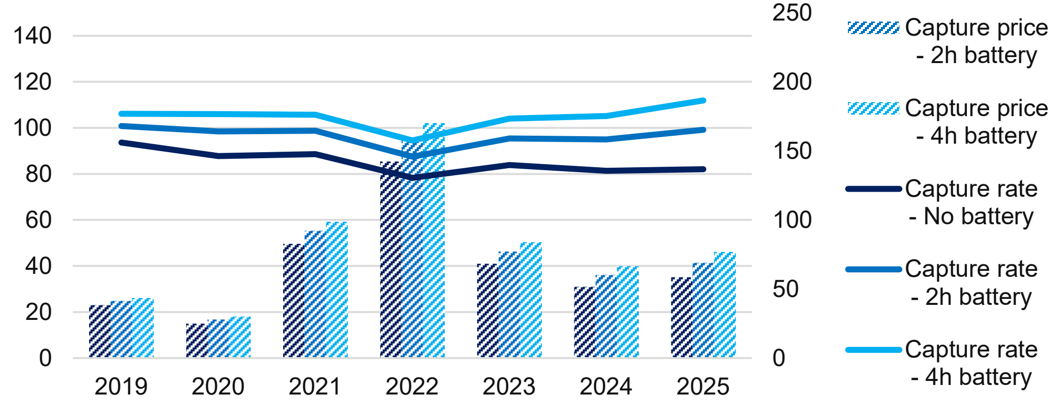
› Our battery valuation model is intentionally simplified and naturally not suitable for commercial decisions. Key assumptions include:

- The battery is small enough not to impact market prices (though this weakens as battery capacity in the power system scales).
- No ancillary service revenues are included; the analysis focuses solely on temporal arbitrage and its effect on capture prices and capture rates. In mature battery markets such as ERCOT (Texas) and parts of Australia, the value of ancillary services has declined significantly over time.
- One full charge/discharge cycle per day is assumed, without timing constraints.
- Perfect foresight of daily prices allows charging at the lowest and discharging at the highest price.

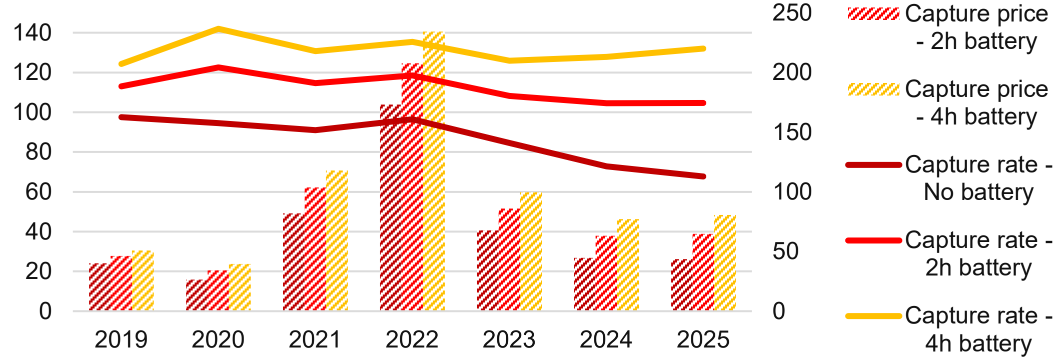
› A 2-hour battery improves wind capture rates from 82% to 99% in 2025 across the five markets, while solar increases from 68% to 105%. Storage appears more valuable for solar when comparing capture prices, but this is a volume effect: total battery revenue is the same in both cases, just distributed over different generation volumes. Wind projects, with higher load factors, spread the benefit over more output, reducing the apparent impact. Solar, with lower volumes, shows a larger relative uplift in capture price and rate.

› If the battery is charged primarily from its own production rather than the grid, solar parks would likely benefit more than wind. This is because solar generates disproportionately during low-price hours, lowering the opportunity cost of charging.

Left: Wind capture rate (%)
Right: Wind capture price (EUR/MWh)



Left: Solar capture rate (%)
Right: Solar capture price (EUR/MWh)

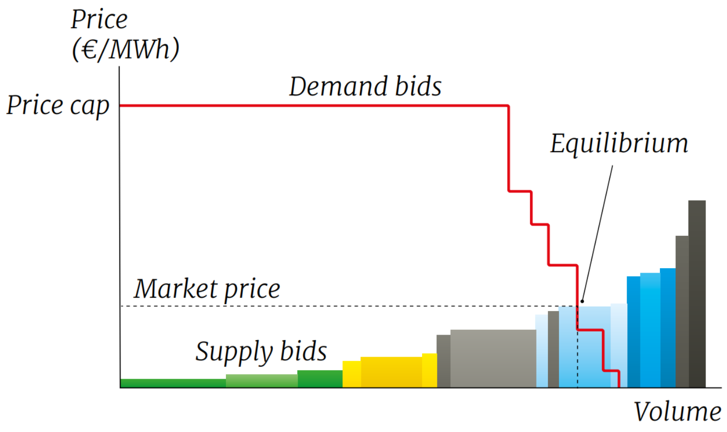


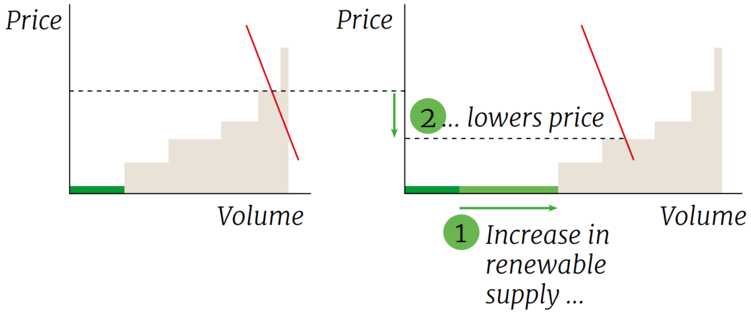
Note: *Data shown is a simple average across the five markets in the analysis.*
Source: *EIFO analysis based in data from ENTSOE via Electricity Maps.*

Method and background

Background
Price formation in wholesale markets

- Prices in the European wholesale electricity market are determined by the balance between supply and demand on a quarterly basis (30 minutes in the UK). The day before real-time delivery, producers and consumers submit bids to the power exchange (e.g., Nord Pool) indicating how much electricity they are willing to produce or consume in each of the 96 quarters of the following day.
- On the supply side, bids reflect the available generation capacity and the price at which producers are willing to supply electricity. Demand for electricity is often relatively inelastic to price changes, particularly in the absence of large-scale energy storage.
- Supply bids typically follow marginal production costs. Variable renewable generation, such as wind and solar power, bids to supply electricity whenever production is available, often at very low or zero prices because their "fuel" is free. In contrast, dispatchable generators - such as gas-fired power plants - usually bid at a price close to their variable production costs. These generators rely on market prices clearing above their variable costs in order to cover fixed costs and earn profits.
- The power exchange orders all bids and determines the market-clearing price where supply and demand intersect, while also accounting for electricity flows between neighboring price areas. This clearing price is the price all producers receive, and all consumers pay, for electricity in that quarter.
- During periods when renewable generation alone can meet demand, market prices tend to fall toward zero. When renewable production is insufficient, the marginal cost of the last activated generator sets the market price. As renewable capacity increases, periods with very low market prices are expected to occur more frequently.





Background
Deriving capture rates from market data

- The (forecasted) spot market price is the starting point for evaluating the long -term financial viability of renewable energy assets. However, average market prices alone are not sufficient.
- The capture rate measures the volume-weighted average price that a power generation asset (e.g., a wind farm) actually earns compared to the overall average electricity price over a given period. While average market prices provide a useful benchmark, it is the capture rate and capture prices that ultimately determine real revenues, affecting both debt repayment and profitability.
- Several factors affect the capture rate:
  - Deployment levels of renewables have a strong relationship with the capture rates of wind and solar assets.
  - Expanding the physical electricity grid and increasing cross-market trading reduce local oversupply and help stabilize prices.
  - New sources of demand from datacenters, hydrogen production, and heat pumps, especially when electricity prices are low, help prevent capture rates from falling too far.
  - Energy storage systems that buy electricity when prices are low and sell when prices are high help smooth price fluctuations and support capture rates.
  - Subsidies for renewable energy can drive additional investment beyond what the market would otherwise support, potentially putting downward pressure on capture rates.
  - Local conditions (e.g., strong sunlight in Spain or wind in the North Sea) can lead to lower capture rates due to higher generation at similar times. However, lower prices may be offset by higher total production volumes.
  - Advances in technology and declining Levelized Cost of Electricity (LCOE) reduce project costs and help mitigate the impact of lower revenues.

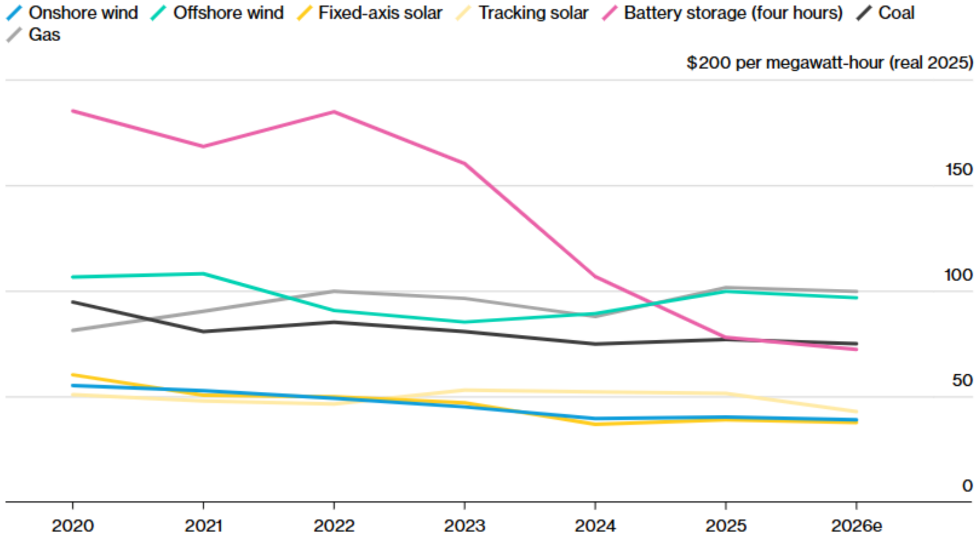
$$\frac{\text{Sum of hourly revenue (hourly market price × hourly wind generation) per MW of wind capacity}}{\text{Annual energy production from wind turbines}} = \text{Average price earned by wind turbines per unit of electricity}$$

$$\textbf{Capture rate} = \frac{\text{Average price earned by wind turbines per unit of electricity}}{\text{Average market price}} \times 100$$

Background
Assessing project profitability

- This analysis focuses on wholesale market capture prices and capture rates as key revenue metrics for renewable energy projects. However, a complete business case must also consider additional factors on both the revenue and cost sides.
- On the revenue side, the capture price reflects the expected value earned per unit of electricity produced. Project profitability, however, also depends on factors such as possible subsidies, capacity market revenues, and ancillary services.
- On the cost side, developers commonly use the Levelized Cost of Energy (LCOE) to assess project economics. In simple terms, LCOE represents the break-even electricity price required for a project to recover its costs over time. Generalized LCOE forecasts are shown in the figure to the right.
- LCOE is defined as the present value of a project's lifetime costs divided by the present value of its total lifetime electricity generation (or energy delivered from a battery). Lower investment costs (CAPEX) and lower operating and maintenance costs (OPEX) reduce LCOE and therefore lower the revenue required for profitability. Higher production volumes also reduce LCOE, as fixed costs are spread across more units of electricity generation.
- As a result, projects with relatively low LCOEs may remain profitable even in markets with low capture prices. Wholesale market capture prices and capture rates are therefore necessary, but not sufficient, indicators when assessing the attractiveness of a renewable energy technology or project. Cost structures matter equally, and project economics will ultimately depend on the specific characteristics of each individual asset.

Levelized Cost of Electricity
USD/MWh (real 2025)



Note: *Values are global average costs.*
Source: *Bloomberg New Energy Finance, 'Levelized Cost of Electricity Update 2026', February 2026.*

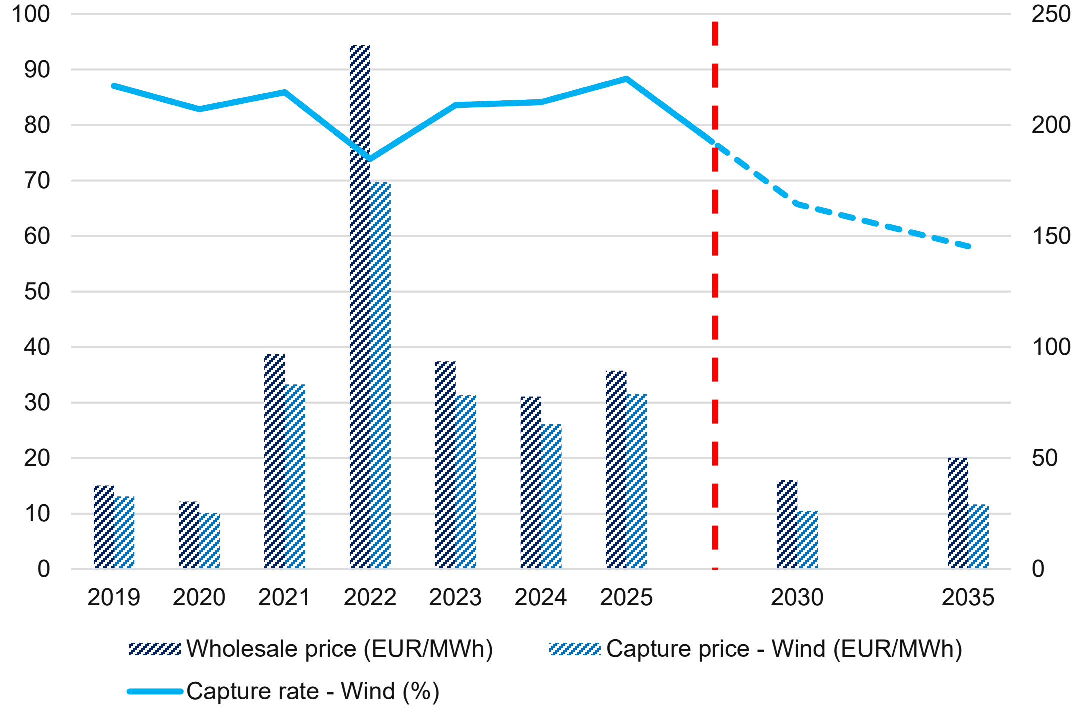
Country focus Germany

***Note**: Historical data are actual prices. Forecast data is real 2024 prices.*
***Source:** EIFO analysis based on ENTSOE-data. Forecast data from S&P Global.*

Germany
Wind power capture rates and capture prices

- Since 2019, wind power producers in Germany have achieved capture rates broadly between 80% and 90%. This indicates that they earn less per unit of electricity sold than the average wholesale price vis-à-vis the income from baseload production.
- Across the seven years of historical data we have, there is no pronounced decline in capture rates, but naturally some year-to-year variation. 2025 was a weak wind year, with low production helping to achieve a higher capture rate than the previous year.
- Russia's war in Ukraine, as well as rising natural gas prices during 2021, has led to generally higher power prices compared to the decade leading up to this event, which has also led to higher capture prices for wind (but not higher capture rates). Capture prices in 2025 were EUR 79/MWh.
- Towards 2030 and 2035, S&P Global forecasts that capture rates are going to decline towards ca. 60%. This indicates a tendency towards the power system becoming increasingly saturated with wind power, and a break from the current 'high' levels of capture rates. For this forecast to occur, further investments in wind - in particular offshore wind projects - must materialize on time.

