Before a Hearing Panel at Levin

under:	the Resource Management Act 1991
in the matter of:	The Proposed Horowhenua District Plan - Rural Environment
between:	**Horowhenua District Council** *Local Authority*
and:	**Transpower New Zealand Limited** *Submitter*

Statement of evidence of Michael James Hurley for Transpower New Zealand Limited

Dated: 26 April 2013

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CHAPMAN TRIPP

STATEMENT OF EVIDENCE OF MICHAEL HURLEY

QUALIFICATIONS AND EXPERIENCE

1 My full name is Michael James Hurley.

2 I hold two Bachelor degrees, one in Resource and Environmental Planning and the other in Arts majoring in Environmental Studies. I have practised resource management for over ten years; with around 10 years in local government. I have worked for Transpower as an Environmental Advisor since February 2011. I have previously been employed as the Planning Manager and Senior Planner at Upper Hutt City Council; where the Planning team were responsible for all of the Council's Resource Management Act 1991 (RMA) functions. Prior to this I was employed by the Hutt City Council as an Environmental Analyst and the Team Leader - Environmental Policy.

3 SCOPE OF EVIDENCE

4 My evidence will deal with the following:

4.1 Introduction to Transpower;

4.2 Transpower's assets within the Horowhenua District, and the role these play locally, regionally and nationally;

4.3 Conclusions.

SUMMARY OF EVIDENCE

5 Transpower owns and operates the National Grid, which transmits electricity throughout New Zealand. There are 5 National Grid transmission lines in Horowhenua District, together with other infrastructure such a substation and switchyard. These lines play a critical role in New Zealand's electricity transmission network.

6 Transpower is aware that a balance needs to be struck between competing issues associated with the use of the electricity transmission network. Only via Resource Management Act 1991 (*RMA*) planning tools such as District Plan rules can sustainable management of the both the transmission resource, and the environment they are located in, be achieved. The NPSET provides that use, development and protection of the transmission network needs to be managed in a way which enables people and communities to provide for their social, economic and cultural well-being and for their health and safety, while sustaining the potential of the Grid to meet the reasonably foreseeable needs of future generations, and while also avoiding, remedying and mitigating adverse effects of activities on the environment. It is important to

note that full mitigation is not possible due to the scale, form, function and technical constraints of the infrastructure and this is recognised in the NPSET.[1] The focus must be on overall effects-based management. Transpower considers that the provisions set out in **Mr Graham Spargo's** evidence will best give effect to the requirements of the NPSET.

INTRODUCTION TO TRANSPOWER

Transpower's role

7 Transpower is a State Owned Enterprise that plans, builds, maintains, owns and operates New Zealand's electricity transmission network – the National Grid – which links generators to distribution companies and major industrial users. The Grid, which extends from Kaikohe in the North Island down to Tiwai in the South Island, transports electricity throughout New Zealand.

8 The National Grid comprises some 12,000 km of transmission lines and around 180 substations across the country. This is supported by a telecommunications network of some 300 telecommunication sites, which help link together the components that make up the National Grid.

9 Transpower is not a generator of electricity and has no retail sales of electricity. It can be considered to be a 'freight company' for electricity, in that it transports electrical energy from the generators to the local lines distribution companies and some major users of electricity (e.g. Carter Holt Harvey at Kinleith).

10 Transpower's main role is to ensure the reliable supply of electricity to the country. Transpower plays a fundamental part in New Zealand's economy.

11 As a State Owned Enterprise, Transpower's principal objective is to operate as a successful business.[2] It must operate within certain legislative constraints and report regularly to its shareholding Ministers. Transpower is required to deliver and operate a National Grid that meets the needs of users now and into the future.[3]

12 The National Grid is a physical resource of national significance. **Mr Spargo's** evidence describes the NPSET, which recognises that the efficient transmission of electricity via the Grid plays a vital role in the wellbeing of New Zealand, its people and the environment. The Grid needs to be operated, maintained, developed and upgraded,

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[1] Policy 3.

[2] State-Owned Enterprises Act 1986, s 4.

[3] Statement of Corporate Intent 2012/2013, https://www.transpower.co.nz/sites/default/files/publications/resources/transpower-sci-2012-13.pdf at 5.

but this needs to be done bearing in mind its special characteristics and the adverse environmental effects it causes, as well as the adverse effects other activities cause to it. The NPSET was implemented by the Government in 2008 to manage these issues.

TRANSMISSION ASSETS WITHIN HOROWHENUA DISTRICT

13 The following National Grid transmission lines (owned and operated by Transpower) are located within the Horowhenua District:

13.1 Bunnythorpe – Haywards A (BPE-HAY A) 220kV single circuit circuit transmission line on towers;

13.2 Bunnythorpe – Haywards B (BPE-HAY B) 220kV single circuit transmission line on towers;

13.3 Mangahao – Paekakariki A (MHO-PKK A) 110kV single circuit transmission line on single poles;

13.4 Mangahao – Paekakariki B (MHO- PKK B) 110kV single circuit transmission line on single poles; and

13.5 Bunnythorpe – Wilton A (BPE-WIL A) 220kV double circuit transmission line on towers.

14 In addition, Transpower operates a substation at Mangahao Road and a Switchyard at Te Paki Road; both of which are designated.

15 The existing transmission network is shown in the map in **Appendix A** to this statement.

TRANSMISSION IN THE MANAWATU-WHANGANUI REGION

16 Transmission in the Manawatu serves a critical role in the New Zealand electricity network, by providing a vital link from remote generation locations to major load centres. The direction of powerflow through the region, north or south, is set by generation and loads outside the region such as the status of the hydro lake generation in the South Island. The Bunnythorpe substation (amongst others) provides a vital link whether the power is flowing from the North Island to the South Island or vice versa.

17 The Central North Island Chapter of the Annual Report[4] (included in **Appendix B**) summarises the Grid development projects that Transpower anticipates will be carried out in Horowhenua over the next 15 years. The following development possibilities have been in identified in the report.

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[4] Paragraph 11.6.

17.1 Replacement of transformers at the Mangahao Substation; as they are reaching the end of their life. The 33kV switchboard is also proposed to be moved inside at the substation; and

17.2 Replace the conductors on the Bunnythorpe – Haywards A&B transmission lines. The two lines are over 50 years old and the conductors are nearing the end of their life. We are using the opportunity to consider whether greater capacity for the lines will be needed over the next 50 years; mainly to provide for more power to flow from the North Island to South Island. The two lines will remain at 220kV following the re-conductoring.

18 The fibre optic cable connection to the Mangahao switchyard and Mangahao power station is about to be upgraded (this is not included in the Annual Report).

19 There are currently no new lines planned within the Horowhenua District. However, Transpower seeks that the District Plan provisions provide for any new lines that may be required to link new electricity generation infrastructure to the National Grid. A summary of the ACRE process that Transpower undertakes when selecting the route of a new line is included (as **Appendix C**).

20 In summary, Transpower's infrastructure (including its infrastructure in Horowhenua) is a significant physical resource that must be sustainably managed and any adverse effects on it, and caused by it, must be avoided, remedied or mitigated. It is the Utilities and Energy section of the District Plan where the Objective and Policies 1-8 of the NPSET are largely given effect to. It needs to be recognised that other sections of the plan provide for other uses around and adjacent to the transmission lines and seek to manage activities around the transmission lines; this section of the plan needs to provide for the lines.

MATTERS RAISED BY OTHER SUBMITTERS

21 I agree with the reporting officer that the District Plan is about managing adverse effects and that there is other legislation that is dealing with property rights and land ownership issues. Transpower's existing lines and access to them are protected and regulated by the Electricity Act 1992. The Electricity Act also allows Transpower to operate, inspect, and as long as there is no injurious effect, upgrade the lines. If Transpower goes beyond those rights then it needs to acquire a property right (easement) from the landowner for which compensation will be paid (under the Public Works Act 1981). The proposed Horowhenua District Plan is drafted under different legislation, the Resource Management Act, and will not in any way affect the provisions of the Electricity Act or landowners' opportunity to negotiate with Transpower.

22 Some submitters have raised concerns about some Transpower activities (such as minor upgrades) resulting in their activities becoming non-compliant with NZECP34. Transpower must comply with NZECP34 – it is a mandatory document. If Transpower was carrying out an upgrade (whether minor or not) it would need to comply with NZECP34. It could not upgrade a line, or move a tower, in a manner that resulted in a landowners activities becoming non-compliant with NZECP34.

CONCLUSIONS

23 In summary, Transpower's infrastructure (including its infrastructure in Horowhenua) is a significant physical resource and the District Plan must provide for it by

> *"facilitating the operation, maintenance and upgrade of the existing transmission network and the establishment of new transmission resources to meet the needs of present and future generations…"* (the Objective of the NPSET).

24 The electricity transmission network is critical to Horowhenua District's (as well as the nations) social and economic wellbeing and the NPSET requires that to be recognised in the District Plan. Transpower needs to be able to operate and maintain its transmission infrastructure in order to enable Horowhenua's community to have a sustainable, secure, safe and efficient supply of electricity to homes, workplaces, schools, neighbourhoods and elsewhere.

25 Transpower supports the District Plan provisions recommended in the Officers Report (with the amendments suggested by **Mr Spargo**) because they will guide future development of the District in a way which takes into account both the transmission infrastructure and other natural and physical resources. Transpower considers that the Proposed Plan strikes the appropriate balance.

