WINTER 2017 – VICTORIAN GAS OPERATIONS OUTLOOK

10 May 2017

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

AGENDA

10:30 - 11:20 Session 1 – Future Gas Supply and Demand

- Introduction (AEMO)
- National Gas Forecasting Report (AEMO)
- Gas Statement of Opportunities (AEMO)
- Victorian Gas Planning Report (AEMO)

11:20 - 12:00 Session 2 – Transmission System – next 5 years

- APA's VTS Regulatory Proposal (APA)
- AER's Regulatory Determination (AER)

12:00 - 1:00 Lunch

AGENDA

1:00 - 3:00 Session 3 – Winter Operations

- 2016 Winter Review (AEMO)
- 2017 Weather Outlook (Weatherzone)
- 2017 APA Augmentations (APA)
- Transmission Operations (AEMO)

3:00 - 3:30 Afternoon Tea

3:30 - 5:00 Session 4 – Market and Emergency Operations

- Abnormal Market Operations (AEMO)
- Emergency Operations (AEMO)
- Summary of Key Messages (AEMO)

5:00 - 6:00 Networking

INTRODUCTION

Presented by Matthew Clemow
Senior Manager, AEMO Gas Real Time Operations

WINTER STRATEGY - IMPORTANCE

- **Winter demand challenges**
  - High morning and evening peak flows
  - System linepack utilisation increases
  - Limited support for Gas Powered Generation (GPG)
  - Weather forecast changes
  - Market outcomes change injection locations
- **Consistent and efficient operations**
  - Predictable outcomes for participants
- **Manage DTS operational risks**
  - Per the AEMO Gas Safety Case

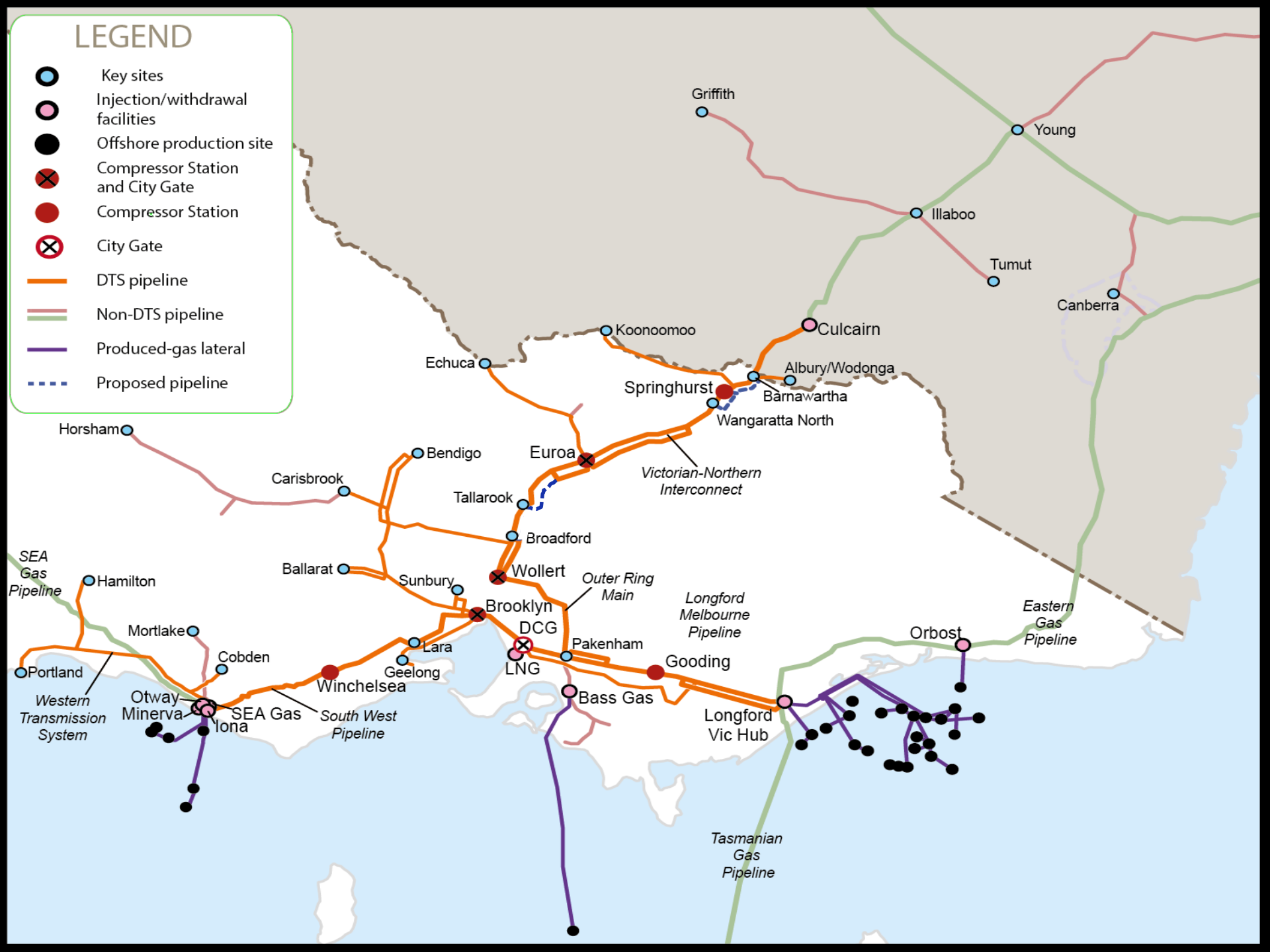
WINTER STRATEGY - IMPLEMENTATION

- **Analysis of transmission system changes**
  - Supply source changes, e.g. TGP
  - Demand changes, e.g. forecast increase in GPG
  - Pipeline changes, e.g. further VNI expansion works
  - How AEMO will manage these changes
- **Preparation and Training**
  - Information for Industry Participants
    - Winter Strategy Presentation
    - Winter Strategy Paper
  - AEMO Gas Operations Engineers
    - Pre-winter training

WINTER STRATEGY – BENEFITS

- Provides participants with information about:
  - System changes
  - AEMO's operations and scheduling
  - Highlights any potential risks
- Increases transparency
- Opportunity to ask questions
- Provides confidence and assurance that AEMO is prepared and ready to manage winter operations

AEMO’S ROLES AND RESPONSIBILITIES


LEGEND
Key sites
Injection/withdrawal facilities
Offshore production site
Compressor Station and City Gate
Compressor Station
City Gate
DTS pipeline
Non-DTS pipeline
Produced-gas lateral
Proposed pipeline
Griffith
Young
Illaboo
Tumut
Canberra
Koonoomoo
Culcairn
Echuca
Albury/Wodonga
Springhurst
Barnawartha
Wangaratta North
Horsham
Bendigo
Euroa
Victorian-Northern Interconnect
Carisbrook
Tallarook
Broadford
SEA Gas Pipeline
Hamilton
Ballarat
Sunbury
Wollert
Outer Ring Main
Brooklyn
DCG
LNG
Longford Melbourne Pipeline
Eastern Gas Pipeline
Orbost
Mortlake
Cobden
Lara
Pakenham
Gooding
Portland
Geelong
Winchelsea
Bass Gas
Western Transmission System
Otway
Minerva
Iona
SEA Gas
South West Pipeline
Longford Vic Hub
Tasmanian Gas Pipeline

AEMO OPERATION OF THE DECLARED TRANSMISSION SYSTEM

Safe, Secure and Reliable Operation of the DTS

- **Maintain System Security**
  - Manage pipeline gas flows using the AEMO Gas SCADA
  - Operating strategies to maintain pipeline pressures
  - Adapt based on expected scheduled injections
  - Engineering modelling tools including Gregg Model
  - Threats to System Security
- **Emergency Management**
  - Assess, Respond and Communicate
- **Monitor and manage Gas Quality**
  - SCADA Communications with Gas Facilities
  - Gas Quality Procedures and Management Plans
- **Gas metering data collection via AEMO Gas SCADA**
  - Facilities, Larger users and GPG, Distribution offtakes

AEMO OPERATING ARRANGEMENTS FOR THE APA OWNED SYSTEM

- **Operate the DTS per the Service Envelope Agreement (SEA)**
  - Agreed operations and reliability standards
  - Incident review and continuous improvement
- **AEMO management of outages to maintain gas supply**
  - Releases APA Assets for Maintenance
  - Victorian Gas Maintenance Coordination process
- **DTS project review and pipeline capacity modelling**
  - Model pipelines to agree transportation capacities with APA
  - Operability including SEA requirements
- **New DTS Connections**
  - Distribution offtakes
  - Facilities including Operating Agreements

MARKET OPERATIONS

- **Gas Demand Forecasting**
  - Market participant forecasts adjusted against actual flow
  - Demand Override Methodology
  - Direct Call to Weather Forecasting Service
- **Monitoring GPG**
  - NEM Pre-dispatch
- **Scheduling Pipeline Injections and Withdrawals**
  - Market Clearing Engine generates schedules
  - Pricing Schedule
    - Infinite Tank Model with no DTS pipeline capacity constraints
  - Operating Schedule
    - Actual scheduled flows accounting for DTS capacity
    - Peak Shaving LNG to support system pressure

HOW THE VICTORIAN DTS IS DIFFERENT

- **The Victorian DTS is complex and different**
  - Three main transmission pipelines – two are bi-directional – with interactions between these.
  - Pipeline pressure and linepack variations are significant
- **Supply sources and pipeline linepack**
  - DTS main supply sources – Longford and the Port Campbell facilities are approx. 200 km from to Melbourne
  - Sydney and Adelaide are each supplied by two pipelines approx. 1,000 km long – more linepack than the DTS
- **Victoria has the coldest winter of the mainland states and the highest residential gas demand**
  - Demand varies substantially with temperature
  - Weather forecast inaccuracies create demand uncertainty
  - Gas Powered Generation impact on linepack

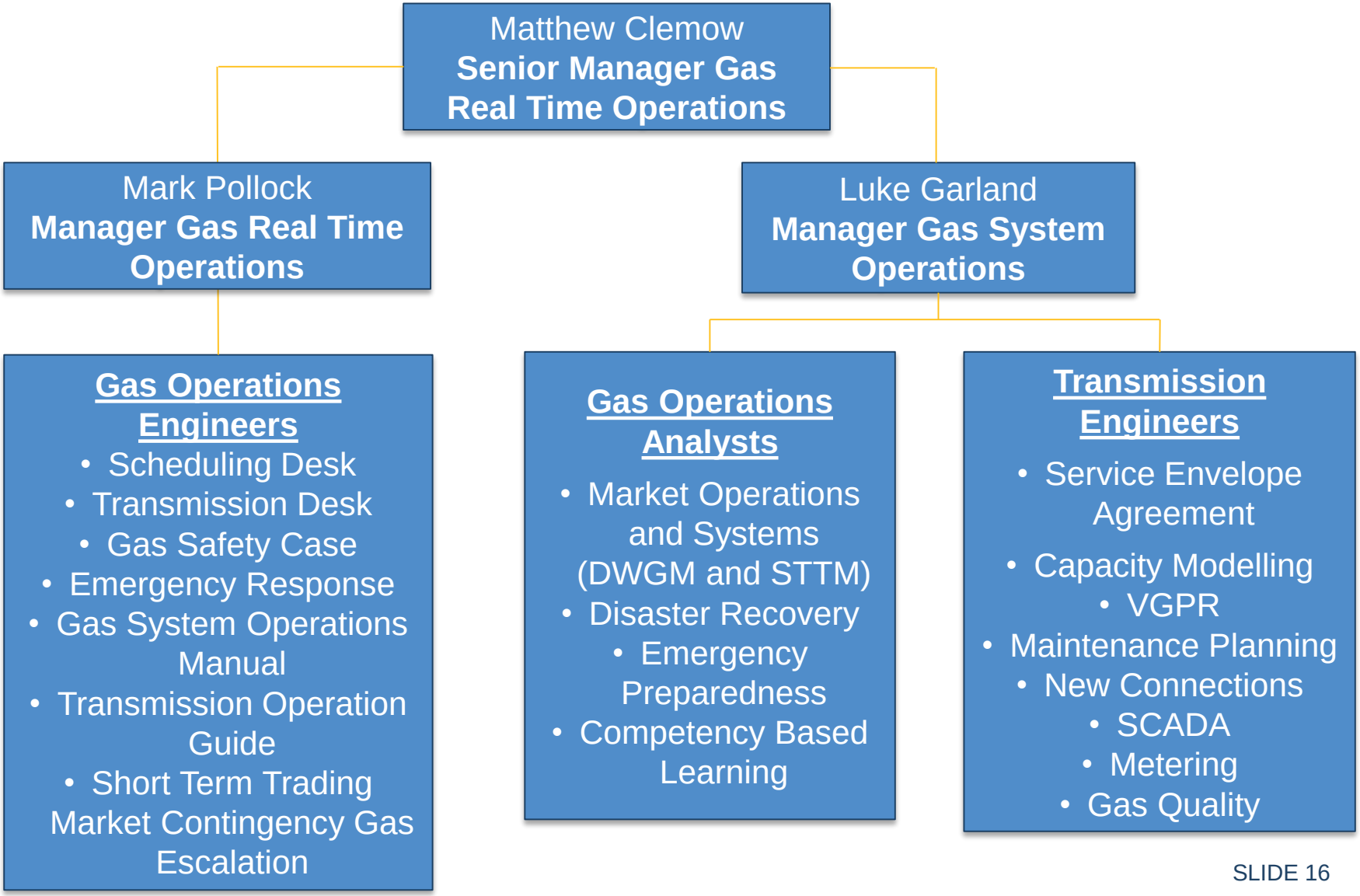
SHORT TERM TRADING MARKET (STTM)

- **AEMO is the market operator not the system operator**
  - Pipeline owners continue to operate their assets
  - AEMO is not responsible for system security
  - STTM facility operators notify AEMO of supply issues via the Contingency Gas Hotline
- **AEMO manages the Contingency Gas process**
  - Assessment Conferences
  - Industry Conferences
  - Contingency Gas determination
  - Contingency Gas scheduling

AEMO GAS CONTROL CENTRE

- **Located in Melbourne**
- **Two staff, 24/7, 12 hour shifts**
  - Operate the Victorian DTS
  - Schedule the Victorian DWGM
- **Regular interaction with Facility Operators, APA, and Market Participants**
  - Maintenance Coordination and Facility Release processes
  - Notification to APA of DTS equipment issues
  - Application of DTS and Facility Constraints (e.g. NFTC, SDPC)
  - Gas Quality monitoring and response
  - Gas Powered Generation monitoring and forecast variations
  - STTM Contingency Gas Hotline

AEMO GAS REAL TIME OPERATIONS STRUCTURE



QUESTIONS?

2016 NATIONAL GAS FORECASTING REPORT (NGFR) OUTCOMES

May 2017

PRESENTED BY GREGORY STAIB

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

AGENDA

- About the 2016 National Gas Forecasting Report (NGFR)
- Summary points and forecasts
  - Total consumption, all regions and VIC
- Next steps and questions

ABOUT THE 2016 NGFR

Uncertainties and challenges – future shapers

The 2016 NGFR provides a gas lens into the increasingly complex interdependencies between the gas and electricity sectors and the relationship between Australia's energy demand and growing links to the international gas sector.

The forecasting scenarios, developed with industry, represents the most probable pathway for Australia, with neutral (most likely), weak and strong economic scenarios.

Changing domestic role of gas, challenging supply and prices.

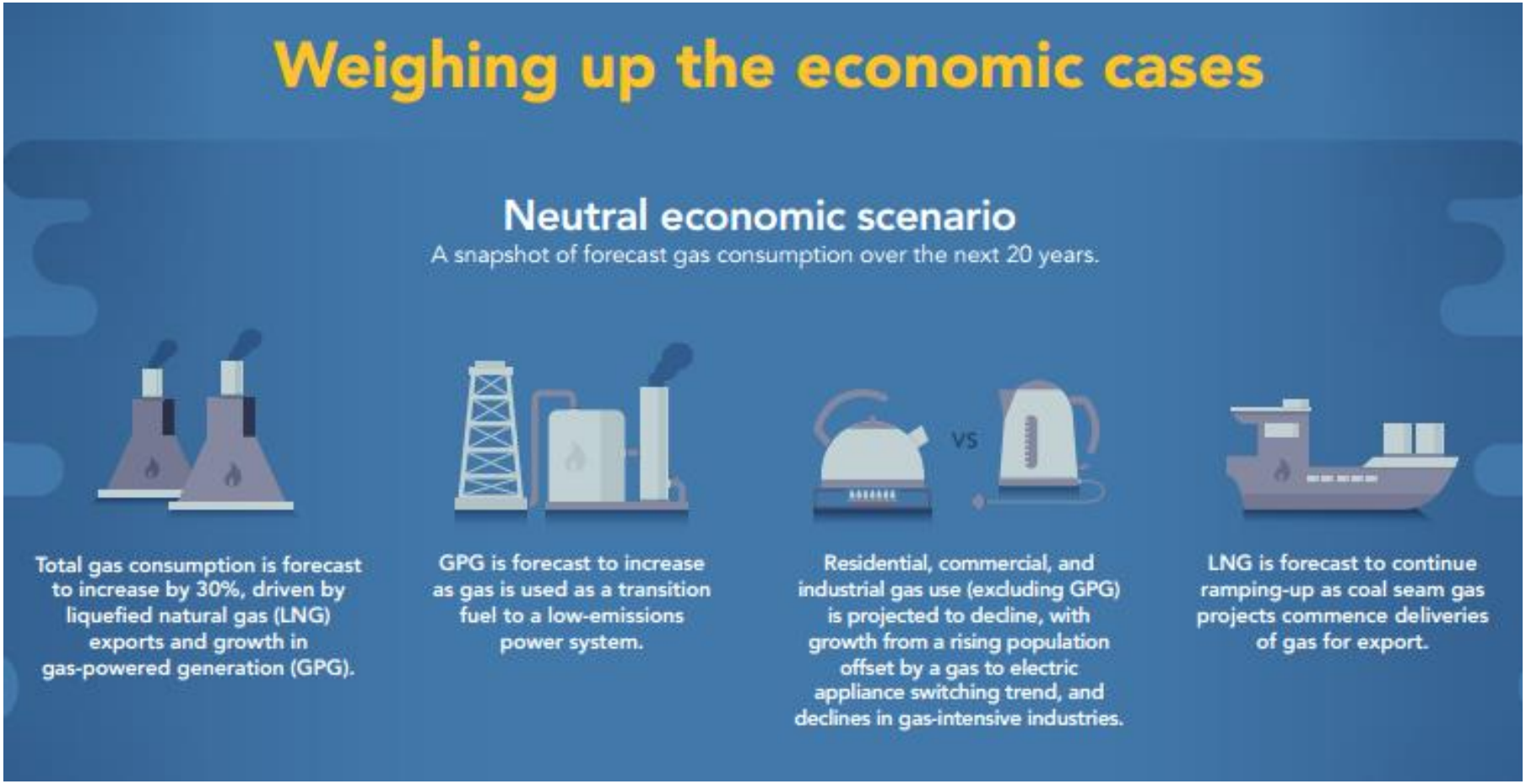
Changing economy; changing industry; changing consumers.

Links to volatile international oil and gas markets.

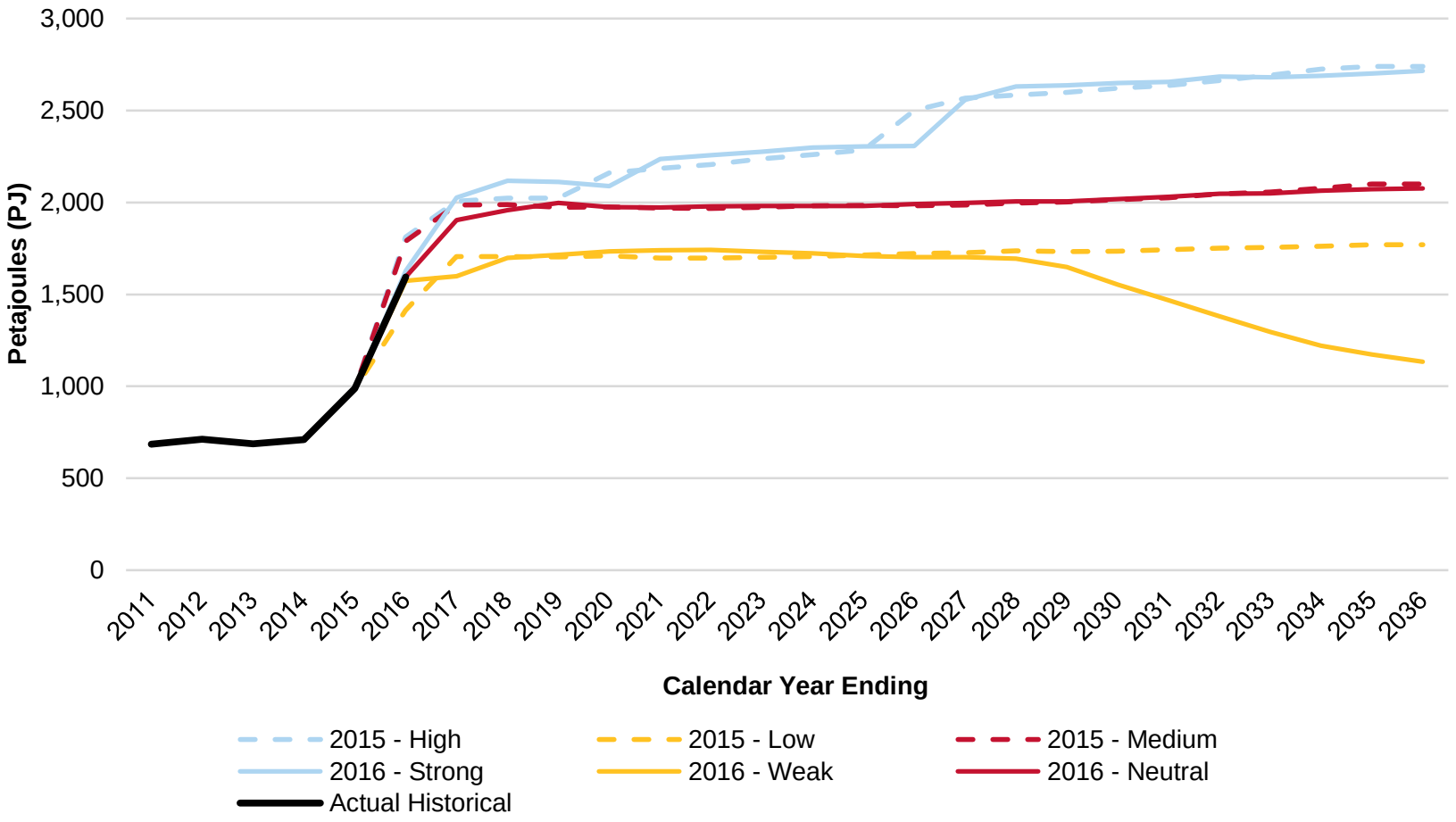
Transforming to a lower emissions power system.

Planning challenges to cater for a range of future economic scenarios.

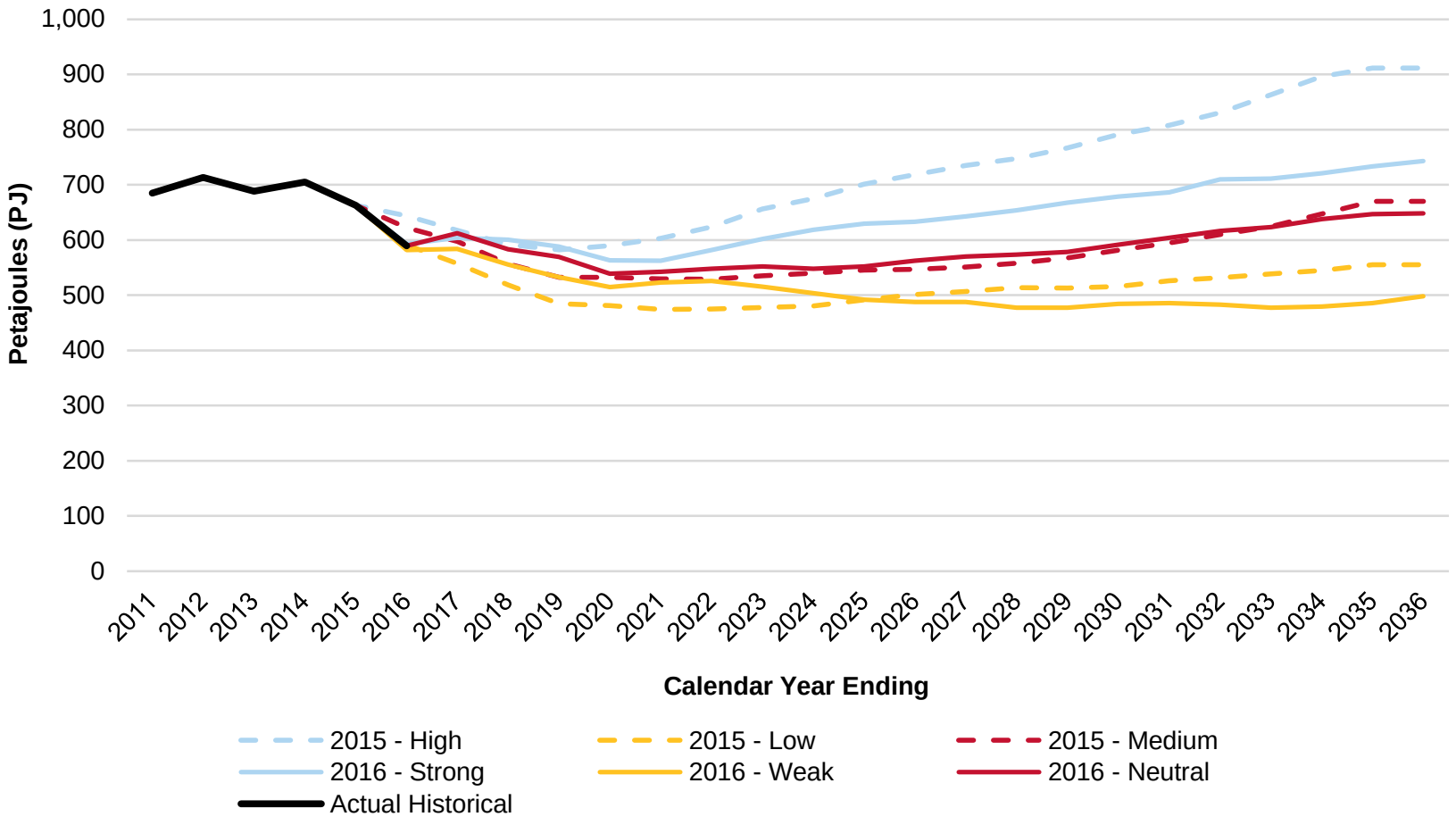
ABOUT THE 2016 NGFR



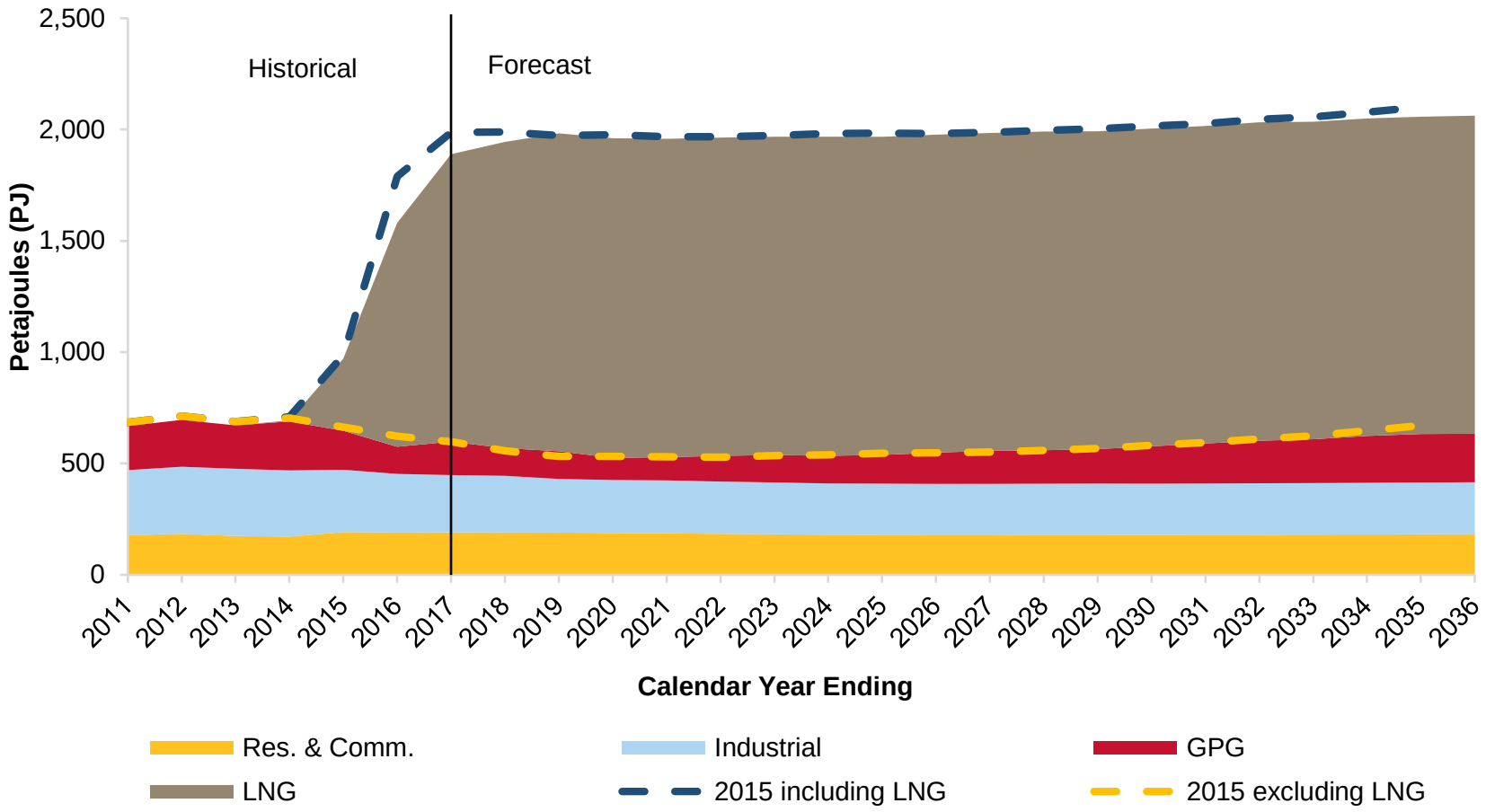
SOUTH-EAST AND EASTERN AUSTRALIA: ANNUAL CONSUMPTION – SCENARIOS (INC. LNG)



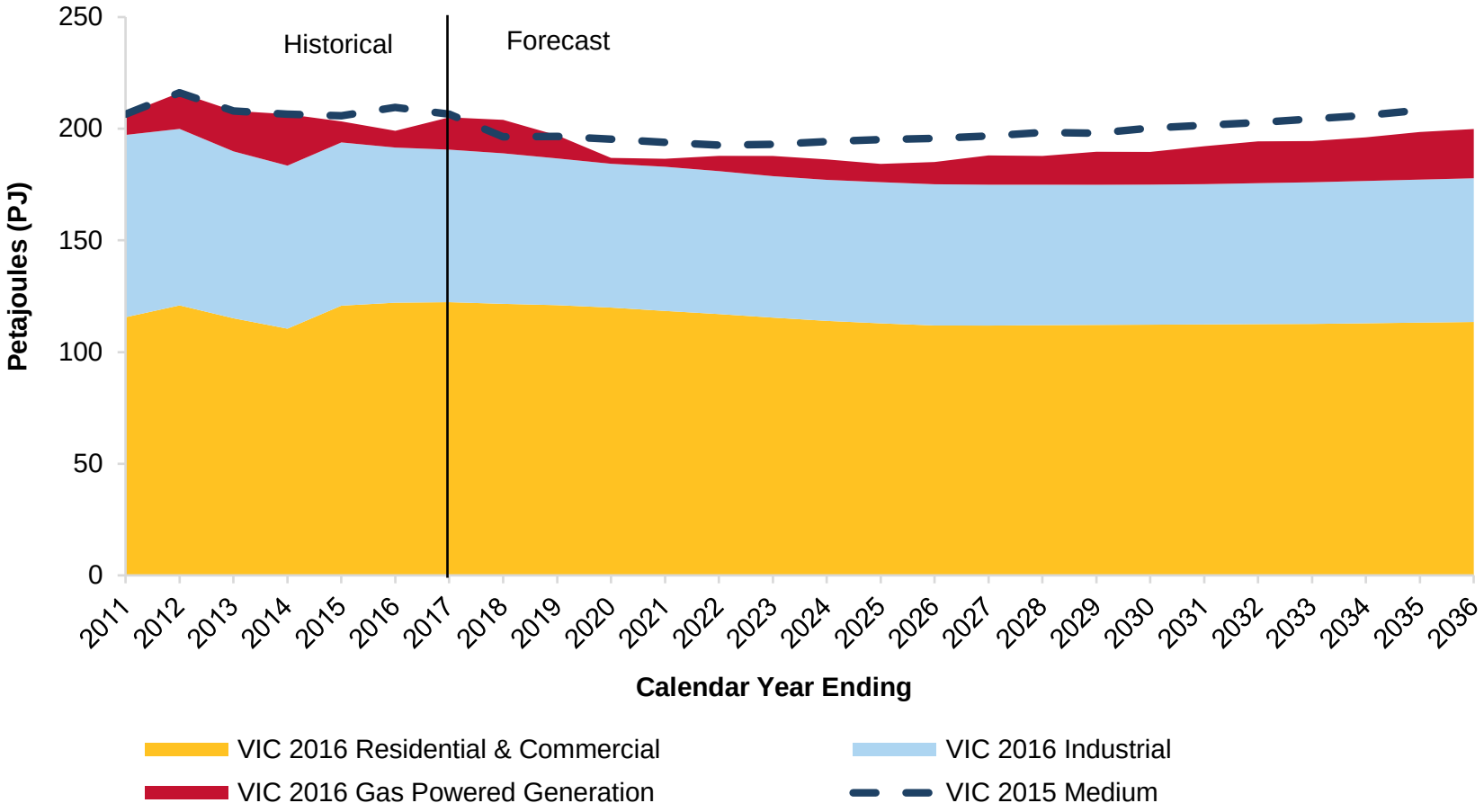
SOUTH-EAST AND EASTERN AUSTRALIA: ANNUAL CONSUMPTION – SCENARIOS (EXCL. LNG)



SOUTH-EAST AND EASTERN AUSTRALIA: ANNUAL CONSUMPTION



FORECASTS FOR VICTORIA



TRANSFORMING FORECASTING

Transformation program aims to:

- Integrate gas and electricity forecasting.
- Integrate supply and demand modelling.
- Make more timely information available as significant industry changes occur.

QUESTIONS

Thank you.

For more information on these AEMO forecasting reports, please contact: *Energy.Forecasting@aemo.com.au*

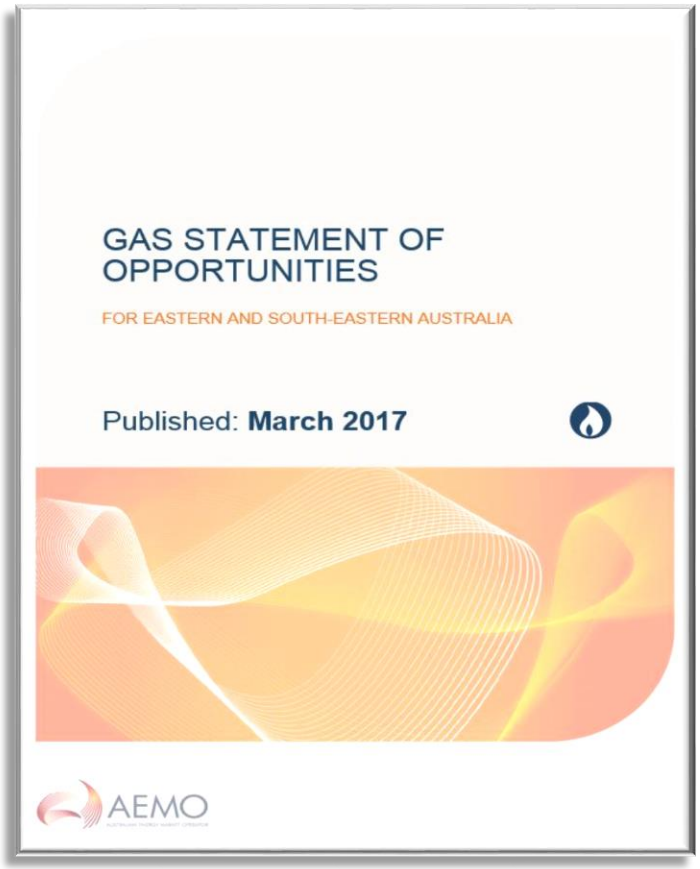
2017 GAS STATEMENT OF OPPORTUNITIES

May 2017

PRESENTED BY AEMO | RACHAEL SAW

THE 2017 GSOO

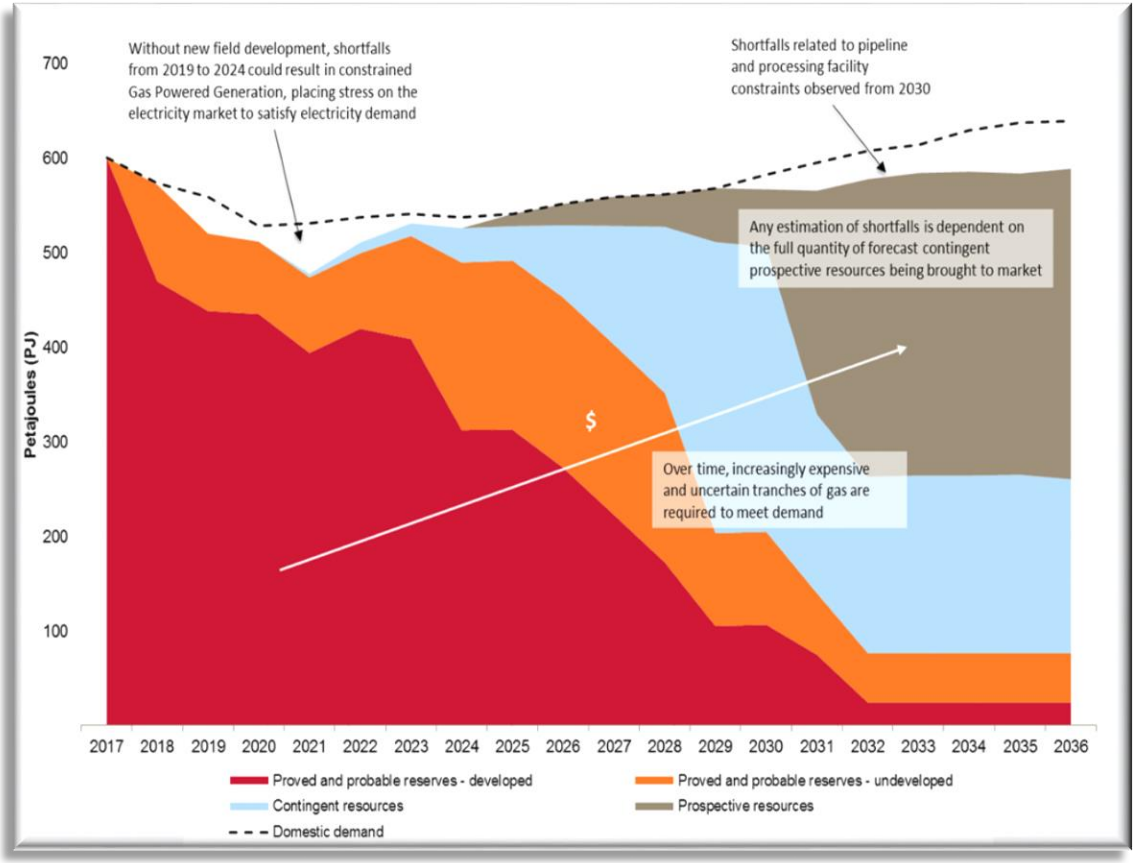
The 2017 GSOO provides industry participants and policy-makers with transparent information to support:



- Decision-making on the supply of gas in Australia's long-term interests
- Adequacy of gas infrastructure, reserves and resources to meet demand in eastern and south-eastern Australia to 2036
- Assess impact of gas supply on generation supply adequacy in the electricity market

DOMESTIC GAS PRODUCTION (EXCLUDING LNG), 2017–36
EASTERN AND SOUTH-EASTERN AUSTRALIA

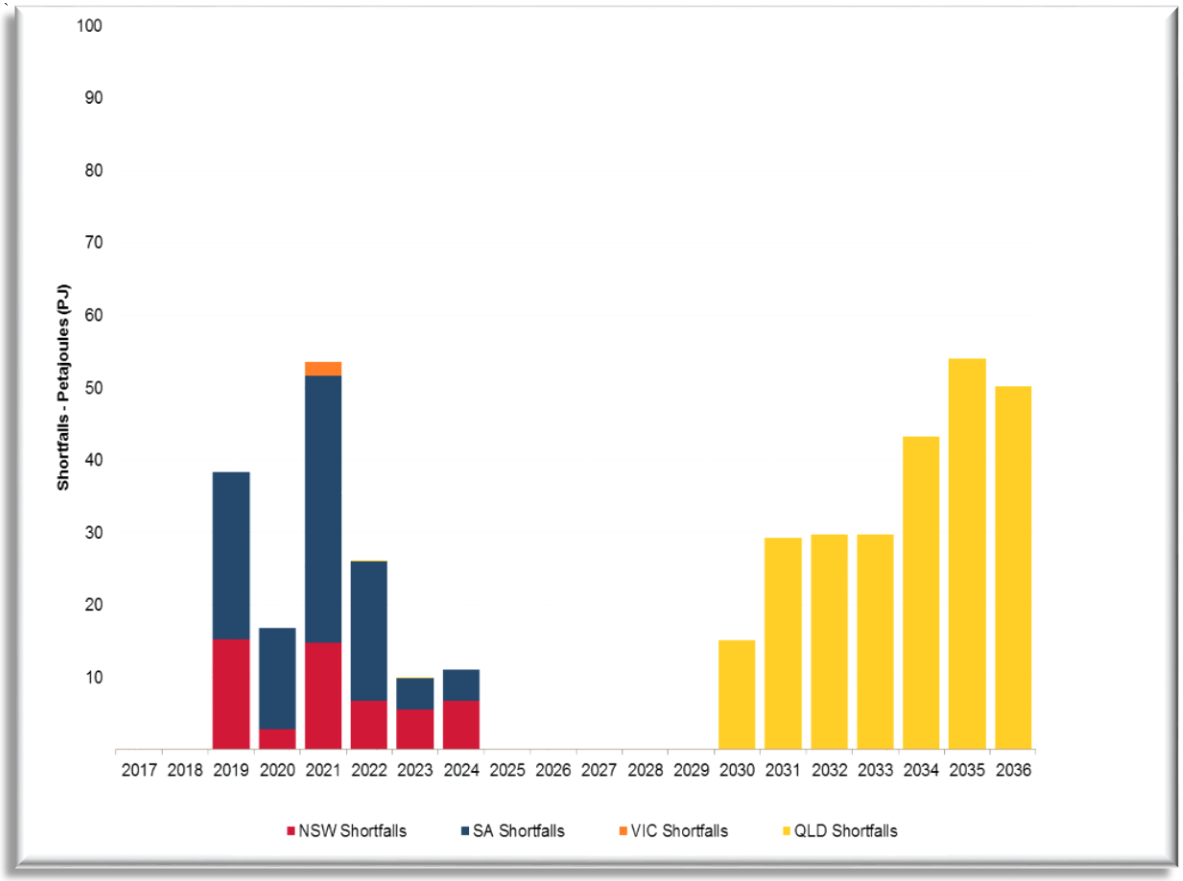
Annual domestic gas production to decline by 122 PJ to 2021 with gas supply shortfalls projected



- Need additional supply
- Uncertainty - contingent and prospective resources
- Longer term, infrastructure plant and pipeline capacity constraints limit supply as GPG demand increases
- Production decline steepest in Victoria - 38% decline between 2017-2021

GAS OR ELECTRICITY SHORTFALLS?

Estimated average electricity supply shortfalls of up to 363 GWh may be experienced in 2018–2019, 2020–2021 and 2021–2022.



Shortfalls in gas-powered generation expected:

- SA from 2019-24 (up to 37 PJ in 2021)
- NSW from 2019-24 (up to 15 PJ in 2019)
- VIC in 2021 (2 PJ)
- QLD 2030-36 (up to 54 PJ in 2035)

POSSIBLE SOLUTIONS TO SHORT TERM SHORTFALLS

Energy reliability and security could be improved through industry responses, if the market provides incentives for industry to increase gas supply or reduce demand.

Some possible options being considered by industry include:

- Redirecting a small portion of LNG supply to the domestic market.
- Increasing production from existing fields.
- Exploring and developing new fields
- Building the Northern Gas Pipeline to access gas in Northern Territory
- Developing the proposed Narrabri Gas Project
- Investing in alternative electricity generation and storage technologies

Some of these options would require changes in state and territory energy policies to lift moratoria on hydraulic fracturing, or onshore gas development.

Energy Supply Outlook – Gas and Electricity

QUESTIONS

Email: Rachael.Saw@aemo.com.au

Phone: (03) 9609 8441

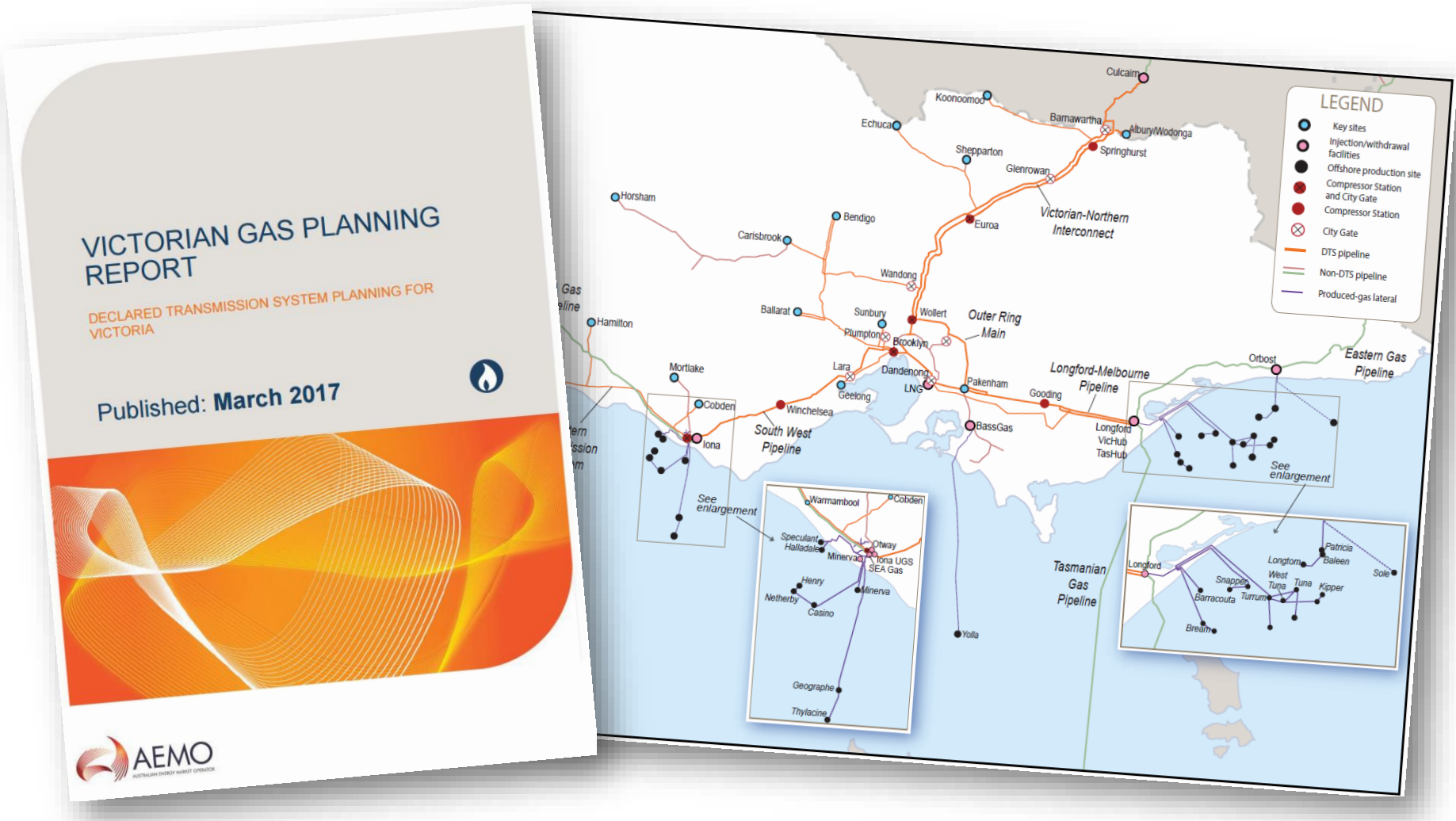
2017 VICTORIAN GAS PLANNING REPORT

10 May 17

PRESENTED BY JESSIE YEUNG

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

WHAT IS THE VICTORIAN GAS PLANNING REPORT?



Available at: https://www.aemo.com.au/Gas/National-planning-and-forecasting/Victorian-Gas-Planning-Report

VGPR: FIVE YEAR OUTLOOK 2017 – 2021

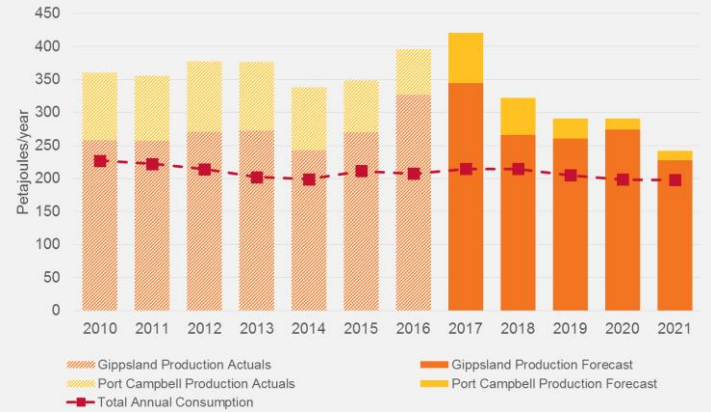
Supply and demand balance

System adequacy

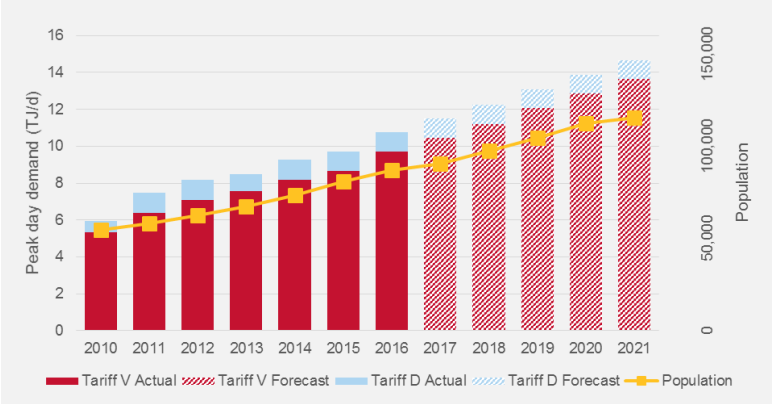
Emerging capacity limitations

OVERVIEW

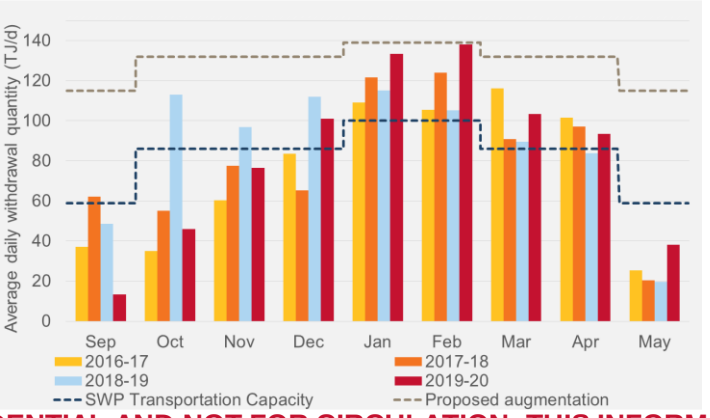
1. SUPPLY ADEQUACY



2. DEMAND DISTRIBUTION



3. THREAT TO SYSTEM SECURITY: SWP TO PORT CAMPBELL

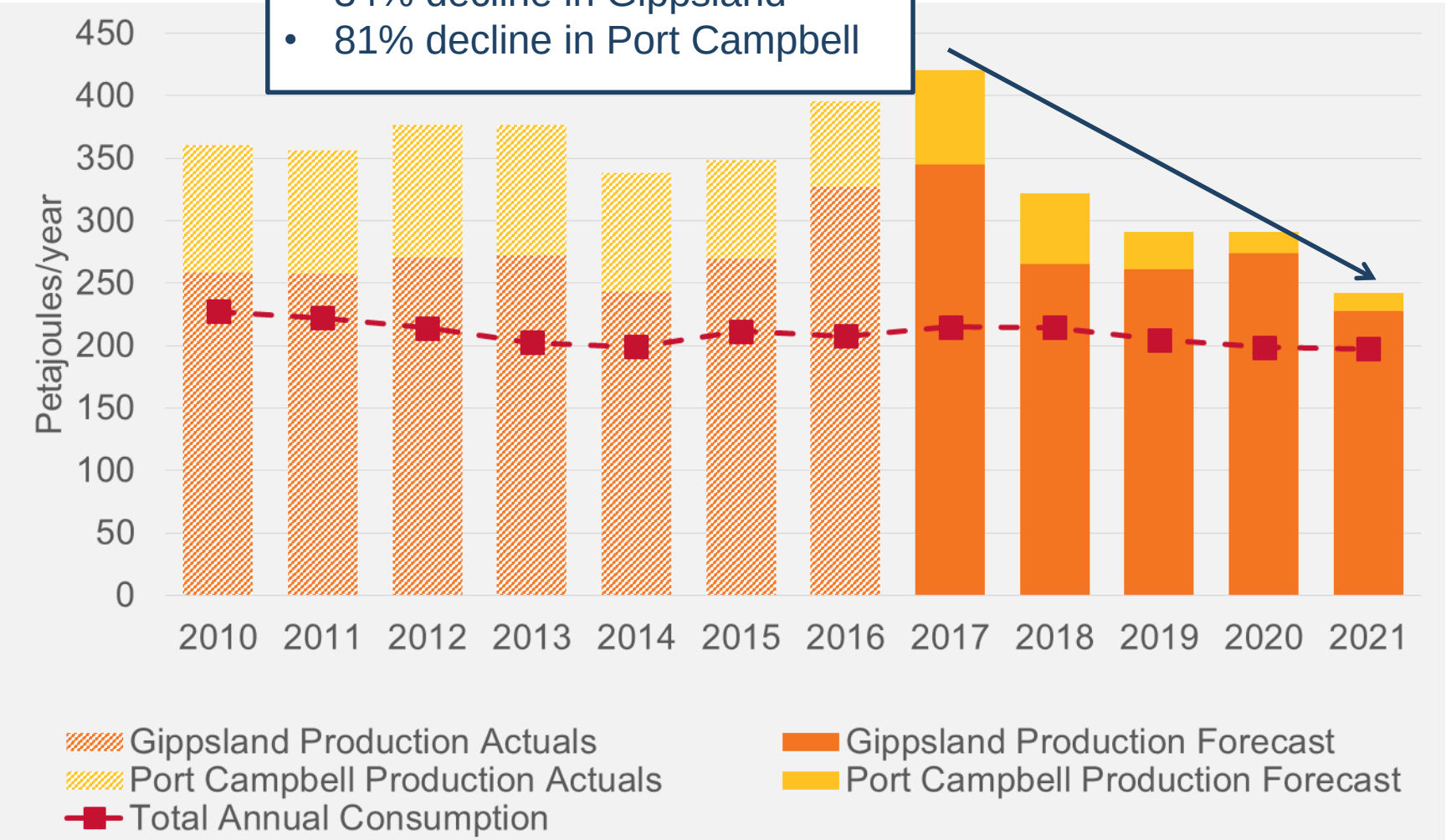


4. THREAT TO SYSTEM SECURITY: WARRAGUL PEAK DAY SUPPLY

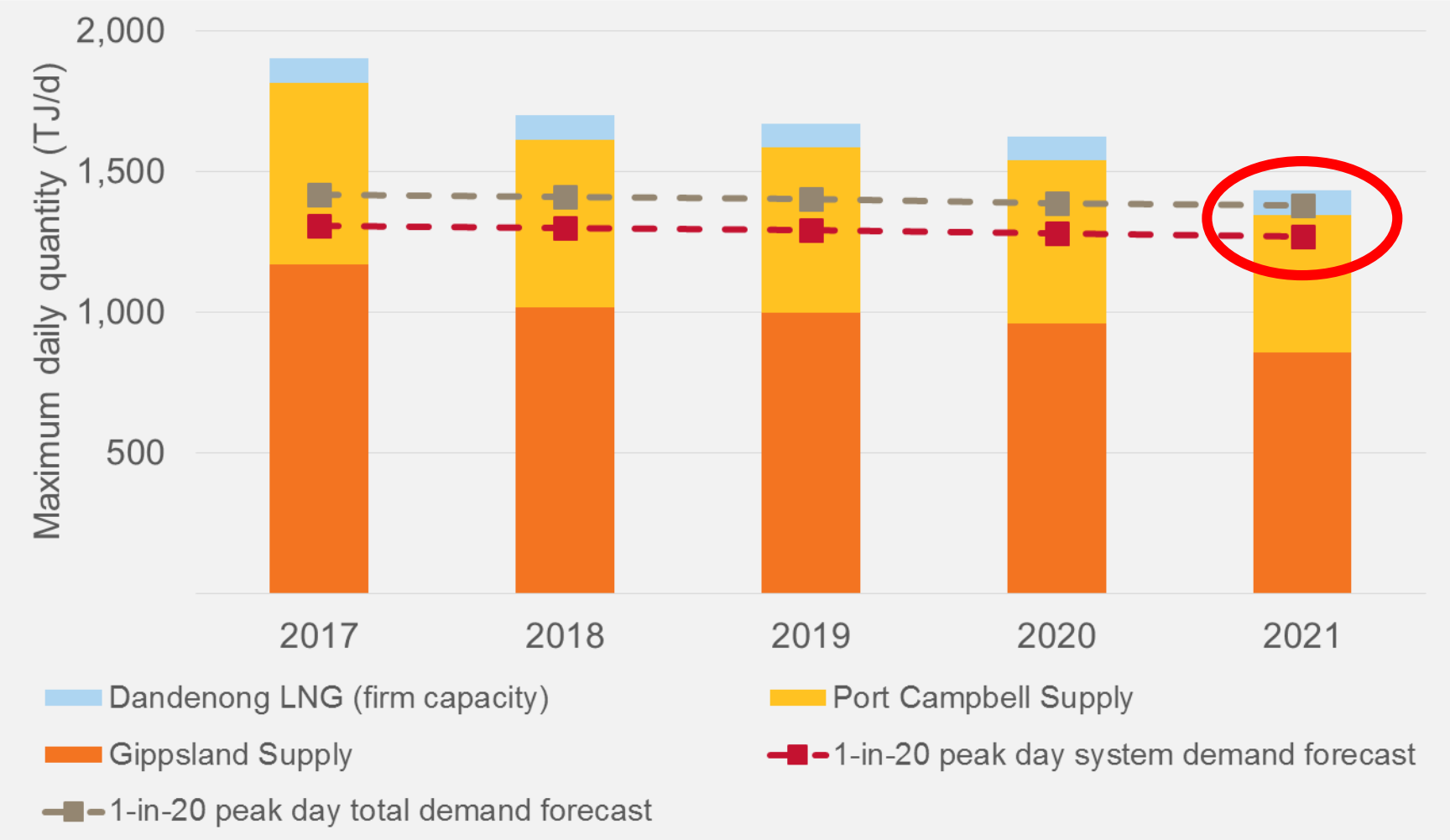
SUPPLY ADEQUACY AND DEMAND DISTRIBUTION

ANNUAL PRODUCTION

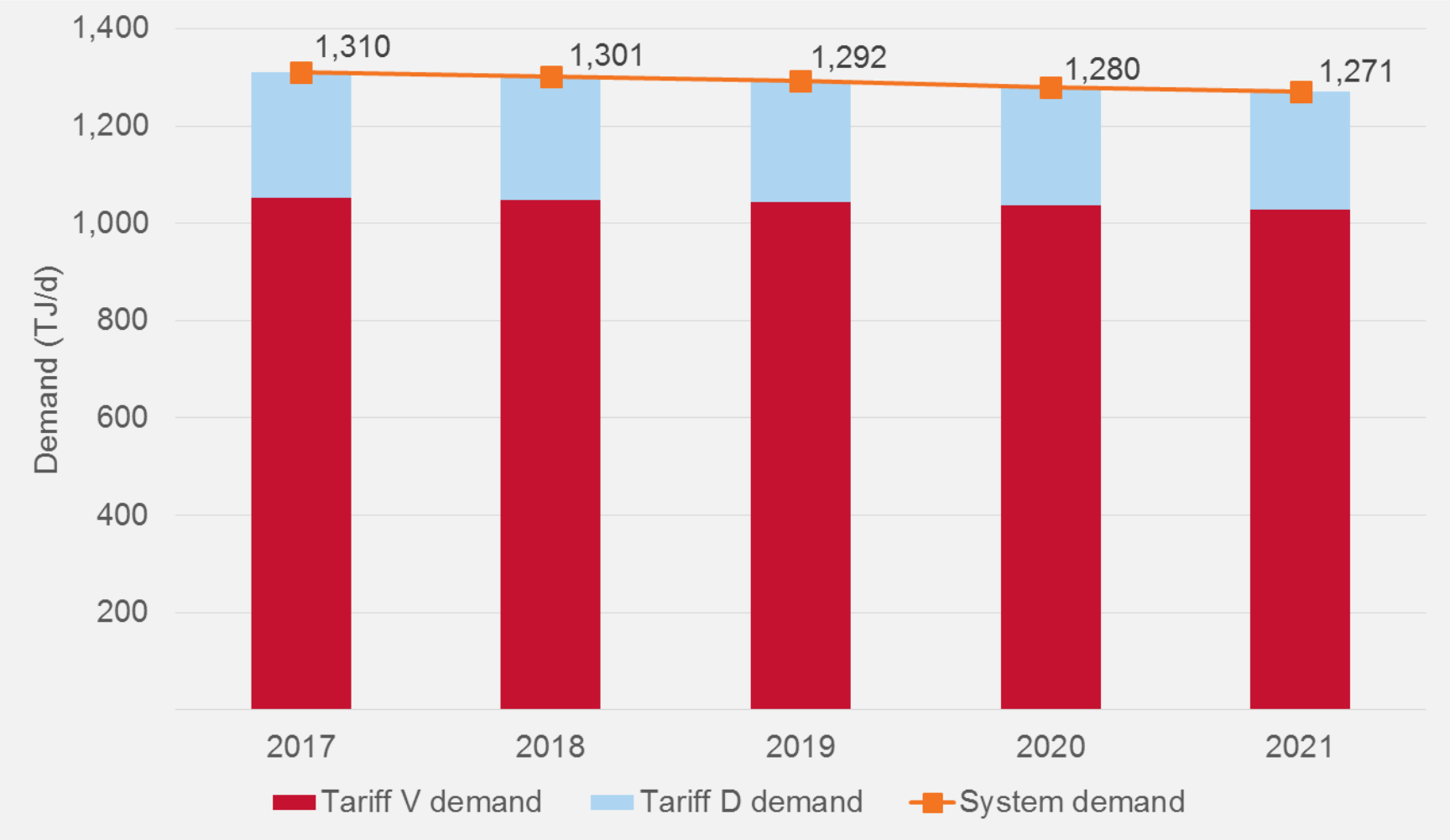
- 34% decline in Gippsland
- 81% decline in Port Campbell



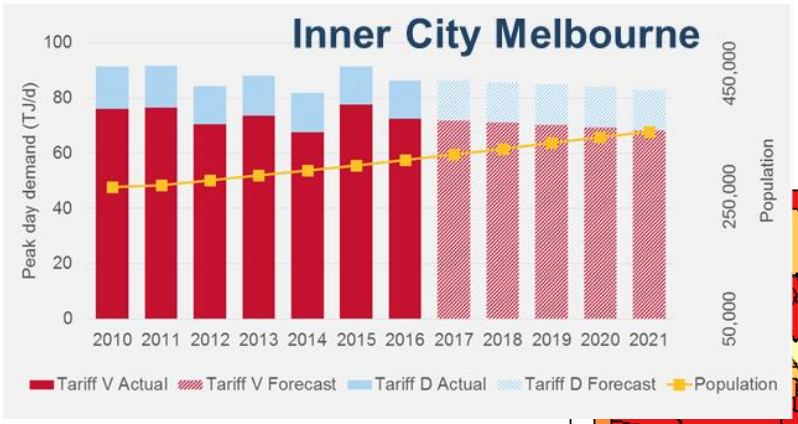
PEAK DAY SUPPLY AND DEMAND

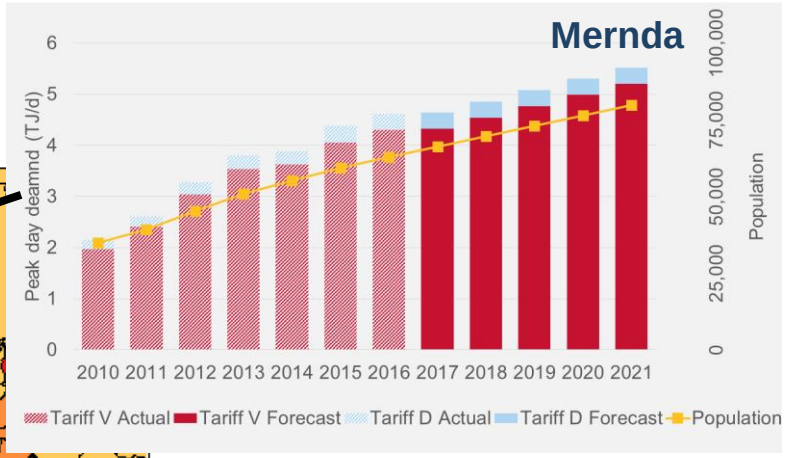


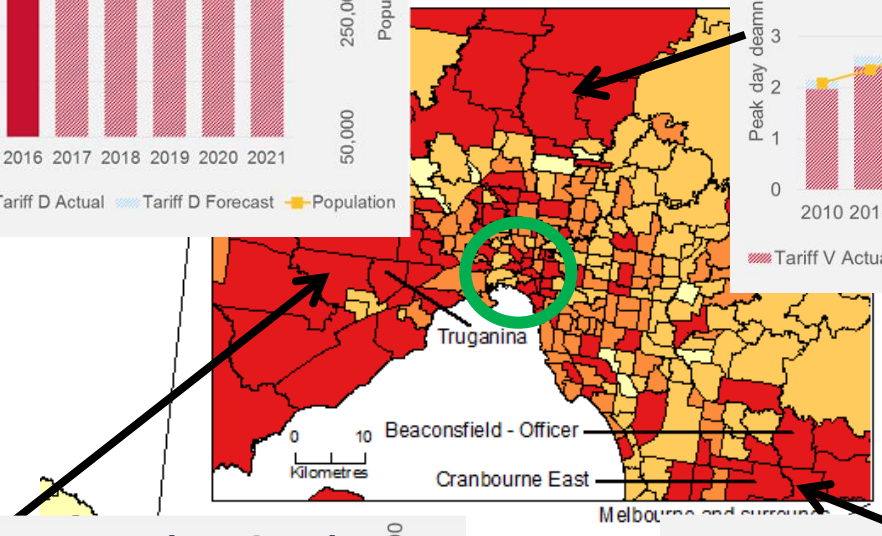
FORECAST 1-IN-20 PEAK DAY SYSTEM DEMAND

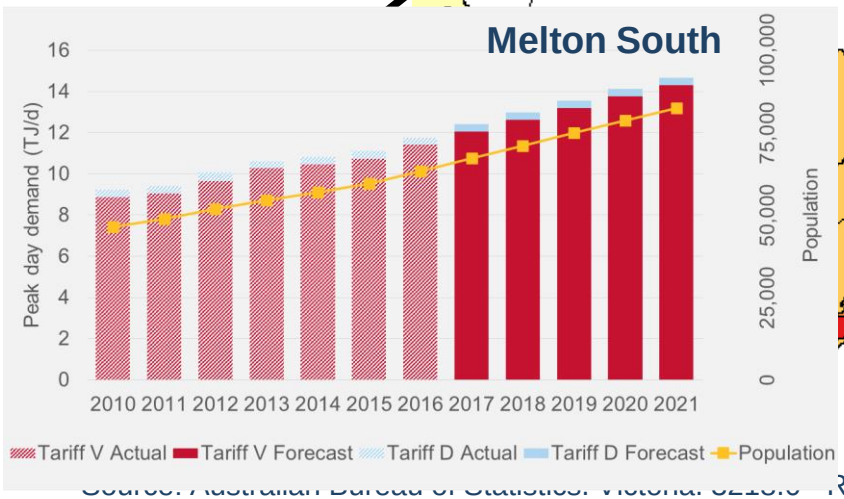


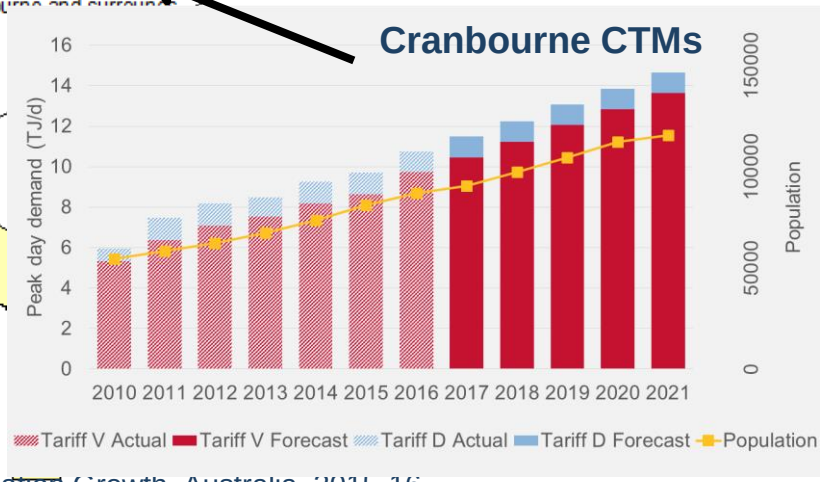
CHANGING LOAD PROFILES







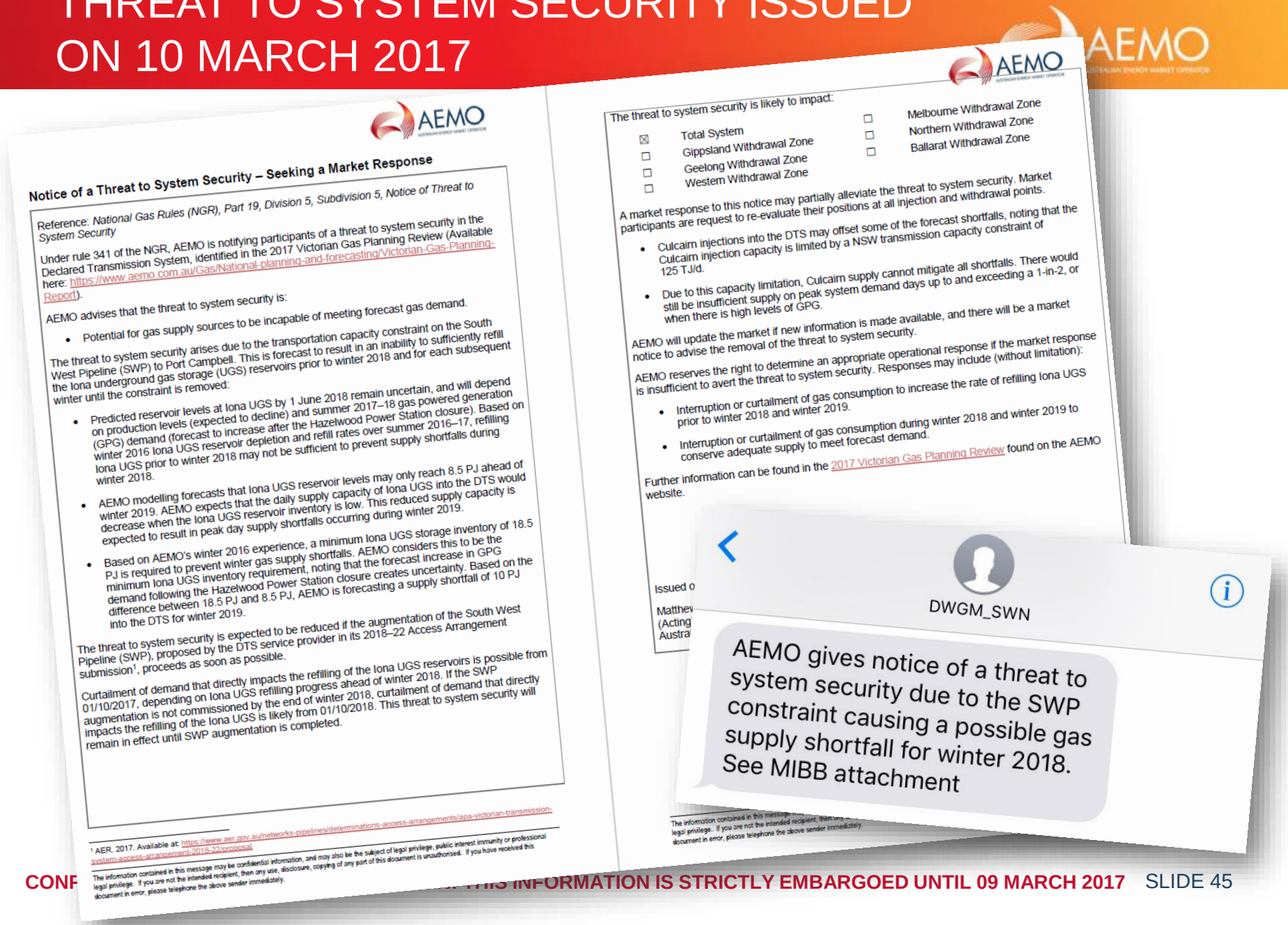




Source: Australian Bureau of Statistics, Victoria, 3218.0 - Regional Population Growth, Australia, 2015-16

THREAT TO SYSTEM SECURITY: SOUTH WEST PIPELINE TO PORT CAMPBELL

THREAT TO SYSTEM SECURITY ISSUED ON 10 MARCH 2017



Notice of a Threat to System Security – Seeking a Market Response

Reference: *National Gas Rules (NGR), Part 19, Division 5, Subdivision 5, Notice of Threat to System Security*

Under rule 341 of the NGR, AEMO is notifying participants of a threat to system security in the Declared Transmission System, identified in the 2017 Victorian Gas Planning Review (Available here: https://www.aemo.com.au/Gas/National-planning-and-forecasting/Victorian-Gas-Planning-Report).

