

Review of Gas Critical Contingency Management: Post Maui Pipeline Outage

Prepared for Gas Industry Company

June 2012



Concept Consulting Group Limited
Level 6, Featherston House
119-121 Featherston St
PO Box 10-045, Wellington, NZ
www.concept.co.nz

Concept Consulting Group

Concept Consulting Group (Concept) is a New Zealand-based consultancy specialising in energy-related issues. Since establishment in 1999, Concept has advised clients in New Zealand, Australia, Ireland, Singapore and the United States. These clients have included energy businesses, governments, international agencies and regulators.

Concept has undertaken a wide range of assignments, including market development, market analysis, technical evaluations, regulatory and policy analysis, and project management.

Preparation of this Report

This report was prepared by Lee Wilson, Ben Farrington and Bridget Moon, and has been reviewed by David Hunt.

Disclaimer

Concept Consulting Group believes the information and opinions expressed in this report to be accurate and complete at the time of writing.

However, Concept and its staff shall not, and do not, accept any liability for errors or omissions in this report or for any consequences of reliance on its content, conclusions or any material, correspondence of any form or discussions arising out of or associated with its preparation.

Contents

Executive Summary.....	6
1 Introduction	11
1.1 Purpose.....	11
1.2 Issues Addressed by this Review	11
1.3 Approach to Review	12
1.4 Information Sources	12
1.5 Structure of Report.....	13
2 Background	14
2.1 The Critical Contingency Arrangements	14
2.2 The October 2011 Maui Pipeline Contingency	15
2.3 The March 2012 Pohokura Outage.....	16
2.4 The Critical Contingency Operator Performance Report.....	17
3 Stakeholder Feedback	19
3.1 Stakeholder Interviews.....	20
3.2 Curtailment Bands	21
3.3 ESP and MLC Designations	22
3.4 Communications.....	23
3.5 Retailer / Consumer Preparation.....	24
3.6 Curtailment and Restoration	24
3.7 Other Issues	25
4 International Approaches to Managing Gas Contingencies.....	27
4.1 Overview of International Approaches	28
4.2 United Kingdom	29
4.3 Ireland.....	31
4.4 Eastern Australia.....	32
4.5 Western Australia	35
4.6 Spain	36
4.7 Italy	37
4.8 Slovak Republic.....	38
4.9 Hungary	40
4.10 United States	41
4.11 Summary.....	42

5	Curtailing Gas Demand during a Contingency	47
5.1	Curtailing Gas Demand in the New Zealand Context	47
5.2	The Curtailment Bands	48
5.3	CCM Regulation Requirements	50
5.4	Comparison with International Approaches to Curtailment	51
5.5	Consumers with Back-up Supplies.....	51
5.6	Essential Service Providers	52
5.7	Health and Safety Issues.....	54
5.8	Critical Care Services.....	54
5.9	Other Essential Service Provider Categories	55
5.10	ESP Designations during October Contingency	56
5.11	Minimal Load Consumers	57
5.12	Band 6 Consumers.....	57
5.13	Recommendations.....	58
6	Preparing for a Critical Contingency	60
6.1	Retailer and Gas Consumer Readiness	60
6.2	Approval of ESP and MLC Designations.....	61
6.3	Retailer Planning.....	62
6.4	Recommendations.....	63
7	Critical Contingency Operations.....	64
7.1	Facilitating CCO Performance	64
7.2	Public Appeals for Gas Savings	64
7.3	Communications during a Critical Contingency.....	65
7.4	Reconfiguring Networks	66
7.5	CCO performance Report	67
7.6	Recommendations.....	68
8	Regional and National Contingencies	69
8.1	October 2011 Regional Contingency	69
8.2	Imbalance and Contingency pricing	69
8.3	Recommendations.....	70
9	Encouraging Compliance.....	71
9.1	Compliance with Curtailment Directions.....	71
9.2	Small Consumer Compliance	71
9.3	Recommendations.....	72

10	List of all Recommendations	73
	10.1 Curtailment bands	73
	10.2 Preparing for a Critical Contingency	73
	10.3 Critical Contingency Operations	74
	10.4 Regional and National Contingencies	75
	10.5 Compliance	75
Appendix 1.	List of Abbreviations and Terms	76
Appendix 2.	Direction to Revise Demand Curtailment	77
Appendix 3.	Critical Contingency Arrangements in the UK.....	79
Appendix 4.	Critical Contingency Arrangements in Ireland	85
Appendix 5.	Critical Contingency Arrangements in Australia.	89
Appendix 6.	Critical Contingency Arrangements in Spain.....	107
Appendix 7.	Critical Contingency Arrangements in Italy.....	112
Appendix 8.	Critical Contingency Arrangements in the Slovak Republic	118
Appendix 9.	Critical Contingency Arrangements in Hungary	125
Appendix 10.	Critical Contingency Arrangements in USA.....	131

List of Figures:

Figure 1:	Proportion that each band represents of demand remaining to be curtailed	50
Figure 2:	National Gas Infrastructure Australia	91
Figure 3:	National Gas Infrastructure Spain.....	108
Figure 4:	National Gas Infrastructure Italy	113
Figure 5:	National Gas Infrastructure Slovak Republic	119
Figure 6:	National Gas Infrastructure Hungary.....	126

List of Tables:

Table 1: Stakeholder Interviews	20
Table 2: Summary of the United Kingdom contingency management arrangements.	30
Table 3: Summary of Ireland contingency management arrangements.	31
Table 4: Summary of Eastern Australian contingency management arrangements.	32
Table 5: Summary of Western Australian contingency management arrangements.	35
Table 6: Summary of Spain contingency management arrangements.	37
Table 7: Summary of Italy contingency management arrangements.	38
Table 8: Summary of Slovak Republic contingency management arrangements.	39
Table 9: Summary of Hungary contingency management arrangements.	40
Table 10: Wisconsin contingency management arrangements.	41
Table 11: Communications Spokesperson during Contingencies	46
Table 12: The Existing Curtailment Bands	48
Table 13: Current Curtailment Bands (following October 2011 Contingency)	49
Table 14: Recommended Curtailment Bands	59
Table 15: National Gas Storage Capacity Australia.....	91
Table 16: Australian Gas Statistics	92
Table 17: AEMO Curtailment Bands for the State of Victoria.....	100
Table 18: National Gas Demand Spain	109
Table 19: National Gas Demand Italy	114
Table 20: National Gas Demand Slovak Republic	120
Table 21: Curtailment for customers with >50% of demand dependent on external temperature	122
Table 22: Curtailment for customers with >50% of demand independent of external temperature	122
Table 23: National Gas Demand Hungary.....	127

Executive Summary

This report reviews the critical contingency management (CCM) arrangements for the gas sector against the background of the six day gas supply outage that occurred over the period 25-30 October 2011. It has a particular focus on the arrangements for curtailing gas demand and explores whether the CCM regulations could be amended or augmented to improve effectiveness.

The approach taken has involved reviewing a number of key documents that collectively comprise the CCM arrangements, conducting a series of interviews with key stakeholders, considering the recommendations made by the Critical Contingency Operator (CCO) in the Performance Report prepared following the October 2011 contingency, and reviewing international practice with managing gas contingencies.

Key findings from interviews

The interviews with stakeholders were extremely helpful in informing this review and we would like to express our appreciation to the individuals who freely gave their time to talk with us.

There was a broad consensus that the CCM arrangements worked well and the outcomes were generally as intended. However, many interviewees felt a number of useful lessons have been learnt, and some detailed provisions could be improved. Key points raised by respondents were:

- There is concern about the order of demand curtailment during a contingency;
- There is concern about the Essential Service Provider (ESP) and Minimal Load Consumer (MLC) criteria and suggestions that they need to be clarified, in particular how they apply to health and safety, food production, and environmental protection;
- Some consumers and retailers were not well-prepared to manage the curtailment process;
- There is concern about communication difficulties experienced during the October 2011 contingency and suggestions that they should be addressed;
- There are problems with enforcing consumer compliance with curtailment directions that could compromise the ability to manage future contingencies;
- There is a lack of clear understanding about the difference between regional and national contingencies and the application of contingency pricing that needs to be addressed.

Key findings from international review

The key findings from the review of international practice were:

- New Zealand is relatively unusual in that it is geographically isolated and does not import or export gas;
- Many international gas markets are part of a large interconnected pipeline network, and therefore have multiple supply points, LNG facilities, and/or gas storage facilities, with the result that they are relatively immune from single pipeline and gas field supply failures.

Accordingly, many of these markets place emphasis on 'supply-side' measures to manage contingencies such as defining security standards in terms of required multiple suppliers, storage facilities, or LNG facilities;

- Where more formalised 'demand-side' regimes (i.e. defined plans to provide for orderly curtailment) do exist, they tend to be found in gas markets where there is significant exposure to single points of failure and/or limited ability to economically mitigate extreme security risks through supply side measures. For example, formalised curtailment regimes are more prevalent in smaller isolated markets (e.g. Australia) or markets at the extremities of major pipeline systems (e.g. Ireland, Spain, United Kingdom);
- Where gas demand curtailment regimes do exist, they typically provide priority supply to domestic users, critical care facilities, and emergency services, while curtailing supply to electricity generation, industrial consumers and commercial consumers;
- It is also common to curtail gas supply progressively from the largest consumers down to the smaller consumers, but practices vary in regard to food production and environmental protection;
- Research did not reveal many arrangements for enforcing compliance with curtailment directions through financial penalties, although Australian state legislation typically has provisions for fining companies and individuals for non-compliance;
- Transmission system owners and operators typically manage any gas contingency, although sometimes Ministers are provided with special powers.

Key findings and recommendations

New Zealand's isolation and the relatively small size of the gas market mean that it is unlikely to be economic to maintain supply-side security options such as investment in storage, additional pipelines, or LNG facilities to address extreme security risks. The most economic means of managing gas contingencies is likely to involve orderly curtailment of some gas demand.

It is therefore important for New Zealand to have critical contingency and demand curtailment arrangements that operate efficiently to minimise economic cost. This involves a high priority on maintaining supplies to domestic and small commercial premises in the first instance (to avoid the very high cost and safety issues associated with any relighting process) and to some essential services.

The order of curtailing supply to gas consumers is important because this has a critical impact on the likelihood of losing pressure in distribution systems and therefore triggering a re-light process. The biggest gains are to be made by curtailing electricity generation (often 70-80% of demand), followed by other large consumers (typically 15% of demand). During a sustained outage, rationing available supply to maintain pipeline pressures and sustain domestic supplies may require further cuts of supply to small (non-domestic) consumers.

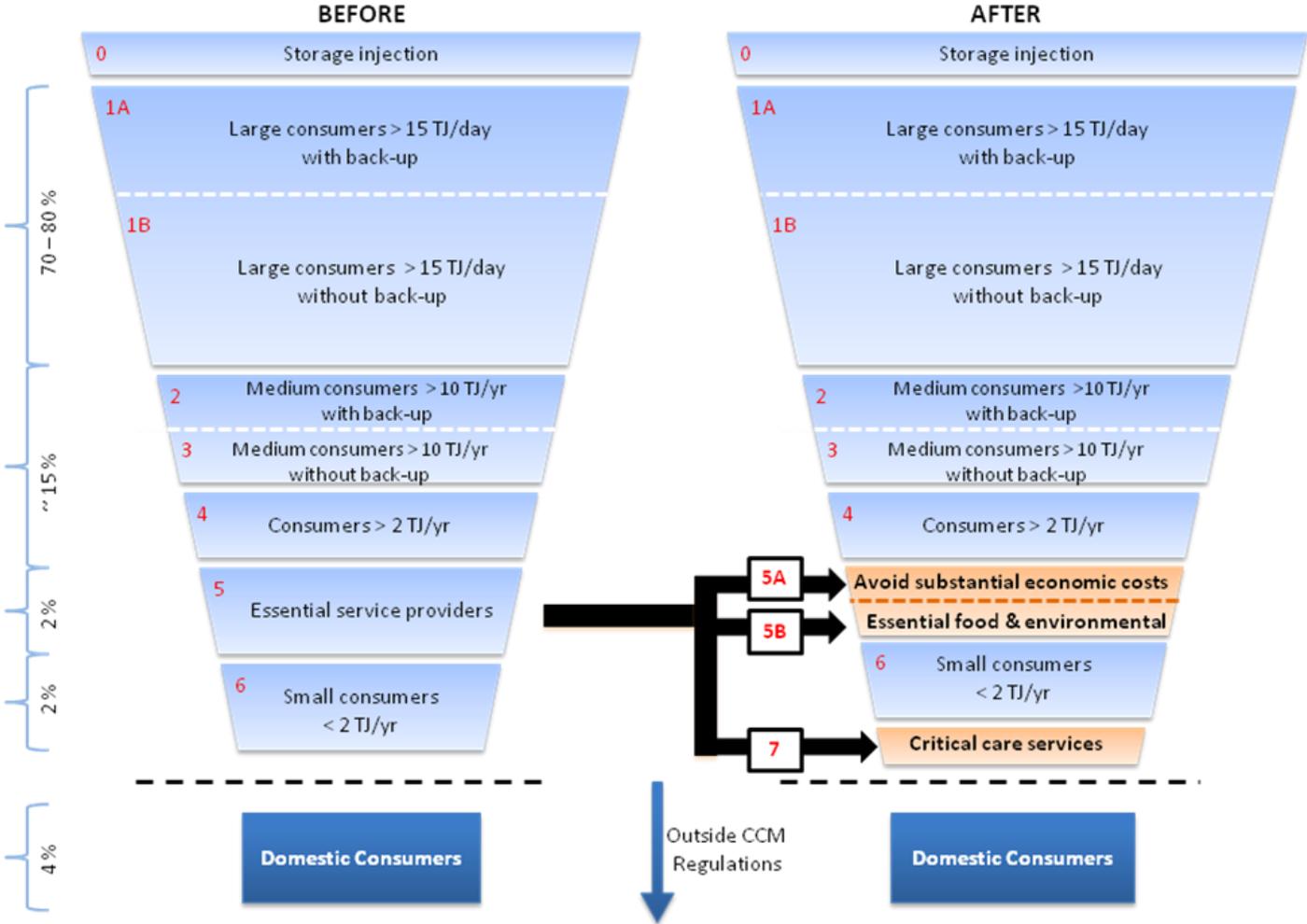
When deep cuts are required (such as during the October 2011 contingency) MLC and ESP designations, and the priority of supply for small consumers, becomes important to minimise the overall costs to the economy. It is therefore important that these arrangements are clear, precise and can be readily implemented.

The problems identified in this review and recommended solutions are summarised in the following table:

Problem Area	Description	Recommended solution
ESP Criteria	<p>The ESP criteria, based on the National Civil Defence Emergency Management Plan (NCDEMP) order are too broad and imprecise resulting in a lack of clarity about what constitutes an essential service.</p> <p>ESPs are able to continue taking full supply despite requiring less than full supply to maintain essential services.</p>	<p>Amend the regulations to remove the reference to the NCDEMP order and incorporate narrow, specific criteria relating to “critical care services” (new band 7), “essential food production” and “environmental protection” (new band 5b) and “minimum supply to avoid substantial economic costs” (new band 5a).</p> <p>Amend the regulations to require all ESPs to specify a minimum level of gas supply required to maintain essential service.</p>
Order of curtailment	<p>Some ESP categories are more important than others and this should be reflected in the priority order.</p> <p>Large ESPs (>2TJ pa) in the critical care category are currently required to be curtailed before small consumers (<2TJ pa).</p>	<p>Amend the curtailment order so that the sequence is for the new band 5a (minimum supply to avoid substantial economic costs) to be curtailed before new band 5b (essential food supplies and environmental protection) which is to be curtailed before band 6 (small consumers) and the new band 7 (critical care services).</p> <p>Consider options for small consumers (<2TJ pa) to acquire ESP status.</p>
ESP and MLC approvals	<p>Criteria for approval of ESP and MLC designations are too weak.</p> <p>Approval of ESP and MLC designations by retailers creates problems with perceptions about approvals favouring some consumers and potentially inconsistent approvals.</p>	<p>Amend the regulations to require ESP and MLC applicants to provide more information, demonstrate that they have emergency plans in place, and to justify a minimum level of gas supply.</p> <p>Amend the regulations to require ESP and MLC designations to be approved by an independent body, following recommendation from a retailer.</p>
Retailer and consumer preparation	<p>Some retailers and consumers were not adequately prepared to cope with the October contingency with the result that several applications for ESP status were made during the contingency.</p> <p>There is no on-going obligation on retailers to contact consumers about gas contingency arrangements.</p>	<p>Retain the flexibility to approve ESP and/or MLC designations during a contingency because it may be important (note that recommended changes to the approval and retailer planning processes are designed to place more responsibility on consumers and retailers to have designations approved in advance).</p> <p>Amend the regulations to provide an on-going obligation on retailers to contact consumers and to require retailers to prepare and maintain “Gas Retailer Curtailment Plans” for approval by an independent body.</p> <p>Consider an independent audit of the registry field “load shedding category”.</p>

Problem Area	Description	Recommended solution
Curtailling small consumers	There are difficulties contacting small consumers (band 6) and confirming that they have followed curtailment directions.	Maintain the current arrangements, but expect “Gas Retailer Curtailment Plans” to include clear strategies for contacting small consumers and confirming that they have followed directions.
Communications during a critical contingency	<p>The CCO has difficulty meeting requirements to manage a critical contingency at the same time as communicating important information to multiple stakeholders.</p> <p>The current arrangements do not require any party to coordinate communications or appoint a spokesperson at an early stage during a contingency.</p>	<p>Amend the regulations to provide for the CCO to coordinate communications, liaise with key stakeholders, and to appoint a spokesperson as soon as reasonably practicable following the declaration of a contingency.</p> <p>Consider whether it is necessary to amend the regulations to provide the CCO with powers to require information from TSOs and other asset owners during a contingency.</p> <p>Retain the current arrangements whereby curtailment and restoration directions are issued to consumers via TSOs and retailers.</p>
Consumer information	The CCO had difficulty acquiring accurate and detailed consumer information, including daily and seasonal profiles, during the October contingency.	Investigate further whether it is necessary to provide the CCO with powers to access information, including information held by the Allocation Agent on daily metered sites.
Regional and national contingencies	<p>There is some confusion about the purpose of the regional/national distinction and under what circumstances contingency pricing should apply.</p> <p>Some participants were uncertain about how they should respond without knowing whether the October contingency was a regional or national contingency.</p>	<p>Retain the current arrangements for distinguishing between regional and national contingencies, but prepare an accessible document that clearly explains the rationale for the distinction. Consider revising the definition to distinguish between a shortage of gas supply (“national”) and a shortage of gas transmission (“regional”).</p> <p>Amend the regulations to require the CCO to declare whether a contingency is regional or national as soon as reasonably practicable following the declaration of a contingency. Provide for that declaration to be changed as events unfold.</p>
Compliance	There is no means of enforcing compliance by applying financial penalties against consumers who are not industry participants.	Consider further how best to encourage compliance with curtailment directions, including a possible change to the Gas Act to allow financial penalties against consumers.

Proposed Change to Curtailment Bands



1 Introduction

1.1 Purpose

Concept Consulting has been engaged by the Gas Industry Company to undertake a review of the critical contingency arrangements for the gas sector, following a six day gas supply outage that occurred over the period 25-30 October 2011. The outage was a result of damage to the Maui pipeline north of Taranaki, and impacted over 11,000 gas consumers who were required to curtail gas consumption while gas transmission through the pipeline was restored.

The Gas Governance (Critical Contingency Management) Regulations 2008 (referred to in this report as the “Regulations”) were introduced to help the industry deal with critical contingency events. The October outage was the first time that curtailments under the Regulations had been required to address a critical contingency¹. This review draws on the experience of industry stakeholders to identify weaknesses in the Regulations that were exposed by the event, and discuss options for addressing them. The process for curtailing demand has been a particular feature of this review.

To inform this review, interviews were held with a range of industry stakeholders, including large consumers, retailers and those involved in managing the contingency. The review has also examined the approaches to contingency management and demand curtailment in international markets.

Drawing on this information, this paper outlines a number of recommendations for improving the critical contingency management arrangements.

1.2 Issues Addressed by this Review

Gas Industry Co specified that this review should:

- Assess the way in which the curtailment bands in the Critical Contingency Management (CCM) Regulations operated in practice, and identify any shortcomings that could impede the orderly management of a future contingency event and/or efficient rationing of available supply;
- Consider the experience in relation to the granting of essential service provider (ESP) and minimal load consumer (MLC) designations ahead of the event, including the criteria for decisions, the incentives on the organisations charged with making the decisions, and the information base on which decisions were made;
- Consider the experience in relation to the granting of essential service provider (ESP) and minimal load consumer (MLC) designations during the contingency event;
- Assess the preparedness of gas consumers, particularly large consumers, including any arrangements these consumers had in place to be resilient against gas outages – and the effects that the framework for granting designations may have on these preparations;
- Gather information on international approaches to allocating consumers or consumer groups to curtailment categories – and compare and contrast those arrangements with the CCM

¹ A critical contingency event was also declared in July 2010 but was able to be managed without the need to curtail end users.

Regulations in New Zealand. This aspect of the review should focus on countries with similar industry structures to New Zealand, especially Australia, the United Kingdom and Ireland;

- Consider the recommendations from the Performance Report prepared by the Critical Contingency Operator(CCO);
- Consider any recommendations stemming from the Ministry of Economic Development report into the event (if available); and
- Identify and assess any parts of the CCM Regulations that need to be amended or augmented so as to improve the effectiveness of critical contingency management in New Zealand

1.3 Approach to Review

The approach we have taken to this review is as follows:

- Reviewed the key documents listed in section 1.4;
- Conducted a series of interviews with key stakeholders as listed in section 3.1;
- Undertook a review of international practice with managing gas contingencies;
- Considered the issues arising from the CCO Performance Report, the stakeholder interviews and the review of international experience;
- Made a series of recommendations about how to improve the effective management of critical contingencies without compromising long-term security of supply.

1.4 Information Sources

In preparing this report, Concept has relied on a number of documents and related sources of information including:

- The Gas Governance (Critical Contingency Management) Regulations 2008;
- The Critical Contingency Performance Report prepared by Vector (in its role as Critical Contingency Operator) pursuant to clause 65 of the Regulations, following the October contingency;
- Information supplied by gas sector participants and consumers during a series of interviews during March and April 2012;
- A range of published online sources documenting gas contingency arrangements in other countries (which are identified separately in the appendices);
- The Critical Contingency Operator Service Provider Agreement;
- The Critical Contingency Operator Information Guide;
- The Critical Contingency Operator Communications Plan;
- The Vector Gas Transmission Critical Contingency Management Plan;
- The Maui Development Limited Critical Contingency Management Plan;

1.5 Structure of Report

This report is structured as follows:

Section	Description
1. Introduction	Outlines the purpose of this review, the issues it addresses and the approach used.
2. Background	Discusses the Regulations and the context in which they were drafted, as well as providing an outline of the other contingency management documents required from participants by the Regulations. This section also describes the Maui pipeline outage in October 2011 and the recommendations arising from a performance review published by the Critical Contingency Operator.
3. Stakeholder Interviews	Summarises the key issues that arose from the stakeholder interviews.
4. International Research	Outlines the scope of the research performed, and provides a brief outline of the contingency management arrangements in the countries examined. More detailed information on these arrangements is included in appendices. This section summarises the extent to which the approaches and experience of other jurisdictions may be able to inform improvements to the arrangements in New Zealand.
5. Curtailing Gas Demand During a Contingency	Discusses curtailing gas demand in New Zealand, the issues identified with the current curtailment bands, the arrangements for Essential Service Providers and Minimal Load Consumers, and options for addressing some problem areas.
6. Preparing for a Critical Contingency	Discusses the issues identified with consumer and retailer preparation and planning, and options for addressing some problem areas.
7. Critical Contingency Operations	Discusses the issues identified with facilitating critical contingency operations and communications during a contingency, and options for addressing some problem areas.
8. Regional and National Contingencies	Discusses the issues identified with the current Regulations and arrangements, and the options for addressing some problem areas.
9. Compliance	Discusses the issues identified with the current Regulations and arrangements, and the options for addressing some problem areas.
10. Recommendations	Summarises the recommendations arising from this review.

2 Background

2.1 The Critical Contingency Arrangements

The Gas Governance (Critical Contingency Management) Regulations 2008

While commercial arrangements are the preferred means of balancing supply and demand, and rationing a limited supply of gas, in situations of system stress it may not be possible for parties to trade effectively, particularly if time is limited.

The Regulations, introduced in 2008 following consultation with industry stakeholders, replaced the 'National Gas Outage Contingency Plan' (or NGOCP), which was a set of industry-led, voluntary arrangements that many stakeholders considered did not suit a market that was no longer dominated by a single supplier (Maui), and provided inadequate legal and commercial incentives to comply.

The Regulations provide a centralised, coordinated and mandatory back-stop mechanism for balancing the system. The purpose of the Regulations is *"to achieve the effective management of critical gas outages and other security of supply contingencies without compromising long-term security of supply"*.

The Regulations:

- identify the onset of a critical contingency;
- require the development of critical contingency management and communications plans;
- provide for the appointment of a Critical Contingency Operator (CCO) whose primary role is to coordinate a response to an event in order to restore the supply/demand balance;
- establish procedures for effective management of a critical contingency, which includes the potential to curtail customer demand to stabilise pipeline pressures according to a notified priority order; and
- in the event of disruption to gas production, establish a price which is used to settle inadvertent trading between those parties whose supplies have failed and those parties who have access to supplies but whose customers have been curtailed.

The Critical Contingency Operator Service Provider Agreement

Vector was appointed as the CCO, pursuant to a service provider agreement between the Gas Industry Company and Vector (SPACCO) in place since 2008². The SPACCO requires Vector to:

- Comply with the Regulations, including undertaking all the duties and obligations of the CCO under the Regulations; and
- Identify and provide all Personnel, resources and processes required to provide the services in the agreement;

² Note that Vector Gas is also the system operator for the Vector pipeline and the Maui pipeline.

Specifically, Vector as the CCO must publish and consider contingency management plans, run contingency test exercises, prepare a communications plan and information guide, and keep a record of consumer information including curtailment bands, ESPs and MLCs, as provided by retailers and large consumers. During a critical contingency, Vector as the CCO must:

- Determine, declare and notify of a critical contingency;
- Monitor pipeline pressures in the affected sections of the transmission system;
- Explore available opportunities to increase upstream gas production and draw on storage in order to mitigate the severity of the critical contingency;
- Receive and consider communications from transmission system owners;
- Direct the curtailment and restoration of gas supply in accordance with the Regulations;
- Give formal notices regarding curtailment and restoration to transmission system owners;
- Ensure interested persons are kept informed of the status of the critical contingency
- Publish information on the status of the critical contingency;
- Give notice of an ongoing critical contingency, or the termination of a critical contingency; and
- Prepare and publish an incident report and performance report after a critical contingency has occurred.

Vector and MDL Critical Contingency Management Plans

Under the Regulations Vector and MDL, as Transmission System Owners, are required to prepare critical contingency management plans covering the transmission system under their ownership. The Regulations outline what the plans must cover, which includes:

- Pipeline pressure operating limits;
- A description of the events that may cause pressures to fall outside of the operating limits and actions taken to remedy such an event;
- A process for implementing curtailment instructions and restoration;
- A communications plan, including information flows to the CCO, other TSOs, distributors, shippers, retailers and large consumers;
- The circumstances in which it may be desirable for the CCO to depart from the default restoration order under the Regulations to better achieve the purpose of the Regulations and curtailment arrangements;
- A process for determining contingency imbalances resulting from a contingency;
- The provision of contact details for direct users of the transmission pipeline, and a contact person for the TSO.

2.2 The October 2011 Maui Pipeline Contingency

In October 2011 a leak was identified on the Maui gas pipeline south of the Mokau compressor station. In order to investigate further, it was necessary to isolate the section of pipeline and purge

it, which meant that there was a major reduction in gas supplies north (and subsequently east) of Taranaki.

The CCO declared a Critical Contingency and directed curtailment of load, beginning with gas-fired power stations supplied via that part of the Maui pipeline north of the leak. Later that same day, load curtailment was expanded to include all curtailment bands. At the same time, Vector reconfigured the smaller (200mm diameter) pipeline that runs parallel to the Maui pipeline so that the Vector pipeline could provide supply to both Auckland and the Bay of Plenty. Although this reduced the likelihood of depressurising gas networks north of Taranaki, it came at the cost of requiring partial load curtailment in the areas served by the Vector Bay of Plenty pipeline.

The sequence of events in October was as follows:

- Monday 24 October – a suspected gas escape was detected adjacent to the Maui pipeline in north Taranaki and a potential critical contingency was notified;
- Tuesday 25 October – a critical contingency was declared by the CCO, demand curtailment directions were issued to all consumers north of the Mokau compressor station in all curtailment bands (1-6), and a public appeal for gas to be used sparingly in the domestic sector was made;
- Wednesday 26 October – gas pipeline pressures were stabilised, gas supply was restored to Essential Service Providers (band 5), and 15 consumers were re-designated as Essential Service Providers;
- Thursday 27 October – 10 further consumers were re-designated as Essential Service Providers and supply was restored to all small consumers (band 6);
- Friday 28 October - 7 further consumers were re-designated as Essential Service Providers and supply was restored to all band 4 consumers;
- Saturday 29 October - 1 further consumer was re-designated as an Essential Service Provider and planning for restored supply to power stations was initiated;
- Sunday 30 October – the Maui pipeline was restored to normal service, supply was restored to all consumers, and the critical contingency was terminated.

The critical contingency lasted just under 5 ½ days.

2.3 The March 2012 Pohokura Outage

On Saturday 3 March 2012, there was a disruption to supplies from the Pohokura gas field, which led to a decrease in pipeline pressures. Gas-fired power stations and major gas users, including Methanex and Ballance Agri-Nutrients, were required to reduce their load for most of the day. A critical contingency was declared shortly before 1pm, though supplies from Pohokura were restored and all load was allowed to resume normal operation by around 9pm.

While this outage is not strictly a part of this review, it provides a useful example of a different form of contingency to the October event – i.e. a disruption to injection from a supply source, rather than a failure of a pipeline. Furthermore, having been affected by the March event, Methanex indicated that it was interested in providing input into the review process, and therefore participated in an interview.

