THE POWER TO KNOW.

SAS® Energy Forecasting 3.1: User's Guide

SAS® Documentation

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SAS® Energy Forecasting 3.1: User's Guide

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Contents

Part 1

SAS Energy Forecasting

Chapter 1

What is SAS Energy Forecasting?

Why Energy Forecasting?

SAS Energy Forecasting improves results by providing trustworthy, repeatable and defensible energy forecasts for planning horizons ranging from very short-term (e.g., an hour ahead) to very long-term (e.g., 50 years ahead). It is designed to meet the energy forecasting needs of the entire enterprise by providing accurate forecast for Energy Trading, Marketing, Risk Management, Operations, Fuels, System Planning, Finance and any other department that may have a need for an energy forecast. The following table summarizes the importance to utilities of energy forecasting.

Very Short Term	Short Term	Medium Term	Long Term
Owners: Asset Management System Operations	Owners: Asset Management System Operations	Owners: System planning	Owners: System planning
• Energy Trading • Unit Commitment • Economic Dispatch	• Asset Management • Unit Commitment • Economic Dispatch • Weekly supply plan	• Budgeting • Outage Planning • Fuel/Power Planning • Capital Rate Making • Revenue Estimation • Business Planning	• Long Term Financials/ Budgets • Integrated Resource Planning • Avoided Unit Rates • Long Term Outage Planning
Horizon: 1–24 hours	Horizon: 1–14 days	Horizon: 1–4 years	Horizon: 30–40 years
Cycle Time: Hourly	Cycle Time: Daily	Cycle Time: 1–3 months	Cycle Time: Annually

Very Short Term	Short Term	Medium Term	Long Term
Users: Energy trading Generation dispatch Fuel supply System operations	Users: Asset management Generation dispatch Fuel supply System operations	Users: All organizations	Users: System planning Finance Engineering Rates

The solution is built on SAS's experience in working with hundreds of utilities worldwide. It enables utilities to operate more efficiently and effectively at all levels of decision making, using their existing resources. The solution will run through a series of models and select the champion model based on quality parameters set by the user. Outliers, holidays and special events are modeled to improve accuracy over all horizons. The solution analyzes a wide range of data including load, weather, economic, calendar and location. The user can also define and use additional explanatory variables that they feel may have an impact on their specific forecast.

This energy forecasting system allows answering the following kinds of questions:

- What will be the forecasted load with the forecasted weather information for the next hour, day, week, month, or year(s)?
- What will be the forecasted load and demand for the next 12 calendar months to 50 years under certain combinations of weather and economic scenarios?
- What is the expected revenue for budget planning?
- When should outages be scheduled?
- How much power can be sold or how much needs to be purchased?
- How should we plan fuel contracts?

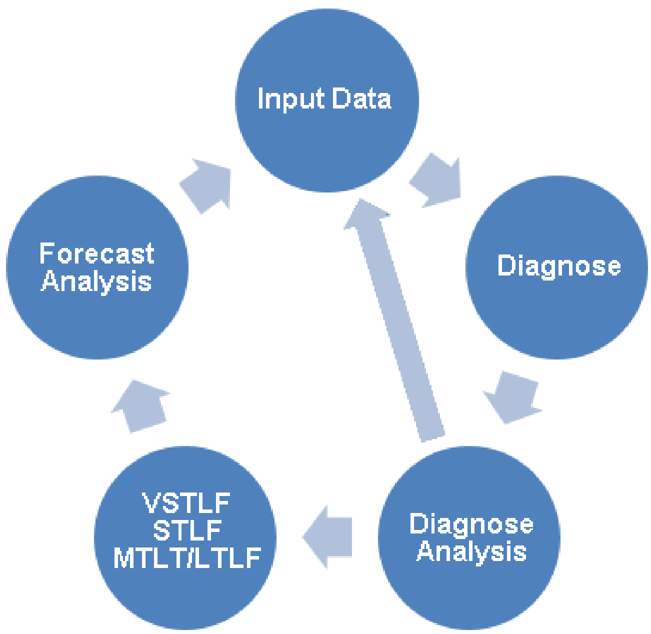
The Forecasting Process

The process starts with understanding the objectives, the key data elements and fields that need to be considered, as well as the time horizons that will be part of the forecasting process. It is also necessary to determine the various hierarchies that will be used (e.g., what metering points, their relationships, what weather stations, etc). This data is normally loaded into a data focused data mart and then transferred into the forecasting engine that will run a diagnose of hundreds of models and select the best fit based on the objectives and quality parameters (for example MAPE). The forecaster has the opportunity to view outliers in the forecast and view the specific data that may have driven the outliers so that adjustments can be made. An example of an outlier driven by an event could be a large sporting event such as the Super Bowl or the World Cup.

After outliers and events have been accounted for and a final diagnose is run, the solution will select the best fit model. This best fit model becomes the champion model. The forecaster then selects the type of forecast they wish to run. This could be very short term (measured in hours), short term (measured in days) medium term (measured in months/years) or long term (measured in years). The forecaster then selects parameters and runs the forecast with the champion model. The forecasted results are continuously assessed to determine the validity of the model. As the model performance begins to drift, the forecaster can re-run the diagnose to adjust parameters and re-set the champion model.

All of this is accomplished through a simple and easy user interface. Results are presented in graphical and tabular forms and can be shared based on roles of the user.

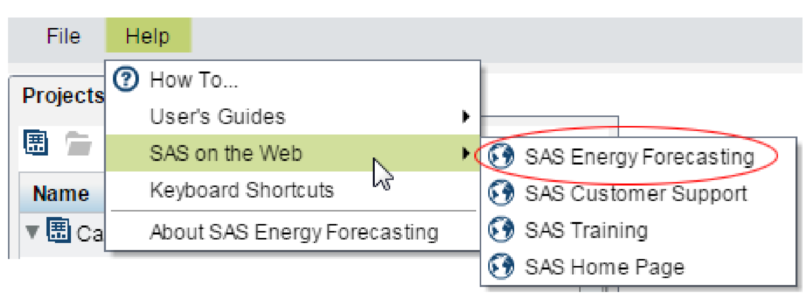
The following picture provides a very brief overview of the forecasting process.



A Note About This Book

You can access the SAS Energy Forecasting User's Guide in two ways:

1. If you select **Help** ⇨ **SAS on the Web** ⇨ **SAS Energy Forecasting** then you access a copy on the internet at support.sas.com and are ensured of seeing any corrections or additions made to the document after the product first shipped.



2. If you select **Help** ⇨ **User's Guides** ⇨ **SAS Energy Forecasting User's Guide (PDF)** then you access a copy that was installed on the mid-tier with the SAS Energy Forecasting product.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SAS on the Web
Keyboard Shortcuts
About SAS Energy Forecasting
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SAS Energy Forecasting User's Guide (PDF)

Chapter 2

The Complete Process in Brief

Overview

Creating and running a forecast involves the following steps:

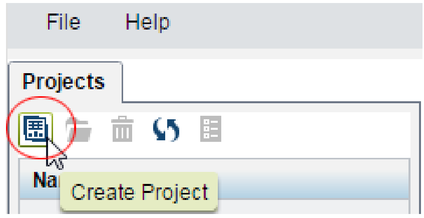
1. "Create a Project" (See page 7.)
2. "Create a Diagnose Definition" (See page 9.)
3. "Run the Diagnose" (See page 12.)
4. "Create a Forecast Definition" (See page 14.)
5. "Run the Forecast" (See page 17.)
6. "Schedule Forecasts" (See page 19.)

Create a Project

A project contains a set of diagnose definitions and forecast definitions. It also contains the results of running with those definitions. Before you can create a diagnose definition or a forecast, you must first create a project to hold them. You can create multiple projects.

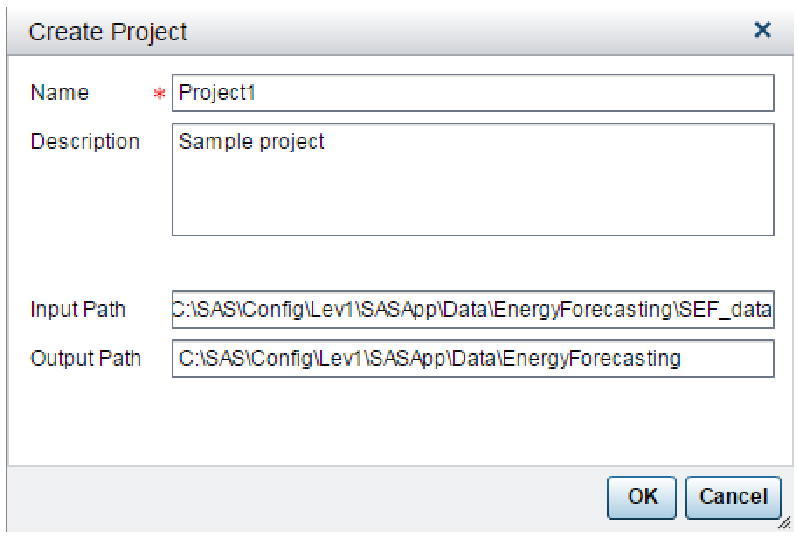
Do the following to create a project.

1. Click on the Create Project icon at the top left of the window.

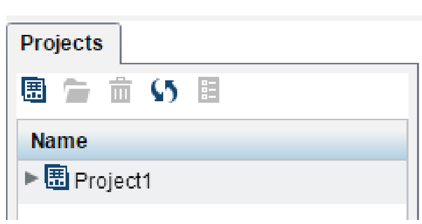


The Create Project window opens.

2. Give the project a name and description (name cannot have any spaces or special characters)



3. Enter the input path for the source data. This is the location of the data that will be used for the diagnosis and the forecast.
4. Enter the output path for the results data. This is the location where the results data will be published.
5. Click **OK**. The project is created and will show up in the UI. A project folder is also created in the output path for capturing the results data.

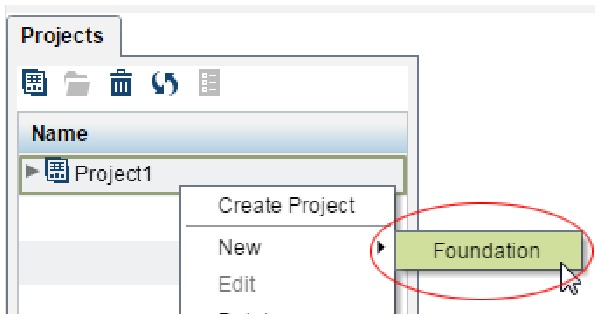


TIP Spend some time thinking about how you would like to structure your projects. Subsequent diagnosis's and forecasts will be presented in a structure below the project. The results for all forecast under this project will be in the same location. You should create a logical structure that works for their process.

Create a Diagnose Definition

The diagnose process runs through a set of models to select the best model to use for forecasting with the specific set of data and with the specific set of parameters. To create a diagnose definition:

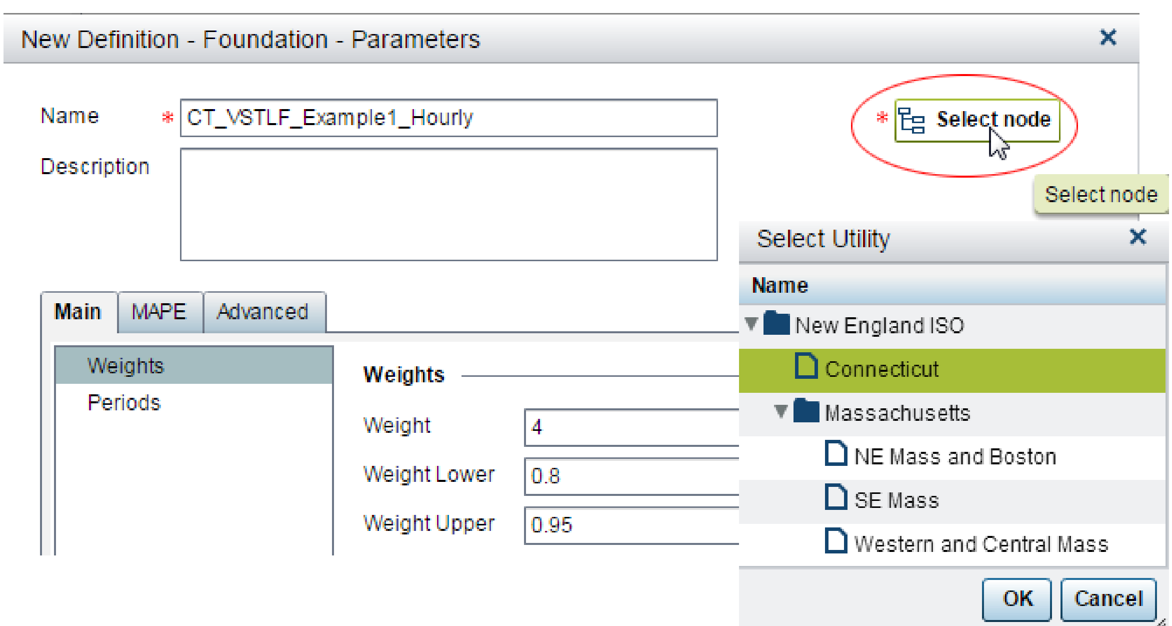
1. Right click on the project name and select **New** ⇨ **Foundation**.



The New Definition window opens.

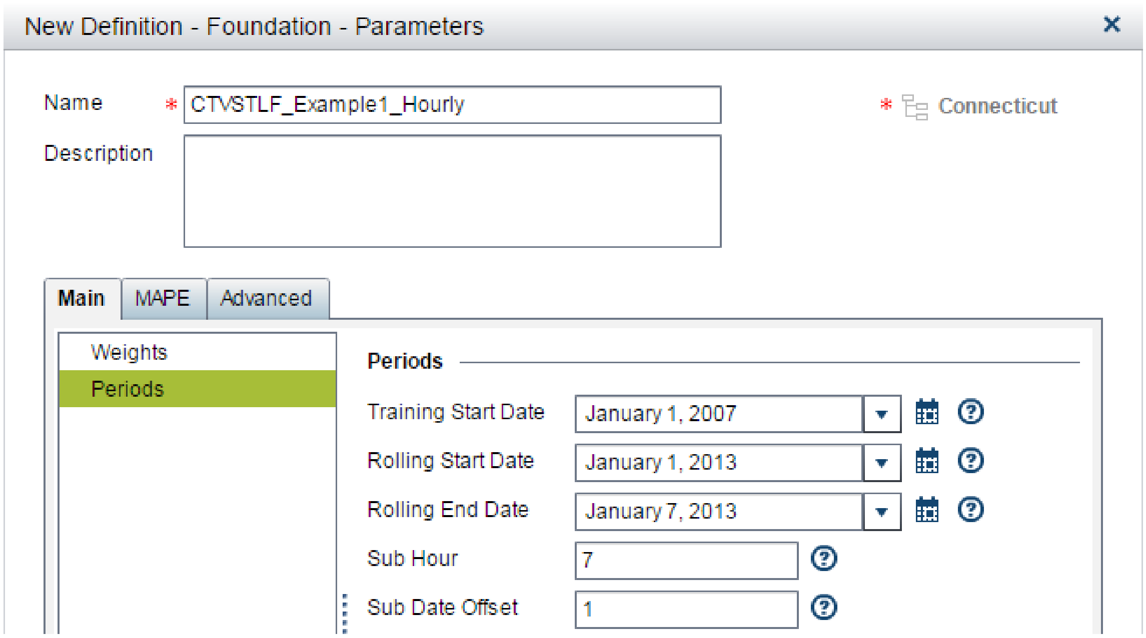
2. Give the diagnose definition a name and description

3. On the top right, click **Select node** and select the diagnosis/forecasting location from the hierarchy. In this example, we choose to analyze Connecticut.



4. The **Main** tab contains **Weights** and **Periods**. Weights are used to define the parameters for exponentially smoothing the temperature. **Weight** can be 1-4 and it represents the number of weights to use in calculating the exponential smoothing. **Weight Lower** and **Weight Upper** represent the lower and upper boundaries for the smoothing. In this example the defaults were selected.

5. Select **Periods** under the **Main** tab. Periods are used to set start dates for history, training and rolling start/end dates.

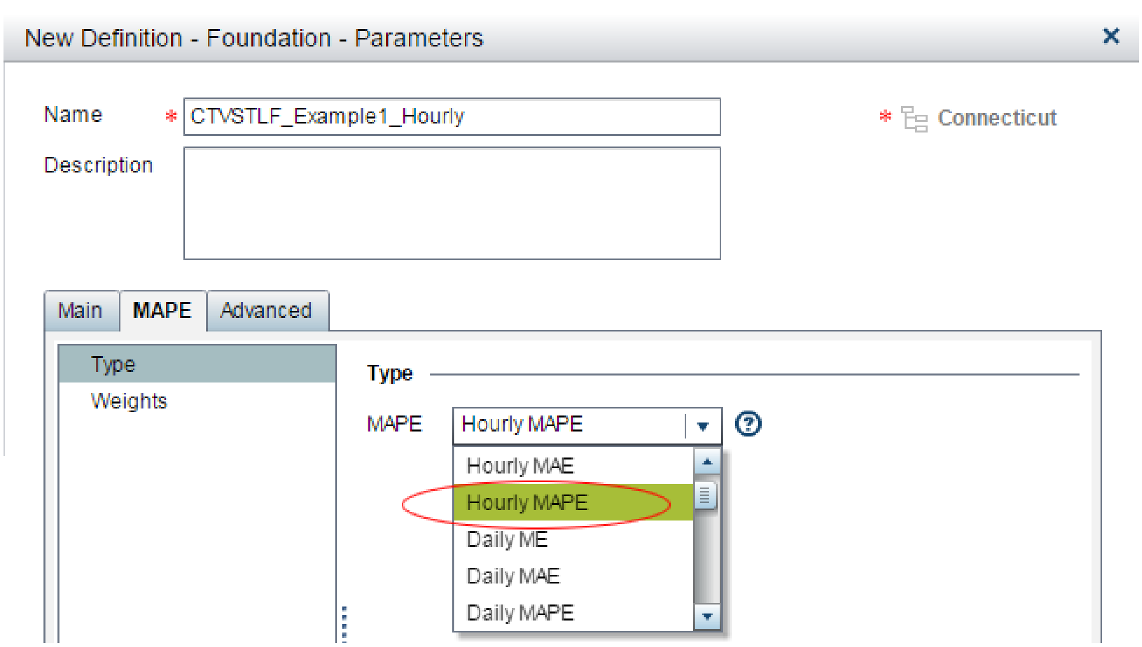


6. Select a **Training Start Date** that is representative of the amount of history that can best describe the time series within the data. The data is used to "train" the model—that is, to select the best model to use for forecasting.

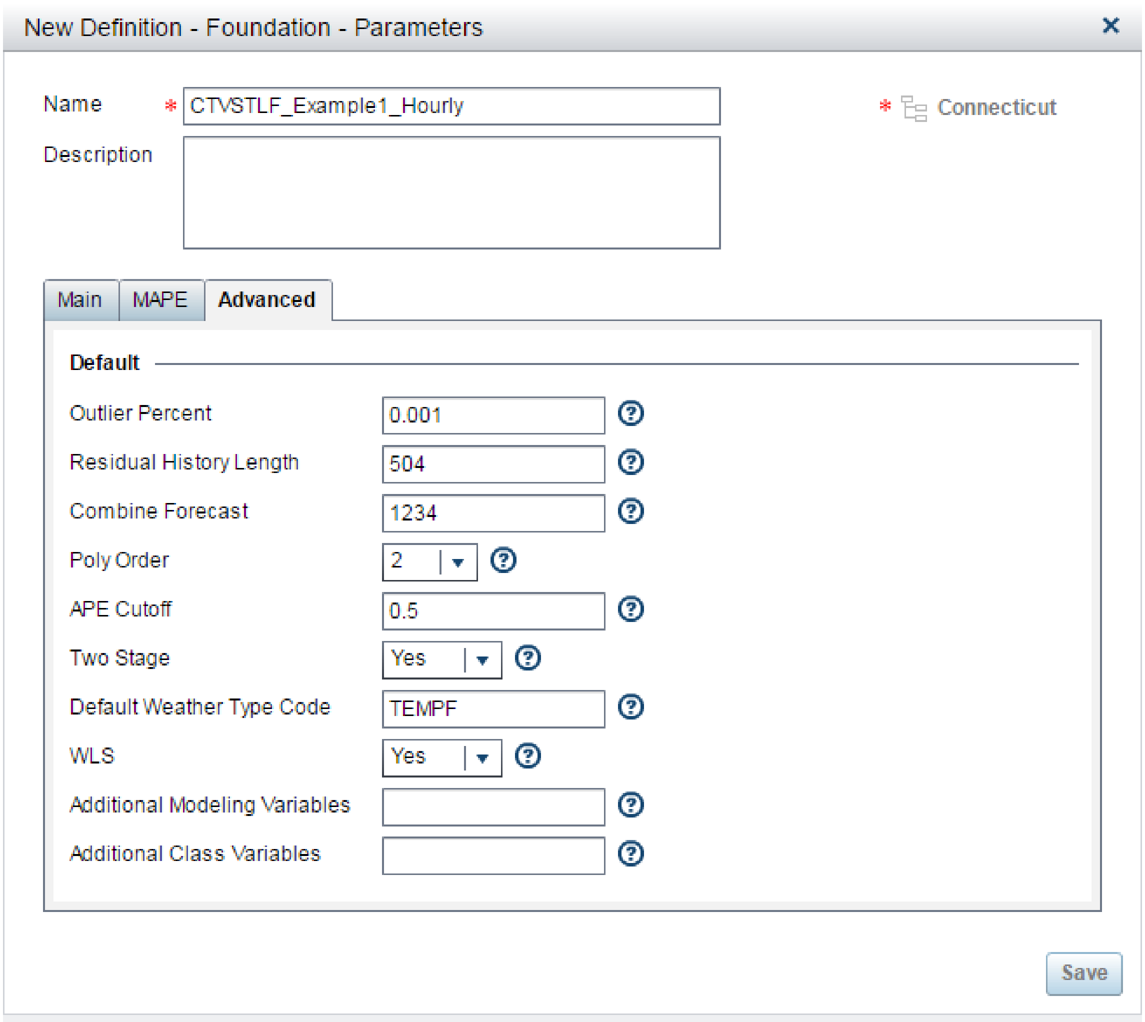
7. Select a **Rolling Start Date** and **Rolling End Date** for the rolling period (also known as the "holdout" period) that will be used to assess the statistics of the models. Data in this period is held out for purpose of validating the tentative forecast.

   The rolling period should be representative of the horizon of the forecast. In this case, the diagnosis is being defined for a very short term forecast. A mid to long term forecast may require a rolling period of 3 months to a year

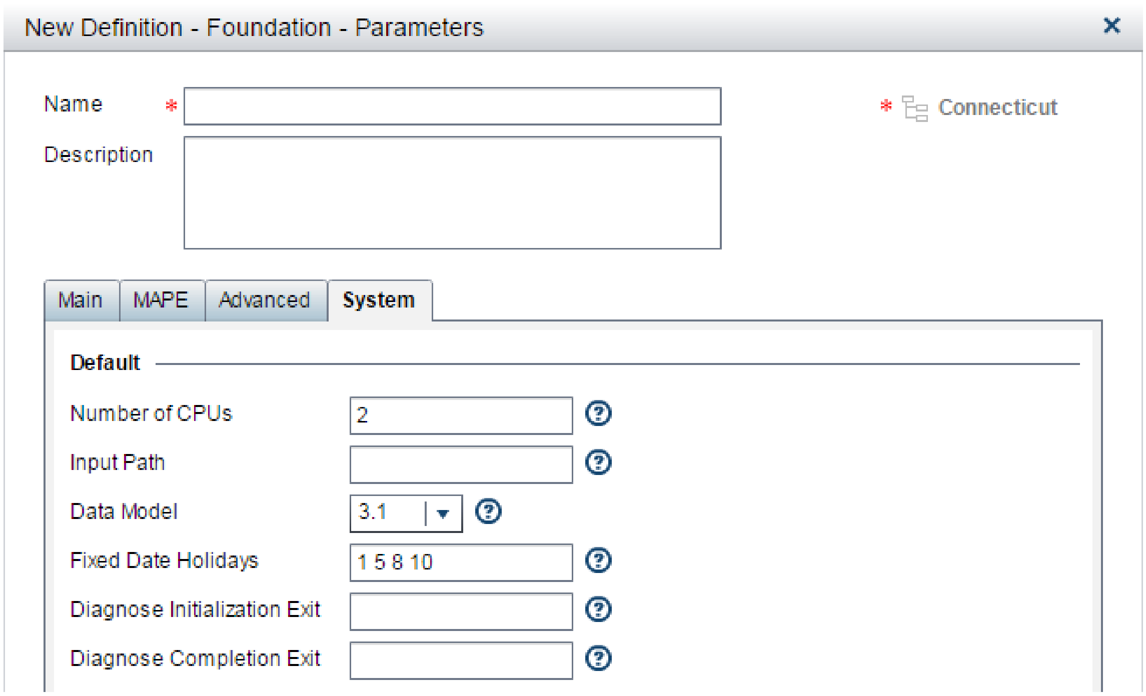
8. Select the **MAPE** tab. Here, you will select the type of quality measure that will be used to choose the champion model and if a weighted MAPE is chosen, you will assign weights to each quality measure they wish to use. The total of the weighted measures must sum to 1. In this example, Hourly MAPE was chosen.



9. Select the **Advanced** Tab. Here, you can choose to adjust advanced settings that are described later. See "Advanced Parameters" on page 176. For this example the defaults are selected. Take note of the **Outlier Percent** value. This is used to determine whether or not an individual measure should be considered an outlier or not. The top values within the outlier percentage are presented in the results for review.



10. The **System** tab is used to configure parameters within the system and to define "exits" that are user defined routines that can be run pre or post diagnose. For this example the defaults are selected.



Note: The System tab is not visible to all users. Whether it is visible or not depends on the **Show System Parameters** preference setting. See "Preferences" on page 165.

11. Select **Save** to save the diagnose definition.

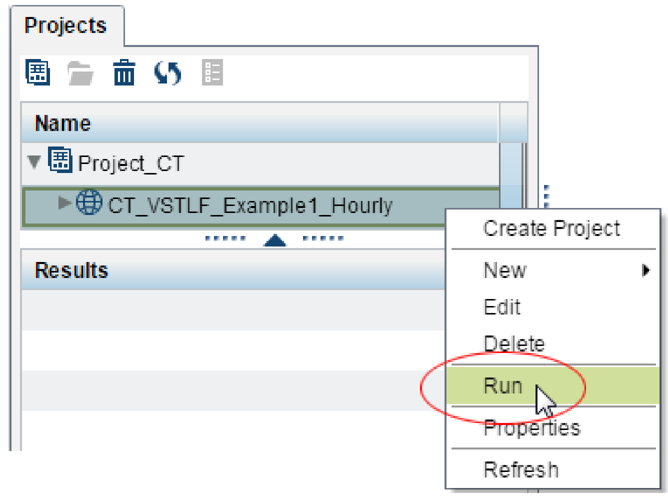
See Also

- Chapter 15, "Create a Foundation Diagnose," on page 135
- Chapter 19, "Parameters for a Foundation Diagnose," on page 170

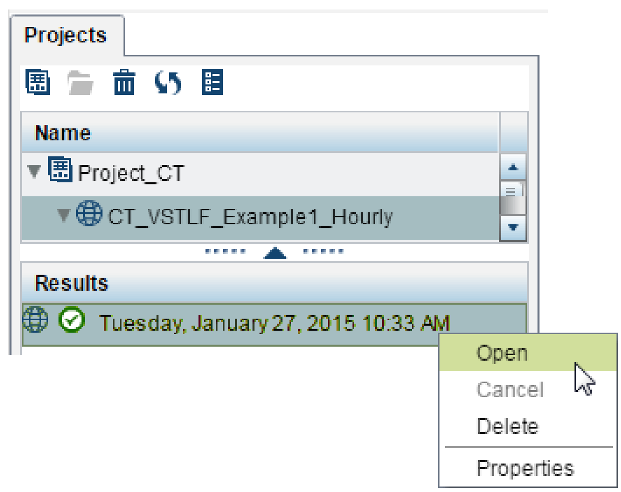
Run the Diagnose

The diagnose definition shows up in the left pane under the project.

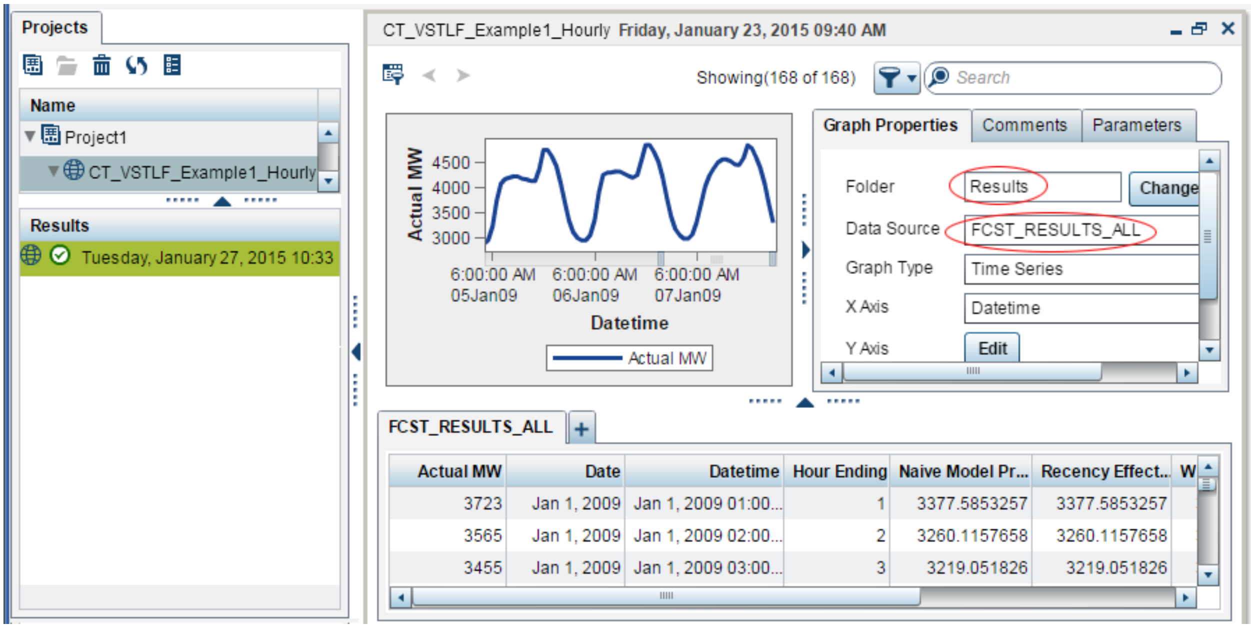
1. Select the diagnose name, right click and select **Run**. This initiates the diagnose for our selected location (Connecticut).



2. When the diagnose is complete, the diagnose run instance will show up with a completed check mark on in the bottom left pane when its diagnose definition is selected.



3. Right-click the completed diagnose and select **Open** (or drag it to the main workspace) and interactive results are presented. Notice that for **Data Source**, FCST_RESULTS_ALL is selected. This displays the results for all forecasts so that you can compare the individual results. Also notice that the **Results** folder is selected. You can also select the **Source** folder to see the input data. This is very useful when analyzing outliers because Outliers is one of the **Data Source** files that you can select to view.



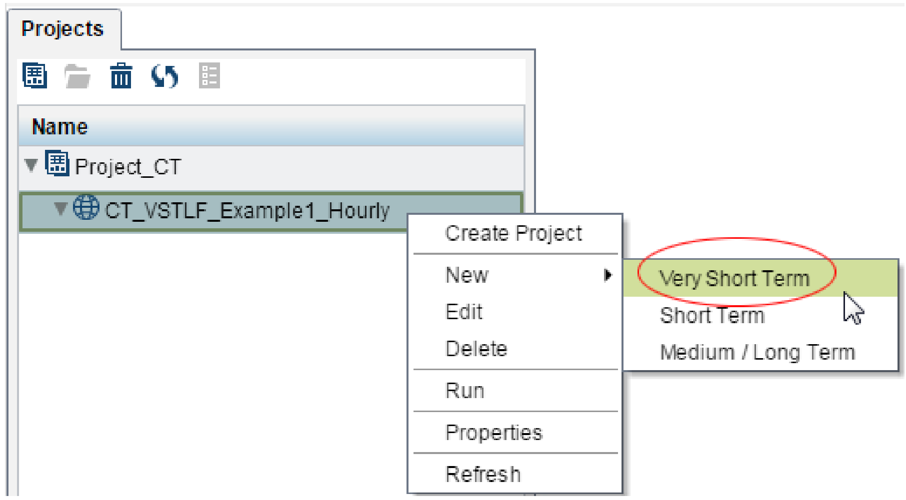
At this point, the diagnose is complete for Connecticut using a very short term setup. You can continue on to create the forecasts or analyze the diagnosis results and adjust the source data. You would then re-run diagnosis and analyze results until the modeling is acceptable.

See Also

- Chapter 20, "The Diagnose Process," on page 185
- Chapter 17, "View the Results," on page 151
- "Identify the Best Model" on page 137

Create a Forecast Definition

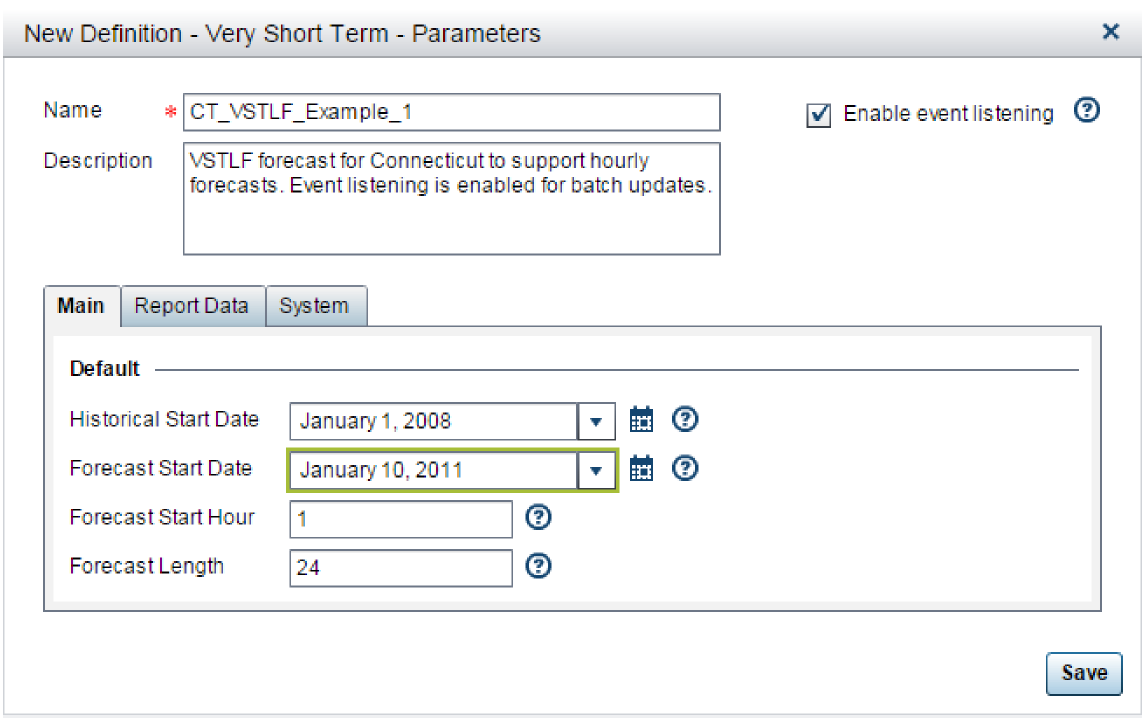
1. Right-click the diagnose definition and select the type of forecast definition to be created. In our example, we configured the diagnosis to support a very short term forecast, so select **Very Short Term**.



The New Definition window opens for you to configure the very short term forecast.

Note: The parameters that are available in the New Definition window vary with on the type of forecast—very short term, short term, medium term\long term.

2. Give the forecast a name and description.

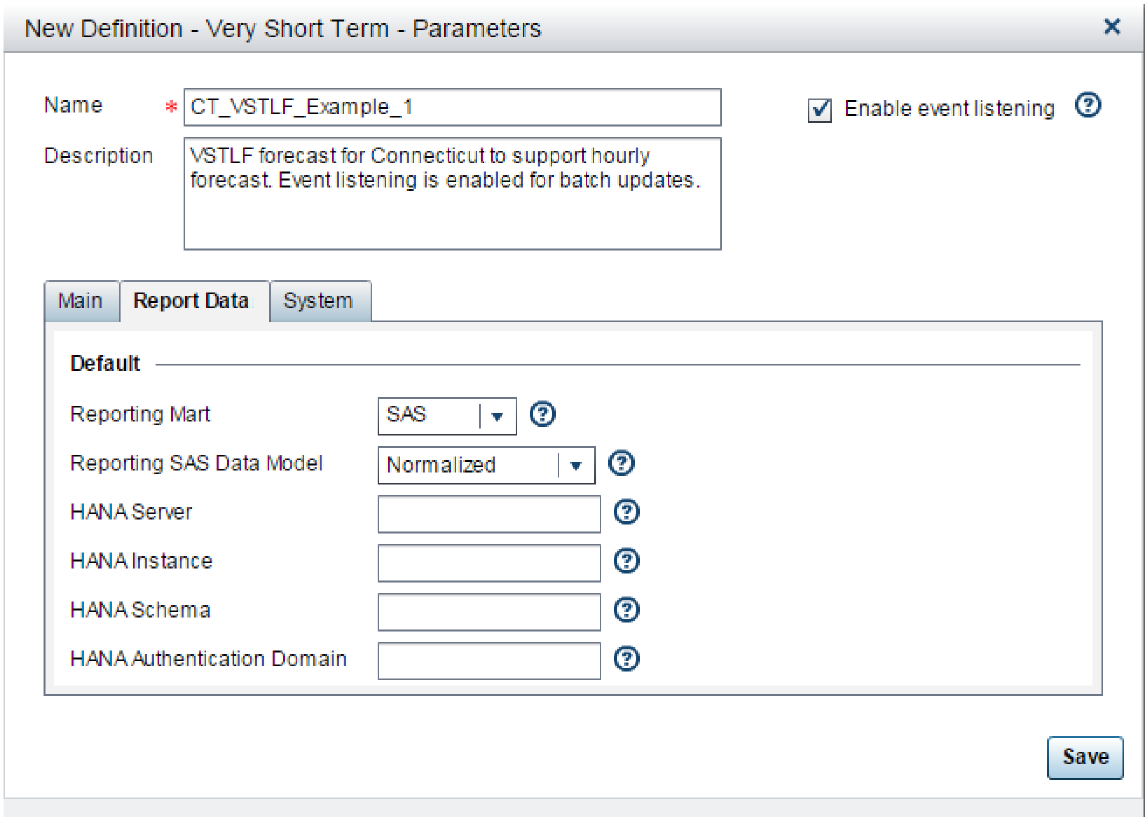


3. If you want to run the forecast automatically each time new data is available, check **Enable event listening**. See Chapter 10, “Run in Batch,” on page 79.

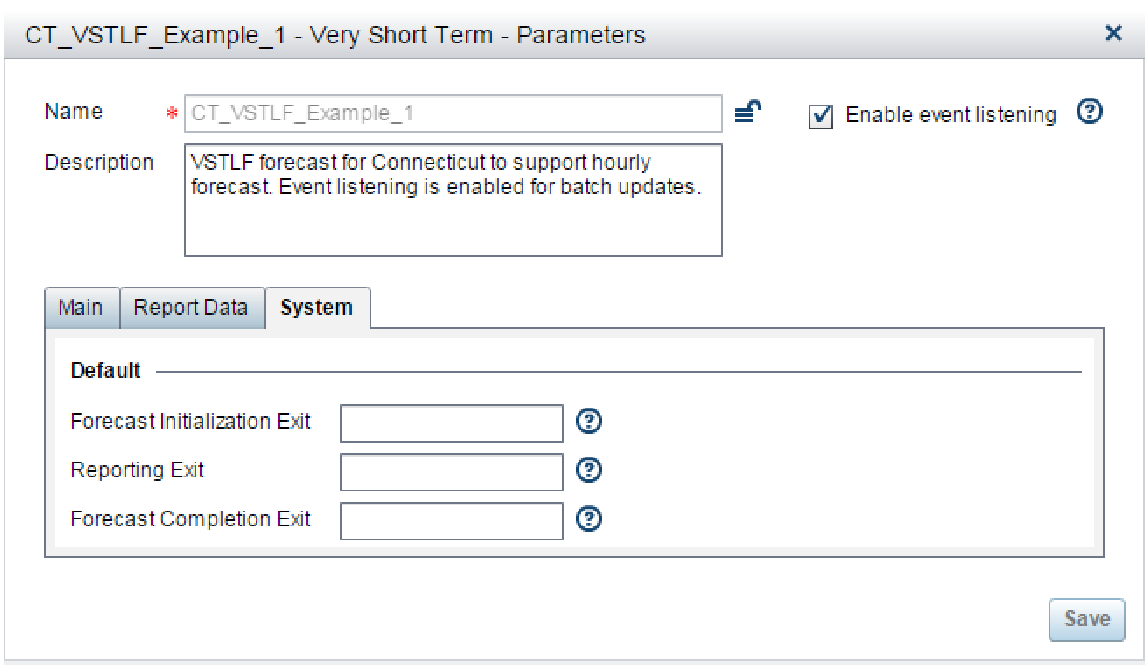
4. The **Main** tab allows you to set the **Historical Start Date** and the **Forecast Start Date**. The hours are based on a 24 hour period. Selecting “1” will start the forecast at 1 a.m.. The forecast will produce hourly results for each hour of the **Forecast Length**.

5. The **Report Data** tab allows you to select the structure of output data for reporting. You can choose to publish the results to a SAS or SAP HANA reporting data mart or choose to not publish the results. You can also choose to publish the data to a

normalized or denormalized data model. See Chapter 11, "Produce Reports," on page 83.



6. The **System** tab allows you to define exits or routines to be run at initialization of the forecast or post forecast.



Note: The **System** tab is not visible to all users. Whether it is visible or not depends on the **Show System Parameters** preference setting. See "Preferences" on page 165.

7. Once you are satisfied with the forecast parameters, click **Save** to save the forecast definition

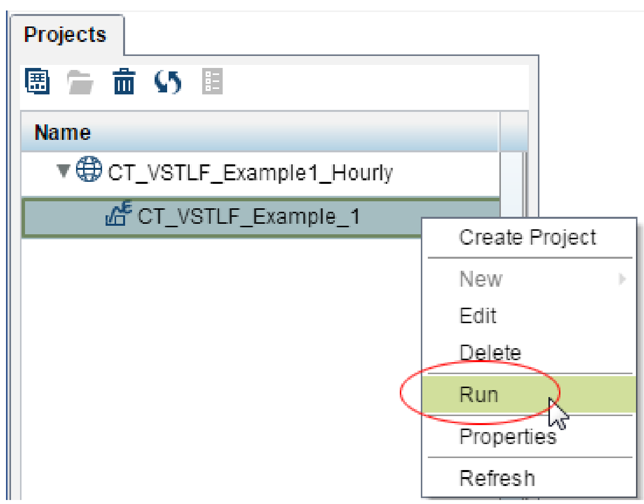
See Also

- Chapter 16, "Create a Forecast," on page 143
- Chapter 22, "Parameters for Very Short Term Load Forecasting," on page 209
- Chapter 25, "Parameters for Short Term Load Forecasting," on page 229
- Chapter 28, "Parameters for Medium Term and Long Term Load Forecasting," on page 244

Run the Forecast

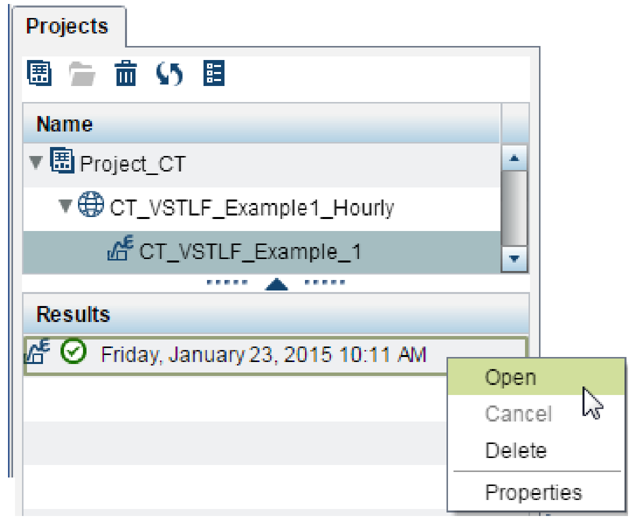
The Forecast Definition will show up in the UI under the diagnose definition which was used to create the forecast.

1. Right click the forecast definition and select **Run**. This will initiate the forecast.

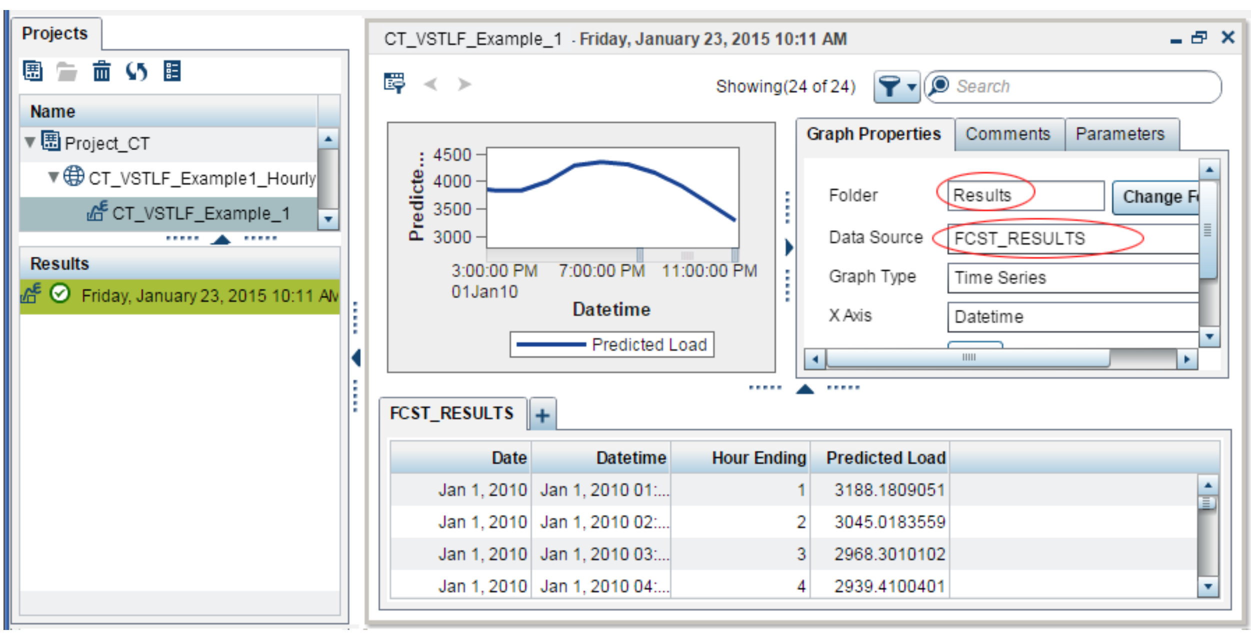


When the forecast is complete, the forecast run instance will show up with a completed check mark on in the bottom left pane when the forecast above is selected.

2. Right click the forecast instance and select **Open** (or drag the competed forecast to the main workspace) and the results are presented.



3. Notice that for **Data Source**, FCST_RESULTS is selected. This displays the results for the “champion model”—the best model for forecasting as selected by the diagnose process. Forecast are run for competing models as well. You can compare the individual results from all models by selecting FCST_RESULTS_ALL from the data source. Also notice that the **Results** folder is selected. You can also select the **Source** folder and see the input data.



See Also

- Chapter 23, “The Very Short Term Forecasting Process,” on page 215
- Chapter 26, “The Short Term Forecasting Process,” on page 235
- “Medium Term / Long Term Forecasting” on page 249
- Chapter 17, “View the Results,” on page 151

Schedule Forecasts

It is expected that you will have a separate diagnose for each type of forecast. It is also expected that you will periodically rerun the diagnose process to ensure that you are forecasting with an optimal model.

Once you have a satisfactory diagnose for each type of forecast, you can use a scheduler (such as Cron, Windows operating system scheduling, or SAS scheduling) to automate the following tasks:

Transform raw data to input data set format
: Assuming that you receive new load and weather data on a regular basis, you can schedule SAS Data Integration Studio jobs to transform the new data to the required input data set format. See Chapter 5, “Prepare the Input Files,” on page 47.

Run forecasts with the new input data
: Once the new data is in input data set format, you can schedule running the %sefdatae macro on the data tier to initiate forecasts. The %sefdatae macro allows you to specify which forecasts to run so that you can run, for example, short term and very short term forecasts at different times. See Chapter 10, “Run in Batch,” on page 79.

Archive forecast results
: SAS Energy Forecasting is very data intensive—it uses large amounts of data and generates large amounts of data. Unless you systematically clean up your result data sets, you risk using up your disk space. SAS Energy Forecasting provides methods to archive your forecasting and diagnose results to free up disk space and preserve forecast results. See Chapter 9, “Archive Results Data,” on page 71.

Chapter 3

How SAS Energy Forecasting Works

Input Data

SAS Energy Forecasting requires a set of input data that resides in a staging area. When you create a SAS Energy Forecasting project, you specify this staging area as the project's Input Path. The data model contains load, weather, calendar, economic, utility, weather station and user defined tables. The data model consists of the following tables:

Calendar Table
Identifies holidays and other special days. See "Calendar Table" on page 47.

Economic Table
Includes data, such as GXP, that defines an economic trend.. See "Economic Table" on page 50.

Load Table
Includes historical load data. See "Load Table" on page 52.

Utility Table
Identifies individual utilities whose data is reported in the load table. See "Utility Table" on page 54.

Weather Station Table
Identifies the weather stations whose data is included in the weather data table. See "Weather Station Table" on page 56.

Weather Data Table
Includes historical weather data. See "Weather Data Table" on page 57.

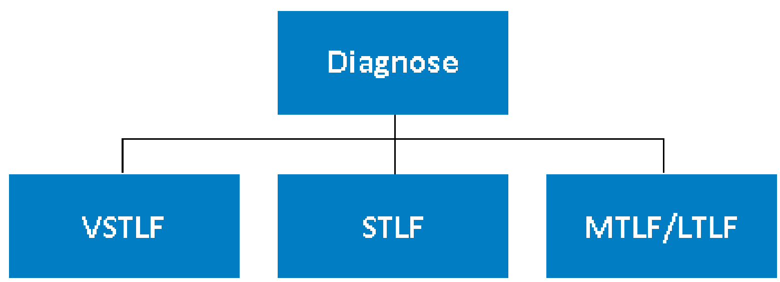
The data model can also include user-supplied data sets to include additional variables as independent variables/effects in the prediction process. See Chapter 8, "Add Additional Variables as Parameters," on page 67.

See Also

Chapter 5, “Prepare the Input Files,” on page 47

Diagnose Process

The diagnose process runs through a set of models to select the best model to use for forecasting with the specific set of data and with the specific set of parameters. The parameters are set up to support the objectives of the forecast. For example, if the diagnose is going to be used for a very short term load forecast, the rolling date parameters (holdout period) will be set for a shorter window than for a medium term load forecast. The result of the diagnose is a forecasting model that is optimized for the objective and horizon of the forecast.



The diagnose process comes before any forecasting. The diagnose process is the same for all types of forecasting except that the parameters that are selected should be specific to the objective and horizon of the forecast.

VSTLF	Very Short Term Load Forecasting
STLF	Short Term Load Forecasting
MTLF/LTLF	Medium Term/Long Term Load Forecasting

It is expected that you will have a separate diagnose for each type of forecast.

See Also

- Chapter 15, “Create a Foundation Diagnose,” on page 135
- Chapter 19, “Parameters for a Foundation Diagnose,” on page 169
- Chapter 20, “The Diagnose Process,” on page 185
- Chapter 17, “View the Results,” on page 151
- Chapter 21, “Diagnose Result Files,” on page 191

Diagnose Analysis

Once the diagnose has run, you can view and analyze the results within the user interface. The results are presented in graphical and tabular form and include information on quality statistics, outliers, model comparisons, source data, etc. You can analyze the diagnose results to see if any adjustments to parameters or outliers need to be performed.

Very Short Term Load Forecasting

Very short term load forecasting is typically used by asset managers, energy traders and system operators. It has a horizon of 1 to 24 hours. It can be enabled to run every time the actual load and weather data is changed so that you have the most up-to-date forecast. Forecast results are generated for the champion model that was selected in the diagnose stage. As the forecasts are updated throughout the day, you can track how forecasted values deviate from actual values and how the forecast changes from hour to hour.

The forecast requires as input a weather data table that contains the expected hourly temperature for each hour of the forecast. See “Weather Data Table” on page 57.

Very short term load forecasting uses a two stage model. The trend variable from the diagnose is replaced with a load-lagged value, and a two stage model is run to fit the residuals for each hour.

See Also

- Chapter 16, “Create a Forecast,” on page 143
- Chapter 22, “Parameters for Very Short Term Load Forecasting,” on page 209
- Chapter 23, “The Very Short Term Forecasting Process,” on page 215
- Chapter 17, “View the Results,” on page 151
- Chapter 24, “Very Short Term Forecast Result Files,” on page 219

Short Term Load Forecasting

Short term load forecasting is typically updated daily with a horizon from 1 day to two weeks. Forecast values are generated for each hour of the forecast horizon. Results of the forecast are used by asset managers, energy traders, system operators, supply planners, and many other organizations within a utility. Forecast results are generated for the champion model that was selected in the diagnose stage. The results can be viewed in both graphical and tablular form. Forecast results for other models can be viewed as well and the user can compare the models and their corresponding quality value, such as MAPE.

