DRAFT Determination of Critical Contingency Price

in respect of the critical contingency of 23rd May 2017

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Introduction

1. This report sets out my initial estimate of a Critical Contingency Price as required by the Gas Governance (Critical Contingency Management) Regulations 2008 ('the Regulations'). The Critical Contingency Price is required in respect of the critical contingency of 23rd May 2017.

2. A critical contingency is defined under the Regulations. It is triggered when the operating pressure reaches a low threshold that defines the pressure required to "maintain the supply of gas across the relevant part or parts of the transmission system and to avoid disruption of distribution systems connected to the transmission system" (Regulation 25(1)(a)(iv)).

3. This draft report and recommended price is for discussion at a workshop with interested parties.

4. My draft determination is that the critical contingency price for 23rd May 2017 is $10.62/GJ. The explanation is given below.

The Event

5. A Critical Contingency was declared on Tuesday 23rd May when the gas pressure threshold at the Kapuni Gas Treatment Plant (KGTP) (3 hours to 37.5 bar g) was breached.

6. The cause was falling linepack in the Maui pipeline because of:
   a) downstream delivery points taking significantly more gas than was scheduled to be injected into the Maui pipeline, and
   b) a planned outage at the Pohokura Production Station (PPS) between 6.30 and 11am.

7. PPS injected additional gas before the start of the outage, but this was insufficient to avoid the demand-supply imbalance. Breaching of the Critical Contingency threshold at KGTP was noted at 10.33 am, the Critical Contingency was determined by the CCO at 10.50am and a Declaration Notice was issued at 11.14am.

8. Following the outage, PPS had started flows of 0.4TJ/hr by 10.35am, reached a flow rate of 5.4TJ/hr by 12.55pm, 7.6 TJ/hr by 1.55pm, 7.8TJ/hr at 2.55pm and 8.7TJ/hr at 3.55pm. Linepack in the Maui pipeline fell from 267TJ at 7am to a low

of 231TJ at 12.55pm before stabilising and starting to rise. Linepack had risen slightly to 234TJ by 5.55pm and the system was regarded as stable at that point, with no increased demand expected.

9. The Critical Contingency was ended at 6.15pm, a total duration of 7 hours and 25 minutes.

10. Neither curtailment nor increased production was required during the Critical Contingency.

Concepts Relevant to Setting a Critical Contingency Price

11. The purpose of the critical contingency price and guidance on setting price is provided under Sections 67 and 71 of the Regulations (Box 1).[1]

Box 1 Regulatory Sections relating to Critical Contingency Price

67. **Purpose of applying critical contingency price to contingency imbalances**

The purpose of regulations 68 to 71 is to determine a critical contingency price to be applied to the contingency imbalances sustained by interconnected parties and shippers during a critical contingency to—

(a) avoid shippers instructing their suppliers of gas to reduce supply during a critical contingency when those shippers' consumers have been curtailed; and

(b) signal to suppliers and consumers of gas that it is a scarce and valuable product during a critical contingency; and

(c) provide incentives before a critical contingency, particularly for retailers who supply gas to consumers who are unlikely to be curtailed, to make alternative arrangements to minimise the financial consequences of a critical contingency.

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*).*

Source: Gas Governance (Critical Contingency Management) Regulations 2008

[1] Sections 68 to 70 address the appointment of the industry expert

12. Section 71 describes how to set the critical contingency price, but this needs to be interpreted in the light of the overall purpose of the price (Section 67). The price needs to:
    - encourage available supply;
    - signal scarcity; and
    - provide incentives to retailers to make arrangements to minimise the financial consequences of a critical contingency if one was to occur.

13. The implications of this are that the price should be relatively high and certainly higher than market price expectation in the absence of a critical contingency.

14. In the critical contingency of 23rd May 2017 there was no curtailment as defined under the Regulations. This means that the relevant Sub-Sections of Section 71 which must be taken into account are 1, 2 and 3(i) only, i.e. the price must:
    - be in $/GJ;
    - be set to reflect a price that would allocate gas efficiently during the contingency; and
    - be set taking into account prices in the wholesale electricity market and any other matters relevant to allocating gas efficiently during the critical contingency.

Approach Used to Define the Critical Contingency Price

Previous Critical Contingencies

15. There have been three previous analyses of a critical contingency price as summarised in Table 1 and discussed in turn below.

