CLEARING MANAGER

SETTLEMENT AND PRUDENTIAL SECURITY CODE AMENDMENT 2013

CONSULTATION ON METHODOLOGIES UNDER SCHEDULE 14.2

- Settlement retention amount
- Forward estimate
- General prudential requirement

3 March 2014

TABLE OF CONTENTS

Contents

Executive summary

The clearing manager is consulting on methodologies required to implement new settlement and prudential security arrangements set out in Parts 14 and 14A of the Electricity Industry Participation Code 2010 (Code) that come into effect on 24 March 2015. The clearing manager will consider feedback from the industry before submitting its draft methodologies to the Electricity Authority (Authority) for approval.

Prudential requirements

The proposed methodology for assessing prudential security for the spot market is to multiply estimated load and generation by known and 'exit period' prices. Hedge exposure for hedges lodged with the clearing manager is valued using the same prices.

Generation and load estimates are proposed to remain consistent with the clearing manager's current methodology. For past generation and consumption that has yet to be settled, reconciliation volumes are used where available. Where reconciliation data is not available, a pro-rata share of consumption is assessed as is generation volume derived from cleared offers. For forecast volumes a three week trailing average provides differentiated values for each node and trading period across business or non-business days.

Projected exit period prices are composed of exit period 'base prices' and an 'adder'. Base prices are profiled ASX futures prices. Base prices are calculated by multiplying an ASX future reference price by month, business/non-business day, time of day, and location factors. The 'adder' is a universal $/MWh (distinct for each quarter) which is calculated so that the expected probability of loss given default is 25%. The factors and adder are published annually and the ASX reference price is published four times a year.

In addition to providing a summary of current prudential exposure, the clearing manager also provides a forecast of prudential exposure for the next three business days. This forecast is based on a persistence forecast of the difference between each day's actual exposure for a participant and the projected exposure which had been calculated based upon the exit period price.

Settlement retention amounts

The clearing manager describes the calculation for the settlement retention amount. This amount is calculated by assessing the single largest percent impact for both the FTR account and the 'general' account should a single participant or related participant group default.

Feedback

Interested parties are encouraged to provide feedback on the methodologies by 1 April 2014, specifically to the questions set out in Appendix 1.

Purpose of this paper

The clearing manager is required to consult on the four methodologies as described in Schedule 14.2 of the Electricity Industry Participation (Settlement and Prudential Security) Code Amendment 2013.

The consultations are for determining:

a) Settlement retention amount (SRA)

b) Forward estimate of prudential requirements

c) General prudential requirements

d) Minimum security required for FTRs.

This consultation will cover the above items excluding (d). The security requirements for FTRs were consulted on in 2012 and are being reviewed in the clearing manager's consultation paper "Review and Consultation of various FTR related methodologies and developments" dated February 2014.

The topics covered in this consultation were initially described in the Authority's Settlement and Prudential Security Review Consultation Paper of 18 June 2013. Submissions on that consultation have been considered in this paper (refer to the summary in Appendix 2).

Consultation process

The clearing manager invites participants to submit feedback on the contents of this document and specifically to the questions asked in Appendix 1. Written responses in electronic form are preferred. The consultation period begins on 4 March 2014. Responses should be emailed to cmanager@nzx.com. If you do not wish to send your submission electronically, you should send one hard copy of the submission to the address below.

Postal address	Physical delivery
Clearing manager c/o NZX Energy NZX Limited P.O. Box 2959 Wellington 6140	Clearing manager c/o NZX Energy NZX Limited NZX Centre 11 Cable Street, Level 1 Wellington

Responses should be received by **5:00pm on 1 April 2014** for full consideration. The clearing manager will acknowledge receipt of all submissions electronically. Please contact cmanager@nzx.com if you do not receive electronic acknowledgement of your submission within two business days.

Please identify any confidential information. The clearing manager may make available non-confidential aspects of submissions on its website. Submitters should indicate any documents attached, in support of the submission, in a covering letter and clearly indicate any information that is provided on a confidential basis. All information received as part of submissions will be

made available to the Authority. Please note that all information provided to the Authority is subject to the Official Information Act 1982.

Approval of the methodologies

This consultation introduces proposed methodologies and associated rationale. Draft methodologies are supplied in the appendices. Based upon this consultation, the clearing manager will either submit the methodologies as published here or revise these methodologies and submit them to the Authority for approval, as required by Schedule 14.2 clause 2.

Methodologies relating to prudential security are presented first followed by the methodologies related to settlement.

1. Prudential assessment

1.1 Background

It is a requirement of the New Zealand electricity market for participants to supply prudential security to cover the exposure they bring to the market. The clearing manager is charged with assessing exposure and prudential security requirements for participants under Part 14 of the current Code. The provisions in the Code were comprehensively reviewed during 2012-13, and new provisions come into force from 24 March 2015.

The current (outgoing) Code provisions provide only the most general guidance to the clearing manager. The clearing manager's methodology for assessing prudential security has historically relied on a number of administrative mechanisms, including persistence forecasts and bids, and involved substantial analyst discretion.

In recent years concerns have been raised about the performance of prudential arrangements given the increase in the number of smaller market purchasers (retailers) and the length of time it could take to exit an insolvent purchaser from the market. The clearing manager noted as part of the Electricity Authority's recent review that the system was often onerous for participants yet also frequently failed to provide protection in the case of a settlement default. Participants commented on the volatility of the prudential assessments and a desire for a predictable methodology.

An assessment by the clearing manager (and a similar assessment by the Authority's Wholesale Advisory Group) revealed that over half of the time, a participant default would lead to a shortfall in the market as prudential security amounts were insufficient to cover actual exposure.

In 2011, the clearing manager voluntarily consulted on proposed changes to its prudential security assessment methodology. The revised methodology implemented in 2012 removed nearly all of the clearing manager's discretion, smoothed the persistence forecast methodology, and revised the estimation of generation and load volumes.

The inception of the FTR market in 2013 was accompanied by another clearing manager consultation - this time on the FTR prudential security assessment methodology. The resulting methodology has greater similarities to the clearing of financial markets than to the methods employed for the spot market. The value of FTRs is evaluated each business day and participant exposure adjusted accordingly.

Further changes to the clearing manager's methodology are now required to reflect the new Code provisions which come into force on 24 March 2015.

1.2 Current methodology

The current methodology for prudential requirements considers exposure for all traded but non-settled electricity and a projection period stretching until seven days following the next settlement. In general, the total assessment period is 58 or 59 days (or even 61 days in some

cases around Easter). The projected exposure period can be as short as seven days or as long as 38 days. This can either over or under protect the market.

This long and variable projection period can lead to large changes in the required amounts of prudential security. Step changes are caused when changes to average consumption, generation or price are amplified as one billing period is settled and another is added on settlement day. The current system uses a 21 day rolling average for quantities and prices. The period is always till seven days after the next settlement day.

The current methodology is designed to approximate exposure for traded quantities as accurately as possible to minimise the probability and extent of loss given default. This task is complicated by the need to assess prudential requirements daily while reconciled volume information is only available monthly and in arrears. Reconciliation data is used in the limited cases where it is available. When the reconciliation data is not available, the current methodology uses the best available generation and consumption data. Load is based on busload metering allocated according to a participant's previous month's market share. Generation is based on cleared offers and supplied embedded and unoffered generation information.

1.3 Fundamental changes

The changes to come into effect on 24 March 2015 are substantial. One important change is that the clearing manager is required to consult on its methodologies with industry and have those methodologies approved by the Authority. While development of the methodologies is the responsibility of the clearing manager, the Code introduces a number of prescriptive requirements.

Many of the changes outlined in the new Part 14A are intended to reduce the volatility of the prudential assessments while ensuring adequate protection for the market in case of default. Substantial volatility under the existing methodology relates to the sudden expansion of the projected period on settlement day from 7 days to 37 days. The new Code eliminates this sudden expansion by specifying a registered exit period which remains fixed for a particular participant - either 7 or 18 days depending on participant type.

Another driver of volatility in the current system relates to the price used to project exposure. A sharp increase in prices will not only affect the clearing manager's view of trading for the days gone by, but also flows into forecast prices established by persistence forecasts.

This driver is eliminated as fixed prices, determined quarterly in advance, will be used for projections.

With price and period fixed, only the estimation of quantities can drive volatility.

Table 1 summarises the current arrangements for prudential security and the issues, and the arrangements proposed in this paper. The new requirement for settlement, discussed later in this paper, is also included for completeness.

Area	Topic	Current	Design points/issues/options	Proposal
Prudential Security	Spot market methodology	Persistence forecasts for price and quantity, cleared offers for generation and market share and metered load or volumes	Code specified changes to calculation required (projection period, determination of price)	
	Price for Projection Period	3 week trailing average (averaged by business/ non-business day, trading period, and location)	Price static for each quarter, set by reference to ASX prices and calculation of 'adder' One price for all nodes/periods or Profile applied Methodology to determine adder	ASX prices profiled by month, business/ non-business day, trading period and location
	Quantity for Projection period	3 week trailing average (wk day/wk end, trading period, location, participant)	Options include: status quo replication of prior period participant submitted quantities forecast based upon seasonality and weather forecast	Status quo
	Handling of washups	N/A	Washups are now required to be included	Only include when calculated
	Handing of ancillary services	Same as prior month	Simple persistence forecast or Sophisticated estimate benefiting from 'advanced' calculation of ancillary charges and payments	Persistence forecast
	Handling of hedges	Settlement as if with projected prices	Inclusion of adder may complicate estimation of hedges (options)	Ignore complications and use forecast price
	Forecast of future assessments	N/A	Method of estimating prudential which will be required in 3 business days reflects the expected difference between forecast (exit period) prices and expected prices (based on best available information)	Propagate measured differences for recent days
Settlement	Calculation of settlement retention amount (SRA)	N/A	Establishment of detailed process so SRA amounts are predictable and calculable. No controversial issues identified.	Single proposed method

Table 1: Affected clearing and settlement aspects

2. Prudential security - General prudential requirements

As defined in the new Schedule 14A.1.7, general prudential is made up to two components - the general outstanding financial exposure and the exit period prudential margin.

