



ADVANTICA

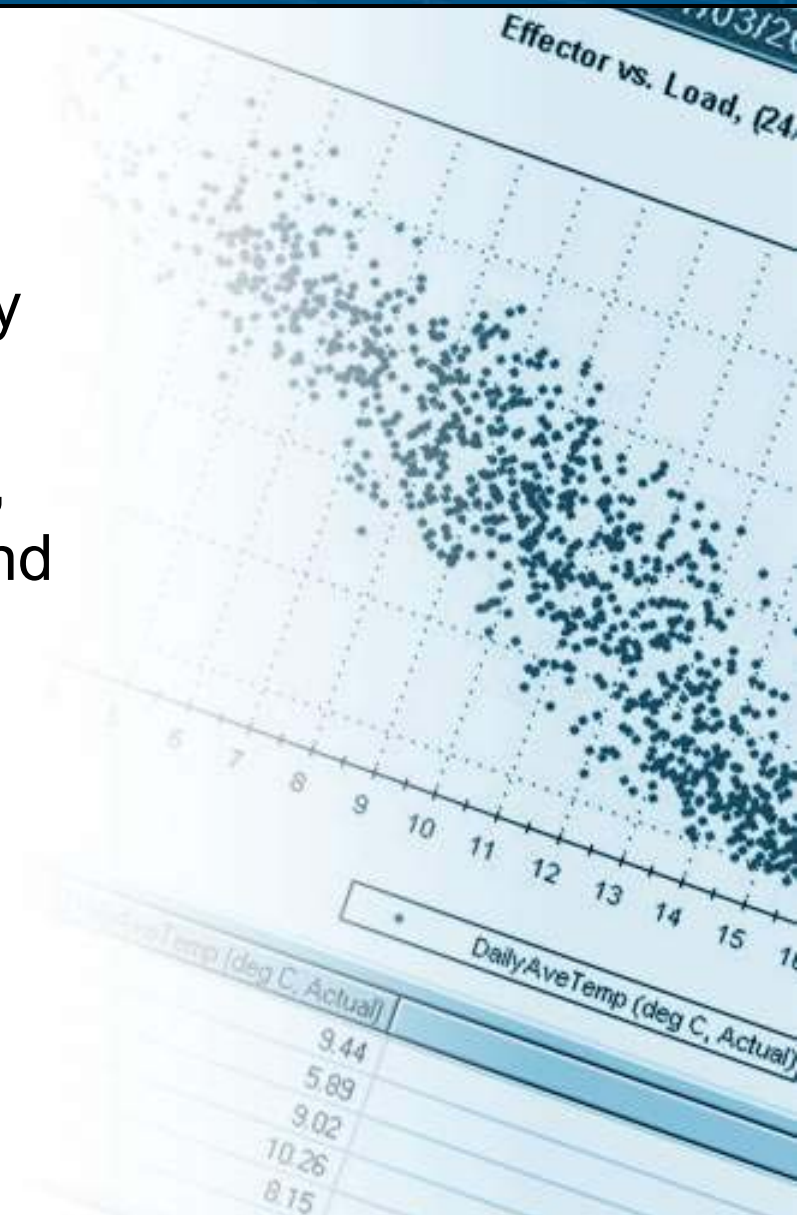
Improving Forecasts




Introduction

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- One of the powerful features of Forecaster is the ability to try out and test different predictors easily
- The Scenario Analysis Module provides facilities to copy meters, assign and test new predictors and try out different scenarios
- Improved predictors can then be deployed very quickly on the live system



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- In this example, we will show how Forecaster can be used to improve the forecast performance for a small part of a gas network
 - Initially, the model being used to forecast the gas demand for the next day is quite simple
 - The forecast is based on the average of the previous 2 weeks load using the load from the same day of the week

Looking at Performance

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This simple report shows a variety of statistical performance indicators for the period that is not performing very well

Notably, the Mean Absolute Percentage Error (MAPE) is 16% and there is a positive bias in the forecast (a tendency to over forecast shown by the mean error of 0.28)

