SIEMENS

Case Study

Amprion GmbH

Adopts Common Information Model (CIM) to simplify network management and planning

Amprion's extra-high-voltage power network is 11.000 kilometers long and transports electricity from Lower Saxony to the Alps.

German TSO partners with Siemens PTI to deploy modern modeling, analysis, and integration solution

Controlling and operating electrical power transmission networks is a vital yet complex function marked by constant growth and change. As new system use cases and databases are added to the grid and optimization initiatives are undertaken, transmission system operators (TSOs) such as Amprion GmbH strive to incorporate them seamlessly while maintaining the security of supply and keeping costs low.

Twenty-nine million people in Germany depend on the reliability of Amprion's extra-high-voltage network. Headquartered in the city of Dortmund, northeast of Düsseldorf, it is one of four TSOs in Germany and has a service area extending from Lower Saxony to the Alps. Modernized processes and a standards-based approach were sought to better connect and manage the transmission network.

The TSO envisioned consolidating on a centralized database for a Common Information Model (CIM) of its connected grid. This would simplify asset management and grid planning while streamlining the integration of new and diverse data sources. The effort would be coupled with an Enterprise Service Bus (ESB) integration to facilitate communication between all the different systems.

Amprion chose to accomplish the CIM cache deployment and ESB integration using PSS®ODMS transmission network modeling and analysis software and expert services from long-time partner Siemens PTI. Implementation began in the spring of 2018 and was completed in December of 2020.

A change in approach was needed

Like most utilities, Amprion faces a constantly growing need to share data and information between multiple databases. It is essential to avoid inconsistencies in model data across domains as it can cause model inaccuracies, sub-optimal system performance, potential regulatory violations, and additional manual labor.

Technological advancements were creating opportunities to improve the way Amprion developed new data exchanges. Introducing standardization and automating connections would improve usability and reduce the maintenance effort by avoiding customized, proprietary data links between the different systems. And while its existing asset information tools and network planning tools for the grid topology were highly effective, exchanges could now be made with more frequency based on the standard procedures described and defined by CIM.

Switching to a centralized CIM database help with problem solving and improve network modeling, analysis, and planning. It would also provide an electrical digital twin of the physical grid, where current and future state models and variations could be tested and optimized in a "single source of truth" before implementation.

The International Electrotechnical Commission (IEC) CIM open standard was Amprion's preference as it enables a common, neutral, and unbiased data model basis for all domains, including planning, operations, asset management, protection, GIS, and more.

Additionally, European TSOs such as Amprion must comply with European Network of Transmission System Operators for Electricity (ENTSO-E) regulations, including producing planning models in Europe's Common Grid Model Exchange Specification (CGMES), which is based on IEC CIM, and maintaining globally persistent and unique identifiers (rdf:IDs) in the models.

