Integrated Electricity Demand and Price Forecasting
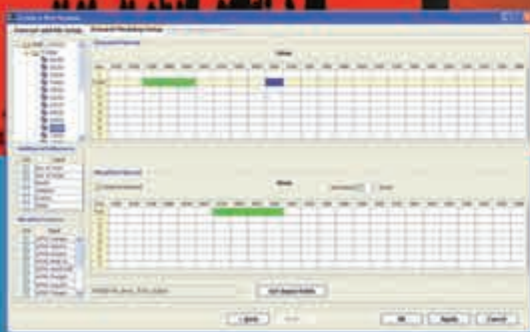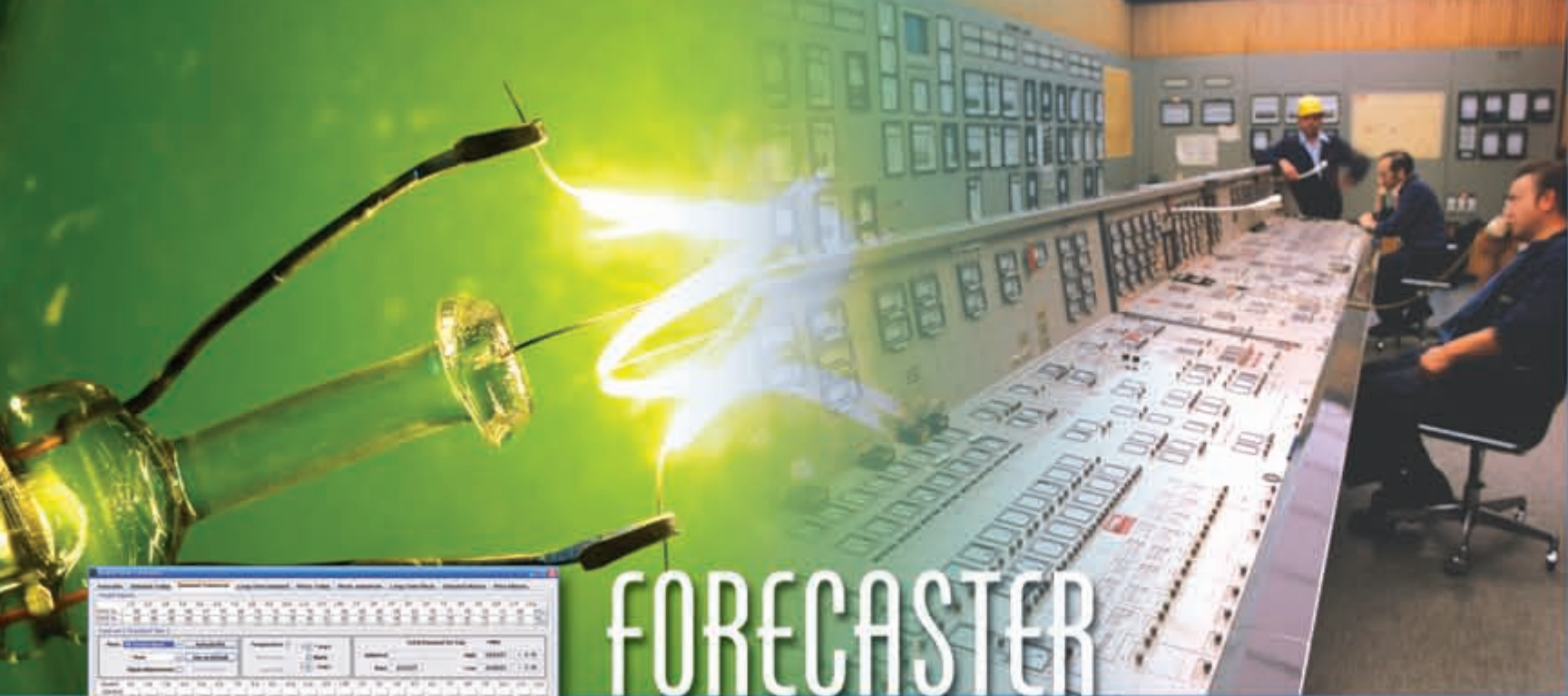
NEURALPOWER

MODELER

Create and Evaluate Forecasting Models

The many interrelated factors which influence demand for electricity cannot be directly modeled by closed-form mathematical formulas. However, historic weather, demand, and price data contain implicit relationships between independent input values – for example, weather conditions – and electricity use. Neural networks are particularly well-suited for finding meaningful patterns in such data, and Modeler is the framework for creating, evaluating, and deploying neural networks which learn the data patterns that underlie electricity demand and price forecasts.

