Firstgas

REPORT

Cost Benefit Analysis:

Proposed Changes to Pressure Ranges in Schedule 1 of the Gas Governance (Critical Contingency) Regulations 2008

First Gas Limited
21 June 2023

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1. Introduction

1.1. Purpose of this document

The purpose of this document is to:

(a) Provide information on First Gas Limited's (**Firstgas**) proposal to amend the Critical Contingency (**CC**) pressure threshold ranges set out in Schedule 1 of the Gas Governance (Critical Contingency Management) Regulations 2008 (the **CCM Regulations**);

(b) Identify and, where possible, quantify the costs and benefits associated with the proposed changes to Schedule 1 of the CCM Regulations;

(c) Discuss some of the perceived risks and opportunities associated with the proposed changes.

1.2. Background

In 2019, Firstgas reviewed the critical contingency thresholds limits and locations on the transmission system. The results of this review led us to recommending to Gas Industry Company (**GIC**) that Schedule 1 of the CCM Regulations be updated. Those recommended changes were endorsed by GIC and incorporated into the draft Statement of Proposal (**SoP**) to amend the CCM Regulations released in May 2020 for industry consultation.[1] Submissions on the draft SoP were received in July 2020 and we understand that GIC is in the process of developing a final SoP for industry consultation prior to making make a recommendation to the Minister to amend the CCM Regulations.

Since our earlier review, we have seen significant changes in policy settings, shifts in the gas supply and demand balance, and revised thinking on how Firstgas can best optimise the operation of the transmission system. We now consider that the parameters we recommended ~4-years ago are no longer suitable.

At the end of 2021, Firstgas requested that the GIC use the ongoing SoP process to make further changes to Schedule 1 of the CCM Regulations to enable wider pressure ranges and consequently greater flexibility for setting the appropriate critical contingency pressure thresholds.

Firstgas held an online webinar for stakeholders in November 2022 that explored the following key reasons why Firstgas considered change to the pressure threshold ranges in Schedule 1 of the CCM Regulations was necessary.[2] Namely, to:

- optimise the operation of the transmission system and improve reliability for gas users;
- safeguard the ability to reduce the pressure in sections of transmission pipeline if required for safety reasons;
- enable future energy initiatives; and
- reduce the likelihood of unnecessary critical contingency declarations and curtailment.

In March 2023 the GIC requested that Firstgas compile an assessment of costs and benefits associated with the proposed changes to Schedule 1 of the CCM Regulations with a particular focus on any potential impacts to customers. This will aid the GIC with the wider cost benefit analysis it is required to undertake pursuant to the Gas Act when making a recommendation to the Minister to amend the CCM Regulations.

[1] Available at https://www.gasindustry.co.nz/our-work/work-programmes/critical-contingency-management/#statement-of-proposal-for-amending-ccm-regulations

[2] The presentation is available on the Firstgas website: https://firstgas.co.nz/about-us/regulatory/

2. Proposed Changes to CC Threshold Ranges

2.1. What changes to the CC Pressure Threshold Ranges are Firstgas proposing?

Critical Contingency thresholds must be set by Firstgas within the ranges (lower and upper limits) set out in Schedule 1 of the CCM Regulations.

Schedule 1 of the CCM Regulations specifies two key ranges:

- **Minimum Operating Pressure (P_{min})** – the range of pressures within which Firstgas sets a minimum operating pressure, having regard to the operational characteristics of that part of the transmission system; and
- **Time to P_{min}** – a range of appropriate amounts of time to allow the CCO to take actions to prevent transmission pressures from falling to Pmin.

The following table sets out the proposed amendments to the CC Pressure Threshold Ranges that Firstgas is seeking be made to Schedule 1 of the CCM Regulations. Firstgas is only proposing changes to the P_{min} ranges and not the Time to P_{min} ranges.

Pipeline Name	Where Measured?	P_{min} (barg) Range (Current)	P_{min} (barg) Range (Proposed)
Maui	Rotowaro	32.0 +/- 2.5	30.0 +/- 5
Firstgas & Maui Pipeline	Any other gas gate*	30.0 +/- 2.5	25.0 +/- 5
South	Waitangirua	35.0 +/- 2.5	27.5 +/- 7.5
Hawkes Bay Lateral	Hastings	30.0 +/- 2.5	25.0 +/- 5
Frankley Road to KGTP	KGTP	35.0 +/- 2.5	35.0 +/- 2.5
Bay Of Plenty	Gisborne	30.0 +/- 2.5	25.0 +/- 5
Bay Of Plenty	Taupo	30.0 +/- 2.5	Removed
Bay Of Plenty	Tauranga	30.0 +/- 2.5	25.0 +/- 5
Bay Of Plenty	Whakatane	30.0 +/- 2.5	25.0 +/- 5
Morrinsville Lateral	Cambridge	30.0 +/- 2.5	25.0 +/- 5
Central (North)	Westfield	40.0 +/- 2.5	27.5 +/- 7.5
North	Whangarei	25.0 +/- 2.5	25 +/- 5

