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# PSS®ODMS

## Transmission Network Modeling and Analysis

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# PSS®ODMS

## Transmission Network Modeling and Analysis

### Overview

PSS®ODMS is a transmission network modeling and analysis tool that is designed to bridge the gap between multiple utility domains – including operations and planning. It provides power system planners, operations planners, system operators and IT managers with a variety of capabilities, including:

- Centralized data management and exchange across multiple domains (e.g. grid operations, network planning, etc.) – based on open CIM standards
- Automated case creation for network operations planning studies
- ENTSO-E CGMES compliance and PSS®E ↔ CIM / CGMES data conversion (for European TSOs)
- Real-time situational awareness (including state estimation and integration with SCADA and measurement data)
- Offline study functions based on operation model, data, and scenarios

Typically, a single customer would not encounter all of these use cases simultaneously. That is why PSS®ODMS can be priced and deployed in different configurations – so you can get only the functionality that matches your use cases. PSS®ODMS is very modular, allowing the addition of functionality over time.

# PSS®ODMS

## Centralized Data Management and Exchange

**Use Cases:**

- Centralized network model management and maintenance
- Exchanging power system network models with external entities (e.g. neighboring TSOs, ISO / RTOs, coordinators, regulatory, etc.)
- Improving data sharing across multiple systems within your organization (e.g. planning, operations, asset management, protection, GIS, etc.)
- Satisfy ENTSO-E persistence and uniqueness requirements (for European TSOs)

There is only one physical transmission grid, but a transmission company usually has many different models of their grid – each associated with a different enterprise domain (e.g. planning, operations, operations planning, protection, etc.). Inconsistencies in model data across these domains result in model inaccuracies, sub-optimal system performance, possible regulatory violations, and excessive manual labor. It also results in a limitation on automation of modeling and case building workflows, and makes it difficult to break out of the vicious cycle where individual engineers have their own homegrown ways of assembling the models and cases that they need. These problems can be solved by maintaining a “single source of truth” for model data across the enterprise, i.e. a single location to coordinate and manage network modeling information across operations, operations planning, and long-term planning.

**Problem Solving Features:**

PSS®ODMS is uniquely positioned to satisfy the requirements of a centralized network model management system. It allows transmission companies to centrally manage, visualize, store, synchronize, and exchange their network model data across multiple departments, systems, entities, and time horizons.

PSS®ODMS is one of the first commercially available and truly viable products built upon the industry-approved CIM standard. PSS®ODMS stores network data in a CIM-based relational database which can be deployed on either Microsoft® SQL Server or Oracle. With the ability to model and analyze transmission networks down to the node-breaker level detail, combined with historical change

tracking and planned future project modeling features, PSS®ODMS fully supports maintenance of a unified transmission operations-and-planning network model. The graphical user interface is the primary tool for creating, deleting and reconnecting equipment as well as modifying attributes – including the ability to copy / paste equipment.

In order to facilitate longer-term changes in the network, the Project Modeling function supports unlimited multi-phase projects and interchangeable alternative future network scenarios. This provides a work area to test modifications to the model before they are committed to the base model.

PSS®ODMS provides a fully integrated topology processing and power flow module for model validation along with contingency analysis functions, and a highly intuitive graphical user interface. Powerful graphical results visualization capabilities include such features as flow arrow animation, color contouring and use of one-line and tabular displays to visualize contingency analysis results.

Since solved snapshot cases from PSS®ODMS can be both manually and automatically exported to PSS®E format and used for planning studies, this type of deployment also provides seamless operations-to-planning data exchange. To support this feature PSS®ODMS provides a full set of extensions that support the mapping of PSS®E identifying information such as bus numbers, names, areas, owners and zones.

The PSS®ODMS database schema can be extended to include custom user-defined fields supported with inclusion of these extensions in the CIM viewer and import / export functions. The product also includes comprehensive Python™ and .NET APIs which allow clients to create their own user interface extensions and / or integrate PSS®ODMS with other systems, such as asset management, EMS, GIS, etc.

More detailed technical features can be found in the “Features Summary” section on pages 16-20 of this brochure.

**Benefits:**

**Improved business process efficiency:**

- Reduction in data maintenance costs achieved by establishing a single data repository that can serve models for multiple utility domains – including transmission planning, operations, and operations planning

- Automate key tasks such as case assembly, data validation, and data submission
- Reduce time required to maintain models, build cases, perform studies, and implement consistent model changes
- Eliminate duplicate effort for network data maintenance and management
- Modeling engineers can work with a consistent set of modeling data

**IT integration cost reduction:**

- Utilizes open CIM data formats, which promotes cross-system integration, and helps to break the dependency on proprietary data formats
- Provides governance on internal and external interfaces

**Regulatory benefits:**

- Enables compliance with North American (NERC) and European (ENTSO-E CGMES) data modeling and exchange standards
- Full auditing capability to track model changes and event re-creation

**Other benefits:**

- Hedges against aging workforce and silos of information
- Establish a sustainable path to interoperability, data governance, and compliance in a world of constantly expanding regulatory and cost pressures

**Differentiators:**

**CIM↔PSS®E conversion accuracy:**

- Being the developer of both PSS®E and PSS®ODMS, Siemens PTI can provide the tightest possible interoperability between PSS®E and CIM data – both today and whenever new CIM / CGMES or PSS®E formats are released.

**People:**

- The staff of Siemens PTI includes some of the world’s top experts in CIM and network model management. These original thought leaders were among the authors of the first CIM standards dating back to 1998. Today – many years later – they continue to lead within the CIM and CGMES communities.

**Proven methodology and experience:**

- Siemens PTI has a history of successfully deploying highly complex network model management systems around the world, and utilizes the award-winning “PM@Siemens” Global Project Management methodology to deliver your solution with excellence.

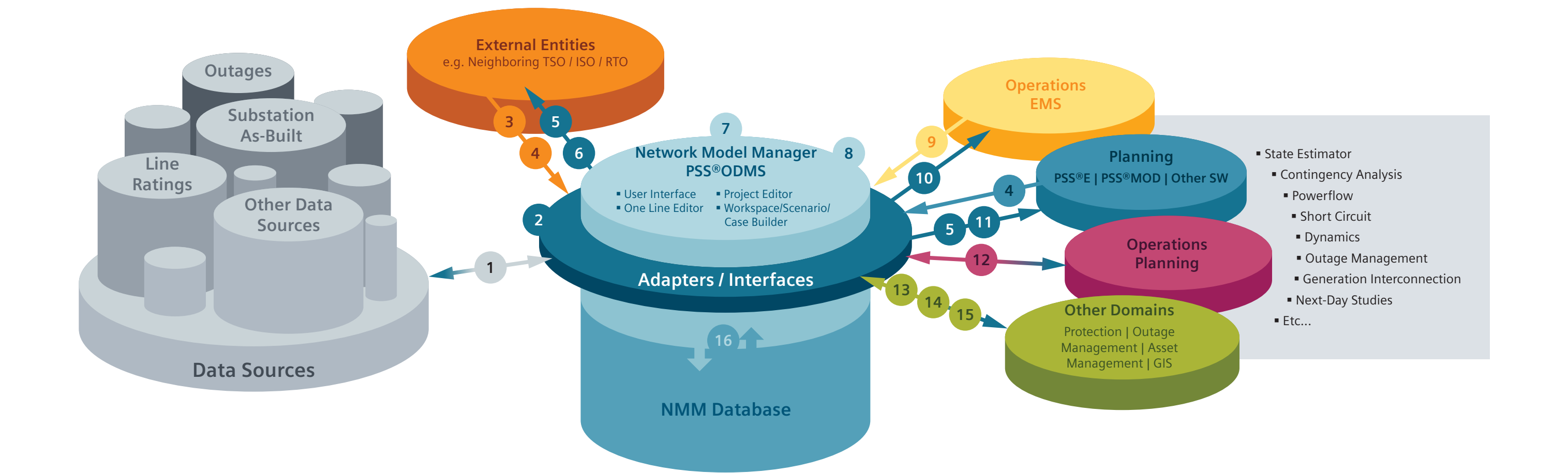
**Vendor-neutral:**

- Interfaces with any EMS, AMS, GIS, etc. that support the industry standard CIM format. Custom interfaces / adapters can be built using PSS®ODMS’s open APIs.