Modeler can use virtually any quantity of historic data to train neural networks, and it includes built-in pre-processing to handle invalid or missing data. It supports building monthly, seasonal, and annual models, any of which can be used in operations or for long-term strategic planning. Modeler accepts historic daily input, such as the day-of-week, and historic hourly input from multiple sources and multiple types of data from each source, such as temperature, wind speed, and relative humidity. Lead times for hourly inputs are specified through a simple "point-and-click" grid interface.

After forecasting models in a *Schema* are trained, Modeler provides powerful analysis and visualization tools for evaluating model performance and the quality of forecasts. Models are easily ranked by standard metrics, and sensitivity analysis indicates which inputs are most influential for any particular model. The *Schema* which demonstrates the best performance (smallest error) across any given training dataset is deployed for use by Forecaster and Scheduler to generate ongoing daily demand and price forecasts.

FORECASTER

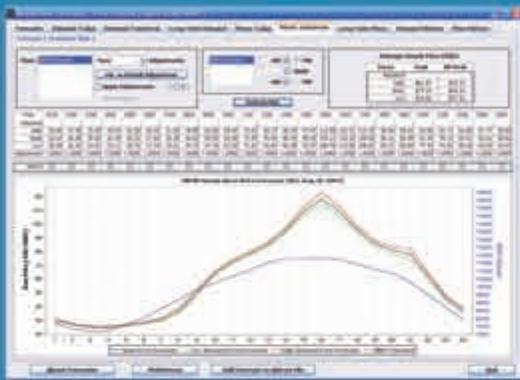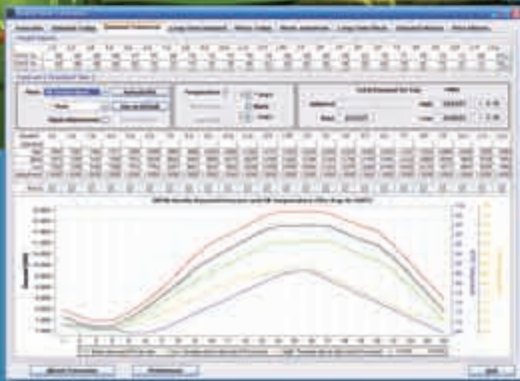## Generate and View NeuralPower Forecasts

Forecaster offers powerful visualization features for baseline demand and price forecasts as well as for "what if" forecasts generated from alternate model input conditions. Demand forecast output can be used directly as input for price forecasts to yield an integrated view of electricity market forces.