* Excluding gas gates supplied by pipelines operated at pressures <20barg

2.2. What specific changes to ranges or locations require further explanation?

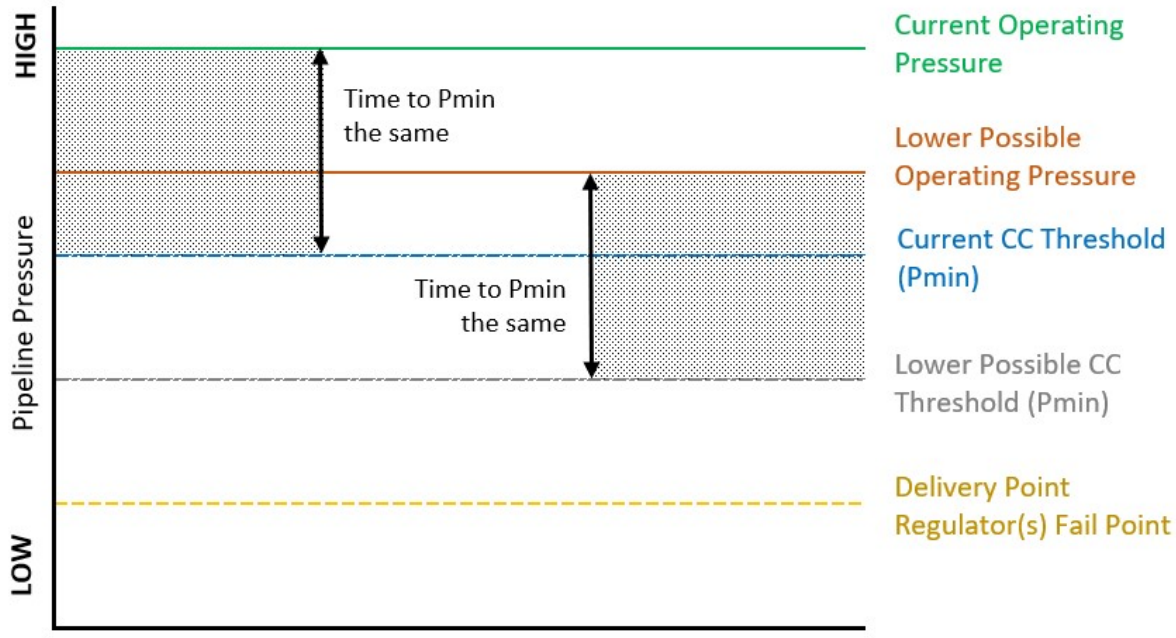
The specific changes to Schedule 1 that Firstgas is proposing can be summarised as follows:

1. **Widen and align the CC pressure ranges at extremities of the transmission system**: this will enable more efficient and reliable operation of the transmission system as well as future-proof for uncertainties and opportunities discussed in this paper. These ranges in the table above have been developed with reference to the failure pressure of the existing equipment and system demand characteristics. Widening the ranges will allow pressure thresholds to be reduced or increased as the circumstances require without further legislative changes.
2. **Remove Taupō as a specific point of measurement**: Taupō is not considered a critical failure point on the transmission system and as such does not warrant being a specific nominated monitoring point. Modelling shows that even with a Pokuru Compressor failure at peak-week loads, pipeline pressure at the Taupō Delivery Point would still not fall to a point where the interconnected distribution system would fail. Sufficient protection is provided by the monitoring of other specific

Delivery Points that are actually located at the extremities of the transmission system in the Bay of Plenty region e.g. Gisborne and Whakatane.

3. **Exclude any Delivery Point supplied by a pipeline not operating at transmission system pressure (below 20 barg)**: there are two known anomalies at the extremity of the transmission system where operating pressures are lower (<20 bar g) than the 'any other gas gate' limit set out in Schedule 1 of the CCM Regulations that Firstgas believes should be excluded. This allows for specific sections of the network to be reduced below this threshold in the future where it is practical and safe to do so, including for reasons of system safety and reliability and to enable future energy initiatives. An example of the latter is the project at Reporoa to upgrade biogas to biomethane for injection into the transmission system, which will require the lateral pipeline to Taupo to be operated at a lower pressure.
4. **Lower range at Westfield:** the primary driver for this is the closure of the Otahuhu B and Southdown gas-fired power stations and reduced load from Marsden Point, which means the higher-pressure range is no longer required at Westfield.
5. **Rotowaro:** expand the potential set point range at this location to cater for future possible system changes.
6. **Waitangirua:** The current minimum operating pressure range at this location is out of line with other points, possibly due to a perceived increase in system resilience. In actuality, the higher threshold decreases the system resilience to potential curtailments, as it could lead to a critical contingency event being declared sooner than may be required.
7. **Any other gas gate:** The proposed pressure range for all other gas gates encompasses the status quo, and also allows for specific delivery points to be lowered over time where it is safe and practical to do so.

Several of the points above refer to the possibility of lowering critical contingency thresholds (i.e. the particular P_{min} set-point within a revised range). A new lower threshold range could allow a lowering of pipeline operating pressure for the reasons set out above and elaborated on in this paper. Any changes to actual critical contingency thresholds are subject to the independent review and approval process set out in the CCM Regulations. The following diagram is intended to provide a simple representation of the possible decrease to some critical contingency thresholds and operating pressures that we believe are currently set unnecessarily high.



As stated above, Firstgas is not proposing to change the time to P_{min} for any of the thresholds. The time to P_{min} represents the amount of time that the CCO has to direct demand curtailment and for curtailed customers to implement those directions. As the chart above shows, the amount of time to respond is the same, and both of the thresholds illustrated are a margin of safety away from the actual failure point of the regulators. It should be remembered that it is the threshold value that the CCO considers in declaring and

terminating a critical contingency and in directing curtailment. The regulator failure point is included in the figure above as an illustration of the margin of safety between the threshold pressure and the regulator failure pressure.

Implementing the proposed changes will allow Firstgas greater flexibility in determining appropriate thresholds in its Critical Contingency Management Plan (**CCMP**) under section 25(1) of the CCM Regulations and address both the current constraints and opportunities canvassed in the following sections of this paper.

Firstgas would like to stress that changes to the CCM Regulations would not mean automatic changes to how Firstgas operates the transmission system. Any changes to thresholds would be consulted on with stakeholders and subject to GIC approval as per the requirements for amending the Critical Contingency Management Plan.

3. Why is Firstgas proposing to amend the CC Pressure Threshold Ranges?

There are five key reasons why we consider changes to the CC pressure threshold ranges are required. Namely, to:

1. reflect the changes since 2008 in Transmission System demand and operation;
2. optimise the operation of the Transmission System and increase reliability for gas users;
3. have the ability to reduce the pressure as low as practically possible in the event of an emergency without creating spurious CC events;
4. enable future energy initiatives;
5. reduce the likelihood of unnecessary critical contingency declarations and curtailment.