Michael James Hurley
26 April 2013

APPENDIX A – MAP OF TRANSMISSION ASSETS

TRANSPOWER

Transpower Assets within the Horowhenua District Council Boundary

Prepared by: ems energy market services

Projection: NZTM 2000 Scale: 1:237,972 Plan Size: A4P

0 1.5 3 6 9 12 Kilometers

25/06/2009

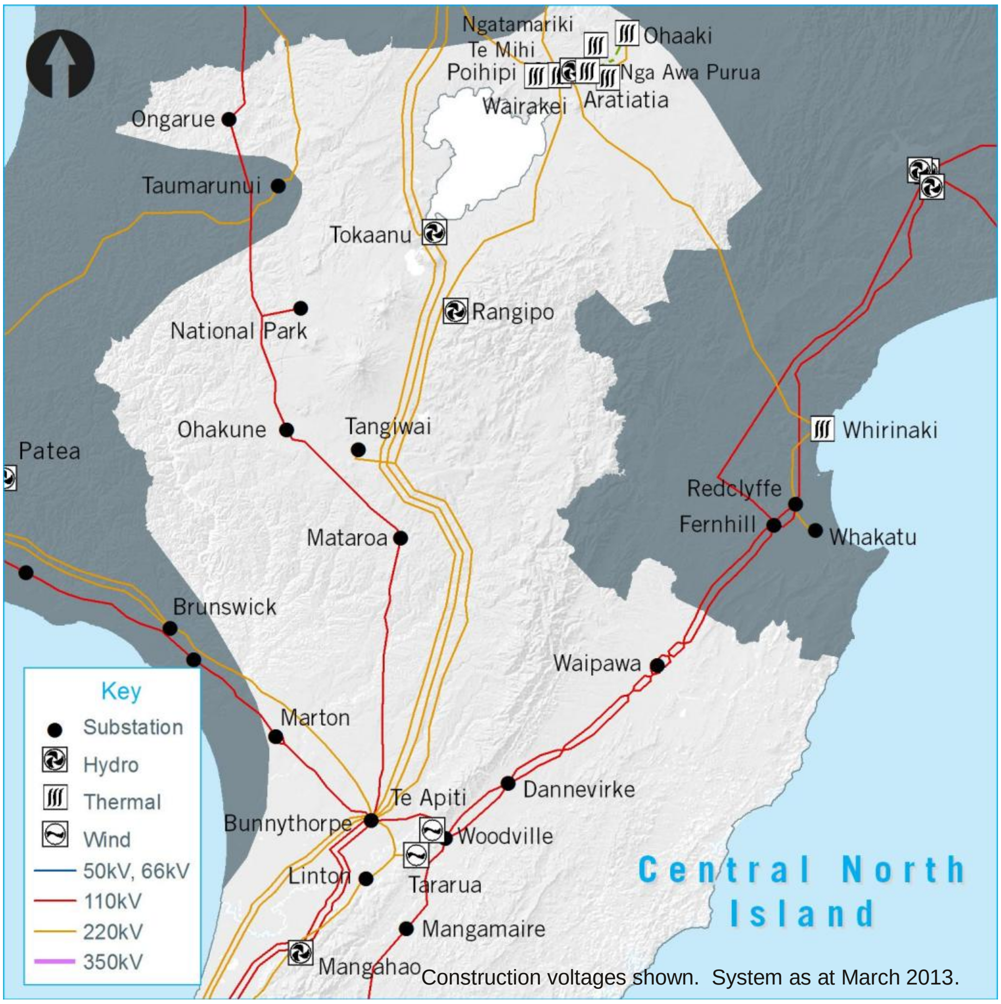
APPENDIX B – CENTRAL NORTH ISLAND REGION CHAPTER OF THE TRANSPOWER 2013 ANNUAL REPORT

11 Central North Island Regional Plan

11.1 Regional overview

This chapter details the Central North Island regional transmission plan. We base this regional plan on an assessment of available data, and welcome feedback to improve its value to all stakeholders.

Figure 11-1: Central North Island region



The Central North Island region includes a mix of grid exit points, from the large load at Palmerston North and environs (supplied from Bunnythorpe and Linton) to numerous medium to small loads. There is also a large industrial load at Tangiwai.

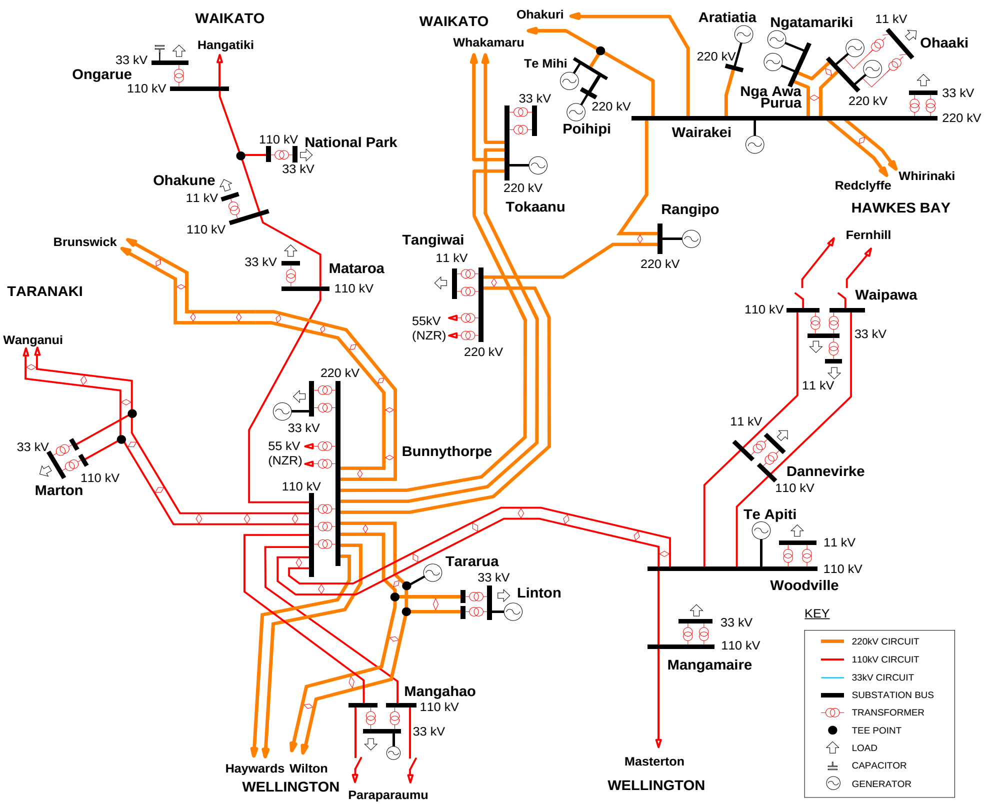
We have assessed the Central North Island region's transmission needs over the next 15 years while considering longer-term development opportunities. Specifically, the transmission network needs to be flexible to respond to a range of future service and technology possibilities, taking into consideration:

- the existing transmission network
- forecast demand
- forecast generation
- equipment replacement based on condition assessment, and
- possible technological development.

11.2 Central North Island transmission system

This section highlights the state of the Central North Island regional transmission network. The existing transmission network is set out geographically in Figure 11-1 and schematically in Figure 11-2.

Figure 11-2: Central North Island transmission schematic



11.2.1 Transmission into the region

The Central North Island region comprises 220 kV and 110 kV transmission circuits with interconnecting transformers located at Bunnythorpe. The direction of power flow through the region, north or south, is set by generation and loads outside the region.

All the 220 kV circuits form part of the grid backbone. The 110 kV transmission network is mainly supplied through the 220/110 kV interconnecting transformers at Bunnythorpe, plus low capacity connections to other regions.

The Central North Island region is a main corridor for 220 kV transmission circuits through the North Island. The 220 kV transmission system connects Bunnythorpe from the south, and Wairakei and Tokaanu from the North.

There is an approved project to replace the 220 kV single circuit Wairakei–Poihipi–Whakamaru line connecting to the Waikato region with a double-circuit line.

Most of the Central North Island's generation capacity is connected to the 220 kV and is significantly in excess of the local demand. Surplus generation is exported over the National Grid to other demand centres.

11.2.2 Transmission within the region

The 110 kV transmission system within the Central North Island region mainly consists of low-capacity circuits. The transmission system may impose constraints under certain operating conditions. Operational measures taken to ensure the 110 kV circuits operate within their thermal capacity are:

- normally splitting the 110 kV system at:
  - Waipawa, for the Fernhill–Waipawa circuits, and
  - Mangahao and Paraparaumu, for the Mangahao–Paraparaumu circuits.
- managing generation output to avoid overloading of the 110 kV:
  - Bunnythorpe–Woodville circuits
  - circuits between Bunnythorpe and Arapuni (Waikato region), and
  - circuits between Bunnythorpe and Stratford (Taranaki region).

Special protection schemes are also used to automatically reconfigure the grid or reduce generation to ensure the circuits operate within their thermal capacity. Schemes that are normally in service are at Tokaanu and Woodville.

11.2.3 Longer-term development path

Longer-term development plans are being formed as part of the Lower North Island investigation.

The transmission development in this region will largely depend on the magnitude and location of future generation, and the commissioning of new generation in the region may bring forward the need for transmission investment. Possible upgrades include duplexing the existing 220 kV lines, and rebuilding some of the 110 kV lines for 220 kV operation.

11.3 Central North Island demand

The after diversity maximum demand (ADMD) for the Central North Island region is forecast to grow on average by 1.1% annually over the next 15 years, from 333 MW in 2013 to 390 MW by 2028. This is lower than the national average demand growth of 1.5% annually.

