



**System Operator commentary on the term
“reasonable estimate” in the context of
interruptible reserves availability**

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Purpose

The Electricity Commission (Commission) is currently undertaking a project to address concerns raised in the Stratagen Report¹. The objective of the project is to ensure that sufficient quantity and appropriate quality of reserves are available to the System Operator and continued downward pressure is applied to the cost of reserves.

As an input to this project, the Commission has sought the System Operator’s advice on how the term “reasonable estimate” should be interpreted and applied in rule 6.3.3 of section II of part G.

This paper provides that advice and addresses this issue and provides other contextual information relevant to the above objective. The sections of the paper are:

1. Overview of why and how instantaneous reserves are procured
2. System Operator requirements for delivery of dispatched reserve quantities
3. Interpretation and application of “reasonable estimate”
4. Changes to clarify rules relating to reserve offer accuracy
5. Effect of compliance regime on participation in the reserve market
6. Potential benefits from improved reporting on performance
7. Summary

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¹ “Investigation and attempt to effect a settlement for the under-frequency event on 4 May 2004” dated 15 March 2005.

1. Overview of why and how instantaneous reserves are procured

The importance of instantaneous reserve (IR) to the System Operator arises out the Principal Performance Obligations (PPOs) under the Electricity Governance Rules and Regulations EGRs).

The frequency PPO, set out in rule 2.2 of section II of part C, requires the System Operator to maintain frequency within the normal band in accordance with the under frequency standard set out in schedule C6. The System Operator is also required to limit the rate of occurrence of under-frequency excursions below certain frequencies.

Reserves procurement is one of the key means of ensuring the frequency PPO is met². The System Operator schedules (and only schedules) sufficient reserve quantities to ensure that, following the largest contingent event, the system frequency falls exactly to 48 Hz within 6 seconds and returns to the minimum statutory limit (49.25 Hz) within 60 seconds.

Two reserve products are procured by the System Operator: fast IR and sustained IR. Fast IR is procured to arrest the fall in island frequency following a contingent or extended contingent event. Sustained IR is procured to return the island frequency above 49.25 Hz. IR can be provided by generators or by interruptible load (IL).

SPD and RMT are used to determine the quantity of reserve required. In determining the quantity, compliance with dispatch is assumed; that is, no allowance is made for under or over delivery of reserve.

Consequently, non-compliance with reserves dispatch puts the frequency PPO at risk of not being met. If an under frequency event were to occur and insufficient reserve provided, possible consequences are the triggering of AUFLS and, in extreme cases, cascade failure.

2. System Operator requirements for delivery of dispatched reserve quantities

Compliance standard applied by the System Operator

As described in section 1, the System Operator relies on reserve providers being able to provide adequate reserve to cover the quantities offered, scheduled and dispatched. This requires providers to construct their offers in a manner that accurately reflects their ability to provide reserve in each trading period.

In assessing compliance with reserve instructions, the standard the System Operator applies is that the quantity provided should be no less than the quantity dispatched, less the accuracy of the MW measuring equipment (in most cases 0.1 MW or 1%, whichever is larger).³

The System Operator applies “reasonableness” in making its calculation of the quantity provided, as described in section 3.

² Others are the reliance the System Operator places on generator compliance with their obligations to stay connected at certain frequencies (AOPOs), and distributor/grid owner compliance with their obligations to maintain AUFLS systems.

³ We note the standard applied by the System Operator is based on a minimum quantity being provided. This is because we believe an over frequency situation is unlikely to occur if reserve providers offer conservatively and over deliver the quantity of reserves dispatched.

Consequences of lowering the compliance standard

To ensure the frequency PPO is met, the System Operator requires certainty as to the quantity of reserves that will be delivered. Consequently, if greater tolerance were permitted in delivered quantities of reserve, the System Operator would need to factor this in to its calculation of the quantity of reserve to be procured. More reserve would need to be dispatched to ensure the risks for each island were appropriately covered. This would result in increased reserve procurement costs.

Decision about how much to offer

The System Operator contracts reserve providers based on certain performance criteria. Contracted quantities are based on the maximum quantities that the reserve provider demonstrates can be provided. The System Operator contracts with providers for maximum limits ranging from 3 MW to over 100 MW.

Subject to the individual maximum quantities agreed with the System Operator, IL providers have the flexibility to choose how much to offer for a given trading period. IL providers are paid based on an availability basis and are required to represent their availability accurately through their offers. Thus, where an IL provider wishes to offer in the maximum quantity it believes is available (to maximise its reserves income), it must consider its capability to actually deliver the full quantity should an under-frequency event actually occur during the relevant trading period.

3. Interpretation and application of “reasonable estimate”

System Operator performance assessment methodology (quantitative)

It is only when an under-frequency event occurs that the System Operator can determine whether a reserves provider was able to deliver the reserves dispatched. Generally, for all other trading periods, the System Operator will be unaware whether it was or was not capable of delivering all the reserve for which it was dispatched.