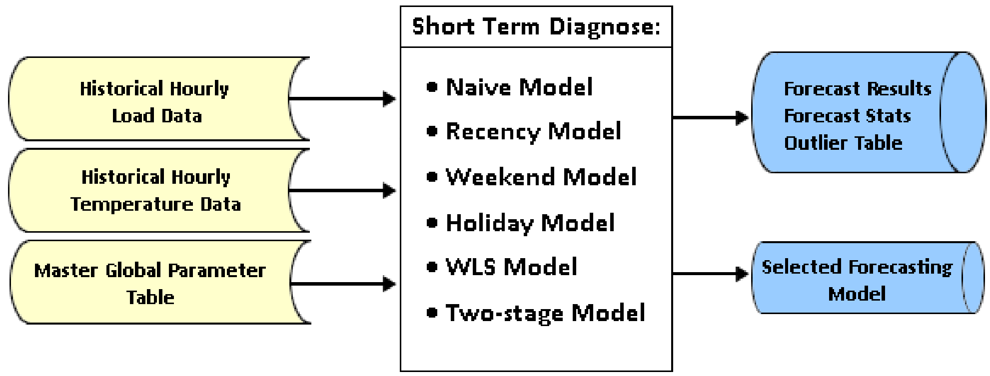
Short-term load forecasting (STLF) generally means hourly forecasting less than 2 weeks starting from the processing time. But, since there are lags (in days) for the actual load data to be received, each series may need more than a 7 day ahead forecast (but should be within 2 weeks). There are two types of short-term load forecasting:

- Ex-ante forecasting: for 14 days ahead, load forecasting will use forecasted weather information
- Ex-post Forecasting: for the historical days with actual weather but not actual load, load forecasting will use actual weather information

The short term forecasting process picks the best model information from the diagnose process and generates a short-term forecast.

The forecast requires as input a weather data table that contains the expected hourly temperature for each hour of the forecast. See “Weather Data Table” on page 57.

The following picture summarizes the diagnose process for STLF.



Short term load forecasting evaluates the following models listed in order of complexity, from less complex to more complex:

Naive Model
: As the first step, a naïve benchmark model is generated. See “Step 1: Generate a Naive Model” on page 186.

Recency Model
: As the second step, the recency effect is added by taking account of recent temperatures. See “Step 2: Add the Recency Effect” on page 186.

Weekend Model
: The weekend effect is added into the winning model (GLMLF-BR) from the recency effect. See “Step 3: Add the Calendar (Weekend) Effect” on page 187.

Holiday Model
: Next holidays indicated in the calendar data set are taken into account. See “Step 4: Add the Holiday Effect” on page 187.

WLS Model
: To emphasize recent status, higher weights are assigned to more recent observations. See “Step 5: Calculate Weighted Least Squares (WLS)” on page 187.

Two-stage Model
: As a second stage, the residual of the best model from the first stage of diagnose is calculated and then used to generate a better model. See “Two-Stage Model” on page 188.

See Also

- Chapter 16, “Create a Forecast,” on page 143
- Chapter 25, “Parameters for Short Term Load Forecasting,” on page 229
- Chapter 26, “The Short Term Forecasting Process,” on page 235
- Chapter 17, “View the Results,” on page 151

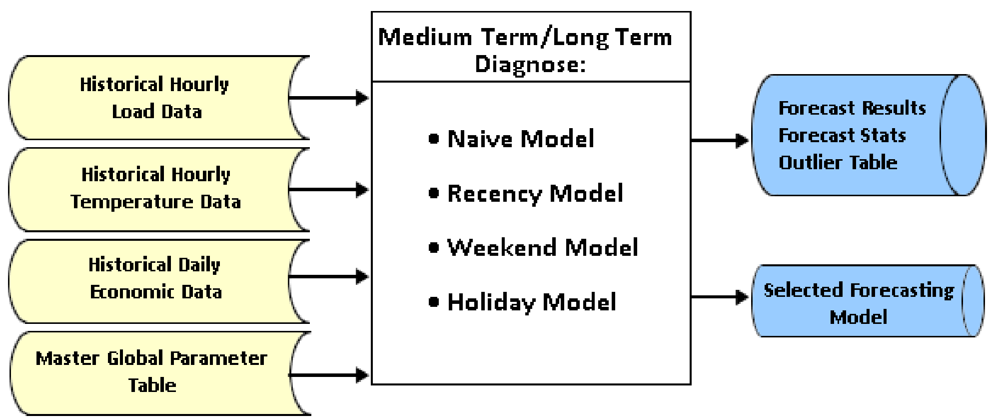
- Chapter 27, “Short Term Forecast Result Files,” on page 237

Medium Term/ Long Term Load Forecasting

Medium term load forecasting (MTLF) generally means hourly forecasting for the rest of the current month and less than 3 years ahead. Long term load forecast means forecasting for more than 3 years ahead.

The process of medium term and long term load forecasting is similar to the process of short term load forecasting. A key difference is that economic data (for example, customer counts or GDP) is taken into account for medium and long term forecasting whereas it is not considered for short term or very short term forecasting.

The following picture summarizes the diagnose process for MTLF.



Medium term/long term load forecasting evaluates the following models listed in order of complexity, from less complex to more complex:

Naive Model
As the first step, a naïve benchmark model is generated. See “Step 1: Generate a Naive Model” on page 186.

Recency Model
As the second step, the recency effect is added by taking account of recent temperatures. See “Step 2: Add the Recency Effect” on page 186.

Weekend Model
The weekend effect is added into the winning model (GLMLF-BR) from the recency effect. See “Step 3: Add the Calendar (Weekend) Effect” on page 187.

Holiday Model
Next holidays indicated in the calendar data set are taken into account. See “Step 4: Add the Holiday Effect” on page 187.

See Also

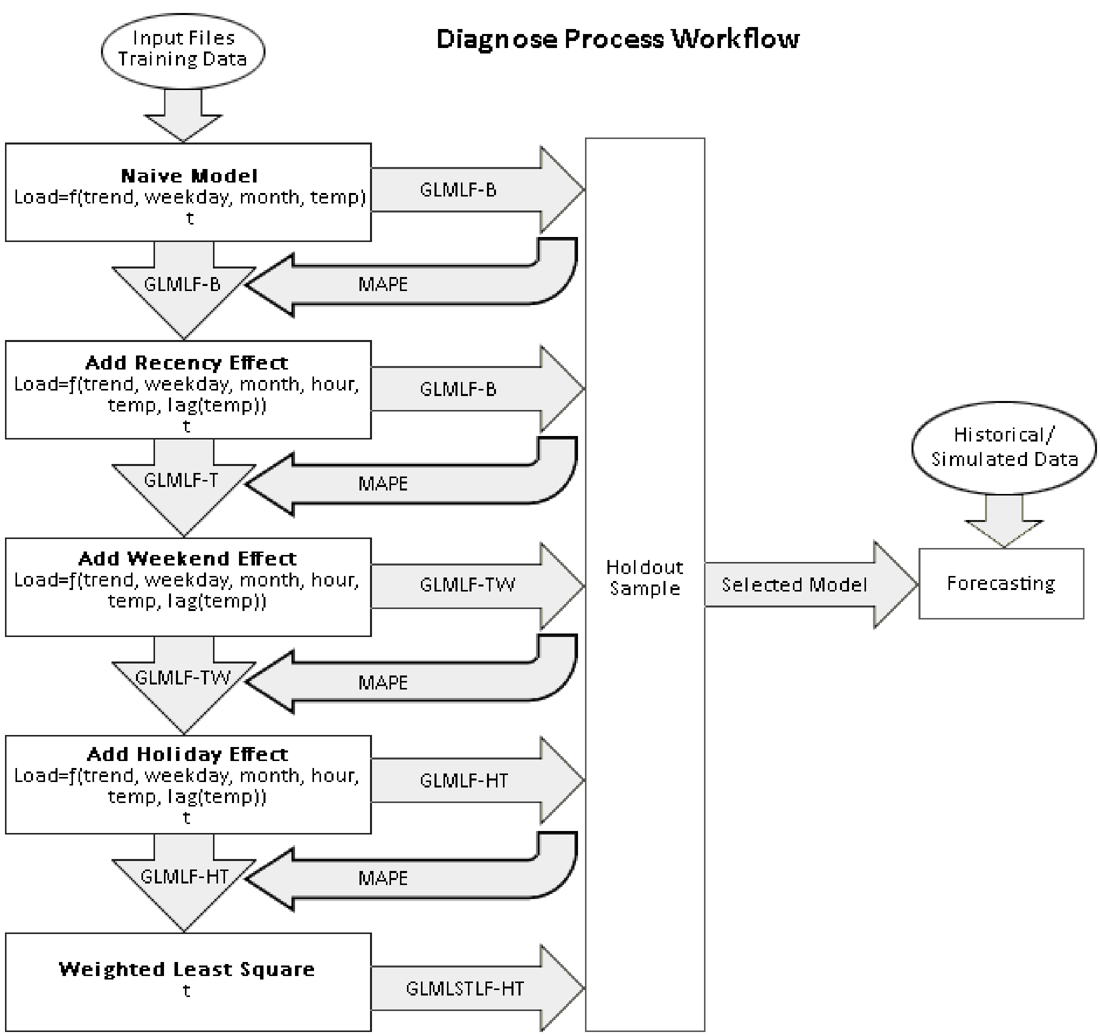
- Chapter 16, “Create a Forecast,” on page 143
- Chapter 28, “Parameters for Medium Term and Long Term Load Forecasting,” on page 243

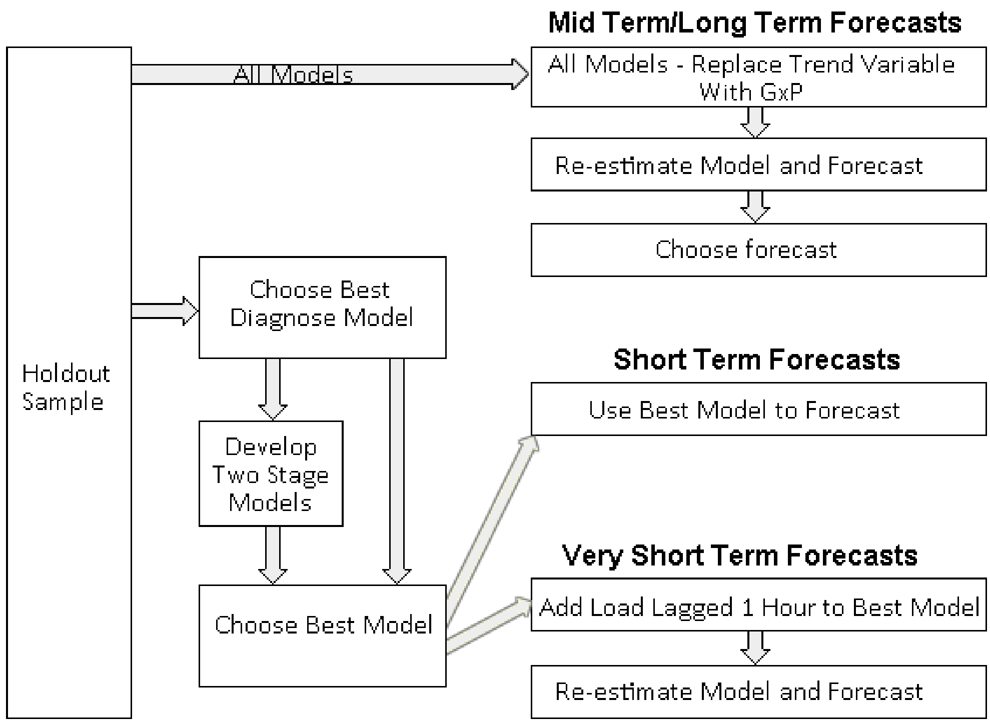
- Chapter 29, "The Medium Term/Long Term Forecasting Process," on page 249
- Chapter 17, "View the Results," on page 151
- Chapter 30, "Medium Term/Long Term Forecast Result Files," on page 251

The Big Picture

The following diagrams depict the entire diagnose and forecasting process. To understand the details, see the following:

- Chapter 20, "The Diagnose Process," on page 185
- Chapter 23, "The Very Short Term Forecasting Process," on page 215
- Chapter 26, "The Short Term Forecasting Process," on page 235
- Chapter 29, "The Medium Term/Long Term Forecasting Process," on page 249




Mid Term/Long Term Forecasts
All Models
All Models - Replace Trend Variable With GxP
Re-estimate Model and Forecast
Choose forecast
Holdout Sample
Choose Best Diagnose Model
Short Term Forecasts
Use Best Model to Forecast
Develop Two Stage Models
Very Short Term Forecasts
Choose Best Model
Add Load Lagged 1 Hour to Best Model
Re-estimate Model and Forecast

Part 2

Product Administration

Chapter 4

Manage Permissions

Overview

As an administrator, you create users, roles, and groups. In general, the sequence you will follow is the following:

1. Create roles. See "Create Roles" on page 32.

   A role is a set of capabilities. When you make a group be a member of a role, users who are members of that group inherit the capabilities of the role.

2. Create groups. See "Create Groups" on page 38.

   A group is a set of users who share the same capabilities. It is convenient to create groups before creating users because if groups exist, then when you create a user you can assign the user to one or more groups and thereby determine the user's capabilities.

3. Create users and assign them to groups. See "Create Users" on page 40.

Note: You can limit the reach and activities of a SAS server by putting it in a locked-down state. When the server is in a locked down state, SAS Energy Forecasting allows only a limited view of the server file system. For more information, see *SAS 9.4 Intelligence Platform: Security Administration Guide* at http://support.sas.com/documentation/onlinedoc/intellplatform/.

Create Roles

Overview

A role is a set of capabilities. There are four groups of capabilities associated with SAS Energy Forecasting:

Forecaster

- Create Diagnose Definition
- Update Diagnose Definition
- Run Diagnose Definition
- Create Forecast Definition
- Update Forecast Definition
- Run Forecast Definition

Forecast Viewer

- View Diagnose Results
- View Forecast Results

Forecast Administrator

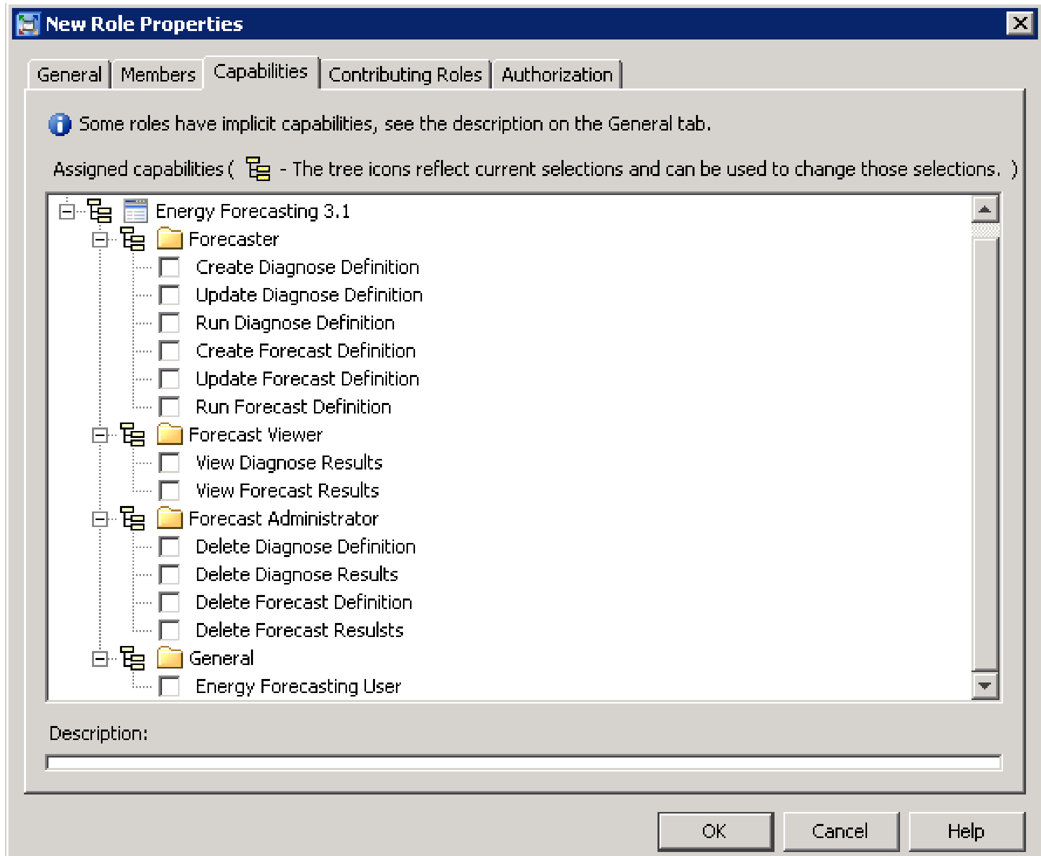
- Delete Diagnose Definition
- Delete Diagnose Results
- Delete Forecast Definition
- Delete Forecast Results

General

- Energy Forecasting User

  Note: This capability is a prerequisite for all the other capabilities. It is required for accessing the SAS Energy Forecasting client and for accessing SAS Visual Analytics from the SAS Energy Forecasting application.

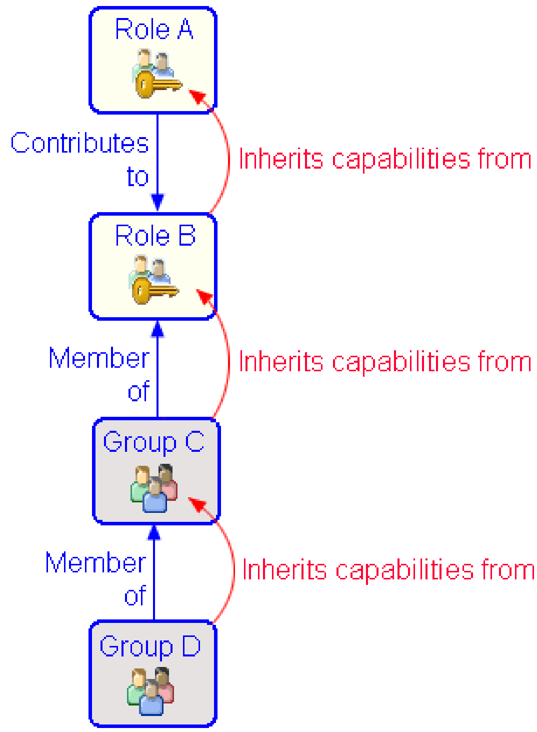
The following picture shows SAS Management Console displaying the SAS Energy Forecasting capabilities that can be assigned to a role.



As an administrator you create roles with one or more capabilities. Then when you create a group, you make the group be a member of a role so that the group inherits capabilities from the role.

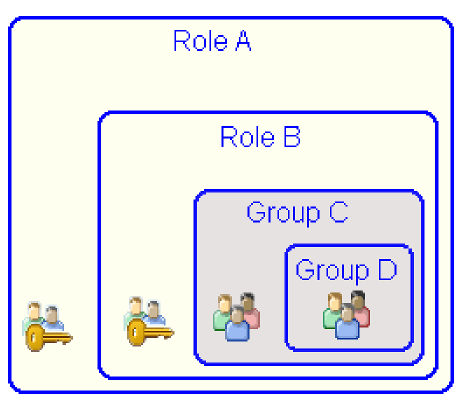
The following picture summarizes the inheritance of capabilities from roles and groups:

- Role B inherits from role A because role A is a contributing role to role B.
- Group C inherits from role B because group C is a member of role B.
- Group D inherits from group C because group D is a member of group C.



Note: The relationship inherits from is transitive. That is if C inherits from B, and B inherits from A, then C inherits from A.

Another way to look at the inheritance of capabilities is as one of inclusion as shown in the following picture which (assumes the Contributes to and Member of relationships in the picture above):

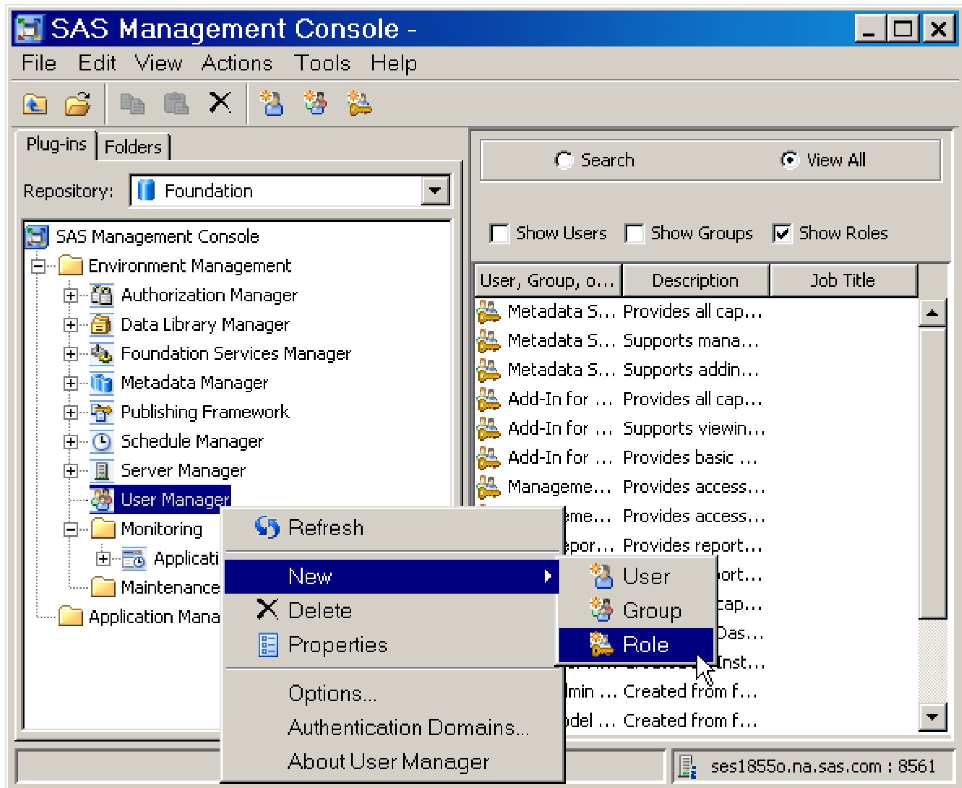


In this picture:

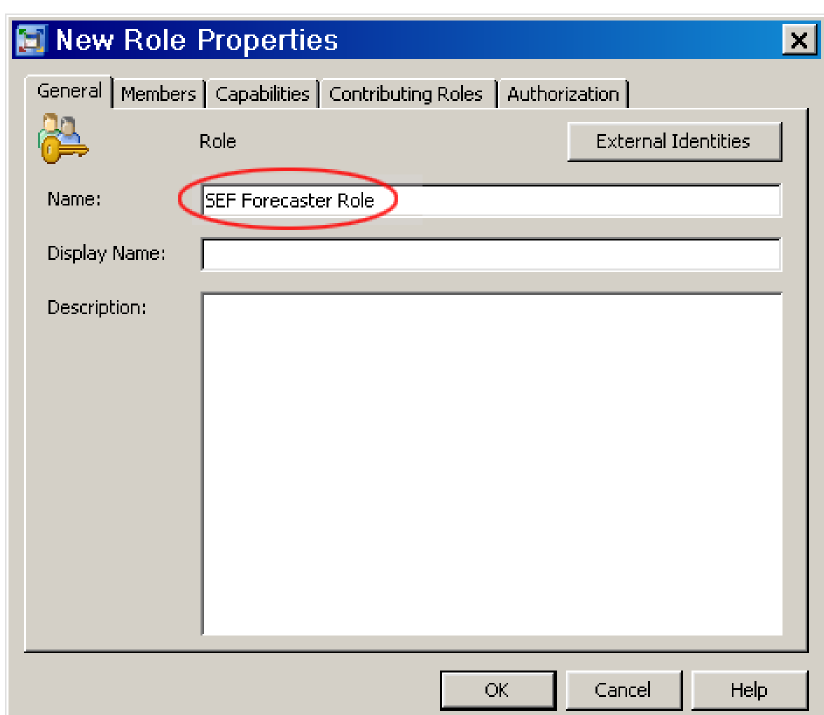
- Users in Role A have only the capabilities of Role A.
- Users in Role B have the capabilities of Role A and Role B.
- Users in Group C have the capabilities of Role A and Role B (and they could have whatever capabilities not pictured that Group C inherits from other roles).
- Users in Group D have the capabilities of Role A and Role B and Group C (and they could have whatever capabilities not pictured that Group D inherits from other roles or groups).

Create a Role

1. Open SAS Management Console, connecting to your metadata server.
2. Select **User Manager**, and then select **New** ⇨ **Role**.

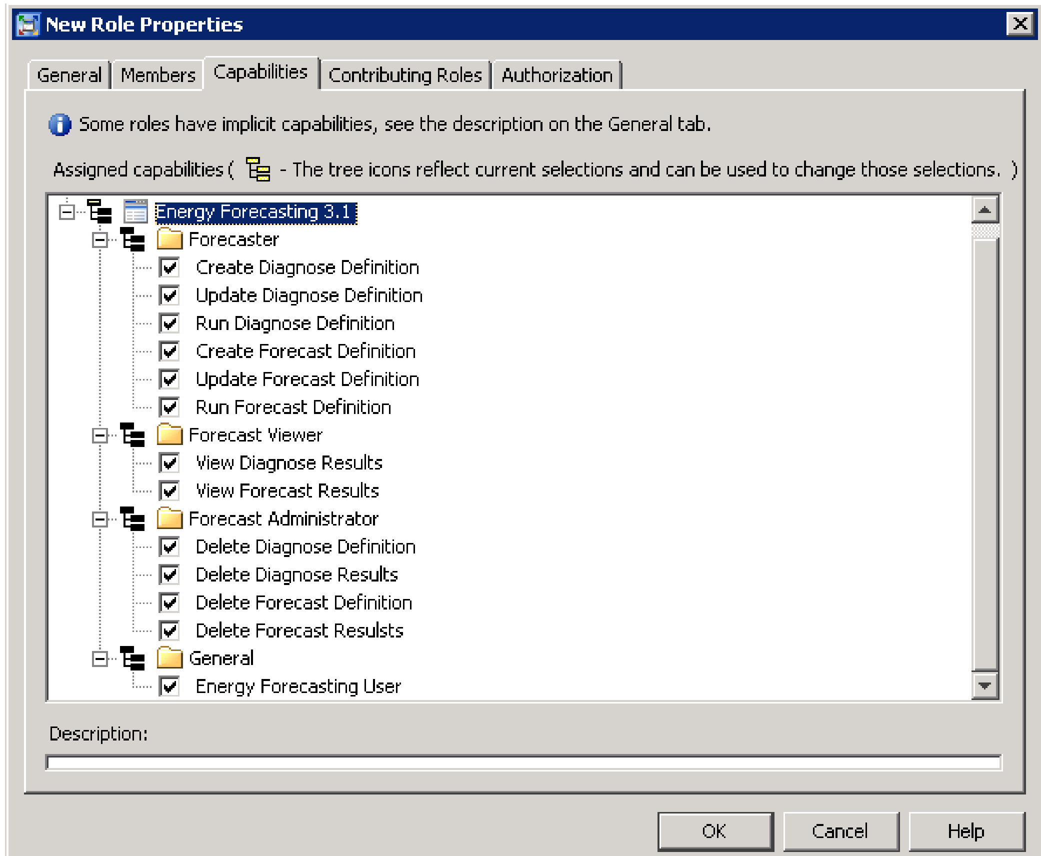


3. Name the role (for example *SEF Forecaster Role*).



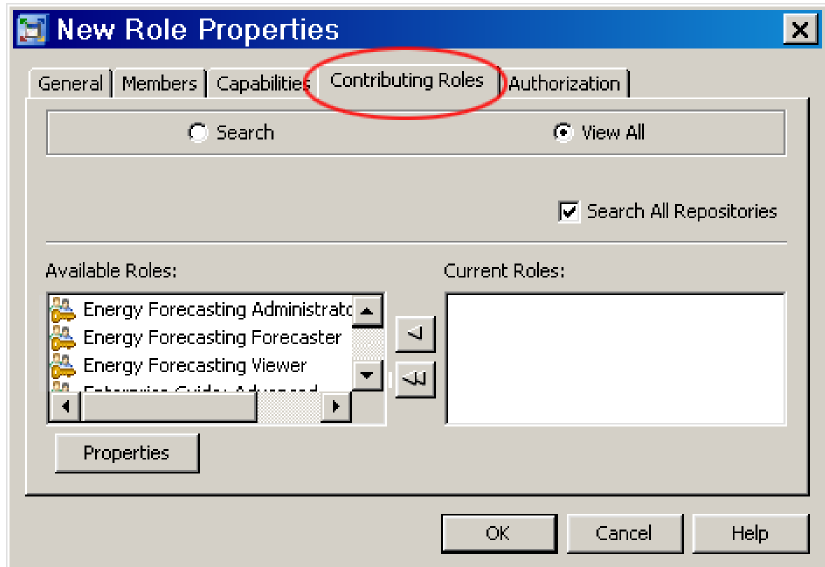
4. Click the **Capabilities** tab and select the capabilities that you want to assign to this role—and indirectly to any group that is a member of this role.

   The following picture shows assigning all the Energy Forecasting capabilities to SEF Forecaster Role.

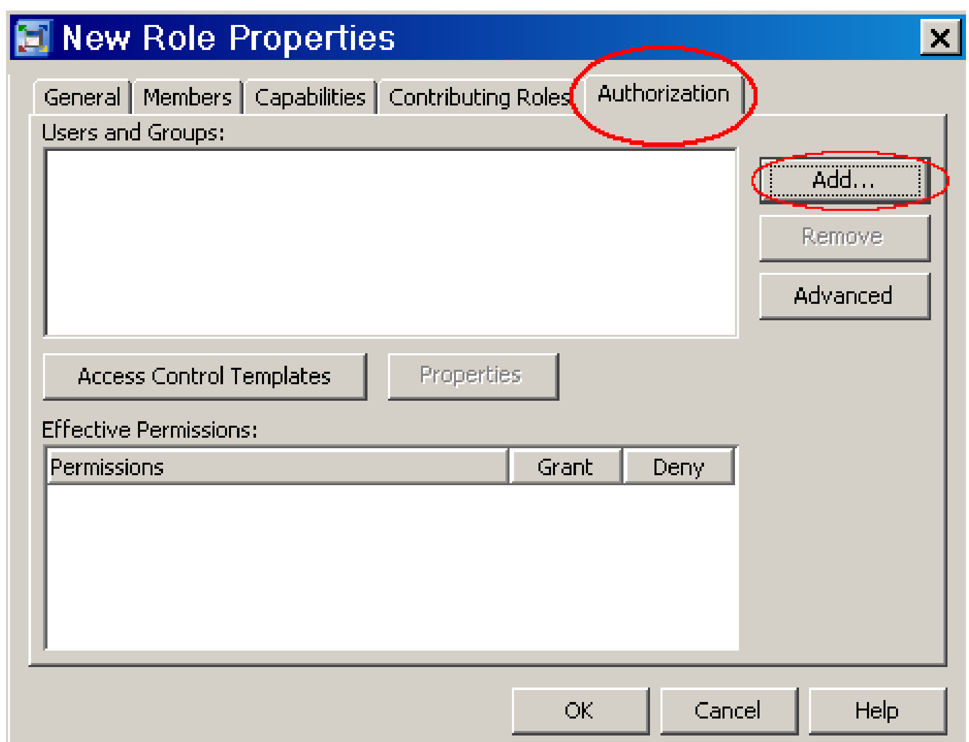


   Note: In the **Capabilities** tab of SAS Management Console, the following icon indicates a capability that has been explicitly assigned to a role, whereas the following icon indicates a capability that has been inherited from a contributing role.

5. Click the **Contributing Roles** tab and add any roles that you want to contribute capabilities to the role being created. This step is optional.



6. Click the **Authorization** tab and add any groups or roles that you want to have authorization to access the role being created. This step is optional.



7. Click **OK** to finish creating the role.

Create Groups

Overview

A group is a set of users who share the same capabilities. It is convenient to create groups before creating users because if groups exist, then when you create a user you can immediately assign the user to one or more groups and thereby determine the user's capabilities.

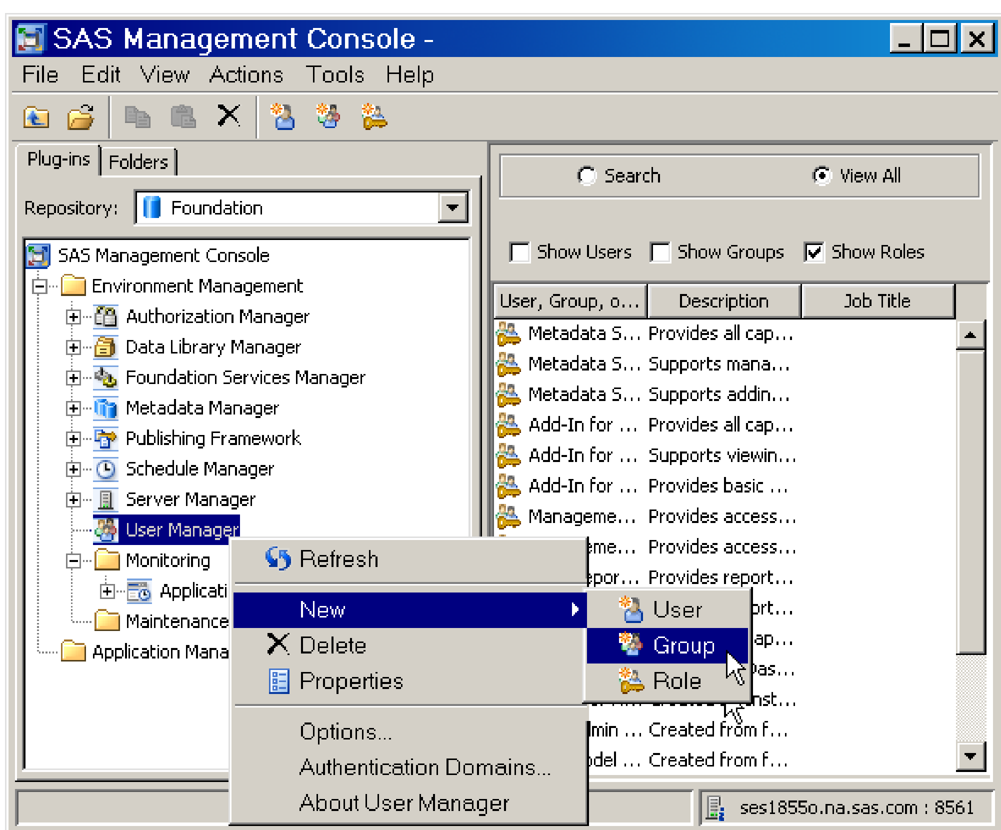
Creating a group is the second part of a two-step process:

1. Create roles with the capabilities that you want to assign to the group.
2. Create a group and make it a member of the roles that you created. This gives the group the capabilities of the roles.

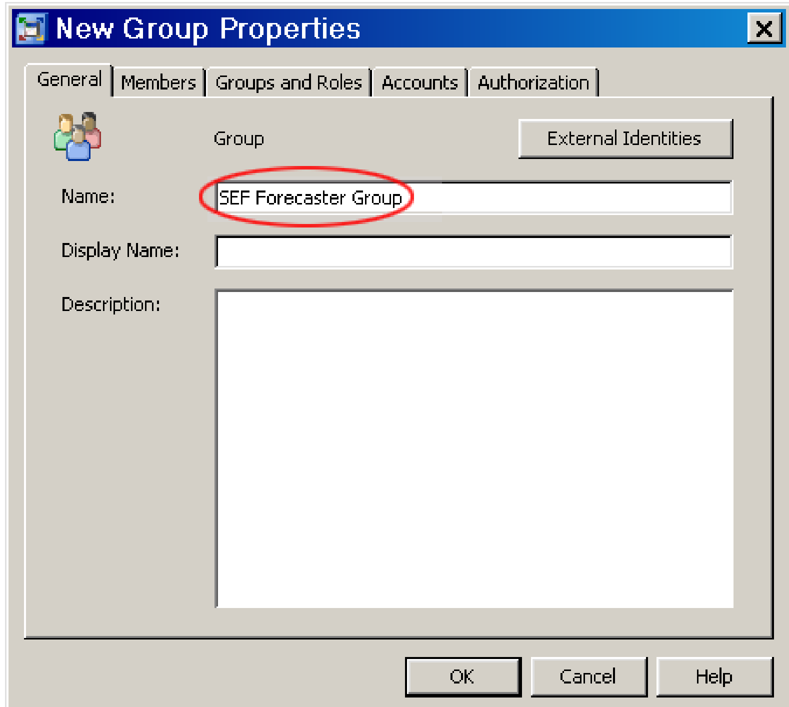
Create a Group

To create a group, do the following:

1. Open SAS Management Console, connecting to your metadata server.
2. Select User Manager, and then select **New** ⇨ **Group**.

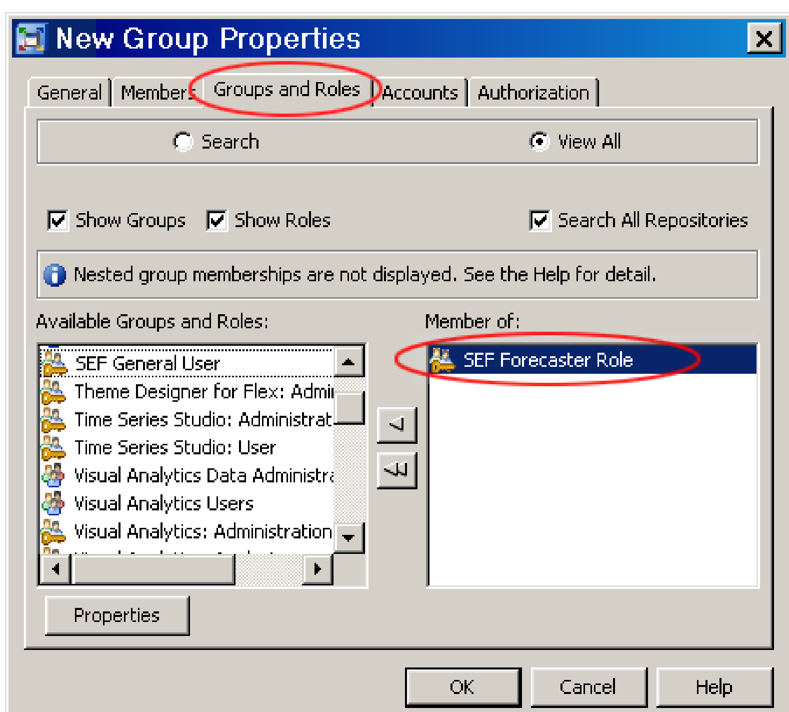


3. Name the group (for example SEF Forecaster Group).



4. Click the **Groups and Roles** tab and add the roles whose capabilities you want the group to have.

   We say that the group is a member of the role. Such roles contribute their capabilities to the group. Alternatively, we can say that the group inherits its capabilities from the roles.

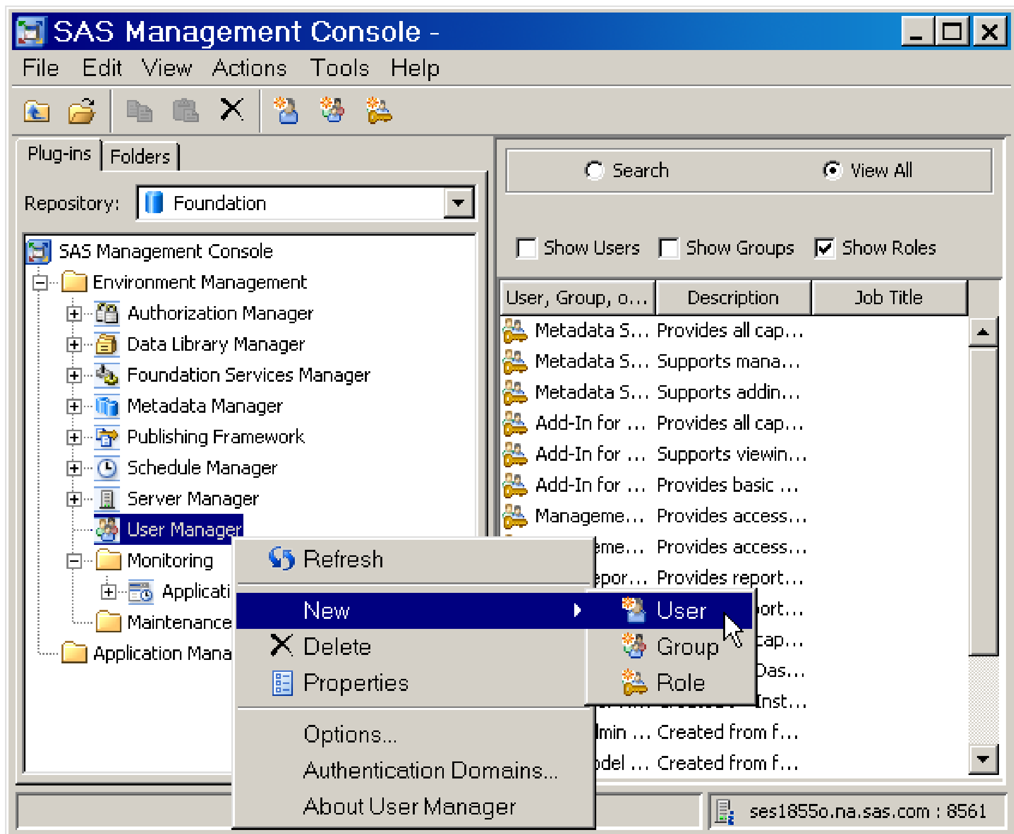


5. Click **OK** to finish creating the group.

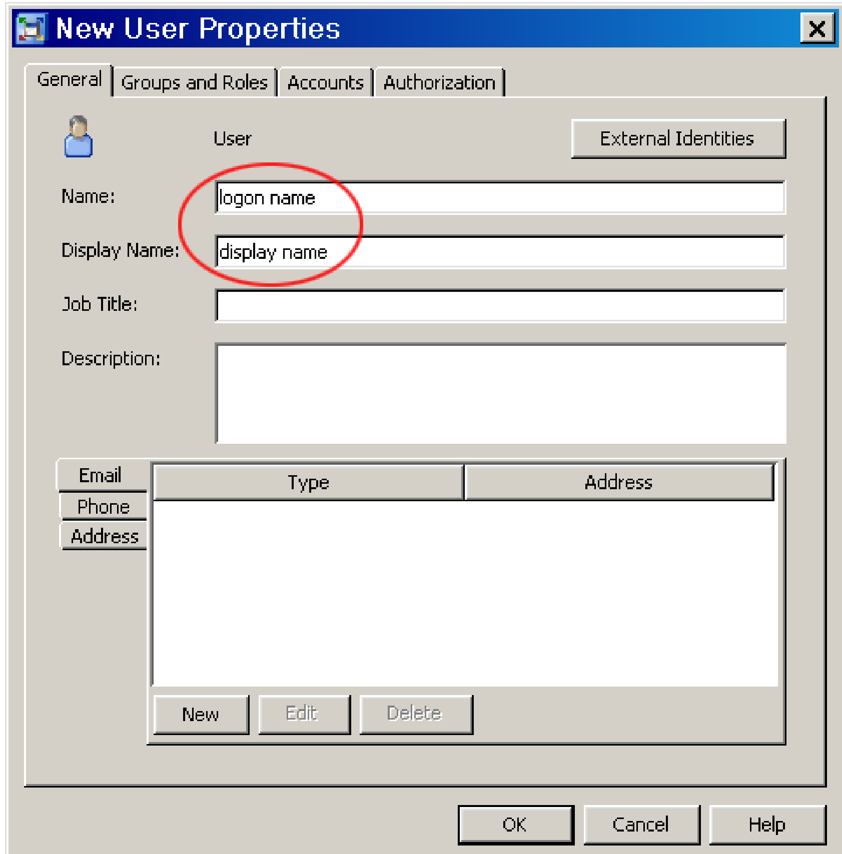
Create Users

To create a user, do the following:

1. Open SAS Management Console, connecting to your metadata server.
2. Select **User Manager**, and then select **New** ⇨ **User**.

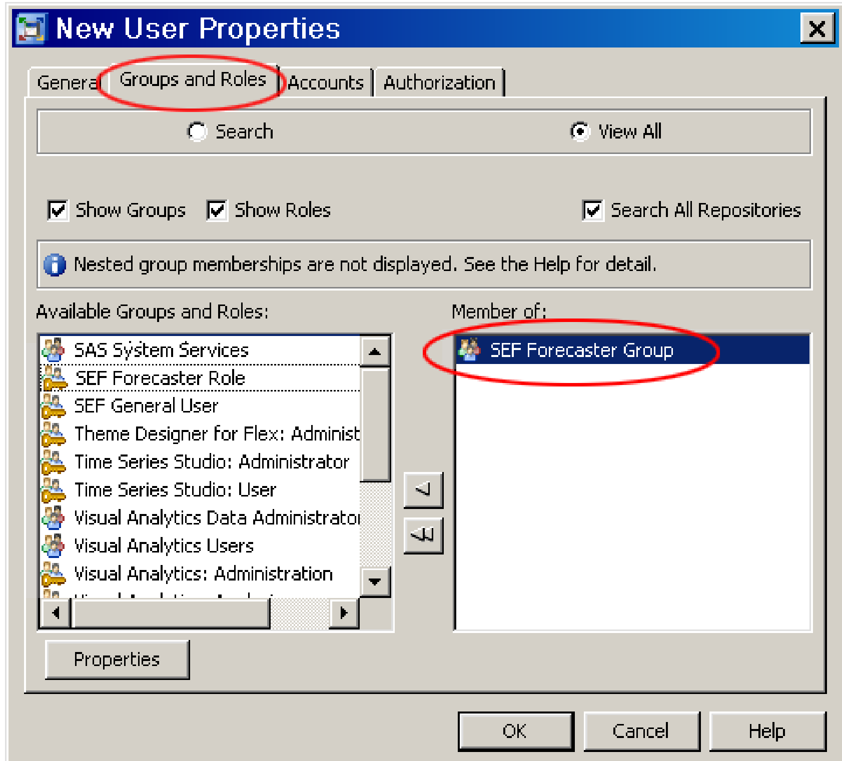


3. Enter the user's Name (which is the user's SAS Energy Forecasting logon name) and the user Display Name.



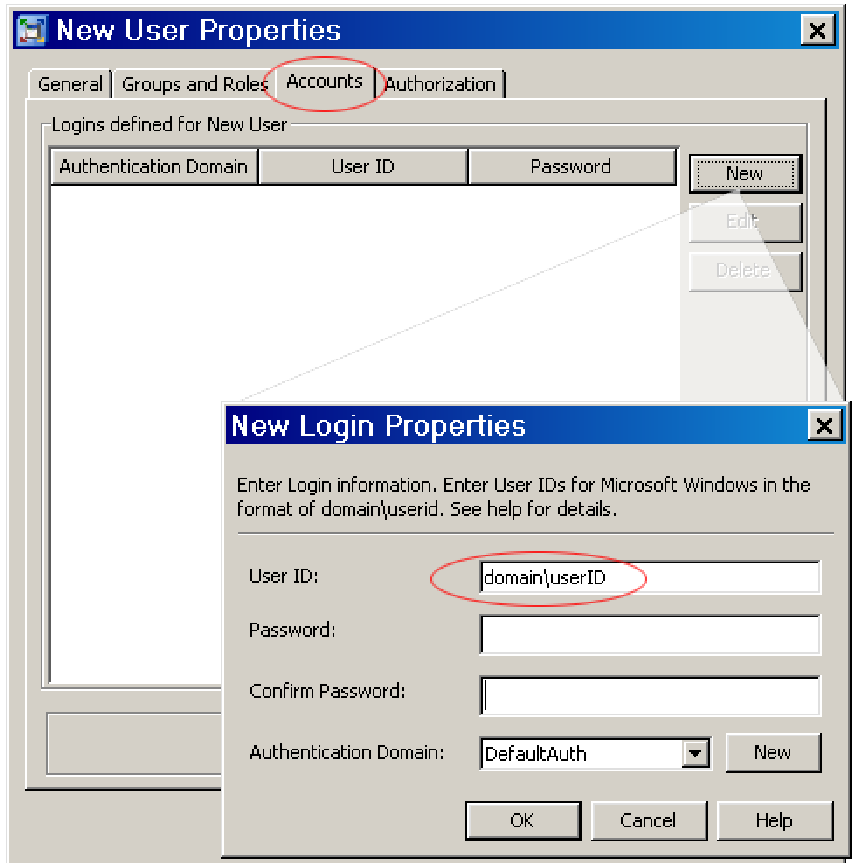
4. Click the **Groups and Roles** tab and add the group or groups of which the user is a member.

   This gives the user all the capabilities of the group. If the user is a member of multiple groups, then the user has the union of the capabilities of the groups of which the user is a member.



5. Click the **Accounts** tab and click **New** to add a new account. Enter the user's domain and user ID.

   You can leave the password blank. When the user logs onto SAS Energy Forecasting, the password that the user enters will be verified against the user's password on the system.



6. Click **OK** twice to finish creating the user.

Note: If the user is defined only on the local machine rather than in a domain, make sure to add the user to Local Users and Groups using Microsoft Management Console (with the Administrative Tool "Computer Management").

Ensure Directory Access

Overview

Following are general principles concerning required directory access:

- Users of SAS Energy Forecasting must have read permission to the templates directory. See "Templates Directory" on page 44.
- Users of the SAS Energy Forecasting must have read permission to project directories—the directories containing diagnoses and forecasts. See "Project Directories" on page 44.
- The SAS Energy Forecasting Workspace Server must have permissions to write to the projects and archive directories.
- All users must be OS users.

Templates Directory

By default, parameter templates are stored in **`C:\SAS\Config\Lev1\SASApp\Data\EnergyForecasting\Templates`**. Each user that creates or views a diagnose or forecast must have read access to the templates directory. See Chapter 6, “Modify the Parameter Templates,” on page 59.

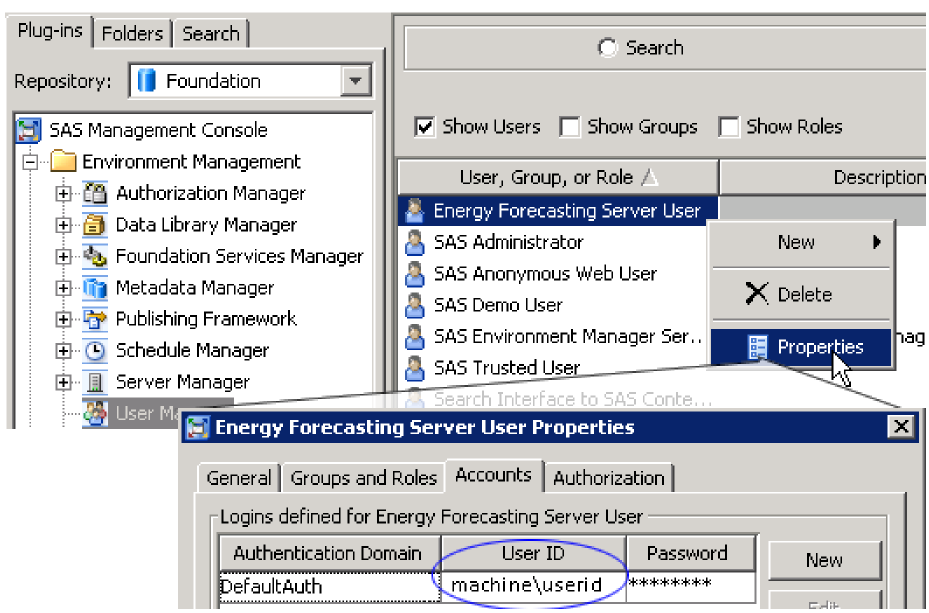
Project Directories

The default output folder of a project is **`SAS\Config\Lev1\SASApp\Data\EnergyForecasting`** with a sub-directory that is the project name. Each diagnose is created as a sub-directory of the project. Each forecast within a diagnose is a sub directory of the diagnose.

Every user that needs to be able to view the output of a diagnose or forecast must have at a minimum read permission to the diagnose or forecast directory. Following are guidelines for establishing minimum permissions and extended permissions to project directories:

Minimum Permissions

For Windows or LAX, a minimal security approach is to have the Energy Forecasting Server User, any other SAS users (sassrv, etc.), and any additional users with capabilities in SAS Energy Forecasting belong to a group that has read write and modify access to the SAS Energy Forecasting data directory (for example **`C:\SAS\Config\Lev1\SASApp\Data\EnergyForecasting`**) and any additional directories that will host SAS Energy Forecasting projects.



Extended Permissions

For LAX deployments the Energy Forecasting data directory **`C:\SAS\Config\Lev1\SASApp\Data\EnergyForecasting`** and any additional project directories should be owned by the Energy Forecasting Server User with full control. All other users should belong to the same group as the Energy Forecasting Server User and that group should have at a minimum read access.

For Windows, you can create multiple OS groups. For purpose of illustration, the following are three sample groups that you might create:

SEF_GENERAL_USERS
These users will need file system permissions to read from the default SAS Energy Forecasting data directory **`C:\SAS\Config\Lev1\SASApp\Data\EnergyForecasting`**.

SEF_PROJECT_USERS
You can create multiple such groups with different users based on project access needs. Users in these groups will need read permission for any projects folders to which they require access.

SEF_ADMIN_USERS
The Energy Forecasting Server User will need read / write / modify permissions to each project folder as well as the SAS Energy Forecasting data directory.

Chapter 5

Prepare the Input Files

View Sample Data

Upon installation of SAS Energy Forecasting, sample data sets are placed in **`C:\Program Files\SASHome\SASFoundation\9.4\enfcsvr\sasmisc`** for you to use to create a diagnose and run forecasts.

Note: The same input tables are used both for diagnose and for forecasts.

Calendar Table

The calendar table, calendar.sas7bdat, defines holidays and regular week days.

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UTIL_LOC_CD	Util Loc	Location of utility	20	Char	$20.	$20.	CT
DATE	Date	Day of year	8	Num	NLDATEM14.	NLDATE20..	10FEB20081

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UTIL_LOC_DIM_RK	Util Loc Dim Key	Row of utility in utility table	8	Num	12.	12.	2
HOLIDAY	Holiday	Holiday identifier	8	Num	BEST12.	12.	8
BEFORE_HOLIDAY	Before Holiday	Before-holiday identifier	8	Num	BEST12.	12.	109
ATER_HOLIDAY	After Holiday	After-holiday identifier	8	Num	BEST12.	12.	209
YEAR	Year	year	8	Num	BEST12.	12.	2008
MONTH	Month	month	8	Num	BEST12.	12.	2
DAY	Day	day	8	Num	BEST12.	12.	30
WEEKDAY	Weekday	weekday identifier	8	Num	BEST12.	12.	3

The following structure is used to define an unlimited number of holidays. The structure allows the day prior and following to be defined as special days where variations from normal load occur.

special_day	Holiday
1	New Year’s Day
101	New Year’s Eve
201	Day after New Year’s Day
2	Martin Luther King, Jr.’s Birthday
102	Day before Martin Luther King, Jr.’s Birthday
202	Day after Martin Luther King, Jr.’s Birthday

For US installations a default US calendar table is provided with the 10 US Federal holidays and the day before and after holidays defined. See also “Fixed Date Holidays” on page 179.