Figure 11-3 shows a comparison of the 2012 and 2013 APR forecast 15-year maximum demand (after diversity[97]) for the Central North Island region. The forecasts are derived using historical data, and modified to account for customer information, where appropriate. The power factor at each grid exit point is also derived from historical data. See Chapter 4 for more information about demand forecasting.

[97] The after diversity maximum demand (ADMD) for the region will be less than the sum of the individual grid exit point peak demands, as it takes into account the fact that the peak demand does not occur simultaneously at all the grid exit points in the region.

Figure 11-3: Central North Island region after diversity maximum demand forecast

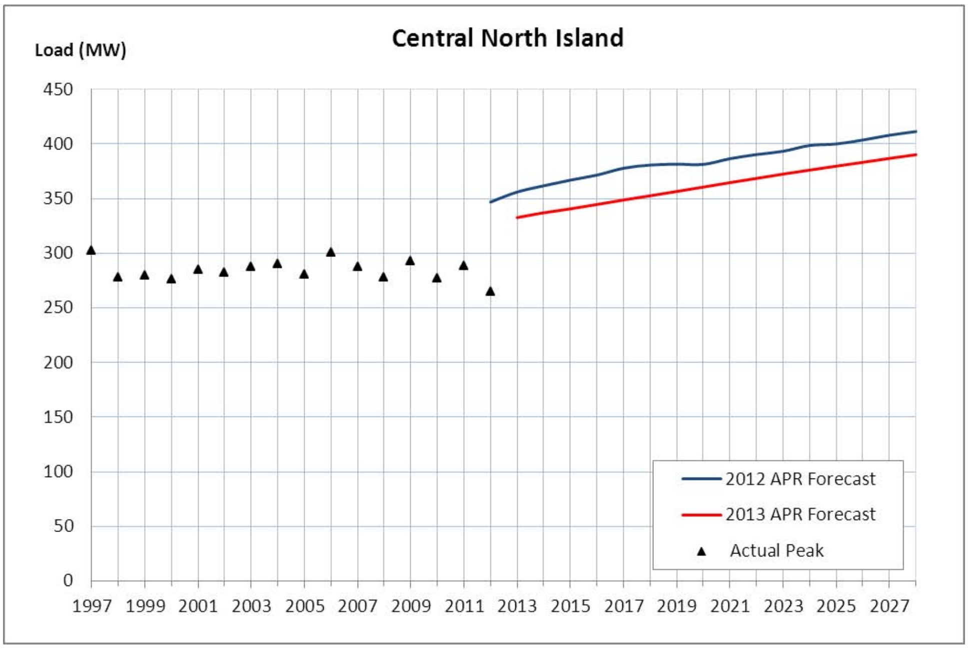


Table 11-1 lists forecasts peak demand (prudent growth) for each grid exit point for the forecast period, as required for the Grid Reliability Report.

Table 11-1: Forecast annual peak demand (MW) at Central North Island grid exit points to 2028

Grid exit point	Power factor	Peak demand (MW)										
		Next 5 years						5-15 years out				
		2013	2014	2015	2016	2017	2018	2020	2022	2024	2026	2028
Bunnythorpe 33 kV	0.97	119	122	124	127	129	132	137	143	148	153	159
Bunnythorpe – NZR	0.79	8	8	8	8	8	8	8	8	8	8	8
Dannevirke	0.97	15	16	16	16	16	16	17	17	18	18	19
Linton	0.99	72	74	75	77	78	80	83	87	90	93	96
Mangamaire	0.97	12	12	13	13	13	13	14	14	14	15	15
Mangahao	0.95	44	44	45	46	46	47	48	50	51	53	54
Marton	0.97	17	17	18	18	18	18	18	19	19	20	20
Mataroa	0.98	8	8	8	9	9	9	9	9	10	10	10
National Park	0.98	8	8	8	9	9	9	9	9	10	10	10
Ohaaki	0.94	6	6	6	6	6	6	6	7	7	7	7
Ohakune[1]	0.98	11	9	10	10	10	10	11	11	12	12	13
Ongarue	0.98	11	11	11	11	11	11	11	12	12	12	12
Tokaanu	0.99	10	10	11	11	11	11	11	12	12	12	13
Tangiwai 11 kV[1]	0.98	44	47	47	48	48	49	50	51	52	53	54
Tangiwai NZR	0.81	10	10	10	10	10	10	10	10	10	10	10
Woodville	0.98	4	4	4	4	4	5	5	5	5	5	5
Waipawa	0.96	22	23	23	23	24	24	25	26	26	27	28
Wairakei	0.90	50	51	51	52	53	54	55	57	59	60	62

1. The customer advised a 2 MW load shift from Ohakune to the Tangiwai 11 kV bus planned for 2014.

11.4 Central North Island generation

The Central North Island region's generation capacity is 1,334 MW, increasing to 1,448 MW after the commissioning of Te Mihi geothermal power plants. This generation contributes a significant portion of the total North Island generation and exceeds local demand. Surplus generation is exported over the National Grid to other demand centres.

Table 11-2 lists the generation forecast for each grid injection point for the forecast period, as required for the Grid Reliability Report. This includes all known and committed generation stations including those embedded within the relevant local lines company's network (Powerco, The Lines Company, Scanpower, Centralines, or Electra).[98]

Table 11-2: Forecast annual generation capacity (MW) at Central North Island grid injection points to 2028 (including existing and committed generation)

Grid injection point (location if embedded)	Generation capacity (MW)										
	Next 5 years						5-15 years out				
	2013	2014	2015	2016	2017	2018	2020	2022	2024	2026	2028
Aratiatia	78	78	78	78	78	78	78	78	78	78	78
Bunnythorpe (Tararua Wind Stage 2)	36	36	36	36	36	36	36	36	36	36	36
Linton (Tararua Wind Stage 1)	32	32	32	32	32	32	32	32	32	32	32
Linton (Totara Road)	1	1	1	1	1	1	1	1	1	1	1
Mangahao	42	42	42	42	42	42	42	42	42	42	42
Nga Awa Purua	140	140	140	140	140	140	140	140	140	140	140
Nga Awa Purua – Ngatamariki	82	82	82	82	82	82	82	82	82	82	82
Ohaaki	46	46	46	46	46	46	46	46	46	46	46
Ongarue (Mokauiti, Kuratau and Wairere Falls)	13	13	13	13	13	13	13	13	13	13	13
Poihipi	51	51	51	51	51	51	51	51	51	51	51
Rangipo	120	120	120	120	120	120	120	120	120	120	120
Tararua Wind Central – Tararua Stage 3	93	93	93	93	93	93	93	93	93	93	93
Tararua Wind Central (Te Rere Hau)	49	49	49	49	49	49	49	49	49	49	49
Te Mihi	166	166	166	166	166	166	166	166	166	166	166
Tokaanu	240	240	240	240	240	240	240	240	240	240	240
Wairakei	161	109	109	109	109	109	109	109	109	109	109
Wairakei (Hinemaiaia)	7	7	7	7	7	7	7	7	7	7	7
Wairakei (Rotokawa)	35	35	35	35	35	35	35	35	35	35	35
Wairakei (Te Huka)	23	23	23	23	23	23	23	23	23	23	23
Woodville – Te Apiti	90	90	90	90	90	90	90	90	90	90	90

11.5 Central North Island significant maintenance work

Our capital project and maintenance works are integrated to enable system issues to be resolved if possible when assets are replaced or refurbished. Table 11-3 lists the

98 Only generators with a capacity greater than 1 MW are listed. Generation capacity is rounded to the nearest megawatt.

significant maintenance-related work[99] proposed for the Central North Island region for the next 15 years that may significantly impact related system issues or connected parties.

Table 11-3: Proposed significant maintenance work

Description	Tentative year	Related system issues
Bunnythorpe interconnecting transformers expected end-of-life	2014-2016	Options for the replacement transformers are under investigation. See Section 11.8.1 for more information.
Bunnythorpe 33 kV outdoor to indoor conversion	2013-2014	The forecast load at Bunnythorpe will exceed the transformers' capacity from 2013. See Section 11.8.4 for more information.
Linton 33 kV outdoor to indoor conversion and supply transformer replacement	2017-2019 2013-2014	The forecast load at Linton will exceed the transformers' capacity from 2018. See Section 11.8.5 for more information.
Mangahao supply transformers expected end-of-life, and 33 kV outdoor to indoor conversion	2020-2022 2014-2016	Managing Mangahao generation can reduce the transformer's loading. See Section 11.8.6 for more information.
Marton supply transformers expected end-of-life	2023-2026	The forecast load will exceed the transformers' capacity from 2023. See Section 11.8.8 for more information.
Mataroa supply transformer expected end-of-life	2017-2019	No n-1 security at Mataroa. See Section 11.8.10 for more information.
National Park supply transformer expected end-of-life	2013-2015	No n-1 security at National Park. See Section 11.8.11 for more information.
Ohakune supply transformer expected end-of-life	2013-2015	The discussion on options to increase the supply security and transformer capacity is underway. See Section 11.8.12 for more information.
Ongarue 33 kV supply transformer expected end-of-life, and Ongarue 33 kV outdoor to indoor conversion	2025-2026 2017-2019	No n-1 security at Ongarue. See Section 11.8.13 for more information.
Wairakei supply transformers expected end-of-life	2024-2026	No system issues are identified within the forecast period.

