

# PPA Insights

## Price developments in Europe

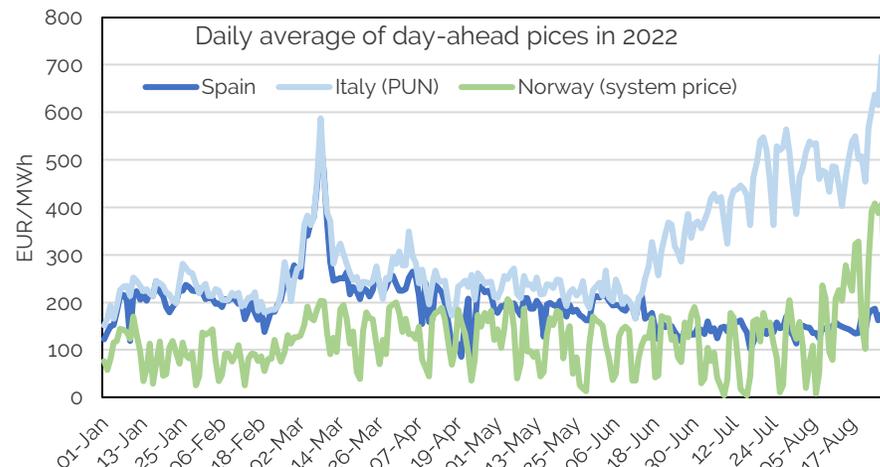
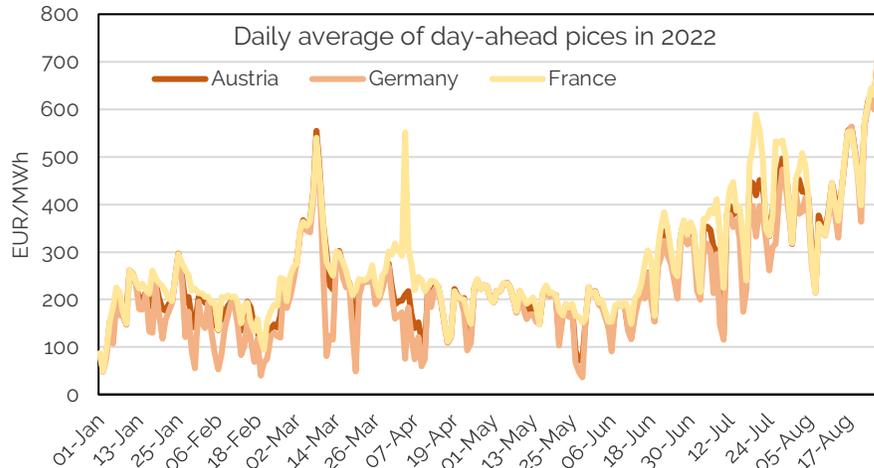
KYOS Energy Analytics

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# Developments in the European power markets

While power prices in Europe have increased significantly in the last quarter due to falling gas imports from Russia, the unavailability of the French nuclear fleet and a very dry summer have put further pressure on the market.



Since our last update in May, 2022:

- Gas supplies to Europe have been tight, which has consistently soared electricity prices. First, Russian Gazprom decreased their gas delivery to its German subsidiaries, followed by cuts from the Nord Stream 1 pipeline under maintenance claims. Germany and Austria – typically heavy importers of Russian gas – were significantly hit by the measures. Italy also suffered from Gazprom actions, but the impact was lessened by the increasing imports from Algeria.
- In June, the gas supply became even tighter for European markets after the blast at the Freeport US LNG terminal in Texas, USA, which halted 17% of the US LNG production capacity. Among fears of an 'LNG war' between Asia and Europe this winter, the port will be back in production in October this year.
- In addition, France continues to face prolonged outage maintenances in their nuclear fleet. The country – usually a net exporter of cheap power to the continent – has amplified the bullish effect on the power prices; and now expects a tight nuclear supply in winter too.
- To absorb the shock, Portugal and Spain capped gas price for power production at 48.80 EUR/MWh for a 12-month period in mid-June. The measure proved effective to reduce prices, but – together with the French nuclear situation – it provoked 'spill-over effects': i.e. Spain has become a net exporter to France, while gas power plants produce much more during an – already- constrained gas market.
- Hot spells and low precipitation weakened the hydrological balance in the Nordics and Germany. Amidst fears of more gas rationing this winter, hydro generation levels have fallen this quarter to preserve the current stock.