**Alignment with industry best practices:**

- Supports EPRI Network Model Manager best practices / technical market requirements (<https://www.epri.com/#/pages/product/000000003002003053/>)

The PSS®ODMS Network Model Management solution (NMM) provides a single location to coordinate and manage network modeling information across operations, operations planning, and long-term planning plus other domains and systems.



- 1

**Interfaces to enterprise data source:** Achieved through a combination of standard (off-the-shelf) adapters and custom adapters which can be built using PSS®ODMS APIs.
- 2

**Standard interfaces:** Includes built-in support for CIM, CGMES, as well as PSS®E and PSS®MOD file formats.
- 3

**Receive external model data from other entities:** Operations staff can receive new external model data / model authority sets pertaining to neighboring TSO / ISO / RTOs. These models can be imported into the PSS®ODMS NMM system to replace the existing ones. The MRID (Master Resource Identifier / rdf:ID) and name attributes can be modified in these model authority sets, based on a name registry, according to the specific requirements of your EMS system.
- 4

**Import projects from PSS®MOD:** Projects can be imported into the PSS®ODMS NMM directly from PSS®MOD via .prj format. Historical and real-time measurement information can also be imported into PSS®ODMS.
- 5

**Export to PSS®MOD:** The PSS®ODMS NMM system can produce stored projects in the PSS®MOD project (.prj) format – these can be provided as required to an internal PSS®MOD system or to neighboring TSO / ISO / RTOs.
- 6

**Export model data to external entities:** Your network model / model authority set can be exported to a CIM / XML file based on the IEC 61970-452 Equipment (EQ) profile plus the extensions for use in neighboring TSO / ISO / RTO EMS systems. In these cases, the MRID (rdf:IDs) and name attributes can be modified, based on a name registry, to the requirements of the receiving EMS systems.
- 7

**Custom adapters:** PSS®ODMS provides APIs which can be used in software built by the customer to extract data directly from the PSS®ODMS NMM model without using any predefined exporters. Siemens PTI also provides engineering services to build custom adapters.
- 8

**Build projects / scenarios natively:** Users can natively create new projects representing future construction work. The project management area can be used as a 'what if' environment for planners. Project data can include descriptive information about the projects and artifacts required by the specifications. Also, the extensions needed by all of the systems using data from the PSS®ODMS NMM projects may be maintained in this environment throughout their life cycle. If projects are modified, they can be copied and the version can be incremented to provide an audit trail. The projects can also be converted to PSS®MOD format to pass to other organizations.
- 9

**Export EMS snapshots** to Planning Group to update the basecase or study specific scenarios.
- 10

**Update the EMS Model as projects are completed:** Once projects are at the stage where construction is near completion, they may be exported then passed to the model management team for testing and committing. The model can be exported to a CIM / XML file containing all of the data needed to update the EMS.
- 11

**Produce PSS®E .raw files:** PSS®E .raw files can be produced using as-built data vetted from the state estimator to replace the base case in PSS®MOD.
- 12

**Create and export forecast study cases to operations planners**
- 13

**Export model information to outage management system**
- 14

**Export to other systems:** The PSS®ODMS NMM system can export a custom profile controlled CIM / XML file export to feed other systems as needed.
- 15

**Export to protection:** The PSS®ODMS NMM can produce .raw files along with sequence data (.seq) files to update models for protection software (e.g. ASPEN, etc.).
- 16

**Maintain both node-breaker and bus-branch models** in a single database.



# PSS®ODMS

## Automated Case Creation for Network Operations Planning Studies

### Use Cases:

- Automated case creation for network operations planning studies
- North America: NERC TOP-002-2.1b compliance (plus other standards and workflows related to operations planning)
- Europe: ENTSO-E CGMES compliance: generate solved D-1 (day-ahead), D-2, W-1 (week-ahead), etc. cases in both PSS®E and CGMES format

Operations planners play an important role within transmission companies: they study predicted system behavior and “what-if” scenarios on a day-ahead (sometimes even same-day) to week-ahead timescale, and use that information to help create operational plans for near-term timescales. Effective operations planning is not only essential to being prepared for reliable grid operations and responses for unplanned events – it is also enforced in many countries through regulations and standards.

In order to achieve their tasks, operations planners need to prepare different “what-if” cases which can then be studied using grid simulation software such as PSS®E. The challenge is that building these cases can be a time-consuming and error-prone manual task that involves fusing information from various sources (outage schedules, generation forecasts, load forecasts, interchange schedules, state estimator snapshots, etc.).

For European TSOs, the problem is even further compounded: European Network Codes require TSOs to produce forecast (e.g. intraday, D-1, D-2, W-1, etc.) cases in a specific format called CGMES – so there is the additional complexity of data conversion / formatting. Achieving compliance requires a tool that produces these cases without introducing errors (for example, due to data conversion and mapping), and without additional manual overhead.

Whether you work for a TSO in North America, Europe, or other location, PSS®ODMS solves the case creation problems outlined above by providing effortless, automated, repeatable, and accurate production of solved forecast cases in both PSS®E and CGMES formats.

### Problem Solving Features:

- Automatically produce solved and validated operations planning cases (e.g. intraday, D-1, W-1, day-ahead, week-ahead, etc.) in both PSS®E and CGMES (Europe) format
- Open APIs to automatically integrate case data from other sources (e.g. outage schedule, load forecast, generation forecast, etc.)
- Vendor-neutral EMS integration captures state estimator / EMS snapshots, which can form the basis for the operations planning study cases

**NOTE:** If you don't have a State Estimator, PSS®ODMS offers one (see pages 12-13, “PSS®ODMS for Real-Time Situational Awareness”)

- Cases can be produced based on a set of configurable variables (e.g. time of day, load / generation forecast data source, etc.)
- Model validation and security checks: comprehensive / verbose debugging and logging, built-in CGMES validation, PSS®E solution validation, and contingency analysis security checking

### Benefits:

#### Improved business process efficiency:

- Automate key tasks such as case assembly and data validation for operations planning
- Reduce time required to build forecast cases and perform operations planning studies
- Generated cases are automatically validated and instantly solvable in PSS®E for study which avoids the need for time-consuming validation and case de-bugging

#### Organizational and IT benefits:

- Promotes automation and helps break organizational silos

#### Regulatory benefits:

- Enables compliance with North American (NERC) Reliability Standards related to operations planning (e.g. TOP-002)
- Enables compliance with European (e.g. ENTSO-E CGMES) case-creation standards
- Full auditing capability for tracking changes, event re-creation, and data validation

### Differentiators:

#### Data quality and solvability of PSS®E cases:

- As the developer of both PSS®E and PSS®ODMS, Siemens PTI is uniquely positioned to ensure that your operations planning cases are automatically produced to be valid, secure, and solvable in PSS®E – as opposed to competing solutions which typically produce “bad” cases that require additional manual effort to get them to solve in PSS®E.