11.6 Future Central North Island projects and transmission configuration

Table 11-4 lists projects to be carried out in the Central North Island region within the next 15 years.

Figure 11-4 shows the possible configuration of Central North Island transmission in 2028, with new assets, upgraded assets, and assets undergoing significant maintenance within the forecast period.

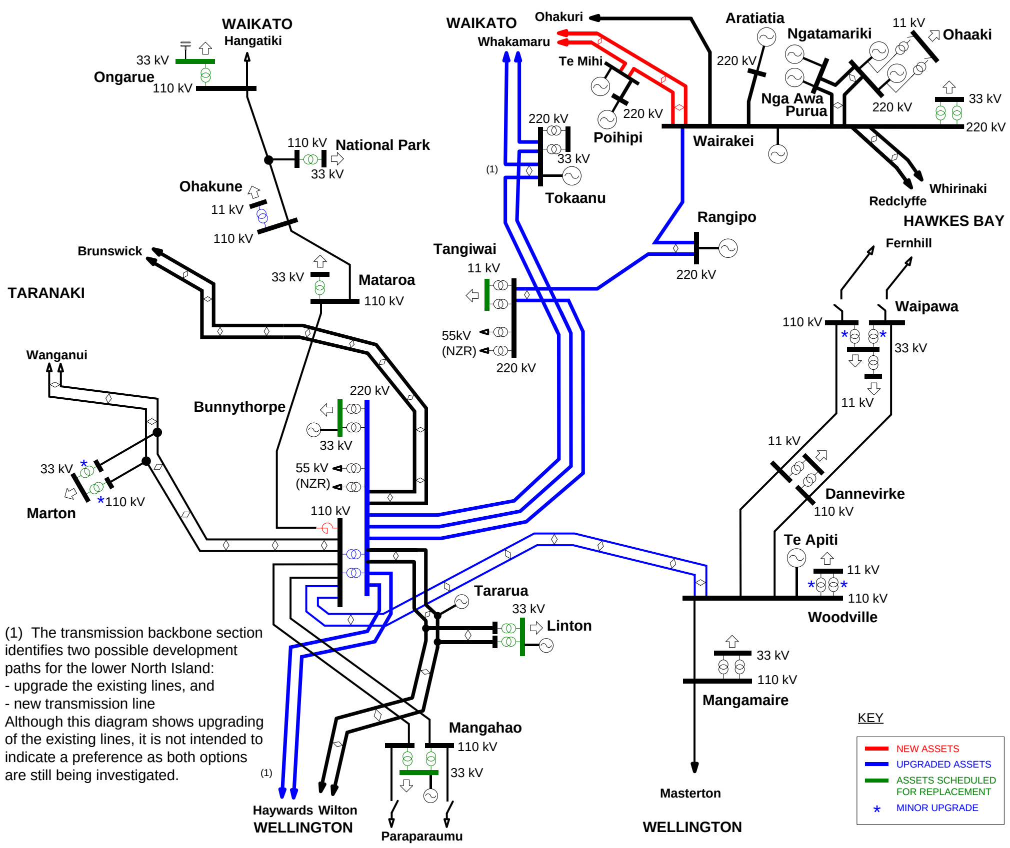
Table 11-4: Projects in the Central North Island region up to 2028

Circuits/site	Projects	Status
Bunnythorpe	Replace existing interconnecting transformers with two 150 MVA units. Convert 33 kV outdoor switchgear to an indoor switchboard. Rearrange the 220 kV bus configuration.	Possible Proposed Possible
Bunnythorpe–Haywards	Bunnythorpe–Haywards–A and B reconductoring.	Preferred
Bunnythorpe–Mataroa	Install a series reactor.	Possible
Bunnythorpe–Woodville	Upgrade the special protection scheme or reconductor the Bunnythorpe–Woodville circuit or convert the circuit's operating voltage.	Possible

[99] This may include replacement of the asset due to its condition assessment.

Circuits/site	Projects	Status
Linton	Convert the 33 kV outdoor switchgear to an indoor switchboard. Replace the supply transformer.	Proposed Proposed
Mangahao	Replace supply transformers. Convert the 33 kV outdoor switchgear to an indoor switchboard.	Proposed Proposed
Marton	Resolve the supply transformers' metering and protection limits. Replace the supply transformers.	Possible Proposed
Mataroa	Replace the supply transformer.	Proposed
National Park	Replace the supply transformer.	Proposed
Ohakune	Replace the supply transformer with a higher rated unit.	Possible
Ongarue	Replace the supply transformer. Convert the 33 kV outdoor switchgear to an indoor switchboard.	Proposed Proposed
Tangiwai	Replace the 11 kV switchgear.	Proposed
Haywards–Bunnythorpe–Tokaanu–Whakamaru	Increase the transmission circuit capacities.	Possible
Waipawa	Resolve the supply transformers' metering and protection limits.	Possible
Wairakei	Replace the supply transformers.	Proposed
Wairakei–Whakamaru	Build a new 220 kV double circuit transmission line and dismantle the existing 220 kV Wairakei–Whakamaru–B single circuit transmission line.	Committed
Woodville	Resolve the supply transformers' metering equipment limit.	Possible

Figure 11-4: Possible Central North Island transmission configuration in 2028



11.7 Changes since the 2012 Annual Planning Report

Table 11-5 lists the specific issues that are either new or no longer relevant within the forecast period when compared to last year's report.

Table 11-5: Changes since 2012

Issues	Change
Marton low voltage	New issue.
Mataroa and National Park low voltage	New issue.
Waipawa low voltage	New issue.
Woodville supply transformer capacity	New issue.

11.8 Central North Island transmission capability

Table 11-6 summarises issues involving the Central North Island region for the next 15 years. For more information about a particular issue, refer to the listed section number.

Table 11-6: Central North Island region transmission issues

Section number	Issue
Regional	
11.8.1	Bunnythorpe interconnecting transformer capacity
11.8.2	Bunnythorpe–Mataroa 110 kV transmission capacity
11.8.3	Bunnythorpe–Woodville 110 kV transmission capacity
Site by grid exit point	
11.8.4	Bunnythorpe supply transformer capacity
11.8.5	Linton supply transformer capacity
11.8.6	Mangahao supply transformer capacity
11.8.7	Marton low voltage
11.8.8	Marton supply transformer capacity
11.8.9	Mataroa and National Park low voltage
11.8.10	Mataroa supply transformer security
11.8.11	National Park transmission and supply transformer security
11.8.12	Ohakune supply security and capacity
11.8.13	Ongarue supply transformer security
11.8.14	Tokaanu supply transformer security
11.8.15	Waipawa low voltage
11.8.16	Waipawa supply transformer capacity and security
11.8.17	Woodville supply transformer capacity
Bus security	
11.9.1	Transmission bus security
11.9.2	Central North Island region low voltage

11.8.1 Bunnythorpe interconnecting transformer capacity

Project reference:	BPE-POW_TFR-EHMT-01
Project status/type:	Possible, Base Capex
Indicative timing:	2014-2016

Indicative cost band:	B

Issue

There are three interconnecting transformers at Bunnythorpe, each rated at 50 MVA, providing:

- a total nominal installed capacity of 150 MVA, and
- n-1 capacity of 116/125 MVA (summer/winter).

Loading on the Bunnythorpe interconnecting transformers may exceed their n-1 capacity for high Central North Island and Wellington loads, coupled with low local generation in Wellington.

Solution

This issue can be managed using operational measures by constraining:

- Mangahao generation on
- HVDC transfer to high north flow, or
- Central North Island regional load down.

The Bunnythorpe interconnecting transformers have an expected end-of-life within the forecast period. One option is to replace these with two 150 MVA transformers.

11.8.2 Bunnythorpe–Mataroa 110 kV transmission capacity

Project reference:	BPE_MTR–TRAN-EHMT-01
Project status/type:	Possible, Base Capex. This project is part of the lower North Island transmission capacity investigation.
Indicative timing:	To be advised
Indicative cost band:	A

Issue

The Bunnythorpe–Mataroa single circuit is rated at 57/70 MVA (summer/winter). This circuit can overload for some generation dispatch patterns such as high HVDC north power flow, high wind generation in the lower North Island, low Arapuni generation, and an outage of a 220 kV Huntly–Stratford, Stratford–Taumarunui, Bunnythorpe–Tokaanu, Tokaanu–Whakamaru or Rangipo–Wairakei circuit.

Solution

This issue can be managed operationally by limiting the HVDC north power flow, and/or increasing Arapuni generation, and/or opening the Arapuni–Ongarue circuit (leaving Ongarue, National Park, Ohakune, and Mataroa on n security).

A short-term option is automatically opening the circuit when it overloads.

Longer-term options are to reduce the power flow along the Bunnythorpe–Mataroa circuit by installing a series reactor, or increase the circuit's rating by reconductoring.

11.8.3 Bunnythorpe–Woodville 110 kV transmission capacity

Project reference:	BPE_WDV-TRAN-EHMT-01
Project status/type:	Possible, Base Capex. This project is part of the lower North Island transmission capacity investigation,
Indicative timing:	Special protection scheme upgrade: to be advised Circuit reconductoring or convert circuit's operating voltage: 2015-2020
Indicative cost band:	Special protection scheme upgrade: A Circuit reconductoring or convert circuit's operating voltage: to be advised

Issue

The Bunnythorpe–Woodville circuits are rated at 57/70 MVA (summer/winter). The loading on these circuits depends on the HVDC transfer direction and level, Te Apiti generation levels and the load in Wellington, Wairarapa, Dannevirke, and Waipawa. The circuits may overload for an outage of:

- one circuit overloading the remaining circuit during high south flow, or
- some 220 kV circuits between Bunnythorpe and Haywards, overloading the Bunnythorpe–Woodville circuits.

