



KyPF : Power market fundamentals

KyPowerFundamentals (KyPF) creates hourly power price forecasts. The software is used to assess the impact of policy changes, assist with strategic investment decisions and to support trading activities.

KyPF has the unique feature of integrating Monte Carlo simulations into fundamental power market modelling. This provides a much broader perspective on potential future developments than in the traditional deterministic fundamental market models.

- ✓ Create power price forecasts and scenarios
- ✓ Get detailed results per power plant per hour
- ✓ Study multi-market, with interconnection capacities
- ✓ Enjoy user-friendly interface and fast calculations

Benefits

Combine Monte Carlo analysis with fundamental modelling

The fundamental market model calculates the expected future power prices based on assumptions for fuel prices, demand, renewable production and interconnection capacities.

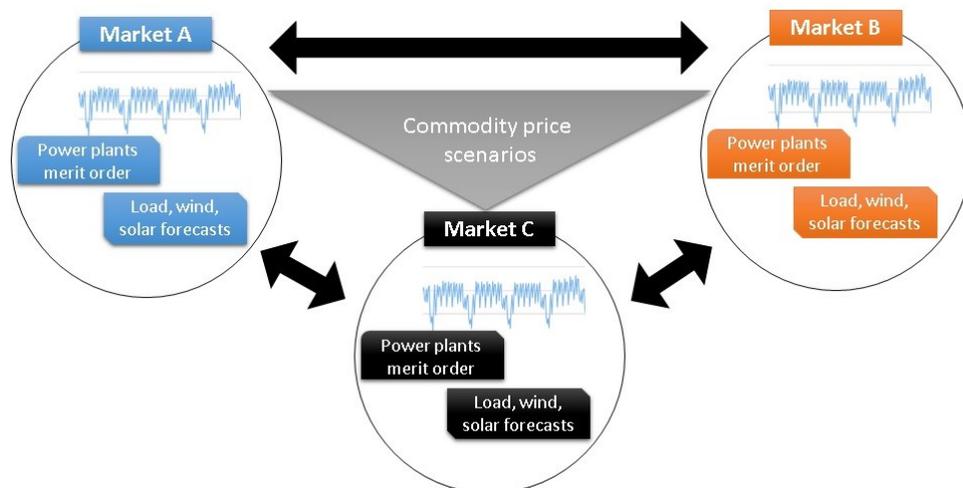
Some of these assumptions may be quite uncertain, which is why the model works with Monte Carlo simulations of fuel prices, demand and renewable production. That is a unique feature, allowing it to generate joint simulations of fuel and power prices. This broader perspective is essential for better trading and investment decisions.

Create future demand and renewable production

For a fundamental hourly optimization, detailed inputs are required for demand and renewable production. Based on capacity growth assumptions, a smart algorithm reshapes historical information into detailed forecasts, seamlessly integrating fundamental capacity forecasts in the KyPF model. Instead of a single forecast for the time series, Monte Carlo simulations can be used as well, being on average equal to the time-series forecast.

Detailed inputs and outputs per power plant

Detailed inputs are provided for each conventional power plant, including capacities, start curves, efficiencies, operating costs, heat supply, and more. In the outputs we show exactly how each plant is dispatched. This allows you to see the contribution per power station to overall production and carbon emissions. This detailed information is the basis for strategic and policy decisions.



Optimize energy storage and other flexibility sources

Conventional power stations, running on fossil fuels, are the main price setters in most markets. However, the renewable energy growth is bringing energy storage more to the forefront. The KyPF model incorporates pump-hydro and other energy storage facilities, such as batteries. Other flexibility instruments and demand response mechanisms can be added as well.

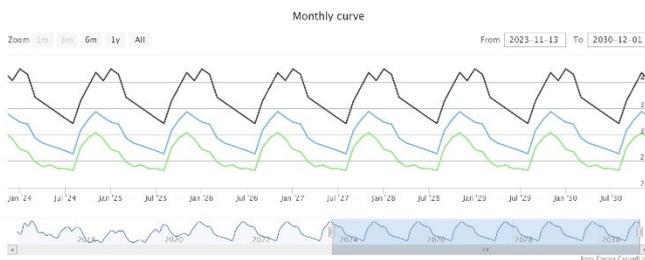
Optimize interconnection capacities between multiple areas

Power markets are generally interconnected to other power markets. This can be within the same country (such as Japan), or between countries. In KyPF the user can define inputs separately per area, as well as the transport capacities between the areas. The model then performs a joint optimization across all areas, making sure that electricity flows from high priced to low priced areas until capacities are fully utilized

Features

KyPF calculates the optimal dispatch of hundreds or even thousands power stations. Detailed hourly modelling is done per power plant, including start curves, maintenance periods, runtimes, etc. Multiple markets are simultaneously modelled, optimising interconnection flows.

KyPF is fully integrated in the KYOS Analytical Platform. With automated data feeds, up-to-date fundamental curves are always available.



Methodology

KyPF goes far beyond a simple merit order or cost minimization model. Instead, it mimics actual behavior in a competitive electricity market: power producers run their plants to maximize revenues, while market prices ensure supply equals demand in every hour.

The KyPF model employs very fast algorithms for the optimal economic hourly dispatch of power stations. This is combined with a methodology to derive the equilibrium hourly market prices, based on Lagrangian relaxation.

The optimization methodology finds the hourly market prices under which the power stations, the energy storage facilities and the interconnection capacities are optimally utilized, and the total production equals the demand in each area.

KYOS Analytical Platform

With KyPF, hourly price forecasts and simulations for one or more power markets are at your disposal. All KYOS Analytical models are developed in Matlab, and part of the KYOS Analytical Platform. Other software modules include:

- **KyPlant:** determine the value of a (portfolio of) power plants by quickly calculating the optimal dispatch,
- **KyStore:** optimize a gas storage and calculate values, delta positions and day-ahead trades
- **KySwing:** helps to generate most income from gas contracts by optimizing the contract flexibility
- **KyCurve:** create detailed hourly price forward curves for power, gas and other commodities
- **KySim:** generate Monte Carlo price simulations, relying on a hybrid approach of statistics and fundamentals
- **AtRisk:** calculate both Cashflow and Earnings-at-Risk. Both metrics show the distribution of future results over longer horizons.

The KYOS Analytical Platform is developed in PHP. A MySQL or MS SQL database is used for data storage. Compiled Matlab models perform the analytical calculations.

Technical information

The Platform can run on a Windows and on a Linux environment. The platform is delivered by default as cloud solution, and it can also be installed on a local server.

The Platform can operate as a stand-alone software application. Automated price connections are possible and recommended. Connections to other systems for contract data and calculation results can be developed based on customer specifications and the XML protocol.