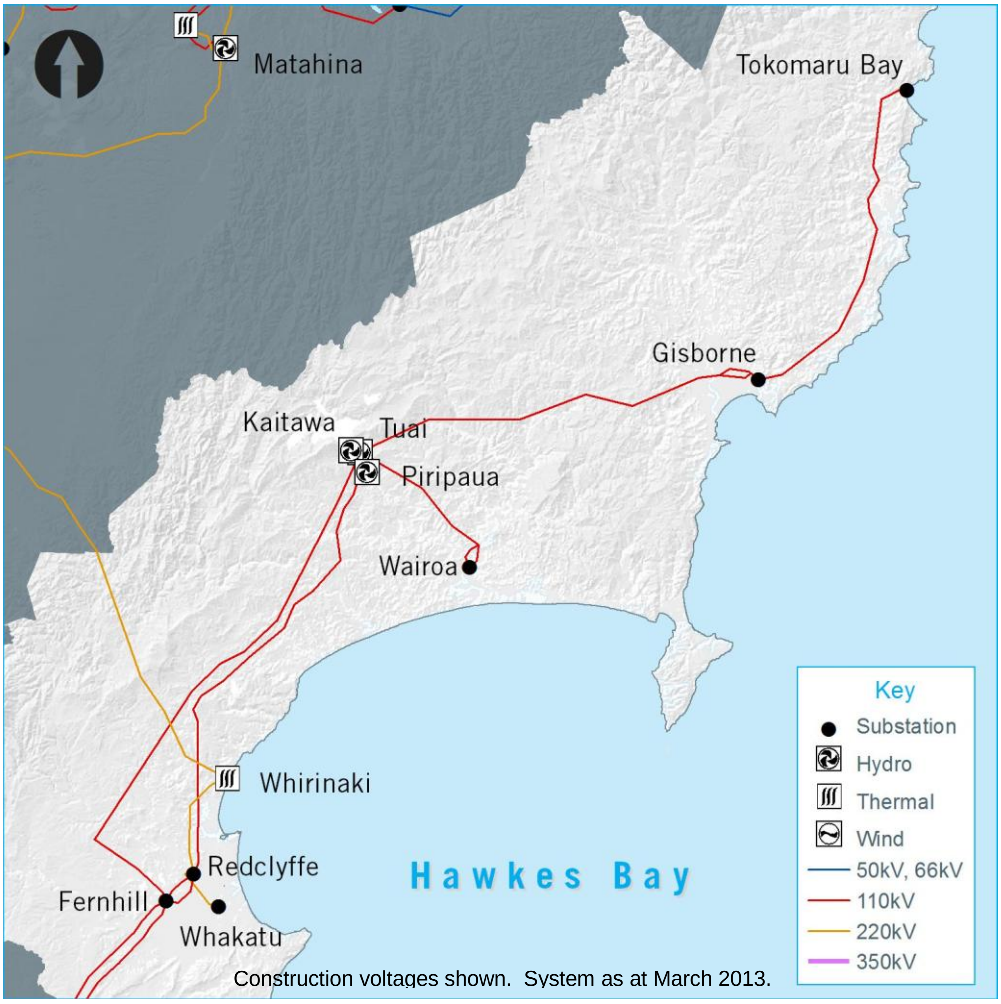
13 Hawke's Bay Regional Plan

13.1 Regional overview

This chapter details the Hawke's Bay 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 13-1: Hawke's Bay region



The Hawke's Bay region load includes a mix of significant provincial cities (Napier, Hastings and Gisborne), heavy industry (the Panpac Mill), and smaller towns (Wairoa and Havelock North).

