Critical Contingency Price: 13 July 2010

Final Report, 6 September2010

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Introduction

1. Several interconnected transmission pipelines deliver gas around the North Island of New Zealand. Operation of the transmission system is not fully centralised, with two firms each having responsibility for part of the network, although Vector undertakes the System Operator role for both firms. Commercial arrangements for these two parts are quite different; the Maui pipeline operates on a common carriage regime, while the Vector system is based on contract carriage.

2. Safety and cost considerations dictate that the pressure in the transmission system be maintained above specified levels and the governance arrangements are designed in part to ensure this. There are regulations[1] that define critical contingency events and prescribe roles and actions before, during and after such events. In general terms, if pipeline pressures deteriorate below pre-defined levels, the Critical Contingency Operator ('CCO') will

    a. Notify participants it is calling a critical contingency ('CC'), and

    b. Manage gas flows including by instructing that certain parties drawing gas cease doing so, those parties having been identified and prioritised in advance.

3. Declining pipeline pressures means that the amount of gas in the pipeline ('line pack') is also declining; that is, there is a decreasing amount of gas in the system with which to supply demand.

4. During the afternoon of 13 July 2010, an unexpected interruption led to less gas being supplied from the Pohokura gas field than was anticipated and scheduled. Both of the welded points supplying Pohokura gas to the transmission system were affected by the outage. The situation persisted for several hours, by which time expectations for several earlier resumptions had been proven wrong. The CCO called a critical contingency event at 7.39pm and notified that the event had ended at 10.36pm.

5. The regulations provide that, following a critical contingency event that the CCO has classified as non-regional, an industry expert will be appointed to determine a price to be applied to the contingency imbalances sustained by interconnected parties and shippers during a critical contingency, known as the critical contingency price ('CCP'). I have been so appointed and this is the final

[1] Gas Governance (Critical Contingency Management) Regulations 2008 ('the Regulations')

version of my report. I discussed a draft report with interested parties at a workshop on the morning of 24 August, and received several helpful written comments before the deadline of COB on Monday 30 August.

6. This is the first critical contingency to be called since the regulations were promulgated. So there are no precedent decisions to consider.

Concepts Relevant to Price-Setting

7. Statutory guidance is provided by s71 of the regulations which is reproduced below.

71. Determining critical contingency price
(1) The industry expert must determine the critical contingency price in dollars per gigajoule of gas.
(2) The industry expert must seek to set the critical contingency price at a level that reflects the price that would be established by an efficient short-term market that allocated scarce gas resources to the highest value uses during the critical contingency.
(3) If—

(a) only consumers in curtailment bands 0 and 1a, or 0, 1a, and 1b, were curtailed during the critical contingency, the industry expert must base his or her determination on the prices in the wholesale market for electricity during the critical contingency except where that would be contrary to subclause (2); and
(b) any other circumstances apply, the industry expert must take into account the following matters:

(i) the prices in the wholesale market for electricity during the critical contingency; and
(ii) the economic cost of the loss of gas supply to those consumers who had their gas supply curtailed; and
(iii) any other matters that the industry expert considers relevant to achieving subclause (2).

8. The CC process sits within a broader governance structure for the industry. Its role is to provide a backstop in case normal commercial behaviour, combined with random natural/physical events, leads to extreme outcomes.

9. The CC price facilitates what might be called a wash-up process, helping to settle imbalances arising from errors in predicting consumption. However it also has forward-looking incentive effects that should be considered. Expectations about the outcome of the CC process affect the incentives of firms, and therefore the likelihood of CC events.

10. The entire gas industry benefits from more reliable and secure supply, i.e. from an absence of critical contingency events. Even though the value of this benefit varies across participants, none can be excluded from enjoying reliable service. The benefits of line pack are therefore socialised across the industry.

11. Conversely, during times of stress, it is individual participants who bear the cost of making contributions to line pack, whether by increasing deliveries to the network or by reducing off-take. The opportunity cost of such contributions varies, but it will rarely be zero in expectation. It is therefore likely that, during times of low line pack, there is a commercial incentive on many participants to take no actions that would improve line pack, but rather to wait for others to do so.

12. The critical contingency regulations provide a circuit-breaker capable of avoiding large scale service outages under these conditions. Rather than rely on voluntary contributions, the CCO is empowered to direct parties to do certain things. To the extent that the CCP creates incentives for participants to help avoid critical contingency events, it does so through expectations of the likelihood of being instructed to do things by the CCO.

