GRIDSCALE X ADVANCED PROTECTION ASSESSMENT

Service Offerings

Tackle complex protection studies for the everchanging power grid

SIEMENS

New Gridscale X Advanced Protection Assessment users are faced with the challenge of how to quickly become productive with the software while at the same time continuing to meet existing workflow and job demands of their department.

It has been estimated that as many as 20 – 25% of protection engineers currently working for utilities may retire in the next three to five years leaving utilities with a deficit in experience and industry knowledge that must be filled. Siemens is uniquely poised to help you implement the Advanced Protection Assessment software in your company whether you are starting to use protection software for the first time or converting from another solution.

Siemens can convert your existing digital data files to an Advanced Protection Assessment database, build a one-line diagram, develop a complete and detailed network and protection model, or perform other implementation tasks, leaving you free to continue with your existing work demands.

Our subject matter experts (SMEs) can also bring the wealth of their experience to train your protection team – whether it is training to use the program, or a "train the trainer" type of coaching to create inhouse Advanced Protection Assessment SMEs in your organization – we can tailor our training programs to suit your needs.

For experienced users of Gridscale X Advanced Protection Assessment, Siemens offers post-implementation services on a variety of topics such as program automation, relay model development, database cleanup activities, refresher training, regulatory compliance studies and protection coordination studies. In a recent survey of our users, engineers expressed interest in a variety of services with training, protection modeling, and relay setting macros among the most needed services.

Siemens has performed implementation and training services for a wide array of utilities from small regional cooperatives to some of the largest utilities in the world. Siemens' global operations allow us to provide services to our customers around the globe and our extensive resources ensure that we will have staff available to support your project needs. Details on the implementation and post implementation (post-production) services that Siemens offers, including the benefits for a customer when they engage Siemens to provide that service, are explained in the following sections.

Advanced Protection Assessment Training – Basic, Advanced and Refresher

The Siemens team offers courses ranging from two-to three-day refresher classes to a five-day new user program. Our advanced courses are designed for protection engineers who are responsible for maintaining and supporting the Advanced Protection Assessment software for their organization.

We offer customized training at your facility, at our training center in Ann Arbor, Michigan or virtually.
Some of our most popular class topics include:

- Basic Introduction to Protection
- Advanced Protection Assessment for New Users
- Relay Settings
- Coordination Graphics
- Inverter-based modeling
- Basic & Advanced Macro Writing
- NERC PRC Standards
- Advanced Protection Assessment -TS Link
- Data Management

Benefits

- Gain insights into better usage of Advanced Protection Assessment, making you more efficient and productive
- Train your new protection engineers in usage of Advanced Protection Assessment and in the principles of power system protection
- Learn about new features, reporting improvements and modules
- CEU/PDH credits for your engineers to maintain professional certification

Advanced Protection Assessment Database Quality Check and Cleanup

The accuracy of short-circuit fault studies, and consequently, the protective relay settings that you develop based on those studies, are dependent on the quality of the data that you store in your Advanced Protection Assessment database.

Siemens offers a database health/quality check service to identify typical primary network and protection model issues in the database that could affect the quality of the studies that you perform. Once the issues are identified and documented, Siemens can clean up the database for you.

Additionally, Siemens has the expertise to align and merge different databases together. For example, updating your current database with a newer representation of the external system model; merging multiple Advanced Protection Assessment databases together (typically from different departments) to create a single, unified database.

Benefits

- Gain confidence in the accuracy of your network & protection models
- Trust the results of the short-circuit and protection simulation studies
- Prove the accuracy of the model to regulatory auditors using documentation from the quality check

Network and Protection Data Modeling Services

To take full advantage of the extensive capabilities of the Advanced Protection Assessment software, you must keep an accurate and up-to-date combined network and protection system model. Our team can either build a brand-new model for you from the ground up or update your existing network and protection models and provide you with a one-line diagram, ready for protection studies.

