

CUSTOMER CASE STUDY

Fingrid Oyj increases innovation with AVEVA™ PI System™

Fingrid Oyj - www.fingrid.fi

Industry - Transmission and distribution

Goals

- Automate manual, time-consuming analysis and visualization processes.

Challenges

- Develop analysis algorithms for efficient use of measurement data to support power system analysis.

Results

- Reduced manual analysis, increased use of data, enabled automatic fault processing, and allowed for live-data modeling of new ways to analyze and plan the power system.

Solution

- AVEVA PI System
- AVEVA™ PI Vision™

Fingrid Oyj is the central source of power for Finland's main electrical grid and is interconnected with the inter-Nordic transmission grids of Sweden, Norway, and Denmark.

The transmission grid managed by Fingrid Oyj consists of about 14,600 kilometers of transmission lines and nearly 120 substations; about 77% of all electricity in Finland is transmitted through this grid.

As a transmission system operator, Fingrid Oyj generates more than 4M samples of measurement data daily. But the company was not using this data efficiently to support power system analysis and missed important findings in the system because of its manual, time-consuming analysis processes. "When we had a fault in the system, it took several hours to get the data and create a report," said Antti-Juhani Nikkila, Specialist at Fingrid Oyj. "We wanted to automate and shorten this process from hours to minutes."

To address these issues, Fingrid Oyj integrated all of its power system measurements into AVEVA PI System for visualization and analysis. The company had initially installed AVEVA PI System in 2005, and added to the system in subsequent years:

- 2009 condition monitoring system
- 2010 added a separate 1,000 data point system for PMU measurements
- 2018 WebAPI interface
- 2019 IoT Portal Development

For years, the company had used AVEVA PI System for asset management and system monitoring. By automating its manual processes, Fingrid Oyj significantly increased the use of its data, enabled automatic fault processing, and allowed for new ways to analyze and plan the power system.

Fingrid Oyj utilizes two production PI Systems and a test environment. The first PI System is a 150,000-tag, high availability system for SCADA, power quality, and other data. The second PI System is a 1,000-tag system for phasor measurement unit (PMU) data, which stores 4.3 million samples per day and processes hundreds of signals continuously. The company uses Mathworks MATLAB for custom coding and algorithms for data mining. AVEVA PI Vision provides visualization. AVEVA PI System provides live data and analysis and extends analysis functionalities to other tools such as MATLAB.

Reducing manual processes, increasing measurement data use

With AVEVA PI System, Fingrid Oyj reduced manual analysis and significantly increased its use of measurement data analysis to support the power system. In contrast to its infrequent use of PMU data in the past, today the company runs hundreds of thousands of queries continuously on this data 24/7.

“With automated processes enabled by the PI System, we have much more time to actually analyze the results,” said Nikkila.

Fingrid Oyj can also analyze long-term trends and changes in the power system because it stores the PMU data for 400 days. Automated analysis processes enable the company to address issues caused by

renewable energy sources being integrated into the power system; AVEVA PI System provides Fingrid Oyj with access to quality data that helps with forecasting and keeps the system running.

Enabling automatic fault tolerance and anomaly detection

Fingrid Oyj chose AVEVA PI System for the flexibility of its test environment, which allows the company to test different algorithms with live data and integrate the results from other R&D projects before applying it. The solution's easy-to-use tools for data access and visualization were also important. The company integrated MATLAB with AVEVA PI System databases using the PI OPC interface. The combination makes it possible to use AVEVA PI System data sources and calculation functionalities together with mathematical analysis performed by MATLAB. It also helps eliminate manual analysis.

One of the test projects developed in-house is a tool that monitors real-time data using AVEVA PI System and MATLAB algorithms to detect disturbances and anomalies in the power system.