The general outstanding exposure covers all unsettled sales, purchases, lodged hedges, and washups. It also includes an estimate for ancillary services. For example, if today is 15 January, the general outstanding amount covers the period from 1 December until 14 January.

The exit period prudential exposure is an estimate of exposure from the date of assessment until the end of the exit period plus 1 day. For retailers, the exit period is 18 days. For direct connect participants, the exit period is 7 days unless otherwise arranged with the Authority[1]. For example, if today is 15 January, a retailer's exit period prudential margin will cover the period from 15 January through and including 2 February.

2.1 Specific requirements of the new Code

The new Part 14A requires that the clearing manager's methodology includes several specific features in addition to the general requirement to consult on the methodology. First, projected energy exposures are to be based upon an estimate of volume and a price which is static and established at least a month ahead of the quarter for which it applies. The price will be comprised of a base exit period price as well as an 'adder'. The base exit period price is derived from a relevant futures market price. The 'adder' is an additional amount added to all exit period base prices which result in the clearing manager expecting to have sufficient security to cover a hypothetical purchaser's exposure in the event of default at least 75% of the time.

There are other provisions relating to timing and data used for assessments outlined in sections 13 of Schedule 14A1 13 of the new Code.

2.2 Proposed methodology for calculating the general outstanding exposure

In 2011, the clearing manager consulted on its methodology for assessing its exposure to spot market participants[2]. The adopted methodology applies to outstanding financial exposure as well as projected financial exposure.

The clearing manager proposes to retain the features of its existing prudential security methodology with regards to estimates of general outstanding exposure. Two minor changes are proposed:

- the use of the exit price when no better price is available, and

[1] See Part 14A.22 of the Code.

[2] http://akp-nzxgroupcms.nzx.com/who-we-are/business-overview/nzx-energy/consultations-submissions

- the addition of washup amounts where these are available.

These changes are motivated by the introduction of a static exit period price and the inclusion of washup amounts in the new Code.

In addition, the methodology will now be published in its entirety. The draft methodology is shown in Appendix 3. The draft methodology for forward estimates of assessed prudential is in Appendix 4.

The next sections provide:

- a summary of the main features of the proposed methodology,
- an introduction to and an analysis of alternatives, and
- a discussion of rationale for supporting proposed methodology.

2.3 Summary of proposed methodology for outstanding exposure

The proposed methodology for assessing outstanding exposure is based on the implemented methodology with only minor changes. These changes include the use of the exit period price if no better price is available, and the addition of calculated washup amounts to prudential outstandings.

Prepayments are not included in this calculation. Prepayments offset a participant's total general and FTR obligations. Prepayments and their effect on prudential amounts are notified on the prudential summary.

Outstandings are to be made up of:

1. invoiced amounts for the days where these are available
2. non-invoiced amounts
3. washup amounts once these are calculated.

Invoiced

Invoices are published on the 9th business day, for the previous month. From this day the outstandings are made up of invoiced and the current month's non-invoiced amounts.

Non-invoiced amounts

For non-invoiced amounts, the clearing manager will use:

- Load and generation

  Estimated exposure to spot energy purchases and sales is calculated by multiplying deemed quantities (sales or purchases) times price for each node and each trading period up to the prior day which has not yet been invoiced.

Load quantities are assessed based upon scheduled dispatch unless reconciled data is available. In the case of unoffered generation, participants may submit actual unoffered generation for inclusion.

Purchase quantities are assessed based on a participant's market share of load as identified for each GXP in the pricing manager's final pricing case unless reconciled data is available. Market share is established based upon the participant's share of reconciled volume at that GXP for the previous billed month and is used until the next reconciled data is loaded by the clearing manager.

For the purpose of this calculation, the price is the final price, or if final prices are not available, interim price, or if interim prices are also not available, the exit period price plus adder as published by the clearing manager. Interim prices are not used if an undesirable trading situation has been claimed.

This proposed treatment of load and generation exposure is consistent with current practice with the exception that the clearing manager currently uses a persistence forecast to establish price where final and interim prices are not used.

- Ancillary services

  Estimated exposure to ancillary services is calculated by reference to the daily average of the historic net ancillary service amounts invoiced over the last month. This method is consistent with current processing.

- Hedge Settlement Agreements (HSAs)

  The settlement value of HSAs are based upon the final price, or if final prices are not available, interim price, or if interim prices are also not available, the exit period price plus adder as published by the clearing manager. This price is used for each period, multiplied by the quantity in the HSA.

Washups

Once washup amounts are published they will be added to prudential security exposure. Washup amounts may be considerable and this may result in sudden changes in prudential requirements.

2.4 Alternatives

In establishing its proposed methodology for the treatment of outstanding energy volumes and ancillary services, the clearing manager reviewed a number of options. A summary of these options and related assessments are provided in Table 2.

Aspect	Current practice	Alternative	Notes
Prior consumption estimation	Market share of SPD load adjusted for embedded generation	Status quo	• Good overall load information, especially for conforming nodes • Complications w/embedded gen • Market share not stable for industrials
		Set equal to prior month's average reconciled volume for each trading period divided by business/ non-business day	• Avoids embedded gen issues • does not respond to changes in consumption
		Status quo except that the above alternative is used for nodes with embedded generation greater than 20% of average load	• Good overall load information, especially for conforming nodes • Reduces complications w/embedded generation • Market share not stable for industrials
Prior generation estimation	Cleared offers plus participant submitted unoffered gen data	Status quo	• Good overall generation information • Non-participating unoffered generation does not receive credit for prudential
		Set unoffered generation equal to prior month's average reconciled volume for each trading period divided by business/ non-business day	• Good overall generation information • Able to reflect periodicity • Poor indicator for many generation types
Ancillary services and constrained on/off	Project previous month's amounts	Status quo	• Simple • Propagates impact of constrained on-off charges • Does not attempt to estimate actual charges which may be possible to estimate
		3 month rolling average	• Could reduce impact of tail events • Simple
		Estimate constrained on/off and reserve payments based upon market data	• Available market data may be used to improve AS estimates • Significant complexity and cost to implement

Table 2: Options for treatment of outstanding energy volumes and ancillary services

The clearing manager has not considered any alternatives to the use of final, interim, or exit period prices in calculating outstanding financial exposure to participants. Similarly, we have not considered alternatives for valuing HSAs.

The estimation of quantity of electricity traded under the clearing manager's methodology may lead to over or under assessment of load or generation. Several alternatives may be considered. Key issues identified to date include:

- potential volatility of market share for industrials,
- difficulty in assessing actual GXP load from SPD bus load data where there is significant embedded and/or unoffered generation, and
- effort required to include unoffered generation in prudential estimates.

The estimation of ancillary services is solely based upon a persistence forecast based upon the average net assessment over the last month. Such an average will tend to propagate the impact of one-off charges.

2.5 Rationale for proposed solution

The current methodology for assessing prudential requirements has been operating for nearly a year. It has generally performed well and its retention would be cost effective. While the treatment of ancillary services is simplistic, the benefit to be gained from adding enhanced estimation is unlikely to outweigh the complexity and cost of altering the clearing system.

The clearing manager discounted the option of shifting from a metered load based estimate to an estimate based upon previous billing period's load due to the anticipated uncoupling of actual load with estimated load in a rising or falling consumption situation. Where the estimated load is significantly less than the actual load, the metric of probability of loss given default is likely to increase. This could, for example, be the case when temperatures drop relative to a previous period - and the impact of the discrepancy in estimated to actual load could be compounded if prices are also higher in the colder period. Changes to the methodology which tend to increase the probability of loss given default will result in the calculation of a higher 'adder' for use over the exit period.

2.6 Proposed method for calculation of general exit period prudential margin

The general exit period prudential margin is specified in Clause 10 of Schedule 14A.1 and is an estimate of the amount that the participant will incur and earn during the prudential exit period.

One significant new requirement is the prescription of fixed length exit periods. The new part 14A also prescribes requirements for the development of the exit period price and adder. New features are mandated relating to prices used in forecasts. The clearing manager proposes to leverage current methods for estimating quantities.

The estimate is to include the clearing manager's exposure to a participant related to the:

- sale and purchase of electricity,
- ancillary services,
- HSA amounts, and
- GST.

The length of the prudential exit period for which these exposures are estimated vary by participant. It is one day plus the post default exit period which is recorded in the register of exit periods as specified in Clause 14A.22(3) and (4).

The default exit periods are:

- For a retailer, 18 trading days.
- For the direct purchaser, 7 trading days.
- For a participant that is not a retailer or direct purchaser, 7 trading days.

These times can be adjusted as described in Clause 14A.22(5), (6) and (7).

The value of the exit period margin is the sum of the volume of electricity purchased or sold, and the price for each trading period, at each node, for the number of days in the exit period.

Volume for the exit period is calculated using a 21 day rolling average aggregated across 96 trading periods (48 trading periods for business and 48 for non-business days) taken from the busload data (as described above) and the market share.

The market share is calculated from the last reconciled month, and is calculated and published at the time the invoices are published, and implemented on the day after settlement. Historical market share is calculated for business/ non-business day in three hour blocks.

The market share is the same as is used for the general outstandings, but is not implemented until the day after settlement to align this change in value with the reduction in the outstandings[3].