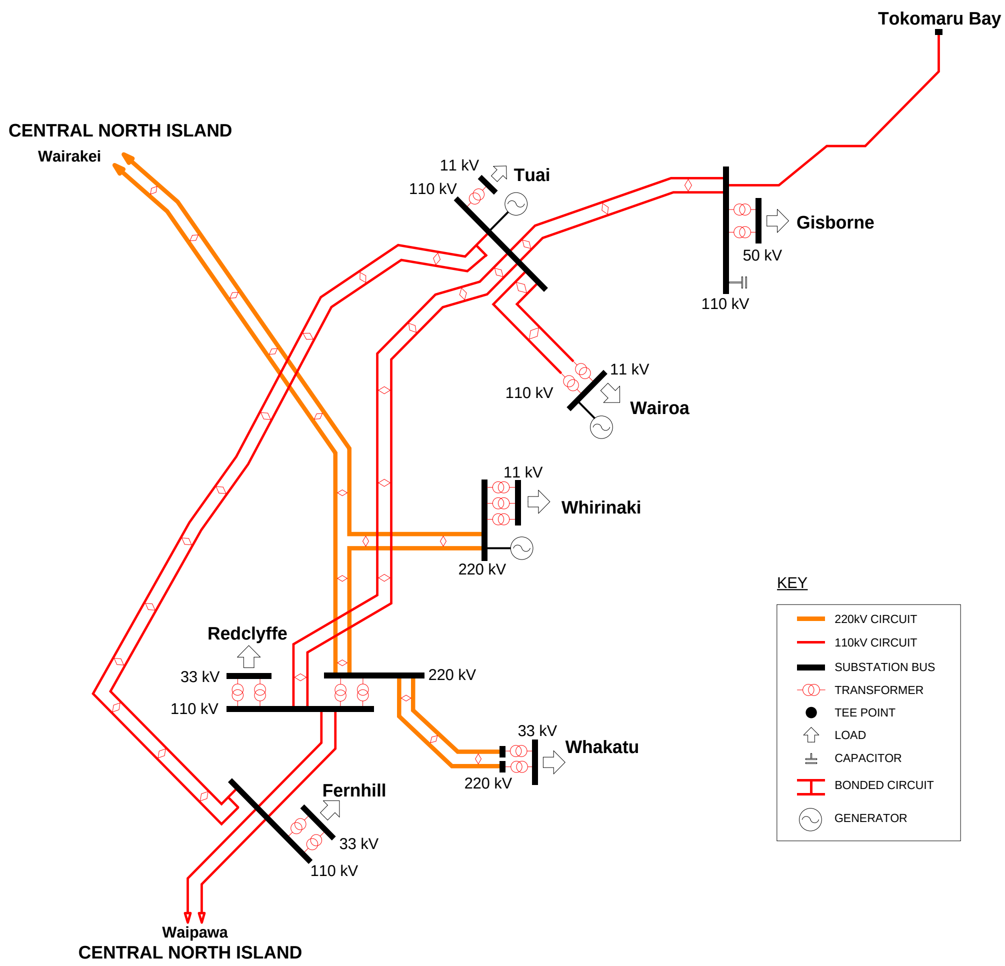
We have assessed the Hawke's Bay region's transmission needs over the next 15 years while considering longer-term development opportunities. Specifically, the transmission network needs to be flexible to respond to a range of future service and technology possibilities, taking into consideration:

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

13.2 Hawke's Bay transmission system

This section highlights the state of the Hawke's Bay regional transmission network. The existing transmission network is set out geographically in Figure 13-1 and schematically in Figure 13-2.

Figure 13-2: Hawke's Bay transmission schematic



13.2.1 Transmission into the region

Transmission into the Hawke's Bay region is via two 220 kV circuits from Wairakei that supply the Whirinaki and Whakatu loads directly, and via two 220/110 kV interconnecting transformers at Redclyffe.

Two 110 kV circuits also connect Fernhill to Waipawa in the south and are normally open at Waipawa.

13.2.2 Transmission within the region

220/110 kV interconnection

The majority of the region's load is supplied via the 220/110 kV transformers at Redclyffe. The transformer capacity may need to be increased as load grows, and/or new generation is connected to the 110 kV transmission network.

110 kV circuits

Transmission within the region is predominantly at 110 kV. The two circuits supplying Gisborne may require a rating increase within the forecast period. For new generation or load connections that exceed the current forecasts in this APR, some 110 kV lines may require capacity upgrades.

13.2.3 Longer-term development path

The two 220 kV circuits from Wairakei are expected to be adequate for the next 30-40 years of regional load growth. Additional reactive support will be required over this period, and the region will be on n security whenever one circuit is out of service for maintenance.

The two 220 kV circuits may need to be thermally upgraded to export power from the region during low load periods if there is a large increase in new generation. A new 220 kV line from the Bunnythorpe area to the Hawke's Bay region may also be considered if an increase in security is required.

We expect the development of new generation in the Hawke's Bay region to drive the need for system upgrades.

13.3 Hawke's Bay demand

The after diversity maximum demand (ADMD) for the Hawkes Bay region is forecast to grow on average by 0.9% annually over the next 15 years, from 320 MW in 2013 to 364 MW by 2028. This is lower than the national average demand growth of 1.5% annually.

Figure 13-3 shows a comparison of the 2012 and 2013 APR forecast 15-year maximum demand (after diversity[115]) for the Hawke's Bay 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.

[115] 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 13-3: Hawke's Bay region after diversity maximum demand forecast