2.4 The Critical Contingency Operator Performance Report

Following a critical contingency, the CCO is required to produce an Incident Report and a Performance Report. The CCO Performance Report following the October event made 19 recommendations aimed at improving the performance of the critical contingency arrangements. Recommendations 1-13 related to the CCO Communications Plan, the CCO Information Guide, and the Critical Contingency Management Plans prepared by Vector and MDL. We understand that these recommendations are all being actively worked on and this will result in changes to those documents. Recommendations 1-13 are not considered in this report

Recommendations 14-19 of the CCO Performance Report involve possible changes to the Regulations and are for Gas Industry Co to consider. They are reproduced here as follows:

14. *GIC to lead an industry consultation process (including a representative cross section of consumers) to consider the above points (all relating to the curtailment bands and consumer classification – see list following recommendations) and any other subsequently identified issues and propose and implement any required amendments to the Regulations.*
15. *GIC to lead an industry consultation process to consider the following and any other subsequently identified issues:*
 - a. *if the regional status of a critical contingency should be designated when a critical contingency is declared;*
 - b. *if a single entity should have the obligation to designate the regional status of the critical contingency;*
 - c. *if the pricing and imbalance methodology could be applied to all critical contingencies hence removing the requirement to determine the regional status; and*
 - d. *propose and implement any required amendments to the Regulations that result from the consultation process.*
16. *We recommend that the GIC give consideration to amending the Regulations to clarify the process for a partial restoration.*
17. *We recommend that the GIC and MED give consideration to the most appropriate mechanism for increasing knowledge and understanding of the critical contingency system.*
18. *We recommend that the GIC and MED give consideration to introducing greater incentives for compliance with directions under the Regulations.*
19. *We recommend that the GIC and MED consider potential improvements to the review and reporting process contained in the Regulations.*

The particular issues the curtailment bands and consumer classification that the CCO considers should be addressed as part of recommendation 14 include:

- *The definitions of essential service providers contained in the Essential Services and Minimal Load Guidelines and whether a new designation of “other essential foodstuffs” in addition to the existing bread and fresh dairy produce categories is appropriate;*
- *Whether the current designation system creates perverse incentives for consumers to under-invest in back-up energy sources to control risk that they are better placed to manage;*

- *The appropriateness of basing gas contingency curtailment bands on the Schedule of the National Civil Defence Emergency Management Plan Order 2005, which may be more suited to large scale natural disaster situations rather than gas supply outages;*
- *The introduction of a new band or sub-band for “Critical Care Providers” or “Life and Limb Services” for hospitals and medical care centres;*
- *The treatment of support services to essential service providers e.g. laundries servicing hospitals;*
- *Whether it would be appropriate to introduce a requirement for essential service providers to nominate a minimum gas usage value to allow their essential processes to continue to operate at their facilities;*
- *The appropriate classification of essential service providers with alternative fuel availability;*
- *Whether, and how, to add avoiding environmental risk as a criteria for placement in curtailment bands;*
- *Whether, and how, to include seasonal variations in usage or maximum daily quantity in place of the current approach of using annual consumption;*
- *Whether, and how, to increase transparency and consistency of band 5 re-designation applications (for example, whether it would be appropriate to introduce a system of independent audit of classifications by retailers or whether it would be appropriate to freeze all designations once a critical contingency has been declared);*
- *Whether it is appropriate for essential service providers to be curtailed prior to band 6 consumers, as currently provided by the curtailment order in Schedule 2 (2) of the Regulations; and*
- *Whether requiring retailers to give curtailment directions to their band 6 consumers in accordance with regulation 56 of the Regulations causes undesirable delays in notices reaching these consumers.*

These recommendations from the CCO are all considered in the context of this report.

The Ministry of Economic Development (MED) has also been requested to provide a report to the Minister of Energy and Resources. That report may raise matters for Gas Industry Co to consider, however in the timeframe for this report the MED report had not been released.

3 Stakeholder Feedback

Summary

There was a broad consensus that the CCM arrangements worked well and the outcomes were generally as intended. However, many stakeholders felt a number of useful lessons have been learnt, and some detailed provisions could be improved. Key points raised by respondents were.

Curtailement bands:

- ESP criteria are too broad and lack clarity
- MLC category may be too restrictive
- Some ESPs should have higher priority than band 6 customers
- Band 6 could be excluded from the curtailment schedule and incorporated in a public appeal
- A need for more detailed seasonal/daily information to identify consumer load
- Possible adverse incentives for investing in back-up fuel arrangements

ESP and MLC Designations:

- Independent body should approve ESP/MLC designation applications
- Consider if designations should be frozen before an event

Communications

- Need for better organisation and formality around communication with industry during a contingency
- Need for media messages to be consistent and organised
- Large users would like more information on the nature, duration and cause of a contingency

Retailer/Consumer preparation:

- The registry “load shedding category” cannot be relied upon to provide the correct curtailment band
- Some consumers were not well prepared for a contingency and this may be a result of poor prior communication from some retailers about possible ESP and MLC designations;

Curtailing and restoration:

- Earlier warning of a possible contingency for some parties would have been valued
- The CCO may need more resources, particularly during the early stage of a contingency
- There was some initial confusion about what “curtail” meant
- Stronger coordination amongst parties during re-pressurisation would be valued

Other Issues

- Several suggestions that stronger enforcement provisions are required
- There was some confusion about the Regional/National distinction and application

3.1 Stakeholder Interviews

It would not be possible to properly assess the effectiveness of the response to the October 2011 contingency event without drawing on the experience of affected parties across the industry. To inform this review, interviews were held with a number of industry stakeholders, these included:

- Large consumers that were asked to curtail their consumption. Many of these consumers had, or sought during the event, a designation as an essential service provider or minimal load consumer. Views were generally focussed on the implications of curtailment for their businesses, what communication they received about contingencies prior to the event and how prepared they felt they were, and the success of communications both during and after the event.
- Retailers that were required to contact customers and inform them of their need to curtail consumption. Retailers maintained contact with customers throughout the event, and received instructions from other stakeholders. They provided views on a wide range of issues, including communications, designations, preparation and curtailment.
- System owners and operators, some of whom were in the middle of the action coordinating the response to the event, and others that played a more indirect role, dealing with stakeholder concerns and managing secondary impacts.

The interviews were extremely helpful in informing this review and we would like to express our appreciation to the individuals who freely gave their time to talk with us. A list of stakeholders interviewed is shown in Table 1.

Table 1: Stakeholder Interviews

Large Consumers	Retailers	System Owners and Operators
Carter Holt Harvey	Contact Energy	The Critical Contingency Operator
Fonterra	Energy Direct	MDL (via Transact)
Methanex ³	Genesis Energy	Vector
NZ Steel	Greymouth Gas	Transpower (System Operator)
NZ Sugar	Mighty River Power	
Wilson Hellaby	Nova Gas	

The consensus amongst stakeholders was that the contingency management arrangements generally worked well, and the outcomes were generally as intended by the Regulations. However, most agreed that there were issues to be addressed and lessons to be learned. Some noted that they had already implemented changes to their systems and processes following the event and would be better prepared if such an event were to happen again soon.

3 Although Methanex was not curtailed during the October event, it was affected by a disruption to supplies from the Pohokura field in March 2012.

It could be expected that an event such as that experienced in October 2011 would cause industry participants to assess their preparedness for a similar event tomorrow. However, contingency events are expected to be infrequent, and this review should therefore seek to ensure that the critical contingency Regulations provide parties with the ability to deal successfully with an event that is some time in the future, without relying on memories of the recent event.

The following sections summarise the main themes that emerged from the interviews.

3.2 Curtailment Bands

There is a widespread view that the current ESP definition and associated guidelines for retailers to follow in determining if a consumer is “essential” are too wide and general, and could potentially allow for many consumers to be considered essential.

The current curtailment bands refer to the National Civil Defence Emergency Management Plan Order (NCDEMP Order). Some stakeholders suggested that this may not be appropriate, as a gas contingency is often different from a Civil Defence emergency. The NCDEMP Order may not appropriately reflect the issues that arise during a gas contingency. For example, there was some suggestion that maintaining gas supply to food processors should not necessarily be considered essential during a gas contingency, because replacements and other sources were likely to be available in many instances. Although Gas Industry Co had issued guidelines⁴ for determining ESP designations, there was a general concern with the link to the NCDEMP Order.

The NCDEMP Order including “preservation of economic activity” is particularly perceived as too broad and lacking in clarity. Several stakeholders suggested that there should be some differentiation between critical care facilities (preservation of life and care of the sick and injured) and consumers involved in food processing, activities that could create environmental problems with loss of supply, or face economic/plant damage if curtailed. In particular there were suggestions that there should be a “band 7” for critical care facilities, and/or splitting the existing band 5 into 2 or more separate bands.

A number of stakeholders also suggested that it should be possible to allow for part loads to be considered “essential”. Under the current Regulations consumers with an ESP designation are allowed to maintain full consumption, despite potentially only a portion of their consumption being essential.

There were some suggestions that the MLC provision is too restrictive in that consumers can maintain some consumption, but only while they perform an orderly and complete shut-down. Some consumers reportedly opted not to apply for an MLC designation because of this restriction, and there was some confusion around whether it was better to be an ESP or MLC.

In the current curtailment bands, consumers that have alternative fuel arrangements are curtailed before similar consumers that do not have an alternative. There were some suggestions that the earlier curtailment of consumers with back-up supply creates adverse incentives to investing in alternative energy sources. Others disagreed that this was a problem, noting that both categories were curtailed and restored at the same time during the October contingency, and that any decision

⁴ Essential Services and Minimal Load Guidelines; Gas Industry Co; February 2009

to invest in alternatives is an economic decision based on the prospect of having no gas supply, and the possibility of having gas supply curtailed slightly earlier was unlikely to be a factor.

According to the Regulations, band 6 is curtailed last during a critical contingency. During the October 2011 contingency a pragmatic decision was made to allow consumption by band 5 consumers before restoring supply to band 6 consumers. Several stakeholders considered that this was the right approach, and that essential services should be restored before small commercial consumers (i.e. hospitals before cafes).

Some retailers affected by the October event suggested that including band 6 consumers within the curtailment schedule is a problem. There are approximately 13,600 customers in band 6⁵, which represents approximately 4-5% of demand. It is resource intensive to contact these customers and some stakeholders suggested the pay-off from curtailing small customers is relatively small⁶. The nature of small businesses can make it difficult to contact them and to confirm the message to curtail is received and understood. Many small consumers don't have time-of-use metering, so it is also difficult to determine compliance.

It was suggested that a better approach might be to treat band 6 consumers in the same fashion as domestic consumers (another 4-5% of total demand) and rely on a public appeal to encourage savings. Other retailers suggested that direct contact is more likely to be effective in achieving compliance, and that the existing approach should be retained.

Some stakeholders suggested that the use of annual consumption information is not necessarily the right means of differentiating between customers and that a seasonal or daily rate should be considered. Using annual consumption figures reportedly created some confusion when loads were restored, as consumption may have been higher or lower than was expected, although in one particular case this confusion could have been averted by requiring more information in the ESP designation process.

3.3 ESP and MLC Designations

It is apparent that ESP designations were not always well organised in advance, with 33 designations granted during the contingency. There may also have been some inconsistencies between retailer designations. In some instances it appears that retailers themselves may have been unclear as to whether a consumer should be considered an ESP.

There was a widespread suggestion from stakeholders that retailers may not be the best party to approve ESP designations and, as a minimum, someone independent should confirm the designation as appropriate, and the guidelines should be clearer. It was suggested that retailers may have a commercial incentive to take a lenient approach to designating consumers as ESPs. It was also noted that designations during a contingency can become "political", with some consumers potentially lobbying via the media and government.

Some stakeholders suggested that designations should be "frozen" in advance of a contingency to avoid parties seeking designations "on the fly" and applying political pressure. On the other hand,

⁵ See section 5 for more detail on curtailment bands.

⁶ Note analysis in section 5 which suggests that curtailing supply to this group of consumers can be very important under some circumstances.

several stakeholders considered that, although it was clearly preferable for designations to be organised in advance, maintaining flexibility to designate consumers during a contingency was important to provide for some cases where designations were clearly wrong. All stakeholders agreed that retailers and consumers need to be aware of their obligations in this respect.

3.4 Communications

Communications were a significant issue for several stakeholders and in some cases were considered a priority issue for improvement. There were several suggestions that the CCO was not sufficiently resourced to cope with providing effective communications at the same time as managing the contingency, particularly in the early phases.

Some stakeholders found the initial curtailment or declaration notices confusing because they received a large number of them from different sources. Some consumers even suggested that they were initially uncertain whether the email notices were legitimate. There was some suggestion that communications to retailers should come directly from the CCO, rather than indirectly via the TSO, to avoid delays in messages being received. However, others considered the TSOs to be the correct party to be delivering directions to retailers, because they need to be aware of directions, manage pipeline pressures throughout networks, and coordinate with the CCO.

All stakeholders indicated that the daily teleconferences scheduled by Vector and Gas Industry Co (in the mornings for retailers, shippers and TSOs, and in the afternoons for consumers) throughout the October 2011 contingency were generally very helpful. They allowed stakeholders to hear information “from the horse’s mouth”, and see that everyone was “in the same boat” and “sharing the pain”. However, some considered that they were slow to get started (the first one being on the Thursday) and became very cumbersome because of the large numbers participating.

Some stakeholders suggested that political and media communications were also slow to get organised and at times the messages were inconsistent with other information provided by the CCO and retailers. There were several suggestions that there is a need to establish a clear point of coordination for communications and appoint a spokesperson early in the process.

There were some suggestions that Vector was too conservative in estimating a timeframe for resolving the pipeline failure and terminating the contingency, and stakeholders would have been better served by a “best estimate” while taking into account an assessment of the risk that the estimate may be wrong. During the event, some large users were not prepared when supply came back earlier than they anticipated based on the Vector estimates, and therefore lost more production time than they considered necessary.

There were also suggestions the TSOs took too long to confirm that load could be restored after the CCO had advised at the daily teleconference that restoration could proceed.

Some large users felt they were, and continue to be, given insufficient information regarding the nature, duration and seriousness of the event, including the impact on the Vector pipeline, and the likelihood that it may happen again, in order to make appropriate risk-management decisions for their businesses. It was also reported that some insurance claims were still unprocessed because of a lack of information on the cause of the event. There was some suggestion that the Regulations should require an independent engineering evaluation to be made publicly available within a reasonable timeframe following the contingency to help with this.

3.5 Retailer / Consumer Preparation

During the October contingency it became apparent that the “load shedding category” in the registry was not accurate for many consumers and in some cases it appears that old “NGOCP designations” may have been “grandfathered” into the registry and became the default curtailment band in some cases. It appears that some retailers may have relied on the designation in the registry when acquiring a new customer. There were some suggestions that it would be preferable to have retailers maintaining the “load shedding category” in the registry rather than distributors, particularly if some form of independent approval of ESP and MLC designations was adopted. It was suggested that, at the very least, the registry bands should be validated through some form of independent audit process.

There was reportedly some confusion as to whether a designation should relate to a specific customer or a specific site, and it was possible that inconsistent approaches in respect of multi-site consumers were being applied.

Some stakeholders suggested there should be transparent access to an official list of ESP and MLC customers.

Preparation of consumers prior to the contingency was mixed. Some retailers had communicated effectively with consumers and they were aware of the possibility that they could be asked to curtail gas and that they were obliged to comply. In other cases the communication may not have been adequate and consumers were surprised by requests to curtail gas demand. Some consumers were aware of the options to be designated as ESP or MLC, but were confused about which was best for their circumstances. Others were not aware of the ESP or MLC designations at all. Some consumers were not aware of their potential obligation to curtail gas demand and spent some time reviewing their contract documentation before shutting down, introducing delays in the curtailment process.

Some stakeholders suggested that large gas consumers and retailers should have pre-approved “participant outage plans”⁷ similar to those required to cope with electricity rolling outages.

Some stakeholders noted that, while it is necessary to prepare customers for the possibility of a contingency, it is also important not to induce unnecessary security of supply concerns.

3.6 Curtailment and Restoration

During the contingency, three electricity generators were required to curtail consumption (Huntly, Te Rapa, and Southdown). Generators appeared to cope well in curtailing consumption, although one had initial communication problems, and subsequently established new procedures to ensure this does not happen again.

Electricity system operations were well prepared in advance, having conducted regular test exercises, and coped well with the loss of gas-fired generation. However, there were concerns, shared by various stakeholders, over having to work with a “single point of contact” with the CCO early in the contingency, with suggestions that it introduced unnecessary delays in getting messages out because the CCO was so busy.

⁷ These provide for mandatory demand reductions in an electricity supply shortage in accordance with redefined plans.

The electricity system operator suggested that, although it coped well with the loss of generation, it would have been helpful to receive more prior warning that a contingency was possible or likely. This would have allowed more modelling and analysis of options before the contingency was declared and facilitated a more considered electricity sector response. It was suggested that there was potential for an earlier warning and more frequent updates in the early phase of the contingency and this would have assisted with planning. Generators and some large consumers shared the view that an earlier warning could have been useful.

There was a suggestion of some initial confusion amongst some consumers about what “curtail” actually means (shut off gas connection, or stop consuming gas, or reduce gas consumption) and that it may be desirable to clarify this in the Regulations.

While most stakeholders accepted that turning off gas appliances and stopping consuming gas was the most appropriate approach, there was a suggestion that shutting off the gas supply at the meter may be preferable in some situations to ensure curtailment (particularly for situations with many staff and many gas consuming appliances). However it was acknowledged that this would require the cooperation of meter owners and would require a gas fitter to be available for restoring supply.

There was a suggestion that there could have been better coordination between the CCO and TSOs for the re-pressurisation process.

3.7 Other Issues

Compliance

Stakeholders generally considered that compliance with curtailment directions was very good overall and all key participants were doing their best in a difficult situation. However, there were some issues identified including:

- Slow compliance updates from some retailers and large consumers;
- Suggestions that there should be obligations on retailers to report breaches by consumers;
- That some users appear to have continued to take supply at reduced levels even though they were not designated as ESP or MLC.

Several stakeholders suggested that the lack of clear enforcement provisions within the Regulations is unsatisfactory and, if some consumers had been aware of this, they may have chosen not to comply with directions to curtail.

Regional / National definition

The interviews highlighted that there is a lack of clear understanding about the difference between regional and national contingencies and the application of contingency pricing. There were several suggestions that there needed to be more clarity around the definitions and when imbalance calculations and pricing would apply.

It was suggested that the CCO should be required to declare whether a contingency is regional or national in the initial declaration notice to give certainty to parties that may wish to respond to the possibility of contingency imbalances and contingency pricing.

Some stakeholders suggested that contingency pricing should be considered to compensate consumers that are curtailed, at the expense of consumers who are not curtailed, even if not a

national contingency. Others suggested that this would be overly complex and controversial, and would not produce any worthwhile gains.

Domestic gas users

One party suggested that there was a need to clarify or address the status of domestic customers, as they are not included under the Critical Contingency Regulations⁸. The suggestion is that there is uncertainty over what would happen if it were necessary to curtail domestic users as well as other consumers and there was scope for inconsistent directions.

⁸ We understand legal advice suggests the provisions of the Gas Act that empower the Critical Contingency Regulations do not allow for directions to domestic consumers and it would be necessary to amend the Gas Act to incorporate domestic consumers.

4 International Approaches to Managing Gas Contingencies

Summary

International approaches to contingency management and curtailment have been examined in the following nine jurisdictions:

- United Kingdom
- Ireland
- Eastern Australia
- Western Australia
- Spain
- Italy
- Slovak Republic
- Hungary
- USA

All of these markets have some form of curtailment provisions in place. The gas infrastructure in each country affects their approach to contingency management. Many have an infrastructure resilient to pipeline failures and are primarily concerned with a situation in which available supplies are insufficient to meet peak demand and must be rationed.

New Zealand may have a greater need for demand curtailment arrangements than many countries because of its long “stringy” pipeline network and lack of storage, LNG or geographically diversified injection.

Authority:

Contingency management is generally administered by the most prominent TSO.

Priority Order:

Each country has a different approach. While there are exceptions, curtailment generally proceeds in the following order:

- Customers on interruptible contracts and electricity generation
- Large non-domestic
- Small non-domestic
- Domestic
- Priority customers

In some countries, domestic customers are included as priority customers and/or may be exempt from curtailing. Priority customers may include health and care facilities, plant facing high damage costs or requiring some gas while switching fuels, and municipal services. Food processing and environmental considerations are provided for in some instances but not others.

Back-up arrangements:

Security standards must be met in some countries in terms of storage quantities or limiting reliance on a single supply source.

Dual-fuel electricity generators are often required to hold emergency oil stocks. Few other requirements appear to exist. Western Australia is considering obligations for retailers to source back-up arrangements sufficient to meet residential demand.

4.1 Overview of International Approaches

As part of this review, international approaches to managing significant gas outages have been examined, particularly approaches to allocating consumers or consumer groups to curtailment bands, and the existence of any requirements for end users to have back-up arrangements in place. The information gathered has then been used to compare and contrast the arrangements under the Regulations in New Zealand, and identify any areas where New Zealand could benefit from the ideas and experience of other jurisdictions.

Some high-level research was initially undertaken to determine which countries would be most appropriate to examine more thoroughly. Ideally the focus would be on countries with similar industry structures to New Zealand. However, this is difficult because New Zealand is relatively unusual in that it is geographically isolated and does not import or export any natural gas. The initial research identified that:

- Many countries depend upon imported gas to a large degree;
- Many countries have significant gas storage capacity;
- Some countries have import capacity that exceeds peak demand and/or highly resilient systems with numerous entry points;
- Several countries import LNG to provide additional supply resilience;
- Some countries have arrangements for interruptible supply contracts and fuel-switching;
- Gas and electricity security are becoming increasingly enmeshed as a result of a trend towards gas-fired CCGT generation and away from coal and oil fired power stations;
- Many countries have taken steps to develop gas contingency policies, and are able to cope if one key supply source is disrupted (i.e. N-1 operation). The European Union and International Energy Agency (IEA) have been encouraging members to take a proactive approach to managing gas security.

These factors all influence the degree to which contingency planning is seen as necessary, and the nature of any such plans.

Virtually all developed countries have some degree of contingency planning arrangements in place. However, these appear less of a concern for some countries that are gas exporters, have a low reliance on gas, or have highly resilient systems with numerous entry points. Furthermore, the major concern for most countries is a disruption to a supply source reducing the ability to meet peak demand, rather than a pipeline rupture that could isolate part of the network. Some countries therefore place a low priority on curtailing end-user demand, or do not have any arrangements in place. Because curtailment bands are a large focus of this review, this international research has focussed on countries that do have arrangements for curtailing customers.

Another factor that has influenced the selection of the countries examined is the ability to work through any language barriers that exist and access quality information. A number of Eastern European countries have been affected by disruptions to imports from Russia due to on-going disputes between Russia and Ukraine, and have reinforced their contingency arrangements in recent

years as a result. Western Australia also experienced a significant gas outage in 2008 and is implementing changes to its arrangements in response. This generally meant there was greater documentation available and discussion of their contingency arrangements.

Research was focussed on the following aspects:

1. The gas supply system, including annual and peak supply, gas pipelines, and the nature of demand;
2. The overall arrangements for managing gas contingencies, including empowering provisions (whether law/regulations or other), criteria for declaring a contingency, who has power to declare a contingency, who manages supply and demand during the contingency, and what powers they have to direct participants;
3. The arrangements for curtailing demand during a contingency, the sequence for curtailing demand (if any) and how the sequence was determined;
4. Any special arrangements for preserving supply to “essential service providers” and/or “minimal load consumers” during a contingency and how consumers get designated as either “essential service providers” or “minimal load consumers”;
5. Any arrangements to inform gas consumers about being prepared for gas contingencies and any planning by participants that is required in order to prepare for a potential contingency;
6. Any relationship with other emergency preparedness agencies such as Civil Defence Authorities;
7. The process for declaring a contingency and relaying curtailment directions to consumers;
8. Any experience with actual gas contingencies and how the arrangements performed in practice;
9. Any mechanisms for enforcing or incentivising compliance with gas curtailment directions.
10. Any other mechanism for ensuring security of gas supply, including requirements for back-up arrangements.

Summaries of the most relevant information for each country studied are provided in this section. A more detailed description of the contingency management arrangements for each country is included in the appendices to this report.

4.2 United Kingdom

The United Kingdom produces a relatively large proportion of its own gas, but also relies on pipeline imports and LNG. There are seven geographically diverse import pipelines, and LNG regasification terminals at the historical extremities of the pipeline network. LNG import facilities also hold a significant amount of storage, and there are multiple commercial storage facilities located throughout the country. The UK infrastructure by itself goes some way to providing security of supply from both supply disruptions and pipeline ruptures.

Curtailement is only used after other available measures (such as drawing on storage and injecting off-specification gas) have proved insufficient to address a contingency. The curtailment plan gives highest priority to hospitals and care facilities, where a lack of supply could put lives at risk. These take precedence above domestic consumers. Special consideration is also given to plant that would incur damage (above a specified threshold), and that requires some gas while switching fuels. Prioritising further consumers, such as food producers, or to avoid environmental damage, has been considered, but was not implemented because the benefits were not expected to exceed the adverse effect on the resilience of the curtailment arrangements.

The UK also transits gas to Ireland. Consumers in Ireland are essentially given the same priority as in the UK, so supplies to Ireland would only be interrupted to the point where curtailment in both countries was at the same level.

Table 2: Summary of the United Kingdom contingency management arrangements.

Aspect	Description
Supply source(s)	Around 65% domestic production. Remainder a mixture of pipeline imports from Norway and North West Europe, and LNG.
Main consumption category	Generation around 36% Residential around 34% Industrial around 13%
Contingency manager	The System Operator – National Grid Gas – takes on the role of Emergency Manager.
Communications protocol	Communication channel as follows: Emergency Manager → Transporter → Shipper → Consumer
Priority consumers	<ul style="list-style-type: none"> • Preservation of life – e.g. hospitals and homes for the elderly/disabled; • Gas to facilitate fuel switching; • Consumers where damage to plant would be in excess of £50m can continue to consume to perform an orderly shut-down to mitigate damage.
Curtailement based on	Curtailement of demand takes place in the following order: <ul style="list-style-type: none"> • Interruptible Supply Points. • Large Firm Supply Points (annual consumption > 2.6TJ) excluding Priority Supply Points (generally TOU). • Firm Supply Points (includes households) excluding Priority Supply Points. • Priority Supply Points.
Restoration based on	Not clear, though likely reverse of curtailment.
Other security arrangements/standards	Interruptible contracts Injection into storage curtailed in the first instance. Allow injection of non-specification gas Maximise withdrawals from storage; Halt to exports (except to Ireland) Public appeal for savings.

4.3 Ireland

Ireland is an isolated market in that the only real supply option is the UK. Storage provides only limited cover. To counter this dependency (to the extent that it can) there are three import pipelines from the UK entering at different points in the pipeline network. The pipeline network also includes a large loop, so if there is a pipeline failure, gas can still be delivered to most of the network.

Ireland uses fuel switching capability to provide security of electricity supplies. Irish consumers have equivalent priority to UK consumers to the extent that supplies can be maintained. However, demand curtailment is likely to be a necessary tool during a significant disruption.

Table 3: Summary of Ireland contingency management arrangements.

Aspect	Description
Supply source(s)	Approximately 90% imported via pipeline from the UK.
Main consumption category	Generation around 65% Residential, Industrial and Commercial each around 12-14%
Contingency manager	The System Operator – Gaslink – takes on the role of National Gas Emergency Manager.
Communications protocol	Emergency Response Team (headed by Gaslink) includes representative of Department of Communications, Energy and Natural Resources who interface with Central Government. Communication channel as follows: Emergency Manager → Network Owner → Consumer
Priority consumers	<ul style="list-style-type: none"> Hospitals and nursing homes including retirement homes; High-security prisons
Curtailment based on	Curtailment of demand takes place in the following order: <ul style="list-style-type: none"> Power generation; Large Daily Metered consumers by size: Daily Metered. Non-daily metered commercial and industrial customers Household customers and priority consumers.
Restoration based on	Not clear, though likely reverse of curtailment.
Other security arrangements/standards	Gas fired generation required to hold secondary fuel stocks sufficient to run at 90% output capacity for 5 days (base-load gen) or 3 days (mid-merit gen). No strategic storage, but commercial storage is required to cease injection, and withdrawals can be required.

4.4 Eastern Australia

The Eastern Gas Market in Australia comprises six states/territories, all of which have different contingency arrangements in place. For the most part this review focussed on the arrangements in Victoria⁹, which are operated by AEMO (Australian Energy Market Operator), and NSW.

NSW relies heavily on the market itself to address a contingency, including the coordination of voluntary demand reductions and load shedding. Commercial arrangements would be expected to adequately address any shortfall in gas supply. The State government may get involved in severe events if rationing is required to ensure supply to priority services and the security of the system. There are hence no real central arrangements for curtailment or other such defined responses, and agencies would likely rely on their wide-ranging emergency powers.

Conversely, Victoria requires AEMO to develop detailed contingency management arrangements, including curtailment and communications plans, and defers to them to maintain pipeline pressures and coordinate a measured and predictable response. AEMO’s plans cover short and long-term contingencies.

It is not immediately clear why the two states would have a different mind-set with regard to contingency management as they are part of an interconnected pipeline network, and AEMO has an operational role in all of the eastern states. AEMO operates a competitive wholesale market in Victoria which may have some influence. However, it may result from a continuation of historic arrangements prior to the opening of the National Electricity Market (and establishment of AEMO).

AEMO is also developing a Short Term Trading Market at defined hubs in various eastern states, and operates a “bulletin board”¹⁰ in the Eastern Market as a whole, which is a website that acts as a source of natural gas related information that is readily available to all interested parties, including the general public, and assists in emergency management.

Table 4: Summary of Eastern Australian contingency management arrangements.

Aspect	Description
Supply source(s)	Supply is from a number of domestic sources
Main consumption category	Industrial around 70% Residential around 17% Generation around 5% (fuelling approximately 8% of electricity output)

Victoria

⁹ The arrangements in other states in the Eastern Market and the Northern Territory were examined, but were found to have less information available and appeared broadly similar to the approach in NSW. Some information on these markets is included in Appendix 5.

¹⁰ See www.gasbb.com.au.

Victoria	
Contingency manager	The AEMO takes responsibility during a contingency. The State may take over high-level management in extreme scenarios.
Communications protocol	<p>Has a “Gas Emergency Communications Protocol” that was developed in consultation with stakeholders.</p> <p>Communications follow a defined path:</p> <p>Text notification to primary stakeholders → teleconference (smaller group of stakeholders) → Issue situation report → update supply/demand balance info (if required).</p> <p>AEMO acts as the media spokesperson, and develops messages in coordination with the wider industry. AEMO also coordinates with other government agencies and the National Gas Emergency Response Advisory Committee if necessary.</p>
Priority consumers	<p>Essential and Critical Services customers identified by the Department of Human Services are given highest priority – i.e. hospitals, aged and infirm residential institutions, laundries servicing these institutions, services providing blood plasma and related products to hospitals.</p> <p>Residential consumption also receives high priority, as do customers that would incur material damage to plant if curtailed.</p> <p>Some customers may be permitted to maintain a minimum level of consumption for public safety, health, plant safety or environmental reasons. Full exemption can only be granted at the time of a contingency provided sufficient grounds are provided.</p>
Curtailement based on	<p>Curtailement aims to stabilise pipeline pressures as quickly as possible, Curtailement hence proceeds on the basis of load size in terms of MDQ, with some exceptions:</p> <ul style="list-style-type: none"> • essential services are curtailed last; • uninterruptible processes and gas for converting or starting up alternative fuelled plant are curtailed after all other large industrial and commercial; • voluntary reductions are formally provided for • Consumers with an uplift hedge on pipeline capacity are curtailed after consumers without. <p>Consideration would also be given to the effect on the electricity system.</p> <p>Small customers are able to “self-exempt” from curtailement if they meet Department of Human Services guidelines on medical and other related grounds.</p>

Victoria	
Restoration based on	<p>When restoring load, or when rationing a restricted supply over longer periods, AEMO operates with regard to a number of defined principles. These include:</p> <ul style="list-style-type: none"> • Priority given to maintaining the integrity and pressures of pipelines ; • Minimising health and environmental risks; • Minimising long term economic damage to industries; • A “jobs before showers and heaters” approach. <p>Restoration/rationing is hence based on the following priority order:</p> <ul style="list-style-type: none"> • Essential services (e.g. hospitals); • Critical services – bread/milk/pharmaceuticals/essential service supply chains; • Services for environment and health, and plant with high associated damage; • Key economic industries – large industries first, industries where workers have been stood down, supply chains, food processing etc; • Residential – cooking and hot water, followed by area heating • Non process heating – building heating, commercial showers, pool heating, dual fuel users.
Other security arrangements and standards	It does not appear that there are any official security requirements.