The screenshot shows a web browser window with the title 'Predictor Properties - Advantica Internet Explorer'. The address bar contains 'ware\Forecaster/Report_005.html'. The main content area displays the title 'Predictor 'DA_Use2WeekDOWAve'' and a link 'Advantica on the Web'. Below this, there is a list of parameters:

- Meter: 'EAST_DAILY'
- Slot: '8 AM Day Ahead' (Eight AM Day ahead forecast slot)

The main section is titled 'Predictor Merit Summary (all dates predicted)'. It contains a table with the following data:

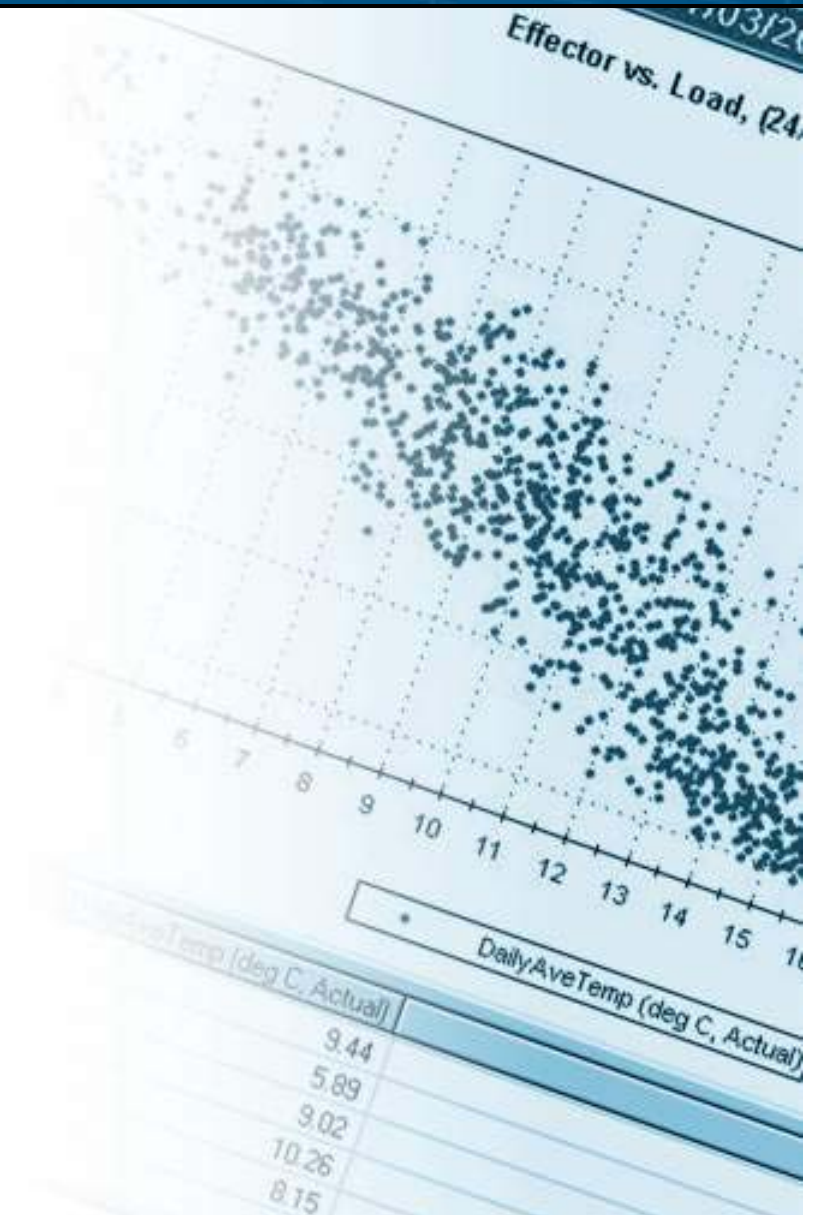
Predictor	Time Range	Slot	Mean Absolute Error	Mean Absolute Relative Error (%)	Mean Error	Mean Relative Error (%)	MAPE (%)	RMS Error	RMS Relative Error (%)
DA_Use2WeekDOWAve	01/01/2002 - 31/10/2002	8 AM Day Ahead	1.76	15.88	0.28	2.55	16.31	2.42	21.79

The browser's status bar at the bottom shows 'Done' and 'My Computer'.

