

Vamp supplies the monitoring technology

Helsinki Energy introduces the world's first system for smart control of secondary substations



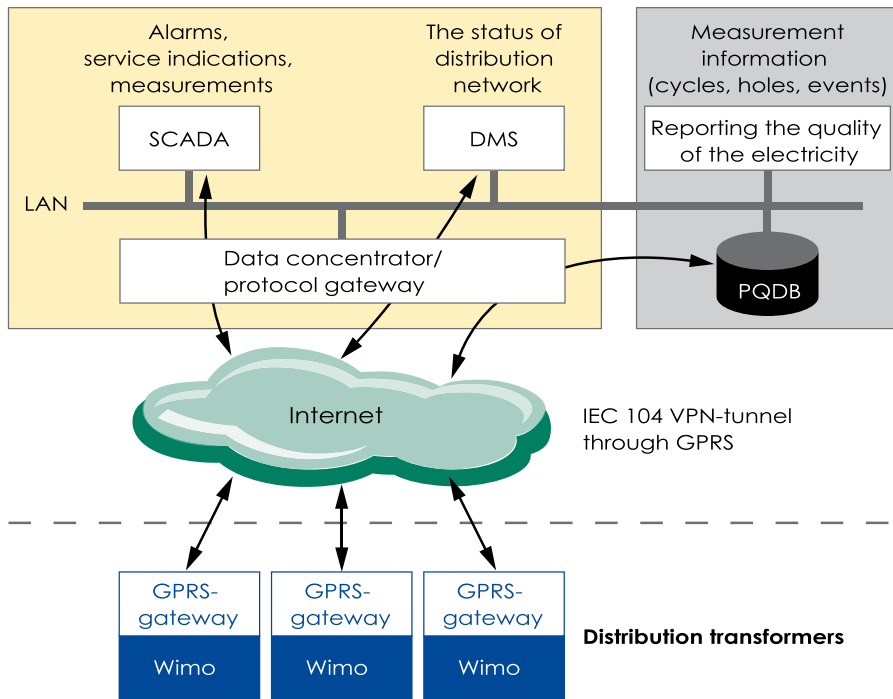
A secondary substation located in the Lauttasaari district of Helsinki is part of the pilot project. Visiting the substation Markku Hyvärinen head of R&D at Helen Electricity Network Ltd (right), and Vamp Ltd's technology director Seppo Pettissalo.

Together with three Finnish hardware and software suppliers, Helen Electricity Network Ltd, a subsidiary of Helsinki Energy, has developed an internationally unique smart system for secondary substation (MV/LV) monitoring. The pilot phase of the project began in March 2008 and to date the system has been installed at five secondary substations in Finland. Operational experience has confirmed the efficiency and cost-effectiveness of the solution.

To minimize outages and disruptions to supply, network companies must be able to locate disruptions more quickly and to develop condition monitoring in a more preventive direction. The medium voltage network together with its secondary substations plays a key role

with respect to interruptions in supply experienced by customers. Nevertheless, secondary substations are at present the least monitored element in a distribution network because the methods available for their remote operation, control and condition monitoring have not been as cost-effective as those available to substations. Moreover, secondary substations situated in basements in particular are often located where manual switching is difficult and where faults – and in the worst case transformer fires – can cause serious damage. In the Helen Electricity Network Ltd project, the idea was to combine the forces of leading suppliers from different sectors to find a comprehensive smart solution for this particular segment.

Control room



A new smart system that enables extensive monitoring of secondary substations and the medium voltage system.

Cost effectiveness the key criterion

The primary goal of the pilot project was to determine the costs and technical effectiveness of the system. Helen Electricity Network Ltd had previously tested various kinds of secondary substation equipment and data transfer technologies and followed developments in technology and costs until a remote control and monitoring system appeared to be a sensible investment in both technical and economic terms. Due to the costs involved, it made sense to link the new system to existing systems and to use their standard interfaces. This would also ensure that the new system would remain technically and economically manageable in the future. Public wireless networks were chosen for data transfer for the same reasons. Five secondary substations were included in the project. One of these was equipped for remote control and the rest for remote monitoring.

On the basis of competitive bidding, the design and implementation of communications and control room

functions for the transformer stations was awarded to Netcontrol Oy.

PowerQ Oy was chosen to provide the software for the measurement database and for reporting on power quality. Vamp Oy was chosen to supply the monitoring equipment and fault location technology. For communications in the project, a secure communications link using IP technology and the IEC 104 protocol was chosen. Netcontrol's Netcon®Gateway communications hardware and software and Netcon®NFE communication software were used for communications between the control centre and the secondary substations.

Individual measurement and monitoring of secondary substations

In the pilot project, Vamp Wimo 6CP10 measurement and monitoring units are used for management and monitoring of loads on secondary substations, monitoring of transformer compartments and measurement and recording of the power quality. In addition to these functions, the units also contain short circuit detectors for the MV network at secondary substations and measurement and detection of earth faults. Information

from Wimo is conveyed to the upper level via a GPRS communications channel. At the control room level, information from Wimo unit is divided so that critical alarm-type data such as short circuit and earth fault detections, overtemperature alarms for transformers, and alarms of nonconformities in power quality are directed to SCADA. The less critical measurement data relating to power quality is transferred to the measurement database.

Results of the Helen pilot project match expectations

Markku Hyvärinen, head of R&D at Helen Electricity Network Ltd, points out that the technical efficiency of the system and equipment has met all expectations and the tight timetable for the project has held. Moreover, data transfer reliability in the pilot project was high compared with information obtained from similar systems in other countries, according to Hyvärinen.

Earth faults occurring in two of the medium voltage feeders during the pilot phase have demonstrated the effectiveness of the system in fault detection. In both cases, the fault occurred in a line section behind the secondary substation equipped with

monitoring and could therefore be indicated. In the control centre it was also possible to see the magnitude of the earth fault current. In one case, this information could be used for fault isolation, which required disconnection due to a high earth fault current. In the other case, control of the disconnectors succeeded as planned. According to Hyvärinen, fault location is a critical factor in system development.

“The primary goal of development is to shorten outage times, and here fault location plays the key role. It is also essential for fault isolation with remote controllable isolators. The other features are by-products of fault control,” he points out.

For the future development of the system, Hyvärinen singles out two key areas of priority:

“To make hundreds of installations possible, the costs of installing and commissioning the system have to be focused. Another factor is location of earth faults in a compensated network. Also, it should be established that the solution is technologically sustainable, especially with respect to wireless data transfer,” he emphasizes.

Applications

- Remote monitoring and operation of secondary substations
- Location of earth faults and short circuit faults
- Monitoring of transformers and transformer compartments
- Monitoring of the quality of the electricity supplied to customers
- Analysis of disturbance recordings captured by the monitoring units
- Transfer of information to different departments within the network company.

Interfaces with other systems

- Uses existing communications networks
- Applicable in control room SCADA systems and in the measurement database for power quality

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