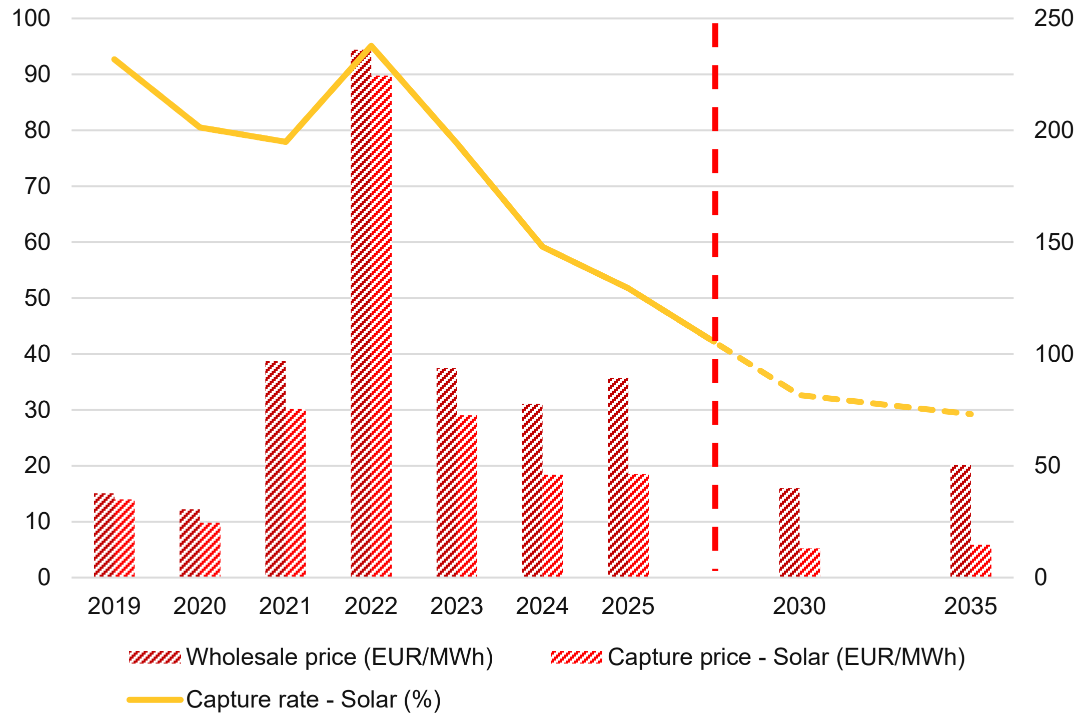
Left: Wind capture rate (%)
Right: Wind capture price (EUR/MWh)



Germany
Solar power capture rates and capture prices

- Since 2019, solar power producers in Germany have generally experienced strongly declining capture rates, from 93% in 2019 to 52% in 2025. The downward trend between these years was interrupted by a temporary uplift in capture rates in 2022 (and 2023) as a result of the EU energy crisis in 2022.
- The drastic downward trend in capture rates marks a profound shift in the economic basis for solar producers, and it happened at a speed that some companies may not have expected, as it has led to defaults by several companies in this space. One can say that, in the absence of the energy crisis and the resulting (temporary) higher capture prices, solar producers would be even worse off today. Capture prices in 2025 were EUR 46/MWh.
- Projected capture rates are expected to fall to around 30% by 2035, signaling substantial revenue decline for projects that lack storage. Consequently, Germany's rapid solar expansion is heavily dependent on integrating storage solutions.
- Continued build-out of solar power in Germany will rely on further declines in the levelized cost of electricity for solar power to retain a margin between revenues and costs. This analysis only concerns the revenue side.

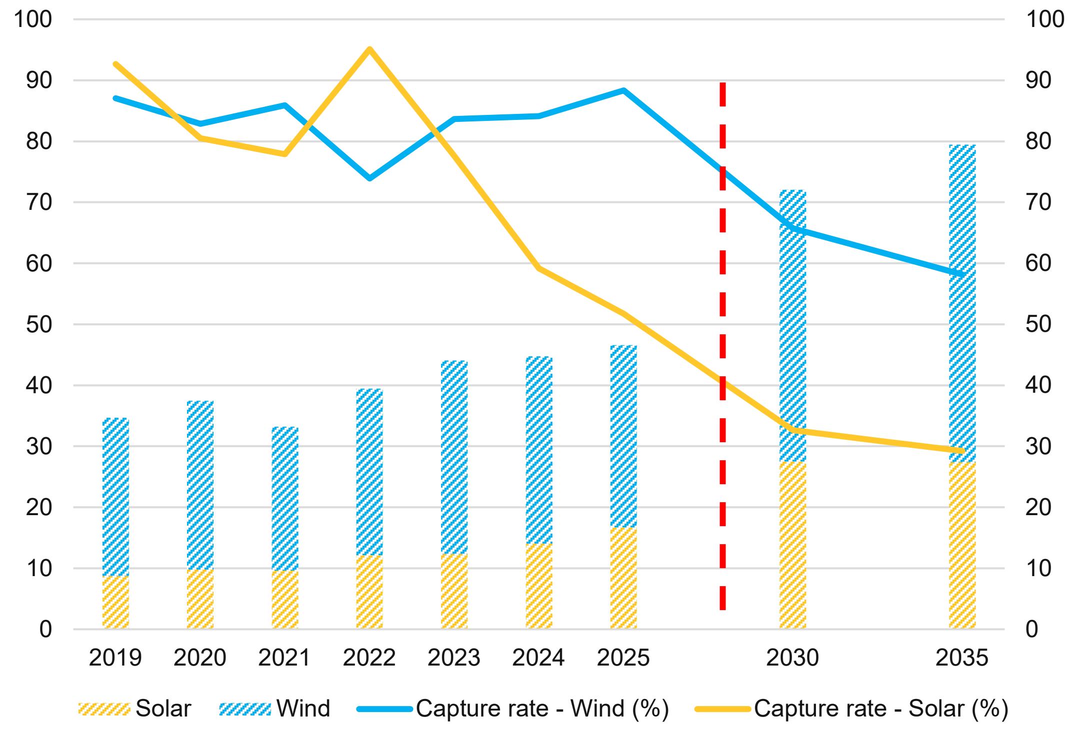
Left: Solar capture rate (%)
Right: Solar capture price (EUR/MWh)



Germany
Capture rates and renewable penetration

- As wind and solar account for a larger share of electricity demand, their capture rates decline. Overall, renewables have steadily increased their share of electricity demand from 34.7% in 2019 to 46.6% in 2025. However, this growth is uneven. Wind's share rose only modestly - from 26.0% in 2019 to 29.9% in 2025 - while solar nearly doubled from 8.7% to 16.7%.
- There is a clear inverse relationship between renewable penetration and capture rates. In 2025, this effect is especially visible for solar. Solar capture rates are just 51.7%, far below wind at 88.3%, even though total wind generation is higher. Despite still being a smaller share, growth in solar production has contributed strongly to declining capture rates. The gap between the two technologies widened notably in 2024–2025.
- This reflects stronger cannibalization of solar. Solar output is concentrated during daytime hours - both within Germany and across Europe - leading to frequent oversupply and lower prices. Wind generation is more geographically and temporally dispersed, which creates better opportunities to export surplus power during high-production periods. As a result, wind has so far integrated into the system with less value loss than solar.
- Looking ahead, renewables are expected to supply up to 80% of demand by 2035. At these levels, value erosion is likely to intensify, particularly for solar, but also for wind. Sustaining further expansion in line with climate goals will require both stronger revenue mechanisms and continued cost reductions.

Left: Capture rate (%)
Right: Share of renewable production to demand (%)



Germany
Price duration curves and renewable production

› The price duration curve shows how wholesale electricity prices are distributed over time. By plotting wind (and solar) generation alongside it, we can illustrate the relationship between prices and renewable output.

› For wind, there is a clear negative relationship, as higher generation generally coincides with lower prices. In 2025, 11% of all hours saw market prices below EUR 10/MWh.

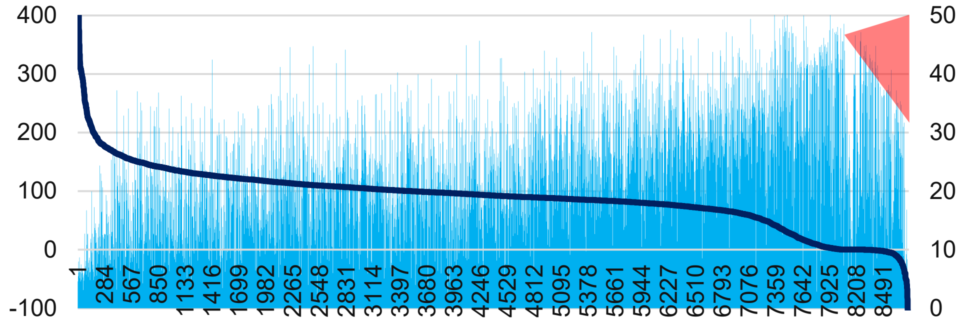
› Interestingly, wind output appears low during the lowest -price hours (the right side of the curve, illustrated in red). This is likely linked to curtailment, which is not directly visible in the data since the electricity is never produced. Curtailment can occur when system operators reduce output in response to low or negative prices, or when grid constraints limit the ability to transport power - such as in Germany's single price zone, where North-South bottlenecks create local imbalances.

› The negative relationship between price and generation is even more pronounced for solar, which helps explain its lower capture rates.

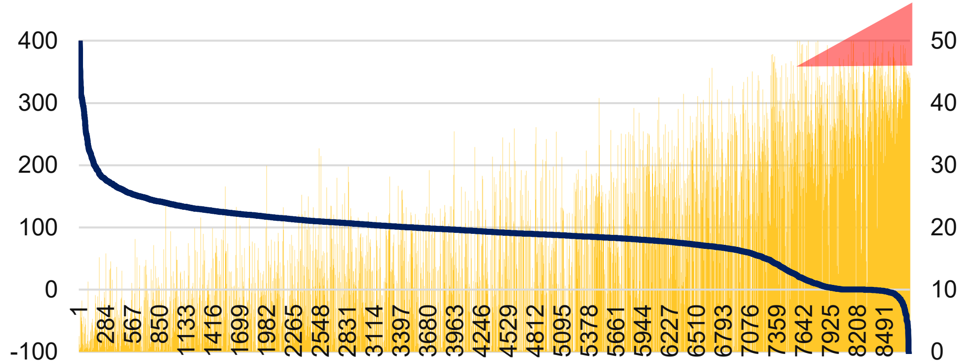
› Solar does not seem to curtail production to the same degree as wind during periods of low market prices. This may be related to older solar panels not being technically able to adjust production remotely, and household solar panels not strongly responding to market price signals.

› Note that the width of the bars can obscure hours with little or no generation. A closer look shows that hours with minimal production occur more frequently at higher-price levels than at lower ones.

Left: 2025 Price duration curve (EUR/MWh)
Right: Wind production (columns) (GWh)



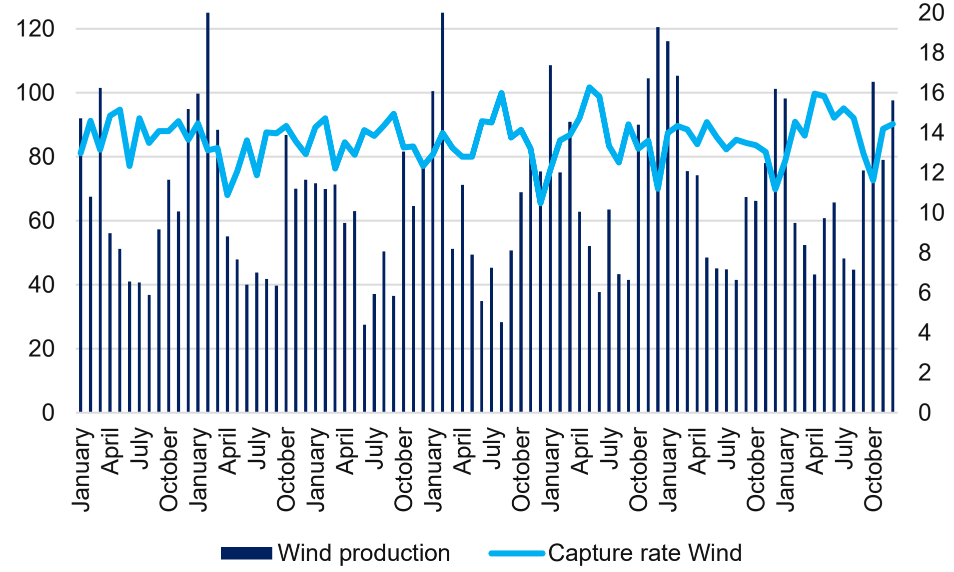
Left: 2025 Price duration curve (EUR/MWh)
Right: Solar production (columns) (GWh)



Germany
Monthly data on production and capture rate

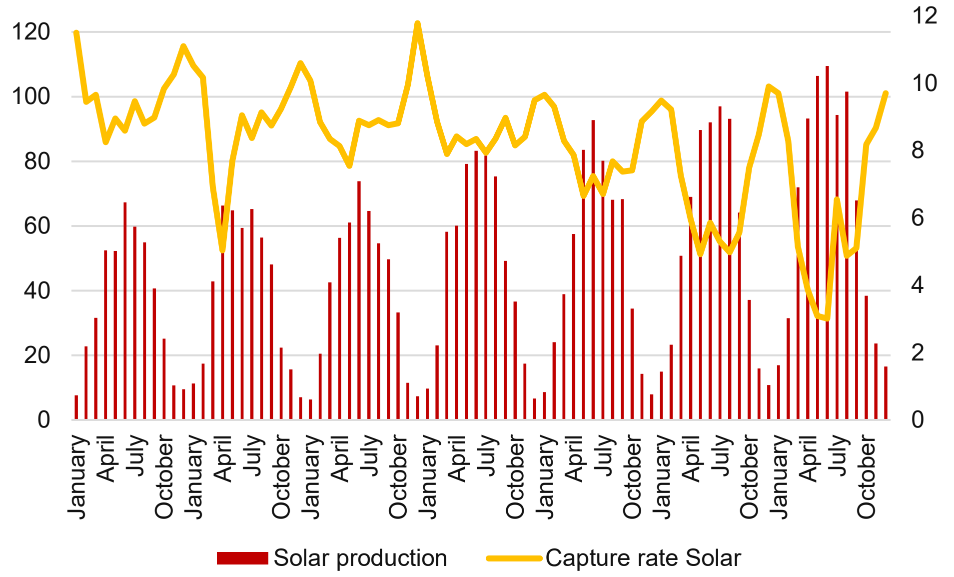
- Wind production displays a clear seasonal pattern, with stronger wind output during winter months than during summer months.
- The wind power capture rate on a monthly basis stays relatively stable from 2019 to 2025. Within-year capture rates reach down to about 70% during winter and closer to 100% during summer.