The table below shows the codes used for the holidays and their surrounding days for the 10 US Federal holidays.

Special Day	Description
1	New Year’s Day
101	New Year’s Eve
201	Day after New Year’s Day

Special Day	Description
2	Birthday of Martin Luther King, Jr.
102	Day before Birthday of Martin Luther King, Jr.
202	Day after Birthday of Martin Luther King, Jr.
3	Washington’s Birthday
103	Day before Washington’s Birthday
203	Day after Washington’s Birthday
4	Memorial Day
104	Day before Memorial Day
204	Day after Memorial Day
5	Independence Day
105	Day before Independence Day
205	Day after Independence Day
6	Labor Day
106	Day before Labor Day
206	Day after labor Day
7	Columbus Day
107	Day before Columbus Day
207	Day after Columbus Day
8	Veteran’s Day
108	Day before Veteran’s Day
208	Day after Veteran’s Day
9	Thanksgiving
109	Day before Thanksgiving
209	Day after Thanksgiving
10	Christmas
110	Christmas Eve
210	Day after Christmas

The following is a sample american calendar: calendar.

VIEWTABLE: calendar

	Util Loc	Date	Util Loc Dim Key	Holiday	Before Holiday	After Holiday	Year	Month	Day	Weekday
1	CT	Jan 1, 2003	1	1	0	0	2003	1	1	4
2	CT	Jan 2, 2003	1	0	0	201	2003	1	2	5
3	CT	Jan 3, 2003	1	0	0	0	2003	1	3	6
4	CT	Jan 4, 2003	1	0	0	0	2003	1	4	7
5	CT	Jan 5, 2003	1	0	0	0	2003	1	5	1
6	CT	Jan 6, 2003	1	0	0	0	2003	1	6	2
7	CT	Jan 7, 2003	1	0	0	0	2003	1	7	3
8	CT	Jan 8, 2003	1	0	0	0	2003	1	8	4
9	CT	Jan 9, 2003	1	0	0	0	2003	1	9	5
10	CT	Jan 10, 2003	1	0	0	0	2003	1	10	6
11	CT	Jan 11, 2003	1	0	0	0	2003	1	11	7
12	CT	Jan 12, 2003	1	0	0	0	2003	1	12	1
13	CT	Jan 13, 2003	1	0	0	0	2003	1	13	2
14	CT	Jan 14, 2003	1	0	0	0	2003	1	14	3
15	CT	Jan 15, 2003	1	0	0	0	2003	1	15	4
16	CT	Jan 16, 2003	1	0	0	0	2003	1	16	5
17	CT	Jan 17, 2003	1	0	0	0	2003	1	17	6
18	CT	Jan 18, 2003	1	0	0	0	2003	1	18	7
19	CT	Jan 19, 2003	1	0	102	0	2003	1	19	1
20	CT	Jan 20, 2003	1	2	0	0	2003	1	20	2
21	CT	Jan 21, 2003	1	0	0	202	2003	1	21	3
22	CT	Jan 22, 2003	1	0	0	0	2003	1	22	4
23	CT	Jan 23, 2003	1	0	0	0	2003	1	23	5
24	CT	Jan 24, 2003	1	0	0	0	2003	1	24	
25	CT	Jan 25, 2003	1		0	0	2003			
26	CT									
27										

Economic Table

The economic table, economy_data.sas7bdat, is used for medium and long term forecasting—not for short or very short term forecasting. Data in the economic table is for the economic variable that will be used to automatically generate multiple economic scenarios. Typically this will be a gross product index for local, state or the nation. Major economic forecast vendors can typically supply a baseline forecast and as many as six scenarios.

The table should:

- be provided at the daily grain (can be provided at monthly if only that is available).
- provide a minimum of 1 (GROSS_PRODUCT_S0_AMT) and a maximum of 7 values (GROSS_PRODUCT_S1_AMT to GROSS_PRODUCT_S6_AMT). Leave columns blank that are not used.
- contain projected values for up to 50 years into the future. The number of future years provided should match the desired forecast horizon.

Note: The economic table can contain only one baseline forecast of a single economic variable and as many as 6 scenarios. Other economic variables can be added as user defined variables but automatic scenario generation will not be possible. Each of the columns Economic Scn 1 through Economic Scn 6 represents a different scenario. Leave higher-numbered columns blank if you have no data for that scenario. For example, if you have two economic values, then provide data for columns Economic Base and Economic Scn 1 and leave the remaining columns blank.

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UTIL_LOC_DIM_RK	Util Loc Dim Key	Record number of the utility in the table UTIL_LOC_DIM. See "Utility Table" on page 54.	8	Num	12.	12.	1
ECONOMY_DT	Date	Date of measurement	8	Num	NLDATEM14.	NLDATE20.	Jan 1, 1977
UTIL_LOC_DIM_RK	Util Loc	Utility Identifier Record number of the utility in the table UTIL_LOC_DIM. See "Utility Table" on page 54.	8	Num	12.	12.	CT
GROSS_PRODUCT_S0_AMT	Economic Base	Economic or Customer Count information Record number of the utility in the table UTIL_LOC_DIM. See "Utility Table" on page 54.	8	Num	NLNUM15.3	NLNUM 15.3	330.363
GROSS_PRODUCT_S1_AMT	Economic Scn 1	Economic or Customer Count information, Scenario 1	8	Num	NLNUM15.3	NLNUM 15.3	234.283
GROSS_PRODUCT_S2_AMT	Economic Scn 2	Economic or Customer Count information, Scenario 2	8	Num	NLNUM15.3	NLNUM 15.3	330.363
GROSS_PRODUCT_S3_AMT	Economic Scn 3	Economic or Customer Count information, Scenario 3	8	Num	NLNUM15.3	NLNUM 15.3	330.363
GROSS_PRODUCT_S4_AMT	Economic Scn 4	Economic or Customer Count information, Scenario 4	8	Num	NLNUM15.3	NLNUM 15.3	234.283
GROSS_PRODUCT_S5_AMT	Economic Scn 5	Economic or Customer Count information, Scenario 5	8	Num	NLNUM15.3	NLNUM 15.3	0.000

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
GROSS_PRODUCT_S6_AMT	Economic Scn 6	Economic or Customer Count information, Scenario 6	8	Num	NLNUM15.3	NLNUM 15.3	0.000

The following is a sample economic table: economy_data.

VIEWTABLE: economy_data

	Util Loc Dim Key	Date	Util Loc	Economic Base	Economic Scn 1	Economic Scn 2	Economic Scn 3	Economic Scn 4	Economic Scn 5	Economic Scn 6
1	1	Jan 1, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
2	1	Jan 2, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
3	1	Jan 3, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
4	1	Jan 4, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
5	1	Jan 5, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
6	1	Jan 6, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
7	1	Jan 7, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
8	1	Jan 8, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
9	1	Jan 9, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
10	1	Jan 10, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
11	1	Jan 11, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
12	1	Jan 12, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
13	1	Jan 13, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
14	1	Jan 14, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
15	1	Jan 15, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	0.000
16	1	Jan 16, 1977	CT	330.363	330.363	0.000	0.000	0.000	0.000	[illegible]
17	1	Jan 17, 1977	CT	330.36[illegible]		0.000	0.000	0.000	[illegible]	
18	1	Jan 18 1977	[illegible]			0.000	[illegible]			
19										

Load Table

The load table, load_data.sas7bdat, contains data on actual utility loads from the past that can be used for forecasting. The table should:

- Be provided at the hourly grain for handling sub-hourly grains.
- Have at a minimum 3 years of history, up to 15 years if possible.

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UTIL_LOC_DIM_RK	Util Loc Dim Key	Record number of the utility in the table UTIL_LOC_DIM. See "Utility Table" on page 54.	8	Num	12.	12.	1
LOAD_DTTM	Datetime	Date and Time of reading	8	Num	NLDATM21.	NLDATM21.	06Jul1961:08:00:00

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UTIL_LOC_CD	Util Loc	Utility Identifier	30	Char	$30.	$30.	CT
LOAD_DT	Date	Month and Day of reading	8	Num	NLDATEM14.	NLDATE20.	0719
LOAD_HR_NO	Hour Ending	Hour of reading	8	Num	BEST12.	12.	23
LOAD_MW_NO	MW	The load reading	8	Num	BEST12.	12.	3935

The following is a sample load table: load_data.

VIEWTABLE: load_data

	Util Loc Dim Key	Datetime	Util Loc	Date	Hour Ending	MW
1	1	01Mar2003:01:00:00	CT	Mar 1, 2003	1	3386
2	1	01Mar2003:02:00:00	CT	Mar 1, 2003	2	3258
3	1	01Mar2003:03:00:00	CT	Mar 1, 2003	3	3189
4	1	01Mar2003:04:00:00	CT	Mar 1, 2003	4	3157
5	1	01Mar2003:05:00:00	CT	Mar 1, 2003	5	3166
6	1	01Mar2003:06:00:00	CT	Mar 1, 2003	6	3255
7	1	01Mar2003:07:00:00	CT	Mar 1, 2003	7	3430
8	1	01Mar2003:08:00:00	CT	Mar 1, 2003	8	3684
9	1	01Mar2003:09:00:00	CT	Mar 1, 2003	9	3977
10	1	01Mar2003:10:00:00	CT	Mar 1, 2003	10	4129
11	1	01Mar2003:11:00:00	CT	Mar 1, 2003	11	4137
12	1	01Mar2003:12:00:00	CT	Mar 1, 2003	12	4053
13	1	01Mar2003:13:00:00	CT	Mar 1, 2003	13	3935
14	1	01Mar2003:14:00:00	CT	Mar 1, 2003	14	3850
15	1	01Mar2003:15:00:00	CT	Mar 1, 2003	15	3804
16	1	01Mar2003:16:00:00	CT	Mar 1, 2003	16	3799
17	1	01Mar2003:17		Mar 1, 2003		
18						

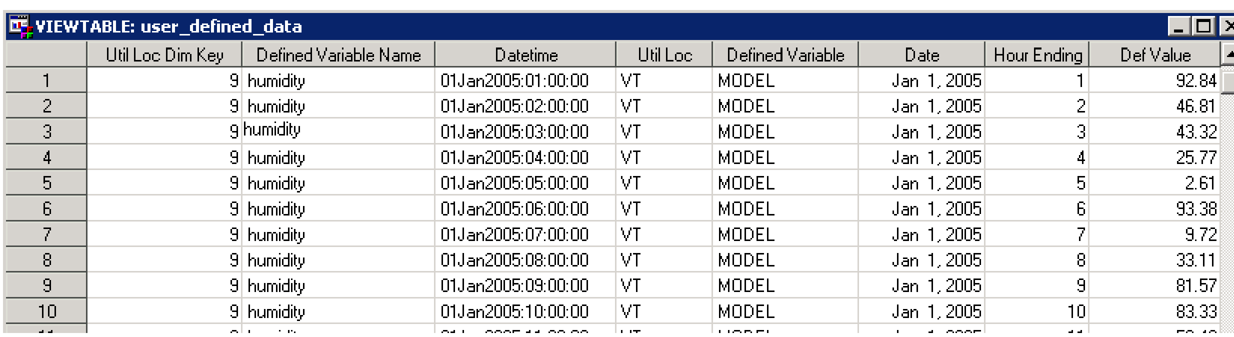
User-Defined Data Table

The user-defined data table, user_defined_data.sas7bdat, contains additional, user-defined variables as independent variables/effects in the prediction process. For example, you can include variables for humidity, customer counts, etc. See Chapter 8, “Add Additional Variables as Parameters,” on page 67.

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UTIL_LOC_DIM_RK	Util Loc Dim Key	Row of utility in utility table	8	Num	12.	12.	2

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UD_TYPE_COL_NM	Defined Variable Name	Name of variable	32	Char	$32.	$32.	humidity
UD_DTTM	Datetime	Date and Time of reading	8	Num	NLDATM21.	NLDATM21.	06Jul1961:08:00:00
UTIL_LOC_CD	Util Loc	Location of utility	20	Char	$20.	$20.	CT
UD_TYPE_CD	Defined Variable	Type of variable. Valid values are: CLASS MODEL	8	Char	$10.	$10.	MODEL
UD_DT	Date	Day of year	8	Num	NLDATEM14.	NLDATE20..	10FEB20081
UD_HR_NO	Hour Ending	Hour of reading	8	Num	BEST12.	12.	23
UD_NO	Def Value	Numeric value of the variable	8	Num	BEST12.	12.	72.45

The following picture shows a sample user-defined data table.


VIEWTABLE: user_defined_data

	Util Loc Dim Key	Defined Variable Name	Datetime	Util Loc	Defined Variable	Date	Hour Ending	Def Value
1	9	humidity	01Jan2005:01:00:00	VT	MODEL	Jan 1, 2005	1	92.84
2	9	humidity	01Jan2005:02:00:00	VT	MODEL	Jan 1, 2005	2	46.81
3	9	humidity	01Jan2005:03:00:00	VT	MODEL	Jan 1, 2005	3	43.32
4	9	humidity	01Jan2005:04:00:00	VT	MODEL	Jan 1, 2005	4	25.77
5	9	humidity	01Jan2005:05:00:00	VT	MODEL	Jan 1, 2005	5	2.61
6	9	humidity	01Jan2005:06:00:00	VT	MODEL	Jan 1, 2005	6	93.38
7	9	humidity	01Jan2005:07:00:00	VT	MODEL	Jan 1, 2005	7	9.72
8	9	humidity	01Jan2005:08:00:00	VT	MODEL	Jan 1, 2005	8	33.11
9	9	humidity	01Jan2005:09:00:00	VT	MODEL	Jan 1, 2005	9	81.57
10	9	humidity	01Jan2005:10:00:00	VT	MODEL	Jan 1, 2005	10	83.33

Utility Table

This utility table, util_loc_dim.sas7bdat, contains the list of utilities.

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UTIL_LOC_DIM_RK	Util Loc Dim Key	Key field for this table	8	Num	12.	12.	1
UTIL_LOC_CD	Util Loc	ID of the utility	20	Char	$30.	$30.	MASS

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UTIL_LOC_NM	Util Loc Name	Name of the utility	60	Char	$60.	$60.	Massachusetts
UTIL_LOC_DESC	Util Loc Description	Description of the utility	150	Char	$150.	$150.	Massachusetts region
PARENT_UTIL_LOC_CD	Parent Util Loc	ID of the parent utility	30	Char	$30.	$30.	NE
UTIL_LEVEL_TYPE_RK	Util Level Type Key	Type of level	8	Num	12.	12.	1
LONGITUDE_NO	Util Loc Longitude	Longitude of the utility	8	Num	BEST12.	12.	123
LATITUDE_NO	Util Loc Latitude	Latitude of the utility	8	Num	BEST12.	12.	123

The following is a sample utility table: util_loc_dim.

VIEWTABLE: util_loc_dim

	Util Loc Dim Key	Util Loc	Util Loc Name	Util Loc Desc	Parent Util Loc	Util Level Type Key	Utl Loc Longitude	Utl Loc Latitude
1	1	CT	Connecticut	Connecticut zone	NEISO	.	.	.
2	2	MASS	Massachusetts	Massachusetts region	NEISO	.	.	.
3	3	ME	Maine	Maine zone	NEISO	.	.	.
4	4	NEISO	New England ISO	New England ISO Company		.	.	.
5	5	NEMASSBO	NE Mass and Boston	Massachusetts and Boston zone	MASS	.	.	.
6	6	NH	New Hampshire	New Hampshire zone	NEISO	.	.	.
7	7	RI	Rhode Island	Rhode Island zone	NEISO	.	.	.
8	8	SEMASS	SE Mass	Southeast Massachusetts zone	MASS	.	.	.
9	9	VT	Vermont	Vermont zone	NEISO	.	.	.
10	10	WCMASS	Western and Central Mass	Western and Central Massachusetts zone	MASS	.	.	.

Utility/Weather Crossing Table

This utility/weather crossing table, util_loc_x_wthr_loc.sas7bdat, maps the utility location to its associated weather station.

Note: Currently, the only valid value for Wthr Station Weight is 100 (100%).

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UTIL_LOC_DIM_RK	Util Loc Dim Key	Key field for this table	8	Num	12.	12.	1
WTHR_LOC_DIM_RK	Wthr Loc Dim Key	Key field for this table	8	Num	12.	12.	1

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
UTIL_LOC_CD	Util Loc	ID of the utility	20	Char	$30.	$30.	MASS
WTHR_LOC_CD	Wthr Station	ID of the weather station	30	Char	$30.	$30.	KPWM
UTIL_WTHR_WEIGHT_RT	Wthr Station Weight	Percentweight to give to this station	8	Num	NLNUM9.4	NLNUM9.4	100

The following is a sample table util_loc_x_wthr_loc

VIEWTABLE: util_loc_x_wthr_loc

	Util Loc Dim Key	Wthr Loc Dim Key	Util Loc	Wthr Station	Wthr Station Weight
1	1	1	CT	KBDL	100.0000
2	2	8	MASS	KMASS	100.0000
3	3	2	ME	KPWM	100.0000
4	4	9	NEISO	KNEISO	100.0000
5	5	3	NEMASSBOST	KBOS	100.0000
6	6	4	NH	KCON	100.0000
7	7	5	RI	KPVD	100.0000
8	8	5	SEMASS	KPVD	100.0000
9	9	6	VT	KBTV	100.0000
10	10	7	WCMASS	KORH	100.0000

Weather Station Table

The weather station table, wthr_loc_dim, contains the list of weather stations.

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
WTHR_LOC_DIM_RK	Wthr Loc Dim Key	Key field for this table	8	Num	12.	12.	1
WTHR_LOC_CD	Wthr Station	ID of the weather station	30	Char	$30.	$30.	KPWM
WTHR_LOC_NM	Weather Station Name	Name of the weather station	60	Char	$60.	$60..	Logan Int Airport
WTHR_LOC_DESC	Wthr Station Desc	Description of the weather station	150	Char	$150.	$150.	Boston Logan International Airport 1 Harborside Dr Boston MA
PARENT_WTHR_LOC_CD	Rollup Wthr Station	ID of the parent utility	30	Char	$30.	$30.	NE

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
LONGITUDE_NO	Wthr Station Longitude	Longitude of the weather station	8	Num	BEST12.	12.	123
LATITUDE_NO	Wthr Station Latitude	Latitude of the weather station	8	Num	BEST12.	12.	123

The following is a sample weather stations table: wthr_loc_dim.

VIEWTABLE: wthr_loc_dim

	Wthr Loc Dim Key	Wthr Station	Wthr Station Name	Wthr Station Desc	Rollup Wthr Station	Wthr Station Longitude	Wthr Station Latitude
1	1	KBDL	Bradley Int Airport	Bradley International Airport Schoephoester Rd Windsor Locks CT		.	.
2	2	KPWM	Portland Int Airport	Portland International Jetport 1001 Westbrook St Portland ME		.	.
3	3	KBOS	Logan Int Airport	Boston Logan International Airport 1 Harborside Dr Boston MA		.	.
4	4	KCON	Concord Municipal Airport	Concord Municipal Airport Concord New Hampshire		.	.
5	5	KPVD	TF Green Airport	T. F. Green Airport 2000 Post Rd Warwick RI		.	.
6	6	KBTV	Burlington Int Airport	Burlington International Airport Burlington VT		.	.
7	7	KORH	Worcester Regional Airport	Worcester Regional Airport 375 Airport Dr Worcester MA		.	.
8	8	KMASS	Massachusetts region	Mean of KBOS KPVD and KORH		.	.
9	9	KNEISO	New England Company	Mean of all New England weather stations		.	.

Weather Data Table

The weather data table, wthr_data.sas7bdat, is used as a source data for load forecasting. The temperature data can be several types of data such as Fahrenheit and Centigrade. The type is specified in the field WTHR_TYPE_CD.

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
WTHR_HR_NO	Hour Ending	Hour of reading	8	Num	BEST12.	12.	23
WTHR_LOC_DIM_RK	Wthr Loc Dim Key	Record number of the utility in the table UTIL_LOC_DIM	8	Num	12.	12.	1
WTHR_TYPE_CD	Wthr Variable	The type of data contained in the column WTHR_NO	15	Char	$15.	$15.	TEMPF
WTHR_DTTM	Datetime	Date and Time of reading	8	Num	NLDATM21.	NLDATM21.	06Jul1961:08:00:00
WTHR_LOC_CD	Wthr Station	Weather station Identifier	30	Char	$30.	$30.	TEMPF

Column name	Column label	Description	Length	Type	Format	Informat	Sample Value
WTHR_DT	Date	Month and Day of reading	8	Num	NLDATEM14.	NLDATE20.	0719
WTHR_NO	Wthr Value	The reading (e.g., Fahrenheit temperature or Centigrade temperature)	8	Num	BEST12.	12.	72

The following is a sample weather table: wthr_data.

VIEWTABLE: wthr_data

	Hour Ending	Wthr Loc Dim Key	Wthr Variable	Datetime	Wthr Station	Date	Wthr Value
1	1	1	TEMPF	01Jan1961:01:00:00	KBDL	01/01/61	19
2	2	1	TEMPF	01Jan1961:02:00:00	KBDL	01/01/61	21
3	3	1	TEMPF	01Jan1961:03:00:00	KBDL	01/01/61	23
4	4	1	TEMPF	01Jan1961:04:00:00	KBDL	01/01/61	24
5	5	1	TEMPF	01Jan1961:05:00:00	KBDL	01/01/61	25
6	6	1	TEMPF	01Jan1961:06:00:00	KBDL	01/01/61	26
7	7	1	TEMPF	01Jan1961:07:00:00	KBDL	01/01/61	27
8	8	1	TEMPF	01Jan1961:08:00:00	KBDL	01/01/61	28
9	9	1	TEMPF	01Jan1961:09:00:00	KBDL	01/01/61	30
10	10	1	TEMPF	01Jan1961:10:00:00	KBDL	01/01/61	31
11	11	1	TEMPF	01Jan1961:11:00:00	KBDL	01/01/61	32
12	12	1	TEMPF	01Jan1961:12:00:00	KBDL	01/01/61	34
13	13	1	TEMPF	01Jan1961:13:00:00	KBDL	01/01/61	34
14	14	1	TEMPF	n1961:14:00:00	KBDL		
15				an1961:15:00:00			

Chapter 6

Modify the Parameter Templates

Introduction

The parameters to be displayed on the New Definition dialogs are defined in template files. You can modify these template files, for example, to change the default value of the parameters.

By default, the template files are located in **`C:\SAS\Config\Lev1\SASApp\Data\EnergyForecasting\Templates`**.

The following table shows the schema for a template file.

Column Name	Type	Description
name	char (256)	The parameter name (e.g. 'utility' or 'weight_num')
value	char (256)	The parameter value to be used by the forecasting macros (e.g. 'CT')
lbl	char (256)	The label to be used in the UI (e.g. 'Utility Code'). An attempt to look up localized string using the name parameter occurs first, if found it is used. If one doesn't exist then use lbl.
type	char (20)	The parameter type, used in the UI to identify the type of input control and format (supported values: char, num, date9)
min	num	The min value used in the UI for validation when the type is num.
max	num	The max value used in the UI for validation when the type is num

Column Name	Type	Description
choice	char (256)	List of choices to be presented in the UI (e.g. mape has the list of choices 'hourly_mape, daily_mape, daily_peak_mape, monthly_mape, monthly_peak_mape, annual_mape, annual_peak_mape'
grp_1	char (30)	The first order of grouping used in the UI (tab)
grp_2	char (30)	The second order of grouping used in the UI (sub group)

The following template files are supplied on installation of the product:

- "PARM_VSTLF" on page 60
- "PARM_STLF" on page 61
- "PARM_MTLTLF" on page 61
- "PARM_VSEL" on page 62

PARM_VSTLF

The table parm_vstlf contains the parameters for a Foundation very short term load forecast.

Name	Label	Sample value	Type	Options
hist_start_date	Historical Start Date	01JAN2005	date9	n/a
fcst_start_date	Forecast Start Date	01JAN2010	date9	n/a
fcst_start_hour	Forecast Start Hour	1	num	n/a
fcst_length	Forecast Length	24	num	n/a
reporting_mart	Reporting Mart	SAS	char	SAS, HANA, NONE
reporting_sas_data_model	Reporting SAS Data Model	Normalized	char	Normalized, Denormalized, Both
hana_server	HANA Server	hana.abc.com	char	n/a
hana_instance	HANA Instance	02	char	n/a
hana_schema	HANA Schema	SEFHanaSchema	char	n/a
hana_authdomain	HANA Authentication Domain	sefsaphana_auth	char	n/a
sefvs_init_exit	Forecast Initialization Exit	C:\sef\init.sas	char	n/a
sefvs_rpt_exit	Reporting Exit	C:\sef\report.sas	char	n/a

Name	Label	Sample value	Type	Options
sefvs_term_exit	Forecast Completion Exit	C:\sef\term.sas	char	n/a

PARM_STLF

The table parm_stlf contains the parameters for a Foundation short term load forecast.

Name	Label	Sample value	Type	Options
hist_start_date	Historical Start Date	01JAN2005	date9	n/a
fcst_start_date	Forecast Start Date	01JAN2010	date9	n/a
fcst_end_date	Forecast End Date	07JAN2010	date9	n/a
reporting_mart	Reporting Mart	SAS	char	SAS, HANA, NONE
reporting_sas_data_model	Reporting SAS Data Model	Normalized	char	Normalized, Denormalized, Both
hana_server	HANA Server	hana.abc.com	char	n/a
hana_instance	HANA Instance	02	char	n/a
hana_schema	HANA Schema	SEFHanaSchema	char	n/a
hana_authdomain	HANA Authentication Domain	sefsaphana_auth	char	n/a
sefsh_init_exit	Forecast Initialization Exit	C:\sef\init.sas	char	n/a
sefsh_rpt_exit	Reporting Exit	C:\sef\report.sas	char	n/a
sefsh_term_exit	Forecast Completion Exit	C:\sef\term.sas	char	n/a

PARM_MTLTLF

The table parm_mtltlf contains the parameters for a Foundation medium term or long term load forecast.

Name	Label	Sample value	Type	Options
hist_t_start	Historical T Start	01JAN2005	date9	n/a
hist_t_end	Historical T End	31DEC2010	date9	n/a

Name	Label	Sample value	Type	Options
hist_load_start_dt	Historical Load Start Date	01JAN2004	date9	n/a
hist_load_end_dt	Historical Load End Date	01JAN2005	date9	n/a
fcst_end_dt	Forecast End Date	31DEC2013	date9	n/a
num_scenarios	Number of Scenerios	2	num	n/a
mtlt_assumption	MLT Assumption	1	num	n/a
reporting_mart	Reporting Mart	SAS	char	SAS, HANA, NONE
reporting_sas_data_model	Reporting SAS Data Model	Normalized	char	Normalized, Denormalized, Both
hana_server	HANA Server	hana.abc.com	char	n/a
hana_instance	HANA Instance	02	char	n/a
hana_schema	HANA Schema	SEFHanaSchema	char	n/a
hana_authdomain	HANA Authentication Domain	sefsaphana_auth	char	n/a
sefml_init_exit	Forecast Initialization Exit	C:\sef\init.sas	char	n/a
sefml_rpt_exit	Reporting Exit	C:\sef\report.sas	char	n/a
sefml_term_exit	Forecast Completion Exit	C:\sef\term.sas	char	n/a

PARM_VSEL

The table parm_vsel contains the parameters for a Foundation diagnose.

Name	Label	Sample value	Type	Options
weight_num	Weight	4	num	n/a
weight_lower	Weight Lower	0.8	num	n/a
weight_upper	Weight Upper	0.95	num	n/a
train_start_date	Training Start Date	01JAN2010	date9	n/a
rolling_start_date	Rolling Start Date	01JAN2010	date9	n/a
rolling_end_date	Rolling End Date	12AUG2013	date9	n/a
sub_hour	Sub Hour	7	num	n/a

Name	**Label**	**Sample value**	**Type**	**Options**
sub_date_offset	Sub Date Offset	1	num	n/a
mape	MAPE	hourly_mape	char	hourly_mape daily_mape daily_peak_mape monthly_mape monthly_peak_mape annual_mape annual_peak_mape
w_hourly_mape	Weight Hourly MAPE	0.25	num	n/a
w_daily_mape	Weight Daily MAPE	0.25	num	n/a
w_daily_peak_mape	Weight Daily Peak MAPE	0	num	n/a
w_monthly_mape	Weight Monthly MAPE	0.25	num	n/a
w_monthly_peak_mape	Weight Monthly Peak MAPE	0	num	n/a
w_annual_mape	Weight Annual MAPE	0.25	num	n/a
w_annual_peak_mape	Weight Annual Peak MAPE	0	num	n/a
mape_improvement	Mape Improvement	0.0001	num	n/a
outlier_percent	Outlier Percent	0.001	num	n/a
residual_hist_length	Residual History Length	504	num	n/a
combine_fcst	Combine Forecast	1234	char	n/a
poly_order	Poly Order	3	num	n/a
ape_cutoff	APE Cutoff	0.3	num	n/a
two_stage	Two Stage	YES	char	YES, NO
default_wthr_type_cd	Default Weather Type Code	TEMPF	char	n/a
wls	WLS	YES	char	YES, NO
add_var	Additional Modeling Variables	wind humidity	char	n/a
add_class	Additional Class Variables	MONTH WEEKDAY	char	n/a
utility	Utility Code	UNITEDILL	char	n/a
num_cpu	Number of CPUs	8	num	n/a
staged_data_path	Input Path	N:/ULF/Data/Staged	char	n/a

Name	Label	Sample value	Type	Options
data_model	Data Model	3.1	char	3.1, 2
fix_date_holiday_list	Fixed Date Holidays	1 5 8 10	char	n/a
sefdg_init_exit	Diagnose Initialization Exit	C:\sef\init.sas	char	n/a
sefdg_term_exit	Diagnose Completion Exit	C:\sef\term.sas	char	n/a

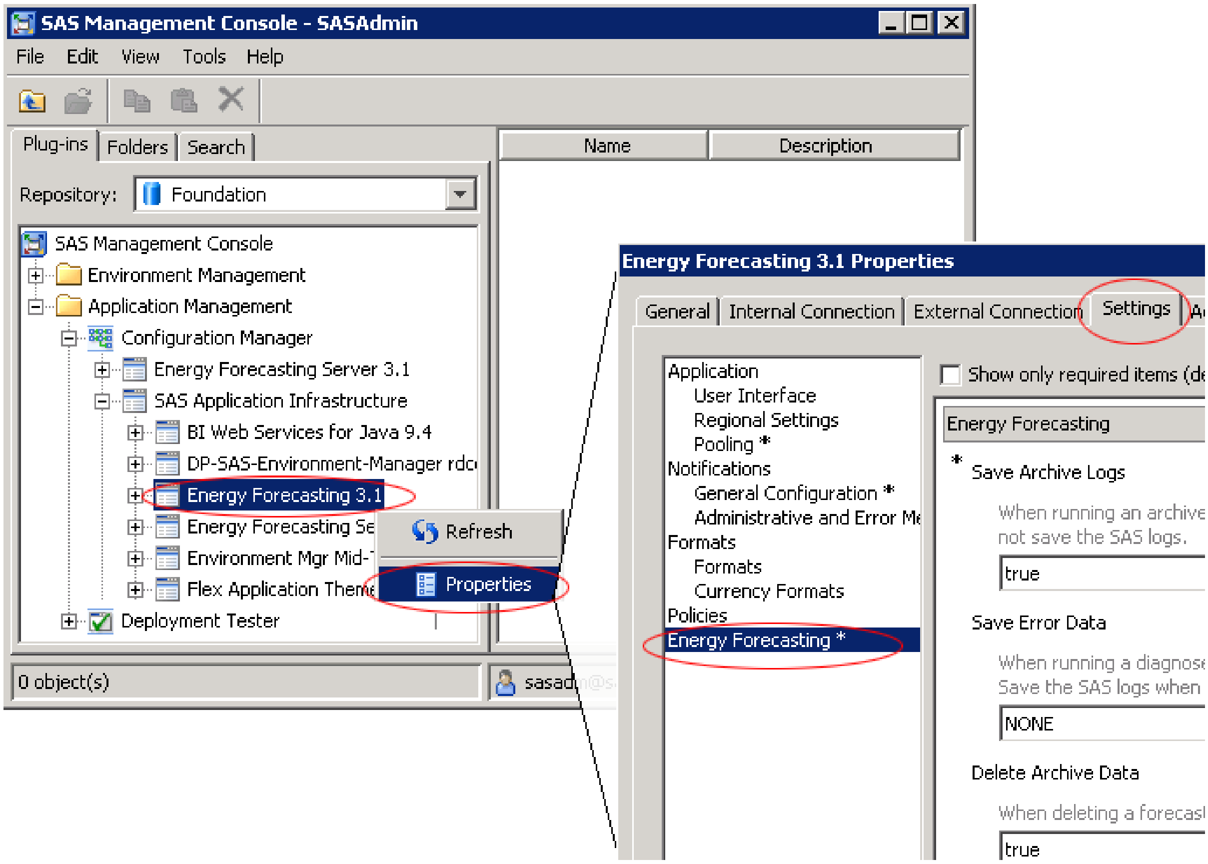
Chapter 7
Modify Application Settings

Application Settings

To modify SAS Energy Forecasting settings:

1. Open SAS Management Console as an administrator.
2. On the **Plug-ins** tab, right-click **Application Management** ⇨ **Configuration Manager** ⇨ **SAS Application Infrastructure** ⇨ **Energy Forecasting Server 3.1** and select **Properties**.

   The Energy Forecasting Properties window opens.
3. Click the **Settings** tab.
4. On the left-hand side of the Properties window, select **Energy Forecasting**.
5. Select and modify the properties that you want.


SAS Management Console - SASAdmin
File Edit View Tools Help
Plug-ins Folders Search
Repository: Foundation
Name Description
SAS Management Console
Environment Management
Application Management
Configuration Manager
Energy Forecasting Server 3.1
SAS Application Infrastructure
BI Web Services for Java 9.4
Energy Forecasting 3.1
Refresh
Properties
Deployment Tester
0 object(s)
Energy Forecasting 3.1 Properties
General Internal Connection External Connection Settings
Application
User Interface
Regional Settings
Pooling *
Notifications
General Configuration *
Formats
Formats
Currency Formats
Policies
Energy Forecasting *
Energy Forecasting
* Save Archive Logs
not save the SAS logs.
true
Save Error Data
NONE
Delete Archive Data
true

Chapter 8

Add Additional Variables as Parameters

Overview

By default, SAS Energy Forecasting uses the load history and temperature history to predict what the demand load is going to be in the future. For medium/long term forecasting, it also uses economic scenarios. However, you can include additional variables as independent variables/effects in the prediction process. For example, you can include variables for humidity, customer counts, etc. To include additional variables, you must:

1. "Supply a Data Set with the Additional Variables and Their Data" on page 67
2. "Specify the Additional Variables as Parameters in the UI" on page 68

Supply a Data Set with the Additional Variables and Their Data

The data set containing the additional variables and their data must be a standard SAS data set named *user_defined_data*. It must contain a datetime column; and the range of dates must be consistent with other incoming data. It can contain one or more numeric variables to be used as additional variables. For more information, see "User-Defined Data Table" on page 53.

The following picture shows a sample data set.

VIEWTABLE: user_defined_data

	Util Loc Dim Key	Defined Variable Name	Datetime	Util Loc	Defined Variable	Date	Hour Ending	Def Value
1	9	humidity	01Jan2005:01:00:00	VT	MODEL	Jan 1, 2005	1	92.84
2	9	humidity	01Jan2005:02:00:00	VT	MODEL	Jan 1, 2005	2	46.81
3	9	humidity	01Jan2005:03:00:00	VT	MODEL	Jan 1, 2005	3	43.32
4	9	humidity	01Jan2005:04:00:00	VT	MODEL	Jan 1, 2005	4	25.77
5	9	humidity	01Jan2005:05:00:00	VT	MODEL	Jan 1, 2005	5	2.61
6	9	humidity	01Jan2005:06:00:00	VT	MODEL	Jan 1, 2005	6	93.38
7	9	humidity	01Jan2005:07:00:00	VT	MODEL	Jan 1, 2005	7	9.72
8	9	humidity	01Jan2005:08:00:00	VT	MODEL	Jan 1, 2005	8	33.11
9	9	humidity	01Jan2005:09:00:00	VT	MODEL	Jan 1, 2005	9	81.57
10	9	humidity	01Jan2005:10:00:00	VT	MODEL	Jan 1, 2005	10	83.33

The data set must reside in the standard staging location (the same location as the input files) prior to running either a diagnose or forecast. See “Input Path” on page 179.

Specify the Additional Variables as Parameters in the UI

There are two parameters in the user interface that you must specify to make your additional variables known to SAS Energy Forecasting:

Additional Modeling Variables

This parameter appears on the **Advanced** tab of Foundation Diagnose parameters. See “Additional Modeling Variables” on page 178.

Separate multiple variables with a single blank. Do not use quotes.

Variables that you specify in this field are used in the MODEL statement of PROC GLM as independent effects. They must contain hourly data.

Note: The column name of the **Additional Modeling Variable**s field in the parm_vsel table is add_var.

Additional Class Variables

This parameter appears on the **Advanced** tab of Foundation parameters as **Additional Class Variables**. See “Additional Class Variables” on page 178.

Separate multiple variables with a single blank. Do not use quotes.

Variables that you specify in this field are used in the CLASS statement of PROC GLM as additional class variables as shown in the following example:

```
proc GLM data = glm_data noprint;
    CLASS Month Weekday HE &add_class;
    MODEL load= trend Weekday*HE Month Month*t0_p1 Month*t0_p2 Month*t0_p3
                HE*t0_p1 HE*t0_p2 HE*t0_p3
                &recency_step2_var
                &recenty_step3_var
                &add_var
         /
          p
          clm
          ss1
          ss3
          solution
          SINGULAR=1E-07;
    weight &wls_weight;
    output out=fcst_results predicted = predicted_load lclm=lower95 uclm=upper95;
```

```
run;
quit;
```

Note: The column name of the **Additional Class Variables** field in the parm_vsel table is add_class.

Chapter 9

Archive Results Data

Overview

SAS Energy Forecasting is very data intensive—it uses large amounts of data and generates large amounts of data. Unless you systematically clean up your result data sets, you risk using up your disk space. SAS Energy Forecasting provides methods to archive your forecasting and diagnose results so that you can:

- free up sufficient disk space for the application to run
- preserve selected result data so that you can justify your forecasting to regulatory bodies.

To archive data, run the SAS macro %sefarche on the data tier to signal SAS Energy Forecasting to archive result data.

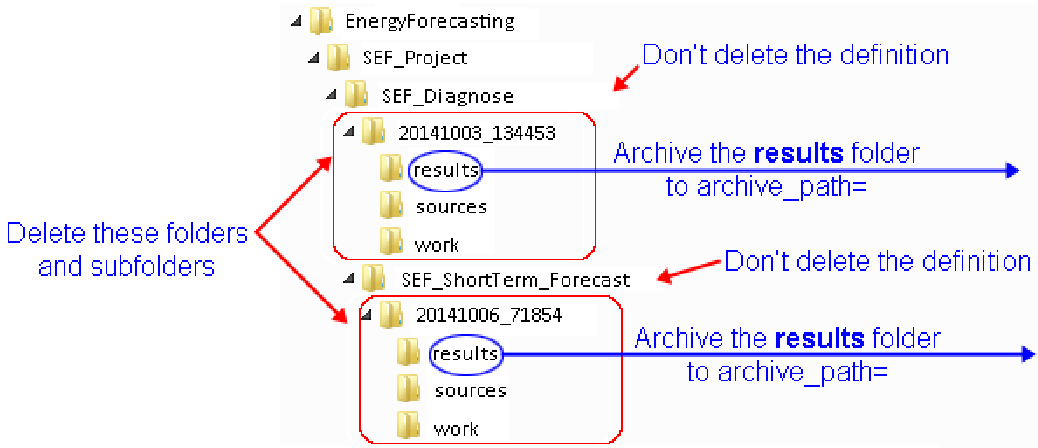
By default, all the **results** folders are archived for every diagnose and forecast definition in every project. However, you can limit what is archived. See the following:

- “Specify Files to Archive by Date” on page 75
- “Specify Files to Archive by Name” on page 76
- “Specify Files to Archive by Name and Date” on page 78

As part of archiving, when a **results** folder is archived the following folders are deleted:

- the **results** folder itself
- the parent folder of the **results** folder
- the sibling folders of the **results** folder (**sources** and **work**)

All that remains by default are the archived files in the archive location and the diagnose and forecast definitions. The following picture shows one diagnose **results** folder and one forecast **results** folders being archived. The parent folders of the **results** folders are deleted along with the **results** siblings. The diagnose and forecast definitions are not touched by the archiving.



Only diagnose result files and forecast result files whose state is SUCCESS or COMPLETE_WARNING are archived. If an error is encountered during archiving, then a file whose status was SUCCESS is not archived and its status is changed to ARCHIVE_PENDING. And a file whose status was COMPLETE_WARNING is not archived and its status is changed to ARCHIVE_PENDING_WARNING. The next time archiving takes place, files in either PENDING state are attempted to be archived. If the archiving is successful, then the file status is changed back to SUCCESS and COMPLETE_WARNING respectively (in its archived location).

Macro %sefarche

Overview

Run the SAS macro %sefarche on the data tier to signal SAS Energy Forecasting to archive your result data. Only one instance of the macro can run at a time.

Syntax

The syntax of the macro is the following:

```
%sefarche(archive_path=<base_path>);
```

where the value of **archive_path=** is a complete file path. For example:

```
%sefarche(archive_path=C:\sef_archive;
```

The file path that you specify can be local to the data tier or it can be on a remote machine that is accessible by the data tier. The file path is the base path for archiving.

Note:

- The parameter **archive_path=** is optional. You can also specify an archive path by specifying the property, ENFC.Archive.path, in SAS Management Console. See "ENCF.Archive.path" on page 74. If ENFC.Archive.path is specified, then if you also specify the parameter archive_path= the parameter overrides ENFC.Archive.path.

- Make sure that the user Energy Forecasting Server User has permission to write to the directories that are created by the archiving process. The user Energy Forecasting Server User is created upon installation of SAS Energy Forecasting. On a Windows system, you grant permission by right-clicking a folder and selecting **Properties**. Then click the **Security** tab.
- Make sure, also, that the user Energy Forecasting Server User has the following capabilities:
- Delete Diagnose Results
- Delete Forecast Results
- Energy Forecasting User

See "Create Roles" on page 32.

The archiving process creates the following subdirectories under this base path:

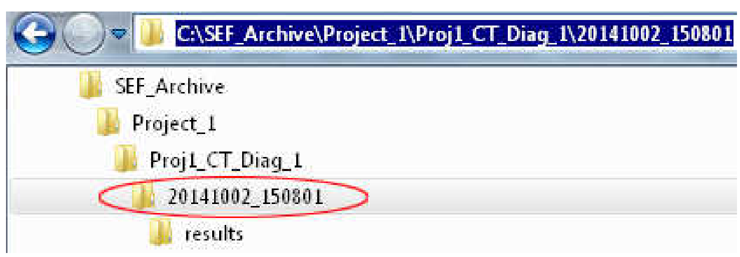
Diagnose archive subdirectories

For each diagnose that is archived, a subdirectory is created using the following naming convention:

```
<base_path>\project_name\diagnose_definition_name\diagnose_results_name
```

For example: **`C:\SEF_Archive\Project_1\Proj1_CT_Diag_1\20141002_150801`**.

The following picture shows a sample diagnose archive subdirectory whose base path is **`C:\SEF_Archive`**.



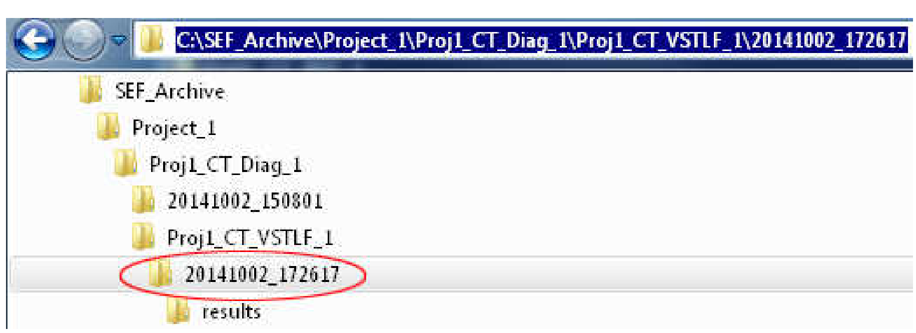
Forecast archive subdirectories

For each forecast that is archived, a subdirectory is created using the following naming convention:

```
<base_path>\project_name\forecast_definition_name\forecast_results_name
```

For example: **`C:\SEF_Archive\Project_1_CT_Diag_1\Proj1_CT_VSTLF_1\20141002_172617`**.

The following picture shows a sample forecast archive subdirectory whose base path is **`C:\SEF_Archive`**.



ENCF.Archive.path

You can specify an archive path by specifying the metadata property **ENFC.Archive.path** in SAS Management Console. To set the property:

1. Open SAS Management Console as an administrator.
2. On the **Plug-ins** tab, right-click **Application Management** ⇨ **Configuration Manager** ⇨ **SAS Application Infrastructure** ⇨ **Energy Forecasting 3.1** and select **Properties**.

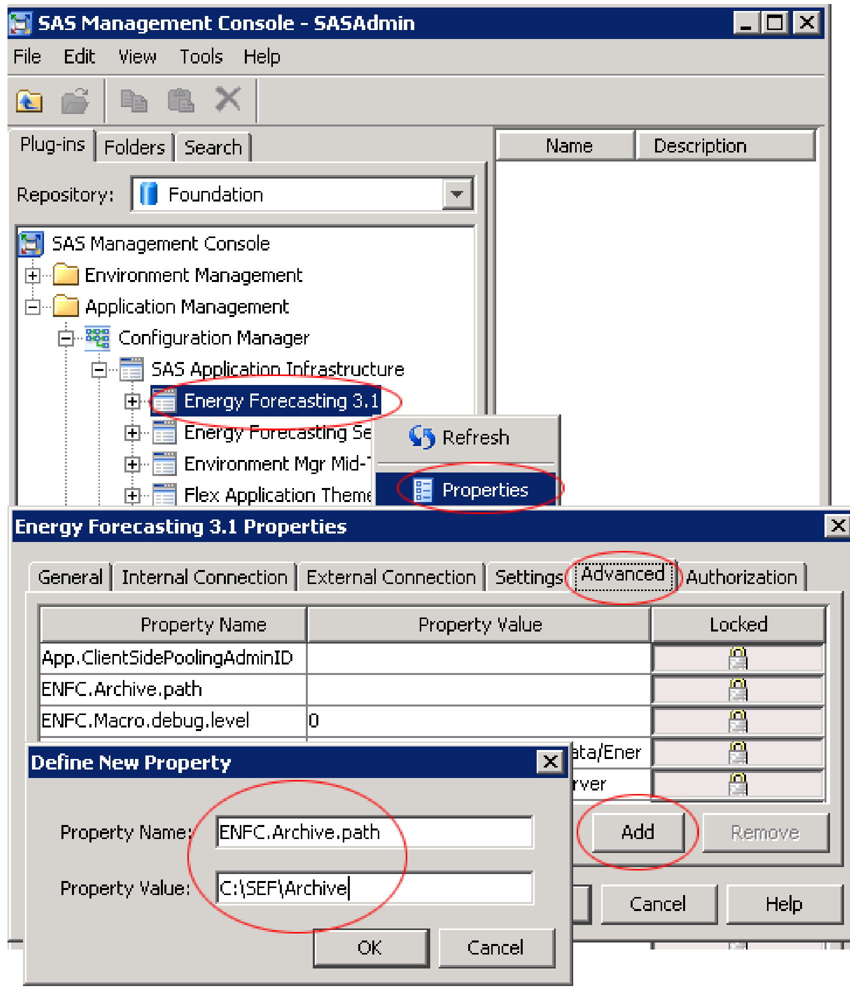
   The Energy Forecasting Properties window opens.
3. Select the **Advanced** tab, and then do one of the following:
   - If the **ENFC.Archive.path** property does not exist, then:
     1. click **Add**.

        The Define New Property window opens.
     2. On the Define New Property window, specify the following:

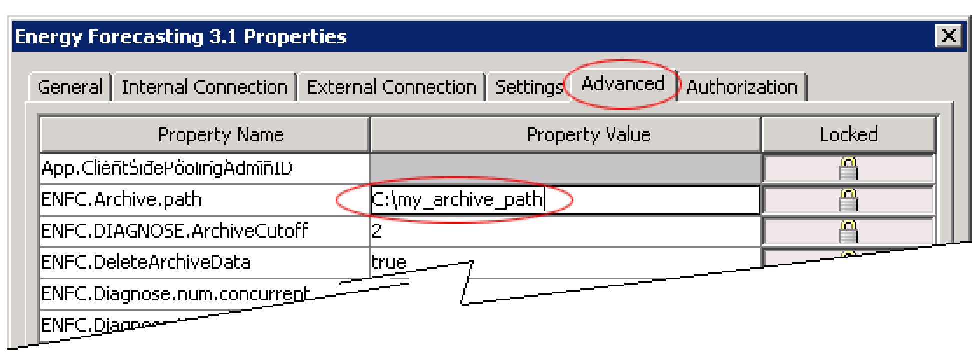
     Property Name
     Specify **ENFC.Archive.path**

     Property Value
     Specify a complete path. The file path that you specify can be local to the data tier or it can be on a remote machine that is accessible by the data tier. The file path is the base path for archiving.

     Note: You must restart the data tier server for the change to take effect.



- If the **ENFC.Archive.path** property already exists, then specify a complete path as its **Property Value**.The file path that you specify can be local to the data tier or it can be on a remote machine that is accessible by the data tier. The file path is the base path for archiving.



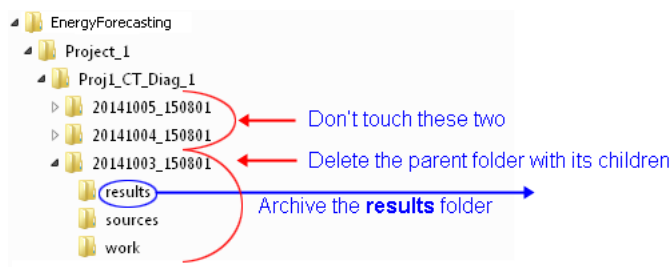
Specify Files to Archive by Date

You can control which result files are archived by specifying how old they must be to be archived. To control what files are archived, you modify settings with SAS Management

Console. For information on modifying these settings, see "Application Settings" on page 65. The settings are the following::

Keep this number of diagnose results
Specifies how many of the most recent diagnose results are to be kept—the rest are archived and then deleted. For example, suppose you enter 2. Then for each diagnose definition, results that are older than the 2 most recent results are archived and deleted. For example, as the following picture shows:

- the two newest diagnose results are left alone
- one older one is archived (that is, its **results** folder is archived)
- and it is deleted (that is, its parent folder is deleted along with its children—the **results**, **sources**, and **work** folders.



Archive MTLT forecast results older than this many weeks
Specifies how many weeks old a medium term/long term forecast must be to be archived. For example, suppose you enter 8. Then, for each MTLTLF definition, all of its forecast results that are older than 8 weeks are archived—that is, the **results** folder is archived. And it is deleted—that is, its parent folder is deleted along with its children (the **results**, **sources**, and **work** folders).

Archive ST forecast results older than this many days
Specifies how many days old a short term forecast must be to be archived. For example, suppose you enter 6, Then, for each STLF definition, all of its forecast results that are older than 6 days are archived—(that is, the **results** folder is archived. And it is deleted—that is, its parent folder is deleted along with its children (the **results**, **sources**, and **work** folders).

Archive VST forecast results older than this many hours
Specifies how many hours old a very short term forecast result must be to be archived. For example, suppose you enter 4. Then, for each VSTLF definition, all of its forecast results that are older than 4 hours are archived—that is, the **results** folder is archived. And it is deleted—that is, its parent folder is deleted along with its children (the **results**, **sources**, and **work** folders).

Specify Files to Archive by Name

You can create SAS data sets to specify by name what files are to be archived. The data sets must be named as follows:

archive_diagnose.sas7bdat
Specifies diagnose files to archive.

archive_vstlf.sas7bdat
Specifies very short term load forecasting files to archive.

archive_stlf.sas7bdat
Specifies short term load forecasting files to archive.

archive_mtltlf.sas7bdat
Specifies medium term/long term load forecasting files to archive.

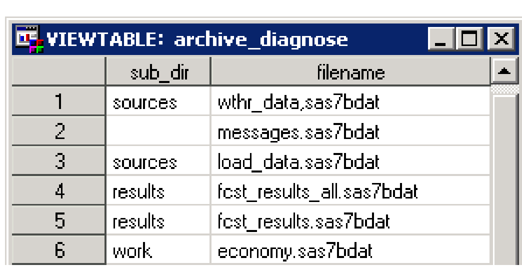
The SAS data sets must contain the following columns:

Column Name	Column Contents
sub_dir	Each row in this column must contain one of the four following string values: **results** Designates files in the **results** subdirectory, **sources** Designates files in the **sources** subdirectory, **work** Designates files in the **work** subdirectory, sas null data set value (**.**) Designates files in the base directory.
filename	Each row in this column contains a string that matches the name of a file to be archived. The file specified must be in the directory specified in the corresponding **sub_dir** column. You must specify the full filename including the file extension, for example .sas7bdat.

There is a set of sample data sets for you to look at and modify. On Windows, they are in the `SAS Home` directory—for example `C:\Program Files\SAS Home\SASFoundation\9.4\enfcsvr\sample`. For further information, refer to the *SAS Energy Forecasting Installation Guide* available at http://support.sas.com/documentation/solutions/ef/.

At run time, these data sets must reside in the same directory as the parameter template files. On Windows, for example, in `C:\SAS\Config\Lev1\AppData\SASEnergyForecasting\templates`. See Chapter 6, "Modify the Parameter Templates," on page 59.

The following picture shows a sample SAS data set, archive_diagnose.



	sub_dir	filename
1	sources	wthr_data.sas7bdat
2		messages.sas7bdat
3	sources	load_data.sas7bdat
4	results	fcst_results_all.sas7bdat
5	results	fcst_results.sas7bdat
6	work	economy.sas7bdat

This sample data set specifies the following:

- In the **sources** directory, archive the following two files:
  - **wthr_data.sas7bdat**
  - **load_data.sas7bdat**
- In the base directory (null in the **sub_dir** field), archive the file **messages.sas7bdat**.
- In the **results** directory, archive the following two files:

- **fcst_results_all.sas7bdat**
- **fcst_results.sas7bdat**

- In the **work** directory, archive the file **economy.sas7bdat**.

