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Understanding Utility Network Model Management

Energy Changemakers Content Services prepared this paper in partnership with Siemens to help educate the utility industry about network model management (NMM). Also see the accompanying video: <u>What is Network Model Management?</u>



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Part I

Is Siloed Electric Grid Model Management Hurting Your Utility's Bottom Line?

How Network Model Management Centralizes Data Truth for Utilities

Grid reliability, operational efficiency and regulatory compliance are at the top of every electric utility's priority list. Aligning every planning and operations silo across the organization to achieve those goals, however, is a daunting task.

For example, utility electric grid data is critical for improving reliability, efficiency, and regulatory outcomes. Yet, individual utility groups often focus on slivers of electrical system data to develop the data-based electrical models they need, iterating them over time until each group ends up with purpose-built electrical models that are different and not necessarily aligned. The silos have no one source of data truth. Data fidelity, version control, and the ability to track changes and reproduce planning scenario results all suffer.

Network model management (NMM) systems can solve the challenge by creating transmission and distribution electrical grid models that provide a centralized, up-todate source of data truth for the specialized applications each utility team needs to perform its work. By helping break down the traditionally siloed approach to utility planning, protection, operations and other functions, an effective NMM system helps deliver improvements to grid reliability, efficiency and operational cost savings.

The problem with utility departmental silos

With a siloed approach to manage and exchange electric grid model data across the entire utility stakeholder landscape, several problems emerge for utilities:

- Planning, operations and protection departments manually maintain their own models of the same physical grid, tracking and implementing changes separately. There is no single source of truth for network model data.
- When model data needs to be synchronized, such as when a regulator asks for a change to a study or analysis in a filing, teams must undertake inefficient and error-prone processes to do it.
- Fragmented data held in separate systems limits opportunities for network optimization and adopting advanced technologies that advance near-term and long-term strategies.
- Proprietary and homegrown databases and data links lead to higher costs when introducing new data sources.

The siloed approach feels natural to planning, operations and protection teams because they only need to focus on certain aspects of grid data and the network model to complete their core tasks. However, the unintended consequence is data and network model fragmentation, which slows down the utility and limits its ability to harness data to accomplish its top priorities.



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Unifying the approach to network model management

Utilities often have dozens of planners spread across multiple teams. They need an approach that allows all planners to access the different parts of the model they need without their work leading to fragmented models. They need a unified approach — managed by a system that tracks changes, updates the data centrally and keeps everyone across the enterprise in sync.

When utilities replace the old, siloed approach to network model management with a unified approach using an NMM system, they provide teams with the tools that suit their unique needs while keeping model data centralized and up to date for everyone.

Master data is created once and used many times — taking advantage of the International Electrotechnical Commission's Common Information Model (CIM) interoperability standards. The NMM system provides a central place to manage electrical data from multiple sources used in multiple applications. When new data is received—for example, from substations or line engineers—the NMM stores and manages it. The NMM system then centrally updates network models and cases, ensuring utility teams conduct network analysis applications with accurate and up-todate electrical data. This improved workflow reduces the effort required to maintain models, improves the quality of analysis and provides a seamless infrastructure to support application needs for simulation. From that unified approach with centralized data management, many benefits emerge:

- Improved coordination across departments
- Interoperability with CIM standards
- Enhanced data quality and validation
- Improved grid and operations planning
- Reduced manual efforts
- Real-time system operation support
- Cost savings
- Future-proofed systems

Vermont Electric Power Co.'s Vermont Exchange (VX) Platform initiative

Like many utilities, Vermont Electric Co. (VELCO) faces a wave of retirements, threatening the loss of important knowledge. On top of workforce changes, VELCO's grid suffered a reliability event attributable to planning that didn't match what was actually happening on its electric grid. VELCO knew it was time to replace informal knowledge transfer, eliminate duplicative efforts and improve reliability.

