



**PROPHET** 2015  
ELECTRICITY MARKET MODEL





# MODELLING POWER SYSTEMS AND COMPETITIVE ELECTRICITY MARKETS

PROPHET is a powerful market simulation and least-cost investment model for market behavioural analysis and investment planning. PROPHET provides this through two distinct yet integrated models, the market simulation model and the least cost planning module. These two components operate separately but share common data sets so that utilising the two systems together is seamless for the user.

## ★ KEY FEATURES



Detailed representation of transmission and generation systems



Transmission security constraints



Detailed representation of market operations



Flexible scenario management



Hydro modelling



Graphical and tabular reporting



Fuel and emission model



## PROPHET - SIM

**PROPHET-SIM** is capable of comprehensively representing the physical power system, market operations and the behaviour of competitive participants. The level of detail modelled can vary from simple macro representations to the very detailed and complex. Outputs from the simulation model include projections of spot price and generation dispatch which are used by our clients to guide a range of decisions including:

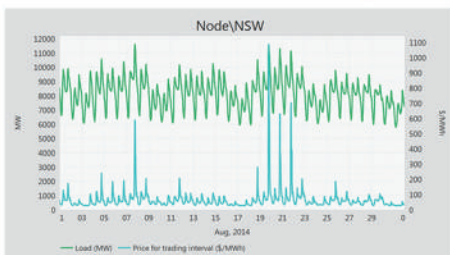
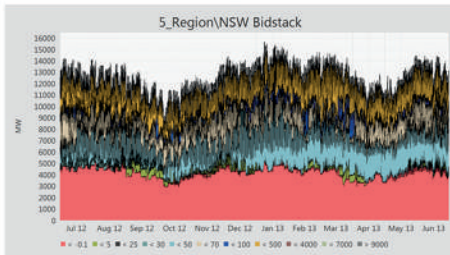
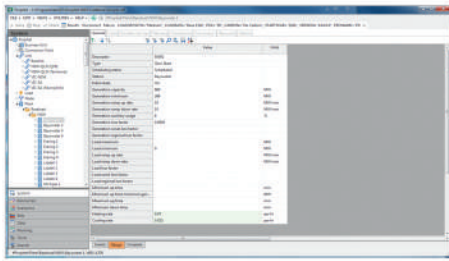
- Budgeting and revenue forecasts
- Contract trading strategy and option calls
- Spot trading strategy
- Plant maintenance and overhaul timing



## PROPHET - PLAN

**PROPHET-PLAN** is a mixed integer programming model that represents the physical power system and associated policies such as renewable energy schemes, network investment options, plant new entry and retirement decisions. The output from the least-cost investment model is generation and transmission development plan. This output is used by our clients to guide a range of decisions including:

- Generation investment opportunities
- Long term strategy
- Transmission augmentation
- Unit commitment



## FULL LP SOLVER

The Full LP Solver module provides for modelling the market in greater detail. This includes generic constraints, N-1 contingency analysis, DC Load Flow model, and reserve and regulation markets. Supports a choice of 3rd party solving engines (including Xpress, CPLEX, and Gurobi) and makes use of parallel processing to maximise performance.

## DYNAMIC BIDDING

The Dynamic Bid Optimiser module manages portfolio bidding behaviour with the aim to maximise their trading profits. Bidding behaviour to realise this outcome is a function of portfolio cost structure, contract levels and price sensitivity at their location. This module provides enhanced capability to study the impact of competition in electricity markets under different scenarios as influenced by the number and size of trading companies, vertical integration, and contracting levels.

## SCRIPTING AND PLUGINS

The Scripting module exposes the PROPHEET Solver object model as a set of programmable interfaces that can be used to add custom behaviour to a PROPHEET simulation. This allows almost limitless potential to accommodate detailed calculations, define specific behaviour or unique asset features.

Plugins can be used to extend the functionality of the PROPHEET user interface. This can automate tedious elements of common workflow to improve productivity and reduce modelling errors.



## FEATURE SUMMARY

### Network

- Flexible network model able to represent macro level or full nodal networks
- Merchant and regulated interconnectors
- DC load flow approximation to AC power flow
- Generic network constraints with dynamic RHS values
- N-1 contingency analysis with excellent agreement to full AC load flow models

### Planning

- Integer and continuous plant new entry
- Plant retirements
- Network investment options
- Staged investment options
- Co-optimised electricity and gas networks
- Optimised unit commitment taking into account fuel and emission constraints

### External Interfaces

- Use external data from file or database queries
- Import tool for bid data from
- Command line interface for running scenarios
- .NET interface for interacting with Prophet from .NET environments

### Generator

- Slow start, rapid start and hydro plant models
- Station auxiliary usage and marginal losses
- Ramp rates
- Scheduled outages
- Partial and full random plant outages
- Minimum up/down times

### User Interface

- Intuitive user interface
- Utilise multiple databases and formats in a single environment workspace
- User accounts with logins and permissions
- Export and import between databases

### Plugins and Scripting

- Extensible frontend framework through plugins
- Add custom menu commands and context menu handlers
- Write script code that runs in the backend solver to add custom business logic and behaviour

### Load

- System load with value of lost load
- Lost load sharing
- Dispatchable load
- Load growth tool using historical load data and projected energy and maximum demand
- Load builder tool using historical load and weather data

### Reporting

- User defined reporting options including aggregated reports, calculated values, time filtered reporting, and bid reporting
- Reporting to file and database
- Themed graphical reports for inclusion in documents and for presentations

### More Features

- Use database servers (e.g. SQL server and Oracle)
- Combine multiple database sources in a single environment
- Simplify scenario management using macro substitution

# ABOUT IES

We help organisations to understand competitive energy markets.

With high-performance software tools for data analysis, visualisation and simulation, we facilitate informed market decisions in key Asia-Pacific electricity and gas markets.

Developed with over 30 years of specialist knowledge, our systems put information directly at your fingertips, with real-time updates and in-depth analysis. From reviewing historical data to forecasting, analysing metering and interpreting the market, our software range meets the diverse needs of various market entities.

We provide support and training to help organisations extract optimal value from our software. Using cloud technology, we also offer Direct Database Access to current NEM data. Our development team has a solid track record in designing and implementing IT systems for energy market organisations.



Our clients include Australian Energy Market Operator (AEMO), Energy Market Authority (EMA) Singapore, Electricity Regulatory Authority of Vietnam (ERAV), Hydro Tasmania, Powerlink, Origin Energy, Asian Development Bank (ADB), Wholesale Electricity Spot Market (WESM), Clean Energy Regulator (CER), Australian Competition and Consumer Commission (ACCC), Australian Energy Regulator (AER), AGL, GDF Suez, Snowy Hydro, Stanwell, Transgrid, CS Energy, Intergen, Delta Electricity, Contact Energy, Deloitte, JACOBS, Macquarie Bank, SN Aboitiz Power (SNAP), Team Energy, Mitsui, NextGen, Ergon Energy, Western Power, State Electricity Commission of Victoria (SECV), Electranet SA and many others.