JUNE 2007

# Connecting and Dispatching **New Generation** in New Zealand

## Overview

TRANSPOWER

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# INTRODUCTION

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| **Document Purpose** | This document provides an overview of the issues and processes for commissioning new generation on the New Zealand power system and applies to all generating units equal or greater than 1 MW in size (including such units embedded in a distribution network). It covers the activities of:<br>• ***connecting*** new generation directly to New Zealand's power system; and<br>• ***dispatching*** new generation onto New Zealand's electricity market.<br>It is intended to provide an overview for generators planning new plant for connection to New Zealand's power system. It is not intended to provide a detailed description of the connection and commissioning process. |
| **Content** | This document sets out the following:<br>• Information on New Zealand's power system and Transpower's roles<br>• The range of information and advice available from Transpower in its capacity as the System Operator and Grid Owner to help existing and potential generators make optimal investment decisions<br>• Issues relating to generation feasibility that potential generators might wish to consider further<br>• A summary of the process for connecting to Transpower's high voltage network of lines and substations (the National Grid)<br>• A summary of the process for commissioning plant onto the New Zealand power system<br>• A summary of the dispatch process<br>• Characteristics specific to wind generation |
| **Amendment history** | A new section 8 has been inserted into the June 2007 edition (version 1.1) to cover characteristics specific to wind generation, in response to customer interest in this issue. |
| **Further Information** | Transpower's website www.transpower.co.nz provides further information on the following connection/dispatch activities:<br>• Commissioning Procedure (Draft)<br>• System Security Report<br>• Grid Reliability Report |

## ELECTRICITY CONNECTION AND DISPATCH IN NEW ZEALAND

**Content**

This section summarises information about:

- Transpower and its roles as System Operator and Grid Owner.
- New Zealand's electricity system.

**Transpower**

Transpower is the state-owned enterprise that owns and operates the National Grid – or high voltage transmission network – that carries electricity around the country.

Transpower has two primary roles:

- Grid Owner
- System Operator

Generators are required to deal with both the Grid Owner and System Operator roles of Transpower.

**Grid Owner**

As Grid Owner, Transpower manages the assets comprising its high voltage network of lines and stations (the National Grid). This involves the condition monitoring and maintenance of the existing grid assets, and the planning and installation of new grid assets.

For new generation connections, Transpower, as Grid Owner, will:

1. assess the connection's impact on the technical performance of the National Grid in accordance with the Grid Owner's obligations under the Electricity Governance Rules; and
2. process requests to connect new generation to New Zealand's power system whether intended for direct connection to Transpower's National Grid or embedded in a distribution network.

**System Operator**

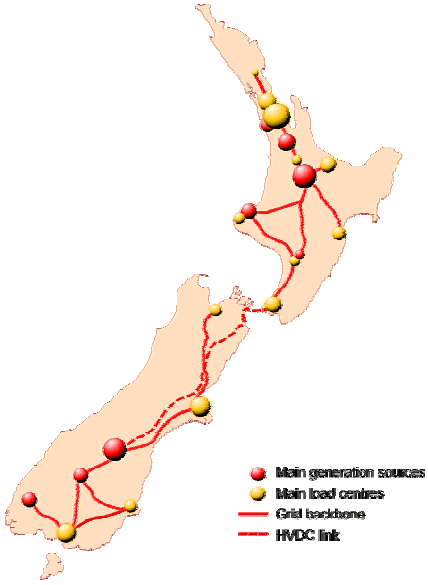
As System Operator, Transpower is contracted to the Electricity Commission. Transpower manages the real-time operation of New Zealand's power system, including managing power system security and scheduling/dispatching generation to meet system demand.

Transpower, as System Operator, is a service provider to the Electricity Commission and has a range of obligations with regard to new generation plant. These are to:

1. assess the technical performance of proposed generation plant against the requirements of the EGRs. This applies to generating plant directly connected to the National Grid and embedded within distribution networks;
2. process requests from new generators to allow them to operate in the New Zealand electricity market (Part G: Wholesale Market); and
3. provide access to the market offering / bid systems (in conjunction with M-Co, the electricity market administrator).

**New Zealand's Power System**

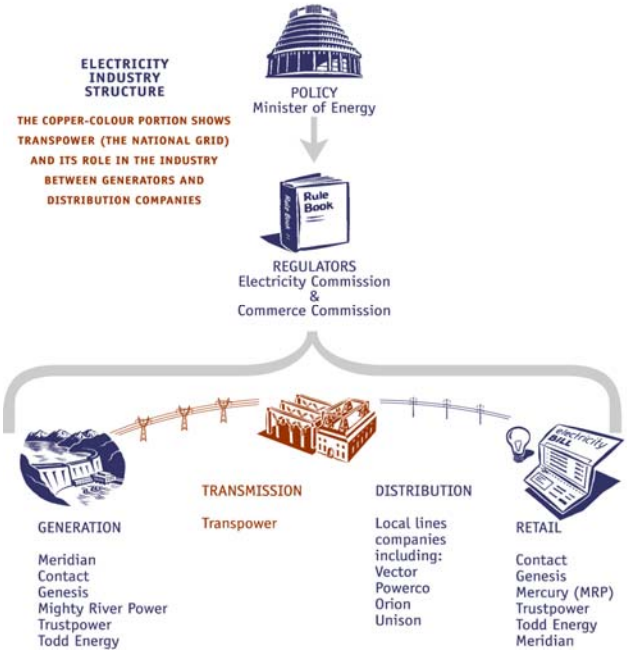
New Zealand has a small islanded power system. Accordingly, some technical requirements for generators are more onerous than those found in larger, interconnected grids of other countries. The map below illustrates the nature of the power system showing the core grid and areas of demand and load.




Prospective generators considering connecting new generation to New Zealand's power system are encouraged to discuss the technical requirements and viability of connection with Transpower prior to making any binding decisions to purchase generation plant.

**Industry Overview**

The structure of the electricity industry is as illustrated below:



**Electricity Regulatory Framework**

The key aspects of this framework are that:

- New Zealand has an electricity market where electricity is sold and purchased;
- the rules governing connection and dispatch of generation onto New Zealand's power system is covered by the Electricity Governance Rules (the Rulebook in the diagram above); and
- from time to time, the Government announces or amends energy or electricity policy by way of Government Policy Statements (the last such statement was in October 2006).

The legislative and regulatory framework specific to the electricity industry is provided by the following statutes:

- Electricity Act 1992
- Electricity Governance Regulations 2003
- Electricity Governance Rules 2003
- Electricity and Gas Industries Act 2003
- Electricity Industry Reform Act 1999

**Other Legislation**

As well as the specific electricity market legislation, a number of more generic statutes may impact on the activities of electricity market participants depending on their activities. These include:

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| Consumer Guarantees Act 1993 | Addressing issues relating to consumer protection |
| Commerce Act 1986 | Addressing issues of competition and market power |
| Resource Management Act 1991 | Setting out the processes and framework for managing environmental effects of activities |

## GENERATION FEASIBILITY INFORMATION AND RISKS

**Content**

This section sets out:

- the information made available to generators by Transpower; and
- other issues (and risks) generators are encouraged to consider further as part of their planning.