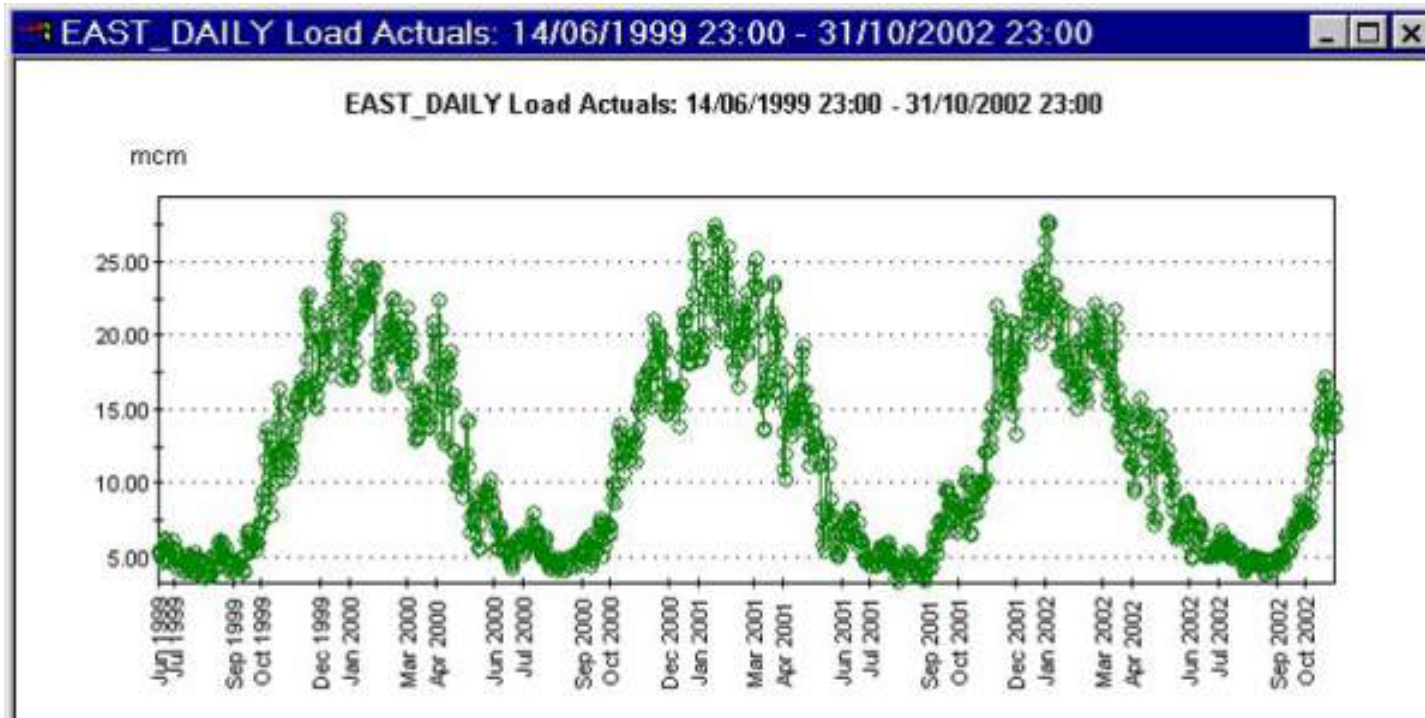
Classifying Behaviour

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- The performance is indeed not very good, so what can we do?
- First we need to look at the load profile and try to classify it's behaviour
- Then we look at what other factors affect it and try out a predictor that may work better



Classifying Behaviour



The load profile for about 3 years of historical data is shown

What sort of load pattern does this meter show????

