

# Technology Innovation Project



Closing  
Project Brief

## TIP 374: Phase 2: Integrate Self-Monitoring Features of Substation Protection and Control System Equipment by enhancing GOOSE I/O Monitoring and Using the Sampled Values Protocol IEC 61850 Standard

### Context

The IEC 61850 standard offers substation automation technology. BPA Substations are consistently in state of requiring updates. BPA has begun to replace entire control houses with Portable Control Assemblies or PCAs. PCAs are a perfect application for 61850 technologies, because they replace entire substation relay houses. Applying 61850 to PCAs will allow BPA to install self-monitoring systems that are PRC-005-6 compliant. Other utilities that have applied 61850 to new control houses have seen a significant reduction in substation footprint.

### Description

This project built on the 61850 lab constructed from the 2015 TI project TIP 315 Develop Self-Monitoring Substation Protection and Control System by further developing the research of binary input/output monitoring using IEC 61850 GOOSE messages and by applying another vendor's 61850 Sample Value technology for AC input monitoring.

Project tasks included:

*Task 1* Develop list of necessary SCL file attributes based on BPA alarm and equipment naming criteria and network switch connections.

*Task 2* Develop statement of Work to contract RTU vendor to application".

*Task 3* Contract RTU vendor to develop application for Phase 1 lab.

*Task 4* Solicit multiple vendors to provide Merging units for evaluation

*Task 5* Complete design of phase 2 lab simulator with merging units

*Task 6* Contract RTU vendor to develop application for Phase 2 lab

*Task 7* Construct phase 2 of substation automation system lab simulator using RTU equipment and protective relays

*Task 8* Troubleshoot Lab for Security and Reliability

*Task 9* Document Results - Technology Transfer

*Task 10* Review Results and determine if knowledge gained can be applied to Capital Project in 2019

### Benefits

Utilities that have implemented the 61850 standard have experienced a 90% reduction in wiring required for control and indication. Utilities have also experienced lower equipment, design, construction, maintenance, and documentation costs.

For BPA, this would mean that the cost of SER/SCADA racks could potentially be lowered by 75%, ADF racks would not be necessary, and Line Relay Racks could potentially see a 10% - 25% reduction in expense. Along with the potential reduction in costs is the potential for the reduction in time to complete a project.

### Accomplishments

The primary goal was to research attributes within the IEC 61850 SCL (Substation Configuration Language) files that can be standardized to allow for an RTU application to import them and auto-generate a monitoring screen with the correct logic thus eliminating the need for custom programming in the GOOSE I/O monitor RTU.

Main Objectives the project achieved were:

- 1: Research 61850 SCL file attributes developed in phase 1 to define the attributes needed for applications that can be automatically imported into a GOOSE monitoring application that auto-generate the HMI file and logic,
- 2: Develop GOOSE monitoring of second 61850 vendor,
- 3: Add relays to phase one lab along with merging units to the existing 61850 Lab using BPA standard protective relays,
- 4: Research the application of 61850 technologies available in the substation RTU equipment, protective relays, and the sampled value data available in merging units for the purpose of developing a self-monitoring automation that meets the NERC-PRC-005-6 standard.

## Deliverables

Project deliverables included:

- 1) Standard 61850 SCL files
- 2) A complete design package
- 3) RTU vendor contract to develop HMI screens and logic to monitor AC Inputs using PMUs. Input and outputs using GOOSE messaging.
- 4) Phase 2 Substation automation simulator
- 5) Report documenting the results of the capabilities of the substation automation system to monitor protective relays and the ways they meet the NERC PRC-005-6 standard.

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**Project Start Date:** October, 2016

**Project End Date:** September, 2018

**For More Information Contact:**

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### Related Projects

TIP 315-Develop Self-Monitoring Substation Protection and Control System

TIP 406: SEL Ambassador Project - DOE CEDS Initiative

### Participating Organizations

Bonneville Power Administration, TEC-- System Protection & Control

### Reports:

The Development of Self-Monitoring Substation Protection and Control System Using the IEC 61850 standard with VLAN translation as a GOOSE Isolation Tool that Expedites the Commissioning and Routine Updating of Existing IEDs.

Aaron Martin, Bonneville Power Administration  
Tracy Kealy, Bonneville Power Administration  
Myla Matson, Bonneville Power Administration  
Jun Zha, Double Tree Systems  
Weiyang Wayne Lu, Double Tree Systems

Western Protective Relay Conference (WPRC), Oct 2018, Spokane, WA

### Conclusions:

The project successfully built on the 61850 lab constructed from the 2015 Technology Innovation Project 315 by further developing the research of binary input/output monitoring using IEC 61850 GOOSE messages and by applying another vendor's 61850 Sample Value technology for AC input monitoring.

Further research in terms of requirements have been transferred to the new DOE-sponsored TIP 406: Ambassador Project.

“In the future, BPA plans to develop an application that would be embedded in a GOOSE Monitor RTU that imports the same IEC61850 SCD file with BPA's Ethernet switch configuration template and automatically configures the switches LAN with a Parallel Redundancy Protocol (PRP) network topology while maintaining control of Ethernet traffic. BPA also will investigate IEC 61850 Edition 2 IEDs that support the MMS logical node LGOS which provides monitor data of subscribed messages from the subscribing IEDs.” A. Martin, et al. (see above) 2018. Pg 32