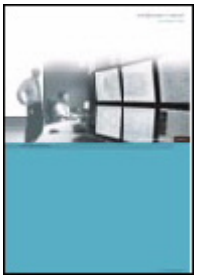
**Available Information from Transpower**

Transpower will provide the following basic information to generators considering a new grid connection, as part of Transpower's initial assessment of that proposed new generation connection:

Transpower's Annual Planning Report provides information about:

- the existing National Grid including the capability of transmission assets forming part of it over the next 10 years;
- planned or possible upgrades to National Grid assets over the next 10 years;
- demand and generation forecasts for the next 10 years; and
- the existing transmission constraints particular to the region in which the generator proposes to connect;

The latest issue of Transpower's System Security Forecast identifies and explains the transmission constraints on the National Grid over a ten year forecast period. This is published by Transpower as System Operator.



**Risks to Consider**

Connection to Transpower's assets does not provide transmission capacity or dispatch rights. The dispatch of generation and trading of electricity occurs within the framework of the Electricity Governance Rules. The following is a list of obvious issues and risks that the generator is urged to consider further:

| Issue | Risks for Generator to consider… |
|---|---|
| Transmission constraints | • Consideration of future capacity of the National Grid given the possibility of other generators connecting.<br>• Type and author of constraint (i.e capacity of asset, or System Operator applied constraint) |
| Constraints on Commissioning Activities | • Large generating units may face delays and additional costs during the commissioning process. Some commissioning activities and tests will only go ahead under suitable power system conditions. Additional instantaneous reserves or voltage support may be required at times during commissioning when the performance of the new plant is not yet confirmed. |
| Electricity market volatility | • The extent to which constraints can affect nodal prices. |
| Generation dispatch patterns | • Future generation may constrain existing generators from delivery energy to the market.<br>• Non dispatch of generation plant due to the availability of lower priced plant.<br>• Non dispatch of generation plant which has become non-compliant. |
| Electricity demand patterns | • Changes to current demand patterns from the national grid may affect existing constraints, or create new ones.<br>• Changes to the expected growth in electricity demand may affect existing constraints or create new ones. |
| Network configuration | • Future reconfiguration of the transmission system may affect existing constraints or create new ones. |
| Asset availability | • The unavailability of assets due to maintenance or replacement can result in constraints. |
| Regulatory risk | • Future changes to the electricity market or governing bodies (e.g. Electricity Commission, Commerce Commission etc)<br>• Effect of existing environmental legislation (i.e. RMA) or future changes to it. |

## CONNECTION OF NEW OR MODIFIED GENERATING UNITS IN NEW ZEALAND

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| **Content** | This section provides an overview of the process for asset owners wishing to connect new or modified generating units to the New Zealand power system.<br><br>This applies to generating units of size 1 MW or greater that are either directly connected to the National Grid or embedded in a distribution network. |
| **First Point of Contact** | In the first instance, prospective new generators, or existing generators considering new plant or modifications to existing plant, should contact Transpower's Customer Services Manager:<br><br>*Customer Services Manager*<br>*+64 4 495 7000 (Phone)*<br>*+64 4 495 7004 (Fax)*<br>*customerservices@transpower.co.nz* |
| **Generator Obligations** | The Electricity Governance Rules place a number of obligations upon owners of generating units connected to the New Zealand power system:<br><br>• Generators who are planning to connect to the National Grid or a local lines network generating units with rated net maximum capability of 1 MW or greater are required to advise the System Operator in writing of the generator's intention to connect. The System Operator may request owners of such plant to provide additional information.<br><br>• Embedded generating stations greater than 10 MW in capacity may be required to provide information regarding the intended output of the station. This may be in the form of an offer in accordance with Part G of the EGRs or as agreed by the embedded generator and System Operator.<br><br>• Asset owners commissioning new or modified plant must agree a commissioning plan with the System Operator.<br><br>Owners of generating units directly connected to the National Grid have obligations under their connection contracts with Transpower:<br><br>• The generator must meet the requirements of Transpower's Connection Policy.<br><br>• The generator must advise Transpower of changes to the capability of their assets. |
| **Distributor Obligations** | Distributors have an obligation under their connection contract contracts with Transpower to advise Transpower of embedded generation connected to their distribution network. |
| **System Operator** | The Electricity Governance Rules require the System Operator to assess and monitor generator compliance with the Asset Owner Performance Obligations and Technical Codes. Details of the process are set out in Section 5. |

## COMPLIANCE ASSESSMENT PROCESS OVERVIEW

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| **Content** | This section provides an overview of the System Operator's assessment of the compliance of new and modified generation plant. |
| **Description** | In order to be dispatched a generator must be assessed as being compliant with the Electricity Governance Regulations (EGRs) and Rules. The EGRs set out the technical performance and dispatch requirements for parties wishing to generate and be dispatched. |
| **Contact** | Transpower's Account Manager will ensure that the appropriate people from System Operations are introduced from the outset of any new generation project. Generators are obliged to provide updated information and assessments in accordance with the EGRs to the System Operator. |
| **Compliance** | All assets connected to the New Zealand power system need to be compliant with the Asset Owner Performance Obligations (AOPOs) and the technical codes set out in Part C (Common Quality) of the EGRs or otherwise obtain:<br>• A dispensation<br>• Approval of an equivalent arrangement (equivalence)<br>• Exemption<br>Generators - whether directly connected to the National Grid or 'embedded' within local distribution networks - must also meet the requirements of Part G (Trading of Wholesale Electricity) of the EGRs. |
| **Dispensations** | New generators can apply to Transpower, as the System Operator, for a dispensation where the proposed plant does not meet the requirements of the EGRs. Transpower, as the System Operator, can grant dispensations where the:<br>• generator can be allocated the cost of any non-compliance with the full requirement of the AOPO; and<br>• non-compliance does not compromise the System Operator's ability to meet its Principle Performance Obligations (PPOs). |
| **Equivalences** | New generators may also seek "equivalence" arrangements. |
| **Exemptions** | The Electricity Commission itself can also issue exemptions from the rule requirements. However, exemptions are not normally issued for asset compliance obligations given the role of Transpower as the System Operator in assessing and granting dispensations and equivalence on behalf of the Commission. |

**Compliance Assessment**

Transpower, as the System Operator, assesses a generator's compliance with the AOPOs and technical codes from information provided by the generator to the System Operator on their assets. The information requirements are set out in the Asset Capability Statement (ACS) templates published on the System Operator section of Transpower's website. Generators considering new projects must provide an initial ACS to Transpower for review so that the System Operator can outline the timing of the necessary technical evaluation and approval process through to final commissioning.

All assets connected to the New Zealand power system need to be compliant with the AOPOs and the technical codes set out in Part C (Common Quality) of the EGRs.

