Meeting Date: 22 June 2018

MANAGEMENT OF CRITICAL CONTINGENCIES IN THE GAS NETWORK

SECURITY AND RELIABILITY COUNCIL

There is over 1700 MW of gas-fired generation in New Zealand, producing ~15% of our annual electricity needs. When the gas network is unavailable, there can be severe flow-on effects to the electricity industry. This paper seeks to promote understanding of the risks and lessons to the electricity industry arising from the gas industry's management of emergency situations.

Note: This paper has been prepared for the purpose of the Security and Reliability Council (SRC). Content should not be interpreted as representing the views or policy of the Electricity Authority.

Management of gas critical contingencies

The Gas Industry Company will present on the management of gas critical contingencies

At its last meeting, the SRC received presentations from:

- John Kidd of Woodward Partners about future gas supply
- First Gas about the management of gas transmission network security and reliability.

A representative from the Gas Industry Company (GIC) will present to the SRC (see attached) about the management of gas critical contingencies. The purpose of the presentation is to enhance the SRC's understanding of the nature of the risks to reliable electricity supply given the dependencies on gas industry arrangements. The GIC have also identified lessons from their experience that may have some application in the electricity sector.

The SRC's secretariat asked the GIC to design the attached slides so they are comprehensive and information-rich. The actual presentation and discussion time on 22 June 2018 will not cover all of the slides and information provided.

Large gas-fired electricity generators

Gas is critically important to New Zealand's electricity industry. It fuels approximately 1,700 MW of large gas-fired North Island generation (or ~40 per cent of North Island peak demand[1]) which generated approximately 15 per cent of grid-supplied electricity in 2017[2].

There are currently three owners of nine large gas-fired generators. They are:

- Genesis Energy, which owns:
  - Huntly Rankine units (2x250 MW)[3] that can also be fuelled by coal
  - Huntly Unit 5 (403 MW)
  - Huntly Unit 6 (51 MW)
- Contact Energy, which owns:
  - Taranaki Combined Cycle (377 MW)
  - Stratford Peakers (2x100 MW)
- Nova Energy, which owns:
  - McKee (100 MW)
  - Whareroa (68 MW)[4]

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1 Assuming: (a) 'large' is a capacity greater than 50 MW; and (b) North Island peak demand was 4,237 MW for 2017. This was sourced from table 14 on page 44 of the system operator's 2018 annual assessment of security of supply.

2 Assuming: (a) GWh measured at Huntly (HLY2201), Stratford (SFD2201) and McKee (MKE1101). As such, this includes any coal-fuelled output from the Huntly Rankine units and excludes Whareroa. (b) Final-priced grid generation of 40,560 GWh for 2017. This was sourced from www.emi.ea.govt.nz/r/u5gki

3 Of Huntly Units 1-4, one was completely decommissioned in 2012 and another was put into long-term storage in 2015.

Electricity supply and demand during a gas supply outage

Taranaki is home to 100% of gas production and 44% of gas-fired electricity generation capacity. This means that if the gas transmission network is damaged at a location north of Taranaki, the region south of the damage will usually be unaffected and continue to produce gas and generate electricity.

In the event the entire gas transmission network is unavailable:

- Contact Energy can supply either of its generators with gas directly from the Ahuroa gas storage facility
- Nova Energy's McKee generation is unaffected as its gas is supplied directly from production fields
- The Huntly Rankine units can be run on coal, though Genesis Energy advised the market of its intention to completely phase out the use of coal by 2030.[5]

In the event of gas supply unavailability, it seems reasonable to expect that electricity demand will usually decline.

- While some gas users may be able to substitute gas use with electricity demand, a handful of large users of both gas and electricity (such as the Glenbrook steel mill) would likely need to cease all large-scale operations during a gas supply outage.
- If a gas supply outage forced the electricity co-generation at Whareroa to shut down, the large-scale operations at Whareroa would also cease with a resultant decrease in electricity usage onsite.

Questions for the SRC to consider

The SRC may wish to consider the following questions.

Q1. Is the SRC interested in having research completed to better understand electricity demand during gas critical contingencies?

Q2. What further information, if any, does the SRC wish to have provided to it by the secretariat?

Q3. What advice, if any, does the SRC wish to provide to the Authority?