# KYOS price assessments (2023-2032)

KYOS baseload and PPA price assessments (EUR/MWh)



## Northern Europe

|               | Baseload | Solar | Wind onshore |
|---------------|----------|-------|--------------|
| Great Britain | 256.0    | 160.3 | 163.6        |
| Denmark DK1   | 227.4    | 137.8 | 136.7        |
| Denmark DK2   | 216.9    | 136.0 | 133.3        |
| Norway NO1    | 218.7    |       | 73.0         |
| Norway NO2    | 214.0    |       | 139.9        |
| Norway NO3    | 222.0    |       | 134.1        |
| Norway NO4    | 159.9    |       | 102.4        |
| Norway NO5    | 210.8    |       | 21.3         |
| Sweden SE1    | 127.6    | 40.9  | 79.7         |
| Sweden SE2    | 124.5    | 58.3  | 78.0         |
| Sweden SE3    | 228.4    | 117.9 | 147.4        |
| Sweden SE4    | 247.7    | 127.7 | 159.6        |
| Finland       | 214.3    | 22.6  | 134.2        |



## Southern Europe

|                      | Baseload | Solar | Wind onshore |
|----------------------|----------|-------|--------------|
| Italy (excl. Sicily) | 255.8    | 152.6 | 170.6        |
| Sicily               | 251.4    | 141.1 | 150.7        |
| Portugal             | 210.5    | 124.6 | 127.2        |
| Greece               | 251.4    | 152.0 | 162.8        |
| Spain                | 197.2    | 105.9 | 116.3        |



## Central-Eastern Europe

|          | Baseload | Solar | Wind onshore |
|----------|----------|-------|--------------|
| Czechia  | 220.2    | 128.3 | 145.5        |
| Slovakia | 234.1    | 135.9 | 105.4        |
| Hungary  | 244.5    | 115.8 | 162.6        |
| Poland   | 217.2    | 132.1 | 140.8        |
| Romania  | 209.0    | 122.7 | 130.0        |
| Bulgaria | 169.9    | 92.4  | 117.5        |
| Serbia   | 163.9    | 93.5  | 105.7        |
| Croatia  | 188.4    | 108.7 | 115.2        |



## Western Europe

|             | Baseload | Solar | Wind onshore |
|-------------|----------|-------|--------------|
| Netherlands | 230.6    | 116.0 | 136.2        |
| Belgium     | 240.1    | 133.0 | 146.9        |
| Germany     | 240.8    | 135.9 | 143.8        |
| France      | 218.4    | 124.2 | 133.4        |
| Switzerland | 253.9    | 143.9 | 169.5        |
| Austria     | 255.5    | 147.6 | 166.4        |

Since our last update in May, 2022:

- PPA deals have closely followed the evolution of the power markets. In a context of soaring electricity prices, we expect baseload prices and PPA prices to continue on the rise (see our price assessments on the left as per trading date **2022-08-26**). In addition to electricity prices, more pressure has been put on PPA contracts in the recent months, as developers face rising prices in solar panels and wind turbines, as well as disruptions in supply chains.
- Amidst the power market turmoil, utilities have been particularly affected in their ability to close PPA deals, as they now face higher margin requirements from the exchanges to cover their credit risk and thus also face limited liquidity. As a consequence, corporate PPAs have seen their market share further increase.
- We also observe that the current market conditions have favoured short-term PPA contracts, as developers are attracted by high revenue streams (due to high power prices), and off-takers expect better conditions in the future (as there is a high uncertainty in the long-run).