Left: Monthly capture rate (%) for wind (2019-2025)
Right: Monthly wind production (TWh)



- Solar production shows clear seasonality, with German solar production increasing 10-fold from 1.03 TWh in December 2024 to 10.2 TWh in June 2025.
- Across the dataset (January 2019 to December 2025), the monthly capture rate for solar tends to correlate increasingly with solar production. Especially during the summer months of 2025, there is a very high degree of cannibalization, with capture rates reaching 31.4% in June 2025 and above 100% in winter.

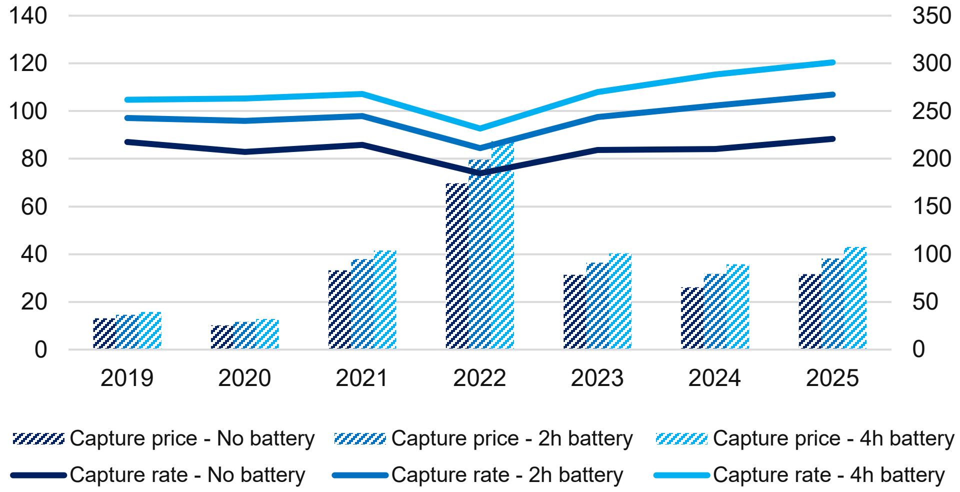
Left: Monthly capture rate (%) for solar (2019-2025)
Right: Monthly solar production (TWh)



Germany
Impact of storage on capture rates and prices

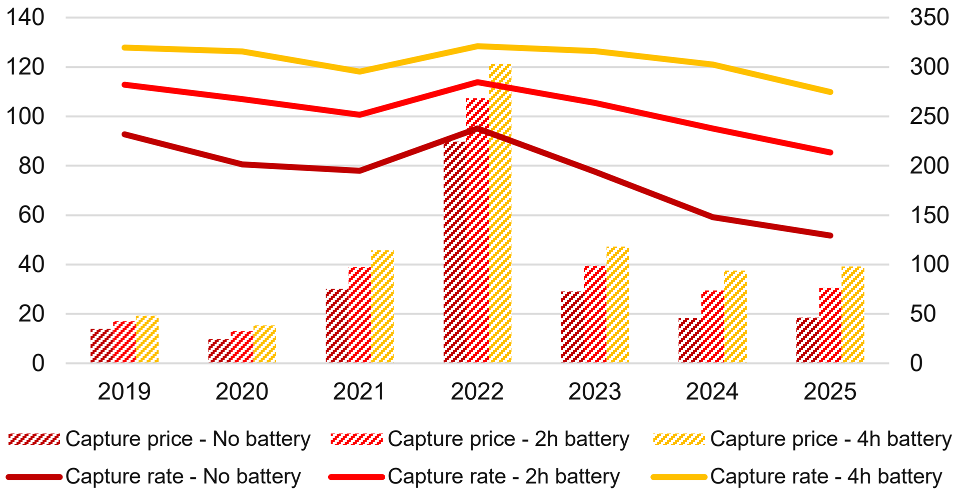
- Integration of battery storage helps projects shift sales from low-price hours to high-price hours and thereby improve their ability to capture higher prices.
- A hypothetical wind project without battery storage in Germany had a capture rate of 88% in 2025. In this analysis, we model the value of battery storage for a project with a 2:1 ratio of electricity production capacity to storage. This could be a 200 MW wind park coupled with a 100 MW battery. We model 0-2-4 hours of storage. If the project integrates a 2-hour battery, it can achieve a capture rate of 107%. A 4-hour battery (1 MW / 4 MWh) gives a capture rate of 120%.

Left: Capture rate wind (%)
Right: Capture price wind (EUR/MWh)



- The first hours of storage (from 0 to 2 hours in our example) are naturally more valuable than the later hours (from 2 to 4 in our example), since they utilize the largest price differences between hourly prices, while subsequent storage capacity utilizes the second-largest price differences.
- For a corresponding battery setup connected to a solar project, the corresponding capture rate is 52% (no storage), 85% (2-hour storage), and 110% (4-hour storage).
- Battery storage can help retain more value in the project and avoid crippling capture rates - at least for a period of time. The battery will not be able to 'turn the tide' on falling capture rates and falling capture prices as renewable penetration increases.

Left: Capture rate solar (%)
Right: Capture price solar (EUR/MWh)



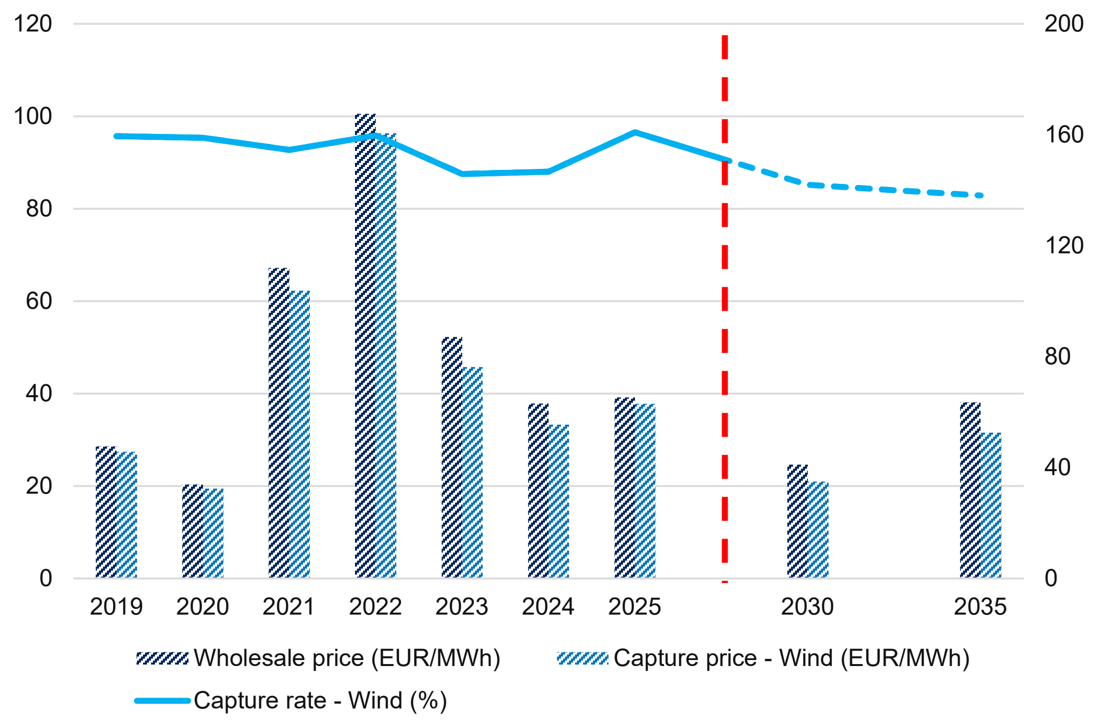
Country focus Spain

***Note**: Historical data are actual prices. Forecast data is real 2024 prices.*
***Source:** EIFO analysis based on ENTSOE-data. Forecast data from S&P Global.*

Spain
Wind power capture rates and capture prices

- Wind producers in Spain have experienced quite stable capture rates over the period from 2019 to 2025, ranging from 96.5% to 87.5%, without a clear trend in either direction. The outlook towards 2035 points to a slight decline in rates to an estimated 82.9% in S&P Global's view.
- Capture prices have increased in the wake of Russia's war in Ukraine, reaching EUR 63/MWh in 2025.
- Interestingly, the Spanish forecast for capture rates and capture prices in 2035 seems to be in the higher end compared to other markets such as Germany and the UK. This is because the forecast does not predict wind growth or wind taking up a greater share of demand. Contributing to this is also the absence of offshore wind in the forecast for Spain.

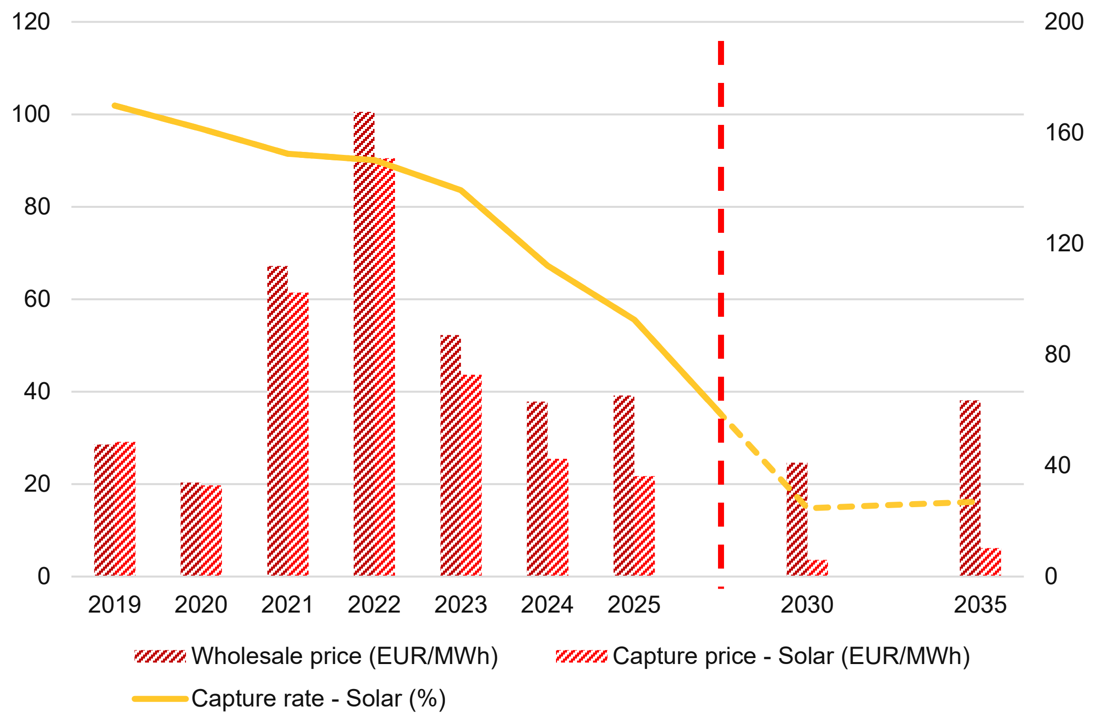
Left: Wind capture rate (%).
Right: Wind capture price (EUR/MWh).



Spain
Solar power capture rates and capture prices

- Capture rates for solar power have been steadily declining in Spain since 2019, dropping from 101.9% in 2019 to 55.6% in 2025. This is a significant erosion of value over a very short period.
- Capture prices have held up due to higher wholesale prices driven by natural gas prices since 2022. Without this spike in prices, capture prices (and capture rates) would likely have fared much worse.
- Looking ahead, the forecast by S&P Global predicts capture rates for solar (without storage) of around 16% by 2035 and capture prices as low as EUR 10.3/MWh.
- The Iberian Exception: During 2022, when gas prices surged across Europe, solar capture rates declined in Spain while increasing in several other markets. In June 2022, the EU Commission allowed Spain and Portugal to temporarily cap the price of gas used for power generation (initially at EUR 40/MWh) to limit electricity price increases.
- In most European markets, high gas prices led to very high electricity prices, especially during midday when gas often set the marginal price. This allowed solar producers, for example in Germany, to capture exceptionally high prices during their production hours.
- In Spain, however, the gas cap suppressed these midday price spikes, and Spanish solar producers were unable to benefit from extreme prices, resulting in lower achieved capture prices and, consequently, lower capture rates compared to uncapped markets.

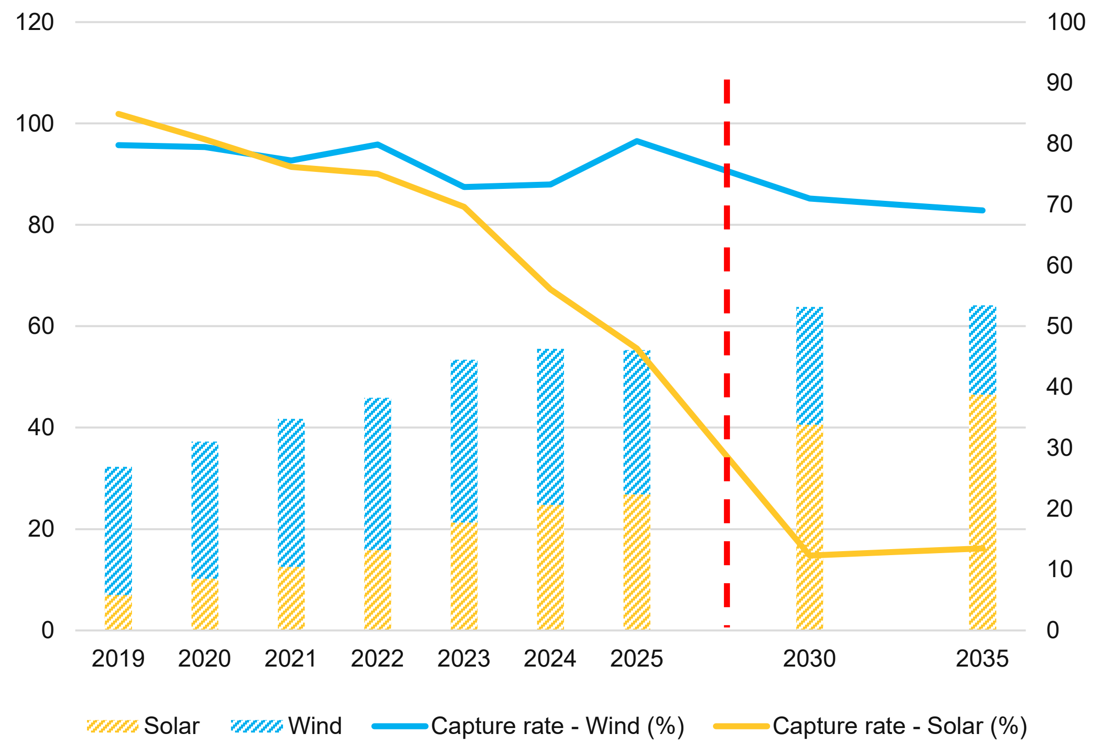
Left: Solar capture rate (%).
Right: Solar capture price (EUR/MWh).