There is clearly a seasonal pattern with peak demand occurring in the winter months

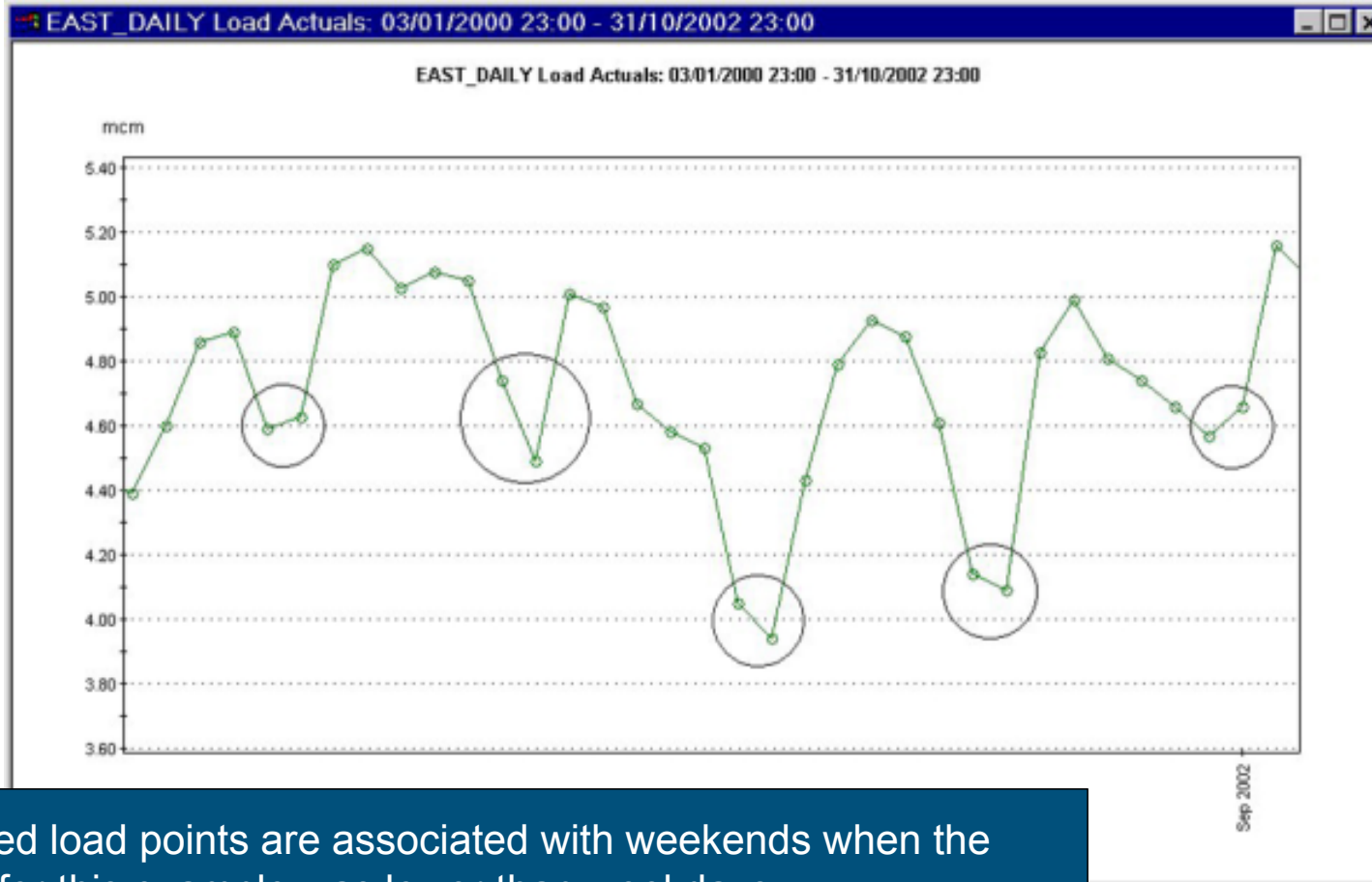
This load is probably temperature sensitive – we can use Forecasters charting tools to confirm this

Classifying Behaviour

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“There is clearly a strong load

temperature
degrees C,
constant



- We have now established that this customer's load is strongly temperature sensitive and cyclic
- The next step is to take a copy of the meter (called "cloning") and try out some of Forecasters other model engines to see if we can improve the performance.
- The next sequence shows how we assign a regression model using temperature and day of week effects to improve the demand forecast...