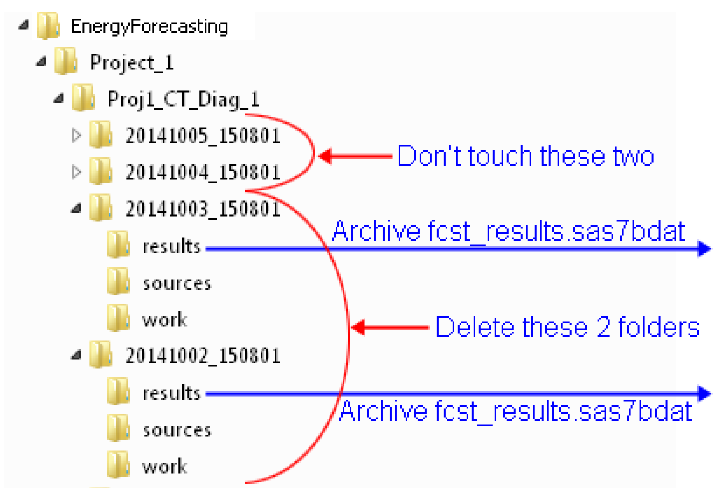
Also, as part of the archiving, the parent folder is deleted along with its children folders —the **results**, **sources**, and **work** folders.

Specify Files to Archive by Name and Date

You can combine specifications of name and date so as to archive specifically named files whose date is older than your specified criterion. For example, suppose that you enter

```
ENFC.DIAGNOSE.ArchiveCutoff=2
```

so as to archive only diagnoses that are older than the two most recent ones. And, suppose also that you provide the data set **archive_diagnose.sas7bdat** to specify that only **fcst_results.sas7bdat** in the **results** folder should be archived. Then, if as shown in the following picture, there exist four diagnose results altogether, only the two files, **fcst_results.sas7bdat**, from the two older diagnose results are archived.



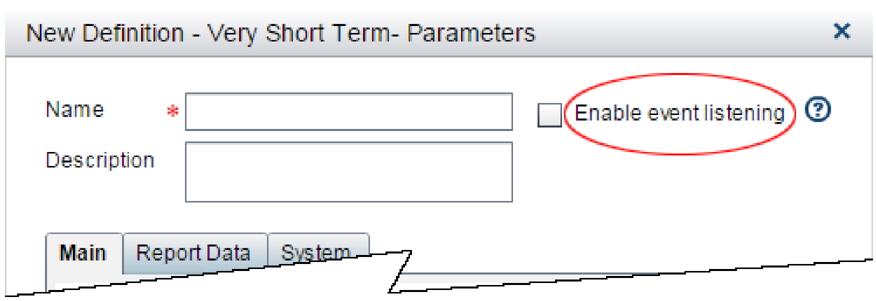
Chapter 10

Run in Batch

Overview

Without opening the SAS Energy Forecasting client, you can use the macro %sefdatae on the data tier to run forecasts for which the property **Enable Event Listening** has been selected. The parameters of the %sefdatae macro specify exactly which forecasts to run.

Typically, you might run the macro after updating input data for a forecast.



You can select **Enable Event Listening** for any forecast.

Macro %sefdatae

%sefdatae(
utility=*utility_code*
, stage_path=*input_path*
, forecast_type=*VSTLF | STLF | MTLTLF*
, name_regexp=*input_path*
);

utility=
Required. A forecast is run only if its definition contains this utility code. The macro can run multiple forecasts in multiple projects if the forecast definitions share the same utility code.

stage_path=
Required. The complete path for the input files. See “Input Path” on page 179.

forecast_type=
Optional. Valid values are:

VSTLF	Very Short Term Load Forecasting
STLF	Short Term Load Forecasting
MTLTLF	Medium Term/Long Term Load Forecasting

If you don’t specify this parameter, then all types of forecast are run.

name_regexp=
Optional. A java regular expression to match a forecast name. A forecast is run only if its name matches this regular expression.

Examples of regular expressions are:

- HOURLY$ matches names that end in HOURLY, such as CT_VSTL_HOURLY
- ^HOURLY matches names that begin with HOURLY, such as HOURLY_CT_VSLT.
- HOURLY and _HOURLY_ both match names that include HOURLY, such as CT_HOURLY_VSLT.

The following restrictions apply:

- The following characters are not allowed:

```
< > ( ) , \N \V \R
```

- You may not use any character or sequence of characters that is not valid as an XML attribute.
- You may not use any character or sequence of characters that cannot be included in a SAS macro variable.

Examples

- `%sefdatae(utility=mass, stage_path=C:\ULF\Data\mass\stage);`

  Runs all forecast definitions defined for the region *mass* and using the input files at the location **`C:\ULF\Data\mass\stage`**

- `%sefdatae(utility=ct, stage_path=C:\ULF\Data\ct\stage, forecast_type=VSTLF);`

  Runs all very short term forecast definitions defined for the region *ct* and using the input files at the location **`C:\ULF\Data\ct\stage`**

- `%sefdatae(utility=ct, stage_path=C:\ULF\Data\ct\stage, forecast_type=STLF);`

  Runs all short term forecast definitions defined for the region *ct* and using the input files at the location **`C:\ULF\Data\ct\stage`**

- `%sefdatae(utility=ct, stage_path=C:\ULF\Data\ct\stage, name_regexp=HOURLY$,`

```
forecast_type=VSTLF);
```

Runs all very short term forecast definitions defined for the region *ct* whose name end with HOURLY. Use input files at the location **`C:\ULF\Data\ct\stage`**

Chapter 11

Produce Reports

Overview

With SAS Energy Forecasting, you can output tables that are suitable for producing reports using SAS Visual Analytics or HANA or another report tool. You can output two types of tables:

Normalized Tables

If you select normalized output, then you get more (but smaller) tables without redundant data than you do with denormalized output where you get fewer (but larger) tables with redundant data. Normalized tables require you to do joins on the tables for reporting.

If you are using HANA as your reporting tool, then you must use normalized tables. The normalized tables are outputted as HANA tables.

See "Normalized Tables" on page 84.

Denormalized Data Sets

If you select denormalized output, then you get fewer (but larger) tables with redundant data than you do with normalized output where you get more (but smaller) tables without redundant data.

Denormalized tables are outputted as SAS data sets. If you are using SAS Visual Analytics as your reporting tool, then you can use either normalized or denormalized tables. If you are using another reporting tool, you might want to use either denormalized or normalized tables depending on the tool.

TIP Particularly if you output denormalized tables, the storage required can become very large. Make sure that you periodically purge these data sets so as to free up space.

See "Denormalized SAS Data Sets" on page 96.

Normalized Tables

Introduction

If you are using HANA as your reporting tool, then you must use normalized tables.

The location to which normalized tables are written is based on the following order of precedence:

1. If you pre-allocated a libref named freport, then SAS Energy Forecasting uses that.
2. If you defined a library named freport of type HANA in the metadata server, then SAS Energy Forecasting uses that.

VSTLF

Summary

Following tables:

- CALENDAR (replaced)
- RUN_INFORMATION (appended to)
- USER_DEFINED_DATA (appended to)(optional)
- VSTLF_FCST_RESULTS (appended to)
- VSTLF_FCST_STAT (appended to)
- VSTLF_OUTLIER (appended to)
- WTHR_DATA (appended to)

CALENDAR

The CALENDAR table is replaced each time a forecast is run. It contains the following columns:

Column Name
UTIL_LOC_CD (key)
DATE (key)
HOLIDAY
BEFORE_HOLIDAY
AFTER_HOLIDAY

Column Name
YEAR
MONTH
DAY
WEEKDAY

RUN_INFORMATION

The RUN_INFORMATION table is appended to each time a forecast is run. It contains the following columns:

Column Name
RUN_ID_NM (key)
RUN_TYPE_CD (key)
RUN_ID_DTTM
UTIL_LOC_CD
RUN_ID_DESC
WTHR_LOC_CD
WTHR_LOC_NM
WTHR_LOC_DESC
UTIL_LOC_NM
UTIL_LOC_DESC

USER_DEFINED_DATA

The USER_DEFINED_DATA table is optional. If it exists, it is appended to each time a forecast is run. It contains the following columns:

Column Name
UD_DTTM (key)
UD_TYPE_COL_NM (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)

Column Name
UD_TYPE_CD
UD_DT
UD_HR_NO
UD_NO

VSTLF_FCST_RESULTS

The VSTLF_FCST_RESULTS table is appended to each time a forecast is run. It contains the following columns:

Column Name
VSTLF_FCST_RESULTS_DTTM (key)
VSTLF_MODEL_NM (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
VSTLF_FCST_RESULTS_DT
VSTLF_FCST_RESULTS_HR_NO
VSTLF_PREDICTED_LOAD_NO
CHAMPION_FLG

VSTLF_FCST_STAT

The VSTLF_FCST_STAT table is appended to each time a forecast is run. It contains the following columns:

Column Name
VSTLF_MODEL_NM (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
VSTLF_HOURLY_ME_NO
VSTLF_HOURLY_MAE_NO
VSTLF_HOURLY_MAPE_NO

Column Name
VSTLF_DAILY_PEAK_ME_NO
VSTLF_DAILY_PEAK_MAE_NO
VSTLF_DAILY_PEAK_MAPE_NO
VSTLF_DAILY_ME_NO
VSTLF_DAILY_MAE_NO
VSTLF_DAILY_MAPE_NO
VSTLF_MONTHLY_PEAK_ME_NO
VSTLF_MONTHLY_PEAK_MAPE_NO
VSTLF_MONTHLY_PEAK_MAE_NO
VSTLF_MONTHLY_ME_NO
VSTLF_MONTHLY_MAPE_NO
VSTLF_MONTHLY_MAE_NO
VSTLF_ANNUAL_PEAK_ME_NO
VSTLF_ANNUAL_PEAK_MAE_NO
VSTLF_ANNUAL_PEAK_MAPE_NO
VSTLF_ANNUAL_ME_NO
VSTLF_ANNUAL_MAE_NO
VSTLF_ANNUAL_MAPE_NO
VSTLF_WEIGHTED_MAPE_NO

VSTLF_OUTLIER

The VSTLF_OUTLIER table is appended to each time a forecast is run. It contains the following columns:

Column Name
VSTLF_OUTLIER_DTTM (key)
VSTLF_OUTLIER_TYPE_CD (key)

Column Name
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
VSTLF_WEEK_DAY_NO
VSTLF_WEEK_DAY_ORIG_NO
VSTLF_SPECIAL_DAY_NO
VSTLF_WTHR_NO
VSTLF_WTHR_TYPE_CD
VSTLF_ACTUAL_LOAD_NO
VSTLF_PREDICTED_LOAD_NO
VSTLF_ERROR_NO
VSTLF_ABS_ERROR_NO
VSTLF_ABS_ERROR_PCT

WTHR_DATA

The WTHR_DATA table is appended to each time a forecast is run. It contains the following columns:

Column Name
WTHR_DTTM (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
WTHR_HR_NO
WTHR_TYPE_CD
WTHR_NO

STLF

Summary

Following tables:

- CALENDAR (replaced)
- RUN_INFORMATION (appended to)
- STLF_FCST_RESULTS (appended to)
- STLF_FCST_STAT (appended to)
- USER_DEFINED_DATA (appended to)(optional)
- WTHR_DATA (appended to)

CALENDAR

The CALENDAR table is replaced each time a forecast is run. It contains the following columns:

Column Name
UTIL_LOC_CD (key)
DATE (key)
HOLIDAY
BEFORE_HOLIDAY
AFTER_HOLIDAY
YEAR
MONTH
DAY
WEEKDAY

RUN_INFORMATION

The RUN_INFORMATION table is appended to each time a forecast is run. It contains the following columns:

Column Name
RUN_ID_NM (key)
RUN_TYPE_CD (key)
RUN_ID_DTTM
UTIL_LOC_CD
RUN_ID_DESC
WTHR_LOC_CD

Column Name
WTHR_LOC_NM
WTHR_LOC_DESC
UTIL_LOC_NM
UTIL_LOC_DESC

STLF_FCST_RESULTS

The STLF_FCST_RESULTS table is appended to each time a forecast is run. It contains the following columns:

Column Name
STLF_FCST_RESULTS_DTTM (key)
STLF_MODEL_NM (key)
STLF_FCST_WTHR_TYPE_CD RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
STLF_FCST_RESULTS_DT
STLF_FCST_RESULTS_HR_NO
STLF_PREDICTED_LOAD_NO
STLF_FCST_WTHR_NO
CHAMPION_FLG

STLF_FCST_STAT

The STLF_FCST_STAT table is appended to each time a forecast is run. It contains the following columns:

Column Name
STLF_MODEL_NM (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
CHAMPION_FLG
STLF_HOURLY_ME_NO

Column Name
STLF_HOURLY_MAE_NO
STLF_HOURLY_MAPE_NO
STLF_DAILY_PEAK_ME_NO
STLF_DAILY_PEAK_MAE_NO
STLF_DAILY_PEAK_MAPE_NO
STLF_DAILY_ME_NO
STLF_DAILY_MAE_NO
STLF_DAILY_MAPE_NO
STLF_MONTHLY_PEAK_ME_NO
STLF_MONTHLY_PEAK_MAPE_NO
STLF_MONTHLY_PEAK_MAE_NO
STLF_MONTHLY_ME_NO
STLF_MONTHLY_MAPE_NO
STLF_MONTHLY_MAE_NO
STLF_ANNUAL_PEAK_ME_NO
STLF_ANNUAL_PEAK_MAE_NO
STLF_ANNUAL_PEAK_MAPE_NO
STLF_ANNUAL_ME_NO
STLF_ANNUAL_MAE_NO
STLF_ANNUAL_MAPE_NO
STLF_WEIGHTED_MAPE_NO

USER_DEFINED_DATA

The USER_DEFINED_DATA table is optional. If it exists, it is appended to each time a forecast is run. It contains the following columns:

Column Name
UD_DTTM (key)
UD_TYPE_COL_NM (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
UD_TYPE_CD
UD_DT
UD_HR_NO
UD_NO

WTHR_DATA

The WTHR_DATA table is appended to each time a forecast is run. It contains the following columns:

Column Name
WTHR_DTTM (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
WTHR_HR_NO
WTHR_TYPE_CD
WTHR_NO

MTLF/LTLF

Summary

Following tables:

- CALENDAR (replaced)
- ECONOMY_DATA (appended to)
- MTLTLF_FCST_RESULTS (appended to)
- MTLTLF_PEAK_STAT (appended to)
- RUN_INFORMATION (appended to)
- USER_DEFINED_DATA (appended to)(optional)

- WTHR_DATA (appended to)

CALENDAR

The CALENDAR table is replaced each time a forecast is run. It contains the following columns:

Column Name
UTIL_LOC_CD (key)
DATE (key)
HOLIDAY
BEFORE_HOLIDAY
AFTER_HOLIDAY
YEAR
MONTH
DAY
WEEKDAY

ECONOMY_DATA

The ECONOMY_DATA table is appended to each time a forecast is run. It contains the following columns:

Column Name
ECONOMY_DT (key)
RUN_ID_NM (foreign key))
RUN_TYPE_CD (foreign key))
GROSS_PRODUCT_S0_AMT
GROSS_PRODUCT_S1_AMT
GROSS_PRODUCT_S2_AMT
GROSS_PRODUCT_S3_AMT
GROSS_PRODUCT_S4_AMT
GROSS_PRODUCT_S5_AMT
GROSS_PRODUCT_S6_AMT

MTLTLF_FCST_RESULTS

The MTLTLF_FCST_RESULTS table is appended to each time a forecast is run. It contains the following columns:

Column Name
MTLTLF_FCST_RESULTS_DTTM (key)
MTLTLF_MODEL_NM (key)
MTLTLF_MODEL_ECONOMIC_SCN_NO (key)
MTLTLF_RESULTS_YEAR_ORIG_NO (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key))
MTLTLF_FCST_RESULTS_DT
MTLTLF_FCST_RESULTS_HR_NO
MTLTLF_RESULTS_YEAR_NO
MTLTLF_ACTUAL_LOAD_NO
MTLTLF_PREDICTED_LOAD_NO

MTLTLF_PEAK_STAT

The MTLTLF_PEAK_STAT table is appended to each time a forecast is run. It contains the following columns:

Column Name
MTLTLF_PEAK_YR_NO (key)
MTLTLF_MODEL_NM (key)
MTLTLF_MODEL_ECONOMIC_SCN_NO (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
MTLTLF_PEAK_NO
MTLTLF_PEAK_MIN_NO
MTLTLF_PEAK_P10_NO

Column Name
MTLTLF_PEAK_ME_NO
MTLTLF_PEAK_MED_NO
MTLTLF_PEAK_P90_NO
MTLTLF_PEAK_MAX_NO
MTLTLF_PEAK_ACTUAL_NO

RUN_INFORMATION

The RUN_INFORMATION table is appended to each time a forecast is run. It contains the following columns:

Column Name
RUN_ID_NM (key)
RUN_TYPE_CD (key)
RUN_ID_DTTM
UTIL_LOC_CD
RUN_ID_DESC
WTHR_LOC_CD
WTHR_LOC_NM
WTHR_LOC_DESC
UTIL_LOC_NM
UTIL_LOC_DESC

USER_DEFINED_DATA

The USER_DEFINED_DATA table is optional. If it exists, it is appended to each time a forecast is run. It contains the following columns:

Column Name
UD_DTTM (key)
UD_TYPE_COL_NM (key)
RUN_ID_NM (foreign key)

Column Name
RUN_TYPE_CD (foreign key)
UD_TYPE_CD
UD_DT
UD_HR_NO
UD_NO

WTHR_DATA

The WTHR_DATA table is appended to each time a forecast is run. It contains the following columns:

Column Name
WTHR_DTTM (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
WTHR_HR_NO
WTHR_TYPE_CD
WTHR_NO

Denormalized SAS Data Sets

Introduction

If you are using SAS Visual Analytics as your reporting tool, then you can use either normalized or denormalized tables.

The location to which denormalized tables are written is based on the following order of precedence:

1. If you have pre-allocated a libref named freport, then SAS Energy Forecasting uses that.
2. If you have created a library named freport in the metadata server, then SAS Energy Forecasting uses that.
3. Otherwise, SAS Energy Forecasting creates a folder named rptdata in the data mart.

VSTLF

Overview

Following tables:

- CALENDAR (replaced)
- RUN_INFORMATION (appended to)
- VSTLF_FCST_RESULTS_MAST (appended to)

CALENDAR

The CALENDAR table is replaced each time a forecast is run. It contains the following columns:

Column Name
UTIL_LOC_CD (key)
DATE (key)
HOLIDAY
BEFORE_HOLIDAY
AFTER_HOLIDAY
YEAR
MONTH
DAY
WEEKDAY

RUN_INFORMATION

The RUN_INFORMATION table is appended to each time a forecast is run. It contains the following columns:

Column Name
RUN_ID_NM (key)
RUN_TYPE_CD (key)
RUN_ID_DTTM
UTIL_LOC_CD
RUN_ID_DESC

Column Name
WTHR_LOC_CD
WTHR_LOC_NM
WTHR_LOC_DESC
UTIL_LOC_NM
UTIL_LOC_DESC

VSTLF_FCST_RESULTS_MAST

The VSTLF_FCST_RESULTS_MAST table is appended to each time a forecast is run. It contains the following columns:

Column Name
VSTLF_FCST_RESULTS_DTTM (key)
VSTLF_MODEL_NM (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
VSTLF_FCST_RESULTS_DT
VSTLF_FCST_RESULTS_HR_NO
VSTLF_PREDICTED_LOAD_NO
VSTLF_HOURLY_ME_NO
VSTLF_HOURLY_MAE_NO
VSTLF_HOURLY_MAE_NO
VSTLF_HOURLY_MAPE_NO
VSTLF_DAILY_PEAK_ME_NO
VSTLF_DAILY_PEAK_MAE_NO
VSTLF_DAILY_PEAK_MAPE_NO
VSTLF_DAILY_ME_NO
VSTLF_DAILY_MAE_NO

Column Name
VSTLF_DAILY_MAPE_NO
VSTLF_MONTHLY_PEAK_ME_NO
VSTLF_MONTHLY_PEAK_MAPE_NO
VSTLF_MONTHLY_PEAK_MAE_NO
VSTLF_MONTHLY_ME_NO
VSTLF_MONTHLY_MAPE_NO
VSTLF_MONTHLY_MAE_NO
VSTLF_ANNUAL_PEAK_ME_NO
VSTLF_ANNUAL_PEAK_MAE_NO
VSTLF_ANNUAL_PEAK_MAPE_NO
VSTLF_ANNUAL_ME_NO
VSTLF_ANNUAL_MAE_NO
VSTLF_ANNUAL_MAPE_NO
VSTLF_WEIGHTED_MAPE_NO
VSTLF_WEEK_DAY_NO
VSTLF_WEEK_DAY_ORIG_NO
VSTLF_SPECIAL_DAY_NO
VSTLF_ACTUAL_LOAD_NO
VSTLF_ERROR_NO
VSTLF_ABS_ERROR_NO
VSTLF_ABS_ERROR_PCT
UD_TYPE_CD
UD_NO
UD_TYPE_COL_NM
WTHR_TYPE_CD

Column Name
UTIL_LOC_CD
WTHR_NO
RUN_ID_DESC
WTHR_LOC_CD
WTHR_LOC_NM
WTHR_LOC_DESC
UTIL_LOC_NM
UTIL_LOC_DESC
CHAMPION_FLG

STLF

Overview

Following tables:

- CALENDAR (replaced)
- RUN_INFORMATION (appended to)
- STLF_FCST_RESULTS_MAST (appended to)

CALENDAR

The CALENDAR table is replaced each time a forecast is run. It contains the following columns:

Column Name
UTIL_LOC_CD (key)
DATE (key)
HOLIDAY
BEFORE_HOLIDAY
AFTER_HOLIDAY
YEAR
MONTH

Column Name
DAY
WEEKDAY

RUN_INFORMATION

The RUN_INFORMATION table is appended to each time a forecast is run. It contains the following columns:

Column Name
RUN_ID_NM (key)
RUN_TYPE_CD (key)
RUN_ID_DTTM
UTIL_LOC_CD
RUN_ID_DESC
WTHR_LOC_CD
WTHR_LOC_NM
WTHR_LOC_DESC
UTIL_LOC_NM
UTIL_LOC_DESC

STLF_FCST_RESULTS_MAST

The STLF_FCST_RESULTS_MAST table is appended to each time a forecast is run. It contains the following columns:

Column Name
VSTLF_FCST_RESULTS_DTTM (key)
VSTLF_MODEL_NM (key)
RUN_ID_NM (foreign key)
RUN_TYPE_CD (foreign key)
STLF_FCST_RESULTS_DT
STLF_FCST_RESULTS_HR_NO

Column Name
STLF_PREDICTED_LOAD_NO
STLF_WEEK_DAY_NO
STLF_WEEK_DAY_ORIG_NO
STLF_ACTUAL_LOAD_NO
STLF_ERROR_NO
STLF_ABS_ERROR_NO
STLF_ABS_ERROR_PCT
STLF_SPECIAL_DAY_NO
STLF_OUTLIER_FLG
STLF_HOURLY_ME_NO
STLF_HOURLY_MAE_NO
STLF_HOURLY_MAPE_NO
STLF_DAILY_PEAK_ME_NO
STLF_DAILY_PEAK_MAE_NO
STLF_DAILY_PEAK_MAPE_NO
STLF_DAILY_ME_NO
STLF_DAILY_MAE_NO
STLF_DAILY_MAPE_NO
STLF_MONTHLY_PEAK_ME_NO
STLF_MONTHLY_PEAK_MAPE_NO
STLF_MONTHLY_PEAK_MAE_NO
STLF_MONTHLY_ME_NO
STLF_MONTHLY_MAPE_NO
STLF_MONTHLY_MAE_NO
STLF_ANNUAL_PEAK_ME_NO

Column Name
STLF_ANNUAL_PEAK_MAE_NO
STLF_ANNUAL_PEAK_MAPE_NO
STLF_ANNUAL_ME_NO
STLF_ANNUAL_MAE_NO
STLF_ANNUAL_MAPE_NO
STLF_WEIGHTED_MAPE_NO
UD_NO
UD_TYPE_COL_NM
UTIL_LOC_CD
WTHR_TYPE_CD
WTHR_NO
RUN_ID_DESC
WTHR_LOC_CD
WTHR_LOC_NM
WTHR_LOC_DESC
UTIL_LOC_NM
UTIL_LOC_DESC
CHAMPION_FLG

MTLF/LTLF

Overview

Following tables:

- CALENDAR (replaced)
- RUN_INFORMATION (appended to)
- MTLTLF_FCST_RESULTS_MAST (appended to)

CALENDAR

The CALENDAR table is replaced each time a forecast is run. It contains the following columns:

Column Name
UTIL_LOC_CD (key)
DATE (key)
HOLIDAY
BEFORE_HOLIDAY
AFTER_HOLIDAY
YEAR
MONTH
DAY
WEEKDAY

RUN_INFORMATION

The RUN_INFORMATION table is appended to each time a forecast is run. It contains the following columns:

Column Name
RUN_ID_NM (key)
RUN_TYPE_CD (key)
RUN_ID_DTTM
UTIL_LOC_CD
RUN_ID_DESC
WTHR_LOC_CD
WTHR_LOC_NM
WTHR_LOC_DESC
UTIL_LOC_NM
UTIL_LOC_DESC

MTLTLF_FCST_RESULTS_MAST

The MTLTLF_FCST_RESULTS_MAST table is appended to each time a forecast is run. It contains the following columns:

Column Name
MTLTLF_FCST_RESULTS_DTTM (key)
MTLTLF_MODEL_NM (key)
MTLTLF_MODEL_ECONOMIC_SCN_NO (key)
MTLTLF_RESULTS_YEAR_ORIG_NO (key)
RUN_ID_NM (foreign key))
RUN_TYPE_CD (foreign key)
MTLTLF_FCST_RESULTS_DT
MTLTLF_FCST_RESULTS_HR_NO
MTLTLF_RESULTS_YEAR_NO
MTLTLF_ACTUAL_LOAD_NO
MTLTLF_PREDICTED_LOAD_NO
MTLTLF_PEAK_NO
MTLTLF_PEAK_MIN_NO
MTLTLF_PEAK_P10_NO
MTLTLF_PEAK_ME_NO
MTLTLF_PEAK_MED_NO
MTLTLF_PEAK_P90_NO
MTLTLF_PEAK_MAX_NO
MTLTLF_PEAK_ACTUAL_NO
GROSS_PRODUCT_S0_AMT
GROSS_PRODUCT_S1_AMT
GROSS_PRODUCT_S2_AMT
GROSS_PRODUCT_S3_AMT

Column Name
GROSS_PRODUCT_S4_AMT
GROSS_PRODUCT_S5_AMT
GROSS_PRODUCT_S6_AMT
WTHR_TYPE_CD
WTHR_NO UD_TYPE_CD
UD_NO
UD_TYPE_COL_NM
UTIL_LOC_CD
RUN_ID_DESC
WTHR_LOC_CD
WTHR_LOC_NM
WTHR_LOC_DESC
UTIL_LOC_NM
UTIL_LOC_DESC
CHAMPION_FLG

Chapter 12

Work with SAS Visual Analytics

Overview

SAS Energy forecasting produces results data sets in SAS format that can be saved to a branch/directory that will enable automatic loading of the results tables into the SAS Visual Analytics LASR server. The process would follow the normal “Project” definition steps in SAS Energy Forecasting. During the step where the output data path is specified, the user would specify the branch path used for automatic loading of data into the LASR server. This will create the branch and directory (by default: rptdata) where the reporting data is written.

Once the data is written to the correct location, the user can follow the instructions within chapter 2 of the *SAS Visual Analytics 7.1 Administration Guide* for configuring the autoloading feature.

Following is a summary of the steps:

1. “Create an Autoload Directory for Forecast Output” (See page 108.)
2. “Direct Forecast Output to the Autoload Directory” (See page 108.)
3. “Create a Directory for Autoload Scripts” (See page 109.)
4. “Create a SAS Metadata Folder” (See page 109.)

Create an Autoload Directory for Forecast Output

This step defines the autoload directory that contains the report data that will be written to the LASR Server. The branch can be user defined. A typical VAAR install will lay down a branch similar to: **`C:\SAS\Config\Lev1\AppData\SASVisualAnalytics\VisualAnalyticsAdministrator\AutoLoad`**

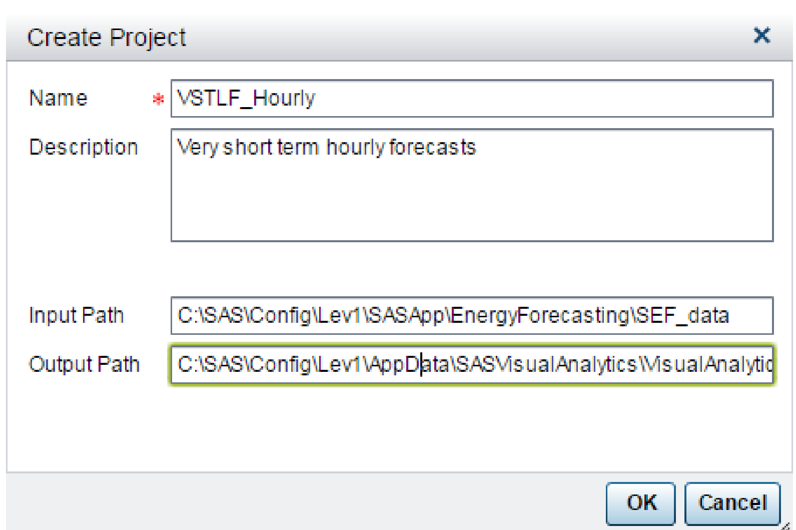
The SAS Energy Forecasting project name will be added to this branch. For example, let's give our project the name of VSTLF_Hourly. The branch would be: **`C:\SAS\Config\Lev1\AppData\SASVisualAnalytics\VisualAnalyticsAdministrator\AutoLoad\VSTLF_Hourly`**

During install of VAAR, several folders are written to the Autoload directory (Append, Formats, Logs, Unload). Copy these folders to the project name folder, example VSTLF_Hourly. This branch will be used when editing the scripts and config files to define the path where the data is located.

Direct Forecast Output to the Autoload Directory

Create a SAS Energy Forecasting project and direct the **Output Path** to the Autoload Directory. See Chapter 14, "Create a Project," on page 131.

The project name is automatically added to the end of the path when the project is created. In the following picture the Output Path is **`C:\SAS\Config\Lev1\AppData\SASVisualAnalytics\VisualAnalyticsAdministrator\AutoLoad\VSTLF_Hourly`**.



Create a Directory for Autoload Scripts

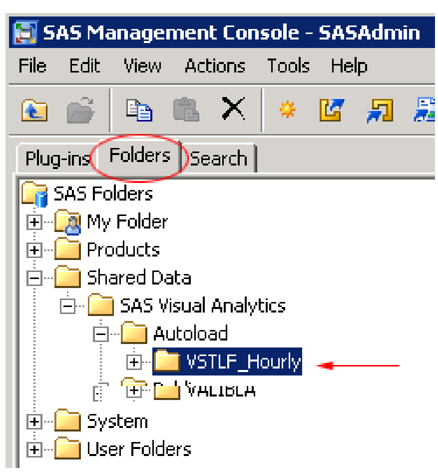
Make a sibling copy on an existing autoload scripts directory and paste in a new directory with the same project name. In our example, we will add a new folder named VSTLF_Hourly to the scripts directory.: `C:\SAS\Config\Lev1\Applications\SASVisualAnalytics\VisualAnalyticsAdministrator\VSTLF_H`ourly.

Then, copy the following folders and files to the VSTLF_Hourly folder.

- Log (folder)
- Autoload.cfg (file)
- Autoload.sas (file)
- AutoLoad_usermods.cfg (file)
- runsas.bat (file)
- schedule.bat (file)
- unscheduled.bat (file)

Create a SAS Metadata Folder

Click the **Folders** tab and create the following folder for storing your metadata: `/Shared Data/SAS Visual Analytics/Autoload/VSTLF_Houly`

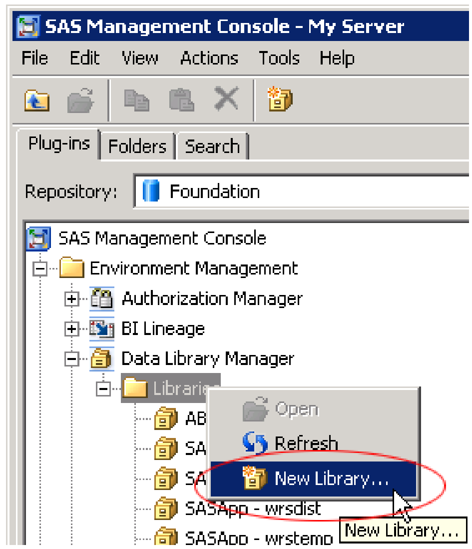


Create a SAS LASR Library

Identify or create a new LASR library that supports the autoload feature. In our example we are going to create a new library named VSTLF_Hourly under High Performance Analytics/SAS LASR Analytic Server Library.

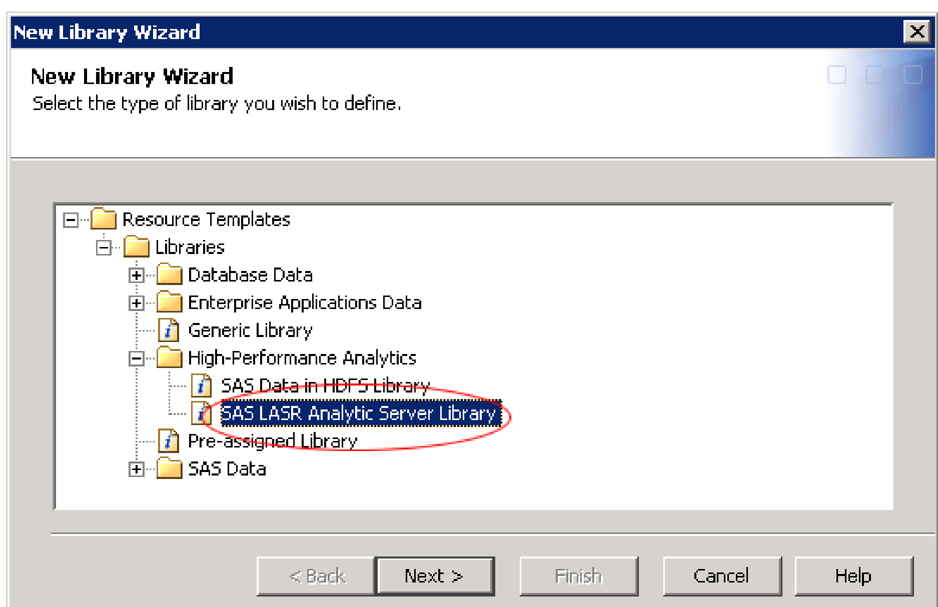
This section describes the steps for creating a metadata library that is enabled for the SAS LASR Analytic Server.

1. In the **Plug-ins** tab of SAS Management Console, right-click **Data Library Manager** ⇨ **Libraries** and select **New Library**.



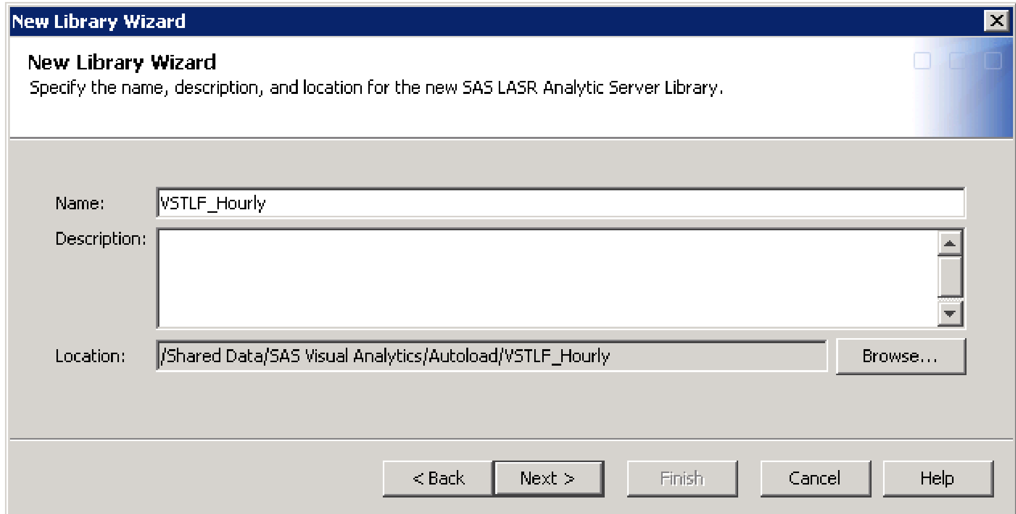
The New Library Wizard opens.

2. Select **SAS LASR Analytic Server Library** under **High-Performance Analytics**.



Click **Next**.

3. Name the new library and select the location of the folder in which the library definition is stored.

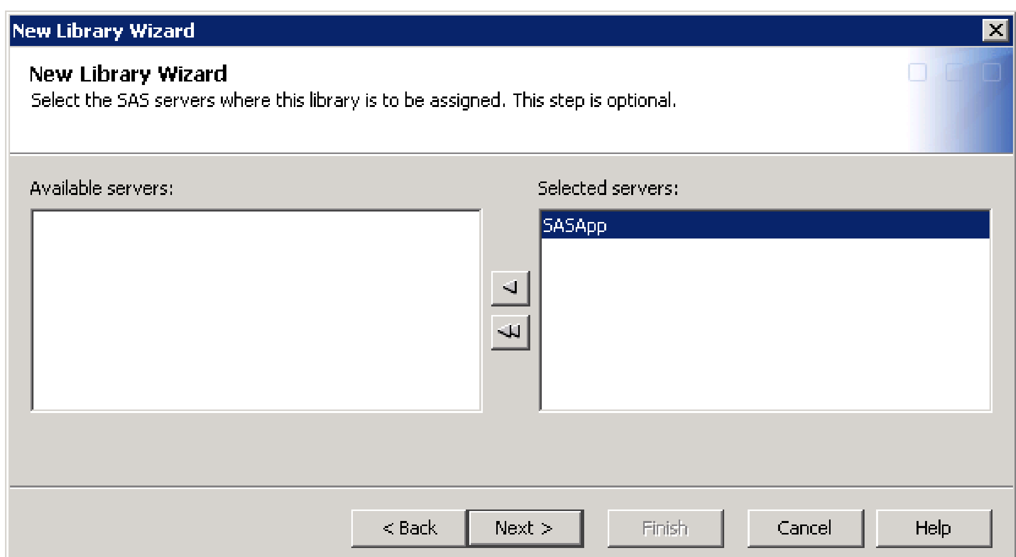


Name
: In this example we are naming the new library VSTLF_Hourly.

Location
: Browse to the folder that you created in the previous step, namely, **`/Shared Data/SAS Visual Analytics/Autoload/VSTLF_Houly`**

Click **Next**.

4. Select **SASApp** as the server that will have access to the new library.



Click **Next**.

5. Specify the following information:

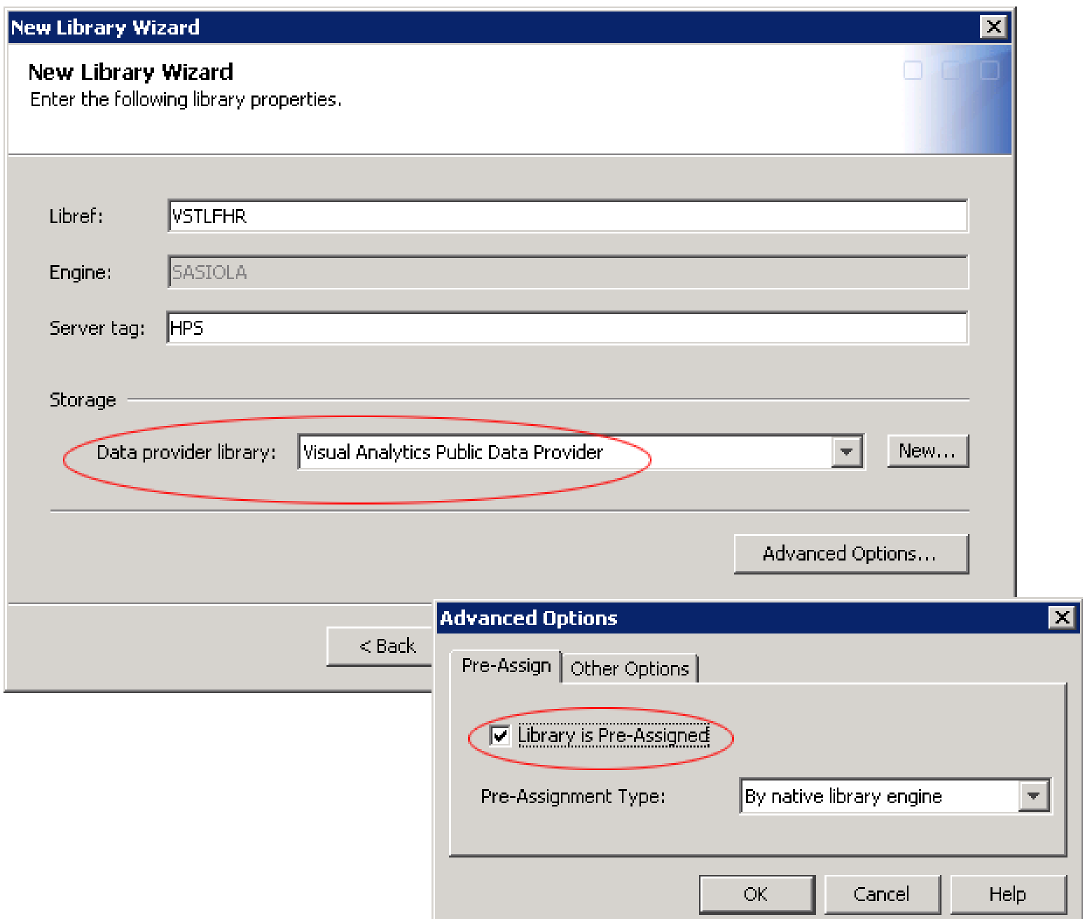
Libref
: For this example we are using VSTLFHR.

Engine
: specifies the engine to use when accessing files in this library. The value is set to **SASIOLA** and cannot be changed.

Server Tag
specifies the tables that are associated with the library. This field corresponds to the TAG= option in the LIBNAME statement. If this field is not specified, a tag of WORK is used.

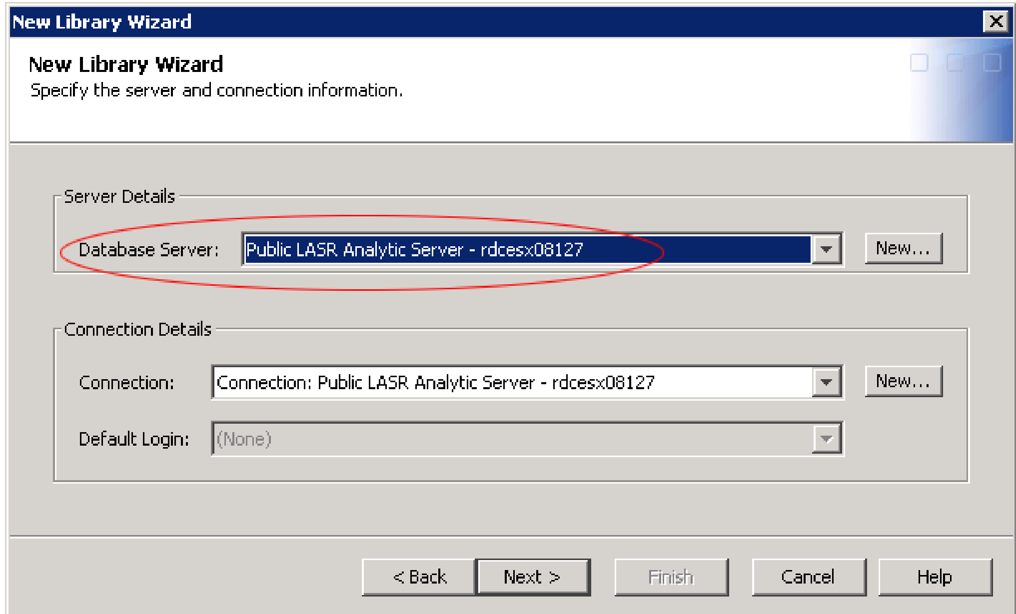
Data Provider Library
Select **Visual Analytics Public Data Provider**.

Advanced tab
Select **Library is Pre-Assigned**.



Click **Next**.

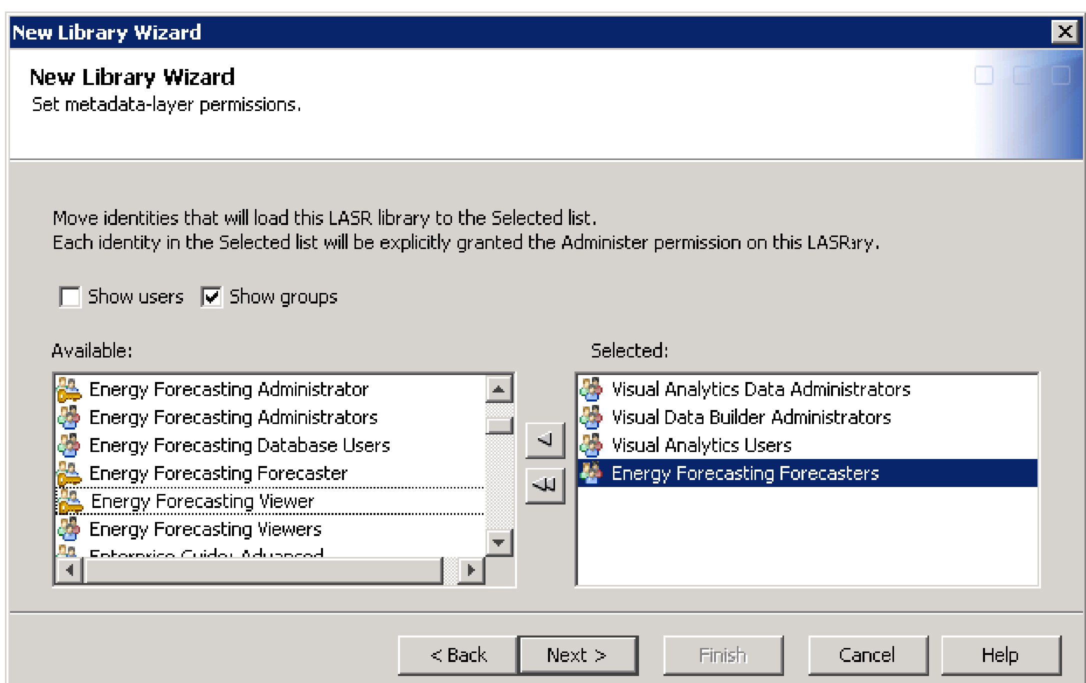
6. For **Database Server** select the **Public LASR Analytic Server**.



Click **Next**.

7. Select the users and groups that have capability to use the LASR library. The following two groups are automatically assigned:
   - Visual Analytics Data Administrators
   - Visual Data Builder Administrators

   You can add the following groups:
   - Visual Analytics Users
   - Energy Forecasting Forecasters

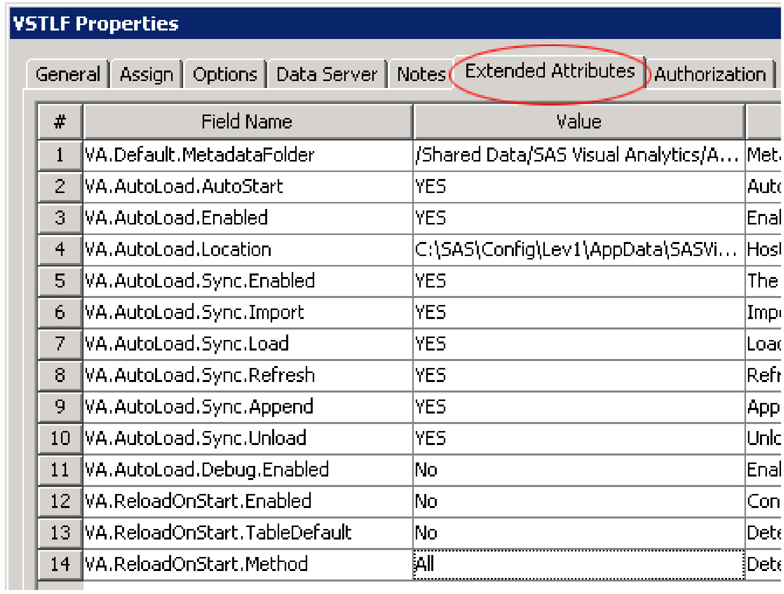


Click **Next**.

8. Review your choices and click **Finish** if you are satisfied.

9. Right-click the library that is created and select **Properties**..

   Click the Extended Attributes tab and set the properties as follows:



#	Field Name	Value	
1	VA.Default.MetadataFolder	/Shared Data/SAS Visual Analytics/A...	Met.
2	VA.AutoLoad.AutoStart	YES	Auto
3	VA.AutoLoad.Enabled	YES	Enal
4	VA.AutoLoad.Location	C:\SAS\Config\Lev1\AppData\SASVi...	Host
5	VA.AutoLoad.Sync.Enabled	YES	The
6	VA.AutoLoad.Sync.Import	YES	Impo
7	VA.AutoLoad.Sync.Load	YES	Load
8	VA.AutoLoad.Sync.Refresh	YES	Refr
9	VA.AutoLoad.Sync.Append	YES	App
10	VA.AutoLoad.Sync.Unload	YES	Unlo
11	VA.AutoLoad.Debug.Enabled	No	Enal
12	VA.ReloadOnStart.Enabled	No	Con
13	VA.ReloadOnStart.TableDefault	No	Dete
14	VA.ReloadOnStart.Method	All	Dete

Modify the Scripts

AutoLoad.sas

Change this:

```
%LET AL_META_LASRLIB= value of the metadata name of the new implementation's LASR library
```

To this:

```
%LET AL_META_LASRLIB=VSTLF_Hourly;
```

Note: In this example, VSTLF_Hourly is the name of our SAS LASR library. See "Create a SAS LASR Library" on page 109. Charge the example to use the name of your SAS LASR library.

runsas

Change this:

```
AUTOLOAD_ROOT= value to reference the new autoload scripts directory
```

To this:

```
AUTOLOAD_ROOT=C:\SAS\Config\Lev1\Applications\SASVisualAnalytics\
VisualAnalyticsAdministrator\VSTLF_Hourly
```

Note: In this example, the directory is the one identified as the **Output Path** of the SAS Energy Forecasting project. See "Direct Forecast Output to the Autoload Directory" on page 108. Change the example to use your output path.

Change this:

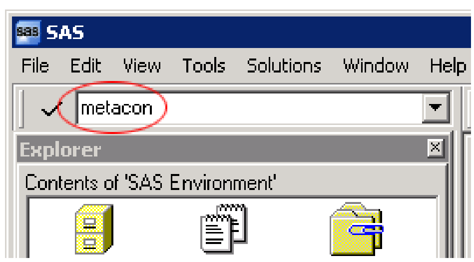
```
call "%SAS_COMMAND%" -sysin %FILENAME% -config %CFG_FILE% -log %LOG_FILE%
-print %LST_FILE% -batch -noterminal -nologo -logparm "rollover=session"
```

To something like this:

```
call "%SAS_COMMAND%" -sysin %FILENAME% -config %CFG_FILE% -log %LOG_FILE%
-print %LST_FILE% -batch -noterminal -nologo -logparm "rollover=session"
-METAPROFILE "C:\SAS\Config\Lev1\lasr_auto_connection.xml"
```

Here the value of –**METAPROFILE** is a connection profile residing at the location specified. For information on connection profiles, see "Specifying a Stored Connection Profile" in *SAS 9.4 Language Interfaces to Metadata, Second Edition* available at http://support.sas.com/documentation/onlinedoc/base/index.html.

The METAPROFILE option supports the use of XML documents that contain user-defined connection profiles. A user-defined connection profile is a connection profile that is created with the Metadata Server Connections dialog box. This dialog box enables you to save (export) one or more user-defined connection profiles to a permanent XML document.Open this dialog box by executing the SAS windowing environment command METACON.



For more information about the METACON command, see the Help in the SAS windowing environment.

schedule

Make the following changes to schedule.sh (or schedule.bat) and unschedule.sh (or unschedule.bat)

Change this:

```
RUNSAS_PATH= value to reference the new implementation's autoload scripts directory
```

To this:

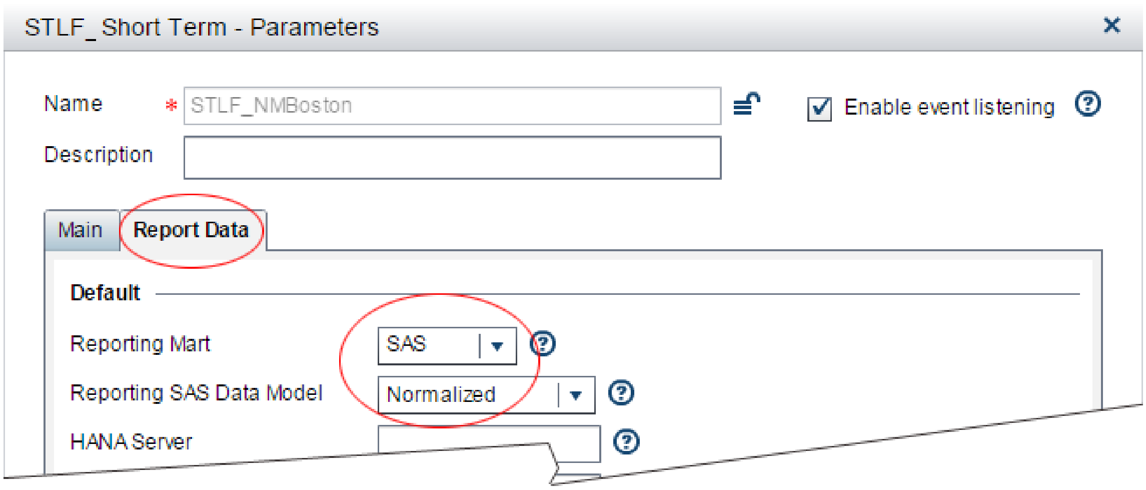
```
RUNSAS_PATH="C:\SAS\Config\Lev1\Applications\SASVisualAnalytics\
VisualAnalyticsAdministrator\VSTLF_Hourly\rptdata\runsas.bat"
```

Note: In this example, the path is the one identified as the **Output Path** of the SAS Energy Forecasting project. See "Direct Forecast Output to the Autoload Directory" on page 108. Change the example to use the path where you locate the runsas program..

