
Security of Supply - Participant Rolling Outage Plan

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1 PURPOSE OF THIS DOCUMENT

The distribution of electricity depends upon the availability of supply to meet demand. Certain events could lead to a lack of supply, such as very low hydro lake levels due to very low rainfall. Such events, while infrequent, could cause widespread disruption. The management of such events would occur through the implementation of rolling outages to reduce demand and balance against the reduced supply of electricity.

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

Under Part 9, Security of Supply, of the Electricity Industry Participation Code (the Code), participants, including Aurora, are required to develop participant rolling outage plans (PROP) to specify the actions that would be taken to:

- reduce electricity consumption when a supply shortage is declared by the System Operator;
- comply with requirements of the Code (Part 9)
- comply with requirements of 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. Aurora will always endeavour to keep consumers supplied. Aurora will only disconnect consumers when directed to by the System Operator.

The procedures outlined are in response to major transmission equipment outages or 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.
EDN	Electricity distribution network.
Code	Electricity Industry Participation Code
Feeder	A high voltage circuit typically supplying up to 2000 consumers.
GXP	Grid exit point
GEN	Grid emergency notice
PROP	Participant rolling outage plan (this plan)
Rolling Outages	Planned electricity disconnections spread over different parts of the network at differing times to avoid prolonged outages at any one location.
Security Coordinator	Person responsible for system security at the System Operator
SOROP	System Operator rolling outage plan
Supply Shortage Declaration	Declaration made by the System Operator under Code clause 9.14
System Operator	Operator of the national electricity transmission grid

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2.1 Associated Quality Procedures

QP1601-18	Notification of Outages.
QP1601-34	Advice to Media re Outages.
QP1602-22	Emergency Load Shedding and Restoration.
QP1602-59	PROP Feeder Schedules.

3 BACKGROUND

3.1 Electricity Authority

The Electricity Authority is a Crown entity set up under the Electricity Industry Act 2010 and responsible for the efficient operation of the New Zealand electricity market.

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 Aurora.

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.

The System Operator has various security-of-supply responsibilities under the Code, including forecasting supply and demand, calculating and publishing hydro risk curves, and implementing the SOROP under certain conditions.

3.3 Aurora

Aurora is the electricity network company that owns and maintains the electricity lines, cables and substations that deliver electricity to consumers in the Dunedin and Central Otago 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;
- A fault on critical transmission circuit.

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

4.1 Load Reduction by Aurora

Aurora has some ability to reduce load by turning off domestic water heaters, via ripple control. Further load reductions would require disconnecting consumers.

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4.2 Range of Events

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

Developing (Category A) Events: Events that evolve over time; for example, low hydro lake levels.

Immediate (Category B) Events: Events that occur with little or no warning, usually as a result of a transmission circuit or major generation failure.

4.3 Significant Incident

A Category A or Category B event will be classed by Aurora as a significant incident and the Operations Manager will assemble a team to manage the incident.

Communication with electricity retailers will be as per normal notification procedures described in QP1601-34 "Advice to Media re Outage".

Local Authorities, civil defence and other stakeholders will be notified of significant events by the Operations Manager.

5 ACTIONS FOR IMMEDIATE (CATEGORY B) EVENTS

An immediate or Category B event is likely to occur due to a major transmission equipment or generation outage. It may be initially handled as a Transmission Grid Emergency and be handled by a grid emergency notice (GEN). Aurora's procedures for handling a GEN are covered under QP1602-22 "Emergency Load Shedding and Restoration".

If the grid emergency is expected to persist for a sustained period, the System Operator may make a Category B supply shortage declaration and cease the GEN.

A Category B event may affect only one GXP, or a small group of GXPs. If this is the case then, where intertie capacity exists, Aurora will transfer load to GXPs unaffected by the emergency, where possible.

A Category B event may only limit peak loads (rather than requiring long term energy savings). If this is the case, Aurora will use its ripple control system to reduce load as a first preference and only use rolling outages if this is insufficient.

Otherwise Aurora will handle a Category B event in an identical manner to a Category A event, as described in section 6.

6 DEVELOPING (CATEGORY A) EVENTS

If the System Operator requests a load reduction for a planned (Category A) event, Aurora must reduce demand to meet the System Operator's targets. The targets are expected to take the form of an energy savings target, reviewed weekly. To reduce energy usage, Aurora would disconnect HV feeders (rolling outages), in a controlled manner, to enable targets to be reached. The shedding of water heating load is not a viable option for energy savings, as this only defers usage and would not save energy.

6.1 Declaration of Category A Event

The System Operator will endeavour to provide nine days prior notice of the requirement for weekly energy savings. It is Aurora's plan to use the standard planned outage notification procedure to

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electricity retailers as detailed in QP1601-18 "Notification of Outages". Any increase in the weekly energy savings target would also need nine days prior notice.