Spain
Capture rates and renewable penetration

- The steep decline in solar capture rates seems to be highly correlated with solar power taking up a larger share of Spanish electricity demand, going from 6% in 2019 to 22% in 2025.
- The outlook towards 2035 is for solar to make up 39% of demand, helping to explain the very low capture rates, down to 15% by 2035.
- Wind energy expansion from 2019 to 2025 has increased only slightly from 21% to 24%, which is also associated with a high level of stability in capture rates for wind.

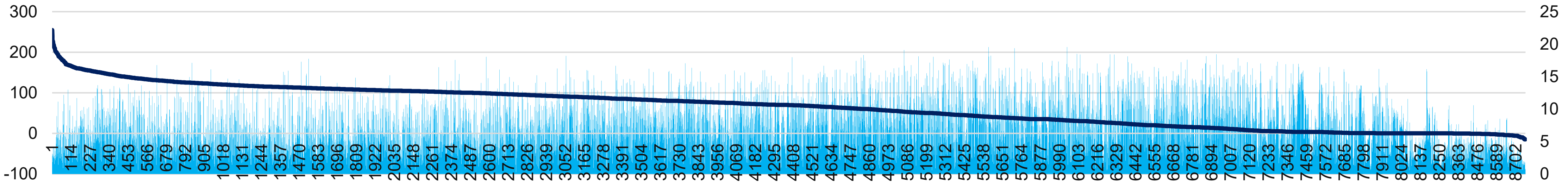
Left: Capture rate (%).
Right: Share of renewable production to demand (%)



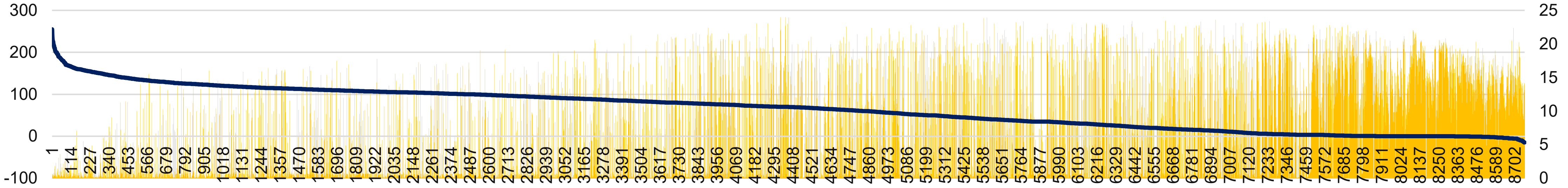
Spain
Price duration curves and renewable production

- Wind production is not strongly correlated with price (the data below are from 2025), as wind production (blue bars) is spread fairly evenly across the entire price duration curve, including during high-price hours. This supports a relatively high capture rate (96.5% in 2025).
- Solar is strongly negatively correlated with price as solar production (yellow bars) is heavily concentrated in the right-hand portion of the curve, i.e. in the hours with the lowest or negative prices. In 2025, 20% of all hours saw market prices below EUR 10/MWh. Wind appears to curtail production when market prices are low, while solar does not seem to do react as strongly to market price signals.

Left: 2025 Price duration curve (EUR/MWh)
Right: Wind production (columns) (GWh)



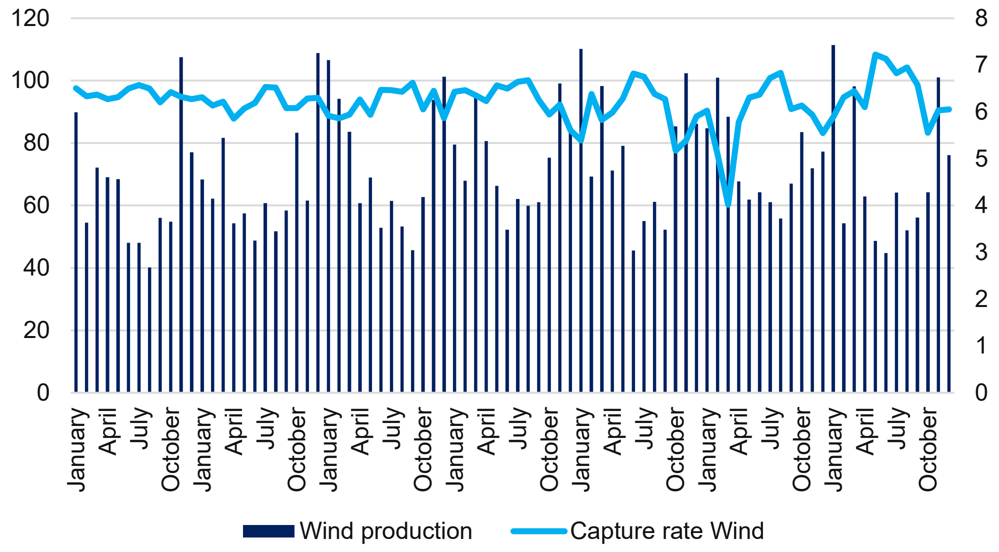
Left: 2025 Price duration curve (EUR/MWh)
Right: Solar production (columns) (GWh)



Spain
Monthly data on production and capture rate

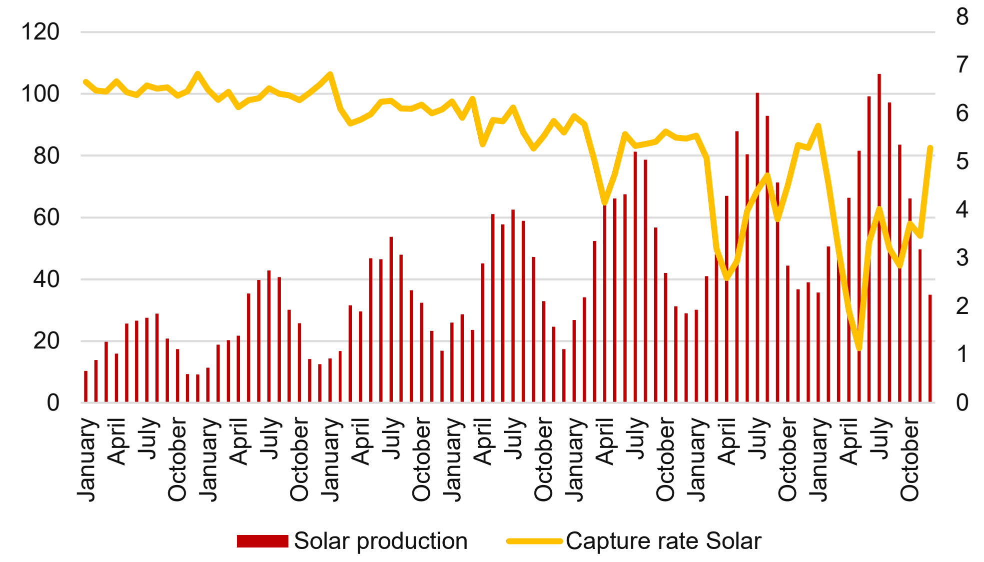
- The wind power capture rate on a monthly basis stays relatively stable from 2019 to 2025 but seems to become more volatile.
- Capture rates reach down to about 80% during winter and up to 100% during summer.

Left: Monthly capture rate (%) for wind (2019-2025)
Right: Monthly wind production (TWh)



- Solar production shows clear seasonality, with Spanish solar production increasing 3-fold from 2.3 TWh in January 2025 to 6.8 TWh in July 2025.
- Across the dataset (January 2019 to December 2025), the monthly capture rate for solar tends to correlate increasingly with solar production. Especially during the summer months of 2025, there is a very high degree of cannibalization, with capture rates reaching 17.7% in May 2025. Capture rates during winter also seem to weaken over time.

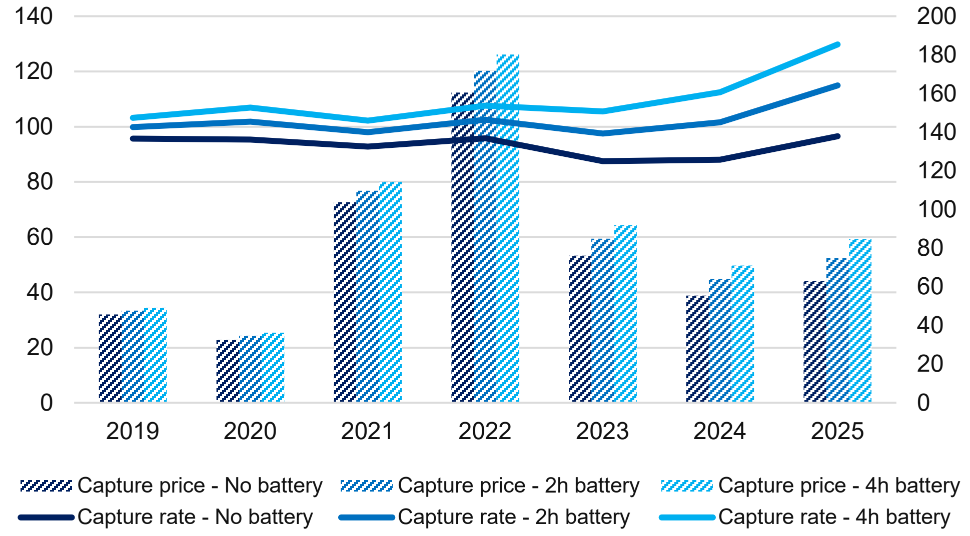
Left: Monthly capture rate (%) for solar (2019-2025)
Right: Monthly solar production (TWh)



Spain
Impact of storage on capture rates and prices

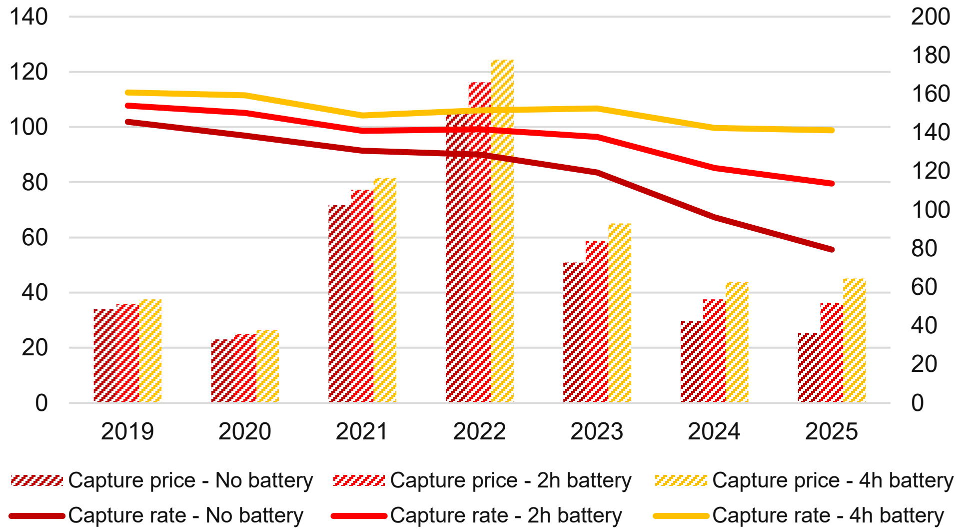
- An average wind project in Spain would achieve a capture rate of 97% in 2025, which is quite healthy and does not show strong signs of cannibalization.
- In this analysis, we model the value of battery storage for a project with a 2:1 ratio of electricity production capacity to storage. This could be a 200 MW wind park coupled with a 100 MW battery. If the project integrates a 2-hour battery (200 MWh), it can achieve a capture rate of 115%. A 4-hour battery gives a capture rate of 130%. The corresponding values for a Spanish solar park are a capture rate of 56% without battery, 80% with 2-hour storage, and 99% with 4-hour storage.

Left: Capture rate wind (%)
Right: Capture price wind (EUR/MWh)



- The battery lifts capture prices (and capture rates) more for solar than for wind. The reason is as described for Germany: we model the battery as an add-on to the wind or solar park that provides a level of revenue that is unrelated to the associated generation asset's production level.
- Since the load factor for the 2 MW wind park is higher than the solar park's load factor, the value that the battery generates is spread across a lower production volume for solar, which makes the battery seem more attractive, although the economic value is the same in both cases.

Left: Capture rate solar (%)
Right: Capture price solar (EUR/MWh)



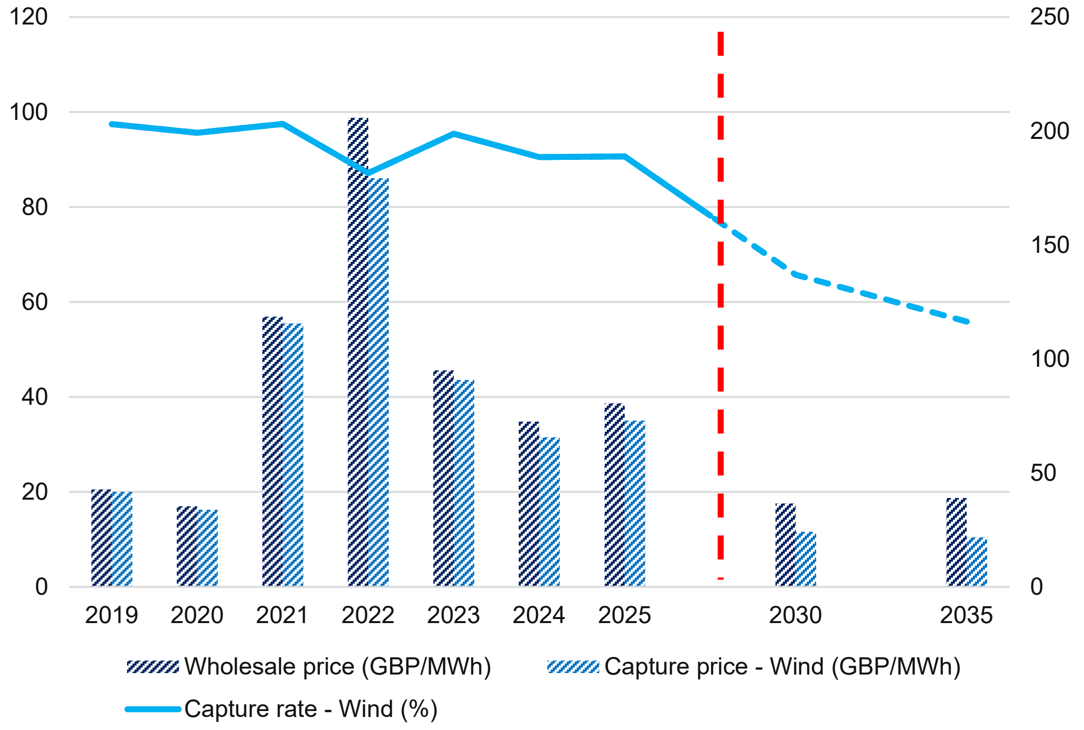
Country focus UK

***Note**: Historical data are actual prices. Forecast data is real 2024 prices.*
***Source:** EIFO analysis based on ENTSOE-data. Forecast data from S&P Global.*

UK
Wind power capture rates and capture prices

- Wind power producers in the UK have achieved relatively high and only moderately declining capture rates, from 98% in 2019 to 91% in 2025.
- Both wholesale and capture prices in the UK rose significantly during 2021–2022 as a result of higher natural gas prices.
- According to S&P Global's forecast data, capture prices for wind are expected to decrease to approximately a third of the current 2025 level by 2030. This development is linked to UK ambitions within wind power. Without the integration of storage (or CfD support), wind power projects in the UK will see lower capture prices than in other markets.
- Cannibalization within wind production is thus expected to become quite pronounced in the UK going forward.