Benefits

- Gain confidence in the accuracy of your network and protection models
- Utilize advanced simulation tools in the software
- Conduct regulatory compliance studies including evaluation of many of the NERC PRC standards

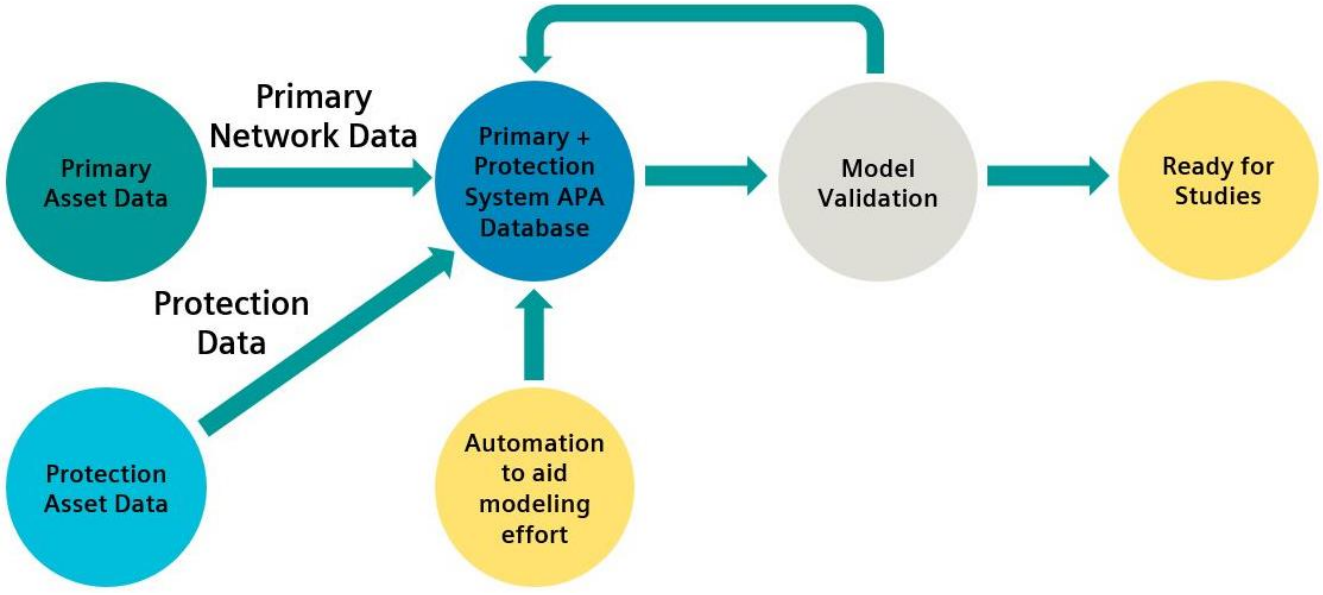

Figure 1: Network and Protection Modeling

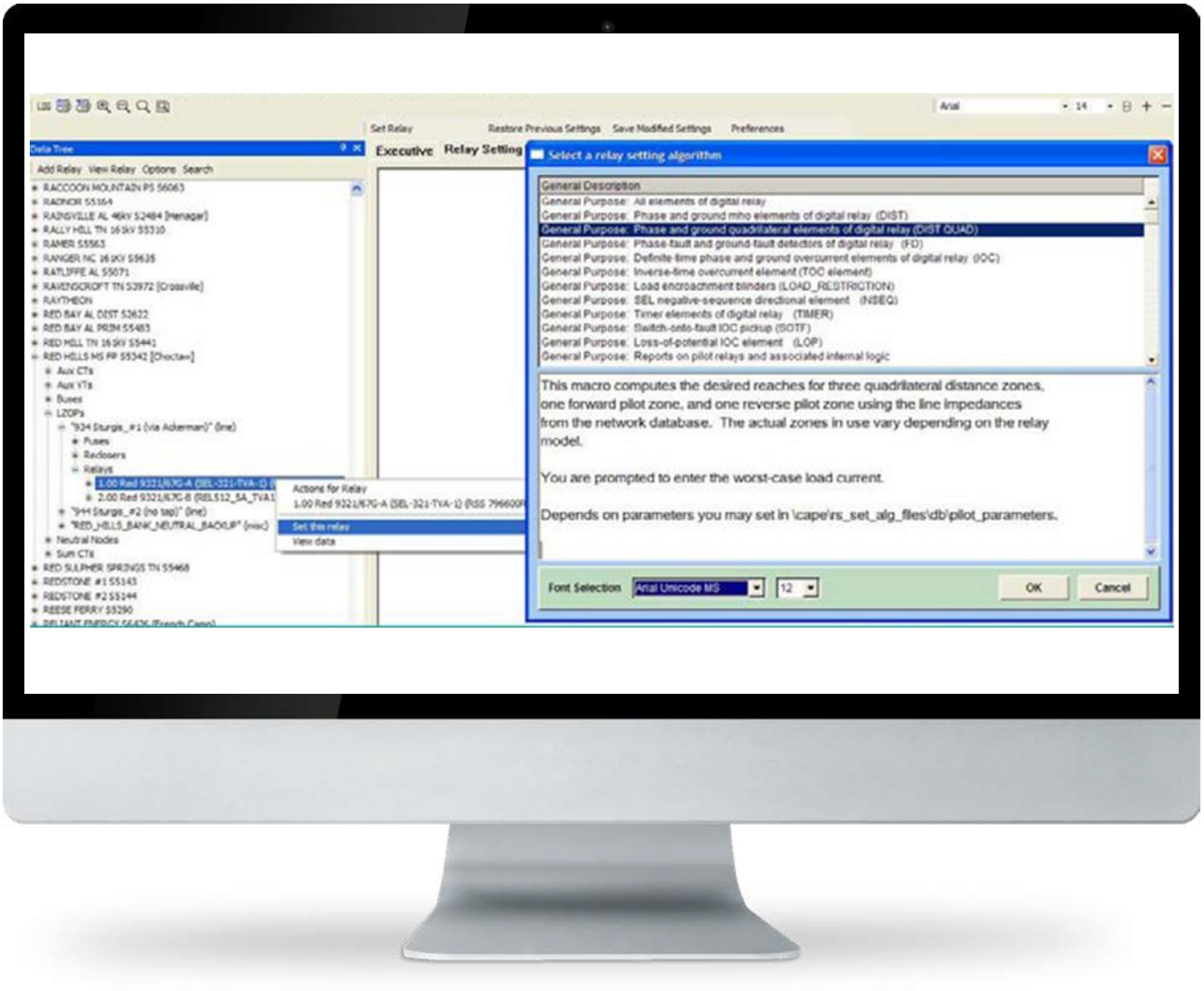

Figure 2: Relay setting macro module in Advanced Protection Assessment. Access one of many existing algorithms to set your relays.

Relay Settings Macro Development

A relay settings macro in Gridscale X Advanced Protection Assessment is an automation function written in the CAPE User Programming Language (CUPL). Such a macro embodies common system protection standards such as the IEEE C37.113 1999, and a utility's own philosophy for calculating protection settings. When applied on the system model, this macro will automatically and systematically determine the settings for your protective relays.

Settings so calculated can be used for further sensitivity and selectivity studies. After validation, they can be pushed back to the Advanced Protection Assessment database for further exchange with protection asset management and relay vendor setting software (via files).

Benefits

- Systematic and automated approach to relay settings calculations removes manual effort on the part of utility protection engineers to run the required studies
- Reduce the chances of human errors in calculations
- Extensive documentation serves as a detailed audit trail for future needs
- Documentation can be used to show compliance with mandatory regulatory requirements

