Electricity Load and Price Forecasting for the Australian Market with MATLAB

This example demonstrates building a short term load forecast system with MATLAB for Sydney, Australia. It also touched on how it could be converted this into a Price forecasting model and the challenges faced in the Australia market. Accurate load forecasts are critical for distribution planning for utilities. The load forecast influences a number of decisions including which generators to commit for a given period, and broadly affects the wholesale electricity market prices. Load forecasting algorithms typically also feature prominently in hybrid models for electricity prices, some of the most accurate class of approaches for modeling electricity markets. The electricity price forecast is used widely by market participants in many trading and risk management applications.

Traditionally, utilities and marketers have used commercial software packages for performing load forecasts. The main disadvantage of these is that they are a black box, offering no transparency into how the load forecast is calculated. They also only typically offer 80-90% of the functionality needed by a utility. In many cases it is just not possible to meet all of the requirements through an off-the-shelf product, for instance taking into account regional loads, different weather patterns and so on.

MathWorks tools provide the flexibility of building a completely customized load forecasting system that meets 100% of the requirements. And because of the built-in models, high-level language and ease of connecting to data, the time taken to develop such a system is also dramatically lower than building an equivalent system in a lower level programming language, as is demonstrated in this example.

# Data

The data used for this example are historical hourly temperatures, system loads and day-ahead electricity prices from the AEMO on NSW and Temperature data of Sydney Observatory from the BOM. We also will be using data from New England Pool region in the USA. AU data is provided in the temp\_data and nem\_data folders, with the matfile file datacombine.m which creates the mat file and excel files. For the USA data, these are provided in both Excel spreadsheets, MAT files and an access database in the *Data* folder

# Models

The historical data is used to calibrate both a Neural Network and a Bagged Regression Tree model for day-ahead load forecasting. The predictors for non-linear regression are generated by the function *genPredictors.* This function creates a matrix of inputs to the model. For the load forecast, the predictors include

* Dry bulb temperature
* Wet bulb temperature
* Humidity
* Dew point temperature
* Hour of day
* Day of the week
* Holiday/weekend indicator
* Previous 24-hr average load
* 24-hr lagged load
* 168-hr (previous week) lagged load

The price predictors also include (spot and lagged) natural gas prices and lagged electricity prices. The model is trained on data from 2004 to 2007 and tested on completely out-of-sample data from 2008.

# Outputs

The load forecasting example includes function and the trained models to perform day-ahead load forecasting using both Neural Network and Regression Tree models. Both Load forecasting examples generate a report that shows the training procedure and validation on out-of-sample data with weekly accuracy plots for the 2008 test period.

# Running the Load Forecasting Example

**PATH SETUP.** Be sure to add the folders to your MATLAB path before running the model. To do so go to “FILE-SET PATH” and “add with subfolders” all directories to the MATLAB path.

The main script *LoadScriptNN\_aus.m and LoadscriptTrees\_aus* will walk you through the analysis*.* These are found in the *\Load* folder.