

T R A N S P O W E R

Auto Synchronisation Points Investigation Project

Assumptions, Approach and Options

Consultation Document

August 2009

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1 Introduction

Transpower owns, operates, maintains and develops the National Grid which underpins New Zealand's electricity industry. Transpower aims to ensure sufficient investment is made in the National Grid to meet the future needs of electricity consumers and participants in the electricity industry.

System synchronisation points are an important control for managing the recovery from an outage event when the transmission system may split into 'islands', that is, some parts may become electrically separated from the rest of the grid.

The current system synchronisation points rely on manual synchronisation by an operator on site. Given that it is impractical to have skilled operators on site permanently, there is a risk that skilled synchronisation operators may take considerable time to travel to and access the substations when synchronisation points need operating. This means that restoration of the system may be delayed.

Automatic synchronisation (**auto synchronisation**) allows the process to be carried out remotely and quickly, thereby reducing the potential number of system minutes lost.

2 Investigation Process

This document describes and seeks feedback on:

- the assumptions and approach to be used in the Grid Investment Test (**GIT**) analysis
- the locations to be considered for installing auto synchronisation points.

The locations chosen will be analysed using the GIT, adopting the assumptions and approach as refined following consideration of feedback from interested parties.

Following this process, Transpower will determine whether it is appropriate to submit a Grid Upgrade Plan (**GUP**) to the Electricity Commission for funding approval.

If the investigation determines that grid investment is required, the regulatory framework Transpower operates within would generally require Transpower to submit an investment proposal to the Electricity Commission for approval under Part F of the Electricity Governance Rules 2003 (**the Rules**). Under the Rules, a proposal of this nature would be treated as a reliability investment and would need to pass the GIT to enable Transpower to recover the costs of the investment from customers.

2.1 Assessment of projects under the Rules

For the Electricity Commission to approve cost recovery by Transpower for a reliability investment, the investment proposal must meet the requirements of the Grid Reliability Standards (GRS) and the Grid Investment Test (GIT).

In order to be approved under the Rules, reliability investment proposals in the core grid are required to:

- ensure an n-1 security standard can be maintained, to meet the requirements of the GRS
- maximise expected net market benefit or minimise expected net market cost, compared to a number of alternatives, to meet the requirements of the GIT.

In order to be approved under the Rules, reliability investment proposals in other parts of the grid are required to:

- ensure an n security standard can be maintained, to meet the requirements of the GRS

- maximise expected net market benefit and the expected net market benefit must be positive, compared to a number of alternatives, to meet the requirements of the GIT.

Given that the primary effect of the project is to reduce unserved energy, the project is considered as a reliability investment under the Rules. However, given that the investigation involves the installation of auto synchronisation points on parts of the non-Core Grid, the latter approval requirements apply.

To determine the expected net market benefit of any option, Transpower must adopt certain input assumptions and parameters and use these to apply the GIT. Sensitivity analysis is then undertaken to test the robustness of the GIT result.

In this document, Transpower sets out the assumptions and approach it proposes to use in applying the GIT, and seeks feedback on them.

2.2 List of potential Auto Synchronisation Point locations

In order to develop a list of appropriate locations for installing auto synchronisation points, Transpower intends this document to also act as a Request for Information (**RFI**). Transpower has begun the process of identifying which locations might merit further investigation and a draft list is set out in section 4. Transpower seeks feedback on this list and any further locations that Transpower might consider adding for this project.

2.3 Timetable for consultation

Transpower invites interested persons to provide feedback on the assumptions, approach to analysis and list of locations it proposes for the Auto Synchronisation Points project.

Some questions have been set out in this document, in order to prompt for information which would be relevant to the investigation. However, respondents are not obliged to answer all of the questions and can simply comment on other issues which they believe might be relevant. We seek responses from interested persons by 30 September 2009. Responses should preferably be in electronic form in either Microsoft Word or PDF format and emailed to:

Manager, Economics and Approvals

Grid Development

PO Box 1021

Wellington

Email: gridinvestmentprojects@transpower.co.nz

Please include in the Subject line: Auto Synchronisation Points project.

Late submissions may not be considered.

Following the close of submissions, Transpower will publish the full submissions on www.gridnewzealand.co.nz. Unless otherwise requested by a respondent, Transpower will include the name of the respondent and the entire submission on the website. If there is any aspect of the submission that is confidential, please indicate which sections you require Transpower to omit from publication and why it is regarded as confidential. Transparency in the transmission planning process is important and whilst Transpower acknowledges that there may be circumstances under which respondents do want to provide feedback confidentially, it is important to recognise that Transpower may not be able to rely on confidential information to justify an investment proposal.

Transpower also asks respondents to provide authorisation for any confidential information to be shared with the Electricity Commission in order to enable the

Commission and Transpower to consider this project. If there is information which cannot be shared confidentially with the Electricity Commission, this must be clearly specified.

2.4 Process following consultation

Transpower will provide any updates on the project on the website www.gridnewzealand.co.nz.

Following this consultation, Transpower will:

- consider feedback received in submissions
- prepare a list of locations for GIT analysis
- apply the GIT
- prepare a GUP for submission to the Electricity Commission, if appropriate.

3 Project Need and Description

This project is investigating the installation of auto synchronisation points at ten substations across the National Grid. These substations have been selected on the basis of their significance in restoring the core grid after a major widespread system event, including restarting from one or more locations, or to aid the reconnection of a region of the grid that has become “islanded” during planned or unplanned outages of equipment.

The potential benefits of the project are through reducing the time taken to restore supply and connect islanded sections of the grid without having to turn off generators and disrupt electricity supply to customers.