Create and Run Forecasts

Create forecasts, whose results you want to display in SAS Visual Analytics, in the project that you created. See "Direct Forecast Output to the Autoload Directory" on page 108.

Make sure for any report that you create that you select **SAS** for the **Reporting Mart** on the **Report Data** tab of the parameters. By default, forecast results are written to the **rptdata** folder on the output path of the project. See Chapter 11, “Produce Reports,” on page 83.



Run the Batch File

1. Use the SAS Visual Analytics Administrator to verify that the SAS LASR server is started. If not, then start the server.
2. Run runsas.bat (or runsas.sh).
3. Go to the Data Builder and the Administrator and verify that tables have been written to LASR.

Schedule Autoloading

Modify schedule.bat (or schedule.sh) to set the time interval for autoloading.

Change this:

```
set Time Interval
```

To this:

```
set TIME_INTERVAL_MINUTES=15
```

Chapter 13

Work with SAP HANA

Overview

Using SAS Energy Forecasting results data with SAP HANA involves the following steps:

- “Step 1. Configure SAS/ACCESS Interface to SAP HANA” on page 117
- “Step 2. Configure SAS Metadata Server” on page 119
- “Step 3. Create a SAP HANA Schema” on page 125
- “Step 4. Create a LIBNAME Statement” on page 125
- “Step 5. Run a Forecast” on page 126

Step 1. Configure SAS/ACCESS Interface to SAP HANA

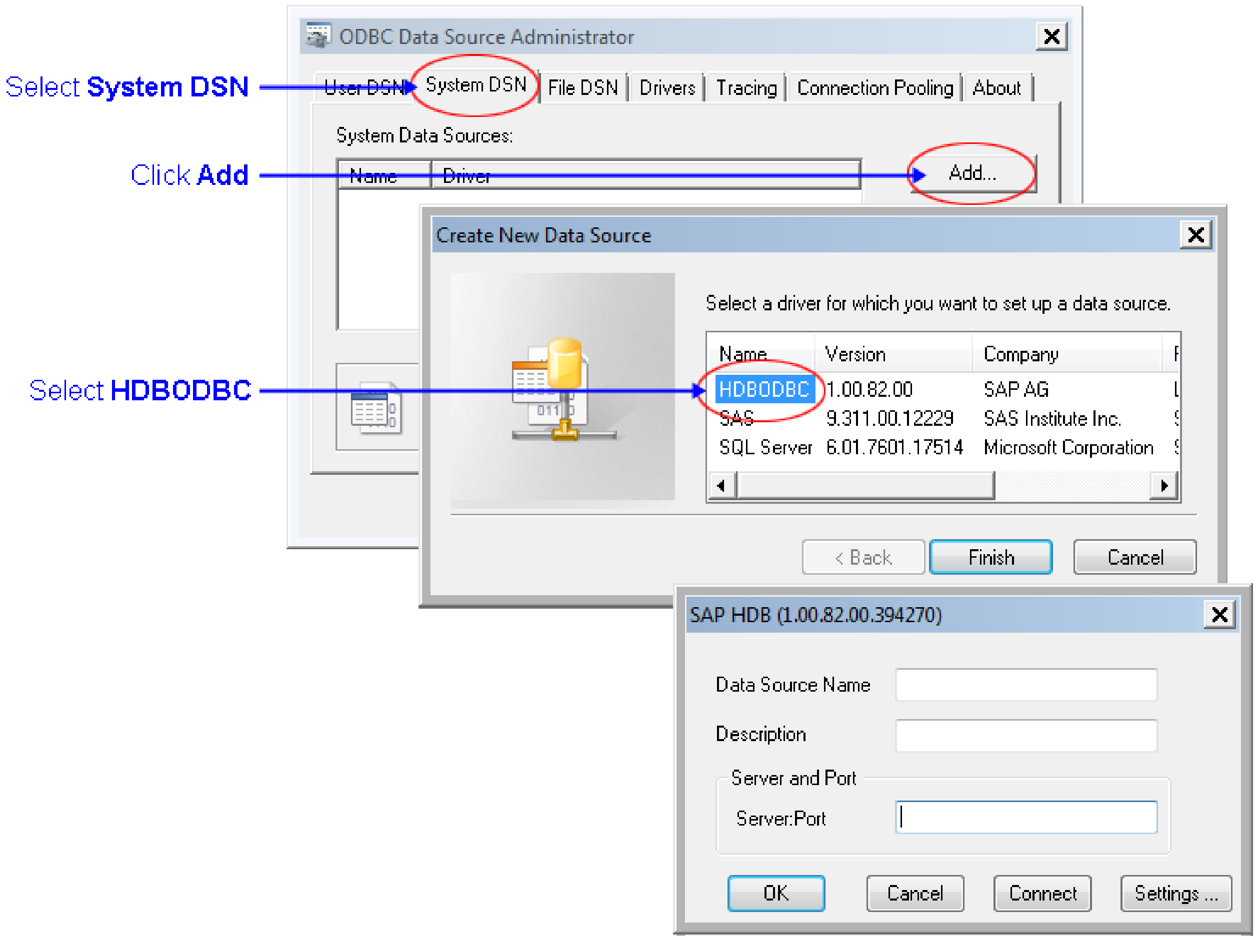
To configure SAS/ACCESS interface to SAP HANA:

1. Logon as a system administrator to the machine that you’re using for accessing SAS HANA.
2. Select **Control Panel** ⇨ **System and Security** ⇨ **Administrative Tools** ⇨ **Data Sources (ODBC)**

3. Click the **System DSN** tab and click **Add**.

   The Create New Data Source window opens.

4. Select **HDBODBC** as the driver for which you want to set upa data source and click **Finish**.



   A SAP HDB configuration window opens.

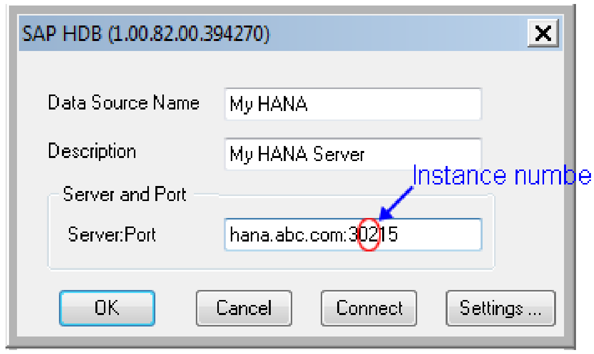
   Note: The HDBODBC driver is installed when you install the SAP HANA client.

5. Specify the following information on the SAP HDB configuration window:

   Data Source Name
   Assign a name of your choice.

   Description
   Type an optional description.

   Server Port
   The SAS Hana Server name and port will have been established on installation of the SAP HANA server.

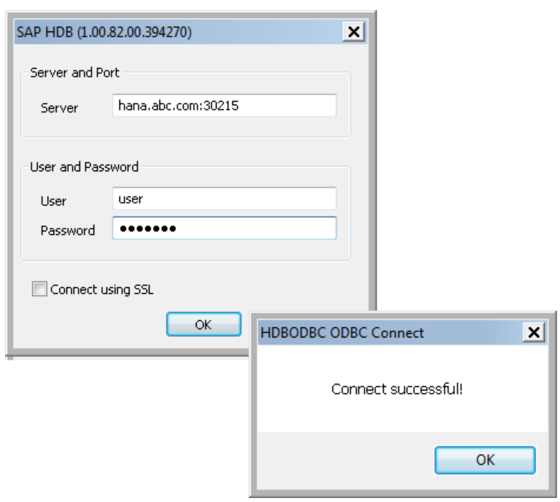


Note: The normal port number is 3xx15, where xx is the instance number that was established on installation of the SAP HANA server.

6. Click **Connect** to test your connection.

   A connection dialog opens for you to specify a **User** and **Password**.

   When you click **OK**, you should receive a message that the connection was successful.

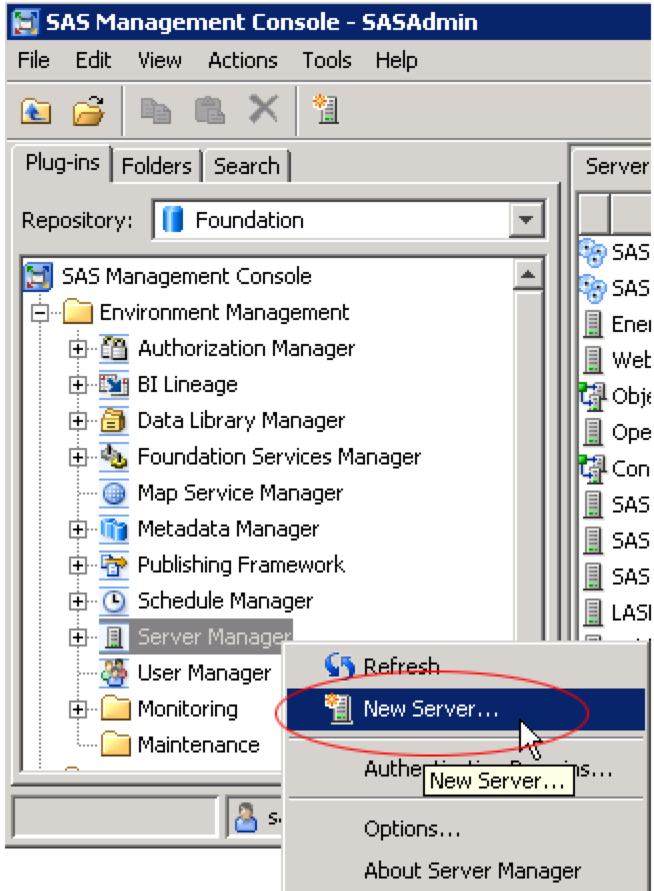


Step 2. Configure SAS Metadata Server

Create a HANA Server in Metadata

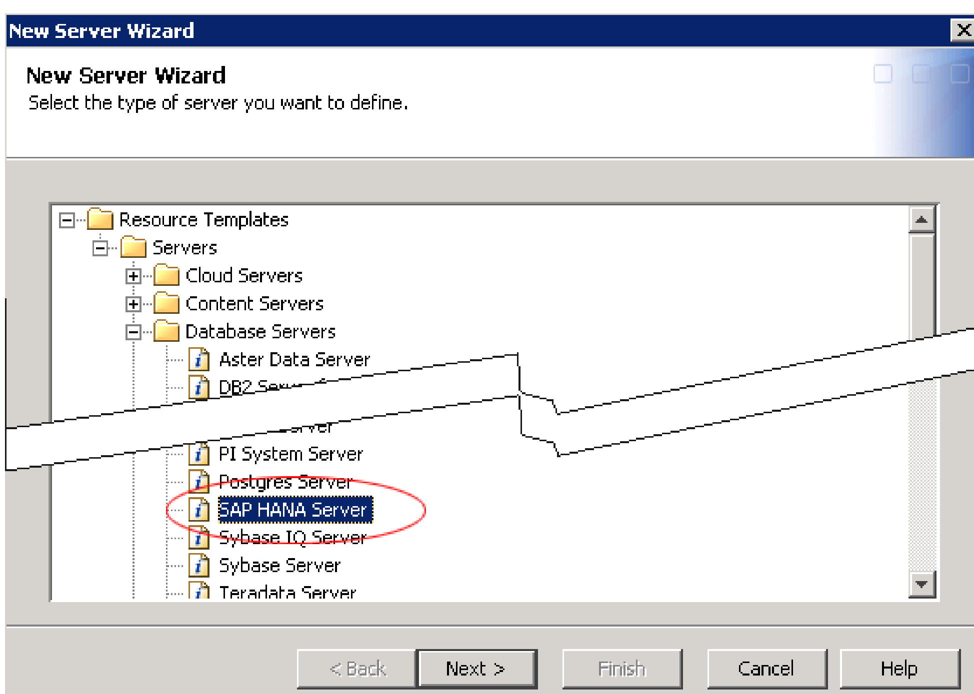
To create the metadata for a SAP HANA server:

1. Open SAS Management Console as administrator.
2. On the **Plug-Ins** tab, expand **SAS Management Console** ⇨ **Environment Managment**. Then right-click **Server Manager** and select **New Server**.

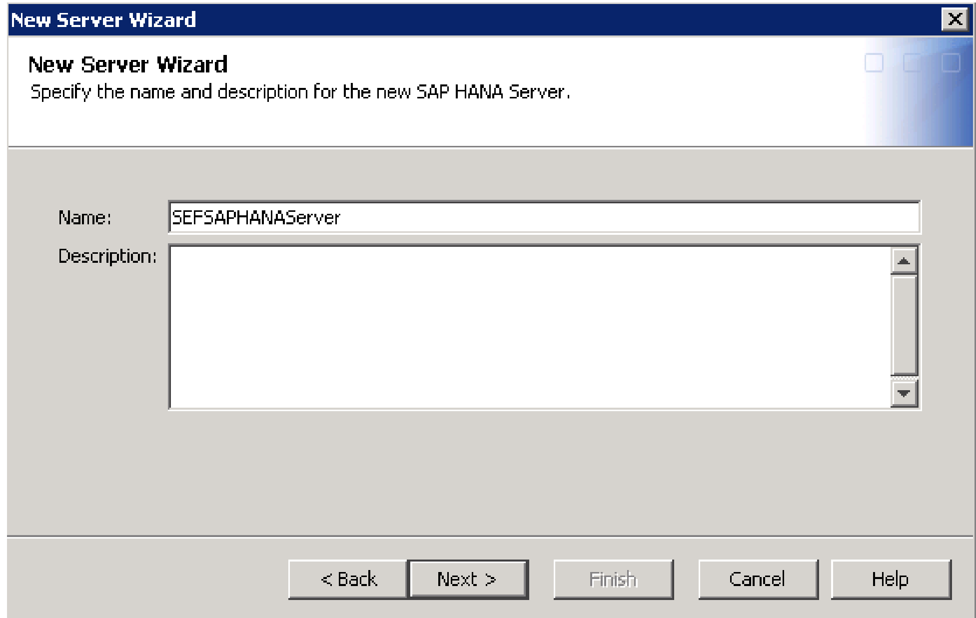


The New Server Wizard opens.

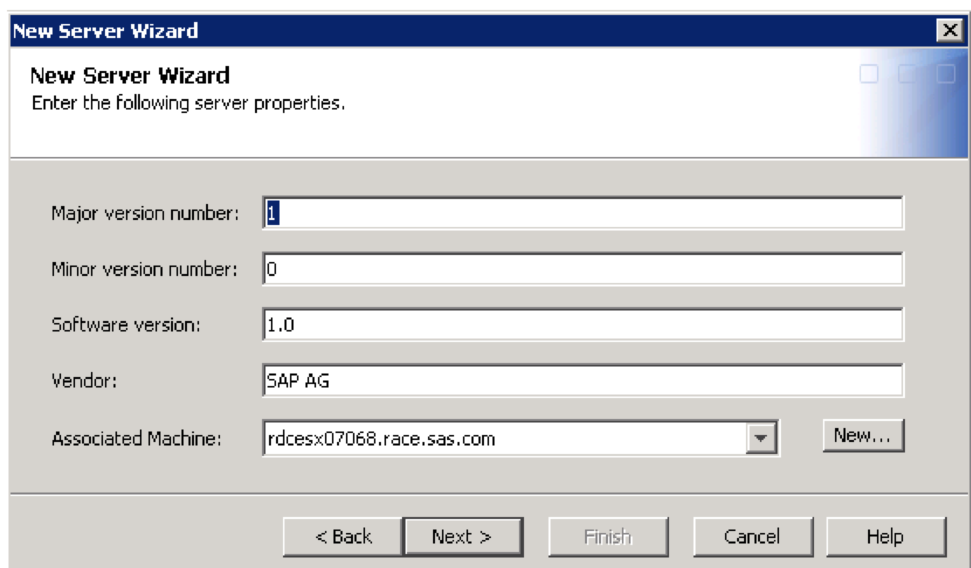
3. Expand **Resource Templates** ⇨ **Servers** ⇨ **Database Servers**. Then select **SAP HANA Server** and click **Next**.



4. Give the server a name, and then click **Next**.



5. Specify the name of the **Associated Machine**—the machine that is hosting your SAS Metadata Server. Then click **Next**.



6. Enter the following connection properties:

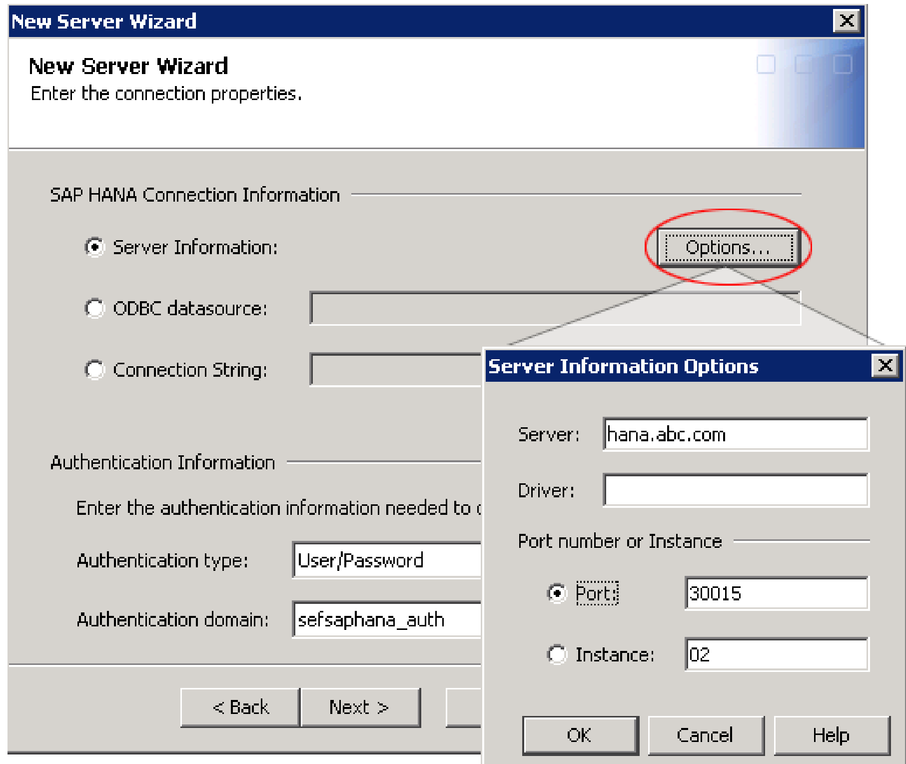
   a. Select **Server Information**, and then click **Options** to specify the following information on the Server Information Options window that opens:

      Server
      Specify the machine on which the SAP HANA database is installed.

      Driver
      You can leave this field blank.

      Port
      By default, the port is 30015.

      Instance
      Specify your instance number, for example 02.



b. Under **Authentication Information**, specify the following:

Authentication Type
User/Password

Authentication Domain
If an authentication domain has not been defined, then click New to create a new authentication domain.

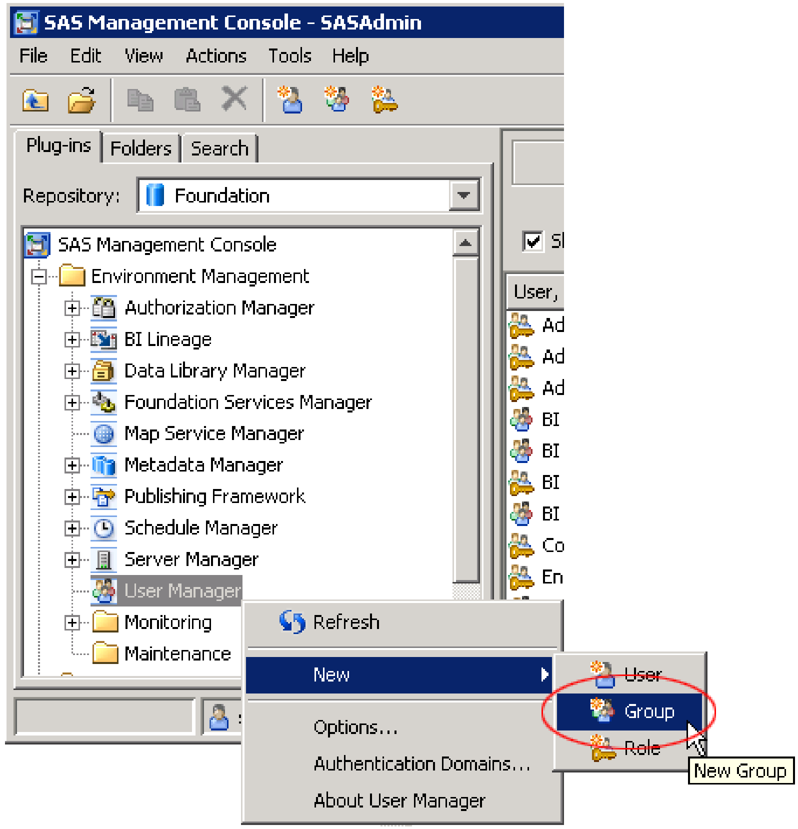
c. For **Advanced Options**, you can take the defaults.

After specifying connection properties, click **Next** and then click **Finish**.

Create a Group for HANA Authorization

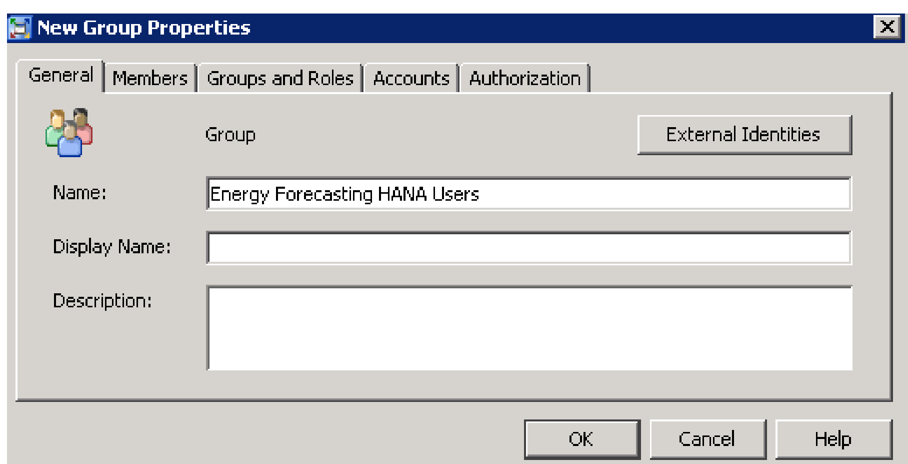
To create the metadata for a SAP HANA server:

1. Open SAS Management Console as administrator.
2. On the **Plug-Ins** tab, expand **SAS Management Console** ⇨ **Environment Managment**. Then right-click **User Manager** and select **New** ⇨ **Group**.

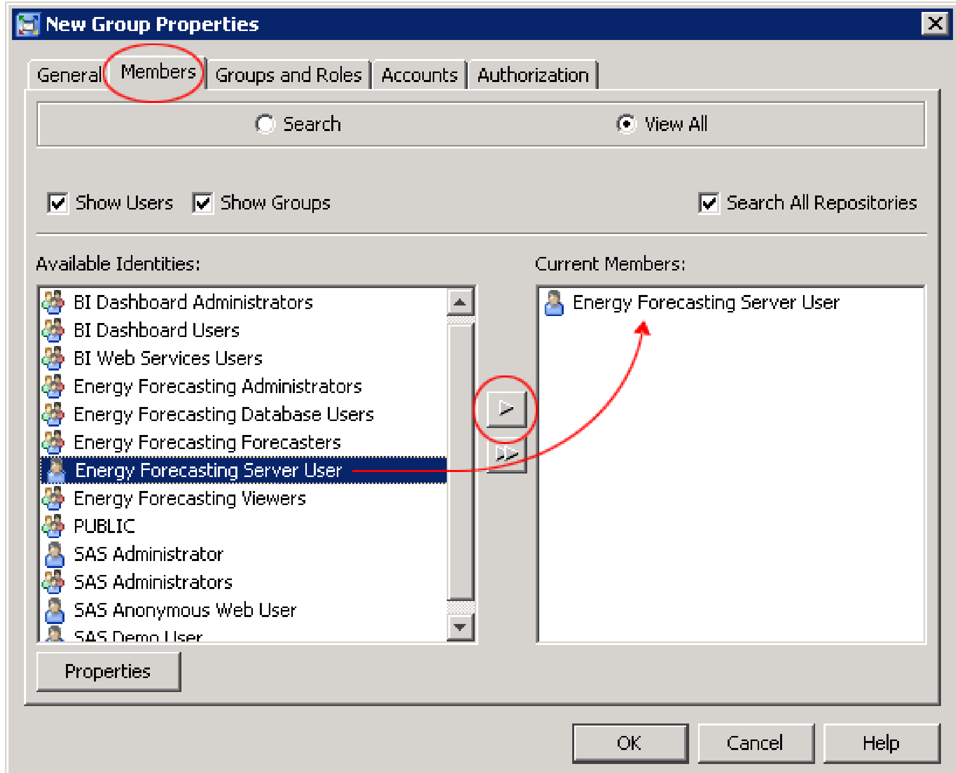


The New Group Properties opens.

3. Give the group a name, such as Energy Forecasting HANA Users.

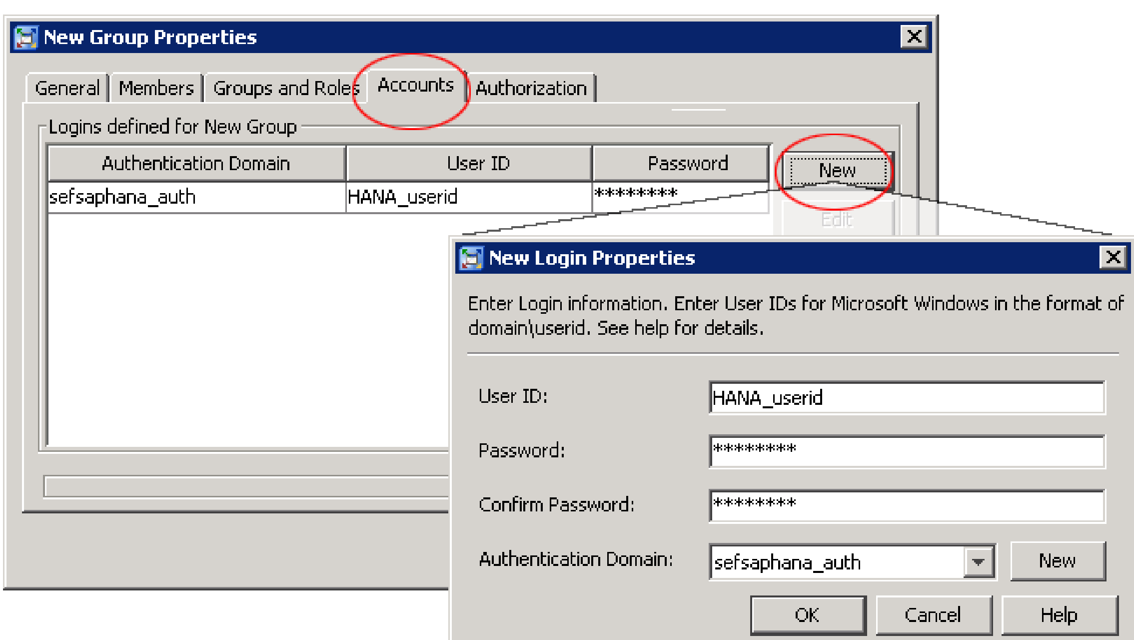


4. Click the **Members** tab, and then select **Energy Forecasting Server User** and add it as a member of the group.



5. Click the **Accounts** tab, and then click **New** and, on the New Login Properties window, specify the following information:
   - **User ID** (for HANA)
   - **Password** (for HANA)
   - **Authentication Domain** (for HANA)

   Note: This should be the same authentication domain as specified in Step 6b on page 122.

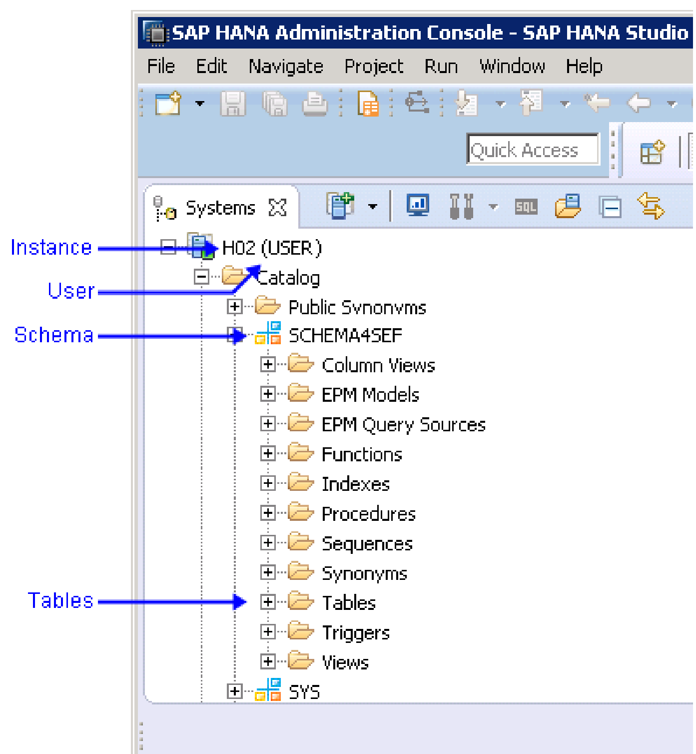


6. Click **OK** to save the group definition.

Step 3. Create a SAP HANA Schema

To access SAP HANA, you need a schema for the SAP HANA database where the tables created by SAS Energy Forecasting are stored. The schema is generally created by the system or data admininistrator who can do so with the following code in Base SAS, SAS Enterprise Guide, or SAS Data Integration Studio (substitute the values for your SAP HANA user and password, server, , instance, and schema name)

```
proc sql;
connect to SAPHANA(user=USERID password=PASSWORD
server='hana.abc.com' instance=02);
execute (create schema Schema4SEF) by SAPHANA;
disconnect from SAPHANA;
quit;
```



Step 4. Create a LIBNAME Statement

Use Notepad or other editor to create a file containing a LIBNAME statement for the SAP HANA database schema. The file should have an extension of .sas and reside anywhere on the server tier. For example: **C:\sefhana\libref.sas**. The name and directory are your choice. You will specify the name and directory as a parameter to the forecast. See "System Tab" on page 127.

The following is a sample LIBNAME statement:

```
LIBNAME freport SAPHANA INSERTBUFF=30000 TABLE_TYPE=column
```

```
DBCOMMIT=30000 SERVER="rndhana.unx.sas.com" INSTANCE=02
SCHEMA=SEFSAPHANA AUTHDOMAIN="sefsaphana_auth";
```

Note:

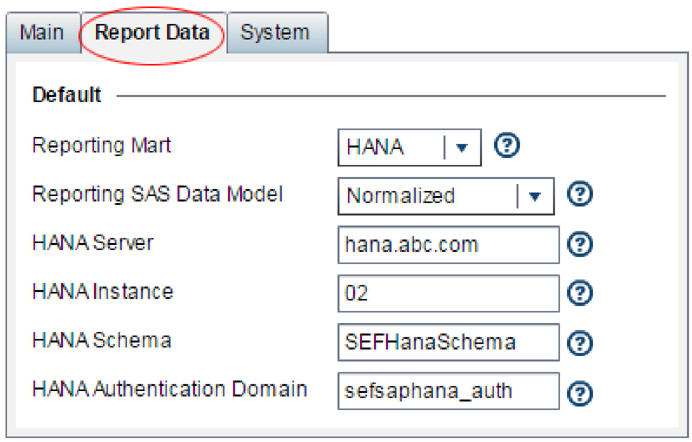
1. The value of LIBNAME must be **freport**.
2. The value of AUTHDOMAIN should be the authorization domain that you specified using the SAS Management Console. See Step 5 on page 124.

Step 5. Run a Forecast

If you want results data to be written to SAP HANA tables when you run a forecast, you must correctly specify forecast parameters on both the **Report Data** tab and on the **System** tab of the New Definition window.

Report Data Tab

Specify the following parameters on the **Report Data** tab:



Reporting Mart
Select **HANA** to cause output tables to be written as HANA tables.

Reporting SAS Data Model
Select **Normalized** for your HANA tables.

Note: Any other choice is ignored.

HANA Server
Specify the machine hosting the SAP HANA database.

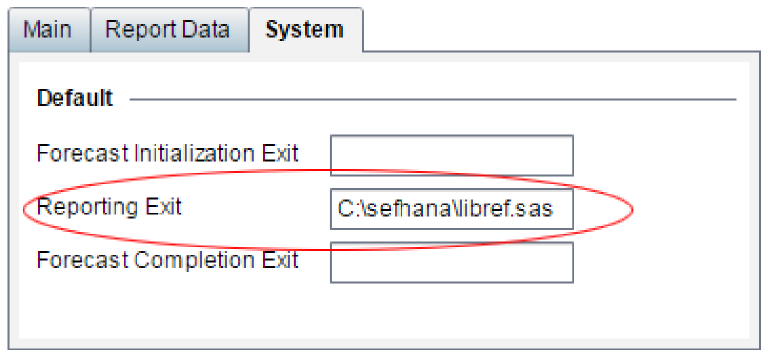
HANA Instance
Specify the instance of the SAP HANA database.

HANA Schema
Specify the schema for the SAP HANA database that describes the HANA tables to be created by SAS Energy Forecasting.

HANA Authentication Domain
Specify the SAP HANA authentication domain.

System Tab

On the **System** tab, in the **Reporting Exit** field, specify the complete path and file name of the file that you created for your libname. See "Step 4. Create a LIBNAME Statement" on page 125.



Part 3

Create a Forecast

Chapter 14

Create a Project

Overview

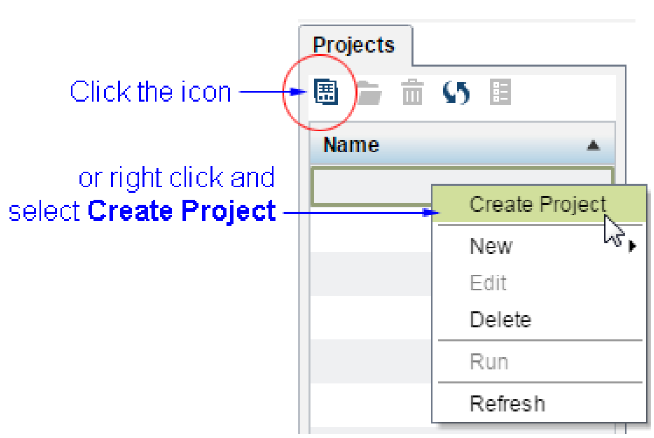
A project contains a set of diagnose definitions and forecast definitions. It also contains the results of running with those definitions.

Before you can create a diagnose definition or a forecast, you must first create a project to hold them. You can create multiple projects.

Create the Project

To create a project:

1. Click the Create project icon, or right-click in the Project area and select **Create Project**.



   The Create Project window opens.

2. Specify the following:

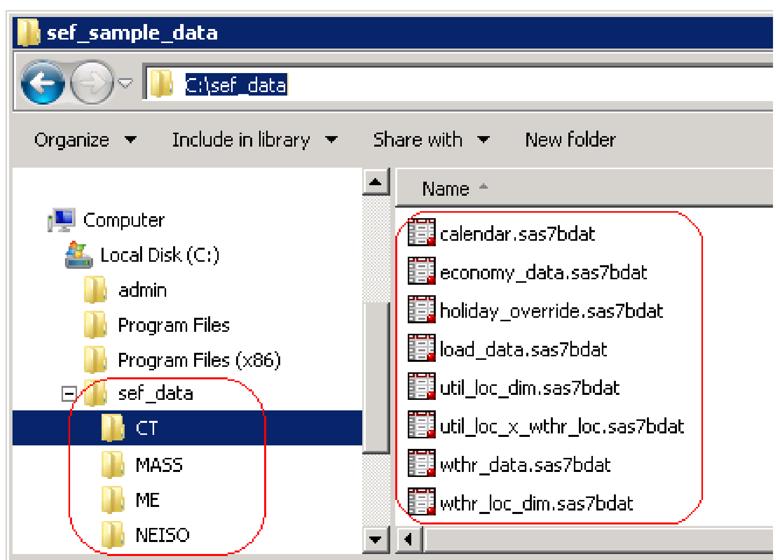
Name
Specify a project name. If the name is invalid, the name field is highlighted in red and a message is displayed.

Description
Optional description.

Input Path
Specify the complete path where input data for the project resides. The input path is the root directory for input data for any diagnose belonging to the project. The path location is arbitrary—your choice of where you want to put the input data.

For each foundation diagnose that you create in this project, SAS Energy Forecasting expects you to create a subdirectory of the input path to hold the input data for the diagnose. The name of the directory is the ID of the diagnose's utility. The ID is in the field UTIL_LOC_CD of the Utility table (see "Utility Table" on page 54). For example, the following picture shows an input path of **C:\sef_data** under which the user has created 4 subdirectories (CT, MASS, ME, NEISO), one for each of the utilities for which a diagnose is to be created in this project. When you run a diagnose, SAS Energy Forecasting expects the input data to be in those directories. Subsequently, when you run a forecast based on that diagnose, SAS Energy Forecasting expects the input data to continue to reside at that location.

The following picture shows the directory CT selected and its input data sets.



For the input data sets, see Chapter 5, "Prepare the Input Files," on page 47.

Output Path
Specify the complete path where result data is to be written.

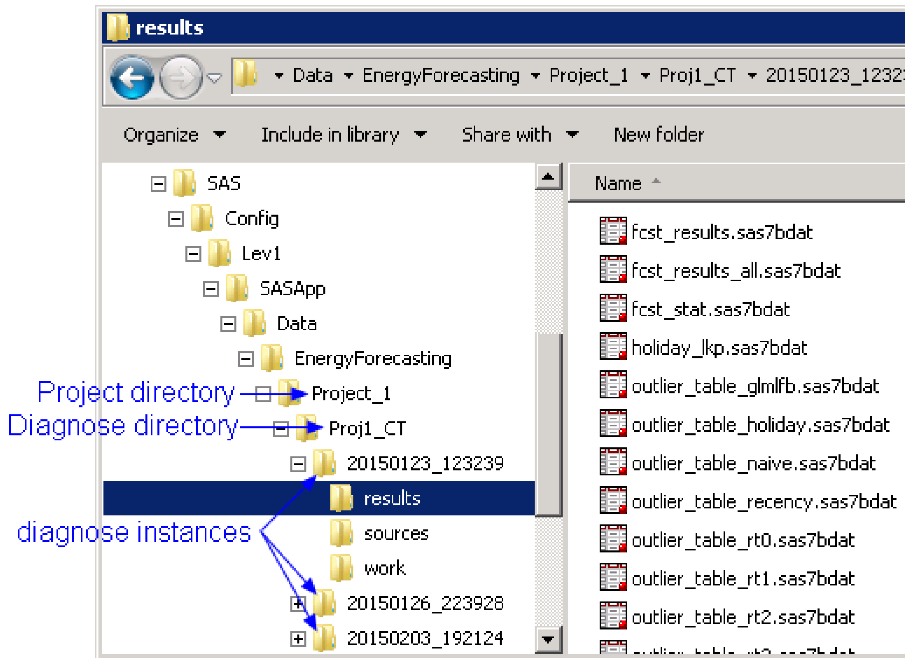
On Windows, the default output path is **C:\SAS\Config\Lev1\SASApp\Data\EnergyForecasting**.

The following picture shows that

- underneath the output path, SAS Energy Forecasting has created a directory for each project (in this case Project_1)
- underneath the project directory it has created a directory for each diagnose (in this case Proj1_CT)

- underneath the diagnose directory it has created three directories (results, sources, work).

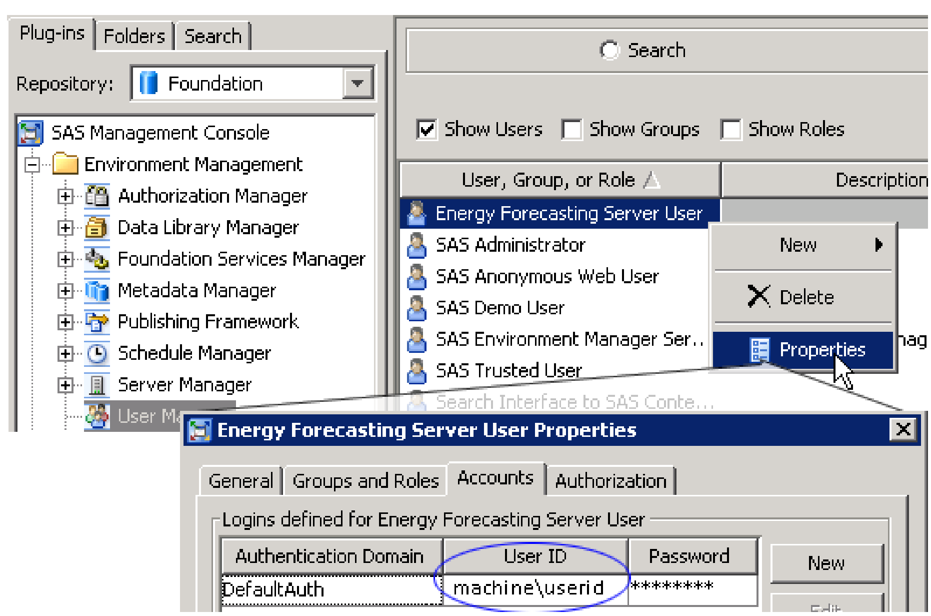
The picture also shows, in the results directory, some of the tables created as a result of running the diagnose.



For more information, see "Where Results are Stored" on page 151.

Note: Make sure that the userid associated with SAS Energy Forecasting Server User has the following permissions for the input and output paths:

- **Input path**: Read permission to the location specified by the input path.
- **Output path**: Read/Write/Delete permissions for the output path.



Chapter 15

Create a Foundation Diagnose

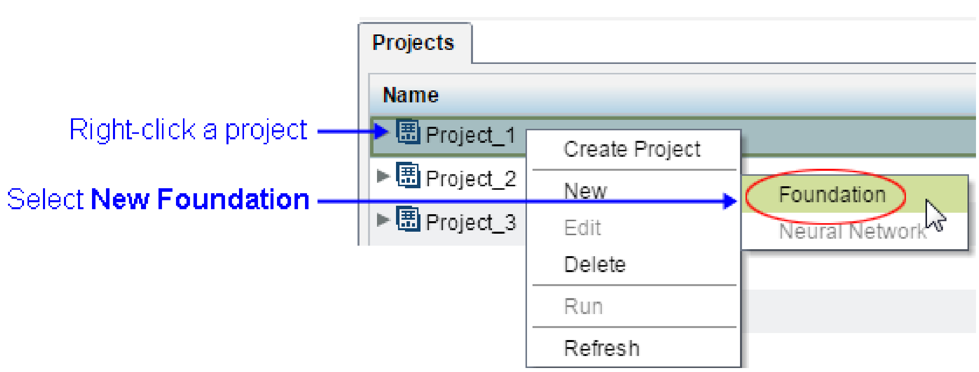
Create the Definition

The diagnose process results in choosing the best model for doing subsequent forecasts. You must run a foundation diagnose before you can run a forecast. It is expected that you will have a different diagnose definition for each type of forecast: very short term, short term, medium or long term.

Note: To create a diagnose definition, you must have created a project in which it resides. See Chapter 14, “Create a Project,” on page 131.

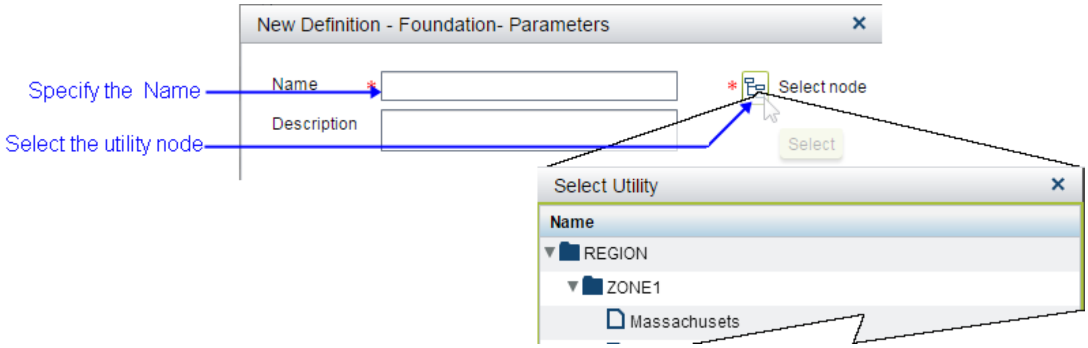
To create a foundation diagnose definition:

1. Right-click a project, and then select **New** ⇨ **Foundation**.



The New Definition dialog opens.

2. Specify a diagnose **Name** and **Description** (optional), and click the **Select node** button to select the utility node to which the diagnose applies.

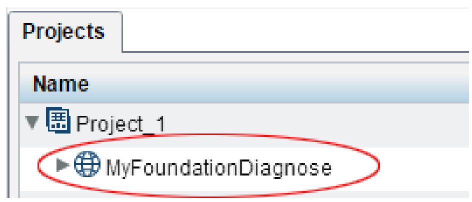


3. Complete the definition by specifying the diagnose parameters.

   See Chapter 19, “Parameters for a Foundation Diagnose,” on page 170.

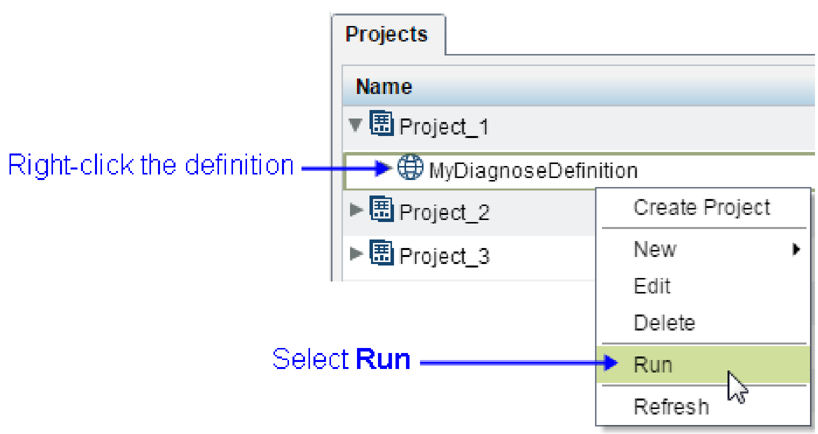
   Note: How you specify parameters can affect how long it takes to run a forecast. See “Parameter Selection and Forecast Performance” on page 180.

   When you finish specifying the parameters, a diagnose definition is displayed.

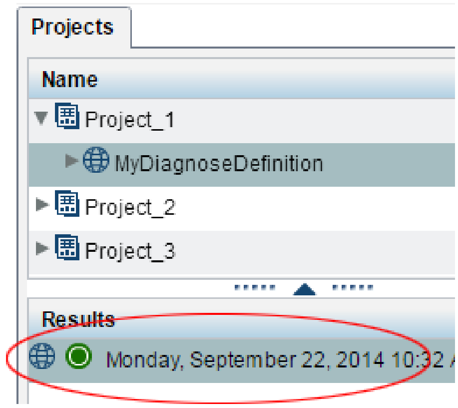


Run the Diagnose

To run a diagnose, right-click a diagnose definition, and then select **Run**.

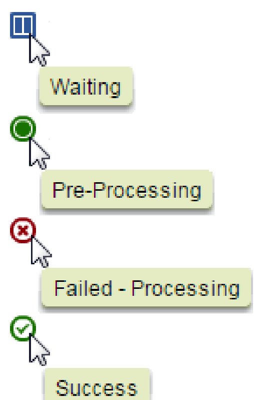


When the diagnose beings running, a line is displayed to display its progress.



Note: As shown in the following picture, an icon indicates one of the following statuses:

- Waiting — another process is running.
- Pre-processing — diagnose has started.
- Failed - Processing. See “View Status Messages ” on page 140.
- Success



For detailed information on the diagnose process, see Chapter 20, “The Diagnose Process,” on page 185.

See Also:

View diagnose progress

“Receive Email Notifications” on page 139

“View Status Messages ” on page 140

View diagnose results

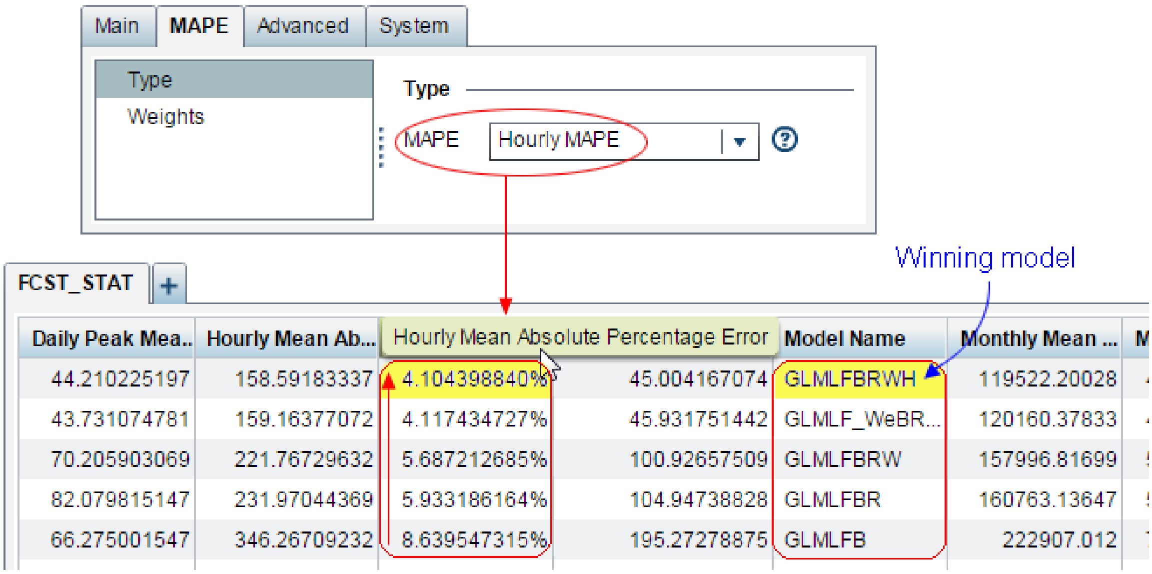
Chapter 17, “View the Results,” on page 151

Identify the Best Model

To identify the winning (champion) model from the diagnose:

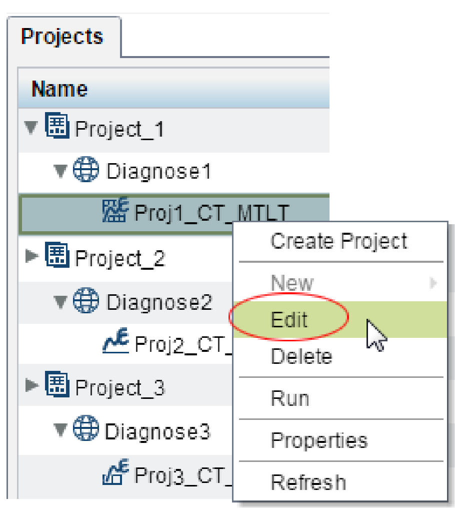
1. View the results of the diagnose. See “View a Table or Graph” on page 153.
2. Open FCST_STAT.

3. In the table view of FCST_STAT, records are sorted by the type of error statistic that is used to judge the best model. So the record for the model with the lowest error statistic—the winning model—is listed first as shown in the following picture.

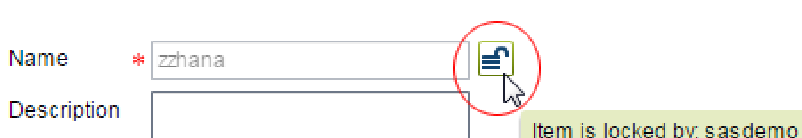


Edit a Diagnose Definition

To edit a diagnose or forecast definition, right-click the definition and select **Edit**.

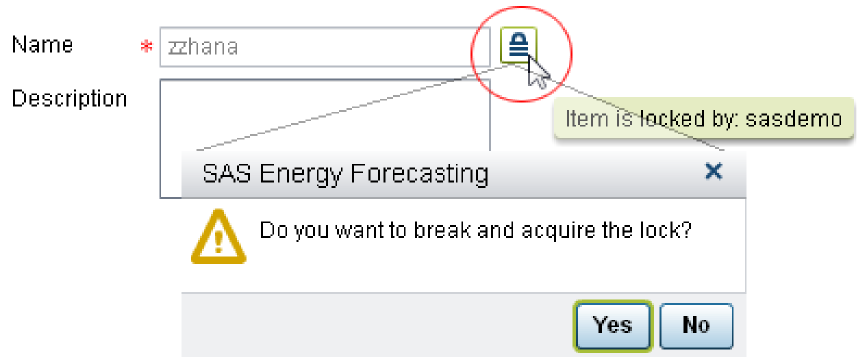


After creating a diagnose or forecast definition, when you edit it subsequently, you automatically acquire a lock on the definition. The fact that you have a lock is indicated by the open-lock icon shown in the picture below:

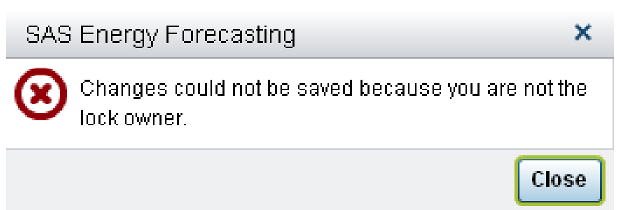


Note: The lock remains in effect only as long as you are in a browser editing the definition. If you close the definition, either saving or discarding any changes that you made, the lock is automatically released.

If someone else tries to edit the same definition while you have a lock, a closed-lock icon and pop-up message warns that user that the definition is in use. That user, however, can break the lock and acquire it by clicking on the lock icon as shown in the picture below.



Now, if you try to save your changes when another person has taken your lock then the system issues an error message that the changes could not be saved because you are not the lock owner.



In order to save your changes, you can take back the lock by clicking the lock icon.

In short, the locking mechanism provides notification that a diagnose or forecast definition is in use.

