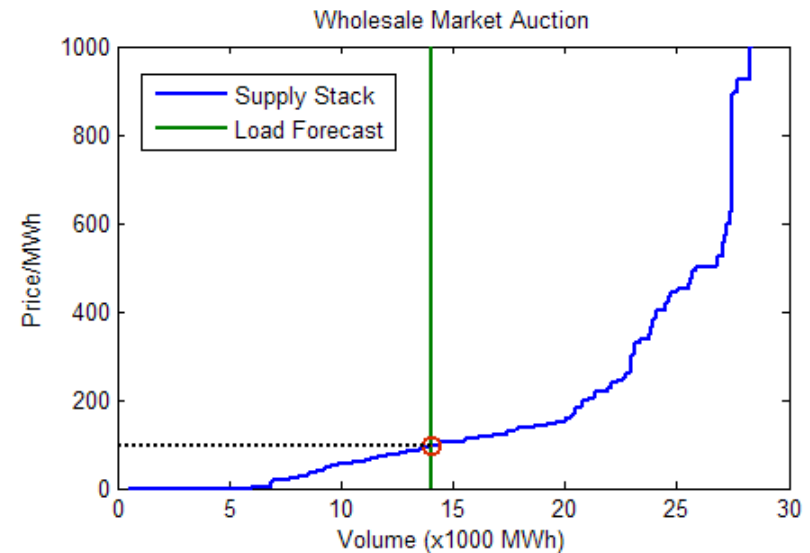# Electricity Load & Price Forecasting for the Australian Market

David Willingham
david.willingham@mathworks.com.au

The Need for Accurate Load & Price Forecasts
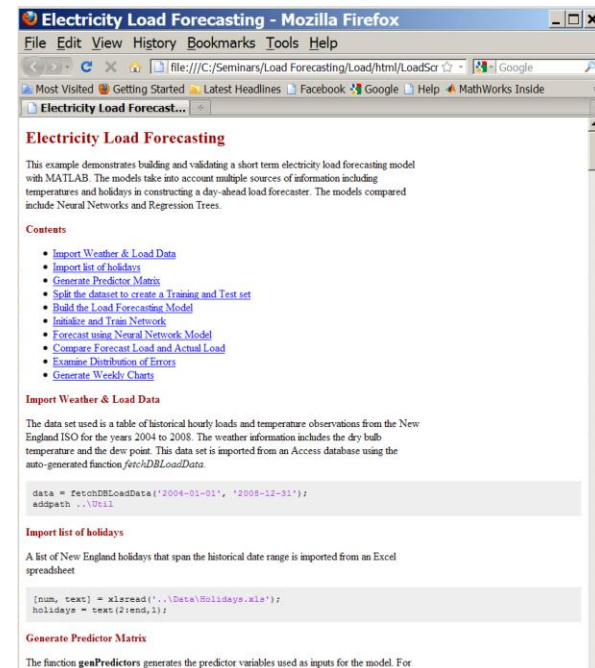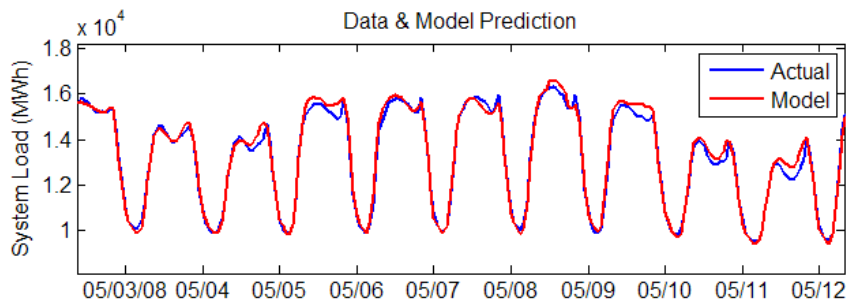
- Utilities

- System Operators

- Generators

- Power Marketers

Wholesale Market Auction

Case Study: Short-term Load Forecaster

- ## Goal:
  - Implement a tool for **easy** and **accurate** computation of day-ahead system load forecast