A special protection scheme at Woodville will prevent overloading for a Bunnythorpe–Woodville outage by:

- detecting an outage of a Bunnythorpe–Woodville 110 kV circuit causing overloading of the remaining Bunnythorpe–Woodville circuit
- opening the Mangamaire–Woodville circuit at Woodville to prevent through transmission, and
- removing Te Apiti generation if the overload on Bunnythorpe–Woodville remains.

Solution

The existing special protection scheme will resolve the issue caused by an outage of a Bunnythorpe–Woodville 110 kV circuit.

The overloading for a 220 kV circuit outage between Bunnythorpe and Haywards can be managed operationally by:

- restricting HVDC south power flow, and/or
- restricting Te Apiti generation, or
- opening either the 110 kV Mangamaire–Woodville circuit or the Mangamaire–Masterton circuit, leaving Mangamaire on n security.

Longer-term options, which do not require operational measures include:

- upgrading the existing special protection scheme to operate for a 220 kV circuit outage (also requiring a bus protection upgrade at Woodville)
- reconductoring the 110 kV Bunnythorpe–Woodville circuits with a higher rated conductor, or
- converting the Bunnythorpe–Woodville circuits to 220 kV operation.

11.8.4 Bunnythorpe supply transformer capacity

Project status/type:	This issue is for information only

Issue

Two 220/33 kV transformers supply Bunnythorpe's load, providing:

- a total nominal installed capacity of 166 MVA, and
- n-1 capacity of 100/100 MVA[100] (summer/winter).

The peak load at Bunnythorpe is forecast to exceed the transformers' n-1 winter capacity by approximately 14 MW in 2013, increasing to approximately 53 MW in 2028 (see Table 11-7). Tararua wind generation (Stage 2) is connected to the Bunnythorpe 33 kV bus, and the forecast assumes minimum generation of 7 MW coincident with the peak load.

[100] The transformers' capacity is limited by cable ratings; with this limit resolved, the n-1 capacity will be 101/106 MVA (summer/winter).

Table 11-7: Bunnythorpe supply transformer overload forecast

Circuit/grid exit point	Power factor	Transformer overload (MW)										
		Next 5 years						5-15 years out				
		2013	2014	2015	2016	2017	2018	2020	2022	2024	2026	2028
Bunnythorpe	0.97	14	16	19	21	24	26	31	37	42	48	53

Solution

Increasing the transformers' cable limit will not solve the overload issue. In the short term, Powerco can transfer load within the distribution system to Linton following a contingency. We are discussing longer-term options with Powerco, which include:

- load transfer to Linton (see Section 11.8.5), and
- a third supply transformer at Bunnythorpe.

We have also discussed with Powerco conversion of the Bunnythorpe 33 kV outdoor switchyard to an indoor switchboard. Future investment will be customer driven.

11.8.5 Linton supply transformer capacity

Project status/type:	This issue is for information only

Issue

Two 220/33 kV transformers (rated at 60 MVA and 100 MVA) supply Linton's load, providing:

- a total nominal installed capacity of 160 MVA, and
- n-1 capacity of 77/81 MVA (summer/winter).

The peak load at Linton is forecast to exceed the transformers' n-1 winter capacity by approximately 1 MW in 2020, increasing to approximately 14 MW in 2028 (see Table 11-8). Tararua wind generation (Stage 1) is connected to the Linton 33 kV bus, and the forecast assumes minimum generation of 7 MW coincident with the peak load.

Table 11-8: Linton supply transformer overload forecast

Circuit/grid exit point	Power factor	Transformer overload (MW)										
		Next 5 years						5-15 years out				
		2013	2014	2015	2016	2017	2018	2020	2022	2024	2026	2028
Linton	0.99	0	0	0	0	0	0	1	4	7	11	14

Solution

Linton normally has two 100 MVA transformers, but one failed and has been temporarily replaced with a 60 MVA transformer. We will discuss options with Powerco, which include:

- retaining the 60 MVA transformer permanently, and using operational measures to manage the overload, and
- replacing the 60 MVA transformer if load is transferred from Bunnythorpe (see Section 11.8.4).

We will also discuss with Powerco converting the Linton 33 kV outdoor switchyard to an indoor switchboard. Future investment will be customer driven.

11.8.6 Mangahao supply transformer capacity

Project status/type:	This issue is for information only

Issue

Two 110/33 kV transformers supply Mangahao's load, providing:

- a total nominal installed capacity of 60 MVA, and
- n-1 capacity of 37/39 MVA (summer/winter).

The peak load at Mangahao is forecast to exceed the transformers' n-1 winter capacity by approximately 9 MW in 2013, increasing to approximately 20 MW in 2028 (see Table 11-9). The Mangahao generation station is connected to the 33 kV bus, and the forecast assumes that Mangahao is not generating during peak load periods.

Table 11-9: Mangahao supply transformer overload forecast

Circuit/grid exit point	Power factor	Transformer overload (MW)										
		Next 5 years						5-15 years out				
		2013	2014	2015	2016	2017	2018	2020	2022	2024	2026	2028
Mangahao	0.95	9	10	11	11	12	13	14	16	17	19	20

Solution

If Mangahao generates at 20 MW or more, this issue could be delayed beyond the forecast period. The supply transformer overload is managed operationally as Mangahao generation is usually available during peak load periods.

We will also convert the Mangahao 33 kV outdoor switchgear to an indoor switchboard within the next five years. In addition, both Mangahao supply transformers will approach their expected end-of-life within the next 5-10 years. We will discuss with Electra and Todd Energy the timing and options for these works. Future investment will be customer driven.

11.8.7 Marton low voltage

Project status/type:	This issue is for information only

Issue

The supply bus voltage at Marton is forecast to fall below 0.95 pu following an outage of a:

- Bunnythorpe–Marton–Wanganui circuit, or
- Bunnythorpe 110 kV bus section.

Marton has supply transformers with off-load tap changers.

Solution

This issue can be managed operationally by managing Taranaki generation and HVDC transfer during peak load periods.

11.8.8 Marton supply transformer capacity

Project reference:	MTN-POW_TFR-EHMT-01
Project status/type:	Possible, Base Capex
Indicative timing:	2023
Indicative cost band:	A

Two 110/33 kV transformers (rated at 20 MVA and 30 MVA) supply Marton's 33 kV load, providing:

- a total nominal installed capacity of 50 MVA, and

- n-1 capacity of 20/20 MVA[101] (summer/winter).

The peak load at Marton is forecast to exceed the transformers' n-1 winter capacity by approximately 1 MW from 2023 (see Table 11-10).

Table 11-10: Marton supply transformer overload forecast

Circuit/grid exit point	Power factor	Transformer overload (MW)										
		Next 5 years						5-15 years out				
		2013	2014	2015	2016	2017	2018	2020	2022	2024	2026	2028
Marton	0.97	0	0	0	0	0	0	0	0	1	1	1

Solution

Resolving the metering equipment limit will solve the transformers' n-1 capacity issue within the forecast period.

In addition, both Marton supply transformers will approach their expected end-of-life within the forecast period. We will discuss with Powerco the rating and timing for the replacement transformers. Future investment will be customer driven.

11.8.9 Mataroa and National Park low voltage

Project status/type:	This issue is for information only

Issue

Supply bus voltages at Mataroa and National Park are forecast to fall below 0.95 pu following an outage of a:

- Bunnythorpe–Mataroa–1 circuit, or
- Bunnythorpe 110 kV bus section.

Both grid exit points have supply transformers with off-load tap changers.

Solution

This issue can be managed operationally by constraining on generation at Arapuni.

11.8.10 Mataroa supply transformer security

Project status/type:	This issue is for information only

Issue

The load at Mataroa is supplied by a single 110/33 kV, 30 MVA supply transformer comprising three single-phase units, resulting in no n-1 security.

Solution

A spare on-site unit may be able to provide backup following a unit failure, with replacement taking 8-14 hours. However, this is an uncontracted spare, which may not be available when needed. Powerco considers the lack of n-1 security can be resolved operationally for the forecast period.

The Mataroa supply transformer is approaching its expected end-of-life within the next five years. We will discuss with Powerco the future supply options at Mataroa. Future investment will be customer driven.

[101] The transformers' capacity is limited by metering equipment, followed by an LV bushing limit (24 MWA) and a protection limit (25 MVA); with these limits resolved, the n-1 capacity will be 26/27 MVA (summer/winter).

11.8.11 National Park transmission and supply transformer security

Project status/type:	This issue is for information only

Issue

The load at National Park is supplied through a single 110 kV transmission circuit and a single 110/33 kV, 10 MVA supply transformer comprising three single-phase units, resulting in no n-1 security.

Solution

A spare on-site unit provides backup following a unit failure, with replacement taking 8-14 hours. Some load can also be backfeed through The Lines Company distribution system and they consider the lack of n-1 security can be resolved operationally for the forecast period.

The National Park supply transformer is also approaching its expected end-of-life within the next five years. We are discussing future supply options with The Lines Company to increase supply security. Future investment will be customer driven.