Table 1 Estimates of Critical Contingency Price for previous events

Date	13 July 2010	20 April 2012	24 May 2016
Duration	3 hours	11 hours	4 hours 30 minutes
Curtailment	None	Curtailment of bands 0, 1a and 1b	None
Measurement approach	Price paid in balancing gas market	Netback of gas price that would curtail Southdown but not CCGTs	Netback of gas price for e3P
Critical contingency price	$15/GJ	$11.10/GJ	$6.66/GJ

13th July 2010

16. In 2010 there was a critical contingency lasting approximately 3 hours. There was no curtailment and a price of $15/GJ was set based on prices paid for balancing gas on the day.[2]

[2] John Small (2010) Critical Contingency Price: 13 July 2010 Final Report, 6 September2010

17. The industry expert (Dr John Small) considered electricity generators as possible providers of gas to the wholesale gas market, such that the wholesale electricity price could be used to estimate the opportunity cost of gas supply. However, he suggested that the wholesale electricity price is not necessarily the price that would emerge from an efficient spot market for gas if it was operating during the critical contingency. Dr Small noted that, if gas use by electricity generators was curtailed, electricity prices would increase such that the price based on willingness to pay (WTP) would be an under-estimate of price in a hypothetical spot market.

18. He calculated that the e3p (Huntly unit 5) CCGT generating plant would have a WTP of up to $12.85/GJ for gas. However, a price of $15/GJ was paid for gas in the balancing gas exchange market. He suggested that this was a better approximation to the critical contingency price because it was actually paid for gas in an attempt to restore pressure.

3rd March 2012

19. In 2012 there was a critical contingency lasting close to 11 hours, resulting in curtailment of bands 0, 1a and 1b (gas storage, electricity generators and other large consumers) (see Table 2).

Table 2 Curtailment required during 3rd March 2012 critical contingency

Curtailed partially	**Curtailed completely**
• Huntly Power Station (Units 5 & 6): 1,700GJ/h • Ngatimaru Rd (Methanex): 1,700GJ/h • Otahuhu B Power Station: 1,700GJ/h • Southdown Power Station: 62 GJ/h • Te Rapa Cogeneration Plant: 300GJ/h	• Ahuroa Storage Facility • Huntly Power Station (Rankine Units 1-4) • New Plymouth Power Station • Bertrand Rd (Methanex) • Ballance Ammonia-Urea (Fuel & Process) • Taranaki Combined Cycle (TCC) • Stratford Power Station Peakers

20. The critical contingency price was estimated as a gas price at which the CCGTs would continue to operate but that Southdown would not. Using a netback calculation of the WTP for gas by these plants, the critical contingency price was set at $11.10/GJ.[3]

21. The wholesale price of electricity during the critical contingency reflected a situation in which some gas plants were not generating such that the electricity price reflected the gas scarcity at the time.

24th May 2016

22. In 2016 a critical contingency lasted for 4 hours 30 minutes but did not require curtailment.

[3] Tim Denne (2012) Determination of Critical Contingency Price in respect of the critical contingency of 3rd March 2012

23. Netback prices for gas for the highest cost electricity generation plants operating during the critical contingency (McKee and Stratford peakers) yielded a low willingness to pay for gas. The critical contingency price was estimated as the average willingness to pay for gas at e3P over the critical contingency period ($6.66/GJ). This is consistent with a number of requirements:
    a) that the price signals scarcity (as required under Section 67(b)) – the price is higher than the highest market price of gas that day of $5.85/GJ;
    b) that the process makes use of prices in the wholesale electricity market (71(3)(i));
    c) that the price would allocate gas to the highest value use within the wholesale market (e3P is defined as a high value use), and on the evidence of market prices, allocate it to higher value uses than other gas users that day also (71(2));
    d) Make use of other matters considered relevant to achieving efficient allocation (71(2)), eg the contractual arrangements at the gas peakers which affected their response to price.

May 2017 Critical Contingency

24. The previous examples differ in the circumstances of the critical contingency (curtailment or not) and the approach used to estimating price. However, as with the event of May 2016, we note the following relevant factors:

    a) The price is to be one which would allocate gas to the highest value uses during the critical contingency.
        i. If electricity generators, or a subset of them, are defined as high value users, a price based on their WTP could be defined as a maximum value for the critical contingency price, as above that price, gas would not be used by them.
        ii. However, if they are not defined as high value users, the WTP might be used to define the minimum.

    b) Prices paid in the gas spot market on the day provide some guidance on whether electricity use is a high value use or not. These prices might also provide information on the minimum value, on the basis that they might need to be above these values to encourage additional supply.

    c) To the extent that they are higher, prices paid in the balancing market might provide additional information on the value of gas on the day.