# KYOS methodology to assess PPA prices

The diagram below shows the methodology employed by KYOS to assess the development of PPA prices in Europe.

Build power forward curves

We build power forward curves for 31 European markets. Given the 10-year period, we use our fundamental power market model (KyPF), which calculates power prices using fuel and CO<sub>2</sub> emissions projections, future electricity demand, renewable generation, storage, interconnection capacities, etc.

Perform Monte Carlo simulations

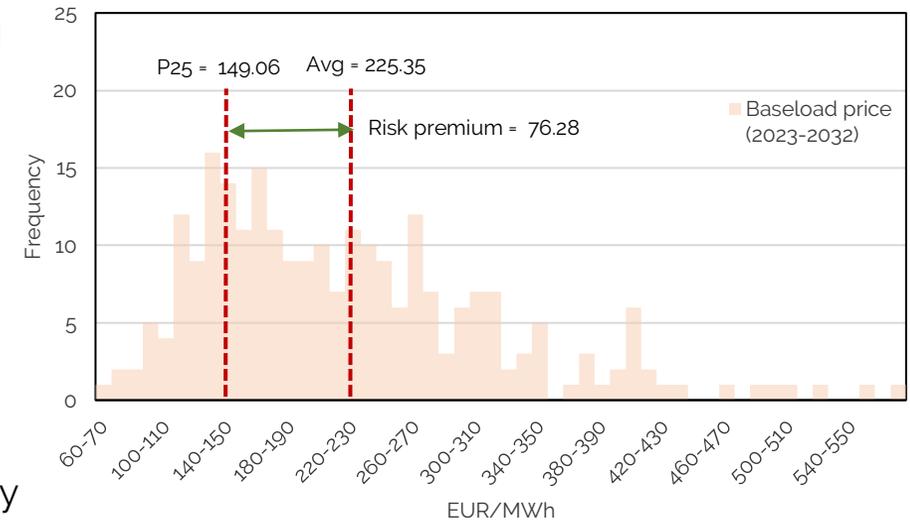
We simulate 250 paths of forward and spot prices using the fundamental power curves as reference. Our Monte Carlo simulation model (KySim) captures short-term, long-term and seasonality effects on forward contract pricing, as well as mean-reverting behavior of spot prices, and changing volatilities. The model is calibrated using two years of historical data (counting from the trading date = **2022-08-26**).

Adjust prices for risk

We calculate the baseload price per simulation path. However, expected prices do not reflect the risks that PPA counterparties are exposed to, and which ultimately determine the fixed price of a PPA. To account for this, we consider a risk premium defined as the difference between the average baseload price and the P25.

Benchmark the PPA price

Our research shows that 10-year fixed-price PPA contracts are generally signed at levels close to the P25 of our power price distribution. P25 means that 25% of the prices are below this level.



The *risk premium* reflects the discount for a fixed price guarantee on a 10-year PPA. It offers compensation for managing fixed-price PPA exposures in the market, leading to credit risk, liquidity (margin) risk, trading costs and other costs.