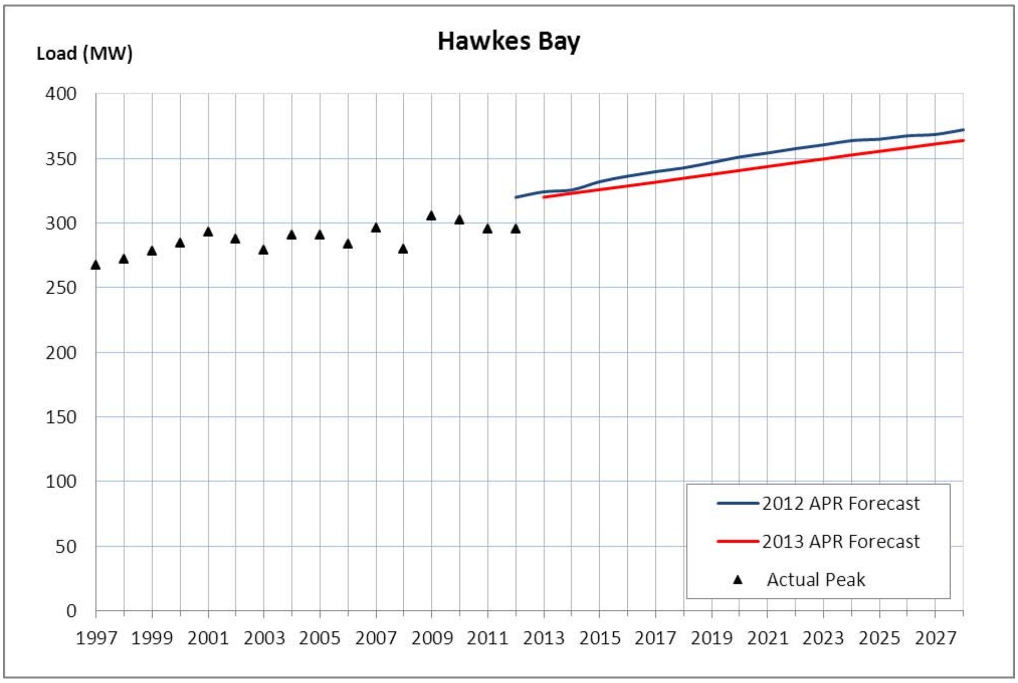


Table 13-1 lists forecast peak demand (prudent growth) at each grid exit point for the forecast period, as required for the Grid Reliability Report.

Table 13-1: Forecast annual peak demand (MW) at Hawke's Bay 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
Fernhill	0.96	56	57	58	58	59	60	62	64	66	68	70
Gisborne	0.98	50	52	53	54	55	57	60	63	66	68	71
Redclyffe	0.97	78	79	80	81	83	84	86	89	91	93	96
Tuai	0.97	1	1	1	1	1	1	1	1	1	1	1
Wairoa	0.95	10	10	11	11	11	11	12	12	13	13	14
Whirinaki	1.00	84	84	84	84	84	84	84	84	84	84	84
Whakatu	0.97	99	100	101	103	105	106	109	113	116	119	123

13.4 Hawke's Bay generation

The Hawke's Bay region's generation capacity is 325 MW. This includes the 155 MW diesel-fired Whirinaki peaker plant, which was acquired by Contact Energy in late 2011, and will now be operated more flexibly without the previous regulated conditions.

Generation from Tuai, Kaitawa, and Piripaua hydro generation stations are collectively referred to as the Waikaremoana Hydro Scheme, and connect to the Tuai 110 kV bus.

Embedded within the Wairoa distribution system are two 2.5 MW Waihi generators. During periods of low load, Wairoa can export up to 1 MW into the 110 kV transmission network. Trustpower is constructing a new 3.8 MW hydro generator in the Esk Valley with commissioning due in June 2013.

Table 13-2 lists the generation forecast at 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 (Unison or Eastland Networks).[116]

Table 13-2: Forecast annual generation capacity (MW) at Hawke's Bay 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
Gisborne[1]	4	4	4	4	4	4	4	4	4	4	4
Gisborne (Matawai)	2	2	2	2	2	2	2	2	2	2	2
Kaitawa	36	36	36	36	36	36	36	36	36	36	36
Piripaua	42	42	42	42	42	42	42	42	42	42	42
Redclyffe (Ravensdown)	8	8	8	8	8	8	8	8	8	8	8
Tuai	60	60	60	60	60	60	60	60	60	60	60
Wairoa (Waihi)	5	5	5	5	5	5	5	5	5	5	5
Whirinaki	155	155	155	155	155	155	155	155	155	155	155
Whirinaki (Pan Pac)	13	13	13	13	13	13	13	13	13	13	13

1. Mobile diesel units are situated in the Gisborne and Tokomaru Bay areas.

13.5 Hawke's Bay 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 13-3 lists the significant maintenance-related work[117] proposed for the Hawke's Bay region for the next 15 years that may significantly impact related system issues or connected parties.

Table 13-3: Proposed significant maintenance work

Description	Tentative year	Related system issues
Fernhill supply transformers expected end-of-life, and 33 kV outdoor to indoor conversion	2018-2020 2013-2015	The forecast load at Fernhill already exceeds the transformers' n-1 winter capacity. See Section 13.8.5 for more information.
Redclyffe outdoor to indoor conversion	2012-2014	No system issues are identified within the forecast period.
Tuai supply transformer expected end-of-life	2013-2015	There is no n-1 security at Tuai. Future investment will be customer driven. See Section 13.8.9 for more information.
Wairoa supply transformers expected end-of-life	2015-2017	The forecast load at Wairoa may exceed the transformers' n-1 summer capacity for a low load power factor. See 13.8.10 for more information.
Whakatu 33 kV outdoor to indoor conversion	2012-2014	An outdoor to indoor conversion project is underway.
Whirinaki 11 kV Bus B and C switchboard replacement	2023-2025	No system issues are identified within the forecast period.