4 This is jointly owned with Fonterra.

5 The announcement also pledged to phase out coal usage under normal market circumstances by 2025. Gas supply unavailability would clearly be abnormal. Refer https://www.genesisenergy.co.nz/about/media/news/genesis-establishes-a-pathway-to-a-coal-free-elect

GAS CRITICAL CONTINGENCY MANAGEMENT: PRESENTATION FOR SECURITY AND RELIABILITY COUNCIL

DATE:

22 June 2018

GAS INDUSTRY COMPANY LIMITED

Agenda

1. Overview of critical contingency management
2. Interface with the electricity system
3. Lessons

Gas Governance (Critical Contingency Management) Regulations 2008 are designed to protect the gas system

- Gas is different from electricity:
  - It can be stored (via linepack); but
  - Consumers can't be remotely disconnected
- For gas to flow in pipelines requires sufficient pressure to "push" it along
- If pressure drops below safe threshold, gas will not flow
  - Consumer sites effectively decommissioned
  - Remedy is to purge networks and recommission customer sites – would take months
- Imperative to keep safe pressures in the networks
- Purpose of Regulations:

  to achieve the effective management of critical gas outages and other security of supply contingencies without compromising long-term security of supply

The Critical Contingency Operator (CCO) manages (most) contingency events

The CCO:

- Monitors pipeline conditions
- Declares a critical contingency if pipeline parameters fall below specified thresholds
- Issues directions for demand curtailment
  Cascade of directions: CCO to transmission system owner to large users & retailers, then retailers to their consumers
- Gives directions to restore demand once pipeline pressures are stable

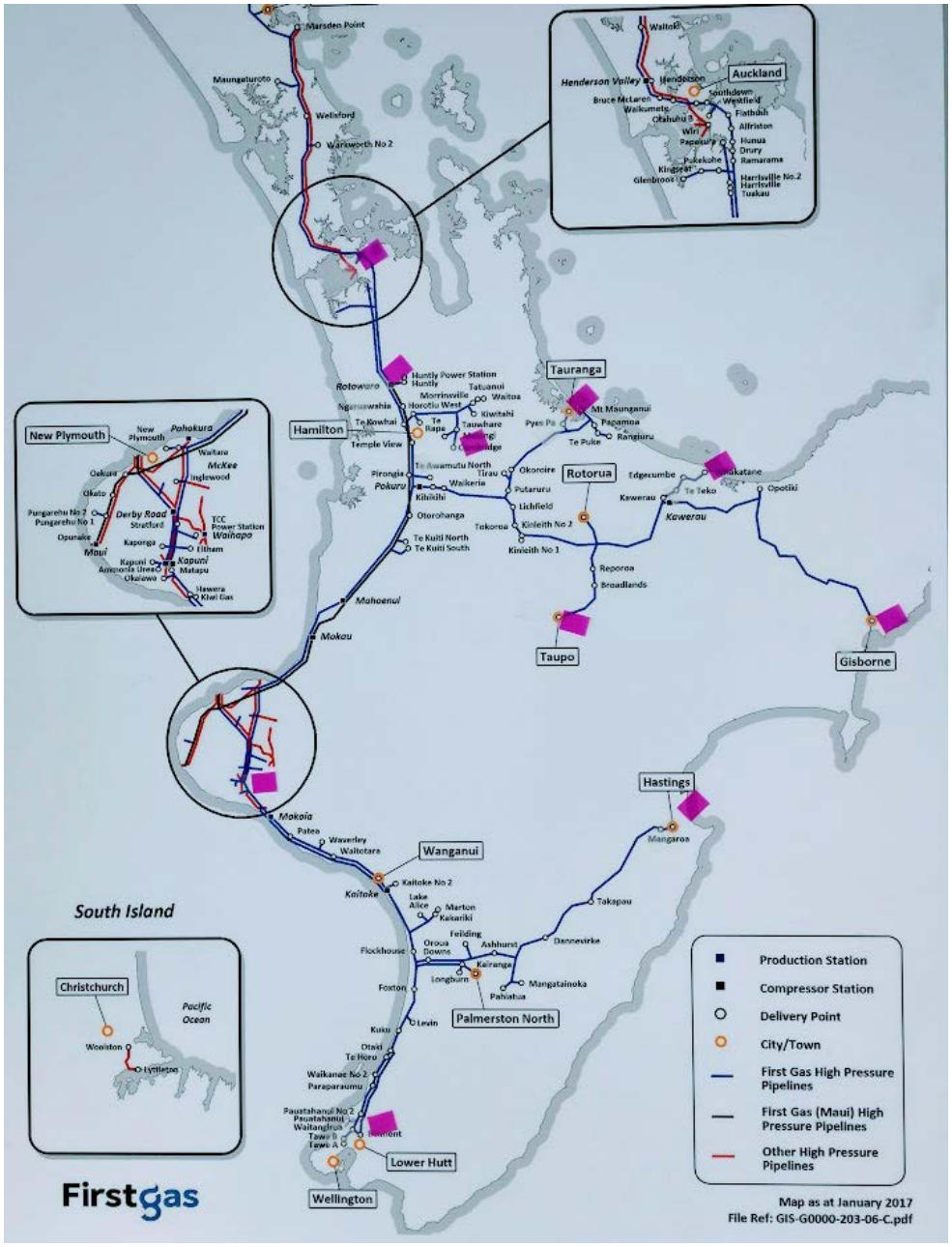
The Civil Defence Emergency Management Act 2002 overrides the CCM Regulations

Pipeline thresholds are specified in terms of minimum pressure and time ...