To declare a Category 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 period. A notification system similar to the GEN procedure would be appropriate.

The System Operator will begin an official conservation campaign if either New Zealand or South Island hydro storage reaches the pre-defined emergency zone.

6.2 Criteria for Rolling Outages

To ensure public health and safety is preserved, and costs to economy are minimised, Table 1 shows a desired criteria for selecting feeders to be included in rolling outages.

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 production	Commercial and industrial premises.

Table 1 – Priority Loads

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.

6.3 Automatic Under Frequency Load Shedding (AUFLS) Criteria

Currently, the same criteria for rolling outages, as shown in Table 1, are also used to select 33kV feeders (zone substations) for AUFLS tripping. Thus, AUFLS load blocks are predominantly from lower priority load categories; however, some higher priority consumers would also be affected.

For system security reasons, Aurora will ensure that load shed from feeders in each AUFLS block is in proportion to the total load shed (unless the system operator advises that one or both of the AUFLS blocks are not needed, as per section 8.11 of the SOROP).

To minimise the effect of AUFLS exclusion during extended rolling outages, it is proposed to shift the AUFLS to high priority zone substations. When a Category A event is declared, Transpower will be requested to change the AUFLS blocks to alternative feeders. It is considered prudent to expose high priority consumers to a low probability short term event, such as AUFLS, rather than have them included in rolling outages.

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6.4 Shutdown Notification

When requested to reduce demand with rolling outages, Aurora will use the planned outage procedure defined in QP1601-18 "Notification of Outages" to advise electricity retailers in advance of pending outages. The time and extent of advertised outages will be approximate.

6.5 Vulnerable consumers and Priority Sites

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

6.6 Grid Emergency during Category A event

If the System Operator declares a grid emergency during a category A event, the grid emergency will take priority. As water heating load generally would not be used to reduce load in a Category A event, Aurora would have the water heating load available for load reduction when required for the grid emergency. If water heating load is insufficient, the rolling outage feeders may have to be rearranged to comply with the GEN. After the grid emergency is over, the rolling outages pattern would continue.

6.7 Supply Disconnection

The System Operator will provide general criteria on acceptable disconnection rate. Schedules of outages will be prepared and sent to the System Operator, as outlined in section 7.

6.8 Supply Restoration

Disconnected load 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

Aurora will keep media and consumers informed of planned interruptions to supply, before and during the outages. Media will be informed as per Aurora's standard communications procedure, and the electricity 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 Dunedin and via PSTN in Central. The main point of communication with the System Operator will be via the National Grid Operating Centre (South).

Prior to notifying and implementing rolling outages, Aurora will consult with the Security Coordinator to establish a process for load shedding and restoration.

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6.10 Delta Staff Responsibilities

Delta Person Responsible	Role
General Manager Network Operations	Receive notification of pending SOROP implementation from the System Operator Receive communication from Network Coordinators Revoking rolling outages Reporting to System Operator Communicate with Emergency Services (incl. Civil Defence) & Local authorities
Operations Manager	Implementation of this plan
Network Analyst	Weekly savings reporting
Network Coordinator	Retailer notification
Marketing and Communications Manager	Reporting to media, public agencies

Table 2 - Delta Staff Responsibilities

If the listed Delta staff member is unavailable, an appropriate alternate must be appointed.

Within one day of declaration of a Category A event, the Operations Manager will notify the System Operator of any updated contact details including telephone numbers and email address for each of the positions named in Table 2.

Contact details for the Operations Manager are:

Delta Utility Services Limited
 P O Box 1404
 Dunedin 9054
 Ph: 03-477 6664
 Fax: 03-479 6653.

Upon receipt of direction from the System Operator to prepare for rolling outages, the Operations Manager will inform Delta's management and commence specific rolling outage plan preparations. Final authorisation to commence a programme of rolling outages will be made by Aurora's Chief Executive.

6.11 Rolling Outages Strategy and Methodology

The General Manager Network Operations will review weekly targets and prepare plans for weekly rolling outages based on savings required. The plans will be forwarded to electricity retailers for consumer and media notification. Rolling outages will, wherever possible, disconnect feeders using the criteria listed in Table 1.

Planned energy savings will be based upon the network energy volumes of the same period in the preceding year.

6.12 Target Monitoring

For load shedding to a weekly target, the Network Analyst will monitor energy savings against target and, together with the Operations Manager and General Manager Network Operations, review future load shedding to increase or decrease the amount of rolling outages required to meet the weekly target. The Network Analyst will be responsible for daily and weekly reporting of consumption relative to target levels. The Network Analyst 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.

