SUBSTATION MONITORING

APPLICATION GUIDE

Substation Monitoring

Aclara's Smart Grid Sensors allow utilities to quickly gain real time visibility in the grid.

"Now that the technology has caught up and is Integrated at the right price point, getting data From the grid through sensors make business sense. We are now of the mindset to monitor everything."

Vince Dow
Vice President, Distribution Operations, DTE Energy

Typical substation monitoring solutions are expensive and time consuming to install. They require the installation of equipment inside the breakers and on the bus work. Substation feeders must be de-energized and new conduits and wiring are required to facilitate installation.

Aclara offers a much simpler way by installing its Smart Grid Sensors at your unmonitored substations. The Aclara line sensors have integrated cellular communications, are easy to install and don't require any ancillary equipment to be installed. They are hot-stick deployable either just inside our just outside the substation fence taking only a few minutes to install. There is no need to install fiber optic cable, de-energize substations or install new control wiring in the substation. Aclara Sensors are battery-free (inductively powered), require no calibration. The sensors are software-defined so you can remotely manage them and they are over-the-air firmware upgradable.

Aclara's Smart Grid Sensors allow utilities to quickly gain real-time visibility into the grid. The sensors provide highly accurate voltage and current measurements at critical substations by installing them at the head of the circuit before the first load connection. This turnkey solution is being used by a variety of utilities to monitor substations including DTE Energy and Manitoba Hydro and is helping these utilities meet key grid modernization initiatives at a much more affordable price point than alternatives. You can read more about these case studies by visiting our website.

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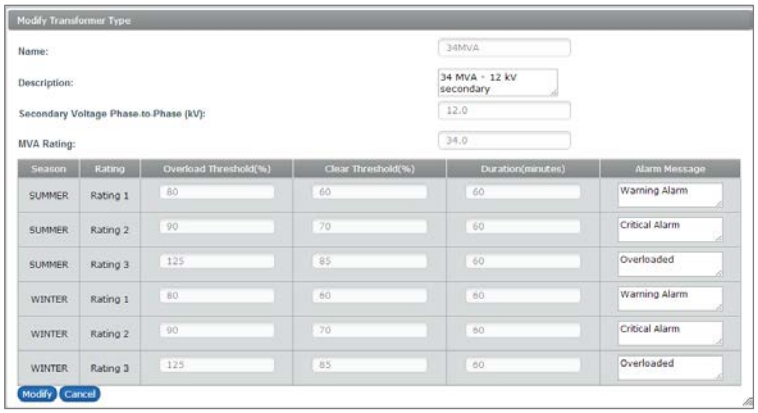

Figure 1: Adding a transformer in Aclara SMS

Deployment and Installation

Aclara's Sensors are installed on each circuit (one per phase) near the substation and are time synchronized to provide coincident load, power factor and voltage measurements, typically on a 15 minute basis The Aclara Grid Monitoring solution monitors the total load per substation transformer, per feeder and per phase. This data from all of the feeders at a substation is aggregated together to provide a coincident load profile on the power transformer inside the substation.

This information is then communicated to the Aclara Sensor Management System (SMS) software, allowing utilities to remotely setup a transformer model including the MVA and voltage rating. Alarm points are also defined for the transformer based on percentage of MVA rating. For example, an alarm can be generated when the load on the transformer reaches 90 percent of the MVA rating and can be automatically emailed to designated personnel. The utility decides which users will receive these alarms as an email message.

Substation monitoring was a new application that became available in the 4.0 platform. Existing Aclara customers that have deployed earlier versions of the system needed only a software upgrade to gain the majority of the benefits of this new application without any changes in the field or to this sensor installation.

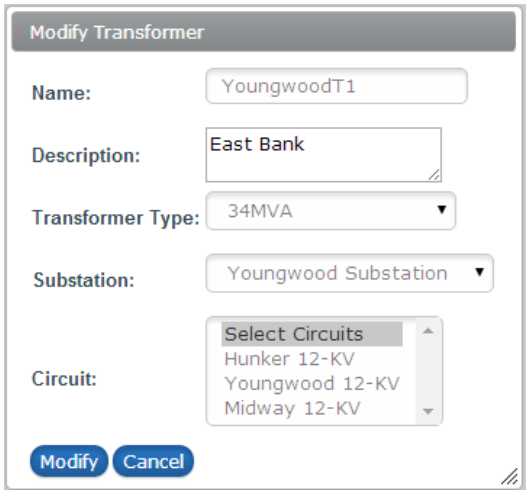

Figure 2: Assigning a transformer in SMS

How Substation Monitoring Works on Aclara's Grid Monitoring Platform

Once Aclara's Smart Grid Sensors are installed on all feeders, the units automatically synchronize their load and voltage interval measurements.

In the SMS software, the various transformer types are modelled. They could be different sizes of transformers or different voltage ratings on the secondary side. For each type, 3 summer alarms and 3 winter alarms are defined to alert the operations or planning departments.