Receive Email Notifications

Because a forecast or diagnose can take a significant amount of time to complete, it is convenient to receive emails notifying you about the status of the job. You can receive an email to notify you of each of the following events:

- Successful
- Complete with Warning
- Cancelled
- Failed

To register to receive email notifications:

1. Select **File** ⇨ **Manage Alerts** ⇨ **Manage Alert Registrations**.

   The Manage Alert Registrations window opens.

2. Click the + sign.

   The Create New Alert window opens.

3. Specify the following:

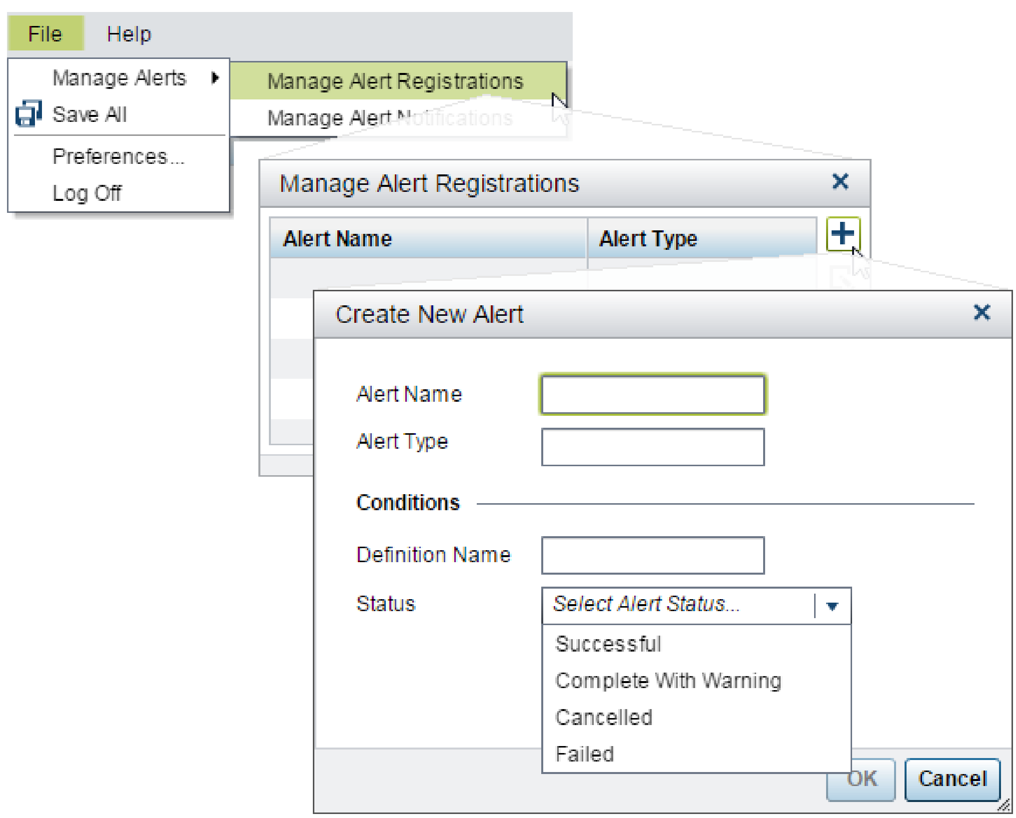
   Alert Name
   Specify the text string that is to appear in the body of the email that is sent.

   Definition Name
   Navigate to and select a diagnose or forecast definition (set of parameters).

   Status
   Select the event that is to trigger the email:

   - Successful
   - Complete with Warning
   - Cancelled
   - Failed

   Alert Type
   Is either **Diagnose** or **Forecast** depending on the type of definition that you selected.



4. Click **OK**.

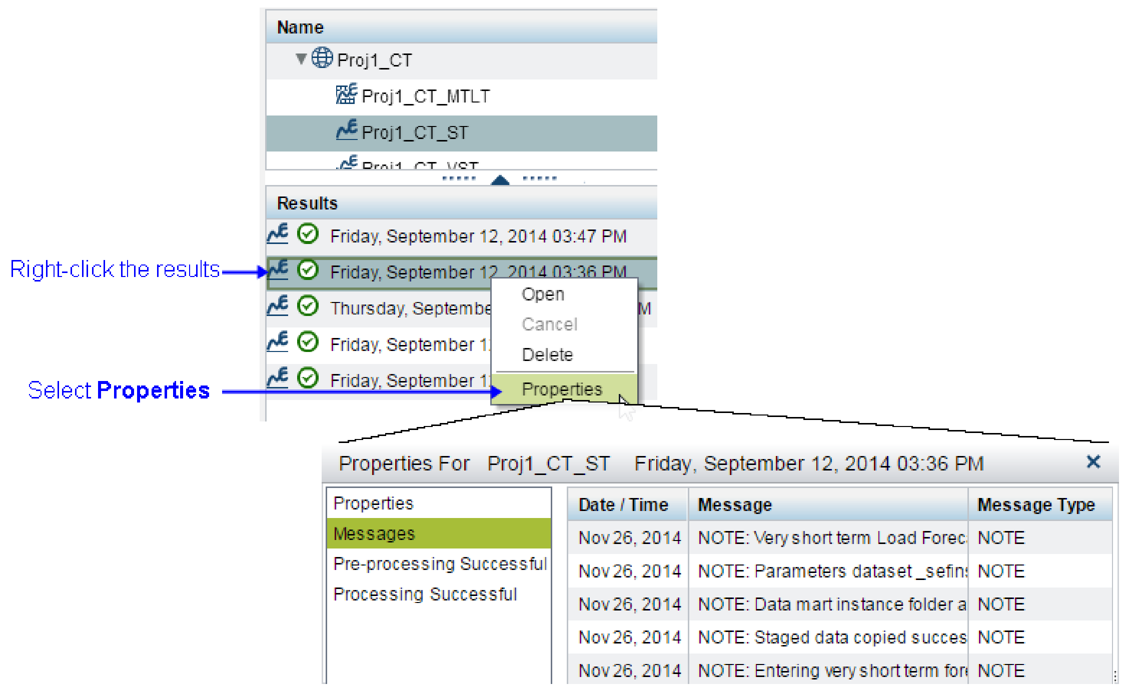
View Status Messages

To view status messages for a diagnose or forecast:

1. Select a diagnose or forecast definition (set of parameters).
2. Right-click the results from the diagnose or forecast, and select **Properties**.

   The Properties window opens from which you can view status messages.

   Note: To view logs, make sure that the application setting **Save Archive Logs** has been enabled. See "Application Settings" on page 65. However, because logs can consume memory, you probably will want to enable logs only for purposes of resolving a problem.



Chapter 16

Create a Forecast

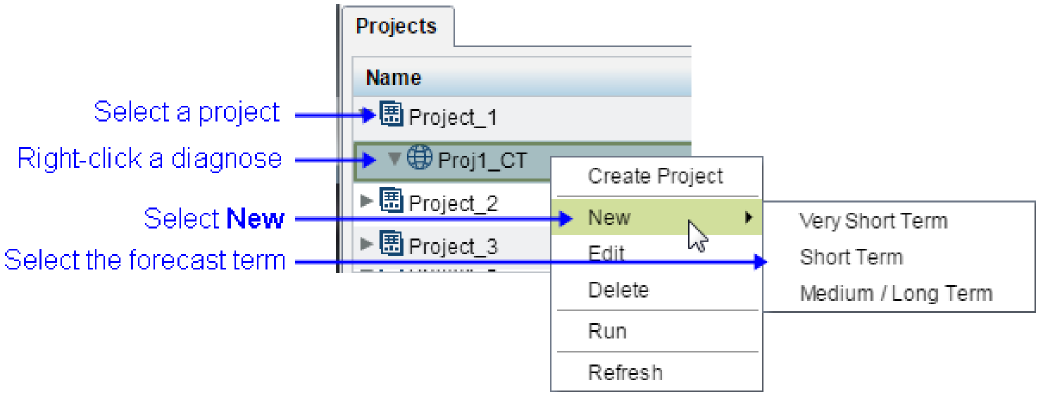
Create the Definition

Before you can run a forecast, you must first run a foundation diagnose. The diagnose process results in choosing the best model for doing subsequent forecasts. It is expected that you will have a different diagnose definition for each type of forecast: short term or very short term, medium or long term.

Note: How you specify parameters for a diagnose can affect how long it takes to run a forecast. See "Parameter Selection and Forecast Performance" on page 180.

To create a forecast:

1. Select a project.
2. Right-click a diagnose, and then select **New**.
3. Select the term for the forecast:
   - Very Short Term
   - Short Term
   - Medium / Long Term



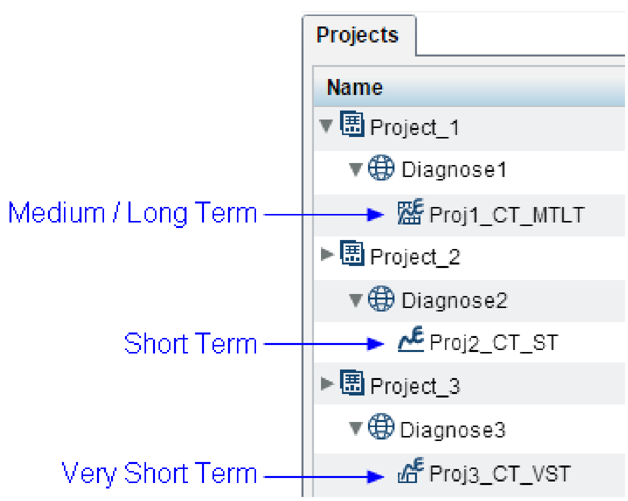
The New Definition window opens for you to specify forecast parameters.

4. Complete the definition by specifying the forecast parameters.

   See the following:

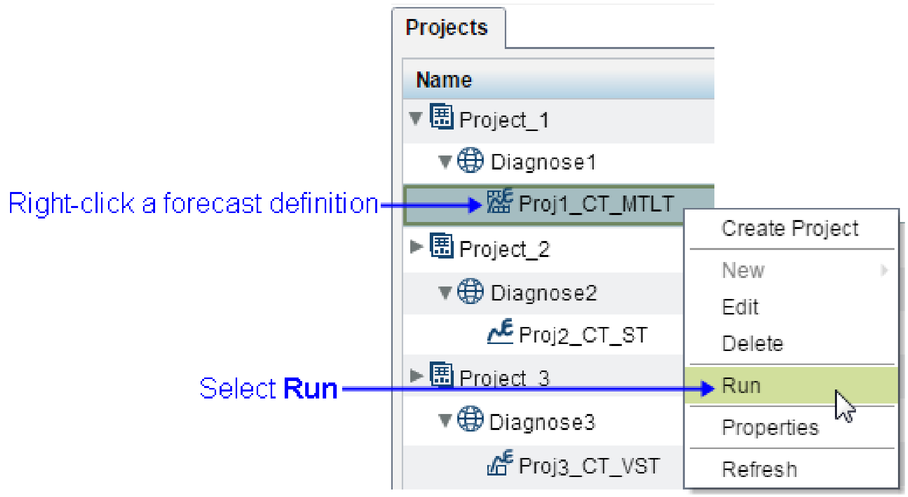
   - Chapter 22, "Parameters for Very Short Term Load Forecasting," on page 209
   - Chapter 25, "Parameters for Short Term Load Forecasting," on page 229
   - Chapter 28, "Parameters for Medium Term and Long Term Load Forecasting," on page 244

   When you finish specifying the parameters, a forecast definition is displayed.

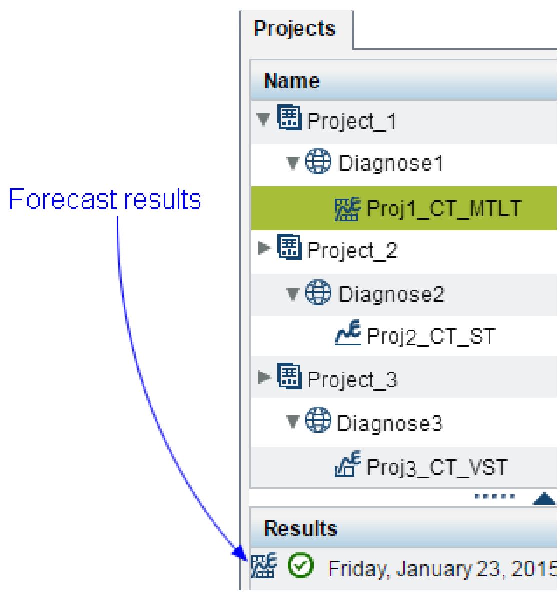


Run the Forecast

To run a forecast, right-click a forecast definition, and then select **Run**.

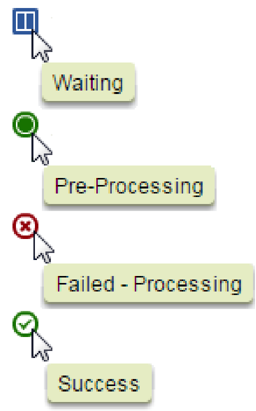


When the forecast begins running, a line is displayed to show its progress.



Note: As shown in the following picture, an icon indicates one of the following statuses:

- Waiting — another process is running.
- Pre-processing — diagnose has started.
- Failed - Processing. See "View Status Messages " on page 149.
- Success



For detailed information on the forecasting process, see the following:

- Very Short Term Forecasting on page 215
- Short Term Forecasting on page 235
- Medium/Long Term Forecastilng on page 249.

See Also:

View forecast progress
“Receive Email Notifications” on page 147

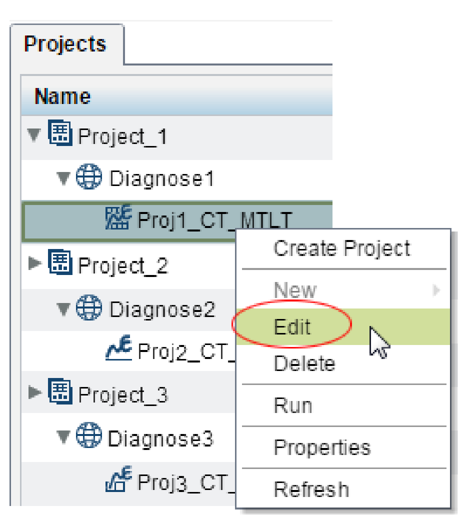
“View Status Messages ” on page 149

View forecast results
Chapter 17, “View the Results,” on page 151

Event Listening
Chapter 10, “Run in Batch,” on page 79

Edit a Forecast Definition

To edit a diagnose or forecast definition, right-click the definition and select **Edit**.



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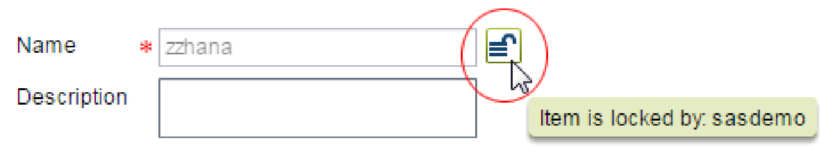

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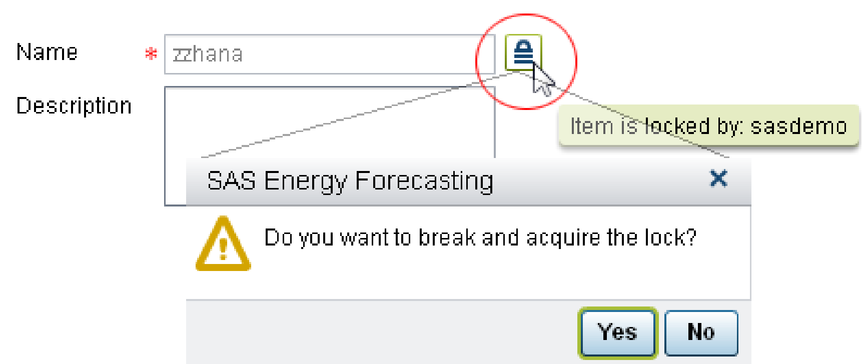

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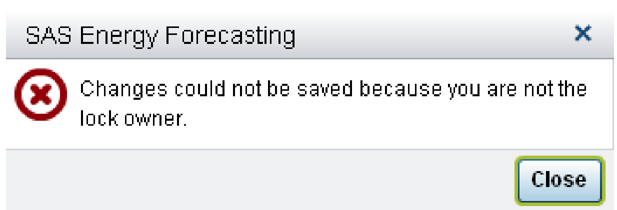

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In short, the locking mechanism provides notification that a diagnose or forecast definition is in use.

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1. Select **File** ⇨ **Manage Alerts** ⇨ **Manage Alert Registrations**.

   The Manage Alert Registrations window opens.

2. Click the + sign.

   The Create New Alert window opens.

3. Specify the following:

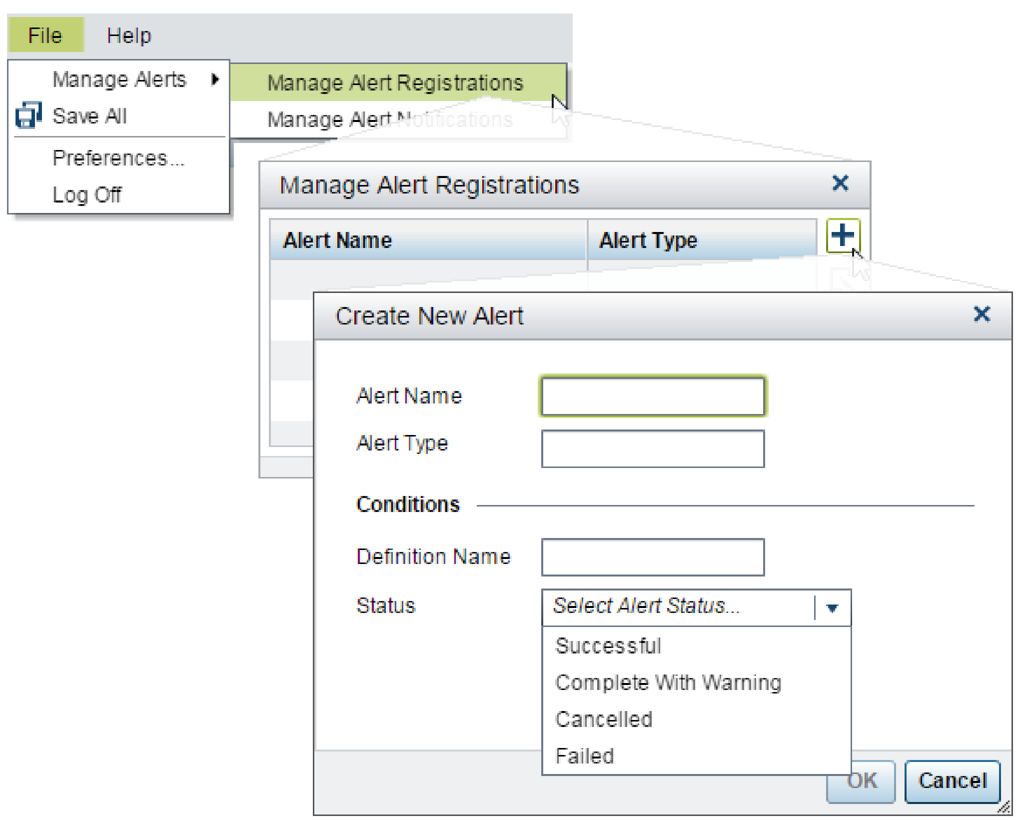
   Alert Name
   Specify the text string that is to appear in the body of the email that is sent.

   Definition Name
   Navigate to and select a diagnose or forecast definition (set of parameters).

   Status
   Select the event that is to trigger the email:

   - Successful
   - Complete with Warning
   - Cancelled
   - Failed

   Alert Type
   Is either **Diagnose** or **Forecast** depending on the type of definition that you selected.



4. Click **OK**.

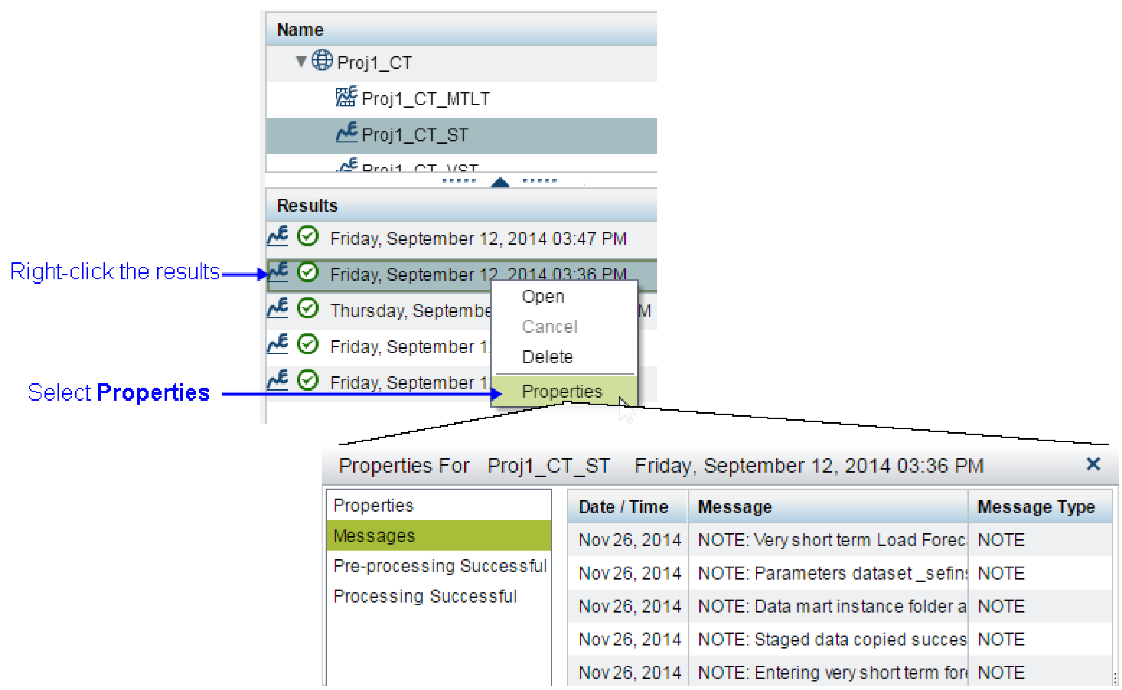
View Status Messages

To view status messages for a diagnose or forecast:

1. Select a diagnose or forecast definition (set of parameters).
2. Right-click the results from the diagnose or forecast, and select **Properties**.

   The Properties window opens from which you can view status messages.

   Note: To view logs, make sure that the application setting **Save Archive Logs** has been enabled. See “Application Settings” on page 65. However, because logs can consume memory, you probably will want to enable logs only for purposes of resolving a problem.



Run a Forecast in Batch

See Chapter 10, “Run in Batch,” on page 79.

Chapter 17

View the Results

Where Results are Stored

When you create a project, you must specify both an input path and an output path. The output path is the root directory for where the results of any diagnose or forecast belonging to the project is stored. See "Create the Project" on page 131.

In the following picture, you can see:

Output path
The output path of Project1 is the default output directory for Windows: `C:\SAS\Config\Lev1\SASApp\Data\EnergyForecasting\`.

Project directory
Underneath the output path, a project directory is automatically created whose name is the same as the project—`Project1`.

Diagnose directory
Underneath the project directory, a directory is automatically created for each diagnose in the project. The name of that directory is the same as the diagnose—`Proj1_CT` in this example.

Forecast directory

Also underneath the project directory, a directory is automatically created for each forecast in the project. The name of that directory is the same as the forecast—**`Proj_1_CT_MTLT`** in this example.

Forecast instance

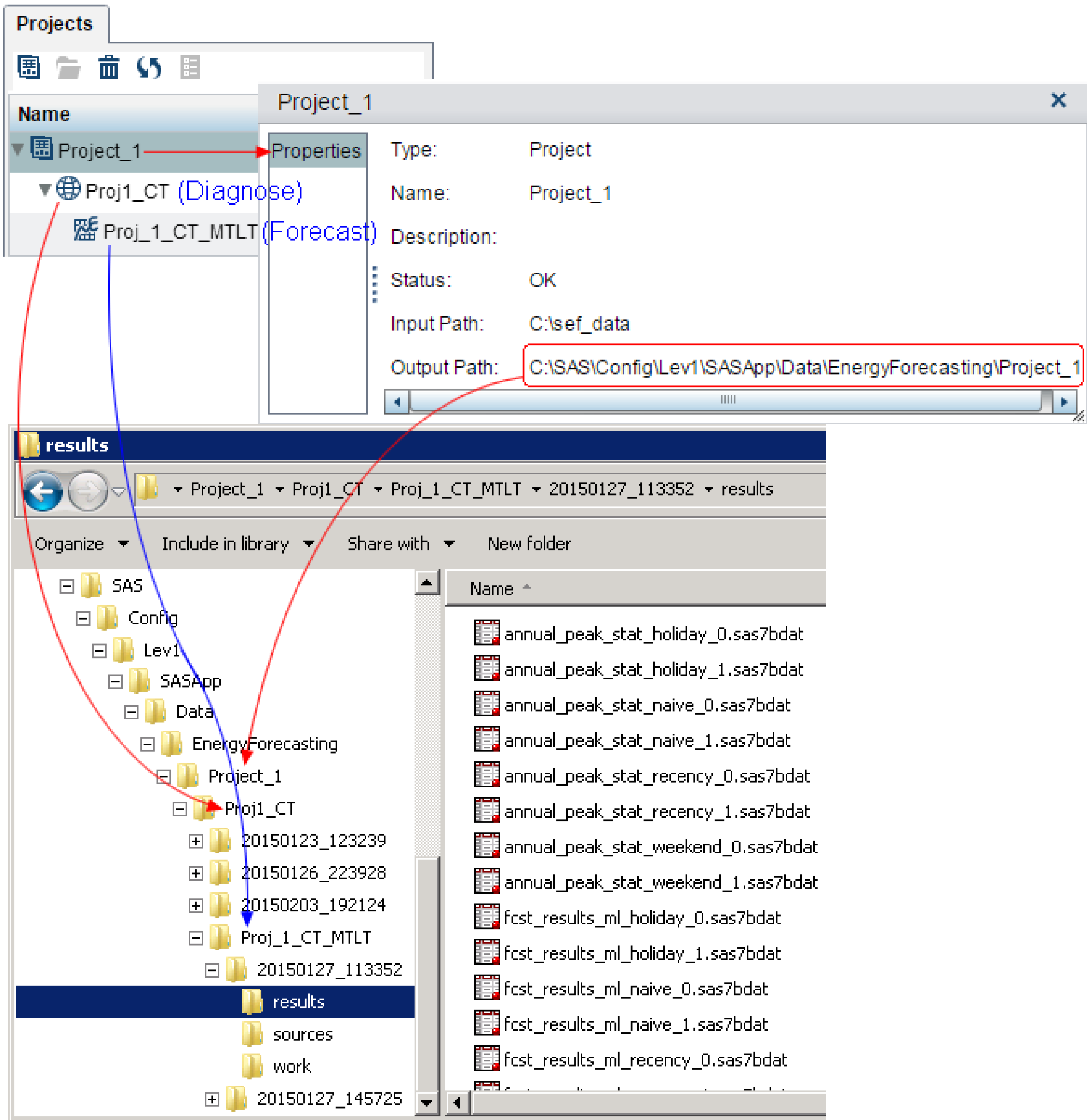
Underneath the forecast directory, a directory is automatically created for each time the forecast is run (each forecast instance). The name of that directory is a timestamp of when the forecast was run—**`20150127_113352`** in this example.

Each forecast instance directory contains three subdirectories:

results
: Contains the forecast results—such as **`annual_peak_stat_holiday_0.sas7bdat`** as you can see in the picture.

sources
: Contains a copy of each input data set used to produce the forecast or diagnose.

work
: Contains data sets created by SAS Energy Forecasting in the process of producing the forecast or diagnose.



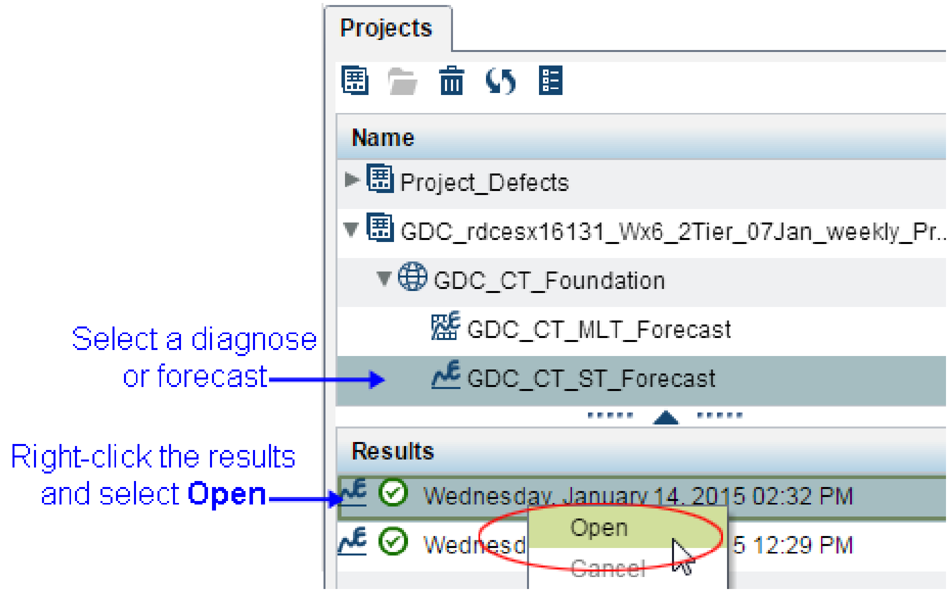
See Also

Chapter 14, “Create a Project,” on page 131

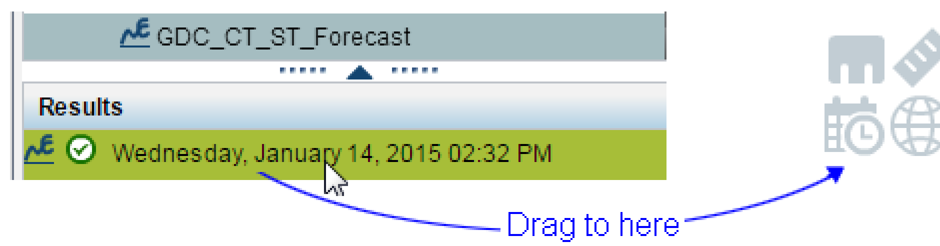
View a Table or Graph

To view the results of a diagnose or forecast:

1. Select a diagnose or forecast definition.
2. Right-click a result associated with that definition and select **Open**.



Note: Alternatively, you can drag the results to the center of the window.



A results data set is displayed both in the form of a table and a graph.

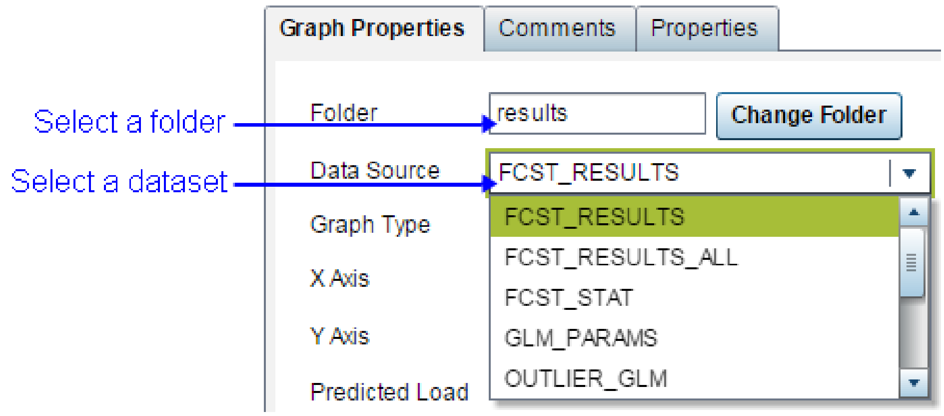
For information on the results data sets that you can view, see the following:

- For **Very Short Term** forecasting, see Chapter 24, "Very Short Term Forecast Result Files," on page 219.
- For **Short Term** forecasting, see Chapter 27, "Short Term Forecast Result Files," on page 237.
- For **Medium / Long Term** forecasting, seeChapter 30, "Medium Term/Long Term Forecast Result Files," on page 251.

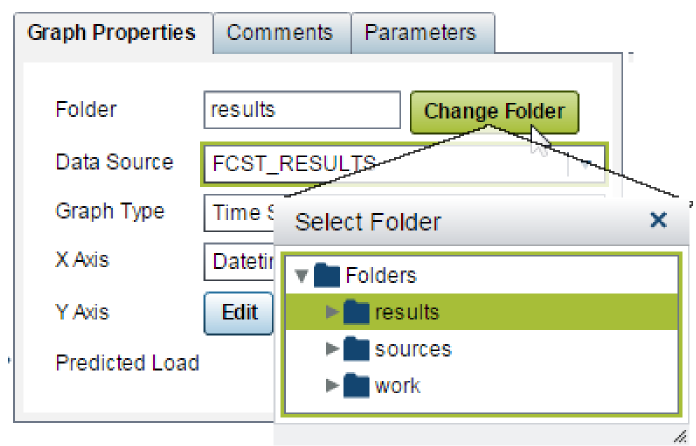
View a Different Data Set

To view a different data set, both in tabular and in graphical form:

1. Select a folder.
2. Select a data set from the dropdown list of result data sets.



3. To select a data set from a different folder, click Change Folder and then select the data set. You can select a data set from the following folders:
   - results
   - sources
   - work



For information on the results data sets that you can view, see the following:

- For **Very Short Term** forecasting, see Chapter 24, “Very Short Term Forecast Result Files,” on page 219.
- For **Short Term** forecasting, see Chapter 27, “Short Term Forecast Result Files,” on page 237.
- For **Medium / Long Term** forecasting, seeChapter 30, “Medium Term/Long Term Forecast Result Files,” on page 251.

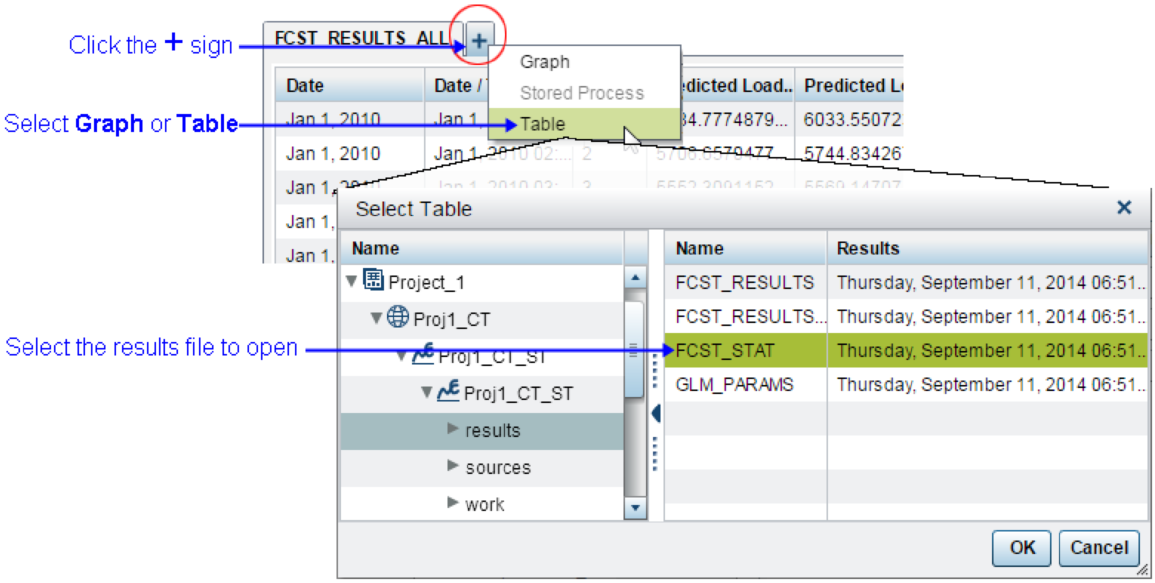
View an Additional Graph or Table

To view an additional table or graph:

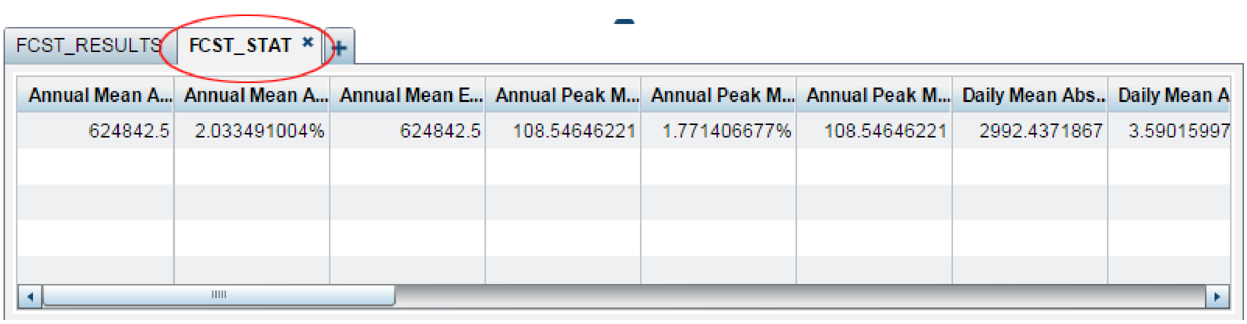
1. Click the plus sign next to the currently-displayed table.
2. Select **Graph** or **Table**.

   The Select Graph or Select Table window opens.

3. Select the file for which you want to see a graph or table.



The additional graph or table is displayed in a new tab.

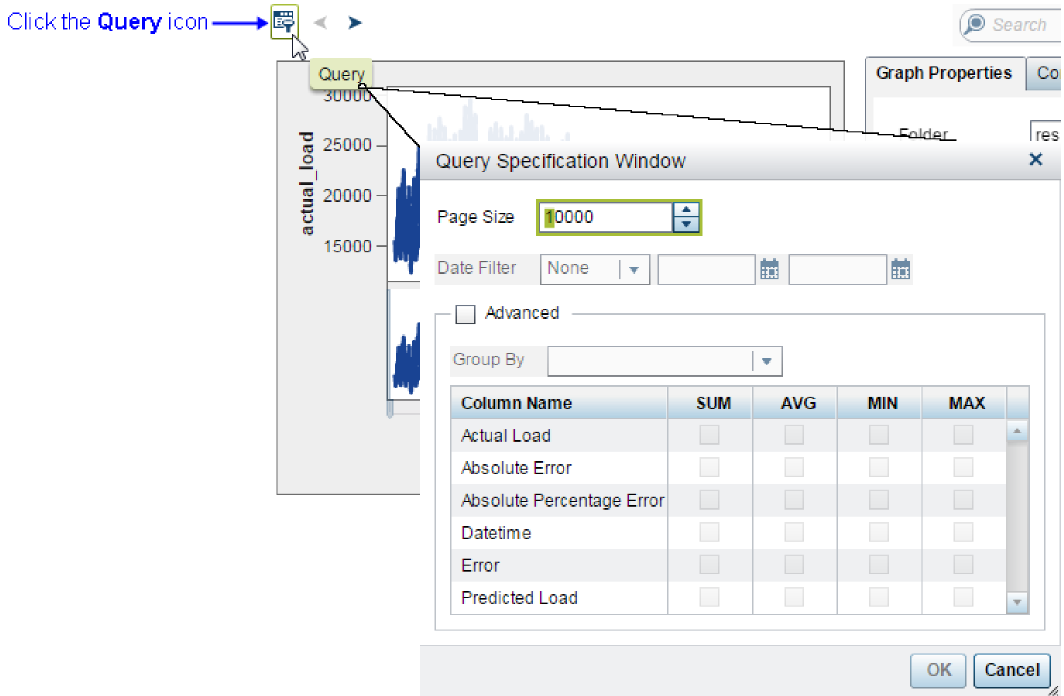


Modify the View by Customizing the Query

How To Invoke the Query Specification Window

Use the Query Specification window to specify a custom query whose results are displayed as a graph and table.

To invoke the Query Specification window, click the Query icon at the top left of an open graph.



Specify the Query

Specify the following parameters to form a custom query whose results are displayed as a graph and table.

Page Size
Specify how much data is to be read from the database at a time.

Note: Specifying too large a page size can result in the system timing out. If the system becomes unresponsive during a query, you can use the Escape key to cancel the current query and try reducing the page size.

Date Filter
Specify the beginning and end date of the results to be displayed.

Note: Specify **None** to not filter by date.

Group By
Specify the variable for the X axis.

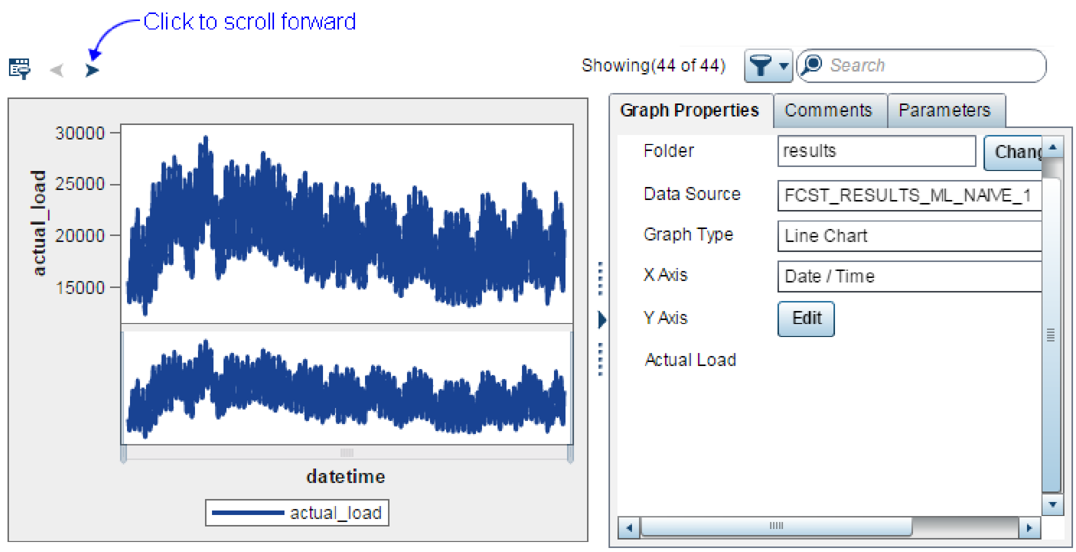
One point is displayed on the X axis for each distinct value of this variable. For example, if you specify *year* as the **Group By** variable, then one point is displayed on the X axis for each calendar year even if there are multiple rows in the database table for the same year. For example, there might be database rows for every day in a year, but only one point would be displayed on the X axis if you group by year.

Column Name
Specify one or more variables for the Y axis.

Because, with the **Group By** variable, every point on the X axis corresponds to multiple rows in the database, you must specify how to aggregate these rows to display a single point on the Y axis. You can specify SUM, AVG, MIN, MAX.

Example

The picture below shows the graph that results from having selected *Date/Time* for the X axis and *actual_load* for the Y axis. You can see that because Date/Time includes an enormous number of rows (one for every point in time at which a load value is obtained), the X axis is crowded with so much data that not all of it fits in the window—you can see that the scroll button is enabled to scroll forward.

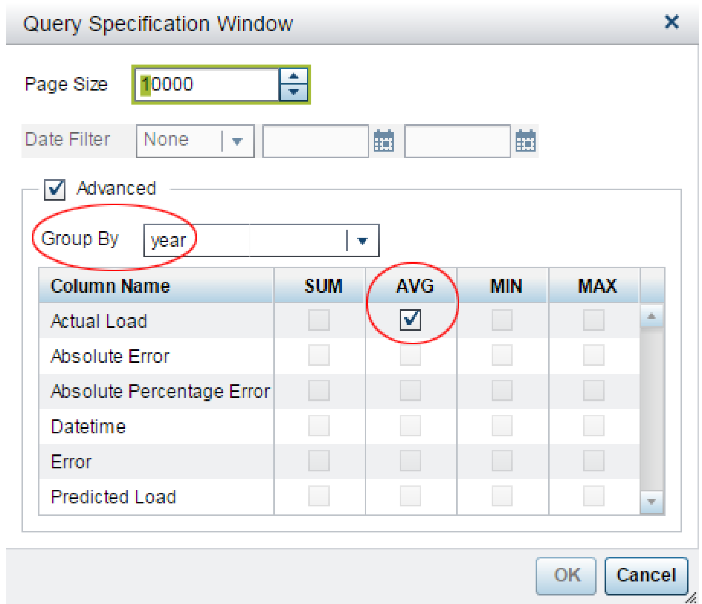


To alleviate the situation of an enormous amount of data being displayed on a single graph, the following picture shows a customer query whereby:

Page Size
: The value of **Page Size** is not changed from the default value. You can experiment with page size, but be careful about asking the system to query more data than your hardware can handle.

Group By
: *Year* is chosen for the X axis instead of *Date/Time*. The result of choosing year is that instead of displaying one point on the X axis for every point in time at which a load value is obtained, only one point is displayed on the X axis for every year. That is, all the rows for a single year are grouped together and displayed on the graph as a single point.

Column Name
: Because, with the **Group By** variable, every point on the X axis corresponds to multiple rows in the database, you must specify how to aggregate these rows so as to display a single point on the Y axis. In this example **AVG** is chosen. That is, for each year on the X axis, the average load is displayed for all the Date/Time load observations taken during that year.

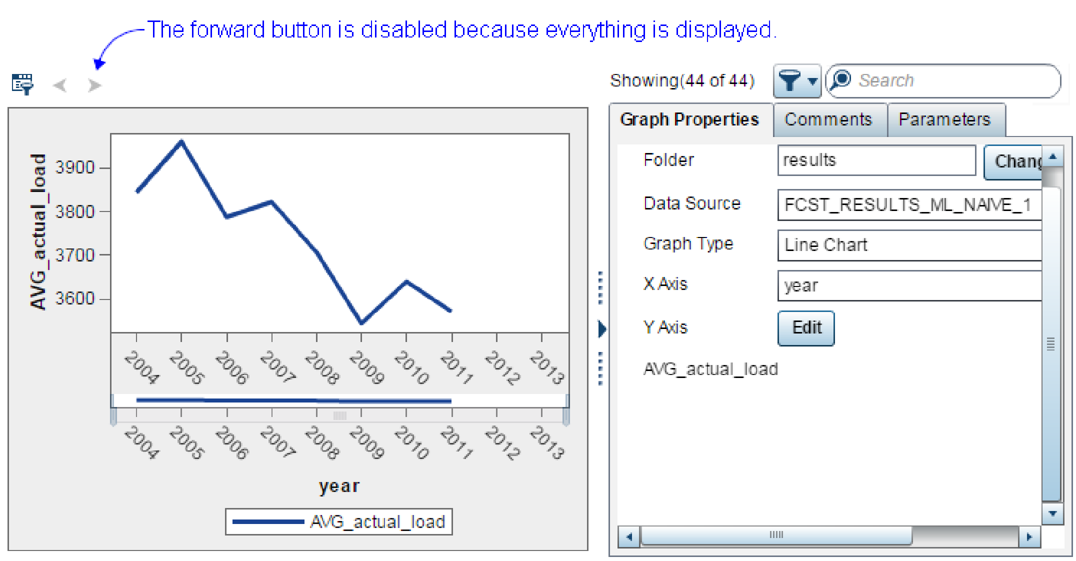


The following picture shows the results of the custom query. You can see that instead of one point on the X axis for every Date/Time load observation, there is only one point on the X axis per year. For each year, the average load during that year is displayed on the Y axis. And, you can see that because the number of years represented in the database is able to be displayed in a single graph, the scroll button is disabled.

You can also see that in place of the values chosen for the initial display, the values chosen for the custom query are now displayed under **Graph Properties**, namely:

X Axis: **year**

Y Axis: **AVG_actual_load**

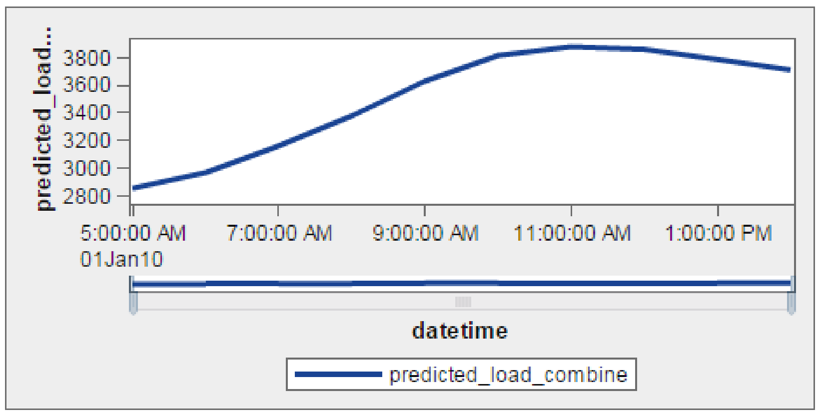


Change the Scale of the X Axis

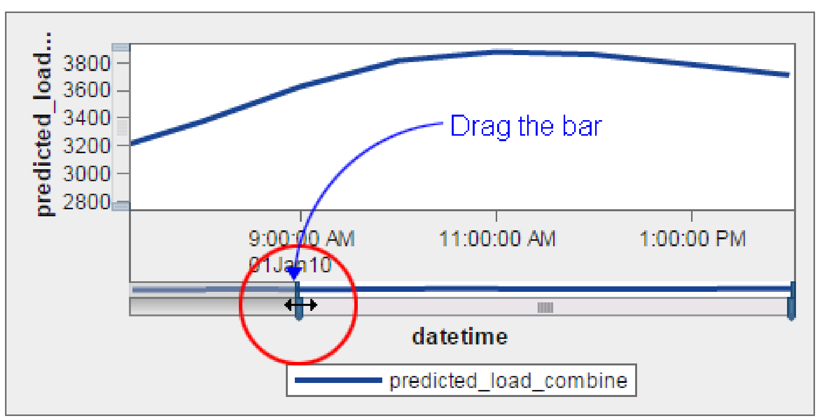
To change the scale of the X axis, drag the bar beneath the graph. You can drag the left bar to the right or the right bar to the left.

The following pictures show a graph before dragging, while dragging, and after dragging.

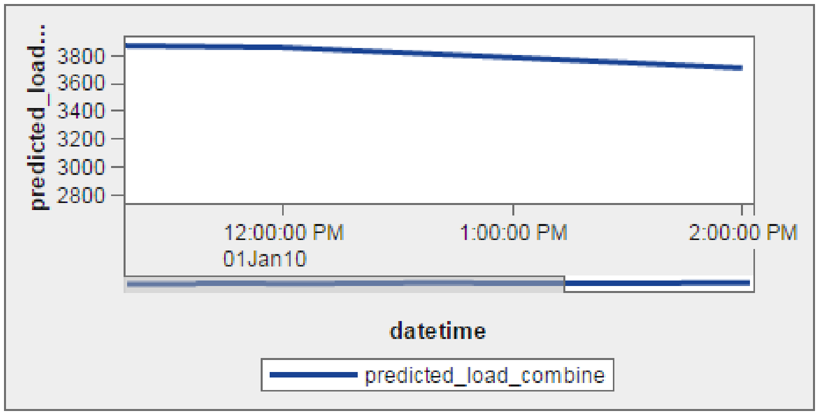
Before dragging:



While dragging the left bar to the right:



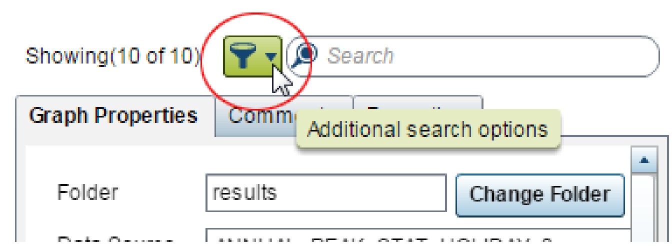
After dragging. Notice that now the X axis shows only the hours between 12 and 2, and the time line is much flatter.



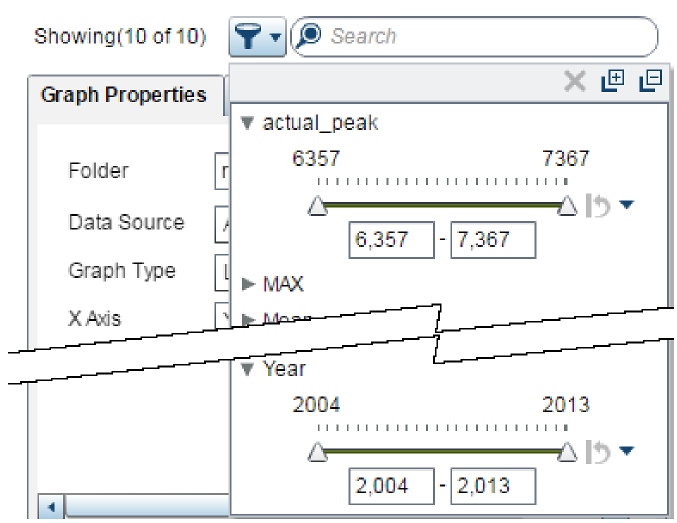
Filter the Results

To filter the result of a query:

1. Select the **Additional search options** button.

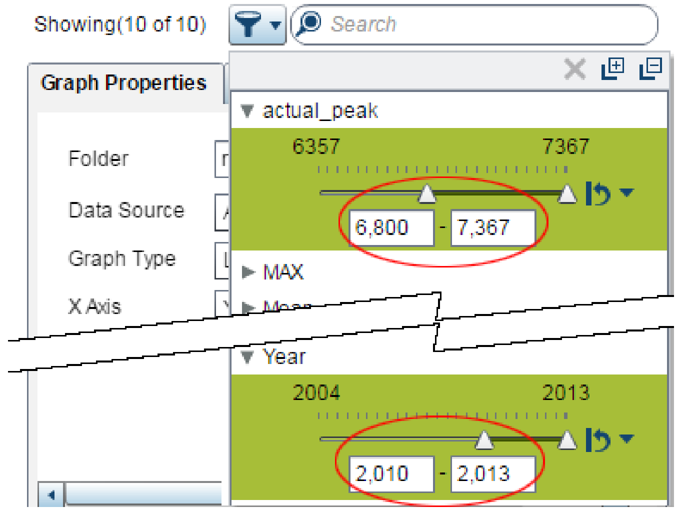


   A dialog opens showing all the fields that you can filter on.



2. For each field that you want to filter on, select the values to include in the results.

   For example, the following picture shows choosing the values from 6,800 to 7,367 for the field **actual_peak** and choosing the values 2010 to 2013 for the field **Year**. Consequently, the graph will show query results that include only the years 2010 to 2013 and only peak values within the specified range.