## CONTACTING TRANSPOWER TO PROGRESS A DIRECT CONNECTION TO THE NATIONAL GRID

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| **Content** | This section provides an overview of the process for generators requiring connection to the National Grid. A summary diagram of the process is included at the end of this section. |
| **First Point of Contact** | In the first instance, prospective new generators, or existing generators considering new plant, should contact Transpower's Customer Services Manager:<br>*ıer Services Manager*<br>*495 7000*<br>*495 7004 Fax*<br>*ıerservices@transpower.co.nz* |
| **Account Manager Assigned** | The Customer Services Manager will assign one of Transpower's Account Managers to arrange an initial meeting with the prospective generator to discuss the proposal and provide guidance and information on the processes required for grid connection. |
| **Initial Meeting** | At the initial meeting Transpower will provide the following information:<br>• the regulatory and compliance requirements of the EGRs and Transpower's Connection Policy;<br>• Transpower's capital works process (the process by which new grid assets are built by Transpower);<br>• Transpower's contractual requirements for grid connection including a:<br>o Detailed Solution Development Contract (DSD)<br>o New Investment Contract<br>o Connection Contract<br>• Transpower's transmission pricing methodology;<br>• generator obligations to provide asset capability information;<br>• details of the compliance assessment processes undertaken by the System Operator including ongoing monitoring;<br>• the commissioning processes for new generation connection; and<br>• likely timeframes for process completion including environment and property timeframes as well as construction. |
| **Generator submission** | Following the initial meeting, the generator owner returns a "new request" form and preliminary information, including generator parameters, models and relevant data. |

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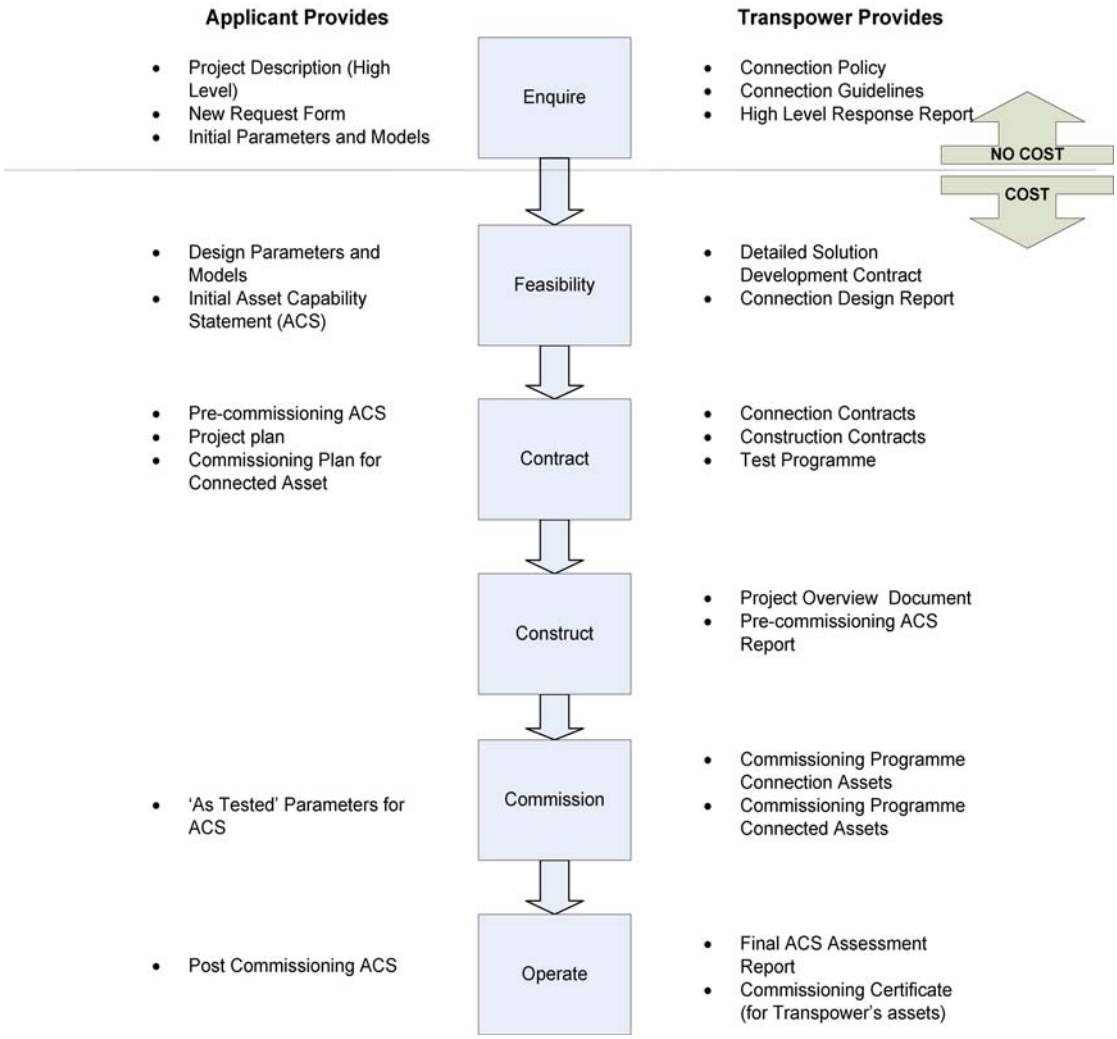
| **Transpower Initial Assessment** | Using the information provided by the generator, Transpower will provide an initial "High Level Response Report". It will contain:<br>• a high level 'desk-top' study which:<br>o evaluates the feasibility of the proposed connection;<br>o identifies potential connection issues;<br>o provides details of the existing transmission capability and the known transmission constraints in the area that the generator wishes to connect; and<br>o outlines possible environmental and property considerations associated with the National Grid.<br>• approximate costs for connection; and<br>• indicative evaluation and highlighting of any compliance issues.<br>NOTE: There is no cost for this response. |
| **Detailed Solution Development Contract** | To carry out further and more detailed planning studies, the generator and Transpower will enter into a Detailed Solution Development (DSD) contract. This will determine the extent of the planning studies to be undertaken and the costs to the generator of doing so.<br>As the generator begins to finalise the type of generation plant being built, it will provide information to Transpower by way of an initial planning Asset Capability Statement (ACS). Transpower may request more details where there are adverse effects due to its location on the grid or the type of generating plant being proposed.<br>The output of these studies will be a Connection Design Report which will include both the connection configuration and power system studies. |
| **New Investment Contract** | Before the project enters Transpower's Capital Works Programme, the generator enters into a construction contract with Transpower for the implementation of the connection assets. A Project Overview Document will be developed (see Appendix B). One key element of the project overview document will be the project programme, detailing both the timetable for the completion of the physical work and the timetable for the completion of compliance studies. |
| **Connection** | Before commissioning the generator must enter into a Connection Contract with Transpower. |


Applicant Provides
Transpower Provides
Project Description (High Level)
New Request Form
Initial Parameters and Models
Enquire
Connection Policy
Connection Guidelines
High Level Response Report
NO COST
COST
Design Parameters and Models
Initial Asset Capability Statement (ACS)
Feasibility
Detailed Solution Development Contract
Connection Design Report
Pre-commissioning ACS
Project plan
Commissioning Plan for Connected Asset
Contract
Connection Contracts
Construction Contracts
Test Programme
Construct
Project Overview Document
Pre-commissioning ACS Report
'As Tested' Parameters for ACS
Commission
Commissioning Programme Connection Assets
Commissioning Programme Connected Assets
Post Commissioning ACS
Operate
Final ACS Assessment Report
Commissioning Certificate (for Transpower's assets)

