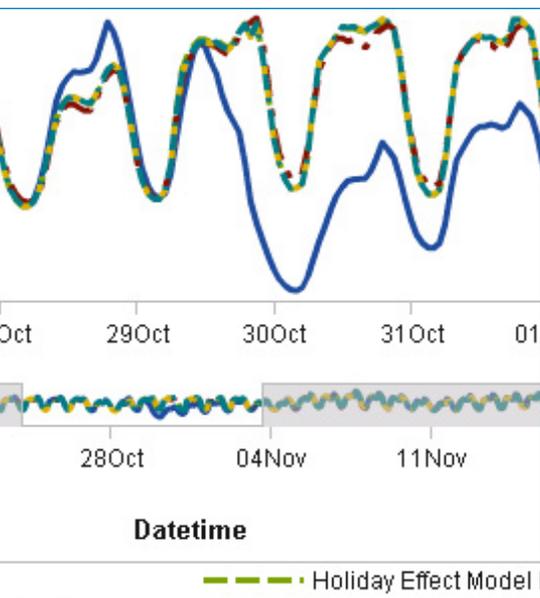


SAS® Energy Forecasting

Improve forecast performance, reduce uncertainties and generate value



In both highly competitive and regulated utility businesses, there's a clear link between the company's bottom line and forecast accuracy and reliability. But most legacy load forecasting solutions were not designed to handle the variability, complexity and volumes of data emerging in the utility landscape today. Disruptive technologies such as battery storage, rooftop solar, microgrids and electric vehicles are changing consumers' demand for electricity. While temperature remains a key driver of load, microeconomic trends are now a significant factor in many regional forecasts.

Traditional solutions lack the automation needed to permit appropriate model selection for each type of forecast required. However, forecasting errors result in costly suboptimal decisions. SAS Energy Forecasting allows utilities to own their forecasting process from beginning to end and use data-driven analytical insights for prudent financial decisions. From advanced data management through best-in-class analytics, forecasters can now handle the complex questions that arise from utilities' dynamic business models.

What does SAS® Energy Forecasting do?

SAS Energy Forecasting produces repeatable, scalable, traceable and defensible energy forecasts. Utilities can respond quickly and confidently to forecasts and can improve forecasting performance for planning horizons that range from very short-term to very long-term.

Why is SAS® Energy Forecasting important?

Customers are changing the way they consume electricity. From rooftop solar prosumers to EV chargers, volatility in hourly electric load is affecting traditional forecast accuracy. Improved forecasting generates tangible value in areas such as planning, operations, energy trading, contract power purchases and demand-side management.

For whom is SAS® Energy Forecasting designed?

The solution is designed for forecasters, analysts and planners at electric utility companies of all sizes.

Key Benefits

- Make better predictions about energy demand by building accurate predictive models based on more data from more sources, including smart meters and other IoT-connected devices. Automatically track model accuracy and easily update the model to reflect changes.
- Get hourly forecasting for all time horizons in a single, comprehensive solution that lets you use existing planning resources and helps everyone work more effectively. By using common forecasting methodology and data integration processes across forecasting horizons, utilities can eliminate the need to train forecasters on multiple software tools.
- Reduce total cost of ownership with self-service BI. Deliver information in the format business users expect, all within a governed, shared BI platform.
- Quickly evaluate more scenarios. Combined economic and weather range scenarios provided by SAS let you evaluate more scenarios faster and with fewer resources. With various scenarios in hand, forecasters can create multiple medium-term and long-term models based on anticipated outcomes and adjust the models with ease.
- Get time-sensitive insights. With automatic re-forecasting based on data updates, your teams can make decisions that mitigate risks, surface new business opportunities and ultimately create a competitive advantage.
- Scale to the scope required for your business today and tomorrow. Forecast a few geographic zones or use automated features to forecast hundreds of thousands of time series to represent customers and distribution system loading.
- Reconcile forecasts across geographic zones and customer or rate groups without affecting model accuracy. Bring new flexibility into your forecasting and planning process.

Overview

SAS Energy Forecasting improves results by providing trustworthy, repeatable and defensible energy forecasts for short-term (an hour ahead) to long-term (50 years ahead) planning horizons. It helps utilities operate more efficiently and effectively at all levels of decision making, while providing a broad degree of automation, scalability, statistical sophistication and transparency.

Forecasting for all time horizons

Without requiring multiple tools, SAS Energy Forecasting gives you an approach to each forecasting situation that arises. It encompasses hourly forecasting for all time horizons, based on trusted data and advanced forecasting algorithms. SAS also provides hierarchical forecasting for big data, including smart meter data. If your organization has relied on third parties

or untrainable models, SAS allows for more sophisticated model creation – so models are selected on their likelihood to produce good forecasts of the future, not just on how well they fit the past.