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6.13 Log of Rolling Outages

Network Coordinators will log times of disconnection and reconnection for all feeder interruptions and enter in the log. The log sheet to be used by Network Coordinators 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 Operations Manager in accordance with this plan and outage strategy. The Operations Manager and General Manager Operation Manager will ensure load shedding schedules are prepared, system control 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 Aurora shall advise the Security Coordinator of this change.

Aurora will endeavour to comply with the criteria stated in Table 1 to select feeders for rolling outages. Aurora will attempt to keep rolling outages to any consumer no longer than 5 hours per day, for a 5% savings target. For savings more than 5%, longer outages may be necessary.

Outages will be programmed between 0800 and 1800 on all days. Night time is excluded from the cut period for safety reasons. Initially, outages will be scheduled for mid-afternoon to limit adverse economic effects.

The timing of outages will be approximate, and could vary daily due to network or System Operator constraints.

Table 3 below shows the planned cut duration for each specified savings level. Cuts are based on five-to-seven days per week, and the listed priorities are the highest priority loads expected to be cut as per Table 1. The savings levels in this table are in addition to any savings made through voluntary, or other, means.

Savings Level	Highest Priority	Maximum Duration	Days per week
5%	5	5 hrs	5
10%	5	8 hrs	6
15%	4	8 hrs	7
20%	3	10 hrs	7
25%	3	10 hrs	7

Table 3 - Rolling Outage Priority

7.1 Feeder Selection

Feeders to be disconnected are shown in QP1602-59 "PROP Feeder Schedules".

Calculation of the expected saving is complicated by two factors:

1. The daytime load of feeders is significantly higher than the nighttime load, therefore the saving from a feeder outage of, say, 6hrs per day will be greater than 25%.
2. On restoration of a feeder, there will be some additional load due to "cold load pickup" (e.g., home heating, water heating, and refrigeration load returning to their temperature settings). This will reduce the expected savings.

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To a certain extent, these two factors will cancel each other out.

The tables below are an estimate of expected savings. The actual outages will have to be modified from this plan, based on measured results in order to meet weekly savings targets.

Consumer Group Priority	Maximum Duration	Days per week	Percentage System Winter Energy	Expected Energy Savings
1			12%	0.0%
2			14%	0.0%
3			16%	0.0%
4			18%	0.0%
5	4 Hr	5	18%	2.1%
6	5 Hr	5	22%	3.3%
			Total	5.4%

Table 4 - Duration of Daily Outages per Consumer Group for 5% Savings

Consumer Group Priority	Maximum Duration	Days per week	Percentage System Winter Energy	Expected Energy Savings
1			12%	0.0%
2			14%	0.0%
3			16%	0.0%
4			18%	0.0%
5	6 Hr	6	18%	3.9%
6	8 Hr	6	22%	6.3%
			Total	10.2%

Table 5 - Duration of Daily Outages per Consumer Group for 10% Savings

Consumer Group Priority	Maximum Duration	Days per week	Percentage System Winter Energy	Expected Energy Savings
1			12%	0.0%
2			14%	0.0%
3			16%	0.0%
4	3 Hr	7	18%	2.2%
5	8 Hr	7	18%	6.0%
6	8 Hr	7	22%	7.3%
			Total	15.5%

Table 6 - Duration of Daily Outages per Consumer Group for 15% Savings

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Consumer Group Priority	Maximum Duration	Days per week	Percentage System Winter Energy	Expected Energy Savings
1			12%	0.0%
2			14%	0.0%
3	2 Hr	7	16%	1.3%
4	4 Hr	7	18%	3.0%
5	10 Hr	7	18%	7.5%
6	10 Hr	7	22%	9.2%
			Total	21.0%

Table 7 - Duration of Daily Outages per Consumer Group for 20% Savings

Consumer Group Priority	Maximum Duration	Days per week	Percentage System Winter Energy	Expected Energy Savings
1			12%	0.0%
2			14%	0.0%
3	4 Hr	7	16%	2.7%
4	8 Hr	7	18%	6.0%
5	10 Hr	7	18%	7.5%
6	10 Hr	7	22%	9.2%
			Total	25.4%

Table 8 - Duration of Daily Outages per Consumer Group for 25% Savings

The outage durations tabled above are indicative only and will be reviewed daily to achieve the specified targets.

7.2 Contingent Events

If an unplanned event occurs, such as a Civil Defence emergency, that could alter the planned rolling outages, the Operations Manager will be responsible for communicating any changes to the advertised program to electricity retailers of, and also to the SO Security Coordinator

7.3 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 those consumers to manage.

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

7.4 Vulnerable Consumers

Electricity retailers maintain lists of consumers with health and safety issues. It is not feasible for Aurora to prevent rolling outages affecting individual vulnerable consumers. During rolling outages general media releases will advise consumers with health problems as to their best course of action.

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