Synchronisation points are considered for sections or islands of the National Grid that have a comparable balance between electricity supply and demand and can therefore operate independently from the rest of the grid. For example, we are not proposing synchronisation points in the Canterbury region because there is insufficient generation in the region to meet demand.

A further reason for proposing automatic synchronisation points is to reduce the operational risks that exist because they are actually used very infrequently. It is conceivable for a synchronisation point to be only used once every twenty years or less. In these circumstances, it is difficult to maintain a group of suitably skilled people that can access the substations where manual synchronisation points are located and operate the equipment correctly. Manual operation, especially when it is so infrequent, introduces an inherently greater element of human error than an automated system. Incorrectly using a synchronisation point can have significant implications and cause major damage to equipment when two parts of the grid are brought together when they are not synchronised correctly.

3.1 Gisborne example

A snow storm on the night of the 25-26th September 2000 caused a loss of grid connection between Redclyffe and Wairakei. To assist with restoration from the 110 kV system, Tuai was black started to restore supply to a Gisborne/Wairoa island and the split at Waipawa was closed to enable limited supply to be restored to Fernhill and Redclyffe.

Tuai does not have a synchronisation scheme, so in order to reconnect the Gisborne/Wairoa island to the National Grid the island had to be shutdown.

The loss of extended power supply twice to the Gisborne region caused significant disruption to residents and businesses. An auto synchronisation point would have minimised disruption and almost certainly avoided the need to turn the power off the second time in order to reconnect the islanded system with the rest of the National Grid.

3.2 Proposed solution

At each location, one or more line breakers would have an automatic synchronisation facility enabled via SCADA. These operate by automatically closing the line breaker when the electrical conditions on either side of the breaker match up sufficiently closely.

In detail, the SCADA system would report the phase angle, frequency and voltage difference across the breaker on operator displays. In order to synchronise two stable “islands” across the breaker, operators would first dispatch generation in the islands to minimise the differences in phase angle, voltage and frequency across the breaker. They would then select the breaker to try to “auto synchronise” for a set period (say 10 minutes) where the breaker will close when the differences in angle, volts and Hz were within tolerances set in the protection equipment for the breaker. Operators would continue to dispatch generators to minimise differences in angle/voltage/Hz until the breaker closed or the auto synchronisation timed out.

There is no alternative technical proposal to compare with installing auto synchronisation points. For the GIT, which requires an evaluation between alternatives, the alternative option is to rely on manual synchronisation by staff as is done currently. The standard GIT process starts with a long list of options, refines this to a short list and carries out an economic analysis of the short listed options. With this project, only the auto synchronisation points proposal and a “do nothing” alternative are on the short list.

3.3 Location of existing manual synchronisation sites

The following sites have manual synchronisation facilities enabled

No	Site	CB	Line
1	ABY	37/38	Local
2	BEN	36	T2
3	BEN	37	T5
4	BPE	582	HAY 2
5	BPE	632	TKU 1
6	BPE	652	TKU 2
7	BPE	742	HAY 1
8	CYD	442	ROX 1
9	CYD	462	ROX 2
10	CYD	522	TWZ 2
11	CYD	542	TWZ 1
12	HOR	72	ISL 1
13	HOR	112	ISL 2
14	ISL	132	HOR 2
15	ISL	292	HOR 1
16	STK	92	UTK 1
17	STK	102	COB 2
18	TIM	132	TKA 1
19	TIM	138	WTK
20	TKA	37	Local
21	WRK	112	WKM 1
22	WRK	122	OHK 1
23	WRK	152	RPO 1
24	WRK	162	RDF 1
25	WRK	172	WHI 1
26	WRK	2002	T29 LV

4 List of Locations

The following sections show maps and diagrams of the proposed locations for auto synchronisation points. The references are to the relevant line breakers.

The final location will depend on feedback from this consultation process and other substation projects that will change the layout of some of the substations identified below, such as Whakamaru and Redclyffe.

For each location the synchronisation points are identified along with the VT associated with each circuit breaker (Reference A & B). This approach has been taken so that the system operator has the ability to choose which parts of the grid to synchronise. This allows synchronisation to occur when one or more circuits are out of service for maintenance.

4.1 Manapouri

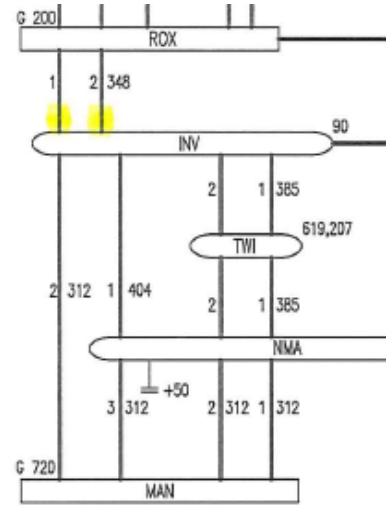
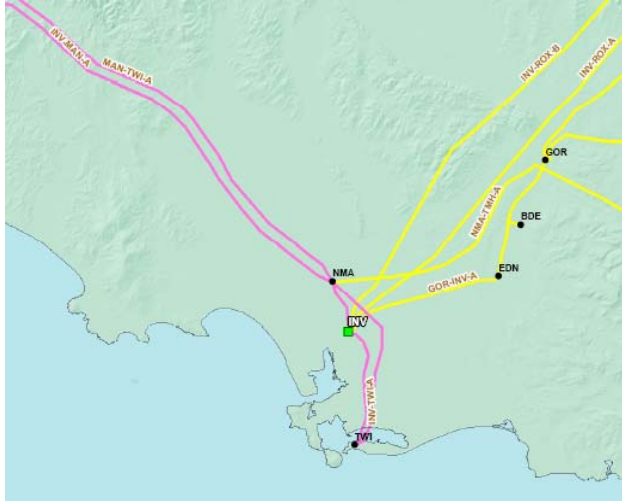
Overview

- Auto synchronisation capability fitted at Invercargill to allow synchronisation of the Invercargill–Roxburgh circuits.
- Provides the ability to reconnect islanded generation and load in the lower South Island.
- The island could be created by a system event or a black start initiated from Manapouri (where part of the South Island system has remained energised), or a South Island black start initiated from two or more locations, one of these being Manapouri. The principal generator in this island is Manapouri.