Integrated data management

Data used for forecasting often has erroneous or missing values and does not reside in one location. SAS helps forecasters manage data integration projects on an enterprise scale in a timely, cost-effective manner while meeting the high data expectations of information consumers. Data governance and data quality capabilities ensure that the data is trustworthy and that its lineage is transparent and auditable. Forecasters can reduce the manual efforts of data collection and transformation, focusing instead on high-value analytical activities.

High-performance load forecasting

SAS Energy Forecasting enables utilities to maximize value from existing planning resources and improve forecast performance by operating with greater efficiency. Because the solution is built on a big data analytics platform, forecasters are not constrained by the size of the data or forecasting objectives. As a result, forecasters and planners can continue to play a role in business decisions at all levels of the organization, using new insights to contribute to a return on smart grid investments.

A common visual interface for analysts and executives

With SAS Energy Forecasting, business managers have a visual interface for viewing forecast results – powered by, yet separate from, the forecast workbench. Forecasters can launch SAS Energy Forecasting from SAS Home, then business users can explore the output. Components of SAS Visual Analytics included with SAS Energy Forecasting provide drag-and-drop and auto-charting capabilities, so no coding is required. Plus, you can share your reporting results via the web and mobile devices.

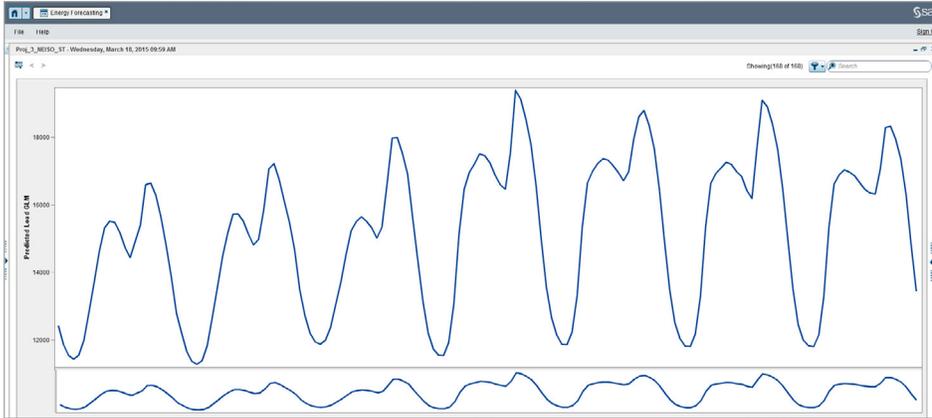


Figure 1. Automatically forecast load for the next seven-day period, based on advanced model testing and selection.

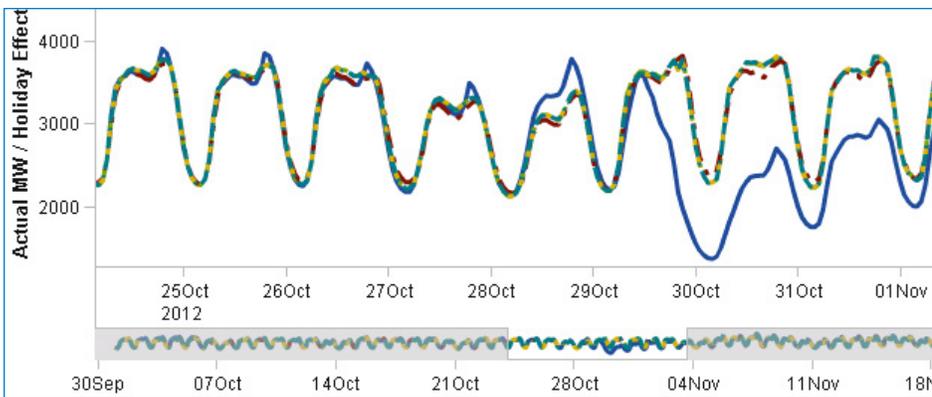


Figure 2. Identify and estimate the impacts of extraordinary weather events such as hurricanes and snowstorms.

Figure 3. In addition to supporting automated forecasting, the graphical user interface provides selections that can be modified for scenario analysis and model development.

Combined economic and weather scenarios

SAS Energy Forecasting provides automatic, combined economic and weather scenarios for better long-term energy forecasting. Scenario analysis lets forecasters evaluate exceptions to prior load history and plan for future events. Forecasters can investigate alternate scenarios using prepackaged economic forecasts to run what-if analyses. And they can simulate and test forecast rigor as a way to select long-term models that meet criteria for planning and operations.