11.8.12 Ohakune supply security and capacity

Project reference:	OKN-POW_TFR-DEV-01
Project status/type:	Possible, customer-specific
Indicative timing:	2016, subject to agreement with The Lines Company
Indicative cost band:	A

Issue

The load at Ohakune is supplied by a single 110/11 kV, 10 MVA supply transformer comprising three single-phase units (currently with one on-site spare). This means Ohakune has no n-1 security, although the spare on-site unit provides backup following a unit failure (with replacement taking 8-14 hours).

The peak load at Ohakune is forecast to exceed the transformer's continuous capacity by approximately 2 MW in 2013. The overload will decrease when load is shifted to Tangiwai, increasing again to approximately 3 MW in 2028 (see Table 11-11).

Table 11-11: Ohakune supply transformer overload forecast

Circuit/grid exit point	Power factor	Transformer overload (MW)										
		Next 5 years						5-15 years out				
		2013	2014	2015	2016	2017	2018	2020	2022	2024	2026	2028
Ohakune	0.98	2	0	0	1	1	1	2	2	2	3	3

Solution

The local lines companies, Powerco and The Lines Company, have not requested a higher security level at Ohakune. We are discussing long-term options, which include:

- using operational measures to constrain load within the transformer's rating
- the customer using diesel generation to remain within the transformer's rating, and
- installing a higher rated transformer.

In addition, the Ohakune supply transformer is approaching its expected end-of-life within the next five years. We will discuss the timing for the replacement transformer with the local lines companies. Future investment will be customer driven.

11.8.13 Ongarue supply transformer security

Project status/type:	This issue is for information only

Issue

The load at Ongarue is supplied by a single 110/33 kV, 20 MVA supply transformer comprising three single-phase units, resulting in no n-1 security.

Solution

Most load can be backfed through The Lines Company's distribution system. The Lines Company considers the lack of n-1 security can be resolved operationally for the forecast period.

We will also convert the Ongarue 33 kV outdoor switchgear to an indoor switchboard within the next 5-10 years. Also the Ongarue supply transformer will approach its expected end-of-life towards the end of the forecast period. We will discuss with The Lines Company the timing of the switchgear conversion work and transformer replacement options. Future investment will be customer driven.

11.8.14 Tokaanu supply transformer security

Project status/type:	This issue is for information only

Issue

The load at Tokaanu is supplied by a single 220/33 kV, 20 MVA supply transformer, with a second transformer that can be manually switched into service when required. This means that Tokaanu does not have seamless n-1 security. Tripping the on-load transformer will result in a loss of supply until the other transformer is manually switched into service.

Solution

The Lines Company considers the lack of n-1 security can be resolved operationally for the forecast period. Future investment will be customer driven.

11.8.15 Waipawa low voltage

Project status/type:	This issue is for information only

Issue

Waipawa is normally supplied at 110 kV from Bunnythorpe via Dannevirke. The supply bus voltages at Waipawa are forecast to fall below 0.95 pu following an outage of a Waipawa–Dannevirke–Woodville circuit. In addition, this outage causes a step voltage change greater than 5%.

The Waipawa supply transformers and Bunnythorpe interconnecting transformers have off-load tap changers, so these transformers cannot be used to manage the voltage.

Solution

Replacing the Bunnythorpe interconnecting transformer with 150 MVA transformers with on-load tap changers (see Section11.8.1) will improve, but not eliminate the low voltage issue.

The Waipawa 110 kV disconnectors have recently been replaced with motorised disconnectors. Therefore, if low voltage occurs, the load can be quickly transferred from the Central North Island to the Hawkes Bay region.

In the longer-term, the 110/33 kV supply transformers can be replaced with transformers that have on-load tap changers. Future investment will be customer driven.

11.8.16 Waipawa supply transformer capacity and security

Project reference:	WPW-POW_TFR-EHMT-01
Project status/type:	Possible, Base Capex
Indicative timing:	2017
Indicative cost band:	A

Issue

Waipawa has loads at 33 kV and 11 kV. Two 110/33 kV transformers (rated at 20 MVA and 30 MVA) supply Waipawa's load, providing:

- a total nominal installed capacity of 50 MVA, and
- n-1 capacity of 26/26 MVA[102] (summer/winter).

The peak load at Waipawa is forecast to exceed the transformers' n-1 winter capacity by approximately 1 MW in 2017, increasing to approximately 5 MW in 2028 (see Table 11-12).

Table 11-12: Waipawa supply transformer overload forecast

Circuit/grid exit point	Power factor	Transformer overload (MW)										
		Next 5 years						5-15 years out				
		2013	2014	2015	2016	2017	2018	2020	2022	2024	2026	2028
Waipawa	0.96	0	0	0	0	1	1	2	2	3	4	5

A single 33/11 kV, 10 MVA transformer supplies Waipawa's 11 kV load, resulting in no n-1 security.

Solution

Resolving the 110/33 kV transformers' metering and protection limits will delay the transformers' capacity issue for a few years. We will discuss with Centralines the future supply options for Waipawa.

Centralines considers the lack of n-1 security for Waipawa's 11 kV load can be resolved operationally within the forecast period. Future investment will be customer driven.

11.8.17 Woodville supply transformer capacity

Project reference:	WDV-POW_TFR-EHMT-01
Project status/type:	Possible, Base Capex
Indicative timing:	2023
Indicative cost band:	A

Two 110/11 kV transformers supply Woodville's 11 kV load, providing:

- a total nominal installed capacity of 20 MVA, and
- n-1 capacity of 5/5 MVA[103] (summer/winter).

[102] The transformers' capacity is limited by a metering limit, followed by protection and transformer bushing (27 MVA) limits; with these limits resolved, the n-1 capacity will be 29/30 MVA (summer/winter).

The peak load at Woodville is forecast to exceed the transformers' n-1 winter capacity by approximately 1 MW from 2023 (see Table 11-13).

Table 11-13: Woodville supply transformer overload forecast

Circuit/grid exit point	Power factor	Transformer overload (MW)										
		Next 5 years						5-15 years out				
		2013	2014	2015	2016	2017	2018	2020	2022	2024	2026	2028
Woodville	0.98	0	0	0	0	0	0	0	0	1	1	1

Solution

Resolving the metering equipment limit will solve the transformers' n-1 capacity issue within the forecast period.

11.9 Central North Island bus supply security

The 2013 APR has been expanded to include issues arising from the outage of a single bus section rated at 50 kV and above for the next 15 years.

Bus outages disconnect more than one power system component (for example, other circuits, transformers, reactive support or generators). Therefore, bus outages may cause greater issues than a single circuit or transformer outage (although the risk of a bus fault is low, being less common than a circuit or transformer outage).

11.9.1 Transmission bus security

Table 11-14 lists bus outages that cause voltage issues or a total loss of supply. Generators are included only if a bus outage disconnects the whole generation station or causes a widespread system impact. Supply bus outages, typically 11 kV and 33 kV, are not listed.

Table 11-14: Transmission bus outages

Transmission bus outage	Loss of supply	Generation disconnection	Transmission issue	Further information
Aratiatia 220 kV		Aratiatia		
Bunnythorpe 110 kV			Bunnythorpe–Woodville overloading	See note 1
Bunnythorpe 220 kV			Bunnythorpe–Woodville overloading	See Note 2
			Regional low voltage	11.9.2
Mangamaire 110 kV	Mangamaire			
Mataroa 110 kV	Mataroa			
Nga Awa Purua 220 kV		Nga Awa Purua		See note 3
		Ngatamariki		See note 3
Ohakune 110 kV	Ohakune			
Ongarue 110 kV	Ongarue			
Rangipo 220 kV		Rangipo		
Tokaanu 220 kV	Tokaanu			
Wanganui 110 kV	Marton			See note 4
Woodville 110 kV	Dannevirke			See note 5

103 The transformers' capacity is limited by metering equipment; with this limit resolved, the n-1 capacity will be 13/14 MVA (summer/winter).

Transmission bus outage	Loss of supply	Generation disconnection	Transmission issue	Further information
	Waipawa			See note 5
	Woodville			
		Te Apiti		
Wairakei 220 kV		Aratiatia		See note 6
		Wairakei		See note 7

1. An outage of a Bunnythorpe 110 kV bus section will also disconnect a Bunnythorpe–Woodville circuit, which may overload the remaining circuit. A special protection scheme at Woodville will operate to remove the overload (see Section 11.8.3). The bus outage may also cause the supply bus voltage at Waipawa to fall below 0.95 pu. See Section 11.8.15 for options to address the low voltage at Waipawa.
2. An outage of a Bunnythorpe 220 kV bus section disconnects circuits to Haywards. This may cause both Bunnythorpe–Woodville circuits to overload, which is not prevented by the special protection scheme at Woodville (see Section 11.8.3).
3. Nga Awa Purua has a single bus, with a single connection to Ngatamariki. A bus outage at Nga Awa Purua will disconnect all generation at Nga Awa Purua and Ngatamariki.
4. Marton is supplied from the Bunnythorpe–Marton–Wanganui circuits. Because there is no bus zone protection at Wanganui (in the Taranaki region), a fault on the Wanganui 110 kV bus will disconnect both circuits, causing a loss of supply at Marton.
5. Dannevirke and Waipawa are normally supplied via the Waipawa–Dannevirke–Woodville circuits as a spur from Woodville. An outage of the Woodville 110 kV bus disconnects both circuits, causing a loss of supply.
6. Aratiatia is connected to Wairakei through a single circuit. A Wairakei bus outage that disconnects this circuit disconnects the Aratiatia generation station.
7. Following the commissioning of the Wairakei–Whakamaru–C line. A Wairakei bus outage will disconnect the Wairakei generation station.