2.7 Arrangements for setting exit period price

In accordance with the Code, the clearing manager will establish and publish an exit period 'base price' based upon a futures price as well as an 'adder'. The base price plus the adder combine to provide the total exit period price.

Exit period base price

The clearing manager proposes to establish exit period base prices by profiling ASX prices by month, trading period, and node, differentiating by business and non-business day.

[3] The market share calculation is available from the day the reconciliation data is loaded (business day seven) but is not used until after settlement to reduce valiantly and allow the market to know their market share amounts from their invoices.

Selecting a relevant ASX reference price

The ASX reference price is set as the arithmetic mean of the daily ASX futures daily settlement price for the quarter for which the Exit Period "Futures" price component is to be calculated. The clearing manager proposes to use 20 days worth of data timed to allow the clearing manager to publish the exit period "futures" price component two months before the beginning of the quarter concerned. Sampling across 20 days is intended to reduce any incentives to game the ASX market to affect prudential requirements.

For example, the October 2013 calculation of the average Benmore Q1 14 quarterly futures product is shown in Table 3 below while the indicative ASX reference prices for the 2011 to 2013 period are shown in Table 4 which follows.

Day	Settlement Price	Day	Settlement Price	Day	Settlement Price
8	65.00	15	57.00	22	54.75
9	64.95	16	57.00	23	52.50
10	64.55	17	58.00	24	51.00
11	64.55	18	58.00	25	51.00
14	60.00	21	57.00	28	51.00
				AVG	**$57.753**

Table 3: Example: Calculation of October 2013 Benmore ASX reference price

Quarter Ending	BEN ($/MWH)	OTA ($/MWH)
31-MAR-11	46.67	57.26
30-JUN-11	76.48	85.4
30-SEP-11	75.8	78.92
31-DEC-11	59.5	68
31-MAR-12	86.51	82.76
30-JUN-12	118.86	109.85
30-SEP-12	132.94	111.65
31-DEC-12	63.87	65.48
31-MAR-13	55.73	68.02
30-JUN-13	63.57	69.47
30-SEP-13	103.63	84.62

Quarter Ending	BEN ($/MWH)	OTA ($/MWH)
31-DEC-13	47.43	56.83

Table 4: Indicative back cast prices for ASX futures values. For reference only[4]

Profiling

The clearing manager proposes to establish profiles to derive exit period base prices by reference to the ASX reference price described above. The application of profiles would result in different prudential assessments for consumption at different times of the day, for example. The price applied in forecasts at any given node and time will be arrived at by multiplying the relevant ASX reference price by each profile factor:

$$(1)\mathrm{P}_{\mathrm{exit\ n,tp}} = futuresPrice_{qtr,island} \times f_{m,island} \times f_{d_{type},island,quarter} \times f_{tp,d_{type},quarter,island} \times f_n$$

Where:

$futuresPrice_{qtr,island}$ calculated as the average of daily closing price of the relevant ASX New Zealand Electricity future. [$57.75 for the above example]

$f_{m,island}$ is the month profile for each island with respect to the quarterly prices at Benmore or Otahuhu.

$f_{d_{type},qtr,island}$ is a factor which represents the relative price levels of business and non-business day prices for each island and quarter.

$f_{tp,d_{type},quarter,island}$ is a intra-day profile factor which is calculated for each quarter, day-type and island.

f_n is a location factor which is calculated for each node in each island with respect to Benmore or Otahuhu.

A sample $f_{d_{type},qtr,island}$ factor for business day is 1.075.

A sample $f_{m,island}$ is illustrated in Figure 1. The factor for March is roughly 1.3.

[4] Manually retrieved values may include spurious data.

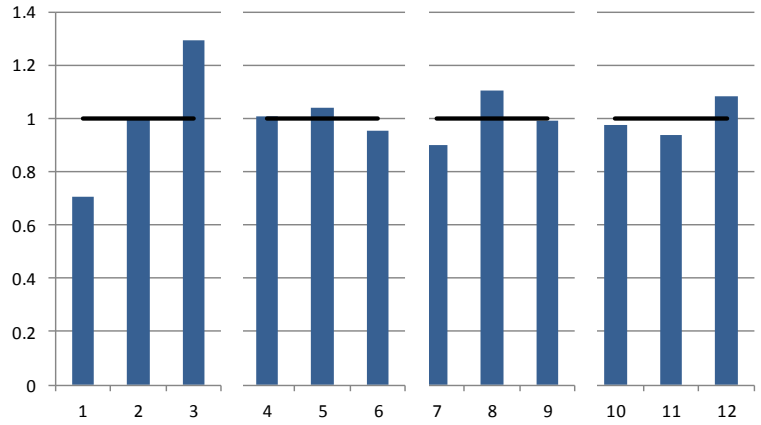

Figure 1: Example: month-to-quarter profile factors

A sample for the intraday profile for Benmore (across all days) is shown in Figure 2. The factor for trading period 12 is 0.875.

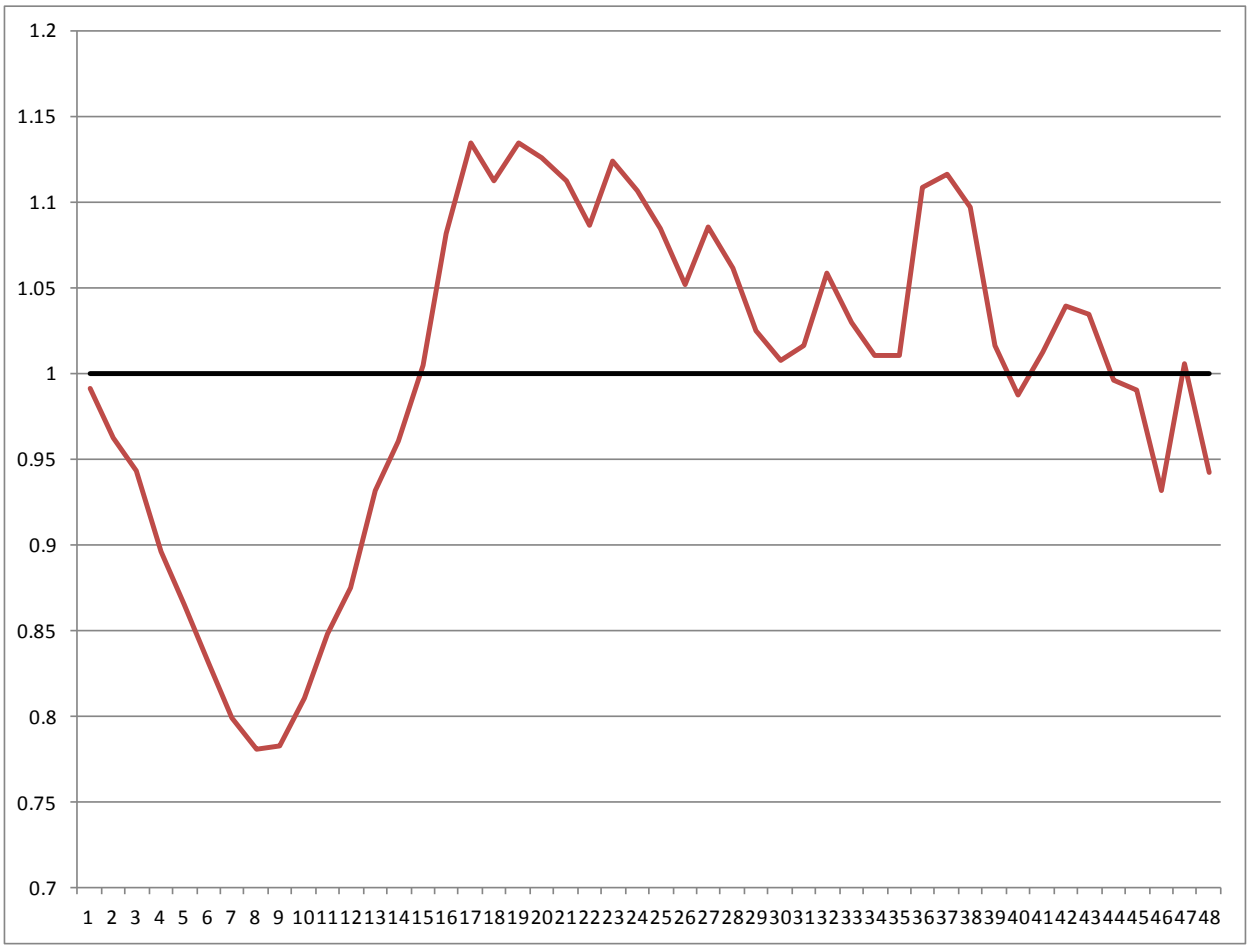

Figure 2: Example: Intraday profile for Benmore

Multiplying across, the exit period base price that would have been pre-determined to apply to Benmore for March on business in trading period 12 is:

$57.75 x 1.3 x 1.075 x 0.875 = $70.61.

The adder is then applied to this price and all prices equally.

2.8 Alternatives

The clearing manager has considered a number of alternative variations to establish exit period prices. Table 5 summarises some of these alternatives.