AEMO advises that the threat to system security is:

- Potential for gas supply sources to be incapable of meeting forecast gas demand.

The threat to system security arises due to the transportation capacity constraint on the South West Pipeline (SWP) to Port Campbell. This is forecast to result in an inability to sufficiently refill the Iona underground gas storage (UGS) reservoirs prior to winter 2018 and for each subsequent winter until the constraint is removed:

- Predicted reservoir levels at Iona UGS by 1 June 2018 remain uncertain, and will depend on production levels (expected to decline) and summer 2017–18 gas powered generation (GPG) demand (forecast to increase after the Hazelwood Power Station closure). Based on winter 2016 Iona UGS reservoir depletion and refill rates over summer 2016–17, refilling Iona UGS prior to winter 2018 may not be sufficient to prevent supply shortfalls during winter 2018.
- AEMO modelling forecasts that Iona UGS reservoir levels may only reach 8.5 PJ ahead of winter 2019. AEMO expects that the daily supply capacity of Iona UGS into the DTS would decrease when the Iona UGS reservoir inventory is low. This reduced supply capacity is expected to result in peak day supply shortfalls occurring during winter 2019.
- Based on AEMO's winter 2016 experience, a minimum Iona UGS storage inventory of 18.5 PJ is required to prevent winter gas supply shortfalls. AEMO considers this to be the minimum Iona UGS inventory requirement, noting that the forecast increase in GPG demand following the Hazelwood Power Station closure creates uncertainty. Based on the difference between 18.5 PJ and 8.5 PJ, AEMO is forecasting a supply shortfall of 10 PJ into the DTS for winter 2019.

The threat to system security is expected to be reduced if the augmentation of the South West Pipeline (SWP), proposed by the DTS service provider in its 2018–22 Access Arrangement submission[1], proceeds as soon as possible.

Curtailment of demand that directly impacts the refilling of the Iona UGS reservoirs is possible from 01/10/2017, depending on Iona UGS refilling progress ahead of winter 2018. If the SWP augmentation is not commissioned by the end of winter 2018, curtailment of demand that directly impacts the refilling of the Iona UGS is likely from 01/10/2018. This threat to system security will remain in effect until SWP augmentation is completed.

[1] AER. 2017. Available at: https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/apa-victorian-transmission-system-access-arrangement-2018-22/proposal

The threat to system security is likely to impact:

- ☒ Total System
- ☐ Gippsland Withdrawal Zone
- ☐ Geelong Withdrawal Zone
- ☐ Western Withdrawal Zone
- ☐ Melbourne Withdrawal Zone
- ☐ Northern Withdrawal Zone
- ☐ Ballarat Withdrawal Zone

A market response to this notice may partially alleviate the threat to system security. Market participants are request to re-evaluate their positions at all injection and withdrawal points.

- Culcairn injections into the DTS may offset some of the forecast shortfalls, noting that the Culcairn injection capacity is limited by a NSW transmission capacity constraint of 125 TJ/d.
- Due to this capacity limitation, Culcairn supply cannot mitigate all shortfalls. There would still be insufficient supply on peak system demand days up to and exceeding a 1-in-2, or when there is high levels of GPG.

AEMO will update the market if new information is made available, and there will be a market notice to advise the removal of the threat to system security.

AEMO reserves the right to determine an appropriate operational response if the market response is insufficient to avert the threat to system security. Responses may include (without limitation):

- Interruption or curtailment of gas consumption to increase the rate of refilling Iona UGS prior to winter 2018 and winter 2019.
- Interruption or curtailment of gas consumption during winter 2018 and winter 2019 to conserve adequate supply to meet forecast demand.

Further information can be found in the 2017 Victorian Gas Planning Review found on the AEMO website.

Issued o

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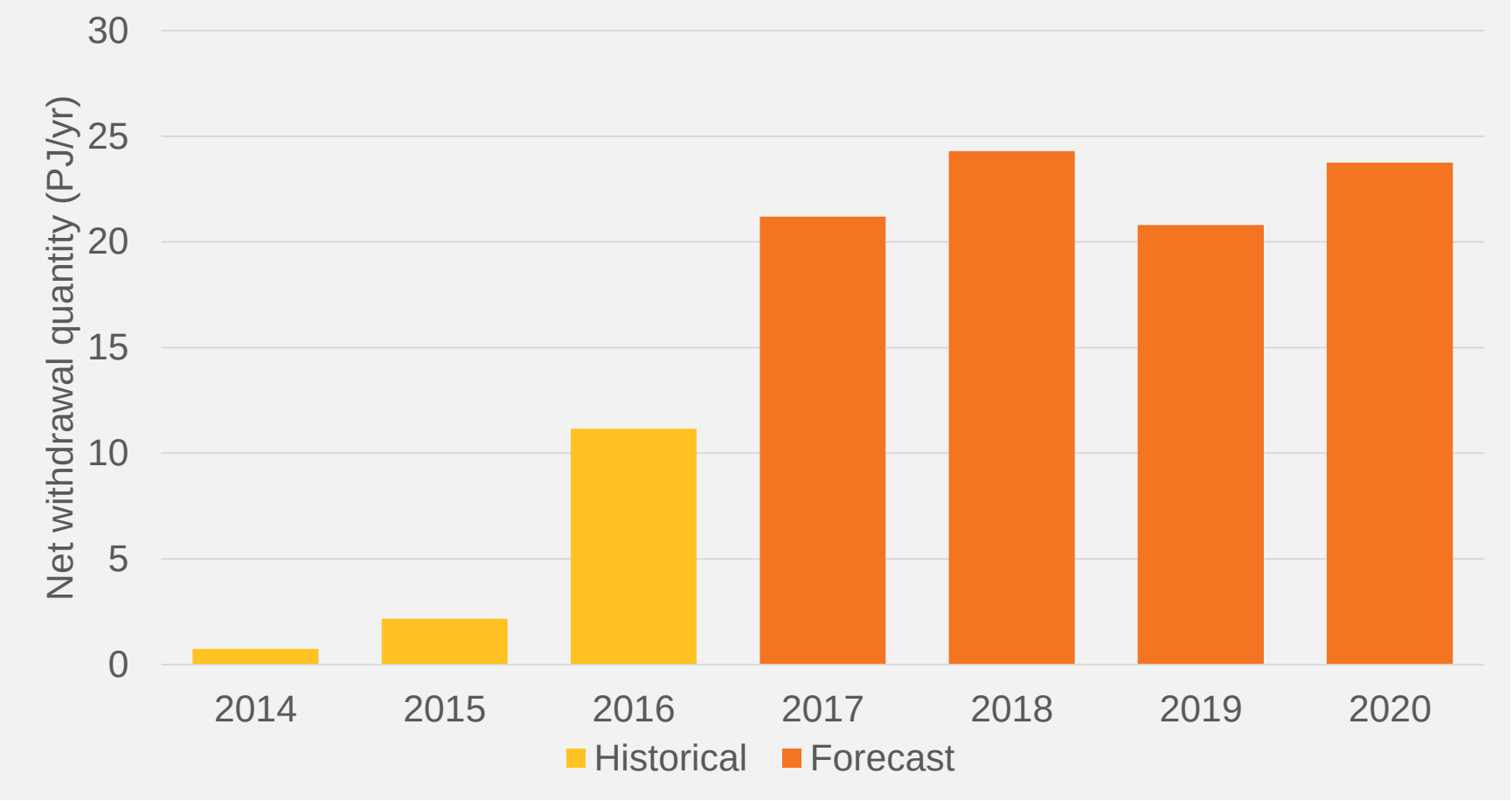
(Acting
Austra

DWGM_SWN

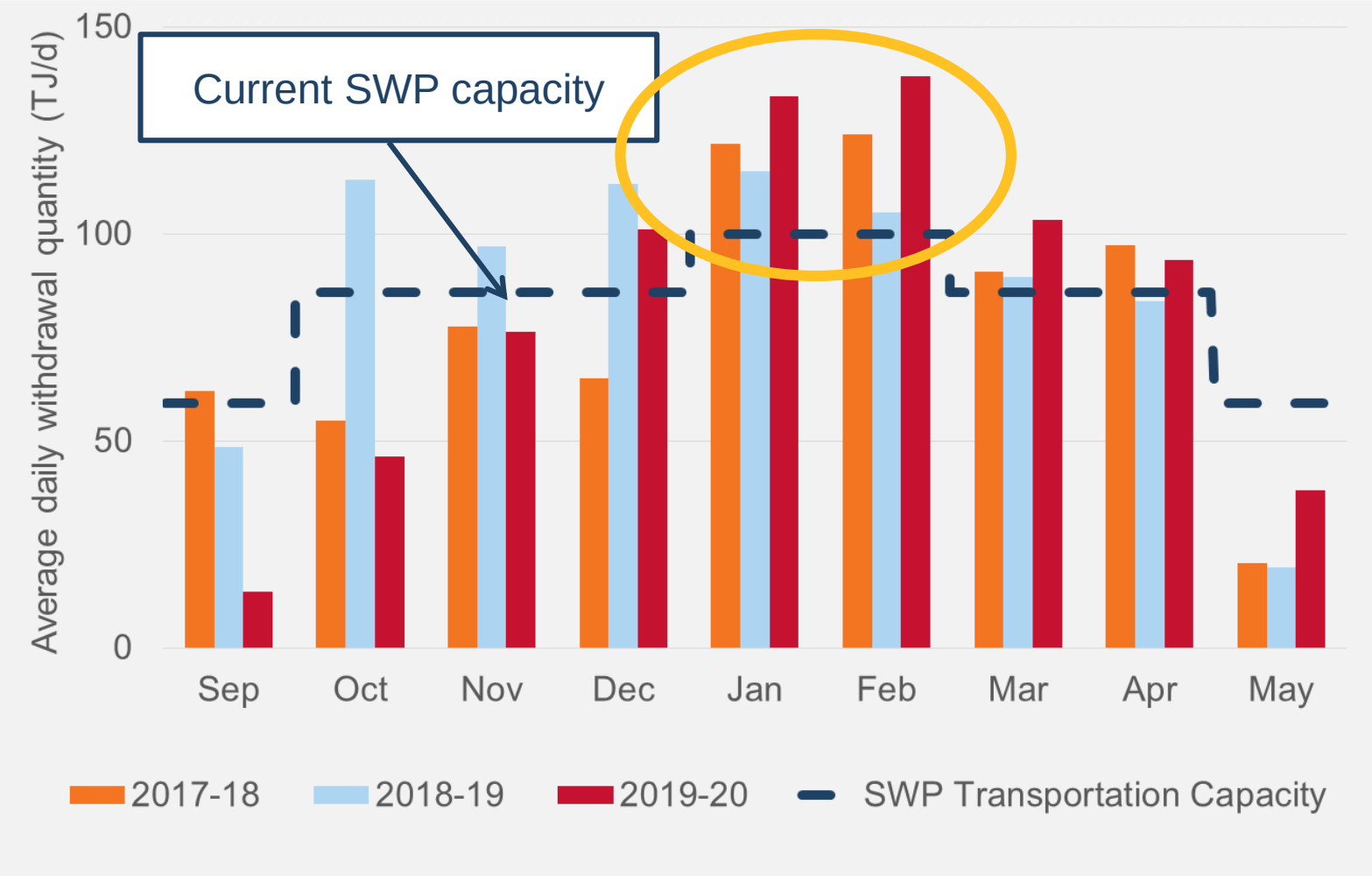
AEMO gives notice of a threat to system security due to the SWP constraint causing a possible gas supply shortfall for winter 2018. See MIBB attachment

SOUTH WEST PIPELINE TO PORT CAMPBELL FORECAST ANNUAL FLOWS

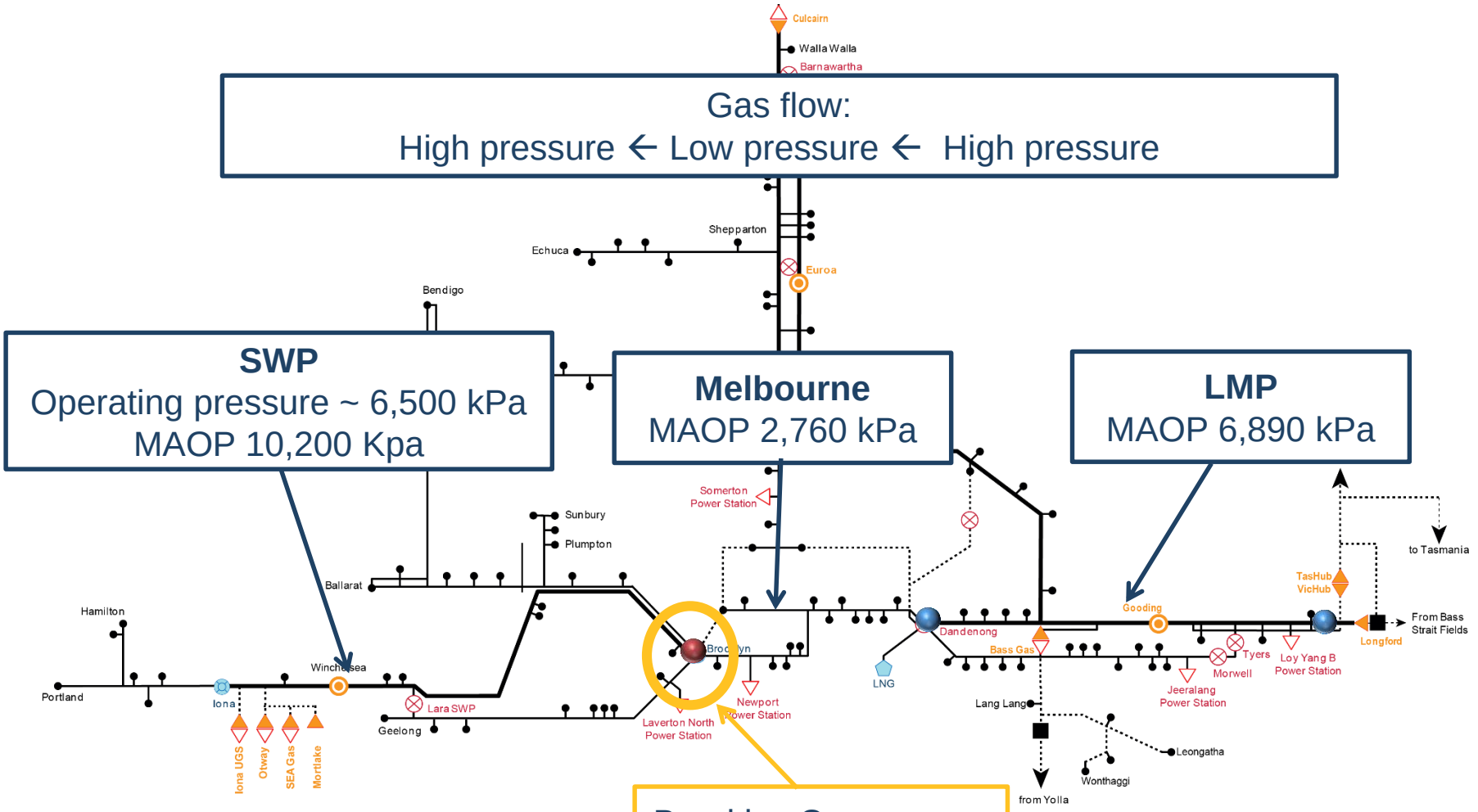
- Forecast flows provided by Participants



SOUTH WEST PIPELINE TO PORT CAMPBELL
FORECAST DAILY FLOW BY MONTH

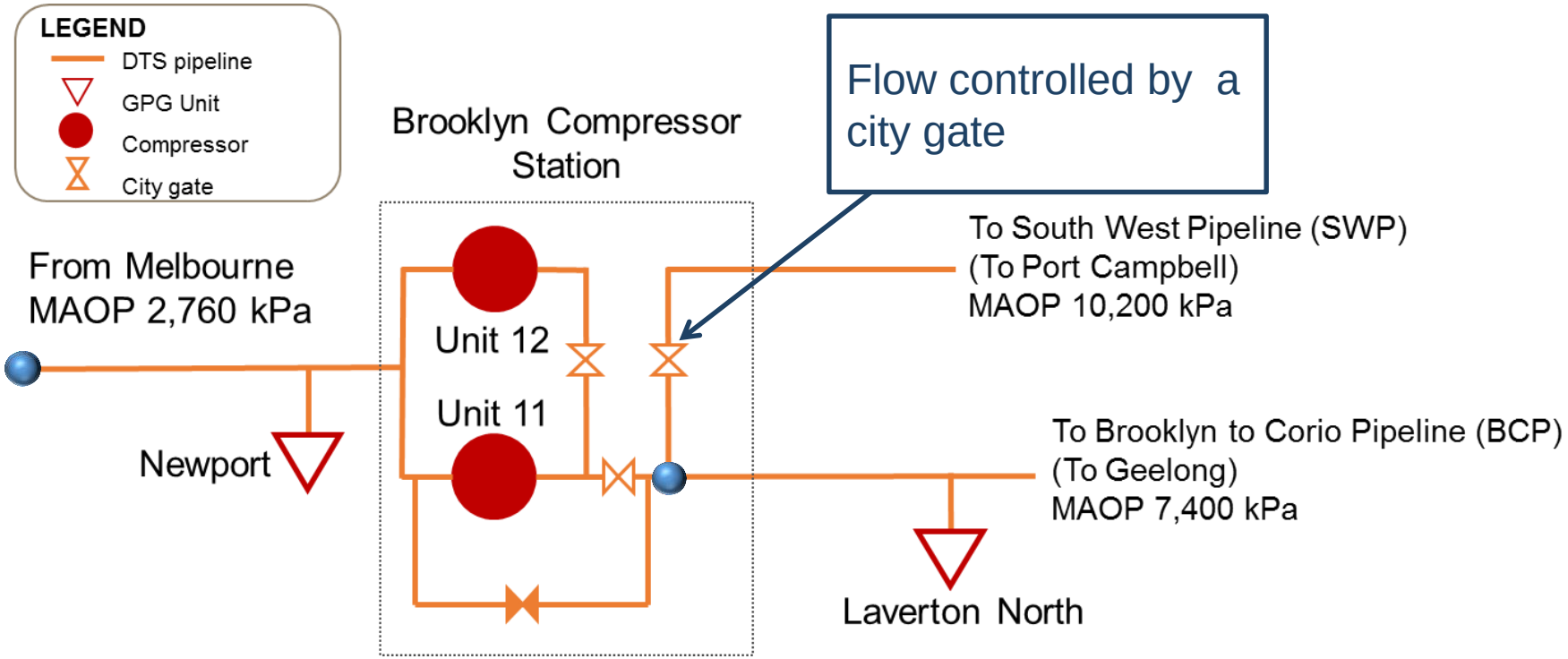


DTS CAPACITY LIMITATION



SIMPLIFIED EXISTING BROOKLYN CS CONFIGURATION

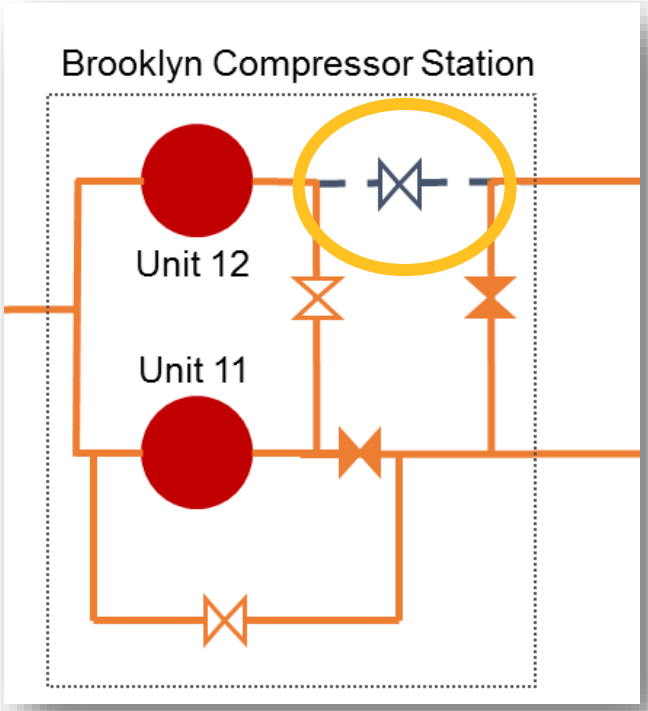
- Gas is compressed unnecessarily to Geelong.



PROPOSED AUGMENTATION

- DTS Service Providers' 2018 – 22 Access Arrangement submission:

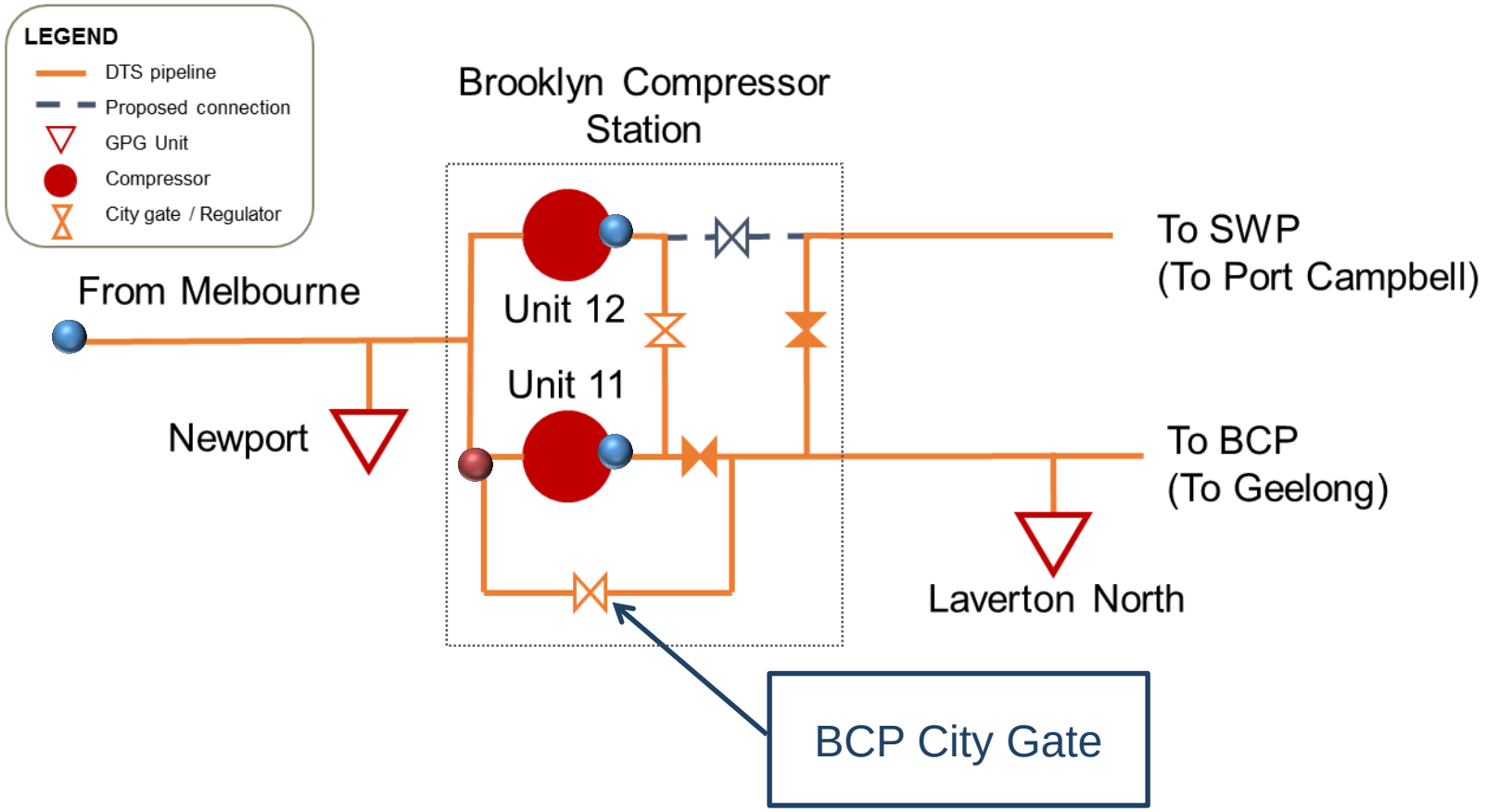
1. Reconfigure Brooklyn Compressor Station



2. Bi-directional compressibility at Winchelsea

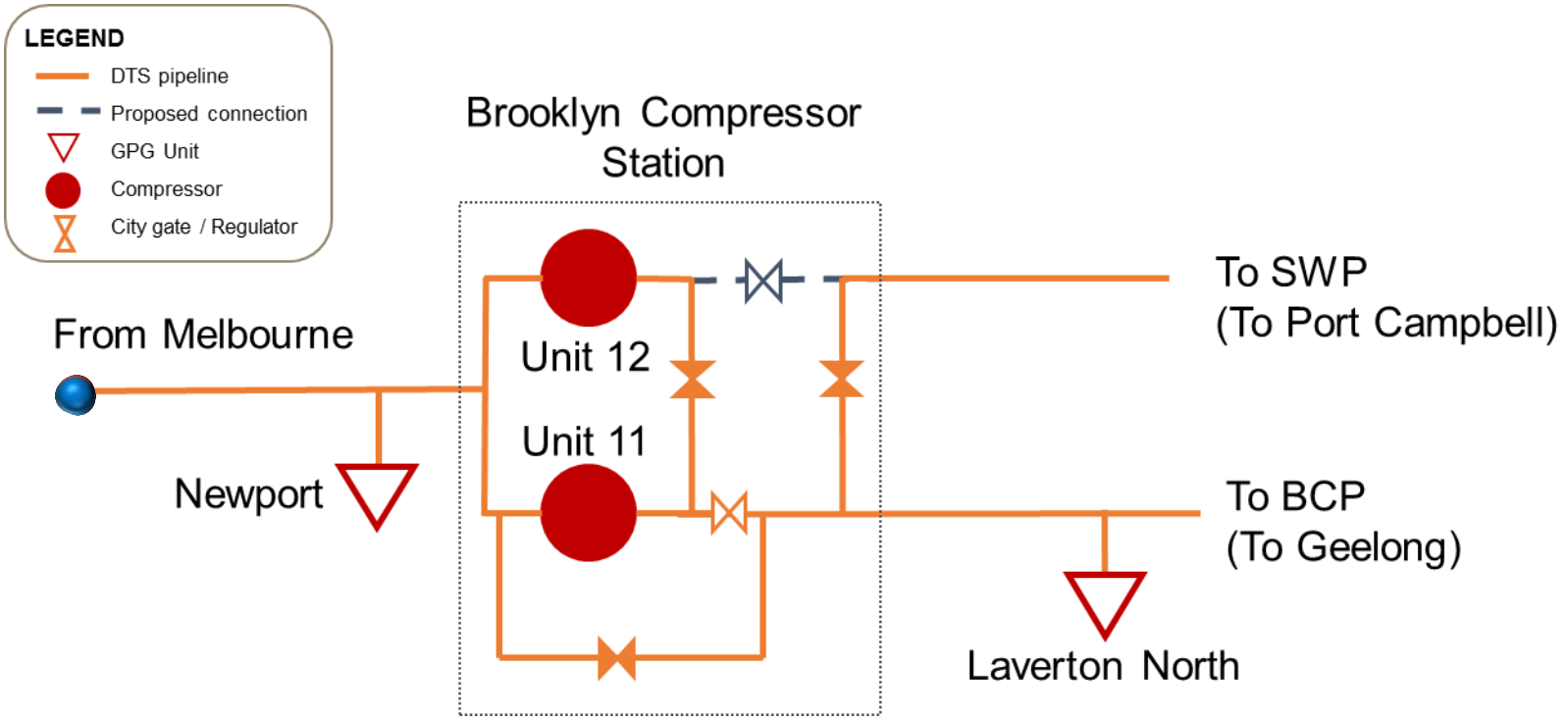
BROOKLYN CS RECONFIGURATION
FLOW TO PORT CAMPBELL

- Gas compressed directly into SWP.
- Geelong demand supported as required by BCP city gate.

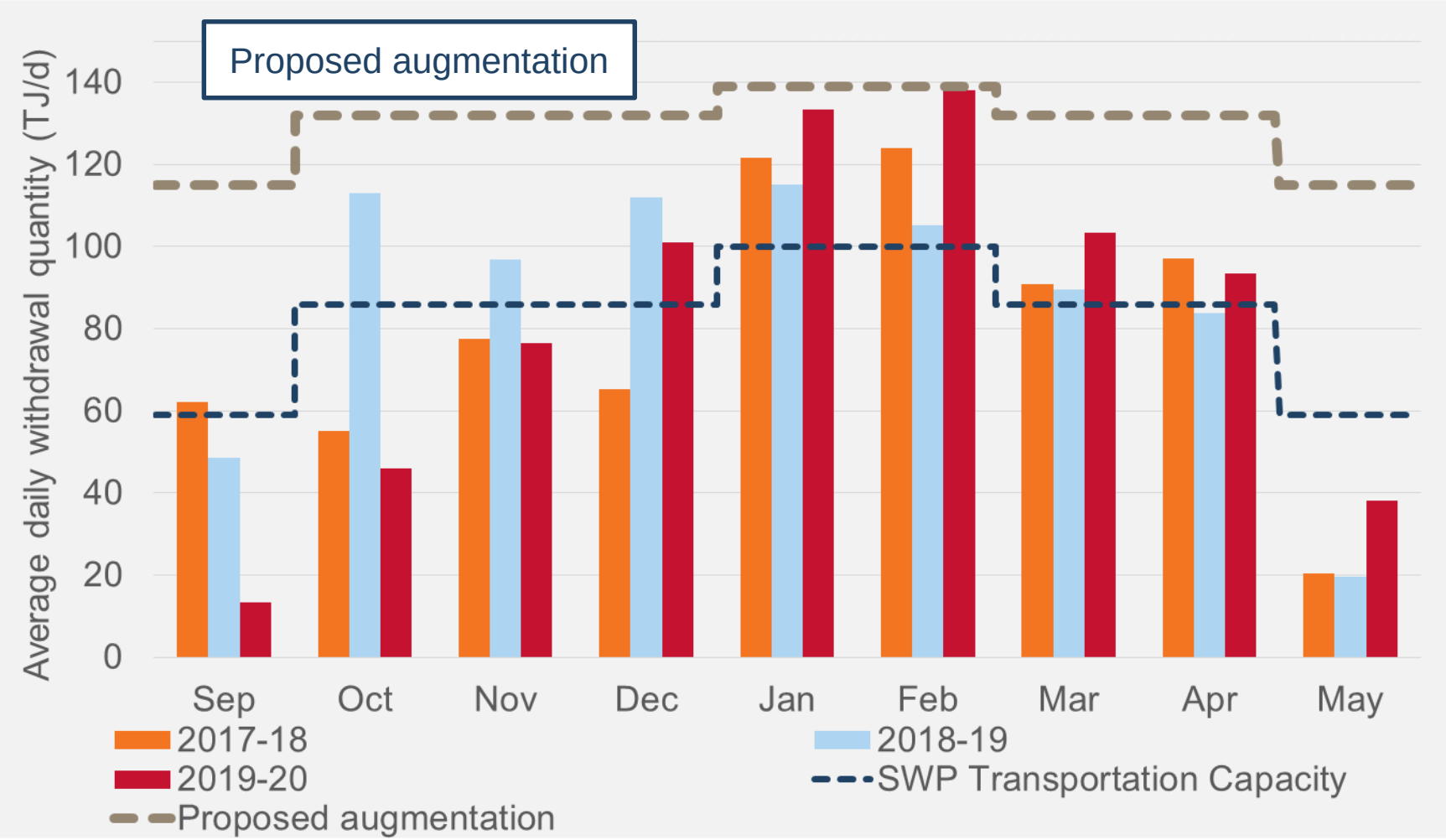


BROOKLYN CS RECONFIGURATION
FLOW TO PORT CAMPBELL AND LAVERTON NORTH

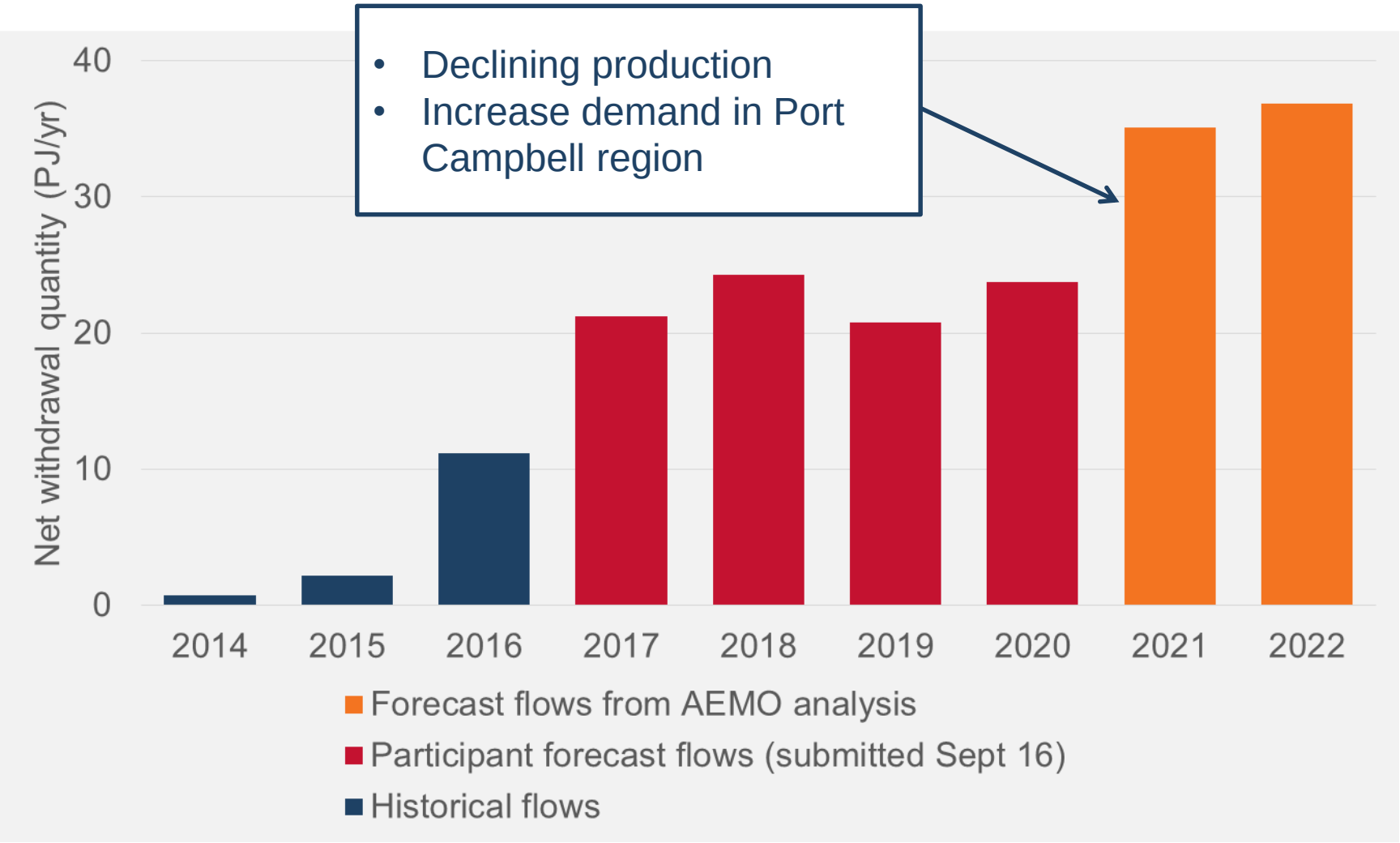
- Flow paths can be separated between the SWP and the BCP.



BROOKLYN RECONFIGURATION AND WINCHELSEA BI-DIRECTIONAL COMPRESSIBILITY



FORECAST FLOWS BEYOND 2020



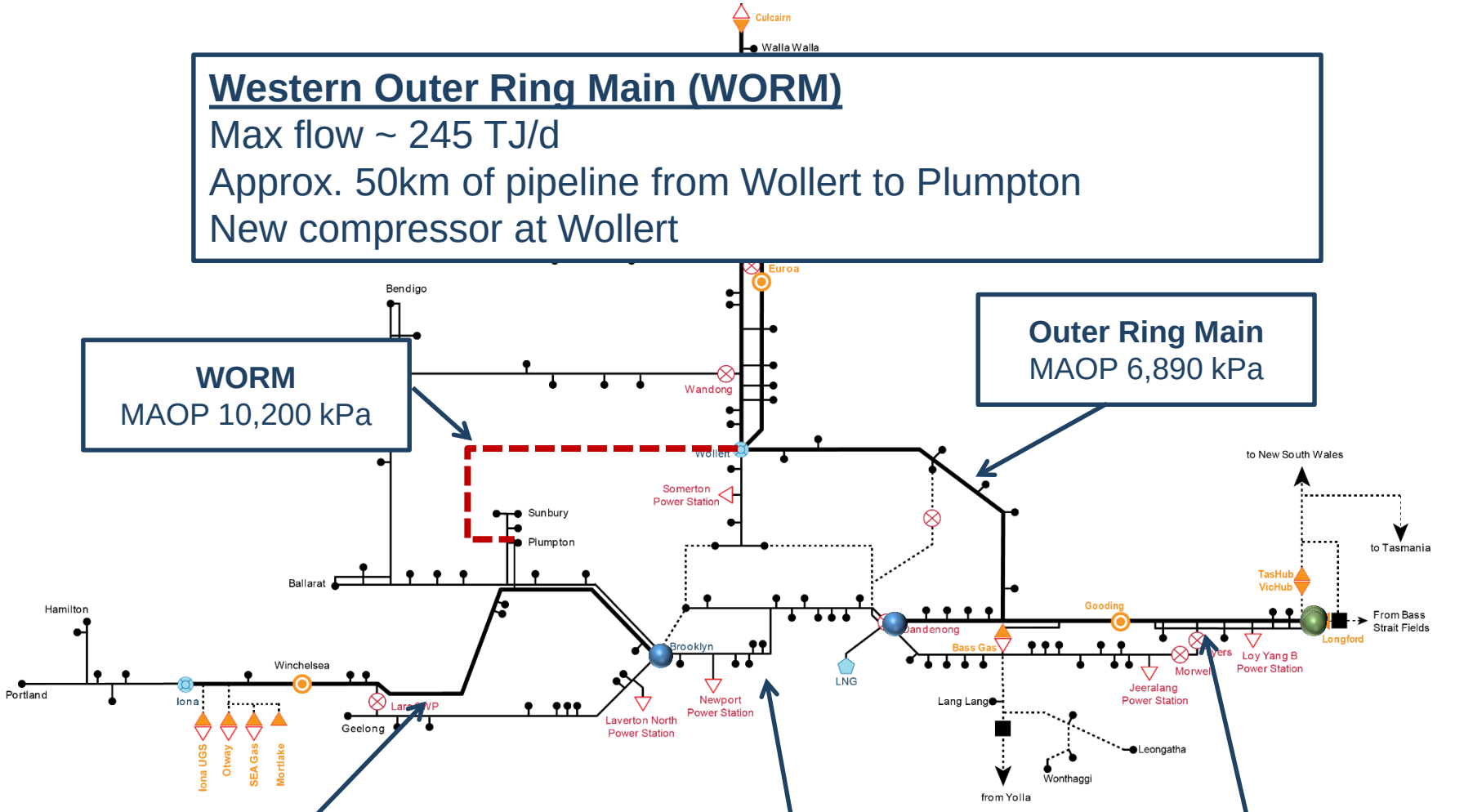
SHORT AND LONG TERM DEVELOPMENT

Western Outer Ring Main (WORM)

Max flow ~ 245 TJ/d

Approx. 50km of pipeline from Wollert to Plumpton

New compressor at Wollert



WORM
MAOP 10,200 kPa

Outer Ring Main
MAOP 6,890 kPa

SWP
MAOP 10,200 kPa

Melbourne
MAOP 2,760 kPa

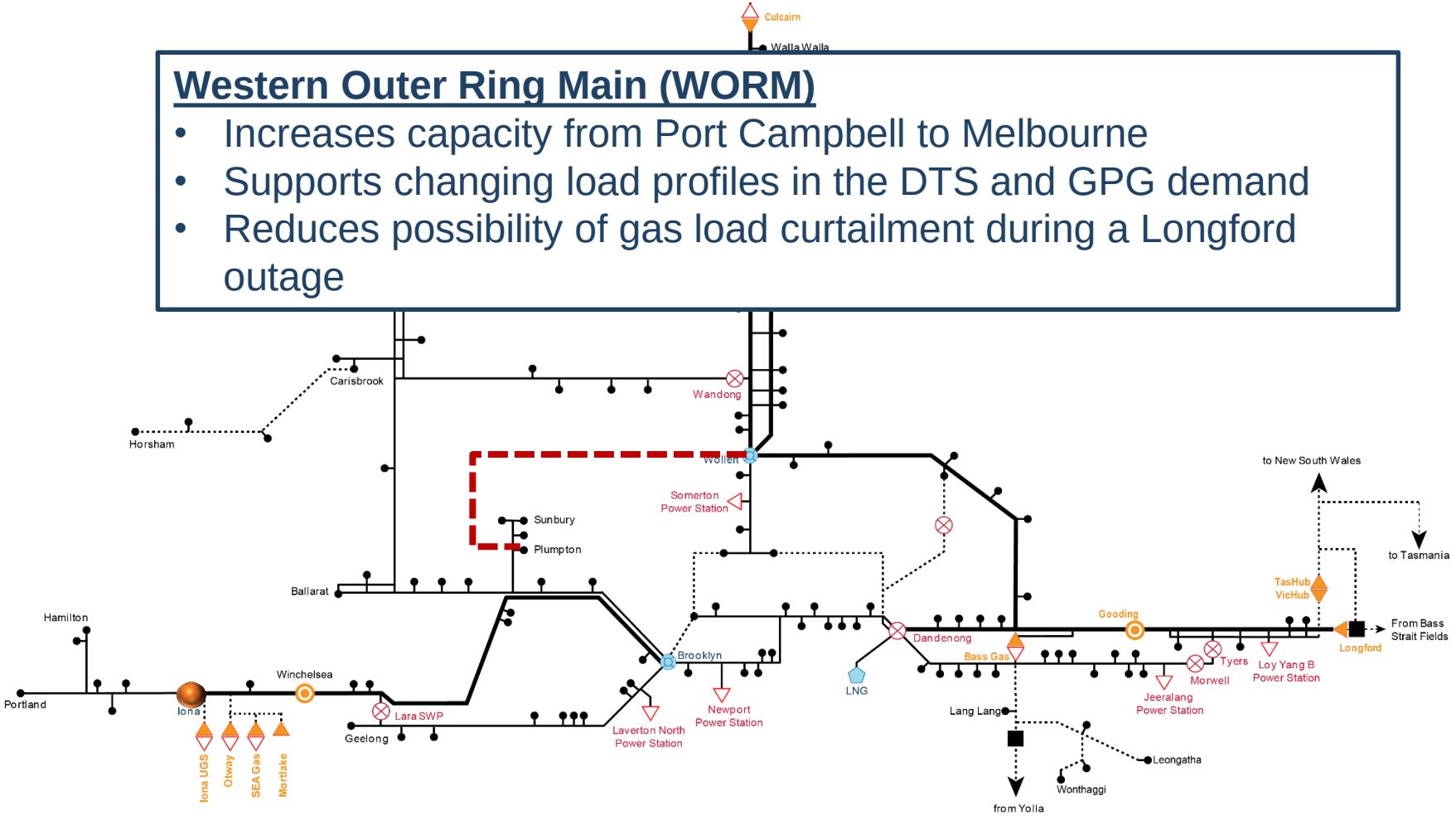
LMP
MAOP 6,890 kPa

C : THIS INFO RGOED UNTI

SHORT AND LONG TERM DEVELOPMENT

Western Outer Ring Main (WORM)

- Increases capacity from Port Campbell to Melbourne
- Supports changing load profiles in the DTS and GPG demand
- Reduces possibility of gas load curtailment during a Longford outage



PROPOSED SOLUTIONS

Short term

- Brooklyn reconfiguration
- Winchelsea bi-directional compressibility

Long term

- Western Outer Ring Main
- Additional compression at Wollert

THREAT TO SYSTEM SECURITY: WARRAGUL PEAK DAY SUPPLY

THREAT TO SYSTEM SECURITY ISSUED ON 10 MARCH 2017

Notice of a Threat to System Security

Reference: *National Gas Rules (NGR), Part 19, Division 5, Subdivision 5, Notice of Threat to System Security*

Under rule 341 of the NGR, AEMO is notifying participants of a threat to system security in the Declared Transmission System, identified in the 2017 Victorian Gas Planning Review. (Available here: https://www.aemo.com.au/Gas/National-planning-and-forecasting/Victorian-Gas-Planning-Report)

AEMO advises that the threat to system security is:

- Potential for gas supply to be incapable of meeting forecast gas demand at the Warragul Custody Transfer Meter (CTM).

DTS expansion work is required to support increased commercial and residential demand supplied by the Warragul CTM. AEMO forecasts show that if investment is not implemented by winter 2019 to support these demand increases, there is a high likelihood of Tariff D curtailment on a peak system demand day. The forecast instantaneous demand that can be supported at Warragul CTM is up to 400 gigajoules per hour (GJ/h). AEMO has identified this as a threat to system security.

The potential for curtailments is expected to start from 01/06/2019, and will remain until a system augmentation is completed or there is a reduction in forecast demand.

The threat to system security is likely to impact:

- ☐ Total System
- ☒ Gippsland Withdrawal Zone
- ☐ Geelong Withdrawal Zone
- ☐ Western Withdrawal Zone
- ☐ Melbourne Withdrawal Zone
- ☐ Northern Withdrawal Zone
- ☐ Ballarat Withdrawal Zone

A market response is not expected to be able to alleviate this issue.

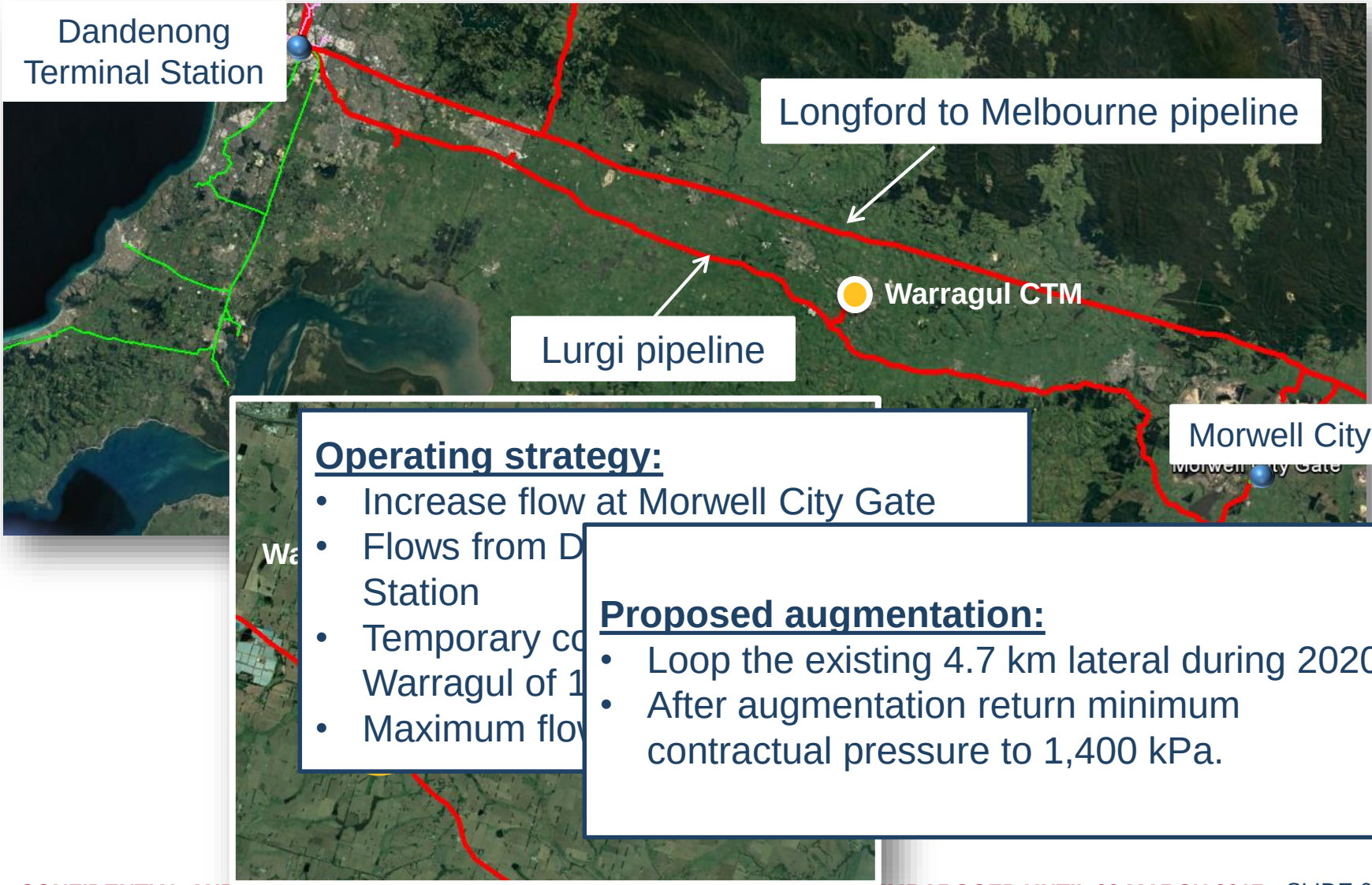
If a peak system demand day occurs during winter 2019 and the proposed system augmentation is not completed, AEMO forecasts that sufficient supply cannot be maintained to meet demand at Warragul CTM:

- If the peak demand is forecast before the gas day, AEMO will curtail Tariff D load in Warragul to maintain system security, consistent with the *Gas Load Curtailment Rationing and Recovery Guidelines*. If the instantaneous demand forecast exceeds 400 GJ/h, approximately 50 GJ/h of demand reductions would be required, between 6:00 to 10:00 AEST.
- If the peak demand is unforecast, Warragul minimum supply pressure will be breached, creating potential public safety issues due to air ingress into the distribution network.

Issued on 10/03/2017

Matthew Clemow
(Acting) Group Manager Gas Real Time Operations
Australian Energy Market Operator

WARRAGUL SUPPLY



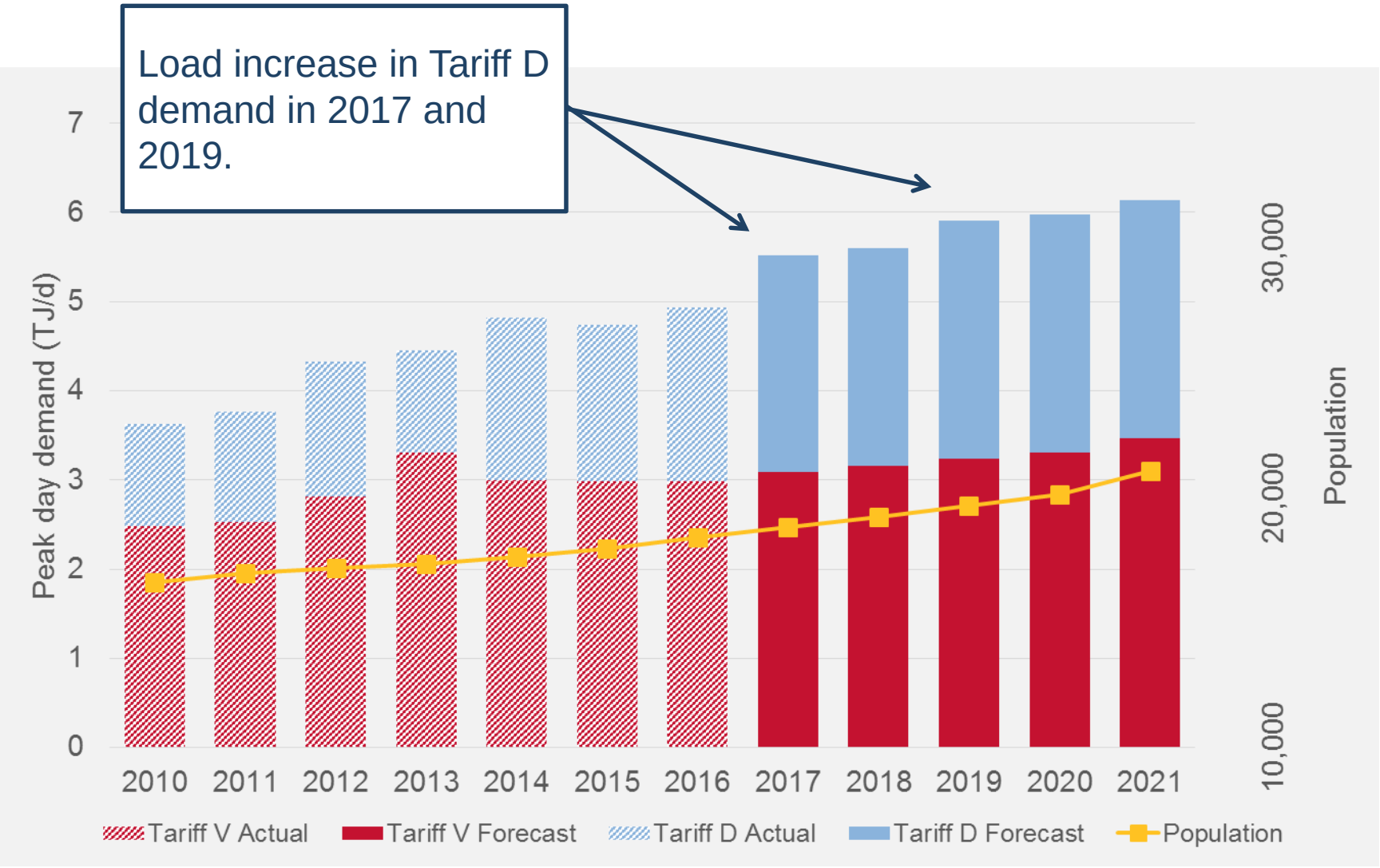
Operating strategy:

- Increase flow at Morwell City Gate
- Flows from D… Station
- Temporary co… Warragul of 1…
- Maximum flo…

Proposed augmentation:

- Loop the existing 4.7 km lateral during 2020.
- After augmentation return minimum contractual pressure to 1,400 kPa.

WARRAGUL 1-IN-20 PEAK DAY DEMAND FORECAST



PEAK DAY OCCURS IN 2019

1. Forecast peak day

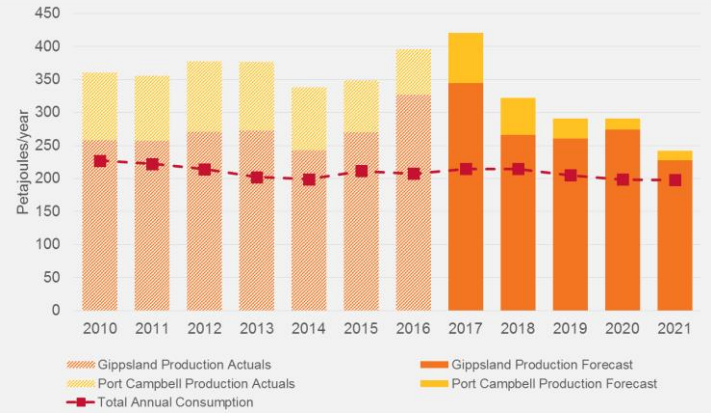
- Day ahead schedule (i.e. D+1)
- Involuntary curtailment of Tariff D demand.

2. Unforecast peak day

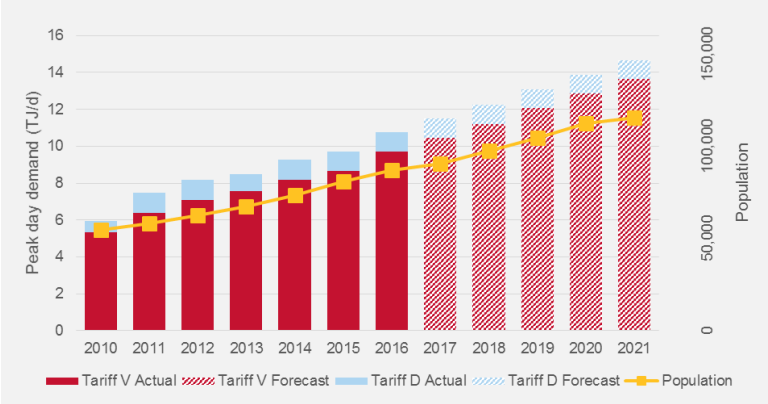
- Involuntary curtailment of Tariff D demand.
- Breach minimum pressure of 1,150 kPa.
- Possible loss of supply to Tariff V (residential) demand.

SUMMARY

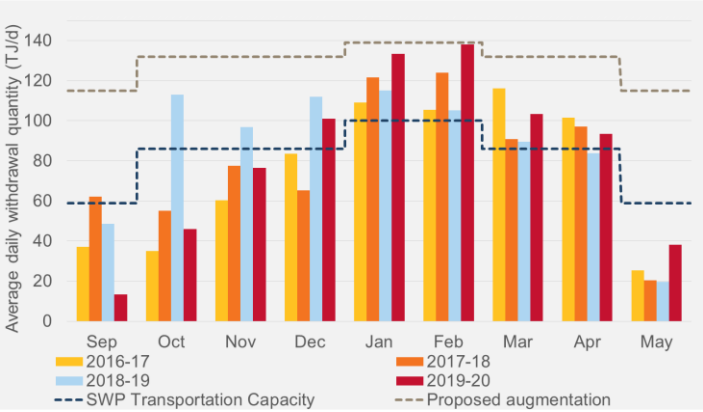
1. DECLINING PRODUCTION



2. CHANGING LOAD PROFILES



3. IMPACTS TO STORAGE INVENTORY FROM 2018



4. POSSIBLE PRESSURE BREACH AT WARRAGUL IN 2019

THANK YOU

Contact details:
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Australian Energy Market Operator
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E: jessie.yeung@aemo.com.au

victorian transmission system
access arrangement revision proposal

AEMO Gas Winter Outlook 2017
10 May 2017

energy. connected.