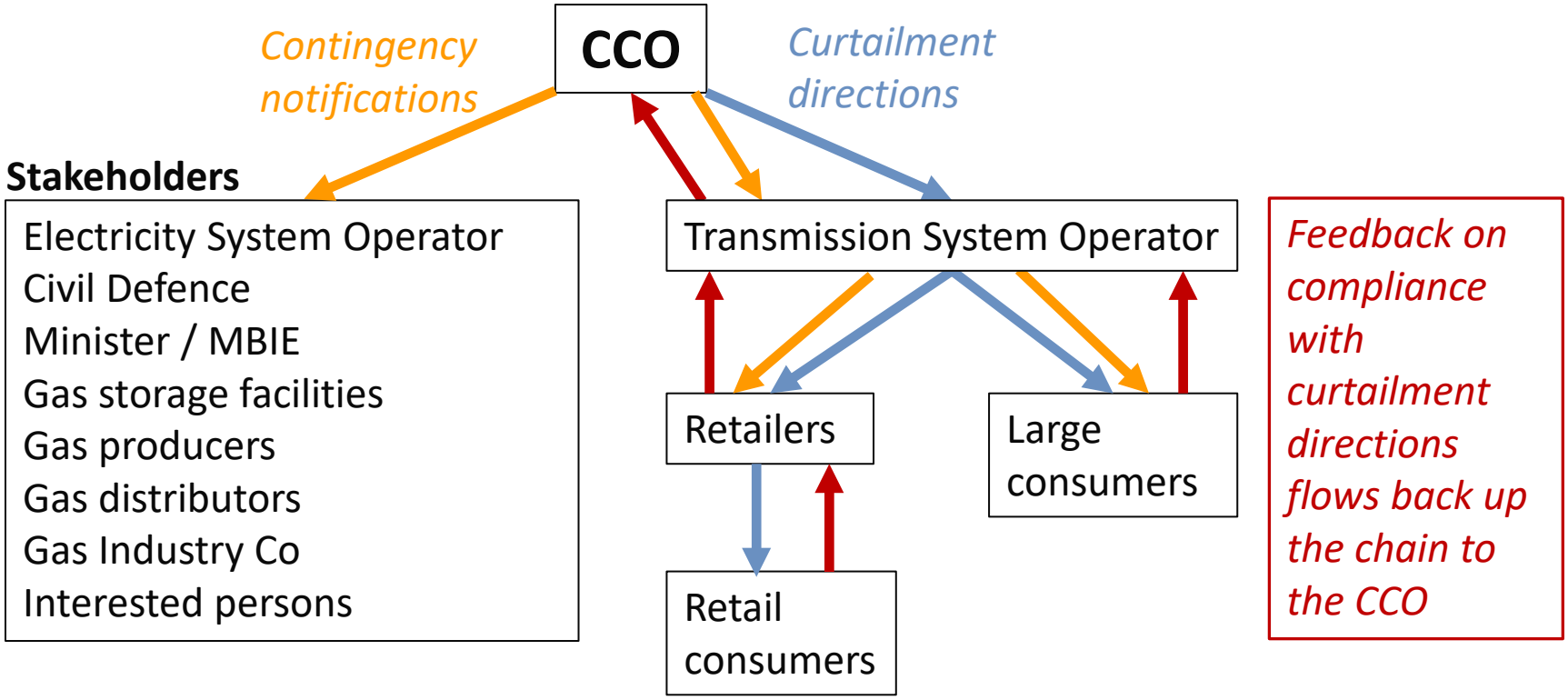
Point of Measurement	Minimum pressure (P_{min}) (barg)	Threshold time (hours to reach P_{min})
Rotowaro	32.0	3
Any other Maui gas gate	30.0	3
Waitangirua	37.0	10
Hastings	32.0	5
KGTP	37.5	3
Gisborne	30.0	5
Taupo	30.0	5
Tauranga	30.0	6
Whakatane	30.0	5
Cambridge	32.0	5
Westfield	42.0	3
Whangarei	25.0	5
Any other non-Maui gas gate	30.0	5