[116] Only generators with a capacity greater than 1 MW are listed. Generation capacity is rounded to the nearest megawatt.
[117] This may include replacement of the asset due to its condition assessment.

13.6 Future Hawke's Bay projects summary and transmission configuration

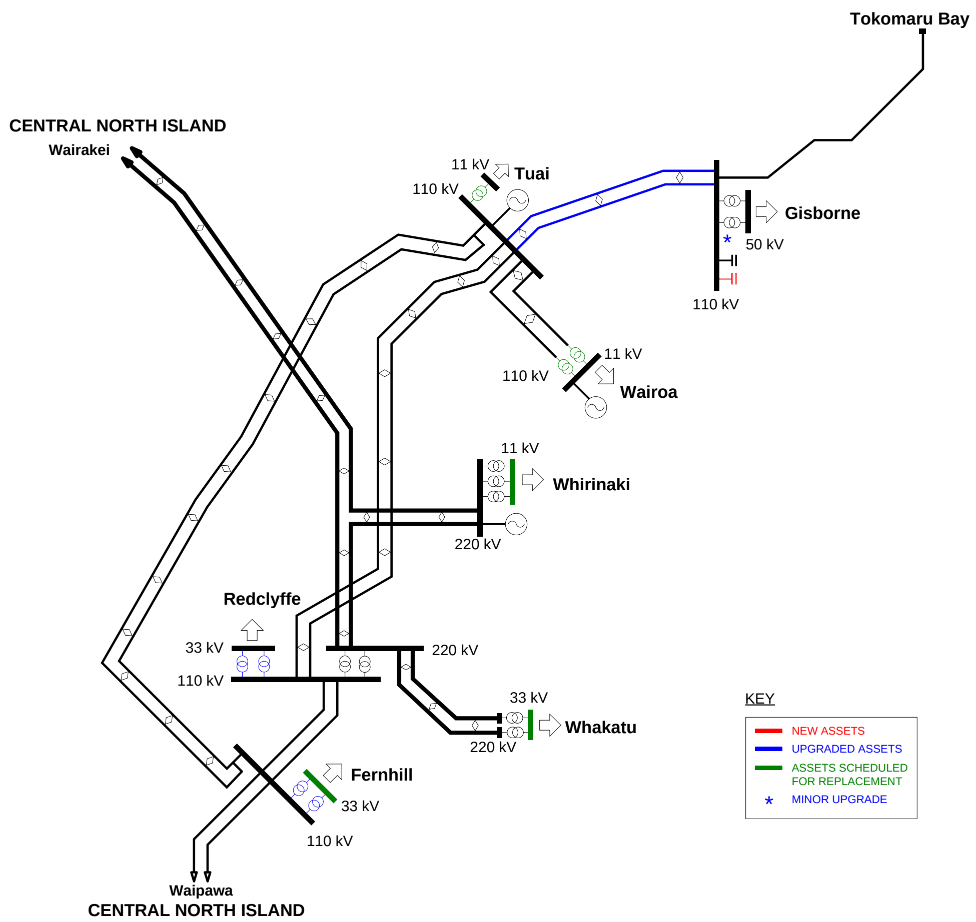
Table 13-4 lists the projects to be carried out in the Hawke's Bay region within the next 15 years.

Figure 13-4 shows the possible configuration of Hawke's Bay transmission in 2028, with new assets, upgraded assets, and assets undergoing significant maintenance within the forecast period.

Table 13-4: Projects in the Hawkes Bay region up to 2028

Circuit/site	Projects	Status
Fernhill	Replace the supply transformers. Convert the 33 kV outdoor switchgear to an indoor switchboard.	Possible Proposed
Gisborne–Tuai	Upgrade the Gisborne–Tuai conductor capacity.	Possible
Gisborne	Recalibrate the supply transformers' metering parameters. Install a new 110 kV capacitor bank.	Possible Possible
Redclyffe	Replace the supply transformers with two 120 MVA units.	Committed
Tuai	Replace the supply transformer.	Proposed
Wairoa	Replace the supply transformers.	Proposed
Whakatu	Convert the 33 kV outdoor switchgear to an indoor switchboard.	Committed
Whirinaki	Replace the 11 kV Bus B and C switchboards.	Proposed

Figure 13-4: Possible Hawke's Bay transmission configuration in 2028



13.7 Changes since the 2012 Annual Planning Report

Table 13-5 lists the specific issues that are either new or no longer relevant within the forecast period when compared to last year's report.

Table 13-5: Changes since 2012

Issues	Change
No new issues or projects completed since 2012	No change

13.8 Hawke's Bay transmission capability

Table 13-6 summarises the issues involving the Hawke's Bay region for the next 15 years. For more information about a particular issue, refer to the listed section number.

