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## ISO/RTO Network Modeling with PSS<sup>®</sup>MOD

New software delivers transformative efficiencies to seasonal modeling processes, improving internal model building processes

Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs) have a tremendous responsibility to ensure that the electric grid infrastructure under their purview operates reliably and efficiently, with benefits to the stakeholders. They must ensure reliable operation of multiple large transmission systems regionally, with independence and fairness by not favoring any one market participant over another. In addition, they are subjected to continual oversight from the Federal Energy Regulatory Commission (FERC), North American Electric Reliability Corporation (NERC), and an independent market monitor.

Working with member utilities across multiple states, an ISO/RTO conducts regular regional planning and operational analysis to ensure that the network remains capable of meeting ever-changing demand. The traditional approaches to seasonal series modeling were highly time-consuming and iterative processes that were repeated year after year. This process was error prone and data changes were not captured in subsequent yearly model builds. The need for a solution was evident when the model inconsistencies caused labor-intensive model building and regional planning data correction across the organization.

A leading U.S. ISO/RTO implemented an innovative solution to this problem. Working with its partner, Siemens Power Technologies International (PTI), a new web-based network modeling solution was deployed that significantly streamlined the entire process, producing valuable labor savings and enabling higher quality deliverables. Substantial, continuing benefits are being realized by the ISO/RTO and its member transmission and generation companies, with indirect benefits extending to the power consumers within the market.

### Essential models were inefficiently built

ISO model builders are responsible for providing coordinated models to the NERC Multiregional Modeling Working Group (MMWG). These models are mathematical representations of the electric grid and used across North America. The seasonal models are built annually and used by the ISO/RTO for long-term planning to ensure the grid's ongoing reliability and adequacy.

Each model is progressive with representations of future seasons, and they typically look out as far as 15 to 20 years. Every year, a series of models is built. The past year's data is dropped and the new final year's data is added, so the total number of models developed year over year remains constant over time.

While the ISO/RTO had long depended on the PSS®E software from Siemens PTI for its core electric transmission system analysis and planning, it had no database or system to hold its seasonal models. As a result, the existing manual process of building seasonal series models was highly labor intensive, repetitive, and error prone. Lacking a proper modeling and case storage system, the data submitters and model builders spent a great deal of time handling the yearly data required to build the model series.

Data inconsistency and model quality was another concern. Models were not necessarily built from a standard set of data, causing inconsistent case accuracy. Model users

affected included next-day planners, long-term planners, outage coordinators, and those within the ISO responsible for transmission system access. As markets developed, near-term and predictive capabilities could become inaccurate as a result. If transmission was oversold, schedules would be cut and market participants could be financially impacted.

To ensure each new yearly model series was current and accurate, a three-step iterative process was required:

1. Data submitters from each participating member company would submit PSS®E change files (\*.idv) to the ISO/RTO seasonal model builders via email, and inform them of what years in the series were represented.
2. Model building personnel collected, compiled, and organized the change files, incorporating them into the appropriate model set manually. Once compiled, the seasonal model builds were returned to the member companies for review and error resolution. Year after year, the same errors would appear and be fixed during this process.
3. Corrected sets of change files were then re-submitted to the ISO/RTO, where the model builders assembled and solved the seasonal models.

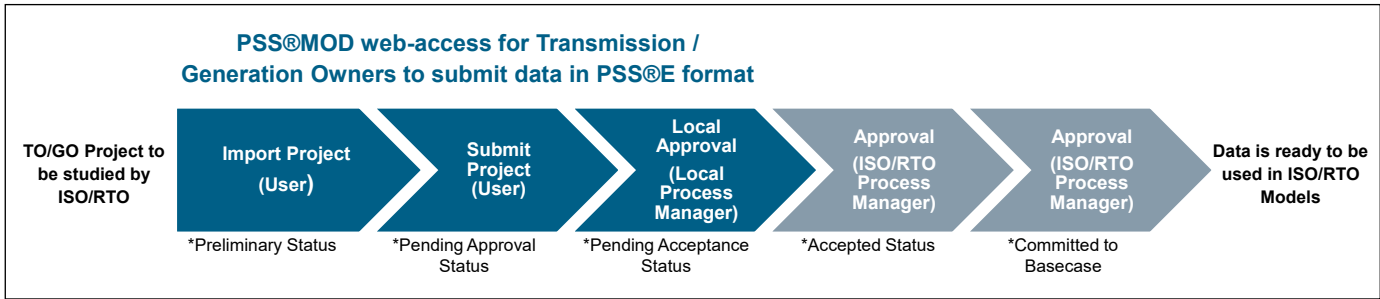
The ISO/RTO realized that a process upgrade was essential. It sought a more systematic approach to model building that addressed its issues with data handling, data quality, documentation, the model building process, and consistency. Delivery of quantifiable, synchronized model data and cost savings was needed.