New South Wales	
Contingency manager	<p>NSW relies heavily on market participants to coordinate load shedding and voluntary demand reductions, with system operators predominantly in charge of this process.</p> <p>The state government may get involved if rationing is required, in which case the “Energy and Utility Services Functional Area Coordinator” (EUSFAC) (an appointed position within the energy ministry) coordinates the response.</p>
Communications protocol	<p>System Operators inform a “Jurisdictional Coordinator” - appointed under emergency legislation – about their actions for mitigating a contingency, and use their normal processes for communicating with other market participants.</p> <p>If government considers it necessary to intervene, the Jurisdictional Coordinator acts as a go between for the industry and EUSFAC, including coordinating with a National response committee if required. The Minister becomes the source for public information.</p>
Priority consumers	<p>The NSW Government prioritises public order, safety and community services, including:</p> <ul style="list-style-type: none"> • Continuity of government; • Municipal services – wastewater, water, communications, transport • Health and care services; • Law and order and emergency provision; • Animal welfare • Banking services etc.

New South Wales	
Curtailement based on	It does not appear that NSW has a specific plan for curtailment, beyond protecting priority consumers.
Restoration based on	It does not appear that NSW has a specific plan for restoration.
Other security arrangements/ standards	None that are apparent.

4.5 Western Australia

The Western Gas Market network is geographically isolated and storage is minimal, but it ordinarily produces significantly more gas than it uses, the excess being exported as LNG. However, the network remains relatively exposed to the loss of a key gas producer (as was experienced in 2008) because it is commercially difficult to divert supply from exports to domestic use. Furthermore, in-State gas demand is concentrated in the south west (Perth area) whereas gas production is mainly in the north west of the State. The pipeline network consists of long, un-meshed arterials, and would therefore likely suffer in the event of a significant pipeline rupture.

Western Australia, like New South Wales, relies heavily on industry participants to address a contingency, and would expect commercial arrangements to prevail in directing a limited supply of gas to its most economic use. The State Government would only get involved as a last resort if commercial strategies are insufficient, and it can assist in rationing gas to stabilise pipeline pressures, or employ other emergency measures as required. Rationing, either by industry participants or government, is based on a recommended priority order developed following an extended outage in 2008. A number of other initiatives have been considered or implemented since that outage to “beef up” security, communication and preparedness.

Table 5: Summary of Western Australian contingency management arrangements.

Aspect	Description
Supply source(s)	Domestic production, largely from basins off the North West Coast. Also exports LNG overseas.
Main consumption category	Industrial around 70% Generation around 25% (fuelling approximately 60% of generation capacity) Very small portions of commercial and residential.
Contingency manager	The Minister for Energy can approve rationing organised by a pipeline owner. For emergencies, the Hazard Management Agency – also the Public Utilities Office coordinates a response. Few formal arrangements outside of a declared emergency.

Aspect	Description
Communications protocol	<p>A communications protocol was developed following the 2008 outage, outlining processes during a “green”, “amber” and “red alert” scenario.</p> <p>Green and amber situations primarily involve just industry participants.</p> <p>For a “red alert” situation, the Public Utilities Office deals with info requests from the public via its Media Liaison Officer. The relevant producer/transporter notifies customers and shippers and deals with info requests from industry.</p>
Priority consumers	<p>The recommended priority order is as follows (from highest to lowest):</p> <ul style="list-style-type: none"> • Energy infrastructure – production/supply/distribution to support electricity/gas/fuel networks, e.g. to maintain pipeline pressures, avoid large-scale electricity black-outs, and ensure supplies of liquid fuels for dual-fuel generation¹¹; • Essential services – water supplies, health services and care facilities, waste and wastewater management, maintain emergency service provision, maintain law and order; • Residential customers; • Industries providing essential goods and services to the community – basic food supplies, child protection, animal industries, mortuary services, communication networks, banking services, government services; • All other industries.
Curtailment based on	<p>Arrangements are relatively informal. A “Priority Allocation Schedule” provides a guide as to how to allocate limited supplies to priority uses, but it appears flexible as to how it is applied.</p> <p>Dual fuel plant would be expected to switch.</p> <p>Commercial mechanisms may work to limit supplies to some customers in the first instance, including electricity generators.</p>
Restoration based on	Not clear
Other security arrangements/standards	<p>Following 2008 outage, consideration of changes to:</p> <ul style="list-style-type: none"> • Provide incentives for generators to include dual fuel capability and strategic fuel stocks; • Require gas retailer to have back-up supply arrangements to cover its small consumers and offer it to any other distribution customers; • Increasing storage capacity near Perth.

4.6 Spain

Spain’s primary concern with regard to gas security is the “islanded” nature of its gas system. While storage can provide cover for around 20 days, it is unable to meet peak demand because of limited withdrawal capacity. Spain’s main contingency management tool is therefore the diversification of

¹¹ Although energy infrastructure has priority, we understand this is only to the extent necessary to avoid shortages in other fuel supplies.

its supply sources, with operators required to maintain a diversified portfolio so as to avoid a single-point-of-failure.

Curtailment of consumer demand, whether by design or default, is relatively unspecific as far as could be ascertained, noting that Spain has not had experience with a significant gas contingency in recent history. However, curtailment is based on a number of specified objectives; In curtailing demand, the contingency manager must use best endeavours to minimise economic and technical harm, maximise the degree of operation, minimise the consumers affected, maintain fairness between the consumers affected, and minimise intervention.

Table 6: Summary of Spain contingency management arrangements.

Aspect	Description
Supply source(s)	Almost entirely imported (>99%): around 75% LNG and 25% pipeline
Main consumption category	Electricity generation (50%) Industrial (30%) Residential (10%)
Contingency manager	Enagás, which owns and operates most of the transmission network and LNG regasification terminals, and operates the storage facilities
Communications protocol	Enagás has a process for communicating with curtailed customers, and is responsible for keeping government agencies up to date at all times and coordinating with the electricity System Operator.
Priority consumers	<ul style="list-style-type: none"> • health centres, hospitals • kindergartens and schools for compulsory education • nursing homes • national defence institutions, fire protection, police etc • public transportation
Curtailment based on	Priority order: industrial & generation > commercial > residential > priority consumers. Arrangements for fuel switching and part loads to be curtailed. Curtailment of generation dependent on effect on electricity network.
Restoration based on	Reverse order of curtailment
Other security arrangements/standards	Operators required to diversify their supply sources to avoid single point of failure Minimum storage requirements (20 days) CCGTs can switch fuels though not required to

4.7 Italy

Italy's contingency arrangements are designed to withstand long periods of reduced supply. Because gas supplies are relatively diversified and there is significant storage capacity, a situation in which it would be required to curtail large amounts of demand is unlikely. Curtailment is financially incentivised, and only required by large industrials and other TOU customers that voluntarily sign up

to the incentive scheme. Furthermore, these consumers are not required to curtail *fully* – but rather reduce consumption on a pro-rata basis to achieve a particular industry-wide reduction.

Italy is heavily dependent on gas-fired electricity generation, which is not obliged to curtail, except where it is generating electricity for export. Switching fuels and importing electricity are all options for reducing gas demand in extreme situations, but these actions are expensive, and hence other measures, including demand curtailment as above, will be employed before either option.

Table 7: Summary of Italy contingency management arrangements.

Aspect	Description
Supply source(s)	Around 90% imported, largely by pipeline from Algeria and Russia, as well as Norway and Netherlands.
Main consumption category	Generation around 40%, with > 50% of electricity met by gas. Industry and commercial around 15% Residential 26%
Contingency manager	Technical Emergency Committee for the Gas System, which includes representatives from industry and the state.
Communications protocol	Not clear.
Priority consumers	All consumers except industrial customers directly connected to the transmission network, electricity generators that are generating electricity for export, and TOU customers that voluntarily sign-up to the curtailment regime. Businesses using gas for cogeneration, or that need to consume a consistent amount of gas over time, are also protected.
Curtailment based on	Three set levels of total curtailment to achieve, which is pro-rated across all affected consumers. These consumers benefit economically for curtailing or are penalised for not curtailing. All other consumers can maintain full consumption, but they also fund the incentives for others to curtail. Essential public services are exempt from funding the regime.
Restoration based on	Not applicable
Other security arrangements/standards	Shippers obliged to import at maximum capacity for winter or face penalties. Dual fuel plant obliged to hold oil stocks, carbon emission limits removed if switching required. Reduced heating time/temperature for residential customers. Import electricity to reduce domestic generation and hence gas consumption.

4.8 Slovak Republic

The Slovak Republic has contingency arrangements that are designed to withstand long periods of reduced or insufficient supply. It is heavily reliant on gas imported from Russia. While it can contract for fuel with its other interconnected neighbours, this is generally only done during a contingency. Slovak Republic is hence susceptible to supply disruptions and maintains storage volumes to help address this concern (as well as to help meet peak demand in winter). However, this storage, while

being able to last for some time, cannot meet peak demand by itself, hence cuts to customers can, and have been used.

Low winter temperatures significantly impact on contingency management strategy, with winter peak demand being 5 times higher than summer peak demand. Maintaining consumption for heating is seen as a high priority, and curtailment for consumers primarily dependent on gas for heating purposes proceeds on a different basis to consumption primarily for processing purposes.

Table 8: Summary of Slovak Republic contingency management arrangements.

Aspect	Description
Supply source(s)	Almost entirely imported from Russia. Transit to Austria and Czech Republic, though pipeline flow direction can be reversed.
Main consumption category	Industry, generation and residential all comprise around 25%
Contingency manager	Largest distribution network operator (SPP distribúcia), the parent company of which also owns the TSO and is the main importer/wholesaler of gas. These parties work together quite closely during a contingency.
Communications protocol	SPP- distribúcia is required to communicate with the Minister of the Economy and inform the public via TV and radio.
Priority consumers	There is a “safety minimum” for most customers. This provides protection for essential services and assurances of safety and damage prevention for production facilities. Essential services include: <ul style="list-style-type: none"> • Customers engaged in production of essential foodstuffs • Animal processing • Health facilities • Waterworks and waste water treatment plants
Curtailment based on	2 broad categories: Those whose gas consumption is primarily for heating purposes and those for whom it isn’t. Consumers using gas primarily for heating are curtailed based on a “heating curve” – i.e. consumption allowance drops to 90%, 85% etc of normal consumption with increased crisis severity. Consumers using gas primarily for processing are curtailed based on their size, larger to smaller, across 7 severity bands. Fuel switching accounts for two of these bands. Both streams may be enacted at the same time, though curtailing process heating would proceed first.
Restoration based on	Reverse order of curtailment
Other security arrangements/standards	Sufficient gas storage must be maintained to cover an instance where: <ul style="list-style-type: none"> • The total gas supply falls by 30% for a period of 10 weeks; • There are five consecutive days where the average daily temperature falls below -12°C; and • The country experiences a 1 in 20 year low-temperature event. Pipelines with neighbours are reversible and supply contracts are also held with these countries.

4.9 Hungary

On the face of it, Hungary is in a similar situation to the Slovak Republic, in that it imports the vast majority of its gas from one source. However, Hungary fared much better in 2008 when supply from Russia was disrupted, and was able to help transit gas to other affected countries. A number of factors contribute to this relative security, including a higher proportion of domestic production, large storage capacity designed to meet full residential demand, and the ability to import gas from western neighbours if necessary.

Hungary can also rely on a number of other tools at its disposal, including alternative fuels for larger power plants, the ability to increase production for short periods, and public appeals for savings, with no obvious reluctance to use any or all of these options. Hungary can also implement demand curtailment, with curtailment bands primarily based on size, although domestic and priority consumers do not face curtailment.

Table 9: Summary of Hungary contingency management arrangements.

Aspect	Description
Supply source(s)	Mostly imported: mostly from Russia, but also other parts of Europe. Transits to other SE and Western European countries. 25% domestic production
Main consumption category	Residential (35%) Electricity generation (30%) Industrial (13%)
Contingency manager	Földgázszállító Zrt (FGSZ) – the TSO, though the regulator/Minister may also get involved.
Communications protocol	Not clear
Priority consumers	Supply to these consumers must be guaranteed in even the most severe crisis: <ul style="list-style-type: none"> • TSO • Domestic consumers and other residential buildings; • Medical centres; • Consumers where restrictions could cause health or environmental risk; • District heating power plants
Curtailment based on	8 categories largely based on hourly consumption (m^3 /hour) in order of decreasing amount. However fuel switching within four hours is provided for in the first instance and time is provided to implement any curtailment instruction. Consumers can distinguish between different loads at the same site by having them in different categories. Consumption for supply of food is curtailed last. Priority customers are exempt.
Restoration based on	There appears to be some allowance for consumers to access up to 10% of their regular load for restricted periods if allowed by the Contingency Manager. Further restoration is assumed to proceed in reverse order of curtailment

Aspect	Description
Other security arrangements/standards	<p>Power plants > 50MW to hold emergency oil stocks for 8 days.</p> <p>Gas production can be increased by around 20 TJ/day (~7%) for 2-3 months.</p> <p>The Government may also:</p> <ul style="list-style-type: none"> • Reduce opening hours and heating temperatures of public buildings; • Make a public appeal for gas reductions; • Declare free public holidays; • Remove the excise tax on imported fuel oils to incentivise switching

4.10 United States

The USA gas market is widely inter-connected, with multiple supply points and sources, and pipelines and pipeline owners that do not necessarily coincide with any single legislative jurisdiction. It appears that, for these reasons, as well as the overall size of the market, contingency management is primarily industry driven, with distribution network owners having most of the responsibility.

Transmission pipeline owners have curtailment plans, which cover any customers connected directly to the grid, and demand curtailment from a distribution network. The distribution network owners typically have their own plan for curtailing demand from their customers, sufficient to meet any direction provided by the transmission pipeline owner. Given that there are often multiple distribution network owners in any state, there are a large number of curtailment plans used throughout the USA.

Transmission owner curtailment plans are governed by federal legislation, and distribution network curtailment plans by varying degrees of state legislation. Collectively, the legislation results in hospitals (and other critical care facilities) and domestic consumers receiving the highest priority in all states, and special protection for agricultural consumers in order to maintain food supply.

For this review, the arrangements at National, State and distribution network level have been described broadly. The Wisconsin Public Service Corporation has been used as an example of a distribution network owner.

Table 10: Wisconsin contingency management arrangements.

Aspect	Description
Authority	<p>National: Secretary of Energy/President</p> <p>State: State Governor, State Regulatory Commission or both, though they are involved to varying degrees in each State. Some can exercise Authority during a contingency while others leave it to distribution network owners.</p> <p>Local: In Wisconsin, the State does not exercise Authority during a contingency, with the Wisconsin Public Service Corporation (WPSC), a private distribution network owner and retailer within Wisconsin, responsible for curtailment of its customers.</p>
Communications protocol	<p>National: President or Secretary of Energy</p> <p>State: Transmission companies will require curtailment from their customers.</p> <p>Local: WPSC notifies its customers of requirement to curtail.</p>

Aspect	Description
Priority consumers	<p>National: Interstate pipeline owners can't curtail customers for "essential agricultural use" or "essential industrial process or feedstock", except if they can switch fuels, or their gas is used for higher-priority purposes, being residents, small commercials, hospitals, schools, or other purposes affecting life/health/physical property. This presumably requires coordination with distribution companies.</p> <p>State: States generally have similar priorities for the use of gas, with hospitals and other medical or care facilities having highest priority. Priority is also given to residential customers, schools, police/fire protection, sanitation, fuel production, perishable food and medicine facilities. Electricity generation may be given priority in some states.</p> <p>Local: For the WSPC network, priority customers are as approved by the WSPC following a request in writing, and where curtailment will result in emergency conditions or shutdown of operations.</p>
Curtailment based on	<p>For the WSPC network, curtailment is based on the customer's tariff category, which results in a priority order broadly as follows:</p> <ul style="list-style-type: none"> • Customers on seasonal contracts and > 2TJ/year; • Fuel switching; • Public call for conservation; • Interruptible customers by size for which there are three categories; • Commercial and industrial customers by size for which there are four categories • Residential customers and priority customers <p>Customers must curtail to levels determined and specified by the WSPC. There are penalties for any consumption above that level (\$1/therm)</p>
Restoration based on	Not clear
Other security arrangements/standards	<p>National: If the President considers a national gas shortage exists, they can require electricity generation to switch to alternative fuels where possible.</p> <p>State: Some states require alternative fuel stocks be held by certain customers. The majority of states have interruptible contracts. One state requires that back-up services are available for high-priority consumers.</p> <p>Local: For the WSPC network, customers that switch to alternative fuels may be reimbursed their incremental costs.</p>

4.11 Summary

When drawing conclusions from the information gathered in the international research it is important to consider the context in each case, and the extent to which that context has application in New Zealand. New Zealand is unusual in that it is geographically isolated and doesn't import or export gas. The New Zealand infrastructure reflects this relatively unusual situation.

New Zealand sources all of its gas from domestic production centred in the Taranaki region. While it is all produced in the same region, it is sourced from a number of different gas fields, therefore providing multiple supply sources. The pipeline network includes a number of single arterials stretching south and east from Taranaki. A larger pipeline stretches north to Auckland and is reinforced by a second smaller pipeline, which allowed some consumers to maintain supply for most

of the October 2011 contingency. However, the pipeline network is not highly “meshed” in the sense that supply could be maintained if there was a fault in any pipeline, by directing gas around another route. NZ has one commercial gas storage facility, also located in Taranaki, and no strategic stocks or LNG facilities.

Most of the international markets examined have a very different infrastructure to New Zealand. Many are part of a large interconnected and “meshed” network, or have supply injected at a number of geographically diversified points on the network. They are therefore relatively impervious to single pipeline failures.

The key concern of the European countries is overwhelmingly a long-term disruption to a key supply source that affects their ability to meet peak gas demand. European Union regulations require that emergency plans cover the “foreseeable” duration of an event. These European countries generally have security standards that have to be met. For example, they must have sufficient storage to cover certain events (such as a particularly cold winter, or a particular reduction in supplies), or diversify their supply sources. Storage and/or LNG play a role, to varying degrees, in maintaining supplies to the most important customers in the European countries. These strategies are likely to be less relevant to New Zealand because it may not be economically feasible to develop LNG facilities, multiple storage facilities, or a “meshed” pipeline network, simply to enhance security of supply against what is expected to be a rare event¹².

In many cases the countries examined specify varying degrees of severity for a contingency. For example, a “level 1” crisis might be solved by increasing imports and a “level 2” crisis by drawing on storage. The existence of multiple methods for balancing supplies provides several options for defining and managing a contingency. Demand curtailment is generally only used while alternative supply arrangements are put in place, or when other contingency arrangements prove insufficient to address a supply shortage.

While New Zealand would be affected by a production failure, as evidenced by the Pohokura outages in July 2010 and March 2012, it is generally expected that commercial arrangements would work to direct scarce gas resources to their most economic use if such an event were sustained over a long period (i.e. over weeks or months). Further, because New Zealand is unable to rely on storage, LNG, or other supply-side measures to ensure supply, and has a long “stringy” pipeline network, it is susceptible to outages caused by pipeline failures. The contingency arrangements are therefore focussed on the shorter term goal of stabilising pipeline pressures. Demand curtailment is the primary tool for addressing a contingency, and is therefore likely to be more important than in many other countries.

The Western Australian gas infrastructure is the most analogous to New Zealand of all the countries examined. It is similarly isolated and features long un-meshed arterial pipelines. The main difference between the two markets is that Western Australia produces much more gas than it consumes. However, it is still susceptible to contingencies, as was evidenced in 2008 when it was

¹² Contact Energy and Genesis Energy formed a joint venture in 2004 to import LNG into New Zealand, though any facilities were to be situated in Taranaki (and would hence have negligible effect during an event such as in October) and the project has since been shelved. Such facilities may be progressed at a later stage if the future gas supply in New Zealand becomes more uncertain. See <http://www.energynews.co.nz/briefs/lng/3428/gasbridge-lng-on-hold>

significantly affected by a supply disruption that it did not appear well prepared for. Western Australia relies on market participants to address any contingency, except in extreme scenarios. Despite the similar infrastructure, there are few similarities with the New Zealand contingency management approach.

The contingency management practices in the Victorian market appear the most analogous to New Zealand. Victoria relies on a designated contingency manager, and while its general infrastructure is somewhat different to New Zealand, curtailment is seen exclusively as a means of stabilising pipeline pressures in the short-term.

Curtailment order

European countries all tend to have large customers on interruptible contracts and supply to these customers would be curtailed in the first instance, often before other contingency management options are used.

Domestic customers are low in the curtailment order (high in priority) in all countries. The European Union has regulations that aim to protect domestic customers in member countries during a contingency. In Hungary and Italy domestic consumers are exempt from any curtailment requirement.

In the Slovak Republic, customers whose consumption is for heating purposes (primarily domestic consumers and public services) are treated differently to consumption for processing purposes, because of low winter temperatures. However, the means by which they curtail gas for heating is interesting, as it is based on what they call a “heating curve”. There are three different levels of curtailment severity for these customers:

- Under level 1, consumers can use gas un-restricted;
- Under level 2, consumers are restricted to a percentage of their regular load (e.g. 90%).
- Under level 3, consumption is restricted further, for example, to 80% of their regular load.

The Victorian and Wisconsin curtailment procedures both provide specifically for a public conservation campaign to be called.

All countries tend to give highest priority to hospitals and other critical care facilities, as well as domestic customers. In Victoria Australia, while domestic consumers can be required to curtail demand, small consumers may “self-exempt” from curtailment on medical or other related grounds as defined by the Department of Human Services. These consumers are instead curtailed along with other critical care services under the final curtailment band.

Further priorities are mixed, although several countries prioritise municipal services such as waste and wastewater services, and police and fire services. The Slovak Republic, Hungary and the United States specifically prioritise food processing. Interestingly, the United Kingdom has considered this but decided against it, because the negative impact on security was considered to be greater than the benefit to food supplies.

The arrangements in Hungary appear to include a “not restricted category” (which includes domestic consumers, hospitals and other critical care facilities), and a category just above that for food production (excluding alcohol and soft drinks) and protection of the environment¹³.

Victoria, while having a fairly typical priority order for curtailment, has different priorities when rationing a limited supply of gas or reinstating load, which includes a “jobs before showers” approach, with supply being provided to critical services and key economic industries, before providing for supply for space heating and residential use. This appears to be one of the most comprehensive approaches to long-term rationing and may reflect that Australia generally has a warmer climate than many European countries, but also reflects a specific principle of preserving economic and employment interests where possible.

Other approaches to rationing a reduced supply of gas include Italy’s plans to reduce consumption on a pro-rata basis across consumers that are incentivised to comply through financial rewards and penalties. Hungary appears to have a provision for consumers to access 10% of their normal load for restricted periods if the System Operator allows.

Consumption metric

There was mixed use across the countries examined of different consumption metrics (annual consumption or daily consumption) for determining curtailment bands. Hungary uses an hourly consumption figure, AEMO and Italy both use a daily consumption figure, and the Slovak Republic, Wisconsin and Ireland use an annual consumption figure.

Back-up arrangements

Italy provides incentives for customers to switch fuels or reduce consumption by providing financial compensation, funded by payments from other customers. It may also suspend carbon emission limits for customers that switch fuels. Wisconsin also considers reimbursing consumers that switch to a higher-cost fuel. Western Australia is currently considering incentives for generators to provide dual fuel capability and hold strategic stocks. Italy requires generators with dual fuel capability to hold emergency stocks. Hungary and Ireland both appear to require generators to have dual fuel capability and maintain stocks. The countries requiring back-up fuel arrangements typically allow time for generators to continue consuming gas while they transition to back-up fuels.

Penalties

In Australia, the relevant legislation for each state¹⁴ (either emergency or gas/energy legislation) includes the potential for financial penalties for any breach of an instruction given during a declared emergency. There are similar provisions in the National Gas Rules for Victoria. These penalties are generally in the vicinity of \$5,000 - \$10,000 for an individual, and are larger for a corporate (from around \$20,000 to \$250,000, depending on the state and legislation). In many states there are further penalties for each day a breach continues after being formally identified (from \$50/day to

¹³ The detail of these arrangements is not entirely clear from review of published documents. This description should therefore be treated as a general guide.

¹⁴ In this instance, including all eight states/territories, not just New South Wales, Western Australia, and Victoria.

\$10,000/day, depending on the state, legislation and whether it’s an individual or corporate offending).

The incentive scheme in Italy imposes financial penalties on consumers that are required to reduce their load but don’t (or don’t drop sufficient load). The scale of these penalties is determined ex-post.

Our research has not revealed the extent to which financial penalties are applied in the other countries examined.

Communications

For most countries the regulations specify a particular party to coordinate media and communications, and many require that Ministers are kept up-to-date. Table 11 summarises spokesperson arrangements for those jurisdictions where we have been able to determine them.

Table 11: Communications Spokesperson during Contingencies

Jurisdiction	Spokesperson	Support and liaison
Victoria	AEMO (in its role as contingency manager).	Key messages are developed in coordination with communications managers from the wider industry.
Western Australia	Public Utilities Office (exercising emergency powers)	Public information coordinated by “Public Information Team” and developed with support from government media advisors.
NSW	Minister or Minister’s delegate (exercising emergency powers)	Public information developed in consultation with other emergency response parties
Spain	Enágas (in its role as contingency manager) coordinates all communications.	
Slovak Republic	SPP distribúcia (in its role as contingency manager)	Key messages are developed in coordination with parent company which also owns TSO

In several instances the Contingency Manager (who is usually a significant transmission or distribution operator) takes on the role as media spokesperson, although media statements are generally required to be formed in coordination with other stakeholders. While government agencies take on this role in NSW and Western Australia, there is no real centralised contingency response in these jurisdictions, except under emergency legislation for extreme scenarios.

5 Curtailing Gas Demand during a Contingency

5.1 Curtailing Gas Demand in the New Zealand Context

New Zealand's isolation and the relatively small size of the gas market mean that it is unlikely to be economic to maintain supply-side security options such as investment in storage, additional pipelines, or LNG facilities that are prevalent in many countries as a means of addressing extreme security of supply risks. The most economic means of managing gas contingencies in New Zealand is therefore likely to involve orderly curtailment of some gas demand.

Curtailing gas supply inevitably involves some costs to consumers and the economy. It is therefore important for New Zealand to have critical contingency and demand curtailment arrangements that operate efficiently to minimise these economic costs. The arrangements in New Zealand involve a high priority on maintaining supplies to domestic and small commercial premises in the first instance and to some essential services. Maintaining supply to domestic and small commercial premises is designed to avoid the very high cost and safety issues associated with any relighting process¹⁵.

By way of example, the Longford Gas Plant accident and Victorian gas supply interruption in 1998 lasted for 19 days and supplies of natural gas to domestic and industrial users were halted. Approximately 1.3 million households and 89,000 businesses were affected. It was estimated that the total cost to industry and commerce was AU\$1,300m¹⁶. A simple estimate based on customer numbers has suggested a cost of approximately \$250m¹⁷ for a similar system wide interruption involving a relighting process in New Zealand.

The New Zealand Institute of Economic Research estimated the October 2011 outage cost the country more than \$40 million a day¹⁸ as a result of the gas supply outages to a myriad of small, medium and large businesses.

The order of curtailing supply to gas consumers is important because this has a critical impact on the likelihood of losing pressure in distribution systems and therefore triggering a re-light process. The biggest gains are to be made by curtailing electricity generation (often 70-80% of supply), followed by other large consumers (typically 15% of supply). During a sustained outage, rationing available supply to maintain pipeline pressures and sustain domestic supplies may require further cuts of supply to small (non-domestic) consumers.

When deep cuts are required (such as during the October 2011 contingency) MLC and ESP designations, and the priority of supply for small consumers, becomes important to minimise the

¹⁵ Gas lines need to be purged, and service restored on a progressive basis across the network. This generally requires the installation of a large number of new isolation valves on the network and a door-to-door relight process

¹⁶ Emergency Management Australia (2006); Longford Gas Plant Accident and Victorian Gas Supply Crisis

¹⁷ Gas Outage and Contingency Management Arrangements; Gas Industry Co; October 2007

¹⁸ www.3news.co.nz/Maui-pipeline-gas-outage-costing-40M-a-day---NZIER/tabid/423/articleID/230942/Default.aspx

overall costs to the economy. It is therefore important that these arrangements are clear, precise and can be readily implemented.

5.2 The Curtailment Bands

The key to managing gas demand during a critical contingency is to curtail supply to gas consumers to the extent necessary to maintain pressure within the pipeline system. The Regulations therefore provide for the CCO to curtail supply to gas consumers according to a series of curtailment bands. The curtailment bands are included in schedule 2 to the Regulations and are reproduced in Table 12.

Table 12: The Existing Curtailment Bands

Curtailment band	Consumption (TJ)	Description
0	N/A	Gas off taken for injection into storage
1a	More than 15TJ per day	Consumers (excluding essential service providers) supplied directly from the transmission system and that have an alternative fuel capability. If minimal load consumer then manage wind-down of plant
1b	More than 15TJ per day	Consumers (excluding essential service providers) supplied directly from the transmission system and that do not have an alternative fuel capability. If minimal load consumer then manage wind-down of plant
2	More than 10TJ per annum and up to 15TJ per day	Consumers (excluding essential service providers) with alternative fuel capability. If minimal load consumer then manage wind-down of plant
3	More than 10TJ per annum and up to 15TJ per day	Consumers (excluding essential service providers) without alternative fuel capability. If minimal load consumer then manage wind-down of plant.
4	More than 2TJ per annum and up to 10TJ per annum	Consumers, excluding essential service providers. Minimal load consumers in curtailment bands 1a to 3 curtailed in full
5	More than 2TJ per annum	Essential service providers
6	2TJ or less per annum	All remaining consumers ¹⁹

Source: Gas Governance (Critical Contingency Management) Regulations 2008

When curtailing gas demand the CCO is required to follow the priority order set out in the table, with band 0 curtailed first and band 6 curtailed last. When restoring gas supply the CCO is required to follow the reverse order, with band 6 consumers the first to be restored. If the TSO and CCO consider that the purpose of the Regulations (having regard to the objectives of the curtailment arrangements) would be best achieved by an alternative restoration order, restoration may occur in a different order from the reverse curtailment order.

¹⁹ This does not include domestic consumers as domestic consumers are not covered by the Regulations

The curtailment schedule was designed to allow the CCO to stabilise the pressure in parts of the pipeline system during a critical contingency, while prioritising the supply of gas to essential service providers and to consumers that require a minimal gas supply to mitigate serious damage to plant or significant environmental damage, and minimising the net public cost of the contingency. The general presumption is that by curtailing gas supply to large consumers first and maintaining gas supply to small consumers, costs to the economy are likely to be minimised.