CIM database provides the core of the solution

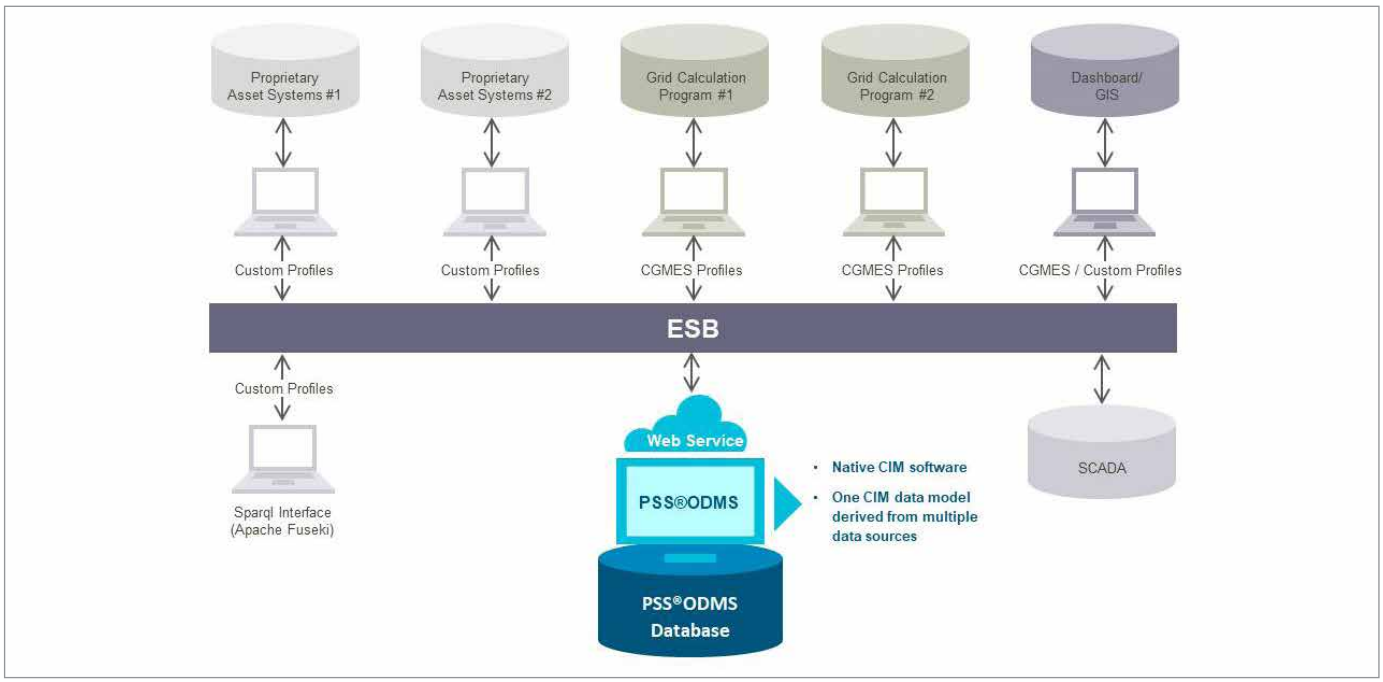
After exploring its options, Amprion chose the PSS®ODMS solution from trusted partner Siemens PTI for the new, centralized CIM database. PSS®ODMS, a CIM-based transmission network modeling and analysis tool, is the most used CIM platform within all the European TSOs for CIM data exchange. The PSS®ODMS data model is well aligned with the ENTSO-E CGMES standards, and nearly all the needed functions are delivered with the software out of the box, including incremental models, historical models, difference models, user profiles, and import validation.

Using PSS®ODMS as the shared CIM database enables:

- Scheduled data exchange
- Native CIM data storage
- Usage of custom profiles and queries
- Tailored data pre- / post-processing
- Version history, incremental handling, time-based modeling for planned projects
- Identification of assets via globally unique identifiers (rdf:IDs)

PSS®ODMS is not able to communicate with an ESB out of the box, so Amprion and Siemens PTI jointly developed and implemented a webservice layer for PSS®ODMS to support ESB communication.

CIM/XML was selected as the common exchange format due to its ENTSO-E CGMES compliance, and because compatibility of standard products used by TSOs and distribution system operators (DSOs) is increasing. All systems need to be able to import/export the standardized format with Amprion's own extensions. Amprion-specific information, which is not yet available in the CIM standard, can be added with extensions. Siemens PTI supported the implementation of the CIM standard.



Envisioned Common Information Model Data Flow

The information exchanged between the systems needed to be described, so the TSO developed custom CIM profiles by extending the CIM standard database and using those profiles to define which information is exported/imported from all the different systems. Finally, globally unique identifiers are assigned by Amprion centrally, and only once, ensuring ENTSO-E compliance.

Expectations are high for modeling optimization

The CIM database project was completed in December 2020. It is enabling Amprion to build one network model derived from different data sources, giving it access to consistent grid data in different systems to support purposes such as analytics and validation.

By describing basic rules for data exchange in a common format for all participants, CIM optimizes the efficiency of data input and validation. It is customizable as needed for additional data, supports future integration of additional domains without having to build custom interfaces, and simplifies integration of existing tools and linking data beyond domain borders.

"The use cases where data and data linking are required are continuously growing at Amprion. Before implementing CIM, a lot of manual work as well as know-how was necessary to do that kind of work," says Stephan Baack, engineer at Amprion GmbH.

Furthermore, leading systems can be identified to maintain information at the right location; globally unique identifiers enable lifecycle tracking of assets and electrical components; and having more efficient and consistent data supports better communication between Amprion and its customers. But the greatest impact of the CIM database project will be the internal process improvements for grid planning which in turn support supply security and cost control.

Planned based on a similar principle, Amprion's substations play a key role in transmitting power to approximately twenty-nine million people in Germany.

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