#### Europe:

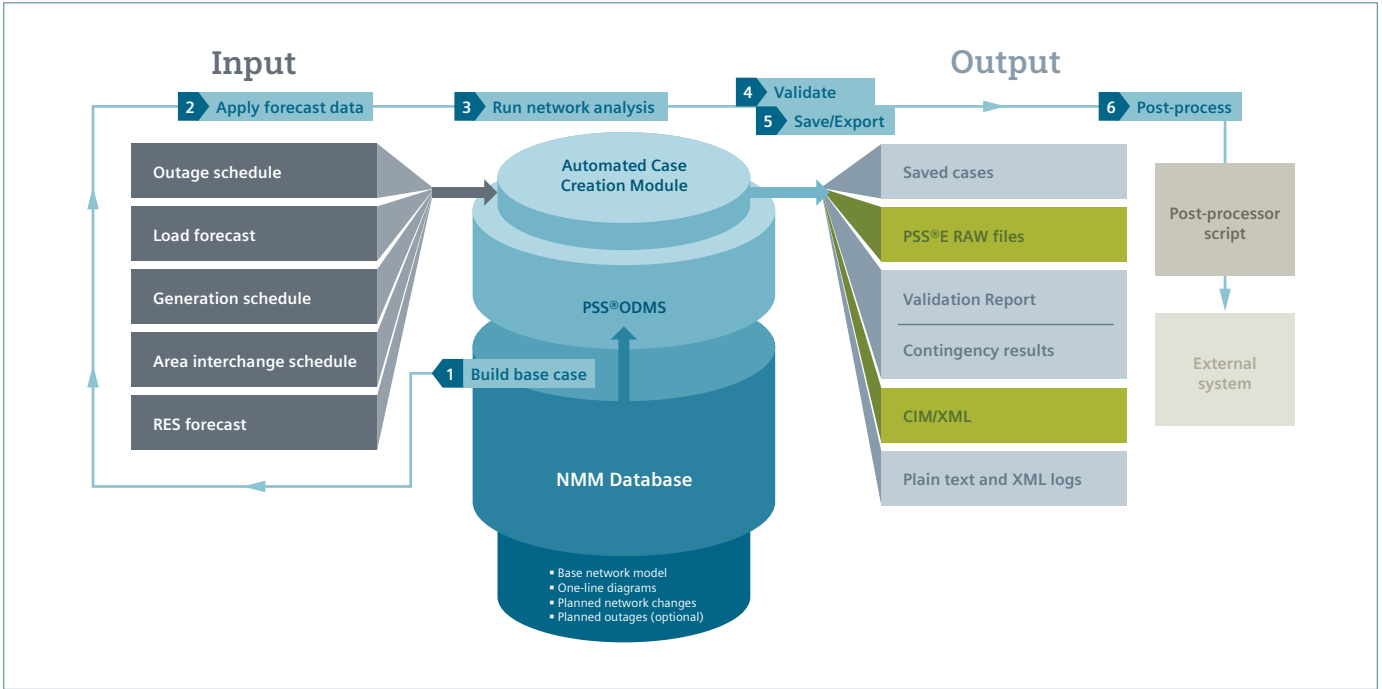
- CIM / CGMES ↔ PSS®E conversion accuracy:** Since Siemens PTI is the developer of both PSS®E and PSS®ODMS, you get the tightest possible interoperability between your PSS®E and CIM / CGMES data, both today and whenever new CIM / CGMES or PSS®E formats are released.
- ENTSO-E CGMES Gold Certification** in all relevant categories ([https://www.entsoe.eu/Documents/CIM\\_documents/Conformity\\_Registry/160108\\_Siemens\\_Attestation\\_of\\_Conformity-PSS\\_ODMS\\_v11.0.pdf](https://www.entsoe.eu/Documents/CIM_documents/Conformity_Registry/160108_Siemens_Attestation_of_Conformity-PSS_ODMS_v11.0.pdf))

### Proven methodology and experience:

- Siemens PTI has a history of success in custom system integration and solution deployments around the world, and utilizes the award-winning “PM@Siemens” Global Project Management methodology to deliver your solution with excellence.

### Vendor-neutral:

- PSS®ODMS can interface with a number of third-party data sources and systems using its open APIs and built-in adapters. This allows a streamlined means of integrating with EMS / state estimator snapshots, outage schedules, load forecasts, generation dispatch data, interchange schedules, etc.



General PSS®ODMS CGMES Case Creation workflow example. Other approaches / variations are possible – with PSS®ODMS playing a different role in each. For example, PSS®ODMS Case Creation can be deployed to more thoroughly leverage your existing Case Creation (e.g. UCTE) data / solution.



# PSS®ODMS

## ENTSO-E CGMES Compliance and PSS®E ↔ CIM / CGMES Data Conversion (for European TSOs)

Use Cases:

- Enable network model data between PSS®E and CGMES formats
- Achieve compliance with ENTSO-E CGMES data formatting requirements
- Achieve compliance with ENTSO-E CGMES rdf:ID persistence and uniqueness requirements

European TSOs are required by ENTSO-E to comply with several regulations related to data formatting and exchange. Namely, all European TSOs are required to: (1) produce planning models in CGMES format; and (2) maintain globally persistent and unique rdf:IDs in their models. This is to ensure interoperable data exchange between TSOs and to support processes such as Ten Year Network Development Plan (TYNDP). Unfortunately, this can be problematic since: (1) planning software traditionally provides (and consumes) data in proprietary format; and (2) maintenance of globally unique rdf:IDs is not a traditional workflow for TSOs or their planning software, presenting both technical and organizational challenges.

Problem Solving Features:

- CIM / CGMES ↔ PSS®E data converter
- Supports PSS®E v30-34 and CIM 10v4-CIM16, including CGMES
- Ability to record and apply model changes incrementally
- “Compare Models Function” allows users to compare two PSS®E or CIM models, automatically extract the changes, and apply them incrementally to any other model (such as your base case)
- Ability to use mapping tables / registries as well as central databases to manage / map rdf:IDs
- Powerful and intuitive model maintenance GUI
- Preserve rdf:ID persistence and uniqueness

Benefits:

- Achieve ENTSO-E requirements for rdf:ID persistence and uniqueness
- Avoid duplicate model maintenance effort
- No need to disrupt your existing model maintenance workflows / process
- Eliminate need for error-prone mapping tables and constant data conversion

Differentiators:

CIM/CGMES ↔ PSS®E conversion accuracy:

- Being the developer of both PSS®E and PSS®ODMS, Siemens PTI can provide the tightest possible interoperability between PSS®E and CIM data – both today and whenever new CIM / CGMES or PSS®E formats are released.

ENTSO-E CGMES Gold Certification in all relevant categories

People:

- The staff of Siemens PTI includes some of the world’s top experts in CIM and Network Model Management. These original thought leaders were among the authors of the first CIM standards dating back to 1998. Today – many years later – they continue to lead within the CIM and CGMES communities.

Proven methodology and experience:

- Siemens PTI has a history of success in custom system integration and solution deployments around the world, and utilizes the award-winning “PM@Siemens” Global Project Management methodology to deliver your solution with excellence.





# PSS®ODMS

## Real-Time Situational Awareness

Use Cases:

- Real-time situational awareness for transmission companies who are too small (or don't want) to deploy a full EMS (or perform a major SCADA upgrade)
- Low-cost and easy to deploy solution for real-time state estimation and contingency analysis with a user friendly interface
- Analyze real-time network conditions in the event of a SCADA interruption

Situational awareness of the power grid is critical for secure and reliable system operation. Lack of situational awareness was cited as a contributing cause in many of the major blackouts of the past 15 years. As a result, there is a landscape of regulations, standards, and best practices dedicated to ensuring a proper level of real-time system visibility (for example, NERC TOP-006-2 in North America).

While the exact definition of situational awareness varies by context, it generally refers to some blend of real-time state estimation, contingency analysis, and other analytical functions that allow operators to anticipate, assess, and mitigate real-time issues.

These capabilities are typically only possible by deploying an EMS, or by performing a major SCADA upgrade / replacement to a new vendor that provides these functions (very few do). Neither of these options are attractive for smaller transmission operators.

PSS®ODMS provides a lightweight, easy to deploy situational awareness solution that works with your existing SCADA system. It is a fraction of the deployment and maintenance cost of a full EMS or SCADA replacement.

