The Challenge
Transmission planning studies based on market-sensitive data drive critical decisions that ultimately affect electric grid reliability. Because of an inability to access the exact planning toolsets used by regional transmission organizations (RTOs), independent power producers (IPPs) and other developers submitting planning ideas routinely spend many hours trying to replicate RTO analysis results but with inferior results.

When the Federal Energy Regulatory Commission (FERC) issued Order No. 1000 in 2011, adding new transmission planning requirements, a large U.S. RTO revisited its planning processes and reporting. The RTO envisioned an internet portal for project modeling submission, and the ability for developers to select an analysis that utilizes market-sensitive data but shields it from ever being seen by the user.

The RTO chose to collaborate with long-time partner Siemens Power Technologies International (PTI) to develop a new, secure, systematic approach to project idea submission and analysis. The new online tool – the first of its kind – will benefit the RTO and all associated stakeholders.

Big Responsibility, Clear Vision
Coordinating the movement of wholesale electricity is a delicate balancing act. It requires the use of sophisticated systems and tools to accurately accommodate ever-changing demand. Any missteps can cause power losses to customers as well as issues with regulators, power producers, and operators.

The responsibility falls on RTOs to operate a competitive wholesale electricity market and manage the high-voltage electricity grid to ensure reliable electric service. These neutral, independent parties work hard to ensure ongoing reliability through effective transmission planning and management practices.

This particular RTO is one of the largest power grid operators in the U.S., managing the electricity transmission interconnections from more than 1,000 power plants to regional operators that serve many millions of customers across several states. Its vision is to be an electric industry leader in reliability, efficiency, and infrastructure development.

To enable this vision, it actively employs transmission system planning studies and network simulations to identify the changes and additions needed to ensure future electric grid reliability. Its studies culminate in an annual transmission system expansion plan.

Model-based Planning
The grid operator uses transmission planning models and broad, interstate perspectives in its regional planning processes. The use of transmission planning software from Siemens PTI’s PSS® Product Suite (PSS®E, PSS®MUST, PSS®MOD) allows the RTO to identify the most effective and cost-efficient improvements to the grid; ensuring system-wide reliability and economic benefits.
Siemens PTI’s Power System Simulator for Engineering (PSS®E) has been at the center of its tool set for more than 20 years. PSS®E is used to conduct long-range planning studies and analyze future demands on the transmission system network. The grid operator regularly receives interconnection requests and ideas from power generators, IPPs, and developers who submit modeling data for their conceptual ideas. This data is then used to help form the basis of the system expansion plan’s impact studies simulations, which includes power flow, short circuit, and dynamic studies.

In addition to PSS®E, Siemens PTI’s Power System Simulator for Managing and Utilizing System Transmission (PSS®MUST) software is used to evaluate grid health as related to transfer analysis. PSS®MUST allows engineers to simulate the impact of power transactions and generation dispatch, and calculate transmission transfer capability in changing network conditions.

To improve modeling, the power grid operator participated in the development of Siemens PTI’s Power System Simulator for Modeling On Demand (PSS®MOD) solution, which it fully implemented in 2012. Accessible from the World Wide Web using a standard web browser, PSS®MOD is the grid operator’s primary modeling gateway. PSS®MOD enables transmission owners to submit project data to the RTO for use in the creation of future transmission system expansion plan cases.

The power grid operator uses a proprietary planning system to test and analyze proposals. It incorporates PSS®MOD, power flow analysis engines, and a job handler for approved transmission changes and additions.

**FERC Order Triggers Enhancements**
FERC Order 1000, issued in July 2011, reformed the Commission’s electric transmission planning and cost allocation requirements. The order requires grid operators such as this RTO to:

- Consider transmission alternatives in their regional transmission planning processes;
- Produce a regional transmission plan; and
- Implement a fair cost allocation methodology.

FERC requires “neighboring transmission planning regions to identify and jointly evaluate interregional transmission facilities, which are facilities located in two or more neighboring transmission planning regions that may be more efficient or cost-effective solutions to the transmission needs of individual regions.”

While the power grid operator’s existing expansion plan process was already compliant with Order 1000, process and system changes were desired to simplify compliance and improve efficiency. For example, projects and ideas from the various infrastructure developers had been manually keyed into its proprietary planning system, which was inefficient, time consuming, and error prone.

In addition, the IPP and other FERC 1000 developers “…had trouble producing compliant solutions for the RTO due to their lack of market-sensitive data and other complexities related to the analysis procedures,” explains Joseph Canterino, Software Solutions Manager at Siemens PTI. This resulted in the grid operator receiving multiple iterations of “best guess” scenarios requiring revision.

A new approach was needed to increase proposal validity and accuracy during the planning windows. In 2014, the RTO began conceptualizing ways to expand upon existing modeling capabilities to streamline the process of transferring project ideas to its proprietary planning system.

To accomplish this goal, it needed a tool to provide secure and direct access, including proper handling of FERC Critical Energy Infrastructure Information (CEII), in the new process. This tool was envisioned to save time, avoid errors, and put the developers directly in the driver’s seat with the ability to run any analysis they require.

**Partner Selection**
The power grid operator at first considered building its own internet portal to handle the modeling system enhancements. Software providers were also considered, but Siemens PTI was well positioned and capable of pursuing the desired solution. Siemens PTI proposed a solution that would allow interoperability between the needed capabilities and its Modeling On Demand tool, PSS®MOD, which the RTO was already using. In 2015, the RTO chose to move forward collaboratively with this solution.

“The Siemens PSS®MOD product has become an industry standard, and it gave Siemens a significant competitive advantage compared to other capable vendors,” says Canterino. “PSS®MOD has a key role of handling user authentication and power flow case building in the RTO’s own planning system.”

**Development Success Shows Promise for Broad Appeal**
The collaborative efforts of the RTO and Siemens PTI ensured the PSS®MOD expansion was completed within a required 90-day window. The PSS®MOD expansion offers a web-based interface for transmission infrastructure developers, including IPPs and FERC 1000 participants, to upload projects and model change ideas directly to the RTO’s planning system, apply them to RTO-provided cases, and then initiate an analysis routine.

With this solution, the only tool a developer needs is a base PSS®E license and a free copy of PSS®MODFileBuilder. PSS®E is used in conjunction with PSS®MODFileBuilder to create the project file outside of PSS®MOD, and a web browser is then used to upload the project, initiate the analysis, and retrieve results.

The analysis routine securely uses market-sensitive data behind the scenes. This means that the developer-initiated analysis does use market-sensitive data, but it is protected from direct access by the user. Additionally, PSS®MOD now enables developers to initialize studies and retrieve their results all in the same tool, before submitting a valid formal proposal to the power grid operator during a planning window. This saves time for both the developer and RTO.

The new PSS®MOD capabilities are utilized to send jobs and power flow cases directly to the RTO’s job scheduler to manage the analysis and ensure timely completion of results. The PSS®MOD
software securely handles user authentication and coordinates reporting to the individual users.

“The combination of PSS®MOD and the RTO’s proprietary planning system has the potential to improve stakeholder transparency and efficiency,” says Canterino.

Following installation of the expanded software in 2016, internal pilot tests were completed and external user pilot tests were conducted with select developers. The solution was brought to market in January 2017, and continued enhancements to the solution are on the product roadmap.