... and are located at the extremities of the transmission system

- Monitored locations at ends of transmission pipelines –
- – plus Kapuni Gas Treatment Plant, which is the start of the South system
- Regulations provide no room for discretion: CCO must declare a contingency if a threshold is breached or is unavoidable



Contingency notices and curtailment directions cascade from CCO to TSO to retailers



Objectives of the curtailment arrangements

- Ensure gas is supplied in a safe, efficient, and reliable manner
- Minimise net public cost
- Prioritise the supply of gas for essential services and critical care
- Allow for gas to be used to complete critical processing
- Allow for gas to be used to fuel certain electricity generating units
- Ensure efficient utilisation of gas in storage facilities
- Ensure effective operational management of a critical contingency

(as laid out in section 1 of Schedule 2)

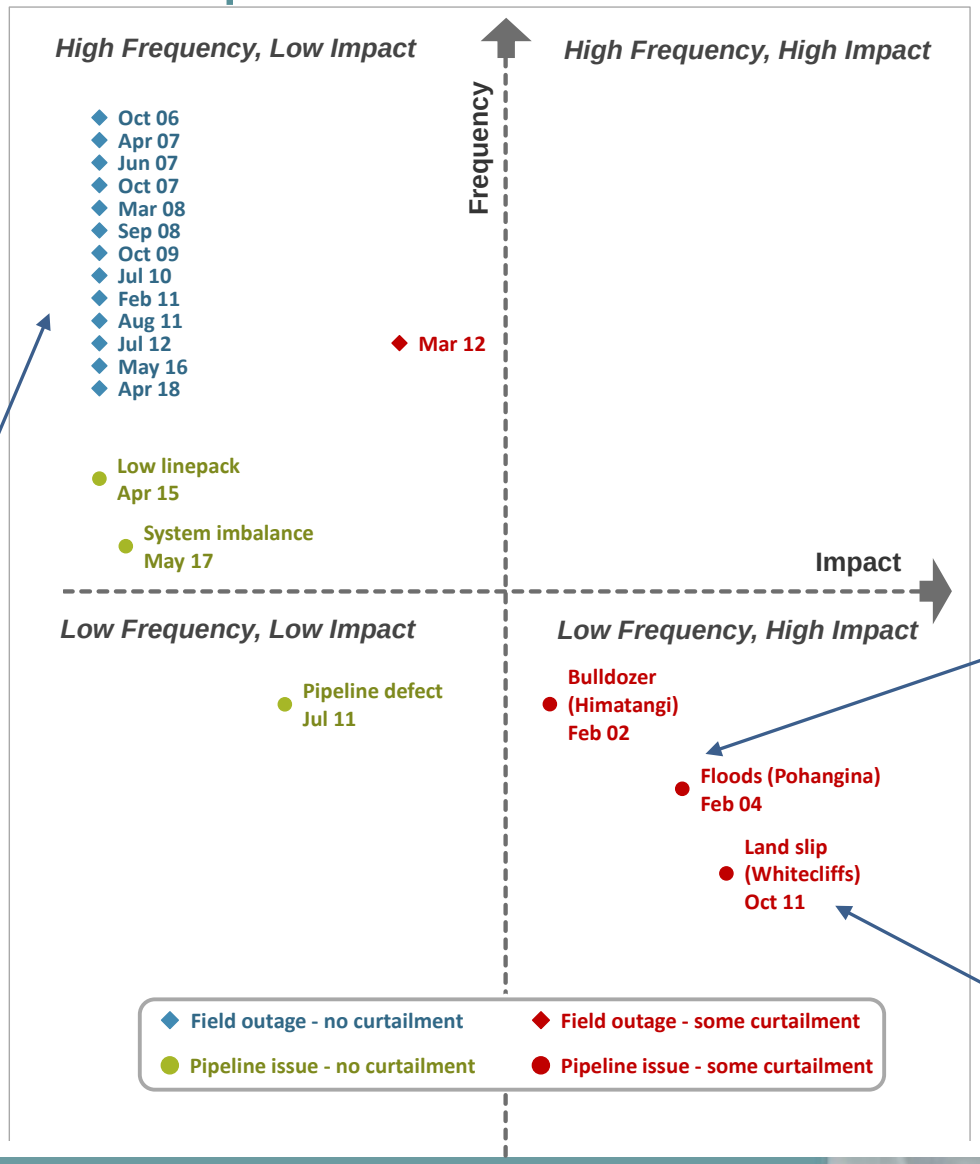
Consumers are classified into curtailment bands by consumption volume; largest consumers are curtailed first