The number of consumers and the aggregate annual consumption for each of the curtailment bands are outlined in Table 13. This table includes consumers who were designated as ESPs during the October contingency. It also includes the number of consumers and associated annual gas volumes that were curtailed during the October 2011 contingency.

Table 13: Current Curtailment Bands (following October 2011 Contingency)

Curtailment Band ²⁰	Number of Consumers		Consumption (TJ pa)		Size of Band (% of annual supply)
	Total	Curtailed	Total	Curtailed	
1 (>15TJ pa)	11	3	118,808 ²¹	52,500 ²²	74%
2 (>10TJ pa)	17	11	2042	1933	1%
3 (>10TJ pa)	1,148	1,020	17,139	14,352	11%
3 (MLC)	28	19	6,281	5,315	4%
4 (>2TJ pa)	1,112	816	2,108	994	1%
5 (>2TJ pa)	321	202	3,708	2,517	2%
6 (<2TJ pa)	13,622	8,997	3,359	2,364	2%
Domestic	253,419	136,006	6,555	3,237	4%
Total	269,678	147,074	160,000	83,212	100%

Source: Critical Contingency Operator and 2011 Energy Data File

Table 13 highlights that curtailing the large band 1 consumers generally provides the greatest opportunity to support pipeline pressure during a major gas contingency (depending upon the region impacted by the contingency). Curtailing consumers with annual consumption exceeding 10TJ per annum (bands 2 and 3) generally offers an additional 16% saving and once bands 1, 2 and 3 are fully curtailed, the remaining bands (4, 5 and 6) would generally provide only an additional 5% saving. Domestic consumers (who are not covered by the Regulations) comprise only 4% of consumption.

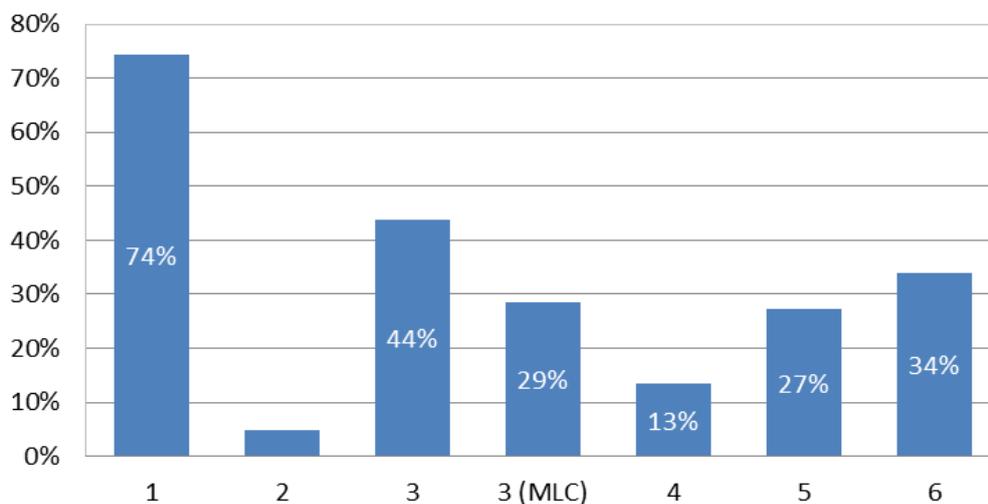
²⁰ Band 0 (injections storage) omitted for convenience

²¹ Estimated based on total gas consumption of 160PJ from 2011 Energy Data File

²² Estimated annual consumption

This suggests that relatively small savings are available from bands 4, 5 and 6, and they might therefore be relatively unimportant. However, during a prolonged contingency when it is becoming difficult to maintain gas pressures, the ability to curtail supply to bands 4, 5 and 6 could become critical to maintaining pressure in the domestic gas network and avoiding a re-light problem. The importance of bands 4-6 in a tight supply situation is highlighted by Figure 1 which illustrates the proportion that each band represents of the demand remaining to be curtailed after prior bands have been curtailed. This highlights that bands 4, 5 and 6 represent 13%, 27% and 34% of the demand remaining to be curtailed, and that curtailing band 6 (small commercial consumers), and preserving the remaining supply for domestic consumers, could extend the “time to failure” by 50%, if all prior curtailment options have been exhausted.

Figure 1: Proportion that each band represents of demand remaining to be curtailed



5.3 CCM Regulation Requirements

The Critical Contingency Management (CCM) Regulations provide for industry participants to determine how consumers fit into the curtailment schedule through a process that requires:

- Retailers to provide information on the number of consumers within each curtailment band for each gas gate and the aggregate volume of gas consumption (r39);
- Large consumers to provide information setting out total annual consumption, curtailment band and any minimal load designation (r40);
- CCO to hold a record of information provided by retailers and large consumers and consider whether it is materially incorrect (r41);
- Audit of particular retailer information by the industry body under certain circumstances (r42);
- Retailers to maintain emergency contact details for all consumers with annual gas consumption greater than 2TJ per annum (r43);
- Designation of consumers as ESPs or MLCs (r44 and r45) by retailers or by the industry body (for large consumers);
- Dispute resolution by the industry body in respect of ESP and MLC designations (r46).

5.4 Comparison with International Approaches to Curtailment

Research into international approaches to curtailment suggests that most countries are focussed on long-term supply disruption and gas rationing arrangements, following major disasters, rather than short-term gas contingencies. This is because the existence of multiple gas supplies, gas storage and LNG facilities, interruptible supply contracts, and highly meshed pipeline networks make short-term contingencies unlikely. Many European countries also have security standards, including storage requirements and diverse gas supply arrangements, which must be met. Meeting these security standards reduces the likelihood of short-term gas contingencies.

Nevertheless, some countries have established curtailment schedules that favour essential services, food production, protection of the environment, and domestic consumers. European Union countries, in particular, are required to protect domestic consumers during any supply disruption.

The arrangements in Australia vary from state to state, but Victoria provides a detailed curtailment schedule that provides priority to essential services (largely hospitals and related activities), domestic users, and small commercial and industrial consumers, and curtails supply first to large gas users and storage facilities. Public appeals for voluntary reductions are also included.

The arrangements in the United Kingdom provide for a strategic storage of 1.5% of total storage capacity to increase the likelihood that adequate pressure can be maintained in the pipeline network during contingencies. If curtailment is required during a contingency this is largely implemented to reflect commercial industry arrangements, with interruptible supply points and large consumers being curtailed before firm supply points and domestic users. Supply to priority supply points (mostly hospitals and homes for the elderly and disabled) is given the highest priority.

Our conclusion from the international research is that there is limited application of curtailment schedules during gas contingencies in other countries (largely because the need to curtail supply to cope with short-term contingencies is limited) but where they are used they are generally consistent with the priority order applied in New Zealand.

5.5 Consumers with Back-up Supplies

The current curtailment bands provide for large consumers (>15TJ per day) with alternative fuel capability to be curtailed prior to other large consumers. Similarly band 2 consumers (>10TJ per annum with alternative fuel capability) are curtailed prior to other similar size consumers. The rationale is that short-term economic costs would be minimised if consumers with alternative back-up supply arrangements use alternative fuels while gas supply is maintained to consumers without alternatives. Put another way, from the economy's perspective, the cost of requiring customers with alternative fuel to use it would be lower than the cost of curtailment for customers without back-up sources.

There were some suggestions emerging from the interviews that this approach created a possible perverse incentive when a consumer is considering whether to invest in alternative fuel supplies as a back-up to cover gas supply outages. The suggestion is that the prospect of being curtailed before other consumers without back-up may influence the decision about whether to invest in back-up supplies.

On this view, it would be preferable to make no distinction in the curtailment bands between consumers that have back-up supply and those that don't. Instead, all parties within a band would be curtailed equally, sharpening the incentive to invest in and maintain back-up capability.

Both viewpoints have merit in principle, and the argument ultimately comes down to which effect is greater – the loss of investment efficiency associated with differentiating curtailment on the basis of back-up supplies, or the short term costs from an ‘inefficient’ order of curtailment.

On balance, we expect the latter to be the greater cost and therefore suggest that the current distinction should be maintained. The reasons for this are:

- In practice, the change in the risk of gas curtailment for a user under the two approaches would be very hard to discern given the wider uncertainties²³ - the marginal effect on back-up investment incentives is therefore likely to be relatively small;
- In an actual contingency, the need to curtail demand will impose costs and these are likely to be material (generally much higher than the ‘normal’ delivered gas price) for consumers that are curtailed - it appears plausible that these costs will be at a level that are similar to, or higher than, the variable cost of back-up fuel and, for this reason, material short term efficiency losses through ‘uniform’ curtailment seem likely.

Ideally it would be possible to achieve both the investment and static efficiency objectives by providing for uniform curtailment (to preserve back-up investment incentives) while allowing users to contract with each other to trade their curtailment priority rights (to preserve short term efficiency). For example, a user with back-up capability could ‘sell’ any residual gas supply rights in a curtailment situation to a party that does not have back-up supply.

However, this approach is not practicable because of the difficulties of using price mechanisms to ration demand during a critical contingency event (e.g. need to act very quickly, and difficulties in gathering high quality information and relaying it to decentralised decision-makers). Indeed, if these difficulties did not exist, there would arguably be no need for the CCM regime at all.

In summary, although the current approach has some imperfections, we think that it is preferable to an alternative which makes no distinction between parties with back-up supply and those without. We also note that in the event of a national curtailment event (see separate section), the perceived weakening of investment incentives should not arise because any curtailed parties with back-up supply should receive the contingency imbalance price for any gas that is diverted to other users.

It is therefore recommended that no change be made in this area.

5.6 Essential Service Providers

Under r44 consumers with annual gas consumption greater than 2TJ per annum may apply to their retailer for designation as an ESP. The retailer must approve an application if the consumer provides services that are necessary to further the emergency response objectives set out in clause 59(4) of the NCDEMP. This schedule includes:

- a) preservation of life;
- b) prevention of escalation of the emergency;
- c) maintenance of law and order;

²³ Back-up supplies can be relied upon during any contingency, while preferential access to gas supply during a contingency is only potentially helpful during contingencies where some restricted supply is available.

- d) care of sick, injured, and dependent people (first aid, medical, and evacuation facilities, and welfare);
- e) provision of essential services (lifeline utilities, food, shelter, public information, and media);
- f) preservation of governance (continuity of the machinery of government);
- g) asset protection, including buildings and historic heritage assets (including structures, areas, landscapes, archaeological sites, and wahi tapu);
- h) protection of natural and physical resources (to the extent reasonably possible in the circumstances);
- i) preservation of economic activity.

There are currently 321 consumers, with aggregate gas consumption of 3,708TJ per annum, designated as ESPs.

A guideline note issued by Gas Industry Co in February 2009 interpreted the objectives of preservation of life, care of sick, injured, and dependent people, and provision of essential services in terms of types of gas users that would fit the criteria. It is notable that the guidance implies that no consumers were likely to qualify under the essential services (shelter) and preservation of economic activity objectives, and only limited food processors were likely to qualify.

Experience with the October 2011 contingency has highlighted the relatively broad and imprecise nature of these emergency response objectives when applied to gas contingencies, particularly items (e) and (i) in the list. Feedback during the interview process highlighted that:

- Retailers found difficulty in applying the NCDemp emergency response objectives when considering designation applications;
- Interpretation of the objectives was likely to lead to inconsistent decisions between retailers;
- Although there is a right of appeal by a consumer to the Gas Industry Co if an application for designation as an ESP is declined, there is limited scope within the Regulations for a designation to be challenged;
- There appears to be scope for designation of some consumers, under (e) and (i) in particular, which many interviewees consider are not involved in providing “essential services”;
- Some services are considered to be more essential than other services and, when considering curtailment and restoration of supply, some interviewees suggested that the “more essential” ESPs should have priority of supply over Band 6 consumers.

We agree with the suggestions that the emergency response objectives set out in clause 59(4) of the Schedule of the NCDemp do not provide sufficient guidance or sufficient discrimination between activities that could be regarded as essential services.

5.7 Health and Safety Issues

Regulation 47 specifies that “no person is required to comply with a provision of this Part to the extent that compliance would unreasonably endanger the life or safety of that person or any other person”. The effect of this regulation is that, regardless of which curtailment band a consumer is in, if curtailing gas demand would endanger life or safety then compliance with a curtailment direction would not be required.

The purpose of this regulation is to allow for circumstances that could endanger life or safety that were not necessarily anticipated at the time when a consumer was considering the possibility of gas outages and designation as ESP or MLC. Although regulation 47 provides an important back-stop, consumers should still be required to take all necessary steps to address health and safety issues that may arise as a result of a gas shortage, including the possibility of back-up supplies or ESP designation.

There is a risk the current provision is too broad and open-ended, and there may not be sufficient sanction available within the framework of the Act and the Regulations to ensure that it is used only in exceptional circumstances.

5.8 Critical Care Services

The interviews highlighted that many stakeholders recognise that preserving critical health services is also an important part of any Essential Service Provider arrangement and that many consider “critical care services” should have higher priority than other potential ESPs. In any “critical care services” category most stakeholders would include the following:

- Preservation of life – hospitals, nursing homes, homes for the disabled, and medical centres;
- Preservation of law and order – police stations and prisons;
- Preservation of health – any situation where loss of supply poses a material risk of creating health risks;
- Preservation of emergency services – wastewater, water, communications and transport;
- Maintaining supplies to health and safety services - hospital laundry facilities and production of blood products.

These services also tend to receive highest priority in the international markets covered in our research.

Several stakeholders suggested that the Regulations providing preference to these consumers should clarify that preferential supply only applies to those services (and only to the minimum supply necessary) essential to providing the critical care service. For example the ESP designation should only apply to a laundry facility to the extent necessary to meet minimum hospital supply requirements, rather than maintaining supplies to a full range of laundry customers.

We agree that a category of “critical care” consumers (as described above) should be eligible to apply for a special ESP designation that provides priority of supply such that it is a “last resort” curtailment option (unlike the present situation whereby small consumer with annual consumption less than 2TJ are the last band curtailed).

Under the current curtailment bands only consumers with annual consumption greater than 2TJ are eligible for ESP designation. If this threshold is preserved, and a special ESP designation for “critical

care” is introduced as the “last resort” curtailment option, large (>2TJ per annum) consumers would effectively have priority of supply ahead of small (<2TJ per annum) “critical care” consumers. It seems clear that all “critical care” consumers, regardless of annual consumption, should have the same priority of supply, and rank ahead of all other consumers. Options for addressing this issue include:

- Removing the 2TJ threshold for designation of “critical care” so that all consumers would be eligible to apply for special ESP status – this could result in a very large number of ESP applications from amongst the 13,600 Band 6 consumers and add an unwieldy overhead bureaucracy;
- Providing for “critical care” ESPs to be curtailed at the same time as Band 6 consumers – this would provide higher priority than the current curtailment bands, and for all “critical care” consumers to be curtailed at the same time, but would not provide priority over other small consumers;
- Allowing small (<2TJ per annum) consumers to self-select as “critical care” ESPs during a contingency – this would allow the highest priority to be applied to all “critical care” consumers without creating undue administration costs, but might be difficult to police.

We think the last option (self-selection by small ESPs) is preferable since it will provide for priority supply to all ESPs, while avoiding the overhead costs associated with a proliferation of applications from small consumers seeking ESP status. We note that it has precedent in Victoria, Australia, where small consumers are able to self-select, but may be required to demonstrate, following any contingency, that they did meet the criteria for “critical care” ESP status. However, we also note that the problem with enforcing compliance on small consumers (see section 9.2) may need to be resolved in order to make this option viable.

5.9 Other Essential Service Provider Categories

The interviews highlighted that many stakeholders were sceptical about whether some consumers that were designated as ESPs under the “food production” and “environmental protection” categories actually warranted that designation, and some stakeholders also suggested that “preservation of economic activity” should not warrant an ESP designation because it lacked discrimination and could potentially apply to many gas consumers, thereby defeating the objective of the curtailment schedule.

Others agreed that maintaining gas supplies in order to support essential food production and avoid environmental damage warranted some priority during a contingency, but suggested that these categories should rank behind “critical care” services and should be more narrowly specified.

Of particular note were concerns regarding the October 2011 contingency about potential environmental impacts associated with the spill of milk onto pasture and into waterways due to the curtailing of gas supply to dairy processing facilities. This issue was made more serious because the contingency coincided with the peak of the dairy season.

Several dairy processing facilities had been designated as ESPs prior to the October 2011 contingency and were able to maintain some gas supply during the contingency. We also understand that some dairy processing facilities were able to adapt by reducing product range and diverting milk supplies towards different products and, as a result, the amount of milk discharged and the resulting environmental impacts were less than initially feared.

Although the environmental impacts were largely successfully contained, partly as a result of ESP designations, we observe that under extended duration gas contingencies it may not be possible to maintain gas supply to ESPs. The dairy sector needs to have emergency plans in place to cope with the possibility that all gas supplies will be cut to one or more processing plants during the milk processing season. We understand that these issues are being considered by dairy companies and regional councils.

Overall, we agree that the application of the current NCDEMP emergency response objectives lack discrimination and should be replaced by more specific and narrow ESP criteria. We also agree that there are some circumstances where the availability of a reduced gas supply to a consumer could significantly mitigate adverse effects in essential food production, in situations where environmental damage could occur, or in situations where economic costs associated with a full loss of supply would be particularly high. Accordingly, we consider that there is merit in retaining the possibility of an ESP designation to cover a limited gas supply in these situations.

We acknowledge that it is difficult to devise criteria that can be applied conclusively and objectively to all situations, and that approval will often involve an element of judgement on the part of any approving body. Nevertheless, we consider that narrower, more robust criteria, combined with more stringent approval processes (as outlined in section 6.2), should lead to more accurate and consistent ESP designations and lower overall costs to the economy during critical contingencies.

This view is generally consistent with our observation of international approaches to curtailment bands and the priorities applied to different consumer categories.

In summary, we suggest that the Regulations should be amended to provide for the following ESP categories with the following priority order:

- “critical care services”;
- “essential food production” and “environmental protection”;
- “minimum supply to avoid substantial economic costs”.

Clear criteria covering each of these categories should be included in the Regulations, and the arrangements should be amended (see section 6.2) to provide a more robust process for considering applications. All ESP applicants should be required to specify and justify a reduced level of gas supply necessary in order to maintain the essential service or avoid the economic cost.

5.10 ESP Designations during October Contingency

During the October 2011 contingency it is evident that some consumers who considered the services they provided to be “essential” had not applied for designation as ESPs. It is not clear whether this resulted from lack of effective notification by retailers or low awareness by consumers about the prospects for gas supply interruptions and the possibility of being designated as an ESP. However, when notified of the contingency and directed to curtail, it is clear some consumers quickly became aware of the possibility of having supply restored earlier if they were designated as an ESP.

The result was a rash of applications to retailers, following the onset of the contingency, for designation as ESPs. Retailers were motivated to respond, the CCO and Gas Industry Co became involved, and 33 applications for ESP status were ultimately approved, with aggregate daily consumption of 16TJ per day (almost 50% of the gas available from the Vector 200 line). The interviews revealed some criticism of this process and some suggestions that ESP designations

should be frozen at the onset of any contingency in order to allow the CCO to focus more on managing the contingency.

Given the circumstances, we consider the designation of some consumers as ESPs during the contingency was an appropriate outcome since otherwise potentially essential services would have been denied gas supply for a longer period. It would clearly be preferable for ESP designations to be organised in advance, and for the CCO not to be distracted by applications while managing a contingency, however it is unrealistic to expect that all consumers with essential service characteristics will be appropriately designated in advance and some flexibility to designate consumers during a contingency should be retained. This flexibility should be limited to exceptional circumstances and some amendments to the current arrangement (see section 6.1) should be considered to ensure that consumers are better prepared than was the case during the October 2011 contingency.

5.11 Minimal Load Consumers

It is also possible under the Regulations (r45) for consumers with annual gas demand greater than 10TJ per annum to apply for Minimal Load Consumer (MLC) status. The purpose is to identify situations where a minimal amount of continued gas supply, for a short period, could provide for an orderly shutdown and avoid serious damage to plant and/or mitigate serious environmental damage. It is important to recognise that this is intended to be a temporary respite and consumers with an MLC designation should always be ready to curtail fully in the event that deeper cuts are required.

As with ESP designations, the process involves application and approval by retailers and rights of appeal to the Gas Industry Co. There are currently 28 approved MLC designations with aggregate gas consumption of 6,281TJ per annum.

The interview process revealed that some consumers with characteristics which suggest that an MLC designation would be appropriate, preferred to apply for an ESP designation. This appeared to be because the MLC designation required a full orderly shutdown in the shortest time possible, while the ESP designation allowed for a higher priority and for continued operation. Some consumers may have succeeded in achieving an ESP designation when an MLC designation would have been more appropriate, again highlighting deficiencies with the current approval process.

Further, it appears that some consumers without designation as either ESP or MLC may have continued to take a reduced level of gas supply for a period following the direction to curtail, in order to avoid damage to plant. In other words they operated as if they had either an ESP or an MLC designation.

We consider that the proposed improvements to the specification of the ESP provisions, combined with a more stringent approval process, should help to ration available supply more effectively during a contingency and lead to more appropriate designation of consumers as either ESP or MLC.

5.12 Band 6 Consumers

There are approximately 13,600 consumers in band 6 (non-domestic consumers using less than 2TJ per annum) with aggregate annual demand of over 6,500TJ (representing about 4% of total gas

demand). Under the current curtailment arrangements this is the last group of consumers to have gas supply curtailed during a contingency²⁴.

The interview process revealed that retailers experienced difficulties contacting some of these consumers, difficulties confirming that they clearly understood the direction and the obligation to curtail, and difficulties establishing that they had indeed curtailed demand. Most band 6 consumers do not have time-of-use metering and have gas meters read typically only once per month, so it is difficult to establish compliance with curtailment directions.

Although this group represents only 4% of total gas demand, when supply is constrained to the point of needing to curtail gas demand in band 6, this group represents approximately 34% of the remaining gas demand. Under these circumstances curtailing supply to this group could preserve supply to domestic consumers for 50% longer than might otherwise be the case – thus increasing the probability of avoiding an expensive re-light process.

We recognise that there are difficulties with communication and compliance, but consider that curtailment directions are likely to be more effective, despite these difficulties, and note that curtailment directions are not mutually exclusive with a public appeal for savings.

We also consider that curtailing gas supply to band 6 consumers should be more effective if retailers are better prepared and have clearer plans in place for contacting these consumers. This is the subject of further proposals in section 6.3.

5.13 Recommendations

It is recommended that:

1. The existing Regulation 47 is reviewed with the aim of ensuring that it is used to deal with health and safety risks only under exceptional circumstances, while maintaining incentives on consumers to consider and manage health and safety risks more generally;
2. The Regulations are amended to remove the reference in 44(3) to the Schedule of the National Civil Defence Emergency Management Plan Order 2005 and incorporate specific criteria relating to “critical care services”, “essential food production”, “environmental protection”, and “minimum supply to avoid substantial economic costs”.
3. The Regulations are amended to require that all designations as an ESP must specify the level of supply that is necessary to maintain the “essential” service. Under most circumstances this would be expected to be less than normal gas consumption;
4. Schedule 2 (the curtailment schedule) to the Regulations is amended to replace the current band 5 with bands 5a (minimum supplies to avoid substantial economic costs), 5b (minimum supplies for essential food production and environmental protection), and band 7 (critical care services);
5. The existing arrangements whereby band 6 customers are required to curtail demand is retained, rather than replaced with a requirement for a public appeal for savings;

²⁴ Noting that smaller consumers may be subject to a public appeal for conservation measures.

6. The Regulations are amended to either:

- a. allow band 6 consumers to apply for “critical care” ESP designations;
- b. provide for band 6 and band 7 to be given equal priority in terms of curtailment and restoration; or
- c. allow band 6 consumers to “self-select” ESP status during a gas contingency.

If these recommendations are implemented the revised curtailment schedule would appear as described in Table 14.

Table 14: Recommended Curtailment Bands

Curtailment Band	Consumption band	Description
0	N/A	Gas off taken for injection into storage
1a	More than 15TJ per day	Consumers (excluding essential service providers) supplied directly from the transmission system and that have an alternative fuel capability. If minimal load consumer then manage wind-down of plant.
1b	More than 15TJ per day	Consumers (excluding essential service providers) supplied directly from the transmission system and that do not have an alternative fuel capability. If minimal load consumer then manage wind-down of plant.
2	More than 10TJ per annum and up to 15TJ per day	Consumers (excluding essential service providers) with alternative fuel capability. If minimal load consumer then manage wind-down of plant.
3	More than 10TJ per annum and up to 15TJ per day	Consumers (excluding essential service providers) without alternative fuel capability. If minimal load consumer then manage wind-down of plant.
4	More than 2TJ per annum and up to 10TJ per annum	Consumers, excluding consumers designated in bands 5. Minimal load consumers in curtailment bands 1a to 3 curtailed in full.
5a	More than 2TJ per annum	Approved minimum supplies to avoid substantial economic costs.
5b	More than 2TJ per annum	Approved minimum supplies required to avoid substantial environmental impacts or required for food preparation that could materially disrupt essential food supplies.
6	2TJ or less per annum	All small consumers (excluding domestic consumers who are not covered by the Regulations).
7	More than 2TJ per annum	Approved minimum supplies required to maintain critical care services.

6 Preparing for a Critical Contingency

6.1 Retailer and Gas Consumer Readiness

The state of awareness of gas consumers to the possibility of a loss of gas supply and their readiness to cope with a gas contingency was mixed prior to the October 2011 contingency. Some consumers appeared to be surprised by the direction to curtail gas consumption and many were not aware of the possibility that they could have been designated as either ESP or MLC.

Some retailers were well prepared for a contingency, had previously communicated with consumers to determine curtailment bands and ESP/MLC designations, and had account managers well-briefed. These retailers were able to promptly contact consumers with clear directions to curtail and explanations about what was required. Other retailers were less prepared and confessed that they *“would be better prepared for any future gas contingency as a result of the experience”* with the October 2011 contingency.

Retailers have a general concern about the possibility of raising unnecessary security of supply concerns amongst their customers and this may have contributed to relatively low key communications with consumers about curtailment bands and the possibility of loss of supply.

It also appears that for some retailers and consumers there was:

- Uncertainty about how to treat multi-site installations when determining how a consumer fitted into the curtailment bands;
- Uncertainty about the ESP and MLC designations and which best suited a consumer;
- Some initial confusion about whether a direction to curtail gas consumption required consumers to shut off gas supply, to stop using gas, or simply to reduce gas consumption.

Overall, the process of communicating with consumers about the possibility of contingencies, assigning consumers to curtailment bands, considering possible ESP or MLC designations, and maintaining up-to-date “load shedding” fields in the registry appears to have been inadequate. When determining curtailment bands some retailers appear to have relied on the registry field that designates curtailment band. This registry field is maintained by distributors and it appears that the initial population of the field relied on the previous NGOCP determined designations. Some retailers also relied on the accuracy of the curtailment band in the registry when acquiring a customer from another retailer. The end result is that many consumers were not correctly placed within the curtailment bands at the time of the contingency in October 2011, and the registry fields appeared to contain many errors.

Although some retailers were well prepared, and all retailers are probably now better-placed to respond to a future contingency as a result of the October 2011 experience, the (hopefully) infrequent nature of gas contingencies means there is a risk that retailers and gas consumers will again not be well-prepared for a future gas contingency. Furthermore, the Regulations provide for retailers to notify consumers *“as soon as reasonably practicable”* following the *“go live date”* in 2008, that they may apply for ESP and MLC designation, and do not establish an on-going obligation. Action needs to be taken now in order to improve retailer and consumer preparation and provide an on-going obligation on retailers.

In our view, there is a need to establish a framework within the Regulations that encourages retailers to communicate with consumers about the possibility of gas contingencies (with a view to

having all consumers accurately allocated with the bands), and encourages consumers to consider whether they need back-up supply arrangements, or whether they have a case for ESP or MLC designation. This framework should ensure that any ESP or MLC designations during a contingency should be granted only under extenuating circumstances, only on a temporary basis, and subject to a subsequent assessment and approval process once the contingency is over.

If such a framework is implemented, the allocation of consumers to curtailment bands should be accurate, the accuracy of the registry “load shedding” fields should improve, and retailer/consumer preparedness should improve. Nevertheless, it may be desirable to transfer responsibility for maintaining the registry “load shedding” field from distributors to retailers and to consider an audit of those fields.

6.2 Approval of ESP and MLC Designations

The interviews revealed widespread discomfort with the process that involves consumers making applications to retailers for, and retailers approving, ESP and MLC designations. This discomfort centres on concerns that retailers may be influenced to approve designations as part of the retailer-consumer relationship rather than make a fully objective decision. These concerns were magnified by the observation that the emergency response objectives set out in the NCDAMP do not provide sufficient guidance or sufficient discrimination between activities that could be regarded as essential services.

Clarification of the criteria for ESP designation (as proposed in section 5.13) should go some way to addressing these problems, but we agree the current process involving retailer approval of ESP and MLC designations has some shortcomings and could be improved. In particular we note that a consumer has right of appeal to the Gas industry Co if a retailer declines to approve an ESP or MLC designation, but there appears to be no ready mechanism to contest a retailer decision to approve an ESP or MLC designation. We agree with stakeholder suggestions that some form of independent approval or oversight of the approval process is necessary to ensure consistent and accurate decision-making.

Further, we consider that the criteria for approval should be enhanced so that any consumer seeking ESP or MLC designation should be required to supply information supporting any application that:

- Provides evidence in support of the essential nature of the service²⁵ or the substantial economic loss that would be involved;
- Satisfactorily explains why having back-up supplies in place to cover gas outages are not an economic alternative;
- Provides evidence in support of the minimum level of gas supply that would be necessary to maintain the essential elements of the service or mitigate the economic loss;
- Satisfactorily describes an approved emergency plan to cope with possible loss of full gas supply in the event that full curtailment is required.

²⁵ In the case of “essential food production” this would need to establish why a particular food supply was considered essential

If the proposal for independent oversight or approval of ESP and MLC designations is accepted, a key issue is who should provide the independent oversight and approval. The main options appear to be the CCO, one of the TSOs, Gas Industry Co, or an independent panel established for the purpose. Gas Industry Co is already involved in the approval process to the extent necessary to consider appeals against a retailer decision to decline approval.

The required characteristics of an approving body are:

- Independence from the consumer and retailer;
- An understanding of the public policy objectives and approach to minimising costs to the economy during a contingency;
- Sufficient understanding of consumer gas use to reach an informed view about the importance or essential character of gas use within the facility.

The CCO and the TSOs may not be considered sufficiently independent of the consumers and retailers. The required characteristics could be provided by either Gas industry Co (possibly supplemented by an independent expert) or an independent expert panel appointed for the purpose.

In terms of process, we prefer to retain the responsibility for retailers to engage with consumers, and to provide the initial consideration of any ESP or MLC application, but for retailers to make any recommendation (to approve or decline) to the independent approving body.