Forecast results are organized on *Today, Tomorrow, Long Term,* and *History* tabs. *Today, Tomorrow* and *Long Term* tabs provide forecast plots. *Today* and *Tomorrow* demand tabs include tables of hourly demand forecast values and the total demand forecast for the selected day. *Today* and *Tomorrow* price tabs include tables with average peak and off-peak prices. *History* tabs show how well forecasts have performed during the recent past.
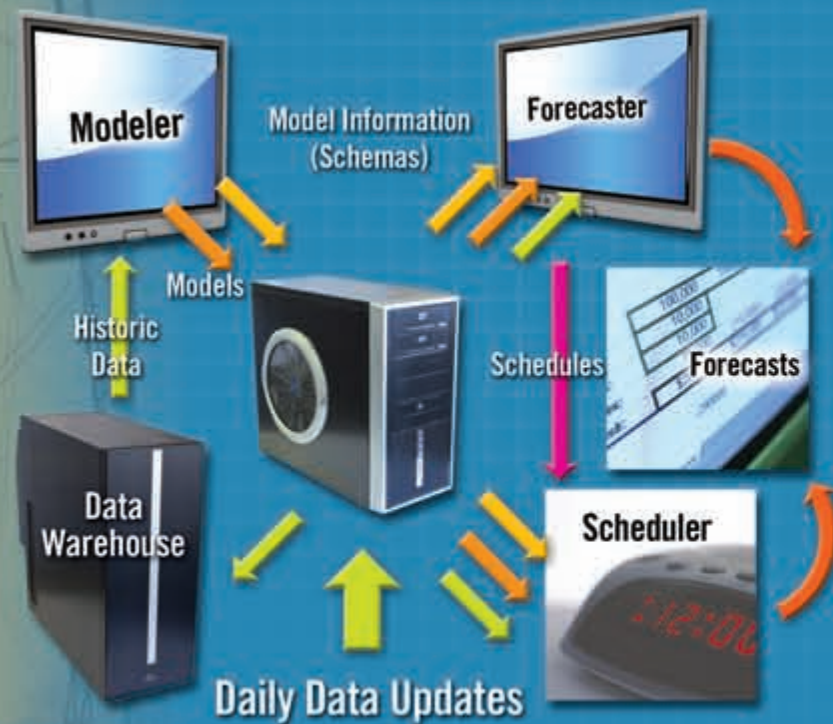
After baseline demand forecasts are generated, selected weather inputs can be modified to determine the impact on demand. After baseline price forecasts are generated, demand projections or temperature inputs can be modified to determine the impact on prices.

Demand and price forecasts can also be fine-tuned to account for unexpected influences that were not represented in training data. Correction factors for specific calendar dates account for the effects of holidays and special events on demand. Recent forecast performance history is used to compute hourly adjustments that are applied to both demand and price forecasts.

Today, Tomorrow, and *Long Term* demand and price forecast results can be saved in files for use by other enterprise software.
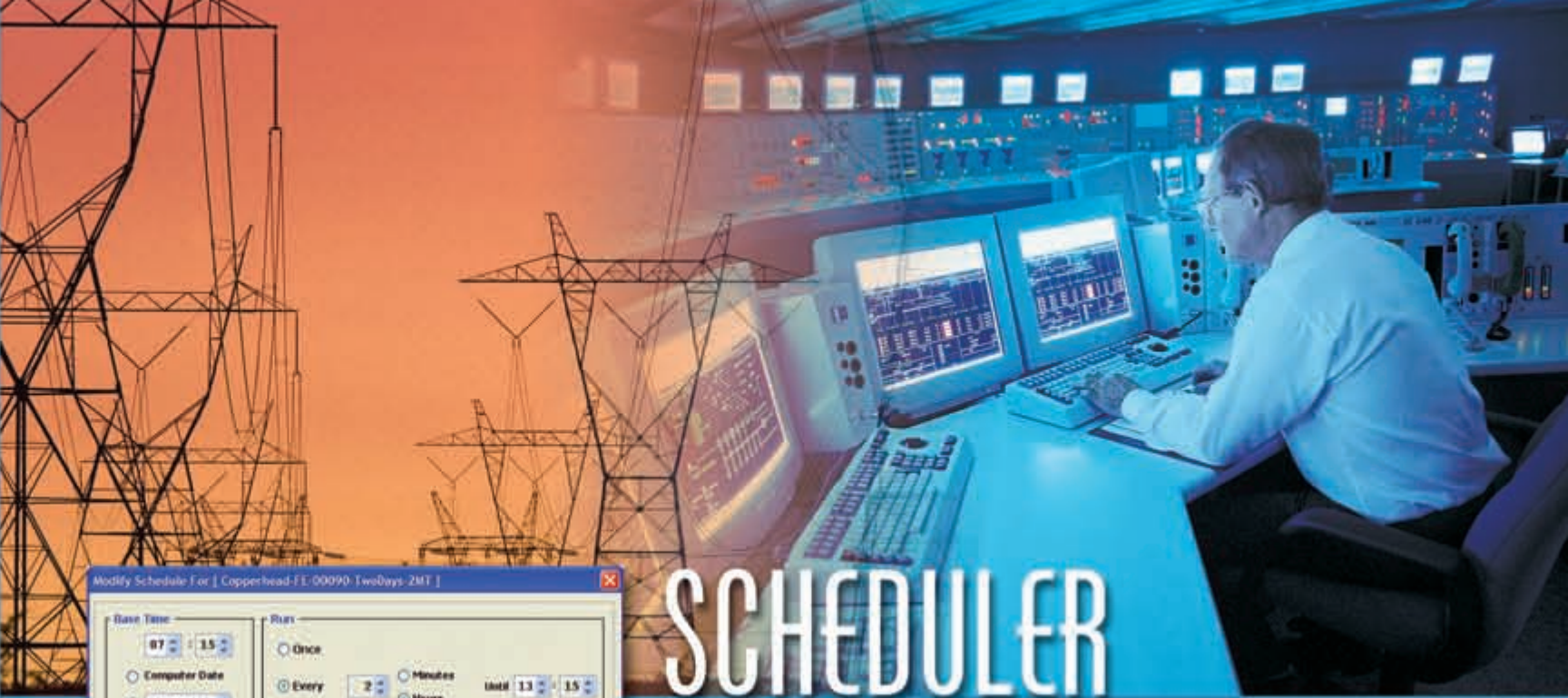
OVERVIEW

