

# Forecasting the German Power Market with Confidence

168-hour forecast horizon • Updated every three hours

Seven-day market forecasting covering renewable generation potential, economic curtailment, negative electricity price probabilities and load/residual load.

## National Wind (Onshore / Offshore) & Solar Generation Forecast – Germany

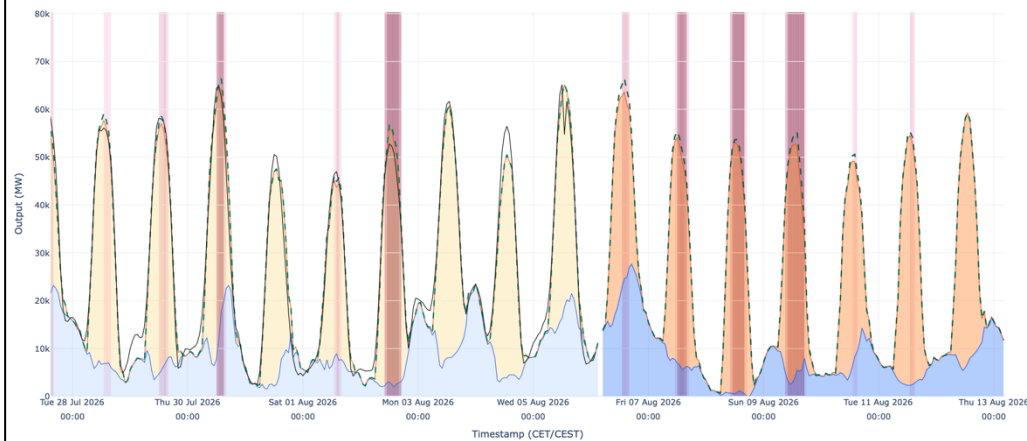
Capra Wind / Solar / Residual Load v1.2

S:10-07-26 W:14-07-26 RL:24-07-26

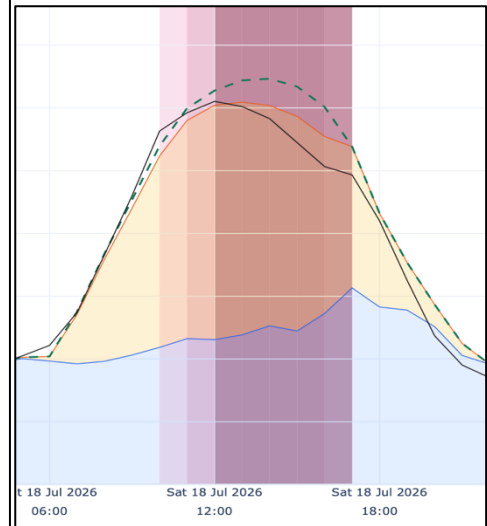
Visible historic-data R2: 0.978 (historic price-curtailed forecast vs actuals, Wind + Solar, n=228)

Features: ☒ Wind ☒ Solar ☐ Residual Load (beta) ☒ Total Actuals of Selected Features Negative Price Heatmap: ☒ On Time Axis: ☒ CET/CEST ☐ UTC  
Forecast: ☒ Historic ☒ Most Recent - 06 Aug 0300Z ☐ -3h - 06 Aug 0000Z ☐ -6h - 05 Aug 2100Z ☐ -12h - 05 Aug 1500Z ☐ -24h - 05 Aug 0300Z

☒ Solar - Price Curtailed ☒ Wind - Price Curtailed ☒ Negative Price Probability ☒ Total Actuals of Features ☒ Production Potential



## Negative Prices Triggering Economic Curtailment



### Commercial Challenge

Wind and solar generation have become the largest sources of variability in spot power markets. In the past, the outage of a few 500 MW thermal units was a major market event; today, variable RES generation can change by 10 GW or more from day to day and from one weather forecast to the next.