For reasonable and prudent reasons, the System Operator’s takes a prudent approach in calculating the delivery of IL, the effect of which is to increase the likelihood the IL provider will be found to be compliant. Practically, this is how the System Operator interprets and applies “reasonableness” in relation to the accuracy of reserve offers.

The calculation methodology the System Operator uses is set out in clauses 125 to 128 of the Procurement Plan, schedule C5.

Data adjustments made to maximise the quantity calculated include:

- adjusting the start time of the event (to maximise quantities delivered by GXP)
- calculating the (maximum) quantities by GXP, which are then summed and will be greater than if the IL quantity is calculated from the total network load
- where appropriate, allowing for load pickup in the reserve calculation. Load pickup calculations are not included where an under frequency event occurs during periods of decreasing load.

The System Operator’s calculation is consistent with the definition of reserve in Part A of the EGRs. For FIR this is the drop in load over 1 second following the under-frequency event. For SIR it is the average drop over the 60 seconds following the under frequency event.

Other factors (qualitative)

As described above, the System Operator applies a quantitative interpretation of “reasonableness” when assessing the performance of IL providers. We are of the view that other, qualitative factors

should also be taken into account when the particular circumstances of each occasion of IL being provided is being reviewed.

These factors include the steps the provider has taken to ensure the estimate it has provided is the best it can be. Such steps should include appropriate testing regimes and offers based on the results of such testing. The standard and frequency of testing should be consistent among providers. It is also clearly not reasonable when a provider continually and consistently under-delivers reserves without implementing appropriate mitigation measures.

Another relevant factor is that a provider cannot incorporate plant problems into an estimate where it is unaware such problems exist. Providers should put in place an appropriate testing and inspection regime that would reasonably be expected to identify such problems.

However, if such a regime were in place and the problems not identified, we would regard the emergence of a plant problem as a reasonably unforeseeable event and not one the provider could reasonably have been expected to incorporate in offers made prior to the plant problem becoming evident.

4. Changes to clarify rules relating to reserve offer accuracy

Flaw in reserve offer rules

The System Operator needs reserve offers to be accurate at all times, from scheduling time through to dispatch. It appears a flaw exists in the current rules in that the requirement for reserve offers to be a reasonable estimate (rule 6.3.3 of G II), when read literally, applies only to reserve offers submitted prior to 13:00 for the following trading day.

We believe this flaw should be remedied by adding a rule for reserve offers that parallels G II 3.15 (in respect of energy offers). Such a rule would require reserve providers to submit revised offers when circumstances change, so the latest reserve offers submitted always represent a reasonable estimate of availability. The threshold levels for requiring revised offers to be submitted should be consistent with the compliance standard and interpretation of reasonable estimate described in sections 2 and 3 of this paper.

5. Effect of compliance regime on participation in the reserve market

Why the compliance regime, in our observation, is not a barrier. To the contrary, participants have demonstrated improved performance, which has been very positive.

The Commission has noted its concerns that if the issues identified in the Stratagen Report are not addressed:

- there will be continued breach allegations with associated compliance costs, and
- providers may withdraw from the reserves market (at least one participant already has), reducing the quantity of reserves available and therefore placing increased risks of system security.

Our observation of the reserves market is that the compliance regime is having a positive influence on reserve provider performance. Rather than withdrawing from the reserves market, the majority of providers have improved the delivery of IL during under frequency events. We believe this is, in part, due to the influence of the governance rules and the reputation risk that arises when providers breach the rules and potentially greater reputational damage if, as a result of an IL under-delivery, the System Operator is unable to properly manage an emergency situation.

Awareness of the issues and requirements on reserve providers has increased over the last 12 months, and this has in part been due to:

- communication between providers and the System Operator under reserve provider contracts
- reserve performance monitoring
- a number of under-frequency events over this period
- the obligation on the System Operator to report a breach to the Board where it believes (on reasonable grounds) other participants have breached the rules.

IL providers have, or are installing, better monitoring systems; have or are about to conduct drop load tests; have reduced their offer quantities and revised their offer profiles. As a result of these actions the performance of reserve providers has, in our view, improved since 2004 (see table 1 in the appendix). It is likely providers will continue to improve with the undertaking of further drop load tests and improved performance monitoring. This will result in further diminishing the number of breaches of the rules.

Where IL providers have withdrawn from the reserves market this has, to our knowledge, been for technical or financial reasons rather than because of the assessment methodology used by the System Operator. We understand the reasons for withdrawal have included a failure of relay systems to provide reserve during under-frequency events, the IL market not providing an adequate return (or better returns being available elsewhere for the same product) and retesting, calibration or installation of equipment.

In several instances where a provider believes it has under-delivered reserve for an under-frequency event, the System Operator has been notified and the provider has actively sought to address the reason for the under-delivery.