6.3 Retailer Planning

The framework for achieving an orderly curtailment of gas supply and minimising the loss to the economy relies heavily on retailers to communicate with gas consumers both before and during a gas contingency. The mixed performance of retailers in this regard is of some concern. Although they are likely to be better prepared for any future contingency as a result of experiences during the October 2011 contingency, there is a need for more confidence that retailers have a clear appreciation of how consumers fit into the curtailment bands, how they plan to communicate with consumers in each band, and how they plan to monitor compliance with directions.

In our view this confidence could be provided by requiring gas retailers to prepare, have approved, and to maintain, up-to-date “gas retailer curtailment plans” that include:

- A list of consumers allocated into curtailment bands (including those designated as ESP and MLC);
- Evidence that all consumers have been contacted about the possible need to curtail gas demand during a contingency, and the possibility of being designated as ESP or MLC;
- How they will go about contacting consumers with curtailment directions within each curtailment band;
- How they will monitor compliance with curtailment directions;
- How they plan to report compliance to the TSOs.

Approval of the “gas retailer curtailment plans” could be provided by the independent approving body established for the purpose of approving ESP and MLC designations.

6.4 Recommendations

It is recommended that:

1. The Regulations are amended to require consumers who wish to be designated as ESP to supply information on the essential nature of service, any back-up supply arrangements in place or the reasons why back-up supply arrangements are not feasible, the minimum supply necessary to maintain the service, and emergency arrangements for coping with full loss of supply (including emergency stores and other back-up arrangements necessary to survive a gas outage);
2. The Regulations are amended to require consumers who wish to be designated as MLC to supply information on the rationale (e.g. probable damage to plant), the economic costs involved with loss of supply, any back-up supply arrangements in place or the reasons why back-up supply arrangements are not feasible, the minimal supply arrangements necessary to avoid damage to plant, and emergency arrangements for coping with full loss of supply (including emergency stores and other back-up arrangements necessary to survive a gas outage);
3. The Regulations are amended to provide an on-going obligation on retailers to notify consumers about the possibility of loss of supply and the opportunity to apply for ESP and/or MLC designation;
4. The Regulations are amended to require all MLC and ESP designations to be approved by an independent approving body, following a recommendation from a retailer. Retailers would retain responsibility to interface with consumers over possible designations, assist with preparation of applications, and to make recommendations to the independent approving body;
5. The Regulations are amended to require retailers to prepare, submit for approval by an independent approving body, and maintain a “Gas Retailer Curtailment Plan” that identifies the consumers in each band, provides evidence that all consumers have been contacted about the possible need to curtail gas demand during a contingency, and the possibility of being designated as ESP or MLC, provides a process for maintaining the consumer lists, provides a process for contacting consumers to issue curtailment directions following the declaration of a contingency, and reporting on compliance to TSOs;
6. Further consideration is given to whether the independent approving body should be Gas Industry Co or an independent panel established for the purpose;
7. The Regulations are amended to clarify that each consumer installation should be separately identified and allocated to a curtailment band based on the characteristics of each installation (rather than aggregating multi-site consumers) ;
8. The Gas (Switching Arrangements) Rules 2008 are amended to provide for retailers to maintain the “load shedding category”;
9. Further consideration is given to the need for an independent audit of the registry fields in order to assess the accuracy of the consumer curtailment designations.

7 Critical Contingency Operations

7.1 Facilitating CCO Performance

The interview process revealed several suggestions that, although the CCO did a very good job in managing the October contingency under difficult circumstances, the resources available during the early phase of the contingency may not have been sufficient to deal with the wide range of issues that emerged. Observations were that the CCO had to balance several competing needs including analysis of the available gas within the system, reconfiguring pipeline networks, interfacing with TSOs, monitoring pressure levels in the pipeline networks, interfacing with other stakeholders, facilitating communications, and analysing the impact of possible ESP re-designations.

At least in part, the heavy workload appears to have been compounded by the lack of preparation by some consumers and retailers, and some initial difficulties in ensuring that curtailment directions were being received and acted upon. Following some initial difficulties we understand that additional resources were allocated and the CCO was able to cope efficiently with the many competing needs.

The services required from the CCO are set out in the Regulations, supplemented by some detail provided in the service provider agreement (SPACCO), which also specifies that the CCO must *“identify and provide all personnel, resources and processes required to provide the services”*. The experiences during the October contingency will have informed the CCO further about the resources required to be available to manage a gas contingency on the scale and timeframe of that contingency and we would expect the CCO to respond accordingly. We note that the CCO Performance Report contains a number of recommendations about improving performance during a gas contingency.

The CCO noted that some difficulties were experienced with access to quality information about consumer load characteristics during the contingency. In particular, the CCO tended to be guided by the annual or daily quantity provided for each consumer when placed within a curtailment band and in some cases this proved to be inadequate as a result of seasonal and daily consumption trends. When restoring supply to some consumers, the CCO was surprised by the extent of gas consumption.

Further consideration should be given to whether the CCO has sufficient access to consumer information from existing sources or whether it needs specific powers to collect information during a contingency.

7.2 Public Appeals for Gas Savings

During the October gas contingency an appeal was made to the public to conserve gas supplies in particular regions and reduce non-essential gas consumption. We understand this appeal resulted in worthwhile gas savings from the domestic sector and may also have helped to get the message about curtailing gas demand through to some parts of the small industrial/commercial sector (i.e. band 6).

There is currently no specific provision within the Regulations that provides for a public appeal for gas savings and it has been suggested that there should be an empowering provision allowing the

CCO to make a public appeal under circumstances where it could materially extend the ability to maintain pressure with the pipeline networks and potentially avoid a re-light situation. Such public appeals have precedent in a number of international markets we surveyed. One possibility is to specify that a public appeal for gas savings should be made in any region where band 6 consumers are directed to curtail gas consumption.

7.3 Communications during a Critical Contingency

The interview process revealed several problems with communications, particularly during the early phase of the October contingency. Most stakeholders considered that the CCO performed well, did a very good job in difficult circumstances, and communicated well with the key participants during the contingency. However, there was general concern about initial communications with wider stakeholder groups and the public, and whether the CCO was sufficiently resourced to cope with this role during a contingency. There were suggestions that the public response was slow to get organised, and some stakeholder communications were unnecessarily delayed.

The Regulations specify that the CCO must “*receive and consider communications from the TSOs and any other persons identified in the information guide*” but there is no clear responsibility for any party to coordinate communications to all stakeholders, including the general public, during a contingency. Similarly, the SPACCO does not establish a specific role for the CCO to coordinate communications or appoint a spokesperson during a gas contingency.

This lack of clear responsibility for coordinating communications and appointing a spokesperson appears to have resulted in a delayed response and many key stakeholders feeling that they “*were kept in the dark*” during the early phase of the October contingency. Once a spokesperson was appointed and the regular media releases and teleconferences were established, communications improved dramatically, and most stakeholders felt they were kept well informed from that point on.

It is inevitable that several parties will be involved in speaking to the media during a major contingency, but we agree that there is a need to better coordinate communications. We consider that this would best be achieved by establishing a clear responsibility within the Regulations for one party to coordinate communications and appoint a spokesperson at an early point following the declaration of a critical contingency. The main options for coordinating communications during a contingency include:

- Gas Industry Co – has to date limited its public role to explaining how the Regulations work. Not directly involved in managing contingencies and does not have technical expertise and knowledge, but if supplied with all the relevant information could potentially help to coordinate communications and appoint a spokesperson;
- The relevant TSO – where a TSO asset has failed and precipitated a critical contingency the TSO will be involved in support of the CCO in managing the contingency, but less likely to be involved where the contingency results from a production failure;
- The relevant gas producer – where a gas production facility has failed and precipitated a critical contingency the gas producer will be involved in support of the CCO in managing the contingency, but unlikely to be involved where the contingency results from a transmission failure;
- The CCO – actively involved in managing any contingency, will be seeking information from many stakeholders in order to facilitate its primary role.

We conclude that the CCO is best-placed to coordinate communications and provide the primary spokesperson during a gas contingency because it will be actively involved in coordinating amongst the key industry stakeholders in any case, will have the best knowledge of a range of relevant factors including the supply-demand situation, the need for curtailment by various bands of consumers, and how long gas supplies might last. It will also have access to information on the cause of the outage and possible timeframe for reinstating supply. These are the issues that will be of most interest to external parties including news media and consumers.

We acknowledge that the CCO needs to have a clear focus on managing the technical aspects of any contingency, monitoring pipeline pressures, formulating plans and directing curtailment, and there is a risk that the role of coordinating communications could detract from this. However, if the CCO is appropriately resourced to manage communications, and is supported by receiving key information from other parties, this should be workable. In any case, any external party appointed to coordinate communications would need ready access to CCO staff and would provide a similar distraction from managing the technical aspects of any contingency.

Our international research suggests that the contingency manager is often given the role of spokesperson in other jurisdictions. This supports our assessment that the CCO is likely to be the most appropriate party to take on this role.

In order to facilitate a role of coordinating communications, it may be necessary to provide powers for the CCO to require information from TSOs and other asset owners during a contingency.

During the interviews there were also suggestions that there were unnecessary delays in restoration instructions from the CCO reaching consumers as a result of the instructions having to be relayed via TSOs and retailers. TSOs need to be in the loop so they can effectively manage pipeline networks during any restoration process and retailers also need to be kept informed so that they can follow up and coordinate with consumers where necessary. It appears that there is room for improvement and we understand that TSOs and the CCO are considering possible amendments to CCMPs to minimise any delays in the process.

7.4 Reconfiguring Networks

During the October 2011 contingency the CCO, in association with Vector (as TSO), agreed to reconfigure the Vector network so that the 200mm pipeline that runs parallel to the Maui pipeline could provide supply to both Auckland and the Bay of Plenty. Although this reduced the likelihood of depressurising gas networks north of Taranaki it came at the cost of partially curtailing load in the areas served by the Vector Bay of Plenty pipeline. A further effect of reconfiguring the BOP pipeline was that, over the ensuing days, the CCO was able to direct restoration of load to selected consumers.

It is important that the CCO, in association with TSOs, is able to take steps to reconfigure networks in this manner, with an overall objective of minimising costs of any contingency across the economy.

It may be helpful to clarify that the CCO should consider, and potentially take, steps to reconfigure networks during a contingency, by amending the Regulations to provide powers for the CCO to direct TSOs to reconfigure networks where reconfiguration could assist with minimising the costs of any contingency.

7.5 CCO performance Report

Regulation 65 requires the CCO to prepare and publish a Performance Report assessing overall compliance with the Regulations and the overall effectiveness of the critical contingency arrangements. The CCO Performance Report prepared following the October 2011 contingency suggested the review process could be improved by:

- Replacing the current arrangement for “self-assessment” by the CCO with some form of independent assessment;
- Clarifying that the report should be provided to Gas Industry Co; and
- Adopting a more flexible approach to the timeframe for reporting to recognise that reports on major incidents such as the October contingency will take longer to prepare.

The CCO Performance Report is an important document because it intends to review how a particular contingency was handled, how all the different parties to the contingency performed, and identify any areas for possible improvement. The central role of the CCO in managing any critical contingency suggests that it is the best-placed party to review how effectively the arrangements performed and identify key areas for improvement. The issue raised by the CCO is whether this review should include a review of its own performance.

We consider that it is appropriate for the CCO to review its own actions and assess the extent to which it complied with its obligations, when preparing the Performance Report. Although the CCO may have an incentive to assess its actions in a favourable light, it is required to consult with other stakeholders, providing an opportunity for those stakeholders to comment on CCO compliance and actions during the contingency. We note that regulation 65(2) requires the CCO to consult with “*each affected TSO and any other person it considers necessary*” when preparing the performance Report. It may be helpful to amend the Regulations to clarify that the CCO should publish a draft Performance Report and seek submissions from stakeholders before finalising the report. This would provide an opportunity for Gas Industry Co and other stakeholders to provide input to the review at this stage, if they were concerned that some aspects of the draft report were deficient.

Furthermore, under the Gas Governance (Compliance) Regulations 2008, Gas Industry Co may notify the Market Administrator of any possible breach of the Critical Contingency Regulations by the CCO or any other participant. This provides opportunity for the CCO to be held accountable for its compliance and actions during a critical contingency, as long as Gas Industry Co has access to the Performance Report and any input from other stakeholders received by the CCO as part of the consultation process.

We agree with the CCO that it would be useful to amend the Regulations to clarify that the Performance Report should be provided to Gas Industry Co, and we further suggest that all submissions made to the CCO as part of the consultation process should also be made available to Gas Industry Co and published.

We note that the Regulations provide for a Performance Report to be published “*no later than 20 business days after making a determination to terminate a critical contingency under regulation 60, or as otherwise agreed between the CCO and the industry body*”. The 20 business day period does not seem unreasonable for a minor contingency and the ability to agree on some other time period appears to provide flexibility to take into account the time required to prepare and consult on a report into a major contingency. In order to address the CCO concerns it may be appropriate to amend the regulations to provide for “*no later than 20 business days after making a determination*

*to terminate a critical contingency under regulation 60, or as otherwise agreed between the CCO and the industry body, **taking into account the duration, scale and complexity of the contingency**".*

7.6 Recommendations

It is recommended that:

1. Further consideration is given to the best means to ensure that the CCO has appropriate access to consumer seasonal or daily consumption data to facilitate analysis and planning during a contingency;
2. Further consideration is given to amending the Regulations to clarify that the CCO may call for public restraint and gas savings in an affected region, following consultation with Gas Industry Co, if band 6 consumers in that region are directed to curtail gas consumption;
3. The Regulations are amended to clarify that the CCO should take responsibility for coordinating communications during a critical contingency, is required to appoint a media spokesperson as soon as reasonably practical following the declaration of a critical contingency, and is required to make timely public announcements at regular intervals during any critical contingency;
4. Further consideration is given to whether it is necessary or desirable to amend the Regulations to provide the CCO with powers to require relevant information to be supplied by TSOs and other asset owners during a critical contingency;
5. The CCO Service Provider Agreement is amended to provide for the CCO to coordinate communications and appoint a spokesperson, and to provide flexibility for the CCO to manage communications in a way that ensures they are appropriate to the circumstance – depending on the circumstances, communications should be coordinated with asset owners, Gas Industry Co and Ministers to ensure consistency of messages, and targeted at consumers where necessary;
6. The Regulations are amended to clarify that the CCO Performance Report should be published in draft form and submissions invited from interested stakeholders, the final version of the report provided to Gas industry Co, and any submissions received by the CCO during the submission process should be published.

8 Regional and National Contingencies

8.1 October 2011 Regional Contingency

The interviews highlighted that, during the October 2011 contingency, there was a lack of clear understanding about the difference between regional and national contingencies and the application of contingency pricing. There were several suggestions that there needed to be more clarity around the definitions and when imbalance calculations and pricing would apply.

It was suggested that, depending upon the circumstances and whether contingency imbalances and pricing applied, some participants may wish to respond in a manner reflecting commercial incentives. To facilitate this there were suggestions that an appropriate body needed to make a declaration, as soon as reasonably practical, as to whether a regional or national contingency existed, rather than relying on participants to determine this for themselves.

8.2 Imbalance and Contingency pricing

Contingency imbalances and a contingency price are calculated following a national contingency in order to provide for the large consumers and retailers who effectively consume gas under contract to other consumers and retailers, to compensate those consumers and retailers for the volume of gas taken, at a contingency price reflecting the value of the gas at the time of the contingency.

The rationale for these arrangements is to provide commercial incentives for contracted gas supplies to be maintained (or even increased) during a contingency even though the consumers who have contracted those gas supplies may not be able to directly use them, or may need to share them with other consumers in accordance with a CCO instruction. The arrangements also provide price-based incentives for demand response. For example, a retailer that loses its contracted supply source (but not its demand) will be exposed to the contingency price, and will have an incentive to reduce its customers' usage where this is feasible.

In short, during a national contingency (when there is a shortage of gas supply), the imbalance price provides a financial incentive for suppliers to make their full production capability available, and for consumers to curtail demand where it is feasible.

By contrast, a regional critical contingency is not expected to reflect a shortage of gas supply per se. Rather it is expected to arise due to a shortage of gas transport capacity. The case for price-based rationing of available transport rights in a contingency is much less clear cut because parties do not typically hold defined rights to differentiated slices of transmission capacity (other than interruptible supplies). It is not clear therefore how a price-based mechanism could operate to trade available transport rights in a contingency under current arrangements²⁶.

For these reasons, contingency imbalance calculations and prices do not apply in regional contingencies, which are defined in regulation 82 as where:

²⁶ Noting that transmission arrangements might change at some future point, and that there may still be good reasons to use price-based mechanisms to allocate transport rights absent a contingency, given that it is likely to be easier to define, trade and enforce those rights in normal market conditions.

- a) *there is a substantial reduction to, or total loss of, the supply of gas to a part of the transmission system; and*
- b) *that part of the transmission system has become isolated from any other significant source of gas supply.*

These conditions clearly applied to the October 2011 contingency, and it would have been helpful for many stakeholders if a party had the authority to declare this at the time of the contingency, rather than have it determined after the contingency was over.

In most circumstances it should be relatively straightforward to determine whether a critical contingency is national or regional and we agree that it would be helpful for this to be declared at the time of the contingency, although it may be necessary to retain flexibility to revise any declaration if there is a change in circumstances. The CCO will have the best information available to determine promptly whether a contingency is national or regional.

8.3 Recommendations

It is recommended that:

1. Further consideration is given to whether it is necessary to provide some supplementary information about the distinction between national and regional contingencies (clarifying that national contingencies reflect gas shortages and regional contingencies reflect transport shortages) and the rationale for imbalance calculations only applying during a national critical contingency;
2. The existing arrangements, whereby contingency imbalance calculations and contingency prices only apply to national contingencies, are retained;
3. The Regulations are amended to provide that the CCO should make a declaration as to whether a critical contingency is national or regional, as soon as reasonably practicable following a critical contingency declaration, and allowing for that declaration to be modified during a contingency if required to reflect developments.

9 Encouraging Compliance

9.1 Compliance with Curtailment Directions

Overall most stakeholders suggested compliance with directions to curtail was very good and the contingency management arrangements performed very much as intended. However there were also several observations that suggested stakeholders were aware of situations where compliance was unsatisfactory. Particular alleged instances brought to our attention included consumers who:

- were slow to respond to directions;
- reduced gas demand but did not fully curtail gas demand;
- did not fully curtail gas demand while seeking an ESP designation;
- failed to respond to directions at all.

It is possible that some instances of non-compliance, by small consumers in particular, could be explained by the difficulties and delays some retailers experienced contacting consumers and confirming that they had received the direction to curtail gas demand. This could be improved by retailers developing clear strategies to communicate with consumers and putting those strategies into practice during a contingency.

9.2 Small Consumer Compliance

The mechanism for enforcing compliance with the Regulations involves the following arrangements:

- Any consumer, participant or other person may notify an alleged breach of the of the Critical Contingency Management Regulations (under r9 and r10 of the Gas Governance Compliance Regulations);
- For the purpose of the Critical Contingency Management Regulations, a participant includes any gas consumer (as per definition of participant in the Gas Governance Compliance Regulations);
- In respect of any breach of the Critical Contingency Management Regulations the Rulings Panel may order payment of civil pecuniary penalties up to \$20,000 (under r52 of the Gas Governance Compliance Regulations).

However, the ability to award civil pecuniary penalties stems from s43X of the Gas Act 1992 (Act) which only empowers the Rulings Panel to award penalties against industry participants as defined in that Act²⁷. This means that, although the Critical Contingency Management Regulations apply to consumers and they are obligated to follow directions made under those regulations, unless they are also an industry participant under the Act, the Rulings Panel cannot award civil pecuniary penalties against them for breach of the Regulations.

²⁷ An industry participant is defined as a gas retailer, distributor, producer, pipeline owner, wholesaler, person who purchases gas directly from a producer or wholesaler, service provider, meter owner, or data administrator. This excludes small consumers that purchase gas through a retailer.

This situation is unsatisfactory because when retailers contact consumers and direct them to curtail gas demand, they need to be able to convey the obligation to follow a direction and the possible consequences of a failure to comply.

9.3 Recommendations

It is recommended that:

1. Further consideration is given to how best to enhance the enforcement provisions to cover breaches by non-participant consumers and whether it is necessary to seek changes to the Gas Act.

10 List of all Recommendations

10.1 Curtailment bands

It is recommended that:

1. The existing Regulation 47 is reviewed with the aim of ensuring that it is used to deal with health and safety risks only under exceptional circumstances, while maintaining incentives on consumers to consider and manage health and safety risks more generally;
2. The Regulations are amended to remove the reference in 44(3) to the Schedule of the National Civil Defence Emergency Management Plan Order 2005 and incorporate specific criteria relating to “critical care services”, “essential food production”, “environmental protection”, and “minimum supply to avoid substantial economic costs”;
3. The Regulations are amended to require that all designations as an ESP must specify a minimum load that is considered “essential”. Under most circumstances this would be expected to be less than normal gas consumption;
4. Schedule 2 (the curtailment schedule) to the Regulations is amended to replace the current band 5 with bands 5a (minimum supplies to avoid substantial economic costs), 5b (minimum supplies for essential food preparation and environmental protection), and band 7 (critical care services);
5. The existing arrangements whereby band 6 customers are required to curtail demand is retained, rather than replaced with a requirement for a public appeal for savings;
6. The Regulations are amended to either:
 - a. allow band 6 consumers to apply for “critical care” ESP designations;
 - b. provide for band 6 and band 7 to be given equal priority in terms of curtailment and restoration; or
 - c. allow band 6 consumers to “self-select” ESP status during a gas contingency.

10.2 Preparing for a Critical Contingency

It is recommended that:

7. The Regulations are amended to require consumers who wish to be designated as ESP to supply information on the essential nature of service, any back-up supply arrangements in place or the reasons why back-up supply arrangements are not feasible, the minimum supply necessary to maintain the service, and emergency arrangements for coping with full loss of supply (including emergency stores and other back-up arrangements necessary to survive a gas outage);
8. The Regulations are amended to require consumers who wish to be designated as MLC to supply information on the rationale (e.g. probable damage to plant), the economic costs involved with loss of supply, any back-up supply arrangements in place or the reasons why back-up supply arrangements are not feasible, the minimal supply arrangements necessary to avoid damage to plant, and emergency arrangements for coping with full loss of supply (including emergency stores and other back-up arrangements necessary to survive a gas outage);

9. The Regulations are amended to provide an on-going obligation on retailers to notify consumers about the possibility of loss of supply and the opportunity to apply for ESP and/or MLC designation;
10. The Regulations are amended to require all MLC and ESP designations to be approved by an independent body, following a recommendation from a retailer. Retailers would retain responsibility to interface with consumers over possible designations, assist with preparation of applications, and to make recommendations to the independent approving body;
11. The Regulations are amended to require retailers to prepare, submit for approval by an independent approving body, and maintain a “Gas Retailer Curtailment Plan” that identifies the consumers in each band, provides evidence that all consumers have been contacted about the possible need to curtail gas demand during a contingency, and the possibility of being designated as ESP or MLC, provides a process for maintaining the consumer lists, provides a process for contacting consumers to issue curtailment directions following the declaration of a contingency, and reporting on compliance to TSOs;
12. Further consideration is given to whether the independent approving body should be Gas Industry Co or an independent panel established for the purpose;
13. The Regulations are amended to clarify that each consumer installation should be separately identified and allocated to a curtailment band based on the characteristics of each installation (rather than aggregating multi-site consumers);
14. The Gas (Switching Arrangements) Rules 2008 are amended to provide for retailers to maintain the “load shedding category”;
15. Further consideration is given to the need for an independent audit of the registry fields in order to assess the accuracy of the consumer curtailment designations.

10.3 Critical Contingency Operations

It is recommended that:

16. Further consideration is given to the best means to ensure that the CCO has appropriate access to consumer seasonal or daily consumption data to facilitate analysis and planning during a contingency;
17. Further consideration is given to amending the Regulations to clarify that the CCO may call for public restraint and gas savings in an affected region, following consultation with Gas Industry Co, if band 6 consumers in that region are directed to curtail gas consumption;
18. The Regulations are amended to clarify that the CCO should take responsibility for coordinating communications during a critical contingency, is required to appoint a media spokesperson as soon as reasonably practical following the declaration of a critical contingency, and is required to make timely public announcements at regular intervals during a critical contingency;
19. Further consideration is given to whether it is necessary or desirable to amend the Regulations to provide the CCO with powers to require relevant information to be supplied by TSOs and other asset owners during a critical contingency;
20. The CCO Service Provider Agreement is amended to provide for the CCO to coordinate communications and appoint a spokesperson, and to provide flexibility for the CCO to manage communications in a way that ensures they are appropriate to the circumstance – depending on

the circumstances, communications should be coordinated with asset owners, Gas Industry Co and Ministers to ensure consistency of messages, and targeted at consumers where necessary;

21. The Regulations are amended to clarify that the CCO Performance Report should be published in draft form and submissions invited from interested stakeholders, the final version of the report provided to Gas industry Co, and any submissions received by the CCO during the submission process should be published.

10.4 Regional and National Contingencies

It is recommended that:

22. Further consideration is given to whether it is necessary to provide some supplementary information about the distinction between national and regional contingencies (clarifying that national contingencies reflect gas supply shortages and regional contingencies reflect gas transport shortages) and the rationale for imbalance calculations only applying during a national critical contingency;
23. The existing arrangements, whereby contingency imbalance calculations and contingency prices only apply to national contingencies, are retained;
24. The Regulations are amended to provide that the CCO should make a declaration as to whether a critical contingency is national or regional, as soon as reasonably practicable following a critical contingency declaration, and allowing for that declaration to be modified during a contingency if required to reflect developments.

10.5 Compliance

It is recommended that:

25. Further consideration is given to how best to enhance the enforcement provisions to cover breaches by non-participant consumers and whether it is necessary to seek changes to the Gas Act.

Appendix 1. List of Abbreviations and Terms

Balancing gas	Gas which is purchased or sold by MDL, via the Balancing Gas Exchange, in order to manage Line Pack
CCO	Critical Contingency Operator
CCMP	Critical Contingency Management Plan
NZCDEMP	New Zealand Civil Defence Emergency Management Plan
EDF	Energy Data File (published by MED)
ESP	Essential Service Provider
GJ	Giga Joule
Gas gate	A point of connection between a transmission system and a distribution system or a consumer installation
GWh	Giga Watt Hour
Linepack	The total quantity of gas the in the pipeline at any one time
LNG	Liquefied natural gas
MED	Ministry of Economic Development
MDL	Maui Developments Limited
MLC	Minimal Load Consumer
NGOCP	National Gas Outage Contingency Plan
OATIS	Open Access Transmission Information System
PJ	Peta Joule
Shipper	The name given to a party that has gas transported through the Maui Pipeline
TJ	Tera Joule
TSO	Transmission System Owner
VTC	Vector Transmission Code

Appendix 2. Direction to Revise Demand Curtailment

This Notice is issued to inform you that the CCO has given direction to implement revised demand curtailment under **Regulation 53 (1) (d) (ii)** of the Gas Governance (Critical Contingency Management) Regulations 2008.

Curtailments to be implemented

Bands 0, 1a and 1b: Demand Curtailment Location & Direction

Gate #	Gas Gate Name	Band	Curtailment Direction
STR00501	AHUROA STORAGE FACILITY (Stratford #3)	0	Not affected
HPS02993	HUNTLY POWER STATION (Rankin Units 1-4)	1a	Curtail all demand by 03:30 25/10/11
HPS02993	HUNTLY POWER STATION (Units 5 & 6)	1b	Curtail all demand by 03:30 25/10/11
NPS00530	NEW PLYMOUTH POWER STATION	1b	Not affected
BER00653	BERTRAND RD (Methanex)	1b	Not affected
NGA00669	NGATIMARU RD (DELIVERY) (Methanex)	1b	Not affected
OTB00301	OTAHUHU B POWER STATION	1b	Curtail all demand by 03:30 25/10/11
SDN00101	SOUTHDOWN POWER STATION	1b	Curtail all demand by 03:30 25/10/11
TRC02003	TE RAPA COGENERATION PLANT	1b	Curtail all demand by 03:30 25/10/11
BAL08201	BALLANCE AMMONIA-UREA (Fuel) (designated as minimal load consumer)	1b	Not affected
BAL09626	BALLANCE AMMONIA-UREA (Process) (designated as minimal load consumer)	1b	Not affected
TCC00201	TARANAKI COMBINED CYCLE (TCC)	1b	Not affected
STR00521	STRATFORD POWER STATION PEAKERS (Stratford #2)	1b	Not affected

Bands 2-6: Demand Curtailment Direction

Curtailment Band	Curtailment Direction
Band 2	Curtail all demand immediately
Band 3	Curtail all demand immediately
Band 4	Curtail all demand immediately
Band 5	Curtail all demand immediately
Band 6	Curtail all demand immediately

Appendix 3. Critical Contingency Arrangements in the UK

Summary

- The UK produces around two thirds of its gas requirements domestically. The rest is imported, either via pipeline from Norway or NW Europe, or as LNG.
- Injection of imports occurs at geographically diversified points on the grid to help mitigate the effect of a pipeline rupture. Gas is also transited to Ireland via pipeline.
- Power generation is the highest consumer of natural gas in the UK, followed by residential.
- Curtailment is only used to address a contingency after other available measures - such as drawing on storage and injecting off-specification gas - have proved insufficient to address a contingency.
- The curtailment plan only prioritises supply to hospitals and care facilities, where a lack of supply could put lives at risk.
- Customers on interruptible contracts are curtailed first, followed by TOU customers on the basis of size, non-domestic customers, and domestic and priority customers last.

Glossary

DECC	Department of Energy and Climate Change
GBA	Gas Balancing Alert
GSMR	Gas Safety (Management) Regulations (the Regulations)
HSE	Health and Safety Executive
NEC	Network Emergency Coordinator (Emergency Manager)
NEP-G&E	the National Emergency Plan for Gas & Electricity
NGG	National Grid Gas is the System Operator (SO) for gas transmission network in Great Britain (England, Scotland and Wales).

Infrastructure and Nature of Supply/Demand

In 2009 annual supply was around 3,800PJ (over 3,600PJ of UK demand and 160PJ of exports to Ireland). About 2,500PJ of supply came from indigenous production; the remaining supply was as a mixture of imports from Norway, North West Europe and LNG. As UK gas production has declined new import capacity has been constructed including four LNG import facilities; two pipelines connecting to NW Europe, and pipelines and connections for imports from Norway. With an import capacity totalling over 6,000PJ per annum (roughly 2,000PJ through LNG regasification terminals; 2,000PJ by pipeline from Norway; and 2,000PJ by pipeline from NW Europe) the UK has the capacity to import supply well in excess of the UK and Irish demand. Supply over and above the UK + Irish demand is exported to NW Europe via the Interconnector (UK) pipeline.

The UK has 180PJ of storage capacity, the largest facility (Rough storage) has the capability to supply for around 80 days. New gas storage facilities added or currently under construction will add a further 40PJ, and these are mainly salt cavern facilities capable of being emptied and re-filled in 20 to 30 days.

Figure 1 shows the UK gas infrastructure. From a security of supply perspective key features include:

- LNG storage for peak shaving at five sites at the historical extremities of the network gave the capability to maintain supply in the event of damage to a pipeline. Today, with the geographical spread of terminals only one of the LNG storage sites is still operational.
- Pipeline supplies enter at seven reception terminals geographically spread out around the country.
- LNG import facilities hold stock in onshore tanks of over 40PJ when full.
- Multiple gas storage facilities located on the east and west side of the country.