Predicting wind and solar output is key. Yet it is no longer merely a job of fitting 'wind-hits-turbine' and 'radiation-hits-panel' to power curves. Grid-enforced curtailment and commercial curtailment driven by negative prices are becoming increasingly important considerations.

### Capra Tensor Platform Delivery

To meet the commercial challenge, we chose to develop neural networks trained over billions of data points. We deploy advanced AI modelling techniques similar to language and image processing applications adapted for electricity-market forecasting. These neural networks capture the non-linear relationships between weather inputs and renewable generation potential, while also learning the grid-technical and economic-behavioural factors that cause output to be curtailed below its available potential.

We continuously feed our models the most up-to-date weather, capacity and other relevant data to produce revised forecasts as new information becomes available. Our models achieve forecast  $R^2$  values of up to 0.98, with performance continuing to improve as the models are adapted and retrained.

## Negative-Price Probability Forecasting – Germany

Capra Negative Price Probability NN v1.NPP26-06-09 (last run: 07:51 06-Aug-2026 UTC)

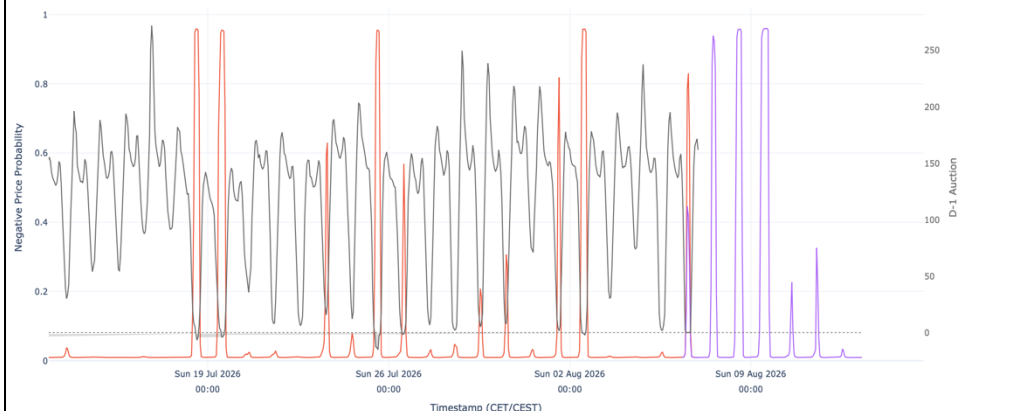
Visible historic-data Brier Score: 0.0198 (price <= EUR0/MWh, n=603, observed 2.8%)

Time Axis: ☒ CET/CEST ☐ UTC

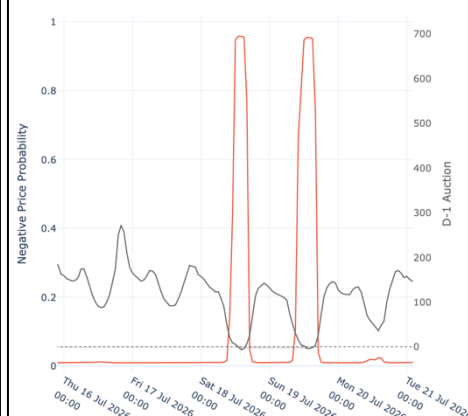
☒ D-1 Auction Price ☐ D-1 Negative Price Occurrence ☒ Negative Price Probability

Forecast: ☒ Forecast at D-1 Auction ☒ Most Recent - 06 Aug 0600Z ☐ -3h - 06 Aug 0300Z ☐ -6h - 06 Aug 0000Z ☐ -12h - 05 Aug 1800Z ☐ -24h - 05 Aug 0600Z

Refresh Data  
06 Aug 0600Z



### Forecasting negative prices with accuracy and precision



### Commercial Challenge

The frequency of zero or negative prices has increased in the German power market to a level that can no longer be ignored.

