OR-108 - Security of Supply
Participant Rolling Outage Plan

Process Group: Network Control

Issue: D

Expert: Steve Hull – Network Operations Manager
Owner: Mat O'Neill – GM Asset Management

DOCUMENT ISSUE STATUS

Issue	Prepared by	Approved by	Date	Detail
A	N Puljic, Network Manager	J van Brink, General Manager Asset Investment and Growth	31/3/2010	
B	N Puljic, Network Manager	T Scott, General Manager Asset Management	15/2/2012	
C	S Parker, Network Operations Manager	T Scott, General Manager Asset Management	28/4/2014	
D	S Hull, Network Operations Manager	M O'Neill, General Manager Asset Management	17/5/2021	

PAGE REVISION SHEET

Page(s)	Updated by	Date	Description
All	N Puljic	15/5/2012	Adjusted to the revised regulatory framework
All	T Hogan	16/5/2012	Reformatted for inclusion in BMS on Ingrid. Update term 'Retailer' to 'Trader'
Various	T Hogan	20/12/2012	Update WIRE to Content Manager
All	S Parker	28/4/2024	General update to Issue C
Cover	T Willetts	10/1/2017	Update to expert and owner
Cover	T Willetts	15/5/2017	Process group
All	S Hull	10/5/21	Update to expert, Communication, contacts, Methodology

Contents

1. Purpose

This plan was written to comply with the System Operator Rolling Outage Plan (SOROP) prepared and published by the System Operator and approved by the Electricity Authority

The plans outlined are prepared in accordance with the requirements of clauses 9.6 to 9.8 of Part 9 of the Electricity Industry Participation Code ("The Code") which requires each specified participant (in this case: WEL Networks) to prepare and publish a Participant Rolling Outage Plan ("PROP") which is consistent with the System Operator Rolling Outage Plan ("SOROP"). The PROP advises the System Operator and the public of WEL's planned response to a declared 'Supply Shortage Declaration' if issued by the System Operator. Typical scenarios where this planned may be enacted are in response to major generation shortages and/or significant transmission constraints. Typical scenarios include unusually low inflow into hydro-generation facilities, loss of multiple generating stations or multiple transmission failures.

The main energy saving measure listed is rolling outages, the structure and implementation of these is summarised in this document.

Under the regulations, Participant Rolling Outage Plans (PROP) are required to specify the actions that would be taken to:

- Reduce electricity consumption when requested by the System Operator
- Comply with requirements of the System Operator Rolling Outage Plan (SOROP)
- Comply with Electricity Industry Participation Code 2010
- Supplement the System Operator Rolling Outage Plan (SOROP)

Reducing demand by disconnecting supply to customers will be treated as a last resort; after all other forms of savings (including voluntary savings) have been exhausted. WEL Networks Limited (WEL) will always endeavour to keep supply on to customers. WEL will only disconnect customers when directed to by the Electricity Authority or its designated agent the System Operator.

2. Definitions

Term	Definition
AUFLS	Automatic Under-Frequency Load Shedding
Authority	Electricity Authority
CG106	Disruption Recovery / Business Continuity Plan
Code	Electricity Industry Participation Code 2010 Part 9 (Security of Supply)
Electricity Act	Electricity Industry Act 2010
Feeder	A high voltage supply line typically supplying between 100 and 2000 customers at 11kV
GXP	Transpower Grid Exit Point

GEN	Grid Emergency Notice
PROP	Participant Rolling Outage Plan (this plan)
Regulations	The Electricity Industry Participation Code 2010
Traders	Electricity Retail Companies
Rolling Outages (Cuts)	Planned electricity disconnections spread over different parts of the network at differing times to avoid prolonged outages at any one location
Security Coordinator SOROP	The person responsible for system security at the System Operator System Operator Rolling Outage Plan
System Operator	Operator of the national electricity transmission grid

3. Background

3.1 Electricity Authority

The Electricity Authority is an independent Crown entity responsible for the efficient operation of the New Zealand electricity market.

The core functions of the Authority are to make and administer the Electricity Industry Participation Code 2010 (Code) governing the New Zealand electricity market; undertake market-facilitation measures (such as providing education, guidelines, information, and model arrangements) and monitor the operation and effectiveness of market- facilitation measures; monitor and enforce compliance with the Code, various regulations, and the Act; proactively monitor the performance of the electricity industry in regard to competition, reliable supply and efficient operation; and contract service providers to operate the New Zealand electricity system and market in accordance with the Code.