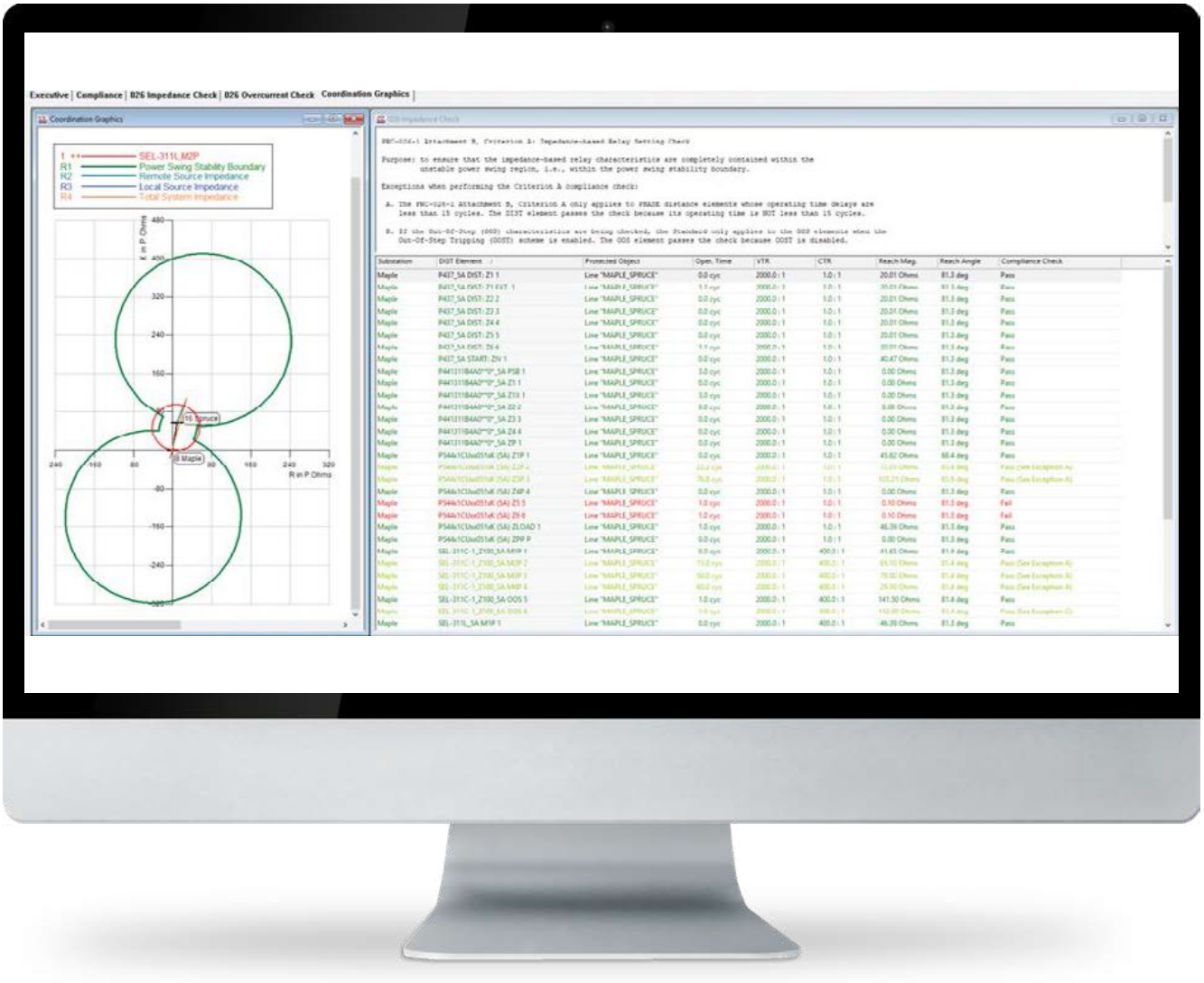

Figure 3: PRC-026 distance element evaluation results and Power Swing Boundary plot – Graphical and written color-coded results help you easily determine

Regulatory Compliance Studies (NERC PRC Standards)

The Siemens team can conduct studies and provide you with reports covering a variety of regulatory compliance standards such as the protection related standards currently imposed by NERC. The Advanced Protection Assessment software supports:

- PRC-002-2 Identifying Required BES Buses for Events Recording (SER) and Fault Recording (FR) Data
- PRC-019-1 Coordination of Generator Voltage Regulator
- Controls with Unit Capabilities and Protection
- PRC-023-2 Transmission Relay Loadability
- PRC-024-2 Generator Frequency and Voltage Protective
- Relay Settings
- PRC-025-1 Generator Relay Loadability
- PRC-026-1 Stable Power Swing Relay Loadability

Outside North America, these standards may be utilized to evaluate the reliability of your protection system.