Cloning

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The screenshot displays the 'Forecaster' application window. The main interface is divided into several panes. On the left, a 'Meters' tree view shows a hierarchy under 'Industrial' with 'EAST_DAILY_TEST' highlighted in a red box. The central pane shows a table of meter data:

Name	Active Predictor	Predictor Type	Active Date Trained
Brick Works			
EAST NETWORK	DA_Reg_RO_Temp_DOW_365d_train	Model Based	27/01/2004 12:18
EAST_DAILY	DA_Reg_RO_Temp_DOW_365d_train	Model Based	05/11/2004 09:11
EAST_DAILY_TEST			
Food Factory	DA_Use2WeekDOWave	Model Based	15/02/2005 13:12
University	DA_Reg_RO_Temp_no_DOW_365d_train	Model Based	19/01/2004 10:51

Below the main window, an 'Expanded View 1' window is open, showing a detailed view of the 'EAST_DAILY_TEST' meter. The 'Recent Items' list contains 'EAST_DAILY_TEST'. The 'Meter Hierarchy' tree in this window shows the following structure:

- Meter Hierarchy
 - EAST_DAILY_TEST
 - Load
 - EA
 - EALDZ
 - Model Based Predictors
 - Composite Predictors
 - Adaptive Combination Predictors

A blue text box on the right side of the screenshot contains the following text:

On completion, a new meter entry appears on our tree and meter view and automatically displays in the Expanded View
We are now ready to try out some different models

Adding a Predictor

Add New Model Based Predictors

Choose a Model Pack Template:

Template Name	Predictor Name	Forecast Spec	Merit Interval Definition
<input type="checkbox"/> DA_UseLatestLoad	DA_UseLatestLoad	Day Ahead	ONE ONE STEP INTERVAL
<input type="checkbox"/> LT_Carnak	LT_Carnak	Year Forecast	ONE 24 STEP INTERVAL
<input type="checkbox"/> DA_Reg_Temp_DOW_365d_train	DA_Reg_Temp_DOW_365...	Day Ahead	ONE ONE STEP INTERVAL
<input type="checkbox"/> DA_Neural_RO_Temp_DOW_BH_730dTrain	DA_Neural_RO_Temp_DO...	Day Ahead	ONE ONE STEP INTERVAL
<input checked="" type="checkbox"/> DA_Reg_RO_Temp_DOW_365d_train	DA_Reg_RO_Temp_DOW...	Day Ahead	ONE ONE STEP INTERVAL

Selected Model Pack Template Description:
DA reg model inc hols and DOW

Details... Clear All Select All

< Back Next > Finish Cancel Help

We then click next to train the model...

Training the Predictor

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Predictor Training

Predictors to Train:

Predictor Name	Reference Dates	Slot	Load
<input checked="" type="checkbox"/> DA_Reg_RO_Temp_DOW_365d...	01/01/2002	8 AM Day Ahead	01/01/1999 - 31/10/2002