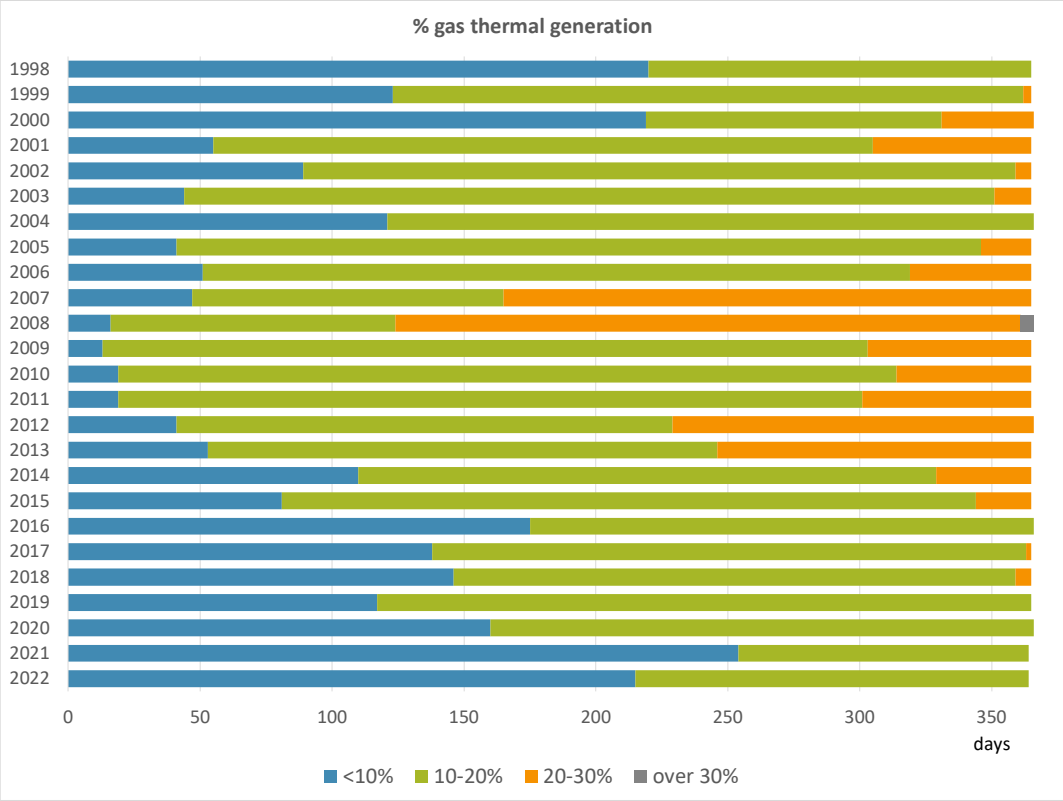
The following sections provide further details on each of these important reasons for changing Schedule 1 of the CCM Regulations.

3.1. Transmission system changes

The CCM Regulations came into force 15-years ago in 2008. At the time, Methanex was restarting its Motunui Methanol Plant, there was significant base-load thermal generation in operation, new gas-fired Peakers were under development and the industry was on the verge of a capacity constraint on Vector's Northern Pipeline. It is important to remember that the pressure threshold ranges contained in Schedule 1 of the CCM Regulations were developed during this demand and operational context.

The *Statement of Proposal for amending the Critical Contingency Management Regulations* published by GIC in 2020 evaluated the change in gas thermal electricity generation from 2008 to 2020. In 2008, gas thermal generation provided 21% of New Zealand's electricity demand. Of the installed thermal generation capacity, nearly all was baseload generation.

The chart below shows the percentage of electricity generation provided by gas thermal plant on a daily basis from 1998 to 2022. As it turns out, 2008 was the peak year for thermal generation. In that year, gas thermal generation provided 20-30% of electricity for 237 days – about two thirds of the time. On five days that year, thermal provided more than 30% of electricity demand.



Since then, the amount of thermal generation has declined markedly – in terms of both MWh generated and in generating capacity. The GIC's SoP noted that over 1,400 MW of baseload thermal generation capacity had been withdrawn in the 13-years from 2008 to 2020, and about 400 MW of thermal peaking generation installed. The chart above shows that no days have seen thermal generation provide more than 20% of electricity demand for the past four years. In both 2021 and 2022, gas thermal generation supplied less than 10% of daily generation over half of the time.

Another major change in transmission volumes occurred when Refining NZ ceased operations at its Marsden Point Oil Refinery in 2022, which was Northland's largest single consumer of gas.

Further changes in generation patterns are expected:

- Contact Energy is closing its 44 MW Te Rapa power station effective June 2023. Contact has also signalled the closure of its 377 MW Taranaki Combined Cycle (**TCC**) power station, likely in 2024 once its operating hours end and the new Tauhara geothermal power station plant is operating.
- Genesis advised in its 27 February 2023 market update and confirmed in its FY2023 results released in May that it had "*successfully completed a biomass burn trial at Huntly Power Station on 14 February, a significant step in its search for alternative fuel options for the Company's thermal plant at Huntly*."
- Transpower's Whakamana i Te Mauri Hiko's (**Energy Futures**) strategy document includes modelling that estimates by 2035, approximately 400 MW of baseload gas-fired electricity generation will have been phased out of the market and replaced by four flexible 100 MW gas-fired peaking power stations. Transpower goes on to say that thermal plants operating in the market will be firming an almost entirely renewable and increasingly intermittent generation base and are likely to be on standby and not generating for long periods of time.

It is against this backdrop of reduced demand and an evolving landscape that Firstgas believes the critical contingency threshold ranges and P_{min} set-points need to be revisited. Such changes will better reflect current operating conditions and enable Firstgas and the industry to adapt to future circumstances more readily.

Firstgas has evaluated the critical contingency thresholds with reference to the failure pressure of the regulators immediately upstream of customers based on their peak loads. Historically there appears to be limited reasoning as to the nominated critical contingency threshold level and the proposed tolerances.