Auto Synchronisation on an Invercargill–Roxburgh circuit at Invercargill

Auto sync CB: INV 692 (INV-ROX 1)	Auto sync CB: INV 742 (INV-ROX 2)
Reference A: INV 712 (INV-TWI 1) ¹	Reference A: INV 772 (INV-NMA 1)
Reference B: INV 772 (INV-NMA 1)	Reference B: INV 712 (INV-TWI 1)

¹ Note that Reference refers to the VT associated with the circuit breaker.



4.2 Twizel

Overview

- Auto synchronisation capability fitted at Clyde and at Twizel to allow synchronisation of the Clyde–Twizel circuits at Clyde or at Twizel.
- Provides the ability to reconnect islanded generation and load where the South Island has split into two or more islands.
- The islands could be created by a system event or a black start initiated from a single location (where part of the system has remained energised) or a South Island black start initiated from two or more locations.

Auto Synchronisation on a Clyde–Twizel circuit at Clyde

Auto sync CB: CYD 542 (CYD-TWZ 1)

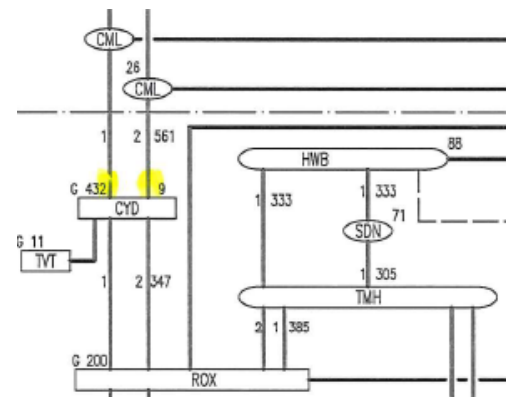
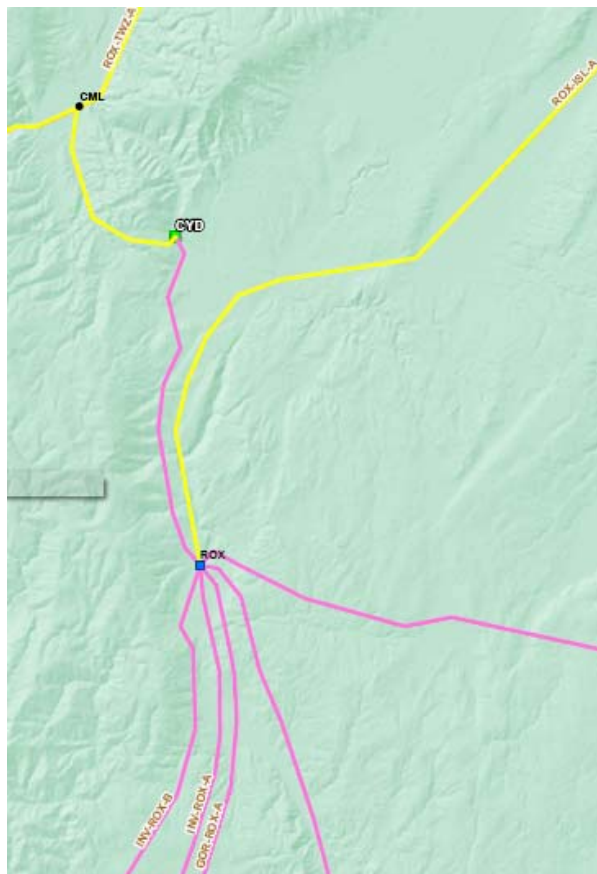
Auto sync CB: CYD 522 (CYD-TWZ 2)

Reference A: CYD 442 (CYD-ROX 1)

Reference A: CYD 462 (CYD-ROX 2)

Reference B: CYD 462 (CYD-ROX 2)

Reference B: CYD 442 (CYD-ROX 1)



Auto Synchronisation on a Clyde–Twizel circuit at Twizel

Auto sync CB: TWZ 2432 (CYD-TWZ 2)

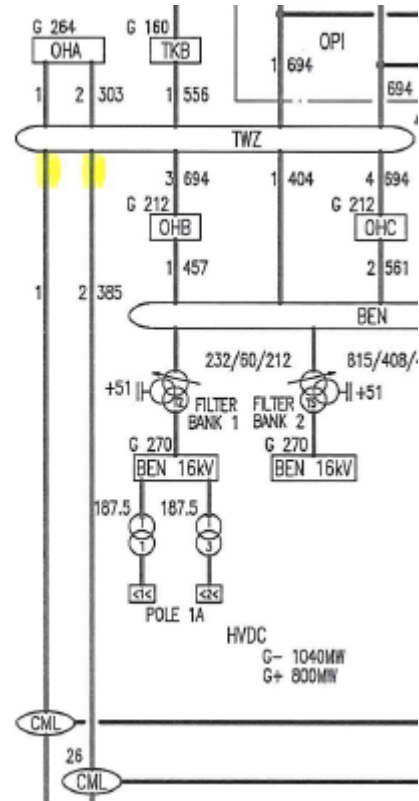
Auto sync CB: TWZ 2462 (CYD-TWZ 1)