Figure 2 – UK Gas Infrastructure



Source: IEA

Table 2 gives the annual and daily demand for gas in UK in 2009 (the peak day figure includes exports to Ireland). Power generation accounted for 36% of the UK demand in 2009. The next largest sector was residential demand which made up around 34%.

Table 2 – Gas demand in UK (2009)

Annual demand	3,600PJ/annum
Average day demand	10,000TJ/day
Peak day demand (planned including supply to Ireland)	19,900TJ/day

Market Framework

National Grid Gas (NGG) is the System Operator (SO) for gas transmission network in Great Britain (England, Scotland and Wales). The Gas Safety (Management) Regulations – GSMR (the Regulations) require the appointment of a Network Emergency Coordinator – NEC (Emergency Manager). In a gas emergency the SO takes on the role of the Emergency Manager, legally independent of National Grid and other parties under GSMR.

Under industry arrangements the Emergency Manager is required to produce a Safety Case describing the arrangements for managing a gas emergency and this Safety Case to be accepted by the Health and Safety Executive (HSE).

The National Emergency Plan for Gas & Electricity (NEP-G&E) sets out the arrangements between the gas and electricity industries, Department of Energy and Climate Change (DECC the lead government department) and other Government bodies for the safe and effective management of gas and electricity supply emergencies. The NEP-G&E is owned by DECC which is responsible for the development, review, updating and testing of the arrangements to maintain their effectiveness.

Declaration of a contingency

If a potential gas emergency is developing then the system operator will issue a Gas Balancing Alert (GBA) to signal to the market that demand-side reduction and/or additional supplies may be required to avoid the risk of entering into a gas emergency. The trigger level for a Gas Balancing Alert is based on a combination of the absolute supply and demand levels and the impact of a potential breach of the safety monitor (minimum storage stock level). The trigger levels for a GBA are published in advance of the winter. During a GBA there are arrangements for major gas users to self-interrupt and sell their supply through the traded market.

Contingency Management Arrangements

In a potential gas emergency the Emergency Manager conducts supply and demand measures to maintain the safety of the system.

An emergency may be triggered for any of the following reasons:

- Gas supply deficit (insufficient gas to meet demand).
- Gas storage safety monitor breach.
- Gas transportation constraint (damage to critical transportation plant).
- Gas quality emergency (including odorant failure).
- Loss of supply to more than 50,000 consumers.

- Failure of major gas market participant.

In an emergency situation the first step by the Emergency Manager is to curtail interruptible supply points, storage injection and to invoke emergency specifications to allow a wider range of gas qualities into the network. Next the Emergency Manager declares an emergency and directs producers (who have a duty under the Regulations), and storage withdrawals, to be maximized. At the third stage: interconnector exports to NW Europe are interrupted (note that supplies to Ireland have the same priority as supplies to GB consumers); Large Firm Supply Points are curtailed; and a public appeal to restrict gas use is issued. The fourth stage is to physically isolate Firm Supply Points (and finally Priority Supply Points) in anticipation of a further loss of pressure.

Following directions from the Emergency Manager the transporter informs the shipper of the curtailment and the shipper notifies the consumer to curtail its demand.

Unlike Ireland, standby fuel capability is only found at a small proportion of the gas-fired generators (CCGTs). There is no legislative requirement for CCGTs to invest in fuel-switching capability. Where it is found the backup capability has been developed for commercial reasons (e.g. to provide 'black-start' services to the grid; for insurance against supplier interruption; or to take advantage of spikes in gas prices).

There is no strategic storage in the UK and all storage is operated commercially. The exception is the storage safety monitor – a minimum storage stock holding amounting to 1.5% of total UK storage volume and required to ensure that an adequate pressure can be maintained in the network at all times and thereby protect public safety.

Curtailment of demand takes place in the following order:

- Interruptible Supply Points.
- Large Firm Supply Points (annual consumption > 2.6TJ) other than Priority Supply Points.
- Firm Supply Points (includes households) but not Priority Supply Points.
- Priority Supply Points.

The curtailment bands reflect commercial industry arrangements – interruptible supply points are where the transporter has the right to interrupt for transportation capacity reasons; large firm supply points are daily metered and firm supply points are (mostly) non-daily metered. Priority supply points relate to gas supply to priority consumers as defined below.

The Emergency Manager carries out practice exercises in which an emergency situation is simulated and this includes testing communications and contacting consumers at Interruptible and Large Firm Supply Points.

Priority consumers are consumers where failure to supply could put lives at risk, for example hospitals or homes for the elderly and disabled. In addition, special consideration is given in the event of curtailment of supply to priority consumers supplied by interruptible contract, to enable the effective switch-over to run on the stand-by fuel. The final category of priority consumer is where curtailment would cause in excess of £50m damage to the plant; these priority consumers are allowed to continue to consume gas to the extent necessary to avoid damage to the plant (i.e. for safe shut-down).

Priority consumers do not include food producers nor does the categorisation give special consideration to the environmental impact of curtailment. A response to DECC's consultation on priority consumers raised the question of including food producers as priority consumers. However, in the government response DECC stated that "any benefit in terms of further enhancing the resilience of the food and drink sector would be outweighed by the adverse impact on safety arrangements overall. In particular, the more sites that are given priority status, the greater the impact on reduction response overall, resulting from removing the potential for demand reduction from some large users.... We therefore have no plans to broaden the current scope of Category A and B priority status to include the food and drink and related sectors." *Gas Priority Users Government Response, DECC, July 2007, page 19.*

If an emergency were at the stage of impacting priority consumers then isolation would be done quickly without regard to a pre-arranged priority order, as it would be critical to isolate and protect these consumers from the safety implications which would follow from a loss of pressure on the network.

Gas transporters are required by their licences to maintain a list of priority consumers, and gas shippers and suppliers have licence obligations to exchange information and cooperate with transporters.

If a consumer wishes to be considered a priority consumer under one of the categories above, they provide details to their gas supplier/shipper who then informs the scheme administrator (a function performed by Xoserve the body that administers the gas supply point database). If the administrator considers that the applicant meets the criteria, it will inform both the transporter and the supplier/shipper who notifies the consumer. The consumer can contest a negative decision if it so wishes, in the first instance by submitting further information via the supplier/shipper to the administrator. If the matter cannot be resolved between these parties, it goes on appeal to the Secretary of State for Trade and Industry for resolution.

Experience with Contingencies

Since the market opening Great Britain has not suffered a national gas emergency. However, GBAs have been issued on the following occasions:

- Feb/Mar 2006 – following a fire at the facility, supply from the largest storage facility (Rough) ceased. Storage stocks held in the remaining storage facilities were drawn down and came close to breaching the safety monitor triggering a GBA. However, increased imports from NW Europe helped make up for the loss of supply and an emergency was avoided.
- Jan 2010 – record gas demand combined with Norwegian gas supply issues triggered GBAs on four days in early January. Once again increased imports from NW Europe helped to make up for the loss until the supply from Norway was restored.

Although the UK has plenty of supply *capacity* there is no *guarantee* that gas from a given supply source will turn up. A shipper's decision to flow depends on the gas price in the UK relative to the price in other markets. Work by the regulator has been looking at ways to improve/sharpen pricing signals at the approach to an emergency and during an emergency itself. As the UK becomes more dependent on imports, the amount of storage in the UK (less than 5% of annual demand) appears lean compared to other countries in Europe which have historically been import-dependent.

Compliance: The Regulations require that relevant persons to co-operate so far as is necessary with transporters and with the Emergency Manager to enable them to comply with the provisions of the Regulations. The arrangements under the Regulations are enforceable in criminal law.

Appendix 4. Critical Contingency Arrangements in Ireland

Summary

- Ireland imports around 90% of its supplies by pipeline from the UK. However, a disruption to supplies in the UK will affect both countries on a pro-rata basis.
- Gaslink – the System Operator – is the Contingency Manager.
- The vast majority of gas use is for electricity generation – around 65%. The country hence relies strongly on generation having dual fuel arrangements in place.
- Curtailment proceeds on effectively the same bases as in the UK, though power generation is cut first.

Glossary

CER	Commission for Energy Regulation
DCENR	Department of Communications, Energy and Natural Resources the lead government department providing an interface with the Central Government emergency response
NGEM	National Gas Emergency Manager
NGEP	Natural Gas Emergency Plan
GERT	Gas Emergencies Response Team

Infrastructure and Nature of Demand/Supply

In 2009 annual supply was around 200PJ of which around 10% was supplied from indigenous production via the Inch Terminal, and 90% of supply was imported from the UK via subsea pipelines. Imports are set to reduce in the future when indigenous production from Corrib is expected to supply around 75% of the annual demand in Ireland.

Ireland has one gas storage facility with a capacity to supply a total of just over 8PJ over a period of 50 days withdrawal.

The natural gas grid in Ireland is shown in Figure 1. From a security of supply perspective significant features of the Irish system are:

- Gas is supplied to the onshore grid at four different locations (five in future) with supplies entering at both ends of the grid.
- The ring main in Ireland means that in the event of damage to the ring main, gas supply could be maintained.
- The networks in Northern Ireland and the Republic of Ireland are connected together.

Figure 1 – the Natural Gas Grid in Ireland



Source: IEA

Table 1 gives the annual and daily demands for Ireland in 2009. A large proportion – around 65% – of the annual demand was for power generation.

Table 1 – Gas Demand in Ireland (2009)

Annual demand	200PJ/annum
Average day demand	560TJ/day
Peak day demand (planned)	920TJ/day

Market Framework

Gaslink is the System Operator (SO) and the designated holder of the natural gas licence for the operation of the transmission system in the Republic of Ireland.

Under the powers derived from Statutory Instrument 697 of 2007 (the Regulations) the Commission for Energy Regulation (CER) appointed Gaslink as the National Gas Emergency Manager – NGEM (the Emergency Manager). Gaslink is required to prepare the Natural Gas Emergency Plan – NGEP (the Plan) which is approved by the CER.

Emergency planning to support the Plan is undertaken by the Gas Emergency Planning Group (GEPG), a body chaired by Gaslink and includes representation from government, regulator and the gas/electricity industries. The GEPG is required to undertake regular review and updating of the Plan as well as ensuring that appropriate joint training and testing of the arrangements is undertaken.

Operational response in an emergency is undertaken by the Gas Emergencies Response Team (GERT) which is chaired by the Emergency Manager. GERT is comprised of representatives from the CER; Gaslink (the gas SO); Bord Gais Networks (gas network owner); ESBNetworks (electricity network owner); Eirgrid (Electricity SO); and the Department of Communications, Energy and Natural Resources (DCENR is the lead government department providing an interface with the Central Government emergency response). The GERT is only established in the event of a potential or actual emergency and supports the Emergency Manager in the implementation of the Plan. The GERT may also be established to test the effectiveness of the arrangements.

Contingency Management Arrangements

In a gas emergency the Emergency Manager convenes the Gas Emergencies Response Team (GERT), and the GERT is responsible for implementing the directions of the Emergency Manager as part of the operational response. With the assistance of the GERT the Emergency Manager makes ongoing assessments of the emergency and directs the actions to be taken to respond to the emergency.

The main triggers for declaring a gas emergency are:

- National or local gas supply deficit (insufficient gas to meet demand);
- National or local gas transportation constraint (damage to critical plant);
- Gas quality emergency (including odorant failure);
- Loss of supply to more than 5,000 gas consumers; and
- Failure of major market participant.

The Emergency Manager determines the quantity of firm load shedding required to rebalance the network and directs curtailment of gas demand. All instructions issued by the Emergency Manager use standard templates. Instructions to consumers are issued by Bord Gais Networks acting on behalf of NGEM. Shippers are responsible for implementing instructions issued by the NGEM including re-nominating gas demand, gas supply and storage.

Located at the western-most extremity of the European gas grid and being highly import dependent the Irish network is potentially vulnerable and gas storage can provide only limited cover. In an emergency it is likely that demand would need to be curtailed and in the first instance this would be power generation demand.

The CER Secondary Fuelling Decision of 2009 uses powers under Statutory Instrument 60 of 2005, and places obligations on gas-fired generation in Ireland to have capability to switch to alternative fuel (usually distillate oil). Base load gas-fired generators are required to hold five days of secondary fuel stocks on site and to be able to run at 90% output capacity for that period during a gas emergency. Mid-merit generating units are required to hold three days of secondary fuel stocks on site and also to maintain a 90% output capacity for that period. Gas powered generators who are unable to hold fuel stocks on site must ensure fuel stocks are located in close proximity to the plant with a dedicated fuel line and pumping facilities.

There is no mandate to hold strategic gas reserves in Ireland. In the event of a gas emergency, the operator of the storage facility is required to cease injection of gas into storage and to release gas from its facility if instructed to do so by the Emergency Manager.

The curtailment of firm demand is in the following band order:

- Power generation;
- LDM sector - three tranches of consumption: >5,400TJ/annum; 930-5,400TJ/annum; and <930TJ/annum in priority order;
- DM sector – daily metered;
- NDM 1 – non-household customers; and
- NDM 2 – household customers and priority institutional customers.

The curtailment bands – LDM (Large Daily Metered), DM (Daily Metered), NDM1 and NDM2 (Non Daily Metered) – are based on categories of demand used elsewhere in the industry arrangements such as the commercial code.

The responsibilities of the shipper and end user in an emergency are described in guidelines which are published on the website of Gaslink.

Issues

The Emergency Manager is responsible for proposing any amendments to the Plan for approval by the CER.

Regional arrangements are also in place to respond to a gas emergency. In the case of a gas supply disruption originating in Great Britain (Ireland is highly dependent on gas imports from GB), then load shedding will apply on a pro-rata basis in Ireland, Northern Ireland and Great Britain.

Ireland is highly dependent on imports from Great Britain. As described in the section on the UK, Great Britain has not suffered a national gas emergency and imports to Ireland by this key route have been maintained. Since market opening Ireland has not suffered a national gas emergency.

Appendix 5. Critical Contingency Arrangements in Australia.

Summary

- The Australian gas market consists of three distinct and geographically isolated markets. The Eastern market is the largest in terms of consumption, while the Western market is largest in terms of production. The Northern market is very small and relatively insignificant.
- Australia is a net exporter of natural gas, with large gas reserves and the potential for the supply/demand balance to further increase in the future.
- Around 33% of consumption is from industry. The energy sector accounts for 19%, and residential 11%, though these figures vary among the different markets – the Western and Northern markets have higher industrial proportions, the Eastern Market, higher proportions of residential and lower proportions of electricity generation.
- The markets are largely privatised, including distribution networks etc, though many aspects of the market are regulated. Formal wholesale market arrangements for gas are the exception rather than the norm.
- Each state has different legislation dictating how contingencies are handled. Generally speaking there are multiple laws addressing the issue, and some overlap does occur.
- Generally speaking, energy ministers are responsible for contingency management, the exception being Victoria, where this role is primarily taken on by AEMO – the Australian Energy Market Operator;
- Markets will generally be left to address a contingency themselves in the first instance, with some infrastructure in place to specifically help with this. Markets will generally rely on increased gas injections or draw on storage to address a contingency before resorting to curtailing customers. Government intervention will generally be considered a last resort. Victoria is the exception to this, where AEMO can respond to contingency situations early on.
- Victoria’s curtailment policies appear more comprehensive than other states. While other states have emergency management plans, these tend to outline the key priority industries, rather than describe an ordered curtailment plan for maintaining system security.
- The emergency management plans generally include clear communication channels to government agencies.
- There are penalties for non-compliance with orders given during an emergency, which are outlined in the overarching legislation.

Glossary

NGR	National Gas Rules
NGL	National Gas Law
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AEMC	Australian Energy Market Commission
MCE	Ministerial Council on Energy
NGERAC	National Gas Emergency Response Advisory Committee
VGEC	Victoria Gas Emergency Communications Protocol
AMDQ	Authorised Maximum Daily Quantity
ERA	Economic Regulation Authority
EUSFAC	Energy and Utility Services Functional Area Coordinator

Description of infrastructure

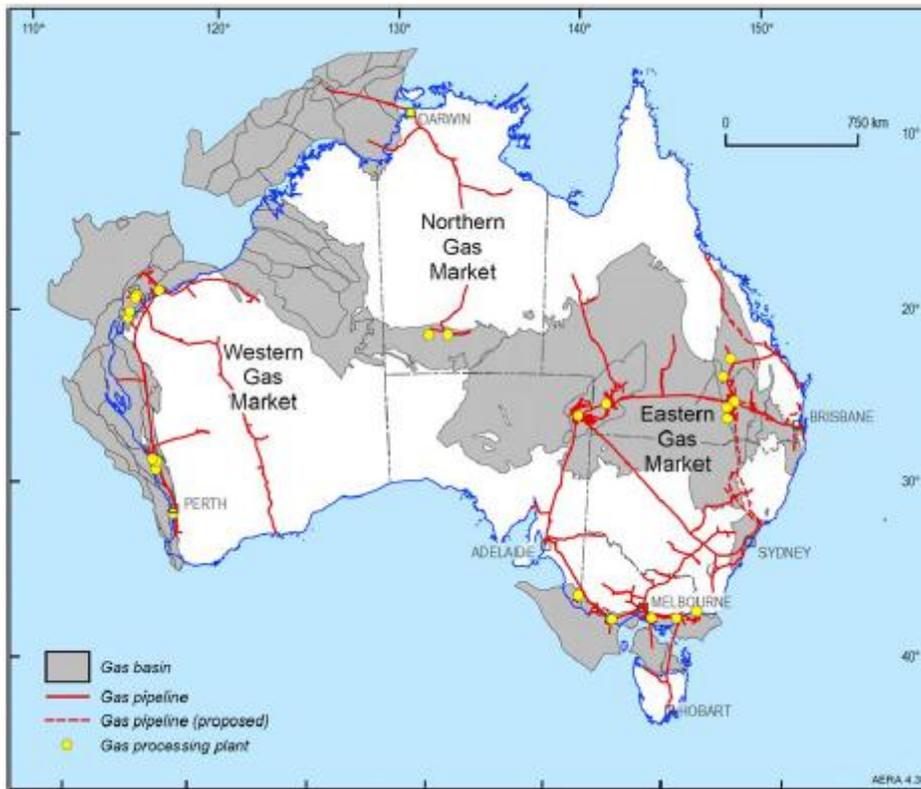
Australia has significant volumes of natural gas reserves. Around 90% of estimated recoverable reserves are located in basins off the north-west coast. Coal seam gas resources are also growing in utility, and are mostly located in Queensland and New South Wales.

The Australian domestic gas market consists of three distinct regional markets: the Eastern market (Queensland, New South Wales, ACT, Victoria, South Australia and Tasmania); the Western market (Western Australia) and the Northern market (Northern Territory). These markets are geographically isolated from one another, and as a result gas production is either consumed within each market or exported as LNG.

- The Eastern gas market accounts for 64% of the country's gas consumption, and 35% of production.
- The Western gas market accounts for around 63% of production and 35% of consumption.
- The Northern gas market is substantially smaller, accounting for 1.5% of production and 1% of consumption in 2010.

The natural gas infrastructure in Australia is shown in Figure 2.

Figure 2: National Gas Infrastructure Australia



Australia has four underground natural gas storage facilities, with a total capacity of 1.3 bcm (billion cubic metres). Details on these storage facilities are included in Table 15.

Table 15: National Gas Storage Capacity Australia

<i>Storage site</i>	<i>Type</i>	Working Capacity (mcm)¹	Peak Output (mcm/day)²
Mondarra, Perth Basin (WA)	Depleted gas field	127	5.0
Moomba, Cooper Basin (SA)	Depleted gas field	623	4.0
Newstead, Surat Basin (Qld)	Depleted gas field	234	..
Iona Field, Otway Basin (Vic)	Depleted gas field	308	5.2
Dandenong (Vic)	LNG peak shaving unit	17	6.0
Total Australia		1 309	20.2

¹ Working gas capacity = total gas storage minus cushion gas

² Peak output = the maximum rate at which gas can be withdrawn from storage

Nature of supply/demand

Australia is a net exporter of natural gas. Domestic gas consumption in Australia totalled some 1300 PJ (32.8 billion cubic metres (bcm)) in 2010 while production was around 1,900 PJ (50.4 bcm).

Australia's large and growing gas resources are sufficient to enable significant expansion in domestic consumption and export production capacity. Identified resources are in the order of 393,000 PJ (10 trillion cubic metres) as of 1st January 2009, equivalent to roughly 200 years of gas at 2010 production rates.

In 2010, 33% of total gas use was consumed in the industrial sector. The transformation sector was the second largest gas user, representing 31%. Some 19% of gas was consumed in the energy sector, which includes amounts consumed in the production of LNG. The residential sector, characterised by a large number of small scale consumers where uses of gas include water heating, space heating and cooking, accounted for 11% of total gas consumption.

Demand for natural gas in the three different markets is shown in Table 16.

Table 16: Australian Gas Statistics

(09-10)	Eastern gas market	Northern gas market	Western gas market	Australia Total
Annual Production	599	27	1,370	1,990
Annual consumption (PJ)	767	38	566	1,370
Daily consumption (TJ/day)	2991 (winter) / 2019 (summer) ²⁸	?	961 avg ²⁹	?
Industrial	70%	62%	70%	33%
Generation	5%	37%	25%	31%
Commercial	6%	1%	~1%	25%
Residential	17%	<1%	~2%	11%

Description of market arrangements

The Australian natural gas industry is largely privatised, with a handful of State/Territory governments fully or partly owning interests in gas retail companies. The major gas distribution systems in Australia are privately owned and there is no local, state or Australian Government ownership or shareholdings in upstream gas projects.

Certain aspects of the wholesale, transmission, distribution and retail industries are regulated by both Australian and State and Territory Governments. These regulations are generally different for each State.

AEMO operates a Short Term Trading Market for gas at defined hubs in NSW and SA (and QLD soon). This market uses bids, offers and forecasts to determine schedules for deliveries through the hub of

²⁸ 2009

²⁹ 2010

gas between shippers and users. AEMO also operates a competitive wholesale gas market in Victoria. There are no formal wholesale market arrangements for the rest of Australia (including Western Australia and the Northern Territory), the majority of gas being supplied under long-term agreements.

Description of legal framework

General legislation

The Australian gas market is regulated by the National Gas Law (NGL). It is applied in each jurisdiction by the National Gas Act (State) 2008 for each state (excluding Western Australia).

The NGL gives authority to:

- AER for the purposes of compliance, performance, breach investigation etc;
- AEMC for the purposes of rulemaking and market development; and
- AEMO to operate, administer and promote development of the market and its rules.

Under this framework, the National Gas Rules (NGR) are administered by AEMC and provide further detail on the market structure, pipeline access, price regulation and obligations of participants etc.

The NGL is applied in Western Australian (WA) by the National Gas Access (WA) Act 2009, which adopts a modified version of the National Gas Law. In this regard, responsibility for rule making and market development in Western Australia lies with AEMC. However, AER and AEMO have no authority in WA. Instead, regulation of the market is undertaken by the Economic Regulation Authority and is administered by the Public Utilities Office (previously Office of Energy) under the Energy Coordination Act 1994.

Contingency legislation

Each Australian State has its own specific legislation outlining how gas contingencies within that state will be managed. Often there are multiple laws covering the issue to differing degrees. It is difficult to discern the distinction and hierarchy of each of these laws, and therefore conclusively determine which would apply in any given situation, or the extent to which coordination among parties under multiple laws may eventuate.

Each state generally has gas or essential-service-specific legislation that can be employed when the available gas is insufficient to meet the reasonable demands of customers. Such legislation generally allows Ministers (to whom the relevant Act is allocated – likely to be an Energy Minister or equivalent) or delegated authorities to ration gas or give directions to gas producers, transporters, consumers and other industry participants.

For more pervasive issues with the potential to threaten life or damage property or the environment, states can rely on general emergency legislation. Such legislation requires the development of emergency management plans and provides more wide-ranging powers to authorities during such an emergency.

The NGL provides for jurisdictions to choose to grant power of direction to AEMO under a gas emergency declaration (Ch 6, Div 2, Part 6). Victoria is the only State to apply these provisions. The

NGR provides detail on emergency situations and the emergency response to be co-ordinated by AEMO in Victoria.

It should be noted that intervention is only likely as a last resort when the market is unable to address a contingency itself. There are some formal market arrangements in place to deal with a contingency. For example, the Short-Term-Trading Market in the Eastern Gas Network provides for market arrangements to address contingency situations through contingency bids/offers etc, and would be the primary instrument for addressing a smaller-scale contingency at the relevant hubs.

In May 2005, the Commonwealth's Ministerial Council on Energy (MCE) signed a Memorandum of Understanding on the emergency response protocol for natural gas supply shortages affecting jurisdictions with interconnected gas supply networks. This protocol applies to natural gas supply shortages affecting two or more jurisdictions and is designed to ensure that natural gas supply interruptions are managed in a nationally consistent manner.

As part of the Memorandum of Understanding the National Gas Emergency Response Advisory Committee (NGERAC) was established. Its membership comprises representatives of governments and all sectors of the gas industry and gas users. NGERAC has no power to direct market participants, but provides advice to the MCE and jurisdictions on efficient and effective responses to major natural gas supply shortages in order to maintain the integrity of the gas supply system and overall public health and safety.

Description of contingency declaration arrangements

As stated, each state has different legislative arrangements for dealing with a gas contingency. Leaving aside the provisions under general emergency legislation which are wide-ranging and unlikely to be employed except in the most extreme circumstances, most states allow the Governor or relevant Minister (likely to be the energy Minister or equivalent) to declare a gas supply emergency, with the Minister then taking the lead role in addressing the situation. Their ability to do this is generally facilitated by powers to give any reasonable directions to industry players – i.e. producers, consumers, transporters etc – that it considers necessary, including curtailing or rationing gas, controlling the flow, production or transportation of gas, and controlling the use or operation of equipment.

The exception to this arrangement is in Victoria which gives AEMO responsibility for declaring and dealing with a gas emergency, though the powers ascribed are similar.

Three states – NSW, WA and Tasmania - have identifiable emergency management plans specifically for gas contingencies which appear to have been prepared primarily under general emergency legislation, but likely to be used for an emergency declared under any authority. It is not clear if other states have explicit gas contingency plans in place. It has also not been possible to access Tasmania's plan. For these reasons, the remainder of this study is confined to NSW, WA and Victoria.

Broad description of contingency arrangements

Victoria

AEMO is given authority to deal with gas contingencies under the NGL, and is required to develop contingency plans and documentation. System Security Procedures prepared by AEMO specify the

minimum pressures that AEMO must provide at critical gas transmission system delivery points in order to maintain gas flows and meet demand.

AEMO can respond to a threat to system security if:

- Guidelines around gas quality are not being met;
- AEMO considers there to be a threat to public safety or the supply of gas; or
- System pressures and flows are outside of the limits specified.

AEMO will also intervene in the market if prompted to do so by the Governor.

Where AEMO reasonably considers that intervention is required to address a contingency, it can take any measures it believes reasonable and necessary to address the situation, including issuing directions such as:

- directing the injection of LNG
- curtailment
- increasing withdrawals
- requiring participants to use reasonable endeavours to inject more gas; and/or
- requiring participants to inject off-specification gas;

Because Victoria operates a wholesale market for gas, any requirements to increase injection or withdraw from storage can be funded through normal market arrangements.

NSW

NSW relies heavily on market participants to coordinate load shedding and voluntary demand reductions, with system operators predominantly in charge of this process. The state government may get involved to coordinate an emergency response if rationing is required to ensure supply of gas to priority services, and the security of the system.

The principles underpinning the NSW emergency response are:

- Market mechanisms shall be the first option when managing a gas supply shortage;
- Pipeline linepack is available for draw down to offset any short term supply demand imbalances in the system. This shall be managed by the market's balancing arrangements;
- Draw down of gas within the pipeline and distribution systems shall be limited so that sufficient gas remains in the system i.e. the systems will remain capable of supplying essential services and immediate full restart when supply is restored;
- Network operations shall only invoke load shedding procedures in network access arrangements or operating plans and procedures when market mechanism are unable to balance supply and demand;
- Government intervention shall only be initiated to ensure supply to essential services whilst not impeding any security system;
- Government intervention shall be limited to reduction of demand and not intervene in production of gas;

The “Energy and Utility Services Functional Area Coordinator” (EUSFAC) (an appointed position) coordinates an emergency response, based on advice from the Department of Water and Energy which would advise on when and what intervention was appropriate.

A “Jurisdictional Coordinator” acts as a go-between for the industry and the EUSFAC.

WA

In the first instance, WA relies on market mechanisms to address a gas contingency by having retailers, shippers and other market participants adjust their supply and demand.

Where this is insufficient gas available to meet demand, demand curtailment by large customers can be enacted by retailers and power system operators.

As a last resort, when commercial curtailment strategies will not achieve the necessary effect, Government – specifically the Minister for Energy – can use its powers to limit the consumption of energy and direct energy supplies to priority uses. An order to ration gas can be given, which would be prepared by the relevant pipeline operator but authorised by the Minister. The primary objective of this is to help avoid depressurisation of the gas distribution system by restricting gas consumption when supply is interrupted; and to ration a limited supply of gas.

If more significant action is required, the “Hazard Management Agency” (i.e. the Public Utilities Office) becomes responsible for coordinating a response to an emergency. The emergency response plan is somewhat vague as to what this response would entail, but powers are as described in the overarching legislation.

Description of communications arrangements

AEMO operates a “bulletin board”³⁰ in the Eastern Market, which is a website that acts as a source of natural gas related information that is readily available to all interested parties, including the general public, and assists in emergency management.

Industry participants must be registered users of the Bulletin Board, and are required to provide information on their production, storage, delivery, pipeline capacity and linepack. It also has a specified “emergency page” that can be activated if an emergency has been declared. The Bulletin Board helps communicate issues with all users across all jurisdictions.

The Public Utilities Office is moving to develop a similar concept for Western Australia which the IMO would operate.

Victoria

When an emergency is declared, AEMO informs the Emergency Manager, Duty Manager or General Manager of each registered participant. AEMO also makes immediate contact with:

³⁰ See www.gasbb.com.au.

- The Director of Energy Safety;
- The Minister for Energy and Resources office; and
- The Department of primary industries

to advise them of the declaration.

Any directions are issued directly to the Emergency Manager, Duty Manager or General Manager of each registered participant.

AEMO uses System Wide Notices to keep registered participants informed during an emergency. It has also developed a Gas Emergency Communications Protocol (VGECP) – a designated protocol to ensure timely and accurate advice and information is disseminated in a coordinated manner during a gas emergency.

The VGECP was developed in consultation with stakeholders and is designed to complement existing AEMO, industry and government emergency policies. It includes four phases: notification, monitoring, response and recovery. Communication follows a defined path:

Text notification to primary stakeholders → teleconference (smaller group of stakeholders)
→ Issue situation report → update supply/demand balance info (if required).

AEMO also has a specified media management plan for gas emergencies invoking a “Single Industry Spokesperson”, being AEMO (with the agreement of government and industry), which speaks on behalf of the industry. Key messages are developed in coordination with communications managers of the wider industry. This ensures that a single, consistent and state-wide event description is available to the media.

AEMO will also coordinate with other government agencies and NGERAC as appropriate.