Table 13-6: Hawke's Bay region transmission issues

Section number	Issue
Regional	
13.8.1	Hawke's Bay voltage quality
13.8.2	Fernhill–Redclyffe 110 kV transmission capacity
13.8.3	Redclyffe–Tuai 110 kV transmission capacity
13.8.4	Redclyffe interconnecting transformer capacity
Site by grid exit point	
13.8.5	Fernhill supply transformer capacity
13.8.6	Gisborne 110 kV voltage quality
13.8.7	Gisborne supply capacity
13.8.8	Redclyffe supply transformer capacity
13.8.9	Tuai supply security
13.8.10	Wairoa supply transformer capacity
13.8.11	Whakatu supply transformer capacity
Bus security	
13.9.1	Transmission bus security

13.8.1 Hawke's Bay voltage quality

Project status/type:	This issue is for information only

Issue

The Hawke's Bay transmission network is primarily supplied from the 220 kV Redclyffe bus, which is in turn supplied from the grid backbone by two 220 kV circuits from Wairakei. The 138 MW Waikaremoana hydro scheme connects to the 110 kV network, which also supplies the region's load.

The loss of a 220 kV circuit at high load and minimal Waikaremoana generation can result in low voltages at the:

- 110 kV bus at Gisborne, and the issue progressively arises at other high voltage buses as load increases, and
- supply buses at Fernhill and Redclyffe, which do not have on-load tap changers.

Solution

The low voltage risk is managed operationally by constraining-on generators at Waikaremoana so that the generators' reactive support is available. As the Hawke's Bay load increases, a 220 kV circuit outage will require more Waikaremoana generators to be in service for reactive support.

There is a project underway to replace the Redclyffe supply transformers, which will have on-load tap changers. We are also in discussions with Unison about the supply transformer replacement at Fernhill.[118] Replacement transformers with on-load tap changers will resolve low voltages on the Fernhill and Redclyffe supply buses.

We consider the issue can be resolved operationally within the forecast period.

13.8.2 Fernhill–Redclyffe 110 kV transmission capacity

Project status/type:	This issue is for information only

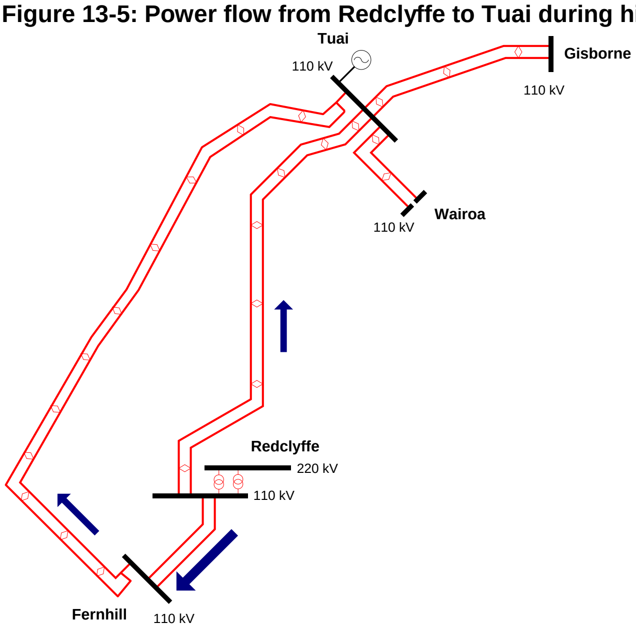
Issue

There are two 110 kV Fernhill–Redclyffe circuits, each rated at 51/62 MVA (summer/winter). During periods of high load and low Tuai generation, power flows from Redclyffe to Tuai via the 110 kV:

- Redclyffe–Tuai circuits, and
- Fernhill–Redclyffe circuits and Fernhill–Tuai circuit (as per the blue load arrows in Figure 13-5).

In these situations, an outage of one Fernhill–Redclyffe circuit can overload the other circuit.

Figure 13-5: Power flow from Redclyffe to Tuai during high load and low Tuai generation



Solution

Options to relieve a remaining Fernhill–Redclyffe circuit from overloading include the following:

- Constraining-on the Waikaremoana hydro generation with a minimum value that controls the Fernhill–Redclyffe circuit power flows. Minimum generation for the

[118] The supply transformers at Fernhill and Redclyffe have an expected end-of-life within the next 10 years and are scheduled for replacement within the next 5-10 years.

2013 winter peak is approximately 13 MW, increasing to approximately 45 MW in 2028.

- Unbonding the 110 kV Fernhill–Tuai circuits. This increases the impedance of the Redclyffe–Fernhill–Tuai path and reduces the power flow through the Fernhill–Redclyffe circuits. This option does not eliminate the requirement to constrain-on Waikaremoana generation but does reduce the level of minimum generation.

An investigation showed that unbonding the Fernhill–Tuai circuit is not economically viable. The estimated generation and demand growth in the region shows that this option is more likely to have an economic benefit beyond the forecast period.

Future investment will be customer driven.