3.2 Transpower

Transpower is a State Owned Enterprise, tasked with owning and operating New Zealand's National Grid – the network of high voltage transmission lines and substations that transports bulk electricity from where it is generated to distribution line companies such as WEL Networks.

As System Operator, Transpower manages the real-time operation of New Zealand's electricity transmission system. It ensures that at any one point in time the energy supplied to the network is matched by the energy demand of all the loads supplied by the network.

3.3 WEL Networks

WEL Networks Ltd is an electricity distribution business which supplies and maintains electricity infrastructure, delivering energy to over 94,000 homes, businesses and organisations throughout the Waikato region.

The company employs approximately 270 staff and has its offices in Hamilton

4. Range of Events

Events that could lead the Authority to make a Security of Supply Emergency declaration can in general terms be categorized as:

- Developing Event – Events that evolve over time, for example low hydro lake or fuel levels
- Immediate Event – Events that occur with little or no warning, usually as a result of a transmission line or major generation failure.

4.1 Major Event

A Developing or Immediate Event will be classed by WEL as a major event and WEL's management team will activate the appropriate contingency plan (CG 106) to manage the event accordingly.

Communication with traders, civil defence and other stakeholders will be as per procedures described in our Business Continuity Disaster Recovery document set.

WEL Network

5. WEL Staff Responsibilities

Specific responsibilities associated with undertaking actions for this method.

Role	Responsibility
Receive communication from System Operator of pending SOROP	Chief Executive or General Manager Asset Management (GM AM)
Receive communication from System Operator	Network Operation Manager
Implement this plan	Incident Controller (normally GM AM)
Preparation of load shedding schedules	Network Operations Manager
Customer notification	Customer Services Manager
Weekly savings reporting	Network Engineer
Revoking rolling outages	Network Operations Manager
Reporting to the System Operator	Incident Controller
Reporting to the media, public agencies	Communications Business Partner
Reporting to CEDM and Lifelines	Customer Liaison Manager (Lifelines representative)

6. Communication with the System Operator

The System Operator will contact WEL for administration purposes using the following details:

WEL Networks Limited
connect@wel.co.nz
Phone: +64 7 850 3100
PO BOX 925, Hamilton 3240
114 Maui Street, Te Rapa Hamilton 3200

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

Transpower
System Operator
PH: 0800 488 500
PH: 07 590 8100
Email: nmdata@transpower.co.nz

22 Boulcott St
Wellington Central

Wellington
Private bag 3215

All other communications with the System Operator will be between WEL's Control Centre and Transpower's Regional Operating Centre (RCN Otahuhu) using Transpower's TSX telephone or normal communication systems.

WEL Control Centre

Duty Controller
DDI +64 7 850 3310
Email: SystemControl@wel.co.nz

WEL Network Operations Manager

Steve Hull
DDI +64 7 850 3220 | MOB +64 21681350
Email steve.hull@wel.co.nz

On receipt of direction to Save Energy from the System Operator WEL will acknowledge this receipt by email.

Prior to notifying and implementing a rolling outage plan, WEL will consult with the System Operator Security Coordinator to establish a process for shedding and restoration, which may include a MW load cap to operate under during restoration phases. Unless a different agreement is made with the System Operator, load shedding and restoration shall be no more than 25MW per any five minute period.

WEL will provide the System Operator with daily, rolling week-ahead forecast of half-hourly load at each GXP, taking into account the impact of the planned rolling outages. Whenever any change in the forecast for a GXP of more than 20% for any half hour is expected WEL will highlight this to the System Operator.

7. Actions for Immediate Events

7.1 System Stability

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 cascade failure of the transmission system.

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 load. Automatic load shedding groups reduce load in stages until the frequency stabilizes.

To recover from Immediate Events, electricity consumption can be reduced by:

7.2 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. The frequency threshold is at or below 49.2Hz. WEL participates in the Reserve market.

7.3 Disconnecting Customers

7.3.1 Automatic Under Frequency Load Shedding (AUFLS)

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

Each distribution network company must, unless exempted, have available at all times two blocks of load, each of 16% of its total load, to be shed by automatic under frequency relays.

At WEL, this protection operates at the feeder level, initiated by relays located at zone substations.