## DISPATCH PROCESS OVERVIEW

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| **Content** | This section provides a high-level description of the dispatch process. |
| **Electricity Market** | Transpower, in its role as the System Operator, schedules and dispatches generation on the basis of the bids and offers made by purchasers and generators. Generators offer electricity into the electricity market. Purchasers bid for electricity. |
| **Pricing** | The New Zealand wholesale market design includes dispatch based on offers with locational marginal pricing (Nodal Pricing) to arrive at the overall lowest cost dispatch solution. The co-optimisation of the cost and quantity of reserve needed to cover the loss of generation with the cost of energy dispatch, is included in meeting the least cost objective. The market settles on an ex-post basis with 30 minute trading periods and a price for each of the 220 nodes in the market model. Generators are paid for the amount of output produced in a trading period, at the final price for the trading period, at the node to which they are connected. Dispatch occurs every five minutes through formal dispatch instructions sent electronically. In New Zealand there is no Automatic Governor Control (AGC). |
| **Generator Offers** | All generation offered under the trading rules in Part G of the EGRs is dispatched through the offer process in real time. There is no provision for dispatch rights based on any bilateral arrangement or hedge arrangements between generators and retailers.<br><br>All generation over 10 MW - if directly grid connected - must offer. Embedded generation above 10 MW can be required to offer if this will assist the System Operator in meeting its principal performance objectives.<br><br>Dispatch rules exist for intermittent (wind) generation (www.electricitycommission.govt.nz/opdev/comqual/windgen). Most participants can change their offer up to two hours ahead of dispatch and a number of schedules are provided to participants up to 72 hours in advance giving an indication of the likely dispatch quantities and prices. There is no day ahead or unit commitment market as such. |
| **No right of Capacity** | A connection to the National Grid does not result in any capacity rights for that connected party. Generators connecting to the National Grid should be aware that existing, or future congestion on the National Grid, will affect the ability of a generator to deliver its energy to the market. |
| **No right of Dispatch** | Connection to the grid and participation in the electricity market does not guarantee that a generator will be dispatched at all times by the System Operator. A generator will not be dispatched where:<br>• there is sufficient lower priced generation to meet demand;<br>• there are constraints on the power system that limit the amount of electricity that the generating unit can produce; or<br>• the generator is non-compliant with the AOPOs and Technical Codes. |

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| **Sufficient Lower Priced Generation** | Dispatch is based on offer price. Generating plant will not be dispatched if there is sufficient lower priced generation offered to meet system demand.<br><br>At times, clearing prices may drop to close to zero if there is a surplus of generation that wants to run irrespective of the clearing price. This happens at times of low system demand; typically overnight in summer, and at other times when there is very high proportion of hydro generation relative to total system demand due to full storage catchments and strong inflows.<br><br>Negative priced offers are not allowed; however, there is a Must Run Dispatch Auction (MDRA) where generators can bid for rights to offer at $0.00 per MWh. The quantity of generation that can be cleared in this auction is limited to 80% of the minimum system demand. All other generation must offer at $0.01 per MWh or above.<br><br>Interim rules for the offering of the limited intermittent generation on the system effectively see it treated as must run generation in most situations. Rules for the dispatch of intermittent generation are being reviewed and it is possible that at times of excess generation, wind may need to "spill" in the same way that can happen with hydro generation at times.<br><br>Holding rights to offer at $0.00 per MWh from the MDRA does not guarantee dispatch. Reserve optimisation, constraints, or potentially wind generation operating as must run under the existing interim rules, could result in dispatch being less than the quantity offered at times of low system demand. In some cases, this may put thermal generating units below minimum running limits, requiring the plant operators to disconnect the generating unit. |
| **Constraints on the Power System** | Transmission constraints on the National Grid may also affect generation dispatch. Transpower, as the System Operator, analyses generation schedule information to identify when and where a constraint may have to be applied to ensure the power system remains within capability. The market solver will bring on higher cost generation within a constrained region once a constraint limit is reached.<br><br>Details of the permanent and temporary transmission constraints applied by the System Operator are available at www.transpower.co.nz. |
| **Ancillary Services Cost Allocation** | Transpower, as the System Operator, procures ancillary services (instantaneous reserve, spinning reserve, frequency keeping, voltage support, and a black start facility) to meet the PPOs. The costs of procurement of these services are allocated to participants as set out in Section IV of Part C of the EGRs.<br><br>Some ancillary services costs are allocated to generators:<br>• The availability costs of reserves for a trading period are allocated to generators when their generating units output is above 60 MW.<br>• An event charge is payable by generators if their assets cause an under frequency event.<br>• Non-compliant generators with dispensations are allocated a share of reserves and voltage support costs related to their non compliance. |

**Implications from the Co-optimisation of Energy and Reserve**

The New Zealand power system currently has single generating units of up to 375 MW output dispatched. Single generating units or multiple generators on a single connection over 150 MW output can be constrained back at times due to the optimisation of reserve in the market model.

In determining the least cost solution for each 30 minute trading period, the market solver optimises the cost and quantity of reserve needed to cover the loss of the largest generating unit connected at that time. Where the cost of the reserve to cover the loss of the largest generating unit (or group of generators on a single connection) is more than dispatching energy from other smaller generators, the solver will dispatch the largest generating unit below where it might otherwise clear based on its offer price alone.

Reserve is offered through the market in a similar way to energy offers. Reserve is offered as generator response or interruptible demand. There can be times where reserve prices are as high as, or higher than, energy offers. There are also times when there is insufficient reserve to cover the full output of the largest generating unit. In such situations, large generating units, or a group of generators on a single connection, may be constrained back.

Common situations where generation unit dispatch can be constrained by reserves include:

- peak times when reserve prices may be high relative to energy prices; and
- times where prices are low and close to zero.

In some situations (i.e. low load), reserve optimisation has resulted in large generators being dispatched below minimum running levels and having to disconnect.

**Further Information**

Electricity market data is available through Energy Market Services (EMS) who provide reconciliation and metering services to New Zealand's electricity market. Refer to www.ems.co.nz for further information. The electricity market is administered by M-co. Refer to www.nz.m-co.com for further information.

## CHARACTERISTICS SPECIFIC TO WIND GENERATION

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| **Introduction** | When connecting a wind farm, Transpower is concerned with performance of the wind farm at the interface with the National Grid. Beyond this interface, a wind farm can be thought of as a set of components, of which the wind turbines are just one component.<br><br>Individual wind turbines are connected together, typically at 11 kV to 33 kV. At the common connection point, there may also be additional components such as switched capacitor banks and/or dynamic reactive power devices such as a DVAR or SVC. There are also transformers, usually with an On Load Tap Changer, to connect the wind farm to the high voltage connection point with the National Grid.<br><br>The wind farm components needed to meet the requirements for connection to the National Grid may differ depending on the characteristics of the National Grid at the point of connection. Therefore, the technical design of the wind farm should be developed in an iterative process with Transpower, in order to ensure both interface and National Grid requirements are met. |
| **Dedicated connection versus 'collection hubs'** | If the National Grid is developed in such a way that each individual wind farm requires its own new dedicated connection substation along a line, this will cumulatively decrease the reliability and availability of the transmission system. An alternative is to establish "collection hubs", to aggregate and connect several wind farms to the National Grid at a single point. There is at present no assurance that "collection hubs" could be approved under the Grid Investment Test (of Part F of the EGRs), and the costs may need to be borne by the wind farm investor(s) |
| **Process – how wind differs from conventional technologies** | The process for connecting a new generator to the National Grid is set out in Section 6 of the Overview document, and is specifically detailed in the diagram on page 15.<br><br>The components of the Feasibility stage which will be influenced by the fact that wind technology is being used are:<br>• design parameters and models;<br>• initial asset capability statement; and<br>• initial assessment of security issues.<br><br>At the Commissioning stage, tests are carried out to test the capability of the plant. The types of tests undertaken may differ across different generation technologies, including across different wind generation technologies.<br><br>Wind developers should be aware that connection does not ensure dispatch, due to security and market conditions. Security issues may include: whether the existing transmission capacity can absorb generation, and firming requirements (reserve required for firming/frequency keeping and for unplanned outages). |