Curtailment Band	Consumption	Description	Customer Numbers
0		Gas storage	1
1	**>15TJ/day**	Consumers with alternative fuel capability. **Huntly Power Station (Rankine units)**	1
2	**>15TJ/day**	Consumers without an alternative fuel capability. Petrochemicals and other thermal generators: **TCC, Te Rapa, Stratford peaker, Huntly e3p and P40**	8
3	**>10TJ/ annum**	Industrial and commercial consumers Eg: steel, timber, oil refining, dairy, meat, etc	350
4	**250 GJ – 10 TJ**	Smaller industrial and commercial consumers	5,000
5	**> 2TJ**	Essential service providers Eg: mortuary services, sewage processing, emergency services	5
6	**<250 GJ**	Small commercial consumers	11,300
7	**Any**	Critical care providers Eg: hospitals, residential care facilities	200
DOM		Can only be asked to conserve	267,000

As at May 2018

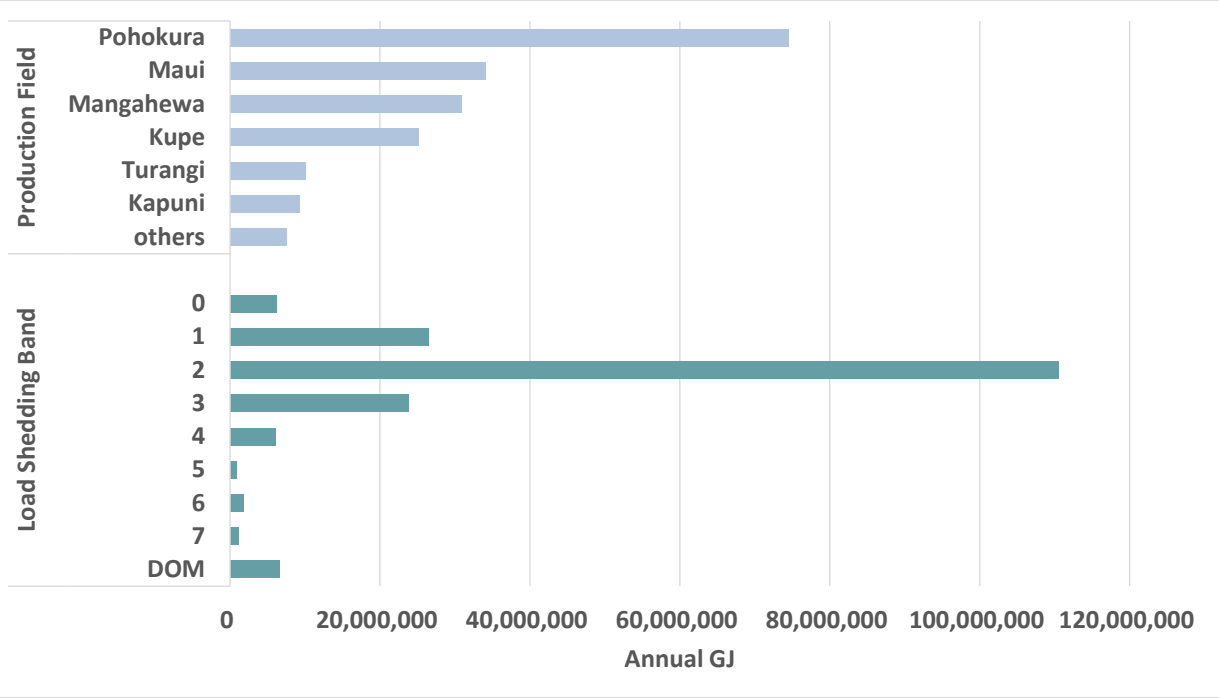
Severity of a critical contingency – and need for curtailments – depend on the cause

Production station outages affect the whole system; curtailment may not be needed (or just the largest consumers)



Pipeline damage events are localised; generally require deep cuts to gas consumption

Most production station outages can be managed by curtailing large industrial consumers only



- Chart shows annual volumes as a proxy for average daily volumes
- Generally, an outage of any single production station can be managed by curtailing bands 0 to 2
- Multiple outages would require deeper cuts

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Electricity supply designation can modify curtailment arrangements

An electricity supply designation can be approved if the consumer requires a specified amount of gas for a specified period of time to:

- Provide fuel to synchronise a generating unit and meet obligations under an ancillary service arrangement
- Start up a generating unit so that it can switch to an alternate fuel
- Allow time for a generating unit already running on gas to switch to an alternate fuel