Problem Solving Features:

**Fast and accurate analytical functions evaluate system operating conditions in real-time and increase system awareness for improved reliability and security**

- Real-time state estimator and contingency analysis
- Can obtain measurements from existing SCADA and historian through open interfaces (ICCP and OPC)
- View finalized results of each contingency with its applied protection scheme

- Topology processor and power flow engine allows to produce planning cases that can be studied in PSS®E
- Can be extended to offline study mode in one click†
- Automatically export a solved operational snapshot case to PSS®E (with consistent bus numbering / naming, etc.) after each solution cycle†
- Retrieve archived measurements and build historical cases for study†

User interface:

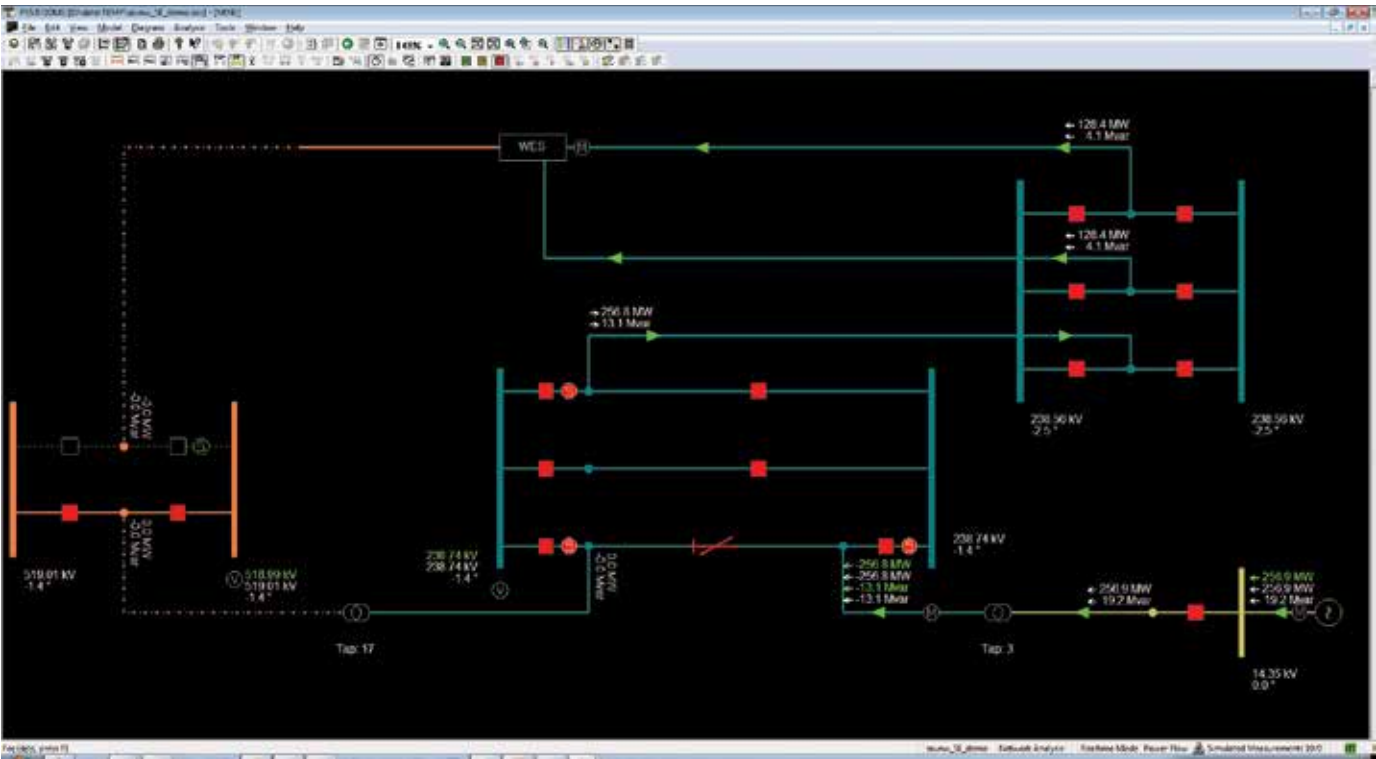
- Intuitive displays for for operators, including; single-substation, geographic overview, and large-scale 'map board' one-line diagram
- Powerful graphical results visualization and network navigation
- Custom symbol support with built-in editor
- Simultaneous measurements-and-results display
- Color-coded and animated flow arrows
- Color contouring by flow or voltage violation
- User-configurable spreadsheet views
- One-click toggle between real-time and study mode

**Powerful open .NET and Python™ APIs for automation and custom scripting**

**Comprehensive and flexible system administration options**

Benefits:

- Lightweight, easy to deploy situational awareness solution that works with your existing SCADA system (vendor-neutral)
- Improve system reliability at a low cost
- Increase situational awareness
- Have fewer network disruptions
- Provides backup situational awareness in the event of a SCADA disruption
- Reduce outage recovery time
- Enables compliance with situational awareness standards / regulations / best practices (for example NERC TOP-006-2 in North America)



PSS®ODMS in real-time situational awareness mode. Measurement values (e.g. from SCADA/ICCP) are shown in green, while state estimator results are shown in white.

Differentiators:

Fast-track deployment

- While conventional EMS deployments take multiple years, PSS®ODMS deployment time normally takes less than six months
- No model building from scratch
- No diagram building from scratch (cosmetic diagram layout editing is the only manual procedure)
- Measurement and result labels are auto-generated: no graphical point mappings required
- Area-wide map board schematic diagrams can be quickly constructed from previously saved individual substation layouts

Low maintenance costs

- While traditional EMS's require multiple full-time employees to maintain, PSS®ODMS requires only a single part-time engineer.
- All functions (modeling, graphical editing and analysis) are contained within a single desktop application
- Intuitive graphical model editing includes the ability to place new equipment and reconnect or delete existing equipment
- Synchronize with model function for topology changes which may occur outside of the diagram editor
- Built-in diagnostic tools point out modeling and telemetry errors

- Model merge function for external model replacement saves months of manual effort

Lightweight solution

- Can be deployed on machines as simple as laptops, and can be brought outside of the control room for training / simulation purposes

Vendor-neutral

- Works alongside your existing SCADA system
- Interfaces with your operational data sources (e.g. SCADA, PI Historian) using open interfaces

Proven methodology and experience:

- Siemens PTI has a history of success in control room / transmission operations deployments around the world, and utilizes the award-winning "PM@Siemens" Global Project Management methodology to deliver your solution with excellence.
- Robust, fast and accurate algorithms leveraging 60 years of Siemens PTI's industry experience

**Automated functions that can produce solved PSS®E cases for additional study functions (e.g. operations planning) outside the control room**

**Automatable / customizable through scripting and open APIs**

† See separate sections on "PSS®ODMS for Automated Case Creation for Network Operations Planning Studies" and "PSS®ODMS for Offline Study Functions Based on Real-Time Data."

# PSS®ODMS

## Offline Study Functions Based on Real-Time Operations Models / Data / Scenarios

Use Cases:

- Create cases and perform offline study functions based on your real-time operations models / data / scenarios
- Training, model validation, and event re-creation
- Instantly create cases and perform studies around system outages, voltage collapse, cascade scenarios, black start sequencing, safe switching procedures, load shedding, and remedial action scheme RAS / SPS modeling

Transmission companies perform several workflows that require creating an offline study case that is reflective of a real-world system condition. For example, this is used for operator training purposes, as well as to re-create and study past events / anomalies. It can also be helpful for model validation purposes (for example, NERC-MOD-33 in North America). In these scenarios, the user collects input “case” data (e.g. state estimator snapshot, measurement information, outage information, generation data, etc.) and fuses it together to create a model that can be studied using a simulation package.

Unfortunately, the creation of these cases can be an error-prone and time-consuming process. Even when the cases are created, they are sometimes only useful (or accessible) within a particular environment such as the control room / EMS.