Note: Filtering applies to an entirely new query. It does not apply to the graph or table already displayed. Therefore, you can select fields to filter on that are not displayed in either the X or the Y axis.

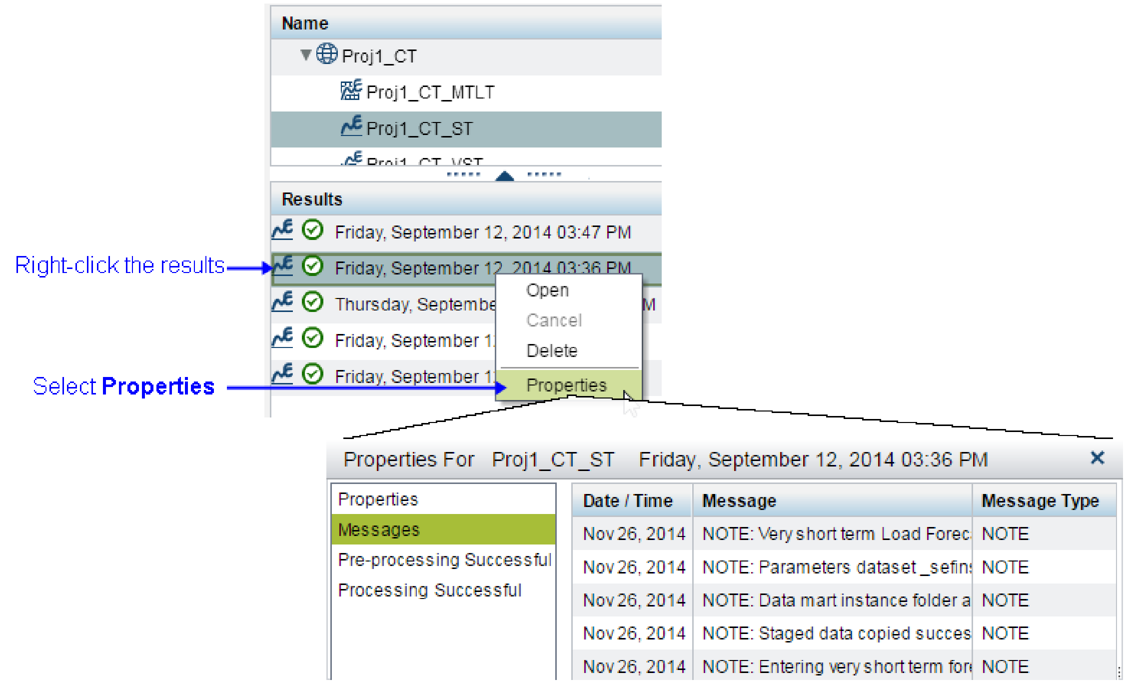
View Status Messages

To view status messages for a diagnose or forecast:

1. Select a diagnose or forecast definition (set of parameters).
2. Right-click the results from the diagnose or forecast, and select **Properties**.

   The Properties window opens from which you can view status messages.

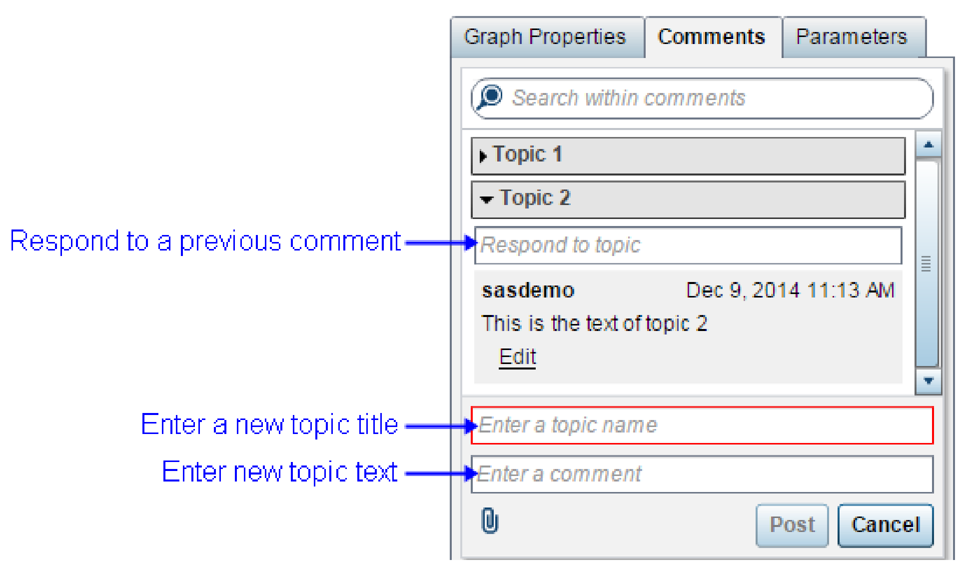
   Note: To view logs, make sure that the application setting **Save Archive Logs** has been enabled. See "Application Settings" on page 65. However, because logs can consume memory, you probably will want to enable logs only for purposes of resolving a problem.



Add Comments

To add comments to the output of a diagnose or forecast:

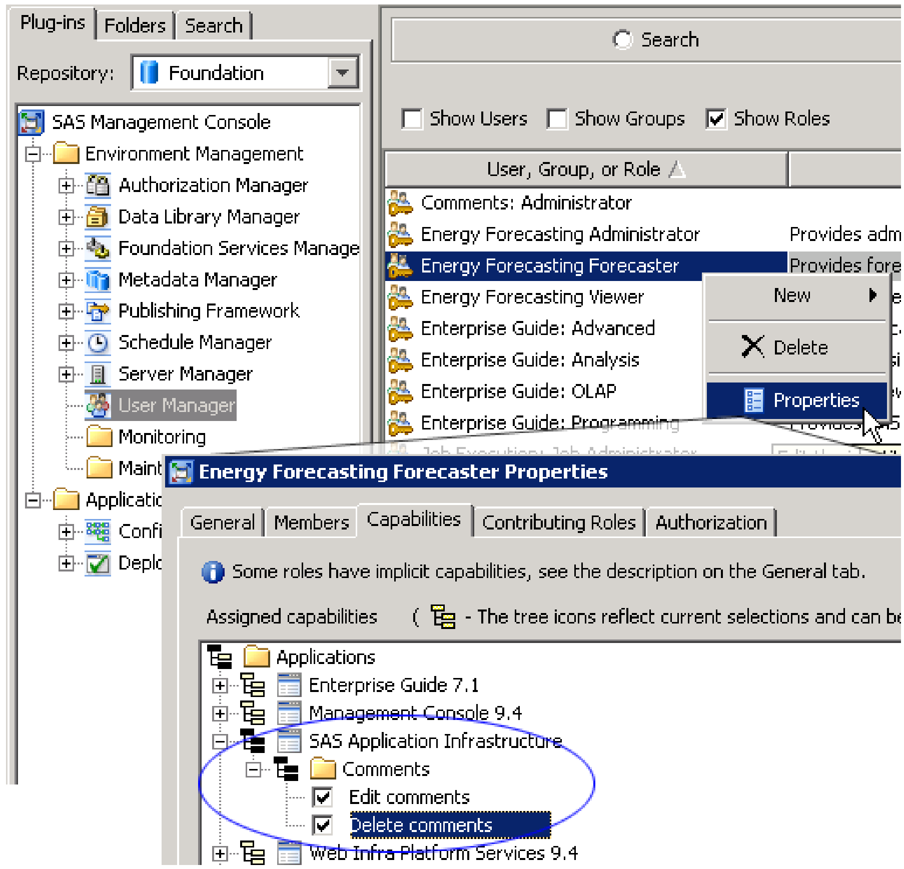
1. View the results of a diagnose or forecast. See "View a Table or Graph" on page 153.
2. Click the **Comments** tab.



3. Type a topic title and topic text.

   You can respond to a previous comment by typing in the field labelled **Respond to topic**.

Note: In order to delete a comment, the user must have the SAS Application Infrastructure **Delete comments** capability. A user has this capability by being a member of a group that has a role with this capability.



Chapter 18

Set User Preferences

Preferences

You can set the following user preferences:

- **Global Preferences** that apply to one user's use of any SAS Web application
- **SAS Energy Forecasting** preferences that apply to one user's use of SAS Energy Forecasting.

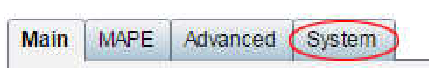
To set SAS Energy Forecasting user preferences:

1. Select **File** ⇨ **Preferences**.
2. Select **SAS Energy Forecasting**.
3. Select among the following preferences:

Show System Parameters

Select this option to show the **System** tab on windows where you set or edit forecast and diagnose parameters. Deselect this option to hide the tab.

Because you do not often change system parameters, you might want to hide them to prevent their being changed inadvertently.



Filter Archived Instances

When you archive diagnose and forecast results, they are moved to an archive location and deleted from their original location. However, they can continue to show up in the list of more recent diagnose and forecast results.

Note: You cannot open archived results with the SAS Energy Forecasting user interface. You must open them from their archived location.

- Select **Filter Archived Instances** so as *not* to show archived results along with more recent results.
- Deselect **Filter Archived Instances** so as to show archived results along with more recent results.

For information about archiving, see Chapter 9, "Archive Results Data," on page 71.

Filter Results After # Weeks

Specify a number of weeks so as not to show diagnose and forecast results that are older than the number of weeks specified. For example, if you specify 5 weeks, then diagnose and forecast results that are more than 5 weeks old are not listed along with more recent diagnose and forecast results.

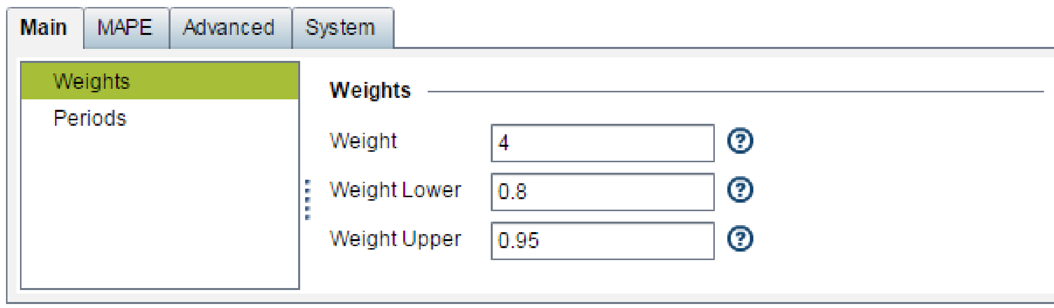
Part 4

Foundation Diagnose

Chapter 19

Parameters for a Foundation Diagnose

Main Parameters: Weights



Weight

Enter the number of weights utilized to calculate the weighted average temperature. The calculation is exponentially smoothed.

You can choose up to four different models for calculating the weighted average temperature based on up to four corresponding weights. Valid values: 1, 2, 3, or 4. If you set **Weight**=1, then, **Weight Lower** should equal **Weight Upper**. Default is 4.

Applies to the Recency model.

Column name in table: weight_num

Weight Lower

Enter the lower boundary of the weight utilized to calculate the exponentially smoothed temperature. Valid values are between 0.8 and 1. Default is 0.8.

Applies to the Recency model.

Column name in table: weight_lower

Weight Upper

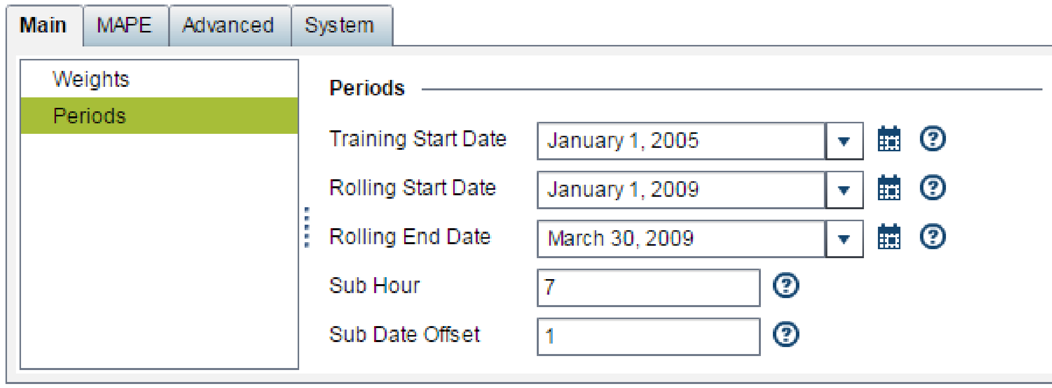
Enter the upper boundary of the weight utilized to calculate the exponentially smoothed temperature. Valid values are between 0.8 and 1. Default is 0.95.

Note: If the number of weights is 1, then **Weight Lower** should equal **Weight Upper**.

Applies to the Recency model.

Column name in table: weight_upper

Main Parameters: Periods



Training Start Date

Select the start date of the historical data to be used to “train” the diagnose model so that it selects the best model. Set the start date of training data to be equal to or later than the start date of the utility’s historical load data (the total input of historical data that is available).

You should have at least two years of data for model training to produce a good diagnose and three years is better.

Column name in table: train_start_date

Rolling Start Date

Select the start date of the holdout period. The holdout period is the period between the **Rolling Start Date** and the **Rolling End Date**. By comparing the forecast results of a particular model with the actual load data in the holdout period (which data is not used in creating the diagnose model), the system calculates a MAPE that is used to select the best model.

The **Rolling Start Date** should be at least 12 months later than the **Training Start Date**. The training period extends from the **Training Start Date** up to the **Rolling Start Date**.

Note: How you specify the holdout period can affect how long it takes to do a very short term load forecast. See “Parameter Selection and Forecast Performance” on page 180.

Column name in table: rolling_start_date

Rolling End Date

Select the end date of the holdout period. The holdout period is the period between the **Rolling Start Date** and the **Rolling End Date**. Following are suggested lengths for the holdout period:

- **Very Short Term**: Last 7 days. For more information, see “Parameter Selection and Forecast Performance” on page 180.
- **Short Term**: Last 30 days

- **Medium Term/Long Term**: Minimum 1 year, and 2–3 years preferred

Note: How you specify the holdout period can affect how long it takes to do a very short term load forecast. See "Parameter Selection and Forecast Performance" on page 180.

Column name in table: rolling_end_date

Sub Hour

Enter the hour for submission (usually 7). For example, 7 means 7 AM.

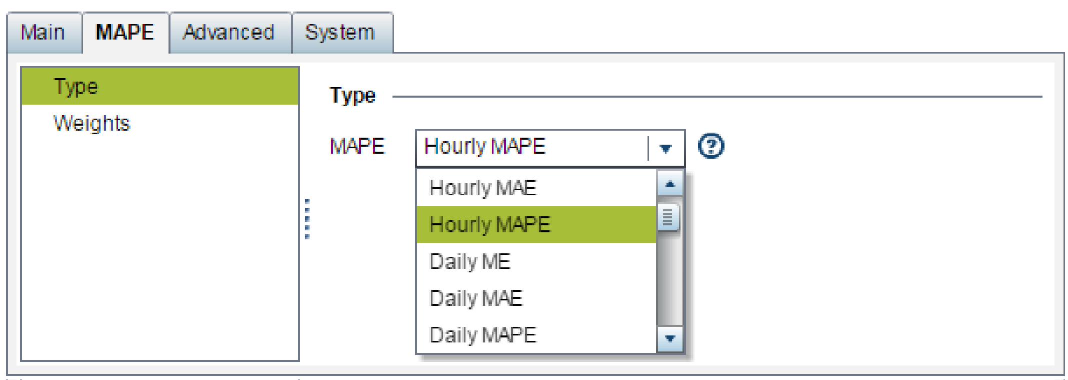
Column name in table: sub_hour

Sub Date Offset

Enter the number of days (usually 1) between the date of submission and the date of forecast.

Column name in table: sub_date_offset

MAPE Parameters: Type



MAPE

Enter the criterion for selecting the best ("champion") model.

Note:

- ME = Mean error
- MAE = Mean absolute error
- MAPE = Mean absolute percentage error

The MAPE selected provides the criteron used for selecting the best (champion) model. It is calculated by comparing the forecast results of a model with the actual load data in the holdout period (the period between the Rolling Start Date and the Rolling End Date). The load data in the holdout period is not used in creating the diagnose model.

The value can be any of the following:

- hourly_me
- hourly_mae

- hourly_mape
- daily_me
- daily_mae
- daily_mape
- daily_peak_me
- daily_peak_mae
- daily_peak_mape
- monthly_me
- monthly_mae
- monthly_mape
- monthly_peak_me
- monthly_peak_mae
- monthly_peak_mape
- annual_me
- annual_mae
- annual_mape
- annual_peak_me
- annual_peak_mae
- annual_peak_mape
- weighted_mape

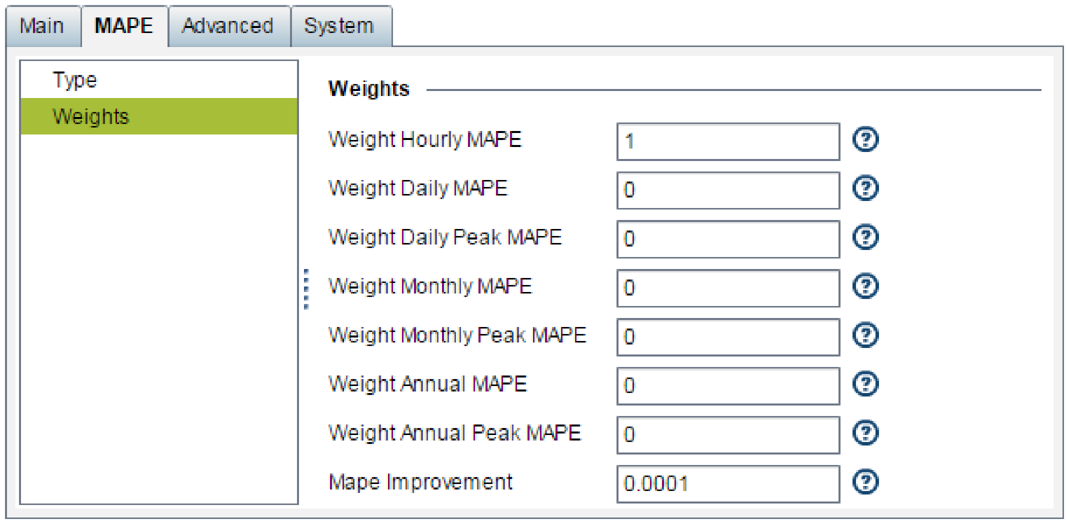
Column name in table: mape

See Also

"Error Analysis Equations" on page 189

MAPE Parameters: Weights

Weight parameters apply only if you selected **weight_mape** as the type of MAPE to use for choosing the best model.



Weight Hourly MAPE

Weighted Hourly Mean Absolute Percentage Error

This is the weight assigned to hourly MAPE in calculating weighted_mape. The weight must be less than or equal to 1 and the sum of all weights must equal to 1. Enter a decimal value rather than a percentage value. For example, 0.1 rather than 10%.

Column name in table: w_hourly_mape

Note: This parameter applies only if you selected **weighted_mape** as the type of MAPE to use in choosing the best model.

Weight Daily MAPE

Weighted Daily Mean Absolute Percentage Error

This is the weight assigned to daily energy MAPE in calculating weighted_mape. The weight must be less than or equal to 1 and the sum of all weights must equal to 1. Enter a decimal value rather than a percentage value. For example, 0.1 rather than 10%.

Column name in table: w_daily_mape

Note: This parameter applies only if you selected **weighted_mape** as the type of MAPE to use in choosing the best model.

Weight Daily Peak MAPE

Weighted Daily Peak Mean Absolute Percentage Error

This is the weight assigned to daily peak MAPE in calculating weighted_mape. The weight must be less than or equal to 1 and the sum of all weights must equal to 1. Enter a decimal value rather than a percentage value. For example, 0.1 rather than 10%.

Column name in table: w_daily_peak_mape

Note: This parameter applies only if you selected **weighted_mape** as the type of MAPE to use in choosing the best model.

Weight Monthly MAPE

Weighted Monthly Mean Absolute Percentage Error

This is the weight assigned to monthly energy MAPE in calculating weighted_mape. The weight must be less than or equal to 1 and the sum of all weights must equal to 1. Enter a decimal value rather than a percentage value. For example, 0.1 rather than 10%.

Column name in table: w_monthly_mape

Note: This parameter applies only if you selected **weighted_mape** as the type of MAPE to use in choosing the best model.

Weight Monthly Peak MAPE

Weighted Monthly Peak Mean Absolute Percentage Error

This is the weight assigned to monthly peak MAPE in calculating weighted_mape. The weight must be less than or equal to 1 and the sum of all weights must equal to 1. Enter a decimal value rather than a percentage value. For example, 0.1 rather than 10%.

Column name in table: w_monthly_peak_mape

Note: This parameter applies only if you selected **weighted_mape** as the type of MAPE to use in choosing the best model.

Weight Annual MAPE

Weighted Annual Mean Absolute Percentage Error

This is the weight assigned to annual energy MAPE in calculating weighted_mape. The weight must be less than or equal to 1 and the sum of all weights must equal to 1. Enter a decimal value rather than a percentage value. For example, 0.1 rather than 10%.

Column name in table: w_annual_mape

Note: This parameter applies only if you selected **weighted_mape** as the type of MAPE to use in choosing the best model.

Weight Annual Peak MAPE

Weighted Annual Peak Mean Absolute Percentage Error

This is the weight assigned to annual peak MAPE in calculating weighted_mape. The weight must be less than or equal to 1 and the sum of all weights must equal to 1. Enter a decimal value rather than a percentage value. For example, 0.1 rather than 10%.

Column name in table: w_annual_peak_mape

Note: This parameter applies only if you selected **weighted_mape** as the type of MAPE to use in choosing the best model.

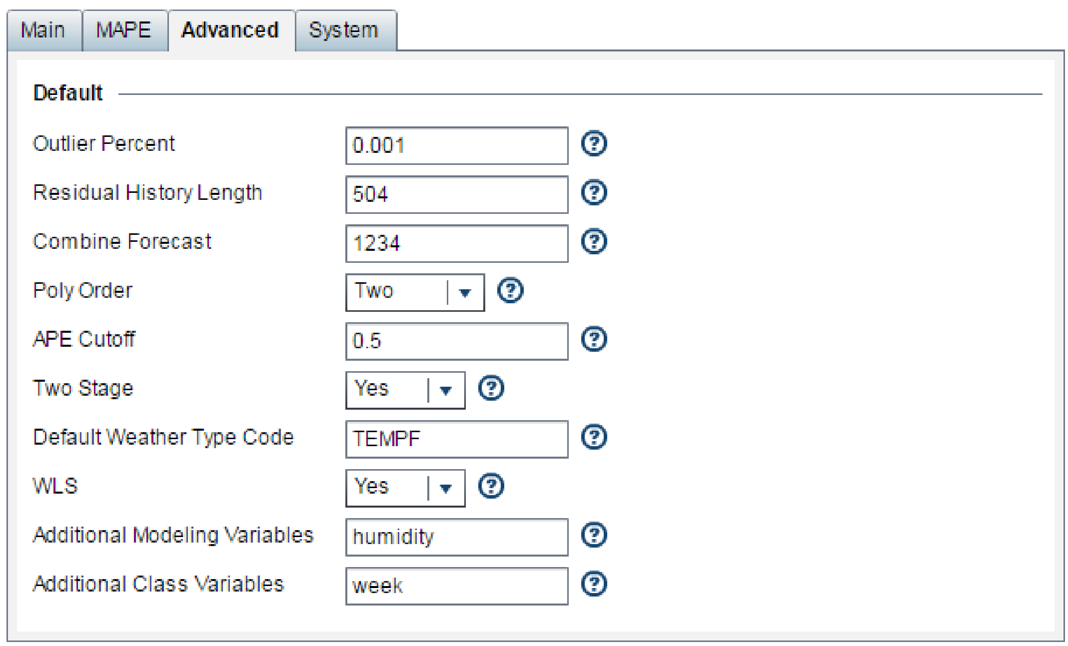
MAPE Improvement

Only if the model MAPE improvement is higher than the entered value should the forecasting improvement be considered significant. The default value is 0.0001.

Column name in table: mape_improvement

Note: This parameter applies only if you selected **weighted_mape** as the type of MAPE to use in choosing the best model.

Advanced Parameters



Outlier Percent

Enter the percentage of observations that are to be considered as outliers. The default value is 0.001 which means the generated outlier table includes the top 0.1 percent of all observations with the largest forecast absolute error (AE).

Note: Enter the number as a decimal value rather than as a percentage. For example, enter 0.001 rather than 0.1%.

The value that you specify for **APE Cutoff** then determines which of the outliers are chosen.

Column name in table: outlier_percent

Residual History Length

Choose the length of time during which to calculate the residual used in the two-stage model (integer value with unit of hour).The default value is 504, which means utilizing the residual of the previous 504 hours (21 days; three weeks). The residual is the difference between the forecast value and the actual value.

Note: Choosing too short a residual history length can have the result that values don't converge. A length of around 500 hours should be adequate.

Column name in table: residual_hist_length

Combine Forecast

This parameter controls which two-stage model(s) will be included for calculating the combined forecast. The value for this parameter will be various combinations of 1, 2, 3 and 4.

1=GLM_ARIMA (auto regressive integrated moving average)

2=GLM_ESM (exponential smoothing modeling)

3=GLM_UCM (unobserved components modeling)

4=GLM_NN (neural network)

For example, 1234 means use GLM_ARIMA, GLM_ESM, GLM_UCM and GLM_NN to calculate the combined forecast, and 124 means use GLM_ARIMA, GLM_ESM and GLM_NN to calculate the combined forecast.

The default value is 1234 and the combined forecast will be calculated only if the two_stage models are enabled and the best model from the diagnose procedure is a combined forecast

Column name in table: combine_fcst

Poly Order

Control using 2nd or 3rd order polynomial of the temperature variables in the model. The value of this parameter should be either 2 or 3. Specifying 3 does result in it taking longer to do the diagnose.

Column name in table: poly_order

APE Cutoff

The APE Cutoff determines which observations are put into the outlier table. Observations with absolute percentage error greater than this threshold will be put into the table.

Note: Enter the number as a decimal value rather than as a percentage. For example, enter 0.05 rather than 5%.

The value that you enter for **Outlier Percent** determines the percentage of observations that are considered as outliers.

Column name in table: ape_cutoff

Two Stage

Enter YES to run the two-stage model.

Enter NO to run the one-stage model.

Note:

- Choosing one-stage or two-stage can affect how long it takes to do a very short term load forecast. See "Parameter Selection and Forecast Performance" on page 180.
- The two-stage model is not recommended if there is insufficient historical data.

See "Two-Stage Model" on page 188.

Column name in table: two_stage

Default Weather Type Code

Specifies the type of data contained in the WTHR_NO field of the weather data source file.

Note: This parameter applies only to a weather table in 3.1 data model format. See "Weather Data Table" on page 57.

Valid values are:

TEMPF
Fahrenheit

TEMPC
Centigrade

Column name in table: default_wthr_type_cd

WLS

Enter YES if the weighted least squares (WLS) model is desired. Otherwise, enter NO.

Column name in table: wls

Additional Modeling Variables

Variables that you specify in this field are used in the MODEL statement of PROC GLM as independent effects. For more information, see Chapter 8, "Add Additional Variables as Parameters," on page 67.

Separate multiple variables with a single blank. Do not use quotes.

Column name in table: add_var

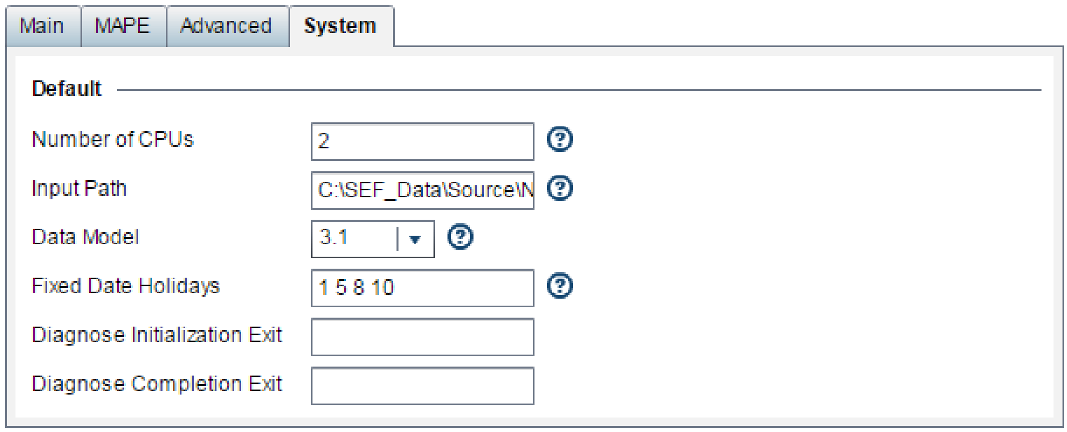
Additional Class Variables

Add a class variable. Variables that you specify in this field are used in the CLASS statement of PROC GLM as additional class variables. For more information, see Chapter 8, "Add Additional Variables as Parameters," on page 67.

Separate multiple variables with a single blank. Do not use quotes.

Column name in table: add_class

System Parameters



Number of CPUs

SAS Energy Forecasting can run parallel processing, which significantly reduces processing time. Select the number of available CPU cores to define how many parallel processes should be run.

Column name in table: num_cpu

Input Path

Specifies the folder containing the input files to SAS Energy Forecasting. You can override the system-specified folder if you want your input files are in a different location.

Column name in table: staged_data_path

See also: Chapter 5, “Prepare the Input Files,” on page 47.

Data Model

Choose the format of the source files to be used for forecasting. Valid values are 3.1 and 2 (3.1 being the newer data model).

Column name in table: data_model

Fixed Date Holidays

Using a numeric code, specify the holidays whose calendar date does not differ from year to year. Separate each numeric code with a blank. The default for the US calendar is 1 5 8 10.

- 1=New Years Day: January 1
- 5=Independence Day: July 4
- 8=Veterans Day: November 11
- 10=Christmas: December 25

Codes for the US holidays whose calendar date varies from year to year are the following:

- 2=Martin Luther King's Birthday
- 3=George Washington's Birthday
- 4=Memorial Day
- 6=Labor Day
- 7=Columbus Day
- 9=Thanksgiving Day

Column name in table: fix_date_holiday_list

Diagnose Initialization Exit

This parameter is optional.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke before the diagnose is run. For example: **`C:\hana\init.sas`**.

Typically, you can use such a program to allocate resources and make connections that might be needed for the diagnose.

Note: If you specify such a program, then you probably want also to specify a program with **Diagnose Completion Exit** to free the resources and connections made during initialization.

Column name in table: sefdg_init_exit.xml

Diagnose Completion Exit

This parameter is optional.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke after the diagnose is finished. For example: **`C:\hana\terminate.sas`**.

Typically, you can use such a program to free resources and connections that you made with your program specified in **Diagnose Initialization Exit**.

Column name in table: sefdg_term_exit.xml

Parameter Selection and Forecast Performance

Overview

It is recommended that you have a different diagnose for each type of forecast: short term, very short term, and medium/long term. How you specify parameters for a diagnose affects both how long it takes to run a forecast and the forecast MAPE. Generally a diagnose can take from one hour to as long as 8 hours to run, so it is recommended that that you run these at night or over the weekend. SAS Energy Forecasting has an adjustable timer that is defaulted to allow a solution to run up to 12 hours before it times out. If a diagnose fails due to this default, you can adjust the value by changing the **System time out, in minutes ...** setting. See "Application Settings" on page 65.

If during the setup for a forecast run, you decide to output report data to the server, the execution times will probably increase due to the large volumes of data being appended to the report files. See Chapter 11, “Produce Reports,” on page 83.

Very Short Term Load Forecasts

Run Time

The amount of time required to run a forecast depends primarily on your choice of the following parameters:

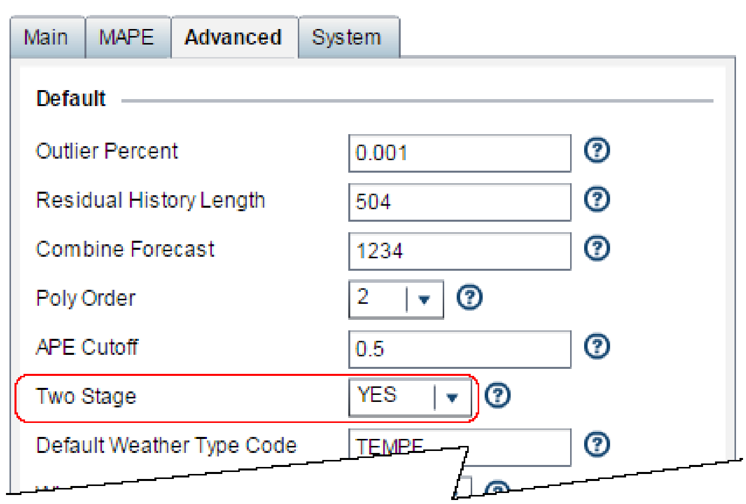
- One or Two Stage model
- Holdout period (Rolling End Date – Rolling Start Date)
- Training period
- History length

One or Two Stage

The choice of either one or two stage model in diagnose will determine how many models are consumed in the diagnose and subsequently the forecast process. Generally a one stage model in diagnose will result in two models being consumed in the forecast. If a two stage model is selected in diagnose, typically up to 7 models are consumed in the forecast. The more models being consumed in the forecast the longer the execution time.

Selecting a two stage model as the diagnose parameter does not guarantee that a two stage model will be chosen as the champion model. The length of the holdout or rolling period selected in diagnose also has an impact on the champion model chosen during the diagnose process.

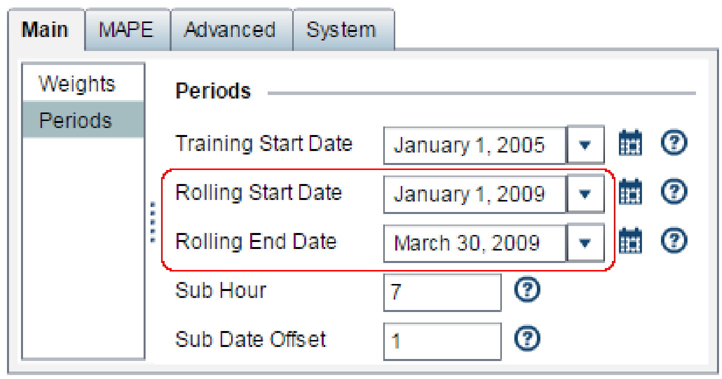
See Chapter 20, “The Diagnose Process,” on page 185.



Holdout period

The holdout period is the period between Rolling Start Date and Rolling End Date. The holdout period is a selected subset of the historical data that is held from the data used in developing the various models but is used later to test the accuracy of the various models during error analysis process by calculating mean error (ME), mean absolute error (MAR), and mean absolute percentage error (MAPE). A shorter rolling or holdout period typically results in the diagnose process selecting a single stage model as the best or champion model. A longer rolling period typically results in the diagnose process selecting a two stage model as the best or champion model. When a forecast is run against the diagnose, the number of models used in the analysis depends on whether a one stage or two stage model was selected as the champion model. A one stage model typically uses 2 models in the forecast while a two stage model can have up to 7 models being consumed during the forecast process. And, the more models used the longer it takes to do the forecast. Basic rules of thumb are:

- Longer holdout results in the best model from a diagnose being a two-stage model.
- Shorter holdout results in the best model from a diagnose being a one-stage model. In general, a one-stage model for diagnose results in a faster forecast than a two-stage diagnose.



Training Period and History Length

The training period extends from the **Training Start Date** up to the **Rolling Start Date**.The longer the training period selected during the diagnose process and the longer the history length selected during the forecast process, more data is used in the calculations and therefore a longer execution time can be expected. Generally the more historical load data that is consumed in the diagnose and forecast processes, the more improvement in accuracy of the model can be expected, as measured by hourly MAPE.

MAPE

The forecast MAPE also depends primarily on your choice of the same parameters:

One or Two Stage
: Generally a two-stage model for diagnose results in a better MAPE for the resulting forecast.

Holdout Period (Rolling End Date – Rolling Start Date)
: In general, the longer the holdout period for diagnose, the better the MAPE for the resulting forecast.

Trade Off Between Run Time and MAPE

When performing very short term forecasting analysis, there is a trade off that must be made between forecast run time and forecast accuracy or MAPE. Extensive testing has provided the following results:

- A longer rolling or holdout period generally results in a two stage model being chosen as the champion model which in turn results in the forecast consuming more models in the analysis. More models translates into a longer run time.
- A longer training period chosen in diagnose and a long history length selected in forecast generally result in longer run times because of the volume of data consumed in the analysis.

- The more data consumed in the forecast process, the better accuracy or MAPE that can be expected. The trade off is in run time.
- Tests have produced run times in excess of 20 minutes when performing very short term forecasts looking 24 hours or longer into the future. Forecasters generally perform very short term forecasting on an hourly schedule which dictates that run times should be held to a minimum, typically 5 minutes or less.

Short Term Forecasts

Short term forecasts are typically run monthly or quarterly, so execution times are not as important as in very short term forecasts. • A holdout period of 30 to 90 days with 2-stage diagnose is sufficient to produce acceptable MAPEs in short term forecasts. Testing has produced run times that are generally less than 5 minutes. Longer rolling periods and more history data generally produce better accuracy as measured by hourly MAPE.

Medium Term/Long Term Forecasts

Medium term/Long term forecasts are typically run once or twice a year, so execution times are not critical.

- A holdout period of 90 days or more with 2-stage diagnose will produce acceptable MAPEs in medium term/long term forecasts.
- A longer holdout period results in longer execution times, so a medium term/long term diagnose can be run at night or on weekends.

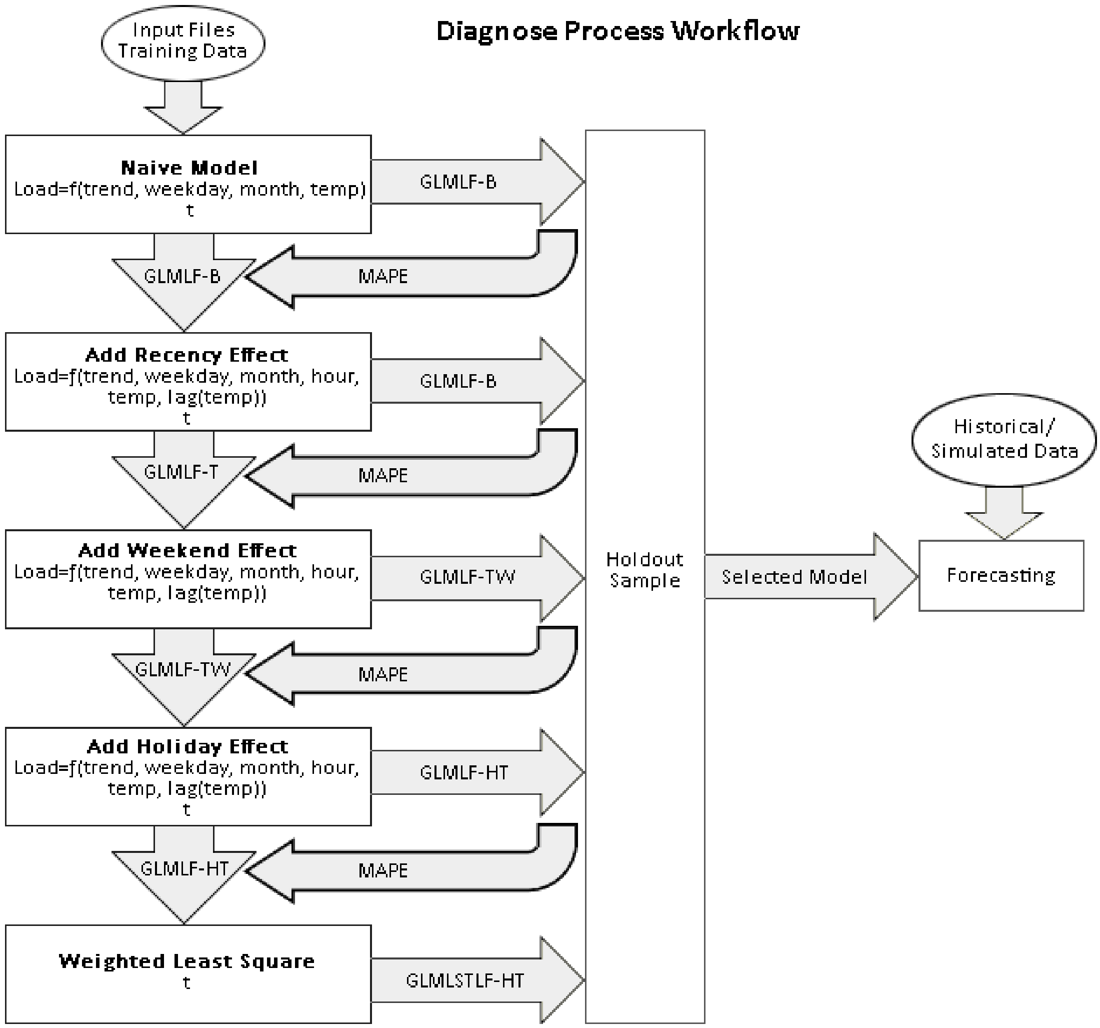
Chapter 20

The Diagnose Process

One-Stage Model

Overview

The diagnose uses the training period data as specified in the diagnose parameters to step though a sequence of possible models. The models are tested against the holdout period defined in the diagnose parameters to determine the best models according to the error definition. Diagnose is a prerequisite process that must be run before any forecasts are developed. The following diagram depicts the diagnose process which is explained in more detail in the subsequent text.



Step 1: Generate a Naive Model

As the first step, a naïve benchmark model is generated. This is described by the following equation known as GLMLF-B:

$$Load = \beta_0 + \beta_1 * Trend + \beta_2 * Weekday * Hour + \beta_3 * Month + \beta_4 * Month * T(t) + \beta_5 * Month * T(t)^2 + \beta_6 * Month * T(t)^3 + \beta_7 * Hour * T(t) + \beta_8 * Hour * T(t)^2 + \beta_9 * Hour * T(t)^3$$

By comparing the forecast results of a particular model with the actual load data in the holdout period (which data is not used in the forecast), the system calculates a MAPE that is used to select the best model.

Step 2: Add the Recency Effect

As the second step, the recency effect is added using models that include combinations of the following:

- the simple moving average of the temperatures from the preceding 24 hours
- temperatures from preceding hours
- weighted moving average of the temperatures from the preceding 24 hours

The forecast for each model combination is tested in the holdout period based on the MAPE or APE specified by the user in the diagnose parameters. After this comparison, the winning model proceeds to the next step.

Step 3: Add the Calendar (Weekend) Effect

The weekend effect is added to the winning model from the recency effect. This is done by grouping two adjacent days together and calculating the holdout MAPE generated by this grouping method. Only if the holdout MAPE improves should those two days continue to be grouped. All adjacent days are tried: Monday/ Tuesday, Tuesday/ Wednesday, Wednesday/Thursday, Thursday/Friday, Friday/Saturday, Saturday/Sunday, and Sunday/Monday.

Step 4: Add the Holiday Effect

The holiday effect is added into the winning model from the weekend effect. Holidays are defined in the Calendar table to reflect the local situation. See "Calendar Table" on page 47. The following structure is used to define an unlimited number of holidays. The structure allows the day prior and following to be defined as special days where variations from normal load occur.

special_day	Holiday
1	New Year's Day
101	New Year's Eve
201	Day after New Year's Day
2	Martin Luther King, Jr.'s Birthday
102	Day before Martin Luther King, Jr.'s Birthday
202	Day after Martin Luther King, Jr.'s Birthday

Models are first developed with the special days modeled as the weekday on which they occur. Models are then developed to test the special day considered to be all other day types of the week. If considering a special day as another day of the week improves model accuracy, then its weekday assignment is modified.

Step 5: Calculate Weighted Least Squares (WLS)

The winning model from the holiday model is modified to include four different exponential weighted least square weighted temperature combinations. To emphasize recent status, higher weights are assigned to more recent observations, and an exponential WLS approach can be deployed. The winning model from the four candidates is chosen.

Step 6: Analyze Errors

The winning model in each step is tested against the holdout period. The following error statistics are calculated for each of the models to identify the best model to use for forecasting:

- Hourly load (ME, MAE, and MAPE)
- Daily peak load (ME, MAE, and MAPE)
- Daily energy (ME, MAE, and MAPE)
- Monthly peak load (ME, MAE, and MAPE)
- Monthly energy (ME, MAE, and MAPE)
- Annual peak load (ME, MAE, and MAPE)
- Annual energy (ME, MAE, and MAPE)

Step 7: Detect Outliers

For each model, the hours with the highest error statistics are identified. This allows identification of data errors and model specification problems by reviewing error statistics, load, predicted load, and temperature for each of those hours.

The data in the following sample outlier table is ranked by descending AE and the top n percent (default is 0.1 percent) of the observations are included:

VIEWTABLE: Tmp1.Outlier_table_wls

	Datetime	Weekday	Original Weekday	Holiday Indicator	Temperature	Actual Load	Predicted Load	Error	Absolute Error	Absolute Percentage Error	outlier_flag
1	28JUL06:17:00:00	6	6	0	76	6307	4930.3262372	1376.6737628	1376.6737628	0.2182771148	wls_holiday_3
2	02AUG06:19:00:00	3	4	0	81	7058	5695.1274236	1362.8725764	1362.8725764	0.1930961429	wls_holiday_3
3	02AUG06:20:00:00	3	4	0	79	6885	5623.9643209	1261.0356791	1261.0356791	0.1831569614	wls_holiday_3
4	04AUG06:12:00:00	6	6	0	78	6096	4850.9163073	1245.0836927	1245.0836927	0.2042460126	wls_holiday_3
5	13JUL06:15:00:00	5	5	0	72	5795	4682.5435838	1112.4564162	1112.4564162	0.1919683203	wls_holiday_3
6	02AUG06:21:00:00	3	4	0	79	6868	5758.3382094	1109.6617906	1109.6617906	0.1615698589	wls_holiday_3
7	26JUL06:14:00:00	3	4	0	78	6177	5092.9355726	1084.0644274	1084.0644274	0.1755001501	wls_holiday_3
8	26JUL06:16:00:00	3	4	0	79	6295	5210.9531936	1084.0468064	1084.0468064	0.1722075943	wls_holiday_3
9	28JUL06:16:00:00	6	6	0	83	6577	5494.6629956	1082.3370044	1082.3370044	0.1645639356	wls_holiday_3

Two-Stage Model

The procedure for the two-stage diagnose model is as follows:

1. The residual of the best model from the one-stage diagnose process is calculated.
2. The residual is forecasted using:
   - UCM (unobserved components modeling)
   - neural network modeling
   - ESM (exponential smoothing modeling)
   - ARIMAX (auto regressive integrated moving average with exogenous input) modeling
3. The forecasted residual is added back to the forecast load to generate the two-stage forecast load.

4. The best model is chosen by comparing the model performance of all one-stage and two-stage models.

Error Analysis Equations

Equations utilized in the error analysis process are the following

Error

$$Error = y_i - \hat{y}_i$$

AE

$$AE = |y_i - \hat{y}_i|$$

MAE

$$MAE = \frac{1}{N}\sum_{i=1}^{N} | y_t - \hat{y}_t |$$

APE

$$APE = |\frac{y_i - \hat{y}_i}{y_i}|$$

MAPE

$$MAPE = \frac{1}{N}\sum_{i=1}^{N} |\frac{y_i - \hat{y}_i}{y_i}|$$

Symmetric mean absolute percentage error (SMAPE)

$$SMAPE = \frac{1}{N}\sum_{i=1}^{N} \frac{|\frac{y_i - \hat{y}_i}{y_i}|}{[(y_i + \hat{y}_i)/2]}$$

Square error

$$Square\ error = (y_i - \hat{y}_i)^2$$

Mean squared error (MSE)

$$MSE = \frac{1}{N-k}\sum_{i=1}^{N} (y_i - \hat{y}_i)^2$$

Root mean squared error (RMSE)

$$RMSE = \sqrt{\frac{1}{N-k}\sum_{i=1}^{N} (y_i - \hat{y}_i)^2}$$

R-square

$$\text{R-square} = 1 - \frac{\sum_{i=1}^{N} (y_i - \hat{y}_i)^2}{\sum_{i=1}^{N} (y_i - \overline{y})^2}$$

Adjusted R-square (ADJRSQ)

$$ADJRSQ = 1 - \frac{(N-1)(1-R^2)}{N-k}$$

Sum of squared errors (SSE)

$$SSE = \sum_{i=1}^{N} (y_i - \hat{y}_i)^2$$

Schwarz's Bayesian criterion (SBC)

$$SBC = N \log(SSE / N) + k \log(N)$$

Akaike information criterion (AIC)

$$AIC = N \log(SSE / N) + 2k$$

Chapter 21
Diagnose Result Files

FCST_RESULTS

Contains forecast results for the best model

The FCST_RESULTS table contains the following columns:

Column Name	Label
date	Date

Column Name	Label
datetime	Datetime
he	Hour
actual_load	Actual Load
predicted_load	Predicted Load Combined

FCST_RESULTS_ALL

Contains forecast results for all models:

- Naïve
- Recency effect
- Weekend effect
- Holiday effect
- WLS (weighted least squares)
- GLM_UCM (unobserved components modeling) if two-stage models are enabled
- GLM_NN (neural network) if two-stage models are enabled
- GLM_ESM (exponential smoothing modeling) if two-stage models are enabled
- GLM_ARIMA (auto regressive integrated moving average) if two-stage models are enabled
- COMBINE if two-stage models are enabled

The FCST_RESULTS_ALL table contains the following columns:

Column Name	Label
actual_load	Actual Load
date	Date
datetime	Datetime
he	Hour
predicted_load_glmlfb	Naive Model Predicted Load
predicted_load_glmlfbr	Recency Effect Model Predicted Load
predicted_load_glmlfbrw	Weekend Effect Model Predicted Load
predicted_load_glmlfbrwh	Holiday Effect Model Predicted Load

Column Name	Label
predicted_load_glmlfwebrwh	Holiday Effect WLS (weighted least squares) Model Predicted Load
predicted_load_glm_esm	Predicted Load GLM_ESM (exponential smoothing modeling)
predicted_load_glm_arimax	Predicted Load GLM_ARIMAX (auto regressive integrated moving average with exogenous input)
predicted_load_glm_ucm	Predicted Load GLM_UCM (unobserved components modeling)
predicted_load_glm_nn	Predicted Load GLM_NN (neural network)

FCST_STAT

Contains the error matrix for the following models:

- Naïve
- Recency effect
- Weekend effect
- Holiday effect
- WLS (weighted least squares)
- GLM_UCM (unobserved components modeling) if two-stage models are enabled
- GLM_NN (neural network) if two-stage models are enabled
- GLM_ESM (exponential smoothing modeling) if two-stage models are enabled
- GLM_ARIMA (auto regressive integrated moving average) if two-stage models are enabled
- COMBINE if two-stage models are enabled

Statistics include MAE, MAPE, and ME for annual energy, annual peak load, daily energy, daily peak load, monthly energy, monthly peak load, and hourly load.

The FCST_STAT table contains the following columns:

Column Name	Label
annual_mae	Annual Mean Absolute Error
annual_mape	Annual Mean Absolute Percentage Error
annual_me	Annual Mean Error
annual_peak_mae	Monthly Peak Mean Absolute Error

Column Name	Label
annual_peak_mape	Monthly Peak Mean Absolute Percentage Error
annual_peak_me	Monthly Peak Mean Error
daily_mae	Daily Mean Absolute Error
daily_mape	Daily Mean Absolute Percentage Error
daily_me	Daily Mean Error
daily_peak_mae	Daily Peak Mean Absolute Error
daily_peak_mape	Daily Peak Mean Absolute Percentage Error
daily_peak_me	Daily Peak Mean Error
hourly_mae	Hourly Mean Absolute Error
hourly_mape	Hourly Mean Absolute Percentage Error
hourly_me	Hourly Mean Error
model_name	Model Name
monthly_mae	Monthly Mean Absolute Error
monthly_mape	Monthly Mean Absolute Percentage Error
monthly_me	Monthly Mean Error
monthly_peak_mae	Monthly Peak Mean Absolute Error
monthly_peak_mape	Monthly Peak Mean Absolute Percentage Error
monthly_peak_me	Monthly Peak Mean Error
weighted_mape	Weighted Mean Absolute Percentage Error

HOLIDAY_LKP_CT

Holiday look-up table used to determine significance of date

The HOLIDAY_LKP_CT table contains the following columns:

Column Name	Label
hgroup	Holiday Group
special_day	Holiday
weekday	Weekday

OUTLIER_TABLE_GLMLFB

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for naïve model

The OUTLIER_TABLE_GLMLFB table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_HOLIDAY

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for holiday effect model

The OUTLIER_TABLE_HOLIDAY table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_NAIVE

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for naïve model

The OUTLIER_TABLE_NAIVE table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag

Column Name	Label
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_RECENCY

Contains percentage of all observations (based on "outlier_percent" parameter) with largest forecast absolute error for recency effect model

The OUTLIER_TABLE_RECENCY table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_RT0

Contains percentage of all observations (based on "outlier_percent" parameter) with largest forecast absolute error for recency effect model step (adding simple moving average of temperature during preceding 24 hours)

The OUTLIER_TABLE_RT0 table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_RT1

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for recency effect model step (adding preceding hour's temperature)

The OUTLIER_TABLE_RT1 table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error

Column Name	Label
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_RT2

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for recency effect model step (changing interaction effects)

The OUTLIER_TABLE_RT2 table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_RT3

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for recency effect model step (changing more interaction effects)

The OUTLIER_TABLE_RT3 table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_RT4

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for recency effect model step (replacing average temperature with weighted temperature 1); iterations based on “weight_num” global parameter. See “Weight” on page 170.

The OUTLIER_TABLE_RT4 table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday

Column Name	Label
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_RT5

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for recency effect model step (replacing average temperature with weighted temperature 2); iterations based on “weight_num” global parameter. See “Weight” on page 170.

The OUTLIER_TABLE_RT5 table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load

Column Name	Label
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_RT6

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for recency effect model step (replacing average temperature with weighted temperature 3); iterations based on “weight_num” global parameter. See “Weight” on page 170.

The OUTLIER_TABLE_RT6 table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_RT7

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for recency effect model step (replacing average temperature with weighted temperature 4); iterations based on “weight_num” global parameter. See “Weight” on page 170.

