Security and Reliability Council

Summer security measures

Progress update

15 August 2012

Note: This paper has been prepared for the purpose of discussion with the Security and Reliability Council. Content should not be interpreted as representing the views or policy of the Electricity Authority.

Contents

Figures

1 Summary

1.1.1 The Authority is in the process of reviewing summer security issues and determining whether any changes to security of supply monitoring frameworks are merited.

1.1.2 The focus is on summer *capacity* (i.e. having an efficient level of generation to meet peak demand) rather than *energy*. The issue arose from participant feedback that the Authority might need to look closely at possible difficulties in meeting summer peaks, as well as winter peaks.

1.1.3 Summer capacity security is influenced by;

a) the amount of installed generation capacity;

b) the amount of that generation that is available *(not out for maintenance)*;

c) the amount of slow-start thermal generation that is committed *(able to synchronise)* ;

d) the transmission (including reactive support) used to transmit energy from where it is produced to where it is used; and

e) the redundancy in the system to deal with unplanned generation and transmission outages.

1.1.4 The efficient level of summer capacity security is driven by the trade-off between the cost of providing the above services and the cost of non-supply.

1.1.5 Pending SRC feedback, the Authority is moving towards the conclusion that summer capacity security is well monitored under current arrangements.

1.1.6 The Authority's remaining concerns are the possibilities that:

a) summer peak demand could grow relative to winter peak demand; and/or

b) scheduling generation outages in the summer period could become increasingly problematic.

1.1.7 In either case the winter capacity margin (WCM) and the corresponding security standard could fail to diagnose an inefficiently low level of summer capacity.

1.1.8 The Authority is considering requesting the system operator to annually:

a) review the level, timing and shape of summer peak demand (relative to winter peak), and any trends that suggested summer peak demand growth might suddenly accelerate;

b) review any difficulties experienced (or anticipated) in fitting generation maintenance into the summer period; and

c) produce a brief report (perhaps as part of the Annual Security Assessment).

SRC discussion points:

The Authority would be pleased to receive feedback from the SRC on:

a) the conceptual framework set out in this paper;

b) your support (or otherwise) of the conclusion that summer capacity issues are well monitored under current arrangements; and

c) the above proposal to request the system operator to carry out an annual review of summer peak demand and maintenance scheduling issues.

2 Background

2.1.1 This paper provides the SRC with an update on the Authority's progress with regard to the value of calculating and publishing summer security margins or standards.

2.1.2 In August 2011, the Authority requested the SRC to consider the priority of developing a summer security margin. The SRC requested the Secretariat to review the need for summer capacity and energy margins.

2.1.3 In December 2011, the Authority presented to the SRC on *Managing security of supply risks*, and noted that the Authority work-plan includes projects to:

a) review winter capacity and energy margins; and

b) consider the need for a new summer capacity standard.

2.1.4 The Authority is now in the process of reviewing summer security issues and determining whether any changes to security of supply monitoring frameworks are merited.

2.2 Related work

2.2.1 The Authority is also in the process of reviewing winter capacity and energy margins. An update on this review has been provided to the SRC, for discussion at the same meeting as this paper.

2.2.2 The Authority is separately considering issues around Pole 3 commissioning, which might have the potential to affect security of supply during the summer of 2012/13.

2.2.3 The system operator is in the process of reviewing the Security of Supply Forecasting and Information Policy (SOSFIP), which sets out the overall security of supply monitoring framework.

2.3 Summer security incidents

2.3.1 Concerns about summer security may in part be motivated by actual security incidents (whether "near-misses" or actual power cuts) that have occurred in recent years, outside the winter period.

2.3.2 Some relevant incidents include:

a) the grid emergency of 4 February 2008 (due to insufficient offers to meet system demand, resulting from a combination of outages, constraints and low wind);

b) six grid emergencies in May and October 2009 (all due to insufficient offers, and resulting in reduced instantaneous reserve cover);

c) the outage of the Henderson-Otahuhu 1 circuit on 30 October 2009 (caused by a forklift hitting the line, and resulting in loss of supply to a substantial proportion of the upper North Island for two hours);

d) the grid emergency of 18 February 2010 (due to insufficient offers, following unplanned outages of both HVDC poles);

e) the October 2011 gas contingency (resulting from a leak on the Maui pipeline); and

f) the North Island AUFLS event of 13 December 2011 (following a Huntly station trip).