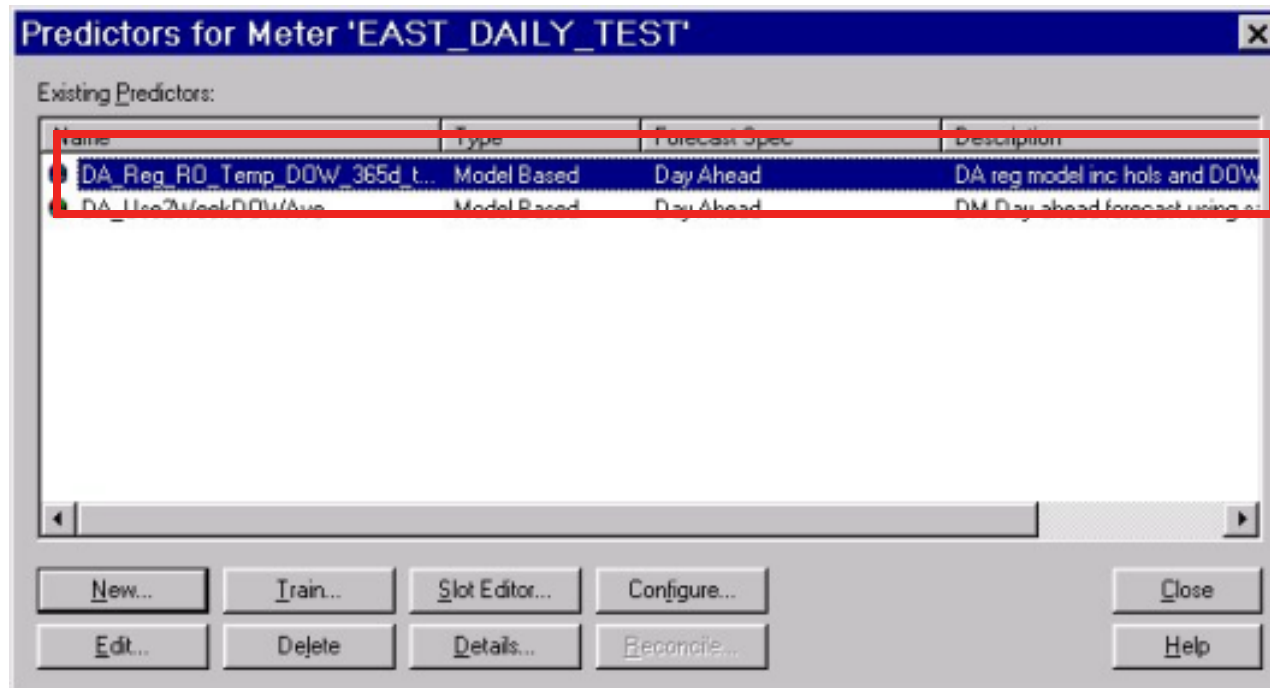
Clear All Select All

< Back Next > Finish Cancel Help

To train the model, we enter the Reference Date as the point at which the model is to be trained and click next...

Activating the Predictor

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The Manage Predictors summary dialog shows the new predictor ready for use

Generating Forecasts

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Generate Forecast

Reference Date
 Partition Forecasts for a range of reference dates

Start Reference Date: 01 January 2002 Today
End Reference Date: 31 October 2003 Today

Forecast Slot

Name	Description
<input checked="" type="checkbox"/> 8 AM Day Ahead	Eight AM Day ahead forecast slot
<input type="checkbox"/> 8 AM Week Ahe...	Eight AM Week Ahead forecast slot
<input type="checkbox"/> 8 AM Year Ahead	Eight AM Medium Term forecast slot

Meters

Show All

Name	Meter Type	Slot Name	Active Predictor
<input checked="" type="checkbox"/> EAST_DAILY_TEST	Individual	8 AM Day Ahead	DA_Reg_RD_Temp_DQv

Forecast progress
304 successful / 0 failed - of 304 to forecast.