New South Wales

When there is a supply disruption, the system operators are responsible for communicating the nature, location, time, likely effect of the event, and details of any actions they are taking to the Jurisdictional Coordinator, and providing situation updates at least daily – either verbally or electronically.

“Normal gas market arrangements” are used to inform affected market participants during lower-level gas contingencies.

If the government considers it necessary to intervene, the Jurisdictional Coordinator is then responsible for declaring this to the designated contact persons of all affected parties and NGERAC (where necessary).

During these events, the authority with power of direction (i.e. depending on the legislation under which the emergency is declared and clarified in the declaration – likely a Minister) becomes the only approved source of public information in relation to direction and orders for the reduction of gas consumption. Public information will be developed in consultation with other parties.

Western Australia

The Public Utilities Office who acts as the Coordinator during an emergency, upon being notified of an event, is responsible for notifying the Minister, Premier, State Emergency Coordinator and stakeholders that would be required to assist with a response.

A colour coded alert warning system is used:

- for a “green alert” situation (increased risk of a significant disruption), the Public Utilities Office will consider publicly communicating a warning of the potential for outages. The relevant producer/transporter notifies its customers or shippers;
- for an “amber alert” situation (limited curtailment of customers), the Public Utilities Office holds meetings with relevant stakeholders, but diverts information requests to the impacted gas producer or transporter. The relevant producer/transporter notifies its customers or shippers;
- for a “red alert” situation (widespread curtailment, threat to critical infrastructure or essential services or a disruption to the supply system), the Public Utilities Office activates its response teams and has a Media Liaison Officer deal with info requests from the community. The relevant producer/transporter notifies its customers or shippers, and deals with info requests from wholesale customers and regarding infrastructure. The State Emergency Coordination Group is also notified;

Description of demand curtailment arrangements

Victoria

Curtailment would only be used after due consideration of alternative sources of gas supply and the lead time required for it to be effective, and follows stated guidelines. The guidelines are designed to achieve the maximum rapid impact of curtailment.

Given this, curtailment proceeds in descending order of load size with some exceptions:

- essential and critical services are placed last;
- approved uninterruptible, continuous processes, and gas for converting or starting-up alternative fuelled plant are curtailed after all other large industrial and commercial;
- voluntary restrictions are formally provided for.

Furthermore, before curtailing generation, AEMO will also consider the effect that it may have on the electricity system. The full order is shown in Table 17. Customers within bands are also curtailed in descending order of their MDQ.

Customers may be permitted to maintain a minimum level of gas consumption where this is required for public safety, plant or process safety, health or environmental reasons, though they must reduce their demand as quickly as possible within these accommodations. Exemption from full restrictions is only granted for specific incidents on the day. Gas users seeking exemption from full restrictions must apply to their gas Retailer and provide grounds for exemption that must then be approved by AEMO. Market Customers must apply directly to AEMO.

Through every-day market arrangements, large customers (> 10 TJ/yr or 10 GJ/hour) can obtain an Authorised Maximum Daily Quantity (AMDQ). This acts as an “uplift hedge” on a particular pipeline, giving them preferential access to pipeline capacity, and hence hedging against congestion. In most instances an AMDQ has to be purchased, but it allows customers that value their gas supply (or part of it) more highly than others to maintain operation for longer if load is curtailed during a contingency.

There is further allowance for industries that would incur significant damage to plant and equipment if their load was curtailed which, it is assumed, is information that is provided to AEMO and stored on its metering database.

Together, the AMDQ and plant damage provision allow participants to hedge against the costs of curtailment to a similar degree as New Zealand’s MDL provision.

The curtailment bands do include consideration of essential services, though these are restricted tightly to those with a “life or limb” function. There is no specific provision for environmental damage in curtailment plans.

Table 17: AEMO Curtailment Bands for the State of Victoria.

Band	Curtailed Customers
0	Customers > 10 TJ/yr or 10 GJ/hour with no AMDQ Consumption above the AMDQ for customers > 10TJ/yr or 10GJ/hour with an ADMQ
1	Withdrawals into underground storage Gas fired generation scheduled by AEMO – except where necessary to start-up/convert authorised dual fuel sites Interruptible contracts Exports through interconnections – to the extent export customers are not also being curtailed beyond an equivalent band.
Consider public appeal for voluntary reductions	
2	Customers with MDQ \geq 5,000 GJ/day curtailed to 40% of MDQ
3	Customers with MDQ between 1,000 and 5,000 GJ/day curtailed to 40% of MDQ
4	Rest of band 2 customers' load ³¹
5	Rest of band 3 customers' load
Public appeal for voluntary reductions	
6	Customers with MDQ between 500 and 1,000 GJ/day
7	Customers with MDQ between 250 and 500 GJ/day
8	Customers registered as being >10 TJ/year or 10GJ/hour but have an MDQ of less than 250 GJ/d
9	Customers with uninterruptible continuous processes that may incur material damage to furnaces or plant Gas required for start-up or conversion of dual fuel sites
10	Gas area heating at all residential dwellings and small commercial and industrial customers Gas use for other than area heating at all residential dwellings and small commercial and industrial customers
11	Essential and Critical Services customers identified by the Department of Human Services – i.e. hospitals, aged and infirm residential institutions, laundries servicing these institutions, services providing blood plasma and related products to hospitals.

³¹ Customers still operating at their AMDQ level are assumed to be fully curtailed under bands 2 - 8, except where they otherwise come under band 9 or 11.

When restoring load or rationing a restricted supply over longer periods, AEMO does not simply reverse the curtailment process, but rather operates with consideration of the following principles:

- Priority given to maintaining gas pressures in transmission pipelines and networks to avoid unmanageable disruption to customers;
- Risks to the safety and integrity of gas transmission and distribution networks and to customer appliance usage should be minimised;
- Risks to the health of persons and their environment should be minimised;
- Long term economic damage to industries should be minimised;
- Restoration will only be done if it can be reasonably expected to be maintained;
- The approach of “jobs before showers or heating” and preserving the economic and employment interests of the state will be adopted where possible.
- Restoration and rationing is based on a specified order of customer categories, including (arrows indicating order of importance):
 - Essential services – hospitals → drug rehab → laundries;
 - Critical services – milk, bread and essential pharmaceuticals → essential services supply chain
 - Non-critical rationed services – plant with high associated damage from gas outage → services for environment and health;
 - Key economic industries – Large industries (<10 TJ/year or 10 GJ/hour) → other industries (in an order to be determined, with consideration of areas where workers have been stood down due to a shortage, supply chains, food processing, perishables etc);
 - Residential – cooking and hot water → area heating
 - Non process heating – building heating, commercial showers, pool heating, dual fuel users.

Under this structure it appears that environmental effects would be given much greater consideration during rationing than during rapid load curtailment. If such a structure were used in New Zealand it could be expected that dairy processing would potentially be one of the first bands of customers whose load was restored, despite them also potentially being one of the earliest curtailed.

In communicating the requirement to curtail load, AEMO issues curtailment directions to all market participants and market customers (i.e. retailers and “direct-connect” equivalents). Gas retailers are responsible for contacting their customers to arrange load curtailments. It is unclear whether this includes small commercial/industrial and residential customers.

New South Wales

Rationing may be instituted if it is considered that a supply disruption event constitutes a significant and widespread danger to life or property resulting from the reduced availability of natural gas.

In enacting any response, the NSW Government prioritises public order, safety and community services. These priorities, the order of which is flexible, include:

- Continuity of government;
- Production, supply and distribution of energy resources, water, liquid fuel supplies and food;
- Waste management;
- Wastewater management;
- Maintenance of communication networks;
- Health services including ambulance services, aged care, quarantine, GP and counselling services;
- Maintenance of emergency provision;
- Maintenance of law and order and judicial systems;
- Maintenance of transport services;
- Maintenance of mortuary services
- Services to populations at risk (e.. residential centres, group homes, carer-dependent persons etc);
- Accommodation – ensuring there is enough accommodation available and accessible for displaced persons;
- Maintenance of banking and financial services;
- Animal welfare services;
- Cooperation and interdependency between agencies.

The NSW emergency response plan for gas shortages allows for market-led load shedding or curtailment as a mitigation approach prior to government involvement (led by the pipeline system operator), and it acknowledges that reinstatement of supply may be progressive. However, it does not appear that the State of NSW has a published plan for the order in which services would be rationed or reinstated given any such event. While it appears that it would sufficiently cater for essential services, in absence of such a plan it could be presumed that any curtailment would be ordered “on the fly”.

Western Australia

Excluding liquid natural gas (LNG) exports, approximately 95% of Western Australia’s natural gas consumption each year is by businesses in manufacturing, electricity generation, mining and transportation, with the remainder used by small use consumers (residential users and small businesses).

During a gas supply disruption, gas and electricity retailers can use the Priority Allocation Schedule (“the Schedule”) as a guide to allocate a limited supply of energy to priority uses. It is not clear if the Hazard Management Agency follows a similar priority.

The objectives of the Priority Allocation Schedule are to:

- protect the health, safety and property of the community;
- minimise broad community disruption; and
- minimise economic impact.

During a gas supply disruption, the following services are considered to be priorities that receive gas and electricity supply (listed in order of importance):

- Energy Infrastructure - production, supply and distribution of energy resources and liquid fuel supplies to support:
 - The natural gas and LPG transmission and distribution networks;
 - Electricity networks; and
 - Production, supply and distribution of liquid fuel supplies.
- Essential Services:
 - Production, supply and distribution of water supplies;
 - Health services including hospitals, ambulance services, aged care facilities, quarantine facilities, primary care services and other critical services supporting these facilities as determined by the State Health Coordinator;
 - Waste and wastewater management;
 - Energy and water services to populations at risk (e.g. in group homes, priority home care services, people who are care-dependent etc);
 - Maintenance of emergency service provision;
 - Maintenance of law and order (including police services), the judicial system and the correctional system;
- Supply to residential customers;
- Industries providing essential goods and services to the community:
 - Production, supply and distribution of basic food supplies;
 - Child protection, children in care and community well-being;
 - Intensive and “just in time” production animal industries and processing where gas disruption would result in significant harm to animal welfare and the environment, including milk processing, pork and chicken meat production and animal waste rendering;
 - Maintenance of mortuary services (identification, certification, religious practices, storage, burial and cremations);
 - Maintenance of communication networks;
 - Maintenance of banking and financial services; and
 - Continuity of Government;
- All other industries.

This schedule is much more analogous to AEMO’s gas rationing priorities which account for the possibility of supply being diminished for long periods, rather than its curtailment policies which are in response to a sudden event for system stability purposes.

The schedule may not apply where customers have other viable alternatives to manage the consequences of a reduction in gas supply – for instance, dual fuel generation plant would not receive gas as a priority under the first bullet-point.

There does not appear to be specific provision for MDL or part of a load to be considered “essential”.

Description of penalties and incentives to comply

The legislation under which each state operates its gas supply emergency management procedures provides for penalties for not complying with a direction made under the relevant Act. These include

financial penalties, either described in terms of dollar amounts or as “penalty units”. The number of penalty units is multiplied by a fixed dollar value declared by the state – for example, in Victoria a penalty unit is equal to A\$122.14, so 10 penalty units would mean a fine of A\$1,222.14.

Failure to comply with the NGL, and hence the NGR administered by AEMO can result in a penalty of \$25,000 for an individual or \$100,000 for a corporate, as well as an additional \$10,000/day for each day the offence continues. Penalties through-out Australia can range from around \$1,000 to up to \$250,000 depending on the type of offender (individual or corporate), the state, and the legislation any non-compliance is considered to have breached.

Breaches are investigated by AER (or ERA in WA).

Description of relationships with other emergency agencies

Emergency response to a gas supply disruption across the different Australian States is generally well co-ordinated with general emergency agencies because the response protocol has been developed under general emergency legislation, and government intervention is considered a last resort. The relationships between agencies are detailed under these response plans.

Victoria is slightly different because AEMO can be involved in coordinating a response to a contingency well before it escalates into an emergency in which other agencies are involved. However, AEMO too has emergency procedure documentation outlining its relationships with the different agencies.

Description of preparedness education arrangements

Victoria

AEMO undertakes an annual program of preparedness, review and testing. This involves testing its text and teleconference facilities, performing simulation exercises, updating notification group details and providing refresher training for participants.

Under the NGRs, Registered participants also have specific obligations with respect to emergency planning, including the provision of information to AEMO, such as emergency contact details and operational information. Participants are also required to ensure that their staff, and where relevant customers, are aware of AEMO’s Emergency Protocols and developing their own safety procedures, ensuring they are consistent with the Emergency Protocols.

New South Wales

Each Agency is responsible for the training of its own personnel to perform the roles and responsibilities assigned in the emergency response plan.

The EUSFAC is responsible for the conducting exercises, and/or testing all or any part of the procedures and arrangements in the emergency response plan.

Furthermore, the emergency plan is to be reviewed:

- Following implementation of the Plan
- Following an exercise designed to practice or test any aspects of the Plan

- When the roles and responsibilities of any Agency involved in the Plan are changed
- At the direction of EUSFAC
- Every five years.

Western Australia

Western Australia's emergency response plan provides detail on their prevention and preparedness initiatives.

Prevention is considered to be a responsibility of industry, which is regulated by a number of safety, offshore petroleum and pipeline regulations.

The Public Utilities Office undertakes the operational planning and implementation of preparedness activities, including:

- Testing its emergency response plans;
- Providing advice on and participating in regular exercises; and
- Contributing to response planning and regular reviews of the plans;

Organisations with roles and responsibilities identified under the response plan are expected to ensure that their staff are provided with emergency management training, and have a good understanding of the procedures and arrangements in the response plan.

The Public Utilities Office also provides information and tips on energy efficiency on an ongoing basis through its website, publications and participation at events. While these tips are a valuable source of information in enabling the community to be more energy efficient, they are especially useful during a gas supply disruption in enabling the community to reduce energy use.

Description of requirement for back-up

While it was not evident that there were any mandatory provisions in place, a recent review of arrangements in Western Australia has suggested changes that would:

- provide an incentive for electricity generators to install or retrofit dual-fuel generation capacity and maintain an adequate strategic stock of diesel to meet abnormal fuel requirements associated with a gas supply disruption and
- require gas retailers to have adequate back-up supply arrangements to ensure continuity of supply for small use customers on standard contracts with standard tariffs (such as residential and small business customers) and offer these back-up supply arrangements as an opt-in service for other gas distribution system retail customers.

The detail around these changes is not immediately clear.

2008 Western Australian Gas Crisis

On 3 June 2008 there was a rupture of a corroded pipeline and subsequent explosion at a processing plant on Varanus Island resulting in a major disruption to the gas supply in Western Australia. The plant, operated by Apache Energy, which normally supplied a third of the state's gas, was shut down

for almost two months while a detailed engineering investigation and major repairs were carried out. Gas supply from the plant partially resumed in late August. By mid-October, gas production at the plant was running at two-thirds of normal capacity, with 85% of full output restored by December 2008.

In a state heavily reliant on a continuous supply of gas for industrial processing, manufacturing, residential use and electricity generation, the sudden loss of almost 35% of gas supply had immediate social impacts, and significant short and long-term economic effects. Many businesses were forced to curtail or cease operations, resulting in workers being stood down or forced to take annual leave, and the government requested that businesses and householders conserve energy usage. When many large gas users switched to diesel for power generation, the risk of a shortfall in transport fuel led to the federal government authorising the release of emergency fuel reserves. Overall, the gas shortage had a large impact on Western Australian industries, particularly mining, construction, and hospitality.

There was no State Government contingency plan before the event. An emergency coordination committee of government and industry representatives was put together to ration and redirect the remaining gas supply sources. The incident raised significant public and political issues related to energy security, adequacy of existing infrastructure, contingency planning, and the role of regulatory agencies.

Since the outage, a number of reviews have been performed to identify and address the lessons from the event. Among them has been the development of the gas supply disruption emergency response plan.

The WA Government established the Gas Supply and Emergency Management Committee (GSEMC) to review and provide advice to Government on the State's gas security, gas supply disruption management and mitigation options for gas supply disruptions.

The GSEMC recommended the Government implement regulatory frameworks that provide for the development of gas disruption contingency services in the electricity and gas markets. The regulatory frameworks would:

- provide an incentive for electricity generators to install or retrofit dual-fuel generation capacity and maintain an adequate strategic stock of diesel to meet abnormal fuel requirements associated with a gas supply disruption and
- require gas retailers to have adequate back-up supply arrangements to ensure continuity of supply for small use customers on standard contracts with standard tariffs (such as residential and small business customers) and offer these back-up supply arrangements as an opt-in service for other gas distribution system retail customers.

In 2009, the Government endorsed the recommendations of the GSEMC, noting that while it is not possible to prevent all gas supply disruptions, putting in place regulatory frameworks for Gas Contingency Services will help to mitigate the potential impacts of such an event.

Appendix 6. Critical Contingency Arrangements in Spain

Summary

- Spain produces negligible gas, importing practically all its gas from overseas, the majority shipped as LNG, and around a quarter through international pipelines.
- Around half of the gas consumed in Spain is for electricity generation, though demand has been decreasing in recent years with increased renewable generation and decreased economic activity.
- Spain requires its gas operators to keep a minimum amount of gas in storage, though this storage alone could not satisfy peak demand due to restricted withdrawal capacity.
- Spanish operators are also required to diversify their supply lines so that there is no single point of failure. This is a cornerstone part of Spain's energy management plans.
- A contingency is assessed by the Technical System Manager, Enagás, as being of specified levels of severity, including an emergency level situation.
- Enagás coordinates the response to any contingency event, and will generally do this by increasing injection at its LNG terminals, drawing on storage, or curtailing customers on interruptible contracts.
- If curtailing non-interruptible consumers is required, this is done along a fairly typical priority order, with large industrials first and domestic customers and essential service providers last. Enagás has scope for discretion in curtailments by having regard to a number of legally defined principles.
- Enagás maintains a communications protocol for engagement with customers that are being curtailed. It is also required to keep government agencies updated at all times.
- Spain does not place much emphasis on dual-fuels or other back up arrangements (other than storage), as its supply system is designed to be flexible enough to deal with a supply disruption.

Infrastructure

Spain's gas network features two import pipelines from Algeria and four export pipelines to Portugal and France (2 each). Flow through these export pipelines can be reversed, but capacity is limited, making the network somewhat islanded.

Six LNG regasification terminals are operative in the Spanish system and are the main points of entry for gas into the system. These plants provide for around 58 bcm of gas each year (~2,260 PJ). More terminals are being planned.

LNG storage totals approximately 1.5 bcm (~60 PJ) with a maximum output of around 6.9 mcm/day (~270 TJ/day). There are also two underground storage facilities with a total capacity of around 1.7 bcm (~65 PJ) with a total injection capacity of 8.2 mcm/d (~320 TJ/day) and withdrawal capacity of 12.5 mcm/d (~490 TJ/day). Two other underground storage sites are under construction.

Figure 3: National Gas Infrastructure Spain



Nature of Supply/Demand

Spain produces a negligible amount of gas - around 50 mcm (~1.95 PJ) in 2010. It is therefore a net importer of gas, relying heavily on gas from North Africa, the Middle East and other regions. The majority of imported gas is brought in as LNG. Just 26% is from the international pipeline connections (2009 figures).

In 2009 demand for natural gas was 34.6 bcm (1,350 PJ). Demand has dropped away in recent years because of increased renewable electricity generation and the economic problems that Spain is experiencing. These economic problems have led to reduced industrial and commercial activity, with a direct and indirect (due to reduced electricity production requirements from combined cycle power plants) impact on gas demand. Approximately 50% of natural gas consumption is from electricity generation, 30% industrial customers and 10% residential customers.

Peak gas demand is approximately 168 mcm/day (~6,550 TJ/day). This is equivalent to around 9 times the peak output from storage sites (18.5 mcm/day or 720 TJ/day), though LNG regasification terminals (173 mcm/day or 6,750 TJ/day) and pipeline imports (74 mcm/day or 2,890 TJ/day) provide ample capacity to meet this demand.

Table 18: National Gas Demand Spain

Annual Production	1.95 PJ
Annual Consumption	1,350 PJ
Peak daily consumption	6,550 TJ/d (winter)

Description of Market Arrangements

The Spanish natural gas sector is privately controlled, including production, distribution, and transmission.

Enagás owns most of Spain's natural gas transmission network and is the “Technical System Manager”. The firm also owns and operates three of the country’s six LNG regasification terminals. Enagás was privatised in 1994. However, since December 2006, the government has limited individual company ownership of Enagás to a maximum of 5%.

There are also five distribution system operators, the largest being Gas Natural (responsible for 85% of the network).

There are around 17 active shippers in the market, the largest of which is, again, Gas Natural.

The total available capacity of Spanish underground gas storage is managed as a whole by Enagás in order to optimise the working of the network and to minimise gas flows from storage facilities to consumers.

Legal Framework

The Spanish Natural Gas System is based on the System Technical Management Rules, published as a Ministerial Order ITC/3126/2005, which has a procedure to cope with exceptional situations that may affect the normal operation of the system.

Contingency Arrangements

A contingency can be caused by unexpected increases in consumption, technical problems in the transport infrastructures and partial or total supply disruption in an international pipeline or regasification terminal.

There are three levels of contingency situation as well as an “emergency” level. These are:

- Level 0: A situation with a probability of a deficit or surplus of gas, caused by a trader or because there are problems with transporting the natural gas. The measures to solve this situation include cuts to interruptible clients of the participant that caused the problem and modifications to shipping schedules.

- Level 1: Relevant when the level 0 measures taken are not enough. The measures taken to solve this situation include cuts to interruptible clients, use of operational natural gas stocks, and imports of additional natural gas quantities by pipeline or ship.
- Level 2: Relevant when the level 1 measures taken are not enough. The measures taken to solve this situation include cuts to non-interruptible clients, according to priority criteria.
- Emergency situation: An emergency situation is declared when the scarcity of natural gas makes the use of strategic stocks necessary. The government assumes control of strategic stocks in emergency situations.

The System Operator is the responsible body for putting this procedure into practice, making the declaration of the level of contingency and coordinating the actions to be taken by the system users - namely traders, infrastructure owners and others and large consumers. It also must keep the Minister, as well as the National Energy Commission, properly informed at any moment, and must be well coordinated with the Electricity System Operator, as far as gas supply for electricity generation is concerned. An Operation Group, composed by representatives of the main gas users, gives support to the System Operator for making decisions.

Spain imposes a stockholding obligation on its gas operators, equivalent to 20 days of consumption at a minimum (10 days of “operational reserves” and 10 days of “strategic reserves”). The use of underground storage is regulated by the Ministry so that all companies obliged to maintain stocks have access to the necessary capacity to store their strategic gas. The Technical System Manager is the body in charge of the capacity allocation among companies.

A public agency – CORES (the Corporación de Reservas Estratégicas de Productos Petrolíferos) - ensures these minimum stockholding obligations are followed. It also ensures that operators follow requirements for them to diversify their supply of Natural Gas to avoid introducing a single-point-of-failure. Diversification of supplies is a key tenant of Spain’s emergency policy design.

Cuts to interruptible clients are made following geographical criteria and other restrictions based on the specific situation. There is also consideration of the potential for users to switch fuels as well as taking into account the availability of an alternative fuel (oil fuel) which can replace natural gas without affecting the production process of the interruptible client. These clients are usually power generators. The Spanish system is designed to be highly flexible (LNG diversification, etc.), and thus fuel switching is not regarded as a priority tool to face disruptions. Nevertheless, combined-cycle power plants can generally work with an alternative fuel (mainly diesel) for short periods of time.

If a contingency reaches Level 2 severity, cuts to non-interruptible clients may be made. This is coordinated by Enagás with consideration of the following priority order:

- Declared essential services
- Domestic consumers
- Commercial consumers
- Industrial consumers including power generation

Essential services include:

- health centres and hospitals

- Kindergartens and schools for compulsory education
- Nursing homes
- institutions directly related to national defence, fire protection, police etc
- public transportation

In curtailing customers, Enagás must also use best endeavours to:

- Minimise the economic and technical harm resulting from a lack of supply
- Select consumers in order to achieve the maximum degree of operation and reduce the number of consumers affected
- Maintain fairness between companies, distributors, retailers and consumers affected
- Act under the principle of minimum intervention

Restoration of supply would be done in the inverse of the order in which they were curtailed.

Notices of curtailment are provided to the relevant parties by Enagas by email in the first instance. The minimum information required in the notice is (noting that interruption notices can also be given for planned maintenance etc):

- consumer ID, name and CUPS code (i.e. meter reference number)
- start time of the interruption
- duration of the disruption (if known)
- cause of the interruption
- type of interruption: “urgent” (contingency) or “normal” (maintenance etc)

Notices would also identify the exact consumption that is to be discontinued in the event that the customer’s consumption contains more than one supply stream. For example, it could identify the number of turbines to be curtailed.

For interruption of a power generator (or the extension of an existing interruption), agreement must be had with the electricity System Operator, which can reject it if there is a risk to the safety of the electricity system but must justify this to authorities.

The carrier or distribution system operator confirms the execution of an order by TOU

Spain has not had any recent experience with higher-level contingency events.

Appendix 7. Critical Contingency Arrangements in Italy

Summary

- Italy is heavily dependent on foreign gas supplies, with large proportions of its imports coming from Russia and Algeria.
- Demand for gas is dependent on the weather, and electricity generation also is a significant contributor to demand for gas.
- Italy has a number of storage facilities, a portion of which is dedicated to strategic storage for use during a supply shortage.
- A specific technical committee was established to formulate Italy's approach to a gas contingency, and to determine the most appropriate way to address any such contingency should it occur.
- There are a number of measures that the committee can use to address a contingency, including maximising imports and imposing fines where this isn't done, requiring generators and industrials to switch fuels, and imposing heating restrictions on residential customers and public buildings.
- There are provisions for curtailing interruptible customers. There are no strict curtailment policies, though there is a scheme to incentivise industrial customers to reduce their consumption, for which they will be paid from fees payable by other customers.
- Italy was heavily affected by a 2005/2006 supply disruption resulting from a Russia/Ukraine dispute, which has shaped a lot of its current contingency management policy.

Infrastructure

There are seven delivery points for imported natural gas in Italy; five are gas pipelines and two are LNG terminals. Two of the pipeline entry points account for almost two-thirds of Italy's gas imports. Italy's biggest entry point is a pipeline interconnection with Austria in the North-East of the country, which in 2009 delivered 22.9 bcm (~890 PJ) of natural gas (maximum capacity of 4.99 mcm/hour (~195 TJ/hour), equivalent to some 33.1% of total gas imports to Italy. An interconnection to Tunisia is also significant, delivering 21.3 bcm (~830 PJ and 30.8% of total gas imports to Italy) in 2009 (maximum capacity of 4.40 mcm/hour or ~170 TJ/hour).

Gas storage infrastructure plays an important part in the Italian gas market. Storage is filled in the low-demand summer months and emptied during the peak-demand winter months. Ten storage fields operate in Italy, totalling about 9 bcm (~351 PJ) of commercial working capacity, though these are geographically concentrated.

Figure 4: National Gas Infrastructure Italy



Nature of Supply and Demand

Italy has the third largest gas market in Europe (after UK and Germany). Demand for natural gas has increased significantly over the last 25 years, and amounted to around 2,970 PJ in 2009. Power generation accounts for around 40% of total gas demand in Italy – more than half of Italian power generation is gas-fired. Industry accounts for around 15% of gas demand, commercial around 13% and residential around 26%.

Peak winter demand in recent years has stood at around 430 mcm/day (~16,800 TJ/day). Italy's maximum withdrawal capacity can theoretically cover almost 70% of peak winter demand (assuming perfect interconnectivity).

Italy has indigenous production of natural gas. Around two-thirds of Italy’s gas reserves are located offshore. Italy’s production has progressively declined over the last thirty years, producing 8.0 bcm (~310 PJ) in 2009.

Import dependency for natural gas is very high, standing at around 90% in 2009. The vast majority (98.1%) of imports were delivered by pipeline in 2009, and the remaining 1.9% was from LNG cargoes. Two countries alone – Algeria and Russia – account for two-thirds of Italy’s imports. The remainder comes from the Netherlands and Norway.

Since May 2000, gas import contracts must have a flexibility of at least 10%, allowing the possibility to import during the winter period a daily gas volume at least 10% higher than the daily average import volume over the whole year.

Table 19: National Gas Demand Italy

Annual Production	310 PJ
Annual Consumption	2,970 PJ
Peak daily consumption	16,800 TJ/d (winter) 8,140 TJ/d (average)

Description of Market Arrangements

Since 2004 a virtual market has been set up for the exchange of gas and respective transport capacities.

Almost half of import activity is conducted on the basis of long term take-or-pay contracts, with an overall duration exceeding 30 years. One-quarter of the import activity is carried out through contracts having a total duration of between 20 and 30 years. The remaining one quarter of contracts involves durations of less than 20 years.

The gas transmission system is majority owned and operated by Snam Ret Gas – a private company owned by Eni. The grid is split into two parts – separate national and regional networks. The national grid transports gas from entry points to international pipelines, the regional network and storage facilities. The regional network transports gas to industrial customers, electricity generators and urban distribution networks.

There are six smaller operators which serve much smaller sections of the network.

The Italian natural gas distribution network is fragmented among 275 active distributors, 7 of which are considered “very large” (>500,000 customers), but most serving less than 100,000 customers. Rationalisation of the distribution industry is being progressed.

Eight of the storage facilities are owned by a single private company (Stogit – also owned by Eni). The other two facilities are operated by a different company (Edison). Both storage operators offer three basic types of service: modulation storage (including storage for TSO purposes), storage for production purposes, and 5.1 bcm (~200 PJ) of strategic storage.

Given Italy's dependence on gas imports from outside the EU, importers are obliged to pay a tariff, approved by the energy regulator, which covers costs to maintain strategic storage. Suppliers are responsible for requesting modulation storage, while importers are responsible for booking strategic storage. Access to storage is based on regulated third-party-access. The Ministry of Economic Development supervises storage activities.

Description of Legal Framework

The Ministry of Economic Development has adopted Decree no 32 of November 2007 which outlines specific emergency procedures. It establishes the roles of parties in the industry, the system monitoring procedures, and the measures to be taken by the Ministry in the case of a crisis.

Ministerial decree of 11 September 2007 outlines a policy regarding the containment of gas consumption during emergencies.

Contingency Arrangements

The Minister of Economic Development set up a specific "Technical Emergency Committee for the Gas System", which was delegated responsibility for defining an emergency, formulating proposals for ways to address a contingency, and for determining the most appropriate measures to address a contingency when it occurs. A contingency can arise from:

- Adverse weather conditions; or
- A failure of major components of the network.

The committee includes representatives from the state - including the regulator, and industry - including the TSOs. The committee can interact with other experts or representatives of other agencies.

There are a number of specified emergency procedures which the committee can implement. These include a series of measures for increasing gas imports and reducing gas consumption.

The committee can draw on Italy's strategic stocks. The level of strategic storage should cover for 60 days a 50% disruption of peak capacity at the main national entry point. There is a penalty system that has been established to discourage drawing on storage during the winter season beyond specific thresholds, which reflect household needs. Gas-fired electricity plants would have to pay this penalty when drawing on gas stocks during gas shortages, effectively raising gas prices and discouraging generation, particularly for exporting electricity outside of Italy.