3 Analysis

3.1 A framework for discussing summer security of supply

3.1.1 The Authority considers that summer security issues are primarily about *capacity* (i.e. having an efficient level of generation to meet peak demand) rather than about *energy* (i.e. having an efficient level of generation to manage dry periods). Lake levels do sometimes dip over summer, but this would not be expected to result in power shortages until later in the year.

3.1.2 Therefore, the Authority sees no need for a summer *energy* margin.[1]

Question: *Do you agree with the conclusion that no summer energy margin is required?*

3.1.3 The rest of this paper deals with summer *capacity* issues. As with winter capacity margins, the focus is on North Island capacity.

3.1.4 Summer capacity security is influenced by;

a) the amount of installed generation capacity;

b) the amount of that generation that is available *(not out for maintenance)*;

c) the amount of slow-start thermal generation that is committed *(able to synchronise)* ;

d) the transmission (including reactive support) used to transmit energy from where it is produced to where it is used; and

e) the redundancy in the system to deal with unplanned generation and transmission outages.

3.1.5 The efficient level of summer security is driven by the trade-off between the cost of providing the above services and the cost of non-supply.

3.1.6 A key difference between the above services is the timeframe over which they can meaningfully be predicted. For instance, generation adequacy (*a* above) can be estimated several years in advance –but maintenance schedules (*b* above) may still be quite uncertain a year in advance, and unit commitment (*c* above) may not be visible until on the day. These differences are important when considering what kind of monitoring regime is appropriate.

3.2 Existing framework for monitoring summer security of supply

3.2.1 This section sets out current arrangements to monitor each of the five services listed above.

Monitoring the amount of generation

3.2.2 In order to have an efficient level of summer capacity, there first needs to be an efficient amount of generation equipment in the system.

3.2.3 Despite the name, the winter capacity margin (WCM) is a reasonable measure of the amount of generation equipment in the system at any time of year. (It weights different types of generation appropriately.)

3.2.4 If it is anticipated that WCM will be at or around the security standard set out in the Code, then the amount of generation equipment should be at or above the efficient level to meet

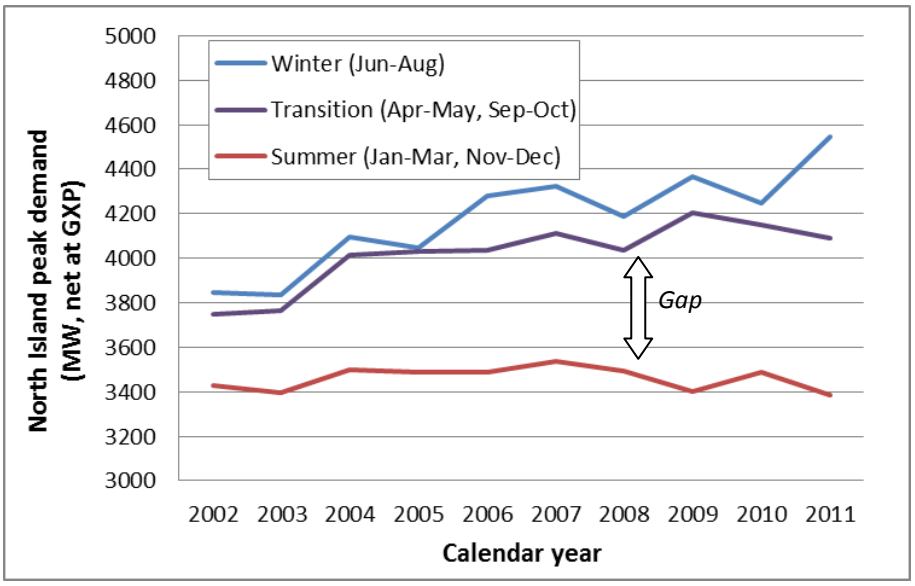
[1] The Winter Energy Margin (WEM) metrics assess the energy margin on a years-ahead basis. The derivation of the WEM standards *does* consider summer hydrology – i.e. it takes into account the possibility that we may finish summer with relatively low lake levels (rather than filling key hydro lakes over summer).

summer needs (although this does not guarantee that an efficient level of generation is *available* and *offered*; see following sections).

3.2.5 However, this result relies on the historical gap between winter peak demand and summer peak demand being maintained – or, at least, on the gap remaining broad enough to accommodate the higher level of maintenance that takes place during summer.