3.2. System optimisation and reliability

Simply put, operating the transmission system at higher pressures than necessary results in higher than needed fuel gas use and needless strain on the transmission compression fleet. Both factors mean higher operating costs for the transmission system, costs that our transmission customers ultimately bear. From an environmental viewpoint, the higher fuel gas usage leads to higher – and preventable – carbon emissions.

In some cases, the transmission system compressors are configured to maintain pressures at the contingency thresholds, rather than operate at a lower point to serve operational requirements. An example of the inefficiency that can result is the Cambridge Delivery Point. The critical contingency threshold at Cambridge Delivery Point is 30 barg. This requires Cambridge's gas supply to travel north to Rotowaro Compressor station and then reverse direction south for a round trip of 45km. Should the Rotowaro Compressors fail, the pressure at Cambridge would fall below the level that they would otherwise see if the less circuitous configuration were open. The compressors at Rotowaro are sometimes operated solely to meet this threshold at Cambridge, which could be set ~6 barg lower with no impact to the objective of the CCM Regulations. Similar examples exist throughout the transmission system.

While such situations have possibly been acceptable in the past, a product of this inefficiency is increased expense to consumers and increased emissions. The emissions are significant, estimated at more than 5,000 tCO2 per year (100 TJ fuel gas consumption).

3.3. Capital and operational investment decisions

Firstgas' transmission compression fleet has a high average unit age with several machines close to replacement. The configuration of the system was designed based on historical demands and expectations for future growth. In turn, the critical contingency thresholds were designed to maintain and support that configuration. To optimise the capital expenditure of the compression replacement decisions, Firstgas needs the flexibility to change how the system is operated and invest based on future scenarios.

For example, one of the compressors at the Kapuni Compressor Station is approximately 40-years old. The operational expense for maintaining this compressor is very high, and the compressor itself is less efficient than newer models. We have investigated alternatives for providing the necessary compression. One option is to increase compression capability at Kaitoke, which would reduce the requirement for compression at Kapuni and optimise compression on the Southern section of the transmission system. However, this Kaitoke solution would require the pipeline between Kapuni and Kaitoke to be operated at a lower pressure than it is now. As all the current equipment can operate at lower pressures than the existing threshold, the lower pipeline pressure at Kapuni would not at all decrease the security of supply to consumers - but it would increase the risk of breaching the currently prescribed minimum critical contingency thresholds at several Delivery Points.

Firstgas estimates that the power output saved by optimising the transmission compressors is 730 kilowatts, as shown in the table below. This savings translates into $1.1 - $1.3 million per year.

Potential Savings from Optimising Compressor Power Output				
Location	**Pressure Drop (Barg)**	**Base kw**	**Optimised**	**kW Saved**
Southern	11	446	307	139
BOP	4	337	294	43
North	11.5	795	246.6	548.4
TOTAL				**730.4**

Firstgas would realise additional savings in terms of capital expenditure. Replacing end-of-life compressors with modern, right-sized units would save approximately $9.1m over the purchase of the larger compressors that would be needed to maintain higher than required transmission pressures.

3.4. Reduction of pressure for safety considerations

A simple and extremely effective way to manage the risks associated with potential external interference or detection of defects is to reduce the operating pressure in a section of transmission pipeline when a defect is discovered. At lower allowable operating pressures there is a greater margin to sustain the effects of damage, defects, and external loads and consequently to increase safety without impacting on security of supply. Lowering the CC thresholds preserves and enables this important aspect of pipeline safety management.

3.5. Enabling future energy initiatives

Firstgas' transmission and distribution networks cover much of the North Island and are ideally placed to support the development, transfer, and use of zero carbon gases such as hydrogen or biomethane. In 2021 we released our Hydrogen Feasibility Study, which shows that we can introduce hydrogen into the Firstgas pipeline network from 2030 and convert to 100% hydrogen by 2050.

We have also released a joint biogas study with Beca, Fonterra and EECA that revealed that biomethane is a viable, untapped solution to decarbonising New Zealand's natural gas network right now, with the potential to replace nearly 20% of New Zealand's total gas usage by 2050.

Firstgas is in the process of building a new facility at Ecogas' Organics Processing Facility in Reporoa to upgrade biogas to biomethane for injection into the Transmission System. This partnership between Ecogas and Firstgas is the first large-scale renewable gas to pipeline project in New Zealand. Initial estimates from this one facility suggest that it will produce renewable gas equivalent to supplying up to 7,200 homes, avoiding about 11,000 tonnes of CO2 emissions per year.[3]

In the future, Firstgas is optimistic about the development of multiple renewable gas to pipeline facilities. We estimate that renewable gas projects could produce enough gas to supply all residential users and three quarters of commercial gas users with low carbon gas, equivalent to taking 415,000 petrol cars off our roads.

To enable the introduction of low emission gases such as hydrogen blends or biomethane into the transmission system, a reduction in operating pressures may be required. It should be noted that often these pressure reductions are only required on short laterals where only one or two delivery points are

[3] Calculation based on 22GJ p.a. average for a residential consumer. Estimated max production is 160TJ = 7,200 houses

impacted. Further, the efficiency of hydrogen and biogas production – and the economics of these projects – can be influenced by transmission pipeline pressure. This mainly relates to the need for additional compression, which comes at a significant capital cost for such renewable gas projects (potentially in excess of $1m), as well as the fuel operating costs. In terms of hydrogen, lower operating pressures can help to manage the risk of hydrogen embrittlement of high strength steels.

As a member of the Climate Leader's Coalition, Firstgas is committed to leading the decarbonisation of New Zealand's gas networks with low emissions technology and to provide our customers with zero carbon gas. One step to achieving this will be to ensure the existing CC pressure threshold ranges don't become an artificial barrier to parties progressing these important future fuels initiatives and achieving the goals set out in this section.

