



MainPower Participant Rolling Outage Plan

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1. Purpose

This plan was written to comply with the System Operator Rolling Outage Plan (SOROP).

Under the regulations, participant outage plans (PROP) are required to specify the actions that would be taken to reduce the consumption of electricity to:

- reduce electricity consumption when a supply shortage is declared by the System Operator;
- comply with requirements of the System Operator Rolling Outage Plan (SOROP);
- comply with Electricity Industry (Enforcement) Regulations 2010, the Electricity Industry Participation Code 2010 and subsequent amendments; and
- supplement the System Operator Rolling Outage Plan.

Reducing demand by disconnecting supply to consumers would be a last resort after all other forms of savings, including voluntary savings, had been employed. MainPower will always endeavour to keep consumers supplied. MainPower will only disconnect consumers when directed to by the System Operator.

The procedures outlined are in response to major generation shortages, including dry year scenarios. How an event is declared and how the System Operator should communicate its requests are detailed. The main energy saving measure listed is rolling outages and how these are structured and implemented is discussed.

2. Definitions

AUFLS	Automatic Under Frequency Load Shedding
Authority	Electricity Authority
EDN	Electricity Distribution Network
Feeder	A high voltage circuit typically supplying up to 2000 consumers
GXP	Transpower Grid Exit Point
GEN	Grid Emergency Notice
MainPower	MainPower (New Zealand) Limited
PROP	Participant Rolling Outage Plan (this plan)
Regulations	Electricity Industry (Enforcement) Regulations 2010, the Electricity Industry Participation Code 2010 and subsequent amendments
Retailers	Electricity Retail Companies
Rolling Outages or Rolling Cuts	Planned electricity outage spread over different parts of the network at differing times
SOROP	System Operator Rolling Outage Plan
Supply Shortage Declaration	Declaration by the System Operator
System Operator	Operator of the national electricity transmission grid

2.1 Associated Operating Standards

OP039 for Load Shedding during Energy Constraint Contingency

OP040 for Media Release

OP041 for Notification of Outages

OP024 for de-Loading MainPower's GXP's in the event of a Transpower Grid Emergenc

3. Background

3.1 Electricity Authority

The Electricity Authority is a Crown entity set up under the Electricity Act to oversee New Zealand’s electricity industry and markets.

3.2 Transpower

Transpower is a State Owned Enterprise, which owns and operates New Zealand’s National Grid – the network of high Voltage transmission lines and substations that transports electricity from where it is generated to distribution line companies, such as MainPower.

As System Operator, Transpower manages the real-time operation of New Zealand’s electricity transmission system. It keeps the right amount of energy flowing to match generated supply with demand.

A function of the System Operator under the Electricity Act is to use reasonable endeavours to ensure the security of the electricity supply. The System Operator’s activities include forecasting supply and demand, developing and publishing guideline hydro levels for security of supply, contracting for reserve energy, and improving the ability of consumers to manage price risks in the market.

3.3 MainPower (New Zealand) Limited

MainPower is the electricity network company that owns and maintains the electricity lines, cables and substations that deliver electricity to consumers in the North Canterbury and Kaikoura regions.

4. Supply and Demand

Transpower, as the System Operator, controls the transmission network to match generation with consumer demand. Constraints on the ability to manage this may be caused by:

- low lake levels reducing hydro generation;
- failure of a large generator; and
- a fault on critical transmission circuit.

The first two causes above could lead to an energy shortage, while the third could lead to a shortage of transmission capacity.

4.1 Load Reduction by MainPower

MainPower has some ability to reduce load by turning off domestic water heaters and irrigation pumps via ripple control in the North Canterbury and Kaikoura regions. Further load reductions would require disconnecting consumers.

4.2 Range of Events

Events that could lead the System Operator to make a supply shortage declaration can in general terms be categorized as:

Developing (Category A) Event:	Events that evolve over time, for example low hydro lake levels
Immediate (Category B) Event:	Events that occur with little or no warning, usually as a result of a transmission line or major generation failure

4.3 Significant Incident

A Developing (Cat A) or Immediate (Cat B) Event will be classed by MainPower as a significant incident and the Assets and Capital Works Manager will assemble a team of senior managers and staff to manage the incident.

Communication with retailers will be as per normal notification procedures described in OP041 for Notification of Outages.

Local Authorities, Civil Defence and other stakeholders will be notified of significant events by the NOCC Manager.

5. Actions for Immediate (Category B) Events

Transpower, as the System Operator, is required to keep enough reserve generation to cover the risk of the largest connected generator tripping (or HVDC link failure). They are also required to keep the system frequency at 50Hz. If a large generator trips, it may cause a reduction in frequency which if not rectified can result in other generators tripping and could lead to complete failure of the electricity network.

As reserve generation cannot immediately pick up the load of a disconnected generator, an immediate load reduction is required until additional generation can pick up the load. Automatic load shedding groups reduce load in stages until the frequency stabilizes.

5.1 Reserve Market

Generators and load users with interruptible load, such as distribution networks, may offer in reserve capacity to cover the risk of the largest generating unit or a critical transmission line tripping. The ability to do this is affected by the numbers of frequency capable relays installed and the likely revenue stream from the market, less the compliance costs of participating in the reserve market. MainPower does not presently participate in this market.

5.2 Disconnecting Consumers

5.2.1 Automatic Under Frequency Load Shedding (AUFLS)

If the load shed by the Reserve Market tripping is insufficient to stabilize the network, further automatic load reduction is required.

Each distribution network company must have available at all times two blocks of load, each of 16% of its total load to be shed by automatic under frequency relays. In the South Island Transpower has installed these relays on selected feeders at the GXP's and the total load at the selected MainPower zone substations is disconnected by Transpower.