The AUFLS scheme is currently under review with the System Operator, WEL Networks submits data to demonstrate compliance with the scheme and will review and adjust internal parameters to maintain this compliance.

7.3.2 AUFLS Zone 1

If system frequency fails to recover after Reserve Market load shed, AUFLS Zone 1 shedding will occur by disconnecting customers' supply. In the North Island within 0.4 seconds after the frequency reduces to and remains at or below 47.8Hz.

7.3.2.1 AUFLS Zone 2

If Zone 1 tripping fails to restore frequency, the next stage, Zone 2 activates. This will disconnect a further 16% of WEL's load. In the North Island after 15 seconds after the frequency reduces to and remains at or below 47.8Hz (remains inside Zone 1) or within 0.4 seconds after the frequency reduces to and remains at or below 47.5Hz.

7.3.2.2 Manual Shedding

If AUFLS Zone 1 and Zone 2 tripping fails to stabilise frequency the System Operator will shed more load. Once the frequency has stabilised the System Operator will advise WEL Networks Control centre when load can be restored.

7.4 Supply Restoration

Disconnected load must be restored in conjunction with the System Operator. This is to prevent overloading the transmission grid and/or creating further instability.

7.5 Transmission Grid Emergency

The System Operator may ask WEL to reduce load under a grid emergency notice (GEN). WEL will shed all water heating load, the System Operator will be advised and, if more shedding is required, the System Operator will instruct the Grid Owner to further disconnect load by shedding feeders to provide a nominated demand reduction.

If **a** transmission grid emergency was declared while an Immediate Event is in place, the grid emergency will take precedence.

If the System Operator declares a supply shortage during a Grid Emergency, then WEL will respond by implementing rolling outages as described in the following sections 8 to 17.

8. Developing Events

If the System Operator requires a load reduction for a planned Developing Event, WEL must reduce supply to customers in a controlled manner to meet the targets. The targets are likely to be in the form of a weekly energy savings target that is reviewed each week. To reduce energy usage WEL would disconnect feeders or groups of feeders where they belong to a parallel or ring supply (rolling outage feeders) in a controlled manner to enable targets to be reached.
WEL Networks has a legal obligation to comply with the targets specified by the System Operator.

Water heating load shedding is generally not an option for energy savings as this only defers usage.

9. Declaration of a Developing Event

The System Operator will endeavour to provide nine days prior notice of the requirement for weekly energy savings or any increase in the weekly energy savings target.

The System Operator will specify the energy savings target to be enforced for a specific region for a specified time-frame.

The System Operator will begin an Official Conservation Campaign if either New Zealand or South Island storage reaches the Emergency Zone.

On receipt of a declaration of a Developing event, WEL will update Appendix A with current load data.

10.Criteria for Rolling Outages

To ensure public health and safety is preserved and costs to the economy are minimised the following table shows the desired criteria for selecting rolling outage feeders to be included in rolling outages. Rolling outage feeders will all contain a variety of customers. The priority for each rolling outage feeder will be based on the priority ratings assessed for the connections within each feeder. Lowest priority loads will be scheduled for interruption before higher priority loads.

10.1 Table 1 – Priority Loads

Priority	Priority Concern	Maintain Supply to:	Examples
1	Public health and safety	Major hospitals, air traffic control centres and emergency operation centres	WDHB hospitals Hamilton International Airport Major police stations
2	Important public services	Energy control centres, communication networks, water and sewerage pumping, fuel delivery systems and major port.	Telecom major connections Rural fire and police stations
3	Public health and safety	Minor hospitals, medical centres, schools and street lighting	Dental Medical Centre Schools Colleges Universities Halls of residence Prisons Major hotels
4	Food production	Dairy farms and milk production facilities	All irrigation category All rural connections with a description that includes dairy, farm, irrigation, pig, poultry or cow. Milk factory
5	Domestic production	Commercial and industrial premises	Every 'BUS' connection with an account name starting with 'Mr' or 'Mrs' Temporary builders' supplies
6	Disruption to consumers	Residential premises	All 'RES' connections Embedded networks Churches Speed cameras Parks (mainly lighting and irrigation)

10.2 Vulnerable Customers and Priority Sites

It is not possible for WEL to prevent rolling outages affecting individual vulnerable customers and priority sites. In addition to the prioritisation of rolling outage feeders WEL will:

- Provide information in its public notices and on its website alerting vulnerable customers to the risks, and
- Request that traders consider individually notifying their vulnerable customers.