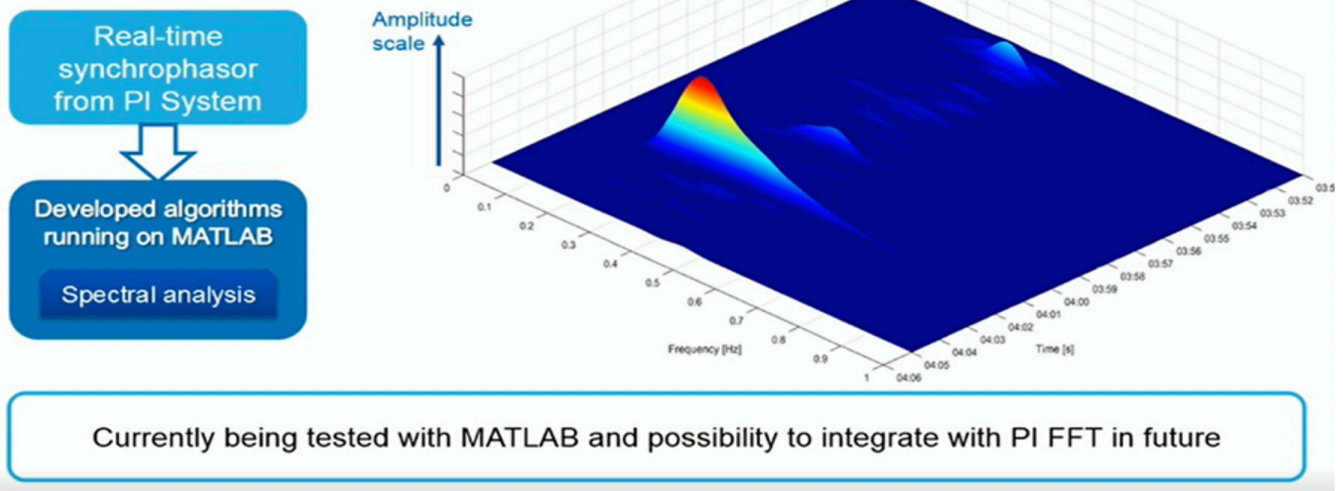
The tool reads about 50 samples per second of real-time interface or synchro phaser data from AVEVA PI System. Custom algorithms analyze changes in frequency on the fly.

“We have already detected anomalies and errors in the power system performance that we would have missed without the PI System. It's hard to put a price tag on detecting these anomalies, but the consequences of power system disturbances can be quite significant.”

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Antti-Juhani Nikkila
Specialist at Fingrid Oyj

When predetermined thresholds are exceeded, the disturbance analysis tool automatically generates a notification and a report that describes what the algorithms discovered. AVEVA PI System stores the measurement data, sends it to analysis applications, and provides visualization of the analysis results.

Example of Online Spectral Analysis



Disturbances or oscillations shown by online spectral analysis help control center operators identify when there are problems in the power system.

Fingrid Oyj also plans to integrate PI notifications and the asset framework in AVEVA PI Server into its new tool.

“With the disturbance analysis tool, we have reduced our fault analysis time from several hours to minutes because we get key results automatically,” explained Nikkila. “Automatic fault processing, made possible by the PI System, enables us to locate high-frequency oscillations in the active power system that we would have missed previously using manual analysis. We can now find problems before they cause equipment downtime or a more critical disturbance.”

Online spectral analysis is another test project enabled by AVEVA PI System and MATLAB. Fingrid Oyj cannot monitor the 150,000 measurement points in the SCADA system at the same time or view time trends from tens or hundreds of measurements due to the volume of data. But with spectral analysis, the company’s control center operators can find disturbances or abnormal events they would otherwise miss if they were using only SCADA measurements.

The control center shows oscillations or vibrations in the system in the form of a red spike or wave. These indicators tell the operators to examine the SCADA system or other measurements to try to explain what happened.

“During the last 12 months, we have found six or seven incidents using these analyses that would have been missed with traditional SCADA measurements. Online spectral analysis is an example of how the PI System makes it possible to test solutions with live production data. It’s a huge advantage.”

Thanks to data from AVEVA PI System, Fingrid Oyj is already seeing successes. In the years 2013, 2014, and 2017, the company used its new system to prevent potentially costly faults (as well as repairs that would need to be made on site) across three megavolt amperes transformers.

For more information about AVEVA’s digital solutions in transmission and distribution, visit our website: aveva.com/en/industries/power-utilities/transmission-distribution