Reference A: TWZ 2412 (ASB-TIM-TWZ 2)

Reference A: TWZ 2442 (ASB-TIM-TWZ 1)

Reference B: TWZ 2442 (ASB-TIM-TWZ 1)

Reference B: TWZ 2412 (ASB-TIM-TWZ 2)



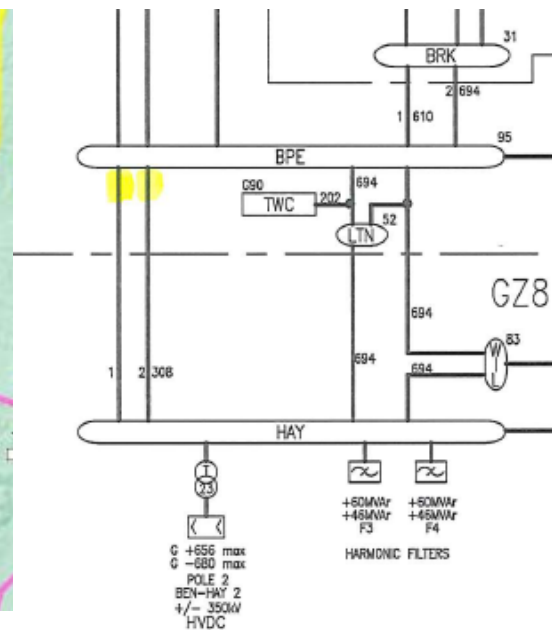
4.3 Bunnythorpe

Overview

- Auto synchronisation capability fitted at Bunnythorpe to allow synchronisation of the Bunnythorpe-Haywards 1 and 2 circuits.
- Provides the ability to reconnect islanded generation and load in the lower North Island.
- The island could be created by a system event, where the HVDC maintained supply in the Wellington region.

Auto Synchronisation on a Bunnythorpe–Haywards circuit at Bunnythorpe

Auto sync CB: BPE 742 (BPE-HAY 1)	Auto sync CB: BPE 582 (BPE-HAY 2)
Reference A: BPE 752 (BPE-TNG 1)	Reference A: BPE 632 (BPE-TKU 2)
Reference B: BPE 632 (BPE-TKU 2)	Reference B: BPE 752 (BPE-TNG 1)



4.4 Whakamaru

Overview

- Auto synchronisation capability fitted at Whakamaru to the following circuits:
 - Whakamaru–Poihipi–Wairakei 1
 - Tokaanu–Whakamaru 1&2, Ohinewai–Whakamaru 1
 - Otahuhu–Whakamaru 1&2
 - the Wairaki ring upgrade.
- Provides the ability to reconnect islanded generation and load where the North Island has split into two or more islands.
- The islands could be created by a system event; or a black start initiated from a single location (where part of the system has remained energised); or a North Island black start initiated from two or more locations.

Auto Synchronisation on Whakamaru–Poihipi–Wairakei 1 at Whakamaru

Auto synchronisation CB: WKM 212 (WKM-PPI-WRK 1)

Reference A: WKM 92 (OHW-WKM 1)

Reference B: WKM 62 (OTA-WKM 1)

Auto Synchronisation on Tokaanu–Whakamaru 1 at Whakamaru

Auto synchronisation CB: WKM 122 (TKU-WKM 1)

Reference A: WKM 92 (OHW-WKM 1)

Reference B: WKM 62 (OTA-WKM 1)

Auto Synchronisation on Ohinewai–Whakamaru 1 at Whakamaru

Auto synchronisation CB: WKM 92 (OHW-WKM 1)

Reference A: WKM 212 (WKM-PPI-WRK 1)

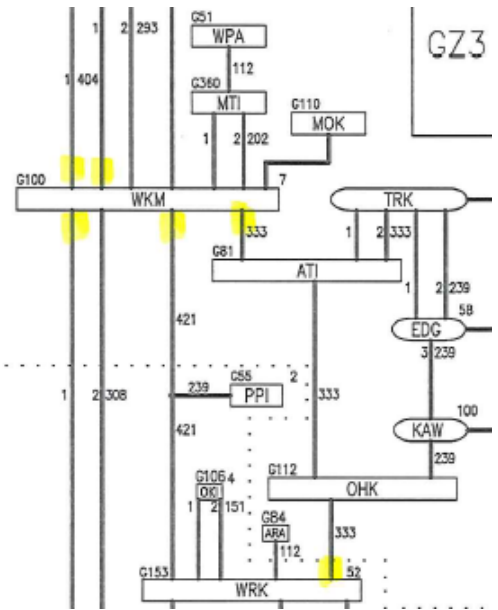
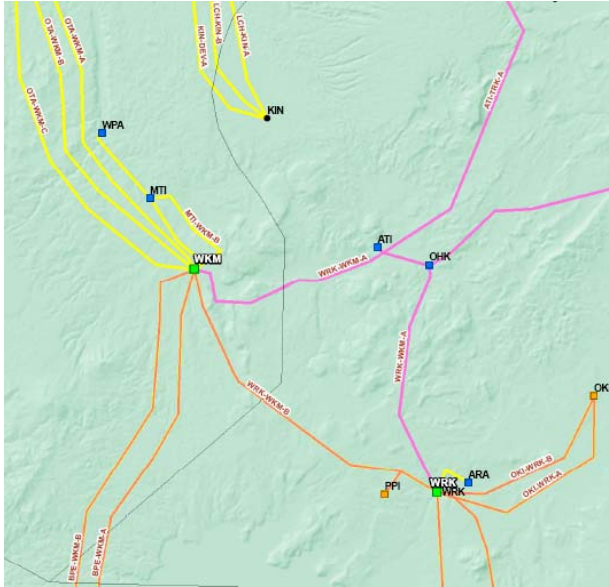
Reference B: WKM 122 (TKU-WKM 1)