Alex Curran
Regulatory Manager

overview

revision proposal key themes

capital base and forecast capital expenditure

demand, cost allocation and pricing

revision proposal key themes

revision proposal key themes

- **Responsiveness to customer demand**
  - Significant new gas flows north to NSW and Queensland
- **Investments for the future**
  - Future growth through Western Outer Ring Main easement purchase, and now the WORM project in the period
  - Safety and integrity spending
- **Possible changes to the policy environment**
  - New market structures under policy consideration
- **Consistency with current arrangements**
  - Consistency in tariff structure and how costs are allocated to tariffs

capital base and forecast capital expenditure

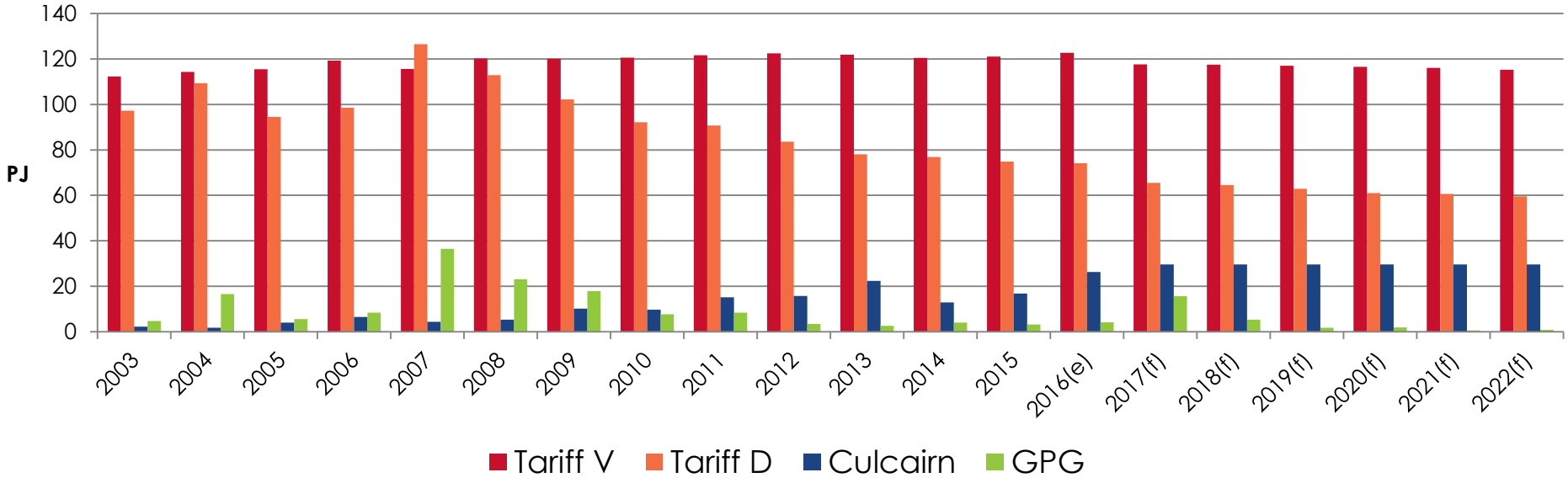
16/05/2017

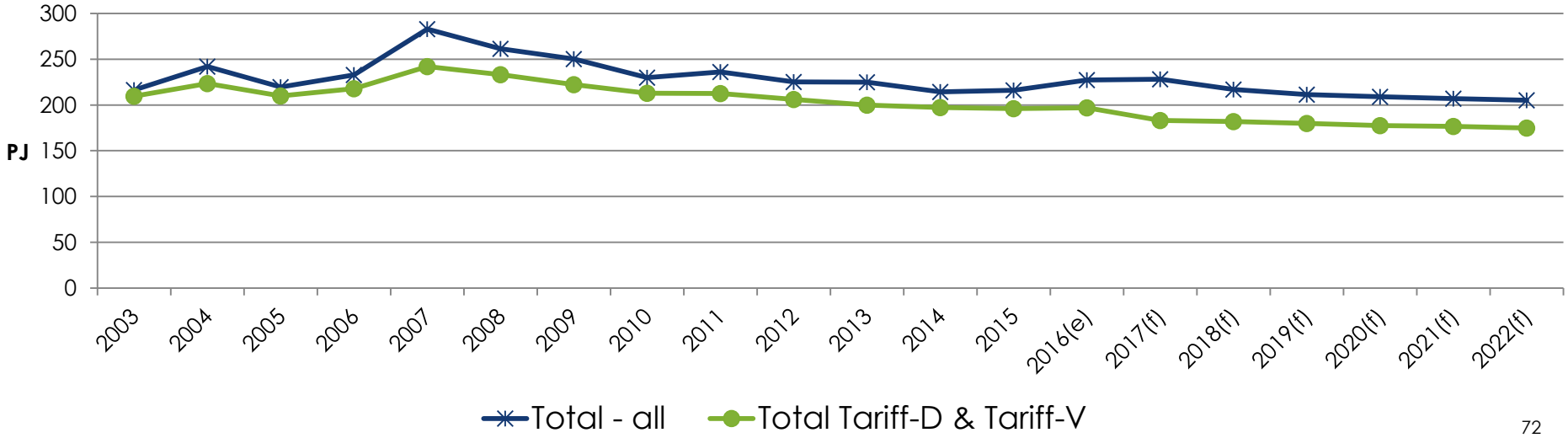
capital base and capital expenditure

- **VTS regulatory capital base at 1 January 2018 is $1,005 billion**
  - Expenditure in current period higher than forecast
  - Driven by expansion to accommodate increased demand for capacity for gas flows north to NSW and Queensland (VNIE project)
  - Increase from incremental 30TJ/day demand for firm capacity at Culcairn to 149TJ/day
  - Total VNIE project expenditure $299 million (approved was $46.4 million)
- **Total forecast capital expenditure in proposal $168.4 million**
  - Anglesea pipeline - $17.4m
  - Warragul - $7.6m
  - Westbound expansion of SWP - $3.5m
  - Western Outer Ring Main (WORM) easement acquisition - $26.7m
- **Subsequent proposal to complete WORM within period (by end 2020)**
  - Total proposed WORM expenditure - $122.4m (includes easement costs)

demand, cost allocation and pricing

historic and forecast demand trends





cost allocation and pricing

- **APA VTS has retained tariff and cost allocation structure from current period**
- **Transmission tariffs apply to injections and withdrawals separately**
  - In VTS gas ownership can change within the system through the operation of the wholesale gas market
  - Shippers do not contract for point to point transportation
- **Injection tariffs recover the cost of transportation of gas from injection points to a nominal "hub"**
  - Hub considered as the Melbourne metro area
- **Withdrawal tariffs recover the cost of transportation of gas from the "hub" to its withdrawal location**
  - Includes transportation within or across the Melbourne metro area
  - Each delivery (withdrawal) point is allocated to a withdrawal zone
- **Demand is split between Tariff D (large industrial) and Tariff V (residential and small business) within each zone**

VNI expansion cost allocation

- **VNI expansion**
  - Capacity related system capital costs
  - Locational
  - Allocated to asset zone
  - Allocated to Culcairn withdrawal tariff
- **All within Tariff-D class (no small customer capex allocation)**
- **Increased VNIE expenditure and volumes takes additional proportional share of non locational costs (eg. non-system capital, corporate, etc)**
- **Victorian domestic customers do not bear the costs of VNI expansion and receive benefit from reduced allocation of common costs**
  - Culcairn allocated $5m of indirect costs that would otherwise be shared throughout the system

For further information contact:

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Regulatory Manager
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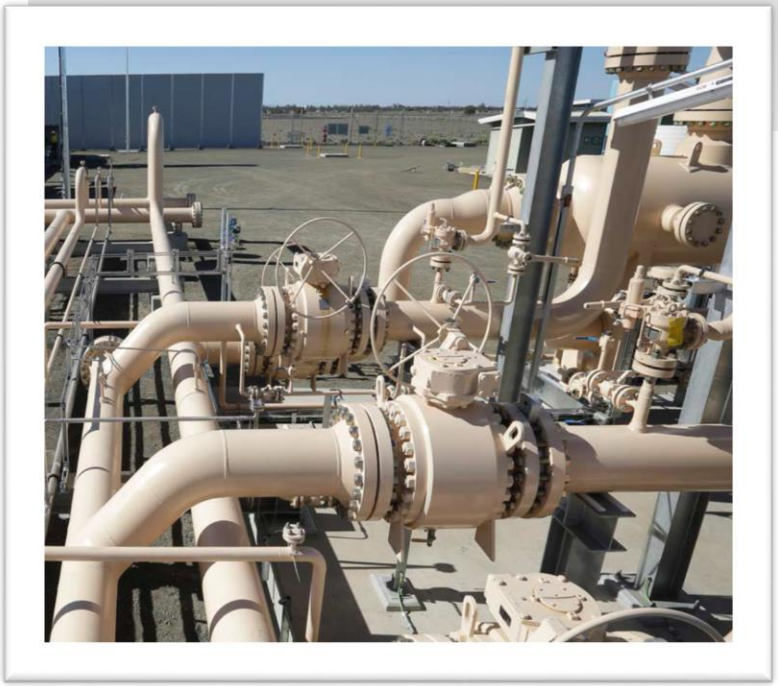
alexandra.curran@apa.com.au

Or visit the APA website at:

www.apa.com.au

Australian Energy Regulator

The Gas Transmission System over the next 5 years



AEMO Victorian Gas Operations Outlook Conference Winter 2017

Sebastian Roberts
GM Network Expenditure

AUSTRALIAN ENERGY REGULATOR

Overview

- APA reset proposal and process
- Submissions – key themes
- AEMC review of DWGM

AUSTRALIAN ENERGY REGULATOR

APA proposal

- On 3 January, APA submitted its Victorian Transmission System 2018-22 access arrangement proposal.

- Key features compared to the previous period:
  - Forecast revenue requirement is $709.3m - up 43.8%.
  - Proposed rate of return is 7.88% - above current rate
  - Forecast capex is $168.4m - down almost 60% compared to actual capex expenditure.
  - Forecast opex is $132 million - up 1.8%.

AUSTRALIAN ENERGY REGULATOR

Reset timeline

Step	Date
Access arrangement proposal submitted to AER	3 January 2017
Proposal published	10 January 2017
Public forum on access arrangement proposal	1 February 2017
Submissions on proposal closed	3 March 2017
AER to publish draft decision	29 June 2017
Revised proposals submitted	14 August 2017
Stakeholder submissions on draft decisions and revised proposals	12 September 2017
AER to issue final decision	30 November 2017
Revised access arrangements commence	1 January 2018

AUSTRALIAN ENERGY REGULATOR

Market Developments

- LNG - tightening market for gas with price increases
- LNG - Northward flow of gas
- Release of GSOO and VGPR by AEMO and the issuing of 2 threats to system security (SWP and Warragul)
- Closure of the Hazelwood power plant and increased GPG in Victoria
- Reviews – Vertigan, AEMC, ACCC, Finkel

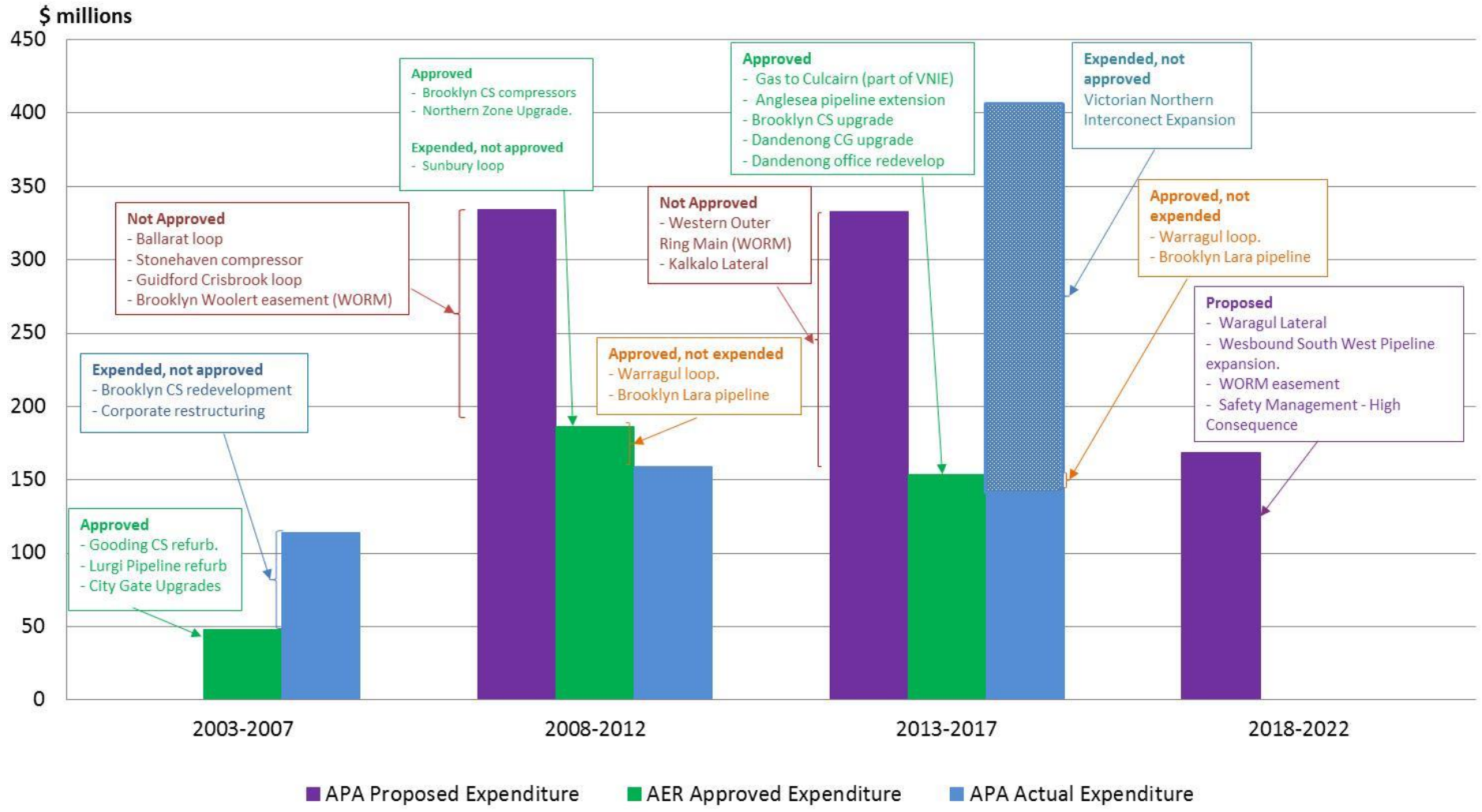
AUSTRALIAN ENERGY REGULATOR

Submissions – Key Themes

- 14 submissions
- Key issues
  1. SWP
     a. Refill of Iona Underground Gas Storage facility
     b. Western Outer Ring Main
  2. Warragul Lateral Expansion
  3. Culcairn withdrawal tariff - Vic Northern Interconnect expansion

AUSTRALIAN ENERGY REGULATOR

APA investment - track record



SWP and Western Outer Ring Main

- The WORM provides a link between the east and west, creating a high pressure ring around Melbourne ($134.64 million)
- APA 2018-22 AA submission proposes pre-purchase of the WORM easements
- Following the stakeholder comments, APA are now proposing to build the WORM in the 2018-22 AA period.
- APA last week provided a business case for the WORM. The AER will consult on the proposal.

AUSTRALIAN ENERGY REGULATOR

Northern Interconnector

- The AER's 2012 decision accommodated $85m for northern expansion
- APA spent $339
- Victorian user concerns that expansion may add to their tariffs in future
- AER is considering the expansion according to the requirements of the NGR

AUSTRALIAN ENERGY REGULATOR

Warragul Lateral Expansion

- Involves looping of 4.8 km of the Warragul Lateral pipeline
- Project has become increasingly urgent (AEMO has issued threat to system security notice)
- AER has approved this capex in 2 previous AAs, but APA is yet to undertake the work.

AUSTRALIAN ENERGY REGULATOR

AEMC Review of DWGM

- The AEMC's draft decision recommended radical reform of the DMGM
  - These reforms would have been difficult to implement
- The AER encourages the AEMC to adopt more incremental change
- A number of beneficial modifications that can be made to the current DWGM in the short term, including:
  - Options to create forward trading, improvements to uplift allocation
- Incentive based regulatory framework is informed by extensive consultation and seems to be delivering efficient investment outcomes
  - Should AEMO have a greater say in investment decision?

AUSTRALIAN ENERGY REGULATOR

ACCC review into gas market

- ACCC inquiry into gas pricing and supply
  - Strongly support moves to increase transparency in the gas market

- Australian Domestic Gas Supply Mechanism
  - Shortfall of domestic supply: importance of understanding domestic exploration and production
  - Fairly reflect international export prices: importance of deriving export parity pricing

- ACCC release reports – First due October 2017

AUSTRALIAN ENERGY REGULATOR

Questions?

AUSTRALIAN ENERGY REGULATOR

WINTER 2017 – VICTORIAN GAS OPERATIONS OUTLOOK

10 May 2017

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

AGENDA

10:30 - 11:20 Session 1 – Future Gas Supply and Demand

- Introduction (AEMO)
- National Gas Forecasting Report (AEMO)
- Gas Statement of Opportunities (AEMO)
- Victorian Gas Planning Report (AEMO)

11:20 - 12:00 Session 2 – Transmission System – next 5 years

- APA's VTS Regulatory Proposal (APA)
- AER's Regulatory Determination (AER)

12:00 - 1:00 Lunch

AGENDA

1:00 - 3:00 Session 3 – Winter Operations

- 2016 Winter Review (AEMO)
- 2017 Weather Outlook (Weatherzone)
- 2017 APA Augmentations (APA)
- Transmission Operations (AEMO)

3:00 - 3:30 Afternoon Tea

3:30 - 5:00 Session 4 – Market and Emergency Operations

- Abnormal Market Operations (AEMO)
- Emergency Operations (AEMO)
- Summary of Key Messages (AEMO)

5:00 - 6:00 Networking

WINTER 2016 REVIEW

Presented by Luke Garland
Manager, AEMO Gas System Operations

AGENDA

1. Yearly Trend
2. Winter 2016 in review
3. Market Interactions

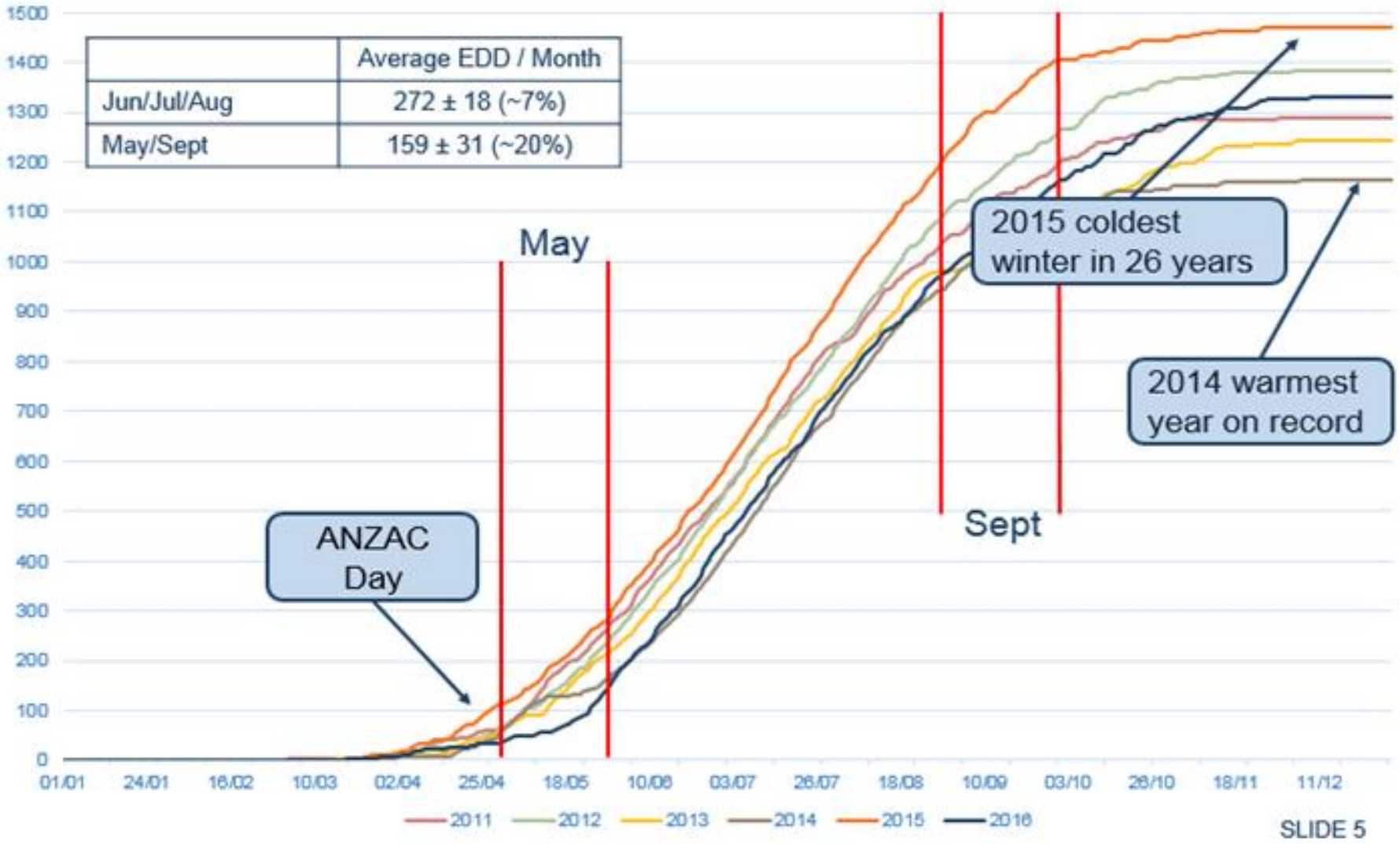
DEMAND AND CONSUMPTION TREND

	2011	2012	2013	2014	2015	2016
Annual System Consumption (Petajoules (PJ))	217	211	200	195	208	204
Annual Cumulative EDD	1289	1384	1242	1163	1472	1331

	2011	2012	2013	2014	2015	2016
1 May - 30 September Consumption (PJ)	123	125	115	115	128	120
Actual Peak Total Demand (TJ/d)	1,154	1,092	1,165	1,214	1,179	1,187
Peak Demand Day EDD	14.2	12.2	13.8	15.3	14.1	14.0

- Approximately 60% of annual consumption occurs in winter
- Annual consumption has on average trended down
- Peak demand days have been relatively consistent from 2013

EDD TRENDS


Average EDD / Month
Jun/Jul/Aug
272 ± 18 (~7%)
May/Sept
159 ± 31 (~20%)
May
Sept
ANZAC Day
2015 coldest winter in 26 years
2014 warmest year on record
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
01/01
24/01
16/02
10/03
02/04
25/04
18/05
10/06
03/07
26/07
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18/11
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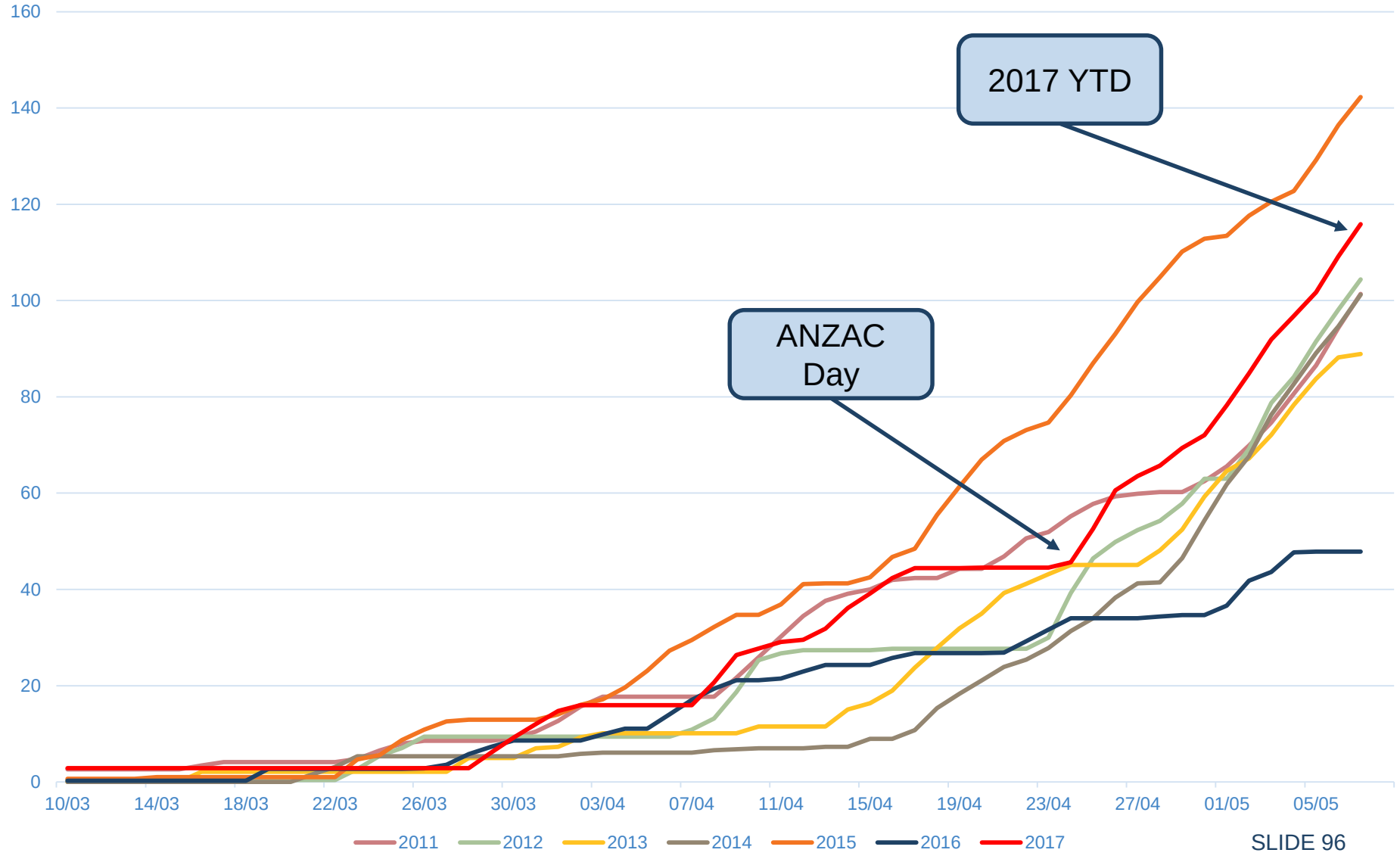
2011
2012
2013
2014
2015
2016

EDD TRENDS


160
140
120
100
80
60
40
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0
10/03
14/03
18/03
22/03
26/03
30/03
03/04
07/04
11/04
15/04
19/04
23/04
27/04
01/05
05/05
2017 YTD
ANZAC Day
2011
2012
2013
2014
2015
2016
2017

WINTER 2016 IN REVIEW

- Winter Period is 1 May – 30 September,
- The 2016 peak demand days for the DTS included;
  - 1,187 TJ on 24 June 2016
  - 1,162 TJ on 13 July 2016
  - 1,140 TJ on 26 July 2016
  - Peak GPG demand day occurred on 7 July of 111 TJ
- Esso injections profiled on the top two demand days.

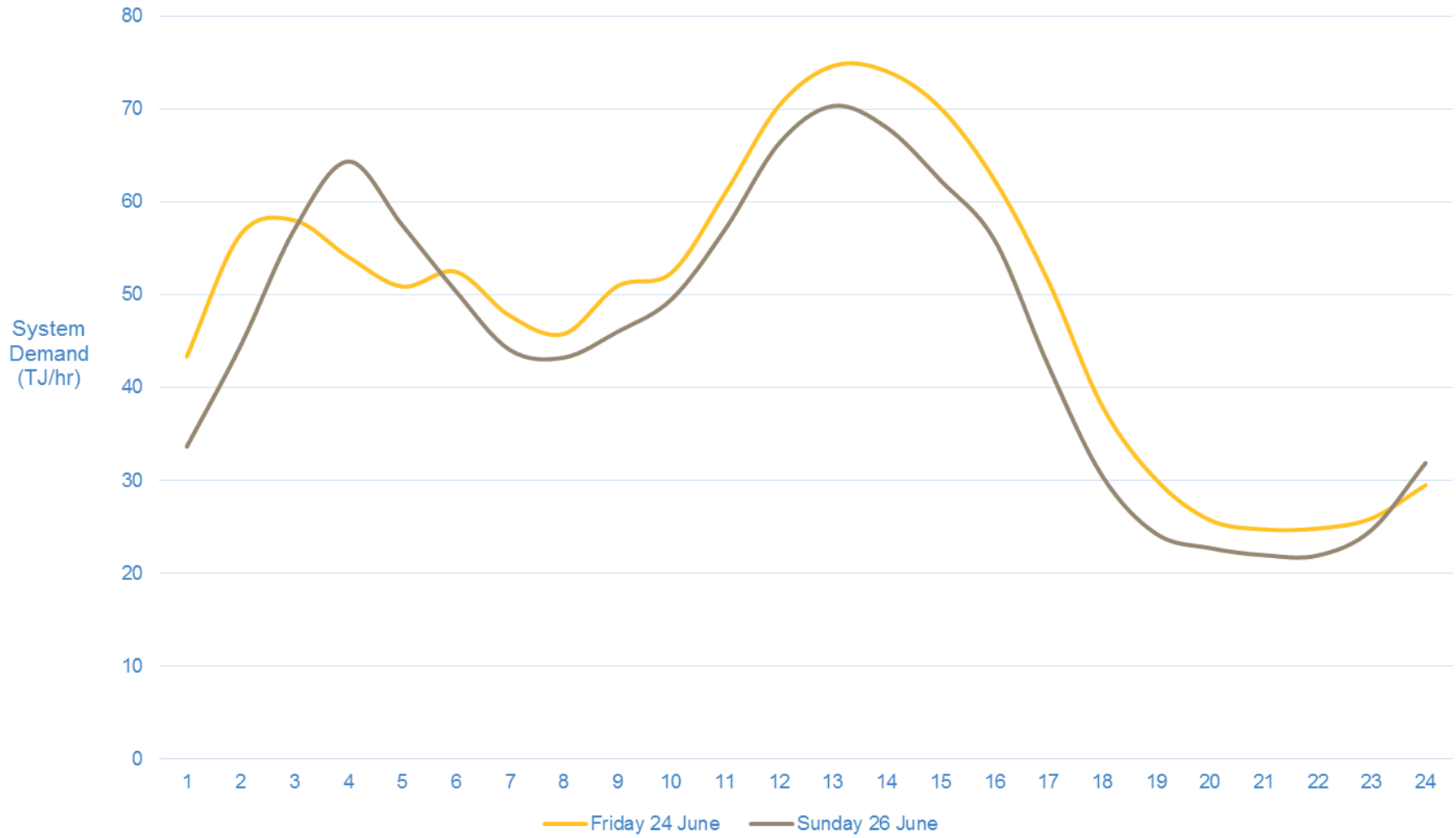
WINTER 2016 IN REVIEW

- Comparing peak days

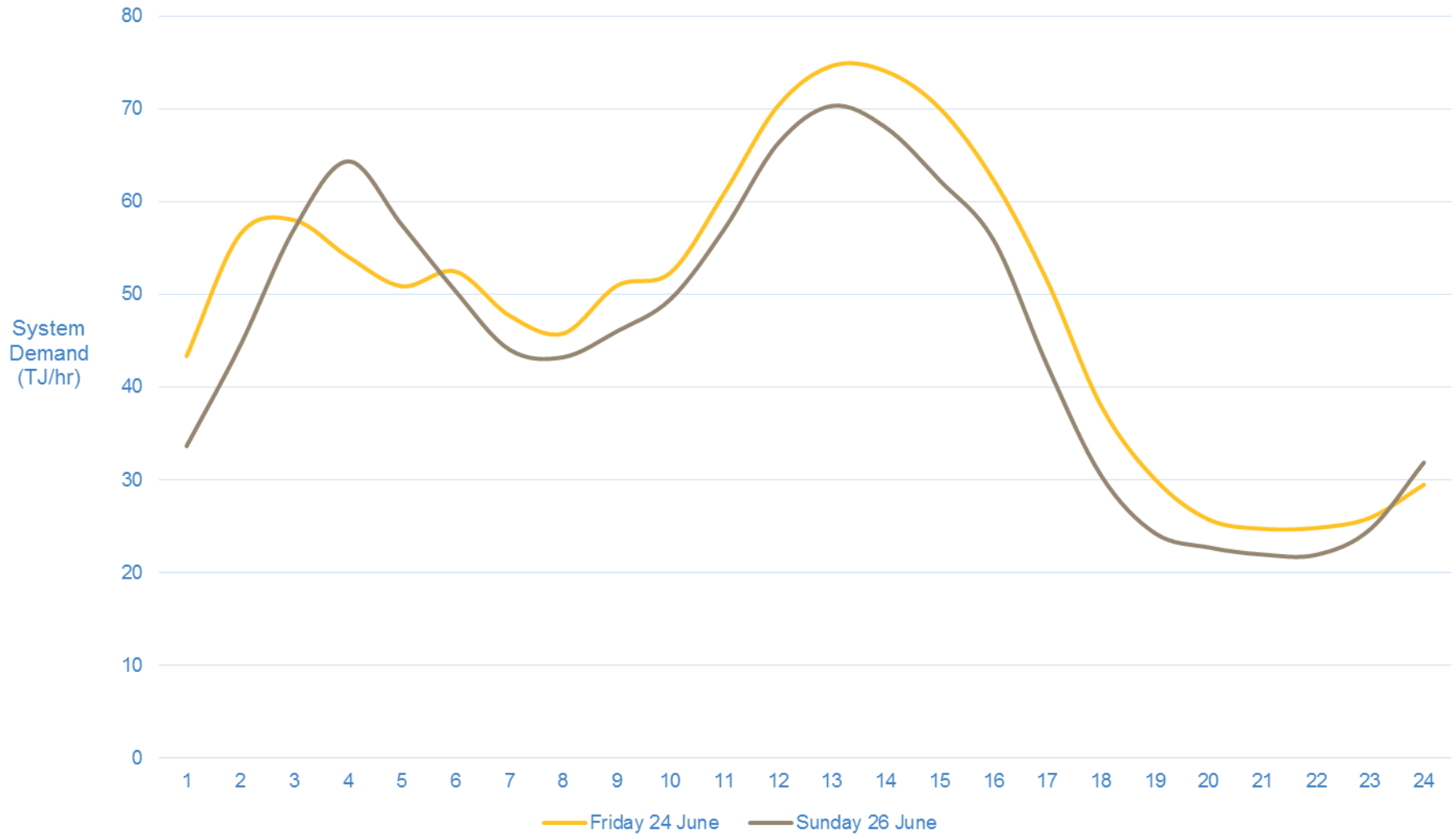
	EDD	System Demand (TJ)	GPG (TJ)	Total Demand (TJ)
Thursday 23 June 2016	10.02	953	12	965
Friday 24 June 2016	13.95	1187	0	1187
Saturday 25 June 2016	12.55	1009	16	1026
Sunday 26 June 2016	14.19	1078	19	1097
Monday 27 June 2016	13.17	1106	12	1118

- Sunday had a 0.2 degree higher EDD, but used 109 TJ less in System Demand due to the day of the week

24 & 26 JUNE COMPARISON



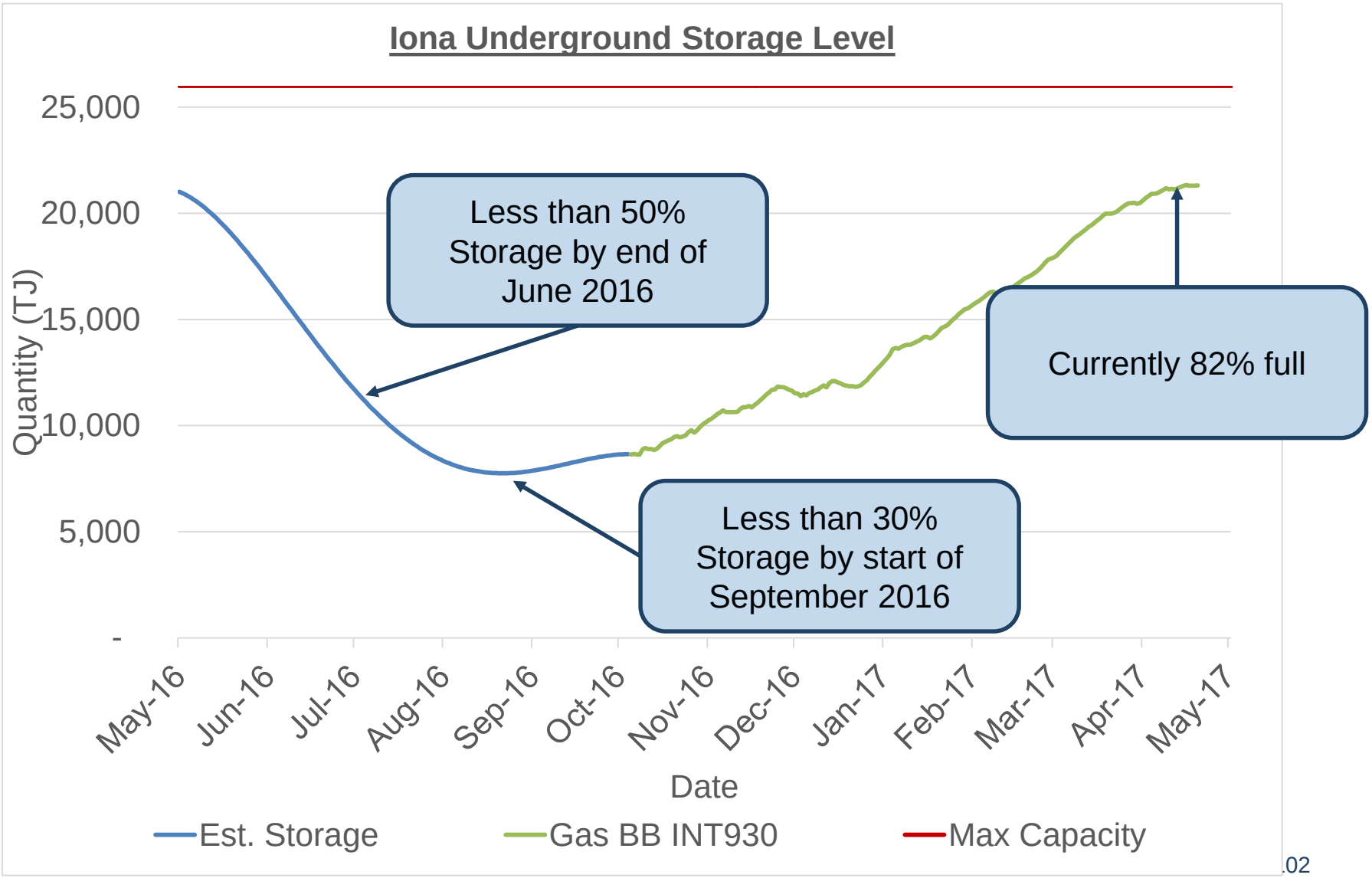
24 & 26 JUNE COMPARISON



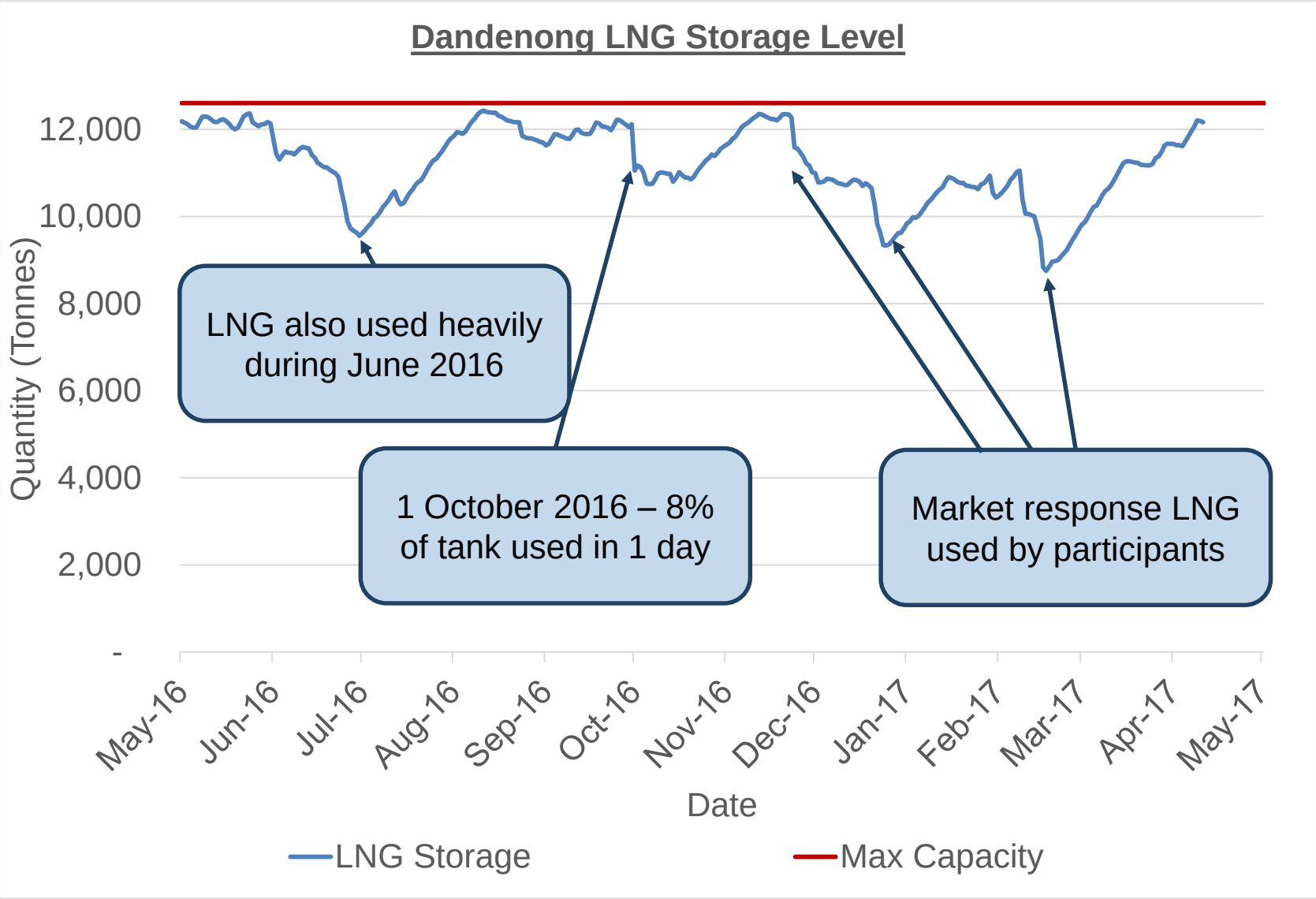
SUPPLY TIGHTNESS

With the East Coast supply tightening, what is happening in the market?

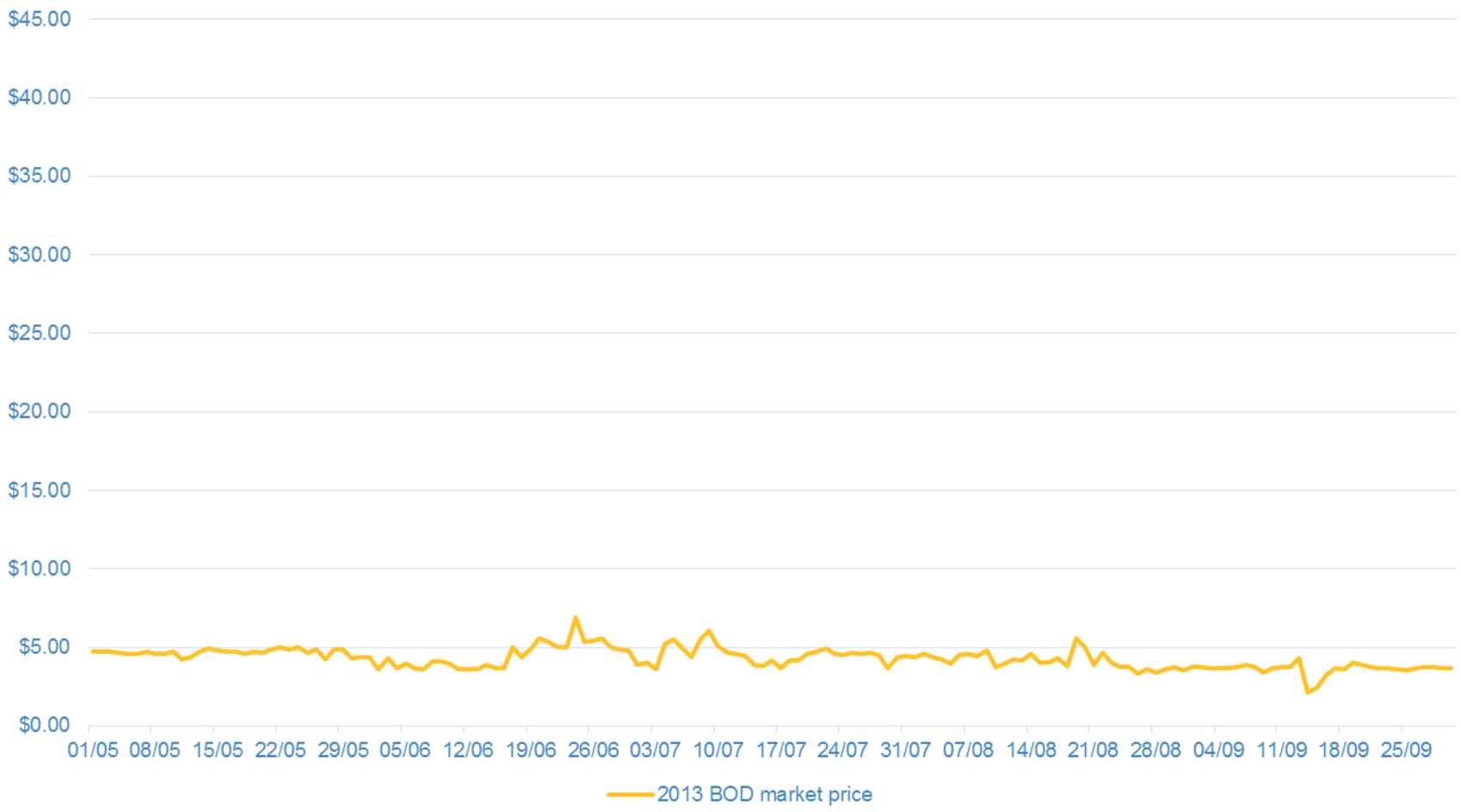
STORAGE UTILISATION



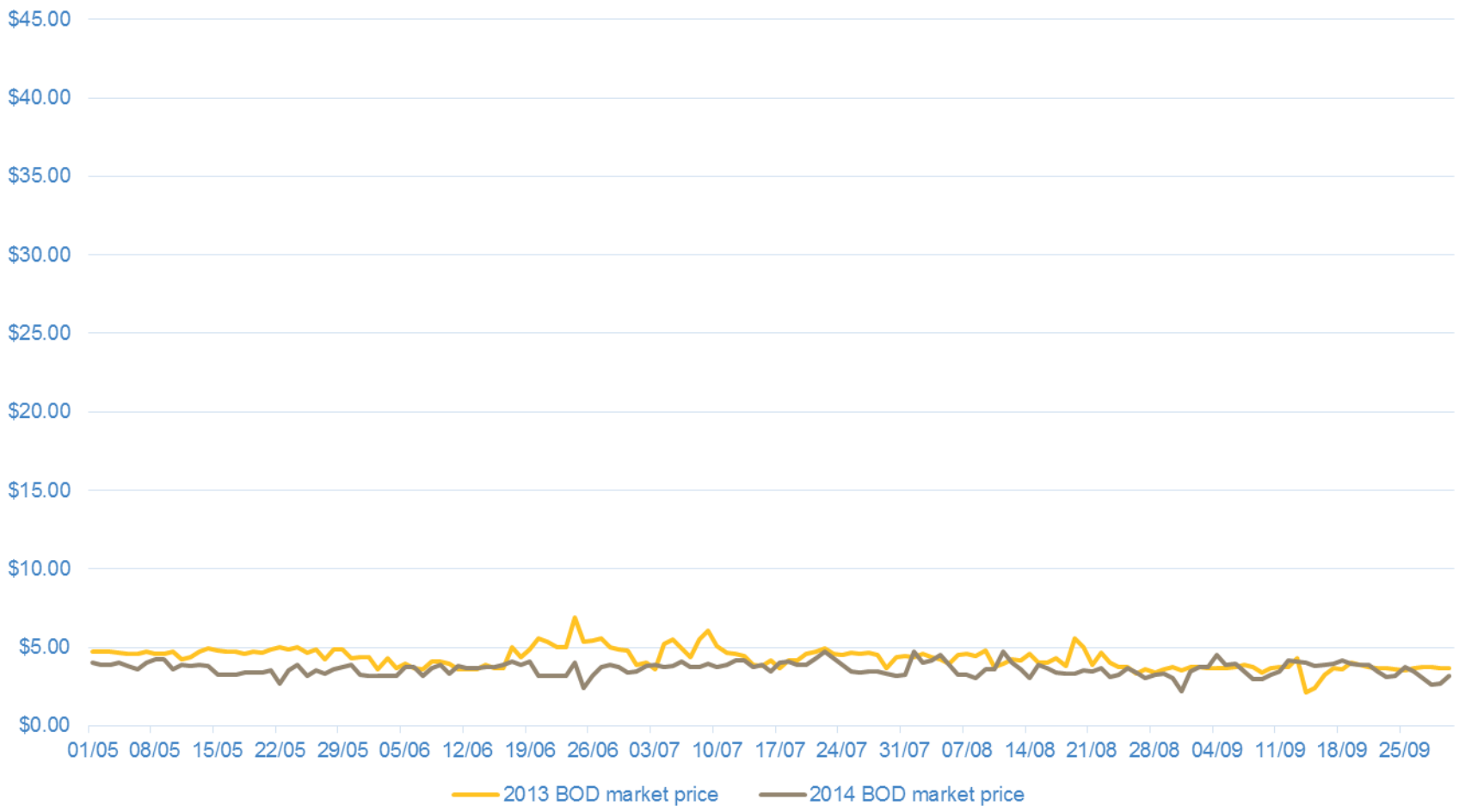
STORAGE UTILISATION



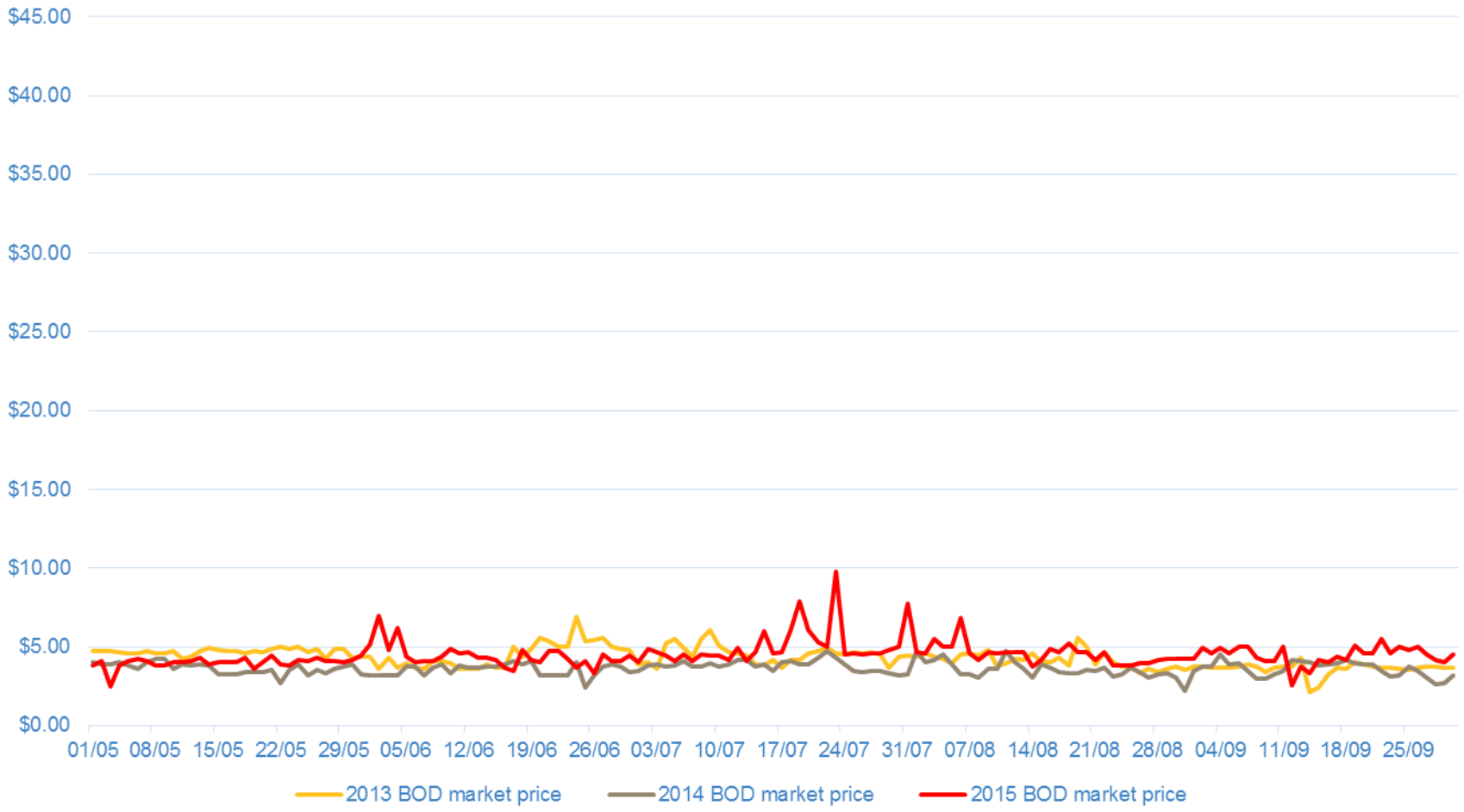
DWGM BOD MARKET PRICE



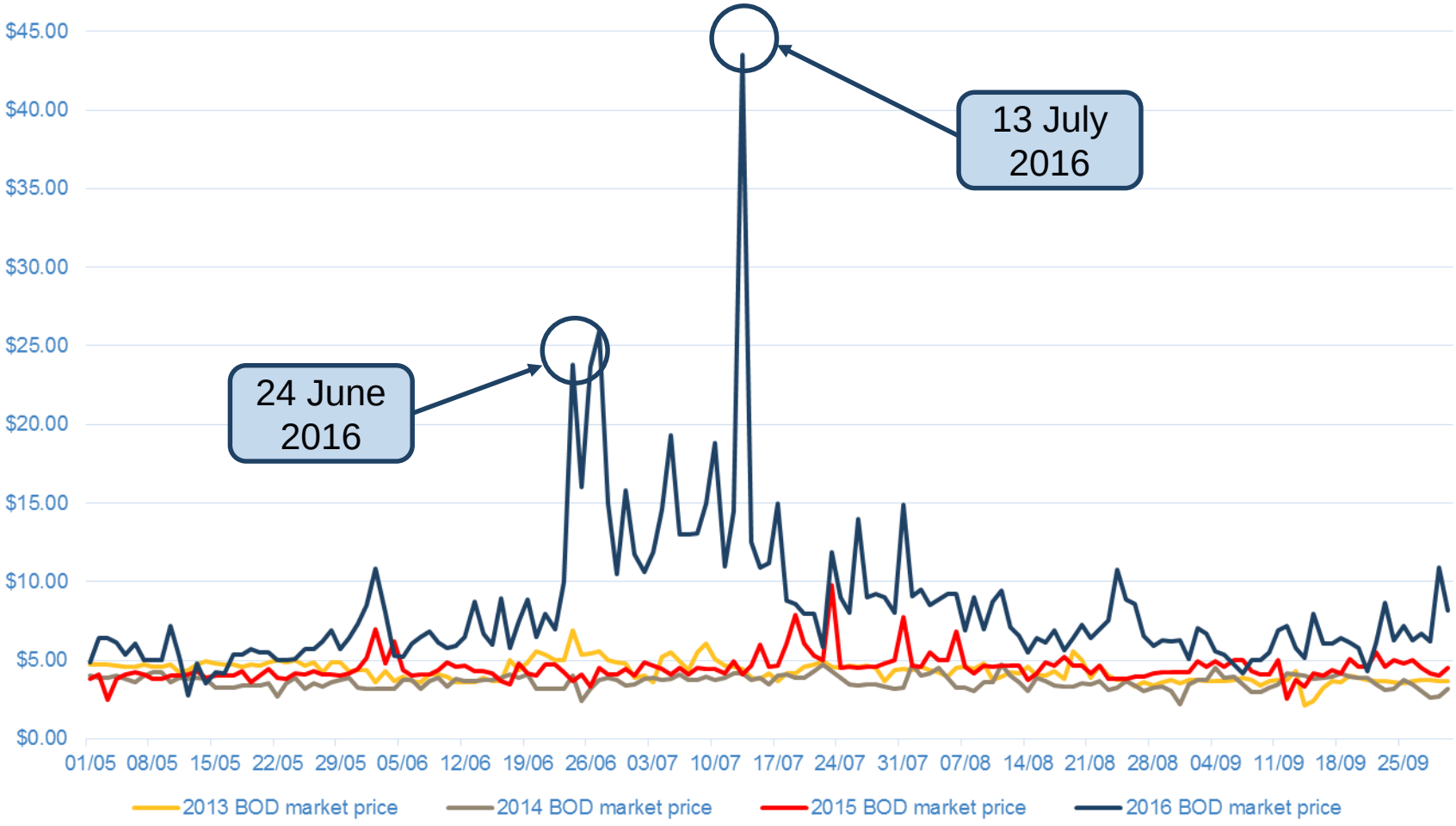
DWGM BOD MARKET PRICE



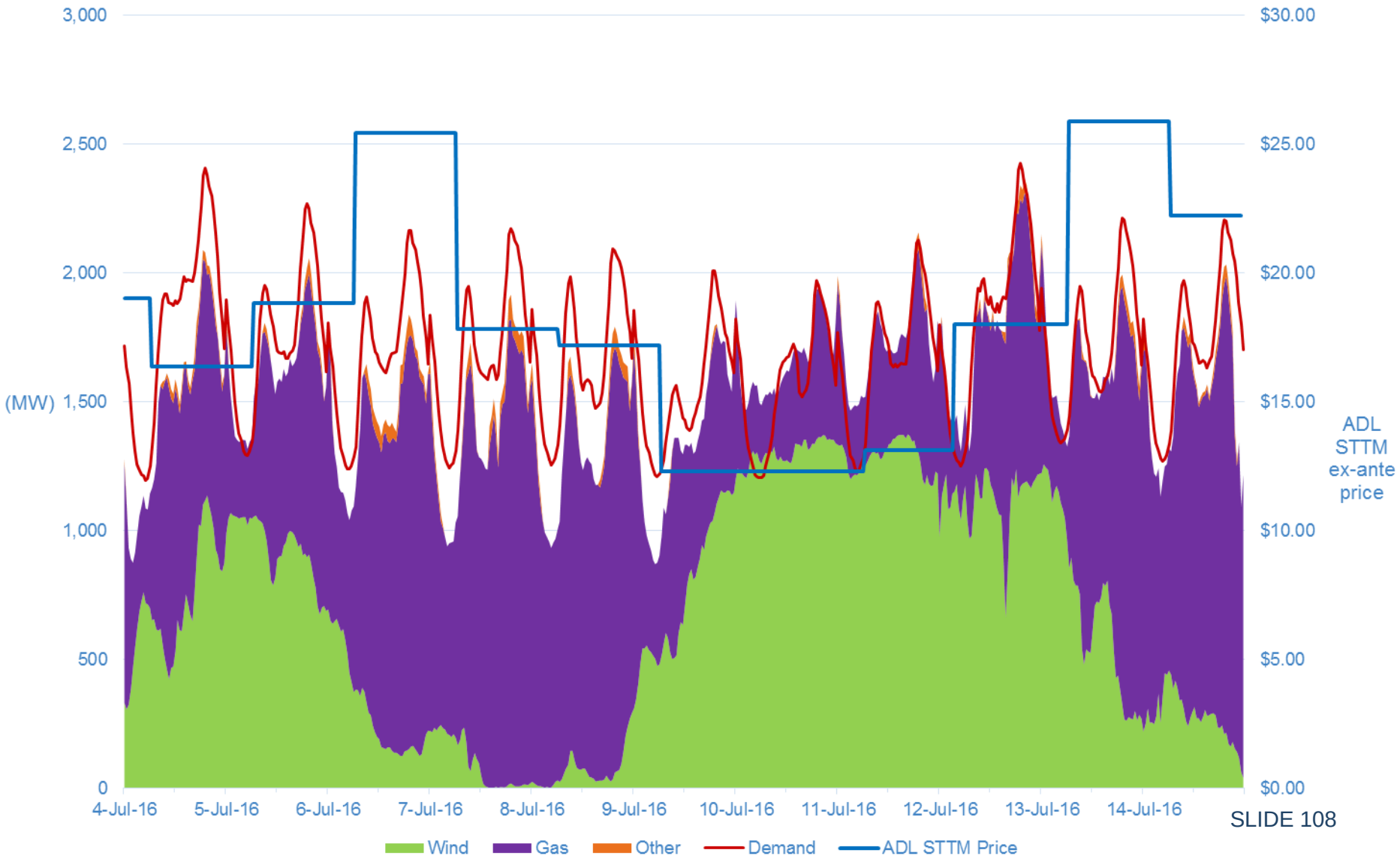
DWGM BOD MARKET PRICE



DWGM BOD MARKET PRICE



MARKET INTERACTIONS



QUESTIONS?