5.2.2 AUFLS Zone 1

If system frequency fails to recover after Reserve market load shed, AUFLS Zone 1 shedding by Transpower will occur. This will disconnect approximately 16% of MainPower's load by disconnecting consumers supply.

5.2.3 AUFLS Zone 2

If Zone 1 tripping fails to restore frequency, the next stage, Zone 2 activates. Transpower would disconnect a further 16% of MainPower's load.

5.2.4 Manual Load Shedding

If AUFLS Zone 1 and Zone 2 tripping fails to stabilize frequency the System Operator will shed more load. Once the frequency has stabilized the System Operator will advise the MainPower Network Control when load can be restored

5.3 Supply Restoration

Restoration of disconnected load must be restored in conjunction with the System Operator. This is to prevent overloading the transmission network and creating further instability.

5.4 System Operator Supply Shortage Declaration

For some Immediate (Cat B) Events, the System Operator may make a supply shortage declaration and directs rolling outages. In such a situation, the procedures for Developing (Cat A) Events will need to be implemented as per section 6 and

5.5 Transmission Grid Emergency

The System Operator may request MainPower to reduce load under a grid emergency notice (GEN). MainPower would commence with shedding water heating and irrigation load and then if necessary shed feeders as per OP024 for de-Loading MainPower's GXP's in the event of a Transpower Grid Emergency

If a Developing (Cat A) Event is in place, the grid emergency will take precedence. Also if an Immediate (Cat B) Event is in place that is not a grid emergency, then the grid emergency will take precedence.

6. Developing (Category A) Events

If the System Operator requests, a load reduction for a planned Developing (Cat A) Event, MainPower would reduce demand to meet the System Operator's targets. The targets are expected to be a weekly energy savings target that is reviewed each week. To reduce energy usage MainPower would disconnect HV feeders (rolling outages) in a controlled manner to enable targets to be reached. There may be financial penalties for not meeting the targets specified by the System Operator. The shedding of water heating load is not a viable option for energy savings as this only defers usage and would not save energy. The shedding of irrigation load is not a viable option as the irrigation load shedding is only to be used in a grid or network emergency. Irrigation customers will be treated as other commercial consumers and will be part of the rolling outage plan (but they may voluntarily reduce load).

6.1 Rolling Outage Requirements for an Immediate (Cat B) Event

The rolling outages requirements specified in section 6 and 7 for the Developing (Cat A) Events will also be implemented for Immediate (Cat B) Events if the System Operator makes a supply shortage declaration and directs the implementation of rolling outages.

6.2 Declaration of a Developing (Cat A) Event

The System Operator will endeavour to provide nine days prior notice of the requirement for weekly energy savings. It is MainPower's plan to use the standard planned outage notification procedure to retailers as detailed in OP041 for Notification of Outages. Any increase in the weekly energy savings target would also need nine days prior notice.

To declare a Developing (Cat A) Event, the System Operator would need to request that a specific weekly energy savings target was to be enforced for a specific region for a specified time-frame. A notification system similar to the GEN procedure would be appropriate.

The System Operator is expected to manage general media advertising of the need to conserve electricity and the impending rolling outages when they are requested.

6.3 Criteria for Rolling Outages

To ensure public health and safety is preserved and costs to economy are minimized the following table shows desired criteria for selecting feeders to be included in rolling outages.

Table 1 - Priority Loads

Priority	Priority Concern	Maintain Supply to:
1	Public health and safety	Major hospitals, air traffic control centres, and emergency operation centres.
2	Important public services	Energy control centres, communication networks, water and sewage pumping, fuel delivery systems, and major port.
3	Public health and safety	Minor hospitals, medical centres, schools, and street lighting.
4	Food production	Dairy farms and milk production facilities.
5	Domestic food production	Commercial and industrial premises.
6	Disruption to consumers	Residential premises.

These priorities are intended as guidelines, and because rolling outages will be implemented on a feeder by feeder basis, it is not possible to discriminate between individual consumers on the same feeder. For example, a predominantly residential feeder may also have small pockets of commercial or industrial consumers.

6.4 AUFLS Under Rolling Outages

The level of AUFLS during rolling outages needs to be maintained at 16% for each AUFLS block.

MainPower will either:

- include AUFLS feeder shedding but limit the shedding to ensure the AUFLS blocks of 16% are maintained. IE. If MainPower sheds 20% of load then 20% of the AUFLS load could also be shed, or
- exclude the current AUFLS feeders from rolling outage plans, which means that supply to lower priority feeders will be maintained while higher priority feeders experience an outage

If the requirement for rolling outages is for an extended period, then Transpower would be requested to switch AUFLS to different feeders, while maintaining two 16% AUFLS blocks. This will allow rolling outages to be distributed more evenly (and on lower priority feeders).

Switching AUFLS to different feeders is not as simple as switching a switch as some protection changes are required. Transpower will require suitable notice (estimated at 10 working days) to make the changes.

6.5 Shutdown Notification

When requested to reduce demand with rolling outages, MainPower plans to use the planned outage procedure as detailed in OP041 for Notification of Outages to advise retailers in advance, of pending outages. The time and extent of advertised outages will be approximate.

6.6 Vulnerable Consumers and Priority Sites

MainPower will endeavour to give retailers as much advance notice as possible of pending rolling outages to enable them to notify vulnerable consumers.

6.7 Grid Emergency During a Developing (Cat A) Event

If the System Operator declares a grid emergency during a Developing (Cat A) Event, the grid emergency will take priority. As water heating and irrigation load generally would not be used to reduce load in a Developing (Cat A) Event, MainPower would have the water heating and irrigation load available for load reduction when required for the grid emergency. If water heating and irrigation load is insufficient, the rolling outage feeders may need to be rearranged to comply with the grid emergency. After the grid emergency is over, the rolling outage pattern would continue.