CCO is required to liaise with the Electricity System Operator

In the event that a curtailment direction is or may be given in respect of curtailment band 1 (Rankine units) or band 2 (remainder of thermal generation), the CCO must:

- Consult the electricity system operator on any need for an electricity supply designated consumer* to use gas
- Have regard to the objectives of the curtailment arrangements (listed above in slide 8)
- Determine whether to allow such gas usage

If they would otherwise be curtailed, electricity supply designated consumers may use gas only in accordance with:

- their designation profile; and
- a determination by the CCO

* Note that designations must be secured ahead of time; they cannot be granted during an event

Band 1: If a serious contingency, Huntly will be one of the first curtailed

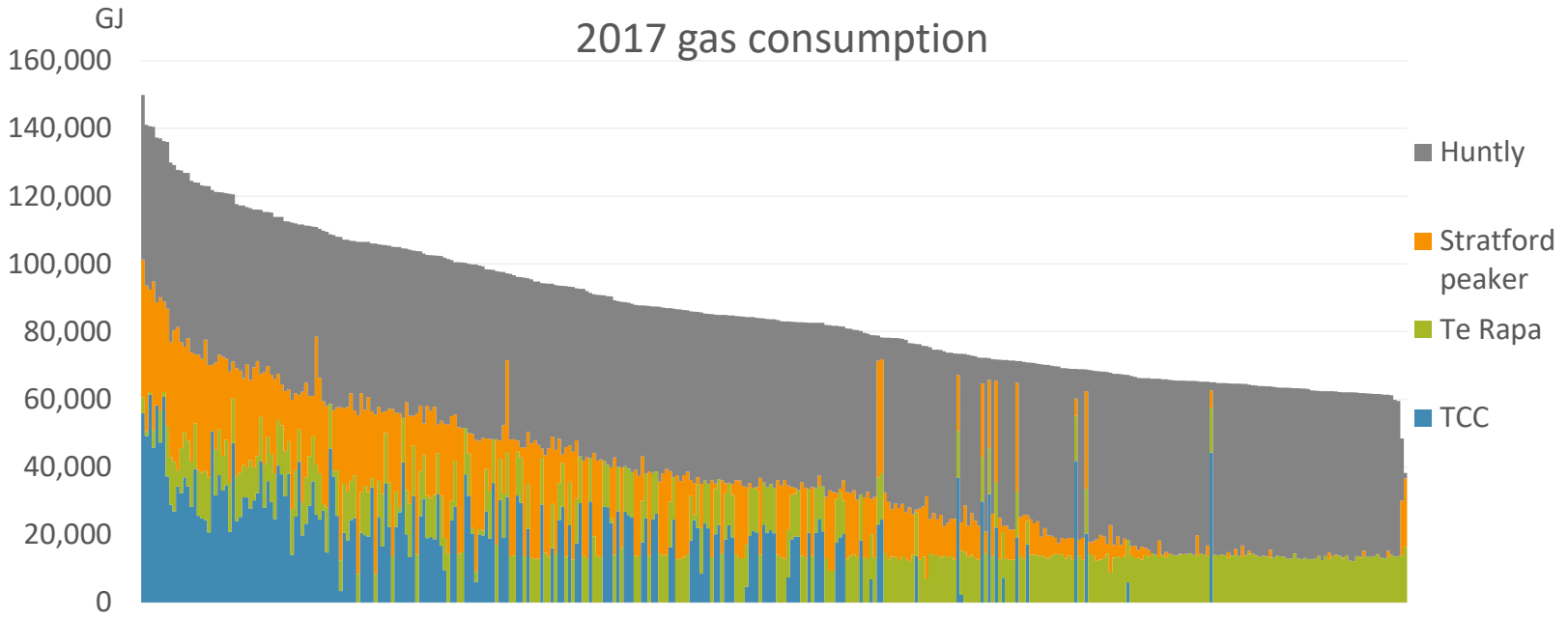
- Huntly Rankine units are in Band 1, with an Electricity Supply Designation
- Designation covers the Rankine units under different scenarios:

Scenario	Maximum gas needed	Duration
Already running, high load	2,000 GJ	1 hour
Already running, low load	685 GJ	1 hour
Hot start	1,000 GJ	3 hours
Cold start	1,200 GJ	12 hours

- Expiration date of designation: 16 December 2018; can be renewed if no material changes

Band 2: other thermal generators

- Huntly units 5 and 6 (e3p and P40)
- Te Rapa cogen
- Taranaki Combined Cycle (TCC)
- Stratford peakers



Some generation not subject to curtailment by the CCO, because not fed by transmission system