3.2.6 As shown in Figure 1, the gap between summer and winter peak demand is relatively substantial and, if anything, may have grown over the last decade. Nonetheless this trend could change in future.

Figure 1: Historical North Island peak demand, by season



3.2.7 Summer peak demand might grow faster than winter peak demand for various reasons, including:

a) increased use of heat pumps for space cooling;

b) increased irrigation;

c) increased dairy processing demand (which has its off season in winter);

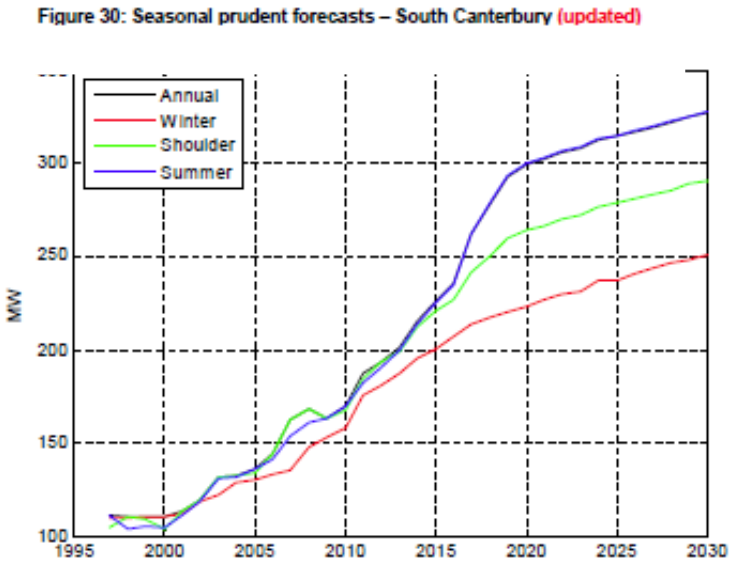
d) seasonally correlated embedded generation; and/or

e) preferential use of load control in winter.

3.2.8 The impact of such changes will vary from region to region. For instance, Figure 2 overleaf shows forecasts of South Canterbury peak demand, as published in Transpower's 2011 demand forecast document.[2] Summer peak is anticipated to grow much faster than winter peak, as a result of increased irrigation in the region.

[2] http://gridnewzealand.co.nz/project-inputs

Figure 2: South Canterbury seasonal demand forecasts *(reproduced from Transpower forecast document)*



3.2.9 Transpower's forecast did not indicate that summer peak demand growth was likely to outstrip winter peak demand growth at an *island* or *national* level, but did not rule out this possibility either. (The report comments that "in recent years, there has been no clear trend of national summer demand increasing relative to winter, or vice versa", but adds that "this may change in future.")

3.2.10 If summer peak demand increased relative to winter peak, then the WCM metric and accompanying security standard could fail to diagnose an inefficiently low level of summer capacity.

3.2.11 Therefore, as set out in Section **Error! Reference source not found.** ("Issues to address"), ***it may be worth monitoring summer peak demand growth on an ongoing basis***.

Monitoring planned generation outages

3.2.12 Major planned generation outages are generally scheduled outside the winter months.

3.2.13 For example, the list of major outages scheduled between October 2011 and April 2012 (inclusive) includes (among others):

a) a four-day outage of Huntly 3, a 3-day outage of Huntly e3p, and complete unavailability of Huntly 4 from November 2011 to May 2012;

b) two fortnight-long outages of Southdown units;

c) a 10-day outage of the Taranaki CCGT;

d) month-long outages of four Aviemore units and three Benmore units;