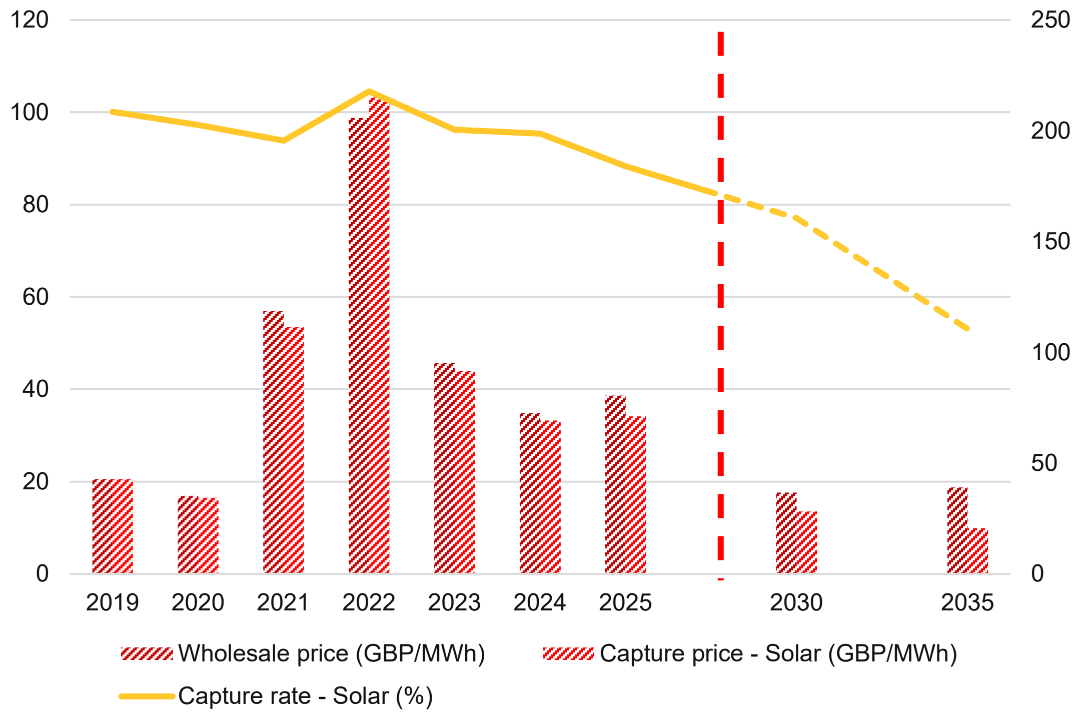
Left: Wind capture rate (%).
Right: Wind capture price (GBP/MWh).



UK
Solar power capture rates and capture prices

- Solar capture rates in the UK have remained high over the seven-year period, even exceeding 100% in 2019 and again in 2022.
- In 2025, the capture rate reached its historical low point at 82.7%, while solar production made up less than 7% of UK electricity demand.
- S&P Global's forecast indicates that future capture prices and capture rates are going to decline further. Capture rates are expected to fall to 77% in 2030 (capture price: 28.2 GBP/MWh) and 53% in 2035 (capture price: 20.7 GBP/MWh).

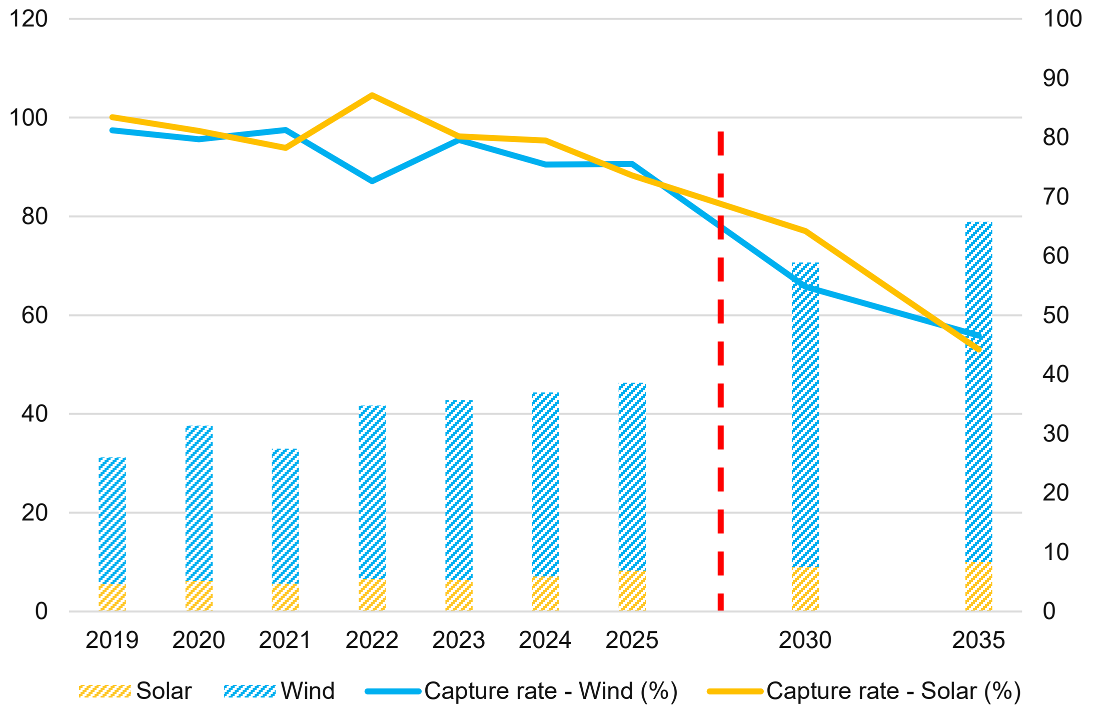
Left: Wind capture rate (%).
Right: Wind capture price (GBP/MWh).



UK
Capture rates and renewable penetration

- Wind power has increased as a share of electricity consumption from 21% in 2019 to 32% in 2025, while at the same time the capture rate has decreased slightly from 98% to 91%.
- Solar power has a much smaller market share in the UK, increasing from 5% to 7% over the period, while capture rates have decreased from 100% to 88%.
- The S&P Global forecast suggests that wind capture rates are going to decrease below 60% as wind power's market share exceeds 57%.
- For solar, capture rates are anticipated to reach 53% as its market share increases slightly to 8%. This seems like a very strong reaction, and we expect that there is another factor at play that is currently unknown to us.

Left: Capture rate (%).
Right: Share of renewable production to demand (%)



UK
Price duration curves and renewable production

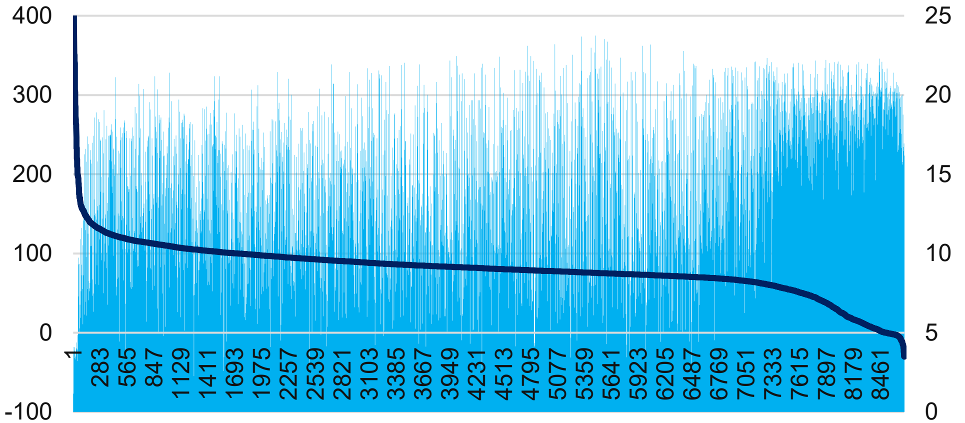
› The price duration curve indicates that the UK wholesale electricity market in 2025 had relatively few hours with very high scarcity-driven electricity prices and also few hours (compared to the other markets) with ‘floor prices’, which we define as prices below EUR 10/MWh.

› Generally, wind output in the UK appears quite stable without a very strong link to market prices, which is also the takeaway from other wind-rich power markets, e.g., Germany and Denmark.

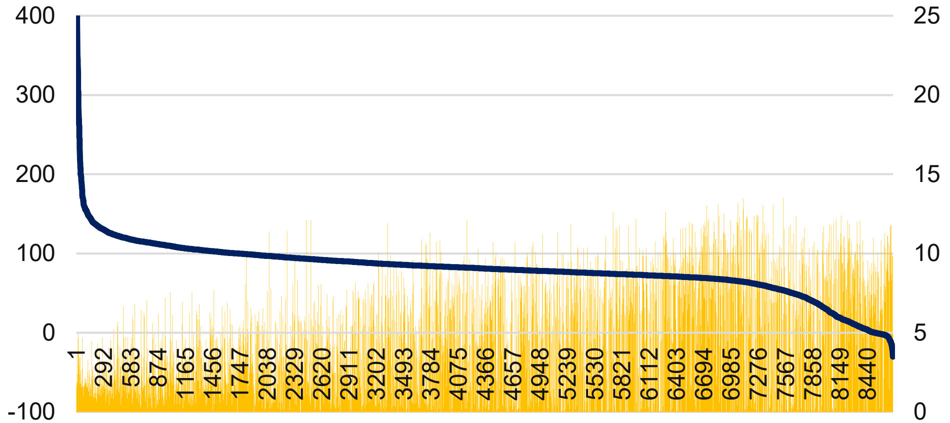
› A (negative) relationship between price and generation is visible for solar power, although relatively stable wholesale prices across 2025 support a high solar capture rate.

› There could be signs of solar curtailment, but it is not a clear pattern. It is, however, clear that hours with minimal production occur more frequently at higher-price levels than at lower ones.

Left: 2025 Price duration curve (GBP/MWh)
Right: Wind production (columns) (GWh)



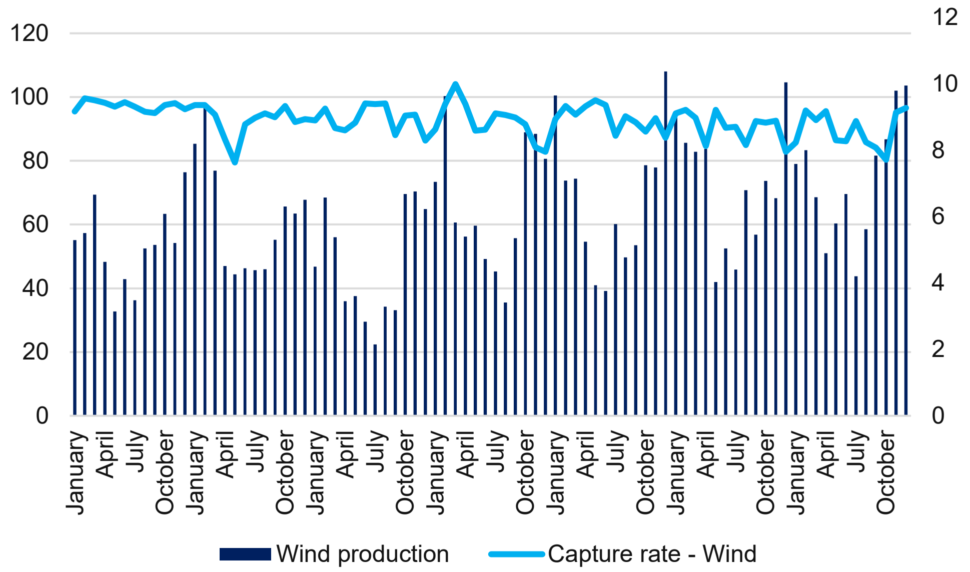
Left: 2025 Price duration curve (GBP/MWh)
Right: Solar production (columns) (GWh)



UK
Monthly data on production and capture rate

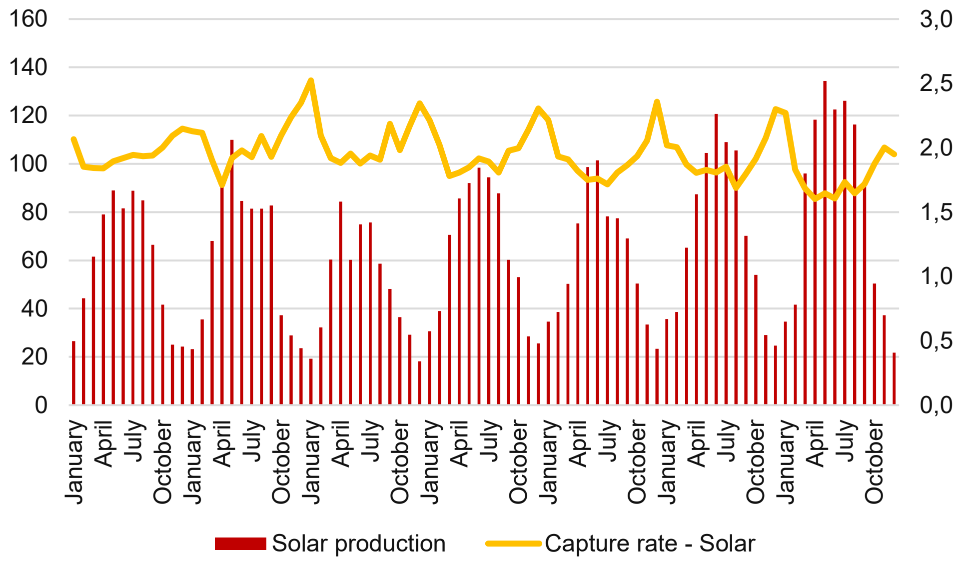
- The wind power capture rate on a month-to-month basis has consistently stayed in the 80%-100% range from 2019 to 2025, even though there is strong seasonality in wind power production. Winter generation is about double that of summer.

Left: Monthly capture rate (%) for wind (2019-2025)
Right: Monthly wind production (TWh)



- UK solar production displays clearer seasonality. Despite this, UK solar capture rates remain relatively high compared to other markets, even surpassing 100% during wintertime.