### Visionary approach to a better solution

When its new vision for seasonal series modeling was crafted, Siemens PTI was the only provider able to demonstrate a core product that contained the ISO/RTO's desired capabilities. PSS®MOD (Model on Demand), is a power transmission network modeling solution that is inherently compatible with the renowned PSS®E analytic software for planning. Originally offered as enterprise software, PSS®MOD became available in 2006 as a web-based solution, which enabled remote access to authorized ISO external companies.

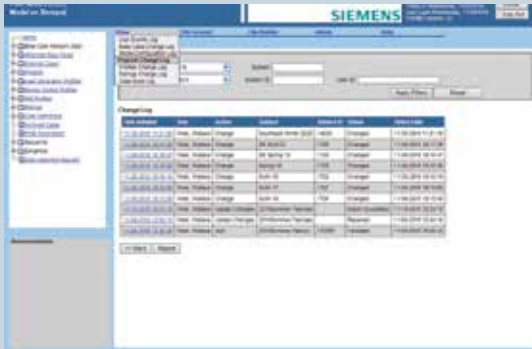
The ISO/RTO and member company users were trained on the software, and their existing processes were mapped utilizing new system. Process gains were realized almost immediately.

Reduce the time to assemble and build seasonal models	
<b>Goal</b>	Handling the data, managing updates, and building seasonal cases was requiring as much as 12 weeks per year for one full-time-equivalent (FTE) ISO engineer. Rather than rebuilding the cases for every year's data, member companies should only have to submit data that is incremental to the next model build (the new final year), and simply revalidate data that had been submitted in prior years. It was anticipated that this would produce significant time savings for both the member data submitters and ISO model builders.
<b>Solution</b>	The model building time period dropped by about 6-8 weeks in just the first year, when the ISO did a dual model building effort to verify and validate the processes using the new system versus the old process. As the system data matured and users became more familiar with the process, the seasonal model build times reduced further. Today, these seasonal series builds using PSS®MOD are completed with little effort in roughly one day, including external model reviews. At the same time, the incremental data submittal process and accuracy of the data submitted has improved the overall model quality.



PSS®MOD web-based user interface submission process

**Reduce change file handling and documentation time**

<b>Goal</b>	Prior to PSS®MOD, changes and corrections to existing model data sets were provided in the form of PSS®E change files. Every year, as many as 1,200 to 1,500 files were exchanged for seasonal model builds and updates. This number could be drastically reduced if models built in previous years didn't have to be rebuilt, since the data to build the models remains consistent. In addition, change file management was difficult. A better method was needed to document which models the change files were applied to, since users can be in different departments, and discrepancies can result in model inconsistencies and divergent study results among departments.
<b>Solution</b>	<p>PSS®MOD's project approach to data management and its provision for a single source location for all changes has significantly reduced the amount of data handled each time seasonal models are developed. Detailed logging of model inputs is also proving beneficial. Not only can the log file be easily carried with the case data, but it provides needed information for possible NERC auditing and compliance.</p> <div style="text-align: right;">  <p>PSS®MOD projects change log</p> </div>

**Improve process and data quality**

<b>Goal</b>	The previous model building process was effective at getting the necessary data, but better control was needed over how the effort was managed, including model review, changes, corrections, etc. For example, operational data that changes from season to season, such as load levels and generation levels, should be handled separately from topology information projects.
<b>Solution</b>	With PSS®MOD, the ISO/RTO has redefined many aspects of its model building process, which has improved the speed of data collection and the turnaround time for reviews and model building, and contributed to better data quality. The software is built to allow the separation of data within the application through the use of profiles for load, generation and voltage data, and projects for the topology information. This separation allows engineers and other data submitters and handlers to focus in on the datasets separately, enabling them to be more efficient at providing the necessary information.