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| **Wind farms and the "Feasibility" stage** | The characteristics of wind technology differ from conventional plant in the following areas:<br>• voltage control, including the additional issues from wind farms often being remote and connecting to weaker parts of the National Grid;<br>• transmission capacity upgrades to facilitate connection and run-back schemes – again due to the fact that wind is often connecting in weaker parts of the National Grid;<br>• fault ride through capability;<br>• wind farm models – conventional plant tends to be reasonably standardised, however every wind farm is different;<br>• power quality – should not negatively impact on assets of the Grid Owner or other connected parties in the area; and<br>• commissioning requirements.<br>These are discussed in the following sections. |
| ***1. Voltage control*** | Wind farms may need to include additional components to aid voltage control requirements to a level required by the EGRs. Control should be automatic and respond in a timeframe suitable to assist in maintaining voltage stability on the National Grid. The voltage control performance of wind farms should be similar to a synchronous machine with AVR.<br>Voltage control capability may be more of an issue in remote areas, where the National Grid is often weaker and voltage is more sensitive to generation output than in more highly meshed parts of the National Grid.<br>National Grid connected wind farms may receive dispatch instructions for voltage or Mvar set points (in addition to MW). – see in particular Rule 3.2 of Section III of Part C.<br>Rule 3 of Section III of Part C deals with voltage control requirements of generators connecting to the grid. Clause 5.2 of Technical Code A of Schedule C3 sets out requirements for voltage response and control. |
| ***2. Transmission capacity upgrades to facilitate connection, and run-back schemes*** | Transmission capacity upgrades may be needed to facilitate a connection. On the interconnected grid, and potentially for shared connection assets, these upgrades will be considered under the Grid Investment Test. One alternative to transmission asset upgrades are run-back schemes.<br>The limit on thermal capacity in lower capacity parts of the National Grid, means some form of run-back scheme may be the most economic solution to manage thermal limits, as opposed to upgrading transmission assets.<br>Run-back schemes will be considered on a case-by-case basis. Transpower will consider runback schemes on spurs, but is unlikely to accept such schemes on the main backbone of the National Grid. If a run-back scheme is not accepted by Transpower and there is no corresponding upgrade of transmission assets, then the amount of generation that can be dispatched from the affected wind farm will be constrained. As explained in Section 3, connection to the National Grid does not guarantee dispatch. |

***3. Fault ride through capability***

The performance requirement for fault ride through capability is that the wind farm must meet the requirements of the EGRs, including assisting the System Operator to meet the PPOs, in the event of a fault. This includes remaining in service in the event of an external fault (i.e. external to the wind farm – including a distribution fault). Remaining in service means as a minimum returning to approximately the pre-fault MW output very rapidly after a fault, which may have implications for ramp rates among other things. Also, wind farms may require additional dynamic voltage control in order to be able to meet this requirement.

There are also requirements to remain connected during under frequency excursions down to 47.5 Hz North Island and 47 Hz in the South Island.

See Section III of Part C for a full description of asset owner performance obligations.

***4. Wind farm models***

Models of wind farms are required to show that:

- there are no adverse impacts on other connected parties, or on the National Grid itself; and
- fault ride through and voltage support requirements can be met.

Models of wind farms tend to differ from models of conventional generating plant in that the latter tend to fit into well established standard industry models, and are well understood. However there are many different types of wind turbine, and how turbines are combined with different components to make up the overall wind farm differs on a case-by-case basis.

For a typical wind installation, the asset capability information required by Transpower will include:

- Turbine
- Generator – including converters and rotor circuit controllers if applicable
- Single line diagram of wind farm
- Model aggregation
- Dynamic voltage control devices
- Control model for switching static capacitors
- Overall voltage control coordination model
- Control systems – voltage control devices
- Ramp rates and maximum output information
- Governor control if applicable

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| **Commissioning requirements** | At the commissioning stage, tests are carried out to test the capability of the plant. The types of tests that are carried out may differ across different generation technologies. Testing of wind farms during commissioning will include:<br>• ACS and AOPO compliance testing<br>• Power quality monitoring<br>• Security requirements and ancillary services |
| ***1. ACS and AOPO compliance testing*** | This testing includes:<br>• Confirmation of system performance for the various components that make up a wind farm; and<br>• Voltage performance of the wind farm as a whole. |
| ***2. Power quality monitoring*** | Transpower will consider a number of factors when assessing a connection, one of which will be the impact on National Grid assets and assets of other connected parties.<br><br>Connection of wind farms should not negatively impact on assets of the Grid Owner or other connected parties in the area.<br><br>Wind farms, due to the location of the wind resource and other factors, often connect in more remote areas where the National Grid is weaker. There may be additional power quality issues for generators connecting to weaker parts of the National Grid.<br><br>Wind farm owners :<br>• need to be aware of the network constraints;<br>• must not allow their plant to create disturbances that would take the National Grid beyond these constraints; and<br>• should not allow their plant to impact on the System Operator's ability to deliver its PPO's – for the following conditions:<br>  • Negative phase sequence voltages<br>  • Harmonics<br>  • Voltage sags/dips<br>  • Voltage steps/flicker.<br><br>See in particular Rule 2.3 of Section II of Part C. This rule states that if another participant identifies an issue with regard to power quality, Transpower will investigate the cause "where reasonably requested by a participant". |
| ***3. Security requirements and ancillary services*** | There will be a requirement for ancillary services to cover the wind farm during commissioning. During commissioning the system may need additional reserves, and the ability to commission a wind farm may be affected by the ability to procure these reserves.<br><br>Ancillary service requirements during commissioning will be the same for wind farms as for any other generator. The rules regarding the requirements for commissioning plant to meet security and ancillary service requirements |

| | |
|---|---|
| | are detailed in Part C and Part G of the EGRs. |
| **Dispatch** | With regard to dispatch of output, a wind farm will be treated as an intermittent generator. As such, a wind developer should refer to the current rules for the dispatch of intermittent generation as set out in Part G (as well as those rules applying generally to all generators).<br><br>The dispatch rules are being reviewed and potentially will change in the future. Wind farm developers should consult with the Electricity Commission as to what these changes may mean. Such future rule changes are likely to have implications for ramp rate requirements, maximum output and re-dispatch capability.<br><br>National Grid connected wind farms may receive dispatch instructions for voltage or Mvar set points (in addition to MW) – see in particular Rule 3.2 of Section III of Part C. |