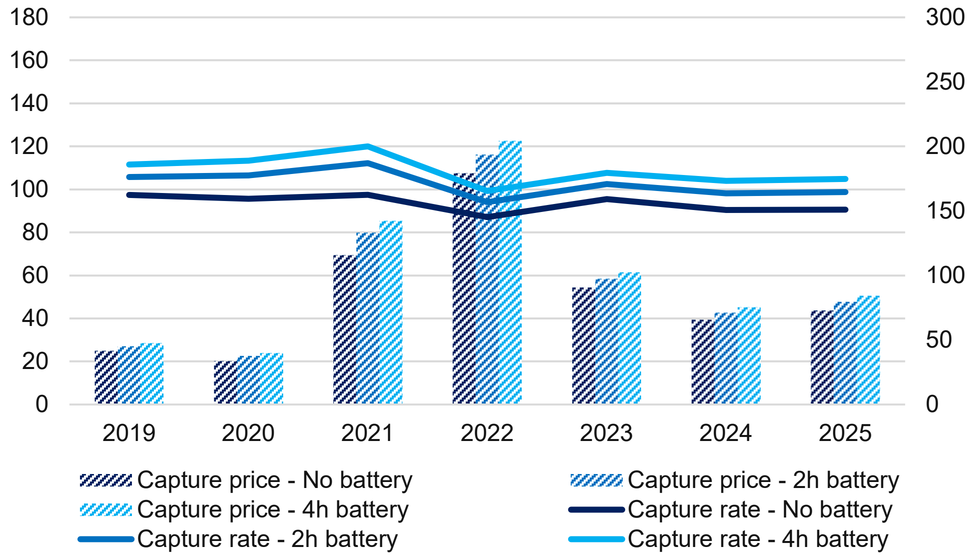
Left: Monthly capture rate (%) for solar (2019-2025)
Right: Monthly solar production (TWh)



UK
Impact of storage on capture rates and prices

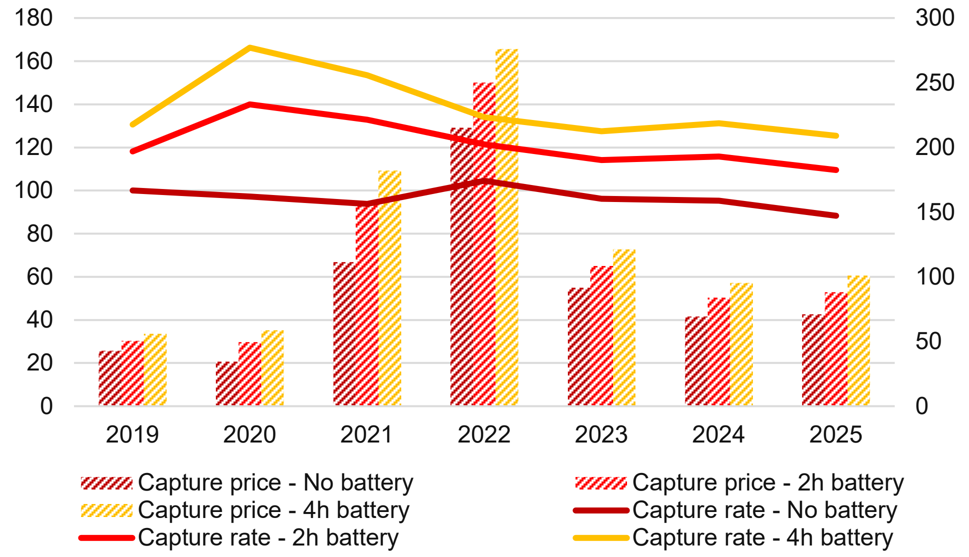
- An average wind project in the UK could achieve a capture rate of 91% in 2025.
- Integrating a 2-hour battery (1 MW capacity, 2 MWh storage) results in a capture rate of 99%, and a 4-hour battery provides a capture rate of 105%.
- In general, the relative benefits of batteries combined with wind production in the UK seem quite modest compared to the other markets in this analysis, which is linked to the relative stability of wholesale prices and the limited number of 'floor price' hours.

Left: Capture rate wind (%)
Right: Capture price wind (GBP/MWh)



- The corresponding values for a solar park in the UK are a capture rate of 88% without battery, 110% with 2-hour storage, and 125% with 4-hour storage.
- The battery thus lifts capture prices (and capture rates) more for solar than for wind. As described earlier, this is due to the modelling approach, where battery revenue is spread across the wind/solar production volume. For wind, the battery value is diluted more due to a higher load factor, which makes the battery seem less attractive, although the numerical value is the same in both cases.

Left: Capture rate wind (%)
Right: Capture price solar (GBP/MWh)



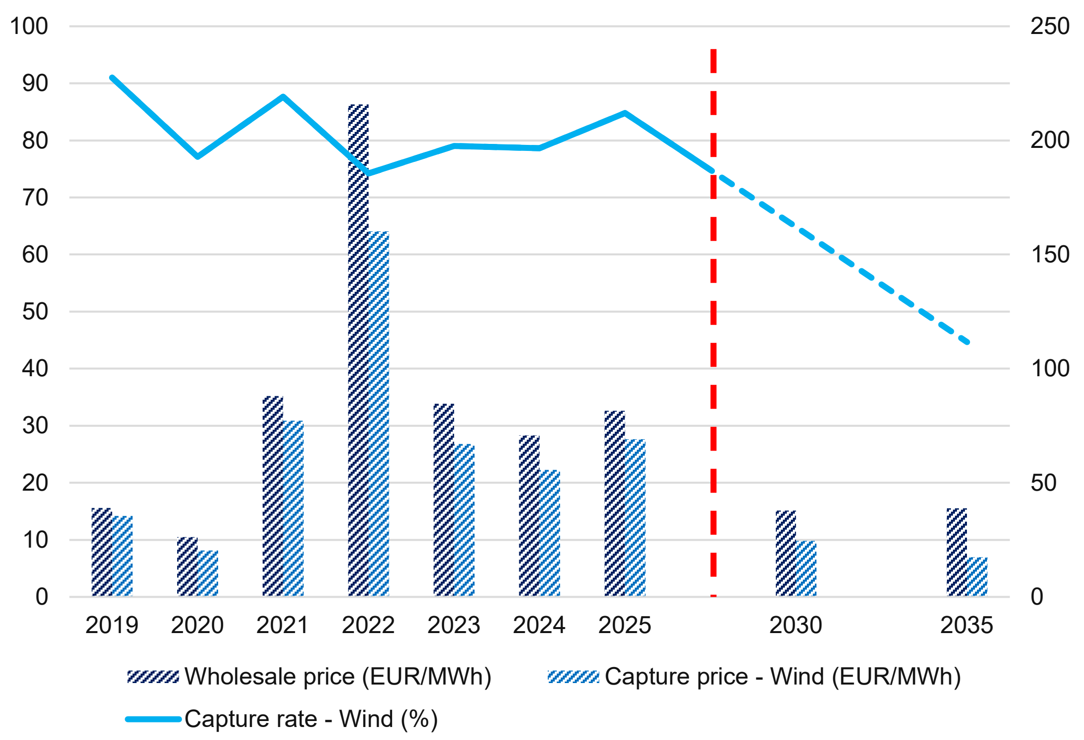
Country focus Denmark

***Note**: Historical data are actual prices. Forecast data is real 2024 prices.*
***Source:** EIFO analysis based on ENTSOE-data. Forecast data from S&P Global.*

Denmark
Wind power capture rates and capture prices

- From 2019–2025, Danish wind capture rates stayed stable at 75–90% with no strong trend in the data.
- S&P Global expects both capture rates and capture prices to decline over the next decade, driven by major planned expansions in onshore and offshore wind.
- Offshore capacity alone is projected to grow from 2.7 GW in 2024 to 44.2 GW by 2050, with 9 GW tendered by 2030.
- Limitations in the available data for generation and load mean that we treat DK1 and DK2 as a single market in this analysis. Although they are technically two separate power markets, market prices are fairly well aligned during most hours of the year, helped along by direct interconnection and through other markets.

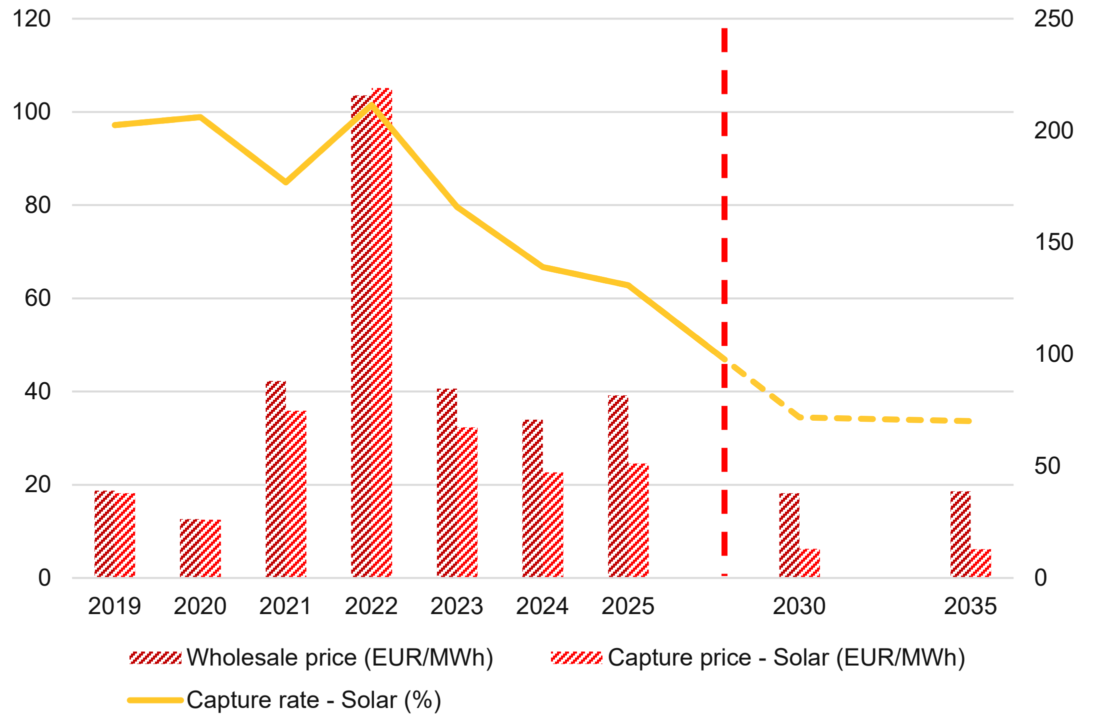
Left: Wind capture rate (%)
Right: Wind capture price (EUR/MWh)



Denmark
Solar power capture rates and capture prices

- Solar capture rates in Denmark have been declining from 2019 –2025, reflecting a steep increase in the share of solar in the grid mix and a profound shift in the business case for solar producers.
- The solar capture rate rebounded temporarily in 2022 following the energy crisis, when high midday prices helped capture rates surpass 100%.
- Over the last three years, the solar capture rate declined steadily to a level of about 63% in 2025. Capture prices also declined but remained at a level above that seen prior to the energy crisis.
- The S&P forecast predicts a further decline in both capture prices and capture rates in 2030–2035 to approximately 34%.

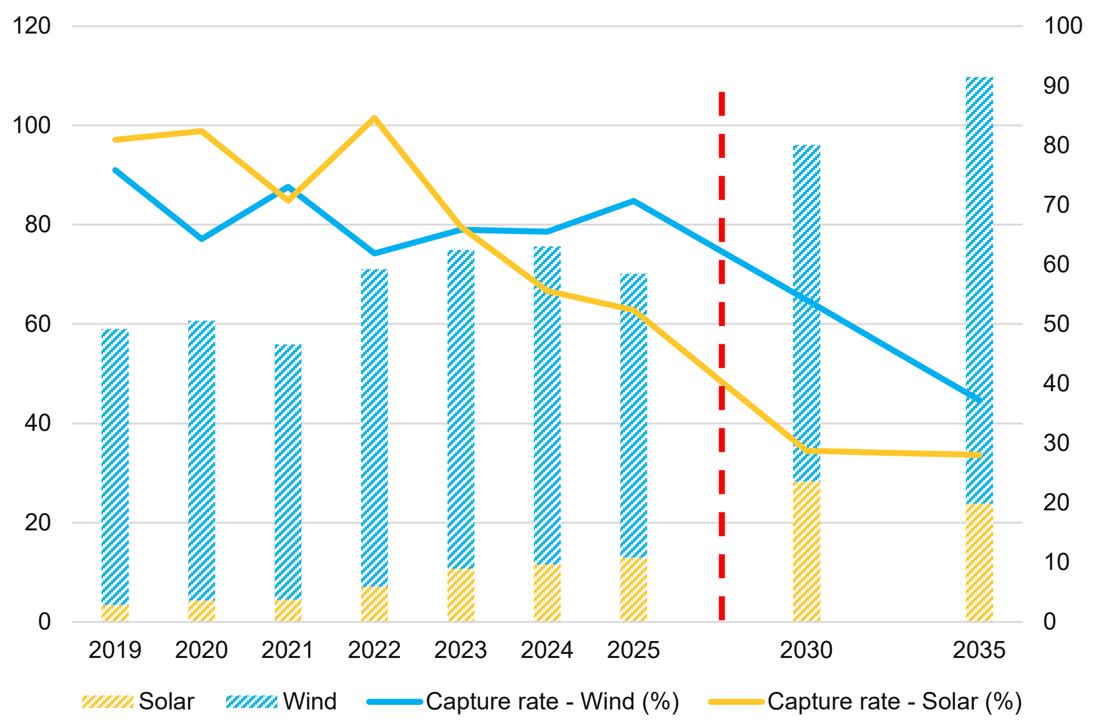
Left: Solar capture rate (%)
Right: Solar capture price (EUR/MWh)



Denmark
Capture rates and renewable penetration

- Overall, renewables' share of demand increased from 49.2% in 2019 to 58.5% in 2025 in Denmark.
- The wind capture rate has remained relatively high despite the high share of wind production in the energy mix, which is likely due to exceptionally strong interconnections linking to no less than five neighboring markets. 2025 was a weak wind year, with low production helping to achieve a higher capture rate than the previous year.
- The solar share of demand has grown steadily throughout the period, reaching slightly above 10% in 2025. The historical data depict an inverse relationship between solar penetration and capture rates, with the exception of the 2022 energy crisis. For wind, the pattern is less pronounced to date.
- Looking ahead, renewables are forecast to supply up to 91% of demand by 2035. This significant increase is expected to drive down capture rates for both wind and solar to historically low levels.
- Both wind and solar capture rates are expected to decline towards 2035, as renewable energy continues to expand. The solar capture rate is expected by S&P Global to reach 33.7%, while the wind capture rate is expected to fall to an all-time low of 44.7%.