Auto Synchronisation on Otahuhu–Whakamaru 1 at Whakamaru

Auto synchronisation CB: WKM 62 (OTA-WKM 1)

Reference A: WKM 212 (WKM-PPI-WRK 1)

Reference B: WKM 122 (TKU-WKM 1)



4.5 Waitaki

Overview

- Auto synchronisation capability fitted at Waitaki to Aviemore-Waitaki 1 and Livingstone-Waitaki 1.
- Provides the ability to reconnect islanded Waitaki generation and load in the North Otago region.
- The island could be created by a major system event. The alternative of shutting down Waitaki to allow reconnection would present significant hydraulic management issues for Meridian.

Auto Synchronisation on Aviemore–Waitaki 1 at Waitaki

Auto synchronisation CB: WTK 452 (AVI-WTK 1)

Reference A: WTK 438 (WTK 220 kV Bus Coupler)

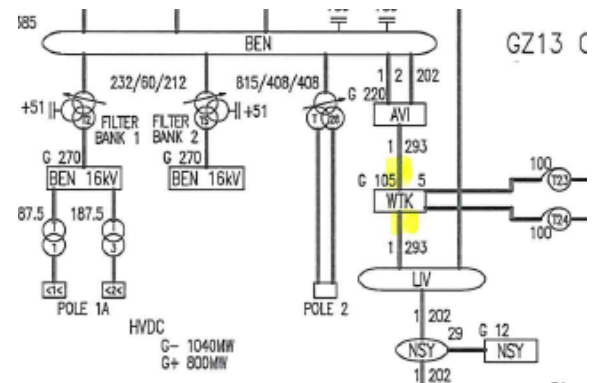
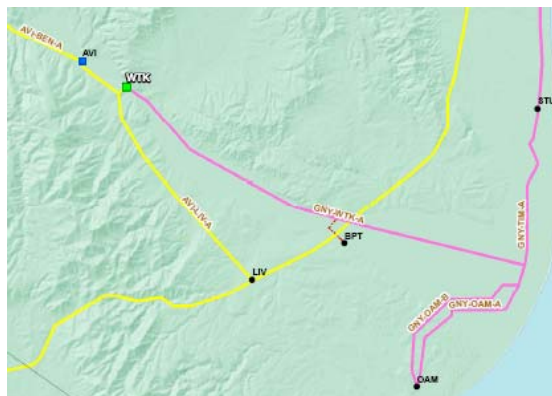
Reference B: WTK 462 (WTK T22 HV side)

Auto Synchronisation on Livingstone–Waitaki 1 at Waitaki

Auto synchronisation CB: WTK 412 (LIV-WTK 1)

Reference A: WTK 438 (WTK 220 kV Bus Coupler)

Reference B: WTK 422 (WTK T21 HV side)



4.6 West Coast

Overview

- Auto synchronisation capability fitted at Hororata, on all four circuits.
- Provides an ability to reconnect islanded generation and load in the West Coast region.
- The island could be created by either:
 - the loss of connection between Islington 66 kV and Inangahua (or other grid exit points within that region) for a contingency coinciding with a planned outage in that region
 - the loss of connection between Islington 66 kV and Inangahua (or grid exit points within that region) for a double circuit contingency on the West Coast
 - a successful West Coast island being created in the event of a major grid event
 - a black start being initiated from Coleridge (where part of the South Island system has remained energised)
 - a South Island black start initiated from two or more locations, one of these being Coleridge.
- Principal generator in this island: Coleridge.

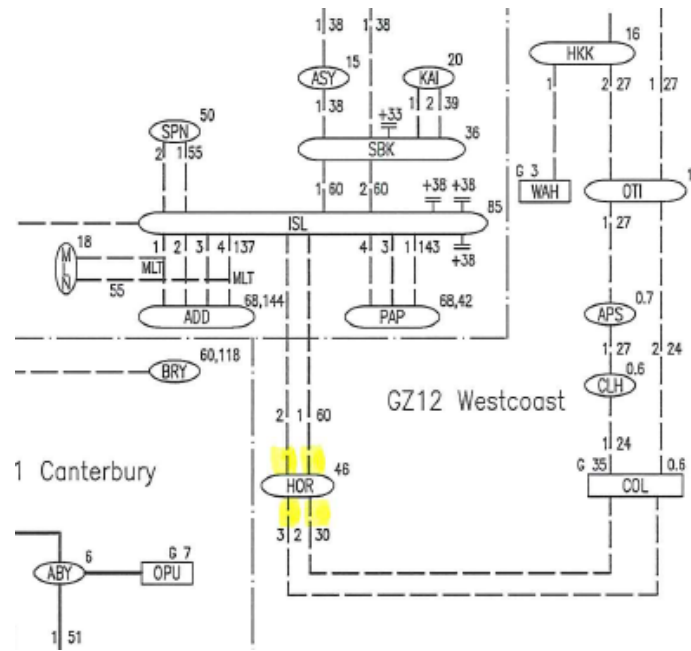
Auto Synchronisation on a Islington–Hororata circuit at Hororata

Auto sync CB: HOR 62 (ISL-HOR 1)	Auto sync CB: HOR 102 (ISL-HOR 2)
Reference A: HOR 112 (COL-HOR 3)	Reference A: HOR 72 (COL-HOR 2)
Reference B: HOR 72 (COL-HOR 2)	Reference B: HOR 112 (COL-HOR 3)