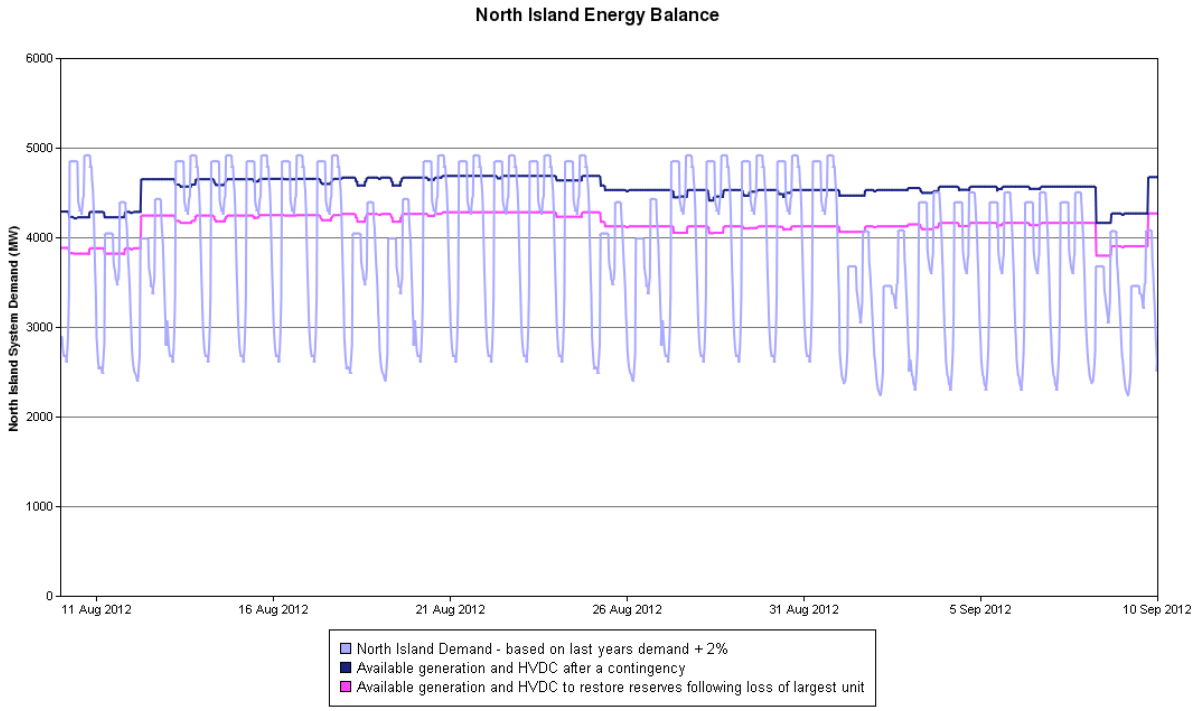
e) one Maraetai unit out for all of summer, and one out for most of summer; and

f) simultaneous month-long outages of two Tokaanu units.

3.2.14 Outage scheduling is managed collaboratively by generators and the system operator, with the key tools being the POCP database. This is supported by the system operator's generation balance

project. As illustrated below, it provides 12 month projections of available generation and HVDC capacity in the North Island relative to demand under post-contingency scenarios. It is also possible for participants to test sensitivities by manually adjusting assumptions.

Figure 3: System operator generation balance project



3.2.15 There is an incentive for generators to schedule their outages at times that allow an efficient level of capacity to be maintained, as otherwise they may find it costly to cover their own hedge and retail commitments.

3.2.16 The system operator's perception is that the outage scheduling process is generally working well at present.

3.2.17 The outage planning situation may in fact become easier over the next few years, with:

a) Pole 3 becoming available;

b) fewer large unit outages to coordinate, with closure (in some form) of one or two coal-fired Huntly units (which will also help to mitigate river heating constraints); and

c) eventually, the closure of one or more ageing CCGTs.

3.2.18 Nonetheless, if scheduling outages in the summer period became problematic, then the WCM metric and accompanying security standard could fail to diagnose an inefficiently low level of summer capacity.

3.2.19 Therefore, as set out in Section **Error! Reference source not found.** ("Issues to address"), ***it may be worth monitoring outage scheduling arrangements on an ongoing basis***.

Monitoring unit commitment

3.2.20 Capacity adequacy is monitored on an hours- to days-ahead basis, through the various market schedules and notices. Generally this provides generators with sufficient warning to commit slow-start units.

3.2.21 There is an incentive for generators to commit units as necessary to maintain an efficient level of capacity, as otherwise they may find it costly to cover their own hedge and retail commitments.

3.2.22 Unit commitment of slow-start plant can certainly cause problems – past experience shows these problems can be accentuated when average prices are low (e.g. in a wet period) and can be aggravated by the variability of wind generation output.

3.2.23 Unit commitment problems were particularly noticeable in 2009, with six occasions (in May and October) in which the system was operated with reduced reserve cover due to insufficient capacity, with substantial amounts of generation uncommitted.[3] Since 2009, however, such incidents have been relatively rare. The Authority believes that this is due at least in part to better incentives, as a result of improvements in the way in which prices are formed when there is reserve or energy scarcity.