13.8.3 Redclyffe–Tuai 110 kV transmission capacity

Project status/type:	This issue is for information only

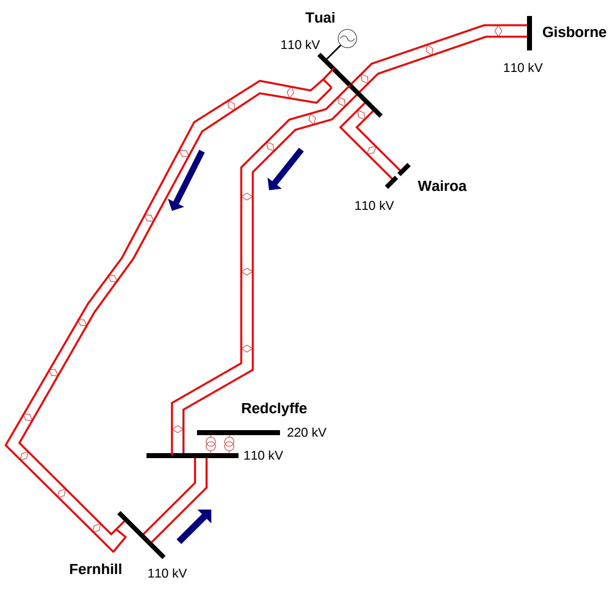
Issue

There are two 110kV Redclyffe–Tuai circuits, each rated at 57/70 MVA (summer/winter). During periods of low load and high Tuai generation, power flows from Tuai to Redclyffe (as per the blue load arrows in Figure 13-6) via the 110 kV:

- Redclyffe–Tuai circuits, and
- Fernhill–Tuai circuit.

In these situations, an outage of the Fernhill–Tuai circuit can overload both Redclyffe–Tuai circuits.

Figure 13-6: Power flow from Tuai to Redclyffe during low load and high Tuai generation



Solution

The 110 kV Redclyffe–Tuai circuit constraints are managed operationally by limiting the maximum Waikaremoana hydro scheme generation.

We consider the issue can be resolved operationally for the forecast period.

13.8.4 Redclyffe interconnecting transformer capacity

Project status/type:	This issue is for information only

Issue

Two 220/110 kV interconnecting transformers at Redclyffe supply the majority of the Hawke's Bay load (except the load at Whirinaki and Whakatu, which is supplied from the 220 kV transmission system). The transformers provide:

- a nominal installed capacity of 160 MVA, and
- n-1 capacity of 101/107 MVA (summer/winter).

An outage of either interconnecting transformer will overload the remaining transformer during periods of:

- high load and minimal Waikaremoana generation, or
- low load and high Waikaremoana generation.

The peak 110 kV load is forecast to exceed the transformers' n-1 winter capacity by approximately 47 MW in 2013, increasing to approximately 77 MW in 2028 (see Table 13-7). The forecast assumes minimal Waikaremoana generation of 12 MW.

Table 13-7: Redclyffe 220/110 kV transformer overload forecast

Circuit/grid exit point	Transformer overload (MW)										
	Next 5 years						5-15 years out				
	2013	2014	2015	2016	2017	2018	2020	2022	2024	2026	2028
Redclyffe	47	49	51	53	55	57	61	65	69	74	77

Solution

The overload is managed operationally by transferring load (within Unison's network) from the 110 kV transmission network to the 220 kV transmission network, and by constraining-on generation at Waikaremoana. As the Hawke's Bay load continues to grow, more Waikaremoana generation will need to be constrained-on more frequently during an outage of an interconnecting transformer at Redclyffe.

The application of the Grid Investment Test shows that installing a third 220/110 kV transformer or replacing the existing transformers with higher rated units is uneconomic at present. The transformer loading can be managed operationally.

13.8.5 Fernhill supply transformer capacity

Project reference:	FHL-POW_TFR-EHMT-01
Project status/type:	Possible, customer-specific
Indicative timing:	2018-2020
Indicative cost band:	B

Issue

Two 110/33 kV transformers (rated at 30 MVA and 50 MVA) supply Fernhill's load, providing:

- a nominal installed capacity of 80 MVA, and
- n-1 capacity of 35/35 MVA[119] (summer/winter).

[119] The transformers' capacity is limited by the rating of the 33 kV overhead bus and LV bushings limits; with these limits resolved, the n-1 capacity will be 42/45 MVA (summer/winter).

The peak load at Fernhill already exceeds the transformers' n-1 winter capacity by approximately 23 MW, and the overload is forecast to increase to approximately 37 MW in 2028 (see Table 13-8).

Table 13-8: Fernhill 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
Fernhill	0.95	23	24	25	26	27	27	29	31	33	35	37

Solution

The short-term operational solution involves a load transfer within the Unison network following a transformer outage.

Possible longer-term solutions include replacing the 30 MVA transformer with an 80 MVA transformer.

Both the existing single-phase supply transformers at Fernhill will approach their expected end-of-life within the next 5-10 years. In addition, we also plan to convert the Fernhill 33 kV outdoor switchgear to an indoor switchboard within the next five years.

We will discuss with Unison the future supply options as well as the coordination of the transformer capacity upgrade with the transformer replacement work. Future investment will be customer driven.

13.8.6 Gisborne 110 kV voltage quality

Project status/type:	This issue is for information only

Issue

The Gisborne 110 kV bus voltage can fall below 99 kV when either one of the Gisborne–Tuai–1 or 2 circuits is out of service, especially during high load, low generation periods.