- ## Requirements:
  - Accurate predictive model
  - Automated Report

Challenges in Implementing a Load & Price Forecasting System

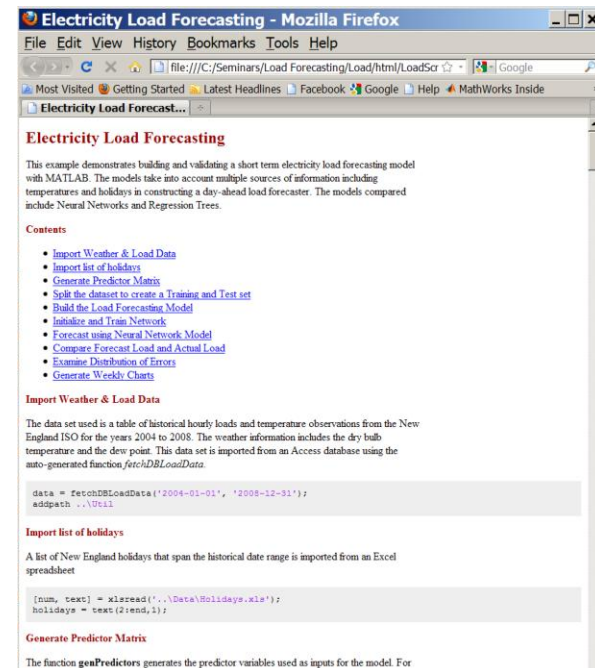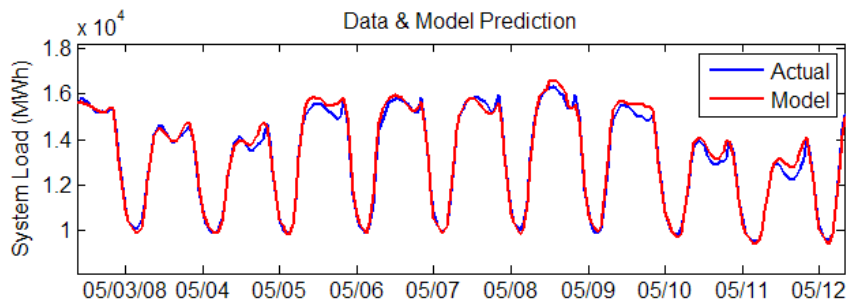| **Traditional Approaches** |
| :--- |
| Off-the-shelf software |
| Third-party consulting |
| In-house development with traditional languages |

Case Study: Short-term Load Forecaster

- # Goal:
  - – Implement a tool for **easy** and **accurate** computation of day-ahead system load forecast

- # Requirements:
  - – Accurate predictive model
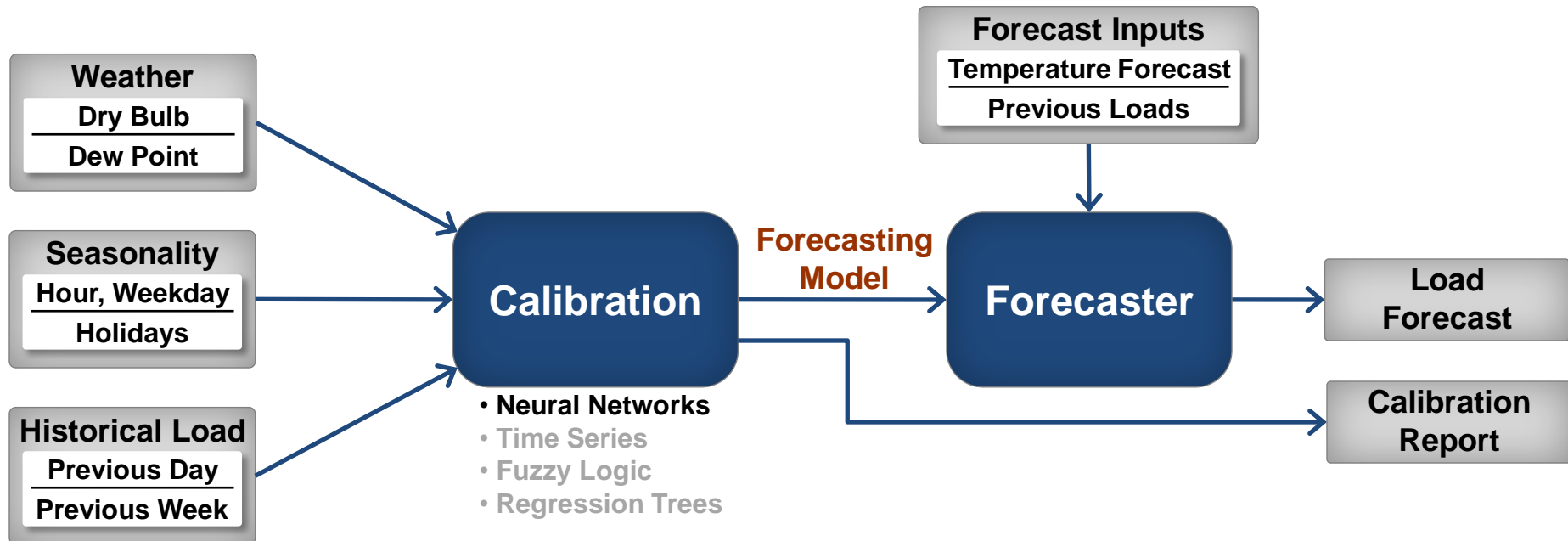 - – Automated Report