13. Regulation 71(2) directs attention to a notional spot market price for gas *during the critical contingency*. This particular CC was signalled as being likely some two hours before it was actually called. It is conceivable that the CC may have been avoided if more supply had been forthcoming and/or some customers had been curtailed during this two hour period.

14. If there was an efficient spot market, the price in that market would have been determined by interaction between

    a. The supply schedule, which would reflect the willingness of parties with gas to accept payment for it; and

    b. The demand schedule, reflecting the willingness to pay for gas.

15. If there were several possible suppliers of spot market gas, any one of whom was capable of meeting total demand, then the price would be driven down close to the cost of supply. Alternatively, if supply to the spot market was somewhat constrained, then those with gas to sell could extract higher prices consistent with willingness to pay.

16. In my view, the fact that the notional spot market is an *efficient* one says nothing in particular about which of these outcomes should be chosen. A market is efficient if it facilitates all feasible trades, thereby ensuring that resources flow to their highest value uses. An efficient market will result in high prices in times of shortage and low prices in times of surplus.

17. The wholesale electricity market benchmark referred to in 71(3) reflects the opportunity cost of gas to an electricity generator, which is a component of the supply curve in the notional spot market rather than the demand curve. From the above discussion, it follows that the wholesale electricity price is not necessarily the price that would emerge from an efficient spot market for gas.

18. On the demand side of the notional gas spot market, purchases from the balancing gas exchange around the time of the critical contingency offer some insight into willingness to pay. However the fact that a critical contingency occurred indicates that line-pack could not be sustained adequately by balancing gas purchases.

Event Severity and the CCP

19. There is a pre-arranged order in which eight different types of gas users will be directed to cease drawing gas during a CC. Elements of this order[2] can be viewed as representing a cost schedule or merit order, though it also reflects some pragmatism over freeing up significant volumes of gas quickly. The first two bands (0 and 1a) release any gas being taken for storage (band 0) and any gas being taken by a large user (more than 15 TJ per day) supplied directly from the transmission system that has alternative fuel sources.

20. The opportunity cost of curtailment to users in bands 0 and 1a is likely to be lower than for other users, so they are called first. From an industry-wide perspective therefore, a CC event that can be remedied without curtailing beyond band 1a is a relatively low cost CC event.

21. The participants in band 1a are electricity generators with the ability to switch fuels at a single plant (eg the first four units at Huntly which can run either gas or coal). Viewing these parties as suppliers into a notional spot market for gas, it is difficult to predict the pattern of supply offers. The price of those offers will depend, among other things, on the cost of alternative fuels and on the offers expected from rivals.

22. It is known that electricity generators have market power under certain conditions. There is no particular reason to expect that CC events will be correlated in time with such periods, but it is clear that serious CC events could transfer stresses from the gas industry to the electricity industry. If the notional spot market did exist, the price of gas would be bid up during times of stress, and this, combined with supply curtailments would tend to increase electricity prices.

23. Electricity generators have supply commitments to customers that must be honoured in some way if supply is to be maintained. If a generator's own capacity is not available at some point, they must purchase power from other suppliers in the spot market.

24. Calculating the opportunity cost of extra gas from electricity generators will generally start from a price higher than the pre-event spot market price. If electricity is currently selling for $100MWh, removing a gas turbine from the supply stack will generally increase the electricity price above $100. In principle, the starting point for estimating the opportunity cost of gas called back from the

[2] Schedule 2 of the Regulations.

electricity sector is the post-exit spot price, which will not be observed unless some supply does indeed exit from the electricity market. For this reason, willingness to pay calculations based on observed electricity prices may under-state the clearing price of gas in a hypothetical efficient spot market, especially during the lead-up to a CC event.

25. It may be worth noting that under some curtailment patterns, estimating the opportunity cost of gas from the electricity market prices may become rather complex. For example, if several turbines are each partially curtailed, their owners will have their output reduced but will earn higher prices on the remaining output. The opportunity cost depends on the net impact of these two effects.

Factual Background

26. The following table is drawn from the incident report and shows the timing of the main events preceding and during the critical contingency.

Time	Event
14.20	Outage at Pohokura
15.19	Low line pack critical notice posted on Maui IX
15.55	SO requested 3000GJ balance gas for ID4
16.08	MPOC curtailment at Ngatimaru Rd
16.43	Second MPOC curtailment at Ngatimaru Rd
17.56	CCO declared "Non-regional Potential Critical Contingency"
19.39	CCO declared "Non-regional Critical Contingency"
20.36	Flow resumed at both Pohokura welded points
22.36	CCO declared "Non-regional Critical Contingency Terminated"

27. The SO requested 3000GJ of balancing gas approximately two hours before the CCO advised of the potential for a critical contingency. Data from the BGX shows that a total of 1800GJ of balancing gas was supplied, in two tranches, priced at $14.95 and $15/GJ.