Auto Synchronisation on a Coleridge–Hororata circuit at Hororata

Auto sync CB: HOR 72 (COL-HOR 2)	Auto sync CB: HOR 112 (COL-HOR 3)
Reference A: HOR 102 (ISL-HOR 2)	Reference A: HOR 62 (ISL-HOR 1)
Reference B: HOR 62 (ISL-HOR 1)	Reference B: HOR 102 (ISL-HOR 2)





4.7 Hawke's Bay and East Coast

Overview

- Auto synchronisation capability fitted at Redclyffe on interconnecting transformers T3, T4 and the new 150 MVA transformer that is currently being proposed in a Grid Upgrade Proposal.
- Provides the ability to reconnect islanded generation and load in the Hawke's Bay and East Coast region.
- The island could be created by either:
 - the unplanned loss of a Redclyffe interconnector or a 220 kV circuit between Wairakei and Redclyffe during a planned outage on the other Redclyffe interconnector or Redclyffe - Wairakei circuit
 - the unplanned loss of both Redclyffe interconnectors or both circuits between Wairakei and Redclyffe
 - a black start being initiated from Tuai (where part of the North Island system has remained energised)
 - a North Island black start initiated from two or more locations, one of these being Tuai.
- Principal generator in this island: Tuai, Piripaua, Kaitawa.

Auto Synchronisation on Redclyffe T3 (LV side)

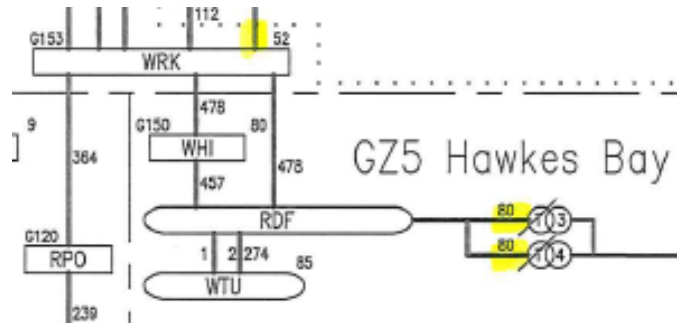
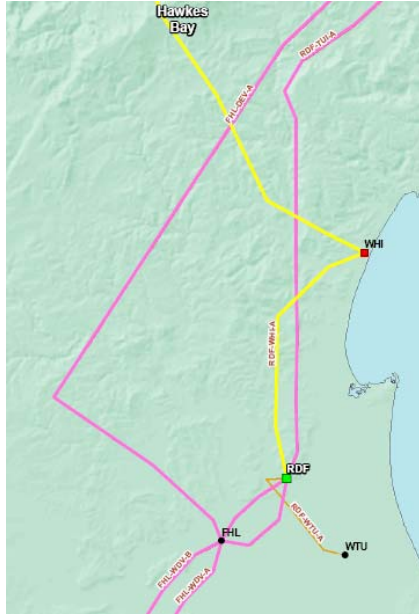
Auto synchronisation CB: RDF 132 (T3 LV side)

Reference A: RDF 642 (T3 HV side)

Auto Synchronisation on Redclyffe T4 (LV side)

Auto synchronisation CB: RDF 112 (T4 LV side)

Reference A: RDF 662 (T4 HV side)



4.8 East Coast

Overview

- Auto synchronisation capability at Tuai on Fernhill–Tuai 1 and Redclyffe–Tuai 1.
- Provides the ability to reconnect islanded generation and load in the East Coast region.
- The island could be created by either:
 - the loss of the 110 kV connection between Tuai and the Hawke's Bay, or the 220 kV connection between Wairakei and Redclyffe through an unplanned outage coinciding with a planned outage, eg double circuit tripping of Redclyffe –Tuai 1 and 2 during a planned outage of Fernhill–Tuai 1, or a tripping of Redclyffe–Wairakei 1 during an outage of Whirinaki–Wairakei 1
 - a successful East Coast region island being created in the event of a major grid event
 - a black start being initiated from Tuai (where part of the North Island system has remained energised)
 - a North Island black start initiated from 2 or more locations, one of these being Tuai.
- Principal generator in this island: Tuai, Piripaua, Kaitawa.

Auto Synchronisation on Fernhill–Tuai 1 at Tuai

Auto synchronisation CB: TUI 142 (FHL–TUI 1)

Reference A: TUI 112 (GIS–TUI 1)

Reference B: TUI 712 (GIS–TU1 2)

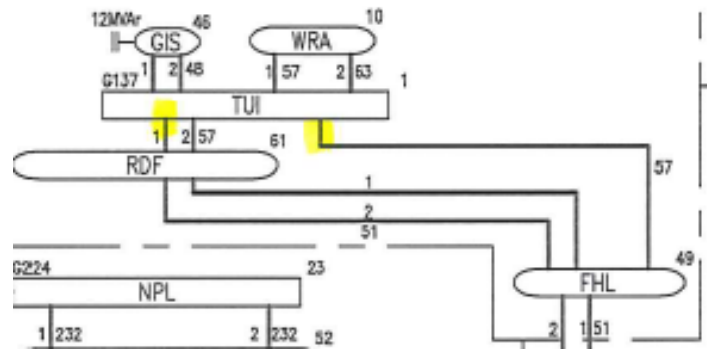
Auto Synchronisation on Redclyffe–Tuai 1 at TUI

Auto synchronisation CB: TUI 162 (RDF–TUI 1)

Reference A: TUI 112 (GIS–TUI 1)