McKee: Todd Energy's 2 x 50MW peakers

- Gas for this plant comes directly from McKee/Mangahewa, does not travel through transmission system

Contact's TCC (385 MW) and Stratford peakers (2 x 100 MW)
(when fuelled by offtakes from Ahuroa gas storage)

- (combined generation limited by Ahuroa's withdrawal rates; can only run one at a time)

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What we've learned along the way

- Regulations trump voluntary agreements
- Limiting discretion in required actions can provide certainty
- Separate roles for crisis management and asset management ensure each gets the focus it needs
- Good communication is key; in particular:
  - Front the media and tell a consistent story
  - Make sure the Minister and officials are well briefed
- Preparation and practice
  - Pre-prepared templates for notices, reporting, media releases
  - Liaison meetings (CCO and TSO must work together efficiently)
  - Annual exercises

Questions?

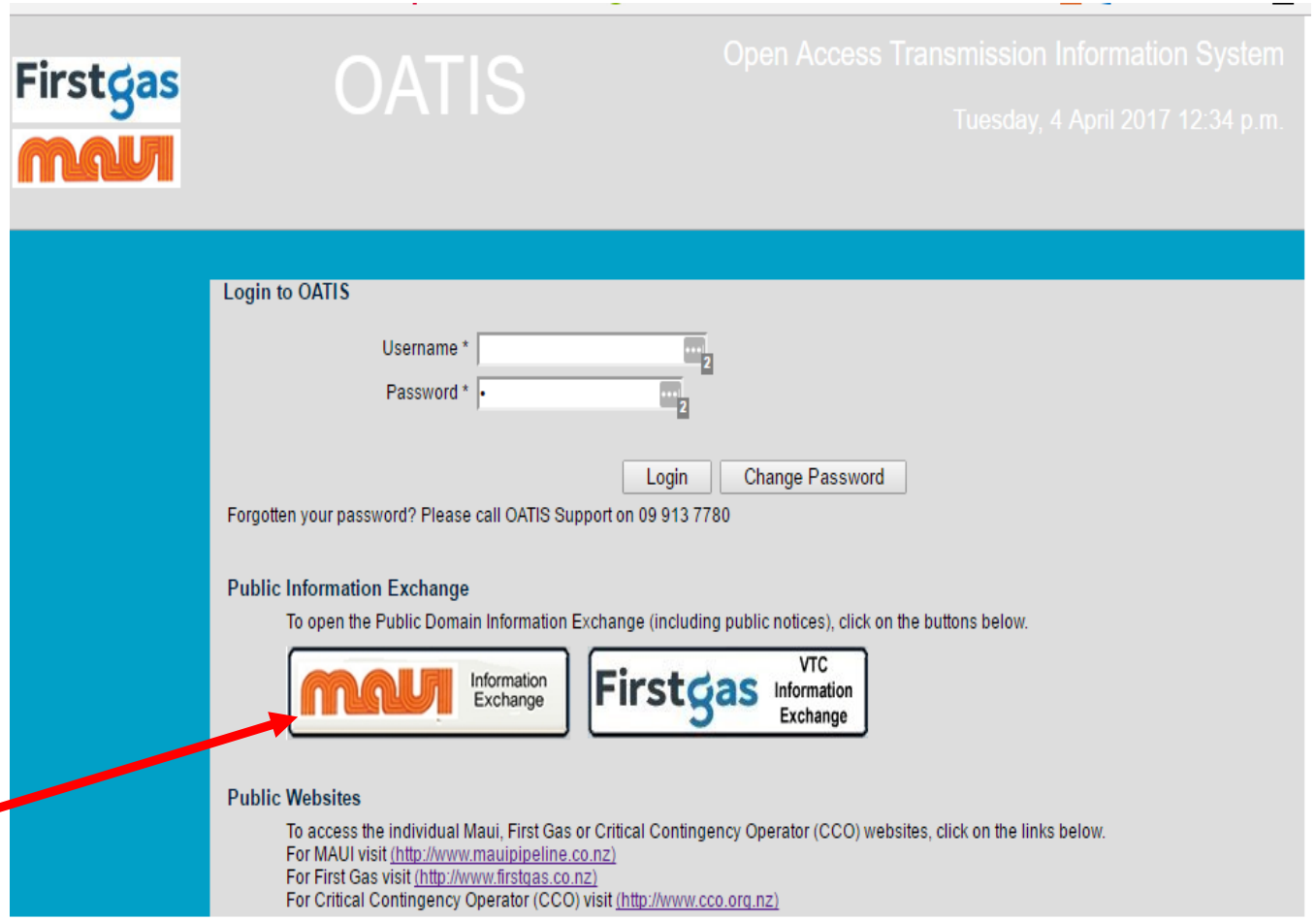
Backup slides

Where to find information

- OATIS

oatis.co.nz

No login needed



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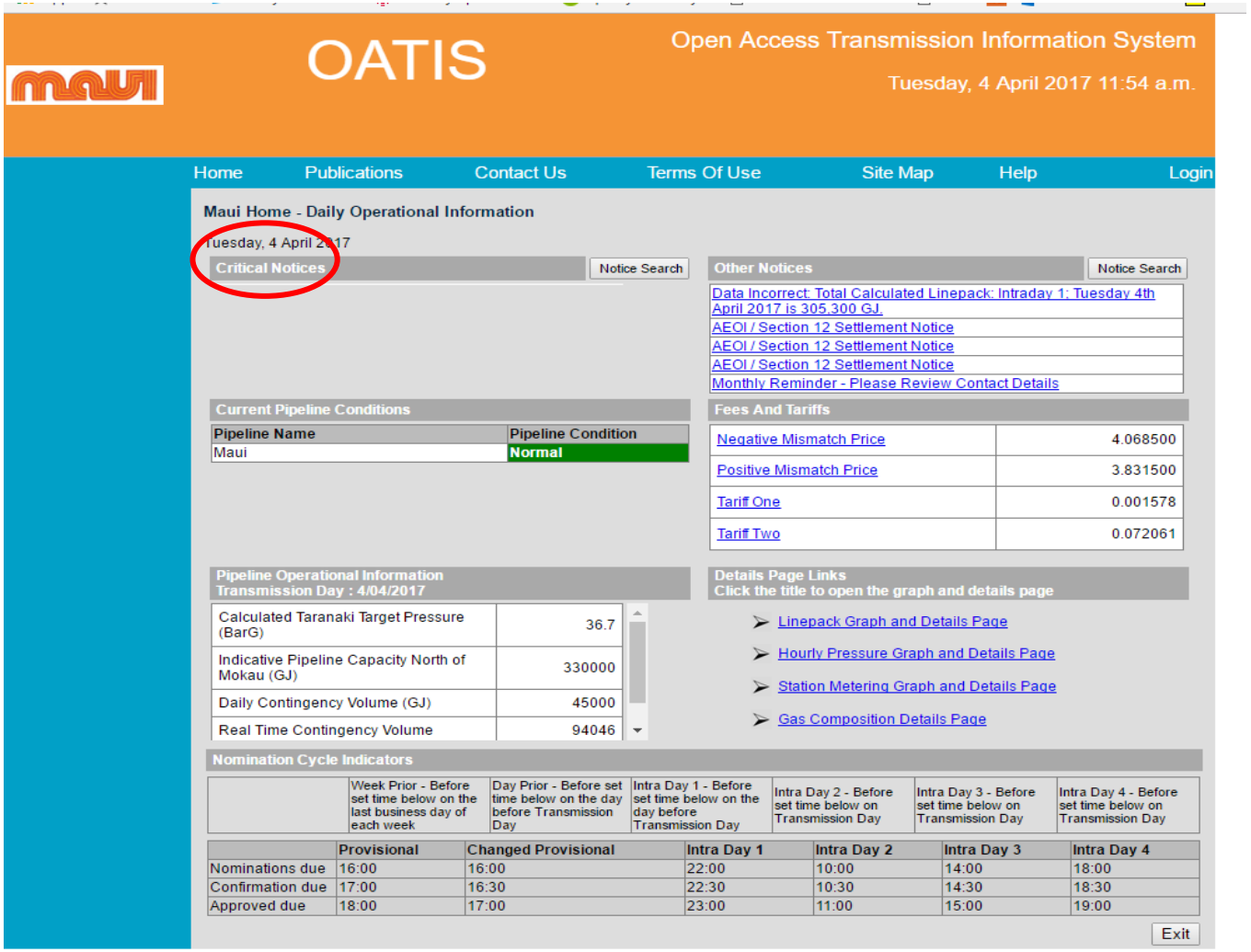

Need more information?

Resources available on cco.org.nz

Under Publications tab	
CCO Information Guide	How CCO will communicate with stakeholders during a critical contingency
CCO Communications Plan	How CCO will communicate with transmission system owner during a critical contingency
First Gas Critical Contingency Management Plan	Sets out transmission system parameters, actions First Gas may take in a critical contingency, and how First Gas will communicate with CCO in a critical contingency
Transmission system map	Includes threshold pressures
CCM Regulations	
Under Historical Events tab	
Notices and reports from previous critical contingencies and annual exercises	