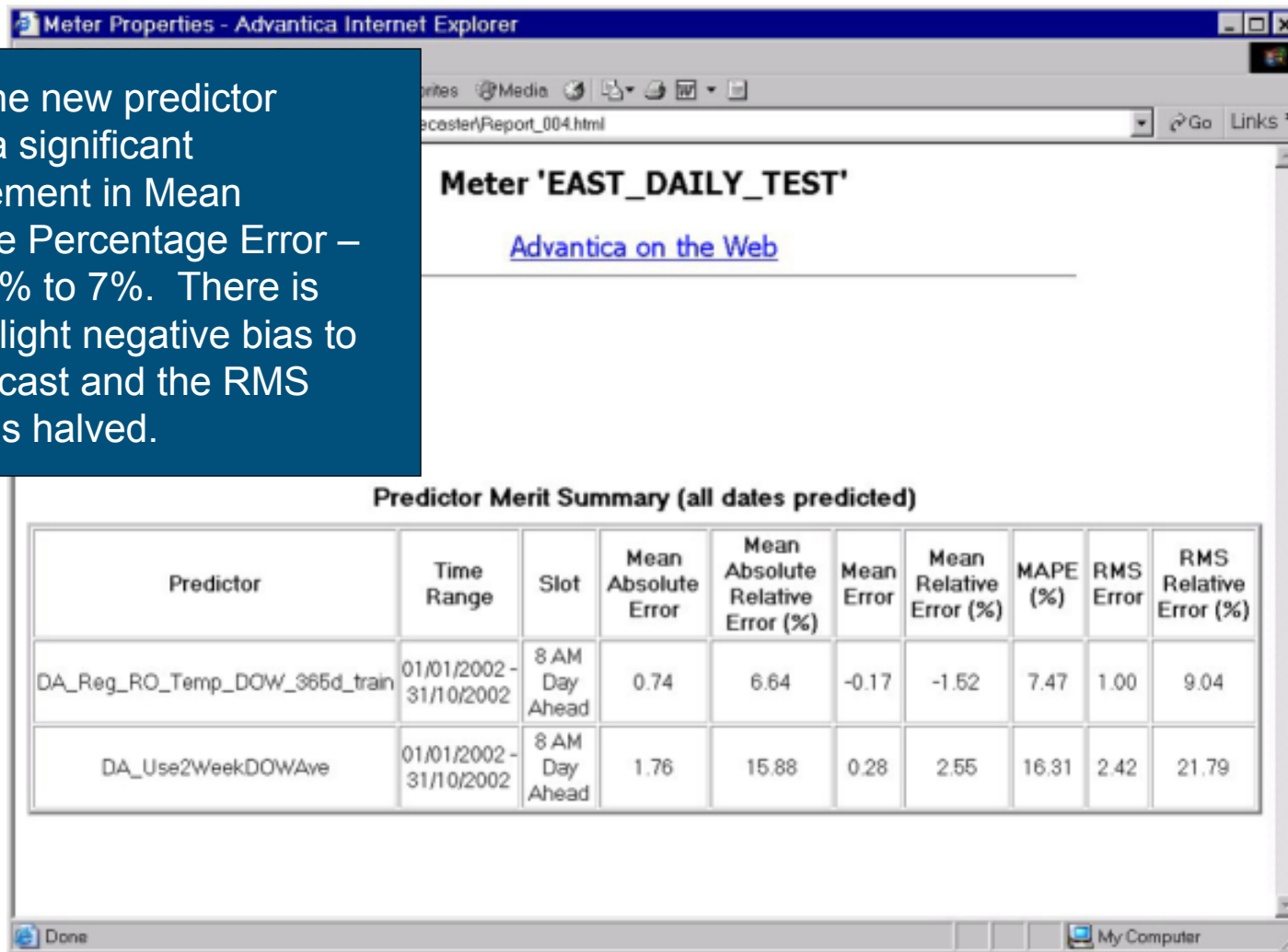
Stop

A range of dates to run the forecasts is entered...

Once completed...

Reviewing Performance

Using the new predictor shows a significant improvement in Mean Absolute Percentage Error – from 16% to 7%. There is now a slight negative bias to the forecast and the RMS error has halved.



