

SRC – System Operation and Grid Planning Standards

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System Operator
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SYSTEM OPERATOR

Keeping the energy flowing

TRANSPower



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1 Introduction and purpose

All transmissions systems are planned and operated to be robust to certain types of events occurring on the system, especially those that are more likely to occur and could have a significant impact on reliability. Equally, they are not operated to be robust to very unlikely events, where the cost of such mitigation would be prohibitive.

System operating and grid planning standards have different purposes. System operation standards are about managing supply of electricity risks with the assets made available at a particular time. Grid planning standards are concerned with what assets should be built to provide a range of benefits to parties generating or consuming electricity.

This note summarises system operation and grid planning standards and their regulatory framework in New Zealand.

2 System operation standards

The principal performance obligations of the system operator, under Part 7 of the Electricity Industry Participation Code (the Code), require it to act as a reasonable and prudent system operator in:

- Dispatching assets made available in a manner that avoids cascade failure resulting in the loss of demand arising from frequency or voltage excursions or supply and demand imbalances
- Maintaining frequency and frequency time error within defined bands, and restoring it if necessary

The system operator identifies credible events that may result in cascade failure, due to these events causing assets to exceed stated capability or voltages to go outside the ranges defined in Part 9 of the Code.

The system operator publishes a policy statement that sets out policies and means that the system operator will use to meet the principal performance obligations. The policy statement is incorporated by reference in the Code following a prescribed industry consultation and Authority approval process. The system operator may depart from the policy statement when a system security situation arises and such departure is required in terms of the system operator acting as a reasonable and prudent system operator.

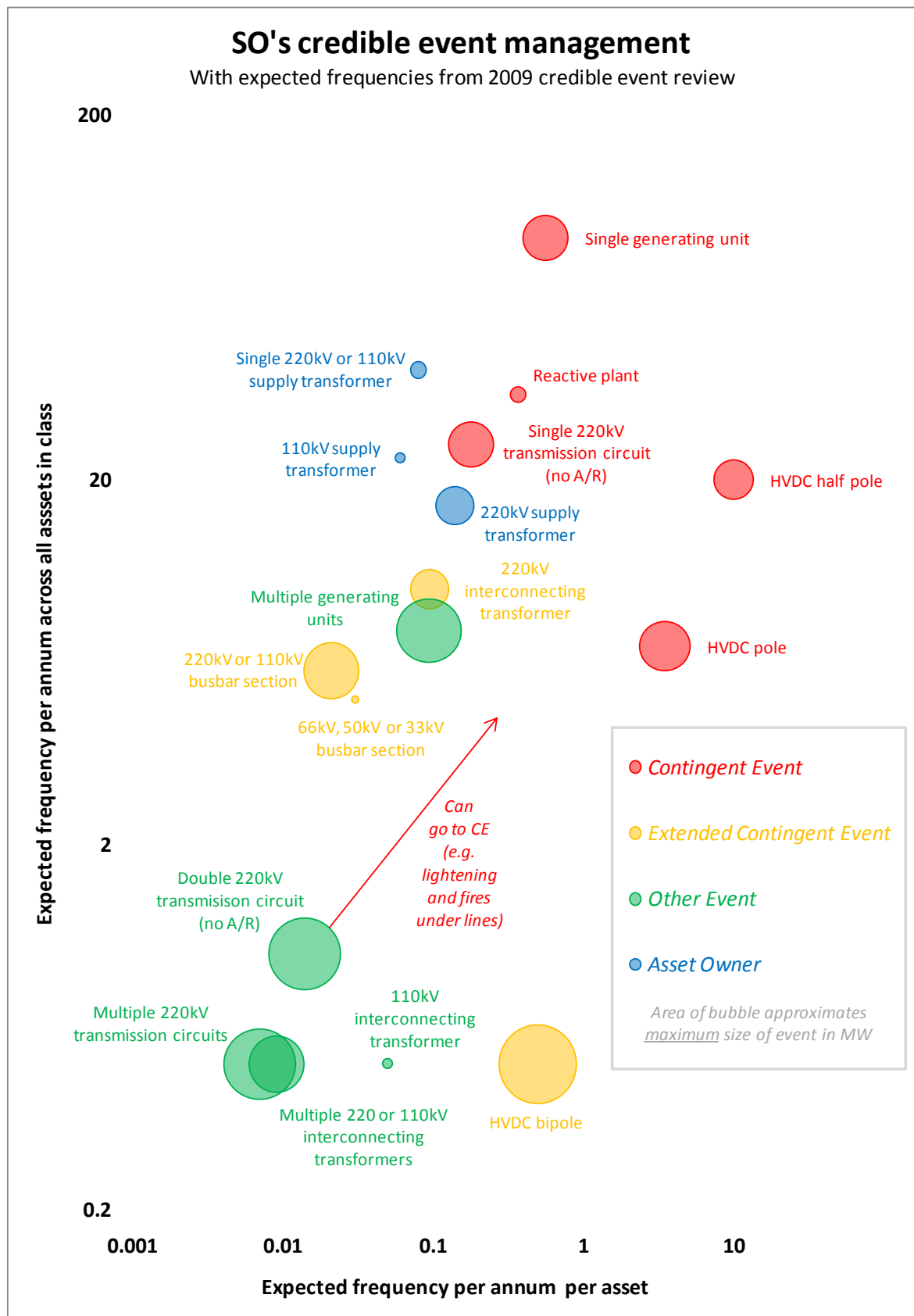
The system operator reviews the identification, assessment and assignment of potential credible events at least every five years. The most recent review was concluded in 2009. The review identifies possible events and, according to their likelihood and physical and economic consequence, divides them into four categories of how they will be managed. The current categories are tabulated overleaf.