6.8 Supply Restoration

Disconnected load from Immediate (Cat B) or Developing (Cat A) Events must be restored in conjunction with the System Operator. This is to prevent overloading the transmission network and creating instability. The System Operator has advised that load changes of less than 25 MW in any five minutes may be implemented by a network without their prior approval.

6.9 Communication

MainPower will keep media and consumers informed of planned interruptions to supply before and during the outages. Media will be informed as per MainPower's standard communications procedure, and the retailers will be responsible for consumer notification.

6.9.1 Communication with System Operator

All communications with the System Operator will be using Transpower's TPSN telephone in MainPower's Control Room in Rangiora or via standard telecommunication systems.

Prior to notifying and implementing rolling outages, MainPower will consult with the System Operator to establish a process for load shedding and restoration.

6.9.2 Communication with the System Operator

MainPower will contact the System Operator for administration purposes (including reporting performance against targets) using the following details:

Transpower	Phone	04 495 7000
Transpower House		
96 The Terrace		
PO Box 1021		
Wellington		
6143		

6.9.3 Communication with MainPower

MainPower New Zealand Limited contact details are:

MainPower NZ Ltd	Phone	03 311 8300
172 Fernside Road	Fax	03 311 8301
PO Box 346	24 Hours	0508 60 70 80
Rangiora	Faults Line	
7440		

6.10 MainPower Staff Responsibilities

Table 2 – MainPower Staff Responsibilities

Role	Person Responsible
Receive communication from System Operator	Network Controller
Implement this plan	Network Operations and Control Centre (NOCC) Manager
Weekly savings report	NOCC Manager
Retailer notification	Network Controller
Revoking rolling outages	Assets and Capital Works Manager
Reporting to System Operator	Assets and Capital Works Manager
Reporting to media, public agencies	Assets and Capital Works Manager

Table 2 – MainPower Staff Responsibilities

Within one day of the declaration of a Developing (Cat A) Event, the NOCC Manager will notify the System Operator of the updated contact details including telephone numbers and email address for each of the positions named in Table 2.

6.11 Rolling Outages Strategy and Methodology

The NOCC Manager and the Assets and Capital Works Manager will review weekly targets and prepare plans for weekly rolling outages based on savings required. The plans will be forwarded to the retailers for consumer and media notification. Rolling outages will wherever possible disconnect feeders using the priority listed in Table 1.

Planned energy savings will be based upon network energy usage for the same period last year.

6.12 Target Monitoring Responsibilities

For load shedding to a weekly target, the NOCC Manager will monitor energy savings against target and, together with the Assets and Capital Works Manager, review future load shedding to increase or decrease the amount of rolling outages to enable the weekly target to be met. The NOCC Manager will be responsible for daily and weekly reporting of consumption relative to target levels. The NOCC Manager will also be responsible for providing the predicted load for the next week on a seven day rolling basis. This prediction is to be by GXP for each half-hour.

6.13 Target Monitoring Requirements

When The System Operator requests a load reduction for a planned Developing (Cat A) Event, MainPower will provide the following information:

- A rolling week-ahead load forecast that forecasts the half-hourly load at each GXP
- Any expected change to the forecast for a GXP of more than 20% for any trading period
- The level of consumption relative to the target levels
- The nature and extent of the rolling outages

MainPower will also report to the System Operator to show compliance with the requirements of the participant outage plan. The System Operator will specify the frequency of the compliance reporting.

6.14 Log of Rolling Outages

Network Controllers will log times of disconnection and reconnection of all feeder interruptions and enter in the log. The log sheet to be used by Network Controllers is shown in Appendix 1. These will be used to monitor the rolling outage program.

7. Rolling Outages

When instructed by the System Operator, following a supply shortage declaration, to reduce demand, rolling outages will be instigated by the NOCC Manager as per this plan and outage strategy. The NOCC Manager will ensure load shedding schedules are prepared, Network Controller rosters are adjusted as required, and load is controlled and monitored to meet desired targets. Schedules of estimated load shedding, restoration times and quantities are to be forwarded to the System Operator seven days before the planned outage. If significant variation is noticed, or expected, from the schedules provided to the System Operator then MainPower shall advise the System Operator of this change.

7.1 Outage Time

Where possible, MainPower will try to comply with priorities in Table 1 to select feeders for rolling outages. MainPower will endeavour to keep rolling outages to any consumer no longer than 4 hours per day for a 10% savings target. For savings more than 10% longer and more frequent outages may be necessary.

Timing of outages will be approximate and could vary daily due to network or System Operator constraints. Example schedules are provided in OP039 for Load Shedding during Energy Constraint Contingency and in Appendix 3 Example Rolling Outage Schedules.

7.2 Priority Consumers Consolidated to Feeders

Rolling outage feeders will contain a variety of customer priorities from Table 1. The priority for each rolling outage feeder will be based on the priority ratings assessed for the connections within each feeder, according to Table 3, below.

Table 3 - Customer priority consolidated to feeder priority

Priority	Feeder
1	Any feeder that has one or more priority 1 connections
2	Any feeder that has three or more priority 2 connections
3	Any feeder that has an average priority between 2.5 & 3.5
4	Any feeder that has an average priority between 3.5 & 4.5
5	Any feeder that has an average priority between 4.5 & 5.5
6	Any feeder that has an average priority greater than 5.5

7.3 Feeder Selection

The demography of MainPower's customer base is rural, rural centres and a wide range of commercial and industrial. MainPower does not supply any cities, major hospitals, major airports or major ports.

The feeder priorities of Table 3 result in the load breakdown shown in Table 4.