WINTER OUTLOOK

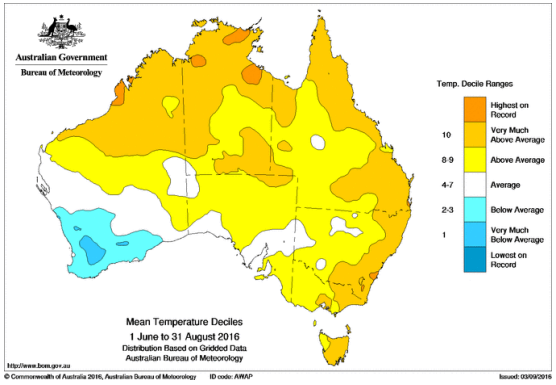
Victorian Gas Operations | May 2017

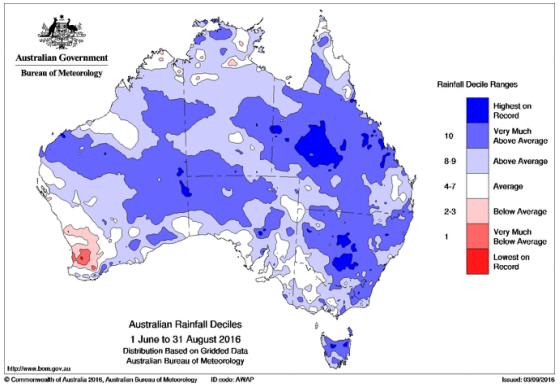
Josh Fisher - Meteorologist/Energy Account Manager

Overview

- **Review of winter 2016**
- State of the climate
- Outlook for winter 2017

Winter Review 2016





Weatherzone Long Range Verification

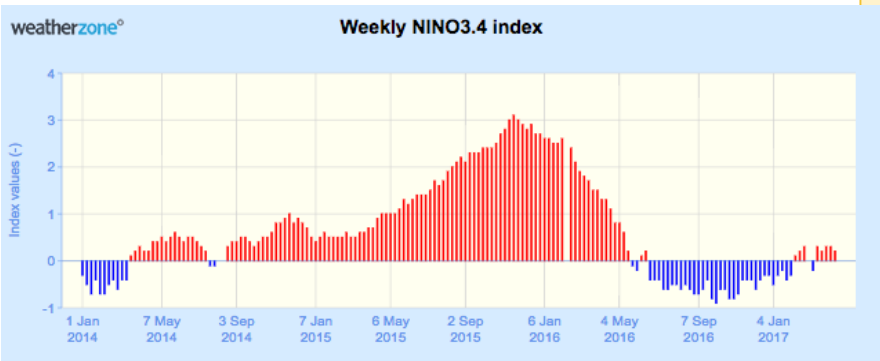
SKILL SCORE
61.9%

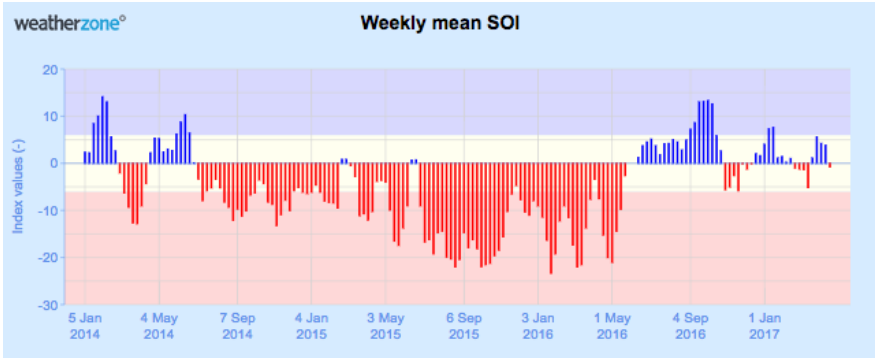
MAE
0.58C

BLOWOUTS
0

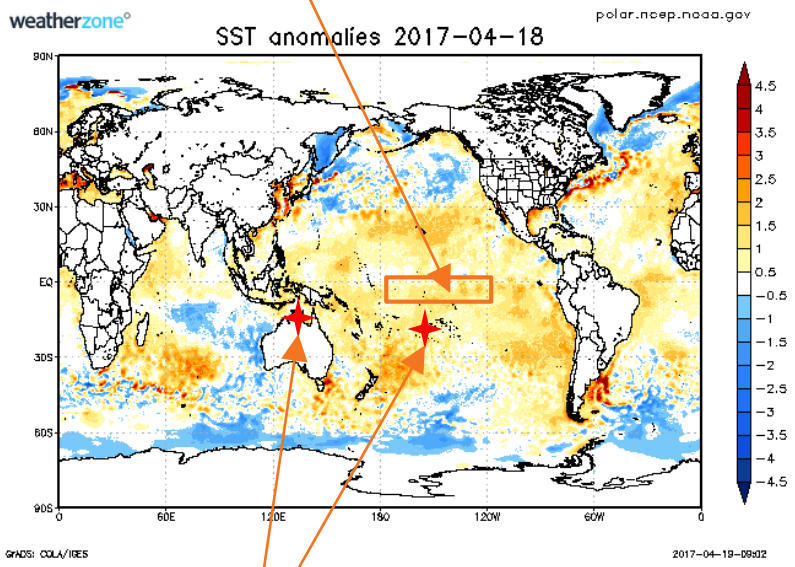
Climate Drivers

ENSO





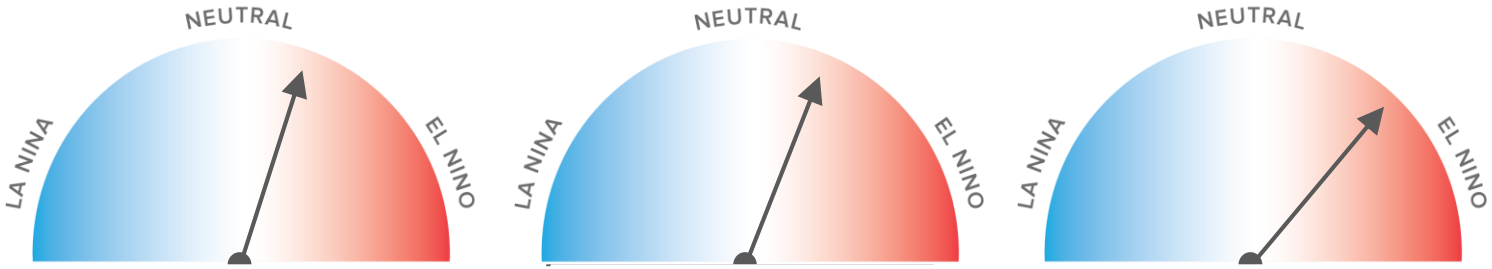
NINO3.4 Index = Average SSTs across the 3.4 region



SOI = Atmospheric pressure difference between Darwin and Tahiti

ENSO Outlook - NINO3.4 Index

Current International Consensus



May

NINO3.4 Index: 0.5

July

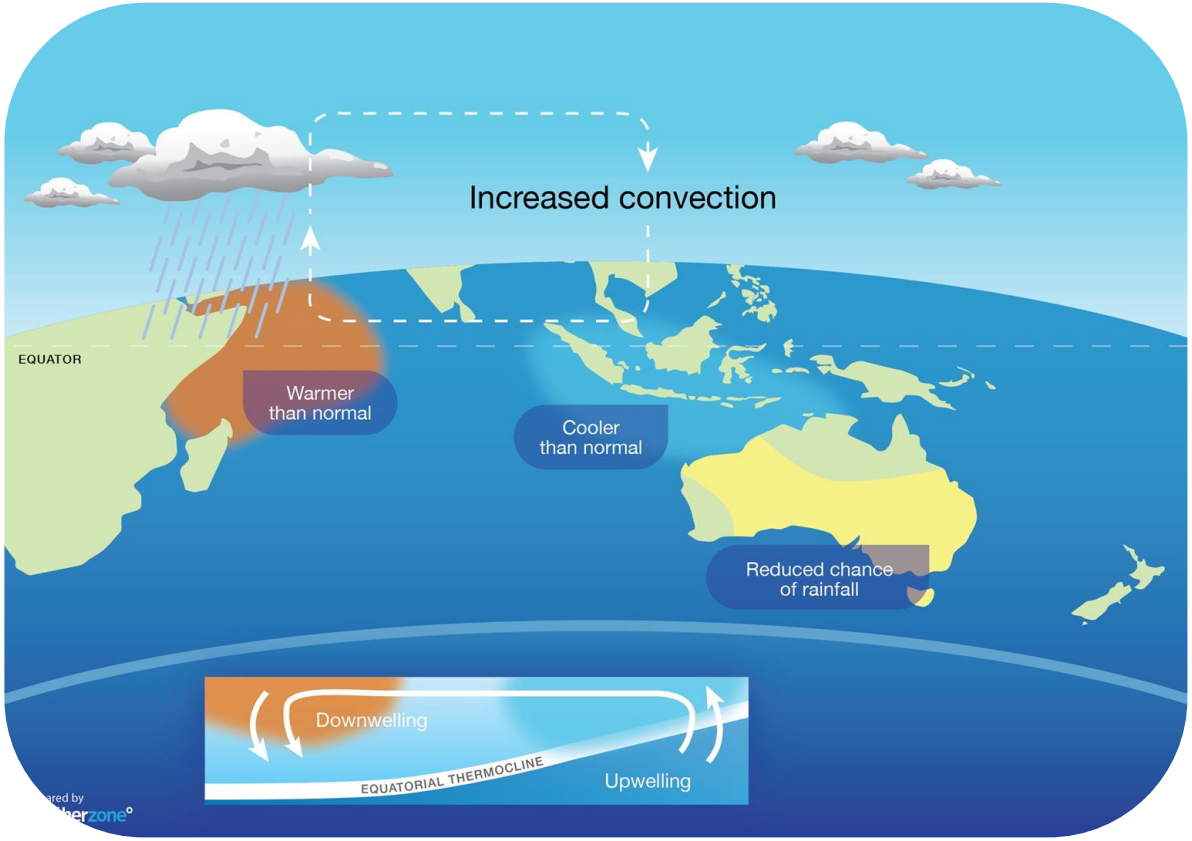
NINO3.4 Index: 0.8

September

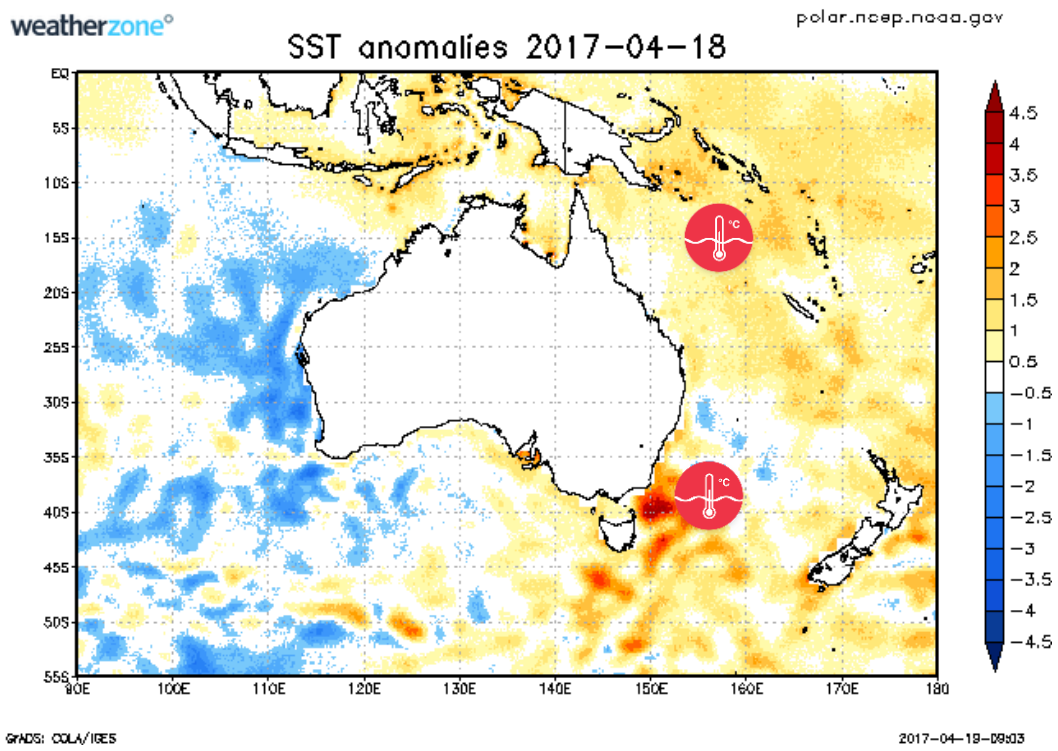
NINO3.4 Index: 1.0

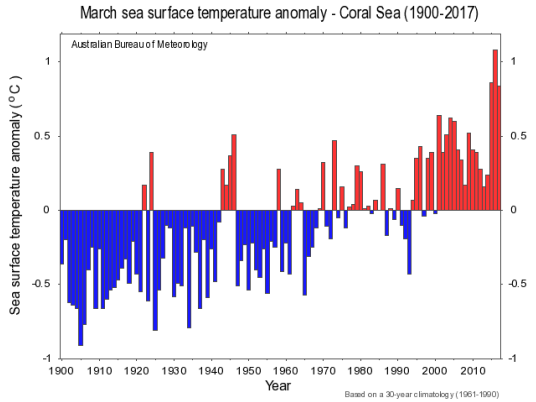
*"For a **La Nina (-0.8)/El Nino (+0.8)** to be declared, thresholds need to be met for at least 3 consecutive months"*

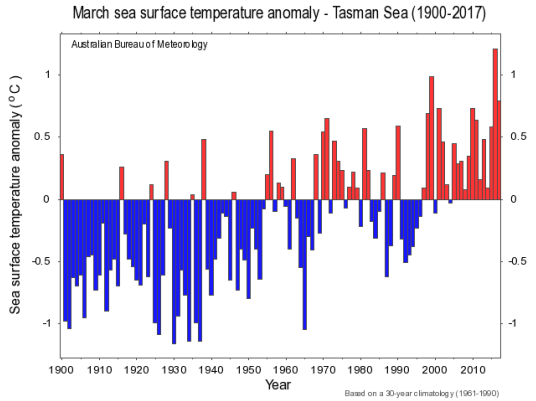
Indian Ocean Dipole - Positive Phase



Sea Surface Temperatures







Climate Drivers

Climate Summary

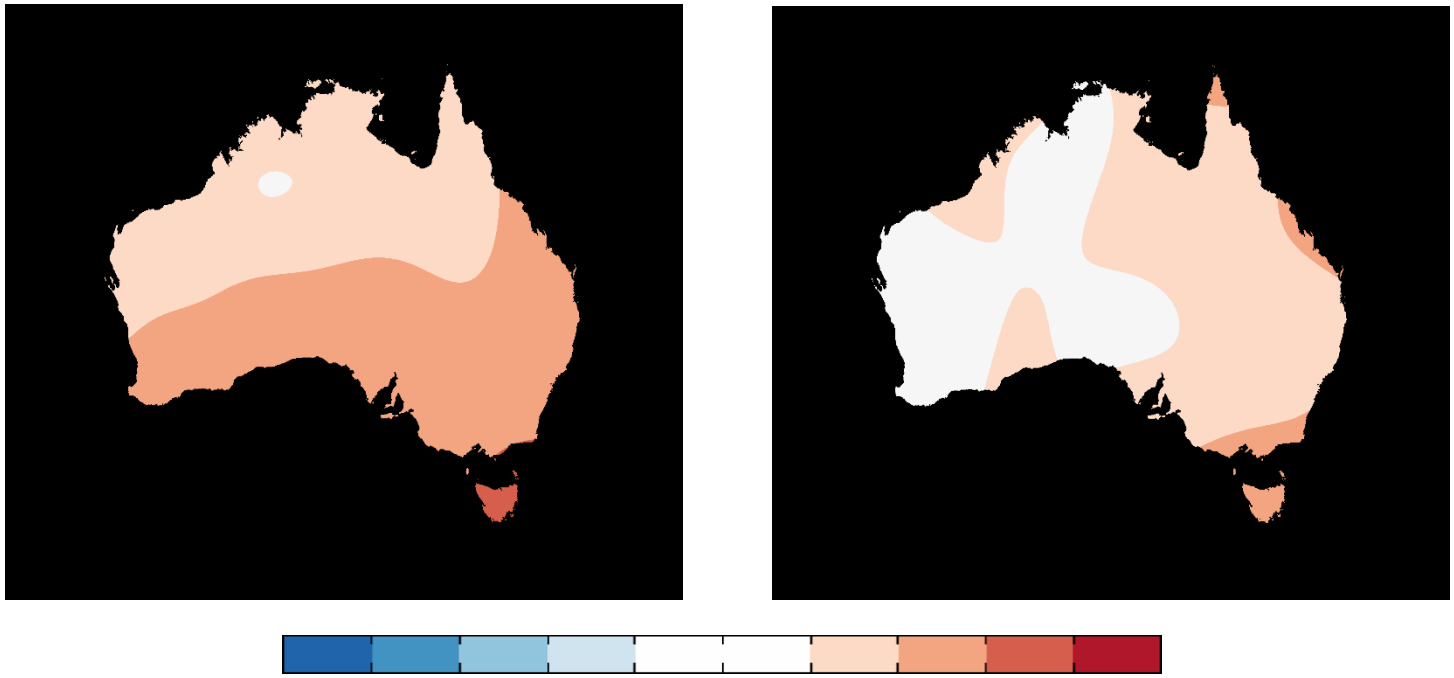
ENSO conditions = Neutral (El Nino watch)

IOD = Neutral (Positive risk)

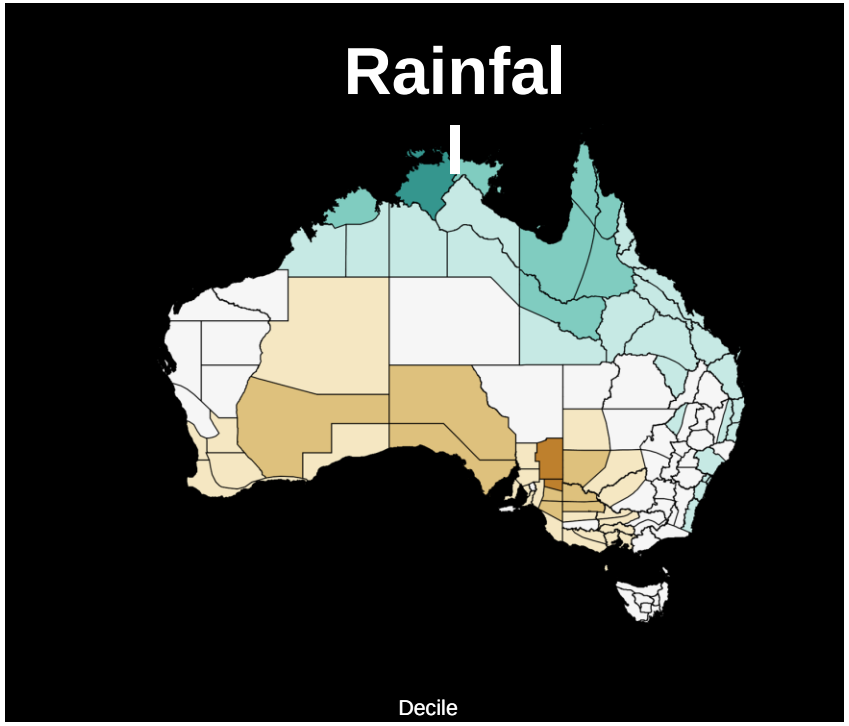
SSTs= Very warm in the east, cooling in the west

No real large scale drivers likely to dominate winter conditions.

National Outlook - JJA

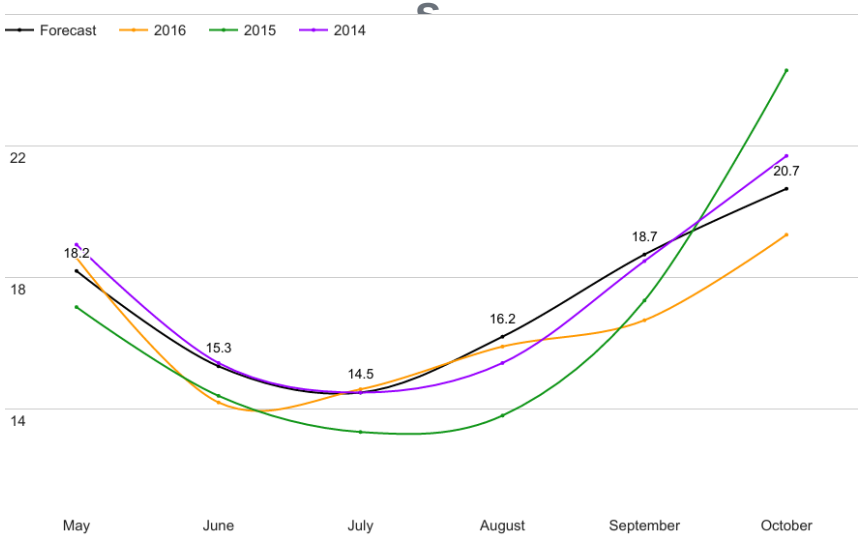


National Outlook - JJA

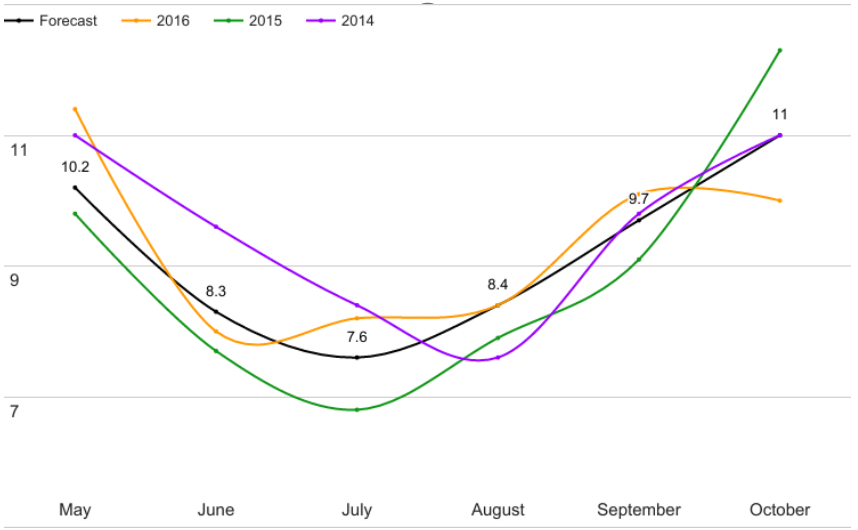


MELBOURNE - Temperatures

Maximum



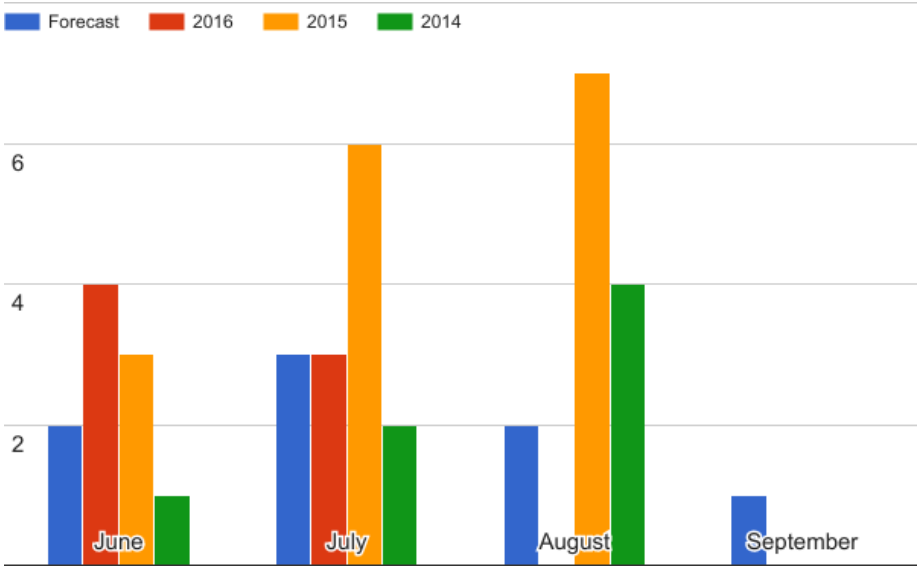
Minimum



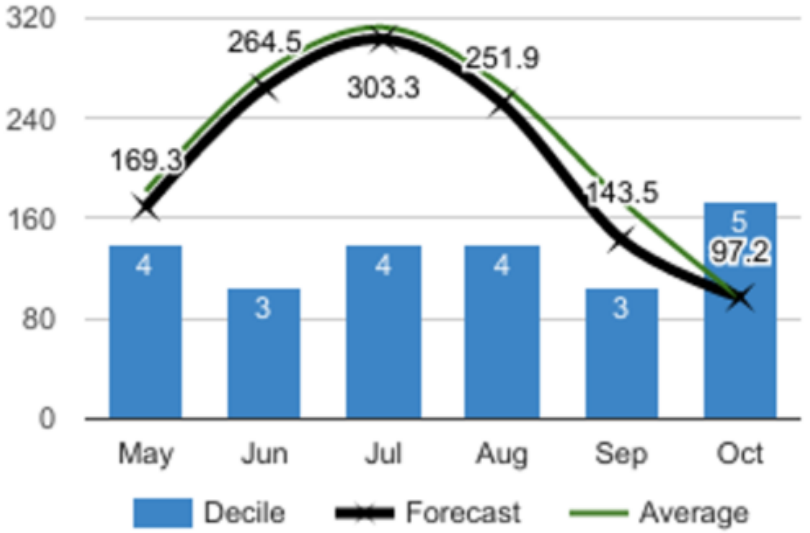
Forecast Anomaly (1981-2010 mean)

MELBOURNE - Temperatures

Days < 12C



EDDs



Outlook Summary WINTER

Numerical models continue to suggest a warming of the Pacific Ocean in 2017.

Increase risk in El Nino-like conditions during winter:

- **D**ecreased cloud cover across the east
- **B**elow Average Rainfall
- **W**armer than average daytime temperatures
  - Though cooler nights across inland areas are possible
- **M**ore mobile weather systems
  - Potential for greater variability in temperatures and near normal amount of cold days

Positive IOD is also a chance:

- **R**einforces ENSO conditions, mainly towards the end of winter

Questions?

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APA Victorian Transmission System

Winter 2017 Operations Outlook

System Augmentations and Modifications

10 May 2017

energy. connected.

Overview

- **Victorian Transmission System – Summary / Overview**
  - Current DTS / VTS Existing Capacities
- **Victorian Northern Interconnect (VNI) – Summary / Overview**
  - Modifications, Enhancements and Augmentations
- **Proposed Augmentations – access arrangement 5 (2018 to 2022)**
  - Warragul Augmentation
  - Anglesea Pipeline Extension
  - SWP Expansion (to Port Campbell)
  - WORM Project

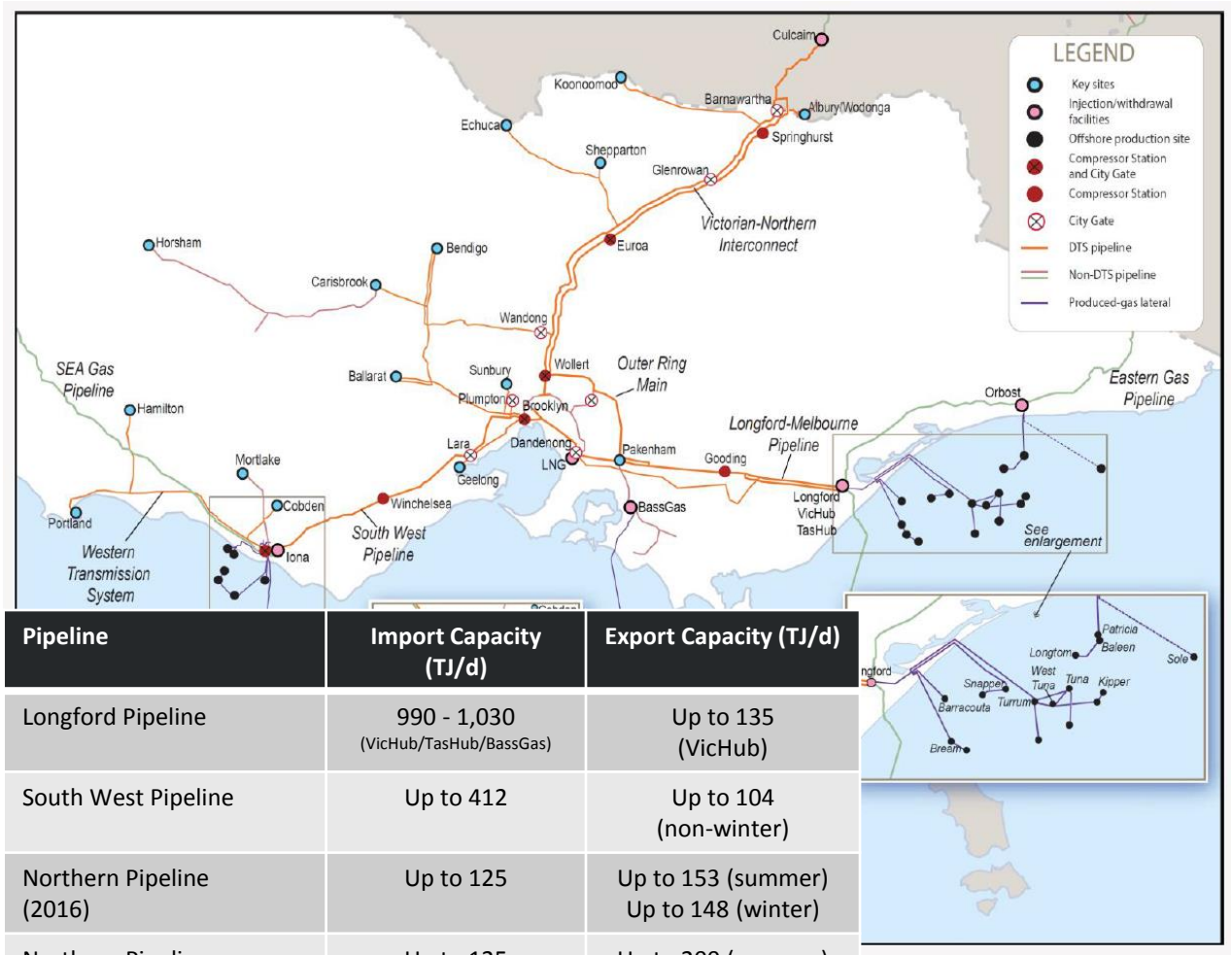
Victorian Transmission System
Summary / Overview

System and Pipeline Capacities

APA Victorian Gas Transmission System – overview

Gas Supply Sources

- Esso Longford
- Cooper and Seven Group – via VicHub (&TasHub)
- Port/Campbell/Iona – also connection to Adelaide via SEAGas
- Queensland gas via Moomba Sydney Pipeline at Culcairn
- Culcairn south flow from MSP to Victoria
- Pakenham – BassGas
- APA Dandenong LNG (DLNG)



Pipeline	Import Capacity (TJ/d)	Export Capacity (TJ/d)
Longford Pipeline	990 - 1,030 (VicHub/TasHub/BassGas)	Up to 135 (VicHub)
South West Pipeline	Up to 412	Up to 104 (non-winter)
Northern Pipeline (2016)	Up to 125	Up to 153 (summer) Up to 148 (winter)
Northern Pipeline (2017)	Up to 125	Up to 200 (summer) Up to 223 (winter)
Western System	17 - 28	n/a

Current DTS / VTS Existing Capacities

Figure 7 Longford CPP injection capacity with varying conditions

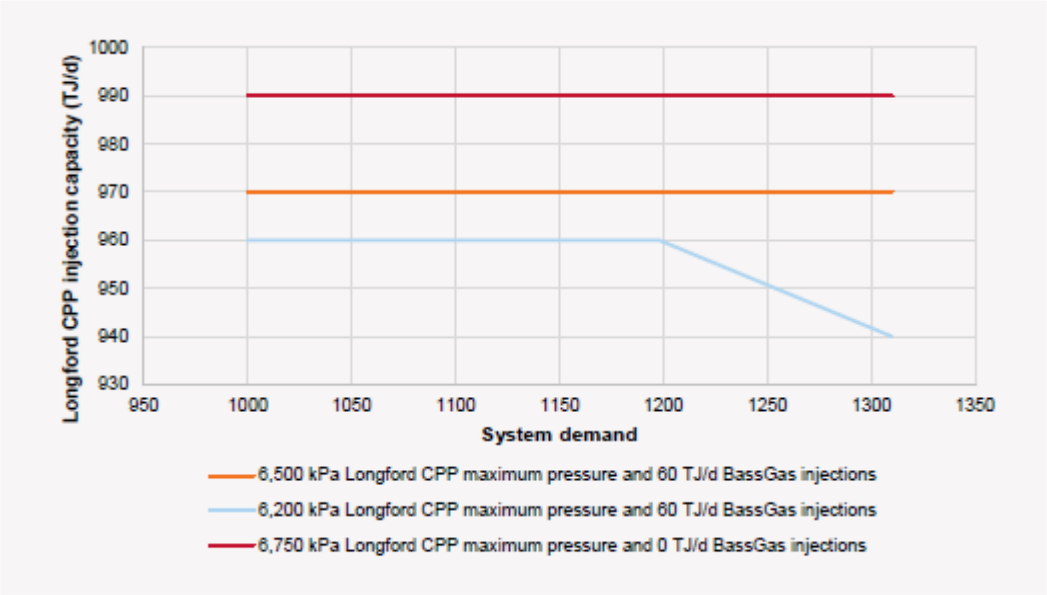


Figure 9 South West Pipeline net withdrawal capacity at Iona CPP

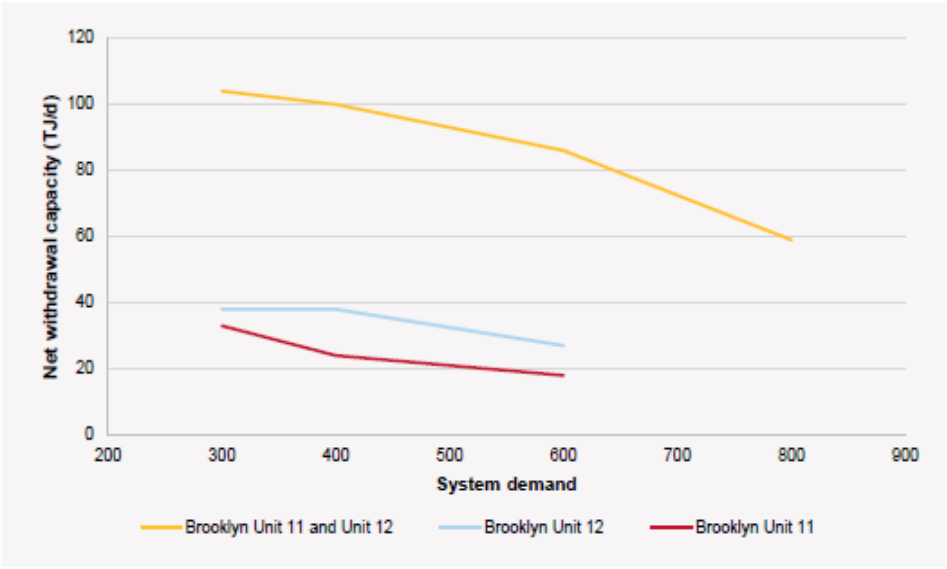
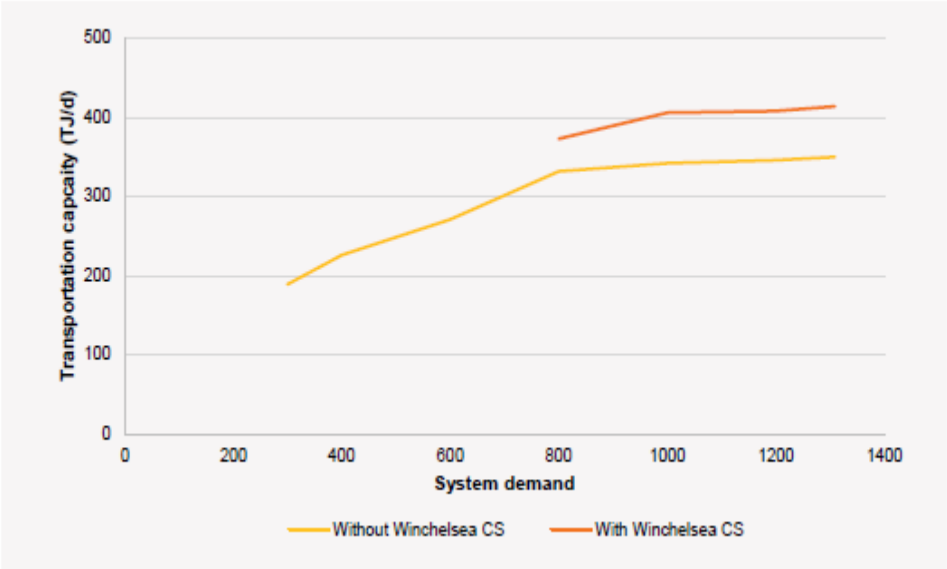


Figure 8 South West Pipeline to Melbourne transportation capacity



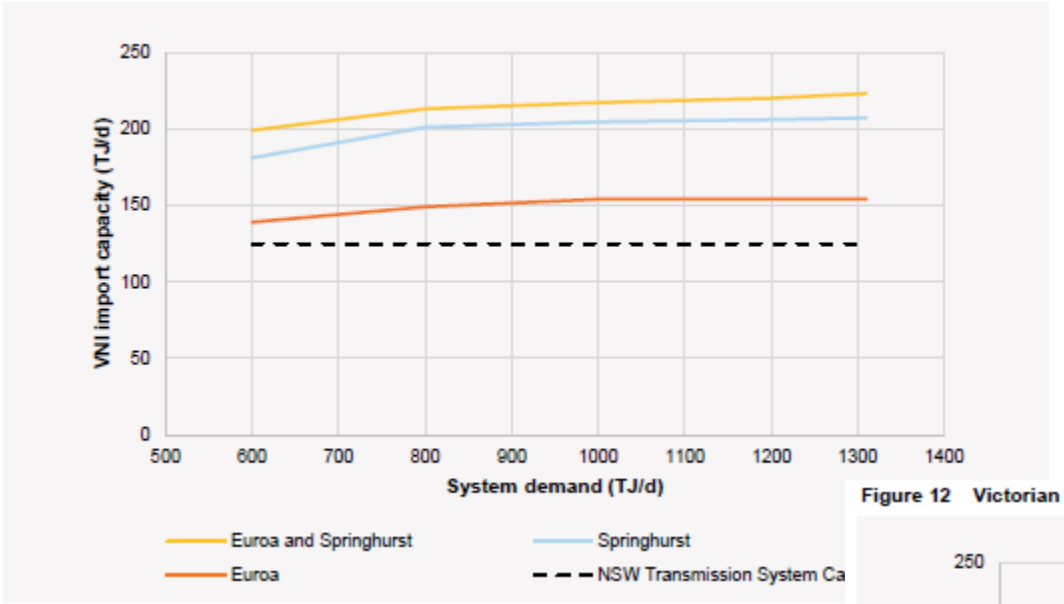
Source: AEMO Victorian Gas Planning Report 2017

Victorian Northern Interconnect
Summary / Overview

Modifications, Enhancements and Augmentations

Post VNI (May 2017) – Import and Export Capacities

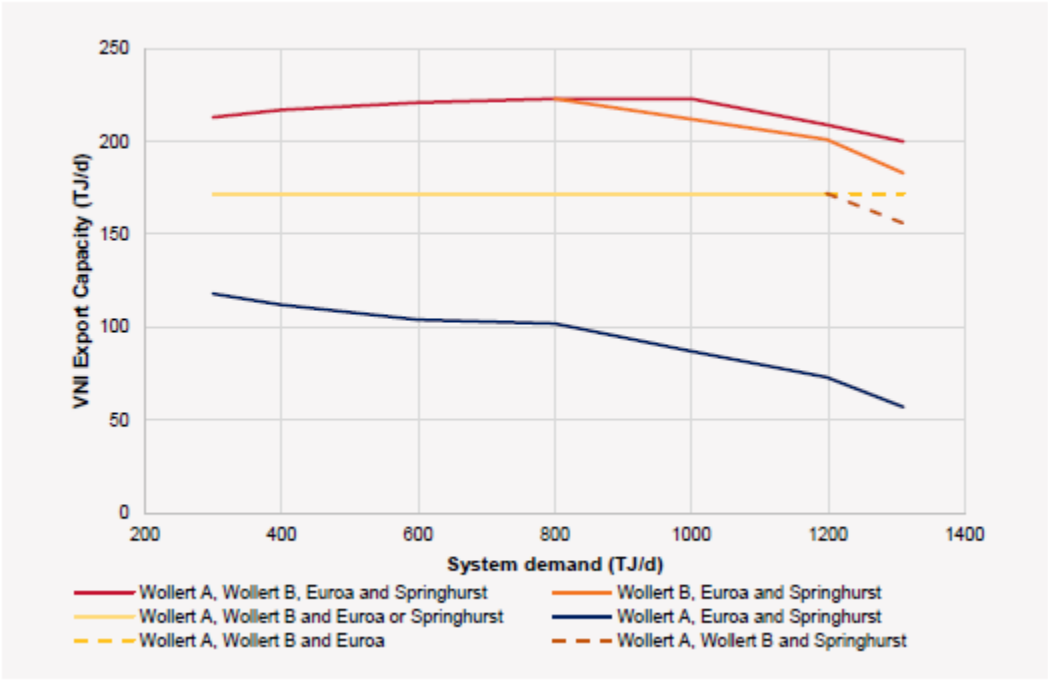
Figure 13 Victorian Northern Interconnect import capacity post VNIE Phase B project



VNI Looping (400mm; #900) (Final Stage – 258.9km (+39.4))

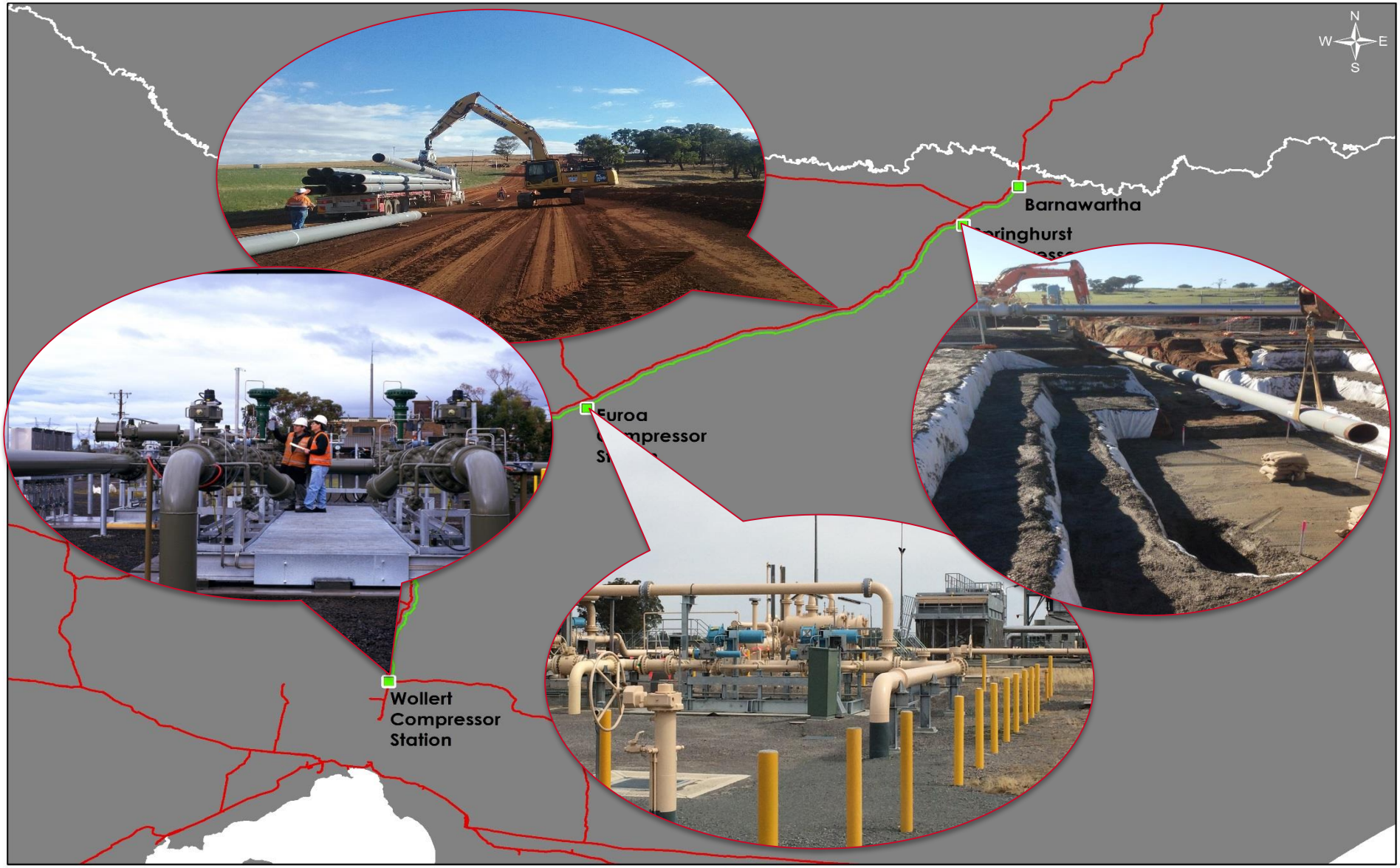
- Project to loop Broadford to Tallarook (13.9km)
- Project to loop Glenrowan to Wangaratta North (25.5km)
- Modifications at Euroa PRS, Barnawartha PRS and Wollert PRS
- Looping in NSW

Figure 12 Victorian Northern Interconnect export capacity post VNIE Phase B project



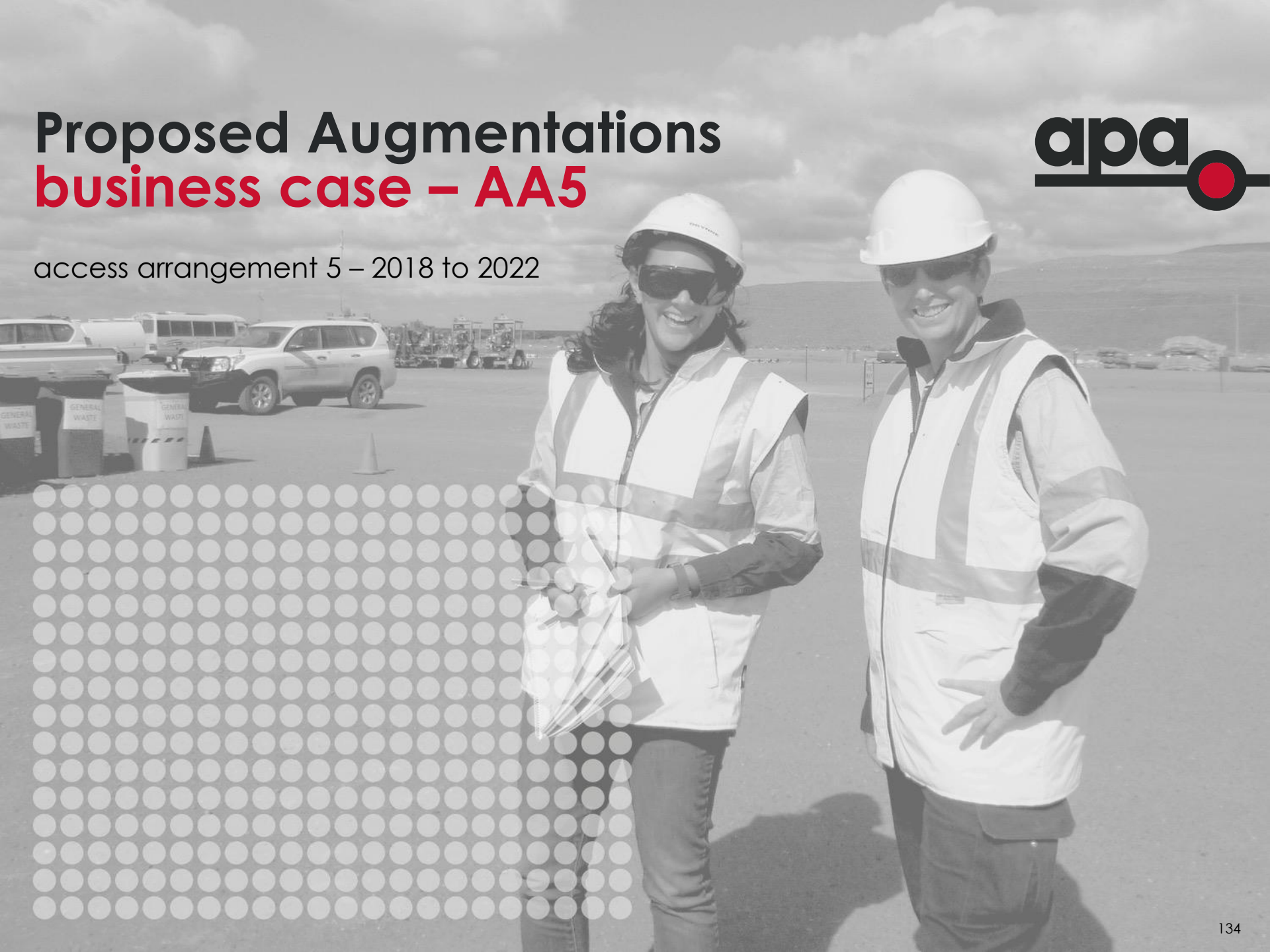
Source: AEMO Victorian Gas Planning Report 2017

APA's Victorian Northern Interconnect (VNI) - SUPERHIGHWAY



Proposed Augmentations
business case – AA5

access arrangement 5 – 2018 to 2022



Proposed – VTS Augmentation - access arrangement projects

Table 22 Proposed DTS service provider augmentations

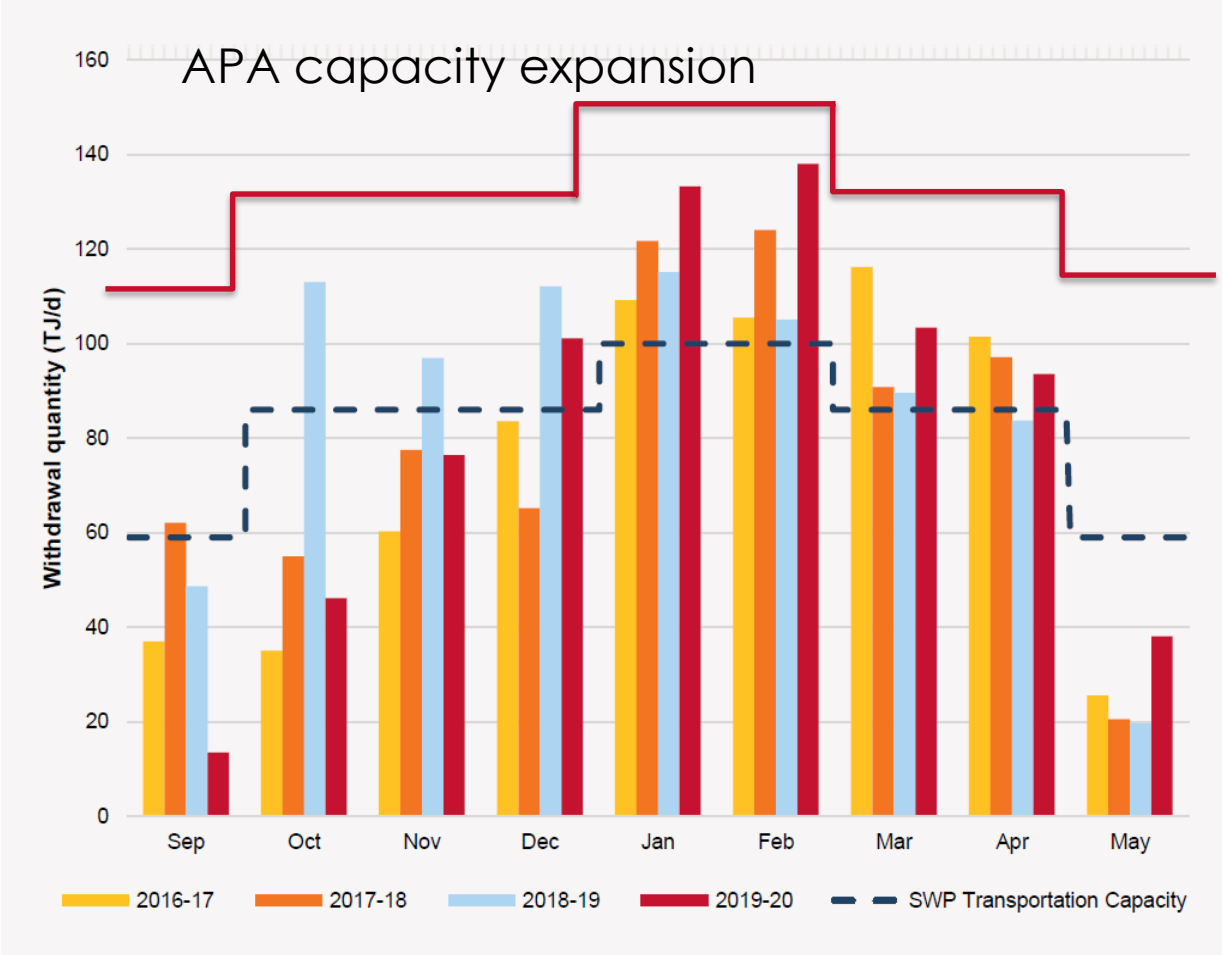
Status	Augmentation	Details	Date effective (winter of)	Comments
Committed	Victorian Northern Interconnect	Broadford to Tallarook (13.9 km, 400 mm) and Glenrowan to Wangaratta North (25.5 km,400 mm)	2017	
Proposed in the 2018–22 Access Arrangement	Iona Compressor Station	Facility upgrade to address WTS constraints	2018	Ensure reliability of the Iona CS to maintain critical fringe pressures in the WTS.
	Anglesea Pipeline Extension	Lateral from the SWP to Anglesea with city gate	2019	AEMO supports this proposal, which may maintain SWP to Melbourne transportation capacity during winter periods.
	SWP Expansion	Reconfiguration of Brooklyn site and Winchelsea bi-directional compression	2019	AEMO supports this proposal to increase SWP to Port Campbell capacity to alleviate system adequacy issues.
	Lurgi Pipeline to Warragul Looping	Pipeline looping to alleviate possible pressure breach at Warragul	2020	AEMO supports this proposal, however potential capacity restrictions may occur from winter 2019 leading to possible curtailment of load in Warragul.
	Rockbank to Wollert pipeline easement	Easements to accommodate a 500 mm Plumpton to Wollert (10,200 kPa) pipeline, 1 Centaur 50 at Wollert and Rockbank PRS	2020	AEMO supports this proposal as prudent planning in the DTS to ensure system linepack adequacy and supply to Gippsland during Longford outages.

Source: AEMO Victorian Gas Planning Report 2017

Proposed – VTS Augmentation - Brooklyn and Winchelsea

- APA has proposed in AA5 a $3.5 m expansion including Brooklyn Compressor Reconfiguration & Winchelsea Compressor bi-directionality
- Achieves additional capacity of 50 TJ/d of SWP western haul (refill) capacity by Mar 2018
- Solution matches current Iona refill capacity but refill may be interrupted if GPG operates more frequently
- APA ready for early construction start pending a positive draft decision from AER

Figure 18 South West Pipeline projected daily withdrawal quantity over the outlook period



These flows represent Iona UGS and SEA Gas flows. Data submissions for 2020–21 were incomplete, so were excluded from analysis. Actual data was used for Sep–Dec 2016, averaged by days of the month.

Interim solution – Relife of Mothballed Brooklyn Compressor

Background

- Brooklyn Compressor Station (BCS) units 11 and 12 currently supply capacity to the South West Pipeline (Iona refill)
- BCS Unit10 has not run for 9 years, is only an emergency back up to units 11 or 12

Proposal

- Carry out major service and minor repairs, approximate cost $150K
- Provides interim solution to ensure that there is sufficient capacity for Iona refill if there are unexpectedly high draws on Iona capacity (eg to support South Australia)
- Standby required for period June 2017 to March 2018 (until VTS Augmentation at Brooklyn (prior slide) in operation)

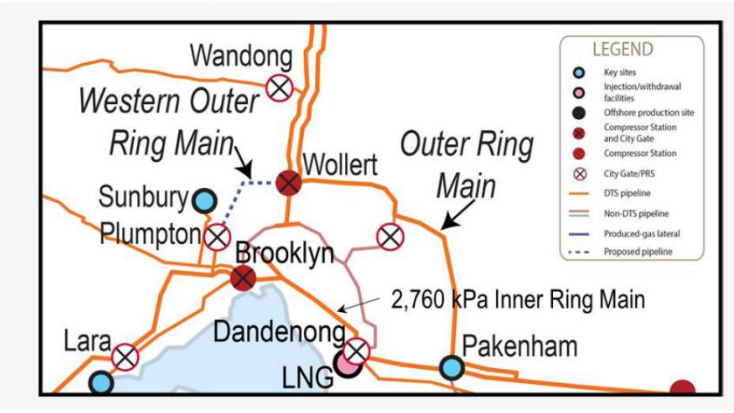
Issues to resolve

- Licensing issues to be addressed including EPA (NOx, noise) and of ESV (wet seals and liquid injection)
- APA working with authorities to resolve

Long term solution - Western Outer Ring Main (WORM)

- Capital Expenditure $122.4m; completed end 2020
- Proposed in last AA as necessary for security of supply – AER did not approve the proposal
- Adds 70TJ towards Iona (max capacity 220TJ/D)
- Half the fuel gas will be required, compared to the current quantity used for transportation via Brooklyn CS
- Addresses ageing infrastructure at Brooklyn with urban encroachment an additional challenge to its operations
- With the additional compression 470TJ to Melbourne demand zone
- Supports localised GPG – Newport (EA) Somerton (AGL) and Laverton (Snowy)
- Long term solution for Security of Supply for Victoria.

Figure 23 Proposed WORM pipeline



Source: AEMO Victorian Gas Planning Report 2017

Figure 24 SWP to Port Campbell capacity with the WORM

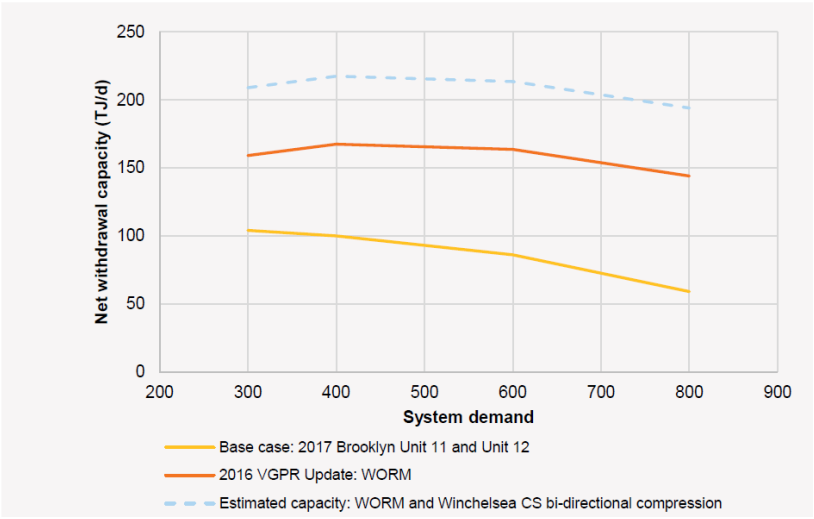
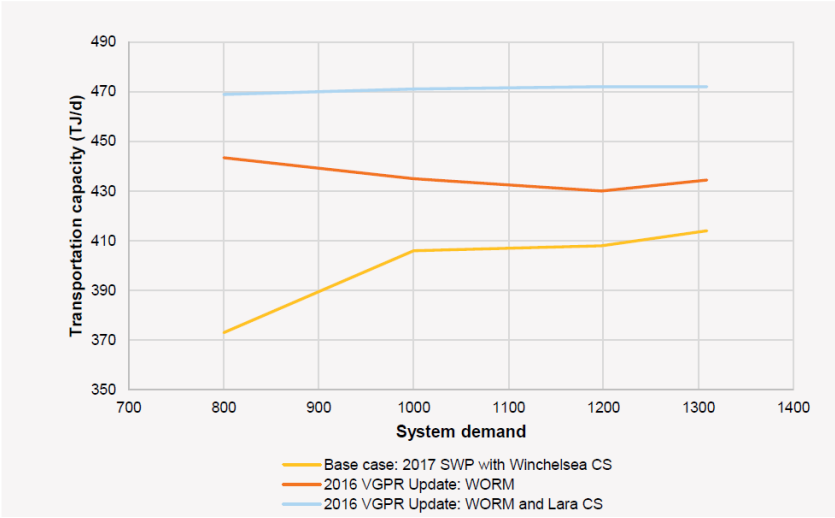
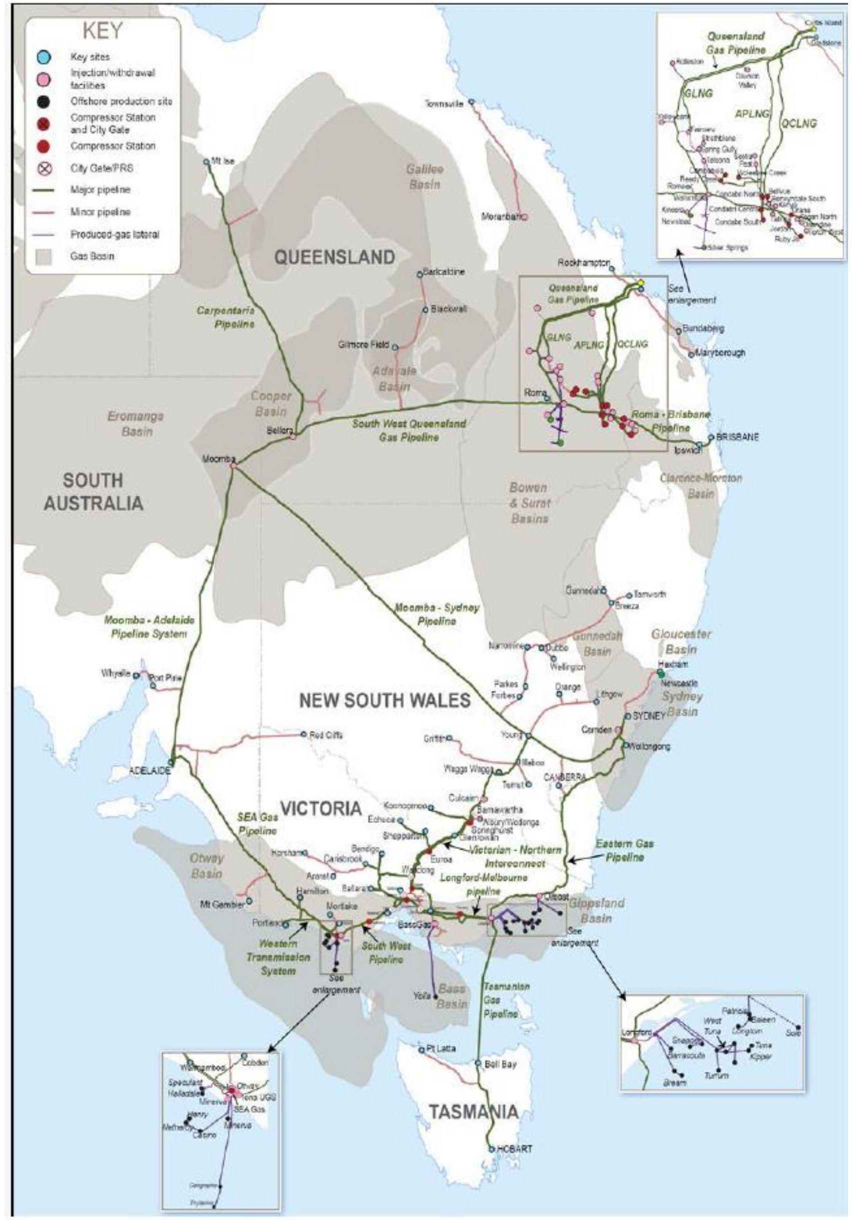


Figure 25 SWP to Melbourne capacity with the WORM



Additional peak day support

- Dandenong LNG facility
- APA Victorian Northern Interconnect 125TJ/day to Victoria
- Storage products for industrials and retailers to manage NSW and Victorian demand peak loads
- New injection point TasHub – 120TJ/day with expansion to 240TJ/day for peak day system support
- Additional compression on the South West Pipeline (e.g. Stonehaven)



Questions ?

For further information contact:

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Title: Infrastructure Development - Senior Concept Engineer

Tel: 03 8533 2111 / 0417 383 196

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Or visit the APA website at:

www.apa.com.au

10 May 2017

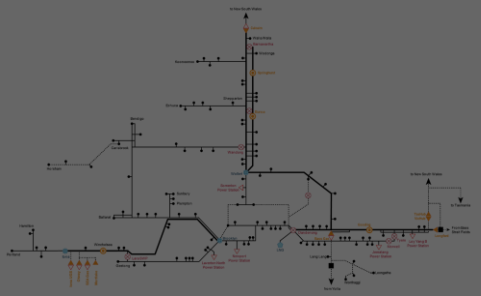
VICTORIAN GAS WINTER OUTLOOK 2017
TRANSMISSION OPERATIONS

PRESENTED BY TRENT SHINNERS

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

AGENDA

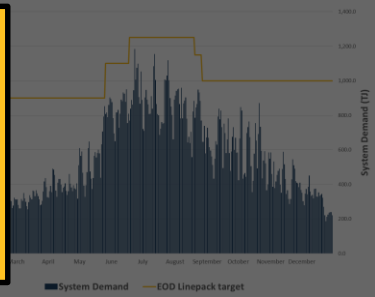
1. Victorian Declared Transmission System (DTS) Operations Overview



2. Linepack Adequacy

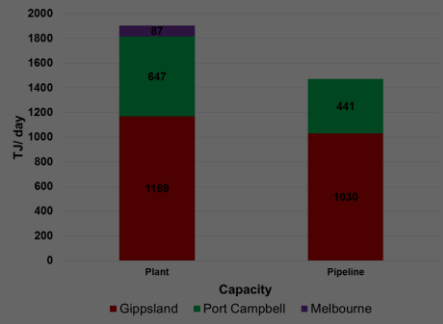
Defined Winter Period

(01 May to 30 September)



3. Supply and Demand Outlook

- Changing Demand Profile
- Gas Powered Generation
- Changing Flow Direction



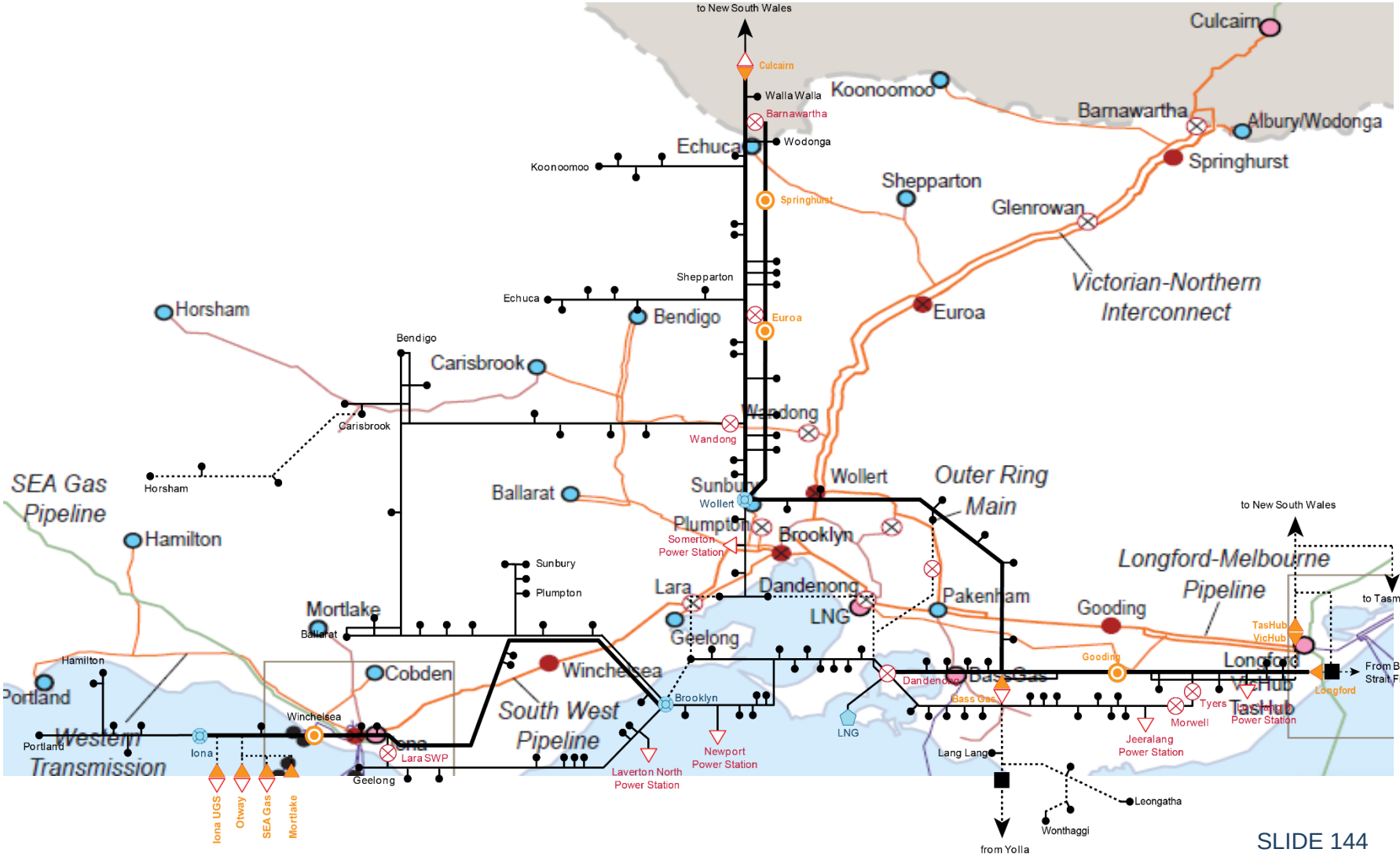
What are the challenges?

How do we manage them?