Category	Description	Operational implication
Contingent events	Events where the impact, probability of occurrence and estimated cost and benefits of mitigation are considered to justify implementing policies that are intended to be incorporated into the scheduling and dispatch processes pre-event.	<i>The system is operated such that if these events occur there will be no loss of load</i>
Extended contingent events	Events for which the impact, probability, cost and benefits are not considered to justify the controls required to totally avoid demand shedding and maintain the quality limits defined for contingent events.	<i>The system is operated such that if these events occur there may be automated load shedding, such as AUFLS or inter-trips</i>
Stability events	Severe power system faults that might lead to a defined contingent event, extended contingent event or loss of an interconnecting transformer or busbar section. For these faults it is deemed prudent to ensure that the transient and dynamic stability of the power system is maintained.	<i>Currently there are no events assigned as stability events.</i>
Other events	Events which are considered to be uncommon and for which the impact, probability of occurrence and estimated cost and benefits do not justify implementing available controls, or for which no feasible controls exist or have been identified, other than unplanned demand shedding, AUFLS and other emergency procedures or restoration measures.	<i>The system is operated such that if these events occur there may be uncontrolled loss of load.</i>

In addition, supply transformer events are managed by the relevant asset owner.

An important consideration is that the system operator manages events with the assets made available at the time. At some times there may be insufficient assets made available to provide a secure grid.

The following diagram illustrates the current categorisation of credible events.



3 Grid planning standards

The grid owner invests in assets that provide benefits to connected parties and end consumers. The grid owner's investment plans are overseen by the Commerce Commission. The Commerce Act (Transpower Input Methodologies) (Capital Expenditure) Determination 2011 is expected to be finalised soon, to replace Part F of the old Electricity Governance Rules (EGRs) as the framework for approving grid investment. It will (assuming its current form) require investments to have:

- Highest positive expected net electricity market benefit (the 'economic limb'), or
- Highest expected net electricity market benefit and meet the deterministic limb of the grid reliability standards, under Schedule 12.2 of the Code.

In this way, the Commerce Commission's approval process references the grid reliability standards in the Code.

The economic limb allows for investments in grid assets where there is a positive expected net market benefit. This benefit may arise from reliability considerations (e.g. avoiding energy not served) or through other considerations such as a reduction in system losses or relief of generation constraints.

The deterministic limb of the grid reliability standards requires that, with all assets that are reasonably expected to be in service, the power system would remain in a satisfactory state during and following a single credible contingency event occurring on the core grid. Thus, it is an N-1 standard, excepting that some allowance may be made for conditions when assets (both transmission and generation) are out of service. The consequences of an N-1 event occurring when assets are out of service should be accounted for on a probabilistic basis and hence proved economically.

Single credible contingency events are defined in Part 1 of the Code as comprising any of the following:

- a single transmission circuit interruption
- the failure or removal from operational service of a single generating unit
- an HVDC link single pole interruption
- the failure or removal from service of a single bus section
- a single inter-connecting transformer interruption
- the failure or removal from service of a single shunt connected reactive component

The determinist limb applies only to the core grid, which is defined in Schedule 12.3 of the Code as those assets that comprise the transmission links explicitly listed in that schedule. The Code provides a formal process for reviewing the core grid definition.

Events on the non-core grid, or other or multiple events on the core grid, are included where covering them has positive expected net electricity market benefit, i.e. under the 'economic limb'. They are therefore analysed separately for each grid upgrade plan or GUP, soon to be replaced by the major capital proposal or MCP.

Planning of the grid must take a number of considerations into account including operational standards. Planning considers the need for windows in which assets can be taken out of service for planned maintenance. Grid upgrades consider the need to take assets out of service to carry out upgrades in terms of timing of the upgrade or the mitigation measures required during the outage to avoid managing load.

It is accepted that there will be times when demand or generation will not have N-1 security (e.g. during planned maintenance outages). This is because it is not economic to provide additional assets to provide that security for a small number of days each year.

Planning of the grid also takes into consideration environmental and property considerations (such as existing and future transmission corridors) and the amount of resources available to design, build, commission and maintain grid assets.

Planning of the grid considers mitigations and restorative measures for major failures. For example, the installation of auto-synchronism points on the grid will enable faster restoration of supply following events which cause the power system to split into separate islands.

4 Consistency

System operating and grid planning standards serve different purposes and so are not identical, but do need to be consistent.

Both system operating and grid planning standards are defined by the regulatory framework of the Commerce Act and the Code.

The interdependency between system operating and grid planning standards is recognised in the Code, which requires that with respect to the grid reliability standards and core grid definition, the Authority must have regard to the desirability of Parts 7 (system operator) and 8 (common quality) and Part 12 (transport) operating in an integrated and consistent manner.