Predictor Merit Summary (all dates predicted)

Predictor	Time Range	Slot	Mean Absolute Error	Mean Absolute Relative Error (%)	Mean Error	Mean Relative Error (%)	MAPE (%)	RMS Error	RMS Relative Error (%)
DA_Reg_RO_Temp_DOW_365d_train	01/01/2002 - 31/10/2002	8 AM Day Ahead	0.74	6.64	-0.17	-1.52	7.47	1.00	9.04
DA_Use2WeekDOWAve	01/01/2002 - 31/10/2002	8 AM Day Ahead	1.76	15.88	0.28	2.55	16.31	2.42	21.79

Further Improvements

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- However, even though this predictor provides an improvement on the original, the customer still wants to try and reduce their forecasting error even further...
- We apply a Neural Network Predictor and an Adaptive Combination Predictor to see if further improvements can be made
- A similar process is followed as for the regression model, but to save time we will just look at the results

Reviewing Performance

We can also look at the overall performance summary - this shows that the Adaptive Combination predictor outperforms any other individual predictor over time
Not only has the MAPE reduced, the forecast bias (mean error) is much closer to zero – both key factors in ensuring that the best forecasting performance can be achieved

Meter Properties - Advantica Internet Explorer

File Edit View Favorites Tools Help

Predictor Merit Summary (all dates predicted)

Predictor	Time Range	Slot	Mean Absolute Error	Mean Absolute Relative Error (%)	Mean Error	Mean Relative Error (%)	MAPE (%)	RMS Error	RMS Relative Error (%)
DA_Neural_RO_Temp_DOW_BH_730dTrain	01/01/2002 - 31/10/2002	8 AM Day Ahead	0.75	6.72	0.08	0.75	6.93	1.11	10.03
DA_Reg_RO_Temp_DOW_365d_train	01/01/2002 - 31/10/2002	8 AM Day Ahead	0.70	6.33	-0.04	-0.37	7.09	0.98	8.80
DA_Use2WeekDOWAve	01/01/2002 - 31/10/2002	8 AM Day Ahead	1.76	15.88	0.28	2.55	16.31	2.42	21.79
EAST_COMBO	01/01/2002 - 31/10/2002	8 AM Day Ahead	0.63	5.64	0.01	0.12	5.77	0.92	8.30

Done My Computer

Deploying the Predictors



- We have now completed our analysis and shown that the combination of the three different types of predictor will improve the forecast
- But how do we assign these new predictors to our original meter?

Deploying the Predictors

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The screenshot shows the 'Forecaster' application window. A context menu is open over a predictor in the 'Expanded View 1' pane. The menu items are:

- Display Series
- Compare Series
- Compare Forecasts with Reference Meter...
- Chart Aggregated...
- New Scenario...
- Reinstate Predictor on Reference Meter...**
- Clone Predictor...
- Delete Predictor...
- Generate Forecast...
- Merit Functions...
- Train Predictor...
- Manage Predictors...
- Predictor Performance Report...
- Predictor Overview
- Predictor Slot Assignment Report
- Find
- Edit...
- Load Hierarchy
- View

The background shows a tree view of meters and a table of predictors. The table has columns for Predictor Name, Predictor Type, and Active Date Trained.

Predictor	Predictor Type	Active Date Trained
Reg_RD_Temp_DOW_365d_train	Model Based	27/01/2004 12:18
Reg_RD_Temp_DOW_365d_train	Model Based	05/11/2004 09:11
Reg_RD_Temp_DOW_365d_train	Model Based	21/02/2005 10:36
Use2WeekDOWAve	Model Based	15/02/2005 13:12
Reg_RD_Temp_no_DOW_365d_train	Model Based	19/01/2004 10:51

The 'Expanded View 1' pane shows a 'Motor Hierarchy' with 'EAST_DAILY' selected. Below it, a list of meters is visible, including 'EAST_DAILY', 'EA', 'EALDZ', 'Model Based', 'DA_R...', 'DA_Use2WeekDOWAve (304)', 'Composite Predictors', and 'Adaptive Combination Predictors'.

From the expanded view we just select the predictor we want to use and from the pop-up menu select "Reinstate Predictor on Reference Meter" this will automatically assign the predictor and all it's trained parameters to our original meter so we can use it straight away!

- Using Forecasters Scenario Analysis Manager allows clients to quickly identify poor forecast performance and take steps to improve it using a variety of modelling techniques
- No software changes were required
- Typically performance is assessed over at least 12 months to ensure performance improvements are consistent over time