PSS®ODMS solves this problem by allowing you to create offline cases based on real-time or historical operational snapshots, and furthermore, provides you with a rich set of analytical tools to study the cases. The cases can also be exported to PSS®E for further analysis. PSS®ODMS is vendor-neutral and works alongside your existing IT landscape / SCADA system through open interfaces. It is a very lightweight solution that can be deployed on machines as simple as laptops, and can be taken outside of the control room environment.

Problem Solving Features:

**Retrieves real-time and historical measurement data from your existing SCADA / Historian and produces solved operational snapshot cases (with consistent bus numbering / naming) for offline study**

Cases can be exported to PSS®E or studied locally within PSS®ODMS via its integrated Power Flow, Contingency Analysis, State Estimation, and Topology Processor

Vendor-neutral integration is achieved via open interfaces (ICCP, OPC)

User Interface:

- Intuitive displays for operators, including; single-substation, geographic overview, and large-scale ‘map board’ one-line diagram
- Powerful graphical results visualization and network navigation
- Custom symbol support with built-in editor
- Simultaneous measurements-and-results display
- Color-coded and animated flow arrows
- Color contouring by flow or voltage violation
- User-configurable spreadsheet views
- 1-click toggle between real-time and study mode

**Powerful open .NET and Python™ APIs for automation and custom scripting**

**Comprehensive and flexible system administration options**

Benefits:

- Bridge the gap between operations and planning
- Lightweight, easy to deploy solution that works with your existing SCADA and historian system (vendor-neutral)
- Save time, reduce errors, and simplify the process of creating operational snapshot / historical cases for offline study
- Enable compliance with model validation standards such as NERC-MOD-33 (North America)
- Reduce outage recovery time
- Strengthen your operator training program

Differentiators:

**Lightweight solution can be deployed on machines as simple as laptops, and can be brought outside of the control room for training / simulation purposes**

Vendor-neutral

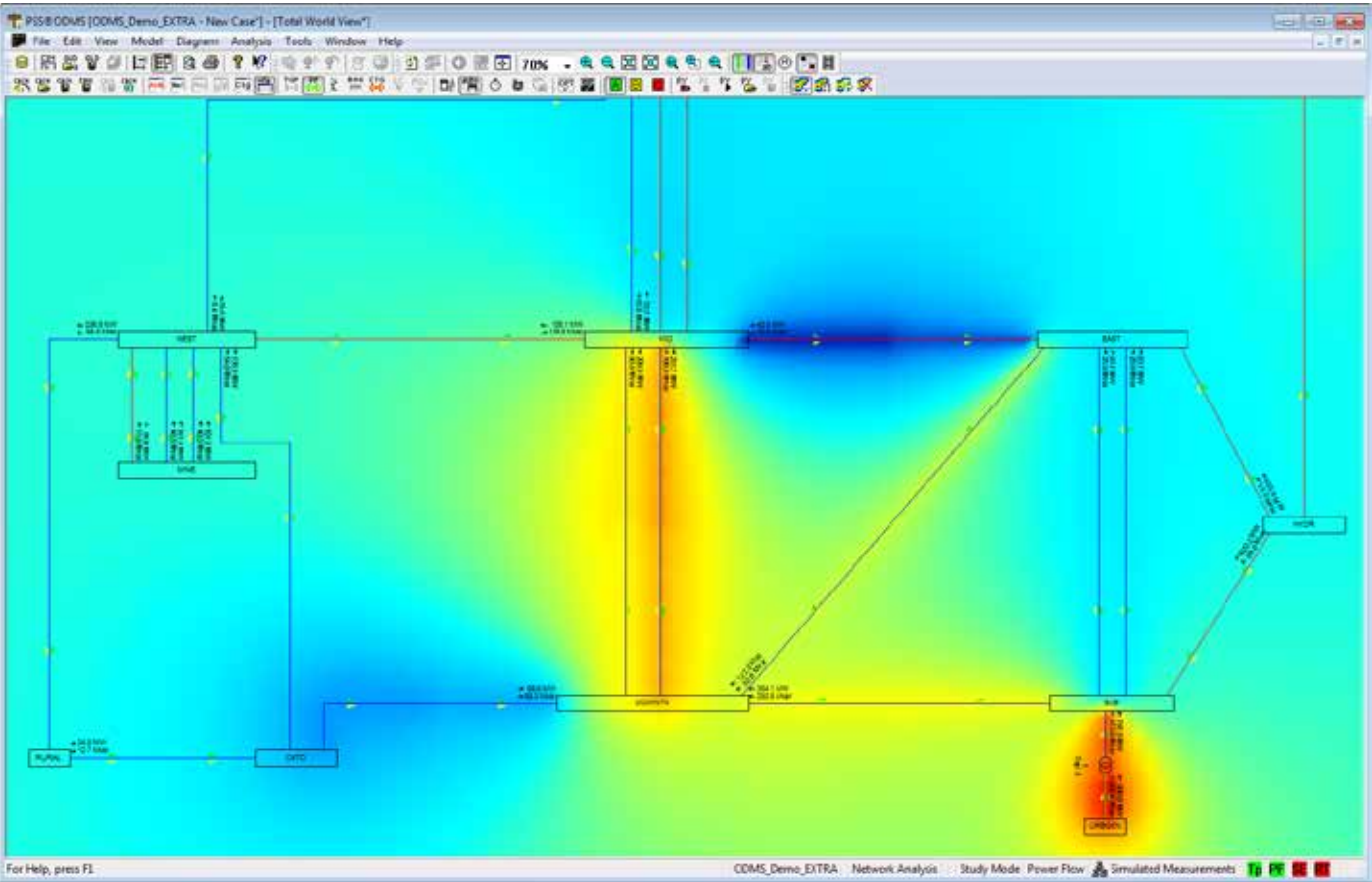
- Works alongside your existing SCADA system
- Interfaces with your operational data sources (e.g. SCADA, PI Historian) using open interfaces

**Data quality and solvability of PSS®E cases: As the developer of both PSS®E and PSS®ODMS, Siemens PTI is uniquely positioned to ensure that your real-time / historical snapshot cases are automatically produced to be valid, secure, and solvable in PSS®E**

Simplicity

- No model building from scratch
- No diagram building from scratch
- Measurement and result labels are auto-generated: no graphical point mappings required
- Area-wide map board schematic diagrams can be quickly constructed from previously saved individual substation layouts