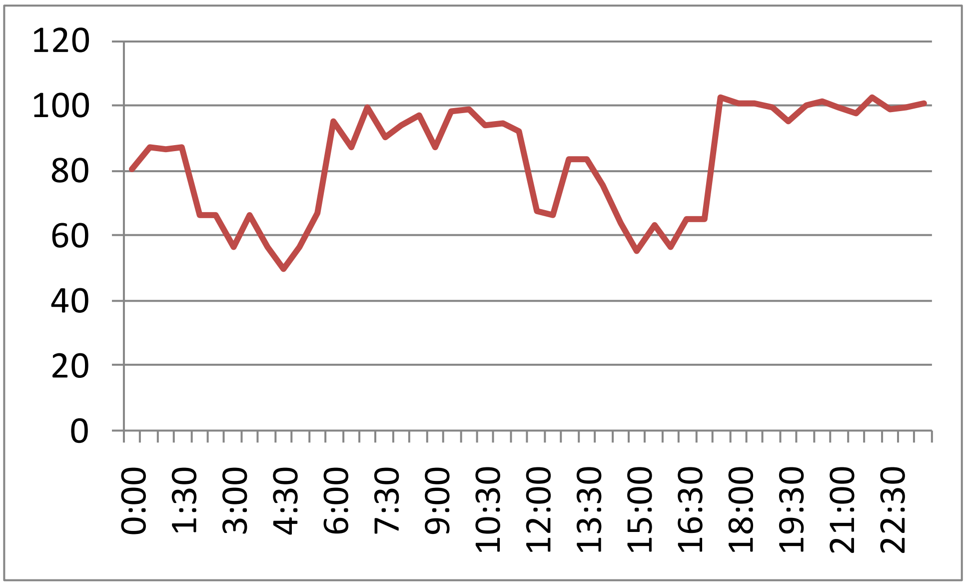
28. MDL buys gas through the BGX in order to maintain line pack. However it is also able to issue curtailment notices under section 15.1 of the MPOC, including during CC events, and welded parties can also initiate curtailments under section 15.2 of the MPOC. Several such curtailments were implemented by MDL before and during the CC event as were a set of operational flow orders.[3] One of the parties whose nominations were curtailed in this way was in band 1b. Curtailments under the MPOC are reductions in rights to gas (scheduled quantities), not instructions to reduce demand as such. A retailer may choose not to reduce its offtakes from the transmission system and, instead, expose itself to cash-outs under MPOC/VTC or contingency imbalances in the event of a CC.

[3] Incident Report, Section 15.2 Curtailments on 13 July 2010, Maui SO.

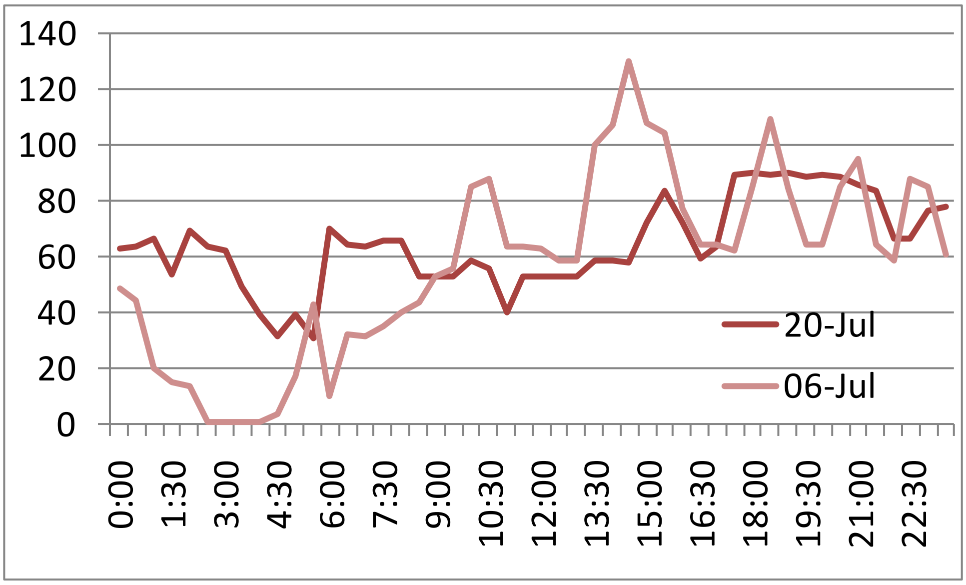
29. The CCO did not issue any curtailment instructions. It is not clear whether this was partly because of curtailments arranged under the MPOC.