3.6. Preventing unnecessary critical contingency declarations and curtailment

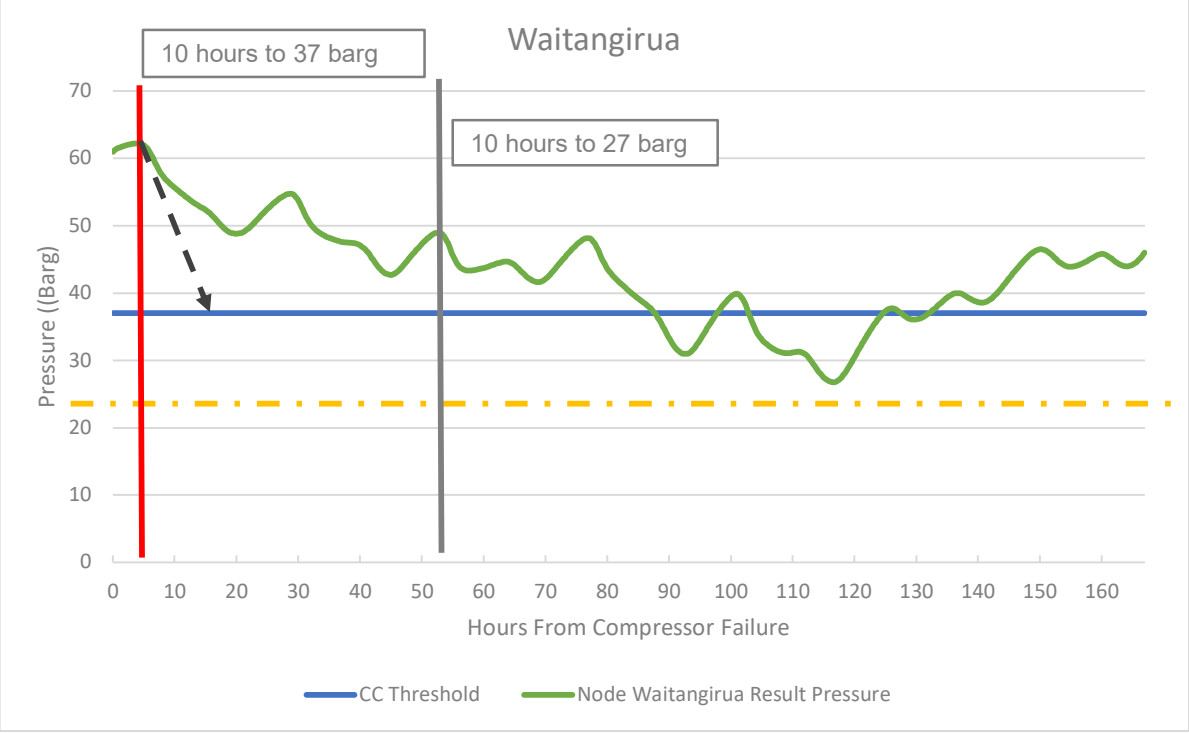
Firstgas' investigations have confirmed that the current lower end limits of the CC threshold ranges are significantly higher than the actual failure pressures at Delivery Points on much of the Transmission System. Setting CC thresholds too high could result in CC declarations and consumer curtailment occurring earlier than required or even unnecessarily.

As an example, the following graph shows the decline of pressure at Waitangirua (Delivery Point into Wellington) using peak week flows in the event of a complete compression failure at Firstgas' Kaitoke Compressor Station.

The blue horizontal line is the current CC pressure threshold and the yellow line marks a conservative assumption of regulator failure pressure. The red vertical line is the point a CC declaration would be made based on current CC threshold settings. At this point, the forecast pressure is 10 hours to 37 barg, which is the current threshold. But as the chart shows, even with no load curtailment, the pressure in the affected pipeline stays well above the regulator failure pressure for several days.

The grey line shows a potential revised threshold of 10 hours to 27 barg. This is still a conservative threshold: it provides for ample time for load curtailment and is triggered well in advance of regulator failure pressure.

However, declaration and curtailment under the revised threshold would be triggered 48 hours later than under the current threshold. That 48 hours could provide time for the event that triggered the pressure reduction to be resolved, potentially avoiding a critical contingency declaration altogether – with no decrement to system security.



Similar examples exist throughout the transmission system. With the current CC pressure ranges, there is a risk of unnecessary or premature curtailment.

Firstgas' proposals represent more moderate, assessment-based CC pressure ranges. They appropriately balance the risk of unnecessary declarations and curtailments with the critical need to protect system security.

As recorded in section 3.5 of Appendix 1 to this paper, three out of the five critical contingencies on the transmission system since the start of the CCM Regulations have **not** required any curtailment action by the CCO. The October 2011 Maui Pipeline outage was a loss of containment due to a landslide and required a regional CC declaration and curtailment irrespective of what the CC pressure thresholds were. The three "no curtailment" CC events may be another indicator that the CC pressure threshold ranges are narrower and the set points higher than is actually required.

4. Costs, Benefits & Risks

Section 3 of this paper has canvassed a number of the costs and benefits that Firstgas considers will be realised by amending the pressure ranges in Schedule 1 of the CCM Regulations to enable lower CC threshold set-points. The purpose of section 4 of this paper is to:

(a) Explore any potential risks associated with our proposed amendments to Schedule 1 of the CCM Regulations; and

(b) Summarise, and where relevant, provide further specific information and analysis on potential costs and benefits associated with the changes we are proposing as compared against the current CC pressure threshold framework.