Electricity Market Information

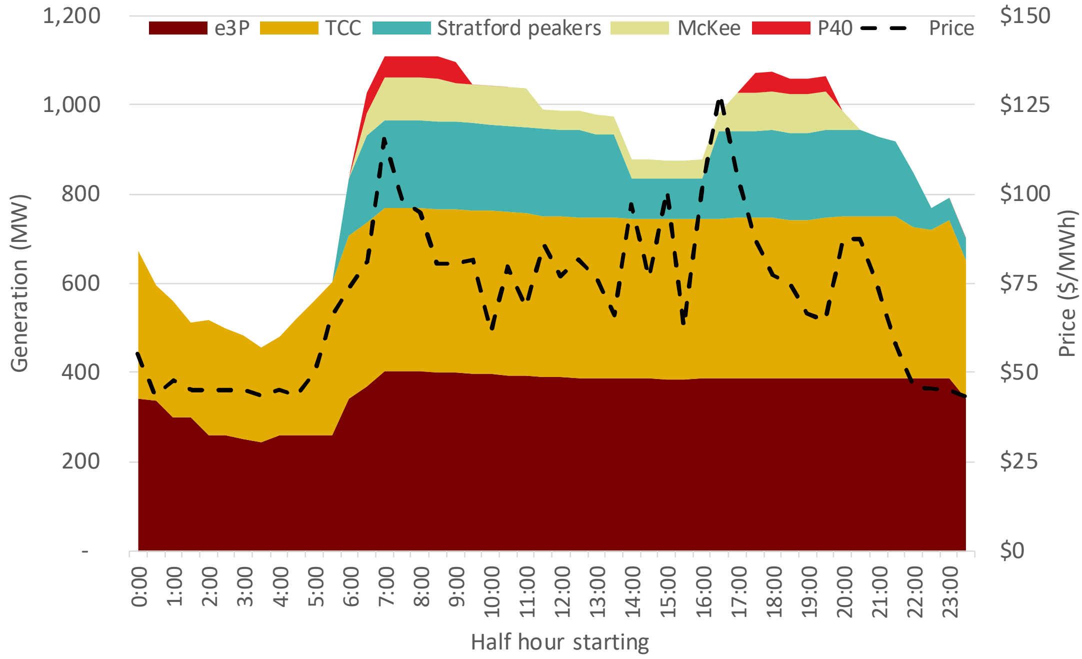
Generation and Market Prices

25. Figure 1 shows the generation from gas-fired plants on 23rd May and the average price across two relevant nodes (HLY2201 and SFD2201).[4] Figure 2 shows the same data for an average across the 14 weekdays of the period from the start of

[4] No prices were reported for MKE1101 for much of May 2017

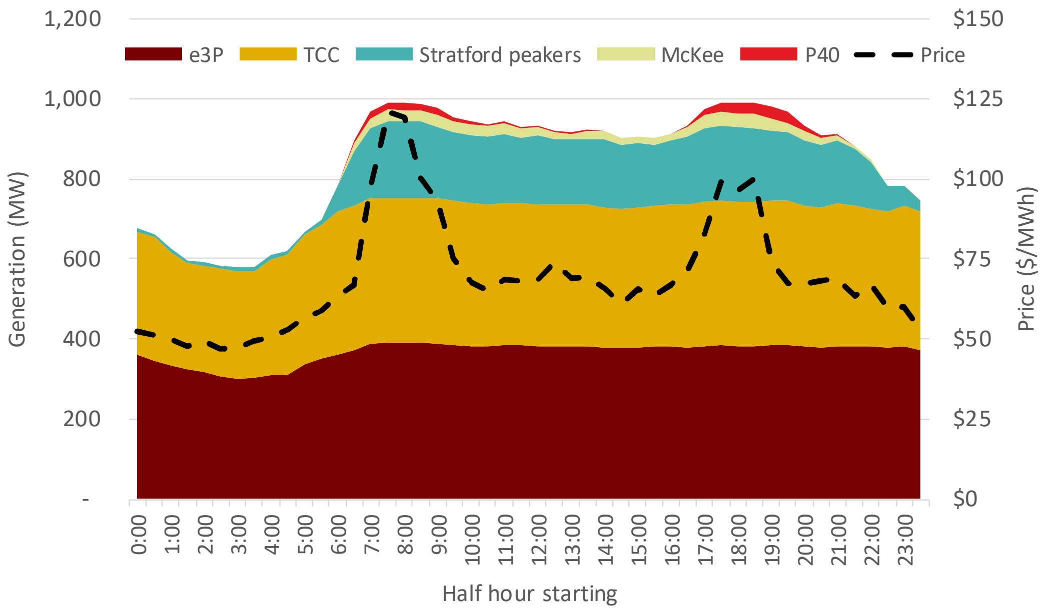
the week before to the end of the week after the critical contingency (excluding the 23rd May).