Aspect	Proposal	Alternative	Notes
Profiling of ASX prices	Profile by month, trading period, and node, differentiating by non-business day and business day. *(results shown in Figure 5)*	Profile by TP and Node only, or other combinations of the factors	• Each of these factors increases the detail of the estimate with an aim that the estimate more closely reflects each participant's business • Reduced complexity, reduced implementation cost. • Increased complexity should be justified by increased efficiency – not yet empirically proven
		No profiling. Set exit period base price to the relevant ASX price (NI,SI) *(results shown in Figure 4)*	• Very simple and easy to understand • Inexpensive to implement • Does not account for intra-day price profiles which may result in a larger adder • Implementation likely to disadvantage base load purchasers and generators that supply in peak periods.
Overall exit period margin calculation method	Build up exit period margin based on projected purchases and sales times exit period base price and add adder.	Calculate a multiplier for each participant based upon the difference between participant's historical average price and hub average price.	• Simple to apply and understand – two to four ratios per month per participant (depending on treatment of generation) • Difficult to integrate with future Code due to timing issues • Further study needed • Impact of unusually high or low price periods unknown
Selecting ASX prices	Average of daily settlement price for 20 days in the last trading month	Utilise a random daily settlement price	• Difficult to manipulate
		Reduce averaging period to five trading days	• May be susceptible to manipulation • Latest prices may be most relevant and incorporate best information

Table 5: Options for determination of projected exposure

The clearing manager modelled the operation of potential exit period methodologies for a three year period from 2011. This period was chosen so that ASX futures data was available. The

assessment included calculating a hypothetical retailer's actual exposure (shown in Figure 3 below) as well as projected exposure based upon various methodologies.

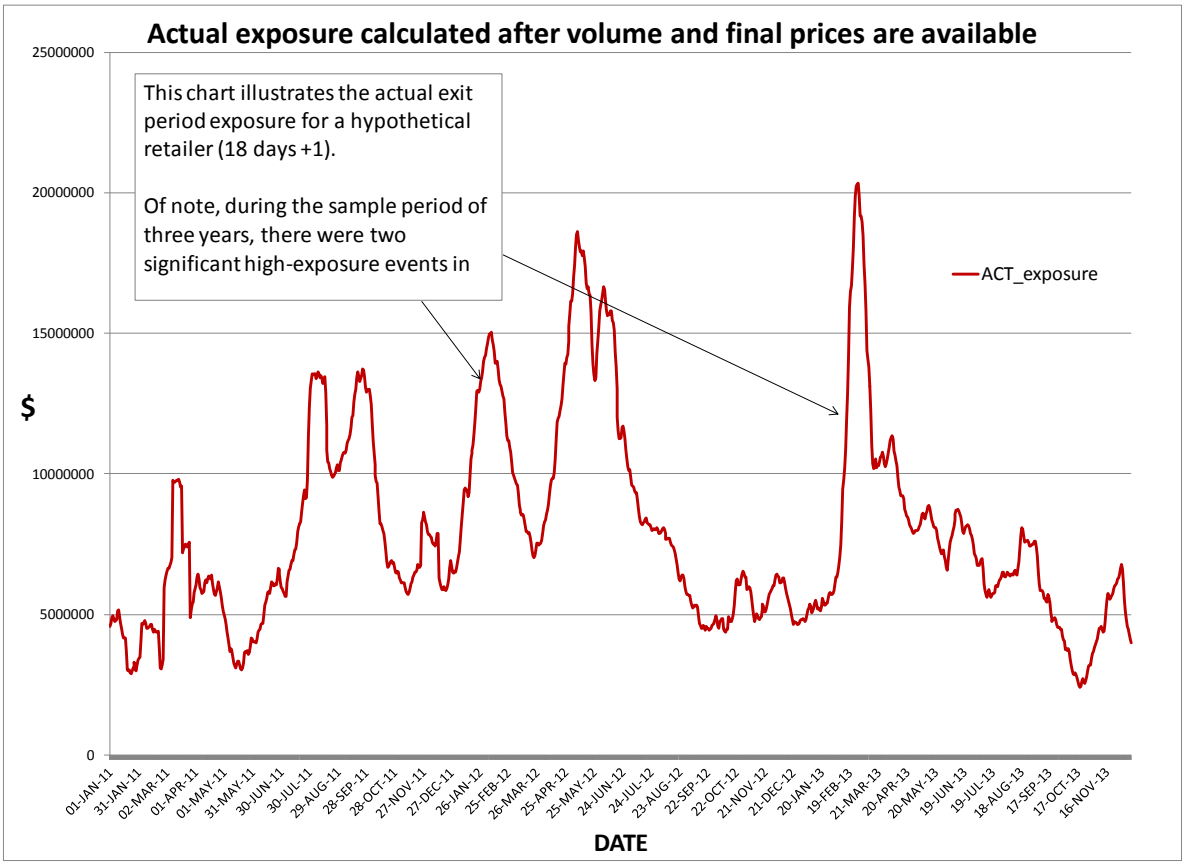

Figure 3: Actual exposure for a hypothetical retailer 2011-2013

One observation is that the three-year sample exhibits strong exposures in the first quarter. The prices that drove these exposures were not reflected in the ASX prices at the time the ASX prices were sampled. For this reason, high adders are required for the first quarter in order to achieve the targeted probability of loss given default of 25% (adders shown in next section). Likewise, the mild pricing environment experienced in the third quarters did not reflect the winter price risk apparent in the ASX prices, leading to low adders for those quarters.

The results of the assessed exit period prudential requirement for a hypothetical retailer are shown for two methodologies in Figure 4 and Figure 5.

The first uses the ASX reference prices without profiling and the second is the proposed methodology which uses profiled ASX reference prices.

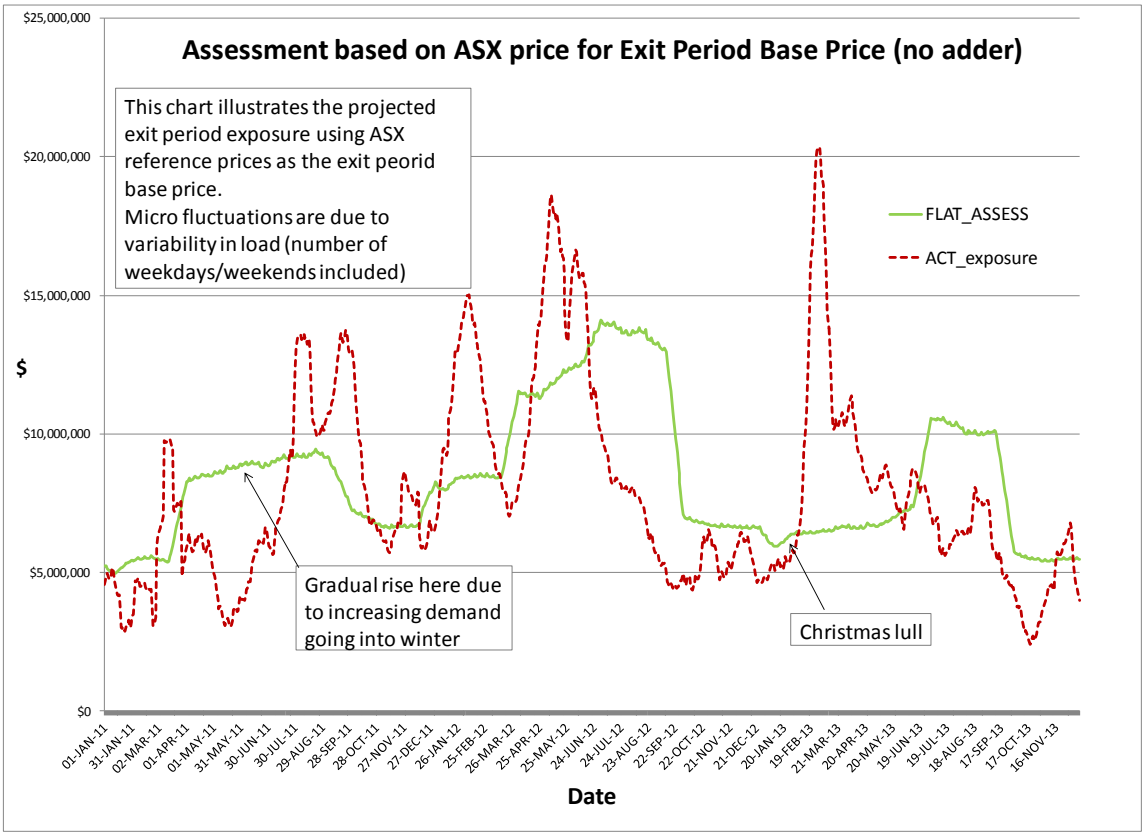

Figure 4: Projected exposure for a hypothetical retailer based upon ASX reference price.