Model Architecture

Step 1: Access Historical Data
Step 2: Select & Calibrate Model
Step 3: Run Model Live

Weather
Dry Bulb
Dew Point

Seasonality
Hour, Weekday
Holidays

Historical Load
Previous Day
Previous Week

Forecast Inputs
Temperature Forecast
Previous Loads

Calibration

Forecasting Model

Forecaster

- **Neural Networks**
- Time Series
- Fuzzy Logic
- Regression Trees

Load Forecast

Calibration Report

Model Development Workflow

Access
- Files
- Databases
- Datafeeds

BZ   NG   CL
71.92 5.332 81.

Research and Quantify
- Data Analysis & Visualization
- Model Development
  ```
  S=31; K=30
  C=blsprice
  P=C-S+K*ex
  ```
- Application Development

Share
- Reporting
- Applications
- Production

.dll C/C++ Java .NET

Automate

Modeling Tasks

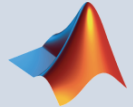**Step 1: Access Historical Data**

Step 2: Select & Calibrate Model

Step 3: Published Report

Modeling Tasks

Step 1: Access Historical Data

- Temperature data from BOM (Bureau of Meteorology)
- Load and Price (RRP) data from AEMO

Step 2: Select & Calibrate Model

Step 3: Published Report

Modeling Tasks

Step 1: Access Historical Data

- Temperature data from BOM (Bureau of Meteorology)
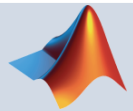- Load and Price (RRP) data from AEMO

Step 2: Select & Calibrate Model

Step 3: Published Report

Modeling Tasks

Step 1: Access Historical Data

- Temperature data from BOM (Bureau of Meteorology)
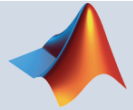- Load and Price (RRP) data from AEMO

Step 2: Select & Calibrate Model

- Leverage numerous built-in functions
- Focus on modeling not programming
- Capture as-you-go and automate the process

Step 3: Published Report

Modeling Tasks

Step 1: Access Historical Data

- Temperature data from BOM (Bureau of Meteorology)
- Load and Price (RRP) data from AEMO

Step 2: Select & Calibrate Model

- Leverage numerous built-in functions
- Focus on modeling not programming
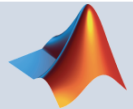- Capture as-you-go and automate the process

Step 3: Published Report

Modeling Tasks

Step 1: Access Historical Data

- Temperature data from BOM (Bureau of Meteorology)
- Load and Price (RRP) data from AEMO