Figure 1 Gas-fired electricity generation and electricity price 23rd May 2017



Source: data from Electricity Authority[5]

Figure 2 Gas-fired electricity generation and electricity price 15 May -2 June 2017 (excl 23rd)



Source: data from Electricity Authority

26. During the critical contingency (11:00 to 18:30) electricity was generated by e3P, Taranaki Combined Cycle (TCC) and the McKee and Stratford peakers; Huntly P40 only generated from 17:30. Generation levels were greater in total on the 23rd

[5] Load_Generation_Price series from:
www.emi.ea.govt.nz/Datasets/Wholesale/Final_pricing/Load_Generation_Price/2017

than on the average weekday for the rest of the month and prices were higher. Total electricity generation in New Zealand on the 23rd May was the 2nd highest day of the month, with the highest generation the previous day (the 22nd). On both days, generation was 6% higher than for the average weekday in May.

27. The Stratford peakers reduced generation between approximately 14:00 and 16:00 on the 23rd, but this does not appear to be a response to electricity price.

Estimates of Willingness to Pay for Gas

28. Plant-specific information on heat rates and costs is provided in Table 3 for the three main plants.

Table 3 Gas plant information and assumptions

	Huntly unit 5 (E3P)	TCC	McKee Peaker	Stratford Peaker
Heat rate (GJ/GWh)	7,300	7,700	10,500	10,600
Variable cost ($/MWh)	$4.40	$4.41	$8.20	$6.50
Gas transmission cost ($/GJ)	$0.50	$0.14	$0.00	$0.14
CO2 Emissions Factor (kg/GJ)	53.89	53.89	53.89	53.89
CO2 price ($/tonne)	$17.00	$17.00	$17.00	$17.00
CO2 cost $/GJ (@ 67%)1	$0.61	$0.61	$0.61	$0.61
Total variable cost ($/MWh) absent gas price	$12.63	$10.21	$14.65	$14.49

[1] From 1 January 2017 the requirement to surrender emission units is 67% of a unit per tonne of CO_2.
Source: MBIE Electricity Demand and Generation Scenarios: Generation Cost Assumptions; Personal communications from Contact and Todd Energy; MBIE Energy Greenhouse Gas Emissions; OMF Carbon Daily Report 23 May 2017

29. We use the data in Table 3 to estimate a WTP for gas given the wholesale electricity price at the nearest pricing node for each plant. The results over the critical contingency period are shown in Table 4. The estimated WTP for gas is estimated using the following equation.

$$WTP = \frac{(WP - VC)}{HR} - GTC - CC$$

Where: WTP = willingness to pay for gas (in $/GJ)
WP = wholesale price of electricity ($/MWh)
VC = variable cost of generation ($/MWh)
HR = heat rate in (GJ/MWh)[6]
GTC = gas transmission cost ($/GJ)
CC = carbon cost ($/GJ)

30. The lowest values are the WTP values for McKee and Stratford. If they were responding efficiently to market prices, the peakers would be the first to reduce

[6] Note the heat rates in Table 3 in GJ/GWh

output when electricity prices fell or if gas prices rose. However, both plants have access to alternative sources of gas which they can use if they are curtailed on the transmission system; the alternatives also limit their exposure to spot prices. For these reasons, we do not consider the WTP by the peakers as useful in setting the critical contingency price.

31. The WTP at the combined cycle gas turbines (CCGTs), ie e3P and TCC, provides a possible estimate of the value of use by a high value use of gas (71(2)). This was the assumption used in defining the critical contingency price, both in April 2012 (when there was curtailment) and in May 2016 (when there was no curtailment, but e3P was regarded as a high value use).

