



T R A N S P O W E R

**Transmission 2040
(Grid Development Strategy)**

**Work package 9 – Transmission Solution
Integration**

Consultation Material

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Table of Contents

TABLE OF CONTENTS	2
1 INTRODUCTION	3
2 MARKET STRUCTURE AND COMPETITION	3
2.1 ISSUE.....	3
2.2 OPTIONS.....	3
2.3 PROPOSED ASSUMPTIONS.....	4
3 COORDINATION OF TRANSMISSION AND GENERATION INVESTMENT	4
3.1 ISSUE.....	4
3.2 OPTIONS.....	4
3.3 PROPOSED ASSUMPTIONS.....	4
4 TRANSMISSION PRICING	4
4.1 ISSUE.....	4
5 ASSET PLANNING BOUNDARY	5
5.1 ISSUE.....	5
5.2 OPTIONS.....	5
5.3 PROPOSED ASSUMPTIONS.....	5
6 TECHNOLOGY	6
6.1 ISSUE.....	6
6.2 OPTIONS.....	6
7 UNDERGROUNDING	6
7.1 ISSUE.....	6
7.2 OPTIONS.....	6
7.3 PROPOSED ASSUMPTIONS.....	7
8 ENVIRONMENT	7
8.1 ISSUE.....	7
8.2 OPTIONS.....	7
9 PROPERTY	7
9.1 ISSUE.....	7
9.2 OPTIONS.....	7
9.3 PROPOSED ASSUMPTION.....	8
10 CONCLUSION AND QUESTIONS	8

1 Introduction

The purpose of this part of work package 9 is to seek feedback on a number of high level assumptions that will be used in the development of the Transmission 2040 document. These assumptions are not intended to replicate or replace those established in other workstreams, but rather for part of the overall context of the project.

Work package 9 will, later in the project, bring together the planning outcomes and provide a mechanism for these to be tested through consultation with key industry stakeholder and experts.

Eight high level assumptions are set out in this document for discussion. Transpower has in some cases suggested an appropriate assumption, but feedback is encouraged on all of the assumptions. Transpower's current list of high-level assumptions is:

- market structure and competition;
- timing of investments;
- pricing;
- asset planning boundary;
- technology;
- undergrounding;
- environment; and
- property.

Transpower would also welcome suggestions of other areas where high level assumptions could be formed and would be useful for the T2040 project team to take into account.

How these assumptions are applied or taken into account will need to be assessed on a case-by-case basis. For some assumptions this may mean the inclusion in the planning work as a sensitivity, while others may need to be applied qualitatively after the T2040 analysis has been completed.

2 Market structure and competition

2.1 Issue

New Zealand's electricity market has been in place for little over one decade. It is likely to evolve significantly over the timeframe of this study. Structurally, it will evolve with the evolution of rules and as technology development and penetration allows. New markets may emerge, such as for capacity, and existing markets might disappear or merge, such as frequency keeping be subsumed by improved dispatch. Financial markets might get deeper and more liquid. Ownership structures may be different, as incumbents invest and divest, and new entrants appear.

The issue is what assumptions about the future market structure are relevant to this study?

2.2 Options

The market has incentives to deliver capacity, energy and security to New Zealand, and market competition should ensure downwards pressure on prices. There is likely

to remain the threat of regulation if the industry does not deliver, or even regulatory intervention on the margin (such as the current Whirinaki arrangements).

It can therefore be assumed that the market will deliver capacity, energy and security. Further, it can be assumed that this deliver will continue even with expected changes in the market participant mix, in particular in increased renewables penetration and demand-side participation. The balancing requirements of the former can be assumed to be met by the market, and this will be allowed for in ensuring that generation scenarios provide a workable balance of generation types and capabilities. Demand-side participation can safely be assumed to increase, but the rate of increase is difficult to estimate. To a degree, assumption on the rate of increase in demand-side participation are not critical to this study, as in general they will affect the precise timings of transmission need, rather than the underlying needs or trends.

2.3 Proposed assumptions

The market will be assumed to evolve in line with significant changes in the supply and demand scenarios to ensure that the system as a whole continues to deliver capacity, energy and security to New Zealand

3 Coordination of transmission and generation investment

3.1 Issue

For the T2040 project, an assumption is required for the coordination of transmission and generation investment. A possible chicken and egg problem exists with generation and transmission investment in that investment in either could feasibly be withheld until the other is committed.

To date, investment submission and approvals have tended to emphasise the need to undertake investment so that it is completed near to or at the need date.

3.2 Options

Transpower considers that, from a planning and modelling perspective, the only practical assumption is that investment in either area is made in full knowledge of the others investment plans. That is, transmission and generation investors have complete information.

The effect of this assumption is that the chicken and egg problem does not exist. It is likely that the coordination of investments will not be this simple in reality, but there is no practical alternatives from a modelling and planning perspective.

3.3 Proposed assumptions

Transpower proposes that it is assumed that transmission and generation investors have complete information in regards to each others investment plans.

4 Transmission pricing

4.1 Issue

The way in which customers are charged for the costs of transmission, known as the transmission pricing methodology, can affect market participant's investment and even operational drivers.

The transmission pricing methodology has in recent history been revised about every five years. There are indications that it may be reviewed again in the next five years. Significant changes of the pricing methodology over the timeframe of this study are quite possible. The transmission pricing methodology is controlled by the regulator, not by Transpower, and so needs to be considered as an externality.

There is no 'perfect' pricing methodology. Pricing methodologies are designed to balance desirable but often contradictory principles. It is generally accepted that for spur assets where one or a few beneficiaries and users can be readily identified, use-pays applies. The problem comes on the interconnected grid where there are multiple beneficiaries and users, and loop flow effects create problems in identifying them. The two main sets of principles that drive the debate on allocation of interconnection asset costs are those of non-distortion, and locational pricing.