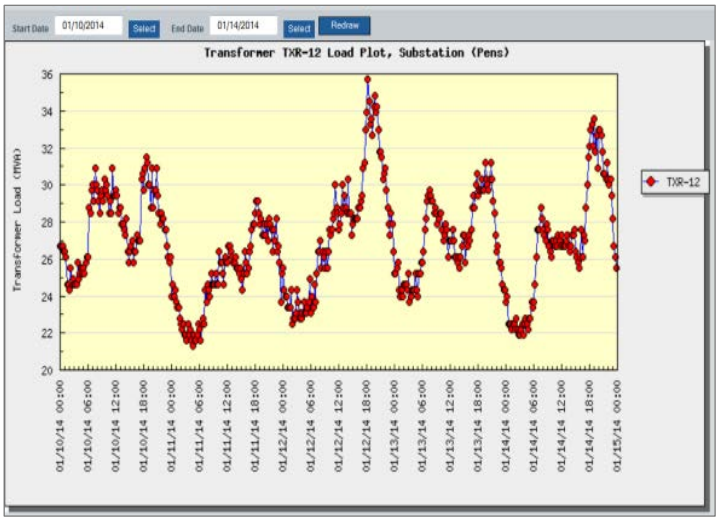

Figure 3: Plotting total substation load over time

Once the various types of transformers are defined, they can then be assigned to a specific substation. The utility names the transformer such as "Center City T1", assigns the transformer type and then assigns the circuits to the transformer. For substations that have two transformers and they are not paralleled on the low side, the circuits can be divided across the two transformers to accurately reflect the loading on each transformer. Separate alarms are defined for each transformer.

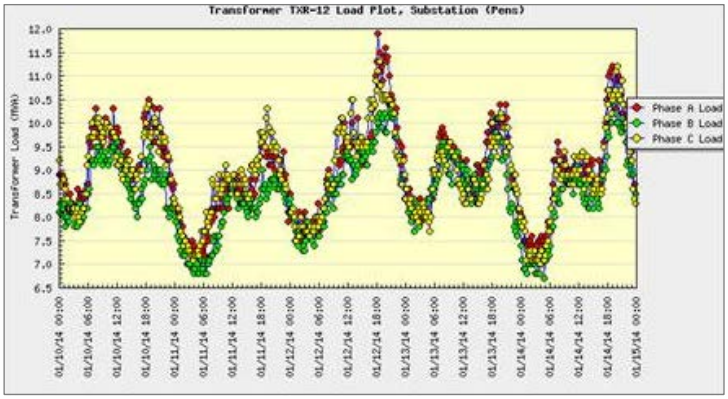

Figure 4: Per Phase Load on the Transformer

Once the substation transformer is modelled, the load data from the line sensors are aggregated into a total load which can then be plotted to show the historical loading on the transformer as shown in the Figure 3. Any alarms generated in an overload will also be available in the Events Summary screen as shown in Figure 5.

The SMS system can also provide graphs that show each feeder's contribution to the total load. The system also shows the per phase loading to easily see the phase balancing on the transformer as shown in Figure 4.

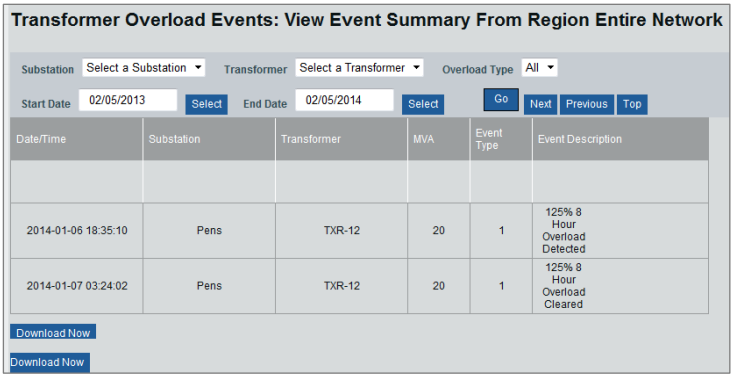

Figure 5: Example of an Overload Event in SMS

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"The most difficult task for the utility engineer is to predict the future reliability of the transformer fleet, and to replace each one in a timely fashion. Meeting the growing demand of the grid while at the same time maintaining system reliability with this ageing fleet will require significant changes in the way utilities operate and care for their transformers"

Hartford Steam Boiler
Inspection and Insurance Company

Conclusion

Upgrading or automating all substations in a utility's service territory is not always an option due to communications or economic factors. For these utilities that have unmonitored substations, the question then becomes how you can affordably monitor aging transformers safely, with a least cost solution.

Aclara's platform offers utilities one of the quickest and most cost-effective solutions to monitor non-SCADA substations to determine loading and voltage on the feeders or substation transformers. This will significantly improve the situational awareness necessary for load transfers during outages or maintenance, and costs a fraction of the equipment, planning, installation and integration costs of the alternative -- a full blown SCADA approach. It also allows the asset management group determine the duration that wire or transformers are overloaded to accurately plan capital projects. Based on this information, existing capital projects may be deferred and the money re-allocated to more immediate needs. The solution offers tremendous pay back and can also be used to detect faults or even prevent outages from occurring (read our Predictive Grid® Analytics whitepaper for more information on how to use the platform for fault detection and prevention).