## GENERATOR CHECKLIST OF INFORMATION SOURCES

| Information/ Issue | Transpower provides | Other Sources of Information |
|---|---|---|
| Electricity Regulatory Framework | General information on Transpower's roles as System Operator and Grid Owner | • Electricity Commission (Electricity Governance Regulations, Electricity Governance Rules 2003)<br>• Ministry of Economic Development (Electricity Act, Electricity and Gas Industries Act, Electricity Industry Reform Act)<br>• Government (Policy Statements) |
| Generic Regulatory Framework | - | • Commerce Commission (Commerce Act 1986)<br>• Ministry of Consumer Affairs (Consumer Guarantees Act 1993)<br>• Ministry for the Environment (Resource Management Act 1991) |
| Existing and Forecast Future Transmission Constraints | • Latest System Security Forecast<br>• Latest Annual Planning Report | - |
| Compliance | • Advice as System Operator on meeting requirements of Parts C and G of the EGRs and the effect of non-compliance. | • Electricity Commission<br>• Electricity Governance Rules |
| Connection to the National Grid/Power System | • Detailed information on Transpower's connection requirements from both Grid Owner and System Operator perspectives including:<br>  • contractual requirements<br>  • rule requirements<br>  • connection capability information<br>  • commissioning procedures<br>  • system modelling<br>  • pricing information | - |
| Dispatch | • General and summary information on how dispatch works | • M-Co<br>• EMS<br>• Electricity Governance Rules (Part G) |

## APPENDIX: RESPONSIBILITIES AND DATA REQUIRMENTS FORM

The template below will provide a guide and record for the tasks and data provision required at each stage of the grid connection process.

**PROJECT NAME:** _____

**EXPECTED COMMISSIONING DATE:** _____

**CUSTOMER PROJECT COORDINATOR:** _____

**TRANSPOWER PROJECT COORDINATOR:** _____

| STAGE | TASK | RESPON-SIBILITY | DOCUMENT(S) TO BE PROVIDED | PROVIDED / DATE | DESCRIPTION |
|---|---|---|---|---|---|
| PLANNING | Notify and seek high level response from Transpower of concept proposed. | Asset Owner Project Coordinator | Customer Request Form | ☐ *Date* | In the first instance the owner of the proposed new generation must contact Transpower's Customer Services Manager[1]. Typically a meeting would be arranged in which the asset owner would provide Transpower with a high level briefing on their proposed project - and Transpower outline the connection process and any immediate thoughts. A Transpower Project Coordinator would be assigned and background documents provided to the Asset Owner. The Asset Owner would be invited to complete a customer request form to initiate the new connection process.<br><br>The generation connection information pack contains the following:<br>• Connection and Dispatch Guide<br>• Commissioning/Decommissioning Policy and Process: TP:OG 41.04<br>• Outage Planning Procedure: TP:MS 47.01<br>• Pricing Methodology Guide<br>• Blank New Investment Contract<br>• Standard Transmission Agreement |
| | Provide Asset Owner with background documentation | Transpower Project Coordinator | Generation Connection Information pack | ☐ *Date* | |

[1] Len Gould – Customer Services Manager: 04 495 7023, 021 571 551, len.gould@transpower.co.nz

| STAGE | TASK | RESPON-SIBILITY | DOCUMENT(S) TO BE PROVIDED | PROVIDED / DATE | DESCRIPTION |
|---|---|---|---|---|---|
| | | | | | • Connection Code<br>• Commissioning Plan Template<br>• Annual Planning Report<br>• Blank ACS<br>• Notification of Intention to Connect Form<br>• Project Overview Template |
| | Provide High Level Response (HLR) | Transpower Project Coordinator | High Level Response Letter: | ☐ *Date* | In response to the customer request form received, Transpower would prepare a high level response. This would take around 6-weeks to complete. A site visit may also be undertaken at this stage.<br>A suggested scope for the detailed studies required (a Solution Study Report – SSR) would be provided. The asset owner would be invited to enter into a DSD Contract to fund the SSR.<br><br>This step would typically be done in conjunction with Transpower's initial ACS assessment.<br><br>As a minimum the HLR would cover the following aspects:<br>• Connection Options<br>• Timeline for Connection<br>• Estimated Costs<br>• Environmental and Property Requirements<br>• System Constraints |

| STAGE | TASK | RESPON-SIBILITY | DOCUMENT(S) TO BE PROVIDED | PROVIDED / DATE | DESCRIPTION |
|---|---|---|---|---|---|
| | Provide Initial ACS | Asset Owner Project Coordinator | An ACS form completed with the information currently available. | ☐ *Date* | Asset Owners requiring a new connection are required to complete an Asset Capability Statement (ACS). Under an ACS the Asset Owner provides the technical details of the new plant to be connected. Using the information contained in the ACS, Transpower assesses compliance of the new plant against the requirements of the EGRs. In practice this is an iterative process, with the Asset Owner providing increasing amounts of information as the project progresses towards commissioning - and as questions and issues are raised by Transpower during the process of undertaking its assessments.<br>At this stage an ACS, filled in as much as possible by the Asset Owner, with the information available, is assessment by the Transpower Compliance Team. Typically, in the early stages of a project, much of the technical detail may not be available, as for example, the Asset Owner may still be tendering and not have finalised the purchase of their equipment. However assumptions can be made and generic generator models used, to make an early assessment. An assessment at this stage allows Transpower to bookmark the new generation in its system models and make a high level assessment of the broader potential impact and issues and advise the Asset Owner accordingly. This initial assessment would typically take around 6-weeks to complete.<br>This step would typically be done in conjunction with Transpower's High Level Response. |
| | Provide Feedback on ACS Data | Transpower Project Coordinator | If required, a meeting will be arranged at which Transpower's assessment of the ACS would be discussed. | ☐ *Date* | |
| | Agree and Sign DSD | Transpower Project Coordinator / Asset Owner Project Coordinator | A signed Detailed Solution Development (DSD) Contract | ☐ *Date* | Following on from the results of Transpower's High Level Response Letter and Initial ACS Assessment, Transpower would agree a scope of works for carrying out the studies required to complete a Solution Study Report. The report would cover both the physical connection aspects and a system impact report. Once a scope has been agreed, Transpower would go out with a request for proposal to Consultants to carry out the agreed studies, and also determine Transpower's internal costs. Transpower would provide a cost estimate and timeframe for completion to the Asset Owner. |

| STAGE | TASK | RESPON-SIBILITY | DOCUMENT(S) TO BE PROVIDED | PROVIDED / DATE | DESCRIPTION |
|---|---|---|---|---|---|
| | Complete and Provide SSR | Transpower Project Coordinator | A Solution Study Report | ☐ *Date* | SSRs typically take around 3-months to complete dependant on the projects complexity. Typically a draft report is completed which is then subjected to an internal Transpower review. Following the review a revised draft is produced is sent to the Asset Owner for comment. A meeting may be arranged at his stage to discuss the report and any concerns or issues raised. A final report is then produced and provided to the Asset Owner.<br><br>An SSR would, as a minimum, contain:<br>• System Impact Report<br>• Connection Design<br>• Detailed Cost Estimates<br>• Detailed Project Timelines<br>• ACRE study |
| | Sign New Investment Contract | Transpower Project Coordinator /Asset Owner Project Coordinator | A signed New Investment Contract. | ☐ *Date* | Transpower has standard Contract to cover the terms and conditions for the Transpower provision of new plant and the recovery of costs for implementation of that new plant. The Contract has standard clauses with appended schedules tailored to each particular project. |