**Automatable / customizable through scripting and open APIs**



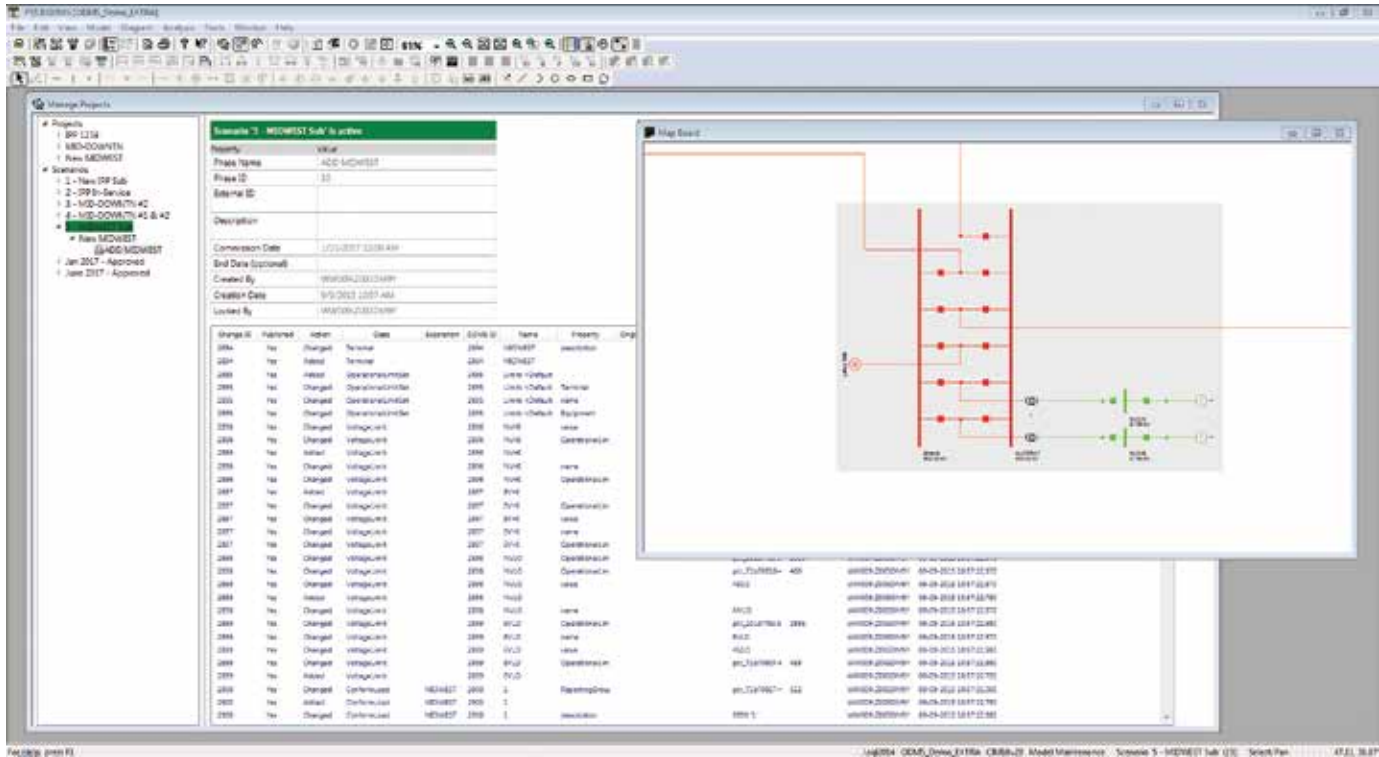
Visualization of contingencies in PSS®ODMS using color contouring



# Feature Summary

## Modeling Alternate Scenarios in PSS®ODMS

- Native CIM-based transmission network modeling environment
- Consolidated node-breaker / bus-branch modeling
- Conformant with ENTSO-E CGMES and NERC CPSPM profiles
- Persistent, globally unique MRIDs (Master Resource Identifier / rdf:ID)
- Fully compatible with PSS®E standard data formats
- Full, partial and incremental CIM / XML import and export capability
- Difference model extraction from side-by-side CIM / XML model comparison
- CIM model validation and CIM version upgrade functions
- Multi-phase project modeling for short-term and long-term transmission grid planning
- Interactive model change recording to individual project phases
- Unlimited future scenarios for previewing and validating alternative model configurations
- Scenario study case build, analysis and export to PSS®E
- Historical change tracking with full audit trail of model changes
- Configurable user roles, privileges and groups
- Public APIs for system integration and / or automation



Modeling alternate scenarios in PSS®ODMS

## PSS®E Compatibility

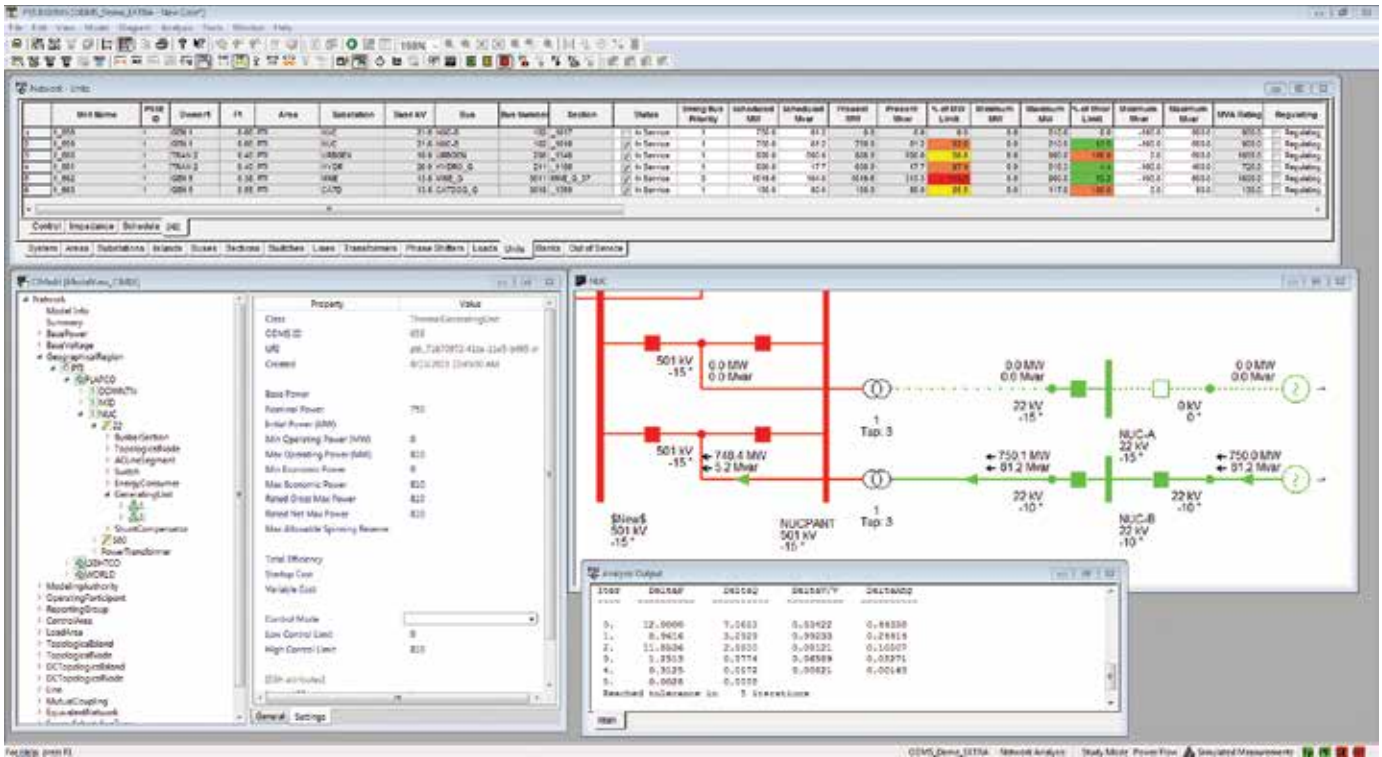
- Import and export network data in RAW and SEQ format
- Import and export dynamic model data in DYR format
- Full preservation and export of all PSS®E identifiers (buses, areas, owners, zones, etc.)
- Import seasonal limit sets and / or profiles from multiple PSS®E RAW files
- Import operational state data from PSS®E RAW files
- Extract incremental model changes from PSS®E RAW / SEQ file comparison
- Import PSS®E project (PRJ) files

## Database

- Multi-user relational database implementation supports SQL Server and Oracle
- SQL Server Express Edition support for standalone workstation deployment
- Model-driven database schema generated from IEC CIM 61970 UML
- Support for user-defined database extensions
- Automatic backup server failover capability for high-availability deployments
- Scalable to any transmission network size