Maximisation of import capacities

As a yearly pre-emptive measure, shippers are obliged by law to import their maximum daily contract quantities in order to make sure that the assigned transport capacities are fully used. The beginning and the end of this obligation is established each year by the Ministry of economic development according to the forecast of gas demand for the winter period. Penalty fees can be applied to importers if they do not comply with import maximisation obligations.

Demand curtailment

If there is a deficit between supply and demand that cannot be addressed by increasing supply or managing gas storage, interruptible customers can be curtailed. However, the Ministry of Economic Development can further employ incentives for other industrial clients directly connected to the national gas grid to reduce gas consumption at times of emergency.

The incentive regime is intended to encourage customers to reduce gas consumption up to the deficit without additional cover. It splits customers up into six different categories:

- Industrial consumers directly connected to the transmission network
- Electricity generators that are generating electricity for export
- Other TOU customers that voluntarily sign-up to the regime
- Businesses exempt from curtailing consumption if it is for cogeneration purposes
- Businesses exempt from curtailing as they are constrained to consuming a consistent amount over time (based on previous 6 months of consumption).
- Everyone else.

Only the first three groups are subject to the regime. These customers benefit economically from compliance and are fined for non-compliance. All other consumers fund these economic incentives. Essential public services are exempted.

There are three levels at which consumption may be curtailed. These are

1. Need to reduce overall consumption by up to 5 mcm/day (~195 TJ/day);
2. need to reduce overall consumption between 5 and 10 mcm/day (~195-390 TJ/day);
3. Need to reduce overall consumption by over 10 mcm/day (~390 TJ/day)

For each level, all required customers and volunteer customers reduce their consumption on a pro-rata basis to the required amount, based on their consumption data over the previous 30 days (weekdays only). These customers are given payment for their level of curtailment, at an amount to be determined by the Electricity and Gas Authority. There are also penalties for not curtailing as required.

Alternative fuels

There are also arrangements for dual-fuelled plant, and for maximising non-gas-fired plant. If import maximisation and demand curtailment is insufficient then dual-fuelled plant can be required to switch to back-up fuel. Carbon dioxide emission limits may be suspended if plants are required to switch fuel.

Six percent of gas-fired power generation can also run on oil, albeit at higher production costs. Dual-fuel plants are obliged to hold oil stocks, but the quantity is not linked to a predetermined number of days. Switching will only occur following a specific governmental request, due to the inherently higher costs involved. Technically speaking, the fuel switch can be achieved at short notice (from hours to days), depending on the technology.

Only 0.5% of the industrial load can operate on fuels other than gas. Furthermore, large industrial facilities are not required to have alternative fuel available. Fuel-switching abilities are thus very limited in the industrial sector.

Reduction of heating temperature

If a supply/demand imbalance still exists, the heating temperatures and heating time for residential customers will be reduced as an extreme emergency measure.

Because so much gas is used to generate electricity, gas policy is strictly linked to arrangements for the electricity markets. There is the potential to import electricity instead. However, while this is an effective measure to contain the use of gas, it is very costly and is thus applied only in case of real necessity. Emergency measures in the thermoelectric sector are based on the constant monitoring of gas consumption in that sector. However, no specific legislation exists to regulate electricity production from gas fuelled plants during a contingency.

Experience with Gas Contingencies

Italy was severely affected by a disruption of gas supplies over the winter of 2005-2006 (partly due to a Russia-Ukraine gas dispute), and has since taken significant measures to better prepare for another such situation.

The Ministry of Economic Development has adopted and updated its legislation regarding specific emergency procedures. The update establishes the roles of the actors involved, the system monitoring procedures, and the measures to be taken by the Ministry in the case of a crisis. The “technical emergency committee for the gas system” within the Ministry was designed to adopt the most appropriate available measures.

During the gas crisis in the winter of 2005-2006, the Italian Administration relied on the release of 1.5 bcm (~55 PJ) from the strategic reserves, in order to alleviate the gas shortage. Public buildings (excluding hospitals and schools) and residential customers were required to reduce their heating by 1 degree Celsius.

Appendix 8. Critical Contingency Arrangements in the Slovak Republic

Summary

- Slovak Republic is almost entirely dependent on foreign gas supplies, with gas generally flowing in from Russia (via the Ukraine), and through the country to Austria and Czech Republic.
- Demand for gas is extremely dependent on the weather, and features a high proportion of residential demand.
- All suppliers operating on the Slovak gas market are required to be able to meet security of supply standards under circumstances related to weather conditions or the disruption of normal supplies.
- The major distribution network owner takes responsibility for managing a contingency, and is the primary communications source. Participants are required to obey any direction from the distribution network owner. The government has virtually no part in addressing a contingency but is kept informed.
- Curtailment provisions distinguish between gas primarily used for heating purposes and gas for processing purposes. Consumers whose demand is primarily for heating are curtailed based on a heating curve, where their consumption is restricted to a stated percentage, decreasing with severity. Consumers whose demand is primarily for processing purposes are curtailed based on their size, but are able to maintain consumption to protect plant, equipment and safety for all but the most extreme contingencies.
- Following a gas contingency in January 2009, the Slovak Republic has taken steps to improve the reversibility, and thus flexibility, of its transmission grid, and is developing a new interconnection with Hungary's gas network.

Infrastructure

The Slovak Republic's (SR) transmission system operator (TSO) - Eustream, manages a domestic and transit pipeline network with three interconnection points; one from the Ukraine, one to Czech Republic and one to Austria.

This network is used both to transport natural gas for consumption into the Slovak Republic and for transit of Russian gas to other end user markets further west. The annual capacity of the system exceeds 90 bcm (~3,500 PJ), though only about 80% of this capacity was utilized in 2009, with 66.4 bcm (2,590 PJ) transited through the country in addition to the 6.4 bcm (~250 PJ) of domestic consumption. Transit gas arrives at the incoming transfer station on the Ukraine border (279 mcm/day or ~10,880 TJ/day capacity) and departs from outgoing transfer stations at the Czech border (117 mcm/day or 4,563 TJ/day) and the Austrian border (137 mcm/day or ~5,343 TJ/day).

It is possible to reverse the flow of gas at the Czech interconnection within two hours to provide up to 25 mcm/day (~975 TJ/day) of gas, and the Austria interconnection for 17 mcm/day (~660 TJ/day).

A new interconnection with Hungary is also being developed.

Figure 5: National Gas Infrastructure Slovak Republic



The Slovak Republic has 2.77 bcm (~108 PJ) of underground gas storage capacity, with a maximum withdrawal rate of 1,340 TJ/day (34.35 mcm/day). A further 3.12 bcm (~122 PJ) of storage capacity is under construction.

Additionally, a storage facility in the Czech Republic is directly connected to the Slovak system and is used for the purposes of physical balancing of the Slovak distribution network and security of supply for households. Storage capacity at this site is 0.57 bcm (~22 PJ) and the maximum withdrawal rate is 8.8 mcm/day (~343 TJ/day). At the same time, part of the Slovak storage facilities (0.5 bcm /20 PJ) is used for supplying the Czech market.

Nature of Supply and Demand

Only a small fraction of the Slovak Republic's natural gas demand is met from domestic production, with the remainder supplied by imports, almost entirely from Russia. In 2010, some 100 million cubic metres of gas (~3.9 PJ) was produced domestically, meeting less than 2% of its total demand. Production is expected to decline rapidly, dropping to roughly one-third of current production by 2014.

In 2010, demand for natural gas was some 6.2 bcm (~240 PJ). Industry, the transformation sector and residential users each account for nearly a quarter of the total gas used in the country.

Daily gas consumption ranges from some 5 mcm/day (~195 TJ/day) in the summer to around 25 mcm/day (~975 TJ/day) in the winter, inferring a 1:5 seasonality of gas demand. The highest average daily demand over the coldest 30-day period was reached in early 2006, at 35.9 mcm/d (~1,400 TJ/day) when temperatures averaged -7.4° C. The historically highest daily peak was reached in December 2001, when gas use reached 46.9 mcm/d (~1,830 TJ/day) with temperatures around -12.2° C.

Table 20: National Gas Demand Slovak Republic

Annual Production	3.9 PJ
Annual Consumption	242 PJ
Daily consumption	195 TJ/d (summer) 975 TJ/d (winter)

Description of Market Arrangements

Transmission and distribution activities in the Slovak Republic were unbundled on July 1, 2006. SPP (Slovenský plynárenský priemysel) is the dominant importer of natural gas into the Slovak Republic, and the parent company of the TSO, Eustream, and the main distribution system operator (DSO), SPP distribúcia (SPP-d). SPP is 51% state-owned and 49% owned by a consortium of private companies.

SPP distribúcia is the biggest distribution network operator in Slovakia, though a number of small independent local distribution companies are also active in the country's gas distribution.

There are two storage system operators (SSOs): Nafta and Pozagas. Nafta also operates the country's domestic gas production.

SPP is the leading wholesale supplier of natural gas on the Slovak gas market with a share of more than 80 percent (in 2010).

The number of shippers trading gas in the Slovak Republic has been constantly increasing since 2005. At the start of 2010, Eustream had twenty shippers. Physical nodes in the transit gas network (interconnections) or domestic off-take points can be used for trading of natural gas. In most cases it is over-the-counter type trading because, with the exception of the Austrian node, no gas exchanges are established on these points.

Description of Legal Framework

The relevant legislation for gas contingencies is under the responsibility of the Minister of Economy (MoE). This includes the Energy Act 2004 and a decree³² stipulating the details on procedure regarding the announcement of the state of emergency, announcement of limiting measures in the state of emergency and provisions aimed at removal of the state of emergency.

Contingency Arrangements

The Energy Act defines a state of emergency as a sudden shortage or an imminent shortage of a type of energy, which may cause the reduction or interruption of energy supplies, or which may put energy facilities out of operation in all or part of SR for a period of more than twenty-four hours as a consequence of:

³² Decree of the Ministry of Economy of the Slovak Republic No. 459/2008 Coll.

- extraordinary events
- measures taken by state authorities during economic mobilisation
- a long-term shortage in energy sources,
- an act of terrorism.

However, strategy documentation suggests the limiting condition for declaring a state of emergency is a situation where there are not enough resources to cover the basic consumption level.

The largest distribution system operator (SPP-d) is responsible for assessing the impacts of any event. It can then declare a state of emergency if it considers it necessary, which can encompass the entire country or a defined part of it. SPP-d is also responsible for cancelling a state of emergency.

The declaration and cancellation of the state of emergency is immediately communicated to the Ministry of the Economy. The Ministry has to ensure its senior management get the message. SPP-d is responsible for informing the public of the state of emergency via the media (radio and TV).

Under a state of emergency SPP-d has control over the interconnected transit networks and distribution networks in the affected area, and is responsible for implementing emergency response measures to address the issue.

Registered market participants are obliged under the Act to participate in mitigating the effects of, or consequences of an event, and must comply with any directions from SPP-d.

The country's underground storage facilities can play an important role in addressing an imbalance between supply and demand. During standard operating mode the gas storage facilities satisfy two functions: those that are used by SPP (as wholesale gas supplier) serve primarily for balancing out seasonal fluctuations in consumption (for example, in winter, when regular daily supplies from Russia are not enough to cover current consumption). Stocks contracted by SPP-d serve to balance out daily differences between gas supplied to the system and that taken off from the system.

Therefore, SPP-d can generally cover unexpected fluctuations in gas supply by drawing on storage. The regulations appear to require sufficient gas arrangements (contracts or storage) to supply customers in the instance where:

- the total gas supply falls by 30% for a period of 10 weeks;
- there are five consecutive days where the average daily temperature falls below -12°C , suggesting high demand; and
- the country experiences a 1 in 20 year low-temperature event.

The SPP group generally contracts for enough gas to be in storage to meet these requirements. However, in the event that these supplies are insufficient, SPP-d may require demand curtailment.

Under the Act, consumption restrictions are applied in the following order:

- Restrict the consumption of large industrial or commercial customers;
- Interrupt the consumption of large industrial or commercial customers;
- Restriction and interruption of customers other than households and public welfare services;

- Restriction and interruption of public welfare services;
- Restriction and interruption of households.

The regulations spell out the order of curtailment more specifically. Crisis severity levels are used to determine the level of restrictions or cut-offs to end users. Customers are first divided into groups according to the type of consumption (e.g. gas used for heating), and then by volume. Disruptions are rated on severity levels, determining the degree to which specific consumer groups would have supplies restricted or stopped.

There are two broad groups related to the type of consumption. Group 1 where more than 50% of consumption is *dependent* on the external temperature (likely to be households and others requiring space heating), and Group 2 where more than 50% of consumption is *independent* of the external temperature – i.e. process gas requirements.

Group 1 is curtailed by a heating curve where consumption is restricted to a stated percentage, which declines with severity. Group 2 is restricted by a “limiting regulation level”. Each has varying degrees of severity as outlined in Tables 2 and 3.

Table 21: Curtailment for customers with >50% of demand dependent on external temperature

Group 1 – gas for heating	Heating Curve
Level 1	No restrictions
Level 2	100% for customers > 400,000 m ³ /year (~15.6 TJ/year) and medical facilities 90% for housing and schools 85% for other customers
Level 3	100% for customers > 400,000 m ³ /year and medical facilities 80% for housing and schools 70% for other customers

Table 22: Curtailment for customers with >50% of demand independent of external temperature

Group 2 – process gas	Limiting regulation
Level 3 – basic offtake level	No restrictions.
Level 4	Alternative fuels to be used for 8h/day where possible.
Level 5	Industrial customers > 400,000 m ³ /year to be reduced to below the contract levels.
Level 6	Alternative fuels to be used for 24hrs/day where possible.
Level 7	Industrial customers > 400,000 m ³ /year reduced between contract levels and the safety level

Group 2 – process gas	Limiting regulation
Level 8	Industrial customers > 60,000 m ³ /year (around 2.3 TJ/year) reduced to safety level except public welfare services which are reduced to 95%
Level 9	Industrial customers > 60,000 m ³ /year fully curtailed except public welfare services which are reduced to safety level
Level 10	Zero gas consumption, all customers curtailed

The “safety minimum” is the natural gas offtake necessary for assurance of safety of manufacturing plants and operators, and prevention of damage to production technology and facilities. However it is not a volume necessary for maintenance of production - e.g. glass factories have to stop glass production and decrease the gas offtake to the minimum level required to prevent the cooling of glass and the deterioration of melting furnaces.

For customers engaged in production of essential foodstuffs, animal processing, operation of health facilities, waterworks and waste water treatment plants, the safety minimum is set at 95% of the basic offtake level.

It is not clear how curtailment requirements are enforced or if there are penalties for breaching directions. Past outages appear to have suggested that there is a lack of incentive for companies to comply. It appears that the introduction of penalties is being considered (or potentially already implemented).

The Ministry of Economy does not interfere in the measures to eliminate the state of emergency, it, however, may require a feed-back from the gas dispatching centre on the implementation of such measures and on the elimination of the state of emergency. SPP-d informs the public about these issues via the mass media.

There is no program in place in the Slovak Republic in order to encourage or otherwise require users of gas to switch to other fuel sources in the event of a gas supply disruption. The potential for short-term switching out of gas into other fuel is limited.

Experience with Gas Contingencies

There have been a couple of instances of gas shortages in the Slovak Republic. The regulations were based on a previous event in which supplies dropped by around 30%, hence the requirement for sufficient gas storage or other arrangements to cover such an event. However, in January 2009 supplies of natural gas from Russia (via Ukraine) unexpectedly suspended due to a contractual issue between Ukraine and Russia. Of particular concern during the crisis was not the capacity of the storage facilities or the volume of gas held in storage at the time, but rather the maximum possible daily output of these storage facilities.

The priority of SPP during the crisis was to secure supplies for households, heating, hospitals and essential services for the population. For this reason SPP-d implemented restricted consumption level 8, which committed industrial customers with a consumption in excess of 60,000 m³ a year (~2.3 TJ/year) to reduce their gas consumption to the level of the safety minimum. Households and

other customers consuming gas primarily for heating purposes were not required to restrict their consumption.

Gas flowing to Austria and Czech were halted. At that time, it was not possible to reverse the flow of gas from these two interconnection points, eventually SPP were able to reverse the flow direction of the Czech interconnection node and negotiate with third parties for an alternative supply of gas, after which the consumption restrictions were removed. Altogether the emergency lasted around 13 days.

Appendix 9. Critical Contingency Arrangements in Hungary

Summary

- Hungary relies heavily on foreign gas supplies, particularly on imports from Russia which transit through Ukraine. However, domestic production meets around a quarter of demand.
- The residential sector is the largest consumer of gas (35%), with electricity generation close behind (30%). Demand hence increases significantly in the winter.
- There are a number of commercial and government owned storage facilities in Hungary which can store sufficient gas to cover relatively long periods.
- The Transmission System Operator has primary responsibility for direction during a gas supply disruption. It will generally rely on storage to meet any shortfalls and can increase production, but may also curtail interruptible customers, and if necessary, non-interruptible customers.
- The curtailment provisions allow for fuel switching in the first instance, and then progressively cuts customers based on the size of their load. There appear to be provisions for maintaining some load to protect plant, and for orderly shut-downs. There are also a number of consumers that are considered essential and are not disrupted in even the most severe crises.
- There are requirements for generators to hold emergency stocks of alternative fuels.
- Hungary fared well during a gas contingency in January 2009 with minimal interruptions, and was able to support other neighbouring countries.

Infrastructure

Hungary imports most of its gas from Russia via Ukraine at (56.3 mcm/day or ~2,200 TJ/day), but also imports small amounts via Austria (12.1 mcm/day or ~470 TJ/day). Hungary is also a key transit country for Russian gas to South-East Europe. A cross-border connection between Hungary and Romania was completed in 2010 and one with Croatia is in operation since the beginning of 2011. Around 12-15 bcm (~470 – 580 PJ) are transported on Hungary's gas transmission network annually, of which some 4.25 bcm (~165 PJ) are reserved for transit through the grid.

Hungary is planning to enhance its import capacity as well as diversifying import routes and sources and is looking at expanding its general role as a transit country.

Gas storage is crucial because of the high dependence of Hungary's electricity sector on gas-fired power plants, and because of the high volumes of relatively inflexible residential demand.

Hungary has five commercial storage facilities, with a total working capacity of 5.43 bcm (~210 PJ) and a withdrawal capacity of 72.0 mcm/day (~2,800 TJ/day) at the beginning of winter. All commercial storage can be accessed by third parties.

Following a supply interruption in January 2006, the Hungarian Parliament approved a new law, on Safety Stockpiling of Natural Gas. This required a strategic underground gas storage of 1.2 bcm (~47 PJ) to be built, so as to provide Hungary with 40-45 days of autonomy if the main import source from

Russia failed. The strategic storage facility had a 1.2 bcm (~47 PJ) working capacity and a withdrawal rate of 20 mcm/day (~780 TJ/day) for at least 45 days. The stockpile aims to protect households as well as customers who cannot switch to other energy sources.

Figure 6: National Gas Infrastructure Hungary



Nature of Supply and Demand

Hungary imports approximately 75% of its natural gas demand. Net imports of gas in 2010 amounted to around 9.4 bcm (~365 PJ), down from 9.6 bcm (~675 PJ) in 2009 and 11.4 bcm (~445 PJ) in 2008.

More than 80% of imports come from Russia, with small amounts also coming from other former Soviet Union countries, France and Germany. Imports from Western Europe have increased incrementally since 2008, as traders have taken the opportunity of cheaper spot gas from this region.

Domestic gas production met approximately 25% of total demand in 2009. The country has proven reserves of 95 bcm (~3,705 PJ) corresponding to 38 years of production in 2010. Gas production comes mostly from mature fields, but the government believes that production can be maintained at close to these volumes until around 2020. Thereafter, however, production is expected to decline considerably if no new resources are developed

Hungary has unconventional gas resources – tight gas – but this potential remains very uncertain and it is too early to estimate if and when unconventional gas could reverse a declining production trend.

Gas demand has been declining since 2005. It dropped by some 14%, to 11.3 bcm (~440 PJ) in 2009 (from 13.1 bcm or ~510 PJ in 2008) due to the economic crisis, but partially recovered to 12.1 bcm (~470 PJ) in 2010.

The residential sector is the largest consumer of natural gas in Hungary, standing at some 35% of total gas demand in 2009. As such, the supplies of natural gas are of paramount importance in the cold winter months, as many homes depend on gas for residential use and heating. Equally important, the transformation sector accounted for around 30% of gas demand. The commercial sector accounted for 17% of gas demand, and industry accounted for another 13%.

Hungary's power sector is heavily dependent on natural gas. Almost a third of Hungary's electricity was produced from natural gas in 2010.

Peak demand in winter is typically 75-80 mcm/day (~2,925 – 3,120 TJ/day). The historical record for peak demand was 91.7 mcm/day (~3,550 PJ), reached in 2005.

Typical winter demand is usually met as follows: imports 40-50 mcm/day (~1,560 – 1,950 TJ/day), domestic production 8-10 mcm/day (~310 – 390 TJ/day) and storage withdrawal 20 mcm/day (~780 PJ).

Table 23: National Gas Demand Hungary

Annual Production	110 PJ
Annual Consumption	470 PJ
Peak consumption	2,925 – 3,120 TJ/d (winter)

Market Arrangements

The gas transmission system is owned and operated by Földgázszállító Zrt (FGSZ), part of MOL Group (private oil company).

The Hungarian Energy Office (HEO) is the regulator for natural gas. It approves the Network Code which provides for transparent and non-discriminatory access to the network for all user groups.

The regulator's powers are, in practice, often limited to providing advice to the Minister, who has the right to set system usage and connection tariffs and the price of "universal supply" (notably to households). HEO co-operates closely with the Hungarian Competition Authority and the Hungarian Consumer Protection Authority.

The gas transmission owner/operator FGSZ remains 100% owned by MOL but is subject to heavy regulation and permanent monitoring to ensure non-discriminatory system operation.

Existing and new entrants may apply for long-term capacities in the transmission annually. In case of congestion, an auction is held. Short-term capacities may be booked as well, at any time during the year. However, long-term capacity demands have priority over short-term capacity demands. If

booked capacity is not nominated, the Transmission System Operator (TSO) has to offer available capacity to system users. Companies can only book pipeline capacity if they have a gas purchase contract.

The Hungarian Hydrocarbon Stockpiling Association (HUSA) is entrusted with the public stockpiling of gas. HUSA was founded and is operated and financed by the Hungarian oil and gas industry. The government has special control rights over HUSA.

Description of Legal Framework

The Hungarian natural gas market is regulated by the Hungarian Natural Gas Law 2008. This outlines demand restrictions that can be implemented in case of supply disruption. A government Decree (265/2009 XII.1) outlines the general response to a gas contingency situation and the roles of parties in such an event.

The responsible authorities named by the decree are the Minister, the Hungarian Energy Office and the TSO (the latter is entitled to order the limitation of gas off-take). Detailed rules are set up for all market players in a crisis situation.

Contingency Arrangements

In the event of a crisis, the TSO is de facto responsible for operational crisis management. However, decisions regarding certain strategic questions may remain in the hands of the regulator and/or government.

System operators are liable for informing the regulator about any circumstance which could indicate a crisis. The regulator assesses the seriousness of an event and classifies it as one of three grades:

- A natural gas supply disruption;
- A natural gas supply crisis – level 1; or
- A natural gas supply crisis – level 2.

The regulator then informs the Minister. The Minister, in agreement with the Crisis Committee, then formally decides upon the crisis level.

A supply disruption is any relatively minor supply disruption, typically at a regional level. Under Crisis Level 1, there is a mismatch in supply and demand, but the system can be operated in line with the existing civil law contracts through a combination of restrictions and the use of strategic stocks. Under Crisis Level 2, the gas market cannot be operated in line with the existing civil law contracts, and the remaining gas sources have to be managed by the TSO.

Any decision to release strategic gas stocks lies with the Minister. HUSA is responsible for monitoring gas stocks, and is responsible for ensuring that any stock release goes to plan.

As stated, the Hungarian Natural Gas Law outlines demand restrictions that can be implemented in case of a supply disruption, when there are no other applicable means for ensuring the balance in the system.

There is a list of priority consumers for which supplies must be guaranteed, even in the event of a severe crisis (Crisis Level 2). This includes the TSO, household customers, other residential buildings, public institutions, medical centres, consumers where the restriction could cause health or environmental risk, district heating power plants, etc.

Other consumers can have their gas supplies curtailed, and are divided into eight specific “limitation” categories. These categories are prioritised, depending on the size and nature of the consumption sectors. Consumers in higher limitation categories can have their gas supplies limited only if curtailment for lower limitation categories has been exhausted.

It is not particularly clear how the categories work. The first category consists of consumers which must be able to reduce consumption and switch to other fuels within four hours of notification. The next categories are consumption based bands: > 2,500 m³/hour, > 500 m³/hour, > 100 m³/hour and <= 100m³/hour. Instructions to curtail under each band must be completed within either 4 or 8 hours (depending on the band). The final band is for food production (excluding soft drinks and alcohol) and protection of the environment.

It appears that consumers can distinguish between different loads on the same site and place them under different categories (e.g. fuel for a boiler under band 2, fuel for other purposes under band 3). There also appears to be provision for consumers to access up to 10% of their load for restricted periods as directed by the System Operator, though it is unclear exactly how this works.

Additional demand restraint measures at the government’s disposal in a crisis are:

- reducing the opening hours and heating temperature of public buildings;
- making a public appeal for gas reductions;
- declaring free public holidays; and
- removing the excise tax on imported fuel oils to incentivise fuel switching from natural gas.

The Hungarian Electricity Law obliges power-plants with over 50 MW output to hold so-called normative and emergency oil stocks, both of which must correspond to a minimum of eight days of average fuel consumption. These power plants account for around 10-12% of total booked gas supply capacity. Some 34 kb/d of gas could be switched to oil in the event of a crisis.

Hungary also maintains the ability to increase gas production during a contingency. The “normal” natural gas production level stands at around 7.5-8 mcm/day. In the event of an emergency, production can be increased by 0.5 mcm/day over a maximum period of 2-3 months.

There are no specific emergency plans between the Hungarian TSO and the neighbouring countries.

Russia-Ukraine Gas Dispute 2009

As with the Slovak Republic, Hungary was affected by a dispute between Russia and Ukraine which resulted in a drop in gas imports (to one third and then nothing) for three weeks in January 2009. It was the largest gas disruption in Europe’s history.

The outage of gas import affected Hungary the least compared to the surrounding countries, thanks partially to the extent of the established gas storage capacity, the adequate winter preparations, and good coordination and cooperation amongst the affected organisations.

Hungary did not need to declare it a “crisis” level disruption. The System Operator initially curtailed interruptible customers, had generation switch to alternative fuels (category 1), and placed restrictions on non-interruptible customers >500 m³/hour (categories 2 and 3), resulting in a drop of ~6-9 Mm³/day. There was also a public announcement calling on people to save gas.

Commercial storage was drawn on to its maximum capability. The Minister also called for withdrawals from strategic storage facilities. Some imports flowed from Western neighbours. Hungary was able to supply some gas to neighbouring countries due to these imports.

Appendix 10. Critical Contingency Arrangements in USA

National

The Secretary of Energy is generally in charge of National contingency management, but the President also has jurisdiction in some areas.

The President can declare a natural gas supply emergency if they find that:

- a severe natural gas shortage, endangering the supply of natural gas for high-priority uses, exists or is imminent; and
- the exercise of authorities is reasonably necessary, having exhausted other alternatives to the maximum extent practicable, to assist in meeting natural gas requirements for such high-priority uses.

The President can also prohibit the burning of natural gas for electricity generation by dual fuel plant.

There are some federal regulations relating to interstate pipeline curtailment plans. Most notably, these state that interstate pipeline owners may not curtail gas for “essential agricultural use” or “essential industrial process or feedstock use”, unless alternative fuels can be used, or the gas is required to supply high priority users.

A high-priority user is a residence, small commercial establishment, school, hospital, or any other use that the Secretary of Energy considers would endanger life, health or maintenance of physical property.

An “essential agricultural use” includes consumption for agricultural production, natural fibre production or processing, food processing, food quality, irrigation or crop drying consumer, or a consumer using gas as a process fuel or feedstock for the production of fertilizer, agricultural chemicals, animal feed or food.

State

The State Governor, State Regulatory Commission, or both, are responsible for contingency management for the State.

Curtailment plans are developed by individual transmission and local distribution companies for their networks. This means that there are potentially hundreds of different curtailment plans in existence in the USA.

A transmission company’s curtailment plan may require that their large industrials and/or distribution companies curtail demand, in which case the distribution companies then enact their own curtailment plans to comply with this direction.

The State Regulatory Commissions review the local distribution companies’ plans. Some aspects of the plans may be regulated by the State.

States generally have similar priorities for the use of gas, with highest priority being given to protecting health and safety. Residential customers are generally also protected from curtailment except in the most severe circumstances.

Example - Wisconsin

Whenever the Wisconsin Public Service (WPS) determines that:

- Gas supplies available, including storage gas volumes needed to meet expected future demand; or
- Interstate pipeline capacity; or
- Distribution system capacity

Is insufficient to meet the requirements of all customers or a Force Majeure condition exists on the system, then the WPS may initiate Curtailment of service. When a Curtailment of service is to be made, the WPS determines the quantity of gas which each customer shall be entitled to receive and shall promptly notify each affected customer of the period of Curtailment and the quantity of gas the customer will be entitled to receive during such period. Such notice shall be given as far in advance as is reasonably possible. The Company may change the Curtailment period and/or the quantity of gas customers will be entitled to receive.

Curtailment is done based on the kind of sales contract a customer is on (of which there are many), but generally seems to proceed in the following order:

1. Curtail customers on seasonal contracts (includes agribusiness, canning companies and asphalt plant) that consume more than 2 TJ/year.
2. Require customers with back-up fuel arrangements to shut down or switch fuels.
3. Make a public call for distribution customers to reduce consumption.
4. Curtail interruptible volume in the following order (noting customers may not assign all of their load as interruptible):
 - a. Electricity generation and other consumption above 250 TJ /year
 - b. Consumption between 20 to 250 TJ/year
 - c. Consumption between 2 to 20 TJ/year
5. Curtail commercial and industrial customers in the following order:
 - a. Consumption of 250 TJ/year or more
 - b. Consumption between 20 to 250 TJ/year
 - c. Consumption between 2 to 20 TJ/year

- d. Consumption up to 2 TJ/year.
6. Curtail residential and other mass-market customers.

However, the following additional conditions and exceptions will be made:

- The WPS may, due to a localized problem, only curtail customers in specific geographic areas if this limited curtailment is sufficient to control gas usage within acceptable physical limits. The curtailment order need not be followed in this localized area, and the WPS may curtail or limit the usage of large volume customers before other customers, in an effort to maintain service to the largest number of customers.
- If any customer notifies the WPS in writing that a curtailment will result in emergency conditions or shutdown of operations, the company may consider exempting that customer from curtailment obligations.

The WPS will file a report with the Commission after each Curtailment or Constraint. The report will be filed on a public, non-confidential basis, and shall be received by the Commission within 30 days following the Curtailment or Constraint.

Whenever the WPS interrupts a customer with alternate fuel capabilities due to a distribution system constraint, it may consider reimbursing the customer the incremental cost of the alternate fuel above the customer's current cost of natural gas.