VELCO chose to unify its approach with NMM. The utility selected partners, including Siemens, to deploy the Vermont Exchange (VX) Platform NMM solution. Through the platform, VELCO seeks to improve three processes:

- Modeling the transmission grid network
- Providing clearer boundaries and more value around transmission and distribution grid network modeling for the utility's members
- Interacting with the New England ISO (ISO-NE) and coordinating VELCO models with ISO-NE models

In the project's first year, VELCO implemented transmission model management using the Siemens NMM solution. In 2025, planners will be able to more efficiently and effectively share new transmission upgrades across departments, providing teams with a common way to understand and schedule projects.

VELCO is also integrating data and systems from teams including protections and controls, operations, ratings, and distribution. The integration means VELCO is eliminating the pain point of siloed, divergent data and models and the significant risk of grid events due to data disconnects among teams. On the ISO front, VELCO now has a more streamlined process to send accurate and up-to-date versions of its network models to ISO-NE and integrate feedback and modeling data ISO-NE sends in return.

Vermont Exchange (VX) Platform



The second phase of NMM deployment will launch in 2025 and continue through 2028, resulting in an enterprise-wide service hub.

The Vermont Exchange (VX) Platform has already created context, traceability, and integrity into a single source of data truth, which is supported by more efficient workflows for VELCO teams. As the initiative advances, it will give VELCO the integrated solution to truly optimize system planning.

Avoid the consequences of utility planning and modeling silos

As VELCO discovered, a siloed approach to network model management can negatively impact grid reliability, creating a risk of backlash from customers and regulators. Many utilities have faced steep fines from federal regulators for grid events that stemmed from poor network model management.

A unified approach using an advanced NMM system breaks down the silos. It provides a centralized, up-to-date single source of electrical data truth with flexible tools that serve various planning, operations and protection team needs.

With its <u>Gridscale X</u> Network Model Manager solution, Siemens partners with utilities to break down the old boundaries of grid planning, development and operation.

Part II

How Better Utility Grid Model Management Improves Reliability, Saves Costs and Prevents Harmful Run-ins with Regulators

An increasingly complex set of rules governs utility electric grids, and the financial consequences of failing to comply are rising. Utilities also face a business imperative to maximize grid reliability and operate cost-effectively.

Increasingly, utilities are finding the sweet spot to manage those priorities through better data - and better tools to manage the data.

Network model management (NMM) is a system of creating centralized master network models for transmission and distribution electrical grids. Through better data fidelity and more accurate models, an NMM system can improve:

- Regulatory compliance
- Protective relay settings and coordination between assets
- Grid planning
- Grid operations

However, without advanced grid modeling solutions such as NMM, utilities face the opposite problems. Fines due to failing to comply with grid regulations. Less efficient and effective planning and operations, which drive up costs. Avoidable grid events that negatively impact reliability and resilience, potentially drawing the ire of customers and regulators.

Complying with the complex web of grid regulations

Transmission grids are regulated by the Federal Energy Regulatory Commission (FERC) and must meet standards set by the North American Electric Reliability Corporation (NERC), making compliance a critical priority for utilities. Grid management models impact reliability and fall under NERC and FERC rules. A slew of new rules has made it more necessary than ever for tools like NMM, which enable the data fidelity required for compliance.

Key rules and network model-related requirements

• FERC Order No. 2003 includes provisions for the management of network models to ensure reliable interconnection of new generation facilities.

- FERC Order No. 2222 requires managing network models to integrate DERs effectively.
- FERC Order No. 845 requires more transparent and timely updates to network models.
- FERC Order No. 2023 amplifies the need for managing grid models by requiring improvements in the interconnection process for large and small generators.
- FERC Orders No. 1000 and 1920 require utilities to use accurate and up-to-date network models for regional transmission planning and cost allocation studies.
- NERC MOD-032-1 requires the collection and sharing of data necessary to develop planning models for reliable operation and planning of the bulk electric system.
- NERC MOD-033-1 ensures models used in reliability assessments are validated and accurate, requiring periodic reviews and updates.