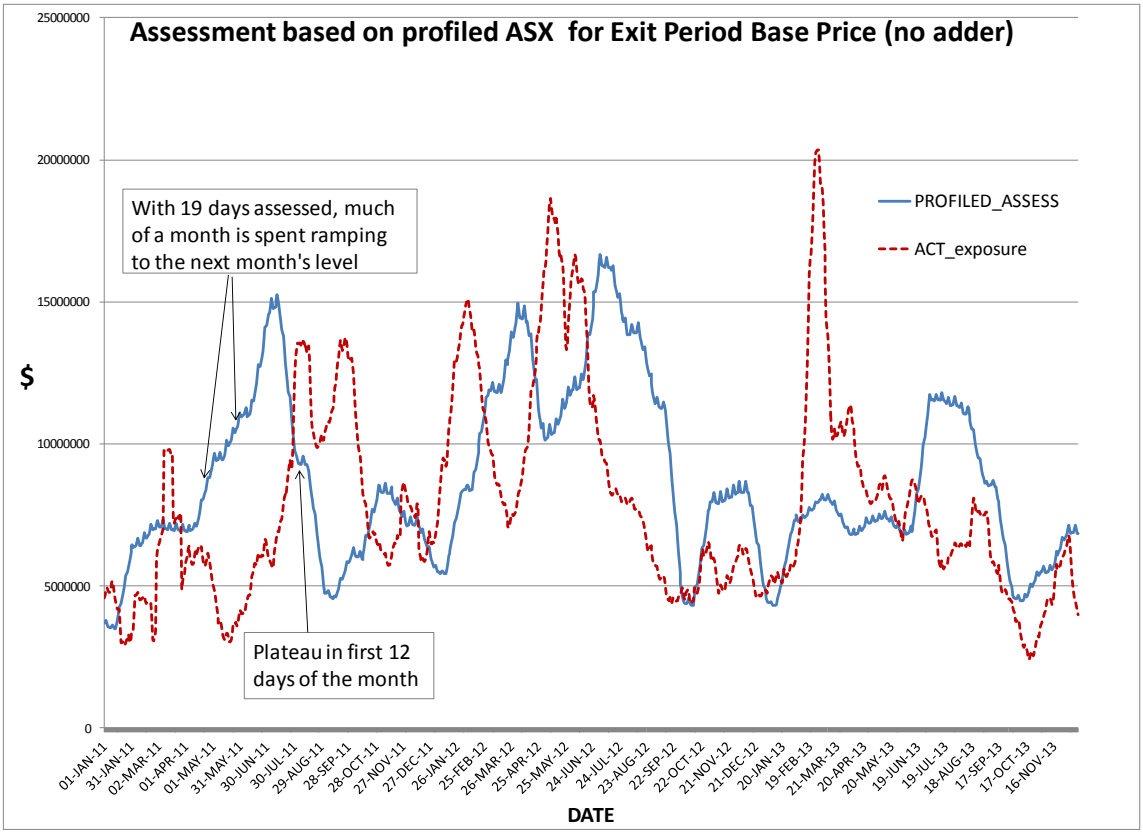

Figure 5: Projected exposure for a hypothetical retailer based upon profiled ASX price.

An alternative approach

One idea presented during an earlier consultation was to estimate future exposure by normalising a participant's historical average price of energy in each island with the average price at the OTA and BEN nodes.[5] This factor would be combined with the ASX reference price to establish a participant specific exit period base price.

Each participant would have an independent factor. This approach would provide some price profiling while limiting the number of factors which need to be assessed to calculate projected exposure. The clearing manager has considered the proposal and is not supporting it at this time in favour of uniform factors across the industry. Additionally, the clearing manager has concerns that small sample sizes may contribute to volatility. Participants are invited to submit on this point.

2.9 Rationale for proposed solution

The clearing manager supports the use of profiling so that the differences between a participant's load and load for a hypothetical retailer are recognised. The inclusion of price patterns in prudential assessment recognises cost differences among participants. These differences can be large, especially in the case of relatively flat load direct connect industrials.

The propagation of established price patterns into the exit period price will enable participants who differ from the Code described 'hypothetical retailer' to be assessed on a basis reflective of their actual consumption and generation profile.

The methodology applied to determine forecast loads and the exit period base price will influence the resulting magnitude of the adder. If the quantity and exit period base price components of the exposure estimation consistently under value exposure, the resulting adder will be greater than if the quantity and exit period base price estimates approximated actual exposure.

The clearing manager evaluated what value the adder would have been using historical spot market prices, load and ASX prices. The assessment is shown in Table 6. It shows a moderate increase in adder would have been required in the absence of profiling. It is not clear if the increase in the adder compensates for any average increase in exit period base price for a hypothetical retailer due to profiling.

[5] Simply Energy submission available at http://www.ea.govt.nz/our-work/consultations/wholesale/settlement-prudential-security-review-code-amendment/submissions/

Quarter	Profiled	Flat
1	$ 37.16	$ 40.79
2	$ 17.84	$ 20.12
3	$ (6.01)	$ (0.77)
4	$ (1.25)	$ (0.09)

Table 6: Adders for profiled and non-profiled exit prices calculated for the periods 1 January 2011 to 12 December 2013

While the clearing manager was unable to show that moving from a flat ASX price for the exit period base price to the profiled price resulted in a material reduction in the adder, the clearing manager continues to support profiled prices.

The main reason for this position is the relative treatment of direct connect purchasers and retailers. The clearing manger considers it will be more efficient for purchasers to have their price/load/generation profile considered when being assessed for prudential security requirements than for all participants to be treated in a homogenous fashion. A direct connect purchaser with flat load could expect a lower requirement than a retailer with peak load at peak price times. This applies similarly to base load generators versus peaking plant.

Figure 6 below shows relative intraday load profiles of typical retail/commercial and industrial nodes. Considering the actual price profile shown in Figure 2 above, the application of a flat profile exit period price to industrial load would likely lead to over procurement of prudential security for industrials represented at the TWI node.

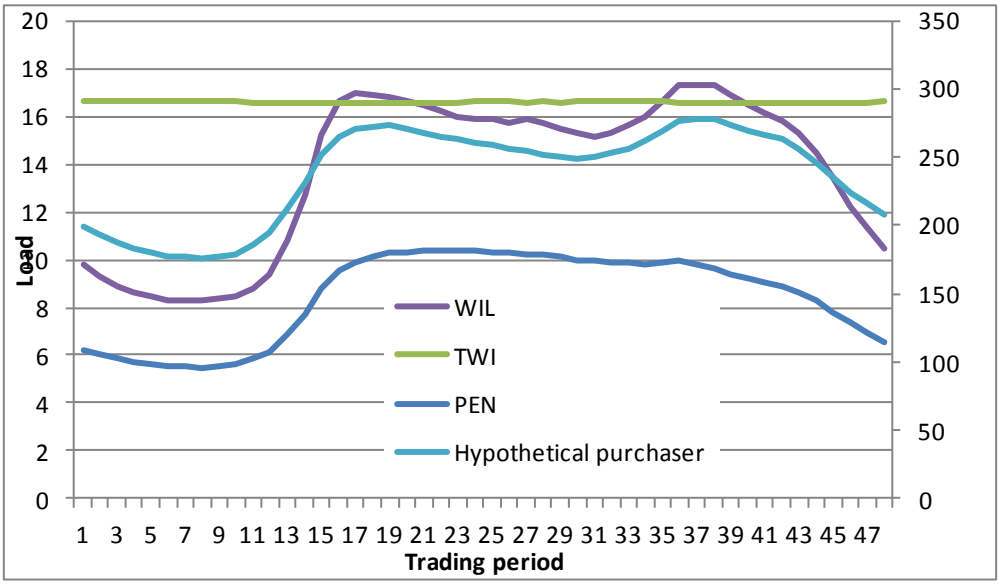

Figure 6: Intraday load profiles

A hypothetical industrial consuming a flat level of 600MW at TWI2201 would need to post 20.6% more prudential security if ASX prices were directly applied to the exit period base price than it would if it was assessed under a profiled exit period base price.

A key disadvantage with profiling is the increased complexity and a reduced ability for participants to readily anticipate their assessments. This point is visually evident by comparing the projected exposure curves in Figures 4 and 5. Another disadvantage is the difficulty in determining appropriate profiles as New Zealand's electricity price patterns are not persistent over time.

2.10 Proposed arrangements for setting exit period price "adder" component

The 'adder' is a $/MWh value that is added to the prices used in the exit period prudential amount in accordance with clause 10(2)(c)(ii) of Schedule 14A.1 and 10(5)(a) and (b) of Schedule 14A.1.

The Code specifies that the adder will be set such that a hypothetical purchaser (a participant who purchases a fixed proportion of national load) who meets the clearing manager's general prudential security requirements should have sufficient security in place so that its prudential security is adequate 75% of the time. In setting the adder, the actual exposure shall be compared to the exposure estimated through the exit period margin when modelled over a 3 to 10 year period.

2.11 Proposed methodology for calculating the 'adder'

The adder is calculated through a process of modelling how actual market exposure compares to what would have been projected using the exit period margin. We call this use of historical data back casting.

The 'adder' is established by first determining the actual sale and purchase exposure that would have resulted for a hypothetical retailer for an exit period starting each day in a quarter for the last ten years or any such number of years such that no quarter is sampled prior to 2011. At the start, the back casting will extend from 2011 to 2013.

An adder is then established for each quarter such that in 75% of cases, the calculated exit margin for each day is greater or equal to the actual exposure calculated for the hypothetical retailer.

The detailed methodology is located in Appendix 3. The adder may be a positive or negative value.

The three year duration of the back casting period was chosen such that the period is:

a) long enough to cover a variety of market conditions so that the price adder reflects as much as possible the full range of possible future market conditions, and

b) short enough so that historic network and market conditions do not unduly influence the calculation of the price adder.

The adder was calculated using this method for both the profiled and non-profiled exit period base price. The results were presented above in Table 6 and are shown again below in Table 7.

Quarter	Profiled	Flat
1	$ 37.16	$ 40.79
2	$ 17.84	$ 20.12
3	$ (6.01)	$ (0.77)
4	$ (1.25)	$ (0.09)

Table 7: Adders for profiled and non-profiled exit prices calculated for the periods 1 January 2011 to 12 December 2013

As discussed previously, the high exposures calculated in the first quarters of the sample periods lead to high adders (in the range of $40/MWh). The adders calculated for the profiled methodology are somewhat lower than that for the methodology based directly on a flat ASX reference price. This is to be expected as the load weighted average price is higher than the flat profile average.

2.12 Impact of the adder on direct purchasers

The Code specifies an adder which may be differentiated by quarter. One question which has been raised is whether a direct purchaser with a seven day exit period should have the same adder as a retailer with an 18 day exit period.

The clearing manager considers that the duration of the exit period is not relevant to the adder as the adder is compensating for the difference between the ASX based exit price and actual prices. As these prices are established long ahead of the prudential assessment date, the variability across a seven day window will be similar to the variability across an 18 day window.