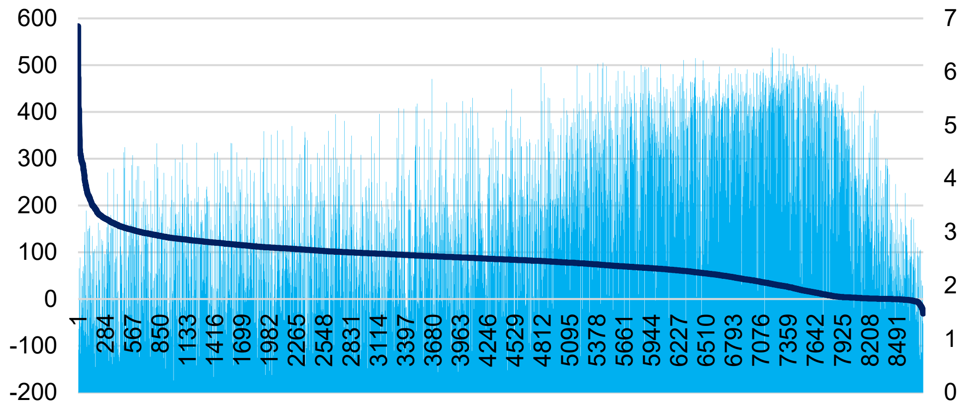
Left: Capture rate (%)
Right: Share of renewable production to demand (%)



Denmark
Price duration curves and renewable production

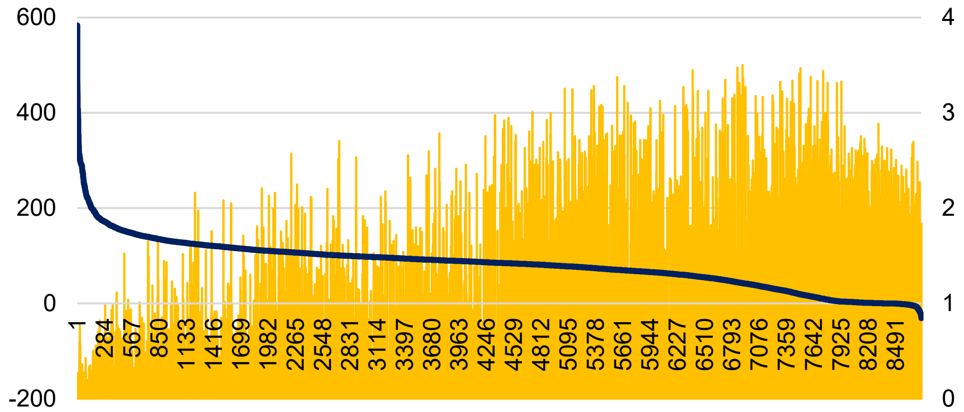
- The graphs plot the price duration curve for Denmark in 2025 alongside wind (and solar) generation to highlight the relationship between prices and renewable output.
- For wind, there appears to be a slight negative correlation: higher wind generation generally coincides with lower prices.
- Interestingly, there is an obvious dip in wind production during the lowest-price hours (the right side of the chart), which is likely due to curtailment. Curtailment can either be voluntary (if the price is too low) or initiated by the TSO to ensure stability in the grid. Curtailment in the Danish wind sector is significant.

Left: 2025 Price duration curve (EUR/MWh)
Right: Wind production (columns) (GWh)



- There is also a negative correlation between market price and solar production, which is more pronounced for solar energy and consistent with low capture rates. As mentioned earlier, the width of the blue and yellow bars obscures hours with little or no generation. These observations are common during higher-price hours.
- The Danish price duration curve has a relatively steep spike on the left side, indicating few observations with very high (scarcity-driven) price spikes. Specifically, 2% of hours had prices above the top level (>200 EUR/MWh). At the other end of the spectrum, 12% of hours in 2025 had prices below EUR 10/MWh.

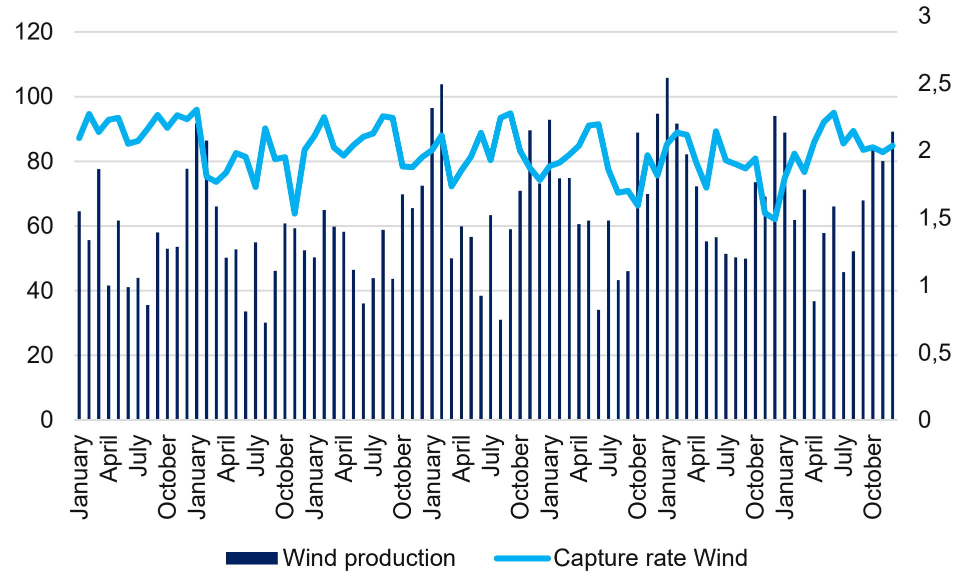
Left: 2025 Price duration curve (EUR/MWh)
Right: Solar production (columns) (GWh)



Denmark
Monthly data on production and capture rate

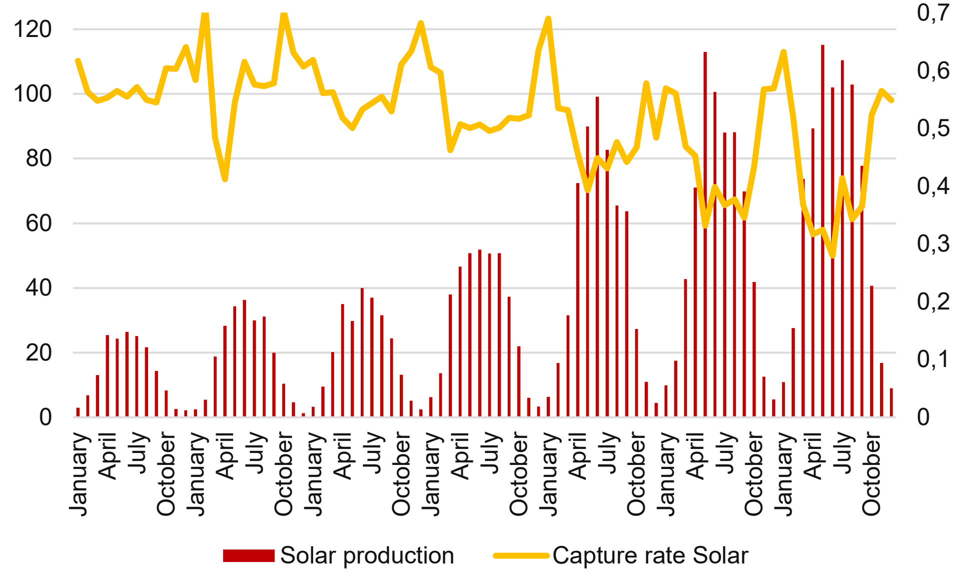
- Wind production displays a clear seasonal pattern, with stronger wind output during winter months than during summer months.
- The monthly wind power capture rate stays relatively stable from 2019 to 2025, with a few larger dips below 70% in autumn/winter months to around 62%-66%.

Left: Monthly capture rate (%) for wind (2019-2025)
Right: Monthly wind production (TWh)



- Solar production shows clear seasonality, with a significant increase in Danish solar production throughout the period.
- There is a clear negative correlation between solar production and monthly capture rates, where higher solar production in later years pushes the capture rate down to increasingly low levels. The lowest capture rate is observed in June 2025 at a level of 50%, while the peak level is seen earlier in the period during winter, at 127.2% in February 2020.

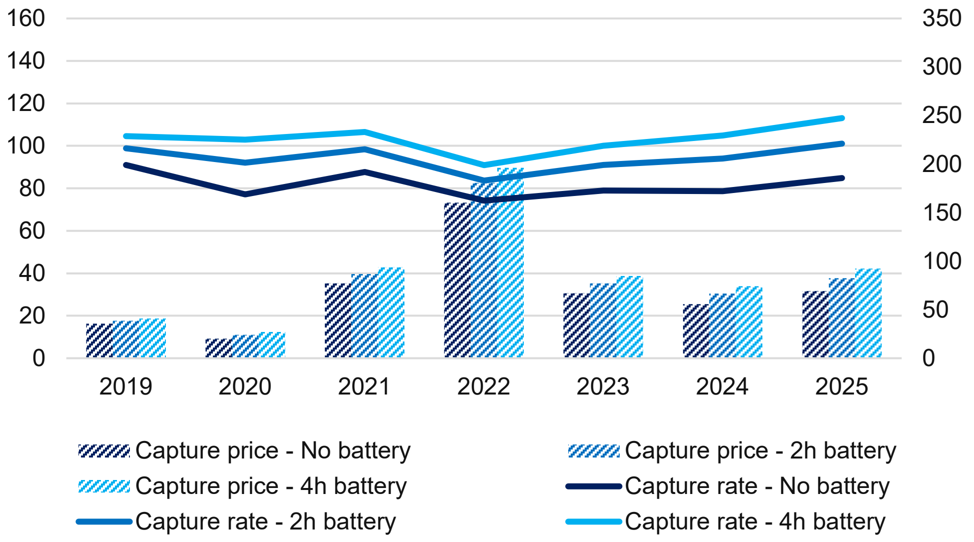
Left: Monthly capture rate (%) for solar (2019-2025)
Right: Monthly solar production (TWh)



Denmark
Impact of storage on capture rates and prices

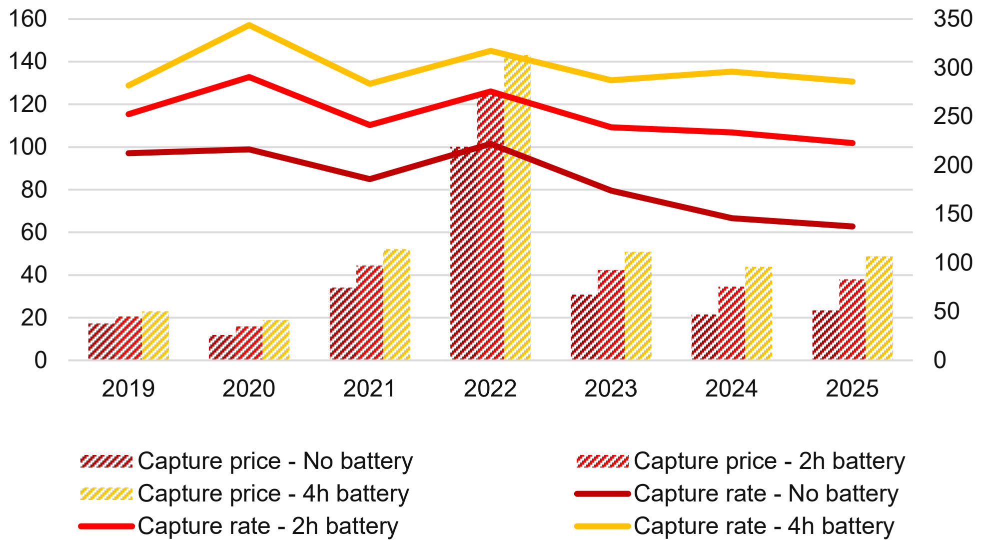
- A hypothetical wind project without battery storage in Denmark had a capture rate of 85% in 2025. Integrating a 2-hour battery yields a potential capture rate of 101%, and a 4-hour battery leads to a capture rate of 113%.

Left: Capture rate wind (%)
Right: Capture price wind (EUR/MWh)



- For a corresponding battery setup connected to a solar project, the corresponding capture rate is 63% (no storage), 102% (2-hour storage), and 131% (4-hour storage).
- The larger increase in capture rate for solar+battery than for wind+battery is related to wind's higher production for the same generation capacity.

Left: Capture rate solar (%)
Right: Capture price solar (EUR/MWh)



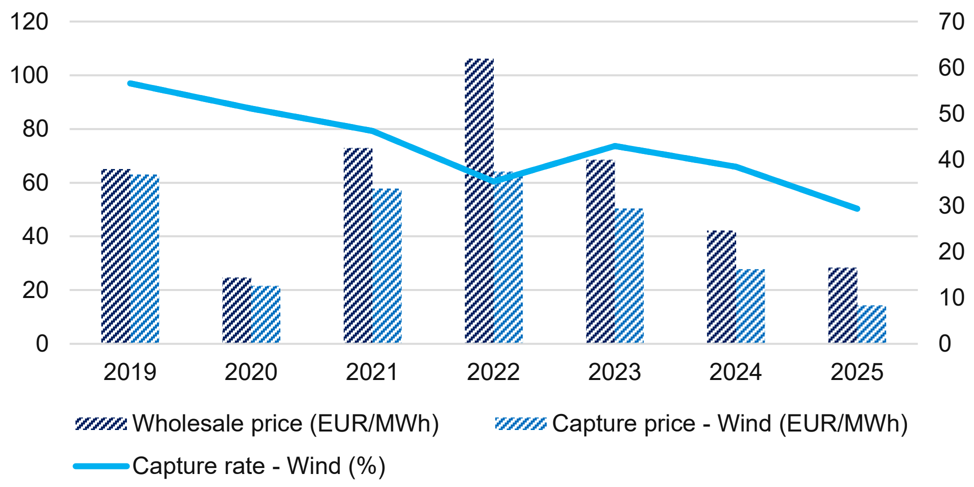
Country focus SE2

Note: *Historical data are actual prices. Forecast data is real 2024 prices.*
Source: *EIFO analysis based on ENTSOE-data. Forecast data from S&P Global.*

Sweden (SE2)
Wind power capture rates and capture prices

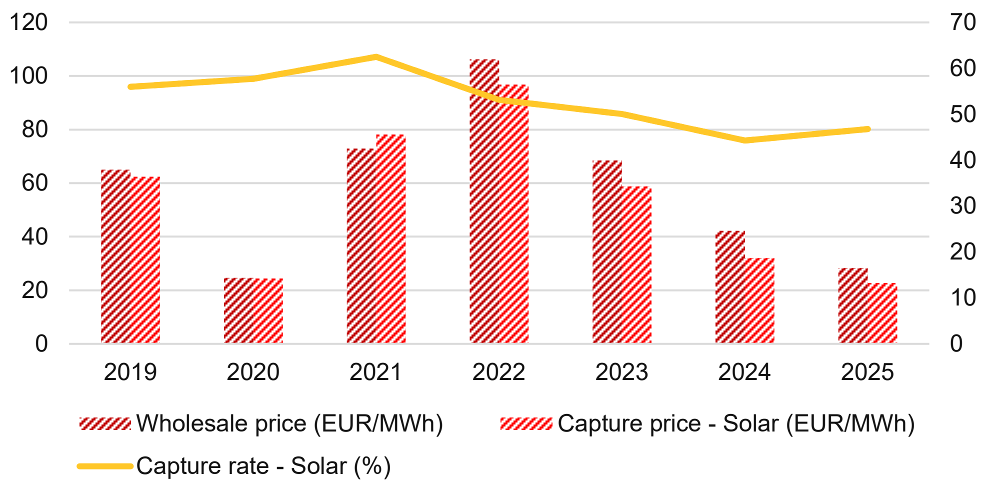
- SE2 is the second northern price zone in Sweden. It has a quite unique generation mix dominated by more than 7 GW of hydropower capacity and more than 6 GW of wind power capacity. Average load is less than 2 GW, with strong exports to neighboring markets, although limited by interconnection capacity to SE3.
- Since 2019, wind power producers in SE2 have experienced a generally declining capture rate from 97% in 2019 to 50% in 2025.

Left: Wind capture rate (%)
Right: Wind capture price (EUR/MWh)



- Overall, solar capture rates in SE2 have proved relatively robust over the period from 2019 to 2025, moving in the range between 75.9% (2024) and 107.1% (2021).
- Since wind power production in SE2 is particularly strong and solar production almost non-existent, solar capture rates (and prices) are at a significantly higher level than wind.
- The analysis only considers SE2 and not all of Sweden. The analysis does not include forecasts for SE2 due to data limitations.