Summer Operations

Winter Operations

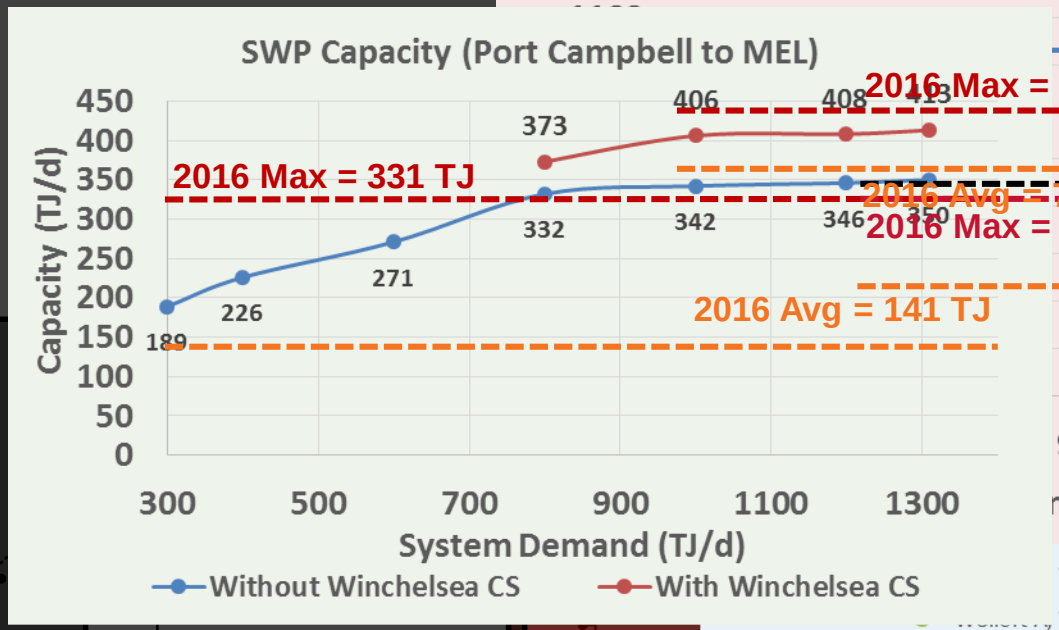
VICTORIAN DTS

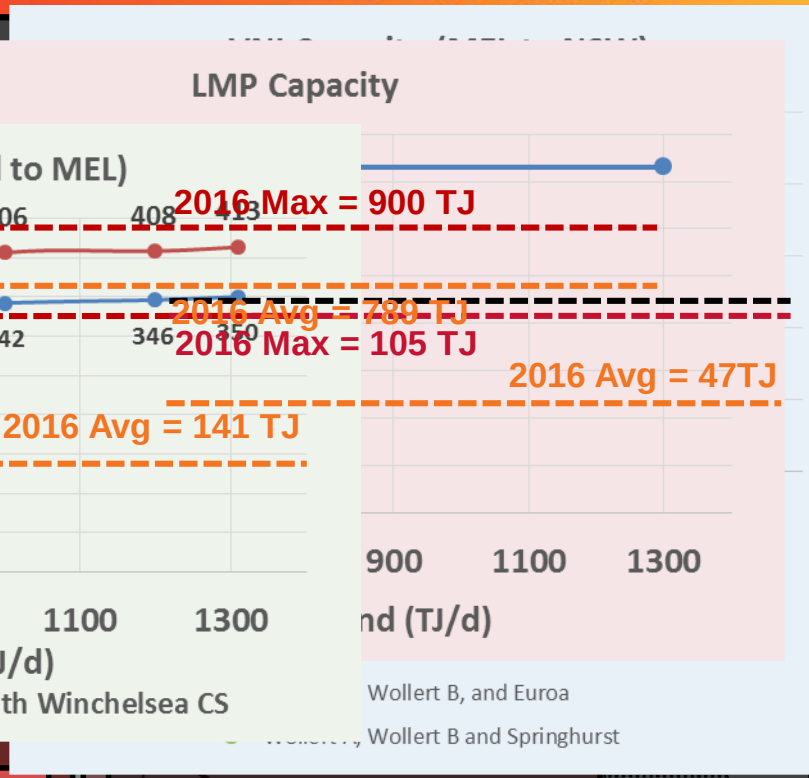


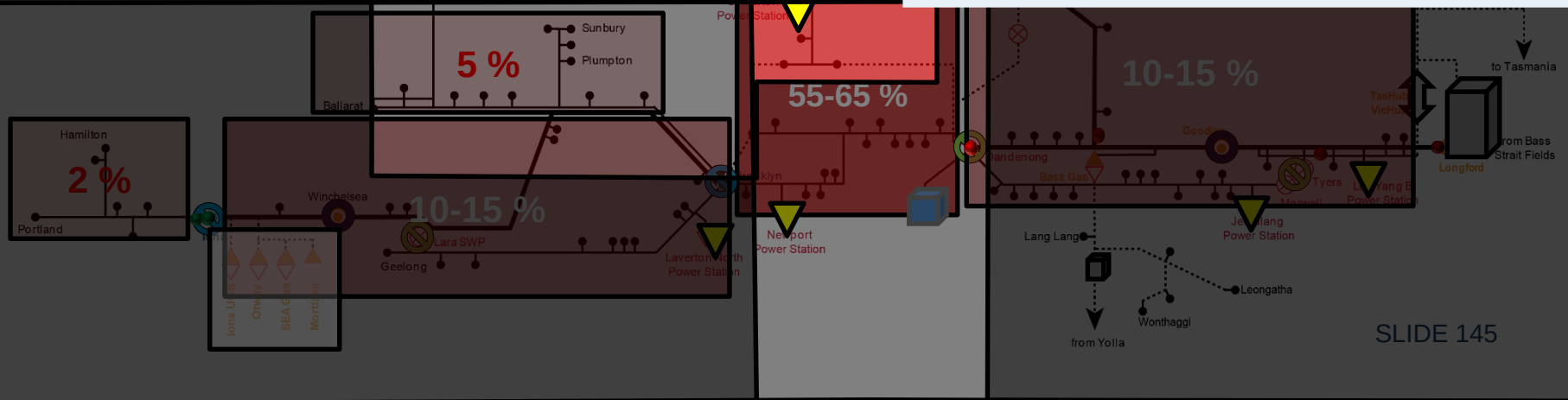
VICTORIAN DTS

- South West Pipeline
- Northern (VNI)
- Longford (LMP)
- Compressor Station + City Gate
- City Gate
- Compressor Station
- Gas Powered Generator (GPG)

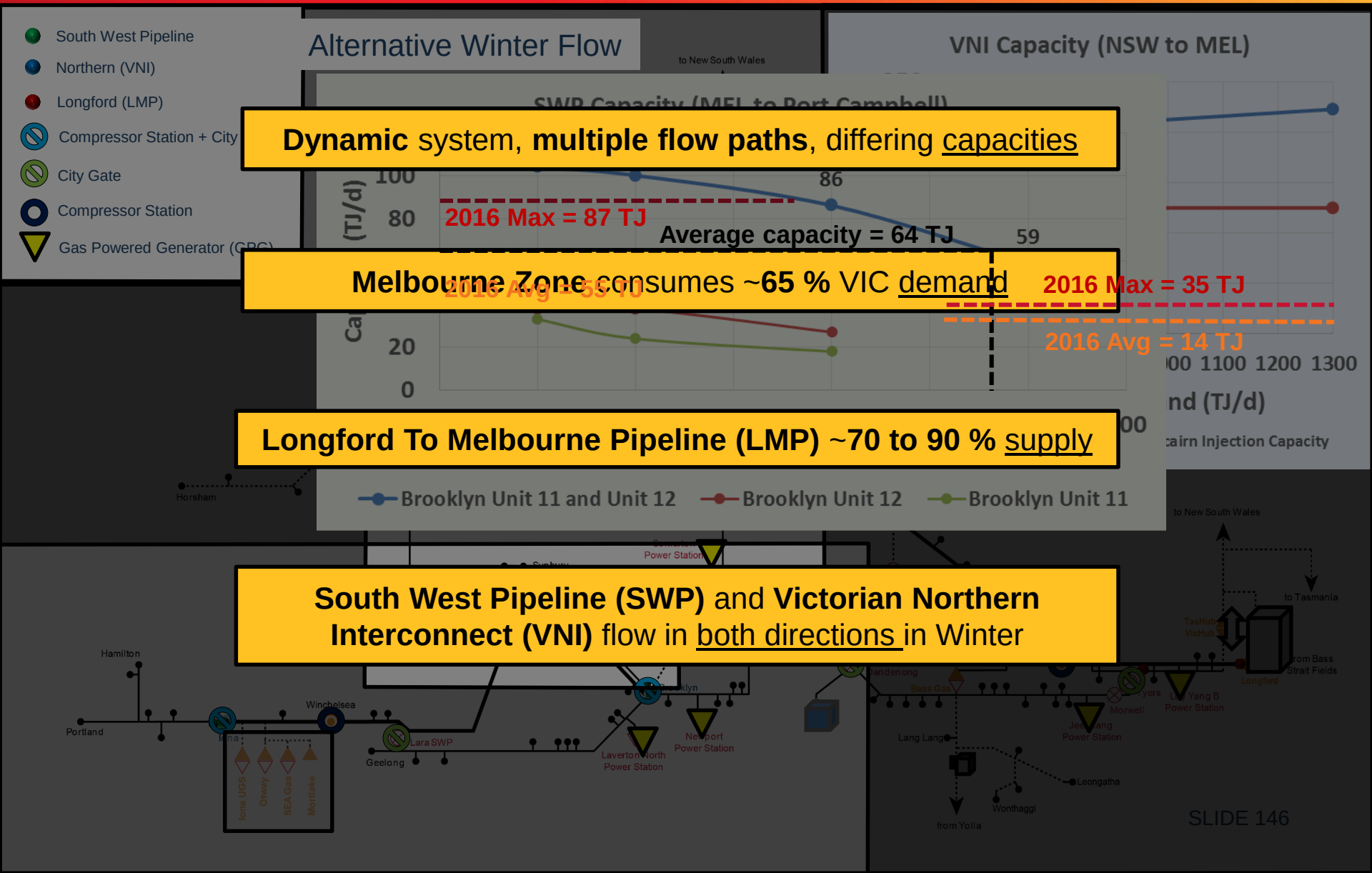
Typical Winter Flow





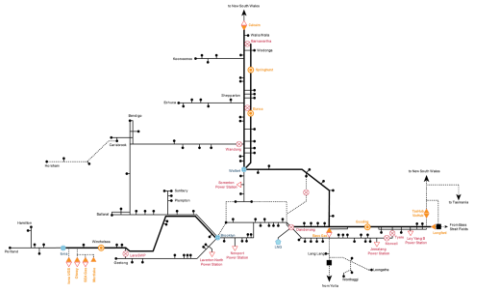


VICTORIAN DTS

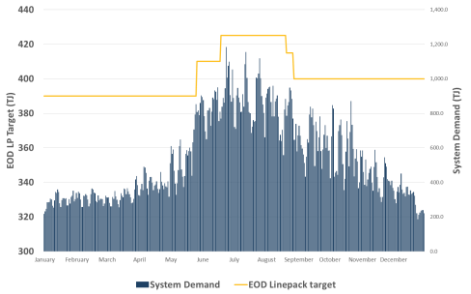


AGENDA

1. Victorian Declared Transmission System (DTS) Operations Overview

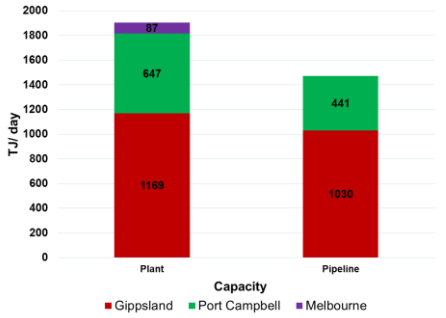


2. Linepack Adequacy



3. Supply and Demand Outlook

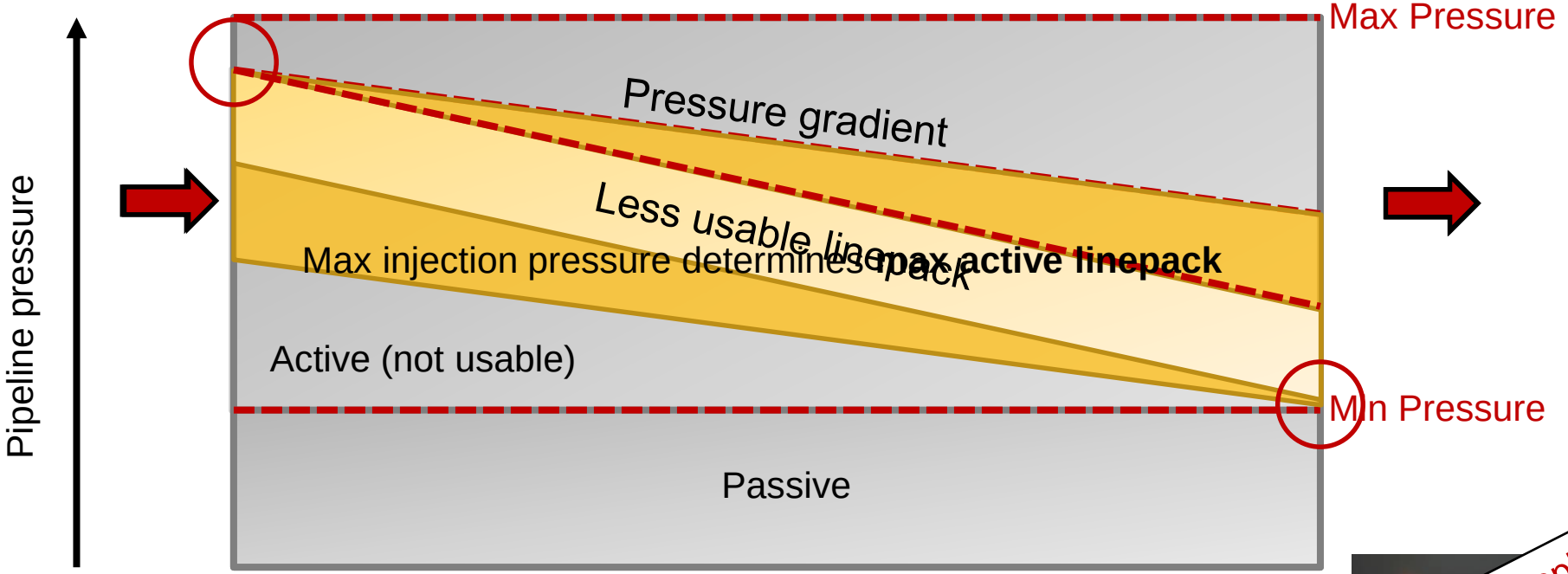
- Changing Demand Profile
- Gas Powered Generation
- Changing Flow Direction



WHAT IS LINEPACK?

Winter = Higher Demand = Higher Gas Flow
= **Less Usable Linepack**

Supply redu … and increase
Supply point … Demand point



DTS LINEPACK VS OTHER PIPELINES

Victorian Winter: **Minimal** time to respond to a major supply failure

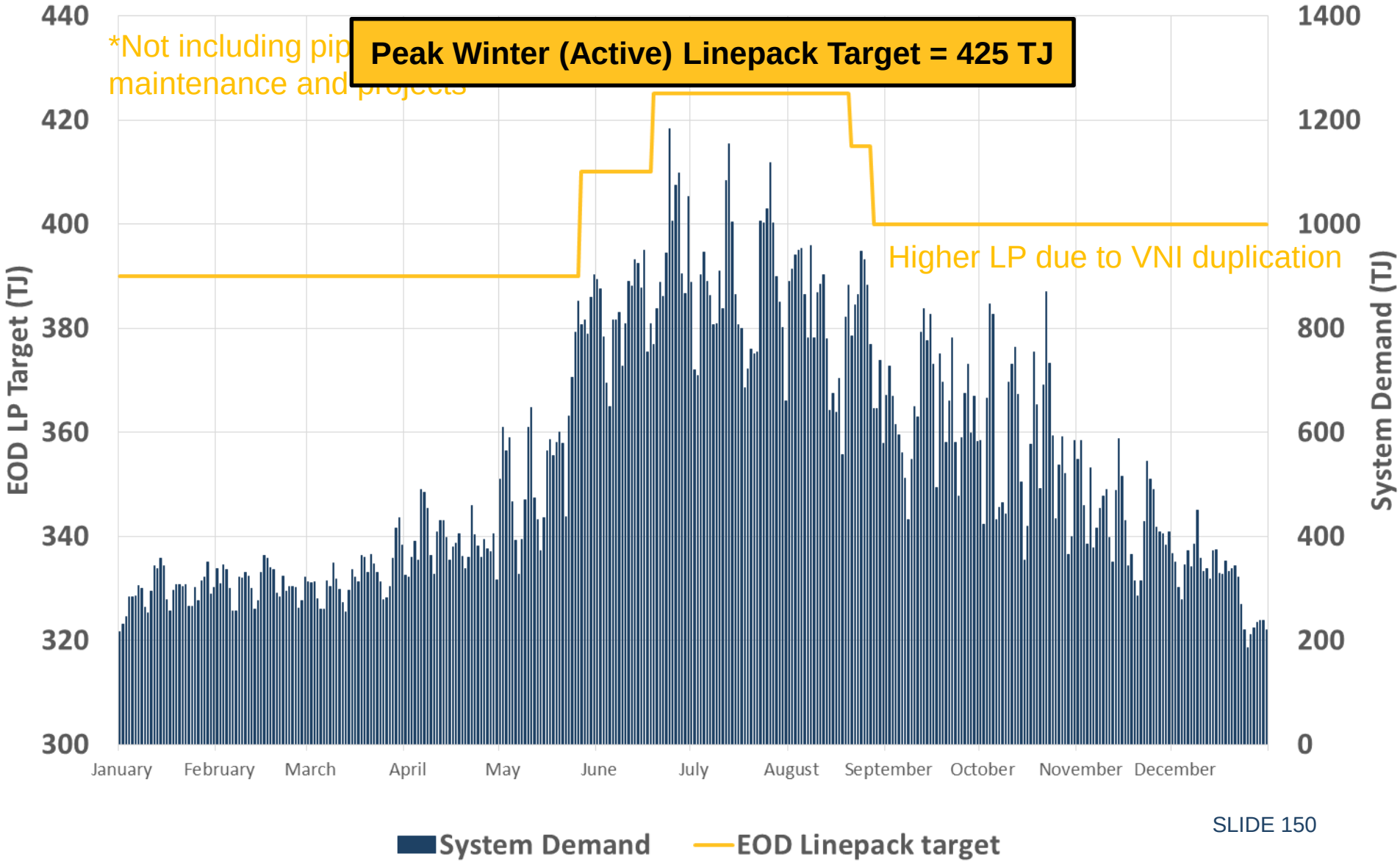
NSW/ ACT demand supplied by **two** major pipelines.

If major supply failure, **usable linepack** could **support NSW/ACT** demand for up to **three days**

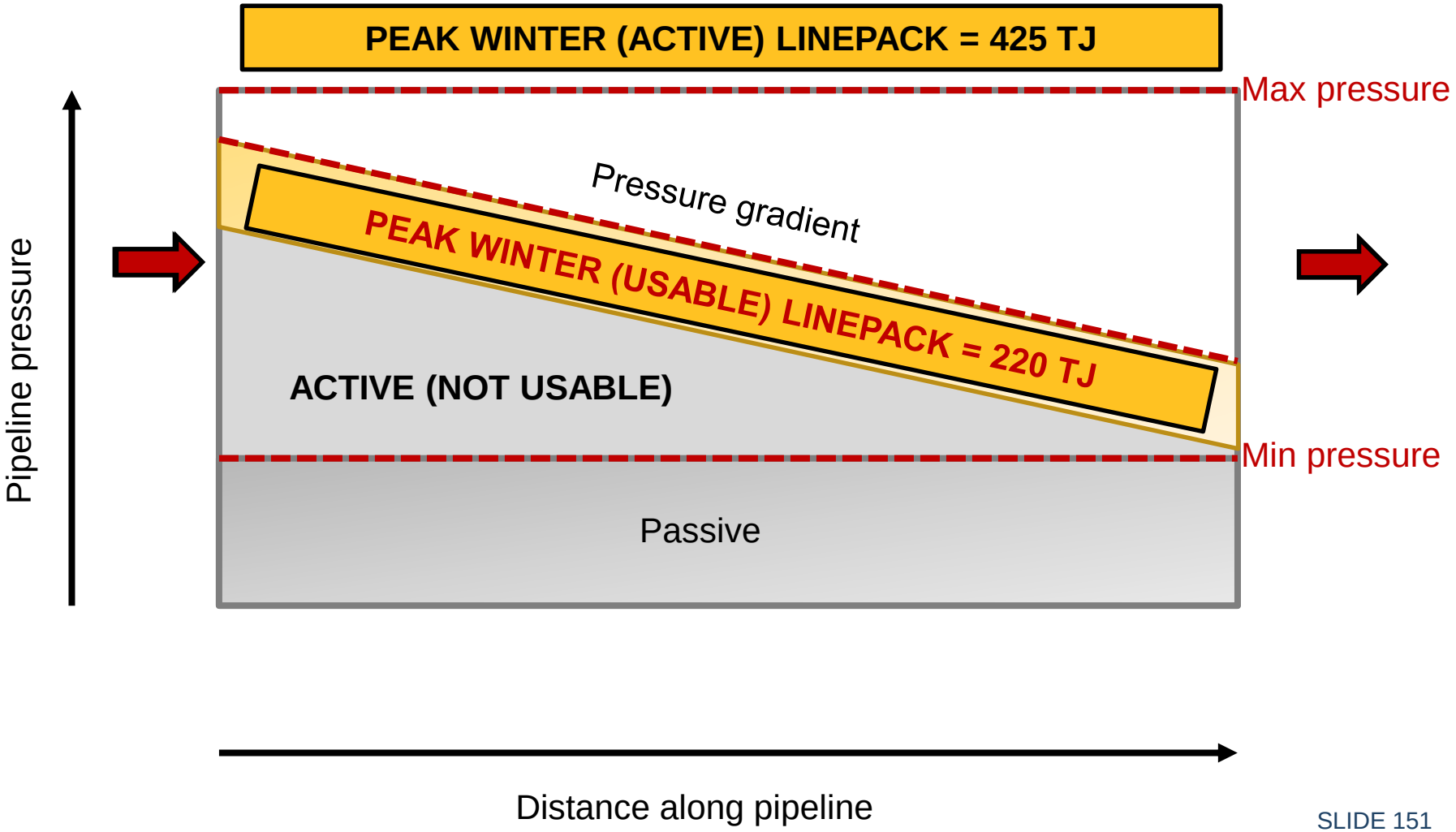
VIC demand supplied by **one** small interconnected network.

If major supply failure, **usable linepack** could **support VIC** demand for **two to four hours**.

SETTING END OF DAY (EOD) LINEPACK TARGET



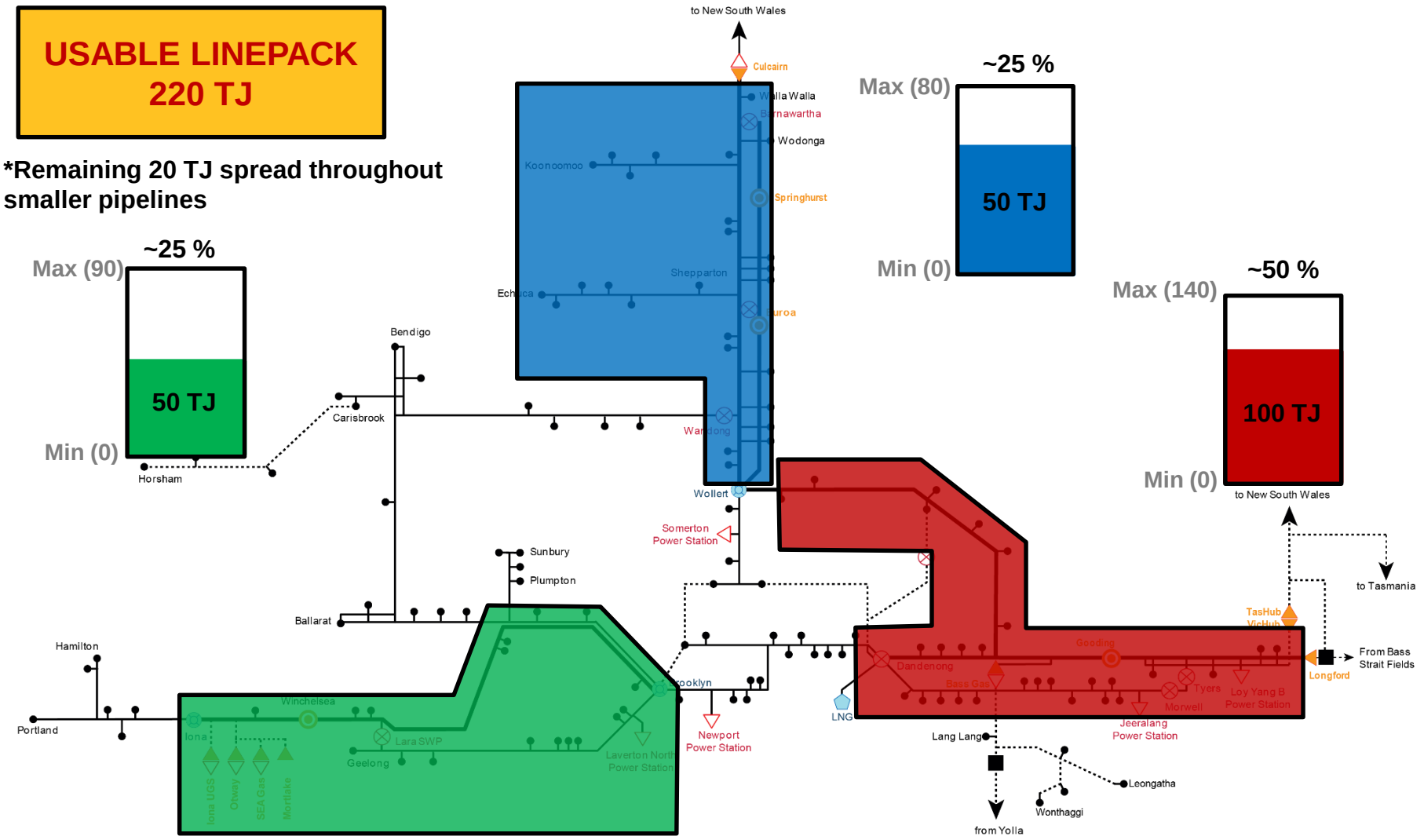
USABLE LINEPACK



IDEAL BEGINNING OF DAY (BOD) USABLE LINEPACK BALANCE

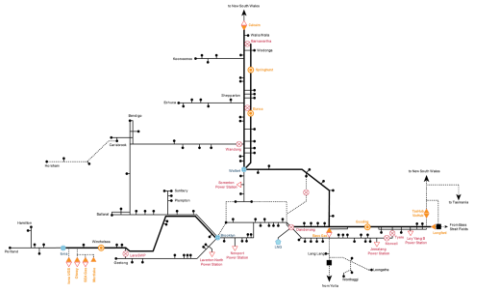
USABLE LINEPACK 220 TJ

***Remaining 20 TJ spread throughout smaller pipelines**

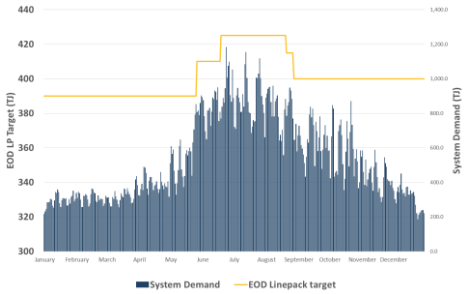


AGENDA

1. Victorian Declared Transmission System (DTS) Operations Overview

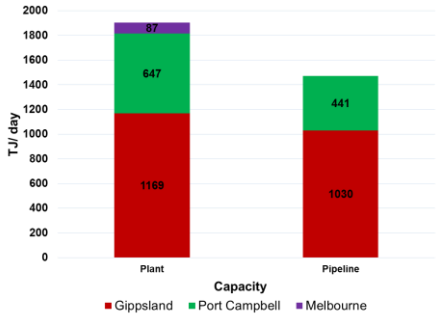


2. Linepack Adequacy



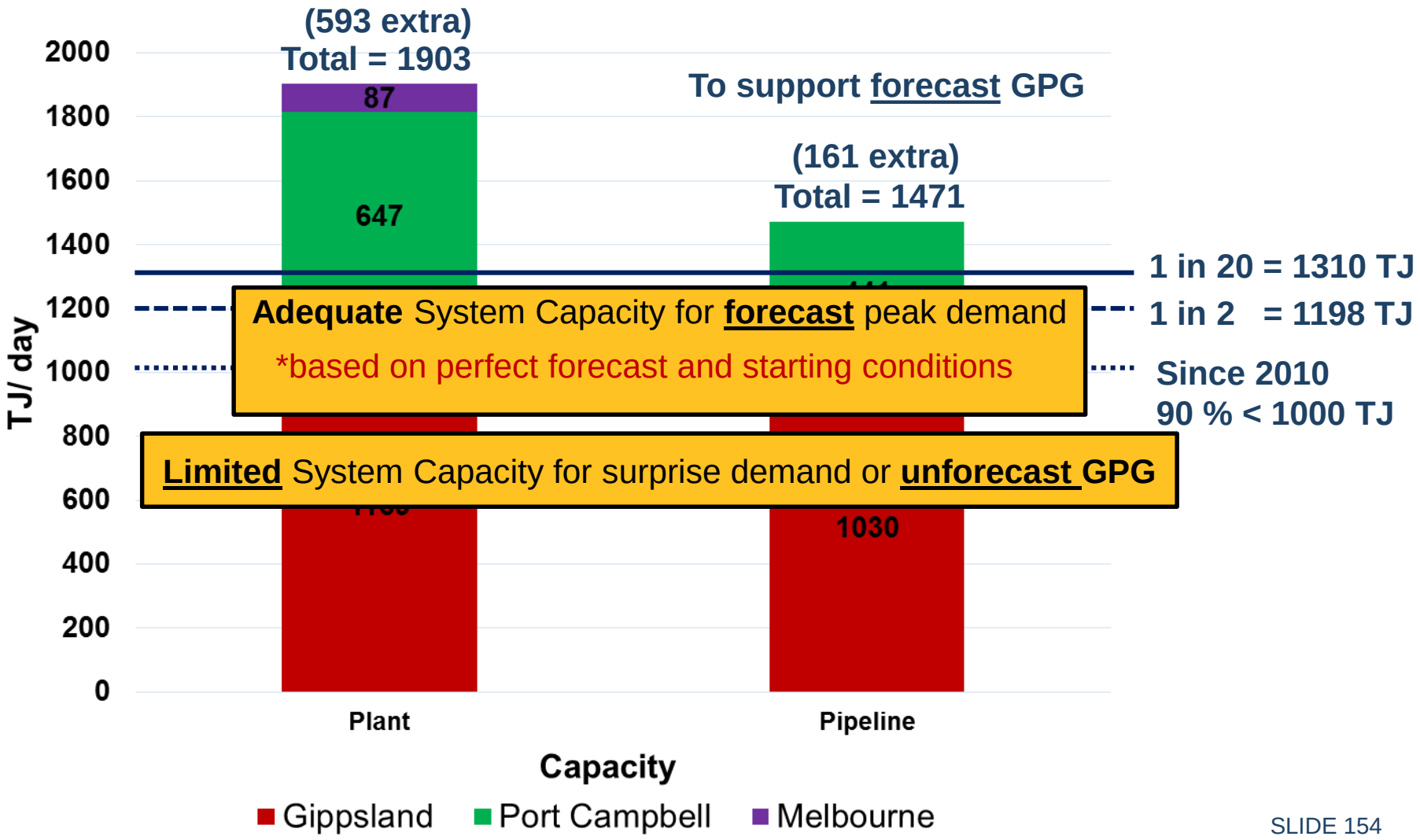
3. <u>Supply and Demand Outlook</u>

- Changing Demand Profile
- Gas Powered Generation
- Changing Flow Direction



SUPPLY DEMAND ADEQUACY

To supply interconnected pipelines and forecast GPG



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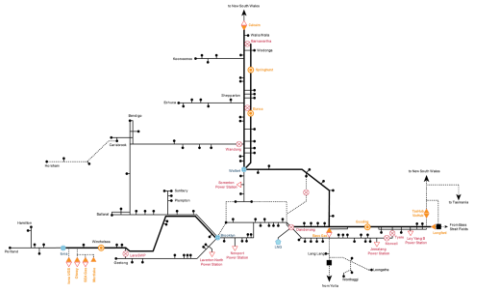

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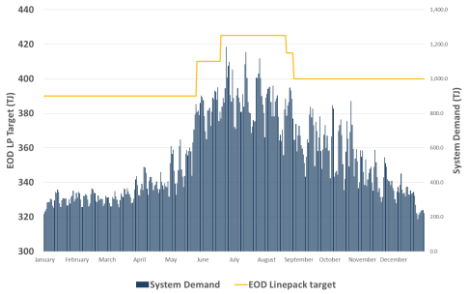
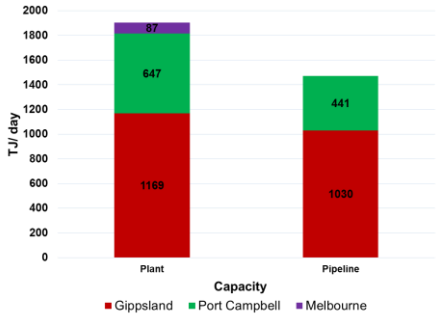
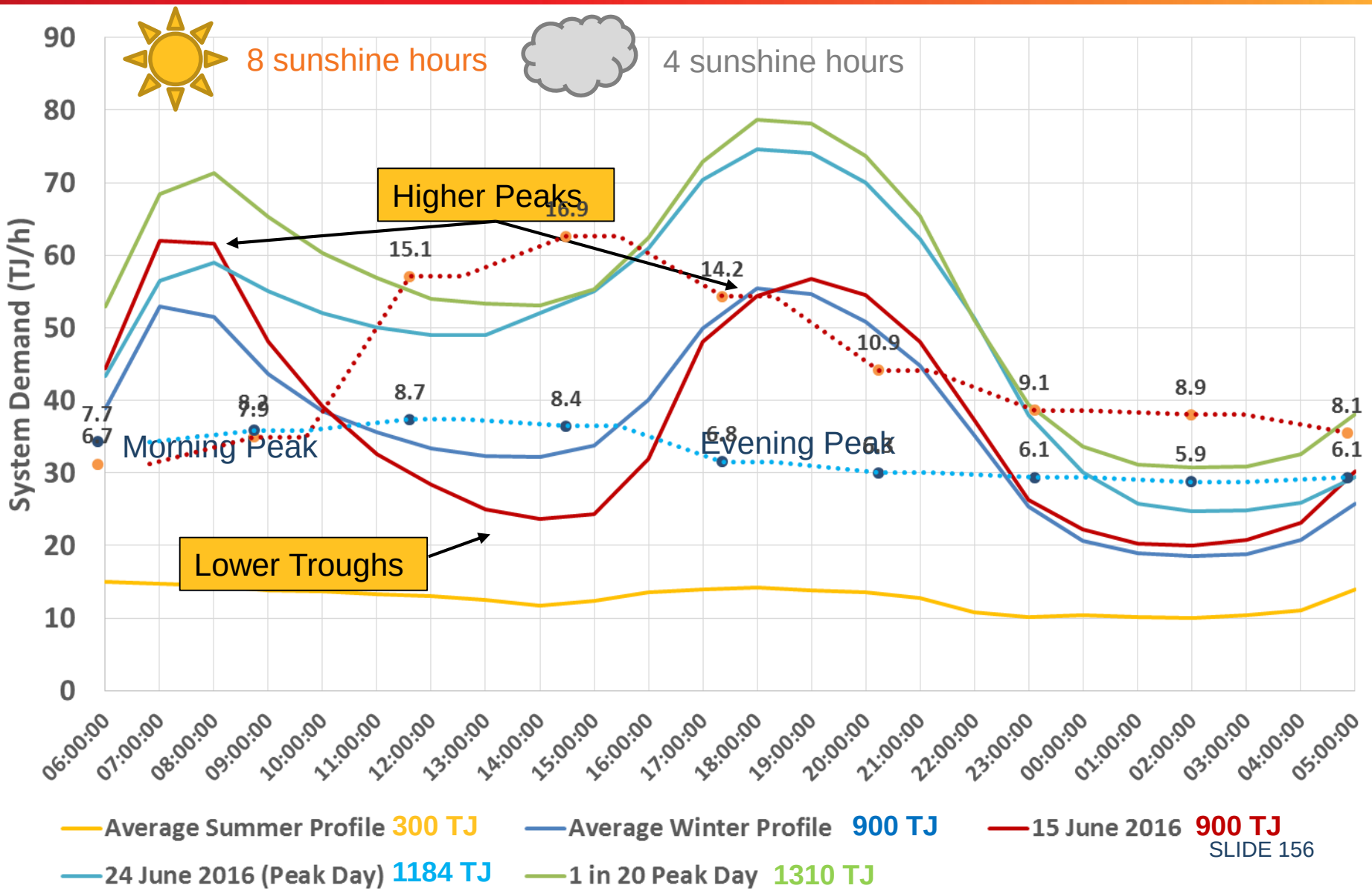


3. Supply and Demand Outlook

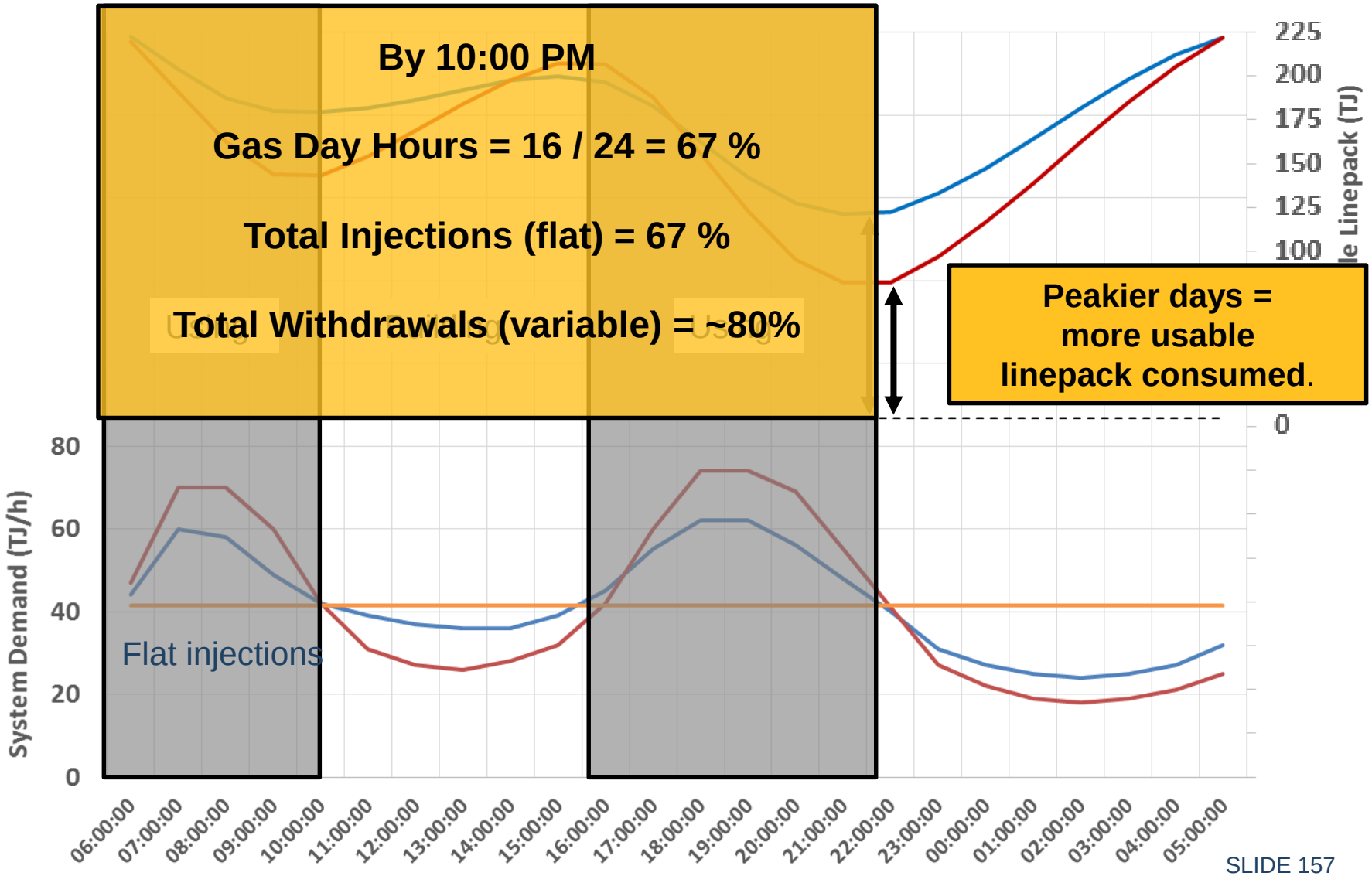
- **Changing Demand Profile**
- Gas Powered Generation
- Changing Flow Direction



DEMAND PROFILE



IMPACT OF PEAKY DAYS ON LINEPACK



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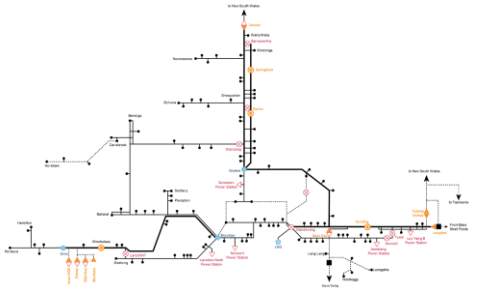

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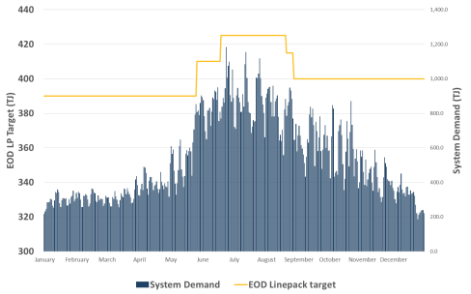
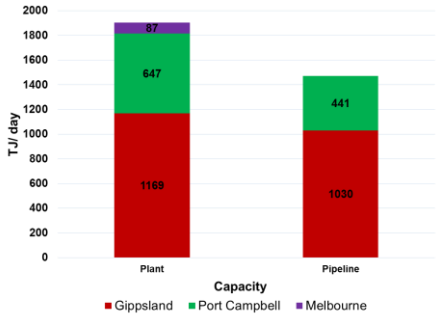
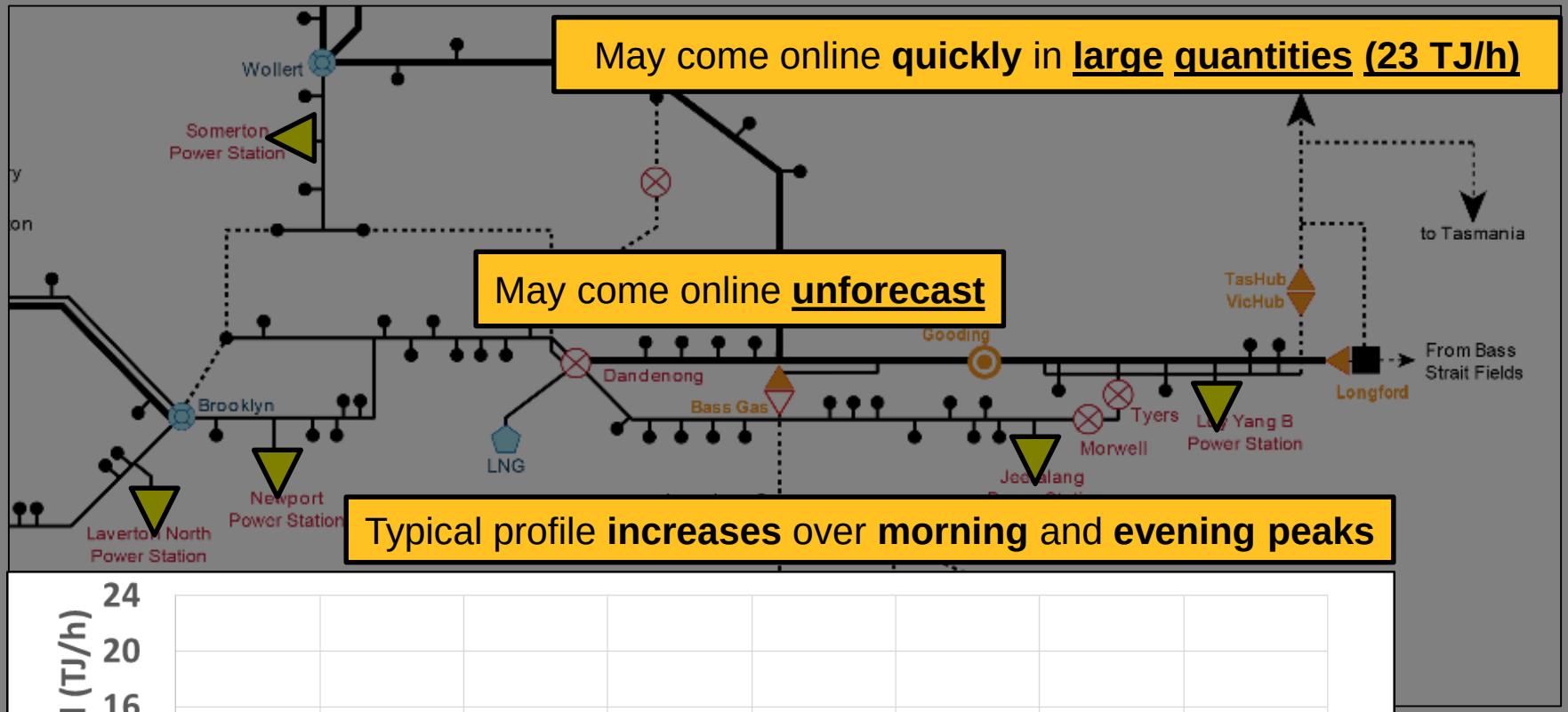


3. Supply and Demand Outlook

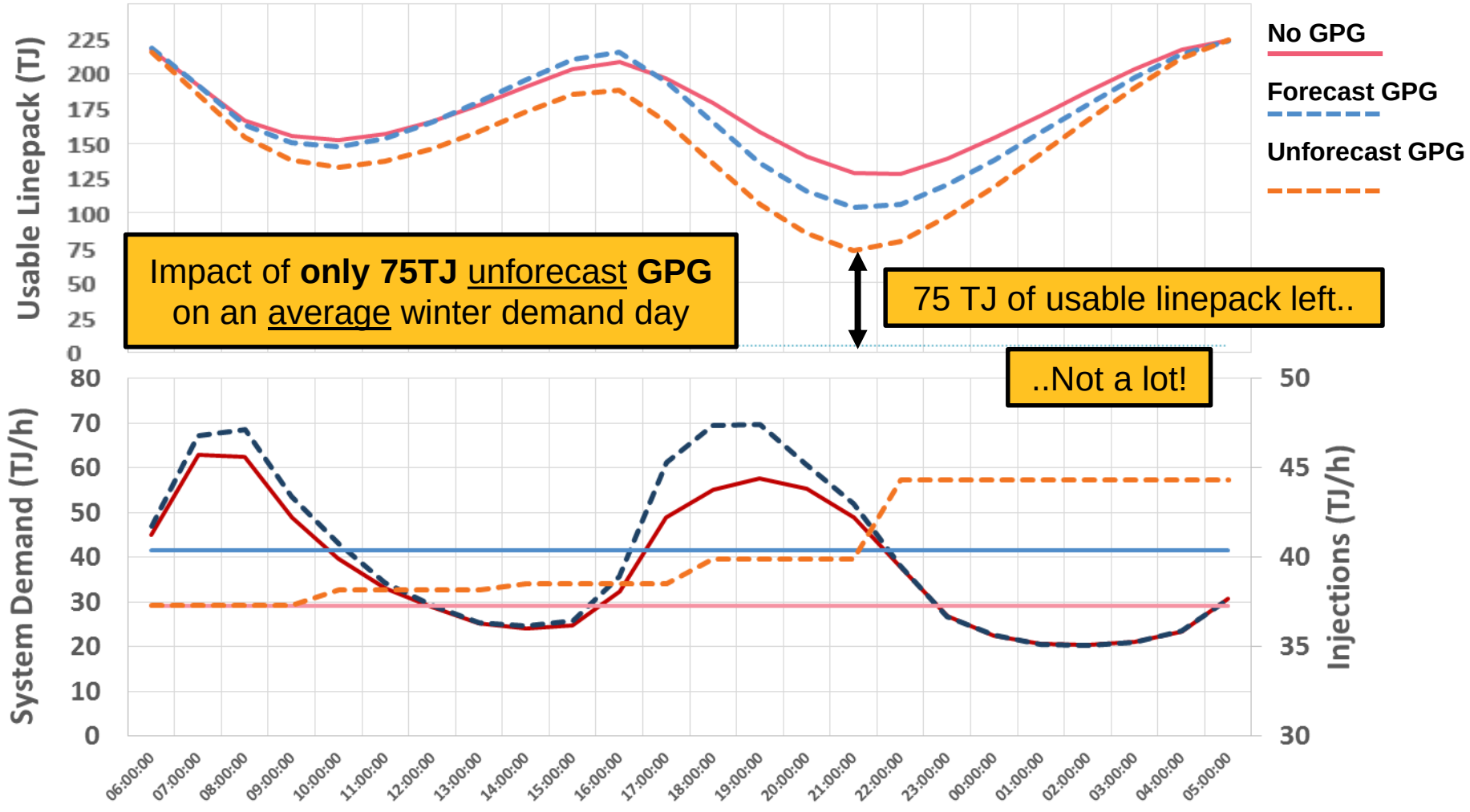
- Changing Demand Profile
- **Gas Powered Generation**
- Changing Flow Direction



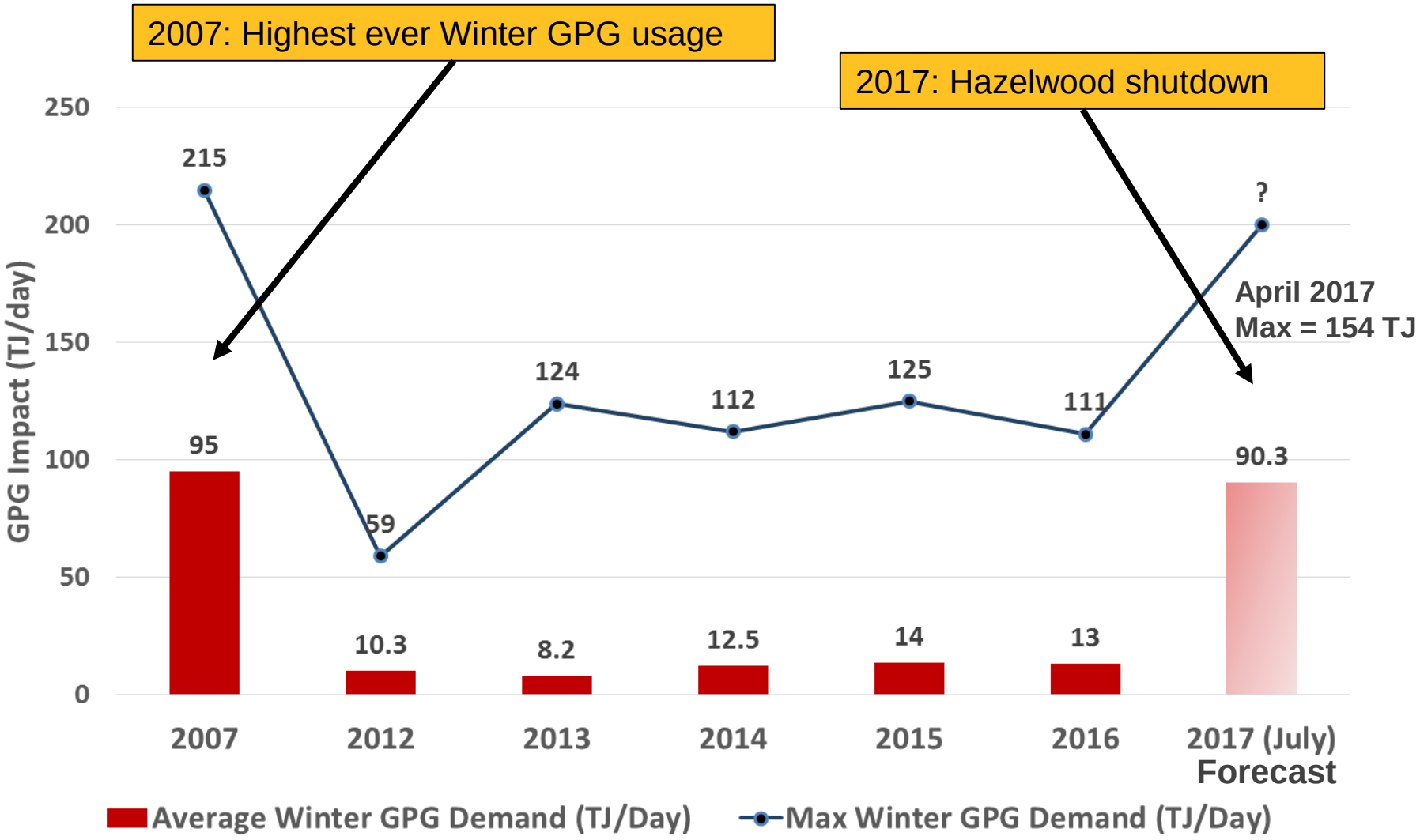
DTS GAS POWERED GENERATORS



Total
~23 TJ/h


Usable Linepack (TJ)
225
200
175
150
125
100
75
50
25
0
No GPG
Forecast GPG
Unforecast GPG
Impact of only 75TJ unforecast GPG on an average winter demand day
75 TJ of usable linepack left..
..Not a lot!
System Demand (TJ/h)
80
70
60
50
40
30
20
10
0
Injections (TJ/h)
50
45
40
35
30
06:00:00
07:00:00
08:00:00
09:00:00
10:00:00
11:00:00
12:00:00
13:00:00
14:00:00
15:00:00
16:00:00
17:00:00
18:00:00
19:00:00
20:00:00
21:00:00
22:00:00
23:00:00
00:00:00
01:00:00
02:00:00
03:00:00
04:00:00
05:00:00
System Demand
Total Demand
Injections (no GPG)
Injections (Unforecast GPG)
Injections (forecast GPG)

GAS POWERED GENERATION (GPG) OUTLOOK



3.4 Gas power generation demand

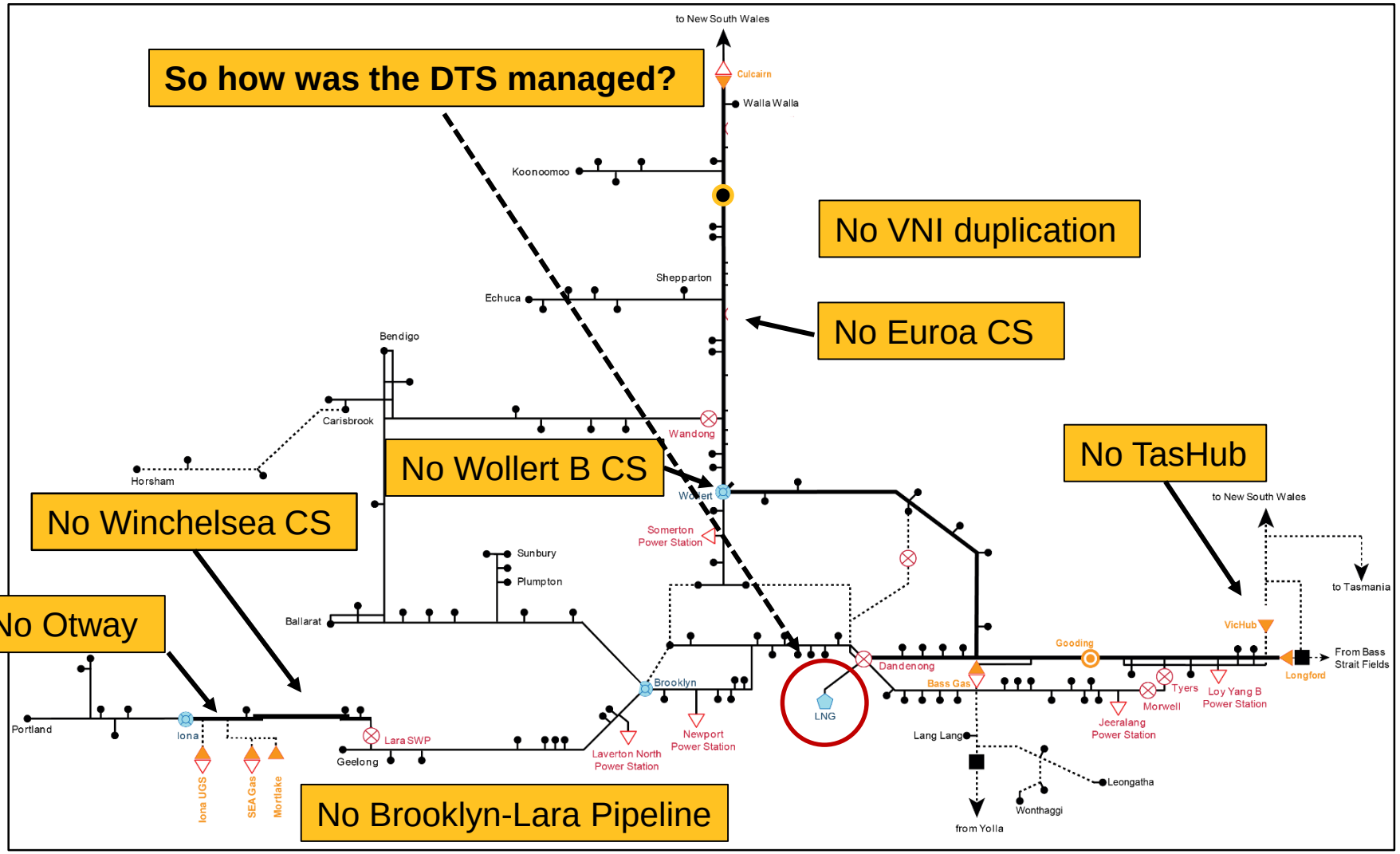
Historically, gas power generation (GPG) demand has been sensitive to a number of factors, including:

- weather conditions, particularly during extreme weather events in summer and winter when peak electricity demands are highest;
- unplanned generation plant outages;
- contractual arrangements between electricity retailers and individual GPGs; and
- planned load transfers, associated with National Electricity Market (NEM) adequacy of supplies and regional capacity transfers.

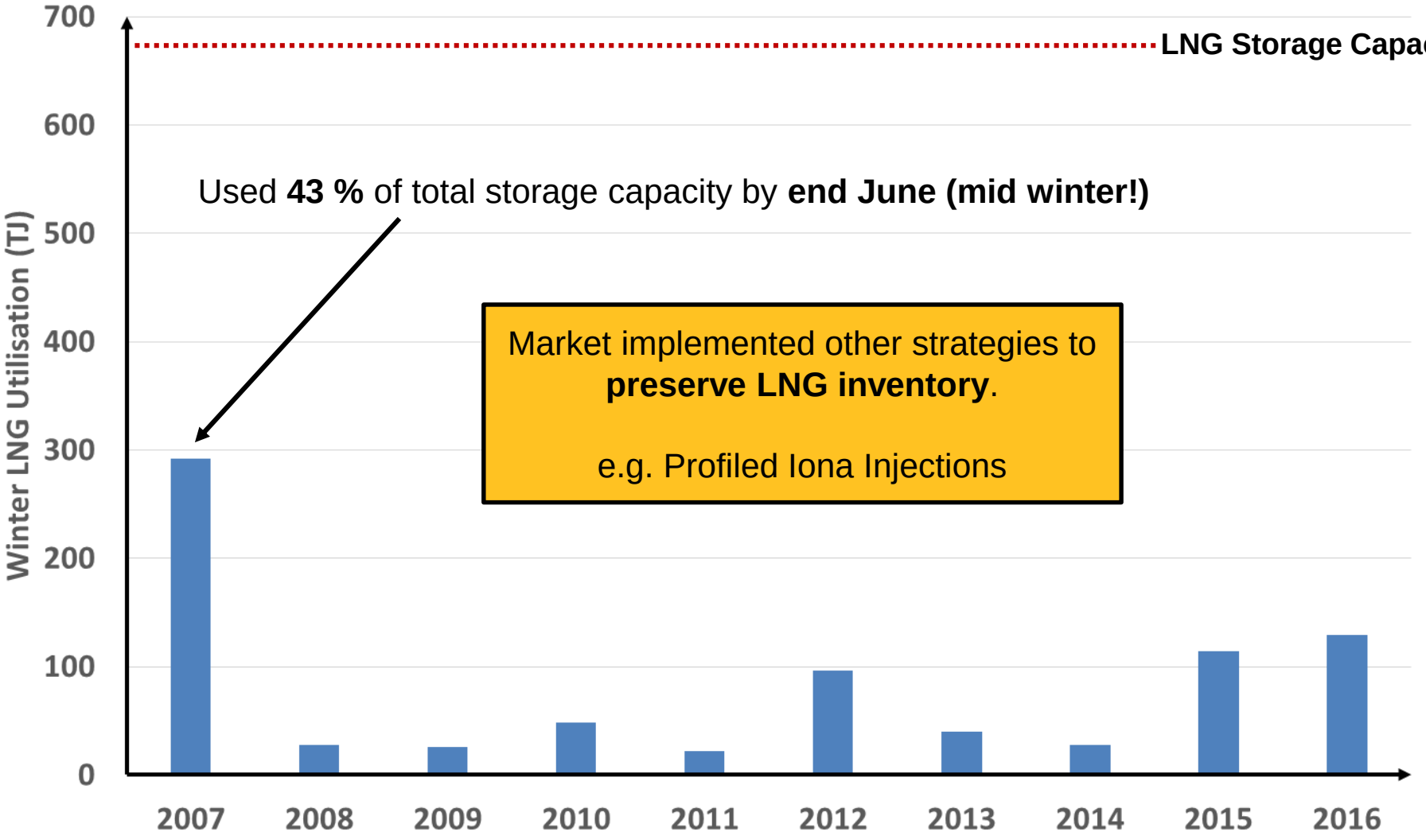
Water restrictions for hydroelectric and coal-fired generation led to **substantially higher GPG** demand.

impact of the drought over the next few years, slowly returning to underlying demand levels by 2010 [3]. A carbon price will reduce the price of gas-fired generation relative to coal-fired generation, potentially increasing GPG demand from 2012 onwards.

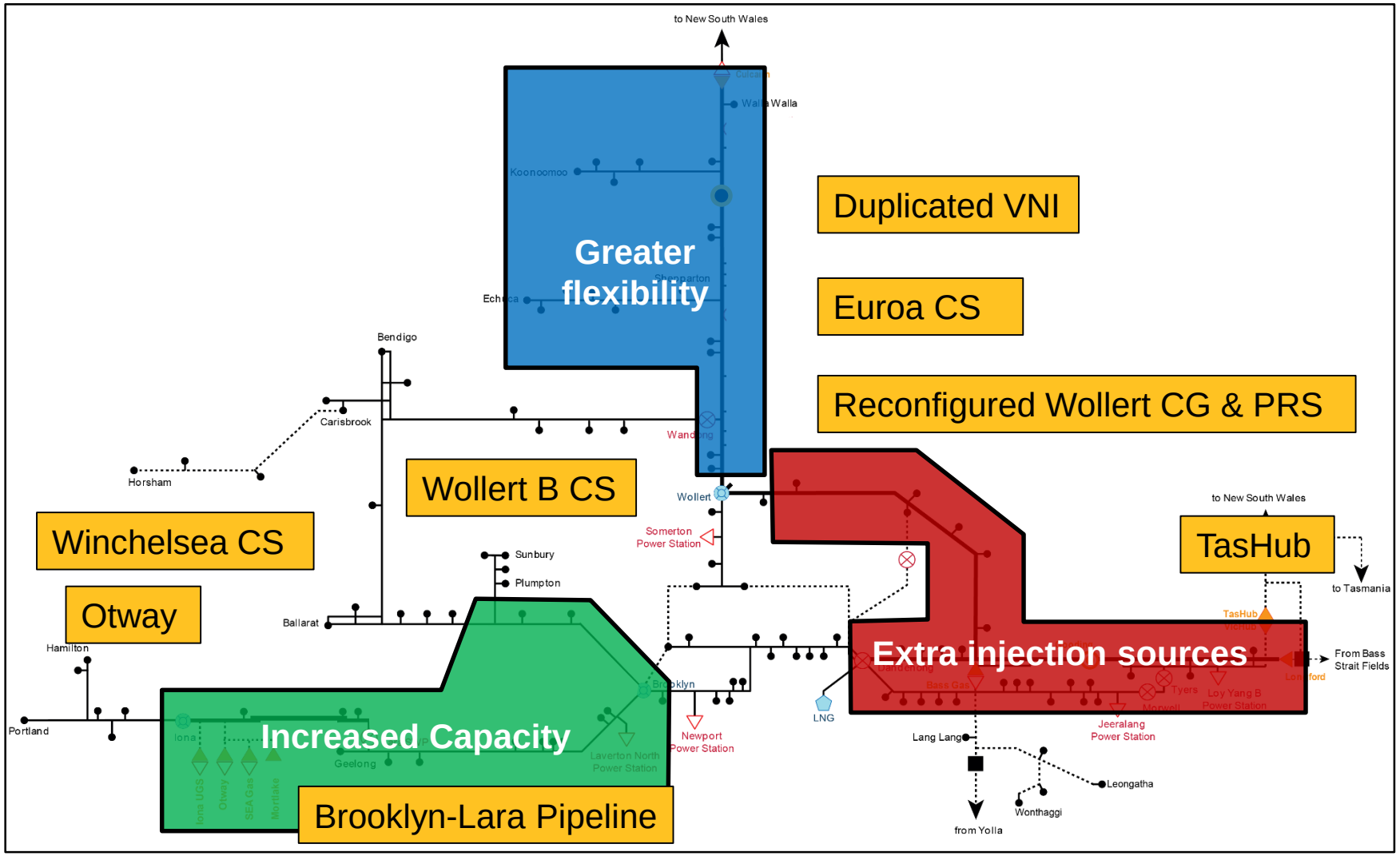
WHAT DID THE DTS LOOK LIKE IN 2007?