The customers (Mighty River Power, Scanpower, Powerco, The Lines Company, or Centralines) have not requested a higher security level. If increased bus security is required, the options typically include bus reconfiguration and/or additional bus circuit breakers. Future investment is likely to be customer driven.

11.9.2 Central North Island region low voltage

Project reference:	BPE_BUSC–EHMT-01
Project status/type:	Possible, Base Capex
Indicative timing:	To be advised
Indicative cost band:	To be advised

Issue

Many of the supply transformers and the Bunnythorpe interconnecting transformers have off-load tap changers, so cannot be used to manage voltage. During periods of high Wellington load and low local generation, the supply bus voltages in the region are forecast to fall below 0.95 pu following an outage of the Bunnythorpe 220 kV bus section that disconnects the:

- 220 kV Bunnythorpe–Brunswick–1 circuit
- 220 kV Bunnythorpe–Haywards–2 circuit
- 220 kV Bunnythorpe–Linton–1 circuit
- 220 kV Bunnythorpe–Tokaanu–2 circuit
- 220/110 kV Bunnythorpe–T3 interconnecting transformer, and
- 220/33 kV Bunnythorpe–T10 supply transformer.

The low supply bus voltages may occur at Waipawa, Marton and/or Wanganui (in the Taranaki region), depending on system conditions.

In addition, the step voltage change for this outage will exceed 5% at some grid exit points.

Solution

Replacing the Bunnythorpe interconnecting transformer with 150 MVA transformers with on-load tap changers (see Section 11.8.1) will improve the supply bus voltages, but will also lower 220 kV voltages, which in turn restricts power transfer between Bunnythorpe and Wellington.

Rearranging the bus connections at Bunnythorpe and/or installing a fourth 220 kV bus coupler will provide n-1 bus security.

11.10 Other regional items of interest

There are no other items of interest identified to date beyond those in Section 11.8 and Section 11.9. See Section 11.11 for specific generation scenarios, proposals and opportunities relevant to this region.

11.11 Central North Island generation scenarios, proposals and opportunities

This section details relevant regional issues for selected generation proposals under investigation by developers and in the public domain, or other generation opportunities. The impact of committed generation projects on the grid backbone is dealt with separately in Chapter 6.

The maximum generation that can be connected depends on several factors and usually falls within a range. Generation developers should consult with us at an early stage of their investigations to discuss connection issues.

11.11.1 Impact of generation scenarios on regional plan

The generation scenarios (see Chapter 5) represent a series of possible future generation outcomes. This section presents only those scenarios relevant to this region for the next 15 years.

All of the generation scenarios anticipate substantial new geothermal generation in the next 5-10 years in the Wairakei ring area. See Section 11.11.2 for information about the opportunities for generation in the area.

Generation scenarios 1 to 4 anticipate substantial new wind generation connected at or near Linton. See section 11.11.4 for information about the opportunities for generation in the area.

Generation scenarios 1, 2 and 4 anticipate renewable generation connected in the central plateau region between Tangiwai and Rangipo. See Chapter 6, Section 6.4.5 for information about the opportunities for generation in the area.

None of the generation scenarios anticipates generation connected to the Central North Island 110 kV network but do anticipate generation in the 110 kV networks of the Wellington, Waikato and Taranaki regions. This generation may reduce the loading on the Bunnythorpe interconnecting transformers depending on the load and generation patterns.

11.11.2 Additional geothermal generation

There are a number of recently or soon-to-be commissioned geothermal generation developments in the region connecting into or near the Wairakei Ring. We are replacing the existing Wairakei–Poihipi–Whakamaru–1 circuit with a new overhead double-circuit line between Wairakei and Whakamaru. This will increase the power flow capacity through the Wairakei Ring (see Chapter 6, Section 6.4.3, for more information).

11.11.3 Tauhara geothermal station

Tauhara will connect into a 220 kV circuit from Wairakei to the Hawkes Bay region. Maungaharuru wind generation station, and Hawke's Bay wind stations) in the Hawkes Bay region will also connect to the same circuit (see Chapter 13, Section 13.11.3), which has enough capacity for the two generation connections.

There is potential for further geothermal generation development in the Tauhara area, as well as further wind and hydro generation development in the Hawkes Bay area. This additional potential generation will require Tauhara to be connected to both 220 kV circuits from Wairakei to the Hawkes Bay region, and a thermal upgrade of the circuits between Wairakei and Tauhara.

11.11.4 Additional wind generation connection to the 220 kV circuits between Bunnythorpe and Wellington

There are several investigations and proposals for wind station connections to the 220 kV double-circuit line between Bunnythorpe, Linton, and Wellington, which could occur at Linton or at new connection points along the line.

This is a high-capacity line and the effect of some additional generation on transmission capacity between Bunnythorpe and Wellington will be a small net percentage increase or decrease in transfer capacity, depending on the direction of power flow. A total of approximately 830 MW maximum generation injection into both the Bunnythorpe–Tararua Wind Central–Linton and Bunnythorpe–Linton 220 kV circuits will not cause system issues.

The wind generation resource under investigation is so large, however, that it is unlikely to be economical to connect it all to these 220 kV circuits because of transmission constraints.

11.11.5 Additional generation connected to the 110 kV buses

There are several possible wind generation sites close to the 110 kV transmission circuits that run from Mangamaire to Woodville, Dannevirke, and Waipawa. The capacity on the existing 110 kV Masterton–Mangamaire–Woodville and Bunnythorpe–Woodville circuits enables the connection of approximately 80 MW of additional generation, depending on where the generation is connected. Higher levels of generation may require occasional generation constraints or incremental and/or major system upgrades (including new lines).

11.11.6 Puketoi ranges

There are several prospective wind generation sites in the Puketoi ranges, with a combined capacity of many hundreds of megawatts. The closest network is the 110 kV transmission network (see Section 11.11.5), which is not nearby. If wind generation is developed in this area, then a single new transmission line may possibly connect all this wind generation to the National Grid at Bunnythorpe.

Generation from the Puketoi ranges can also connect along the 220 kV double-circuit line from Bunnythorpe to Wellington. However, care is required to ensure that the total generation from the Puketoi ranges, plus other generation along the 220 kV Bunnythorpe–Wellington line, does not become too high (see Section 11.11.4). It is also possible that some of the 110 kV lines may be rationalised as part of this work.

APPENDIX C – TRANSPOWER ACRE PROCESS

THE ACRE MODEL: A Site and Route Selection Tool

Summary Guide

17th November 2011

Keeping the energy flowing




TRANSPOWER

Transpower New Zealand Limited The National Grid

THE ACRE MODEL
A Site and Route Selection Tool

Transpower has developed the ACRE model to identify and secure the most suitable location for new and replacement transmission infrastructure (such as lines, substations and switching stations).

The ACRE process encourages integration across disciplines (eg engineering, environment and property) and utilises principles designed to be adapted to suit individual projects, commensurate with scale and complexity.

1.1 Why use ACRE?

The ACRE model provides a robust and consistent method for locating transmission assets that ensures the selection of sites and routes for new or replacement transmission assets will:

1. **Meet statutory requirements under the Resource Management Act 1991:**
   - ***National Policy Statement on Electricity Transmission***– requiring Transpower to manage the adverse environmental effects of its network, including minimising adverse effects on various sensitive areas/activities and utilising route site and method selection to avoid, remedy or mitigated adverse effects;
   - ***Designations and Consents*** **-** for designations, this principally centres around the section 171(1)(b) requirement to demonstrate adequate consideration of alternative sites, routes and methods. For the resource consent process this relates to matters included under Schedule 4;
2. **Meet statutory tests under the Public Works Act 1981:**
   - The ability to demonstrate a robust assessment of alternative sites, routes, or other methods is important in the event that compulsory acquisition of land is required. Specifically, where a compulsory acquisition process has been initiated **and** an objection to the Notice of intention to take land has been lodged with the Environment Court, section 24(7)(b) of that Act requires the Court to enquire into the adequacy of the consideration given to alternative sites, routes, or other methods of achieving the objectives of the work.
3. **Minimise difficulties gaining approvals** - Reduce difficulties during the consenting and designation processes, the construction period and in the longer term due to the robust assessment of the advantages and disadvantages of alternatives and to identify the most suitable site for Transpower, the customer and the local community.
4. **Deliver good environmental outcomes** - Achieve good, publicly demonstrable environmental outcomes, leading to more positive relationships with local authorities and communities.
5. **Facilitate integrated decision making** - Allow the different disciplines – engineering, property and environment to work together in a clear series of steps that enables the team to come to an informed decision taking in account all the competing requirements and issues;
6. **Ensure transparency** – demonstrates how decisions were made and factors taken into account in choosing sites and routes – vital when preparing for Council and Environment Court proceedings.

ACRE was originally developed and adopted by Transpower to apply to the North Island Grid Upgrade Project. Thus the acronym:

Area, ***C***orridor, ***R***oute, ***E***asement

refers specifically to the process to determine the location of the proposed 220kV/400kV transmission line. However the principles can be applied equally to the locating of non linear transmission assets.

1.2 What is ACRE?

The ACRE model is a decision-making tool that involves progressively detailed investigation and filtering of information to identify, select and confirm a final location for transmission assets. ACRE ensures that information from the relevant disciplines (engineering, environmental planning and property) is integrated and coordinated in order to achieve the most appropriate outcome.

ACRE ensures that information from the relevant disciplines (engineering, environmental planning and property) is integrated and coordinated to achieve the most appropriate outcome.

