

## Vattenfall – Low voltage monitoring

**Participants:** Vattenfall Eldistribution

**Categories:** Wide-area monitoring and control, Advanced metering infrastructure

**Time plan:** Started 2016

**Contact person:** Marina Milosevic, Vattenfall Eldistribution

**Location:** Solna

**Possible to visit:** No physical installation

### Background

In 2016, Vattenfall started the project Low Voltage Monitoring, where the purpose is to use data from the smart meters installed at Vattenfall's customers, to monitor the health of the low voltage grid. The project started as a test, but soon proved to be successful and today includes roughly 75-85 % of Vattenfall's meters. This is enough to monitor their entire low voltage grid.

### Implementation of the project

The project has been developed entirely in-house by Vattenfall Eldistribution, and new functionality is added continuously. The core of the project is not the data itself, but the algorithms and artificial intelligence used to analyze and combine the massive amounts of data and to make them useful. The data collected in the smart meters is used by the low voltage monitoring tool to monitor the low voltage grid in terms of for example power quality, faults and deviations. In these cases, there are alarm functions to alert the control center of problems in the low voltage grid. Apart from reactive measures to problems that occur in the grid, the tool can also be used for predictive analysis, such as identifying weak areas in the grid.

At the start, the tool was mainly aimed to help the control and operation unit, but it soon proved to be useful also in other areas of the Vattenfall organization.

The LVM (Low Voltage Monitoring) application consists of three parts:

- **Real-time monitoring**  
The low voltage grid is monitored with a delay of a few minutes. This data can be retrieved by Vattenfall through "pinging" the meters, which means that a request for data about delivery and communication status that is stored in the meter is sent. This is in comparison to the once-daily data transfer that was possible earlier on.
- **Back office monitoring**  
This is more aimed at the grid itself, at a longer time-scale. In this module large amounts of data are analyzed to identify trends and patterns, and to understand phenomena that are revealed from the big data analysis. For example, data is used to identify weak areas in the grid. In the future Vattenfall also thinks that LVM will be substantial for flexibility services, by providing real time monitoring of important properties such as network capacity and tariffs. This is a later addition, however.
- **Visualization**  
How to visualize data in an interface that is useful for different purposes. Included in the visualization are parameters such as the grid, delivery status, and data about cables that are offline for maintenance. These data are presented in GIS.

### Benefits

The main benefit of the system is that it allows for the grid operator to make use of the massive amounts of data that is collected by their smart meters. This makes it possible to monitor the grid almost in real time and to detect faults earlier or even to avoid them completely. It has also proved that the low voltage monitoring system can be used to improve other areas such as network planning and maintenance.

By using LVM, Vattenfall has lowered the duration of interruptions (SAIDI) and improved the efficiency in such diverse areas as the operating center, customer service and for field personnel. By being able to detect broken neutral faults, the system also has helped increase safety.

### Scalability

The system is highly scalable. As long as there is a sufficient share of smart meters that can provide the system with data, the size of the grid is not a limiting factor.

### Interoperability

For the system to work, the meters need to be smart enough to provide the necessary data at a resolution that is high enough. Vattenfall includes the bulk of their meters throughout Sweden, regardless of meter specifications, but some of the oldest meters are not part of the scheme.

### Investment horizon

Low voltage monitoring started as a test but was soon turned into a large-scale project. As it has been improved on continuously, and relies on software, handling of data and algorithms, it is hard to define an investment horizon.

### International potential

The use of data from meters to monitor the low voltage grid has a significant potential internationally, where smart meters are present.