WINTER LNG UTILISATION



DTS IN 2017

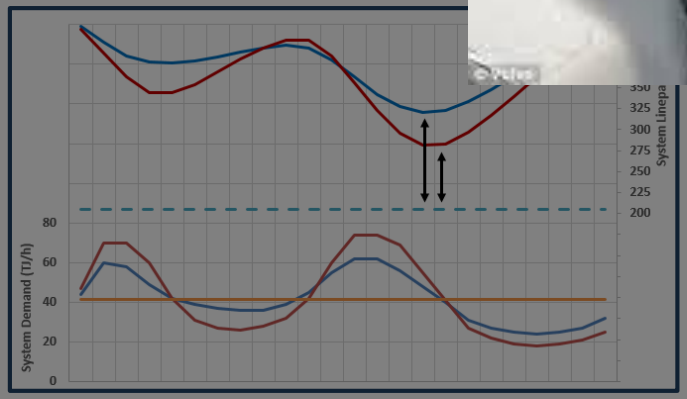

to New South Wales
Culcairn
Wagga Wagga
Koonoomoo
Greater flexibility
Duplicated VNI
Euroa CS
Reconfigured Wollert CG & PRS
Bendigo
Carisbrook
Horsham
Wollert
Wollert B CS
Winchelsea CS
Somerton Power Station
Sunbury
Plumpton
Ballarat
Otway
Hamilton
Portland
Iona
Geelong
Brooklyn
Laverton North Power Station
Newport Power Station
Increased Capacity
Brooklyn-Lara Pipeline
LNG
Extra injection sources
Bass Gas
Tyers
Loy Yang B Power Station
Jeeralang Power Station
Lang Lang
Leongatha
Wonthaggi
from Yolla
to New South Wales
TasHub
to Tasmania
From Bass Strait Fields

GPG IMPACT 2007 VS 2017

CHALLENGES

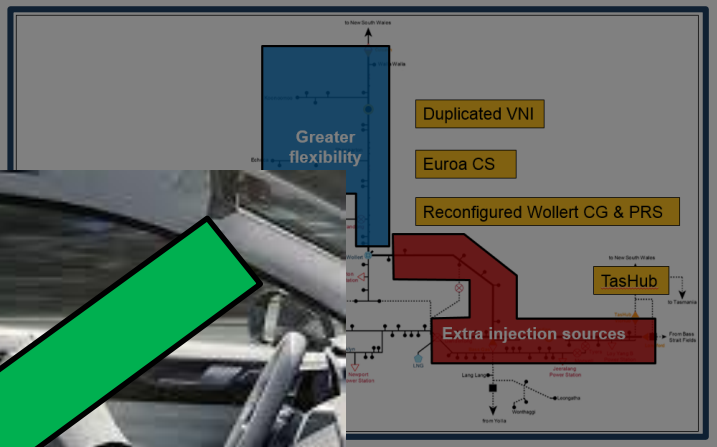
Tighter east coast gas supply

Changing load prof



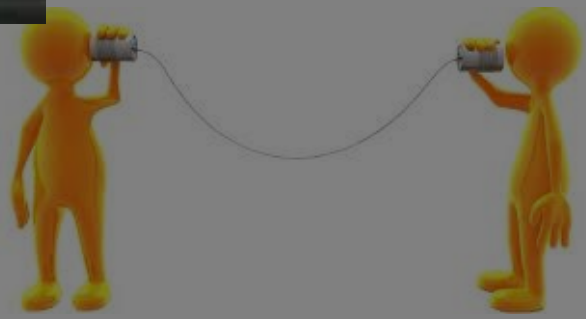
ADVANTAGES

Better equipped gas system



RTICIPANTS

Good communication



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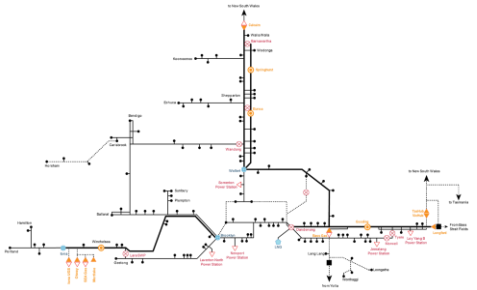

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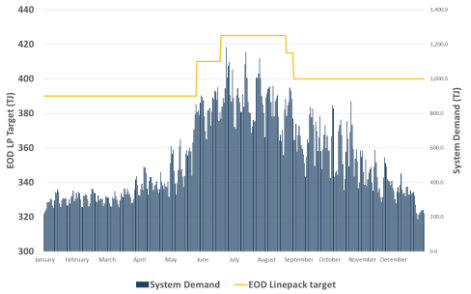

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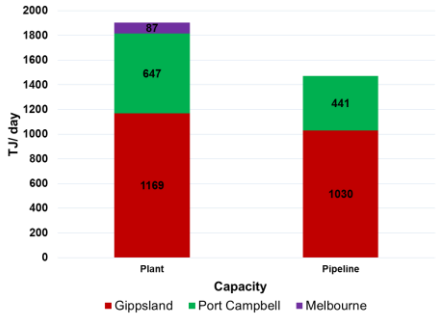
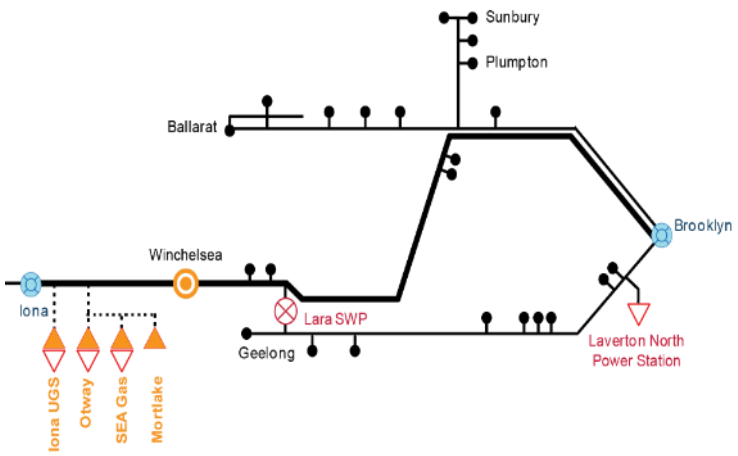
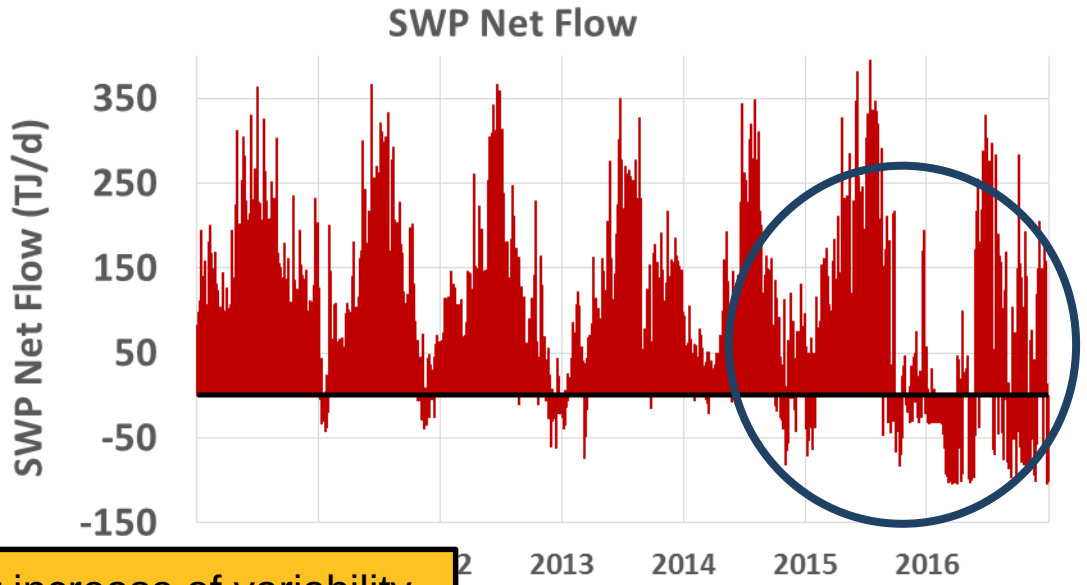
- Changing Demand Profile
- Gas Powered Generation
- **Changing Flow Direction**

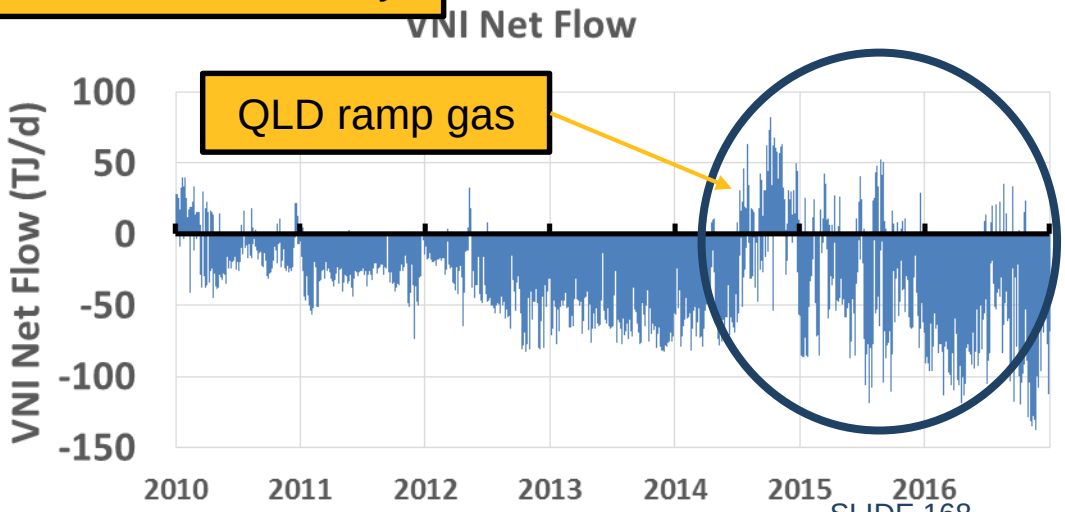


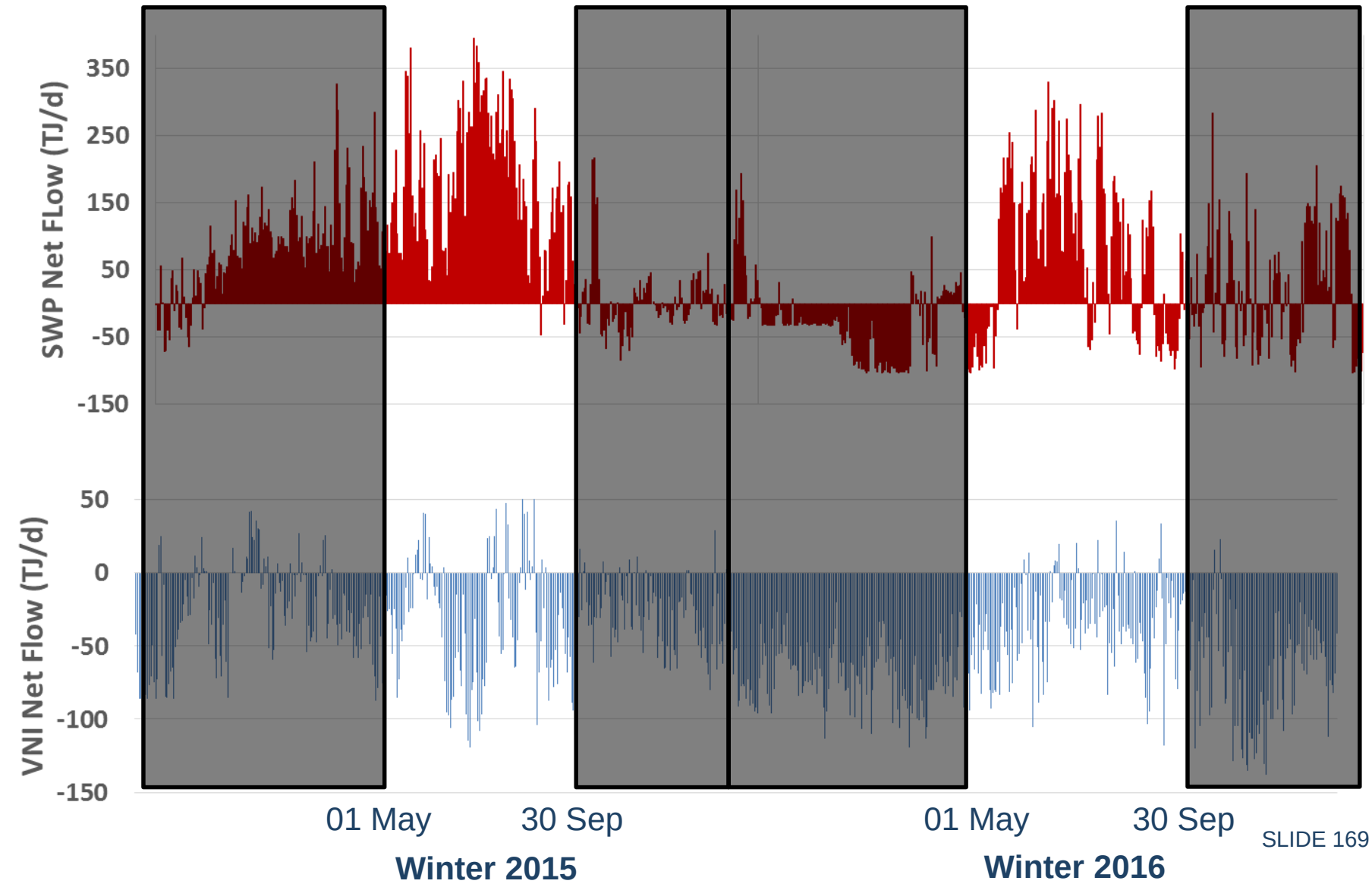
CHANGING FLOW DIRECTION



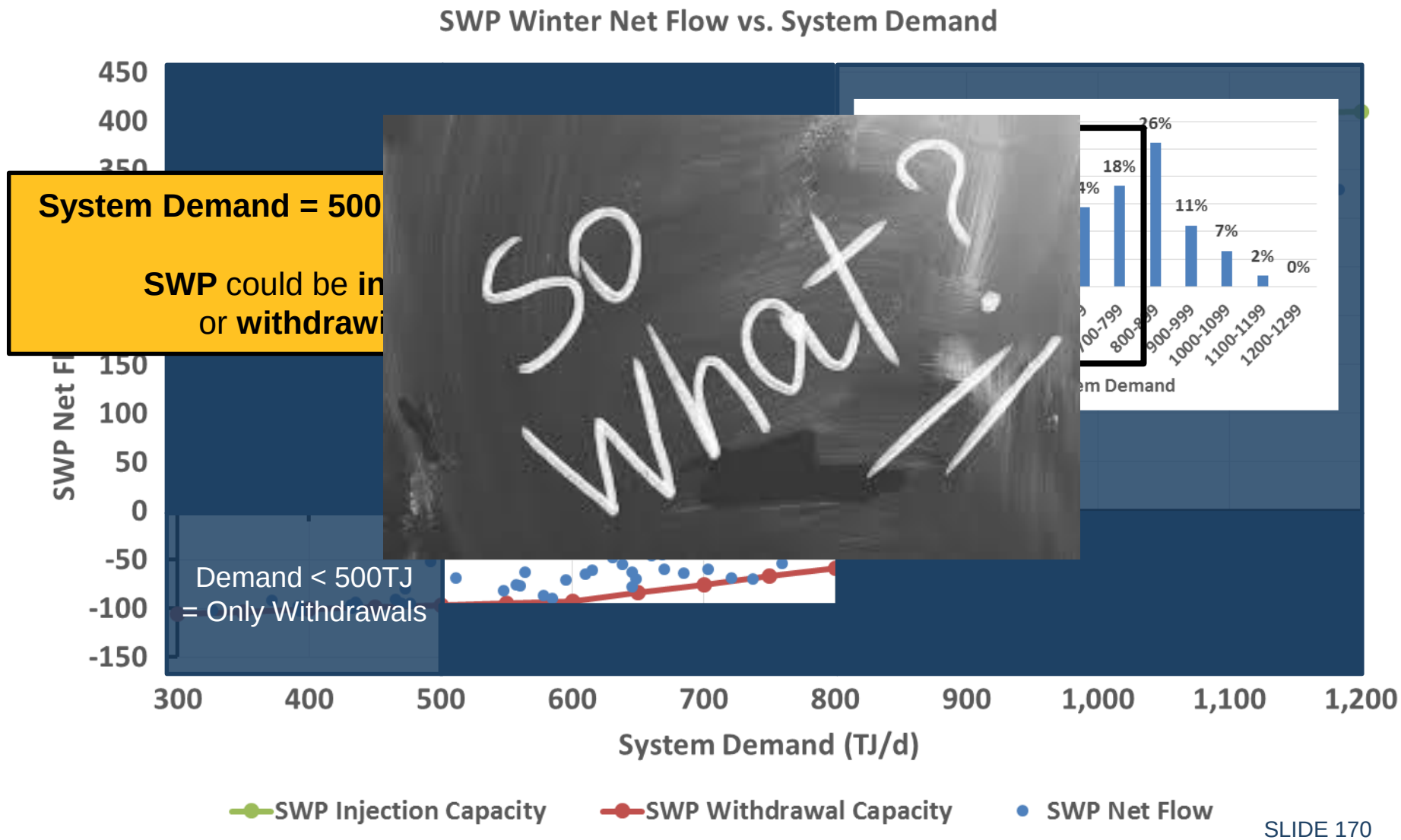


Significant increase of variability



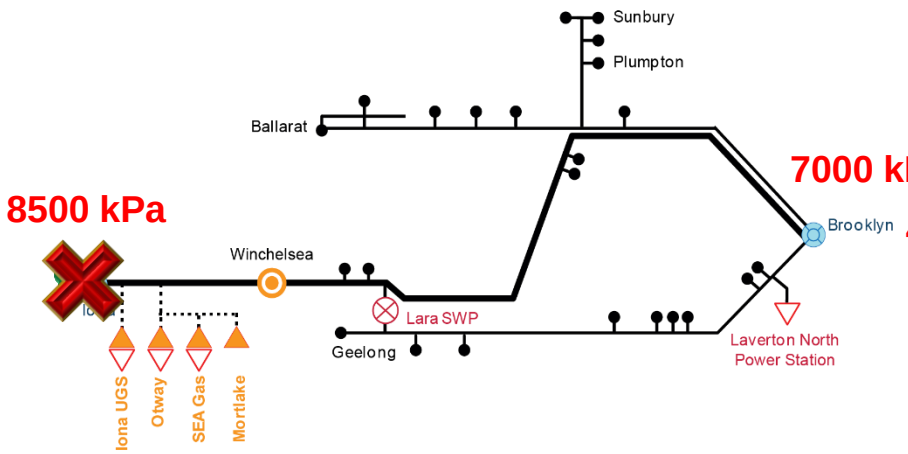

SWP Net FLow (TJ/d)
350
250
150
50
-50
-150
VNI Net Flow (TJ/d)
50
0
-50
-100
-150
01 May
30 Sep
01 May
30 Sep
Winter 2015
Winter 2016

SWP WINTER NET FLOW



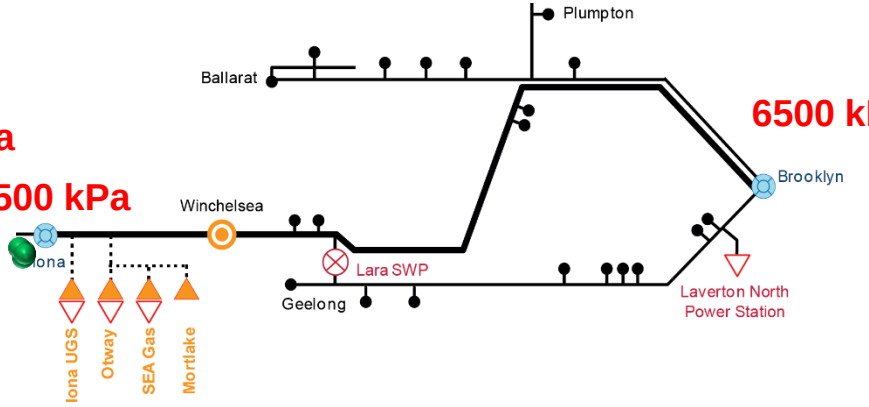
IMPACT OF FLOW DIRECTION CHANGES

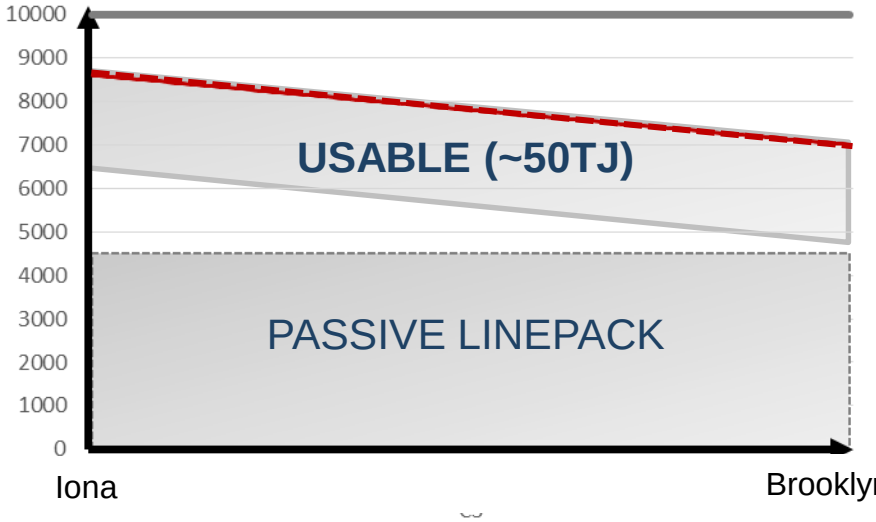
SWP INJECTIONS

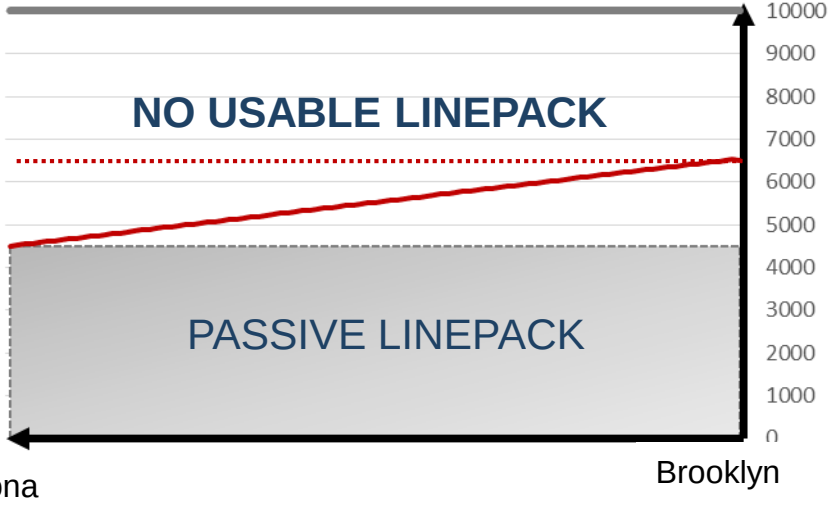


SWP WITHDRAWALS

Maximum Brooklyn CS Discharge Pressure

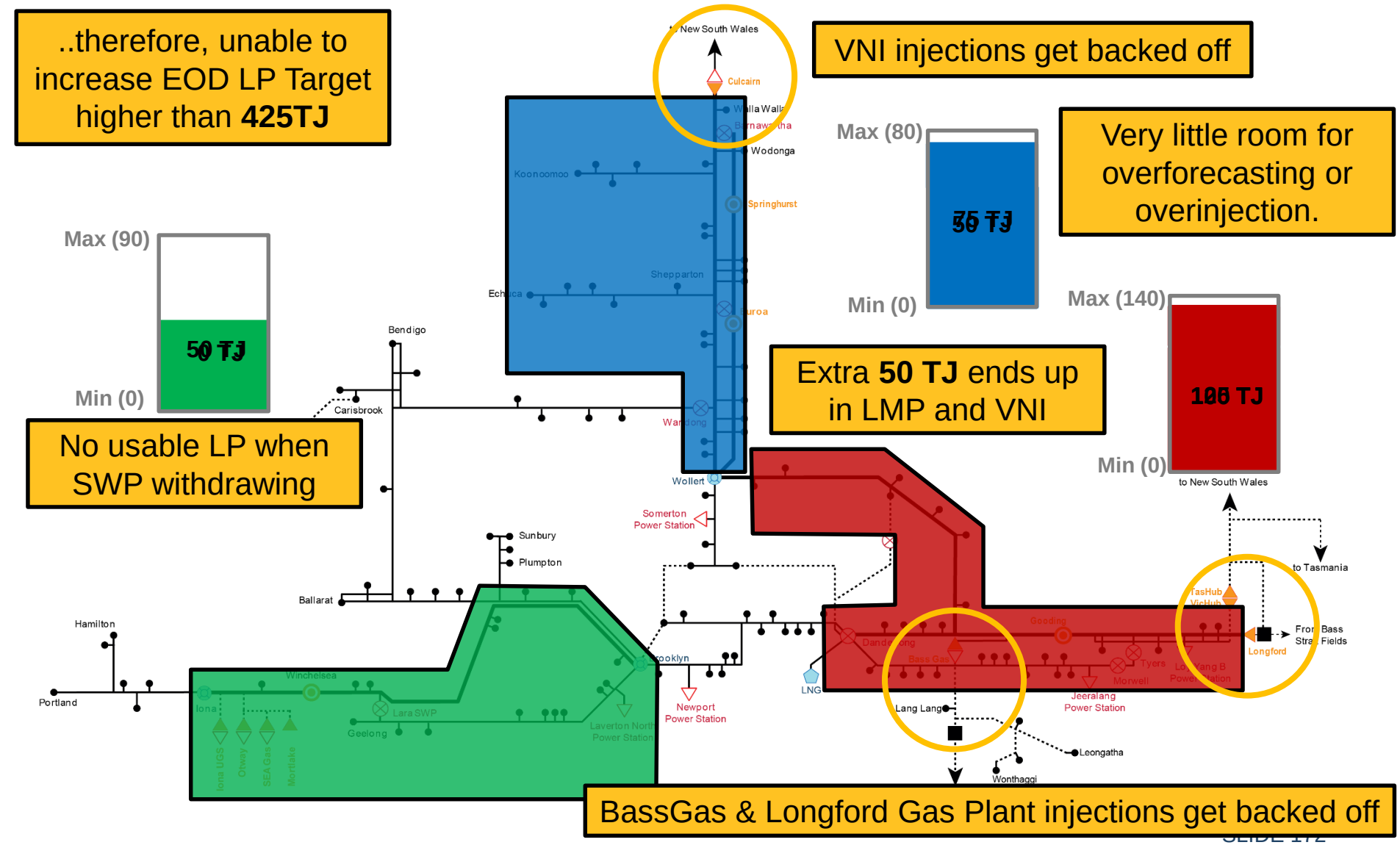






MANAGING SWP SWINGS

..therefore, unable to increase EOD LP Target higher than **425TJ**



Max (90)

50 TJ

Min (0)

No usable LP when SWP withdrawing

VNI injections get backed off

Max (80)

35 TJ

Min (0)

Very little room for overforecasting or overinjection.

Extra **50 TJ** ends up in LMP and VNI

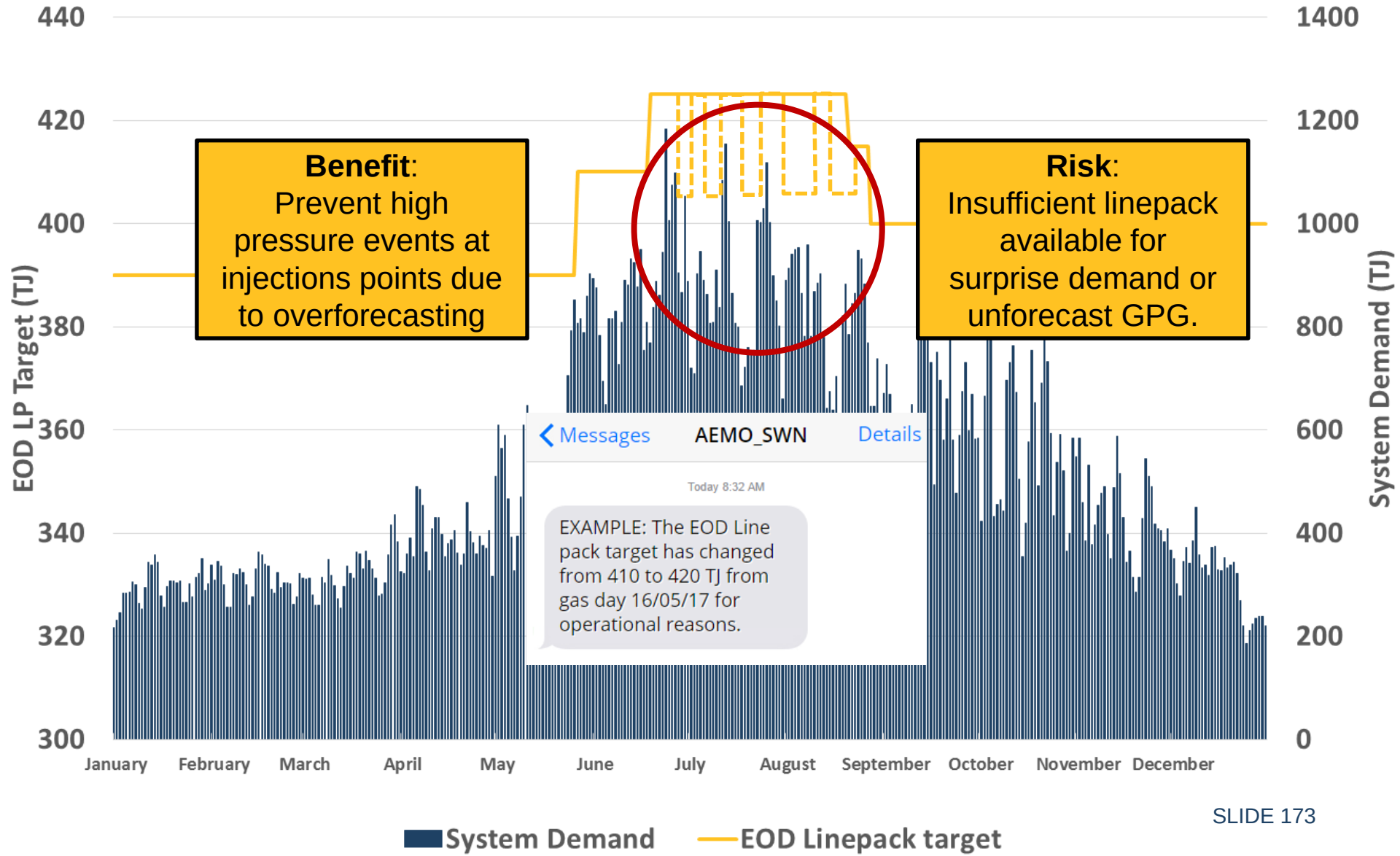
Max (140)

100 TJ

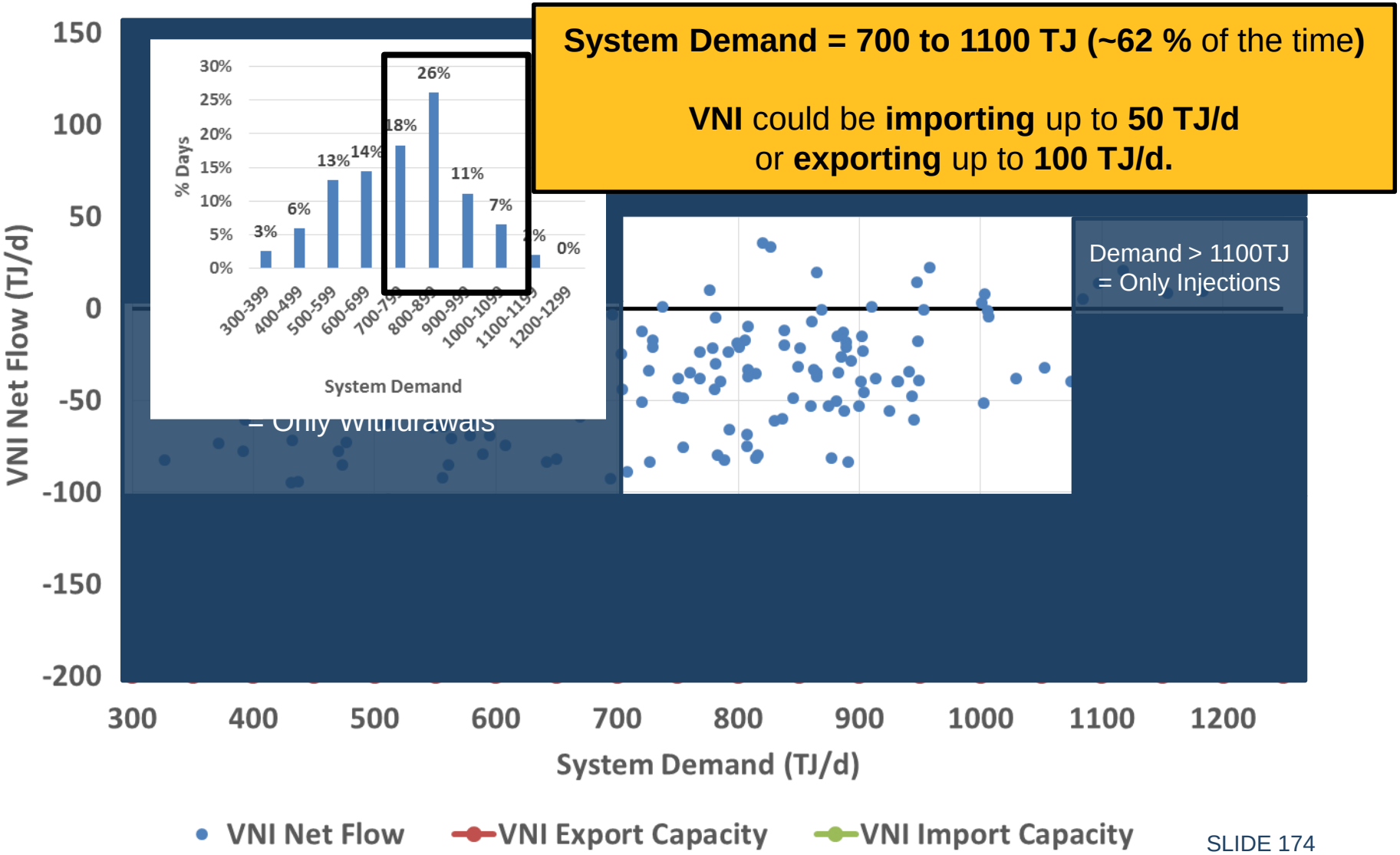
Min (0)

BassGas & Longford Gas Plant injections get backed off

REDUCING LINEPACK TARGET



VNI WINTER NET FLOW



MANAGING VNI SWINGS

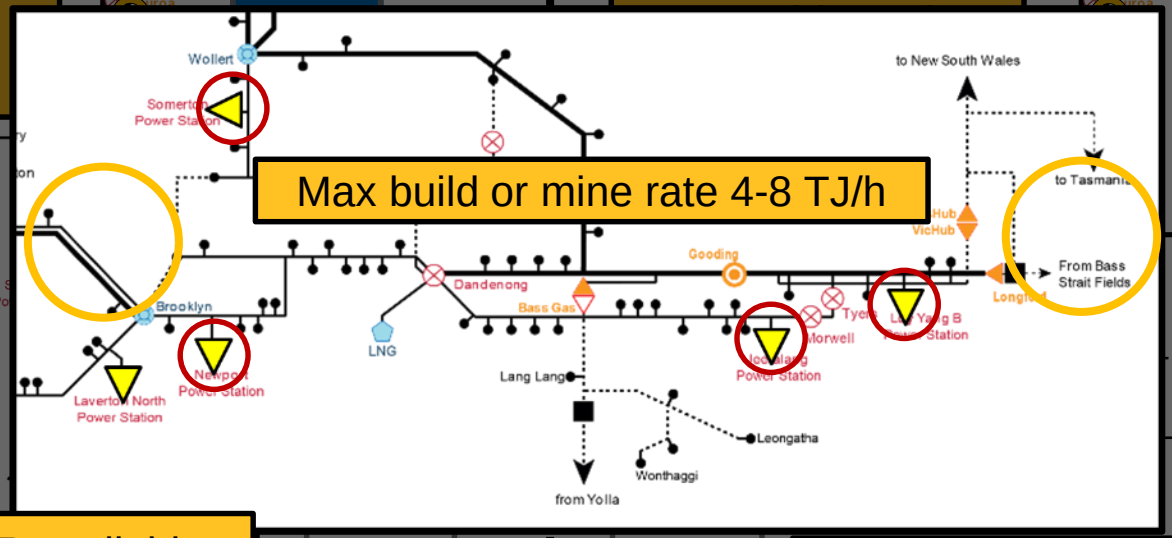
VNI EXPORTS

Increase VNI

Exports may be impacted if pressure too low

Operate Wollert, Euroa and Springhurst CS **north**bound

65 TJ



Less LP available, Higher chance of LNG requirement

VNI IMPORTS

Reduce VNI LP

Imports may be impacted if pressure too high

Operate Springhurst and Euroa CS

25 TJ

Store extra LP in LMP to support GPG

AGENDA

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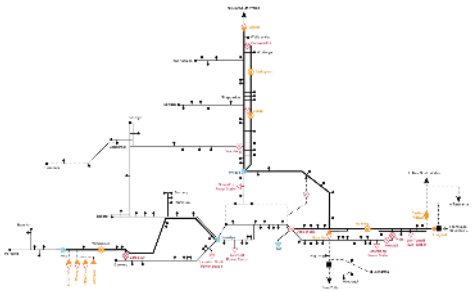

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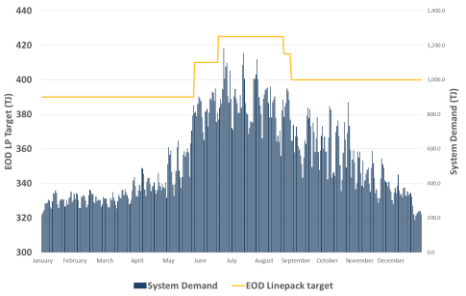

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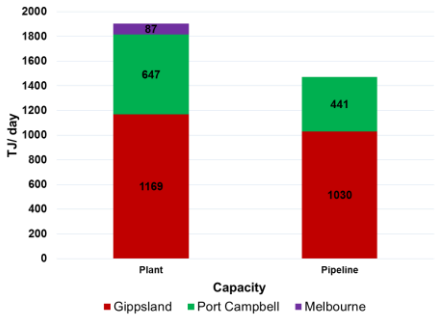


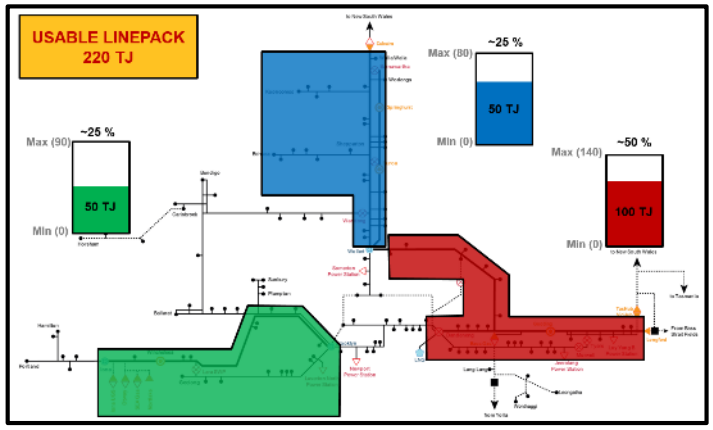
What are the challenges?

How do we manage them?

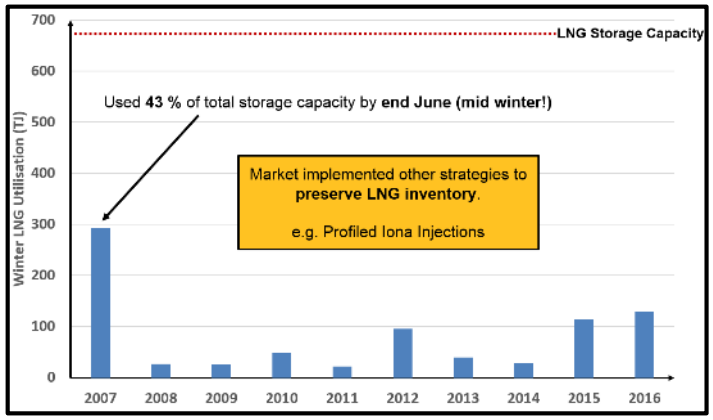
PREVENTATIVE MEASURES

What have we touched on?

Manage system linepack



Monitor storage inventory



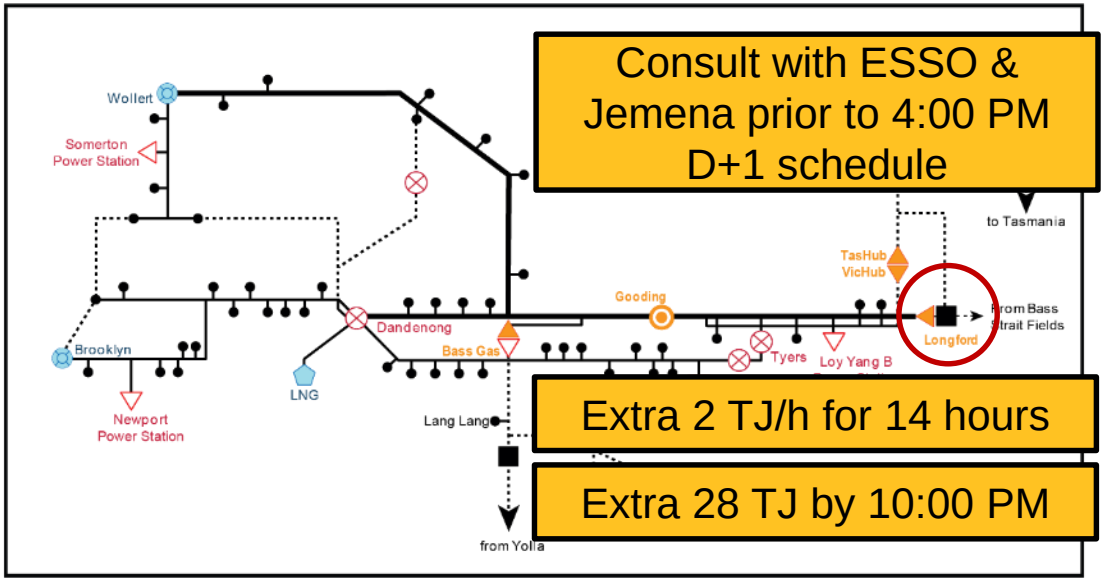
What else do we do?

Monitor GPG forecasts (NEM Pre Despatch) and communicate with NEM control room

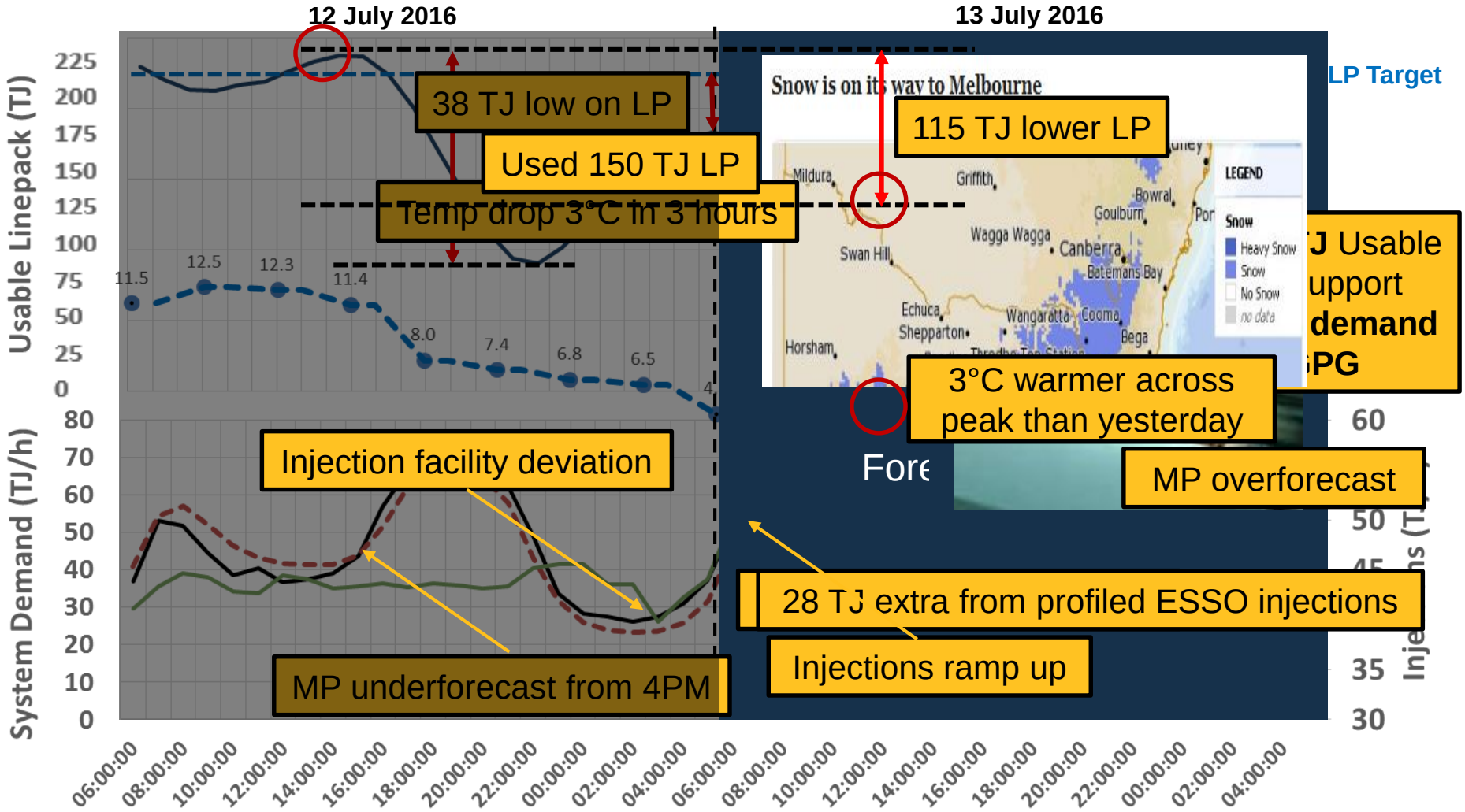
Demand override methodology
(Luke Stevens, AEMO)

ESSO Injection Profiling

If D+1 Demand > 1150 TJ



ESSO PROFILED INJECTIONS



Actual System Demand

MP Forecast Demand

Actual Injections

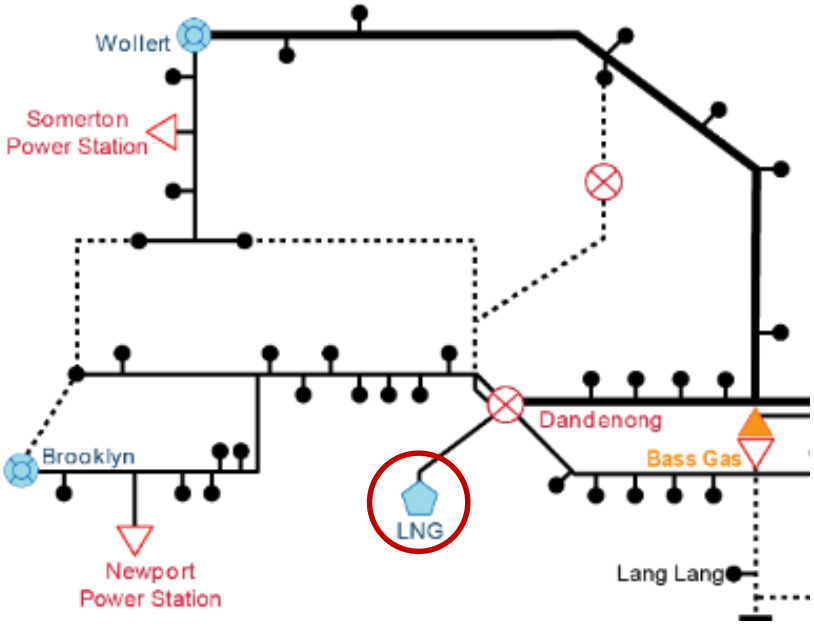
Injections (ex ESSO profile)

System Linepack

System Linepack (ex ESSO)

OPERATIONAL RESPONSE

Peak Shaving LNG (Ad hoc schedule)



Direction

Curtailment

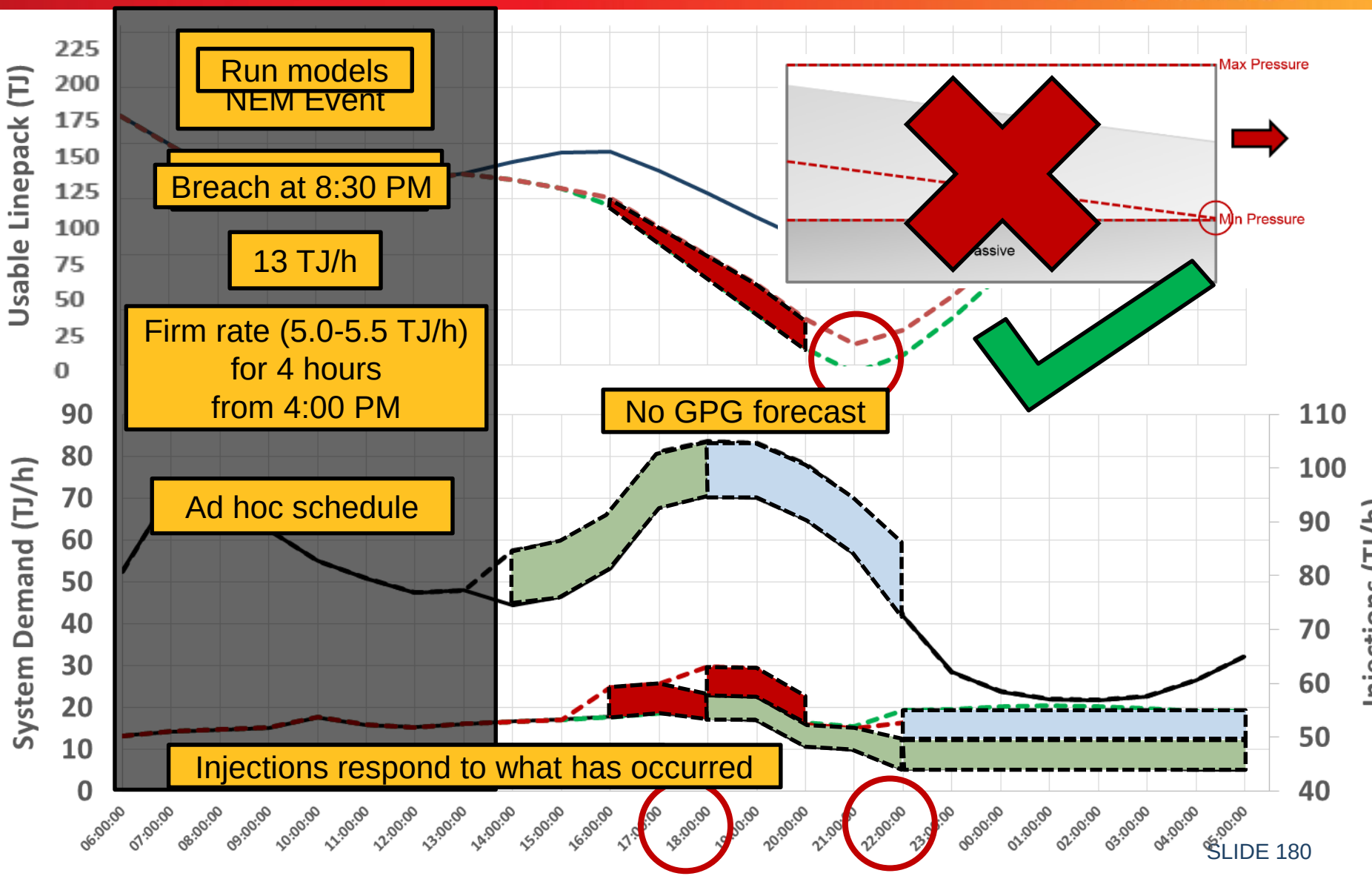
Market Operations (Luke Stevens, AEMO)

Used when models indicate LNG requirement to maintain minimum system linepack

Firm rate **5.5 TJ/h**

Max rate **9.8 TJ/h** or **87 TJ/d**

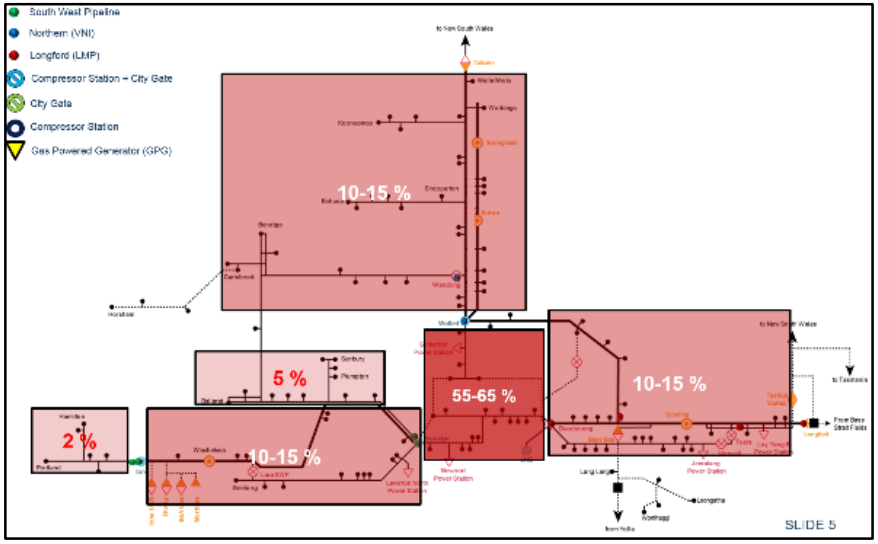
OPERATIONAL RESPONSE LNG



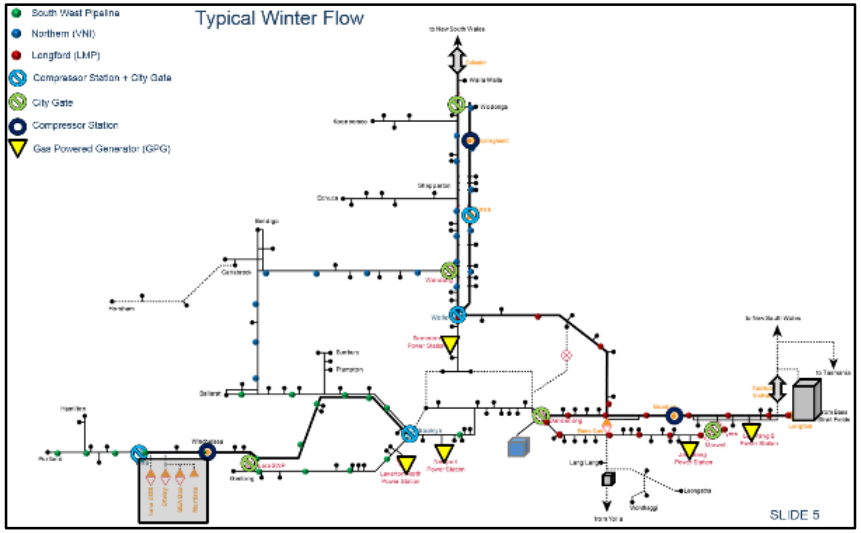
SUMMARY

Declared Transmission System

Several demand zones, Melbourne 65%



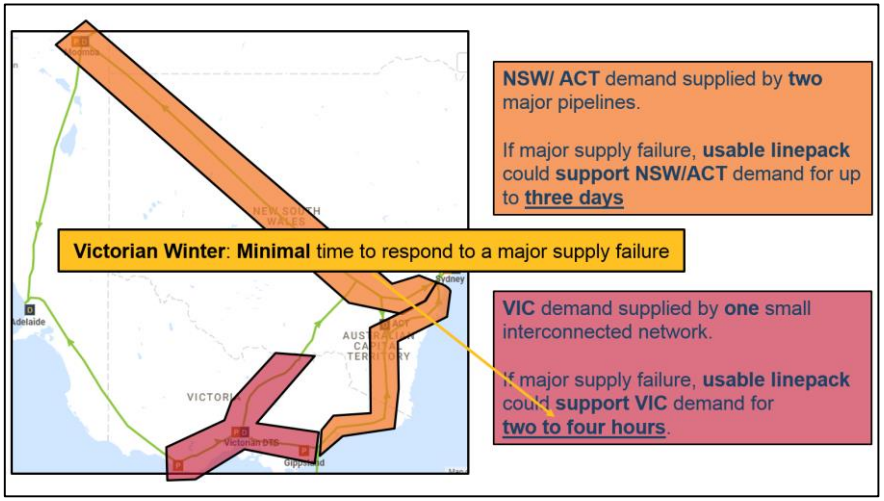
Dynamic & bidirectional flow, differing pipeline capacities



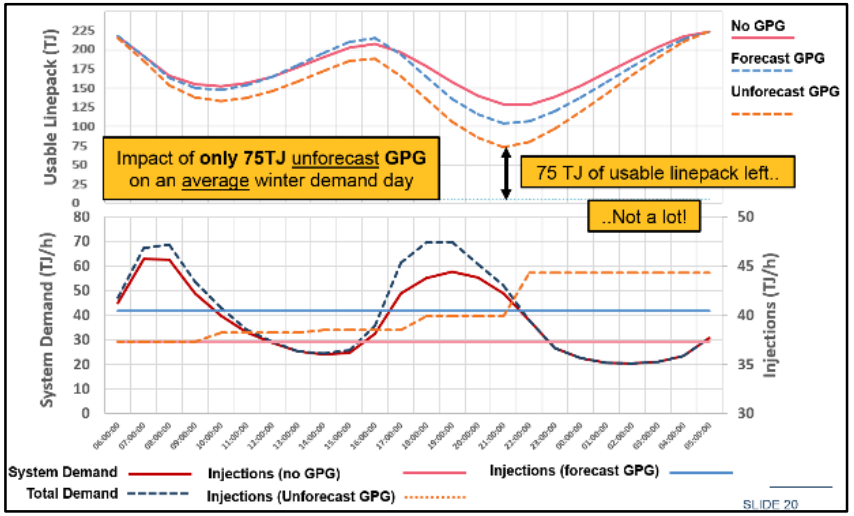
SUMMARY

Linepack Adequacy

If major supply failure, 2 – 4 hours survival time peak winter



Limited usable linepack for unforecast demand or GPG

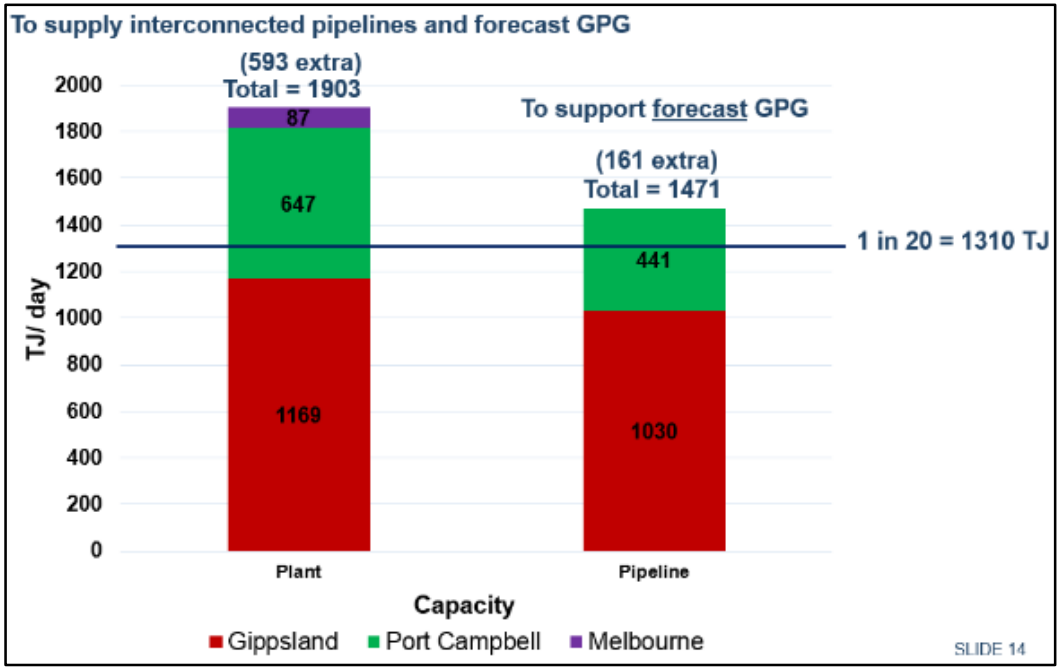


SUMMARY

Supply and Demand Outlook

Adequate System Capacity for forecast peak demand day

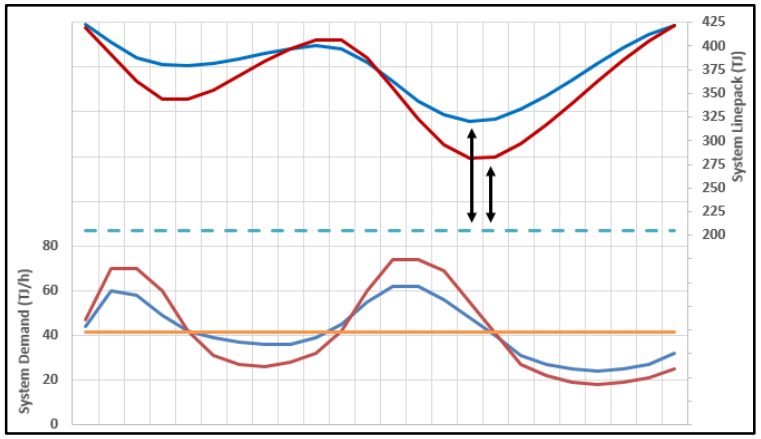
Limited System Capacity for unforecast demand or GPG



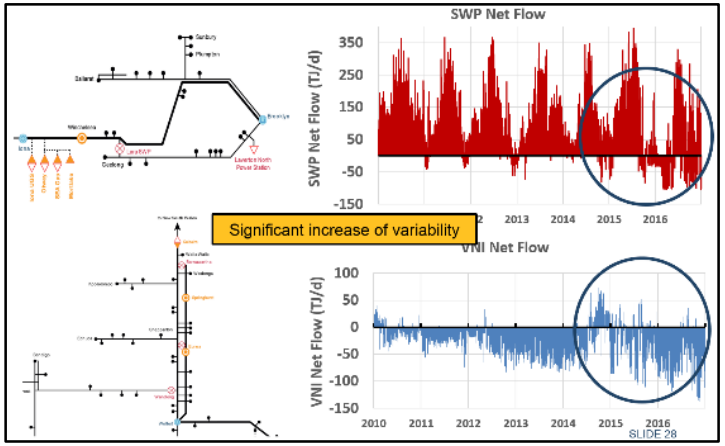
SUMMARY

What's different?

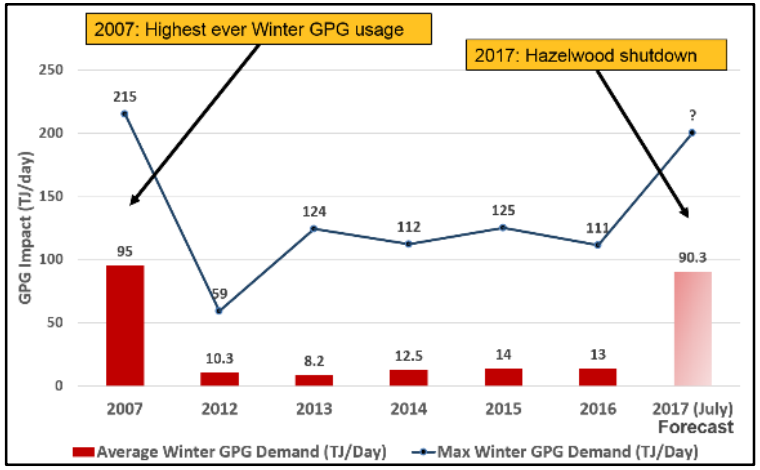
Peakier demand profiles



Increased flow direction changes



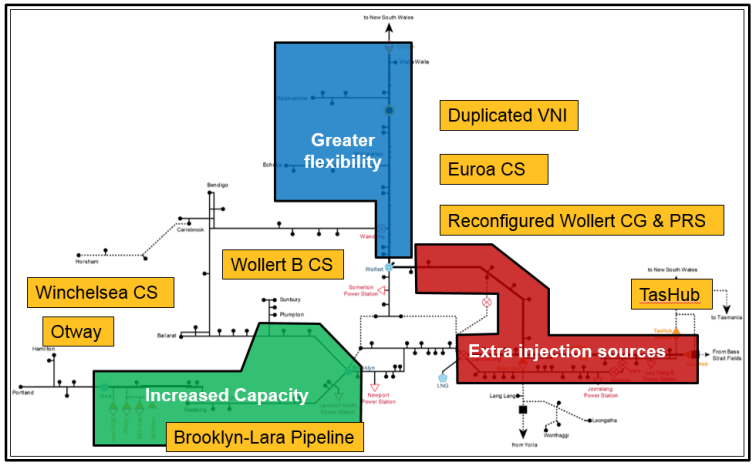
Increased GPG forecast



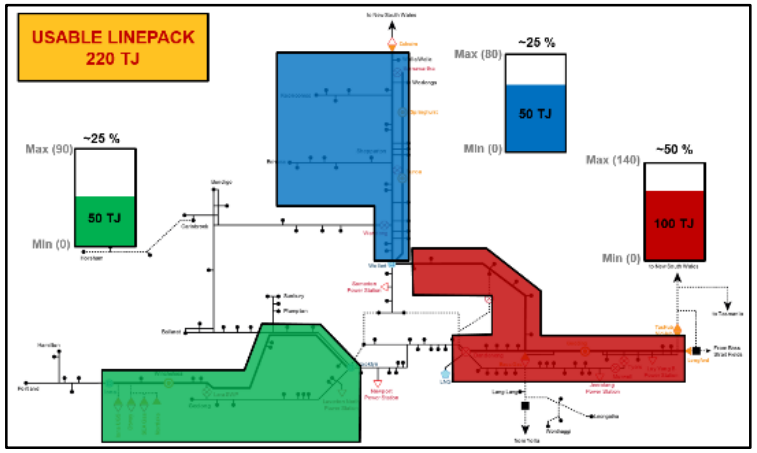
SUMMARY

AEMO Preparedness

Better equipped gas system



Effective linepack management strategies



Preventative Measures

- Monitor storage inventory
- Monitor GPG forecasts
- Demand override methodology
- ESSO Injection Profiling

Operational Response

- Peak Shaving LNG
- Direction
- Curtailment

SUMMARY

Market Participants

Good forecasting

Good communication

Questions?