| STAGE | TASK | RESPON-SIBILITY | DOCUMENT(S) TO BE PROVIDED | PROVIDED / DATE | DESCRIPTION |
|---|---|---|---|---|---|
| PRE-COMMISSIONING | Provide notification letter | Asset Owner Project Coordinator | Letter to Transpower 'Generator Notice of Intention to Connect'<br><br>Email to: system.operator@transpower.co.nz | ☐ *Date* | Under rule 2.6 of Section III of Part C of the Electricity Governance Rules, the Asset Owner is required to provide Transpower with written notice of their intention to connect.<br>*'Whether likely to be an excluded generation station of not, a generator that is planning to connect to the grid or a local network a generating unit with rated net maximum capacity equal to or greater than one MW will provide the System Operator with written advice of its intention to connect together with such other information relating to that generating unit in accordance with rule 4.4.'* |
| | Complete and Agree Overview of Project Progress (continuous) | Transpower Project Coordinator /Asset Owner Project Coordinator | Project Overview Document | ☐ *Date* | The Project Overview Document is prepared by both Transpower and the Asset Owner. Its purpose is to provide an overview for commissioning of Asset Owner and Transpower equipment, in compliance with EGR requirements. The document also sets out a programme including key milestones for the project.<br>In addition, the overview document identifies information which needs to be exchanged between Transpower as Grid Owner, Transpower as System Operator, the Asset Owner, and any other Parties affected by the new generation. The purpose being to facilitate the required information exchange in a timely manner.<br>It is intended that the document be continuously updated as the project progresses.<br>The document is not intended to be a substitute for the commissioning and test plans. The commissioning and test plans are detailed engineering documents whose content is prescribed in the EGR requirements. The Project Overview is aimed for a more general audience and is a means by which the key elements of the project are recorded in one place.<br>Transpower (System Operator) will use the Project Overview document to describe the general scope of their requirements. The Asset Owner will use the Project Overview document to describe the overview of the project, its timelines and milestones. |

| STAGE | TASK | RESPON-SIBILITY | DOCUMENT(S) TO BE PROVIDED | PROVIDED / DATE | DESCRIPTION |
|---|---|---|---|---|---|
| | Put in place a Transmission Agreement | Transpower Project Coordinator /Asset Owner Project Coordinator | Agreed Transmission Agreement | ☐ *Date* | Asset Owners connecting to the National Grid are required to be party to a Transmission Agreement (TA). The TA stipulates the terms and conditions for connection to the Grid. A copy of the standard TA can be found in Part F Schedule F2. |
| | Provide Updated ACS | Asset Owner Project Coordinator | Updated ACS | ☐ *Date* | The Asset Owner must periodically – as more data comes to hand – provide more technical details of their plant via an updated ACS.<br><br>The ACS should be filled in and updated on a minimum of four occasions, at the: 1. planning stage, 2. pre-commissioning stage, 3. commissioning stage, and finally, 4. post commissioning stage.<br><br>However what tends to happen is a more iterative process whereby there is a more fluid, collaborative, exchange of information issues are raised.<br><br>Each party under the TA – that is Transpower and the Asset Owner - are responsible for ensuring that their plant meets the technical requirements as defined in Schedule 8: The Connection Code.<br><br>The Connection Code specifies, amongst other things, the requirements for Insulation Coordination, Protection Coordination, Power Factor and Harmonics.<br><br>Under the TA, before any new plant is connected to the Grid, Transpower must be satisfied that the requirements of the Connection Code can be met. Where it is technically impossible or impractical for an Asset Owner to meet a particular requirement of the EGRs or the Connection code they can apply to Transpower for a dispensation or equivalence. |
| | Compliance with Connection Code | Asset Owner Project Coordinator | Document outlining how the new plant and Connection will meet the requirements of the Connection Code | ☐ *Date* | |
| | Request Dispensation(s) from EGRs and Connection Code | Asset Owner Project Coordinator | Dispensation Request Form | ☐ *Date* | |
| | Provide Feedback on ACS Data, Connection Code Compliance and Dispensation Requests | Transpower Project Coordinator | A meeting will be arranged at which Transpower's assessment would be discussed. | ☐ *Date* | |

| STAGE | TASK | RESPON-SIBILITY | DOCUMENT(S) TO BE PROVIDED | PROVIDED / DATE | DESCRIPTION |
|---|---|---|---|---|---|
| | Agree and Produce a Commissioning / Test Plan | Asset Owner Project Coordinator | Completed Commissioning Plan | ☐ *Date* | Part C of the EGRs sets out the requirements and obligations that need to be satisfied in order to allow an Asset Owner to connect to the Grid. In order to satisfy these requirements Transpower and the Asset Owner need to agree on a commissioning and testing plan.<br>Transpower's requirements in relation to commissioning plant to be connected to the Grid are outlined in the Transpower standard TP.OG.41.04: 'Commissioning/decommissioning - policy and processes.<br>The following components are key items of the plan:<br>• Description of the equipment to be commissioned **(#)**<br>• Special provisions required during commissioning **(#)**<br>• Indications and measurements (including backup systems) **(#)**<br>• Protection co-ordination between Grid Owner and Asset Owner at grid interface **(#)**<br>• Market Systems set up to receive bids/offer and dispatch **(*)**<br>• Dispensations<br>• Commissioning and test activity time-table **(#)**<br>• Communications framework and process during commissioning phase of project **(#)**<br>• Detail of specific test activity – e.g. Drop load testing (ramp rates, VArs, MW). **(*)**<br>• Tests System Operator will need to witness on-site (if any) **(*)**<br>• Risk assessment of tests and impact on the power system **(*)**<br><br>***Prerequisites for:***<br>***(#) first connection and enlivening onto the grid***<br>***(*) commencing commissioning activities of the generation***<br><br>***Note: The following are no included in the commissioning plan but are prerequisites for first connection to the grid and commissioning:***<br>• ***Certified metering installation***<br>• ***Contract with Pricing and Reconciliation Managers*** |
| | Provide Feedback on Commissioning Plan | Transpower Project Coordinator | A meeting will be arranged at which Transpower's assessment would be discussed. | ☐ *Date* | |