Solution

The short-term operational solutions include:

- in the case of planned outages, dispatching the Waikaremoana hydro generation station to raise the local 110 kV bus voltage to 116 kV (this is not a preferred long-term solution as it limits the maximum active power generation), or
- raising the 110 kV voltage at Redclyffe.

A possible longer-term option includes installing additional 10 to 20 Mvar capacitors at Gisborne. Installing capacitors at Gisborne 50 kV bus or within the distribution network will also help to extend the Gisborne supply transformers' real power capacity. See Section 13.8.7 for more information.

13.8.7 Gisborne supply capacity

Project reference:	Line capacity: GIS_TUI-TRAN-EHMT-01 Transformer capacity: GIS-POW_TFR-EHMT-01 New capacitor: GIS-C_BANKS-DEV-01
Project status/type:	Line capacity: possible, customer-specific Transformer capacity: proposed, Base Capex New capacitor: possible, customer-specific
Indicative timing:	Line capacity: 2017 Transformer capacity: 2018

Indicative cost band:	New capacitor: to be advised Line capacity: to be advised Transformer capacity: A New capacitor: A

Issue

The Gisborne load is supplied by:

- two 110 kV circuits, each rated at 48/59 MVA (summer/winter) from Tuai, and
- two 110/50 kV transformers, providing:
  - a nominal installed capacity of 120 MVA, and
  - n-1 capacity of 63/63 MVA[120] (summer/winter).

The peak load at Gisborne is forecast to exceed the:

- circuits' n-1 capacity from 2017 for an outage of one Gisborne–Tuai circuit, and
- transformers' n-1 winter capacity by 1 MW in 2018, increasing to approximately 16 MW in 2028 (see Table 13-9).

Table 13-9: Gisborne–Tuai circuit and Gisborne 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
Gisborne–Tuai	NA	0	0	0	0	2	3	6	9	12	15	17
Gisborne	0.98	0	0	0	0	0	1	4	7	10	13	16

Solution

We will discuss future supply options with Eastland. In the short-term, one possible option is to operationally manage the issue by limiting the load at Gisborne to the supply transformers' and circuits' capacity.

For the Gisborne–Tuai circuits, possible longer-term solutions include:

- installing a 10 Mvar capacitor on the Gisborne 50 kV bus or within the distribution network, which will resolve the overloading issue to near the end of the forecast period, then
- thermally upgrading or reconductoring part or all of both circuits.

For the supply transformer, recalibrating the metering will resolve the overloading issue for the forecast period and beyond.

13.8.8 Redclyffe supply transformer capacity

Project reference:	RDF-POW_TFR-EHMT-01
Project status/type:	Committed, customer-specific
Indicative timing:	Q3 2013
Indicative cost band:	C

Issue

Two 110/33 kV transformers (rated at 40 MVA and 50 MVA) supply Redclyffe's load, providing:

- a nominal installed capacity of 90 MVA, and
- n-1 capacity of 43/43 MVA[121] (summer/winter).

[120] The transformers' capacity is limited by the metering equipment; with these limits resolved, the n-1 capacity will be 73/77 MVA (summer/winter).

The peak load at Redclyffe already exceeds the transformers' n-1 winter capacity by approximately 34 MW, and the overload is forecast to increase to approximately 52 MW in 2028 (see Table 13-10).

Table 13-10: Redclyffe 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
Redclyffe	0.97	34	36	36	37	38	39	42	44	47	49	52

Solution

We have entered into an agreement with Unison to replace the existing transformers with two 120 MVA transformers that will provide a secure supply for the forecast period and beyond.

13.8.9 Tuai supply security

Project status/type:	This issue is for information only

Issue

A single 110/11 kV, 2.2 MVA transformer supplies the load at Tuai, resulting in no n-1 security. This transformer is also approaching its expected end-of-life within the next five years.

Solution

The lack of n-1 security can be managed operationally. However, we will discuss with Eastland Network Limited the options for increasing security and coordinating outages to minimise supply interruptions when replacing this transformer.

13.8.10 Wairoa supply transformer capacity

Project status/type:	This issue is for information only

Issue

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

- a nominal installed capacity of 20 MVA, and
- n-1 capacity of 11/12 MVA (summer/winter).

An outage of one transformer will cause the remaining transformer to exceed its n-1 summer capacity by 1 MW in 2017, increasing to 3 MW in 2028 (see Table 13-11).

Table 13-11: Wairoa 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
Wairoa	0.95	0	0	0	0	1	1	1	2	2	3	3

[121] The transformers' capacity is limited by LV circuit breaker and disconnector limits, followed by protection and LV bushing limits of 48 MVA; with these limits resolved, the n-1 capacity will be 49/53 MVA (summer/winter).

Solution

Eastland Network Limited can manage the issue operationally.

Both Wairoa supply transformers are approaching their expected end-of-life within the next five years. We will discuss with Eastland Network the appropriate timing and capacity for the replacement transformers.

Future investment will be customer driven.

