



**T R A N S P O W E R**

## **Wairakei Ring Investigation**

Project Reference: CTNI\_TRAN-DEV-01

### **Grid Investment Test Consultation**

#### **Attachment F – Models and Data**

October 2008

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# 1 Introduction

## 1.1 Purpose

This document outlines the files released associated with the economic analysis. It forms part of the consultation material published for the Wairakei Ring Investigation.

## 1.2 Consolidation of Output Files

Due to the large amount of information used and produced by the models utilised in the economic analysis for the Wairakei Ring, the published information has been consolidated. However, should more information be required it is available on request. To request further information, models or data files please email [gridinvestmentprojects@transpower.co.nz](mailto:gridinvestmentprojects@transpower.co.nz) with "Request for additional information – Wairakei Ring" in the subject line.

# 2 Outline of the Files Released

## 2.1 Generation Expansion Model and Input Files

The Generation Expansion Model (GEM) is written for the General Algebraic Modeling System (GAMS), a high-level modeling system for mathematical programming and optimization. The GEM model is stored in a folder called Programs and consists of the following files:

- RunGEM.bat calls GAMS and the RunGEM\_WRKBase\_TP.gms file that itself sets parameters and calls the other GAMS files that make up the GEM model;
- GEMbase.gms defines the optimisation problem to be solved;
- GEMexec.gms calls the solver to solve the optimisation problem and reports some results;
- GEMxpress.gms and GEMcplex.gms contain settings for the XPRESS and CPLEX solvers;
- GEMreports.gms produces reports of the results;
- GEMplots.gms can be used to produce various plots;
- GEMbase\_Debug.gms is used to check the data and produce various reports;
- GEMcompare.gms can be used to compare build schedules.

Input data is stored in a folder called Data and consists of the following files:

- GEM\_TERG\_TP\_Main\_081008.xls contains the majority of the data used by GEM. It includes:
  - a list of potential future generators along with their capability;
  - the cost of potential future generators;
  - assumptions made about the timing of generators;
  - assumptions about carbon costs, HVDC charges, and fuel prices etc.
- GEMdemanddata\_SOO08\_080920.xls contains the demand data used by GEM.
- GEM\_TERG\_SOO08\_Trans\_Base\_080920.xls contains the values associated with the transmission network used by GEM. In this case only that used in the base run, assuming the existing constraints, is provided for illustration. For each option, and each year an option is assumed to be built, a slightly different transmission spreadsheet is required. These alternative spreadsheets are available on request.

- Otag\_CYD hydro sequences.csv etc contains information on the electricity that would have been produced by the schedulable hydro generation plants given historical inflows. They represent the hydro generation available.

GEM outputs results to an Output folder.

## 2.2 Generation Expansion Model Results

The results from running the generation expansion model have been consolidated into 3 spreadsheets, as described below:

- SummaryResultsTP.xls collates the overall results for the cost of electricity generation, including expansion, dispatch costs and HVDC charges, over the period from 2008 to 2043, for a variety of runs assuming a variety of assumptions about the transmission capacity in the Wairakei Ring.
- BuildSchedulesTP.xls collates the build schedules from each of the GEM runs reported in SummaryResultsTP.xls.
- SummaryResultsTP\_Sensitivities.xls collates the overall results assuming both high and low demand, and high and low carbon charges.
- BuildSchedulesTP\_Sensitivities.xls collates the associated build schedules.

GEM produces detailed information by quarter and wind state for each run. As each file is typically in excess of 100MB this information is not reported but is available on request.

## 2.3 SDDP data

Due to the size of the files associated with SDDP these have not been published. However, both the input and output files are available for the SDDP for each option and for all the scenarios.