The OUTLIER_TABLE_RT7 table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_WEEKEND

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for weekend effect model

The OUTLIER_TABLE_WEEKEND table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error

Column Name	Label
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

OUTLIER_TABLE_WLS

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for WLS model (weighted least squares)

The OUTLIER_TABLE_WLS table contains the following columns:

Column Name	Label
Holiday	Holiday Indicator
Weekday	Weekday
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
outlier_flag	Outlier Flag
predicted_load	Predicted Load
t0_p1	Temperature
wd_orig	Original Weekday

PARAMETER_CONTROL_CT

Stores some macro variables used by VSEL (value selection). These values will be passed to STLF, VSTLF, and MTLF/LTLF programs

The PARAMETER_CONTROL_CT table contains the following columns:

Column Name	Label
Best_Model	Best Model
FS	Friday Saturday
MS	Sunday Monday
MT	Monday Tuesday
SS	Saturday Sunday
TF	Thursday Friday
TW	Tuesday Wednesday
WT	Wednesday Thursday
airport	Airport
holiday_override	Holiday Override
mape	Mean Absolute Percentage Error
num_cpu	Number of Parallel Processes to Run
rolling_end_date	Rolling End Date
rolling_start_date	Rolling Start Date
single_temp_code	Single Temp Code
sub_date_offset	Number of Days Between the Submission Date and the Forecast Date
sub_hour	Hour Submission
train_start_date	Start data of history
utility	Utility
w_annual_mape	Weighted Annual Mean Absolute Percentage Error This is the weight assigned to annual energy MAPE in calculating weighted_mape.
w_annual_peak_mape	Weighted Annual Peak Mean Absolute Percentage Error This is the weight assigned to annual peak MAPE in calculating weighted_mape.

Column Name	Label
w_daily_mape	Weighted Daily Mean Absolute Percentage Error This is the weight assigned to daily energy MAPE in calculating weighted_mape.
w_daily_peak_mape	Weighted Daily Peak Mean Absolute Percentage Error This is the weight assigned to daily peak MAPE in calculating weighted_mape.
w_hourly_mape	Weighted Hourly Mean Absolute Percentage Error This is the weight assigned to hourly MAPE in calculating weighted_mape.
w_monthly_mape	Weighted Monthly Mean Absolute Percentage Error This is the weight assigned to monthly energy MAPE in calculating weighted_mape.
w_monthly_peak_mape	Weighted Monthly Peak Mean Absolute Percentage Error This is the weight assigned to monthly peak MAPE in calculating weighted_mape.
weight_lower	Lower Boundary of the Weight Used to Calculate the Exponentially Smoothed Temperature
weight_num	The Number of Weights to Calculate Exponentially Smoothed Temperature
weight_upper	Upper Boundary of the Weight Used to Calculate the Exponentially Smoothed Temperature
weighted_temp_code	Weighted Temp Code
wls_weight	Weight Least Square Model Weight

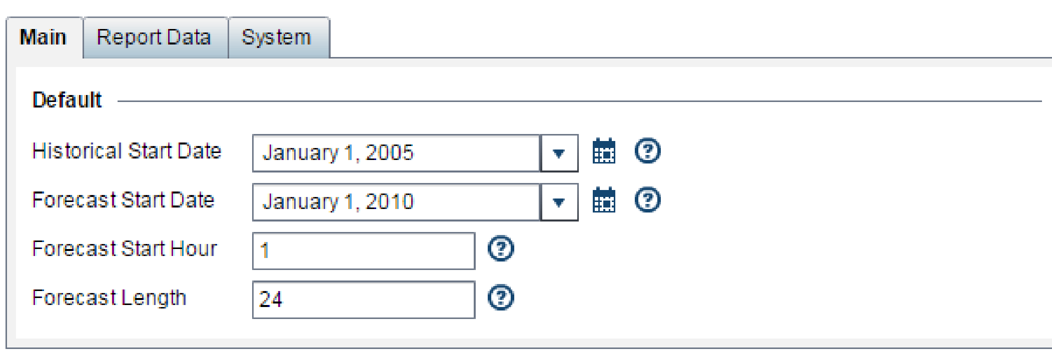
Part 5

Very Short Term Load Forecasting

Chapter 22

Parameters for Very Short Term Load Forecasting

Main Parameters



Historical Start Date

Select the start date for historical date that is to be used for creating the forecast.

Note: The forecast start date should be at least 12 months later than the historical start date—a full year of history is required for making a forecast.

Column name in table: hist_start_date

Forecast Start Date

Select the start date for the forecast horizon.

Note: The forecast start date should be at least 12 months later than the historical start date—a full year of historical data is required for making a forecast.

Column name in table: fcst_start_date

Forecast Start Hour

Select the start hour for the forecast horizon (between 1 and 24).

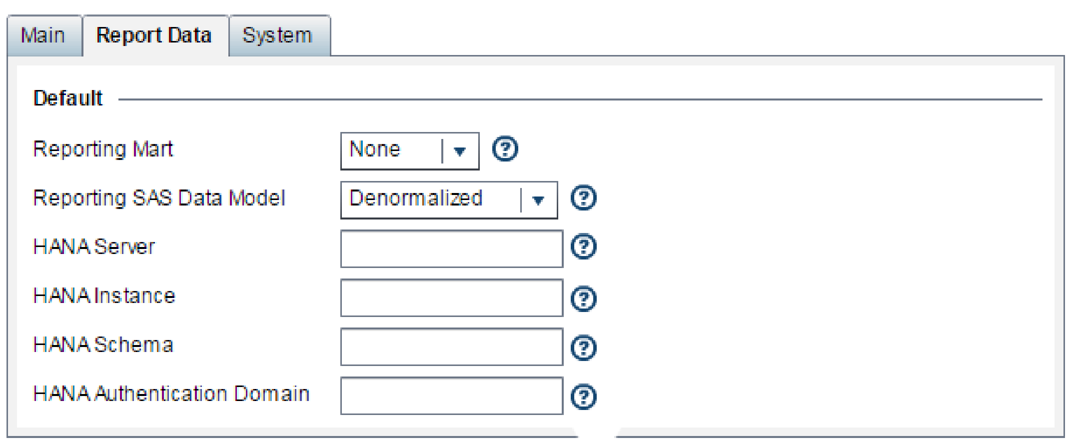
Column name in table: fcst_start_hour

Forecast Length

Select the length for the forecast horizon, which is the number of hours to be forecasted (integer value).

Column name in table: fcst_length

Report Data Parameters



Reporting Mart

In addition to the regular diagnose and forecast results, you can request data to be outputted in a form that is suitable for producing reports with SAS Visual Analytics, HANA, or another reporting tool. This report data is created by selecting fields from the individual diagnose and forecast result tables. You can request:

SAS
Report data outputted as SAS data sets

HANA
Report data outputted as HANA tables

NONE
No report data is outputted. Only the regular diagnose and forecast results are outputted.

Column name in table: reporting_mart

Reporting SAS Data Model

If, in the **Reporting Mart** field, you select report data to be outputted for either SAS or HANA, then select how the report data is outputted:

Normalized
to produce more tables but smaller ones which you must join for reporting purposes. If you select HANA for your report output, then the tables are automatically **Normalized**.

Denormalized
to produce fewer tables but larger ones. If you select SAS to output SAS data sets for use with SAS Visual Analytics, then you can select either **Normalized** or **Denormalized**.

Note: If you select **Denormalized**, then the amount of storage space required can grow very quickly. Make sure periodically to purge your files so as not to stress the system.

Both
Both normalized and denormalized files are outputted.

Note: This option applies only if you selected SAS in the **Reporting Mart** field. If you selected HANA, then the **Normalized** option is assumed.

For information, see Chapter 11, “Produce Reports,” on page 83.

Column name in table: reporting_sas_data_model

HANA Server

Specify the machine hosting the SAP HANA database.

For information, see Chapter 13, “Work with SAP HANA,” on page 117.

Column name in table: hana_server.

HANA Instance

Specify the instance of the SAP HANA database.

For information, see Chapter 13, “Work with SAP HANA,” on page 117.

Column name in table: hana_instance.

HANA Schema

Specify the schema for the SAP HANA database that describes the HANA tables to be created by SAS Energy Forecasting.

For information, see “Step 3. Create a SAP HANA Schema” on page 125.

Column name in table: hana_schema.

HANA Authentication Domain

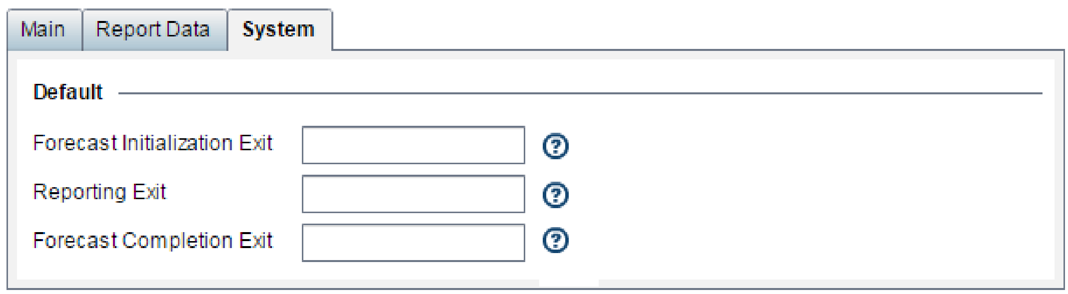
Specify the SAP HANA authentication domain.

For general information, see Chapter 13, “Work with SAP HANA,” on page 117.

More specifically, see Step 6b on page 122.

Column name in table: hana_authentication.

System Parameters



Forecast Initialization Exit

This parameter is reserved for internal SAS use only.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke before the forecast is run. For example: **`C:\hana\init.sas`**.

Typically, you can use such a program to allocate resources and connections that you need to run the forecast.

Note: If you specify such a program, then you probably want also to specify a program with **Forecast Completion Exit** to free the resources and connections made during initialization.

Column name in table: sefvs_init_exit.xml

Reporting Exit

This parameter is reserved for internal SAS use only.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke after the forecast is run but before data is written out either to SAS data sets or to a SAP HANA for reporting. For example: **`C:\hana\report.sas`**.

Column name in table: sefvs_rpt_exit.xml

Forecast Completion Exit

This parameter is reserved for internal SAS use only.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke after the forecast is finished. For example: **`C:\hana\terminate.sas`**.

Typically, you can use such a program to free resources and connections that you made with your program specified in **Forecast Initialization Exit**.

Column name in table: sefvs_term_exit.xml

Enable Event Listening to Run in Batch

If you select **Enable Event Listening** for a forecast, then you can run it from the data tier by using the macro %sefdatae without having to open to the SAS Energy Forecasting client. The macro includes information as to which forecasts are to be run of those for which **Enable Event Listening** is selected

Typically, you might run the macro after updating input data for a forecast. You can select **Enable Event Listening** for any forecast.

See Also

Chapter 10, “Run in Batch,” on page 79

Chapter 23

The Very Short Term Forecasting Process

One-Stage Model

The modeling methodology for VSTLF (very short term load forecasting) is as follows:

Data pre-processing

The "parameter_control" table ("PARAMETER_CONTROL_CT" on page 204) and the holiday look-up table ("HOLIDAY_LKP_CT" on page 194) are generated from the diagnose process. (See Chapter 20, "The Diagnose Process," on page 185.) The VSTLF code uses the parameters read from the "parameter_control" table to set the recency and weekend effects.

Forecasting

If the selected best model from the diagnose process is not the WLS holiday model, VSTLF uses the selected best model as the base model and the lag load of the previous hour is added to it. Otherwise, VSTLF uses the second-best model as the base model and the lag load of the previous hour is added to it. For example, if the selected best model for STLF is the naïve model, the model for VSTLF would be as follows (Equation VSTN1):

$$Load = \beta_0 + \beta_1 * Trend + \beta_2 * Weekday * Hour + \beta_3 * Month + \beta_4 * Month * T(t) + \beta_5 * Month * T(t)^2 + \beta_6 * Month * T(t)^3 + \beta_7 * Hour * T(t) + \beta_8 * Hour * T(t)^2 + \beta_9 * Hour * T(t)^3 + \beta_{10} * Load(t-1)$$

If the forecasting horizon is more than one hour, the forecasted load is used to forecast the next hour's load, instead of the actual load. However, the forecasted load becomes more and more inaccurate as the forecasting horizon gets longer. If the lag load is included, it should be available when doing forecasting.

The following table summarizes the very short term modeling methodology.

Temperature	Updating cycle	Horizon
Required	<= 1 hour	Within 1 day

Example 1: One-Hour-Ahead Forecasting

The following example explains why the lag load is required. If it is some point between 7:00 a.m. and 8:00 a.m. and a forecast for 9:00 a.m. for that particular day using the “VSTN1” model is desired, all time points prior to and at 7:00 a.m. of Day 1 have historical load data but all time points after 7:00 a.m. of Day 1have no historical load data. The “VSTN1” model includes the load for the previous hour, so the load for 8:00 a.m. should be available if the load for 9:00 a.m. is being forecasted. The actual load for 8:00 a.m. is of course not available for a 9:00 a.m. forecast, so the following procedure should be followed:

1. Forecast the load at 8:00 a.m. using historical load data.
2. Use the forecast load for 8:00 a.m. as load(t-1) in the “VSTN1” model along with the historical load to forecast the load for 9:00 a.m.

...	Day 1, 7:00 a.m.	Day 1, 8:00 a.m.	Day 1, 9:00 a.m.	Day 1, 10:00 a.m.	Day 1, 11:00 a.m.
Historical data is available	Current time point	Future time point	Future time point	Future time point	Future time point

Example 2: One-Day-Ahead Forecasting

If it is some point between 7:00 a.m. and 8:00 a.m. of Day 1 and forecasts for every hour of Day 2 using the “VSTN1” model are desired, the following procedure should be followed:

1. Forecast the load at 8:00 a.m. of Day 1 using historical load data.
2. Use the forecast load for 8:00 a.m. of Day 1 as load(t-1) in the “VSTN1” model along with the historical load to forecast the load for 9:00 a.m. of Day 1.
3. Use the forecast load for 9:00 a.m. of Day 1 as load(t-1) in the “VSTN1” model along with the historical load to forecast the load for 10:00 a.m. of Day 1.
4. Use the forecast load for 11:00 p.m. of Day 1 as load(t-1) in the “VSTN1” model along with the historical load to forecast the load for midnight of Day 2.
5. Use the forecast load for midnight of Day 2 as load(t-1) in the “VSTN1” model along with the historical load to forecast the load for 1:00 a.m. of Day 2.
6. Use the forecast load for 1:00 a.m. of Day 2 as load(t-1) in the “VSTN1” model along with the historical load to forecast the load for 2:00 a.m. of Day 2.
7. Use the forecast load for 11:00 p.m. of Day 2 as load(t-1) in the “VSTN1” model along with the historical load to forecast the load for midnight of Day 3.

This procedure does one hour ahead for each hour of Day 2, a total of 24 calculations. At the end of it, the forecast load for every hour of Day 2 (a complete “day”) has been obtained.

...	Day 1, 7:00 a.m.	Day 1, 8:00 a.m.	Day 1, 9:00 a.m.	Day 1, ...	Day 2, 1:00 a.m.	Day 2, 2:00 a.m.	Day 2, ...	Day 3, midnight
Historical data is available	Current time point	Future time point	Future time point	Future time point	Future time point	Future time point	Future time point	Future time point

Two-Stage Model

If the best model from the two-stage diagnose process is one of the two-stage models (GLM_UCM, GLM_NN, GLM_ESM, or GLM_ARIMAX), the load (GLM) and the residual (UCM, neural network, ESM, or ARIMAX model) are forecasted and then added together to generate the final predicted load. Otherwise, the onestage model method is utilized to forecast the load ("One-Stage Model" on page 215).

Chapter 24

Very Short Term Forecast Result Files

FCST_RESULTS

Contains forecast results for best chosen model

The FCST_RESULTS table contains the following columns:

Column Name	Label
Datetime	Datetime
He	Hour
predicted_load	Predicted Load

FCST_RESULTS_ALL

Contains forecast results for:

- GLM

- GLM two-stage (depends on if two-stage models are enabled and the best model from diagnose process)
- COMBINE model (depends on if two-stage models are enabled and the best model from diagnose process)
- WLS (weighted least squares) model(only if “wls” parameter =yes)

Column Name	Label
date	Date
datetime	Datetime
he	Hour
predicted_load_2stage	Predicted Load Two Stage
predicted_load_GLM	Predicted Load GLM
predicted_load_GLM_WLS	Predicted Load GLMWLS

FCST_STAT

Contains forecast statistics for:

- GLM
- GLM two-stage models (depends on if two-stage models are enabled and the best model from diagnose process)
- COMBINE model (depends on if two-stage models are enabled and the best model from diagnose process)
- WLS (weighted least squares) model (only if “wls” parameter =yes)

Statistics include MAE, MAPE, and ME for annual energy, annual peak load, daily energy, daily peak load, monthly energy, monthly peak load, and hourly load

The FCST_STAT table contains the following columns:

Column Name	Label
annual_mae	Annual Mean Absolute Error
annual_mape	Annual Mean Absolute Percentage Error
annual_me	Annual Mean Error
annual_peak_mae	Monthly Peak Mean Absolute Error
annual_peak_mape	Monthly Peak Mean Absolute Percentage Error

Column Name	Label
annual_peak_me	Monthly Peak Mean Error
daily_mae	Daily Mean Absolute Error
daily_mape	Daily Mean Absolute Percentage Error
daily_me	Daily Mean Error
daily_peak_mae	Daily Peak Mean Absolute Error
daily_peak_mape	Daily Peak Mean Absolute Percentage Error
daily_peak_me	Daily Peak Mean Error
hourly_mae	Hourly Mean Absolute Error
hourly_mape	Hourly Mean Absolute Percentage Error
hourly_me	Hourly Mean Error
model_name	Model Name
monthly_mae	Monthly Mean Absolute Error
monthly_mape	Monthly Mean Absolute Percentage Error
monthly_me	Monthly Mean Error
monthly_peak_mae	Monthly Peak Mean Absolute Error
monthly_peak_mape	Monthly Peak Mean Absolute Percentage Error
monthly_peak_me	Monthly Peak Mean Error
weighted_mape	Weighted Mean Absolute Percentage Error

GLM_PARAMS

Contents depend on the diagnose and forecast model.

Column Name	Label
Dependent	—
Parameter	—

Column Name	Label
Estimate	—
Biased	—
Standard Error	—
tValue	—
Probt	Pr > |t|

OUTLIER_GLM

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for GLM model

The OUTLIER_GLM table contains the following columns:

Column Name	Label
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
predicted_load	Predicted Load
special_day	Holiday
t0_p1	Temperature
wd_orig	Original Weekday
weekday	Weekday

OUTLIER_GLM_W1

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for WLS (weighted least squares) model 1

The OUTLIER_GLM_W1 table contains the following columns:

Column Name	Label
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
predicted_load	Predicted Load
special_day	Holiday
t0_p1	Temperature
wd_orig	Original Weekday
weekday	Weekday

OUTLIER_GLM_W2

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for WLS (weighted least squares) model 2

The OUTLIER_GLM_W2 table contains the following columns:

Column Name	Label
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
predicted_load	Predicted Load
special_day	Holiday
t0_p1	Temperature

Column Name	Label
wd_orig	Original Weekday
weekday	Weekday

OUTLIER_GLM_W3

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for WLS (weighted least squares) model 3

The OUTLIER_GLM_W3 table contains the following columns:

Column Name	Label
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
predicted_load	Predicted Load
special_day	Holiday
t0_p1	Temperature
wd_orig	Original Weekday
weekday	Weekday

OUTLIER_GLM_W4

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for WLS (weighted least squares)model 4

The OUTLIER_GLM_W4 table contains the following columns:

Column Name	Label
actual_load	Actual Load

Column Name	Label
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
predicted_load	Predicted Load
special_day	Holiday
t0_p1	Temperature
wd_orig	Original Weekday
weekday	Weekday

OUTLIER_GLM_WLS

Contains percentage of all observations (based on “outlier_percent” parameter) with largest forecast absolute error for WLS (weighted least squares) model

The OUTLIER_GLM_WLS table contains the following columns:

Column Name	Label
actual_load	Actual Load
ae	Absolute Error
ape	Absolute Percentage Error
datetime	Datetime
e	Error
predicted_load	Predicted Load
special_day	Holiday
t0_p1	Temperature
wd_orig	Original Weekday
weekday	Weekday

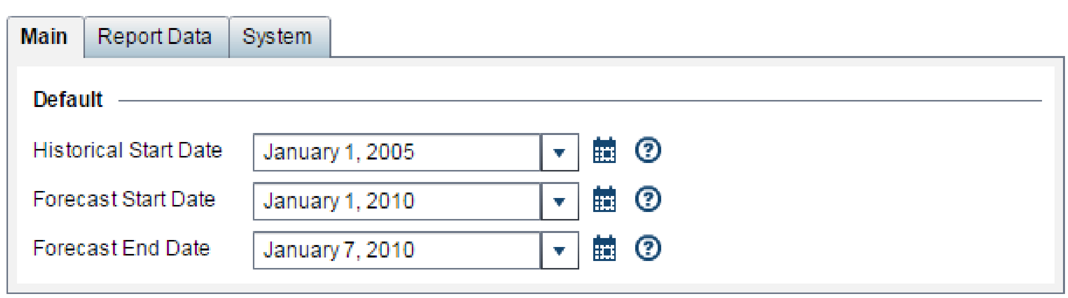
Part 6

Short Term Load Forecasting

Chapter 25

Parameters for Short Term Load Forecasting

Main Parameters



Historical Start Date

Select the start date for historical date that is to be used for creating the forecast.

Note: The forecast start date should be at least 12 months later than the historical start date—a full year of history is required for making a forecast.

Column name in table: hist_start_date

Forecast Start Date

Select the start date for the forecast horizon.

Note: The forecast start date should be at least 12 months later than the historical start date—a full year of historical data is required for making a forecast.

Column name in table: fcst_start_date

Forecast End Date

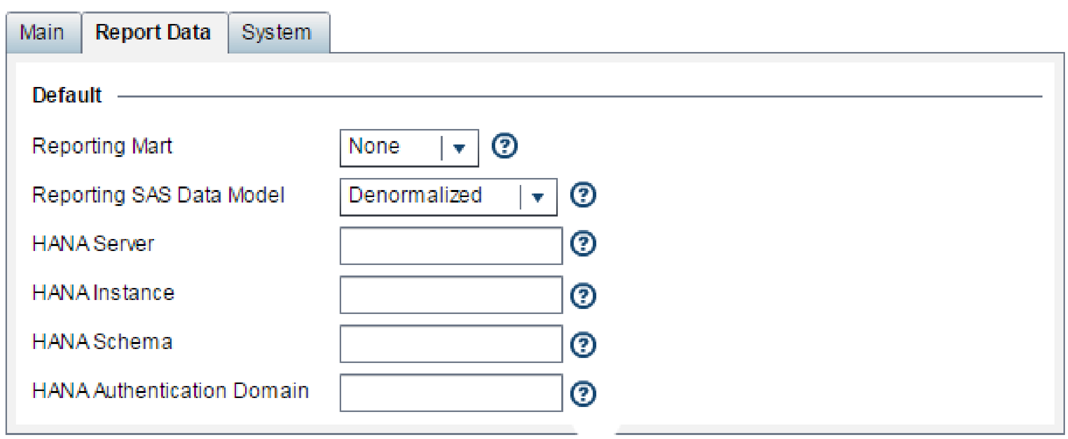
Select the end date for the forecast horizon, which should be:

- the same as or later than the start date for the forecast horizon
- and less than or equal to the end date of the temperature data.

The load to the last hour of this day is forecasted.

Column name in table: fcst_end_date

Report Data Parameters



Reporting Mart

In addition to the regular diagnose and forecast results, you can request data to be outputted in a form that is suitable for producing reports with SAS Visual Analytics, HANA, or another reporting tool. This report data is created by selecting fields from the individual diagnose and forecast result tables. You can request:

SAS
Report data outputted as SAS data sets

HANA
Report data outputted as HANA tables

NONE
No report data is outputted. Only the regular diagnose and forecast results are outputted.

Column name in table: reporting_mart

Reporting SAS Data Model

If, in the **Reporting Mart** field, you select report data to be outputted for either SAS or HANA, then select how the report data is outputted:

Normalized
: to produce more tables but smaller ones which you must join for reporting purposes. If you select HANA for your report output, then the tables are automatically **Normalized**.

Denormalized
: to produce fewer tables but larger ones. If you select SAS to output SAS data sets for use with SAS Visual Analytics, then you can select either **Normalized** or **Denormalized**.

  Note: If you select **Denormalized**, then the amount of storage space required can grow very quickly. Make sure periodically to purge your files so as not to stress the system.

Both
: Both normalized and denormalized files are outputted.

  Note: This option applies only if you selected SAS in the **Reporting Mart** field. If you selected HANA, then the **Normalized** option is assumed.

For information, see Chapter 11, “Produce Reports,” on page 83.

Column name in table: reporting_sas_data_model

HANA Server

Specify the machine hosting the SAP HANA database.

For information, see Chapter 13, “Work with SAP HANA,” on page 117.

Column name in table: hana_server.

HANA Instance

Specify the instance of the SAP HANA database.

For information, see Chapter 13, “Work with SAP HANA,” on page 117.

Column name in table: hana_instance.

HANA Schema

Specify the schema for the SAP HANA database that describes the HANA tables to be created by SAS Energy Forecasting.

For information, see “Step 3. Create a SAP HANA Schema” on page 125.

Column name in table: hana_schema.

HANA Authentication Domain

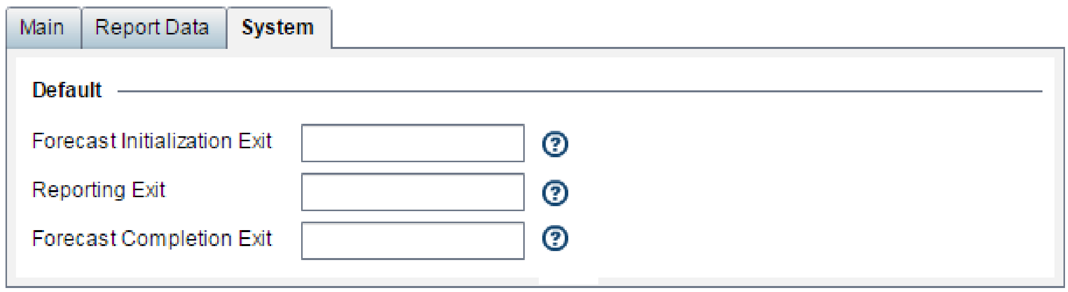
Specify the SAP HANA authentication domain.

For general information, see Chapter 13, “Work with SAP HANA,” on page 117.

More specifically, see Step 6b on page 122.

Column name in table: hana_authentication.

System Parameters



Forecast Initialization Exit

This parameter is reserved for internal SAS use only.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke before the forecast is run. For example: **`C:\hana\init.sas`**.

Typically, you can use such a program to allocate resources and connections that you need to run the forecast.

Note: If you specify such a program, then you probably want also to specify a program with **Forecast Completion Exit** to free the resources and connections made during initialization.

Column name in table: sefsh_init_exit.xml

Reporting Exit

This parameter is reserved for internal SAS use only.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke after the forecast is run but before data is written out either to SAS data sets or to a SAP HANA for reporting. For example: **`C:\hana\report.sas`**.

Column name in table: sefsh_rpt_exit.xml

Forecast Completion Exit

This parameter is reserved for internal SAS use only.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke after the forecast is finished. For example: **`C:\hana\terminate.sas`**.

Typically, you can use such a program to free resources and connections that you made with your program specified in **Forecast Initialization Exit**.

Column name in table: sefsh_term_exit.xml

Enable Event Listening to Run in Batch

If you select **Enable Event Listening** for a forecast, then you can run it from the data tier by using the macro %sefdatae without having to open to the SAS Energy Forecasting client. The macro includes information as to which forecasts are to be run of those for which **Enable Event Listening** is selected

Typically, you might run the macro after updating input data for a forecast. You can select **Enable Event Listening** for any forecast.

See Also

Chapter 10, "Run in Batch," on page 79

Chapter 26

The Short Term Forecasting Process

One-Stage Model

The modeling methodology for short term load forecasting is as follows:

Data pre-processing

The "parameter_control" table ("PARAMETER_CONTROL_CT" on page 204) and the holiday look-up table ("HOLIDAY_LKP_CT" on page 194) are generated from the diagnose process. (See Chapter 20, "The Diagnose Process," on page 185.) The short term load forecasting code uses the parameters read from the "parameter_control" table to set the recency and weekend effects.

Forecasting

The short term load forecasting code (ulf_stlf.sas) runs a generalized linear model (GLM) with the pre-processed data in order to forecast the specified short term load forecasting.

The following table summarizes the short term modeling methodology.

Temperature	Updating cycle	Horizon
Required	1 day	1 day to 2 weeks

Two-Stage Model

If the best model from the two-stage diagnose process is one of the two-stage models (GLM_UCM, GLM_NN, GLM_ESM, or GLM_ARIMAX), the load (GLM) and the residual (UCM, neural network, ESM, or ARIMAX model) are forecasted and then added together to generate the final predicted load. Otherwise, the one-stage model method is utilized to forecast the load ("One-Stage Model" on page 235).

Chapter 27
Short Term Forecast Result Files

FCST_RESULTS

Contains forecast results for best chosen model

The FCST_RESULTS table contains the following columns:

Column Name	Label
date	Date
datetime	Datetime
he	Hour
predicted_load	Predicted Load

FCST_RESULTS_ALL

Contains forecast results for:

- GLM model
- GLM two-stage model (depends on if two-stage models are enabled and the best model from diagnose process) and/or:
- COMBINE model (depends on if two-stage models are enabled and the best model from diagnose process)

Column Name	Label
date	Date
datetime	Datetime
he	Hour
predicted_load	Predicted Load GLM
predicted_load_2stage	Predicted Load Two Stage

FCST_STAT

Contains forecast statistics for:

- GLM
- GLM two-stage models (depends on if two-stage models are enabled and the best model from diagnose process) and/or:
- COMBINE model (depends on if two-stage models are enabled and the best model from diagnose process)

Statistics include MAE, MAPE, and ME for annual energy, annual peak load, daily energy, daily peak load, monthly energy, monthly peak load, and hourly load

The FCST_STAT table contains the following columns:

Column Name	Label
annual_mae	Annual Mean Absolute Error
annual_mape	Annual Mean Absolute Percentage Error
annual_me	Annual Mean Error
annual_peak_mae	Monthly Peak Mean Absolute Error
annual_peak_mape	Monthly Peak Mean Absolute Percentage Error
annual_peak_me	Monthly Peak Mean Error
daily_mae	Daily Mean Absolute Error
daily_mape	Daily Mean Absolute Percentage Error
daily_me	Daily Mean Error
daily_peak_mae	Daily Peak Mean Absolute Error

Column Name	Label
daily_peak_mape	Daily Peak Mean Absolute Percentage Error
daily_peak_me	Daily Peak Mean Error
hourly_mae	Hourly Mean Absolute Error
hourly_mape	Hourly Mean Absolute Percentage Error
hourly_me	Hourly Mean Error
model_name	Model Name
monthly_mae	Monthly Mean Absolute Error
monthly_mape	Monthly Mean Absolute Percentage Error
monthly_me	Monthly Mean Error
monthly_peak_mae	Monthly Peak Mean Absolute Error
monthly_peak_mape	Monthly Peak Mean Absolute Percentage Error
monthly_peak_me	Monthly Peak Mean Error
weighted_mape	Weighted Mean Absolute Percentage Error

GLM_PARAMS

Contents depend on the diagnose and forecast model.

Column Name	Label
Dependent	—
Parameter	—
Estimate	—
Biased	—
Standard Error	—
tValue	—
Probt	Pr > |t|

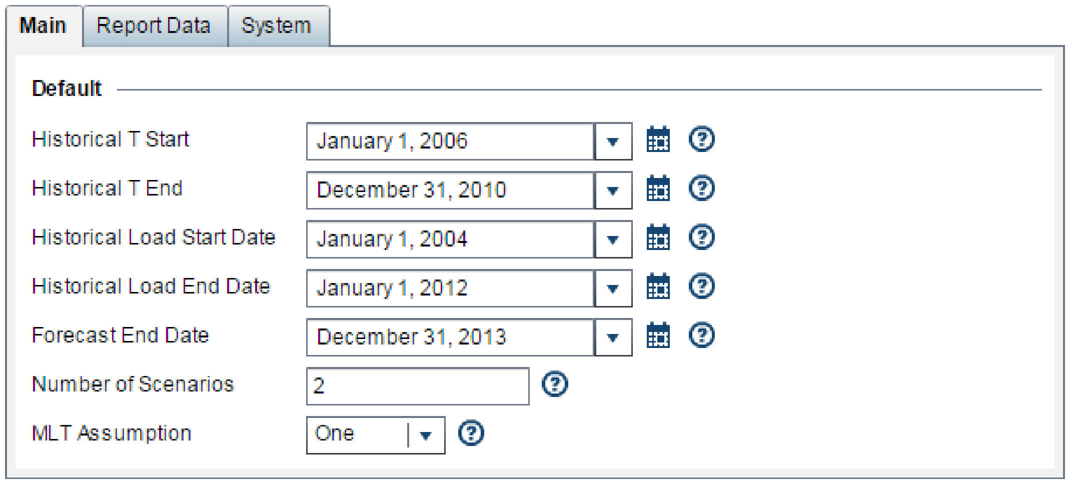
Part 7

Medium Term and Long Term Load Forecasting

Chapter 28

Parameters for Medium Term and Long Term Load Forecasting

Main Parameters



Historical T Start

Select the start date for the historical temperature data which should be equal to or greater than the start date of the utility's temperature data.

Mid term and long term forecasts do not require an input of forecasted temperature but are intended to use multiple years of historic temperatures to create a probabilistic load forecast. For example, if 30 years of temperature data are included in the **Historical T Start** to **Historical T End** period, then SAS Energy Forecasting automatically creates 30 forecasts for each hour. The median load value is selected as the forecasted load; and the data is available for creating additional forecasts such as at a 90% confidence level or at a 10% confidence level. If the user wants the forecast to mimic a specific year's temperatures, then you can specify a single year with **Historical T Start** and **Historical T End**. Additionally, if the user wanted to create a "normal temperature year", then you could input it as a year prior to the start of actual history and specify the year with the **Historical T Start** and **Historical T End** dates.

Column name in table: hist_t_start

Historical T End

Select the end date for the historical temperature data which should be less than or equal to the end date of the utility's temperature data. Ideally you will have 20 years of temperature data, but of course you can use what you have.

Historical T is a subset of the Temperature data source. For more information, see "Historical T Start" on page 244.

Column name in table: hist_t_end

Historical Load Start Date

Select the start date for history.

Column name in table: hist_load_start_dt

Historical Load End Date

Select the end date for history. Set the end date to be at least 12 months after the start date—one year of historical data is required.

Column name in table: hist_load_end_dt

Forecast End Date

Select the end date for the forecast horizon, which should be:

- the same as or later than the start date for the forecast horizon
- and less than or equal to the end date of the economic data.

The load to the last hour of this day is forecasted.

Column name in table: fcst_end_date

Number of Scenarios

Enter the number of economy scenarios to be used (an integer between 1 and 7, with a default of 7). Specifying 1 means to use the first scenario. Specifying 2 means to use the first two.

Column name in table: num_scenarios

MLT Assumption

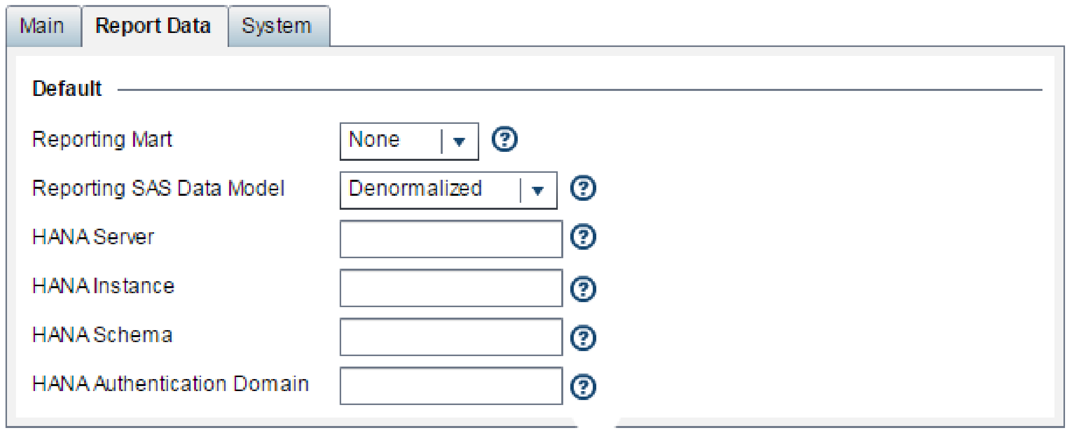
This parameter is used to set how GXP (gross x product) will be included in the forecast model. The values can be 1, 2 or 3 which represent one of the following:

- 1=Include GXP as Trend
- 2=Include GXP as Trend and Interact GXP with other factors
- 3=Divide Load by GXP

Column name in table: mtlt_assumption

See “Medium Term / Long Term Forecasting” on page 249.

Report Data Parameters



Reporting Mart

In addition to the regular diagnose and forecast results, you can request data to be outputted in a form that is suitable for producing reports with SAS Visual Analytics, HANA, or another reporting tool. This report data is created by selecting fields from the individual diagnose and forecast result tables. You can request:

SAS
Report data outputted as SAS data sets

HANA
Report data outputted as HANA tables

NONE
No report data is outputted. Only the regular diagnose and forecast results are outputted.

Column name in table: reporting_mart

Reporting SAS Data Model

If, in the **Reporting Mart** field, you select report data to be outputted for either SAS or HANA, then select how the report data is outputted:

Normalized
to produce more tables but smaller ones which you must join for reporting purposes. If you select HANA for your report output, then the tables are automatically **Normalized**.

Denormalized
to produce fewer tables but larger ones. If you select SAS to output SAS data sets for use with SAS Visual Analytics, then you can select either **Normalized** or **Denormalized**.

Note: If you select **Denormalized**, then the amount of storage space required can grow very quickly. Make sure periodically to purge your files so as not to stress the system.

Both

Both normalized and denormalized files are outputted.

Note: This option applies only if you selected SAS in the **Reporting Mart** field. If you selected HANA, then the **Normalized** option is assumed.

For information, see Chapter 11, “Produce Reports,” on page 83.

Column name in table: reporting_sas_data_model

HANA Server

Specify the machine hosting the SAP HANA database.

For information, see Chapter 13, “Work with SAP HANA,” on page 117.

Column name in table: hana_server.

HANA Instance

Specify the instance of the SAP HANA database.

For information, see Chapter 13, “Work with SAP HANA,” on page 117.

Column name in table: hana_instance.

HANA Schema

Specify the schema for the SAP HANA database that describes the HANA tables to be created by SAS Energy Forecasting.

For information, see “Step 3. Create a SAP HANA Schema” on page 125.

Column name in table: hana_schema.

HANA Authentication Domain

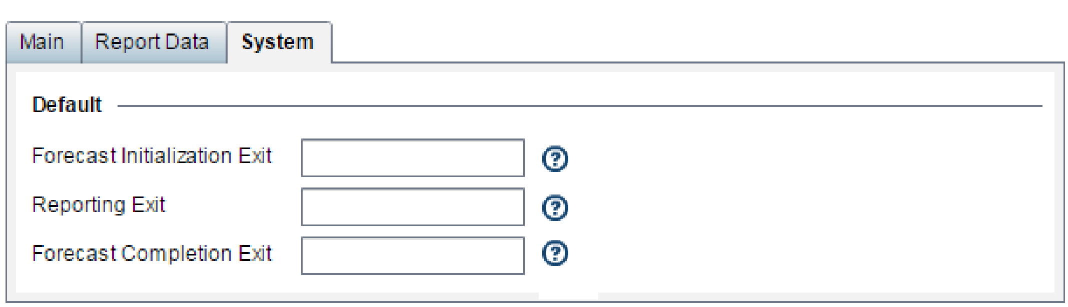
Specify the SAP HANA authentication domain.

For general information, see Chapter 13, “Work with SAP HANA,” on page 117.

More specifically, see Step 6b on page 122.

Column name in table: hana_authentication.

System Parameters



Forecast Initialization Exit

This parameter is reserved for internal SAS use only.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke before the forecast is run. For example: `C:\hana\init.sas`.

Typically, you can use such a program to allocate resources and connections that you need to run the forecast.

Note: If you specify such a program, then you probably want also to specify a program with **Forecast Completion Exit** to free the resources and connections made during initialization.

Column name in table: sefml_init_exit.xml

Reporting Exit

This parameter is reserved for internal SAS use only.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke after the forecast is run but before data is written out either to SAS data sets or to a SAP HANA for reporting. For example: `C:\hana\report.sas`.

Column name in table: sefml_rpt_exit.xml

Forecast Completion Exit

This parameter is reserved for internal SAS use only.

Specify the path and file name of a SAS program or macro that SAS Energy Forecasting will invoke after the forecast is finished. For example: `C:\hana\terminate.sas`.

Typically, you can use such a program to free resources and connections that you made with your program specified in **Forecast Initialization Exit**.

Column name in table: sefml_term_exit.xml

Enable Event Listening to Run in Batch

If you select **Enable Event Listening** for a forecast, then you can run it from the data tier by using the macro %sefdatae without having to open to the SAS Energy Forecasting client. The macro includes information as to which forecasts are to be run of those for which **Enable Event Listening** is selected

Typically, you might run the macro after updating input data for a forecast. You can select **Enable Event Listening** for any forecast.

See Also

Chapter 10, “Run in Batch,” on page 79

Chapter 29
The Medium Term/Long Term Forecasting Process

Medium Term / Long Term Forecasting

The diagnose process parameter setup and processing for MTLF is the same as that for STLF except that MTLF diagnose does not need to process two-stage and WLS models.

The MTLF process selects the best model information from the diagnose process and generates a forecast for middle-term.

The modeling methodology for MTLF/LTLF is as follows:

1. Run the diagnose process (see Chapter 20, “The Diagnose Process,” on page 185) and assume that the best model is as follows (Base equation):

$$\begin{aligned} Load = {} & \beta_0 + \beta_1 * Trend + \beta_2 * Weekday * Hour + \beta_3 * Month + \beta_4 * Month * T(t) + \\ & \beta_5 * Month * T(t)^2 + \beta_6 * Month * T(t)^3 + \beta_7 * Hour * T(t) + \beta_8 * Hour * T(t)^2 + \\ & \beta_9 * Hour * T(t)^3 \end{aligned}$$

2. Replace the trend with gross x product (GxP) and interact GxP with all variables. This yields the “ML1” model.

   Assuming that 10 years of historical hourly temperature, load, and economic data is available, it can be used to estimate the “ML1” model. In general, there is annual, quarterly, or monthly economic data, which means that the same economic data is used for every hour, as follows (Equation ML1):

$$\begin{aligned} Load = {} & \beta_0 + \beta_1 * GXP + \beta_2 * Weekday * Hour + \beta_3 * Month + \beta_4 Weekday * Hour * GXP + \\ & \beta_5 * Month * GXP + \beta_6 * Month * GXP * T(t) + \beta_7 * Month * GXP * T(t)^2 + \\ & \beta_8 * Month * GXP * T(t)^3 + \beta_9 * Hour * GXP * T(t) + \beta_{10} * Hour * GXP * T(t)^2 + \\ & \beta_{11} * GXP * Hour * T(t)^3 \end{aligned}$$

Other aspects of the MTLF/LTLF methodology are as follows:

- For a national utility, GxP can be gross domestic product
- For a cross-state utility or state power system, GxP can be gross state product
- For a utility with service territory covering a metropolitan area, GxP can be gross metropolitan product.

Historical weather scenarios and economic forecasts are used to simulate normal loads, as follows:

- Assuming that there are 50 years of historical hourly weather data (1960 – 2010), the “ML1” model can be used to do forecasting under 50 scenarios; at the very least, 30 years of historical weather data should be available
- In general, economic forecasts provide several different scenarios (e.g., base, strong rebound, slower recovery, and double-dip recession); forecasts are run under each economy scenario.

For example, 50 forecasts can be generated under the base economy scenario, as shown in a table such as the one below. For each economy scenario, forecasts are simulated using each year of weather data for 50 years (1960 – 2010) as the weather for 2012 – 2041 (30 years of forecasts using 50 years of weather data). The median of these 50 forecasts is the normal load under the base economy scenario, which is known as weather normalization. Users of SAS Energy Forecasting should be able to choose how many years of historical weather data they would like to use, but at least 30 years of historical weather data should be used.

	gxp_base *temp_1960	**gxp_base *temp_1961**	**...**	**gxp_base *temp_2010**
01Jan201 1 01	—	—	—	—
01Jan201 1 02	—	—	—	—
01Jan201 1 03	—	—	—	—
01Jan201 1 04	—	—	—	—
...	—	—	—	—

The following table summarizes the long term and medium term modeling methodology.

	Temperature	**Economics**	**Updating cycle**	**Horizon**
Medium Term LF	Simulated	Required	1 month	1 – 3 years
Long Term LF	Simulated	Required	1 year	30 years or up

Chapter 30

Medium Term/Long Term Forecast Result Files

ANNUAL_PEAK_STAT_NAIVE_0

Contains annual peak load statistics for naïve model for economic scenario 0; statistics are summarized based on temperature scenarios taken from specified historical range

The ANNUAL_PEAK_STAT_NAIVE_0 table contains the following columns:

Column Name	Label
MAX	The Maximum Value
Mean	The Arithmetic Mean
Median	The Median Value
Min	The Minimum Value
Num	Number of Simulated Values
P10	The 10th Percentile
P90	The 90th Percentile
Year	Year
actual_peak	Actual Peak

ANNUAL_PEAK_STAT_NAIVE_1

Contains annual peak load statistics for naïve model for economic scenario 1; statistics are summarized based on temperature scenarios taken from specified historical range

The ANNUAL_PEAK_STAT_NAIVE_1 table contains the following columns:

Column Name	Label
MAX	The Maximum Value
Mean	The Arithmetic Mean
Median	The Median Value
Min	The Minimum Value
Num	Number of Simulated Values

Column Name	Label
P10	The 10th Percentile
P90	The 90th Percentile
Year	Year
actual_peak	Actual Peak

ANNUAL_PEAK_STAT_NAIVE_2

Contains annual peak load statistics for naïve model for economic scenario 2; statistics are summarized based on temperature scenarios taken from specified historical range

The ANNUAL_PEAK_STAT_NAIVE_2 table contains the following columns:

Column Name	Label
MAX	The Maximum Value
Mean	The Arithmetic Mean
Median	The Median Value
Min	The Minimum Value
Num	Number of Simulated Values
P10	The 10th Percentile
P90	The 90th Percentile
Year	Year
actual_peak	Actual Peak

ANNUAL_PEAK_STAT_NAIVE_3

Contains annual peak load statistics for naïve model for economic scenario 3; statistics are summarized based on temperature scenarios taken from specified historical range

The ANNUAL_PEAK_STAT_NAIVE_3 table contains the following columns:

Column Name	Label
MAX	The Maximum Value
Mean	The Arithmetic Mean
Median	The Median Value
Min	The Minimum Value
Num	Number of Simulated Values
P10	The 10th Percentile
P90	The 90th Percentile
Year	Year
actual_peak	Actual Peak

ANNUAL_PEAK_STAT_NAIVE_4

Contains annual peak load statistics for naïve model for economic scenario 4; statistics are summarized based on temperature scenarios taken from specified historical range

The ANNUAL_PEAK_STAT_NAIVE_4 table contains the following columns:

Column Name	Label
MAX	The Maximum Value
Mean	The Arithmetic Mean
Median	The Median Value
Min	The Minimum Value
Num	Number of Simulated Values
P10	The 10th Percentile
P90	The 90th Percentile
Year	Year
actual_peak	Actual Peak

ANNUAL_PEAK_STAT_NAIVE_5

Contains annual peak load statistics for naïve model for economic scenario 5; statistics are summarized based on temperature scenarios taken from specified historical range

The ANNUAL_PEAK_STAT_NAIVE_5 table contains the following columns:

Column Name	Label
MAX	The Maximum Value
Mean	The Arithmetic Mean
Median	The Median Value
Min	The Minimum Value
Num	Number of Simulated Values
P10	The 10th Percentile
P90	The 90th Percentile
Year	Year
actual_peak	Actual Peak

ANNUAL_PEAK_STAT_NAIVE_6

Contains annual peak load statistics for naïve model for economic scenario 6; statistics are summarized based on temperature scenarios taken from specified historical range

The ANNUAL_PEAK_STAT_NAIVE_6 table contains the following columns:

Column Name	Label
MAX	The Maximum Value
Mean	The Arithmetic Mean
Median	The Median Value
Min	The Minimum Value
Num	Number of Simulated Values

Column Name	Label
P10	The 10th Percentile
P90	The 90th Percentile
Year	Year
actual_peak	Actual Peak

FCST_RESULTS_ML_HOLIDAY_0

Contains the predicted load generated with various weather scenarios for holiday model for economic scenario 0

The FCST_RESULTS_ML_HOLIDAY_0 table contains the following columns:

Column Name	Label
Datetime	Datetime
Date	Date
Hour	Hour
Actual_load	Actual Load
Year_orig	Original Year
Year	Year
Predicted_load	Predicted load
Lower95	Lower 95 Confidence Interval
Upper95	Upper 95 Confidence Interv

FCST_RESULTS_ML_NAIVE_0

Contains the predicted load generated with various weather scenarios for naïve model for economic scenario 0

The FCST_RESULTS_ML_NAIVE_0 table contains the following columns:

Column Name	Label
Datetime	Datetime
Date	Date
Hour	Hour
Actual_load	Actual Load
Year_orig	Original Year
Year	Year
Predicted_load	Predicted load
Lower95	Lower 95 Confidence Interval
Upper95	Upper 95 Confidence Interv

FCST_RESULTS_ML_RECENCY_0

Contains the predicted load generated with various weather scenarios for recency model for economic scenario 0

The FCST_RESULTS_ML_RECENCY_0 table contains the following columns:

Column Name	Label
Datetime	Datetime
Date	Date
Hour	Hour
Actual_load	Actual Load
Year_orig	Original Year
Year	Year
Predicted_load	Predicted load
Lower95	Lower 95 Confidence Interval
Upper95	Upper 95 Confidence Interv

FCST_RESULTS_ML_WEEKEND_0

Contains the predicted load generated with various weather scenarios for weekend model for economic scenario 0

The FCST_RESULTS_ML_WEEKEND_0 table contains the following columns:

Column Name	Label
Datetime	Datetime
Date	Date
Hour	Hour
Actual_load	Actual Load
Year_orig	Original Year
Year	Year
Predicted_load	Predicted load
Lower95	Lower 95 Confidence Interval
Upper95	Upper 95 Confidence Interv

GLM_PARAMS

Contents depend on the diagnose and forecast model.

Column Name	Label
Dependent	—
Parameter	—
Estimate	—
Biased	—
Standard Error	—
tValue	—

Column Name	Label
Probt	Pr > |t|

GLM_PARAMS_ML_HOLIDAY_0

Column Name	Label
Dependent	—
Parameter	—
Estimate	—
Biased	—
Standard Error	—
tValue	—
Probt	Pr > |t|

GLM_PARAMS_ML_HOLIDAY_1

Column Name	Label
Dependent	—
Parameter	—
Estimate	—
Biased	—
Standard Error	—
tValue	—
Probt	Pr > |t|

GLM_PARAMS_ML_NAIVE_0

Column Name	Label
Dependent	—
Parameter	—
Estimate	—
Biased	—
Standard Error	—
tValue	—
Probt	Pr > |t|

GLM_PARAMS_ML_NAIVE_1

Column Name	Label
Dependent	—
Parameter	—
Estimate	—
Biased	—
Standard Error	—
tValue	—
Probt	Pr > |t|

GLM_PARAMS_ML_RECENCY_0

Column Name	Label
Dependent	—
Parameter	—
Estimate	—
Biased	—
Standard Error	—
tValue	—
Probt	Pr > |t|

GLM_PARAMS_ML_RECENCY_1

Column Name	Label
Dependent	—
Parameter	—
Estimate	—
Biased	—
Standard Error	—
tValue	—
Probt	Pr > |t|

GLM_PARAMS_ML_WEEKEND_0

Column Name	Label
Dependent	—
Parameter	—
Estimate	—
Biased	—
Standard Error	—
tValue	—
Probt	Pr > |t|

GLM_PARAMS_ML_WEEKEND_1

Column Name	Label
Dependent	—
Parameter	—
Estimate	—
Biased	—
Standard Error	—
tValue	—
Probt	Pr > |t|

HIST_FCST_RESULTS_ML_NAIVE_0

Contains the predicted load generated with the actual weather scenario for naïve model for economic scenario 0

The HIST_FCST_RESULTS_ML_NAIVE_0 table contains the following columns:

Column Name	Label
Datetime	Datetime
Date	Date
Hour	Hour
Actual_load	Actual Load
Year_orig	Original Year
Year	Year
Predicted_load	Predicted load
Lower95	Lower 95 Confidence Interval
Upper95	Upper 95 Confidence Interv

HIST_FCST_RESULTS_ML_RECENCY_0

Contains the predicted load generated with the actual weather scenario for recency model for economic scenario 0

The HIST_FCST_RESULTS_ML_RECENCY_0 table contains the following columns:

Column Name	Label
Datetime	Datetime
Date	Date
Hour	Hour
Actual_load	Actual Load
Year_orig	Original Year
Year	Year
Predicted_load	Predicted load
Lower95	Lower 95 Confidence Interval
Upper95	Upper 95 Confidence Interv

HIST_FCST_RESULTS_ML_WEEKEND_0

Contains the predicted load generated with the actual weather scenario for weekend model for economic scenario 0

The HIST_FCST_RESULTS_ML_WEEKEND_0 table contains the following columns:

Column Name	Label
Datetime	Datetime
Date	Date
Hour	Hour
Actual_load	Actual Load
Year_orig	Original Year
Year	Year
Predicted_load	Predicted load
Lower95	Lower 95 Confidence Interval
Upper95	Upper 95 Confidence Interv

HIST_FCST_RESULTS_ML_HOLIDAY_0

Contains the predicted load generated with the actual weather scenario for holiday model for economic scenario 0

The HIST_FCST_RESULTS_ML_HOLIDAY_0 table contains the following columns:

Column Name	Label
Datetime	Datetime
Date	Date
Hour	Hour
Actual_load	Actual Load
Year_orig	Original Year

Column Name	Label
Year	Year
Predicted_load	Predicted load
Lower95	Lower 95 Confidence Interval
Upper95	Upper 95 Confidence Interv