The System Operator is primarily concerned that sufficient incentives exist for reserve providers to perform in a manner consistent with it achieving the PPOs. The Commission needs to balance the compliance incentives against ensuring the objective to reduce barriers to entry in the reserve market is not compromised. Our observations, however, are that the current compliance regime is not having a detrimental effect, and we do not believe the compliance standard should be ‘watered down’. As noted above, if this were to occur, the System Operator would need to compensate by procuring additional reserve. This would increase reserve costs.

6. Potential benefits from improved reporting on performance

Note: For a detailed discussion on IR monitoring options, refer to the paper by Ray Hardy titled “Instantaneous Reserve Monitoring Survey Results” dated 7 October 2004. This was made available to the CQAG for its meeting on 14 October 2004 and is available on the System Operator’s website at <http://www.transpower.co.nz/?id=5963>.

FIR is defined currently as the drop in IL that is provided 1 second after the grid frequency falls to or below 49.20 Hz.

For several of the IL reserve providers, performance 1 second after the event cannot be assessed because the measurement data is provided in time steps greater than 1 second. The minimum sampling rate for monitoring data is 6 seconds for FIR and 10 seconds for SIR (clause 129.1 of the 2006/7 Procurement Plan, schedule C5). Assessment is therefore based on the IL provided between successive time steps, one before and the other after the frequency drops to 49.20 Hz. Thus the System Operator can only assess if there has been an under-delivery of reserve, not if delivery was provided at 1 second.

If higher resolution data were provided, greater certainty around delivered quantities could be achieved. This would also provide the ability to introduce additional IL FIR products provided later

than 1 second after the event and up to 6 seconds after the event.⁴ In determining the amount of reserve to be procured the System Operator would take account of the timeframe under which the IL would be provided; the later the delivery of the product, the lower the “security” or MW value of that reserve.

To distinguish and check compliance of the delivery of such FIR products, the measurement data would need to be provided in time steps no greater than 1 second. Obviously, there are costs arising from installing better measurement equipment. This would need to be balanced against the potential benefits. Some IL providers have already taken the step and installed better equipment.

The advantage to the reserve market and the industry would be that more FIR would likely be available at longer timeframes out from the event than 1 second. This may therefore act to increase participation in the fast reserves market and lower reserve costs. As an example, if the definition of FIR were changed to include the provision of reserve at time intervals greater than 1 second, a participant who could provide 10 MW of fast reserve at 3 seconds would be able to offer in an equivalent amount of FIR (somewhat less than 10 MW) as if it were being provided 1 second from the event.⁵ Thus there is a potential return to those who invested in better instrumentation and were able to provide FIR at intervals up to 6 seconds from the time of the under frequency event.

7. Summary

IR is an essential system capability on which the System Operator relies in order to meet the PPOs. The System Operator must have certainty about the quantities that will be delivered. Reserve energy products are critical to the System Operator’s management of rare, but critical events. In the absence of participants providing reliable, reasonable estimates of availability through their reserve offers the System Operator is obliged to manage the arising risk through the purchase of additional reserve products.

There is an opportunity for the industry to improve the monitoring and measuring requirements for reserve products. This would not only provide the System Operator with better information (and potentially reduce the need for any ‘margin for error’ to be built into its current reserve management tools) but also offer new product opportunities to the industry. Improved measuring would also reduce the extent to which participants currently debate what is or is not a “reasonable estimate”.

Currently a flaw exists in the rules, in that reserve offers are not technically required to be a reasonable estimate at all times. We believe this should be addressed in the rules by requiring participants to revise their reserve offers when circumstances change so the latest offers submitted are always a reasonable estimate of availability.

Any such rule change should be consistent with the interpretation and application of reasonable estimate described in section 3. It should not have the effect of ‘watering down’ the currently applied standard for compliance with reserve dispatch instructions, described in section 2.

If the compliance standard were to be ‘watered down’, the System Operator would need to factor this in to its reserve calculation. More reserve would need to be procured, resulting in increased reserve costs.

⁴ Generator FIR is calculated as that delivered at 6 seconds.

⁵ The System Operator would need to undertake analysis to determine the relative value of FIR provided at different timeframes.

Appendix

Table 1 – Summary of under-delivery of IL by event since April 2004. South Island events, and events where Island frequency was not below the IL trip threshold for the required time have been omitted. The table shows the number of providers the System Operator alleged breaches of the EGRs against for under-delivery of IL.

Event Date	Time	Number of IL providers
4-May-04		4
23-Jun-04		4
6-Aug-04		2
8-Oct-04	2:18	4
8-Oct-04	17:23	2
16-Jan-05	15:51	1
01-Jul-05		1
16-Oct-05		1
11-Dec-05		
23-Dec-05		1
28-Dec-05		
8-Nov-06		3
1-Dec-06		1

Since the commencement of a more rigorous assessment in 2004, including the provision of better data, performance has improved. Earlier assessments were made using Transpower 10 second SCADA data. Participants now either supply their own measurement data or contract with Transpower for this to be provided.