Step 2: Select & Calibrate Model

- Leverage numerous built-in functions
- Focus on modeling not programming
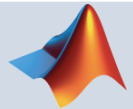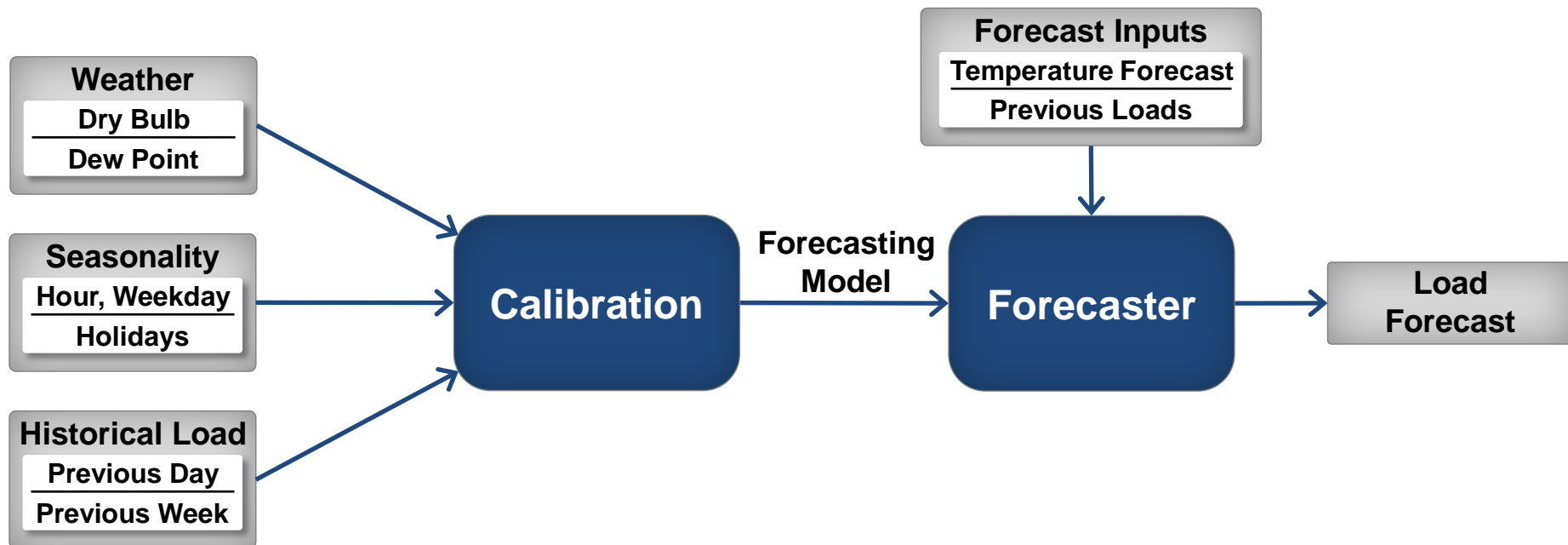- Capture as-you-go and automate the process