**Improve policies**

<b>Goal</b>	The ISO/RTO wanted to eliminate finger pointing and unnecessary delays caused by incorrect interpretation of responsibilities for the various aspects of data management and model building.
<b>Solution</b>	PSS®MOD helps to delineate and clarify the roles and responsibilities of the data submitters as well as the various model user departments within the company. This leads to clearer definitions and making the accountability for data submissions, data quality, and model builds more straightforward. Ultimately, it saves time in the creation of seasonal models.

## Ensure model consistency and quality

### Goal

Many ISO/RTO departments utilize models to predict everything from available transmission capacity, generation dispatch, congestion management, and outage coordination. It is imperative that results from these efforts are accurate, because bad predictions can lead to lost opportunities and unnecessary costs. Having consistent, quality models improves the overall planning functions. It ultimately generates savings by reducing errors and inconsistencies across the various studies conducted within the organization.

### Solution

The new modeling software was incorporated across all the planning aspects of the organization. PSS<sup>®</sup>MOD aligns all forward (near- and long-term) planning model datasets, providing consistent study results and improved model quality. For large ISO/RTO organizations like this one, coordination of the efforts is improved when there is model consistency, accuracy, and quality. They become better at planning the required facilities rather than over- or under-building or planning facilities or capacity.

By preventing miscalculation or overselling of the transmission system, money is saved for energy market operators in conducting forward studies for day-ahead market analysis, financial transmission rights/congestion rights allocation, and reserving/selling transmission access. The dollars saved because of model consistency could easily be in the millions, though market impacts of this nature are rarely, if ever, quantified.



PSS<sup>®</sup>MOD time-based modeling

### Ongoing benefits boost the bottom line

In addition to the intangible benefits of improved data quality and model consistency, the ISO/RTO and its member companies are experiencing enormous labor savings, year over year, as a result of implementing Siemens PTI's PSS<sup>®</sup>MOD.

The ISO/RTO achieved an immediate 6-8 week reduction in the model building period, from the prior 12 weeks, even before the software training was completed. Model building time has continued to decline each year since the solution was implemented. Currently, it takes the builders approximately one day to assemble and solve a complete suite of seasonal series models, including time for case reviews.

For model builders who earn an estimated \$90,000 salary per year, a 15% labor cost savings translates to \$14,000 in direct savings for one year. Furthermore, as modeling efficiency and data quality improves year after year, the labor savings will continue to increase. Eliminating another few weeks of time from the process could yield time savings of 22%, or roughly \$20,000, for one FTE in that year. When an FTE's time saved is spent providing additional service to the company, it provides a corresponding improvement in productivity to the organization.

Likewise, each member company's data submitters are realizing sizeable labor savings. Submitters previously reviewed completed models three times before finalization. Now, with better data, only one review is required, coupled perhaps with some incremental work. In addition, the submitters no longer handle large amounts of data on a seasonal basis since prior year models are no longer rebuilt from scratch.

Previously, a couple of weeks' worth of time was required just to submit the data to the ISO/RTO, and now it takes only a few minutes. At \$90,000 per FTE, roughly \$7,000 was spent per year, per member company, for four weeks of data handling and modification under the old process. That time and cost is now avoided. Assuming there are 36 participating companies, the combined estimated savings is approximately \$250,000 for one year, freeing up time for other value-added activities.

Ultimately, the PSS<sup>®</sup>MOD implementation completely transformed and streamlined how the ISO/RTO and its member companies conduct seasonal modeling, resulting in enormous, continuing time and cost savings, and benefiting the market as a whole.

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