Reference B: TUI 712 (GIS–TU1 2)





4.9 Karapiro

Overview

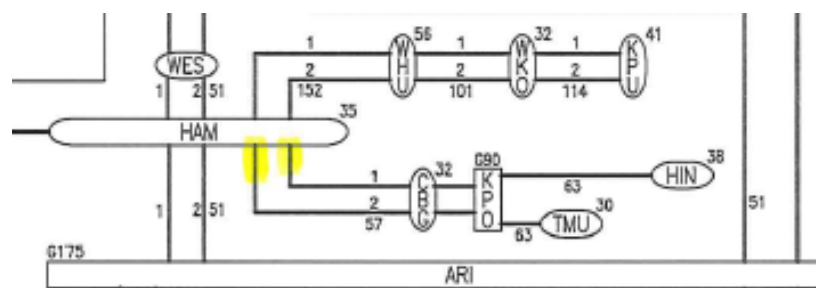
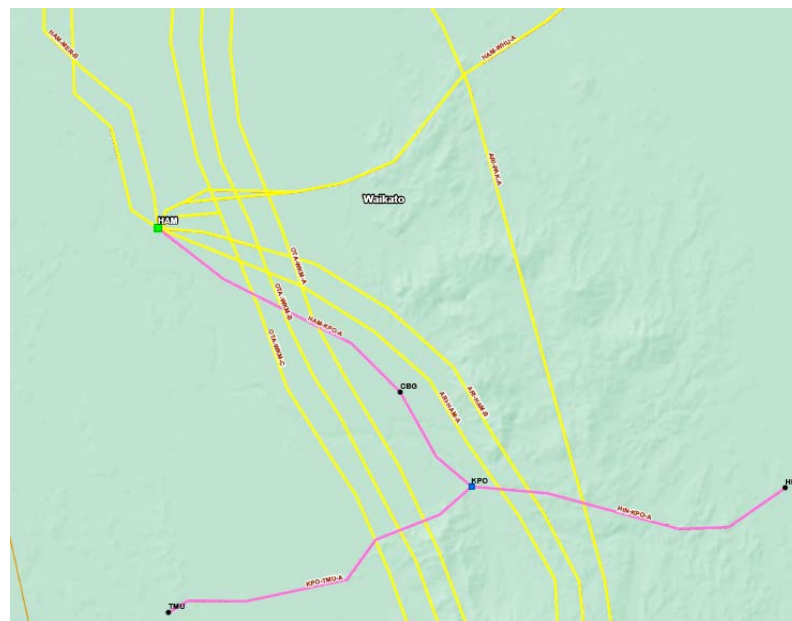
- Auto synchronisation capability fitted at Hamilton on Hamilton–Karapiro 1 & 2.
- Provides the ability to reconnect islanded generation and Te Awamutu, Hinuera and Cambridge load.
- The island could be created by the loss of a Hamilton–Karapiro circuit during a planned outage on the other circuit, or the unplanned loss of both circuits.
- Principal generator in this island: Karapiro.

Auto Synchronisation on a Hamilton–Karapiro circuit at Hamilton

Auto sync CB: HAM 112 (HAM-KPO 1) Auto sync CB: HAM 132 (HAM-KPO 2)

Reference A: HAM 152 (T6 LV side) Reference A: HAM 222 (T9 LV side)

Reference B: HAM 222 (T9 LV side) Reference B: HAM 152 (T6 LV side)



4.10 Bay of Plenty

Overview

- Auto synchronisation capability fitted at Whakamaru on Atiamuri–Whakamaru 1 and at Wairakei on Ohakuri–Wairakei 1.
- Provides the ability to reconnect islanded generation and load in the Bay of Plenty region.
- The island could be created by either:
 - the loss of the Atiamuri–Whakamaru circuit when it is spur feeding the Bay of Plenty region
 - the loss of the Ohakuri–Wairakei circuit when it is spur feeding the Bay of Plenty region
 - a successful Bay of Plenty island being created in the event of a major grid event
 - a black start being initiated from Atiamuri or Ohakuri (where part of the North Island system has remained energised)
 - a North Island black start initiated from 2 or more locations, one of these being Atiamuri or Ohakuri.
- Principal generator in this island: Atiamuri, Ohakuri.

Auto Synchronisation on Atiamuri–Whakamaru 1 at Whakamaru

Auto synchronisation CB: WKM 192 (ATI-WKM1)

Reference A: WKM 92 (OHW-WKM 1)

Reference B: WKM 122 (TKU-WKM 1)

Auto Synchronisation on Ohakuri–Wairakei 1 at Wairakei

Auto synchronisation CB: WRK 122 (OHK-WRK 1)

Reference A: WRK 112 (WKM-PPI-WRK 1)

Reference B: WRK 152 (RPO-WRK 1)

5 Suggested Submission Content

Transpower invites respondents to suggest any other locations they think should also be considered. With respect to the locations listed in Section 4, Transpower welcomes receiving submissions on the choice of circuits and/or substations.

There may be various developments and considerations that could affect the choice for locating auto synchronisation points. For example, these could include other works already scheduled at the locations listed above or significant new generation that may potentially form new islands.

In this manner, this document acts as an RFI for the Auto Synchronisation Points project. Any submission on this consultation should include sufficient technical detail to enable an assessment of the option, and contact details in case the parties wish to discuss the option in more detail.

As the list of alternative options will be made public, please identify if there is any aspect of the submission that should be treated as confidential and which should not be published. Transpower may wish to share the confidential information with the Electricity Commission in order for Transpower and the Electricity Commission to discuss any GUP submitted by Transpower. If confidential information is identified, Transpower asks respondents to provide authorisation to allow it to share that information with the Electricity Commission.