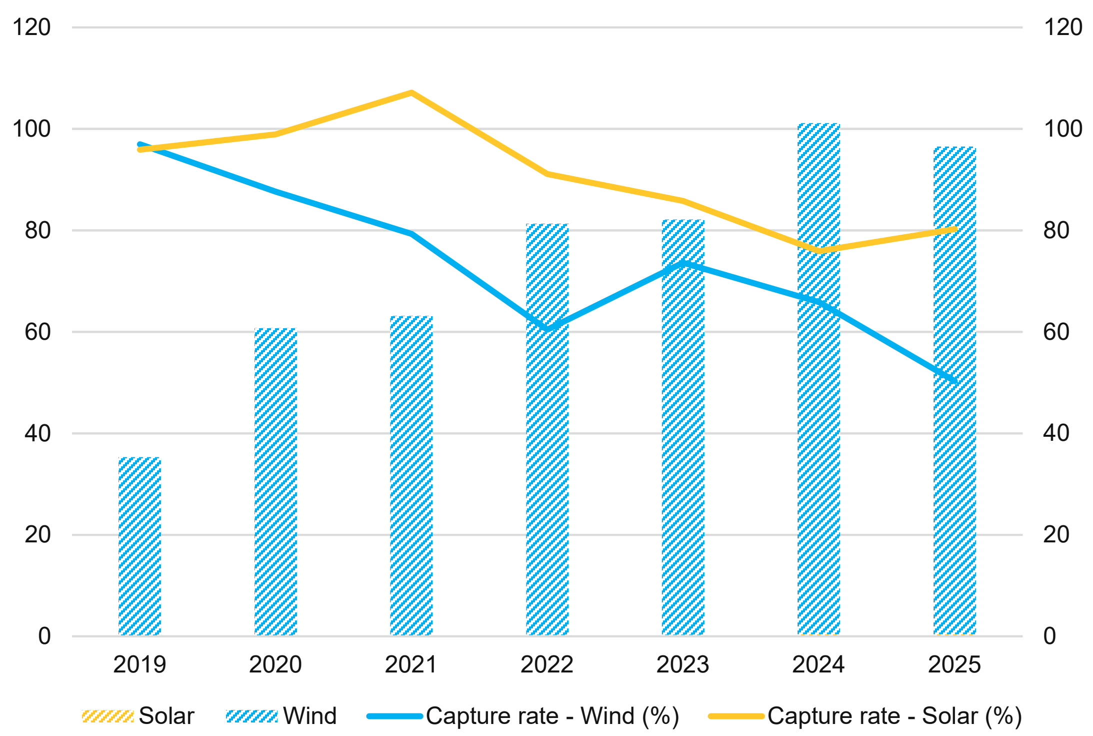
Left: Solar capture rate (%)
Right: Solar capture price (EUR/MWh)



Sweden (SE2)
Capture rates and renewable penetration

- Wind power has increased as a share of consumption from 35% in 2019 to 96% in 2025, coinciding with a gradual decrease in capture rates.
- Solar production amounts to a negligible share of total demand (less than 0.5%). Contrary to all the other markets, solar capture rates in SE2 are above wind power capture rates.

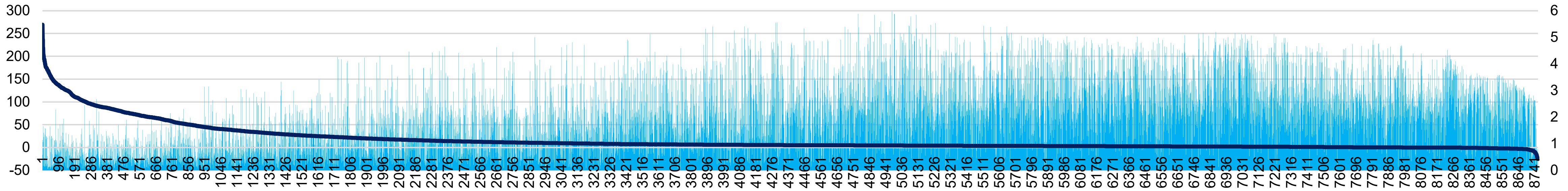
Left: Capture rate (%)
Right: Share of renewable production to demand (%)



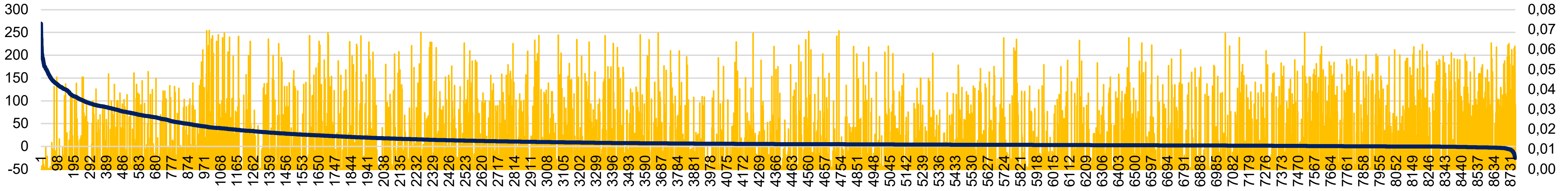
Sweden (SE2)
Price duration curves and renewable production

- Wind production negatively correlates with prices, reflecting the low capture rate in 2025. In particular, wind power production during the hours with the highest prices is limited.
- For solar production, there is no strong sign of correlation with price.
- In general, wholesale prices in SE2 are very low in 2025, with an average of EUR 16.5/MWh and 67% of hourly prices below EUR 10/MWh.

Left: 2025 Price duration curve (EUR/MWh)
Right: Wind production (columns) (GWh)



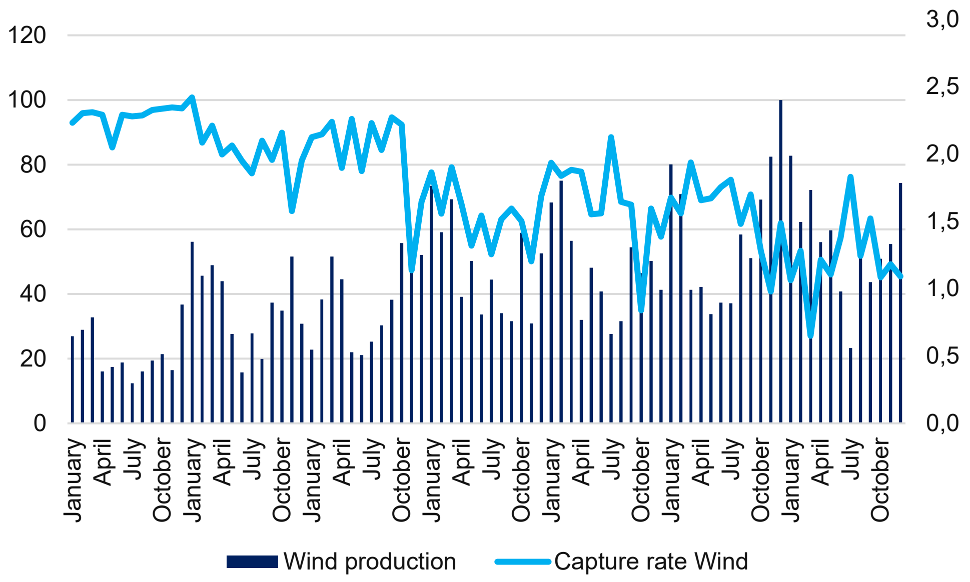
Left: 2025 Price duration curve (EUR/MWh)
Right: Solar production (columns) (GWh)



Sweden (SE2)
Monthly data on production and capture rate

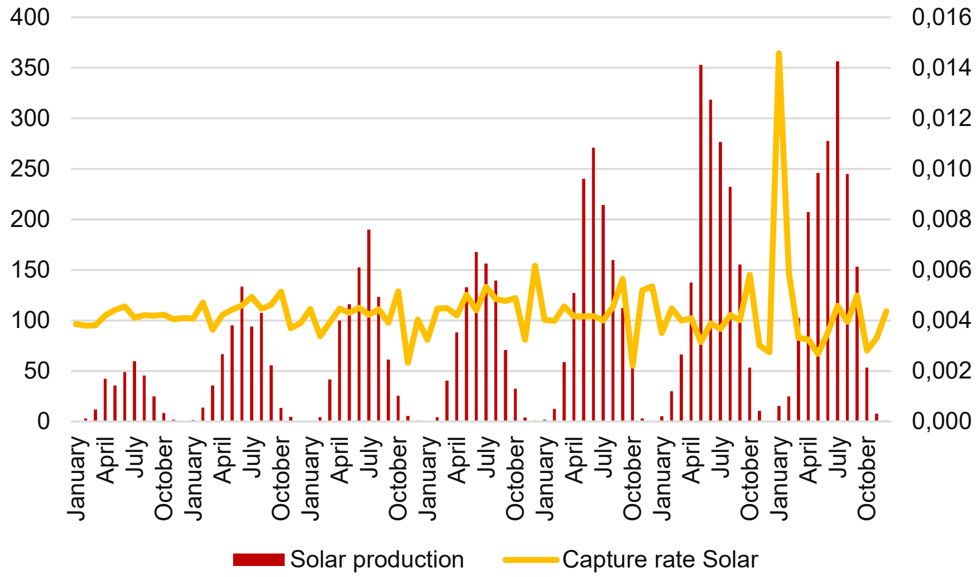
- Wind production in SE2 shows a seasonal pattern, with higher output during winter months than during summer months.
- The monthly wind power capture rate fluctuates quite heavily between months, reaching a maximum of 101% in January 2020 and an all-time low of 27% in March 2025. The capture rate displays a strong downward trend towards the end of the period as wind output increases.

Left: Monthly capture rate (%) for wind (2019-2025)
Right: Monthly wind production (TWh)



- Monthly solar capture rates fluctuate wildly over the period around a rather stable level. The pattern likely reflects that solar production remains a negligible share of total demand and is not subject to cannibalization. Instead, the fluctuation is primarily rooted in other market developments and bottlenecks in interconnection capacity.

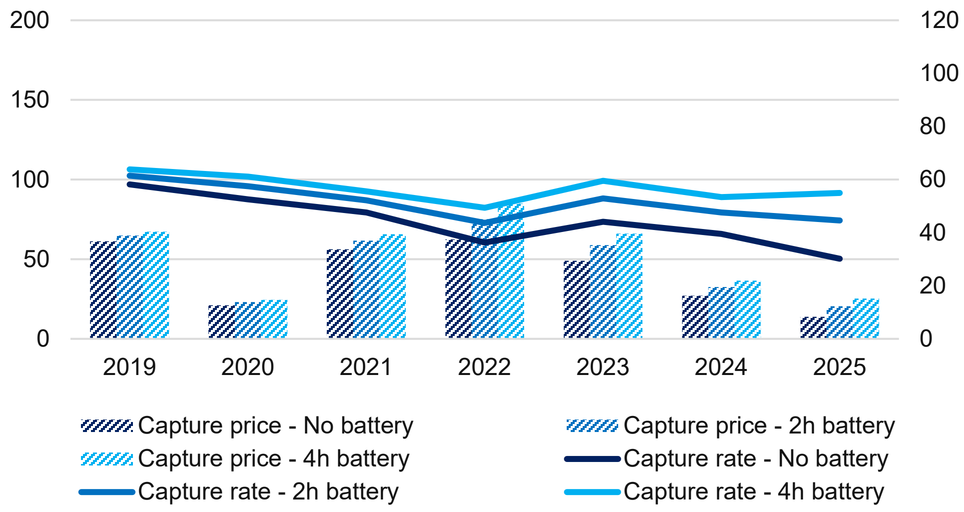
Left: Monthly capture rate (%) for solar (2019-2025)
Right: Monthly solar production (TWh)



Sweden (SE2)
Impact of storage on capture rates and prices

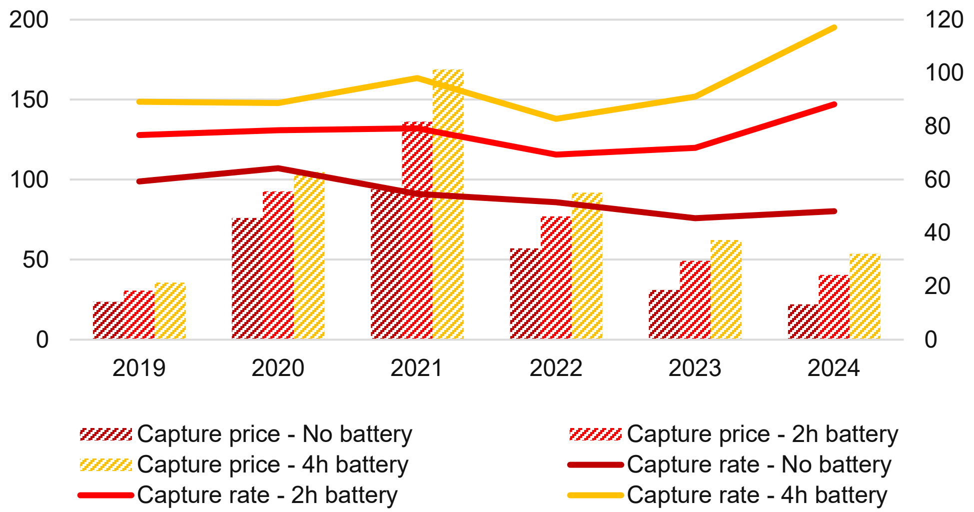
- Our hypothetical wind project without battery capacity in SE2 displays a capture rate of 50% in 2025.
- This is improved moderately when battery capacity is integrated. A 2-hour battery helps achieve a capture rate of 74%, and a 4-hour battery results in a capture rate of 92%.

Left: Capture rate wind (%)
Right: Capture price wind (EUR/MWh)



- For the corresponding solar project, the capture rate sits at 80% without storage, 147 with 2 hours of storage, and 195% with 4 hours of storage.

Left: Capture rate solar (%)
Right: Capture price solar (EUR/MWh)



Contact:

Christian Dahl Winther
Denmark's Export- and Investment Fund
Chief Energy Economist

cdw@eifo.dk

IDA Damsgaard
Denmark's Export- and Investment Fund
Senior Consultant

idda@eifo.dk

Notes and sources

Notes and methodology

- Historical capture rates are calculated from hourly data on observed prices, load, and production volumes. This also means that periods with negative prices and positive production volumes will factor into capture rates. We do not adjust observed behavior/data (e.g., setting renewable production to zero if prices are negative), even if such observations are illogical from a commercial perspective.
- Historical prices are market prices as they were, i.e., nominal prices. Forecasted prices are real 2024 prices. We use these data together to combine accuracy in the historical data with better comparability between recent historical price levels and future price levels.
- The data we have access to does unfortunately not distinguish between onshore wind and offshore wind, and for this reason our analysis treats them as a single technology.
- UK price data has about two months of missing data.
- Denmark is treated as a single market using load-weighted price data. This is done to remain consistent with the available format of the forecast data we use.
- No forecast data is available for SE2.

Sources

- Historical data based on ENTSO-E's Transparency Platform via Electricity Maps.
- Forecast data delivered by S&P Global.
- Bloomberg New Energy Finance, 'Levelized Cost of Electricity Update 2026', February 2026.