3.2.24 ***The Authority does not plan to review arrangements for monitoring unit commitment as part of this workstream.***

3.2.25 The Authority does, however, understand that the system operator may wish to review its arrangements from time to time – for instance, there may be a case for reducing the frequency of reserve shortfall notices.

Monitoring transmission capability

3.2.26 The system operator's System Security Forecast (SSF)[4] is the key document that identifies potential transmission issues over the next decade (but focusing on the next 3-5 years), and discusses how such issues can be managed. The SSF considers both summer and winter issues (in large part, because transmission line ratings vary seasonally). The Authority has recently carried out a review of the SSF.

3.2.27 Transpower's Annual Planning Report (APR)[5] identifies transmission investment needs over a fifteen-year horizon. Again, both summer and winter issues are considered. Many of the potential investments discussed in the APR are driven by summer constraints.

3.2.28 There is the potential for transmission constraints to limit power flows into the upper North Island (UNI) and upper South Island (USI). The system operator convenes UNI and USI summer security groups, as necessary, to assess the adequacy of transmission and generation to serve these regions through the summer period. The groups' reports are published on the system operator website.

3.2.29 Planned transmission outages can increase stress on the system and need to be coordinated with generation outages. This occurs through the PCOP process noted previously – i.e. as for generators, the grid owner submits all planned equipment outages for system operator review. All outages are visible on the POCP website.

[3] http://www.ea.govt.nz/document/4550/download/industry/ec-archive/security-of-supply/asa/

[4] http://www.systemoperator.co.nz/publications#cs-1345746

[5] http://www.transpower.co.nz/annual-planning-report-2012

3.2.30 Completion of key transmission upgrades should alleviate some regional transmission issues, both by increasing transmission capacity and by reducing the need for major transmission outages.

3.2.31 ***The Authority does not plan to review arrangements for monitoring transmission capability as part of this workstream.***

Monitoring risks associated with unplanned outages

3.2.32 Naturally, unplanned transmission and/or generation outages can temporarily reduce security of supply. Much the same risks exist in summer as in winter, though summer can bring particular challenges with low load levels, which can affect how the system responds to disturbances.[6]

3.2.33 Various arrangements are in place to manage disturbances on the power system, including but not limited to:

a) instantaneous reserves;

b) AUFLS;

c) dynamic reactive support equipment;

d) automatic protection systems; and

e) grid emergency provisions.

3.2.34 The adequacy of such arrangements is monitored both *ex ante* and *ex post*.

3.2.35 ***The Authority does not plan to review monitoring of these arrangements as part of this workstream.***

3.3 Adequacy of the monitoring framework

3.3.1 Pending SRC feedback, the Authority is moving towards the conclusion that summer security issues are well monitored under current arrangements.

3.3.2 The Authority's remaining concerns are the possibilities that:

a) summer peak demand could grow relative to winter peak demand; and/or

b) scheduling generation maintenance in the summer period could become increasingly problematic.

3.3.3 In either case the winter capacity margin (WCM) and the corresponding standard could fail to diagnose an inefficiently low level of summer capacity.

3.3.4 A comprehensive approach would be to institute a summer capacity margin (SCM) measure, and require the system operator to forecast SCM several years in advance and compare it to some standard (calculated on the basis of an optimal trade-off between unserved energy and generation capacity, as per the WCM standard).

3.3.5 However, the emerging Authority view is that it may be sufficient to keep a watching brief on:

a) the level, timing and shape of summer peak demand (relative to winter peak demand);

b) any emerging trends that suggested summer peak demand growth might suddenly accelerate; and

[6] High proportions of motor load can also complicate reactive power management in summer.

c) any difficulties experienced (or anticipated) in fitting generation maintenance into the summer period.

3.3.6 The Authority is considering requesting the system operator to annually review these issues and produce a brief report (perhaps as part of the Annual Security Assessment).

3.3.7 With regard to maintenance scheduling, the system operator might need to make assumptions about planned outages beyond the twelve-month POCP horizon, ideally on the basis of indicative longer term outage plans received from asset owners.[7]

3.3.8 If it appeared that summer peak was growing relative to winter peak, or that scheduling outages in the summer period was becoming problematic, then a more rigorous monitoring regime could be considered further.

[7] There might be a case for extending the POCP planning horizon, although this might not be favoured by asset owners.