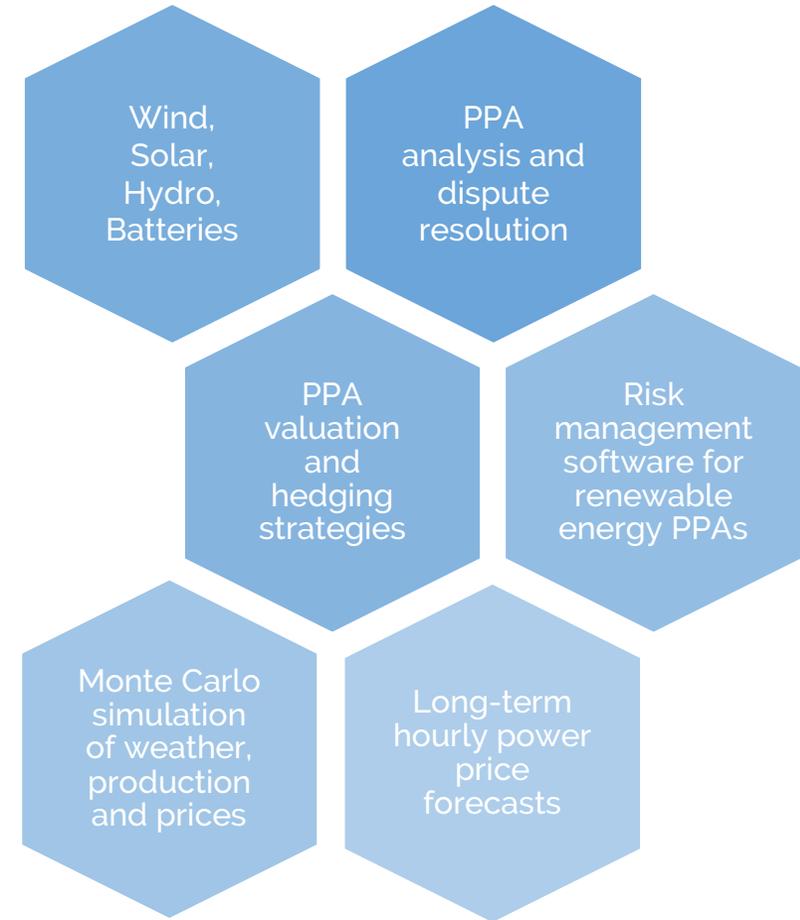
# KYOS Analytical Platform



# KYOS PPA valuation

PPAs often include complex pricing structures, e.g. price floors, risk sharing elements and specific reconciliation mechanisms. To capture all of this, KYOS offers:

- A fundamental power market model (KyPF) to create long-term electricity price forward curves. This is important given the long duration of many PPAs.
- Software modules to simulate price and volume risks. These are necessary to assess future earnings and hedging strategies.
- The ability to calculate capture rates using historical data, long-term fundamental curves, or user-defined.
- A flexible tool that breaks down PPA valuations into different components (e.g. price risk, cannibalization risk, etc.) With this tool, it is also possible to define own pricing structures.
- The option to evaluate and monitor the risk of one or more PPAs or as part of a larger portfolio, with or without hedging strategies.



# KYOS Renewable Risk Management



The KYOS renewable risk management system is part of the KYOS Analytical Platform, a cloud-based software solution. This system provides a complete picture of a renewable power portfolio with PPA contracts and hedges. Reporting includes: volumetric position, mark-to-market value, value-at-risk and earnings-at-risk.

The system also allows users to analyze the effect of applying different hedging strategies to lock-in value of e.g. a specific renewable project. Strategies range from basic static hedges to advanced stack and roll strategies. If the project is in a market with limited liquidity, our system will show the effectiveness of proxy hedging the exposure in other markets, even by using other commodities than electricity.

We offer five different modules/packages to assess renewable power portfolios:

## KYOS PPA Modules



|              |  |  |
|--------------|--|--|
| Advanced     | <b>Module D:</b> Single project / PPA valuation<br>Monte Carlo simulations | <b>Module E:</b> Portfolio management<br>Monte Carlo simulations         |
|              | PFC builder KyCurve or KyPF  | PFC builder KyCurve or KyPF  |
|              | Price data services – market prices  | Price data services – market prices                                      |
| Intermediate | <b>Module B:</b> Forward curves builder KyCurve<br>Market curves           | <b>Module C:</b> Forward curves builder KyPF<br>Fundamental power curves |
|              | Price data services – market prices  | Price data services – market prices                                      |
| Basic        | <b>Module A:</b> Price data services – market prices                       |  |



# Contact Details



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