| Period  | Total Hours | Hours <= 0 | Share |
|---------|-------------|------------|-------|
| 2020    | 8,784       | 302        | 3.44% |
| 2021    | 8,760       | 146        | 1.67% |
| 2022    | 8,760       | 75         | 0.86% |
| 2023    | 8,760       | 325        | 3.71% |
| 2024    | 8,784       | 496        | 5.65% |
| 2025    | 8,760       | 502        | 5.73% |
| H1 2026 | 4,343       | 222        | 5.11% |

With more than 5% of hours settling at or below zero, anticipating when these events are likely to occur is commercially critical for short-term operations. It matters for trade positioning, BESS optimisation, maintenance planning and forecasts of renewable output and curtailment.

### Capra Tensor Platform Delivery

We have developed a classification model to complement the regression neural networks used for RES production forecasting and extended the input features to account for market determinants. Negative-price probability and renewable generation are forecast simultaneously, i.e. RES production dynamics are an input to the negative-price model, and vice versa. This captures the strong interdependence between renewable generation, curtailment and electricity prices.

Brier scores of less than 0.03 demonstrate very strong probabilistic forecast performance, with predicted negative-price probabilities closely aligned with observed outcomes. Our neural networks will not only improve as we retrain and develop the model architecture; they already provide strong performance against demanding operational validation metrics.

In line with the RES production models, the NPP model produces new forecasts eight times per day as new input information becomes available. Each forecast has a 168-hour horizon.

**Capra Tensor transforms the latest available data into market intelligence, helping market participants reduce uncertainty and make better-informed commercial decisions.**

**IOIO  
IOIO**

Data-driven  
forecasts



Updated  
every three  
hours

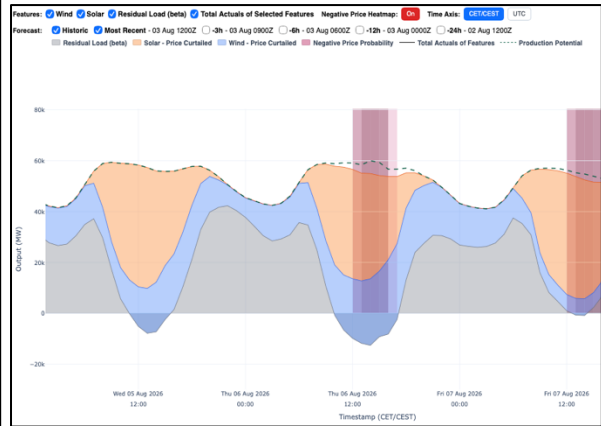


168-hour  
forecast  
horizon

## Seven-Day Residual Load (and Load) Forecasting – Germany (Beta Version)



## Analyse Residual Load and Negative-Price Risk - Seven Days Ahead



### Key Drivers of Power Prices

We have recently introduced the first beta version of our **Load/Residual Load neural network**, extending the Capra Tensor forecasting suite alongside our renewable generation and negative-price models.

In Capra Tensor, residual load is defined as electricity demand minus wind and solar generation, as these are by far the largest and most variable drivers of short-term market conditions.

Residual load is one of the main determinants of wholesale electricity prices as it sets the marginal power plant need to cover demand. It provides key insight into evolving market conditions, helping identify periods of system tightness or surplus and thereby price levels and volatility.

Together with our renewable generation and negative-price forecasts, the residual load model provides a more complete view of the drivers shaping the electricity market.

### Capra Tensor Platform Delivery

Capra Tensor combines forecasts of national electricity demand with its wind and solar generation models to produce an hourly residual load outlook across the full 168-hour forecast horizon.

The interactive platform allows users to analyse load, renewable generation and residual load independently or in combination, alongside negative-price probabilities and historical day-ahead market prices. Users can compare successive forecast cycles to identify how changing weather and demand expectations alter the market outlook.

This integrated view helps traders and asset operators to identify periods of increasing system tightness, surplus and volatility before they manifest in the market.

### Be Ahead of the Rest

Stay up to date as each model incorporates the latest available data and produces a new 168-hour forecast every three hours.