Benefits

- Clean up your Advanced Protection Assessment network and protection model (separate effort)
- Relieve protection engineers in your team from the tedium of performing the NERC PRC compliance studies
- Utilize the reports created by Siemens to prepare for NERC audits
- Evaluate the reliability of your protection system

Automation Support

While the Advanced Protection Assessment software includes a large variety of macros to perform many different tasks, users may need to customize a macro to provide a specific level of detail or to offer some additional flexibility beyond what is already provided. Siemens engineers have developed custom macros for clients from the most simplistic to complex multi-thousand-line ones. Next time you have a project and feel you would benefit from a custom macro, contact Siemens for a proposal.

Benefits

- Obtain Siemens SME advice in identifying your processes that could benefit from automation
- Utilize Siemens SMEs to develop such automation to make you more productive and efficient
- Obtain training for your own engineers with programming skills to develop automation

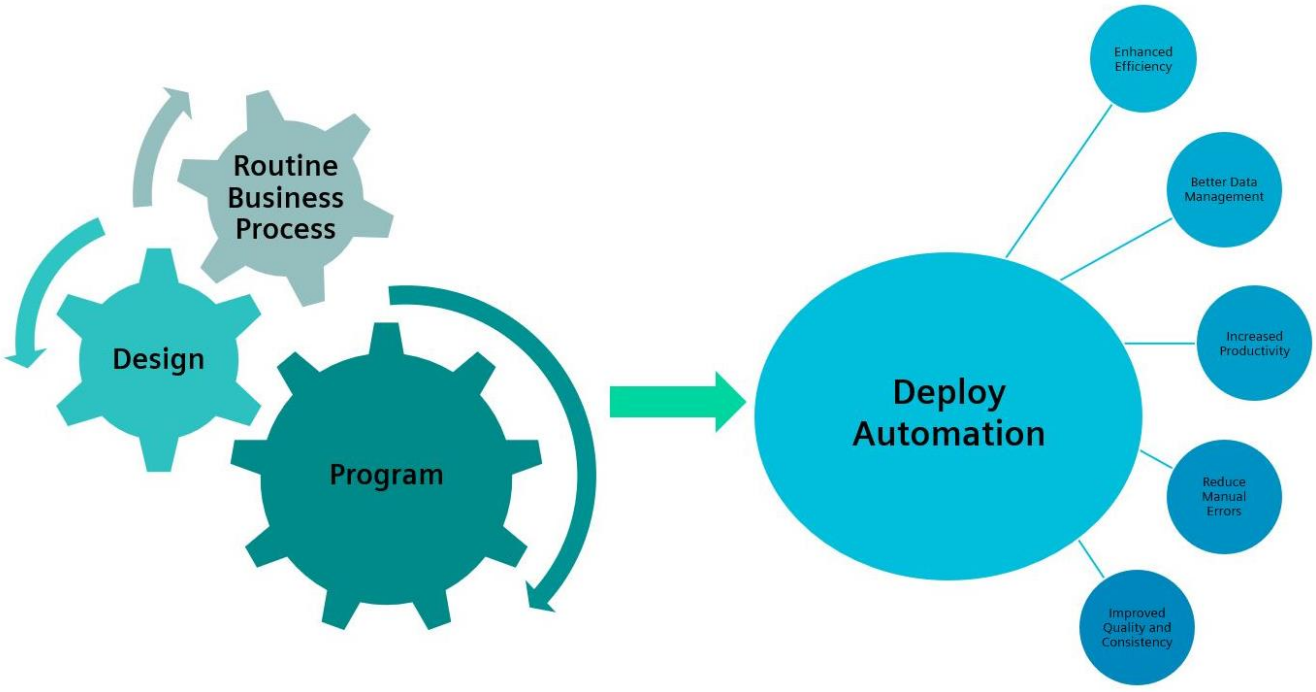

Figure 4: Automation Support

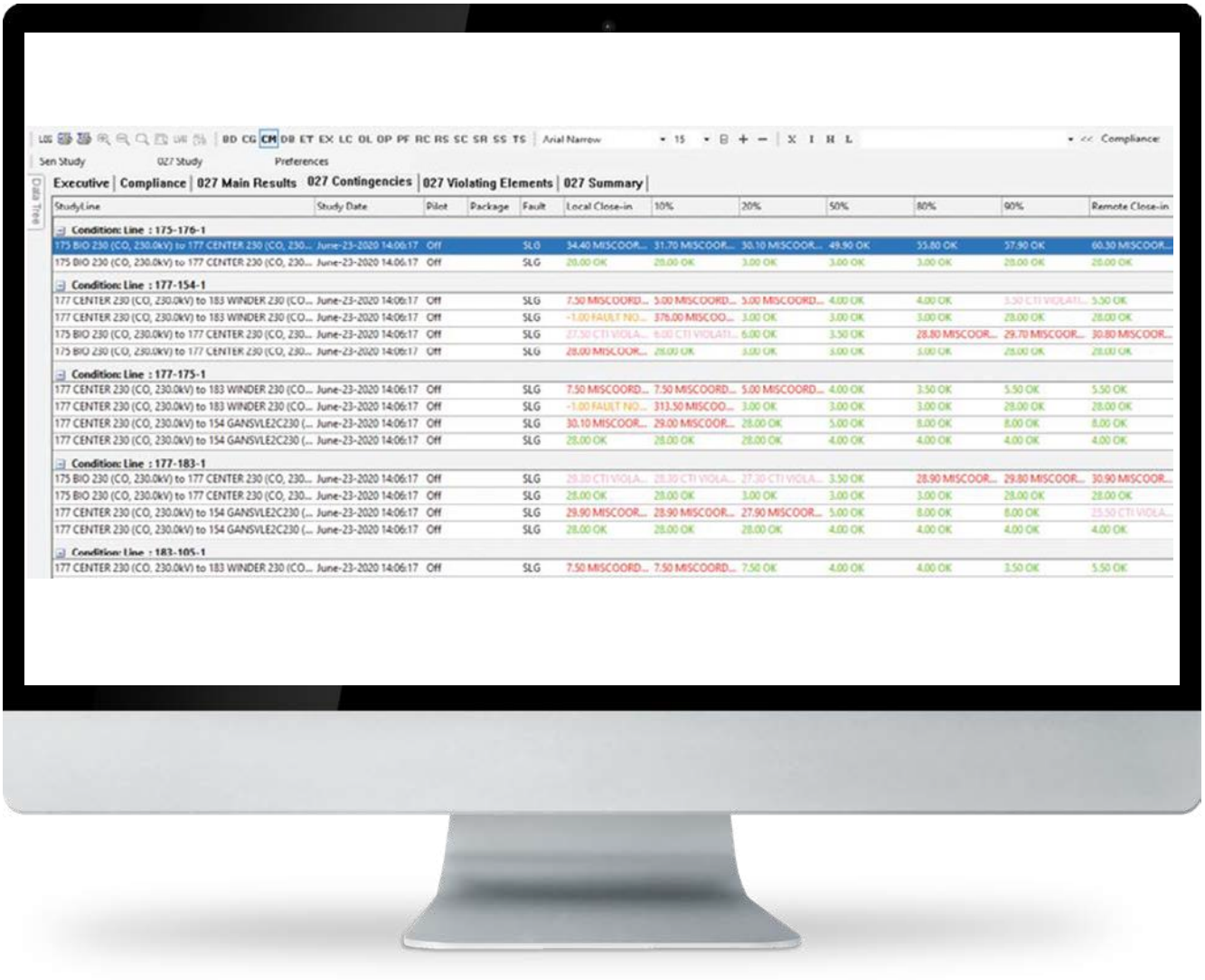

Figure 5: PRC-027 Requirement 2 Option 1: Coordination Study Contingency Report – The detailed, organized, color coded report information makes it straightforward to identify compliant coordination studies and the violating protection functions which require rem

Wide-Area Protection Coordination Studies and Compliance with NERC PRC-027 (Protection System Coordination for Performance During Faults)

The Advanced Protection Assessment team (former PSS®CAPE team) revolutionized the simulation capabilities available to the protection industry when it developed the Wide Area Coordination Review tool for its users. The first wide area coordination study using the Advanced Protection Assessment software was conducted in 2006
in cooperation with Red Eléctrica de España (REE) in Spain. Since that time, we have conducted or supported studies for many utilities around the world and we are ready to support your needs as well.