Table 4 - Load breakdown from feeder priority

Priority	MW	% of Total Load
1	0.0	0.0%
2	19.6	27.3%
3	0.0	0.0%
4	14.3	19.9%
5	19.2	26.8%
6	18.5	25.9%
Total	71.7	100%

Feeders to be disconnected are shown in OP039 for Load Shedding during Energy Constraint Contingency which reflects the priority guidelines shown in Table 1. The consumer priority type, that will make up rolling outages for various levels of savings are shown in Table 5, below.

Table 5 - Saving Percentage for Required Saving for Priority Type

	5% Saving	10% Saving	15% Saving	20% Saving	25% Saving
Priority	Percentage Breakdown of Required Saving				
1	0	0	0	0	0
2	0	10	15	21	27
3	0	0	0	0	0
4	26	20	22	21	20
5	37	35	30	28	27
6	37	35	31	30	26

The outage breakdown percentages are indicative only and will be reviewed daily to achieve the specified targets.

7.4 Contingent Events

If an unplanned event occurs, such as a Civil Defence emergency that could alter the planned rolling outages, Network Controllers will be responsible for communication with retailers of any changes to the advertised program.

7.5 Consumer Liaison

For major consumers, with dedicated HV feeder supplies, short-term rolling outages may not be appropriate. As an alternative, longer single outages could be offered if that was easier for them to plan.

Other consumers are advised to contact their retailer for information on the priority of the feeder they are supplied from and outage times.

7.6 Vulnerable Consumers

Retailers maintain lists of consumers with health and safety issues. It is not feasible for MainPower to prevent rolling outages affecting individual vulnerable consumers. MainPower will endeavour to give retailers as much advance notice as possible of pending rolling outages to enable them to notify vulnerable consumers. During rolling outages general media releases will advise consumers with health problems as to their best course of action.

7.7 Rolling Outage GXPs

The following GXPs will experience rolling outages:

- Southbrook
- Kaiapoi
- Waipara
- Culverden
- Kaikoura

Ashley GXP has only 1 customer and will not be part of the rolling outages but will provide savings by controlled plant shutdown as detailed in Section 7.5 of this document. Any reduction in load on Ashley GXP will be communicated to the System Operator and the Authority.

Wigram customers are connected to Islington GXP via Orion's Networks and will not be part of MainPower's rolling outages as they will be part of Orion's outage plan.

APPENDIX 2 – FEEDER TABLE

GXP	AUFLS	Urban or Rural	Biggest Towns	Voltage	ICPs 27/06/17	MW Summer (peak)	MW Summer Scaled	Percentage of Total Scaled Load	MW Winter (peak)	MW Winter Scaled	Percentage of Total Scaled Load	Feeder Class	Percentage of Total Load (Summer)	Percentage of Total Load (Winter)	Priority as per Table 1
Southbrook	Nil	Rural/Milking		22	450	3.2	2.58	2.5%	1.0	0.8	0.8%	F4	3.0%	1.0%	4