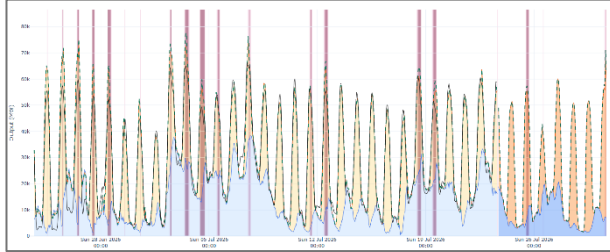
Assess market conditions up to seven days ahead, understand how the principal drivers evolve from one forecast cycle to the next and evaluate your options with greater confidence.

### Coming Soon ...

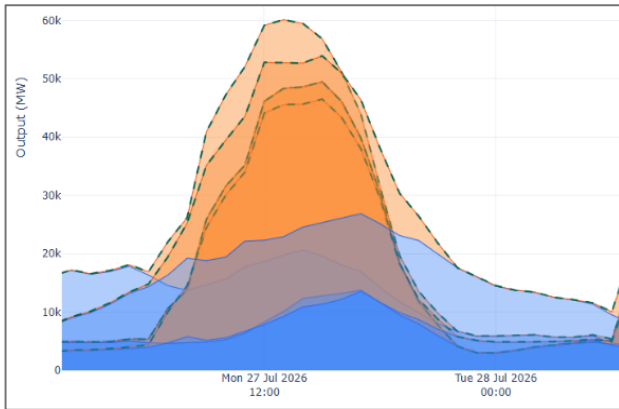
Our model suite for Germany is being extended to include **day-ahead and intraday power price forecasts** across the full 168-hour horizon.

Forecasts are delivered through an easy-to-use, feature-rich web interface or configured for integration with your system

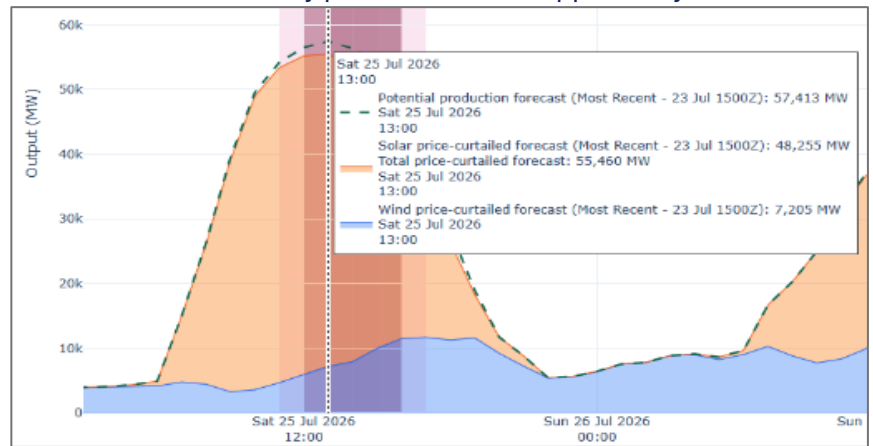
- ☑ 30 days of history, seven days of hourly forecasts



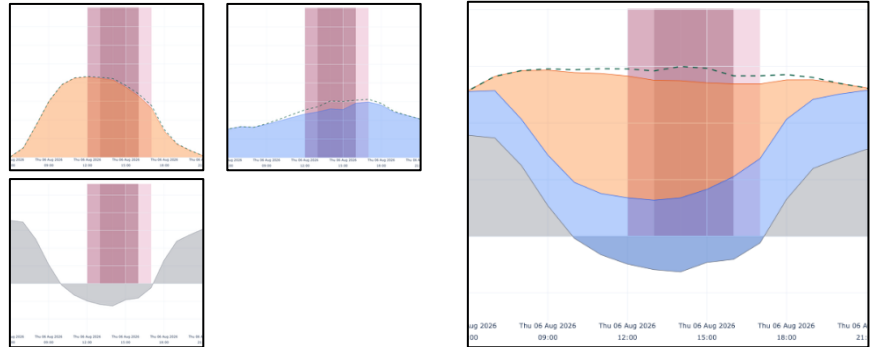
- ☑ Compare forecast evolution across the most recent, t-3, t-6, t-12 and t-24hrs