Perhaps more relevant is the question as to whether the relative load profiles of the direct purchaser and the retailer would lead to similar adders. The Code, however, only provides for developing the adder based upon a hypothetical purchaser based upon a fixed proportion of national load. While such a profile more closely resemble a retail profile than an industrial profile, the impact of this disparity may be mitigated by electing to profile ASX prices when applying them as exit period prices.

2.13 HSAs and the general exit period prudential requirement

The amounts incurred and earned by a participant in relation to an HSA are also relevant for calculating the general exit period prudential margin. Clause 10(8) of Schedule 14A.1 provides

that HSA amounts incurred and earned over the exit period must be based on the exit period price described above. In accordance with this clause, the clearing manager proposes to use the exit period price (base price plus adder) to evaluate projected hedge exposures.

The term “based on”, however, is intended to be somewhat flexible for the reasons discussed below.

If a pure purchaser hedges their load with an HSA that takes the form of a contract for difference (CfD), it is envisaged that the profiled prices used to determine the expected amount incurred for purchases over the exit period would be the same prices used to determine the amount earned on the CfD.

A note about the value of HSAs in the prudential exit period: Since the ASX based forward prices used for prudential purposes will be set two months in advance and based on the average prices in the month before that, the prudential prices will be relatively “flat” over time. They will exhibit some seasonality and will move with long run marginal costs, but they will not be affected much by current spot market conditions (e.g. hydrology) on the assessment day. If the strike price of an HSA-CfD was determined similarly far in advance, it may be quite close to the ASX-based price for the quarter. Consequently many HSAs may be assessed as having quite small values for amounts incurred or earned over the prudential exit period, even if current spot market conditions are extreme. While this may be of concern, associated spot exposure will also be evaluated at this price. Furthermore, once prices are known, both the hedge and spot exposures are recalculated at actual prices.

If a pure purchaser hedges their load with an HSA that takes the form of a cap (HSA-Cap), it may not make sense to use those same prices. The payments under a cap with a strike price like $250/MWh would almost certainly be assessed at zero. An alternate approach would be to develop some kind of statistical method for valuing the cap “based on” the ASX-based estimate of the average quarterly price. This is relevant where the ASX price reflects an expected weighted average of numerous low prices with few very high prices.

While the clearing manager agrees the treatment of HSA’s is imperfect when using the exit period price to evaluate the future value of hedges, it does not consider that there is sufficiently material disadvantage to participants over the exit period to merit the cost and complexity of an alternate system.

2.14 Forward Estimate

Forward estimate of prudential requirements

Each business day the clearing manager must estimate the amount of prudential that is required to be provided for that day, and each of the following 3 business days.

The methodology for calculating the estimate for today is covered above (the general prudential amount). This consultation item covers the method of forward projection - in other words, an estimate of what the assessment will be in the future. The draft methodology is included in Appendix 4.

The three day forward estimate

The consequence of the three day forward estimate is that for every business day the clearing manager will have published an estimate three times in advance and again on the day. The participant must meet the minimum requirement of those four estimates or will be in default.

For the estimate on the day (the assessment of exposure for that day), price and volume information which had previously been estimated based upon ASX prices and persistence forecasts are replaced by actual prices and base load data. The improved quality of data, plus the fact that an increased number of days is included in outstanding exposure, are considered in the forecast.

The clearing manager proposes to measure the average growth of outstanding general prudential amounts and project that growth forward.

The forward estimate will be based on the average daily growth in the participants' general outstandings for business and non-business days measured over the past seven days and projected ahead for the next three business days. The clearing manager will exclude the impact of step changes due to settlement and the loading of reconciliation data.

FTR, exit period prudential and washups (where published) are considered separately. HSA amounts would be included in the average daily growth.

Due to non-business days the numbers of days ahead can jump around in order to cover three business days by up to seven trading days.

In general, the general prudential amount will increase throughout the month until settlement day, and drop the next day.

Estimates which extend beyond settlement day will include expected settlement payments. This forecast assumes there will be no settlement day default. An alternate forecast amount will also be provided reflecting the forward estimate in the absence of settlement day payment. In the event of default, the alternate amount will be deemed to be the forward estimate.

Prepayments will be included in the calculation, as these funds are held by the clearing manager for this purpose.

Confirmed payments from prudential cash deposits will also be included as they are a payment that will be made on settlement day.

An alternative, more explicit means of generating the forward estimate is introduced in Table 8.

Aspect	Proposal	Alternative	Notes
Calculation of likely future exposure	Extrapolation differences between daily exit period estimates and daily outstandings calculations	Produce an alternate estimate by replacing the exit period price with an alternate price for the next three business days	• Increased complexity and implementation cost • Price can be based on persistence model or other price model

Table 8: An alternative for the forward estimate of security required.

3. Settlement Retention Amount (SRA)

3.1 Introduction

The settlement retention amount (SRA) is described in clause 14.21, which specifies that the clearing manager will formulate and publish the methodology for the calculation.

While the market is moving to 'partial' net settlement, the method prescribed in the Code for allocating shortfalls remains consistent with the current Code. Shortfalls in the FTR account are absorbed by payments to the grid owner and then other FTR participants. Shortfalls in the general account are prorated amongst those owed money by the clearing manager for all payments except FTRs, loss and constraint excess, and ancillary services. The pro rata calculation considers gross amounts owed, rather than net amounts owed.

The general principle of the settlement retention amount methodology is to ensure that, when there is a large default, each non-defaulting party can have their payment from the clearing manager scaled back according to the priorities specified in the Code, without the clearing manager having to seek further funds on settlement day from that non-defaulting participant. The SRA is set by determining the risk (which could be default by a single party or a group of related parties) that that would cause the largest percent reduction in payments in either the general market or the FTR market.

An SRA is determined for each participant. The SRA is used to determine the amount payable by the participant according to the formula APp = Max[0, AOp-AOcm + SRA]. The amount payable by the clearing manager to the participant is then calculated as APcm = AOcm – AOp + APp.

Parties that are related are to be treated as a single default for the SRA calculation.

The methodology is to be consulted on as per Schedule 14.2 of the Code. The draft methodology is included in Appendix 5.

3.2 Summary of the methodology

Each participant has an SRA. A participant's SRA is the sum of its general account SRA and its FTR account SRA.

A participant's general account SRA is the product of a general SRA percentage which applies to all participants for that billing period (see below) and the amount owed by the CM to the participant for generation, HSAs, constrained on, proceeds from the must-run dispatch auction (MRDA) and washups.

The general SRA percentage is the percentage by which amounts owing for generation (and HSAs, constrained on, MRDA, washups) would need to be scaled back if the largest single default affecting the general pool occurred.

A participant's FTR account SRA is the product of an FTR SRA percentage which applies to all participants for that billing period and the amount owed by the CM to the participant for FTRs.

The FTR SRA percentage is the percentage by which amounts owing for FTRs would need to be scaled back if the largest single default affecting the FTR pool occurred.

3.3 Design considerations

Publication of SRA information

The clearing manager proposes to publish SRA percentages, the value of the respective pool's SRA values along with the amounts owing in the monthly statements. The SRA percentages apply as a single ratio to the entire market.

Related parties

Currently the clearing manager bundles the prudential security for some related parties. The relationships may be approved by the Authority acknowledging a parent/child relationship in response to a "Schedule 1.1 notice of assumption of rights and obligations".

In other cases a single participant may have multiple participant codes, and these are combined for security purposes but processed separately for invoices. The amounts earned and owed are combined and then the total is used in the prudential calculation. The participant will be treated as a 'related participant' for the SRA calculation while separate invoices will be generated for distinct participant codes.

Where none of the above situations apply, the clearing manager will still consider companies to be related where the clearing manager is aware that the companies meet the definition of related company under the Companies Act 1993.

The clearing manager will keep an internal register of related parties. The clearing manager will not publically disclose these relationships.

Alternatives considered

Provided the risk setting participant[6] fulfils its settlement obligations in full, the market will face a lower scaling factor if the next largest risk participant or group of participants defaults. One alternative is to reflect this lower risk by providing the risk setting participant a reduced SRA. The clearing manager considered and rejected this option. Such an arrangement would promote greater capital efficiency for the risk setting participant. On the other hand, system complexity would increase, there would no longer be a level playing field with respect to the SRA requirement and there could be a potential for perverse incentives. The issue is summarised in Table 9.

[6] One risk setting participant for FTRs and one for the spot market.

Aspect	Proposed	Alternative	Notes
Uniform ratio used to calculate SRAs	A uniform ratio is applied for all participants	A lesser ratio can apply to the risk setting participant resulting in a reduced SRA for that participant	• Reduced capital requirements for risk setter • Issue of fairness (even playing field) and incentives to be considered • Additional complexity • Lower SRA amounts may reduce risk of default due to reduced financial stress • Only the largest possible defaulter would know that they are the largest, as they would have a SRA % that was different than the published %.

Table 9: Option for application of SRA ratio

An example SRA calculation is shown in Table 10 below. In the example, the $SRAratio_{gen}$ is calculated to be 0.10, (or 10%).

Value	Parti A	Parti B	Parti C	Parti D	Parti E
AOp	10	5	10	0	10
AOcm	5	10	0	10	10
APp (before SRA)	5	0	10	0	0
APcm (before SRA)	0	5	0	10	0
SRA	0.5	1	0	1	1
APp	5.5	0	10	0	1
APcm	0.5	5	0	10	1

Table 10: SRA example

Appendix 1: Consultation questions

1. Do you support the proposed methodology for estimating general outstanding exposure?
2. Do you consider the clearing manager's current treatment of ancillary services for prudential security assessment to be fit for purpose? If not, what enhancements do you support?
3. Do you support the proposed approach to estimation of future volumes?
4. Do you support the proposed approach to profiling ASX prices to arrive at exit period base prices?
5. Do you support the proposed method of calculating the adder?
6. Do you support the use of three years of data to calculate the adder upon commencement, extending to ten years? Do you believe there is value in including a longer period of time up front (such as including the 2008 dry year)?
7. Do you support the proposed method of calculating the settlement retention amount (SRA)?