Southbrook	Nil	Rural/Milking		22	30	1.2	0.97	0.9%	0.6	0.5	0.5%	F4	1.1%	0.6%	4
Southbrook	Nil	Urban/Rural		22	1400	1.8	1.45	1.4%	2.1	1.7	1.6%	F3/F4	1.7%	2.0%	2
Southbrook	Nil	Rural/Milking		22	120	3.2	2.58	2.5%	1.0	0.8	0.8%	F4	3.0%	1.0%	4
Southbrook	Nil	Rural/Milking		22	240	3.2	2.58	2.5%	0.9	0.8	0.7%	F4	3.0%	0.9%	4
Southbrook	Nil	Rural/Milking		22	330	3.4	2.75	2.6%	2.6	2.1	2.0%	F4	3.2%	2.5%	2
Southbrook	Nil	Rural/Milking		22	762	2.8	2.26	2.2%	2.8	2.3	2.2%	F4	2.7%	2.7%	4
Southbrook	Nil	Rural/Milking		22	292	3.9	3.15	3.0%	1.1	0.9	0.8%	F4	3.7%	1.0%	4
Southbrook	Nil	Rural/Milking		22	1003	2.8	2.26	2.2%	2.8	2.3	2.2%	F4	2.7%	2.7%	4
Southbrook	Nil	Rural/Milking		22	568	1.1	0.89	0.8%	2.3	1.9	1.8%	F4	1.0%	2.2%	4
Southbrook	Nil	Rural/Milking		22	808	4.4	3.55	3.4%	2.0	1.6	1.5%	F4	4.2%	1.9%	4
Southbrook	Nil	Sthbrk Comm		11	1221	4.2	3.39	3.2%	5.1	4.1	3.9%	F2/F3?	4.0%	4.9%	2
Southbrook	Nil	Comm/Res		11	802	3.1	2.5	2.4%	4.3	3.5	3.3%	F2/F3?	3.0%	4.1%	2
Southbrook	Nil	Comm/Res		11	1155	2.2	1.78	1.7%	3.3	2.7	2.5%	F2/F3?	2.1%	3.1%	2
Southbrook	Nil	Comm/Res		11	1330	3.4	2.75	2.6%	4.9	4.0	3.8%	F2/F3?	3.2%	4.7%	2
Southbrook	Nil	Res		11	1435	0.0	0	0.0%	0.0	0.0	0.0%	F3	0.0%	0.0%	6
Southbrook	Nil	Res		11	1435	0.0	0	0.0%	0.0	0.0	0.0%	F3	0.0%	0.0%	6
Southbrook	Nil	Res		11	132	0.2	0.19	0.2%	0.4	0.3	0.3%	F3	0.2%	0.4%	6
Southbrook	Nil	Res		11	516	0.7	0.57	0.5%	1.2	1.0	0.9%	F3	0.7%	1.1%	6
Southbrook	Nil	Res		11	952	1.5	1.21	1.2%	2.9	2.3	2.2%	F3	1.4%	2.8%	2
Southbrook	Nil	Res		11	1270	2.2	1.78	1.7%	3.6	2.9	2.8%	F3	2.1%	3.4%	6
Southbrook	Nil	Res		11	1031	1.7	1.37	1.3%	3.0	2.4	2.3%	F2?	1.6%	2.9%	6
Southbrook	Nil	Res		11	526	1.1	0.89	0.8%	1.8	1.5	1.4%	F3	1.0%	1.7%	6
Southbrook	Nil	Rural		11	96	0.2	0.19	0.2%	0.4	0.3	0.3%	F4	0.2%	0.4%	4
Waipara	Block 1	Res/Rural		11	1029	1.8	1.45	1.4%	2.2	1.8	1.7%	F3/F4	1.7%	2.1%	4
Waipara	Block 1	Comm/Res		11	908	1.7	1.37	1.3%	2.2	1.8	1.7%	F3	1.6%	2.1%	2
Waipara	Block 1	Res/Rural		11	684	0.9	0.73	0.7%	1.3	1.1	1.0%	F3/F4	0.9%	1.2%	6
Waipara	Block 1	Rural		11	287	0.6	0.48	0.5%	0.6	0.5	0.5%	F4	0.6%	0.6%	6
Waipara	Block 1	Rural		11	135	0.5	0.4	0.4%	0.3	0.2	0.2%	F4	0.5%	0.3%	6
Waipara	Block 1	Rural		11	298	1.6	1.29	1.2%	1.6	1.3	1.2%	F4	1.5%	1.5%	2
Waipara	Block 1	Rural		11	134	0.8	0.65	0.6%	0.4	0.3	0.3%	F4	0.8%	0.4%	6
Waipara	Block 1	Rural		11	248	0.3	0.26	0.2%	0.3	0.3	0.2%	F4	0.3%	0.3%	6
Waipara	Block 1	Rural		11	188	0.5	0.4	0.4%	0.5	0.4	0.4%	F4	0.5%	0.5%	6
Kaikoura	Block 1	Rural/Milking		11	222	1.6	1.29	1.2%	0.5	0.4	0.4%	F4	1.5%	0.5%	4
Kaikoura	Block 1	Res/Rural		11	504	0.9	0.73	0.7%	0.7	0.5	0.5%	F3/F4	0.9%	0.6%	6
Kaikoura	Block 1	Rural/Milking		11	231	1.2	0.97	0.9%	0.4	0.3	0.3%	F4	1.1%	0.4%	4
Waipara	Block 1	Rural		11	334	0.4	0.32	0.3%	0.6	0.5	0.5%	F4	0.4%	0.6%	6
Waipara	Block 1	Res?/Rural		11	553	1.3	1.05	1.0%	0.8	0.6	0.6%	F4	1.2%	0.8%	6
Waipara	Block 1	Rural/Milking		11	187	1.9	1.53	1.5%	0.4	0.3	0.3%	F4	1.8%	0.4%	4