Benefits

- Clean up your Advanced Protection Assessment network and protection model (separate fee, refer to section Database Quality Check and Cleanup)
- Relieve protection engineers in your team from the tedium of performing the wide-area coordination studies

Utilize the PRC-027 reports created by Siemens (in the Compliance Module) to standards guidelines to prepare for NERC audits

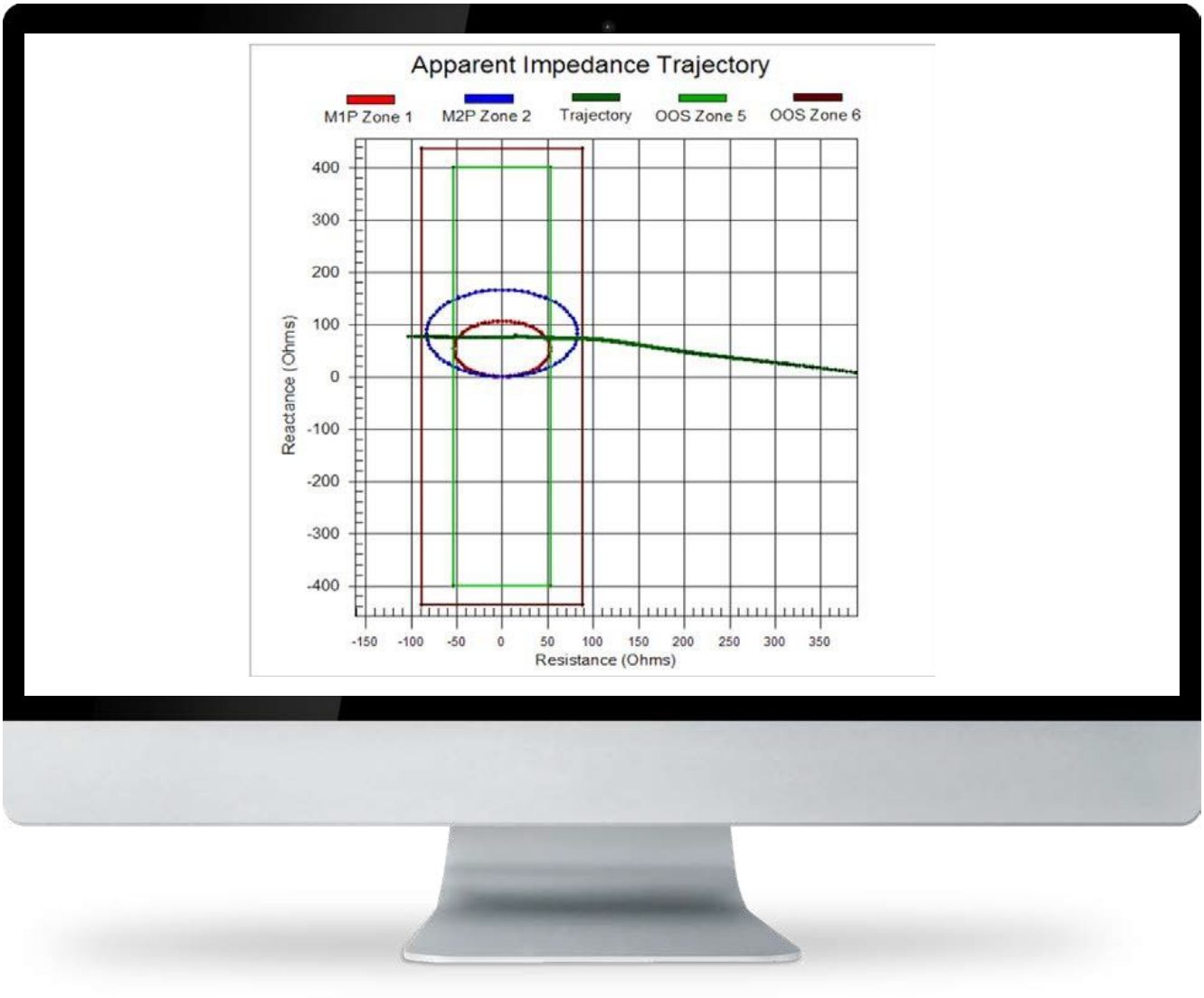

Figure 6: The apparent impedance trajectory enters the relay characteristic from the right. The out-of-step blinders measure the impedance traveling speed and declare a stable power swing condition. Therefore, the operations of Zone 1 and 2 distance protection have been blocked.

Transient Stability and Protection Simulation

The Gridscale X Advanced Protection Assessment TS Link module establishes interoperability between the detailed protection simulation in Advanced Protection Assessment and the dynamic transient stability simulation in PSS®E. With this module, planning engineers can simulate relay behavior instead of assuming a time of operation. Protection engineers can gain increased confidence that the settings that they have calculated for the relays will allow protection to operate reliably under credible contingencies and planned outages.

Our SMEs have several years of experience in performing such studies for our customers. We can align the two models to create suitable mapping between Advanced Protection Assessment and PSS®E, an essential first step. We can also support you with performing the studies and analyzing the results, and giving you targeted training in the use of the TS Link module.

Benefits

- Protection and planning engineers maintain their respective models and utilize the TS Link module to perform advanced studies
- Relay behavior is simulated in planning studies, instead of being assumed

- Protection engineers can set and validate protection functions such as out-of-step, loss-of-field, volts/Hz and under-frequency
- Evaluate protection system behavior under high penetration of inverter-based resources
- Implement and test the behavior of Remedial Action Schemes (RAS)

Customer Staff Augmentation

Advanced Protection Assessment SMEs can augment your modeling or protection studies staff, and advise them on modeling best practices, provide ideas for automation, short-notice training, etc.

Benefits

- Advanced Protection Assessment SME works as part of your team
- Obtain modeling advice, resolve product issues immediately – customer support on steroids (hyper-care)