Appendix 2: Submissions on June 2013 consultation

A summary of submissions from the Authority's June 2013 consultation relating to the methodologies discussed in this paper is provided in Table 11.

Topic of question	Number	Summary with respect to the issues in this paper
SRA	Q8	General agreement
Exit period register and exit period prudential	Q9	General agreement, but questions over the number of days. This is not a subject for this consultation.
Broad approach to prudential requirements	Q17	Yes, but comments regarding treatment of un-offered generation.
Make up of general prudential	Q18	General support but not always for the adder
Calculation of out standings	Q19	All comments were in agreement
Profiling the prudential exit period	Q20	Support for profile to TP, Node, business/non-business days. Request for a method that can be simulated by participants.
Use of the ASX values	Q21	General support for using ASX
Publish the quarterly prices two months ahead	Q22	If static approach is taken, general agreement but specific points on the time frame.
Determination of the adder	Q23	On the method of calculation, very little comment to direct the methodology
Method of valuing HSAs for prudential	Q24	General support for valuing HSAs
Guidance for the forward estimate	Q25	Many comments on the accuracy that appear to over value the significance of the forward estimate. They call for high accuracy and an evaluation of the clearing manager's methodology.
Provision of security to meet the forward estimate rather than calls	Q26	Yes.

Table 11: Submissions from the Authority's June 2013 consultation

Appendix 3: General prudential requirements methodology

General prudential requirements methodology

The clearing manager's general prudential exposure of a participant or group of related participants is the sum of the estimate of financial oustandings and the exit period prudential margin.

$$(1) G_{exp} = G_o + G_e$$

Where

G_o is the clearing manager's estimate of outstanding general financial exposure and

G_e is the exit period margin

Estimate of outstanding financial exposure

The estimate of outstanding financial exposure is the sum of:

- the estimate of purchased energy quantities times price
- less the estimate of sold energy quantities times price
- the estimate of net ancillary service charges
- the estimate of the value of hedged to be settled, and
- the net value of washups owed to the clearing manager.

$$(2) G_o = E_{po} - E_{so} + AS_o \pm HSA_o + W_o$$

Where

$$(2a) \mathrm{E_{po}} = E_{pb} + \sum_{tp} \sum_{n} \left(\mathrm{P_{n,tp}} \times \mathrm{QP_{n,tp}} \times 1.15 \right)$$

$$(2b) \mathrm{E_{so}} = E_{sb} + \sum_{tp} \sum_{n} \left(\mathrm{P_{n,tp}} \times \mathrm{QS_{n,tp}} \times 1.15 \right)$$

Where

E_{pb} represents any billed but not settled purchased energy amounts inclusive of GST (no account taken for pre-payments)

E_{sb} represents any billed but not settled sales amounts inclusive of GST,

tp represents all unsettled and unbilled trading periods up to the end of the previous day,

$P_{n,tp}$ represent final prices, or if final prices are not available, interim prices, or if interim prices are also not available, the exit period price plus adder as published by the clearing manager for node n and trading period tp; and

$QS_{n,tp}$ represents the clearing manager's estimate of a participant's electricity sales for node n and trading period tp.

$QP_{n,tp}$ represents the clearing manager's estimate of a participant's electricity purchases for node n and trading period tp.

$$(2c)\ AS_o = AS_b + AS_{daily\_avg} \times d$$

And AS_b represents any billed but not settled ancillary service charges (net), AS_{daily_avg} represents the net daily average ancillary service payment to the clearing manager over the last t settled billing month and d represents the number of days since the end of the last settled billing period less any days included in invoiced but not settled amounts.

$$(2d) HSA_o = HSA_b + \sum_{tp}\sum_{n} -HSAsettlement\ value_{n,tp}$$

and HSA_b represents any billed but not settled hedge settlements owed to the participant (net), tp represents all trading periods up to the end of the prior day which have not yet settled and n represents lodged HSA 'n' for all lodged HSA's and the HSA settlement value is the value the participant is due to be paid according to the terms of the hedge settlement agreement for that period when calculated using final prices, or if final prices are not available, interim prices, or if interim prices are also not available, the exit period price plus adder.

$$(2e) W_o = \sum_{bp} w_{bp}$$

and for all bp, w_{bp} is the net published but not yet settled washup amount owed by a participant for billing period bp

The clearing manager's estimate of volumes

The estimated consumption quantity for trading period tp, node n, and participant p:

(3) $\mathrm{QP}_{\mathrm{tp,n,p}}$

$$= \begin{cases} \mathrm{QP}_{\mathrm{recon}_{\mathrm{tp,n,p}}} & \text{for trading periods where reconciliation data available} \\ \mathrm{QP}_{\mathrm{cob}_{\mathrm{tp,n,p}}} & \text{V recon data unavailable and change of business noted for node n} \\ QP_{tp,n} \times Lshare_{tp,n,p} + Q_{DCLS_{tp,n,p}} & \text{V recon data unavailable and no change of business} \\ \mathrm{QP}_{\mathrm{wind}_{\mathrm{n,p}}} & \text{V recon data unavailable and nodes with grid connected wind} \end{cases}$$

Where

Change of business volumes are applied to new participants and

$\mathrm{QP}_{\mathrm{recon}_{\mathrm{tp,n,p}}}$ is consumption reconciliation information for trading period tp, node n, and participant p,

$\mathrm{QP}_{\mathrm{cob}_{\mathrm{tp,n,p}}}$ is the consumption information applied by the clearing manager in consultation with the participant where the participant is a new purchaser or had advised a significant change of business, as per 14A.16 and 14A.17,

$Q_{DCLS_{tp,n,p}}$ are nominated dispatch bids in the post_SADS_order from the system operator for trading period tp, node n, and participant p,

$Lshare_{tp,n,p}$ is the market share of participant p at node n calculated across blocks of six trading periods with respect to load for the latest reconciliation month for which the clearing manager has reconciliation data,

$QP_{tp,n}$ is the deemed consumption at node n in trading period tp where

$$(3a) QP_{tp,n} = \begin{cases} Max\left[L_{MA_{tp,n}} - G_{offered_{tp,n}}, 0\right] & \text{for nodes with direct consumers} \\ L_{MA_{tp,n}} + Max[G_{embedded_n} - G_{avg\ offered_n}, 0] & \text{for all other nodes} \end{cases}$$

Where:

$L_{MA_{tp,n}}$ = half hour metering information as described in 13.141(bi) as uploaded by the pricing manager to WITS for that node and trading period,

$G_{offered_{tp,n}}$ = for nodes with direct consumers only (as advised by the reconciliation manager); total cleared offers in the post_SADS_order from the system operator for trading period tp and node n,

$G_{embedded_n}$ = the average total embedded generation recorded for node n in the most recent month contained within reconciliation information held by the clearing manager,

$G_{avg\ offered_n}$ = total average cleared offers in the post_SADS_order from the system operator for node n, for the corresponding month for which embedded generation data is available, and

$QP_{wind_{n,p}}$ for nodes with grid connected intermittent generation; this is the average consumption recorded for participant p and node n, in the most recent month contained within reconciliation information held by the clearing manager.

The estimated generation quantity for trading period tp, node n, and participant p:

$$(4)\ QS_{tp,n,p} = \begin{cases} QS_{recon_{tp,n,p}} & \text{for trading periods where reconciliation data available} \\ QS_{cob_{tp,n,p}} & \text{V recon data unavailable and change of business noted for node n} \\ QS_{tp,n,p} & \text{V recon data unavailable and no change of business volumes apply} \end{cases}$$

Where

Change of business volumes are applied to new participants and

$QS_{recon_{tp,n,p}}$ is generation reconciliation information for trading period tp, node n, and participant p,

$QS_{cob_{tp,n,p}}$ is the generation information applied by the clearing manager in consultation with the participant relating to a significant change of business notified by a participant as per 14A.17,

$$(4a)\ \ QS_{tp,n,p} = ClearedOffers_{tp,n,p} + G_{unoff_{tp,n,p}}$$

Where:

$ClearedOffers_{tp,n,p}$ are the relevant cleared offers identified by trading period, node, and participant in the post_SADS_order from the system operator, and

$$(4b)\ G_{unoff_{tp,n,p}} = \begin{cases} participant\ data & has\ been\ supplied \\ G_{unoff\_proj_n} & data\ not\ supplied \end{cases}$$

Where:

$$(4c)\ G_{unoff\_proj_n} = \frac{\sum_{i=1}^{21} G_{unoff\_supplied_{tp,n}}}{\sum_{i=1}^{21} 1}$$

for trading periods (tp) on days (today -i) where the clearing manager holds participant supplied unoffered generation data. If there are no trading periods for which the clearing manager holds unoffered generation data supplied by the participant, $G_{unoff\_proj} = 0$.