Contact: trent.shinners@aemo.com.au

VICTORIAN GAS OPERATIONS - WINTER 2017 - MARKET OPERATIONS

10 May 2017

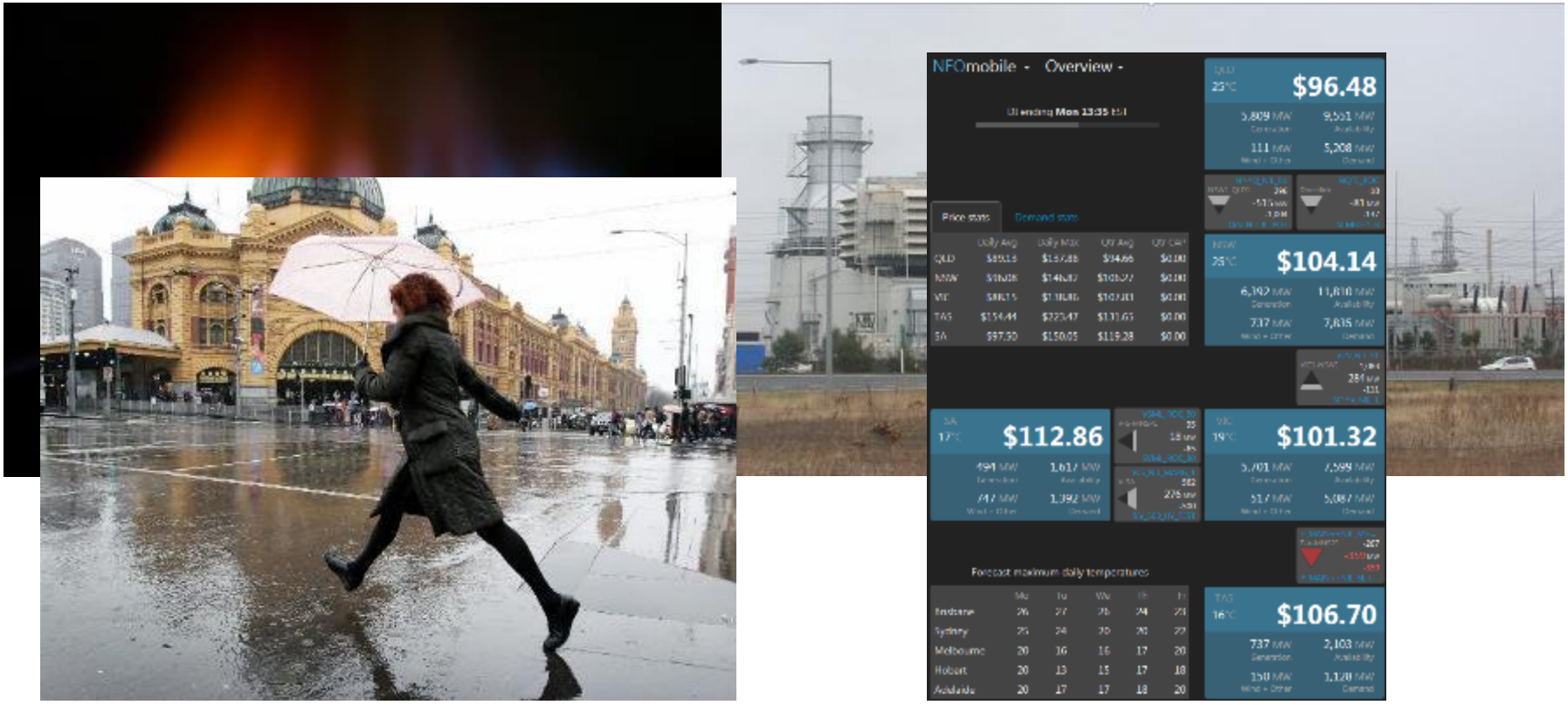
PRESENTED BY LUKE STEVENS

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

OVERVIEW

DEMAND FORECAST

DEMAND FORECAST UNCERTAINTY - TOTAL DEMAND FORECAST

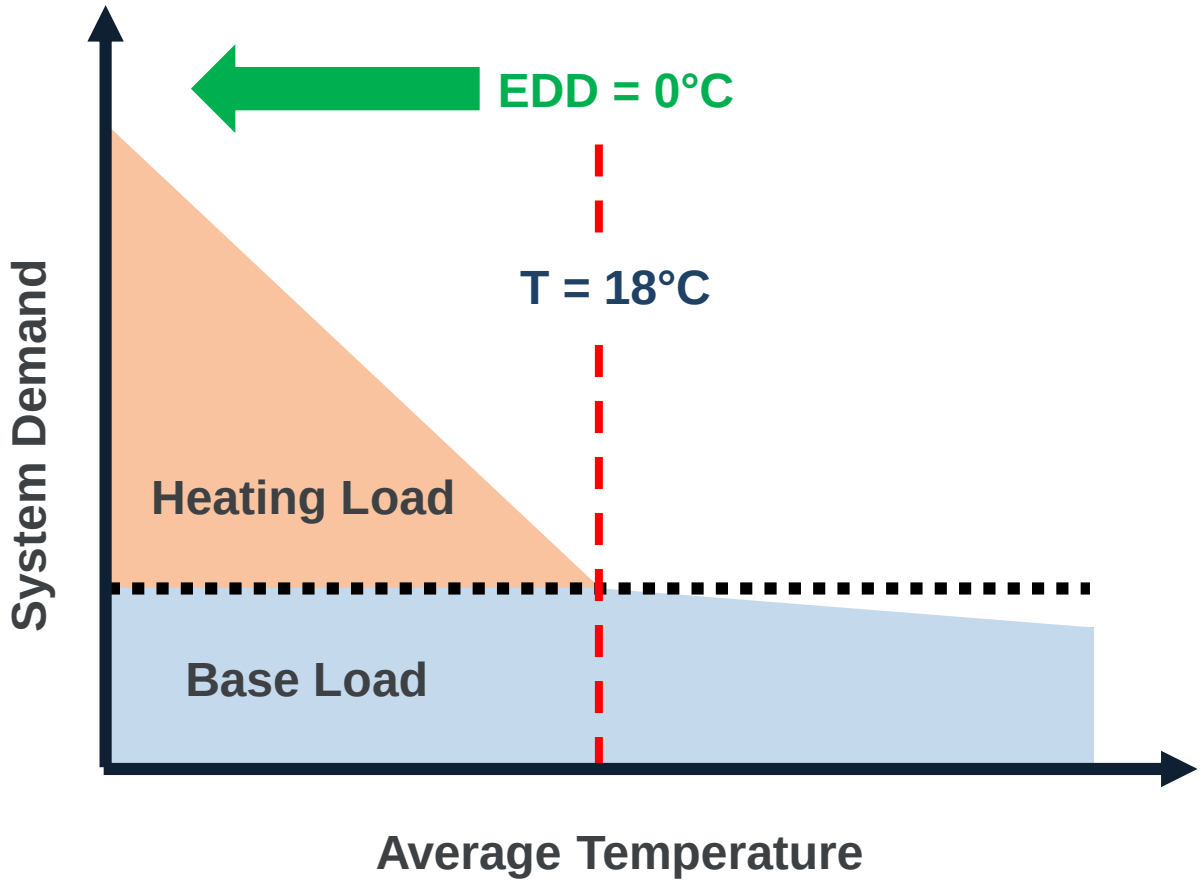


Total Demand = System Demand + GPG Demand

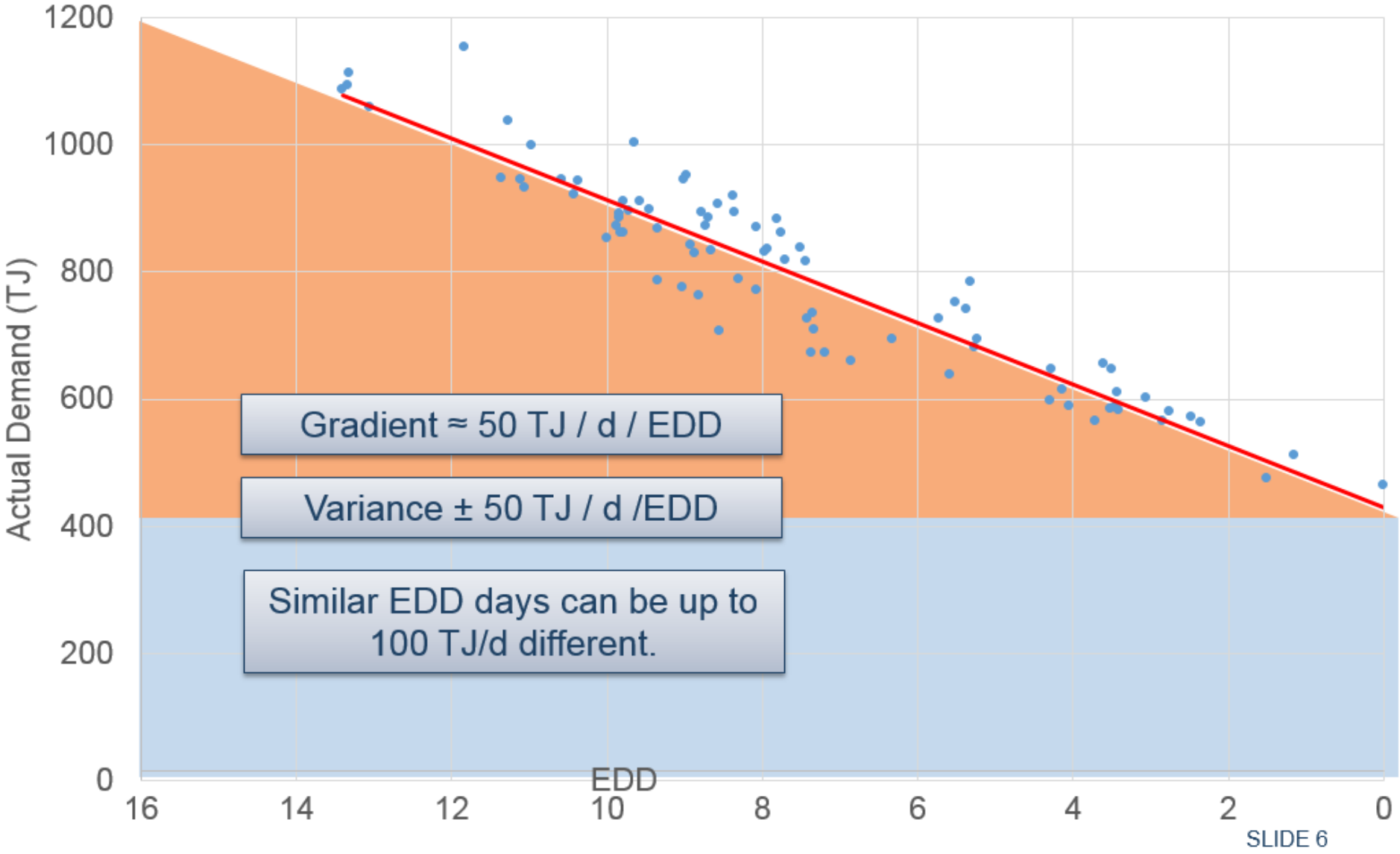
DEMAND FORECAST UNCERTAINTY – SYSTEM DEMAND AND WEATHER

Effective Degree Day (EDD) – Average Temperature, Wind Speed, Sunshine Hours

Inverse magnitude to Average Temperature



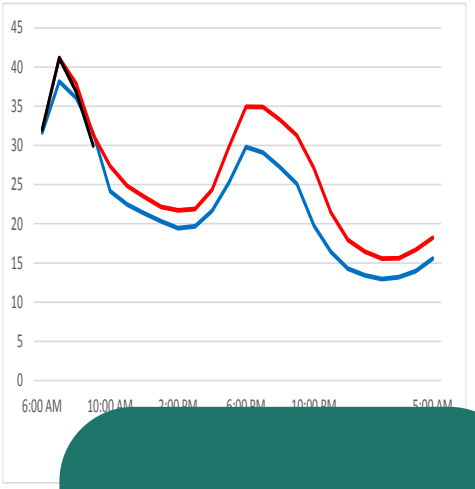
DEMAND FORECAST UNCERTAINTY – EDD AND DEMAND – WINTER 2016



DEMAND FORECAST UNCERTAINTY – MONITORING WEATHER

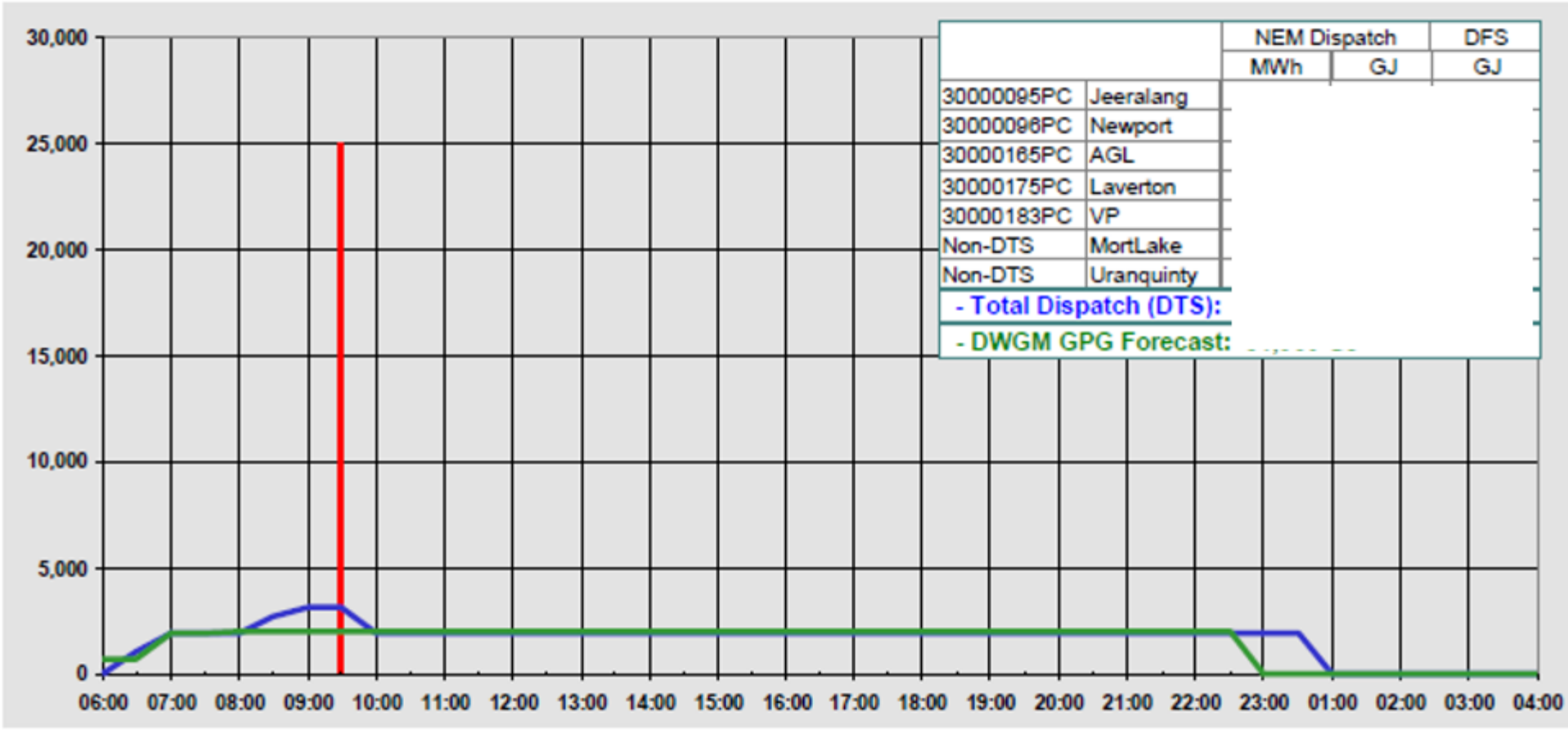
Monitor Weather

Demand Forecast



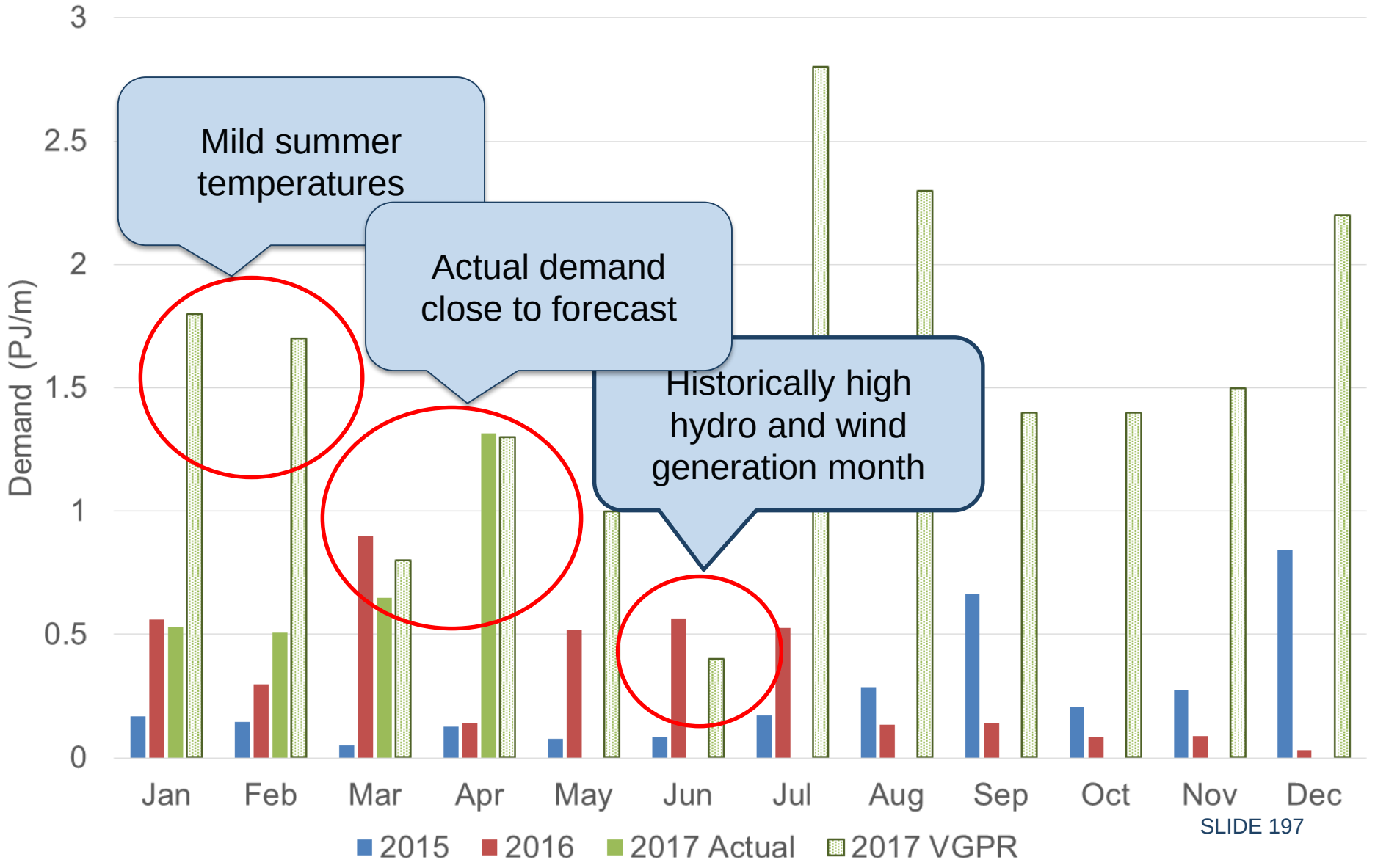
Demand Profile

DEMAND FORECAST UNCERTAINTY – MONITORING GPG DEMAND



DEMAND FORECAST UNCERTAINTY – MANAGE GPG DEMAND

DEMAND FORECAST UNCERTAINTY – MONTHLY GPG DEMAND FORECAST

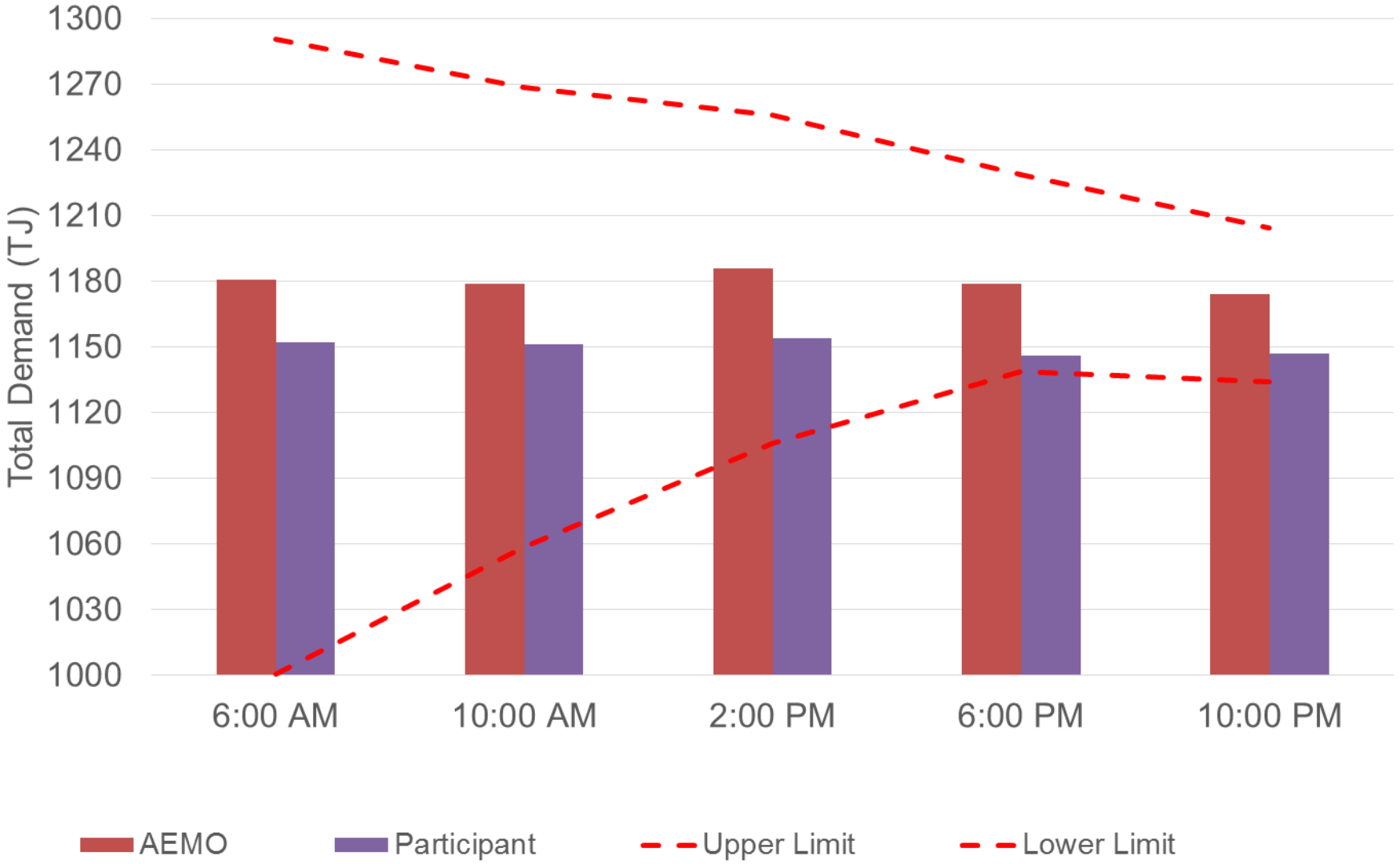


FORECAST DEMAND

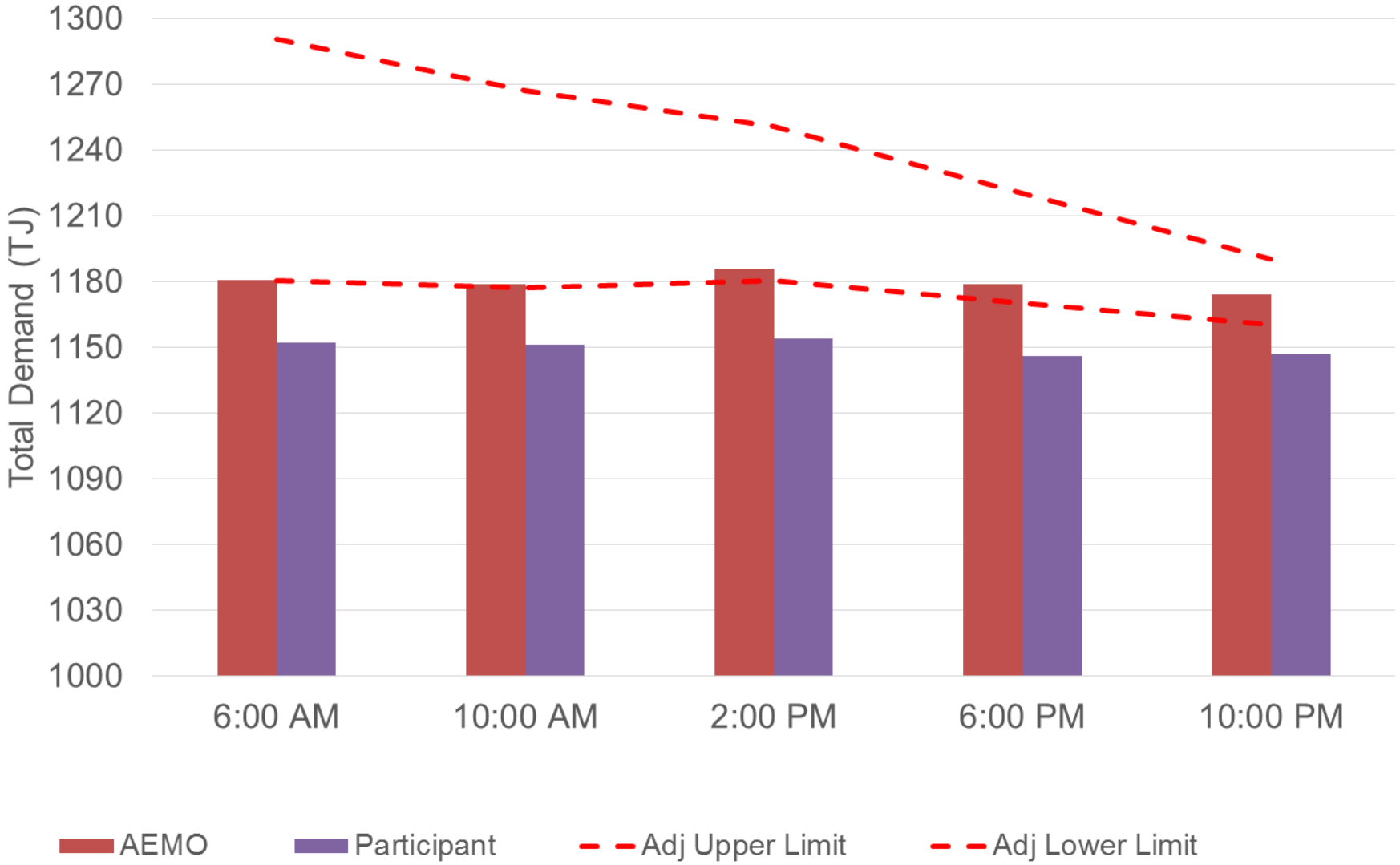
Update your system demand and GPG forecasts!

DEMAND FORECAST OVERRIDE

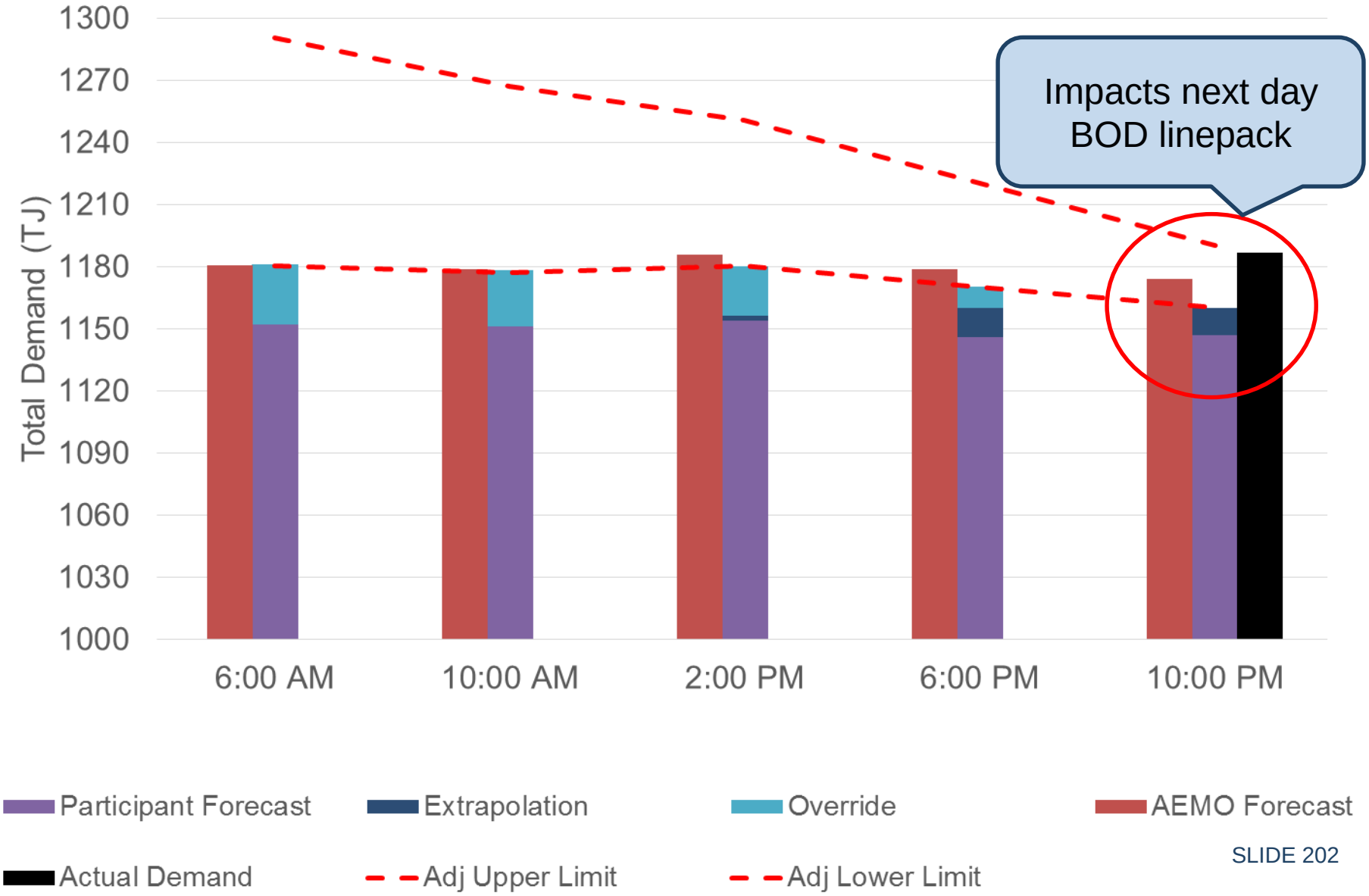
DEMAND OVERRIDE – 24 JUNE 2016 – INPUT DATA



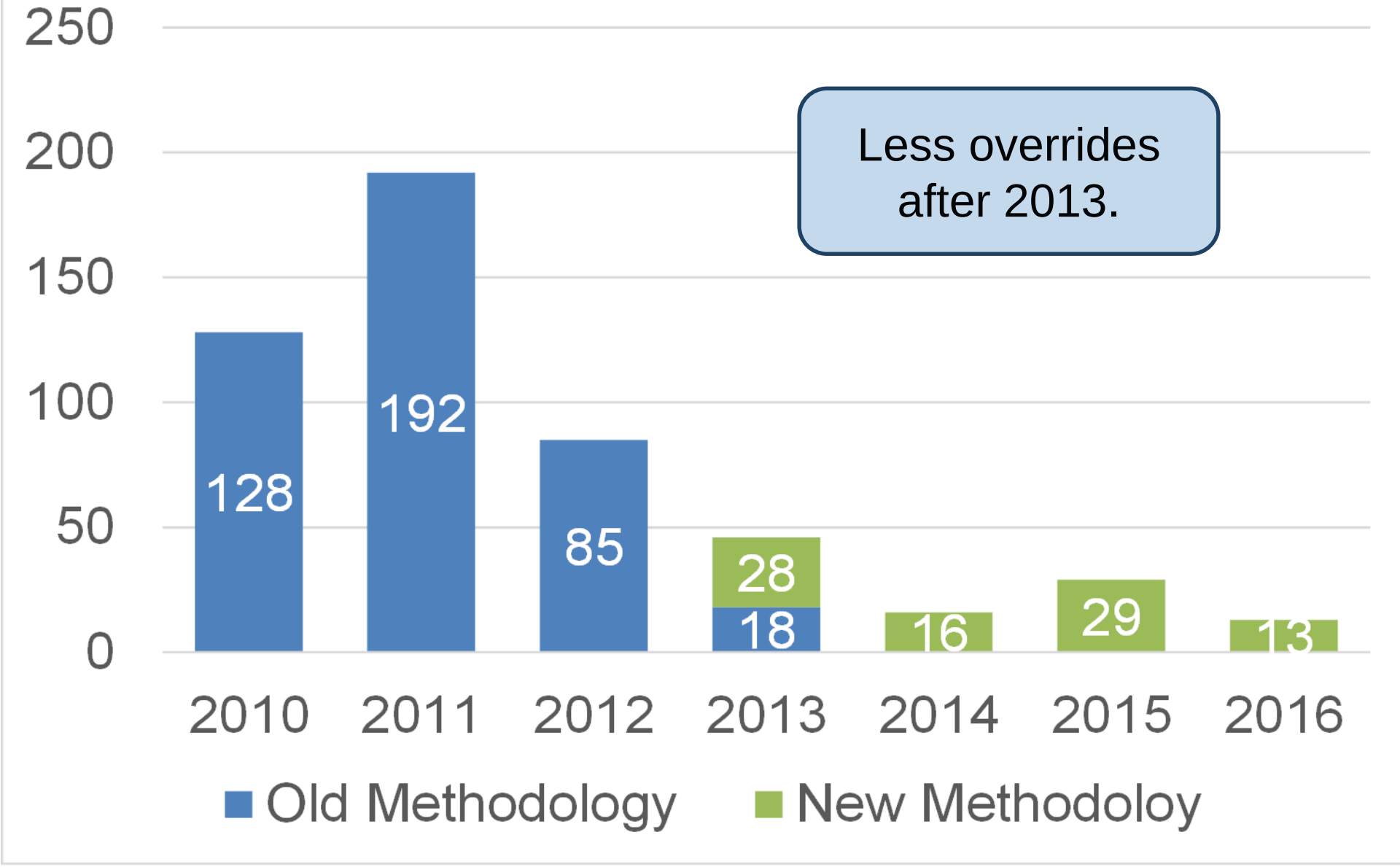
DEMAND OVERRIDE – 24 JUNE 2016 – ADJUST LIMITS



DEMAND OVERRIDE – 24 JUNE 2016
ACTUAL AND OVERRIDE



DEMAND OVERRIDES – NUMBER OF WINTER OVERRIDES

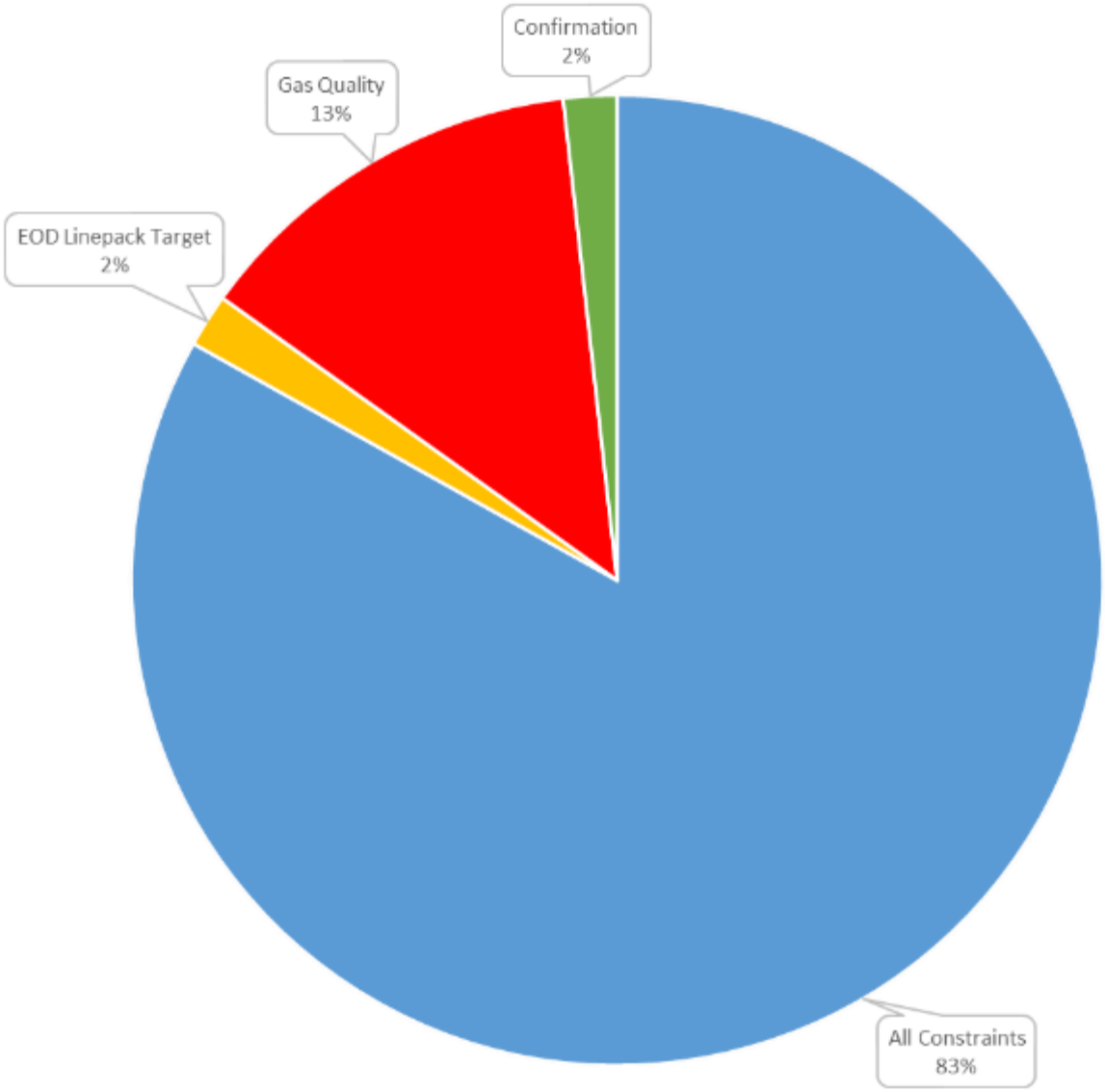


FORECAST DEMAND

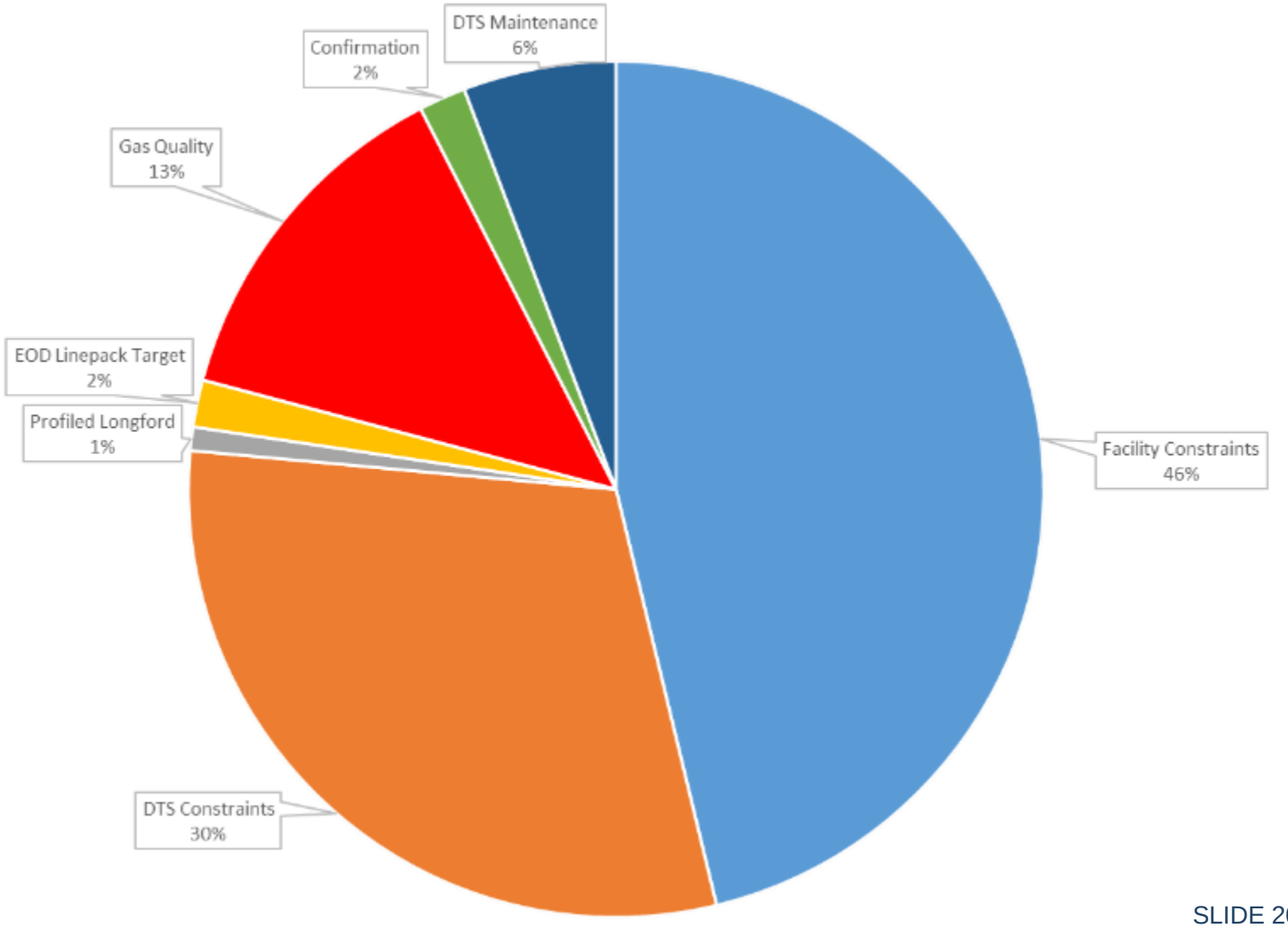
A demand override is applied to *both* forecast system demand and forecast GPG demand!

CONSTRAINTS

CONSTRAINTS – WHY ARE THEY IMPORTANT?



CONSTRAINTS – WHY ARE THEY IMPORTANT?



CONSTRAINTS

SDPC	• Supply demand point constraint
DFPC	• Directional flow point constraint
NFTC	• Net flow transportation constraint
SSC	• Supply source constraint

CONSTRAINTS – SUPPLY DEMAND POINT CONSTRAINT

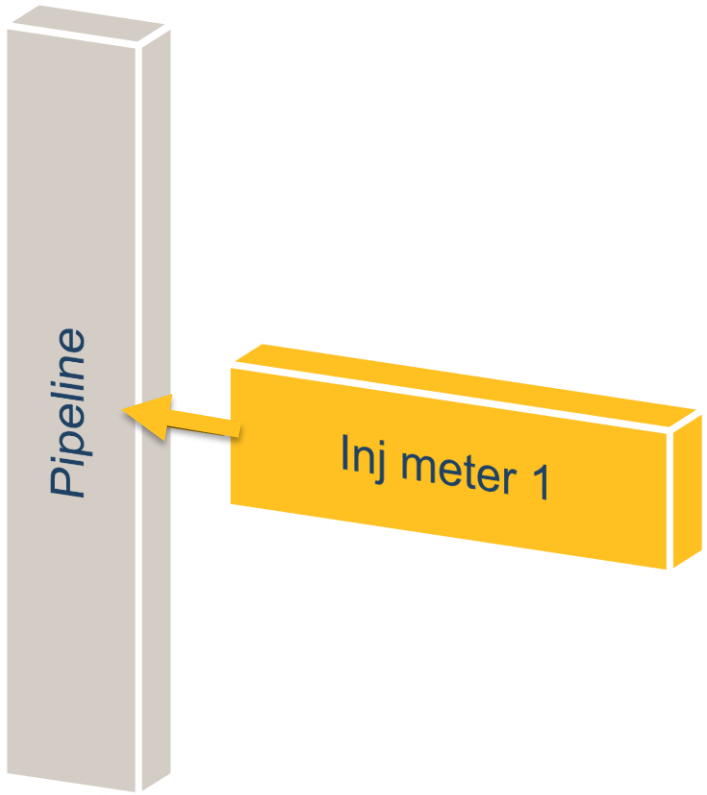
Supply Demand Point Constraint (SDPC)

Restrict flow at a facility injection or withdrawal meter

Implemented due to maintenance or outage.

Applied at any facility injection or withdrawal meter

If a threat is identified, is used to force in injections



CONSTRAINTS –
SUPPLY DEMAND POINT CONSTRAINT

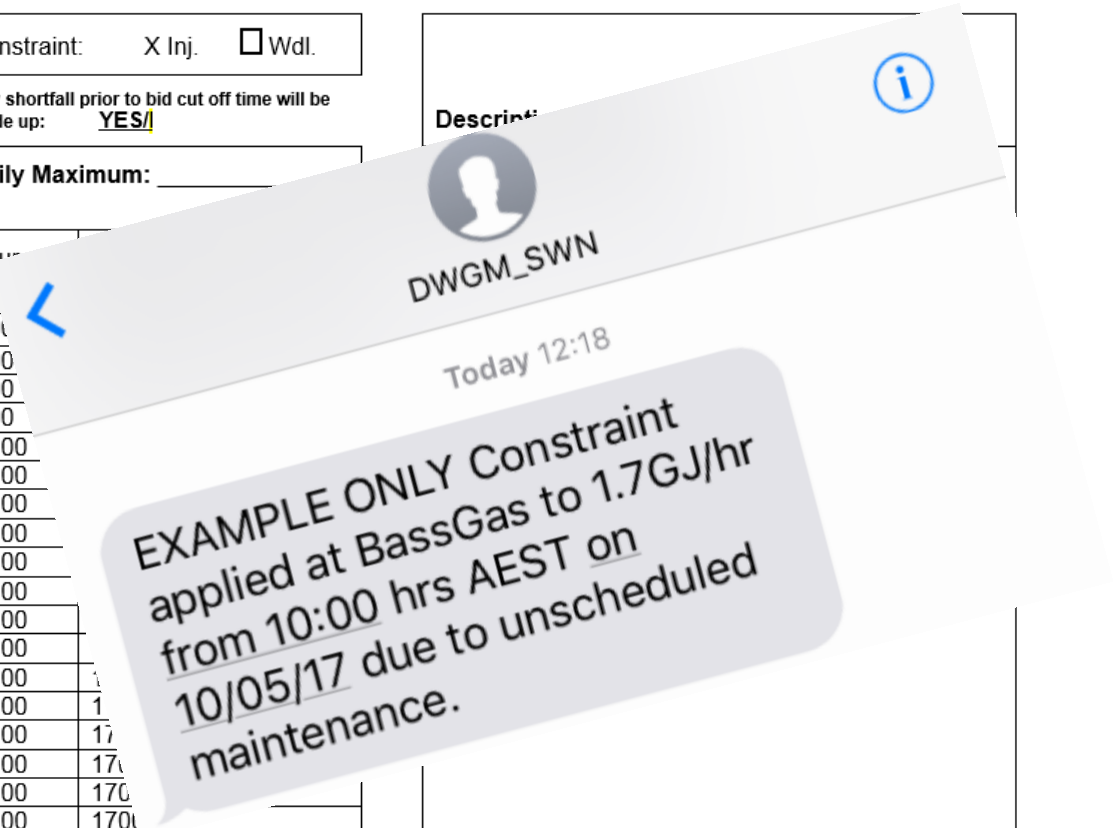
Gas Day Applicable: 10 / 05 / 2017	Meter / Meter Pairing (MIRN): 30000170PC

Constraint: X Inj. ☐ Wdl.

Any shortfall prior to bid cut off time will be made up: YES/I

Daily Maximum: _____ GJ

Hour (A	
6:0	
7:00	
8:00	
9:00	
10:00	
11:00	
12:00	
13:00	
14:00	
15:00	
16:00	
17:00	
18:00	1
19:00	1
20:00	17
21:00	17
22:00	170
23:00	170
0:00	1700
1:00	1700
2:00	1700
3:00	1700
4:00	1700
5:00	1700



CONSTRAINTS – DIRECTIONAL FLOW POINT CONSTRAINT

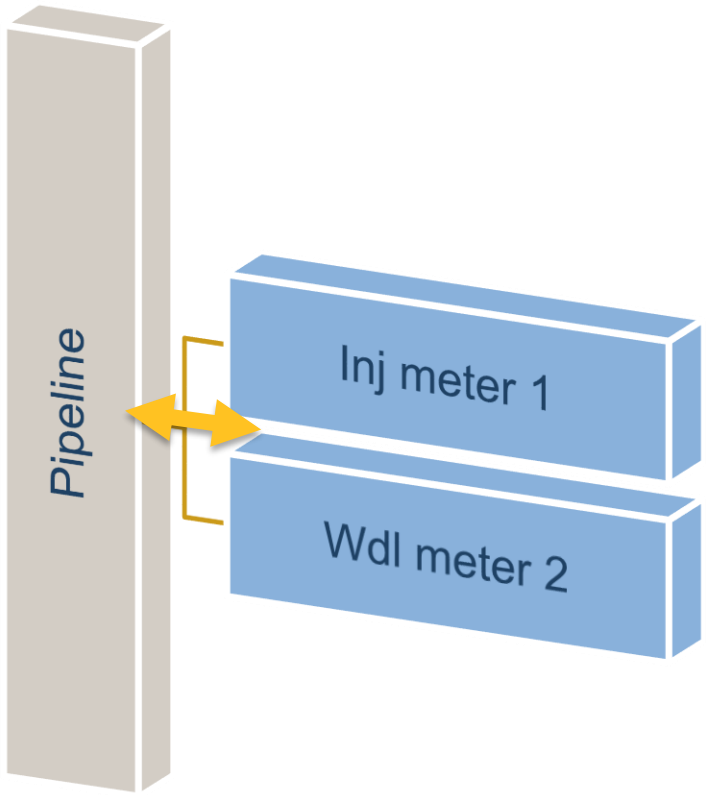
Directional Flow Point Constraint (DFPC)

Applied to bi-directional meters to limit net flow

DFPC at VicHub, SEAGas and TasHub for 0GJ net withdrawal

May be applied at Culcairn, Iona and Otway meters to reflect limit

Replaced with SDPC to remove financial flows if a facility has an outage.



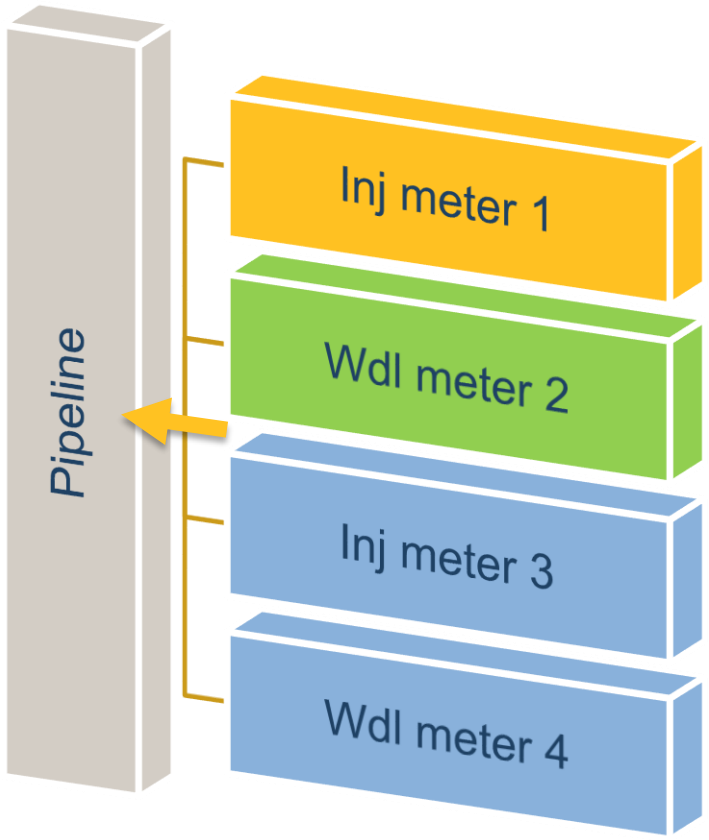
CONSTRAINTS – NET FLOW TRANSPORTATION CONSTRAINT

Net Flow Transportation Constraint (NFTC)

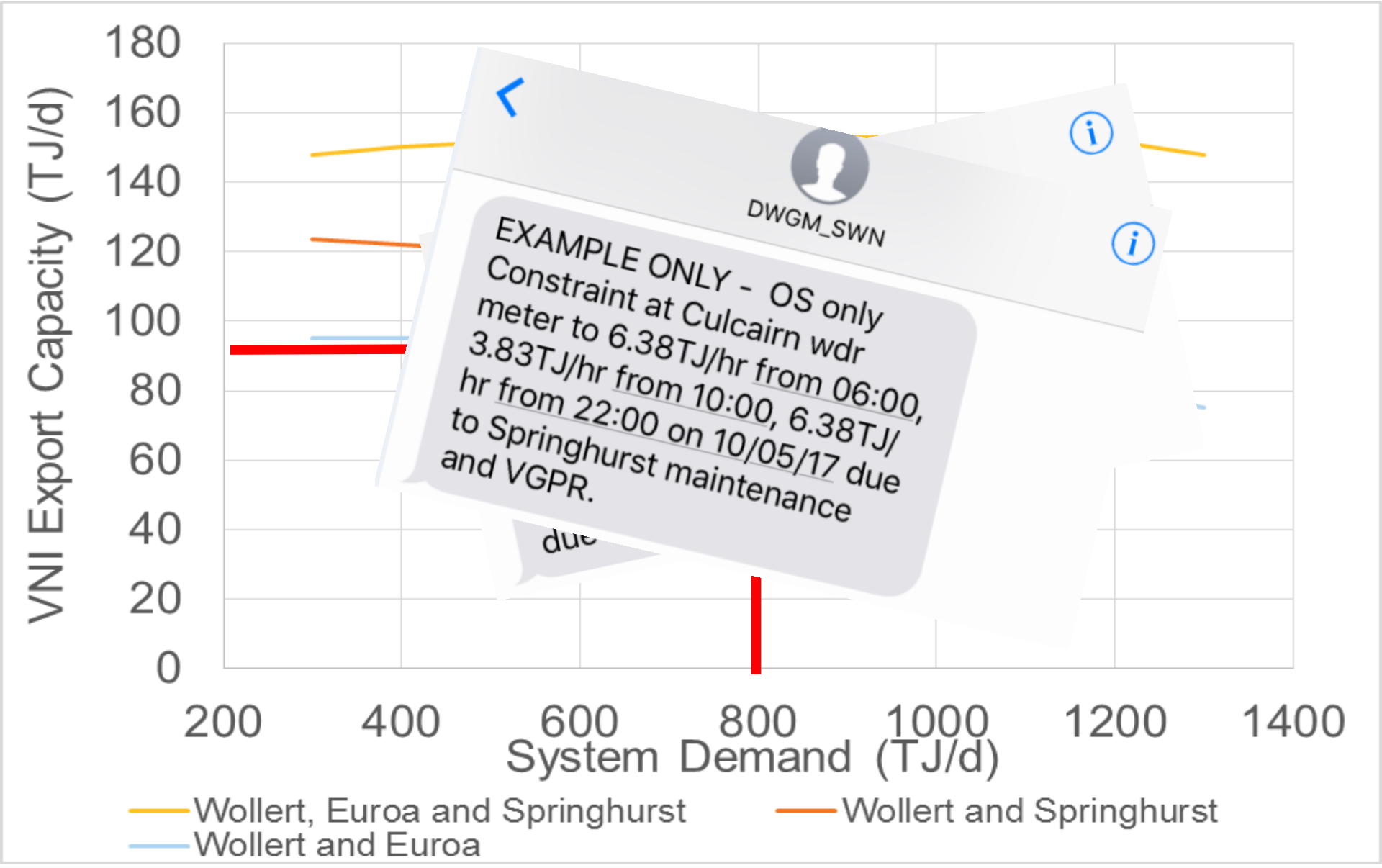
Applied to reflect DTS transportation capacity

Impacts all facility injection and withdrawal meters on a pipeline

Only applied in the Operating Schedule



CONSTRAINTS –
Net Flow Transportation Constraint

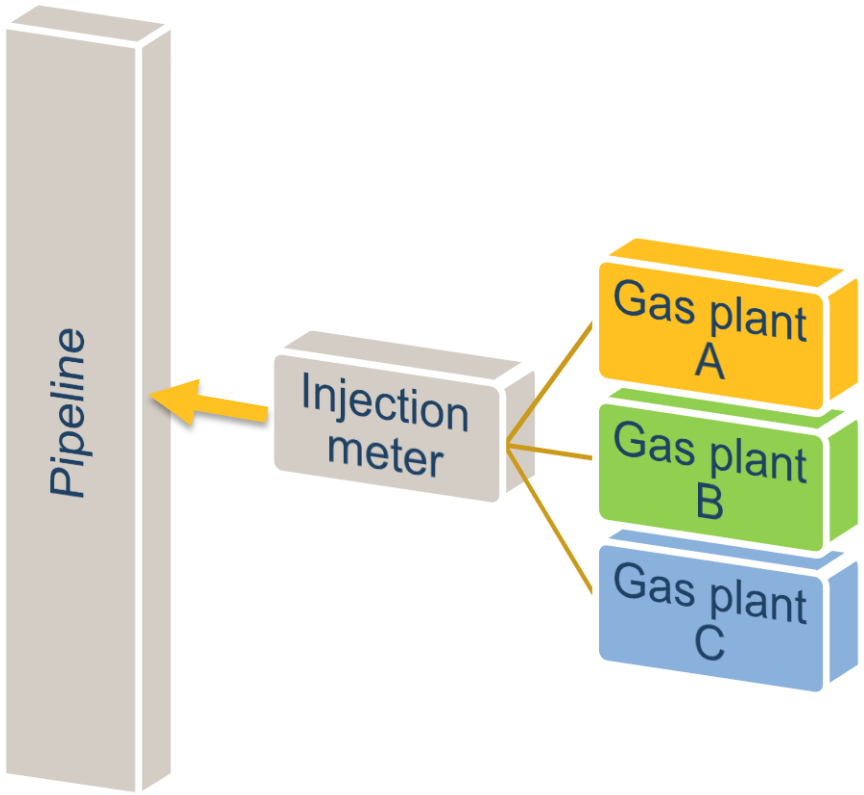


CONSTRAINTS – SUPPLY SOURCE CONSTRAINT

Supply Source Constraint (SSC)

Applied when a meter has multiple supply sources.

Register facility to use constraint (eg SEAGas)



CONSTRAINTS

Constraints impact market outcomes!

MARKET OPERATIONS SUMMARY

- Demand forecast
  - System demand
  - GPG demand

- Demand Override

- Constraints

WINTER AND ABNORMAL MARKET OPERATIONS

OVERVIEW

Market Operations

- Demand Forecast ✓
  - Weather
  - GPG
- Demand Forecast Override ✓
- Constraints ✓

Winter and Abnormal Market Operations

- Longford Profiling
- Responding to Threats
- Curtailment
- Market Suspension
- Market Administration

WINTER OPERATIONS

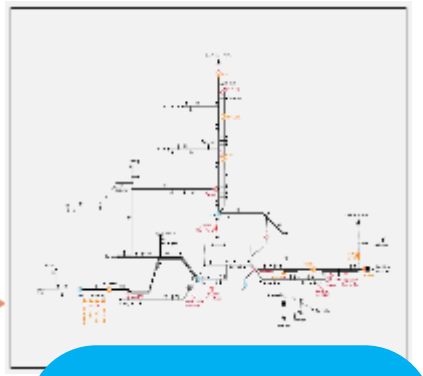
WINTER OPERATIONS - LONGFORD PROFILING

Trigger

- > 1,150 TJ/day

Process

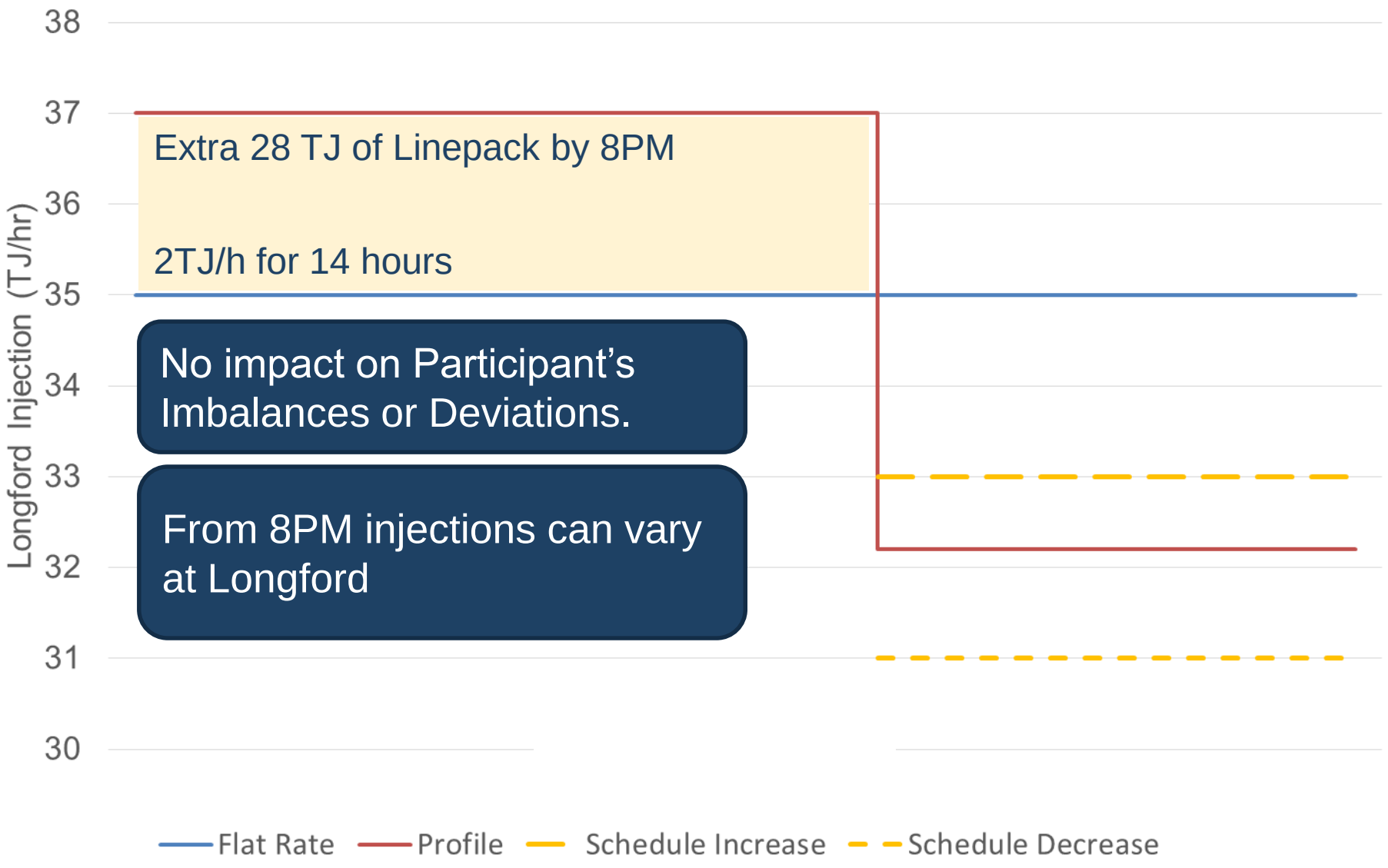
- Consult
- SDPC



Impacts

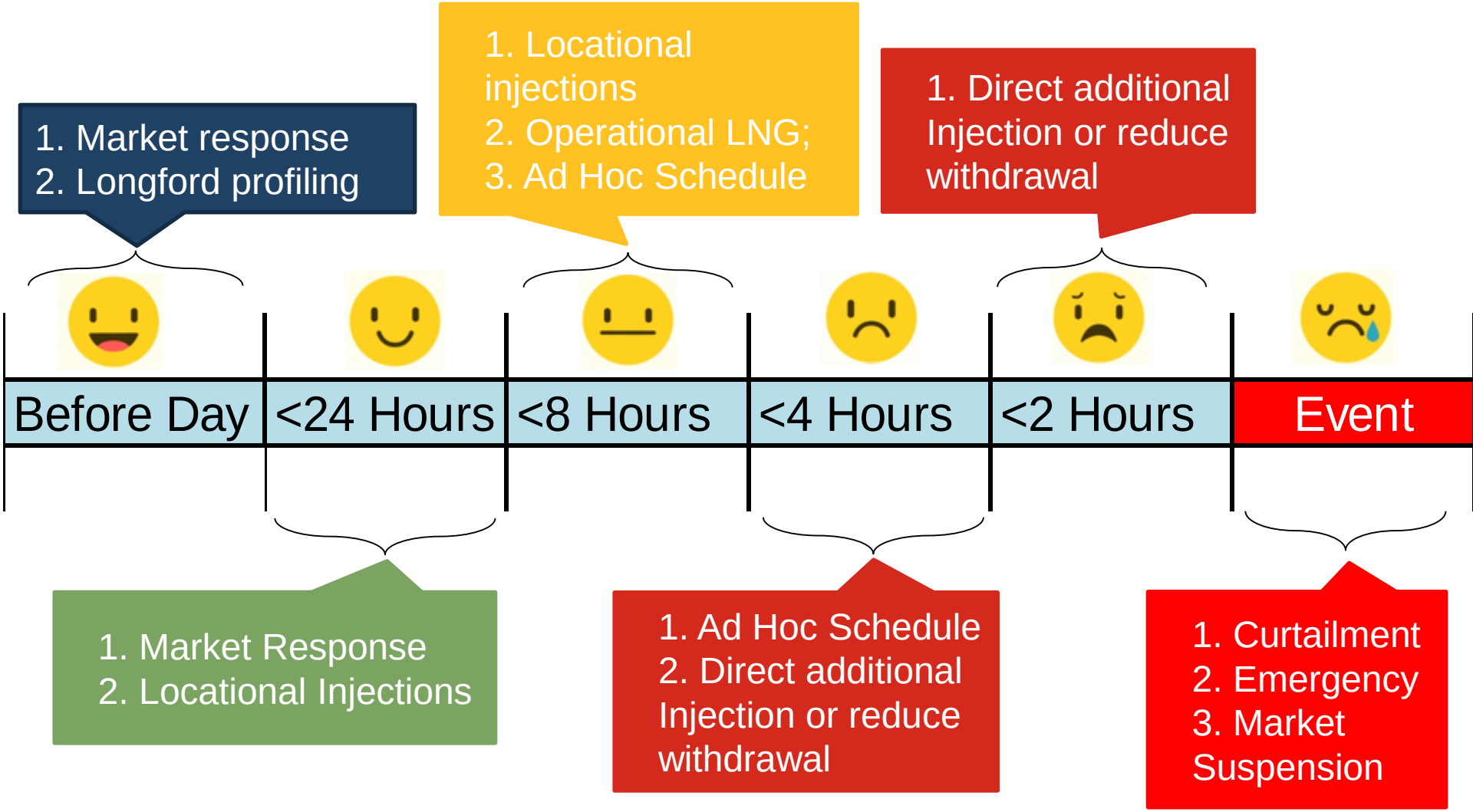
- System
- Market

WINTER OPERATIONS - LONGFORD PROFILING



ABNORMAL MARKET OPERATIONS – RESPONDING TO THREATS TO SYSTEM SECURITY

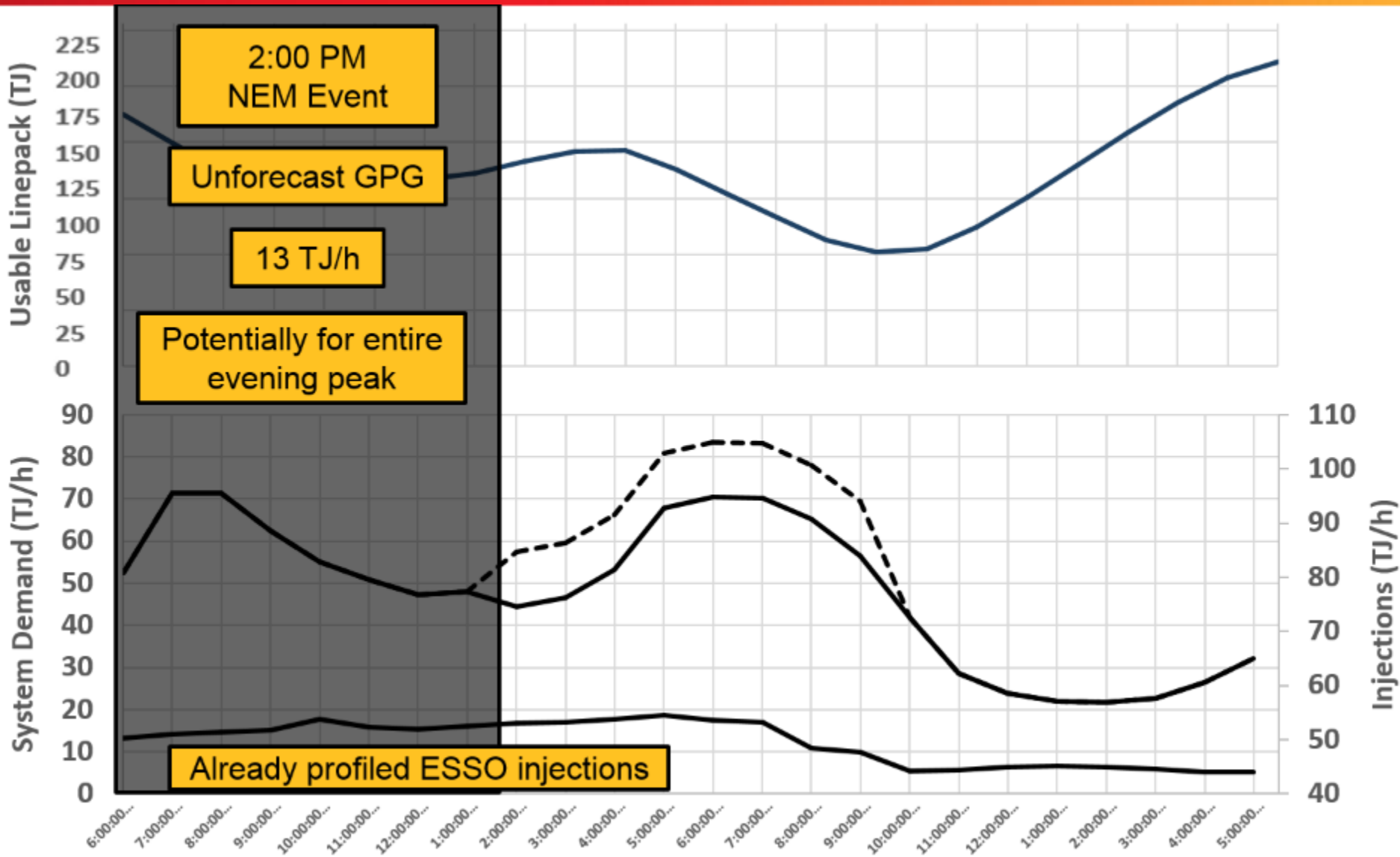
RESPONSE TO THREATS TO SYSTEM SECURITY



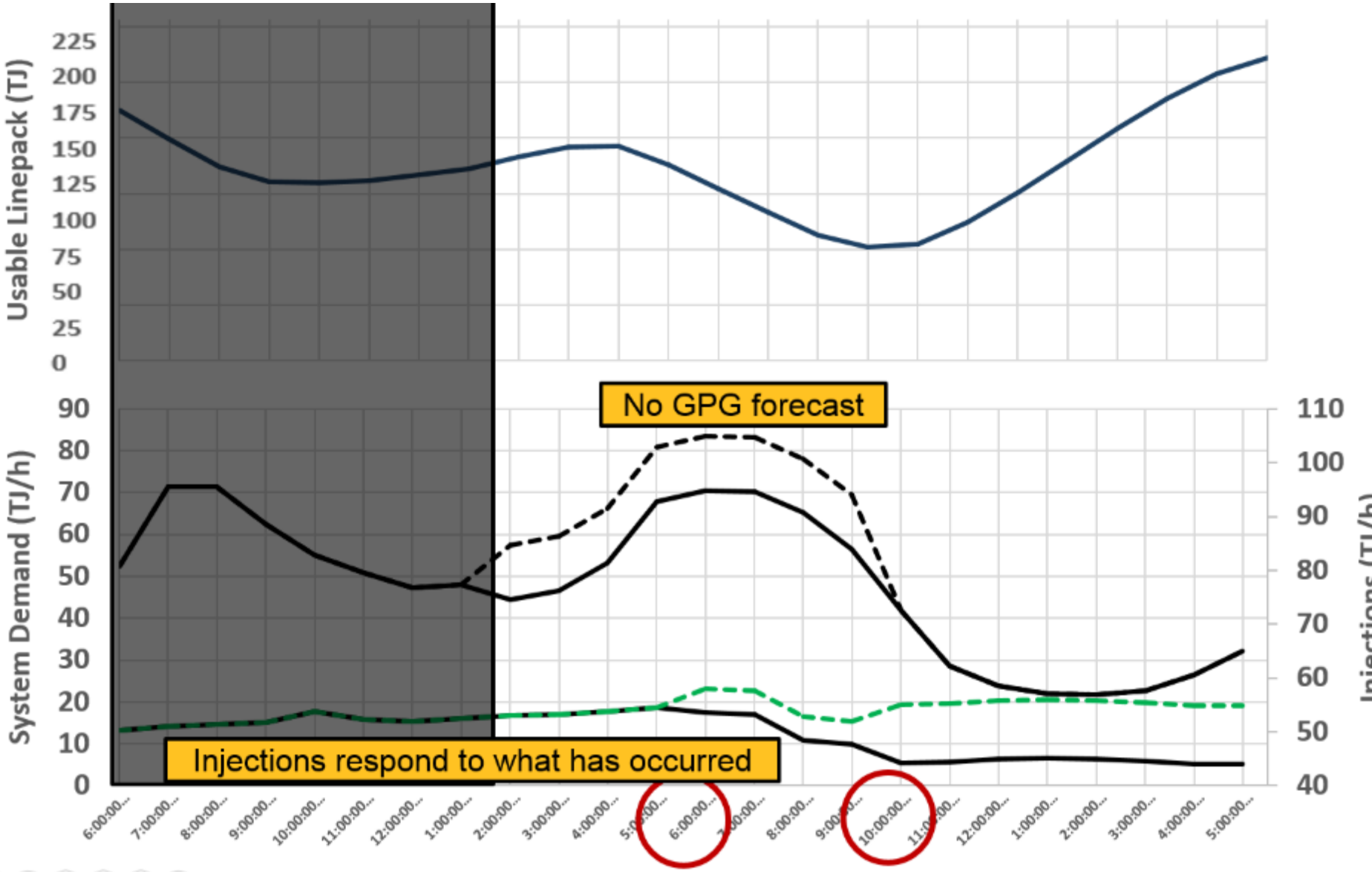
ABNORMAL MARKET OPERATIONS

1. **Market Response**
2. Operational Response
3. Ad Hoc Schedule
4. Direction
5. Curtailment
6. Market Suspension

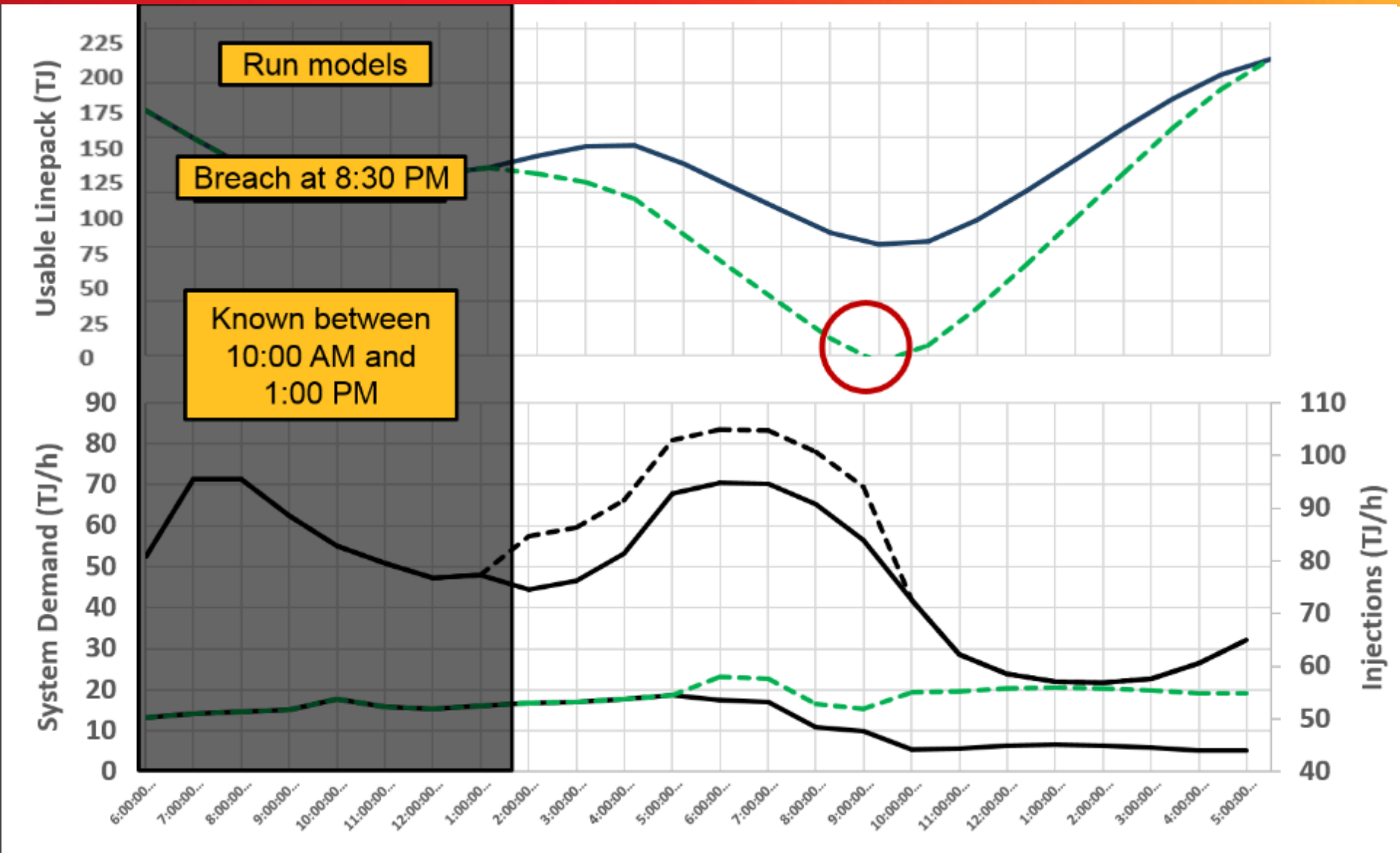
ABNORMAL MARKET OPERATIONS - SCENARIO



ABNORMAL MARKET OPERATIONS - SCENARIO



ABNORMAL MARKET OPERATIONS - SCENARIO



ABNORMAL MARKET OPERATIONS SCENARIO

ABNORMAL MARKET OPERATIONS - - MARKET RESPONSE

Notice of a Threat to System Security – Seeking a Market Response

Reference: *National Gas Rules (NGR), Part 19, Division 5, Subdivision 5, Notice of Threat to System Security*

Under rule 341 of the NGR, AEMO is notifying participants of a threat to system security in the Declared Transmission System.