| STAGE | TASK | RESPON-SIBILITY | DOCUMENT(S) TO BE PROVIDED | PROVIDED / DATE | DESCRIPTION |
|---|---|---|---|---|---|
| | Provide results of compliance assessment of EGR and Connection Code requirements, dispensation / equivalence requests, and agreement with Commissioning Plan | Transpower Project Coordinator | Letter outlining findings of Transpower's compliance assessment on the pre-commissioning ACS | ☐ *Date* | Following ongoing discussion with the asset owner, Transpower would provide a written documentation outlining the results of its compliance assessment. This letter would outline where data provision is deficient, the decision(s) on any Asset Owner requests for dispensations, where the new plant has been assessed as non-compliant, and what mitigation would be required before the new generation plant would be allowed to connect to the Grid. |
| **COMMISSIONING** | Implement Construction of New Grid Connection Point | Transpower Project Coordinator | Monthly Project Reports | ☐ *Date* | In accordance with the terms of the New Investment Contract, Transpower would undertake the physical works – eg transmission line, switching station, substation etc - to connect the new generation.<br>Under the terms of the Contract, Transpower is required to provide a monthly progress report as the connection project progresses.<br>Meeting would also be arranged as dictated by any issues arising. |
| | Provide Updated Data as Required | Asset Owner Project Coordinator | • Updated ACS<br>• Updated Comm and Test Plan<br>• Updated Connection Code Compliance | ☐ *Date* | The Asset Owner needs to provide all outstanding data and advise of any amends made from the previously advised ACS, Connection Code Compliance and Commissioning Plan. |
| | Review Updated Data | Transpower Project Coordinator | | ☐ *Date* | |
| | Provide Test Data | Asset Owner Project Coordinator | Copies of test results. | ☐ *Date* | As commissioning proceeds the Asset Owner would provide the results of testing as agreed in the Commissioning Plan. |
| | Compare test results with model outputs | Transpower Project Coordinator | Report showing how well the test data compared to modelled data. | ☐ *Date* | The test results provided by the Asset Owner from tests undertaken on the plant during commissioning are compared by Transpower to the results obtained from Transpower's System models, using data provided by the Asset Owner in their submitted ACS, in its earlier compliance testing. |

| STAGE | TASK | RESPON-SIBILITY | DOCUMENT(S) TO BE PROVIDED | PROVIDED / DATE | DESCRIPTION |
|---|---|---|---|---|---|
| POST COMMISSIONING | Provide Post Commissioning ACS | Asset Owner Project Coordinator | Final ACS | ☐ *Date* | Following Commissioning the Asset Owner provides a final ACS. |
| | Final Assessment of compliance | Transpower Project Coordinator | Letter of Notification and Final Assessment Report | ☐ *Date* | Transpower provides a final assessment of compliance. |
| | Final processing of dispensations / equivalences | | | | |
| | Final Contractual Obligations | | • Commissioning Certificate<br>• Updated TA Schedules | ☐ *Date* | Under the New Investment Contract Transpower is required to provide the Asset Owner with a Commissioning Certificate with the date of commissioning of the new grid connection assets. Charges will apply from this date.<br><br>Under the TA schedules are required to be updated. |

# Project Overview Document
<<Name of Commissioning Project>>
<<Date>>

## CONTENTS



Note : Numbers in this table of contents refer to the page numbers in the abridged document for ease of reference.

## GENERAL

### *1.1 Purpose*

The Project Overview Document is prepared by Transpower and it identifies the basic requirements for commissioning of equipment owned by connected parties into the National Grid owned by Transpower, in compliance with EGR requirements.

This document will identify information which needs to be exchanged between Transpower (Grid Owner), Transpower (System Operator) and the Connected Party (<<name of asset owner>>) in various areas and facilitate information exchange in a timely manner.

It is essential that the contents of the document be reviewed and agreed to between the three parties involved, prior to commissioning of equipment to be connected to the National Grid.

This is only the first draft of the document; it is a "living" document that reflects the agreed methodology and processes involved in the commissioning of grid equipment. Any agreed changes to the commissioning process during the commissioning period shall be documented.

It is essential that this document:

- is to be kept up to date by both parties during the commissioning process
- is subject to version control.

This document is not a substitute for the commissioning and test plans. The commissioning and test plans are detailed engineering documents whose content is prescribed in the EGR requirements. The Project Overview is aimed for a more general audience and is a means by which the key elements of the project are recorded in one place. Transpower (System Operator) should use the Project Overview document to describe the general scope of their requirements. <<name of asset owner>> should use the Project Overview document to describe the overview of the project and its timelines.

### *1.2 Version Control*

| Version number | Author | Date | Reason for revision | Changes made |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

## *1.3 Summary*

1.3.1 Change in Asset Capability

1.3.2 New equipment (inc size) - <<name of asset owner>>

- New Transformers – current and voltage
- Static Var Compensators
- Circuit breakers
- Disconnectors
- High Voltage Bus Systems
- New Generator

1.3.3 New equipment (inc size) - Transpower (Grid Owner)

- New Transformers – current and voltage
- Static Var Compensators
- Circuit breakers
- Disconnectors
- High Voltage Bus Systems

1.3.4 Where and how connected

- Geographic location
- Grid connection point

1.3.5 Key commissioning dates

- Transpower (Grid Owner) equipment
- <<name of asset owner>> equipment

## *1.4 Timeline*

Project timeline/Gantt chart attached showing key dates/critical dates and milestones (**Note** this is not specific to this document)

## *1.5 Critical Items - "Show stoppers"*

| Critical Item | Date item was last actioned | | Current action pending | Who is responsible for action pending (GO/SO/AO) | Status |
|---|---|---|---|---|---|
| Protection | | | | | |
| Indications and Measurements | | | | | |
| Arrangements for Reserves | | | | | |
| Commissioning/ Test Plan | | | | | |
| ACS | | | | | |
| Genco | | | | | |
| SPD / EMS / RMT | | | | | |
| Metering | | | | | |
| SCADA | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## *1.6 Contacts*

| Company | Personnel | Contact details | Responsibility |
|---|---|---|---|
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| | | | |

## *1.7 Reference Documents/Drawings*

The following list shows common interest documents, not confidential to any party

| Reference Documents /Drawings | Version | Date last updated | File location (or attached) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

## 2 INFORMATION REQUIRED BY TRANSPOWER

| Report/Document/Contract name and content | Delivery date | Status |
|---|---|---|
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## 3 INFORMATION REQUIRED BY <<NAME OF ASSET OWNER>>

| Report/Document/Contract name and content | Delivery date | Status |
|---|---|---|
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# 4 TESTING

Depending on the type and magnitude of tests undertaken, the System Operator is likely to request tests that may have an effect on system voltage and/or frequency are carried out during normal working hours when the system load (hence inertia) is significant. Test will generally be expected to be undertaken between 09:00 and 16:30 to avoid system peak load.

The commissioning/test plan is required to cover:

- Proposed tests to validate relevant dynamic models and/or plant capabilities (e.g. plant component responses to step-changes in power/voltage/frequency set-points, plant response to localised 'drop load' events, etc,)
- List of measurement parameters for data capture (electronic data to be provided to Transpower), and an indication of where measurement is physically derived. Sufficient data is required that will allow the System Operator to validate all dynamic models against test results.
- Profiles (time-based) of relevant test signals proposed, generator loading, etc. It is expected these may not be too accurate initially, but we would like to be advised of estimated magnitudes and test durations as soon as possible to assist in system planning.

## *4.1 <<name of asset owner>> Tests*

| Proposed test | Prerequisite tests | How test will be carried out | Proposed timing for test |
|---|---|---|---|
| | | | |
| | | | |
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## *4.2 Transpower (Grid Owner) Tests*

| Proposed test | Prerequisite tests | How test will be carried out | Proposed timing for test |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
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# 5 OTHER INFORMATION

## *5.1 Dispensations*

| Dispensation | From<br>( EGR / Connection Policy ) | Status |
|---|---|---|
| | | |
| | | |
| | | |
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## *5.2 Other Issues which may impact on the commissioning*