4.1. Risks

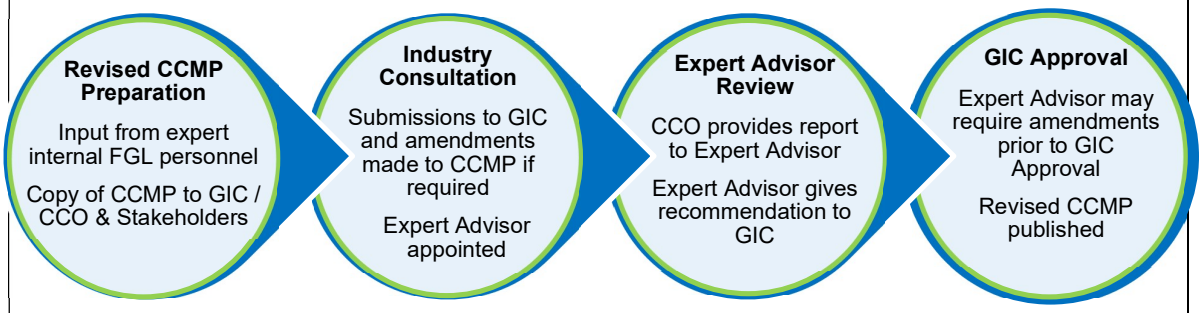
Below we respond to questions received from customers and stakeholders on the potential impacts of the proposed changes to CC threshold ranges and potentially lowering the operating pressures of some transmission pipelines.

No.	Question	
	If Firstgas set lower CC pressure thresholds and lowered the operating pressures of some transmission pipelines, would it mean:	
	(a)	*There is less time for Firstgas and consumers to respond to critical contingency circumstances and take corrective actions?*
		No, as the time to Pmin threshold is not proposed to be changed. If Firstgas were to continue to operate the system at current pressures, reducing the critical contingency pressure thresholds would actually increase the amount of time available to respond to CC circumstances as the pressure difference between the failure point and operational point would be greater.
	(b)	*There is a reduced ability to flow gas to the extremities of the transmission system?*
		No, there is no change in the ability to flow gas to any parts of the transmission system associated with these changes as they apply consistently to all points on the system.
	(c)	*There is less gas to act as an emergency "buffer" before a critical contingency is triggered?*
		No, the CCM Regulations do not require a buffer to be included above the existing threshold. Once the threshold is breached, then a CC must be declared to stabilize the system pressure. Therefore, curtailment would typically happen sooner under the current regulations than the proposed regulations. Should the existing pressures be maintained and the thresholds moved, technically there would be more "buffer" before a CC is declared. The only situation that is negatively impacted by these proposed changes would be a complete failure of the pipeline, where supply is certain to be lost over time and no alternate supply is available. In this instance there is a small decrease in line pack between no line pressure and the CC threshold, which would result in a small decrease in the time between an event and ultimate system failure.
	(d)	*Distribution systems are at increased risk of failure and being unable to provide services to customers?*
		No, the CCM Regulations are exactly as they are today, only the threshold pressure would move. There is no increased risk of failure or inability to provide services to customers connected to distribution systems.

	(e)	*Consumers need to be redefined within the existing CC curtailment bands?*
		No. Consumers will not need to be redefined within the CC curtailment bands set out in Schedule 3 of the CCM Regulations
	(f)	*CC events will be more frequent?*
		It is First Gas's opinion that these changes will make the likelihood of a CC event less likely, as the useable operational window of the pipeline would be greater than it is today.
2	**What checks and balances are there to ensure that the CC Thresholds that Firstgas selects within the Schedule 1 ranges are appropriate?**	

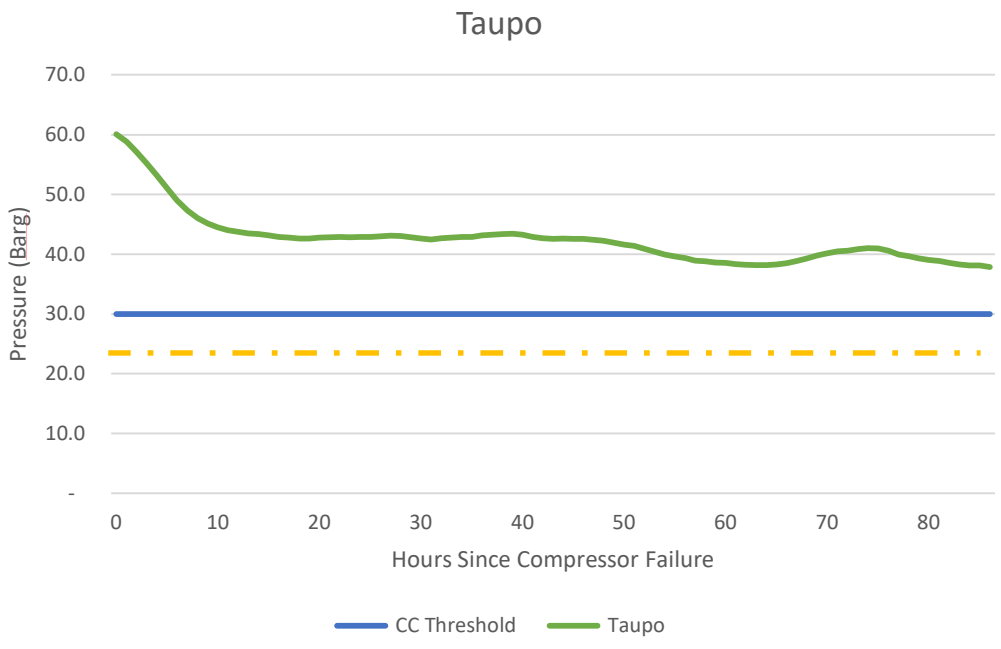
As noted previously, Firstgas sets a specific CC pressure threshold within the prescribed Schedule 1 CCM Regulations ranges at various locations on the Transmission System and records them in the CCMP.

The steps required by the CCM Regulations in updating the CCMP ensure that any CC threshold change is subject to robust independent scrutiny before being implemented as is shown by the following diagram.



All material changes to a CCMP require industry consultation and review and approval by a GIC-appointed Expert Advisor. The CCO also reviews the proposed changes to a CCMP and provides a report to the Expert Advisor.