- ☑ Zoom in on key periods of risk or opportunity



- ☑ Select solar, wind, and residual load independently or in combination



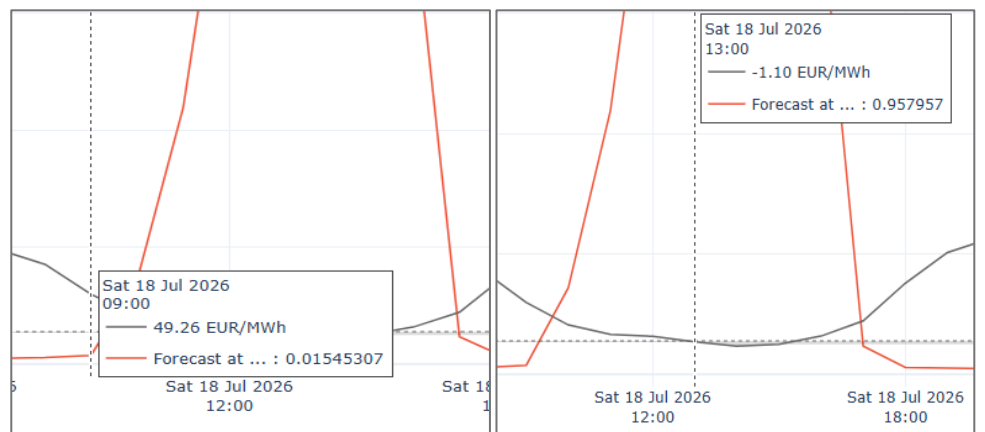
- ☑ Toggle controls enable you to refine your view and switch between time zones UTC and CET



## Implementation Flexibility

You can use our standard web-based platform and input data or integrate our models into your operational systems using proprietary inputs such as in-house weather forecasts.

- ☑ Analyse historical performance by comparing realised output against the forecast available at market closure



# Why Capra Tensor

## ☑ Independent Insight for Electricity Markets

Purpose-built neural networks, trained on billions of data points and designed using decades of electricity market experience.

## ☑ Updated Every Three Hours

Fresh forecasts generated from the latest weather, market and operational data.

## ☑ Multiple 168-Hour Forecasts. One Platform.

- Renewable generation
- Negative-price probabilities
- Residual load
- *Coming soon.....* Day-ahead and intraday power prices

## ☑ Flexible Delivery Solutions

Use our feature-rich web interface or configure an integrated solution.

## ☑ Built for Commercial Decisions

Helping traders and asset operators:

- Anticipate market conditions
- Reduce forecasting uncertainty
- Capture commercial opportunities

## Designed for electricity markets and built to evolve

# About Capra Renewables

Capra Renewables provides independent intelligence for European electricity markets.

|                                                                                     |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <b>Our Philosophy</b><br>Better decisions come from better information. Our focus is on delivering clear, independent and practical electricity market intelligence. | <div><b>Request a Demonstration</b><br/><br/>Discover how the Capra Tensor platform can help your business reduce uncertainty and improve commercial outcomes.<br/><br/> <a href="mailto:curators@caprarenewables.com">curators@caprarenewables.com</a><br/><br/> <a href="https://caprarenewables.com">caprarenewables.com</a></div> |
|    | <b>Our Focus</b><br>High-quality data, robust analytics and deep market expertise enable us to transform complex data into actionable insight.                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|  | <b>Proven Performance</b><br>Objective forecast validation and continuous improvement underpin every intelligence product.                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

**Better commercial decisions with Capra Tensor**