## User Interface

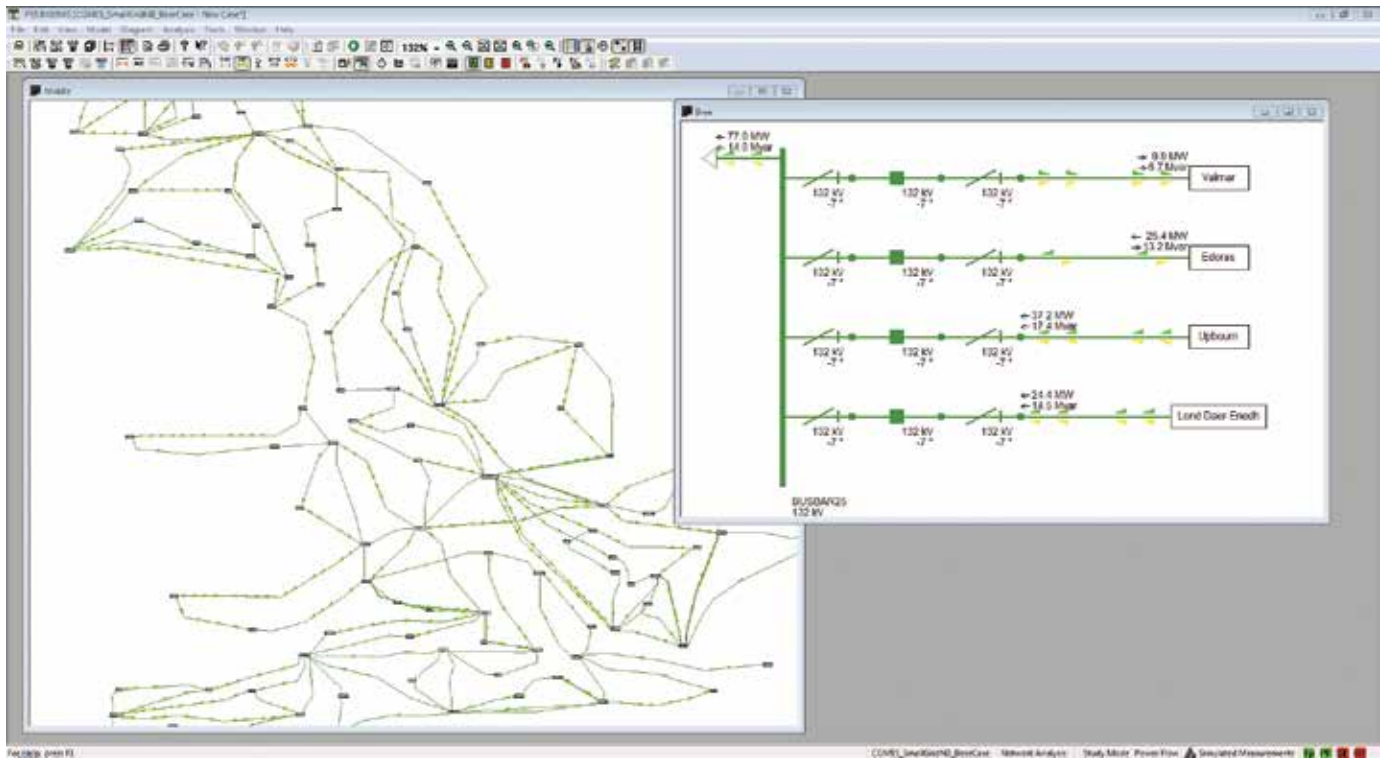
- Native Windows desktop application with intuitive menus, toolbars and windows
- User-configurable and extensible hierarchical network model interface
- Interactive one-line diagrams that support model maintenance and network analysis tasks
- Tabular network analysis displays including pre-filtered, sorted limit violation reports
- Scrolling network analysis textual progress window
- Project modeling interface for structured future grid planning
- Model history interface for detailed audit trail of committed model changes
- Convenient navigational / lookup features



General PSS®ODMS GUI showing (clockwise from top): Contingency Results; Network Diagram; Analysis Output; Model Editor (CIM)

Diagrams

- Individual substation, system overview and map board-style one-line diagrams
- Automatic diagram generation with support for geographical coordinates
- Automatic diagram synchronization with network model changes
- Intuitive zooming, panning and selection features
- Informational graphical object tooltips
- Shared diagram settings including standard voltage level colors
- User-specific display settings, including side-by-side measurements and analysis results
- Color contouring based on percentage of flow / voltage limits or base voltages
- Optionally animated and color-coded flow arrows
- Built-in custom symbol editor
- Standard image file support including embedded images
- Free-form graphical and text annotations
- Printing support including PDF
- Import and export functions compliant with CIM16 Diagram Layout profile



(Left) Geographical overview diagram; (Right) Substation diagram with power flow results

Topology Analysis

- Dynamic node-breaker to bus-branch model conversion
- Identification of energized / de-energized islands and buses
- Identification of out-of-service devices
- Individually “retained” switching devices for fixed buses
- Exports snapshot of operations data and equipment status

Power Flow

- Newton-Raphson, fast-decoupled and DC solution algorithms
- Flat-start and non flat-start solution options
- Generator var limit checking option
- Automatic transformer and switched shunt control adjustment
- New slack load mismatch distribution method

State Estimator

- Field-tested, proven accuracy comparable to any EMS
- Fast performing solution with robust convergence
- Identifies critical and bad measurements
- Automatic switch status correction
- Intuitive SE tuning reports identify topology, flow direction, and injection mismatches
- Supports ‘hybrid’ operations / planning models
- Supports flow measurements on breakers / switches
- Reliably estimates sub-transmission (low voltage) regions with limited telemetry
- Supports telemetered flow limits
- Supports direction-dependent flow limits

Contingency Analysis

- Fast DC power flow-driven N-1 contingency generation and screening
- Full AC power flow solution for each selected contingency
- Complex user-defined contingencies via Python scripting
- Protection / remedial action schemes via Python scripting
- Supports RAS and SPS post-contingency switching
- Interactive Python script recording for user-defined contingencies
- Contingency analysis overview, summary and detailed reports
- Unique individual contingency activation feature for system-wide visualization
- Supported in online network analysis and off-line study mode
- Full automatic contingency runs at user specified periodicity
- Full breaker to breaker contingency definitions

Measurement Integration

- OPC DA client interface for real-time measurement input data
- OPC HDA client interface for historical measurement input data
- Compatible with SISCO AX-S4 ICCP