3.	**Why is Firstgas removing the Taupo location from Schedule 1 of the CCM Regulations?**



Taupō is no longer considered a critical failure point on the transmission system. Modelling shows that even with a Pokuru Compressor failure at peak-week loads, pipeline pressure at the Taupō Delivery Point would still not fall to a point where the interconnected distribution system would fail. Sufficient protection is provided by the monitoring of other specific Delivery Points that are actually located at the extremities of the transmission system in the Bay of Plenty region e.g. Gisborne and Whakatane.	
4.	**Why is Firstgas proposing a significant reduction in the CC pressure range at Westfield?**
	The CC threshold at Westfield was reduced from 42 barg to 37.5 barg in the October 2020 Firstgas CCMP revision, which is now at the minimum of the permissible pressure range for this location in Schedule 1 of the CCM Regulations. Closure of the Otahuhu B and Southdown gas-fired power stations means the higher pressure is no longer required at Westfield. At the time the Schedule 1 critical contingency pressure ranges were set, both power stations were significant gas users in the Auckland region and had minimum contractual pressures in excess of 47 barg. Consequently, Firstgas considers that the critical contingency pressure range for Westfield can be reduced and align with other locations and critical contingency pressure ranges on the transmission system.
5.	**Will Target Taranaki Pressure (TTP) on the Maui Pipeline be impacted by the proposed changes to Schedule 1 of the CCM Regulations?**
	No. Firstgas will also continue to meet its section 2.5 and 2.19 MPOC requirements with regard to TTP.
6.	**Why is Firstgas proposing to exclude any gas gates supplied by pipelines operated at pressures below 20 barg from Schedule 1 of the CCM Regulations?**
	Firstgas highlighted in its submission to the GIC on the 2021 SoP to amend the CCM Regulations that there are two known anomalies at the extremity of the transmission system where pressures are lower (<20 barg) than the “any other gas gate” limit set out in the CCM Regulations (Rangiuru and Tawa A). This has been the case since the inception of the CCM Regulations. We believe a Schedule 1 CCM Regulations “carve-out” for these locations (and any possible similar future locations) is the most sensible solution. One such future location under consideration is the 508 lateral from Reporoa to Taupo. An operating pressure of less than 20 barg would improve the operational efficiencies and economics associated with the previously mentioned Biomethane project. Our modelling and engineering assessments shows that the existing demand in this area would continue to be safely and reliably supplied at a lower pressure. These locations (and the customers downstream) retain the “protection” provided by the CCM Regulations through the CC threshold set-points at the Delivery Points immediately upstream and downstream of these locations.
7.	**Has the CCO been advised of Firstgas’ proposed changes to Schedule 1 of the CCM Regulations and do they have any concerns?**
	The CCO has been advised of Firstgas’ proposed changes to Schedule 1 of the CCM Regulations and has not raised any concerns as far as Firstgas is aware. As noted above, the CCO has the ability under the CCM Regulations to provide input to the Expert Advisor’s deliberations on CCMP amendments, including when Firstgas proposes modifications to CC pressure thresholds.

4.2. Costs & Benefits Summary

This table records the costs and benefits associated with Firstgas' proposal to widen the CC pressure threshold ranges in Schedule 1 of the CCM Regulations and potentially operate parts of the transmission system at a lower operating pressure:

	Category	Assessment & Conclusion
Costs of Status Quo	***Costs associated with CC Declaration and Potential Curtailment***	Setting CC thresholds too high could result in CC declarations and consumer curtailment occurring earlier than required or even unnecessarily. Three out of five CC-declarations since 2008 have not required curtailment action by the CCO and may have been avoided completely if CC thresholds had been lower: • CCs involve considerable resource, time and effort, including the mobilisation of emergency response teams across multiple organisations whenever a CC is declared • CCO has a suite of costs / rates set out in its published Service Provide Agreement that are incurred when a CC event occurs. • There is significant additional cost and disruption to customers and their operations during a CC event where curtailment is required. • Where a non-regional CC event occurs the CC Imbalance provisions apply (irrespective of whether curtailment occurs), which means a CC Price is determined and used to settle imbalances accrued during a CC event. • CC events caused by a failed transmission pipeline (such as the 2011 Maui Pipeline outage) are likely to result in curtailment irrespective of CC pressure ranges as the CCO will determine that a breach of the CC pressure threshold is inevitable.
	Inefficient system operation	• Transmission System compressors are periodically operated solely to maintain pressure pipeline above some Pmin CC threshold points that Firstgas considers are unnecessarily high (see Rotowaro and Cambridge Delivery Point example). • In some locations P_{min} set-points could be ~10 bar g lower with no impact to the objective of the CCM Regulations. • A product of this inefficiency is increased expense to consumers as higher transmission operating costs are ultimately borne by customers. • There is also the environmental impacts of increased emissions, which estimated at more than 5,000 tCO2 per year (100 TJ fuel gas consumption). • The current Schedule 1 pressure threshold limits may distort investment decisions and drive additional capital investment and operational expense (see Kaitoke Compressor example).
	Consumer & Customer Costs	• Firstgas does not anticipate any increase of costs to customers or consumers • Firstgas does not consider that any changes to consumers' plant, facilities or gas installations will be required to accommodate the proposed changes.