- Utilize our SMEs in your day-to-day activities

Protection Relay Modeling

The Advanced Protection Assessment software includes more than 7,300 manufacturer-specific relay, recloser, and fuse models created by Siemens engineers. New protective relays are being developed and released every day by relay vendors. Our team models those relays that we determine are of greatest interest to our users as determined through online communications with our customers.

For users who require a specific model before a fixed deadline or wish to add customized features to a model, the Advanced Protection Assessment team offers customized relay modeling for a fee.

Depending on the complexity of the model and availability of our engineers, relay models may take from as little as one to three weeks for a simple electromechanical relay to two to three months for complex digital relays.

Benefits

- Validate your laboratory testing of a new relay with testing in the Advanced Protection Assessment software
- Ensure that the settings calculated for the relay are correct for the application by evaluating the model's behavior in Advanced Protection Assessment
- Gain confidence that your simulation results are accurate because you are using a detailed model as opposed to a generic model of the relay
- Demonstrate to auditors that your settings have been calculated and verified based on a detailed model of a relay

Advanced Protection Assessment Team: Expertise, stability, and responsiveness … when you need us

We are dedicated to serving the utility industry and protection engineering. Whether it is through one of the capabilities listed in this brochure, or something else that we can support, when you use Advanced Protection Assessment, we become an active partner in your success.

Our implementation and services team gets your team started quickly and confidently. We are known for our ongoing technical support: Expert, thoughtful, and very responsive.

How can Gridscale X Advanced Protection Assessment's power help you?

Contact us any time. Our dedicated staff is happy to answer your questions about putting Advanced Protection Assessment to work to improve the effectiveness of your protection engineering function.

Published by
Siemens AG
Smart Infrastructure
Grid Software

Siemens Technopark
Humboldtstr. 64
90459 Nuremberg, Germany

For the U.S. published by
Siemens Industry Inc.

3617 Parkway Lane
Peachtree Corners, GA 30092
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Article No. SIGSW-B90092-00-76US –
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