30. Several parties who were consulted reported that they had taken no action during the CC because they had received no instructions from the CCO.

31. Electricity spot market prices experienced a significant jump at 17.30 on 13 July, at the key reference nodes of Haywards and Huntly. The time profile of Huntly prices on 13 July is shown below.



32. It is not unusual for spot prices to jump around 5.30pm however; this is likely to be related to an evening peak demand. The following graph shows Huntly prices for the Tuesdays before and after Tuesday 13th July. On both days the price jumped either at 5.30pm or 6pm.



33. The average price at Huntly throughout the duration of the CC event was $99.87. If this was used as the starting point, it is possible to estimate willingness to pay for thermal fuels at particular power stations. The following table illustrates the calculations for units 1-4 at Huntly running coal, and for Huntly 5, also known as e3p, which is a combined-cycle gas turbine.

	Huntly Coal	**Huntly e3p**
Spot Price ($/MWh)	$99.87	$99.87
less Variable O&M ($/MWh)	$9.60	$4.25
	$90.27	$95.62
Heat Rate (GJ/MWh)	10.5	7.08
raw WTP for fuel ($/GJ)	$8.60	$13.51
Emissions factor (t/GJ)	0.0912	0.0528
Emissions cost ($/GJ)	1.14	0.66
post-emissions WTP	$7.46	$12.85

34. These calculations use $12.50 as the price of one tonne of CO_2 emission, because up until 2012 generators only surrender 1 NZU for every 2 tonnes of emissions. The heat rates were sourced from recent work for the Electricity Commission.[4]

Setting the CC Price

35. While this was a fairly short duration CC event and the CCO did not issue curtailment orders, some parties were curtailed via the MPOC. No parties were curtailed by the CCO however. Regulation 71(3)(b) therefore applies, and in particular items: (i) wholesale electricity prices, and (iii) any other matters relevant to assessing the price expected from an efficient spot market for gas.

36. In this case electricity prices during the event were such that the (relatively efficient) e3p gas plant would have been willing to pay up to $12.85/GJ for gas. This is less than the $15/GJ that MDL actually did pay in the balancing market before the CC was called. Moreover, the balancing gas purchase quantity was constrained down by lack of supply.

37. The balancing gas exchange is different to the hypothetical market relevant to this process, in several significant ways. First, it is a one-sided market, by which I mean there is only competition on one side of every trade. This feature may tend to depress the price of call contracts (because the buyer is a monopsonist) and inflate the price of put contracts for which the seller is a monopolist, though it is worth noting that the MPOC itself governs the requirements for balancing and in doing so tends to mitigates market power. Second, but perhaps related to the first point, only quite small quantities of gas are traded in it. Third, under the

[4] Thermal Power Station Advice, Report for the Electricity Commission, PB New Zealand Ltd, July 2009.

terms of MDL's Standard Operating Procedure, balancing gas is not available after a CC has been declared, so the market cannot actually operate during such an event.

38. Nevertheless, in this particular instance, the balancing gas exchange price ($15/GJ) seems a better approximation to the CCP than the price derived from the electricity market calculation. The reasons are that

    a. It was actually paid for gas in an attempt to restore pressure.
    b. The supply of balancing gas was restricted, so additional gas from this source would have been more expensive.
    c. The spot price for electricity is likely to have increased in the event that curtailment orders were issued by the CCO.

39. A further reason to rely on the balancing gas price in this case is that these prices are readily observable by market participants, making it a feasible way of signalling the value of gas during the lead-up to future CC events of a similar magnitude. It must be recognised however that in a future event of greater severity, the price of all transactions from the balancing market on the day in question could significantly under-estimate the appropriate CC price. In other words, there is limited precedent value from the use of the balancing gas price in this instance, because the event itself was relatively minor.

40. The merits of using a balancing gas price would be undermined if doing so gave the system operator (MDL) incentives to manipulate those prices. My understanding is that MDL earns its revenues primarily based on volumes transmitted through the pipeline, so it has a strong interest in maintaining those volumes. MDL does not buy and sell gas except for balancing purposes. Moreover, under Schedule 10 of MPOC any over-recoveries by MDL in a year will be compensated by lower tariffs in subsequent years. In summary, it seems to me that MDL has strong incentives to avoid CC events, but no particular interest in high or low CCPs.

41. For these reasons, I recommend that the CCP for this event be set at $15/GJ.