APPENDIX 2 – FEEDER TABLE continued

GXP	AUFLS	Urban or Rural	Biggest Towns	Voltage	ICPs 27/06/17	MW Summer (peak)	MW Summer Scaled	Percentage of Total Scaled Load	MW Winter (peak)	MW Winter Scaled	Percentage of Total Scaled Load	Feeder Class	Percentage of Total Load (Summer)	Percentage of Total Load (Winter)	Priority as per Table 1
Kaikoura	Block 1	Rural		11	569	1.4	1.13	1.1%	1.1	0.9	0.8%	F4	1.3%	1.0%	6
Kaikoura	Block 1	Rural		11	324	0.9	0.73	0.7%	0.8	0.6	0.6%	F4	0.9%	0.8%	6
Kaikoura	Block 1	Comm/Res		11	1156	1.7	1.37	1.3%	2.2	1.8	1.7%	F3	1.6%	2.1%	5
Kaikoura	Block 1	Comm/Res		11	542	2.2	1.78	1.7%	1.8	1.5	1.4%	F3	2.1%	1.7%	2
Kaikoura	Block 1	Remote Rural		11	134	0.3	0.2	0.2%	0.3	0.2	0.2%	F5	0.2%	0.3%	6
Kaikoura	Block 1	Remote Rural		11	78	0.1	0.08	0.1%	0.1	0.1	0.1%	F5	0.1%	0.1%	6
Kaikoura	Block 1	Rural/Milking		11	75	1.3	1.05	1.0%	0.2	0.2	0.2%	F4	1.2%	0.2%	4
Kaikoura	Block 1	Rural		11	162	0.2	0.16	0.2%	0.2	0.2	0.2%	F4	0.2%	0.2%	
Culverden	Block 2	Rural/Milking		22	350	5.2	4.2	4.0%	1.3	1.1	1.0%	F4	5.0%	1.2%	4
Culverden	Block 2	Rural/Milking		22	519	5.3	4.28	4.1%	1.7	1.4	1.3%	F4	5.0%	1.6%	4
Culverden	Block 2	Rural/Milking		22	643	7.1	5.73	5.5%	2.2	1.8	1.7%	F4	6.8%	2.1%	4
Culverden	Block 2	Rural/Milking		22	387	3.2	2.58	2.5%	1.0	0.8	0.8%	F4	3.0%	1.0%	4
Culverden	Block 2	Comm/Res		11	912	1.4	1.13	1.1%	2.1	1.7	1.6%	F3	1.3%	2.0%	2
Culverden	Block 2	Comm/Res		11	529	1.7	1.37	1.3%	2.3	1.9	1.8%	F3	1.6%	2.2%	2
Culverden	Block 2	Remote Rural		11	61	0.0	0.03	0.0%	0.2	0.1	0.1%	F5	0.0%	0.1%	6
Culverden	Block 2	Remote Rural		11	9	1.1	0.89	0.8%	1.1	0.9	0.8%	F5	1.0%	1.0%	
Kaiapoi	Nil	Res		11	1474	3.1	2.5	2.4%	3.1	2.5	2.4%	F3	3.0%	3.0%	6
Kaiapoi	Nil	Comm/Res		11	1084	5.2	4.2	4.0%	5.2	4.2	4.0%	F3	5.0%	5.0%	2
Kaiapoi	Nil	Res?/Rural		11	718	2.8	2.26	2.2%	2.8	2.3	2.2%	F3/F4	2.7%	2.7%	6
Kaiapoi	Nil	Res?/Rural		11	1321	3.8	3.07	2.9%	3.8	3.1	2.9%	F3/F4	3.6%	3.6%	6
Kaiapoi	Nil	Comm/Res		11	1373	0.0	0	0.0%	0.0	0.0	0.0%	F2	0.0%	0.0%	5
Kaiapoi	Nil	Comm/Res		11	1373	0.0	0	0.0%	0.0	0.0	0.0%	F2	0.0%	0.0%	5
Kaiapoi	Nil	Res		11	644	1.0	0.81	0.8%	1.5	1.2	1.2%	F3	1.0%	1.4%	6
Kaiapoi	Nil	Res		11	971	1.8	1.45	1.4%	2.8	2.3	2.2%	F3	1.7%	2.7%	6
Kaiapoi	Nil	Res		11	628	1.7	1.37	1.3%	2.4	1.9	1.8%	F3	1.6%	2.3%	6
Kaiapoi	Nil	Comm/Res		11	430	2.0	1.58	1.5%	2.4	1.9	1.8%	F2/F3	1.9%	2.3%	5
Kaiapoi	Nil	Res		11	1326	0.0	0	0.0%	0.0	0.0	0.0%	F3	0.0%	0.0%	6
Kaiapoi	Nil	Res		11	1326	0.0	0	0.0%	0.0	0.0	0.0%	F3	0.0%	0.0%	6
Kaiapoi	Nil	Res		11	105	0.3	0.2	0.2%	0.5	0.4	0.4%	F3	0.2%	0.4%	6
Kaiapoi	Nil	Res		11		0.0	0	0.0%	0.0	0.0	0.0%	F3	0.0%	0.0%	6
Kaiapoi	Nil	Res		11	571	0.8	0.65	0.6%	1.4	1.1	1.1%	F3	0.8%	1.3%	6
Kaiapoi	Nil	Res		11	858	1.5	1.21	1.2%	2.6	2.1	2.0%	F3	1.4%	2.5%	6
Kaiapoi	Nil	Res		11	1118	1.6	1.29	1.2%	2.8	2.3	2.2%	F3	1.5%	2.7%	6
Ashley	Block 2	Rural		11	1401	2.5	2.02	1.9%	3.5	2.8	2.7%	F4	2.4%	3.3%	6
Ashley	Block 2	Rural		11	196	0.3	0.23	0.2%	0.6	0.5	0.5%	F4	0.3%	0.6%	6
Ashley	Block 2	Rural		11	125	0.6	0.48	0.5%	0.4	0.3	0.3%	F4	0.6%	0.4%	6
Ashley	Block 2	Rural		11	224	0.4	0.36	0.3%	0.6	0.5	0.5%	F4	0.4%	0.6%	6

APPENDIX 2 – FEEDER TABLE continued

Total Coincident Load	105
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Total Summer Peak	130.0
Total Winter Peak	117.9

AUFLS	MW (Summer)	MW (Winter)	% Total Load (Summer)	% Total Load (Winter)
Nil	62.25	65.75	59.3%	62.6%
Block 2	22.47	12.88	21.4%	12.3%
Block 1	19.44	15.77	18.5%	15.0%

In Summer, remove Ashley from Block 1 will give ~16%

Priority	MW (Summer)	MW (Winter)	% Total Load (Summer)	% Total Load (Winter)
1	0.00	0.00	0.0%	0.0%
2	26.98	32.63	25.7%	31.1%
3	0.00	0.00	0.0%	0.0%
4	44.12	20.10	42.0%	19.1%
5	2.96	3.72	2.8%	3.5%
6	28.83	36.43	27.5%	34.7%
			98%	88%

APPENDIX 3 – EXAMPLE ROLLING OUTAGE SCHEDULES

Example of 5% Saving

TransPower rolling feeder outage schedule
Energy Shortage Constraint

 Transpower Controlled

AUFLS Block 1
AUFLS Block 2

Load must not be reduced by more than 1.42MW
Load must not be reduced by more than 1.37MW

A request will be received from the Grid Owner for an average continuous load reduction. See OP042 for more details
Shed Blocks are setup to maintain two AUFLS Blocks of 16% of total load
All available feeders affected once at most suitable time of day
6 x 8 repeating schedule.

	MW	MWhrs
Estimated Total	71.7	1376.64
Average Saving	4.9%	4.9%
Reduction	4.0	67.2