10.3 Retailer Agreements

Currently WEL do not have any contractual restrictions with retailers or consumers which would adversely affect WEL's ability to comply with System Operator directions.

11.AUFLS Criteria

The level of AUFLS during rolling outages has to be maintained. The criteria used to select feeders for the AUFLS scheme was very similar to the criteria for rolling outages as shown in Table 1, Thus, AUFLS load blocks are predominantly from lower priority load categories. WEL will include AUFLS feeders in shedding, but will limit the participation ratio to ensure that both AUFLS blocks of 16% are maintained at all times.
Note: The AUFLS scheme is currently under review with the System Operator, WEL Networks submits data to demonstrate compliance with the scheme and will review and adjust internal parameters to maintain this compliance.

12.Shutdown Notification

With the wide scale impact of rolling outages it is not feasible to use our standard planned outage notification process (mainly because retail and postal systems could not process the hundreds of thousands of outage notifications required).

When implementing a rolling outage plan, WEL will notify the outages in a number of ways:

- WEL website – a dedicated website page will be set up which shows the approximate rolling outage timetable.
- Online Social Media – Will be utilised as appropriate
- Customer Support Team - will communicate with customers throughout
- Trader notification – WEL will provide the rolling outage timetable to all electricity traders together with a schedule showing the rolling outage group for all ICPs (it would probably not be practical to filter the schedule for an individual trader's ICPs).

Where possible, WEL will provide up to 7 days' notice of all rolling outage plans.

13.Grid Emergency during a Developing Event

If the System Operator declares a grid emergency during a Developing Event, the grid emergency will take priority. As water heating load generally would not be used to reduce load in a Developing Event, WEL would have water heating load available for load reduction when required for the grid emergency. This load would

be shed, the System Operator advised and, if more shedding is required, the System Operator will instruct the Grid Owner to further disconnect load. The rolling outage feeders may have to be rearranged to comply with the grid emergency.

After the grid emergency is cancelled the rolling outages pattern would continue.

14. Rolling Outages Strategy and Methodology

If and when it comes to rolling outages there is always a chance that, due to a positive change in circumstances (e.g. steady rain in key catchment areas), the need for them will cease to exist sooner than originally expected. To avoid a situation where some customers are repeatedly selected for interruption at the start of an event, WEL has developed and employs a "Feeder Shedder" modelling App to randomly select feeders for load shedding.

Some of the key features of the shedding model are:

- The model takes the snapshot of all feeder load (Amps) on request, with an update every 5 minutes (through a prompt).
- An amount of load reduction, either as a percentage or absolute value, is specified and a proposed list of feeders is generated to meet the load drop request, taking into account the various constraints including priority and AUFLS reserve,
- A record is maintained of feeders that have already experienced outages, to ensure “equity”.
- Overall load shed ratio is not pre-set to pre-defined values. This feature can be used to fine tune customer outages near the end of a shed period (say a week) so that no more customers than absolutely necessary are disconnected and customers are not disconnected for any longer than necessary, whilst still complying with the target given by the System Operator.
- The model can deal with seven levels of load shedding priorities. Priority 0 is for feeders where shedding is not allowed, followed by up to six subsequent priority levels from most to least allowed.

Note the Feeder Shedder App assumes the system is in a "normal" configuration. If a particular feeder is being supplied from another GXP it does not recognise this. Feeder shed recommendations will require confirmation the feeder is fed from selected GXP.

WEL will start with randomly selected lower priority feeders. If the need for shedding is required for a longer period, the established order will be cyclically repeated. Flexibility in selecting the required amount for shedding combined with the outage duration will provide the required daily/weekly saved amount of energy.

Where possible WEL will apply internal rules to minimise consequences of these outages, including:

- No longer than 4 hours per day for any customer (possible for the targets under 10%).
- Shed only between 0800 and 1700 on all days (daylight time).
- Cater for specific needs such as milking times
- Lower priority feeders up to 10%, mid priority up to 20% almost all for 25% and above.

A set of switching instructions will be generated for each GXP feeder selected to drop load. Sufficient time must be planned for switching, particularly during restoration phases.