These rules create more pressure for utilities to develop and maintain more accurate grid models that can reproduce results or track changes seamlessly. Yet, the current reality for utilities not using NMM is that when FERC or NERC asks for a change in planning or assumptions months or years after the utility submits a filing, they cannot reproduce the modeled results with the requested changes. It's inefficient and costly, at best, and at worst, can result in compliance failures.

Compliance failures have real financial consequences. In 2018, Duke Energy was fined \$10 million for failing to maintain accurate network models, which produced incorrect load forecasts and contributed to a major blackout. In 2019, Entergy was fined \$2.5 million for violations related to inaccurate network models that contributed to a significant reliability event. In 2020, PG&E faced fines and intense scrutiny when inaccurate models were found to have contributed to widespread power outages during wildfire prevention efforts.

Changing grid rules can only be managed with higher-fidelity grid models shared across each utility's application environments. NMM provides this form of modeling using a centralized system, enabling more powerful analytics and more accurate scenario planning. NMM becomes the one true source of accurate data from which utility teams can use individualized tools to comply with regulations and standards.

Centrally managed data means better planning and efficiency

Ensuring accurate data behind network models, tracking changes and recreating model results are essential to run high-quality scenario planning for peak load conditions, DER integration, grid reliability, and more.

On the transmission side, most utilities have an accurate transmission electrical network model. However, it's a different story when it comes to meaning the model, which negatively impacts planning and efficiency. Different utility groups have different needs for the transmission network model, resulting in different versions built on similar data but diverge as teams optimize what they're being used for. When a state public utility commission asks a utility to update a filing that required the input of multiple utility teams — as is often the case with rate filings or integrated resource plan filings — it is difficult for the utility even to know which model they used if they aren't managing their data with a centralized NMM solution. Inadequate version control means they can't reproduce the results, and it then becomes costly and time-consuming to make the requested changes.

On the distribution grid side, accurate network electrical models are rare. Yet utilities increasingly need data fidelity to conduct more extensive studies for such purposes as understanding how more DERs will impact the distribution grid and associated impacts to the transmission system and generation needs.

If different utility groups from the protections team to the asset management team to the distribution operation center are all using different versions of a bad electrical model, the utility can face more questions than it has answers. These questions include things as simple as not knowing where solar systems, EVs and battery systems are located on the grid.

Utilities need a way to aggregate their data to build a quality distribution electrical network model, and NMM is an essential tool for this. Once a solid distribution electrical network model is in place, utilities can do more technical evaluations, plan further to the grid's edge and run the grid closer to the edge.

Looking at the bigger picture, accurate and up-to-date network models help utilities synchronize transmission models with relevant ISOs and do real integrated transmission and distribution planning.

The power of integration

Regulatory compliance, grid reliability, and efficient and cost-effective operations are core motivators for every electric utility. Their success or failure often boils down to the quality of the tools they use to achieve them.

In today's data-driven business environment, data fidelity and integration are foundational. NMM solutions are an integral piece of the applications puzzle to help utilities:

- Improve the accuracy and speed of data exchange, integrating data from utilities' GIS, SCADA and AMI systems
- Provide model validation and quality control
- Deliver advanced analytics for efforts such as load balancing or asset optimization
- Ensure modeling tools used by different teams stay in sync with centralized data and a master network model

From those improved capabilities come improved grid and operations planning, reduced manual efforts and errors, improved coordination across departments, realtime system operation support, cost savings and future-proofed systems. Perhaps most importantly, NMM systems help utilities comply with increasingly complex grid rules, thereby avoiding costly fines and reputational damage with regulators and customers.

With its Gridscale X Network Model Manager solution, Siemens partners with utilities to break down the old boundaries of grid planning, development and operation. Learn more about <u>Gridscale X</u>.

Siemens is an Energy Changemakers Ambassador Member.