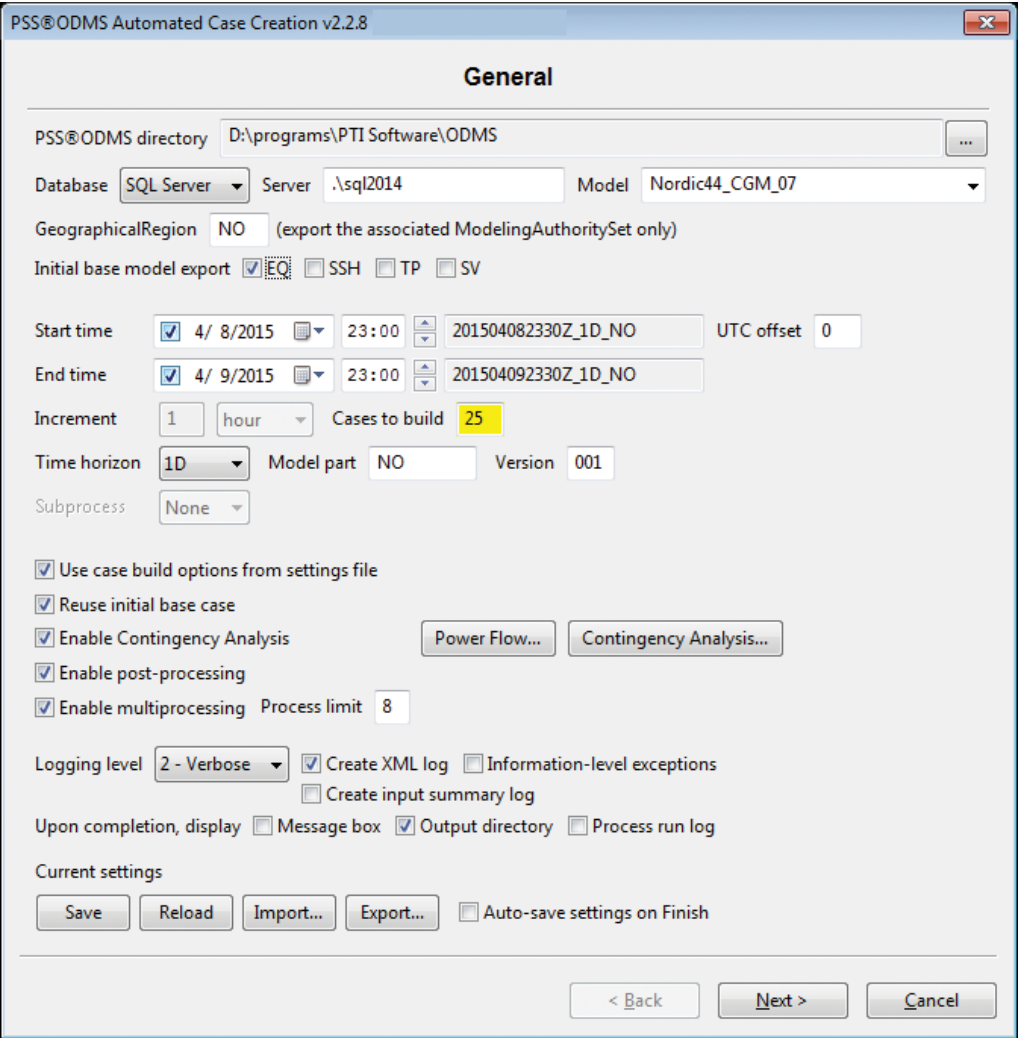
Public APIs

- odmsPy – Python API for importing and exporting model data
- pssoPy – Python API for network analysis functionality
- sliderPy – Python API for graphical data conversion and / or manipulation
- CIMdbNET – .NET API for CIM database model low-level data access
- PMdbNET – .NET API for project modeling functionality



Automated Case Creation

- Builds near-term operational forecast cases for the selected time period (e.g. next day, two days ahead, one week ahead, etc.)
  - Imports outage, load, generation and interchange schedule / forecast data via standard and / or custom interfaces
  - Integrated power flow and contingency analysis
  - Exports solved forecast cases in CIM / XML (CGMES) and PSS®E RAW format
  - Saves forecast cases in native binary file format for later troubleshooting
- Detailed plain text and XML logging
  - Network analysis HTML reports
  - Standalone GUI for selecting custom settings and invoking the process
  - Visual feedback while the process is running and at completion
  - Multiprocessing support for maximum performance
  - Designed for customization, extension and integration via Python



PSS®ODMS Case Creation Module GUI

# Product Support

Support

- Application support offered by dedicated in-house Siemens PTI Customer Care team with direct access to subject matter experts
- Premium access to product updates, enhancements and improvements as well as new functionality
- Interactive online forums to facilitate knowledge sharing among the community of professionals
- Extensive knowledge database
- Power packed technical user conferences with regional focus to increase product roadmap awareness, providing opportunities to meet with Siemens PTI experts and fellow users

PSS® Ideas Portal

- Platform for PSS® Product Suite users to submit, track, and vote on product ideas
- [www.siemens.com/pss-ideas](http://www.siemens.com/pss-ideas)
- To request access to the PSS® Ideas Portal, contact [pti-support-energy@siemens.com](mailto:pti-support-energy@siemens.com)

System Requirements

- Microsoft Windows-compatible desktop, laptop, server or virtual machine
- Windows 7, 10, or Server 2012 R2
- 2.6 GHz CPU (4+ cores recommended for automated case creation multiprocessing)
- 4 GB RAM (plus additional 2 GB RAM per user on an application server)

- 1280x720 or higher screen resolution support
- Microsoft .NET Framework 4.6.1 (minimum)
- Python 2.7 (32-bit Windows version)
- Oracle Client (for Oracle database deployment only)
- Dedicated database server
  - Microsoft SQL Server 2014, 2012 or 2008 R2 (SP1)
  - Oracle 12c (12.1.0.2 minimum) or 11g Release 2 (11.2.0.4 minimum)

Siemens Power Academy

- Beginner level PSS®ODMS training:
  - Learn how to operate the software
  - Understand the models and database
  - Learn how to export / import data between EMS and PSS®E
  - Perform network analysis
  - Measurement requirements and mapping for state estimation
  - Gain familiarity with the graphical interface

- Standard or customized training
- Various delivery options available
- For more information on Siemens Power Academy visit [www.usa.siemens.com/pti-education](http://www.usa.siemens.com/pti-education)

Sales Contact

- Email: [pti-software-sales.ptd@siemens.com](mailto:pti-software-sales.ptd@siemens.com)

# Company Profile

Siemens Power Technologies International

From strategic advisory to technical consulting and state-of the art software solutions: Siemens PTI offers a holistic approach to mastering the technical and economic challenges of today’s and future energy systems. Drawing upon more than 60 years of experience and continuous innovations in power system planning, Siemens PTI’s renowned experts address the full scope of power system analysis, design and optimization studies. Experiences gained in international studies and the dynamic changes to the industry, directly flows into Siemens PTI’s comprehensive suite of power system planning and software tools which reliably support the power and energy industry around the world. Our strategic consultants help optimize business value by providing valuable advice in the fields of business transformation, infrastructure development, as well as market and transaction advisory. Siemens’ financial strength and regional competence centers around the world make Siemens PTI an ideal partner to develop individual, innovative solutions which create sustainable value for our customers and turn change into opportunities.



### Software Solutions

Siemens PTI offers a powerful suite of software applications and solutions to efficiently support system planning and operations with their daily simulation and analysis work. The Power System Simulator (PSS®) Product Suite provides a full set of integrated and specialized applications for the simulation, analysis, and modeling of transmission, distribution, and industrial power networks, as well as gas, water, heating, and cooling infrastructures. Easily integrated into any existing IT environment, these powerful and user-friendly tools feature an intuitive graphical user interface, customizable visualization options, automation capabilities, and efficient data management. Data exchange with other systems (e.g. EMS, DMS, AMS, GIS, other planning tools, etc.) is provided through industry standards (i.e. CIM) and native interfaces. Siemens PTI also provides custom software solutions based on its blend of engineering and software architecture expertise, custom software development capabilities, award-winning project management, and existing product functionality.

### Energy Business Advisory

Energy business advisory guides enterprises to maximize their value in an increasingly complex, global, and evolving energy marketplace. Siemens’ consulting service combines technology and market expertise and decades of industry experience in a flexible methodology toolbox covering all project stages from strategy development to implementation. Our expertise in strategic planning is enhanced by Pace Global’s long-standing experience in the fields of risk management, market advisory, infrastructure development and transaction advisory. With our collective resources we bring a complete best practice perspective to power, natural gas, renewable generation and environmental markets.

### Power System Consulting

Ever changing industry challenges and opportunities along with the rising complexity of modern power systems call for comprehensive, systematic grid planning. Siemens PTI’s renowned Power System Consulting experts leverage experiences gained in numerous and diverse projects to derive grid concepts which follow the overall business strategies of utilities and end-customers. Profound power system analysis, both technically and economically, together with leading planning competence provide insight that enable our clients to take well-informed decisions influencing the structure, performance and operation of their systems. Our services address utility as well as industrial or commercial grids and cover the complete range of studies: from steady-state, dynamic and transient analyses to protection and control concepts or power quality aspects. In studies, continuous partnerships, long-term planning or research projects, we tailor our services to individual demands.

### Did you know?

- Siemens PTI founded in 1956
- Headquarter in Erlangen, Germany
- 26 offices worldwide
- 2000+ customers  
1000+ projects p.a.
- 200+ consultants  
Renowned experts  
Profound experience
- Global leader in power systems planning