When disconnecting or restoring demand, best endeavours will be made to:

- Unless a different agreement is made with the System Operator, load shedding and restoration shall be no more than 25MW per any five minute period.
- Minimise the impact on frequency and voltage stability.
- Minimise the disconnection and restoration of demand during times when demand is typically ramping up or down in the region affected by the supply shortage (for example, either side of morning and evening peaks).

14.1 GXP's

Feeders that could be subject to rolling outages will be separately shown as belonging to zone substations and GXPs. WEL has four GXPs:

GXP	Rolling Outages may occur Yes/No	Reason for there being no rolling outages
Hamilton 33kV	Yes	n/a
Hamilton 11kV (single zone substation)	Yes	n/a
Te Kowhai 33kV	Yes	n/a
Huntly 33kV	Yes	n/a

GXP	Percentage of average annual demand available for interruptible load (MW)
HAM (11kV & 33kV)	12.93%
HUN	10.91%
TWH	10.91%

14.2 Prop Priority Groups

PROP group priority	Criteria - Weighted Avg Lower Bound	Criteria - Weighted Avg Upper Bound	Other Criteria
1			1 or more ICPs with priority concern 1 load on feeder
2			1 or more ICPs with priority concern 2 load on feeder
3	3.5		
4	2.5	3.5	
5	1.5	2.5	
6		1.5	

14.3 Savings Plan

5% Savings Plan			
Group Priority	Cuts per Week	Cut Duration (hours)	Weekly Savings (MWh)
1	0	0	-
2	0	0	-
3	0	0	-
4	0	0	-
5	5	5.5	480
6	5	6.25	1,042
Average Weekly Winter Volume			30,260
Estimated Percentage Savings			5.03%

10% Savings Plan			
Group Priority	Cuts per Week	Cut Duration (hours)	Weekly Savings (MWh)
1	0	0	-
2	0	0	-
3	6	4	176
4	6	6	331
5	7	7	856
6	7	7	1,633
Average Weekly Winter Volume			30,260
Estimated Percentage Savings			9.90%

15% Savings Plan			
Group Priority	Cuts per Week	Cut Duration (hours)	Weekly Savings (MWh)
1	3	5	144
2	4	7	359
3	5	6	220
4	7	6.5	418
5	7	8.5	1,039
6	7	10	2,333
Average Weekly Winter Volume			30,260
Estimated Percentage Savings			14.91%

20% Savings Plan			
Group Priority	Cuts per Week	Cut Duration (hours)	Weekly Savings (MWh)
1	5	4	191
2	6	6	462
3	6	7.5	329
4	7	9	579
5	7	10	1,223
6	7	14	3,267
Average Weekly Winter Volume			30,260
Estimated Percentage Savings			20.00%

25% Savings Plan			
Group Priority	Cuts per Week	Cut Duration (hours)	Weekly Savings (MWh)
1	7	6.5	435
2	7	8	719
3	7	9.5	487
4	7	11	707
5	7	12	1,467
6	7	16	3,733
Average Weekly Winter Volume			30,260
Estimated Percentage Savings			24.95%

15.Target Monitoring

To avoid discrepancy over the accuracy of different data sources, the System Operator will report on actual demand versus the target.

For load shedding to a weekly target, the Network Engineer will monitor our actual cumulative savings compared to our target and together with the Commercial Manager and Network Operations Manager, adjust as required future load shedding to increase or decrease the amount of rolling outages and enable the weekly target to be met. The Network Engineer will be responsible for daily and weekly reporting to the System Operator of consumption relative to target levels. The Network Engineer will also be responsible for providing to System Operator the predicted load for the next week on a seven day rolling basis. This prediction will be by GXP for each half hour.

16.Log of Rolling Outages

Controllers will enter in the Rolling Outage Log, times of disconnection and reconnection of all feeder interruptions. The log sheet to be used by Controllers is shown in Appendix 1.

The WEL Network Management System (NMS) will also capture detailed switching and specific action times under the unique job number generated by the Feeder Shedder App.

17.Contingent Events

If an unplanned event occurs that will alter planned rolling outages, the Incident Controller or Network Operations Manager will be responsible for all decisions. Where possible, any changes to the planned timetable should be published on WEL's website and communicated to traders. The Network Operations Manager will also advise the SO Security Coordinator.

Appendix A – Rolling Outage Log

Date:				Controller:			
GXP	**Feeder Code**	**Load (amps)**	**No. of Customers**	**Time Off**	**Time On**	**Duration**	**Notes**