Capabilities beyond the traditional forecast

Based on years of forecasting software development, SAS knows that today's utility analyst is under more pressure than ever. That's why SAS Energy Forecasting lets analysts explore complex forecasting issues by including additional solutions such as SAS Forecast Server, SAS Forecast Studio and SAS® Enterprise Miner™ software. This allows data scientists to create specific forecasting models for a wider range of behaviors by using an extensible model repository, including decision trees and neural networks. Forecasters can also interact with additional data sets to answer questions from the meter to the system level, even understanding maximum load under certain conditions.

Surface key insights and share across the organization

SAS helps utility load forecasters collect, explore, analyze and interpret all types of data, without limitations. With SAS software's unique depth and breadth of analytics, you can test alternatives, build models and measure results, for better efficiency and accuracy. Then you can share results across all levels of the business.

Key Features

Energy forecasting

- Multiple regression models form the foundation for load forecasting, where additional variables and combinations are tested sequentially for model improvement; models are tested at each iteration to prevent over-fitting.
- Second-stage models are developed using UCM, ARIMAX, exponential smoothing and neural nets.
- Users can choose the level of automation for the forecasting process. (Default is fully automated, hands-off forecast generation.)
- Users can set automatic selection criteria in the model.
- Custom models can be built within the software, from data in any structure or frequency.
- Existing externally developed models can be imported to use in the software, automating parameter estimation.
- Users can choose to re-estimate any model at any time, as often as needed.
- Model results and statistics are available at each step of the process.
- Outlier files are automatically generated and can be reviewed and visualized with a GUI.

User-driven hierarchical forecasting

- Includes a graphical user interface for energy forecasting – from model development through testing and publication.
- Lets you organize projects by time horizon, execution date or member companies.
- Employs a common hour-by-hour forecasting methodology across all time horizons that allows users to look at errors and outliers.
- Common search, drill-down and filter options across all time horizons.
- Define multiple hierarchies based on different groupings and reconcile the resulting forecasts for a consistent view.

Data management

- Access data and store results regardless of format.
- Easy-to-use, point-and-click GUI has an intuitive set of configurable windows for managing data integration development processes. Drag-and-drop functionality eliminates programming.
- Dedicated GUI for profiling data quality, to identify and repair source system issues while retaining the business rules for use in other ETL processes.
- Support for unstructured and semistructured data to parse and process files.
- Access to static and streaming data for sending and receiving via web services.
- Metadata is captured and documented throughout transformations and data integration processes, and is available for immediate reuse.
- Capability to determine the path, processes and transformations taken to produce the resulting information.
- Data lineage (reverse impact analysis) is available – critical for both validating processes and building user confidence in data.

What-if analysis and scenario planning

- What-if planning capabilities using economic and weather scenarios provided by SAS.
- Ability to change model parameter estimates to determine effects on forecast scenarios.

One-stop shop for forecast process efficiency

SAS Energy Forecasting covers the entire forecasting process, from data integration and model development to forecasting and reporting. The solution integrates smoothly with a larger suite of analytics and business intelligence offerings from SAS. It prevents headaches that result from trying to patch together mismatched components – and provides you with a complete forecasting solution that encompasses data management, analysis, visualization and reporting. To learn more about SAS Energy Forecasting system requirements, download white papers, view screenshots and see other related material, please visit sas.com/energy-forecasting.

Key Features (continued)

SAS Visual Analytics Administration and Reporting*

- Design and distribute BI reports and dashboards through an interactive user interface, no programming required.
- Present data and results in the most insightful way through a broad array of visualization techniques.
- Enable viewing, interaction and collaboration via dynamic reports and dashboards through native mobile BI apps for Apple® iOS and Android devices.
- Native integration with ESRI mapping technology.
- Recipients can add consolidated comments to a report. Mobile users, Microsoft Office users and web users can all share and view comments in a central location. Comments stay with the reports so that everyone can see them.
- Data can be interactively prepared for analysis – this includes including joining tables, defining custom calculated columns and creating custom expressions.

* A subset of SAS Visual Analytics capabilities, specifically for designing and sharing interactive dashboards and reports with stakeholders.

Integration with SAP HANA

- Select data from SAP HANA as an input data source for forecasting processes.
- Export the results of forecast analyses to SAP HANA for further reporting in HANA or other SAP applications.

Flexibility and scalability beyond the GUI

- Includes data mining, linear and logistic regression, decision trees and neural networks.
- Re-diagnose and identify candidate models, re-estimate existing model parameters, or generate forecasts using existing models and parameters.
- More effective, statistics-based forecasting methods to use throughout the organization.
- Extensible model repository, including intermittent demand models, unobserved components models, ARIMAX models, dynamic regression, exponential smoothing models with optimized parameters, and user-defined models – enabling you to create more appropriate forecasting models for a wide range of behaviors.

To contact your local SAS office, please visit: sas.com/offices