The non-distortionary principle aims to ensure that there are no locational signals, achieved typically through some version of a uniform 'postage stamp' pricing. Locational pricing, on the other hand, deliberately seeks to have transmission pricing reflect the long run marginal costs of transmission investment, in order to incentivise investment in areas with greater transmission capacity. The pricing methodology can be expected to converge on either a non-distortionary or a locational pricing approach, or even to oscillate between them over the timeframe of this study.

In terms of the proposed scenario divisions of remote or local generation, a pricing methodology developed on one of these principles will tend to change the weightings between these scenarios.

As a baseline, Transpower will assume that the pricing methodology will be based on the non-distortionary principle, and thus will not affect participants' investment decisions. In determining the generation scenarios, it is expected that a very high level generation/transmission trade off will be considered

5 Asset planning boundary

5.1 Issue

Transpower owns and operates a wide range of assets (e.g. 11kV through to 350kV lines and stations). Some of these assets have single users, while others make up the backbone of the grid and are used by a wide range of participants.

Transpower needs to determine which of these assets will be assessed in the T2040 project.

5.2 Options

Transpower considers that there are three high level options. These are:

- core / non-core assets as defined by the Grid Reliability Standards in part F of the Rules;
- connection / interconnection assets as defined by the pricing methodology; and
- interconnected grid assets as defined by the System Operator.

5.3 Proposed assumptions

Transpower proposes that it is assumed that the interconnected grid as defined by the System Operator is the most appropriate set of assets to assess in the T2040 project. While asset boundaries might move up or down key spur lines and connection assets over the timeframe of the study, T2040 will focus on the interconnected grid which will remain in Transpower ownership and control.

This approach identifies those assets where electricity flows to other parts of the interconnected grid (i.e. through transmission flows). This set of assets, as it is based on the flow of electricity on the network, identifies those assets that Transpower will need to assess for the purposes of assessing the overall transmission system.

This assumption excludes assets at particular GXPs that will be the subject of bilateral contracts for augmentation.

6 Technology

6.1 Issue

Technology changes will affect the transmission grid throughout the planning horizon of the T2040 project. A range of technology changes are being considered in the specific workstreams. For example:

- as set out in work stream 1, the adoption of new technologies that will affect demand (such as electric cars and smart metering); and
- as set out in work stream 3, Transpower will monitor the trends towards smart grid and integrated equipment technologies, and use of dynamic line ratings.

This issue relates to any technology assumptions that are additional to those being developed in the specific workstreams.

6.2 Options

Transpower has not identified any additional specific technology assumptions and intends to include introduction of new technologies as they emerge and are proven. Transpower welcomes feedback on areas where additional assumptions or assessment would be beneficial.

7 Undergrounding

7.1 Issue

Undergrounding transmission assets is significantly more expensive than overhead lines, except where costs of acquiring property are very high.

Where there is a requirement to underground sections of a line asset, consideration needs to be given to what is accepted practice for the termination and reconnection with the overhead line sections.

7.2 Options

Transpower considers that there are two high level options. These are:

- Status quo, continue to use overhead lines technology and only underground where necessary due to environmental and property issues close to large metropolitan centres; and
- Adopt an undergrounding policy that dictates that undergrounding will be factored into all major new line builds or line refurbishments;

Termination of overhead line sections with underground cable sections can be completed using the following two options:

- The use of termination towers with pothead connections to cable sections; and
- The use of purpose built termination station at either end of an underground cable section.

7.3 Proposed assumptions

Transpower proposes that it is assumed that an undergrounding policy will be adopted that this will be tested by local and regional councils to set an appropriate scope.

Transpower is proposing that, for the purposes of the T2040 project, a 40 year boundary to determine the point at which undergrounding will be considered for all new transmission assets into large metropolitan areas.

Where overhead line sections are to be terminated for connection of an underground cable section Transpower will complete these transitions using purpose build terminal stations.

8 Environment

8.1 Issue

Transpower, in considering what new investments in transmission it needs to make, must give due consideration to social, cultural and environmental effects. This is required to gain designations that, in part, allow Transpower to undertake transmission development.

8.2 Options

There a wide range of scenarios that could be considered for the T2040 project. Selected options will have different weightings placed on the effects of transmission and will also depend on costs, new technology, community expectations and changes in land use.

Because the range of options is difficult to establish outside of detailed consideration, Transpower does not consider that it is practical to make high level assumptions in the absence of undertaking work package 10 and knowing the planning outcomes.

9 Property

9.1 Issue

The Crown lawfully established transmission lines on private property under appropriate Orders in Council until the 31 December 1987 with provision for compensation under the Public Works Act. From 1 January 1988 statutory entitlement to erect lines on private lands ceased.

Transpower is now required to acquire property rights for new lines and may be required to acquire property rights where existing lines that are being significantly upgraded.

9.2 Options

For new transmission lines, Transpower considers that the only reasonable assumption is that all new lines will require Transpower to acquire property rights.

For upgrades of existing lines, the need to acquire property rights will be considered on a case-by-case basis taking into account a range of factors such as the National Environmental Standards for Transmission. A more detailed assumption is not practical at this stage. Developments

9.3 Proposed assumption

Transpower will assume, for all new lines, that property rights are required. For upgrades of existing lines, the need for property rights will be considered on a case-by-case basis.

10 Conclusion and questions

The issues, options and assumptions proposed above are only Transpower's initial view and we welcome feedback on all of the elements. Transpower would also welcome suggestions of any additional areas where assumptions can be made and would be valuable.

Questions

Q1 Do agree with Transpower's set of issues and assessment of those issues set out above? If not, why and what issues should be added / removed?