Benefits of Proposed Changes	***Enable sensible Capital and operational investment decisions***	• Approximately $1.1 – 1.3 million per annum could be saved by optimising the power output at key existing compressor stations to support lower operating pressures. • Replacing end-of-life compressors with modern, right-sized units would save approximately $9.1m over the purchase of the larger compressors that would be needed to maintain higher than required transmission pressures. • To optimise the capital expenditure of compression replacement decisions, Firstgas needs the flexibility to change how the system is operated and invest based on future scenarios.
	Safety Considerations	• Lowering the pressure in a Transmission Pipeline is an important safety response if an integrity issue is discovered. • It is possible that a pipeline may need to operate at this reduced pressure for a prolonged period and that a CC may be required for an extended duration if set higher than required. • At lower operating pressures there is a greater margin to sustain defects, damage, external loads and consequently increase safety without impact on security of supply.
	Enable Future Energy Initiatives	• The efficiency of hydrogen and biomethane production – and the economics of these projects – can be influenced by transmission pipeline pressure, mainly relating to the need for additional compression, the cost of which can be upwards of $1m. • Initial production estimates from the proposed Biomethane facility at Reporoa are that it will supply enough renewable gas equivalent to supplying up to 7,200 homes avoiding about 11,000 tonnes of CO2 emissions per year. • The existing CC pressure threshold ranges are impediments to parties progressing these important “future fuels” initiatives (which could be located throughout the transmission system) and achieving NZ’s decarbonisation goals.
	Reduce Unnecessary Critical Contingency Declarations and Curtailment	• Firstgas aims to set CC thresholds that balance the risk of unnecessary declaration and curtailment against the risk of leaving action too late to avoid system failure. • The current CC pressure ranges and thresholds need amending to enable Firstgas to adapt the operation of the transmission system in response to future demand for transmission services.

5. Appendix 1 – Critical Contingencies & Pressure Thresholds

5.1. What is a Critical Contingency?

A critical contingency (**CC**) occurs when there is a shortage of gas supply relative to demand due to damage or failure of assets that make up the transmission system or connected upstream assets, including gas producers. The pressure on the transmission system can fall to a point where intervention is required to ensure that enough gas is maintained in the transmission system to supply distribution networks and domestic consumers. It is expensive and time consuming to reinstate gas distribution networks if the pressure drops too low.

The CCM Regulations state that Firstgas, as a Transmission System Owner (**TSO**), must set CC pressure thresholds at various locations on the Transmission System and record them in Firstgas' Critical Contingency Management Plan (**CCMP**).[4]

When a CC pressure threshold is breached, the Critical Contingency Operator (**CCO**) is required to declare a CC and work to restore pressure back above the CC threshold, primarily through the curtailment of gas consumers (excluding domestic users).

5.2. What are CC Pressure Thresholds?

Critical Contingency thresholds must be set by Firstgas within the ranges (lower and upper limits) set out in Schedule 1 of the CCM Regulations.

Schedule 1 of the CCM Regulations specifies two key ranges:

- **Minimum Operating Pressure (P_{min})** – the range of pressures within which Firstgas sets a minimum operating pressure, having regard to the operational characteristics of that part of the transmission system; and
- **Time to P_{min}** – a range of appropriate amounts of time to allow the CCO to take actions to prevent transmission pressures from falling to P_{min}.

Firstgas' CCMP must specify the value for the minimum operating pressure and time to minimum pressure within the ranges established in Schedule 1. We aim to set CC thresholds that balance the risk of unnecessary declarations against the risk of leaving action too late to avoid system failure.

The specific pressure thresholds that Firstgas select are subject to the independent CCMP review and approval process required by the CCM Regulations.

5.3. Minimum operating pressures

Delivery Point regulator valves are designed to operate at a pressure to deliver the expected maximum demand of the downstream distribution system. The minimum operating pressure is the point when the pressure leaving the Delivery Point station falls below the pressure the distribution system is designed to receive. The minimum operating pressure in question is measured at the inlet to the Delivery Point station at the end of the transmission pipeline feeding that station.

Most Delivery Points have two regulator streams, one set to a higher pressure and one set to operate at a lower pressure. The design being that if the higher-pressure regulator stream closed, the lower pressure regulator stream will activate and deliver gas as the gate station outlet pressure starts to drop, thereby increasing overall station supply reliability.

5.4. What are the current Schedule 1 Pressure Ranges and Locations?

The CCM Regulations set out thresholds for specific system locations (typically the ends of pipelines) as well as a general threshold for any other gas gate on the Transmission System.[5] If pressure is maintained above the required minimum at these end-points, the rest of the system can generally be assumed to also be above the minimum operating pressures.

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[4] Firstgas' CCMP can be viewed and downloaded from the Publications section of OATIS: https://www.oatis.co.nz/Ngc.Oatis.UI.Web.Internet/Common/Publications.aspx

[5] Rotowaro and Kapuni are also threshold locations even though they are not at the extremities of the Transmission System. These are inlets to compressors which are fundamental to supply across the system. Protecting their ability to operate is therefore a key part of ensuring security of supply.

Pipeline Name	Point of Measurement	P_{min} (barg) Range (Current)
Maui	Rotowaro	32.0 +/- 2.5
Firstgas & Maui Pipeline	Any other gas gate	30.0 +/- 2.5
South	Waitangirua	35.0 +/- 2.5
Hawkes Bay Lateral	Hastings	30.0 +/- 2.5
Frankley Road to KGTP	KGTP	35.0 +/- 2.5
Bay Of Plenty	Gisborne	30.0 +/- 2.5
Bay Of Plenty	Taupo	30.0 +/- 2.5
Bay Of Plenty	Tauranga	30.0 +/- 2.5
Bay Of Plenty	Whakatane	30.0 +/- 2.5
Morrinsville Lateral	Cambridge	30.0 +/- 2.5
Central (North)	Westfield	40.0 +/- 2.5
North	Whangarei	25.0 +/- 2.5

These lower and upper pressure limits were established in 2008 as part of the original development of the CCM Regulations and have not been revisited since.

Firstgas believes that Schedule 1 of the CCM Regulations is out of date. Greater flexibility in the CC threshold ranges will ensure that important opportunities can proceed and enable Firstgas and the gas industry to respond more efficiently and effectively to the rapidly evolving energy environment.

5.5. How many CC Events have there been?

The following table records the CC Events that have occurred on the transmission system since the commencement of the CCM Regulations:

Date	Primary Cause	Curtailment Required
July 2010	Pohokura Production Station outage	No curtailment
October 2011	Maui Pipeline Outage – Pukearuhe landslip	Up to Band 6 for 5-days
March 2012	Pohokura Production Station outage	**50% of Band 1 for 8-hours**
May 2016	Pohokura Production Station outage	No curtailment
May 2017	System Imbalance Event	No curtailment