Table 4 Wholesale electricity price per node and resulting willingness to pay for gas

	Pricing node			Plant			
Period starting	**HLY2201**	**SFD2201**	**MKE1101**	**e3P**	**TCC**	**Stratford Peaker**	**McKee Peaker**
		$/MWh			**$/GJ**		
11:00	$71.72	$64.57	$57.02	$8.09	$7.06	$4.72	$4.04
11:30	$90.01	$81.38	$76.21	$10.60	$9.24	$6.31	$5.86
12:00	$80.68	$72.92	$68.29	$9.32	$8.14	$5.51	$5.11
12:30	$85.40	$77.20	$72.30	$9.97	$8.70	$5.92	$5.49
13:00	$79.97	$72.81	$68.18	$9.22	$8.13	$5.50	$5.10
13:30	$68.97	$63.37	$59.34	$7.72	$6.90	$4.61	$4.26
14:00	$100.78	$92.98	$87.07	$12.08	$10.75	$7.40	$6.90
14:30	$79.56	$73.41	$68.75	$9.17	$8.21	$5.56	$5.15
15:00	$105.01	$96.90	$90.74	$12.65	$11.26	$7.77	$7.25
15:30	$65.01	$59.60	$55.82	$7.18	$6.41	$4.26	$3.92
16:00	$105.01	$96.43	$90.30	$12.65	$11.20	$7.73	$7.21
16:30	$134.50	$121.63	$113.90	$16.69	$14.47	$10.11	$9.45
17:00	$111.40	$97.11	$85.75	$13.53	$11.29	$7.79	$6.77
17:30	$92.94	$82.42	$72.73	$11.00	$9.38	$6.41	$5.53
18:00	$81.46	$72.96	$62.61	$9.43	$8.15	$5.52	$4.57
Average				$10.62	$9.29	$6.34	$5.77

Source: prices from Electricity Authority datasets Wholesale

32. We assume that the CCGTs would not ramp down and up over a short period. This means the minimum WTP during the critical contingency is not relevant to defining a price at which they would be assumed to generate. Rather, we use the average WTP over the entire critical contingency period, which is the same assumption as adopted in 2016. The average WTP was $10.62/GJ for e3P and $9.29 for TCC.

Market Prices of Gas

33. Data from EMS suggests that prices in the physical market on 23rd May 2017 averaged $5.60/GJ.[7] This average price was used, with a 10% upwards

[7] http://www.emstradepoint.co.nz/market-results/

adjustment,[8] to produce a marginal buy price (mbp) for balancing gas of $6.16/GJ.

34. These prices which appear to be representative of normal market conditions, rather than being elevated prices relevant to a critical contingency. They would represent a floor for the critical contingency price.

35. The market-defined prices of gas are lower than the estimated WTP for gas by the CCGTs over the period, reinforcing the assumption that it was a high value use of gas.

Critical Contingency Price

36. In determining a critical contingency price, I am steered by Section 71 of the Regulations (Sub-Sections 2 and 3(i)) that I must take account of prices in the wholesale electricity market in deciding a price that would allocate gas efficiently during the contingency.

37. The estimated WTP for gas by the CCGTs is higher than market prices on 23rd May 2017 and is equivalent to the value of gas in its highest value use within the wholesale electricity market. The choice of whether to use the WTP for TCC or e3P comes down to other considerations, particularly the need to signal scarcity. A WTP for e3P provides the highest price that can be calculated from price observations in the wholesale electricity market.

38. A critical contingency price based on the WTP of e3P ($10.62/GJ) would:
   - Signal scarcity (67(b));
   - Make use of prices in the wholesale electricity market (71(3)(i));
   - Allocate gas to the highest value use within the wholesale market, and on the evidence of market prices, allocate it to higher value uses than other gas users that day also (71(2)); and
   - Make use of other matters considered relevant to achieving efficient allocation (71(2)), such as the factors affecting the price response of the peaking plants.

39. The critical contingency price plays a role in signalling, to the market, the value of supplying gas during a critical contingency. A price of $10.62/GJ is significantly above average market prices.

40. My draft determination is that the critical contingency price for the 23rd May 2017 should be $10.62/GJ.

[8] The uplift factor changed from 3% to 10% on 23rd May 2017.