13.8.11 Whakatu supply transformer capacity

Project status/type:	This issue is for information only

Issue

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

- a nominal installed capacity of 200 MVA, and
- n-1 capacity of 116/121 MVA (summer/winter).

An outage of one transformer will cause the remaining transformer to exceed its n-1 winter capacity by 2 MW in 2016, increasing to 22 MW in 2028 (see Table 13-12).

Table 13-12: Whakatu 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
Whakatu	0.96	0	0	0	2	4	5	8	12	15	18	22

Solution

Unison can shift load between the Whakatu and Fernhill grid exit points. Future investment will be customer driven.

13.9 Hawke's Bay bus 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).

13.9.1 Transmission bus security

Table 13-13 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 13-13: Transmission bus outages

Transmission bus outage	Loss of supply	Generation disconnection	Transmission issue	Further information
Fernhill 110 kV	Fernhill			
Gisborne 110 kV	Gisborne			
Redclyffe 110 kV			Redclyffe 220/110 kV	See note 1

Transmission bus outage	Loss of supply	Generation disconnection	Transmission issue	Further information
			transformer overloading	
Redclyffe 220 kV			Redclyffe 220/110 kV transformer overloading	See note 1
Tuai 110 kV	Tuai			
Whirinaki 220 kV	Whirinaki			See note 2
		Whirinaki – G1, G2, G3		See note 2

1. An outage of a Redclyffe 110 kV or 220 kV bus section disconnects a 220/110 kV transformer. This may cause the remaining transformer to overload (see Section 13.8.4).
2. Whirinaki has a single bus zone, so a bus fault disconnects all generation and supply transformers (causing a total loss of supply). An increase in bus security is not expected to be economically justified.

The customers (Genesis, Contact, Unison, Eastland, or Pan Pac) 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.

13.10 Other regional items of interest

There are no other items of interest identified to date beyond those in Sections 13.8 and 11.9. See Section 11.11 for information about generation scenarios, proposals and opportunities relevant to this region.

13.11 Hawke's Bay generation scenarios, proposals and opportunities

This section details relevant regional issues for selected generation scenarios, 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.

13.11.1 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.

Generation scenarios 1 and 2 anticipate the connection of 50 MW of new hydro generation at Wairoa. This level of generation will need to connect at 110 kV, potentially requiring the Wairoa 110 kV split bus to be upgraded to a solid bus to provide security and operational flexibility.

No issues are anticipated by generation scenarios 3, 4 or 5.

13.11.2 Maximum regional generation

All generation in excess of the load is exported from the Hawke's Bay region over the 220 kV double-circuit line from Redclyffe to Wairakei. Each circuit is rated at 478/583 MVA (summer/winter, subject to replacing some substation equipment), and there is scope for thermally upgrading the circuits to approximately 690/760 MVA (summer/winter). Additional reactive power sources such as capacitors may be required as these circuits are relatively long (137 kilometres), and they absorb reactive power when highly loaded.

Generation connected to grid exit points on the 110 kV network in the Hawke's Bay region is exported via the Redclyffe interconnecting transformers. Each interconnecting transformer has a 24-hour post-contingency rating of 114/120 MVA (summer/winter).

Estimates for maximum generation assume a North Island light load profile, and assume existing generation is high (Waikaremoana is generating 139 MW).

For generation connected at the Redclyffe 220 kV bus, the maximum generation that can be injected under n-1 is approximately 530 MW, or approximately 650 MW if the 220 kV circuit station constraints are removed. The constraint is due to an overload of the 220 kV Redclyffe–Whirinaki circuit when the 220 kV Redclyffe–Wairakei circuit is out of service.

For generation connected at the Redclyffe 110 kV bus, the maximum generation that can be injected under n-1 is approximately 10 MW. The constraint is due to an overload of the Redclyffe interconnecting transformer when the other interconnecting transformer is out of service.

13.11.3 Titiokura and Hawke's Bay wind generation stations, and Tauhara geothermal station

Maungaharuru wind generation station (formerly known as Titiokura, and Hawke's Bay wind farms) is approximately 27 km from Whirinaki, with a capacity of up to approximately 330 MW. A 220 kV double-circuit line traverses the site, and is the main supply to the Hawke's Bay area from Wairakei.

The proposed Tauhara geothermal generation station in the Central North Island region also connects to one of the 220 kV circuits to Wairakei.

There are no issues with connecting the wind and geothermal generation into the same 220 kV circuits to Wairakei (see Chapter 11, Section 11.11.4).

13.11.4 Additional generation connected to the 110 kV network

There are a number of potential wind and hydro generation prospects that may connect into one or more of the 110 kV circuits in the region.

The impact new generation has on circuit loading depends on the connection's location and configuration. For some connection locations and configurations, altering the hydro generation at Tuai removes the circuit overloads, although this may adversely impact the energy market. To increase transmission capacity, the circuits will need to be reconductored and/or the Fernhill–Tuai circuit unbonded.

The Redclyffe 220/110 kV interconnecting transformer capacity may also need to be increased to avoid overloading when there is high generation and low load, as power flows from the 110 kV transmission network into the 220 kV transmission network.