The process starts with the broadest feasible area and systematically and progressively narrows the area of interest down to a single preferred site/route through increasingly detailed information collection and analysis of potential effects at each stage.

The ACRE process systematically documents key considerations in the selection of a site/route. It takes into account local constraints and conditions to identify issues that will affect the successful completion of a project.

The process requires high level risks to the project to be highlighted at the end of each section of work. These risks can then be further investigated, reported and fed into decision-making for the project as required.

1.3 When should the ACRE model be used?

The ACRE model should be used for the following situations:	
1. Proposed new transmission lines and structures not located within an existing designation already secured for that purpose;	✓
2. Relocation of existing transmission lines;	✓
3. Proposed new substations and switching stations.	✓
Activities not addressed by the ACRE process are:	
1. Minor relocation of one or two transmission towers	✗
2. Upgrading of existing assets not involving the relocation of lines or switchyard assets.	✗

1.4 Pre ACRE Requirements

To enable the initiation of the ACRE process, the following steps need to be completed first:

1. The establishment of a project team and of a project plan. The project plan should identify relevant Transpower policies on matters such as consultation and communication, and specify clear accountabilities, outcomes and time frames.
2. A high level scoping of the scale and complexity of the project.

To provide a robust platform for the ACRE process and enable inadequacies to be addressed appropriately, before they adversely affect site/route selection and the environmental approvals process, the following critical engineering information is also required:

1. **Justification for works** - This is particularly important where a designation is to be sought, as the RMA requires Transpower, as the requiring authority, to establish that the work and designation is 'reasonably necessary';

2. **Confirmation of what consideration of engineering options/alternatives has occurred -** This is necessary to help fulfil Transpower's obligations under the Resource Management Act 1991(RMA) to consider alternative methods (applicable to both consent and designation processes);

3. **System/engineering constraints defining the area in which the new infrastructure could feasibly be located** - to define the study area within which to assess constraints and search for preferred sites/routes. While geographical and environmental issues influence study area boundaries, the area is primarily defined by system and engineering matters, thus ACRE cannot begin without this data.

1.5 Key process stages

While the ACRE model provides a set of generic principles and outcomes, the application of the process requires tailoring commensurate to the scale and complexity of the particular project. Aspects such as extent of consultation and the level of detail and scale of asset location options analysis will vary.

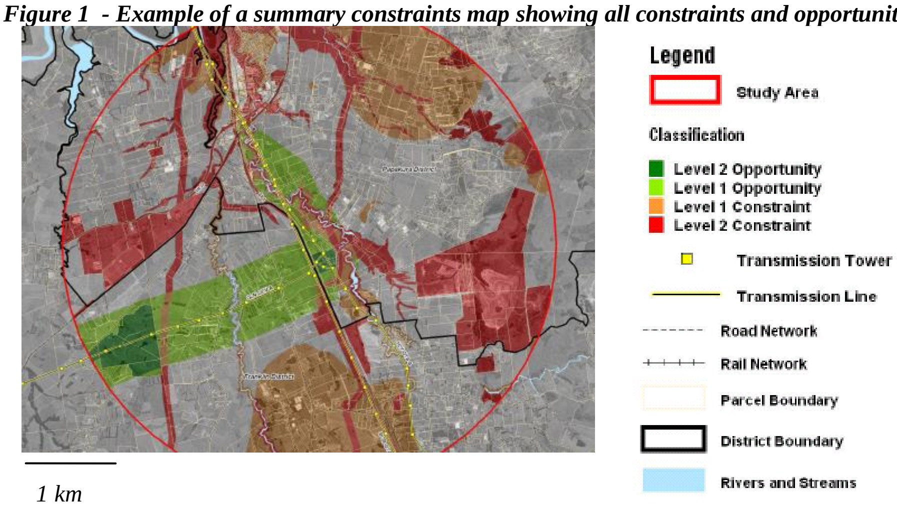
ACRE provides a set of generic principles and required outcomes that can be tailored in their application to suit individual projects, commensurate to their scale and complexity.

The generic project stages are briefly outlined below:

Stage 1 (A) - Constraints Analysis/ Area report

This stage is primarily a desk-top information gathering exercise. At a macro level, generally available information is gathered and mapped on a comparable basis. Within the study area, sub areas unsuitable for locating transmission assets are identified, along with 'areas of least constraint' and/or 'areas of opportunity' for potentially locating transmission infrastructure. These areas provide the focus for more detailed investigations. Stakeholder engagement will be minimal at this stage, and primarily focused on communication rather than consultation.

Figure 1 - Example of a summary constraints map showing all constraints and opportunities



Stage 2 (C/R/E) – Confirming the preferred location for the proposed transmission asset

This stage involves more detailed information gathering, filtering and analysis of the areas of least constraint (identified in Stage 1), and the identification and assessment of the available alternatives for locating an asset and confirmation of a preferred site/route for the asset.

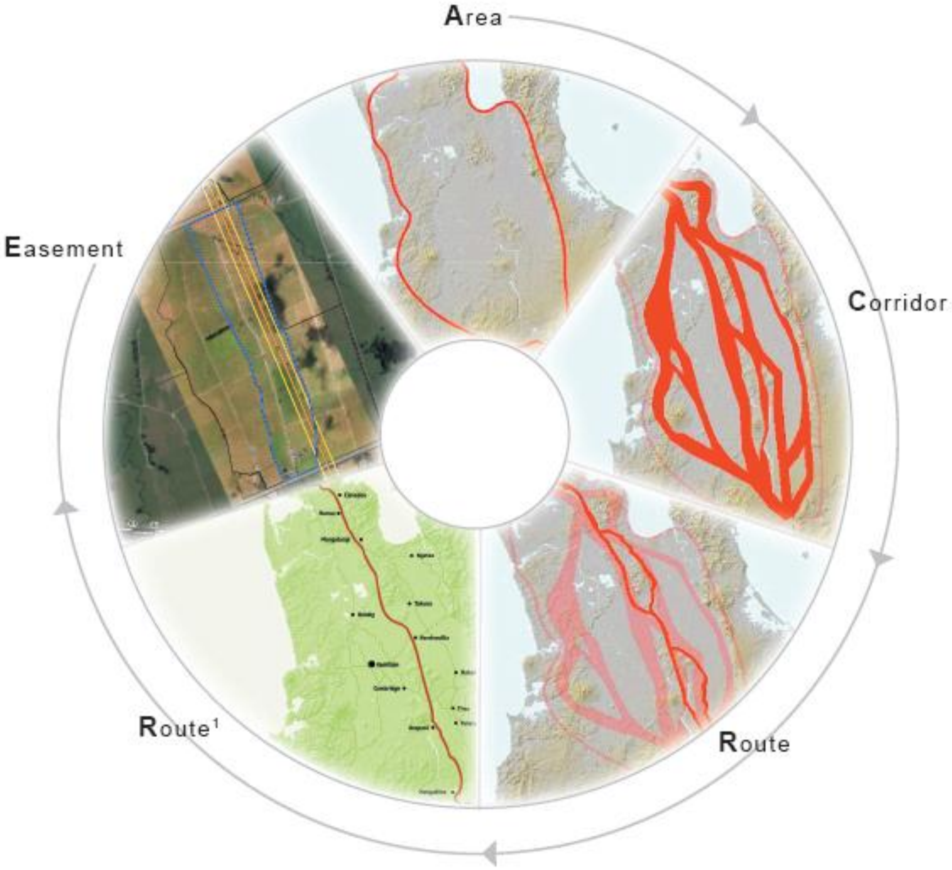
The level of analysis involved in this process could vary significantly from project to project depending on the size of the study area and the availability of areas of least constraint available within it. Subsequently, this stage may or may not require 'sub stages', entailing the evaluation and ranking of:

- alternative transmission corridors within the study area (for linear assets); and/or
- alternative route options within wider corridors; and/or
- alternative locations within the study area (for non linear assets); and/or
- alternative site options within locations.

This process will require significant coordinated input from the engineering, property and environmental workstreams to come up with a preferred site/route.

A carefully planned stakeholder engagement strategy will be required for these phase and the assessment of alternatives is likely to involve significant consultation with potentially affected parties.

ACRE site and route selection process – mapping example



Stage 3 - Statutory Processes

This stage involves:

1. Ongoing consultation and communication with stakeholders
2. Engineering detailed design to support consenting and property processes
3. The preparation of all documentation (Notices of Requirement, consenting applications and other supporting information) for lodgement with Councils based on the outputs of the proceeding stages;
4. Statutory processing of Notice of Requirement and consent applications
5. Council Hearings
6. Environment Court appeal process and mediation (if necessary)
7. Confirmation of the designation and gaining of all consents (eg ancillary district, regional consents).
8. Property negotiations to secure appropriate property rights
9. Compulsory acquisition under the Public Works Act 1981 (if necessary)

Activity	Indicative Timeframe
▸ **ACRE Stage 1** Constraints Analysis	▸ 2-4 months
▸ **ACRE Stage 2** – Confirming the preferred location for the proposed transmission asset	▸ 5 – 10 months
▸ **ACRE Stage 3** - Statutory Processes ▸ (processing of Notice of Requirement and consent applications by council)	▸ 7 months *minimum* (timeframes can be doubled by the territorial authority)
▸ Resolution of Appeals (either out of court or via court process)	▸ 5 – 18 months
▸ Compulsory Acquisition process	▸ 18 months plus
For more information contact Transpower's Environment Group	