Step 3: Published Report

- Point-and-click publishing

Forecasting Electricity Loads

Weather
- Dry Bulb
- Dew Point

Seasonality
- Hour, Weekday
- Holidays

Historical Load
- Previous Day
- Previous Week

Calibration

Forecasting Model

Forecast Inputs
- Temperature Forecast
- Previous Loads

Forecaster

Load Forecast

Forecasting Electricity Prices
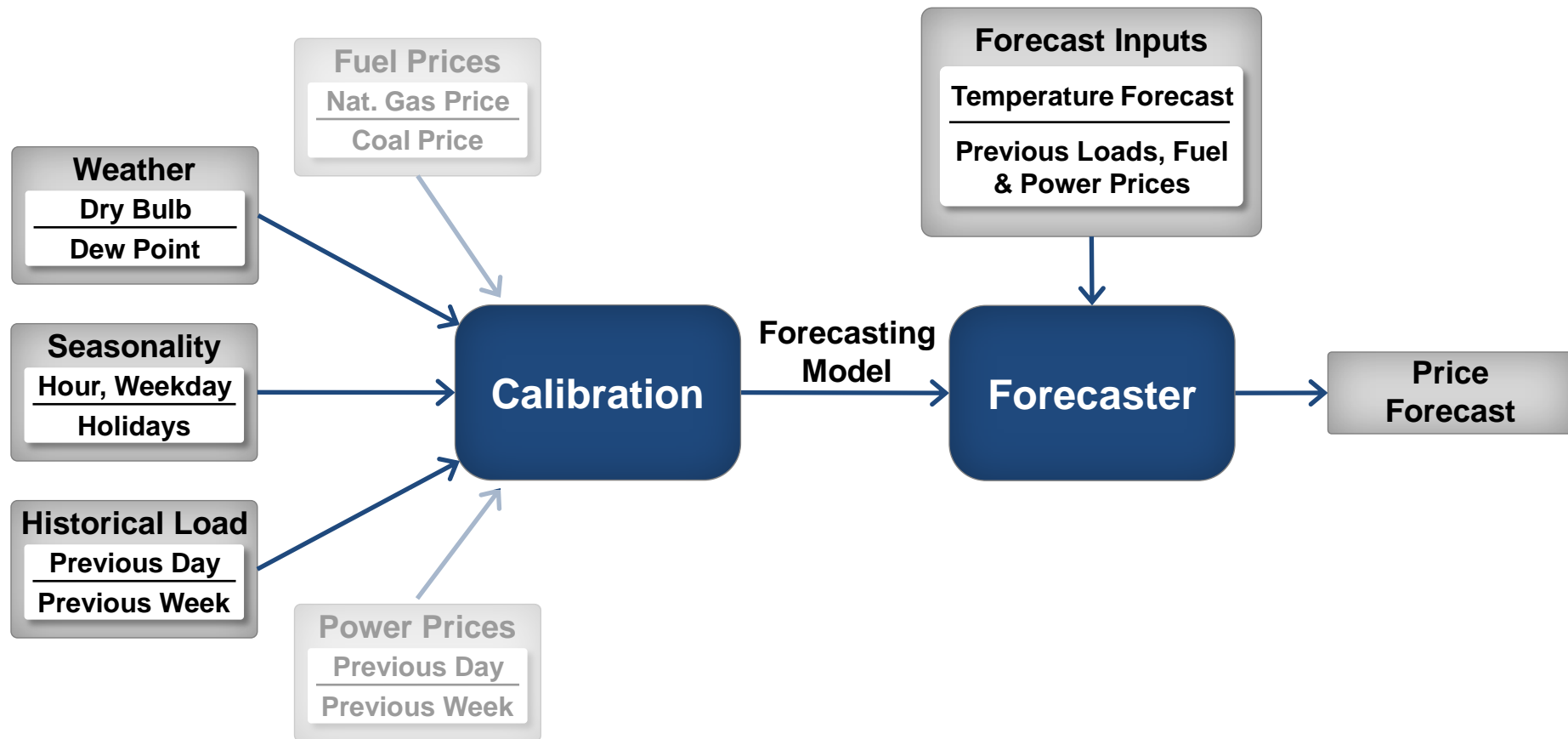
Other considerations:

Pre Processing Data
Batch importing
Cleaning

Deployment
Stand Alone Application
Excel Add In
Java, .NET

MATLAB Solutions

Traditional Approaches	Challenges
Off-the-shelf software	Inability to customize
Third-party consulting	Lack of transparency
In-house development with traditional languages	Long development time

MATLAB Solutions

| Challenges	Solutions
Inability to customize	***Flexible modeling*** ▪ Complete development environment ▪ Libraries of customizable functions
Lack of transparency	***White-box modeling*** ▪ Viewable-source functions ▪ Interactive debugging
Long development time	***Quick prototyping*** ▪ Focus on modeling not programming ▪ Point-and-click deployment

Additional Resources

- ## Recorded webinars:

  - ***Energy Load & Price Forecasting (US Version)***

  - ***Energy Trading & Risk Management***

  - and other recorded webinars, at mathworks.com.au/events

- ## User stories:

  - Horizon Wind Energy Develops Revenue Forecasting and Risk Analysis Tools for Wind Farms

  - GAS NATURAL FENOSA Predicts Energy Supply and Demand Using MathWorks Tools

  - and others, at http://mathworks.com/energy-production
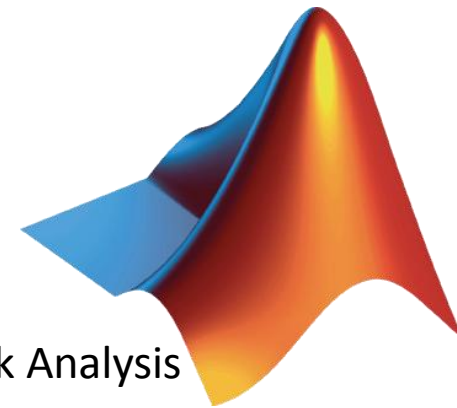
Questions?

My Email:
david.willingham@mathworks.com.au