

Engineering Studies and Simulations



Understand and optimize power system reliability and performance

- Experienced engineers provide insight and analysis that improve system performance.
- Studies support regulatory compliance and help validate custom solutions.
- Large library of validated models increases system simulation accuracy.
- State-of-the-art closed-loop testing decreases commissioning times to get your system online faster.
- Feasibility analysis and planning determine the viability of a project before development in order to minimize risks.





Studies Set You Up for Success

Engineering studies are essential for reliable power system operation. They aid engineering design and reduce the likelihood of unscheduled outages. A well-designed system can withstand and adapt to disturbances. Along with improving performance, you can use study results to comply with local or national regulations. There are many real-world examples that prove the valuable benefits of engineering studies.

Production Cost Savings

Optimize generation limits and avoid unnecessary costs.

Access to Renewable Energy

Determine the optimal placement of renewable resources.

Improved Market Effectiveness

Better understand operational limits and strengths with engineering study analysis.

Storm Hardening

Understand impacts and mitigation strategies for extreme weather event scenarios.

Compliance

Comply with regulations that require studies to be performed and documented.

Short- and Long-Term Planning

Coordinate approval with transmission planning authorities, and receive an economic analysis.

Reliability Analysis

Help prevent unplanned outages.

SEL Engineering Services (ES) conducts power system studies using software modeling. The experienced team of ES engineers has the software and equipment necessary to model any power system and operating scenario. Their experience has allowed them to develop the most comprehensive library of validated software models in the industry. Validated models are more accurate and produce better results than standard models. The results of these studies increase power system awareness or confirm reliable performance. With this insight and analysis, you can improve performance, ensure safe operation, and optimize device settings.

Protection Studies

Protection studies are important to identify any deficiencies and develop recommended improvements to alleviate concerns and ensure a reliable electric power system. A protection study can improve relay coordination and reduce system outages. SEL engineers will review or build a model to determine the system impacts during a faulted condition. Our engineers use software applications, such as Electrocon International's Computer-Aided Protection Engineering (CAPE), AspenTech's Aspen, and solutions from SKM Systems Analysis, EasyPower, and ETAP, to model the entire network. They then compare model results and calculated values against the equipment's ratings to verify the system is safely operated and protected. Services include:

- Real and reactive (VAR) power flow and optimization
- Voltage drop and regulation analysis
- Short circuit analysis
- Circuit breaker and bus rating evaluation
- Protection coordination, settings, and conversions
- Arc-flash hazard analysis
- Harmonic and power quality assessment
- Power factor improvement
- Transient stability analysis

Transmission Planning Studies

A transmission planning study is an important first step when designing or upgrading a transmission network. Robust transmission systems reduce the likelihood of widespread outages. System owners often require transmission planning studies to ensure reliable, timely, efficient, and cost-effective transmission solutions. Additionally, there can be complicated regulatory requirements associated with these studies.

SEL offers transmission planning analysis and design services over a wide range of study scenarios for all transmission voltage levels. Using the appropriate software applications and other tools, our engineers can perform the following:

- Western Electricity Coordinating Council (WECC) path-rating studies
- Federal Energy Regulatory Commission (FERC) generator interconnection studies
- Wires-to-wires interconnection studies
- North American Electric Reliability Corporation (NERC) MOD-026 and -027 compliance studies
- Import/export studies
- Load-serving studies
- Underfrequency load-shedding (UFLS)/undervoltage load-shedding (UVLS) studies
- Transient/dynamic stability studies
- Small signal stability studies
- Voltage stability studies
- Congestion studies
- NERC Protection and Control (PRC) studies

Our studies include electronic and hard copies of all reports and models for future use.



Hardware-in-the-Loop Testing

Hardware-in-the-loop testing improves power system reliability and reduces costs associated with real-time transient power system testing. Our engineers integrate a validated power system model with your system's associated control and protection devices to simulate real-time operation. Validated models confirm that the simulated response to a disturbance or event reasonably matches the measured response to a similar disturbance. Incorporating these models with hardware-in-the-loop testing demonstrates the performance of the control scheme as well as its effect on the power system. The ES model library includes scenarios for short-term versus long-term capacity limits, which aren't usually available in standard models. This unique capability of modeling validated performance limits ensures a more accurate model of a system's operations. Thorough modeling and understanding result in better system performance.

A combined model and equipment approach allows ES to test steady-state, transient, and rare emergency operating conditions. We can quickly and easily repeat all defined conditions to investigate, understand, and optimize the system's behavior. Our engineers can perform hundreds of tests in a few days, providing years of operational experience. Hardware-in-the-loop testing can test scenarios that would be too risky or impossible to field-test. With this type of testing, there is no worry about damaging power system assets or affecting customers. The results of these tests provide the necessary proof and confidence that the solution will maintain system stability.

Thorough closed-loop testing has the benefit of significantly reducing field commissioning and testing times. SEL has the largest commercial closed-loop testing lab in the United States, allowing our engineers to test many complicated scenarios, including:

- Series compensation schemes
- Communications-assisted schemes
- Validation of autosynchronizing schemes
- Load-shedding schemes
- Generation shedding and runback schemes
- Control schemes
- Islanding detection and decoupling schemes
- Remedial action schemes
- Phase-shifting transformer protection and control schemes
- Open-phase detection schemes
- Fast motor bus transfer schemes
- Re-acceleration schemes

Visit selinc.com/solutions/system-modeling for additional engineering studies and simulation information.



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