Calculation of the exit period base price

G_e is the exit period margin described in equation 1. With respect to energy, it is comprised of exit period base price times an estimated quantity at each node plus an adder times total quantity.

$$(5) G_e = \sum_{\mathrm{tp}} \sum_{\mathrm{n}} \mathrm{P}_{\mathrm{exit\ n,tp}} \times \mathrm{Q}_{\mathrm{n,tp}} + A_{Qtr} \times \sum_{tp} \sum_{\mathrm{n}} \mathrm{Q}_{\mathrm{n,tp}} + AS_f + HSA_f$$

where

tp represents all trading periods across all days in the participant's registered exit period

n represents all relevant nodes

$P_{exit\ n,tp}$ is the clearing manager's exit period price for each trading period of each day (tp) in the exit period and each node

$Q_{n,tp}$ is the clearing manager's exit period net purchase quantity estimate for each trading period of each day in the exit period and each node from equation 3 and 4 above $(QP_{n,tp} - QS_{n,tp})$ (averaged over 21 days by business/non-business day and trading period), and

A_{Qtr} is the clearing manager's weighted average 'adder' which applies to the quarters represented by the set to trading periods in the exit period.

$$(5a) \mathrm{P}_{\mathrm{exit\ n,tp}} = futuresPrice_{qtr,island} \times f_{m,island} \times f_{d_{type},island,quarter} \times f_{tp,d_{type},quarter,island} \times f_n$$

Where:

$futuresPrice_{qtr,island}$ calculated as the average of daily closing prices of the quarterly ASX New Zealand Electricity futures Otahuhu price (for north island nodes) and quarterly ASX New Zealand Electricity futures Benmore price (for south island nodes). The average is taken across 20 days in the calendar month before the price is set by the clearing manager. These values will be published quarterly no later than two months before the quarter in which they will apply. The sample period for determining derived prices is 10 years of historical data starting from 1 October 2010.

$f_{m,island}$ is the month profile for each island with respect to the quarterly prices where prices are taken at Benmore (South Island) or Otahuhu (North Island). It is calculated by dividing the month's historical average price by the historical quarterly average price.

$f_{d_{type},qtr,island}$ is a factor which represents the relative price levels of business and non-business day prices for each island in each quarter. It is determined by calculating the average price (Otahuhu or Benmore) for business and non-business days in each quarter and dividing by the overall average quarterly price (Otahuhu or Benmore).

$f_{tp,d_{type},quarter,island}$ is a intra-day profile factor which is calculated for each quarter, day-type and island. It is determined by calculating the average price for that trading period, grouped by quarter and business and non-business day for both Otahuhu and Benmore; and dividing by the average business/non-business day price for each quarter for both Otahuhu and Benmore.

f_n is a location factor which is calculated for each node in each island with respect to Benmore in the South Island and Otahuhu in the north island in the manner as described in 13.211 of the Code apart from the substitution of island area for grid zone area.

Factors are calculated and published before 1 November of the year preceding the calendar year in which they will be applied. The sample period for determining factors other than f_n is 10 years of historical data starting on 1 October 2010.

$$(5b)\ \mathrm{AS_f} = \mathrm{AS_{daily\_avg}} \times \mathrm{d_{exit\_period}}$$

Where $\mathrm{AS_{daily\_avg}}$ represents the net daily average ancillary service payment to the clearing manager over the last three settled billing months and $\mathrm{d_{exit\_period}}$ represents the number of days since the end of the last settled billing period less any days included in invoiced but not settled amounts.

$$(5c)\mathrm{HSA_f} = \sum_{\mathrm{tp}} \sum_{\mathrm{n}} -\mathrm{HSAforcastvalue_{n,tp}}$$

For all trading periods in the participant's registered exit period the HSAforecastvalue is calculated in accordance with the terms of the hedge settlement agreement while substituting the applicable exit period base price plus the adder.

Calculation of the adder

A_{Qtr} is established by first determining the actual sale and purchase exposure that would have resulted for a hypothetical retailer for an exit period starting each day in a quarter (Qtr) for the last ten years or any such number of years such that no quarter is sampled prior to 2011. These values are compared with the corresponding day's result of the exit price portion of the exit period margin calculation:

$$(6) G_{epp} = \sum_{\mathrm{tp}} \sum_{\mathrm{n}} \mathrm{P}_{\mathrm{exit\ n,tp}} \times \mathrm{Q}_{\mathrm{n,tp}}$$

A_{Qtr} is set equal to the smallest of the top quartile differences between G_{epp} and the actual exposure calculated with final prices.

The hypothetical retailer is set as a consumer of 1% of the load at all nodes, with a 18 day exit period.

The adder is calculated at least two months before the start of each calendar year as per Clause 10(6)(ii) of Schedule14.1. This will require that the adder for quarter 4 is calculated the year before the one used in quarter 3.

The adder will be published by the clearing manager on the clearing manager portal during the month of October each year.

The $/MWh price adder will be a single non-negative number that applies across all the prices in a quarter.

Appendix 4: Forecast exposure methodology

Forecast exposure

The clearing manger is required to estimate prudential security for each business day and for each of the following three business days (14A.5, Schedule 14A.1 Part 2).

The methodologies to estimate prudential exposure are the clearing manager's FTR Prudential Security Assessment Methodology and General Prudential Security Assessment Methodology.

This document describes the methodology for establishing a forecast exposure estimate three business days into the future.

The method utilises the average for the forward estimate will be calculated using the last 7 days (segregated by business/non-business day averages). The estimate will include prepayments, the invoiced settlement amount from the day of settlement (if a positive number) and amounts to be settled from prudential (once confirmed).

For each participant, forecast exposure for day *d* $((1)\ ForcastExposure_d)$ is described as follows:

$$(1)\ ForcastExposure_d = G_o + G_e + FTRexposure - payments_d + wd \times G_{o\ increment_{business\ day}} + di \times G_{o\ increment_{non-business\ day}}$$

Where:

G_O is the most recently calculated general outstandings amount,

G_e is most recently calculated general exit period prudential amount,

d is the number of days in the future for which the estimate is calculated (i.e. today plus *d* days),

wd is the number of business between day d and today (being 1, 2, or 3),

di is the number of non-business day, if any, between day d and today ,

$FTR_{exposure}$ is the participant's most recently calculated FTR exposure,

$payments_d$ are any cleared funds prepayments or settlement payments to be received by the clearing manager by day d, as per the settlement statement or as advised by the participant,

$$(1a)\ G_{o\ increment_{business\ day}} = \frac{\sum_{i=1}^{7}\left(G_{o_{n+1-i}} - G_{o_{n-i}}\right)}{\sum_{i=1}^{7} 1} \quad for\ all\ (n-i) = business\ day, \text{ and}$$

$$(1b)\ G_{o\ increment_{non-business\ day}} = \frac{\sum_{i=1}^{7}\left(G_{o_{n+1-i}} - G_{o_{n-i}}\right)}{\sum_{i=1}^{7} 1} \quad for\ all\ (n-i) \neq business\ day$$

Where

n is the current date and

$G_{o_{n+1-i}}$ was the general outstandings component assessed on day n+1-i and n is today

Appendix 5: Settlement retention amount methodology

Methodology to determine settlement retention amounts

The settlement retention amount (SRA) is calculated pursuant to14.21 of the Code.

SRAs are calculated for each participant. The calculation is set to ensure that the clearing manager holds sufficient funds on settlement day to manage any single default. An SRA is calculated as a percentage of the amount payable to the participant by the clearing manager.

For each participant (p) other than the grid owner:

$$(1)\ SRA_p = AOgen_{CM_p} \times SRAratio_{gen} + AOftr_{CM_p} \times SRAratio_{ftr}$$

Where

$AOgen_{CM_p}$ represents the amount to be applied by the clearing manager to the participant (p) relating to amounts referenced in 14.56(e) of the Code,

$AOftr_{CM_p}$ represents the amount owed by the clearing manager to the participant (p) relating to amounts referenced in 14.57(1)(a) of the Code, and

the SRA for the grid owner is zero.

$$(2a)\ SRAratio_{ftr} = Max[0,1 - \frac{Cfull_{FTR} - X_{ftrMAX}}{FTR_{required} - APftr_{CM_{gridowner}} - \sum_p APftr_{CM_p}}]$$

Where

$\sum_p APftr_{CM_p}$ represents the sum of amounts payable to related participants by the clearing manager for the group of participants which represent the largest potential shortfall of FTR funds,

$Cfull_{FTR}$ represents the amount available for the settlement of FTRs in the event all amounts payable to the clearing manager are paid,

X_{ftrMAX} is the largest potential FTR shortfall amount for a single default of a related participant group where the shortfall is determined by the formula provided in 14.55(4) of the Code,

$FTR_{required}$ is the sum of all amounts required to settle FTRs in respect of the billing period as defined 14.57(2)(c) of the Code, and

$APftr_{CM_{gridowner}}$ is as above.

$$(2b)\ SRAratio_{gen} = Max[\frac{GSTreserve + \sum_{p\ in\ rpg}\left(AP_{P_p} - AP_{CM_p} - Xftr_p\right)}{Genfunds_{required} - \sum_{p\ in\ rpg} Genfunds_p}]$$

Where $SRAratio_{gen}$ is the largest ratio selected amongst all ratios calculated for related participant groups (*rpg*).

$GSTreserve$ is an amount sufficient to meet the clearing manager's goods and services tax (GST) exposure which would result from the shortfall. GST exposures develop as the Energy Clearing House Limited files its GST returns on an invoice basis. GST is to be retained for any non-payments to the clearing manager as well as to cover any reductions in GST input credits which relate to scaled payments.

$\sum_{p\ in\ rpg}\left(AP_{P_p} - AP_{CM_p} - Xftr_p\right)$ represents the aggregate shortfall in a related participant group which is not attributed to the FTR pool,

$Genfunds_{required}$ represents the total funds required for complete settlement of the amount described in 14.56(1)(e) of the Code plus any associated GST,

$Genfunds_p$ represents the total funds required for complete settlement of the clearing manager to participant (p) amounts described in 14.56(1)(e) of the Code and any associated GST.