- Q1. Are there any other alternatives to auto synchronisation points which should be considered as part of this investigation?**
- Q2. Are there any other locations which should be considered for the Auto Synchronisation Points project?**
- Q3. Are there any other development plan issues or considerations that should be incorporated into the analysis of the Auto Synchronisation Points project?**

6 Analysis Approach and Assumptions

6.1 Base case

The Rules define the term Base Case as being the reasonable future state of the electricity industry without the proposed investment or any alternative project.

For an economic investment, a Base Case can be “do nothing” with the resulting effect on the ability of the existing system to meet demand.

Transpower proposes using a “do nothing” Base Case in this instance.

Q4. Do respondents consider that the identified Base Case is appropriate for this investigation project?

6.2 Demand forecast

In terms of examining the impact of demand growth for this investigation, Transpower proposes to use the after diversity maximum demand prudent peak demand forecast produced for the Electricity Commission's 2008 Statement of Opportunities² (SoO).

Transpower intends to apply a sensitivity analysis around the demand forecast, considering the 2008 SoO expected demand forecast and the peak demand forecast included in Transpower's 2008 APR.

Q5. Do respondents consider that the demand assumptions are appropriate for this project?

6.3 Commensurate GIT Approach

Under the Rules, the rigour and comprehensiveness of the GIT analysis should be commensurate with the estimated capital expenditure of a proposed investment.

In order to ensure commensurate analysis for this investigation project, Transpower has assessed the requirements for application of the GIT and believes that only the following need to be considered in applying the GIT:

- project costs
- loss differences
- reliability differences (under limited circumstances)

The reliability differences between options will be calculated as the difference in expected unserved energy times the value of lost load (VoLL). In other words the option with auto synchronisation points will have a benefit over the base case (status quo) of the expected saving in unserved energy times the VoLL.

Q6. Do respondents consider this commensurate GIT approach to be reasonable for Transpower to apply when considering the Auto Synchronisation Points project?

Q7. Are there other market costs or benefits which should be reflected in the analysis?

6.4 Value of Lost Load (VoLL)

If reliability differences are relevant to a consideration of the short list options, Transpower will need to use a Value of Lost Load figure in the reliability analysis.

The Rules require that unserved energy differences are valued at \$20,000 per MWh.³ The \$20,000 per MWh was determined in December 2004 and Transpower proposes to inflate it accordingly to a June 2008 value of \$22,400 per MWh.

² <http://www.electricitycommission.govt.nz/pdfs/opdev/transmis/soo/pdfssoo/2008/Final2008SOO.pdf>.

Q8. Do respondents consider this Value of Lost load is appropriate for valuing lost load?

7 Summary

The purpose of this document is to seek feedback, on the approach and inputs Transpower will use in applying the GIT to the Auto Synchronisation Points project.

Transpower is not committed (except where the Rules prescribe certain factors) to any input variable or approach set out in this document.

Transpower's intention in releasing this document is also to solicit additional locations for auto synchronisation points to those identified above. To this end, Transpower will assess any further locations proposed, to determine whether they should be added.

A commensurate GIT will then be applied to each location to determine whether they meet the requirements of the GIT and a GUP will be prepared for the Electricity Commission if appropriate.

³ Clause 8.3.4, Schedule F4 of the Rules.

Appendix A Glossary

Term	Description
Alternative Project	Options which are reasonable alternatives to any investment proposal as defined in clause 19, Schedule F4 of the Rules.
Economic Investment	Investments in the grid that can be justified on the basis of the Grid Investment Test set out at Schedule F4 of the Rules and are not reliability investments.
Electricity Commission	A Crown entity established under the Electricity Act 1992 to oversee New Zealand's electricity industry and markets.
Expected unserved energy	A forecast of the aggregate amount by which the demand for electricity exceeds the supply of electricity at each grid exit point as a result of likely planned or unplanned outages of primary transmission equipment.
GIT	Grid Investment Test. A test for reliability investments and economic investments in the grid developed in accordance with Rule 6. The specific rules defining the Grid Investment Test are set out in Schedule F4 of Part F of the Rules.
GPS	Government Policy Statement on Electricity Governance.
National Grid	The system of transmission lines, substations and other works used to connect grid injection points and grid exit points to convey electricity throughout the North and South Islands of New Zealand.
GRS	Grid Reliability Standards are standards for reliability of the grid developed in accordance with Rule 4. The standards themselves as currently developed are detailed in Schedule F3 of Part F.
GUP	Grid Upgrade Plan. A plan for grid expansions, replacements and upgrades.
MWh	Megawatt hour of electrical energy
Primary Transmission Equipment	Any plant or equipment forming part of the grid which enables the bulk transfer of electricity, including without limitation transmission circuits, busbars and switchgear.
Reliability investment	Investments by Transpower in the grid, or alternative arrangements by Transpower, the primary effect of which is, or would be, to reduce expected unserved energy.
RFI	Request for Information
RMA	Resource Management Act 1991
Rules	The Electricity Governance Rules 2003. Unless otherwise specified, the reference to the Rules in this document is to the rules in Part F, Section III of the Electricity Governance Rules 2003.
SCADA	Supervisory control and data acquisition. The monitoring and remote control of equipment from a central location using computers.
SDDP	A model developed by Power Systems Research in Brazil.
SoO	Statement of Opportunities developed by the Electricity Commission in accordance with Rule 9.
Transpower	Transpower New Zealand Limited, owner and operator of New Zealand's high-voltage electricity network (the National Grid).
USE	Unserved Energy
VoLL	Value of Lost Load