Start Date	29/03/10
Start Time	1:00
Period Length	4:00
Outage Time	2:00

Monday 1:00 - 3:00			Monday 5:00 - 7:00			Monday 9:00 - 11:00			Monday 13:00 - 15:00			Monday 17:00 - 19:00			Monday 21:00 - 23:00		
Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load
R47	Loburn	2.2	S16	Rangiora Ea	3.2	S13	Flaxton Wod	3.0	K4	Ohoka Rd	2.5	K16	NW Kaiapoi	2.4	S15	Waikuku	2.2
S36	South Belt	1.9	K7	Wetheral	1.8	K6	Clarkville	1.8	K19	SE Kaiapoi	1.8	R37	West Belt	1.7	K18	NE Kaiapoi	1.6
K15	SW Kaiapoi	1.5	S34	West Belt	1.4	R27	River Road	1.1	P45	Waiau	1.0	S33	Fernside	1.0	P35	Culverden	0.9
X48	Burnt Hill	0.9	X38	Ashley Gorg	0.9	X28	View Hill	0.9	SW63	South	0.8	SW62	North	0.7	BN24	Horriville	0.6
C20	Summerhill	0.5	C30	West Eyreto	0.4	SW64	East	0.4	SW65	West	0.4	C40	Springbank	0.3	BN23	Bennetts	0.2
U26	North	0.7	H21	Waikari	0.5	W21	Omih	0.4	W23	Mt Cass	0.7	H31	Hawarden	0.7	U46	Churchill Str	0.8
T41	North	0.3	H41	Medbury	0.2	G31	Ethelton	0.2	Y43	Broomfield	0.3	T43	South	0.3	U36	South	0.4
L53	Parnassus	0.1	V75	Claverley	0.0	G32	Motunau	0.2	W22	Weka Pass	0.1	L52	Leader Rd	0.1	O76	Oaro	0.0
Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0
Nil	0	0.0	E80	Lochiel	0.1	Q79	Marble Poin	0.0	J77	Leslie Hills	0.2	N34	Argelins	0.9	N44	Scarboroug	1.1
Total		8.0	Total		8.5	Total		8.0	Total		7.8	Total		8.0	Total		7.9
Outage Saving %		11.2%	Outage Saving %		11.9%	Outage Saving %		11.1%	Outage Saving %		10.9%	Outage Saving %		11.2%	Outage Saving %		11.0%

Example of 10% Saving

TransPower rolling feeder outage schedule Energy Shortage Constraint

Transpower Controlled

AUFLS Block 1
AUFLS Block 2

Load must not be reduced by more than 1.42MW
Load must not be reduced by more than 1.37MW

A request will be received from the Grid Owner for an average continuous load reduction. See OP042 for more details
Shed Blocks are setup to maintain two AUFLS Blocks of 16% of total load
All available feeders affected once at most suitable time of day
6 x 8 repeating schedule.

Summary table with columns: MW, MWhrs. Rows: Estimated Total (71.7), Average Saving (9.8%), Reduction (8.0).

Summary table with columns: Start Date, Start Time, Period Length, Outage Time. Values: 29/03/10, 1:00, 4:00, 4:00.

Main grid of 48 tables representing daily outage schedules from Monday to Saturday, showing feeder locations, loads, and outage savings percentages.

Example of 15% Saving

TransPower rolling feeder outage schedule
Energy Shortage Constraint

Transpower Controlled

AUFLS Block 1
AUFLS Block 2

Load must not be reduced by more than 1.42MW
Load must not be reduced by more than 1.37MW

A request will be received from the Grid Owner for an average continuous load reduction. See OP042 for more details
Shed Blocks are setup to maintain two AUFLS Blocks of 16% of total load
All available feeders affected once at most suitable time of day
6 x 8 repeating schedule.

Estimated Total	MW	MWhrs	Start Date	29/03/10
Average Saving	14.6%	1376.64	Start Time	1:00
Reduction	12.0%	201.6	Period Length	4:00
			Outage Time	6:00

Monday 1:00 - 7:00			Monday 5:00 - 11:00			Monday 9:00 - 15:00			Monday 13:00 - 19:00			Monday 17:00 - 23:00			Monday 21:00 - 3:00		
Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load
R47	Loburn	2.2	S16	Rangiora Bc	3.2	S13	Flaxton Wod	3.0	K4	Ohoka Rd	2.5	K16	NW Kaiapoi	2.4	S15	Waikuku	2.2
S36	South Belt	1.9	K7	Wetheral	1.8	K6	Clarkville	1.8	K19	SE Kaiapoi	1.8	R37	West Belt	1.7	K18	NE Kaiapoi	1.6
K15	SW Kaiapoi	1.5	S34	West Belt	1.4	R27	River Road	1.1	P45	Waiau	1.0	S33	Fernside	1.0	P35	Culverden	0.9
X48	Burnt Hill	0.9	X38	Ashley Gorg	0.9	X28	View Hill	0.9	SW63	South	0.8	SW62	North	0.7	BN24	Horriville	0.6
C20	Summerhill	0.5	C30	West Eyreto	0.4	SW64	East	0.4	SW65	West	0.4	C40	Springbank	0.3	BN23	Bennetts	0.2
U26	North	0.7	H21	Waikari	0.5	W21	Omih	0.4	W23	Mt Cass	0.7	H31	Hawarden	0.7	U46	Churchill Str	0.8
T41	North	0.3	H41	Medbury	0.2	G31	Ethelton	0.2	Y43	Broomfield	0.3	T43	South	0.3	U36	South	0.4
L53	Parnassus	0.1	V75	Claverley	0.0	G32	Motunau	0.2	W22	Weka Pass	0.1	L52	Leader Rd	0.1	O76	Oaro	0.0
Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0
Nil	0	0.0	E80	Lochiel	0.1	Q79	Marble Point	0.0	J77	Leslie Hills	0.2	N34	Argelins	0.9	N44	Scarborough	1.1
Total		8.0	Total		8.5	Total		8.0	Total		7.8	Total		8.0	Total		7.9
Outage Saving %		11.2%	Outage Saving %		11.9%	Outage Saving %		11.1%	Outage Saving %		10.9%	Outage Saving %		11.2%	Outage Saving %		11.0%

Example of 20% Saving

TransPower rolling feeder outage schedule
Energy Shortage Constraint

Transpower Controlled

AUFLS Block 1
AUFLS Block 2

Load must not be reduced by more than 1.42MW
Load must not be reduced by more than 1.37MW

A request will be received from the Grid Owner for an average continuous load reduction. See OP042 for more details
Shed Blocks are setup to maintain two AUFLS Blocks of 16% of total load
All available feeders affected once at most suitable time of day
6 x 8 repeating schedule.