Introducing NeuralPower

In competitive electricity markets, accurate predictive modeling is essential for promoting efficient short-term operations and supporting long-term strategic planning. With expanding global deregulation and ongoing requirements for capital investment to ensure reliable electricity generation and delivery, accurate demand and price forecasts provide a critical foundation for key production, transmission, trading and distribution decisions. And while traditional modeling approaches cannot capture the many consumer, commercial, and environmental relationships that drive electricity use and present challenges for forecasting, NeuralPower® can.

NeuralPower is NeuralWare's fully-integrated electricity demand and price forecasting platform. It delivers extremely accurate forecasts that are easily tailored for service areas, rate classes, market segments, or other usage categories. NeuralPower is based on NeuralWare's time-tested and field-proven NeuralWorks Predict® engine – the world's most advanced neural network application development software.
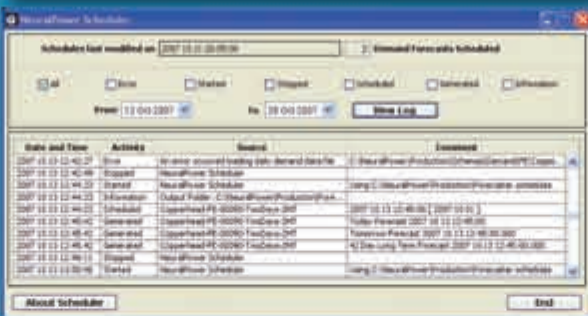
NeuralPower consists of three components – Modeler™, Forecaster™ and Scheduler™.

- **Modeler** is used to create, evaluate, and deploy collections of neural network models – called *Schemas* – that Forecaster and Scheduler run to produce electricity demand and price forecasts.
- **Forecaster** runs neural network models and provides visualization and reporting capabilities for plant operators, financial analysts, traders, and others who base decisions on demand and price forecasts.
- **Scheduler** also runs neural networks to produce demand and price forecasts. However, Scheduler automatically places forecast output in computer files that can be accessed directly by other software.

Through these components, NeuralPower harnesses highly advanced yet easy-to-use neural network technology to consistently deliver superior forecasting results.

SCHEDULER

Automatically Generate NeuralPower Forecasts

Scheduler is a small-footprint stand-alone program that executes forecast models based on user-defined daily schedules. Scheduler has no forecast display interface – output is placed in files for archiving or for use by other applications.

NeuralPower provides very flexible options for specifying when forecast models should run. They can run once daily, or multiple times in a day up to a particular time. Forecasts can be scheduled to run as frequently as every 5 minutes, or on an hourly basis.

Forecast files generated by Scheduler can be stored on a local computer or on a central file server. Scheduler maintains a comprehensive log file of all forecast-related activity that it performs. The log can be sorted by activity to view forecasts that are scheduled or error conditions in the event forecast models fail to execute successfully.

Scheduler forecast files are in a standard tab-delimited format that can be easily imported by other software. Scheduler also appends current day and next-day forecast output to specially-formatted files that Forecaster uses to produce forecast performance charts and to compute short-term forecast adjustments.

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