OPENSTEF DELIVERS OPERATIONAL FORECASTS AT HUNDREDS OF GRID LOCATIONS FOR ALLIANDER

CHALLENGE

As a grid operator, Alliander – the largest distribution system operator (DSO) in the Netherlands – required accurate forecasts of the load on the electricity grid looking hours to days ahead. With the rise in renewable energy and electrification of energy consumption pushing the capacity of grids even further, this need will only continue to grow. To address this important topic, Alliander started the project OpenSTEF (short for Short-Term-Energy-Forecasting) to anticipate congestion in the distribution grid, allow for grid safety analysis in the transmission grid, and enable smart grid innovations to locally balance supply and demand within the constraints of the grid. This is essential for anticipating local congestion levels and making the most of existing assets to achieve load balance and improve efficiency.

SOLUTION

OpenSTEF provides a full toolstack to deliver accurate load forecasts over short term periods of up to several days. Given a time series of measured (net) load or generation, a fully automated machine learning pipeline is executed which delivers a probabilistic forecast of future load. The tool works for energy consumption, (renewable) generation, or a combination of both.

“In the real world, input data is not perfect, and measurements can become defective or data sources become unavailable,” said Frank Kreuwel, data scientist at Alliander and lead maintainer of OpenSTEF. “OpenSTEF was built to provide validation of the input data, combine measurements with external predictors such as weather data and market prices, train any scikit-learn compatible machine learning model, and deliver forecasts via both an API and an expert graphical user interface.”

The OpenSTEF stack is based on open source technology and standards and is organized in a microservice architecture optimized for cloud deployment. Alliander has also completely open sourced the OpenSTEF code and contributed the project to LF Energy to ensure it is neutrally governed. By open sourcing the stack, OpenSTEF can provide an industry standard for generating and evaluating forecasts in the operational time-domain, as well as allow for structured collaboration.

Those who wish to contribute may get involved by exploring the OpenSTEF Project on GitHub and subscribing to the community mailing list.

https://www.lfenergy.org

RESULTS

Today, OpenSTEF is delivering operational forecasts at hundreds of locations in the grid for Alliander. These forecasts are used for grid safety analyses, communication on DSO-to-TSO interfaces, and to enable smart-grid based innovations. The most prominent features and use cases for OpenSTEF include:

- Resiliency: As forecast availability is critical in energy sector applications, OpenSTEF deploys multiple fallback strategies, meaning a forecast is always available. When a fallback forecast is issued this is always labeled as such making it possible to reconstruct on which forecasts a decision is based.
- Cloud-based and platform-agnostic OpenSTEF is fully containerized and runs on any container platform. A reference implementation is available that can be deployed directly. Most users will however have a unique IT landscape in which case the modular nature of OpenSTEF enables users to easily adapt OpenSTEF to their environment.
- Making decisions can be difficult, so OpenSTEF enables making risk-based decisions by providing probabilistic forecasts. This way users can work towards a standard policy to react to predicted events.
- With renewable sources making up an increasing fraction of the energy mix, balancing the grid can be challenging. OpenSTEF provides insight into the portion of power coming from wind and solar generation, which is particularly relevant for meeting EU commision regulation No. 543/2013, which “lays down the minimum common set of data relating to generation, transportation and consumption of electricity to be made available to market participants.”

“OpenSTEF is proving to be highly effective at short term forecasting, but there is still work to be done. In light of continuing digital transformation activities across the power sector and the growth in renewables, we need to further expand OpenSTEF’s functionality and improve its performance.”

Frank Kreuwel

Data Scientist at Alliander and Lead Maintainer of OpenSTEF