	MW	MWhrs	Start Date	29/03/10
Estimated Total	71.7	1376.64	Start Time	1:00
Average Saving	19.5%	19.5%	Period Length	4:00
Reduction	16.0	268.8	Outage Time	8:00

Monday 1:00 - 9:00			Monday 5:00 - 13:00			Monday 9:00 - 17:00			Monday 13:00 - 21:00			Monday 17:00 - 1:00			Monday 21:00 - 5:00		
Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load
R47	Loburn	2.2	S16	Rangiora Bc	3.2	S13	Flaxton Wod	3.0	K4	Ohoka Rd	2.5	K16	NW Kaiapoi	2.4	S15	Waikuku	2.2
S36	South Belt	1.9	K7	Wetheral	1.8	K6	Clarkville	1.8	K19	SE Kaiapoi	1.8	R37	West Belt	1.7	K18	NE Kaiapoi	1.6
K15	SW Kaiapoi	1.5	S34	West Belt	1.4	R27	River Road	1.1	P45	Waiau	1.0	S33	Fernside	1.0	P35	Culverden	0.9
X48	Burnt Hill	0.9	X38	Ashley Gorg	0.9	X28	View Hill	0.9	SW63	South	0.8	SW62	North	0.7	BN24	Horriville	0.6
C20	Summerhill	0.5	C30	West Eyretc	0.4	SW64	East	0.4	SW65	West	0.4	C40	Springbank	0.3	BN23	Bennetts	0.2
U26	North	0.7	H21	Waikari	0.5	W21	Omih	0.4	W23	Mt Cass	0.7	H31	Hawarden	0.7	U46	Churchill Str	0.8
T41	North	0.3	H41	Medbury	0.2	G31	Ethelton	0.2	Y43	Broomfield	0.3	T43	South	0.3	U36	South	0.4
L53	Parnassus	0.1	V75	Claverley	0.0	G32	Motunau	0.2	W22	Weka Pass	0.1	L52	Leader Rd	0.1	O76	Oaro	0.0
Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0
Nil	0	0.0	E80	Lochiel	0.1	Q79	Marble Point	0.0	J77	Leslie Hills	0.2	N34	Argelins	0.9	N44	Scarborough	1.1
Total		8.0	Total		8.5	Total		8.0	Total		7.8	Total		8.0	Total		7.9
Outage Saving %		11.2%	Outage Saving %		11.9%	Outage Saving %		11.1%	Outage Saving %		10.9%	Outage Saving %		11.2%	Outage Saving %		11.0%

Example of 25% Saving

TransPower rolling feeder outage schedule
Energy Shortage Constraint

Transpower Controlled

AUFLS Block 1
AUFLS Block 2

Load must not be reduced by more than 1.42MW
Load must not be reduced by more than 1.37MW

A request will be received from the Grid Owner for an average continuous load reduction. See OP042 for more details
Shed Blocks are setup to maintain two AUFLS Blocks of 16% of total load
All available feeders affected once at most suitable time of day
6 x 8 repeating schedule.

	MW	MWhrs
Estimated Total	71.7	1376.64
Average Saving	24.4%	24.4%
Reduction	20.0	336.0

Start Date	29/03/10
Start Time	1:00
Period Length	4:00
Outage Time	10:00

Monday 1:00 - 11:00			Monday 5:00 - 15:00			Monday 9:00 - 19:00			Monday 13:00 - 23:00			Monday 17:00 - 3:00			Monday 21:00 - 7:00		
Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load	Feeder	Location	Load
R47	Loburn	2.2	S16	Rangiora Bc	3.2	S13	Flaxton Wod	3.0	K4	Ohoka Rd	2.5	K16	NW Kaiapoi	2.4	S15	Waikuku	2.2
S36	South Belt	1.9	K7	Wetheral	1.8	K6	Clarkville	1.8	K19	SE Kaiapoi	1.8	R37	West Belt	1.7	K18	NE Kaiapoi	1.6
K15	SW Kaiapoi	1.5	S34	West Belt	1.4	R27	River Road	1.1	P45	Waiau	1.0	S33	Fernside	1.0	P35	Culverden	0.9
X48	Burnt Hill	0.9	X38	Ashley Gorg	0.9	X28	View Hill	0.9	SW63	South	0.8	SW62	North	0.7	BN24	Horriville	0.6
C20	Summerhill	0.5	C30	West Eyreto	0.4	SW64	East	0.4	SW65	West	0.4	C40	Springbank	0.3	BN23	Bennetts	0.2
U26	North	0.7	H21	Waikari	0.5	W21	Mt Cass	0.7	W23	Mt Cass	0.7	H31	Hawarden	0.7	U46	Churchill Str	0.8
T41	North	0.3	H41	Medbury	0.2	G31	Ethelton	0.2	Y43	Broomfield	0.3	T43	South	0.3	U36	South	0.4
L53	Parnassus	0.1	V75	Claverley	0.0	G32	Motunau	0.2	W22	Weka Pass	0.1	L52	Leader Rd	0.1	O76	Oaro	0.0
Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0	Nil	0	0.0
Nil	0	0.0	E80	Lochiel	0.1	Q79	Marble Point	0.0	J77	Leslie Hills	0.2	N34	Argelins	0.9	N44	Scarborough	1.1
Total		8.0	Total		8.5	Total		8.0	Total		7.8	Total		8.0	Total		7.9
Outage Saving %		11.2%	Outage Saving %		11.9%	Outage Saving %		11.1%	Outage Saving %		10.9%	Outage Saving %		11.2%	Outage Saving %		11.0%