AEMO advises that the threat to system security is due to:

- A significant unforeseen increase in gas demand
- A supply and demand imbalance exists such that the projected pressure at Dandenong City Gate may breach the minimum operating pressure of 3200 kPa.
- The threat to system security is expected to start at 18:00 AEST 10/05/2017 and end at 22:00 AEST 10/05/2017.

The threat to system security is likely to impact:

☐	Total System	☒	Melbourne Withdrawal Zone
☐	Gippsland Withdrawal Zone	☐	Northern Withdrawal Zone
☐	Geelong Withdrawal Zone	☐	Ballarat Withdrawal Zone
☐	Western Withdrawal Zone		

A market response to this notice may alleviate the threat to system security and remove the need for AEMO to take action. Market participants are asked to re-evaluate their bids and offers.

The market may alleviate the threat by increasing injections from Longford CPP to obtain a total net daily injection quantity of 64 TJ.

- There will be a market notice to advise the removal of the threat to system security.
- AEMO reserves the right to determine an appropriate operational response if the market response is insufficient to avert the threat to system security

ABNORMAL MARKET OPERATIONS

1. Market Response
2. **Operational Response**
3. Ad Hoc Schedule
4. Direction
5. Curtailment
6. Market Suspension

ABNORMAL MARKET OPERATIONS - LOCATIONAL INJECTIONS

Notice of a Threat to System Security

Reference: *National Gas Rules (NGR), Part 19, Division 5, Subdivision 5, Notice of Threat to System Security*

Under rule 341 of the NGR, AEMO is notifying participants of a threat to system security in the Declared Transmission System.

AEMO advises that the threat to system security is due to:

- A significant unforeseen increase in gas demand
- A supply and demand imbalance exists such that the projected pressure at Dandenong City Gate may breach the minimum operating pressure of 3200 kPa.
- The threat to system security is expected to start at 18:00 AEST 10/05/2017 and end at 22:00 AEST 10/05/2017.

The threat to system security is likely to impact:

☐	Total System	☒	Melbourne Withdrawal Zone
☐	Gippsland Withdrawal Zone	☐	Northern Withdrawal Zone
☐	Geelong Withdrawal Zone	☐	Ballarat Withdrawal Zone
☐	Western Withdrawal Zone		

AEMO has determined that there is insufficient time for the market to coordinate a response to the threat and that a response in the next operating schedule is required.

AEMO intends to alleviate the threat by increasing injections from Longford CPP to obtain a total net daily injection quantity of 64 TJ.

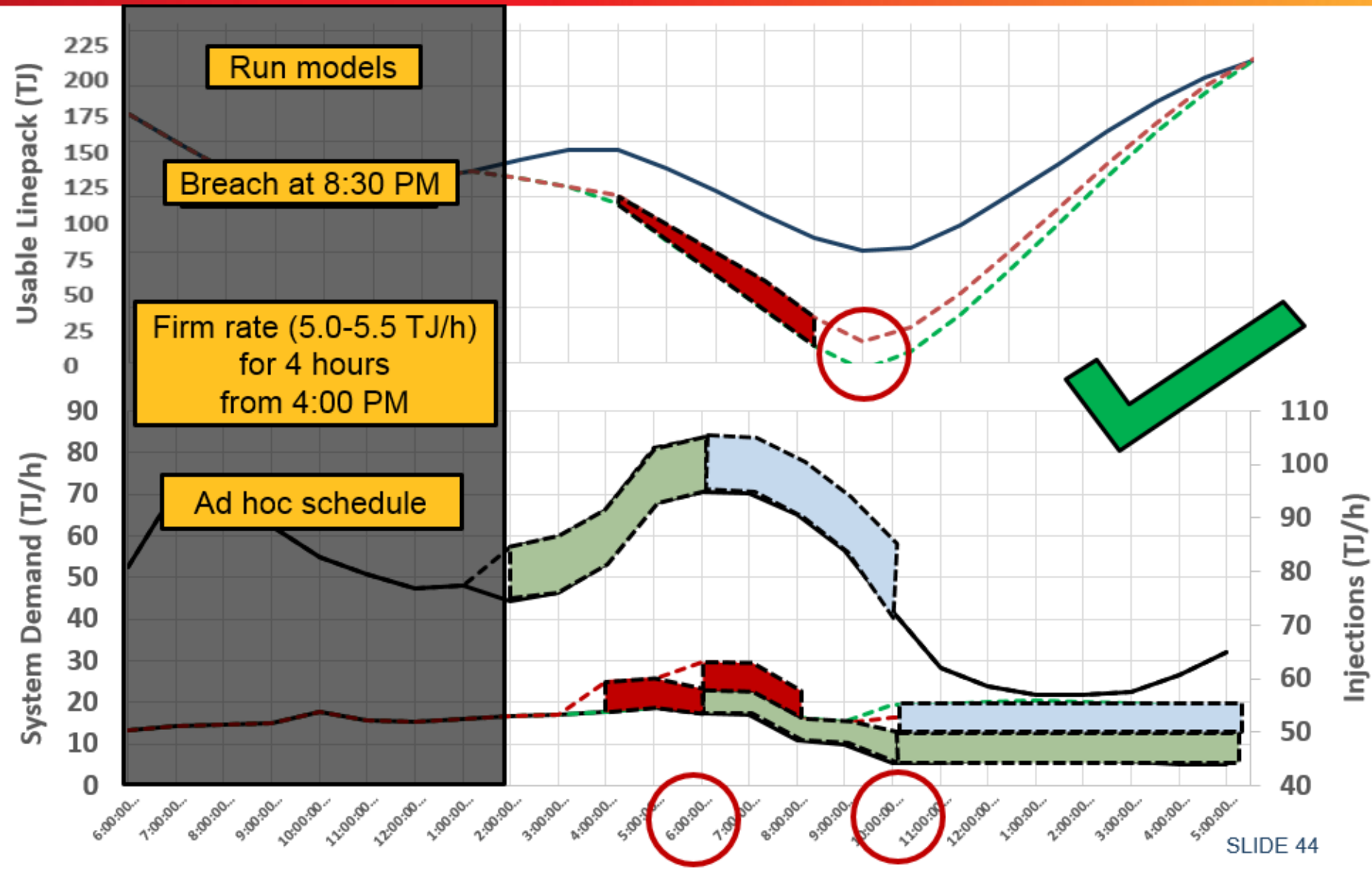
The production of a feasible Operating Schedule under 215(3) is is not an intervention under rule 343 of the NGR.

There will be a market notice to advise the removal of the threat to system security.

ABNORMAL MARKET OPERATIONS

1. Market Response
2. Operational Response
3. **Ad Hoc Schedule**
4. Direction
5. Curtailment
6. Market Suspension

OPERATIONAL RESPONSE LNG



ABNORMAL MARKET OPERATIONS - AD HOC SCHEDULE

Notice of a Threat to System Security

Reference: *National Gas Rules (NGR), Part 19, Division 5, Subdivision 5, Notice of Threat to System Security*

Under rule 341 of the NGR, AEMO is notifying participants of a threat to system security in the Declared Transmission System.

AEMO advises that the threat to system security is due to:

- A significant unforeseen increase in gas demand
- A supply and demand imbalance exists such that the projected pressure at Dandenong City Gate may breach the minimum operating pressure of 3200 kPa.
- The threat to system security is expected to start at 16:00 AEST 10/05/2017 and end at 19:00 AEST 10/05/2017.

The threat to system security is likely to impact:

☐	Total System	☒	Melbourne Withdrawal Zone
☐	Gippsland Withdrawal Zone	☐	Northern Withdrawal Zone
☐	Geelong Withdrawal Zone	☐	Ballarat Withdrawal Zone
☐	Western Withdrawal Zone		

AEMO has determined that there is insufficient time for the market to coordinate a response to the threat and that a response in the next operating schedule is required.

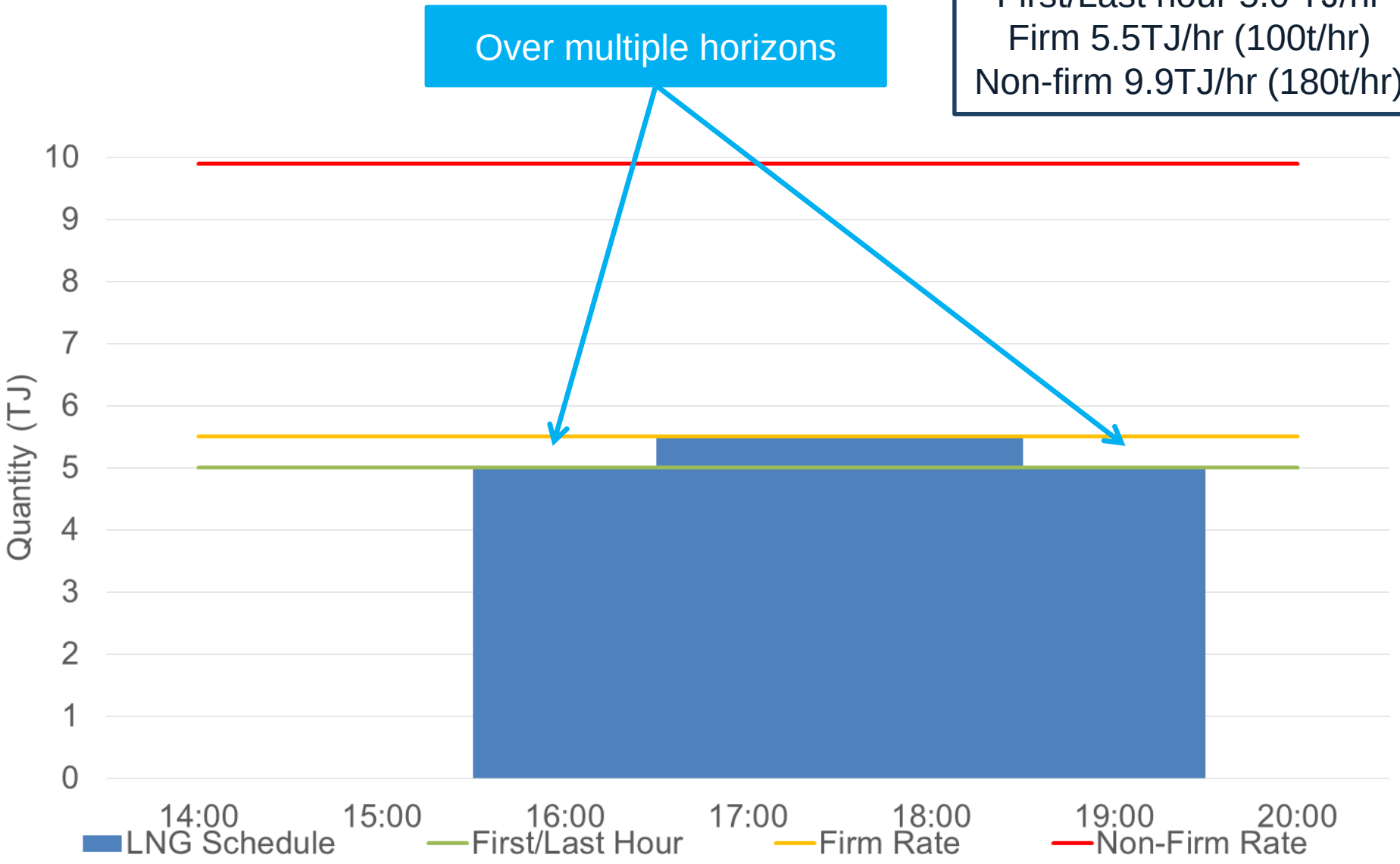
AEMO intends to alleviate the threat by increasing injections from Dandenong LNG Facility to obtain a total net daily injection quantity of 21 TJ.

The production of an ad hoc operating schedule is an intervention under rule 215(4) of the NGR.

There will be a market notice to advise the removal of the threat to system security.

ABNORMAL MARKET OPERATIONS - OPERATIONAL RESPONSE LNG

First/Last hour 5.0 TJ/hr
Firm 5.5TJ/hr (100t/hr)
Non-firm 9.9TJ/hr (180t/hr)



ABNORMAL MARKET OPERATIONS - AD HOC SCHEDULE

What about 1 October 2016?

ABNORMAL MARKET OPERATIONS - AD HOC SCHEDULE – 1 OCTOBER

4:28 AM – Initial Longford plant trip

4:45 AM – Begin to reconfigure the DTS

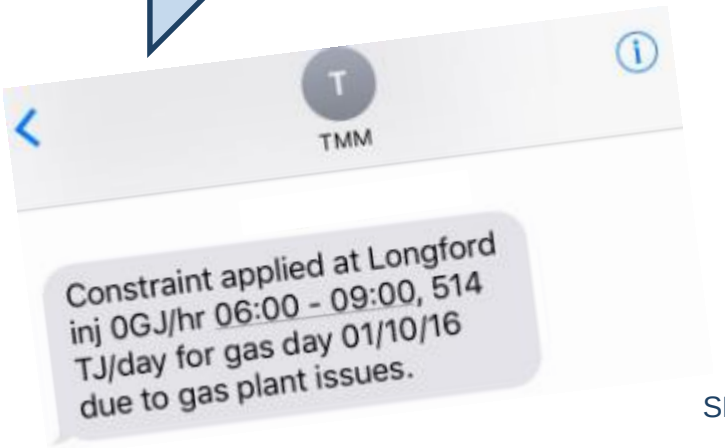
4:50 AM – Longford start to flow some gas

5:30 AM – Modelling confirms no threat.

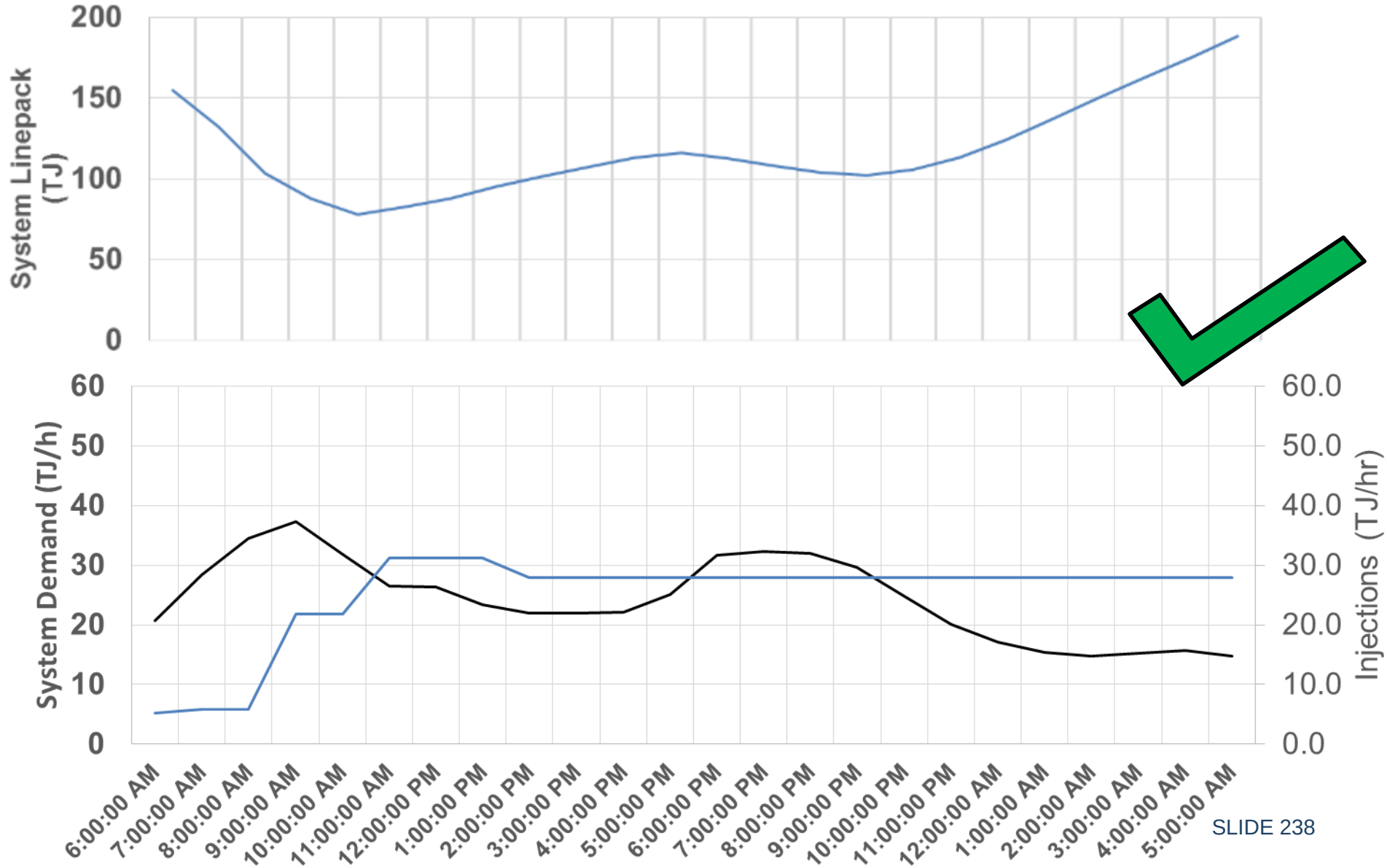
5:37 AM – Longford reduces flow to 0TJ/h.

5:47 AM – Constraint request for 0 TJ/h until 9:00 AM.

5:53 AM – AEMO approves 6:00 AM Schedule.



ABNORMAL MARKET OPERATIONS - AD HOC SCHEDULE – 1 OCTOBER

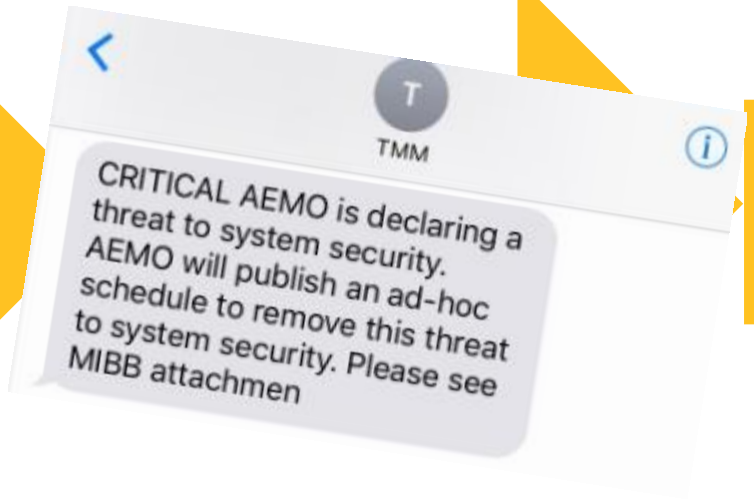


ABNORMAL MARKET OPERATIONS - AD HOC SCHEDULE – 1 OCTOBER

6:00 AM to 6:40 AM – AEMO works with distributors on minimum CTM requirements

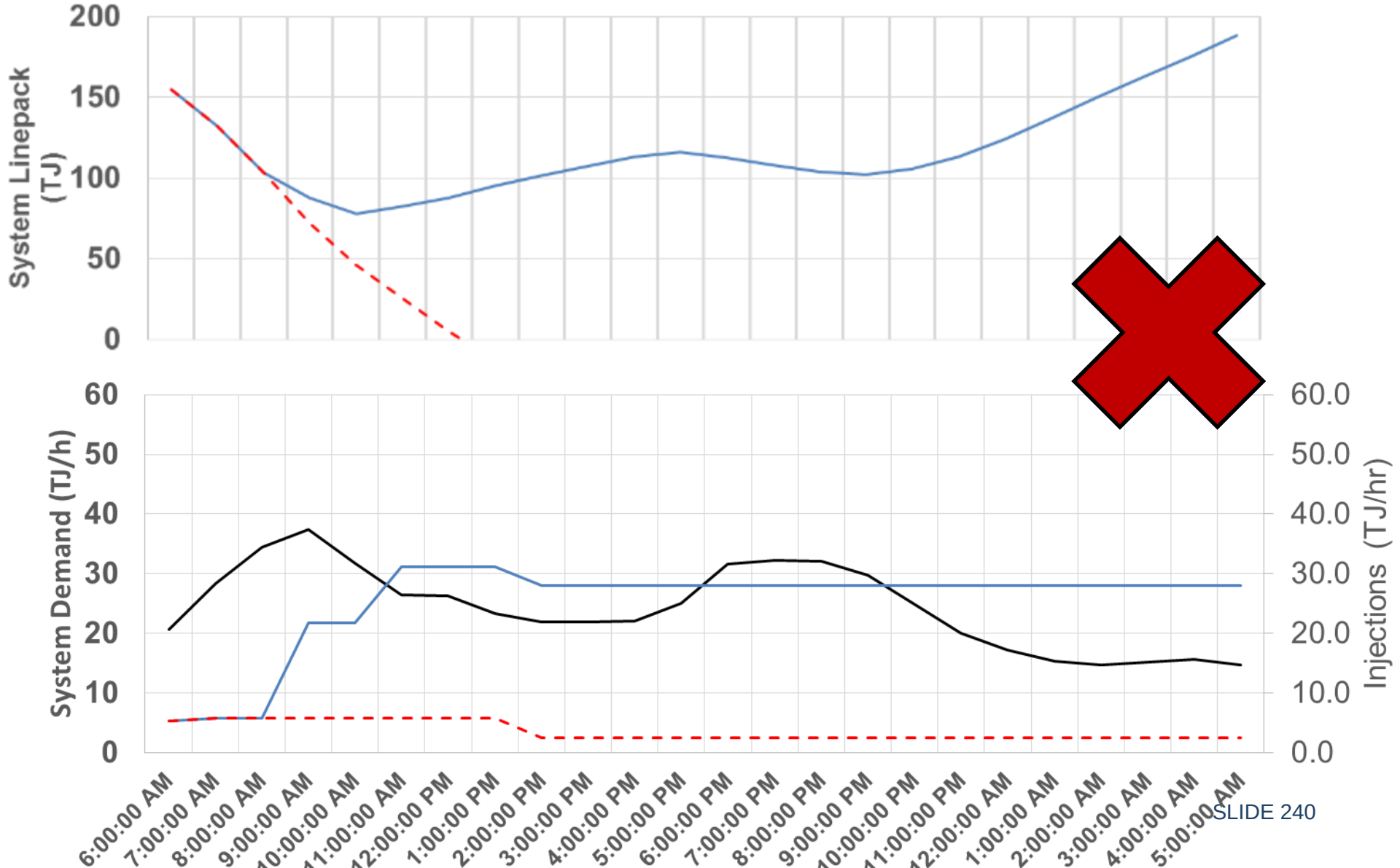
AEMO reduces DCG outlet pressure below contractual pressures within Melbourne as agreed with Distributors

7:00 AM – 8.30 AM discussions with all facility operators



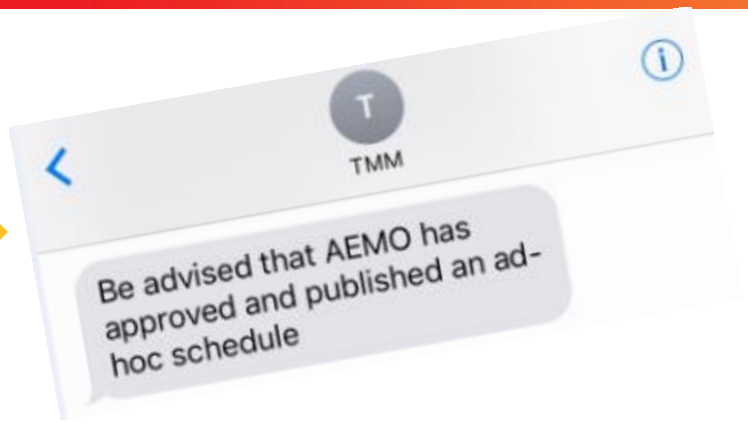
8.40 AM decision to proceed with Ad Hoc Schedule

ABNORMAL MARKET OPERATIONS - AD HOC SCHEDULE – 1 OCTOBER



ABNORMAL MARKET OPERATIONS - AD HOC SCHEDULE – 1 OCTOBER

9:03 AM – AEMO approves Ad Hoc Schedule

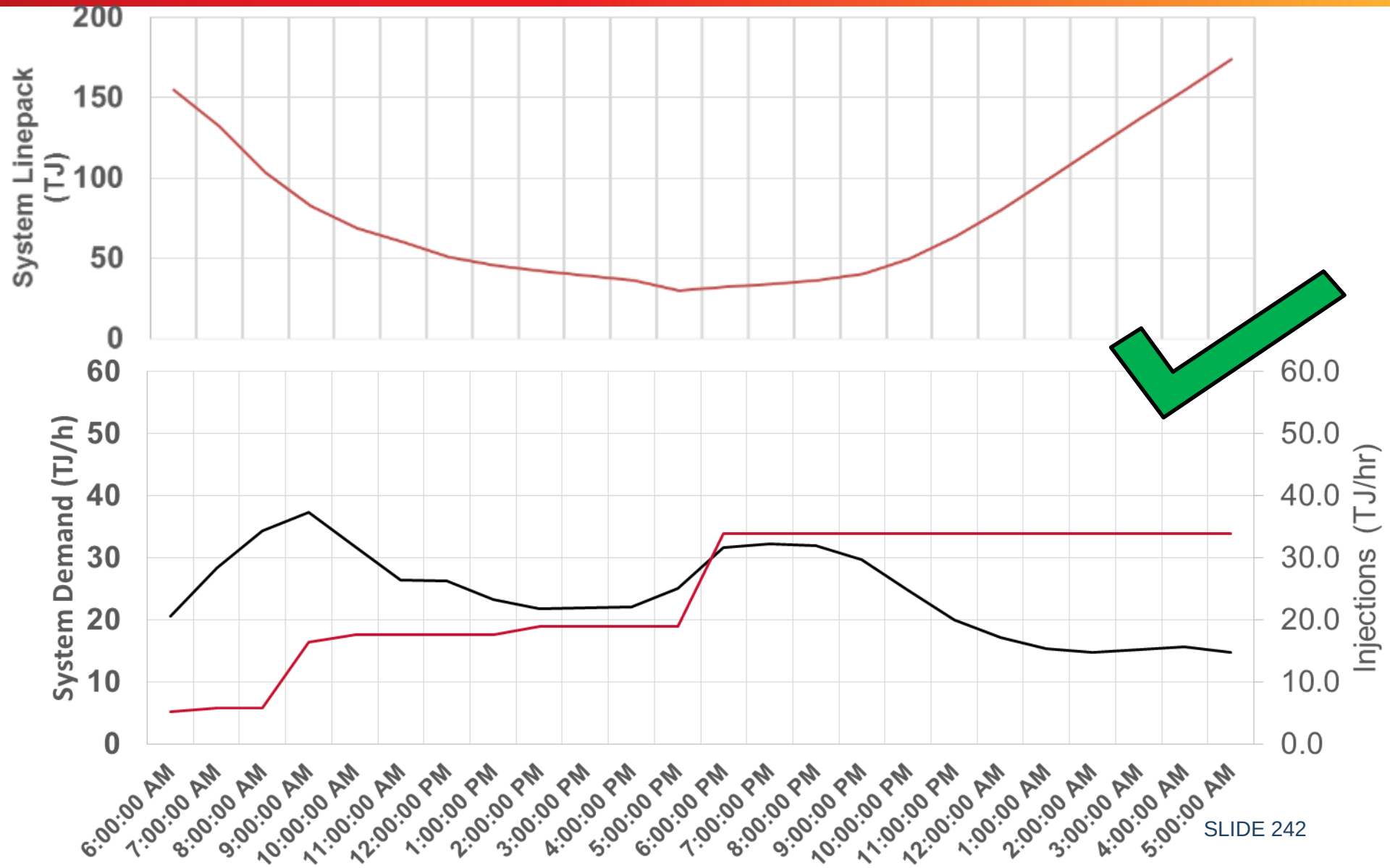


10:12 AM – Sale CTM Pressure breach

10:45 AM – Longford recommences injections

12:16 PM – Sale CTM pressure above minimum pressure

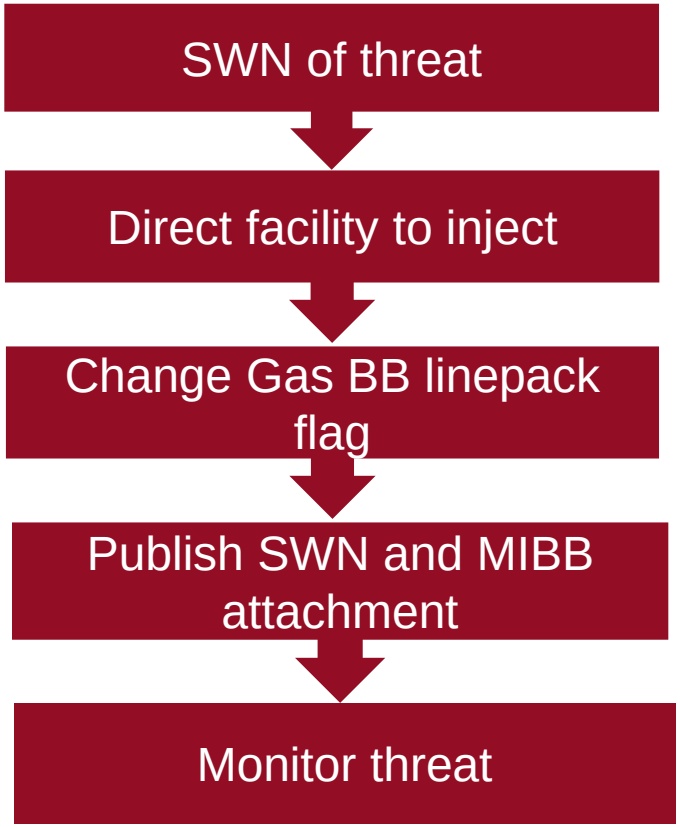
ABNORMAL MARKET OPERATIONS - AD HOC SCHEDULE – 1 OCTOBER



ABNORMAL MARKET OPERATIONS

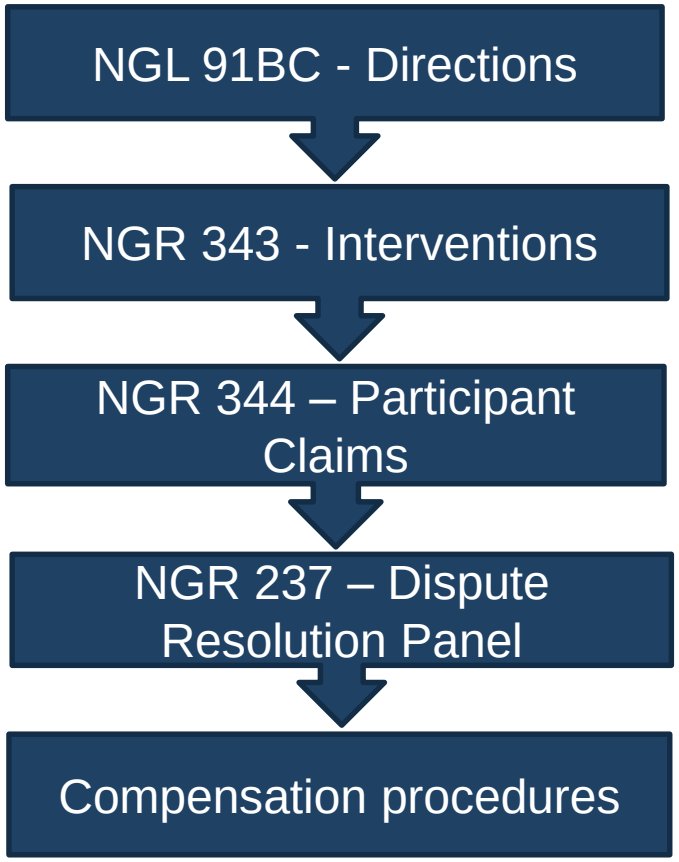
1. Market Response
2. Operational Response
3. Ad Hoc Schedule
4. **Direction**
5. Curtailment
6. Market Suspension

ABNORMAL MARKET OPERATIONS - DIRECT INJECTIONS



CURTAILMENT

CURTAILMENT



MARKET SUSPENSION

MARKET SUSPENSION

Notice of Market Suspension

Reference: National Gas Rules (NGR), Subdivision 6, Market Suspension

Under rule 347 of the NGR, AEMO is declaring that the DWGM will be suspended effective from 18:00 on 10/05/2017. This state will ensue until AEMO makes a further declaration of a time to resume normal market operation.

AEMO determines that it is necessary to suspend the Market due to emergency.

During the DWGM suspension, AEMO will:

- Administer the market price for each scheduling horizon in accordance with Wholesale Market Administered Pricing Procedures.
- Advise the market of the process for the submission of information by Market Participants and issuing gas scheduling instructions by AEMO.

Trigger Event → SWN – Start of Market Suspension → Administer Market → SWN - End of Market Suspension → Return to normal Market Operations

ADMINISTERED MARKET

ADMINISTERED MARKET

Trigger Event → SWN for start of Admin Period → Admin price cap ($40/GJ) applied → SWN for end of Admin Period → Return to normal Market Operations

ABNORMAL MARKET OPERATIONS SUMMARY

- Longford Profiling
- Responding to Threats
  - Market Response
  - Operational Response
  - Ad hoc schedule
  - Directions
- Curtailment
- Market Suspension
- Market Administration

QUESTIONS?

10 May 2017

EMERGENCY MANAGEMENT IN THE DWGM

PRESENTED BY MARK POLLOCK

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

PURPOSE

- AEMO’s operational response
- AEMO’s management response
- Emergency Management Team structures
- Communication Protocols

AEMO'S RESPONSIBILITIES & POWERS

National Gas Law

Section 91BA	AEMO's responsibility for operation and security of DTS
Section 91BC	AEMO's powers to direct participants, up to and including curtailment

National Gas Rules

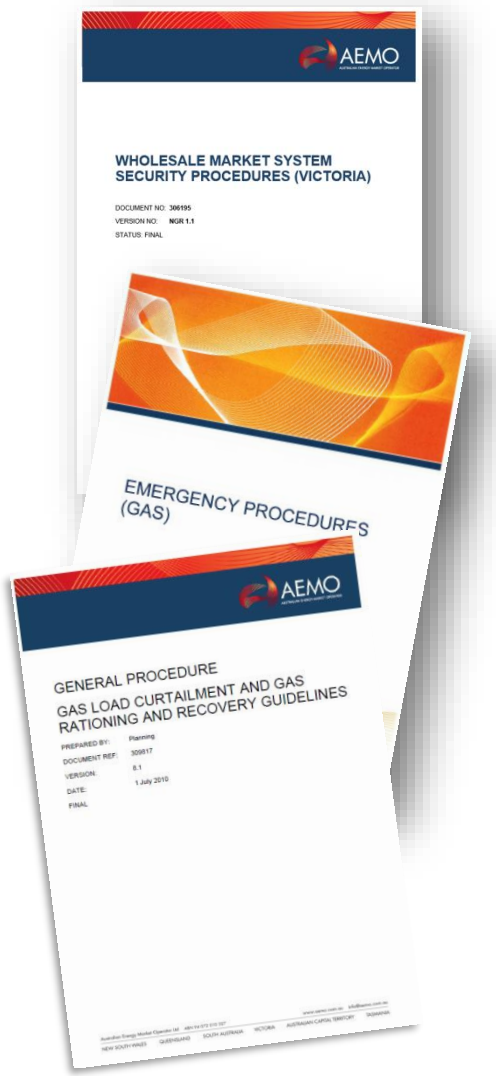
Rule 339	Declarations and directions in an emergency
Rule 341	Notice of threat to system security
Rule 342	Market response to threat to system security
Rule 343	Intervention due to system security threat

GAS EMERGENCY PROTOCOL

Wholesale Market System Security Procedures

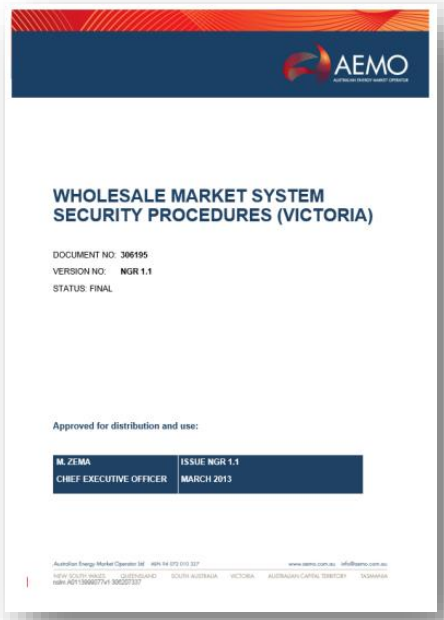
Emergency Procedures Gas

Wholesale Market Gas Load Curtailment and Gas Rationing and Recovery Guidelines



AEMO'S RESPONSIBILITIES & POWERS

Wholesale Market System Security Procedures



Response to a Threat

1) Market Response

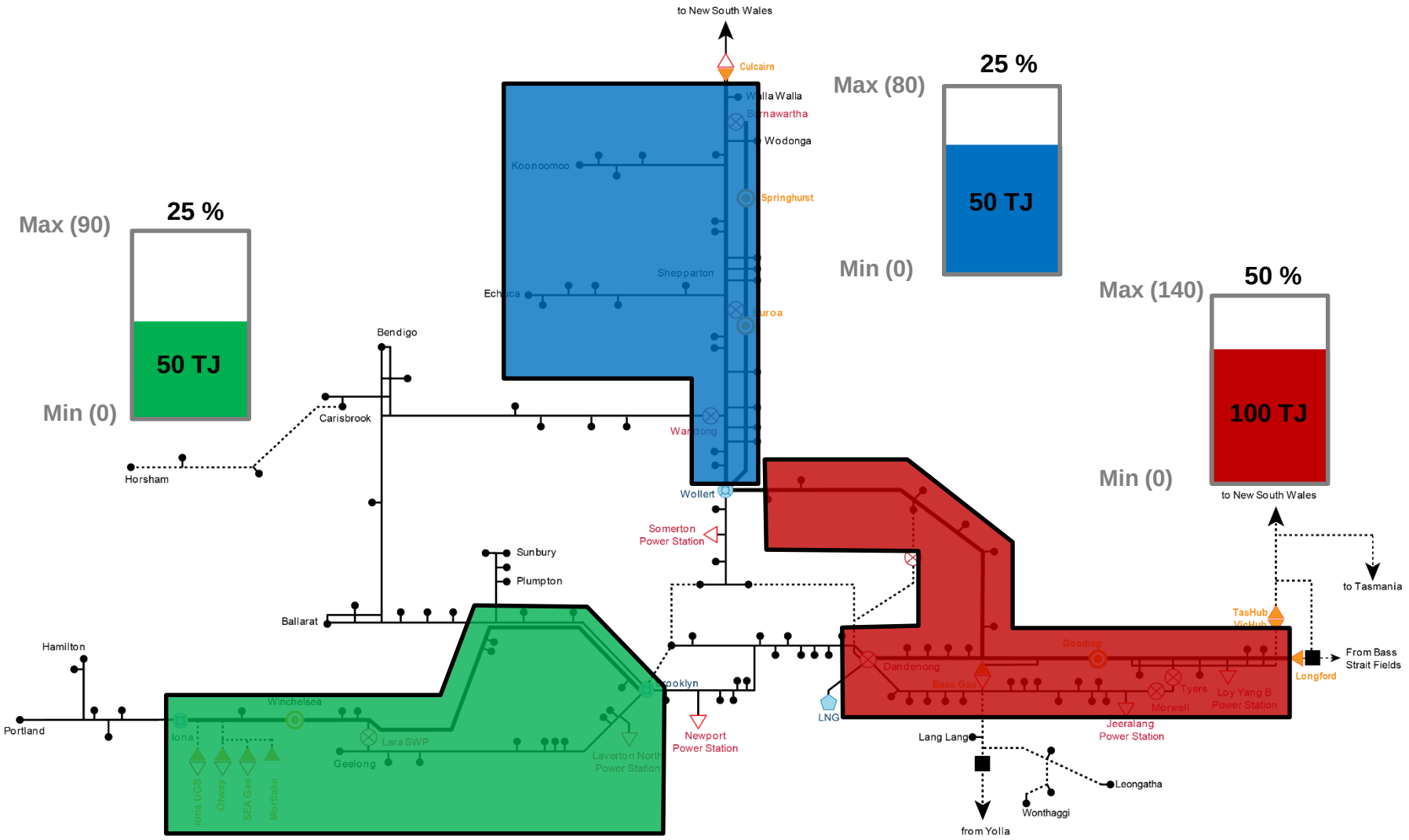
2) Out of merit order gas at next schedule

3) Publish Ad-Hoc Operating schedule

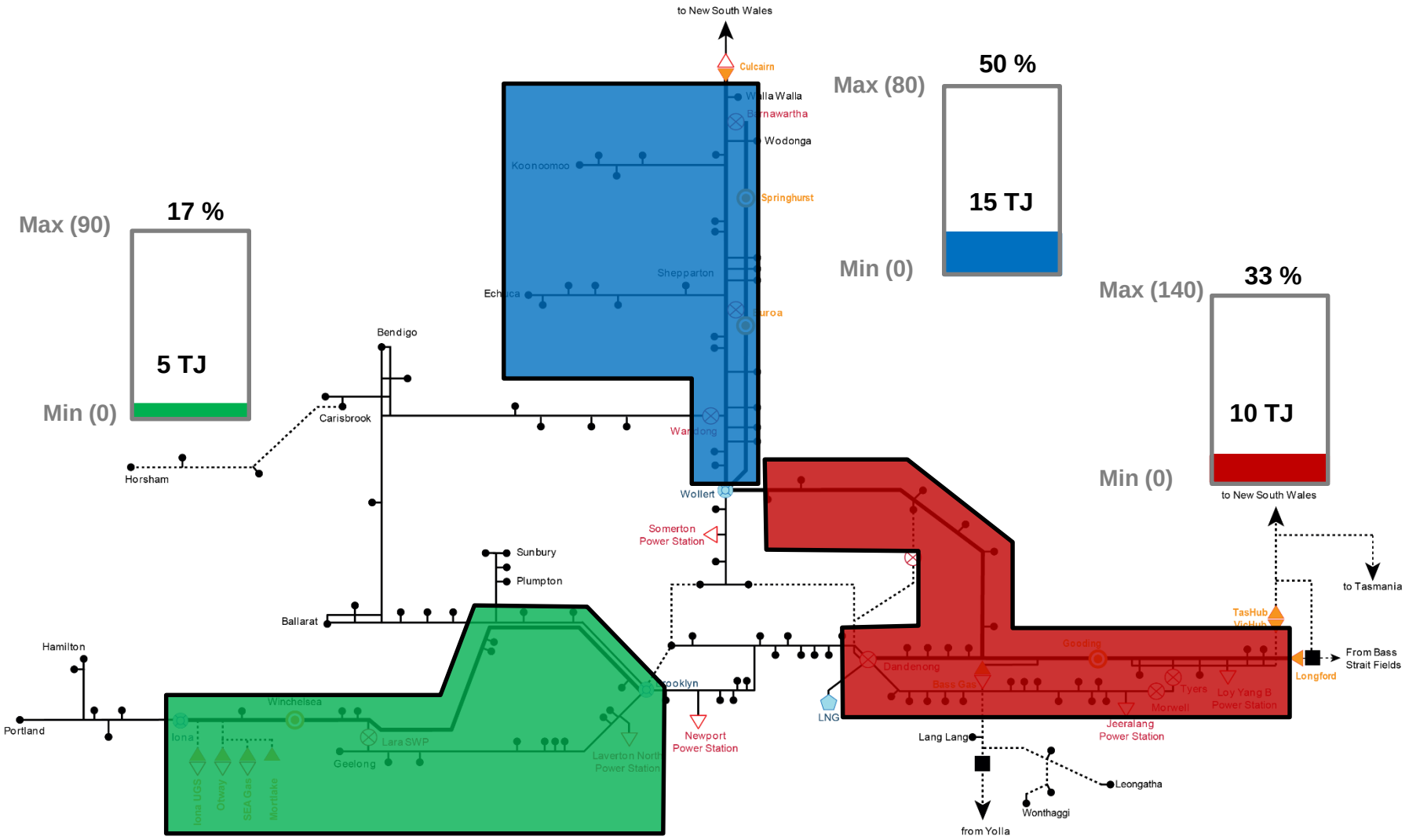
4) Issue Direction to inject or withdraw

5) Curtailment

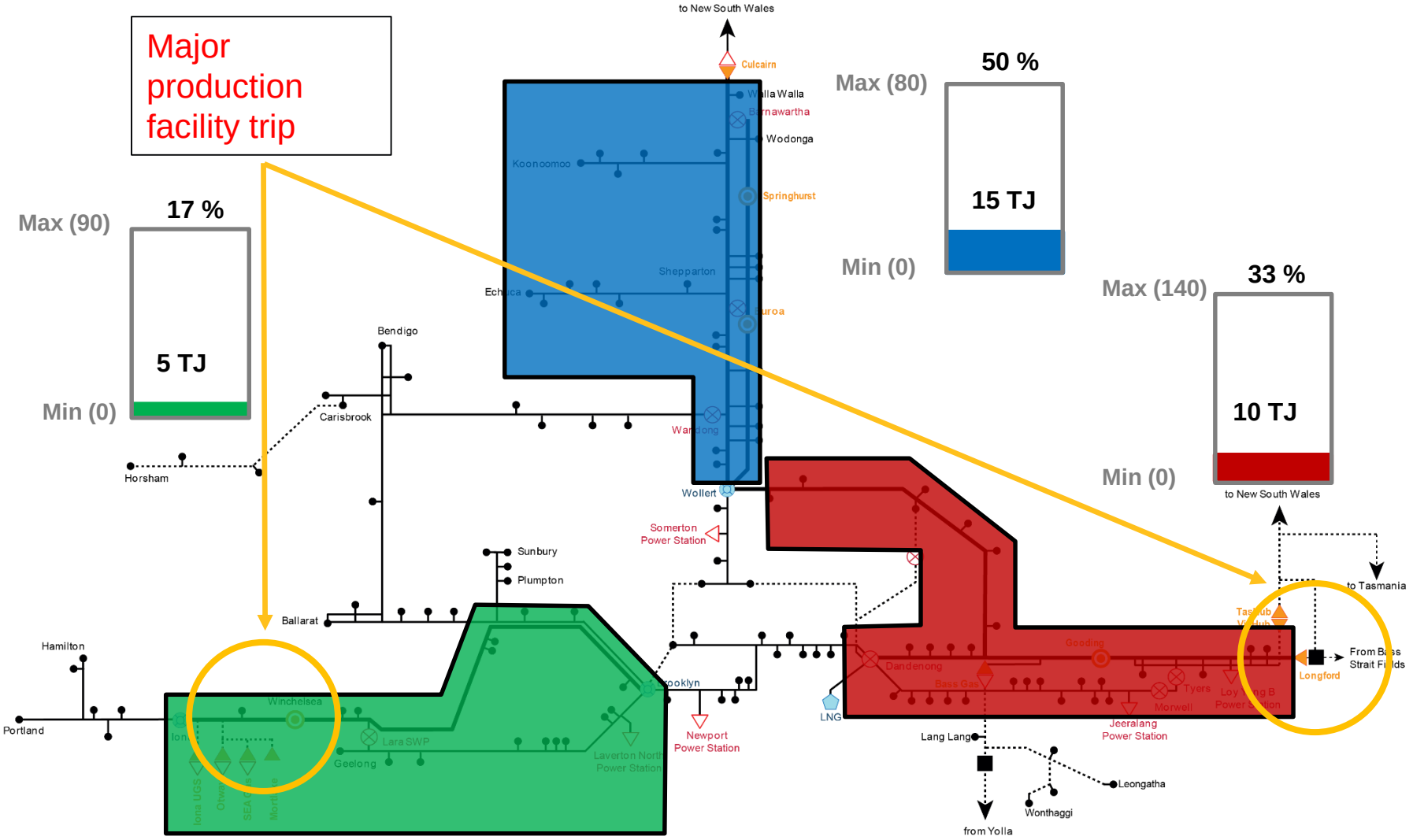
IDEAL BOD LINEPACK BALANCE



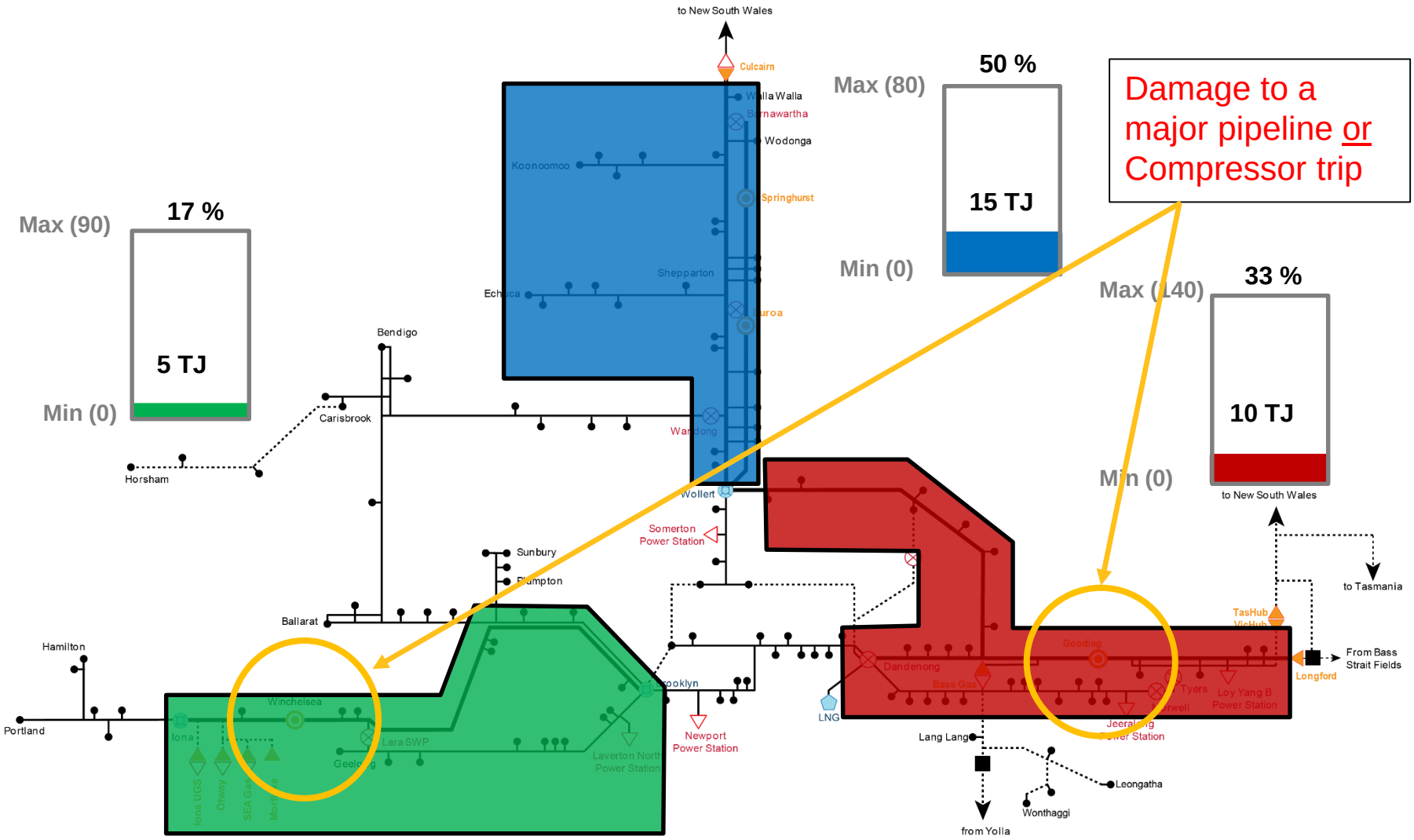
LINEPACK BALANCE – MIDDLE OF EVENING PEAK ON A HIGH DEMAND DAY



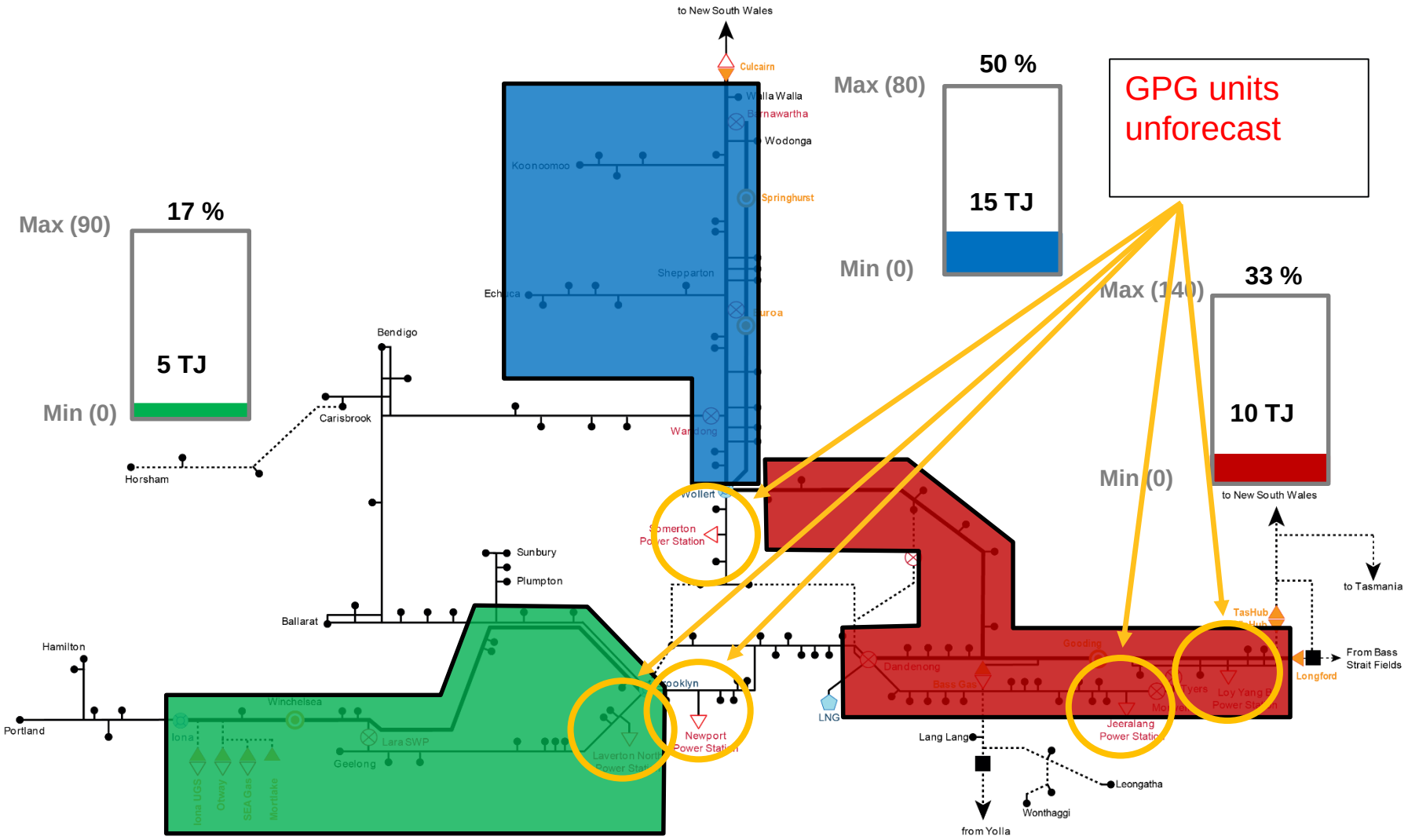
PRODUCTION FACILITY OUTAGE - INSUFFICIENT SUPPLY



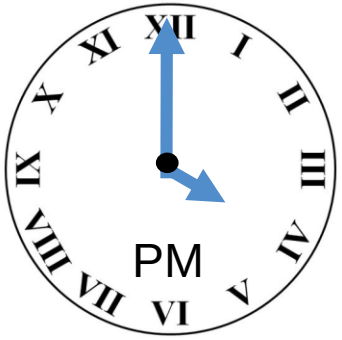
PIPELINE DAMAGE OR COMPRESSOR OUTAGE – INABILITY TO TRANSPORT



SUDDEN INCREASE IN DEMAND – GPG DEMAND



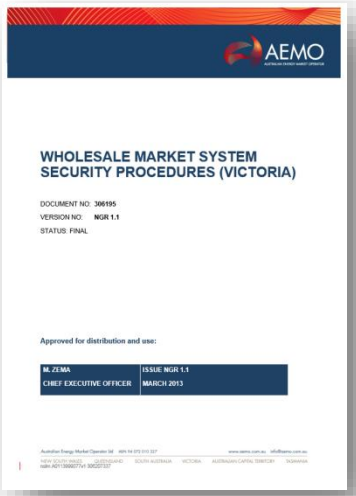
SCENARIO
-HIGH DEMAND WINTER DAY



- High demand day
- Moderate level GPG
- VNI exports
- Incident in NEM occurs
  - Large amount of unforecast GPG
- How do we respond?

GAS EMERGENCY PROTOCOL

Wholesale Market System Security Procedures



Response to a Threat

1) Market Response

2) Out of merit order gas at next schedule

3) Publish Ad-Hoc Operating schedule

4) Issue Direction to inject or withdraw

5) Curtailment

MARKET RESPONSE

Notice of a Threat to System Security – Seeking a Market Response

Reference: *National Gas Rules (NGR), Part 19, Division 5, Subdivision 5, Notice of Threat to System Security*

Under rule 341 of the NGR, AEMO is notifying participants of a threat to system security in the

22:00 AEST 31/07/2016.

The threat to system security is likely to impact:

☐	Total System	☒	Melbourne Withdrawal Zone
☐	Gippsland Withdrawal Zone	☐	Northern Withdrawal Zone
☐	Geelong Withdrawal Zone	☐	Ballarat Withdrawal Zone
☐	Western Withdrawal Zone		

A market response to this notice may alleviate the threat to system security and remove the need for AEMO to take action. Market participants are asked to re-evaluate their bids and offers.

The market may alleviate the threat by increasing injections from Dandenong LNG Facility to obtain a total net daily injection quantity of 30 TJ.

- There will be a market notice to advise the removal of the threat to system security.
- AEMO reserves the right to determine an appropriate operational response if the market response is insufficient to avert the threat to system security

A market response to this notice may alleviate the threat to system security and remove the need for AEMO to take action. Market participants are asked to re-evaluate their bids and offers.

The market may alleviate the threat by increasing injections from Dandenong LNG Facility to obtain a total net daily injection quantity of 30 TJ.

OUT OF MERIT ORDER GAS – NEXT SCHEDULE

- Run schedule after bid cut off at 5 PM

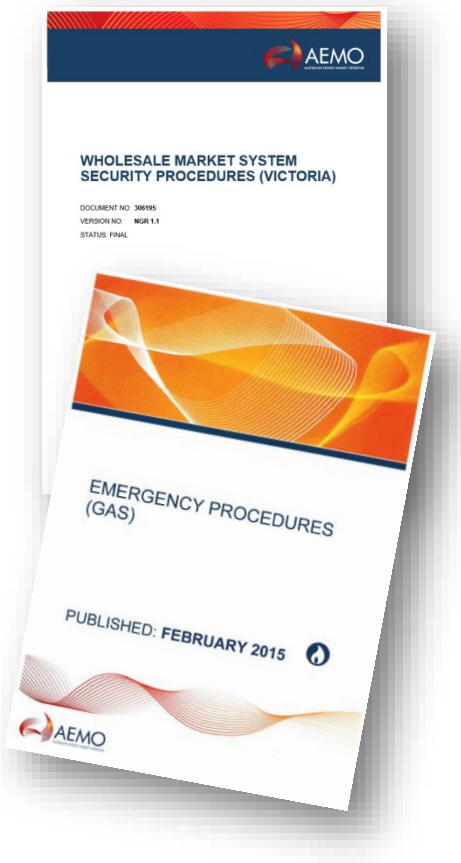
- Did the market respond?
  - Some participants may have moved injection bids to LNG meter to cover their positions, less out of merit order LNG required

- Re-model with new schedule
  - Market response insufficient
  - AEMO schedules LNG above the market price

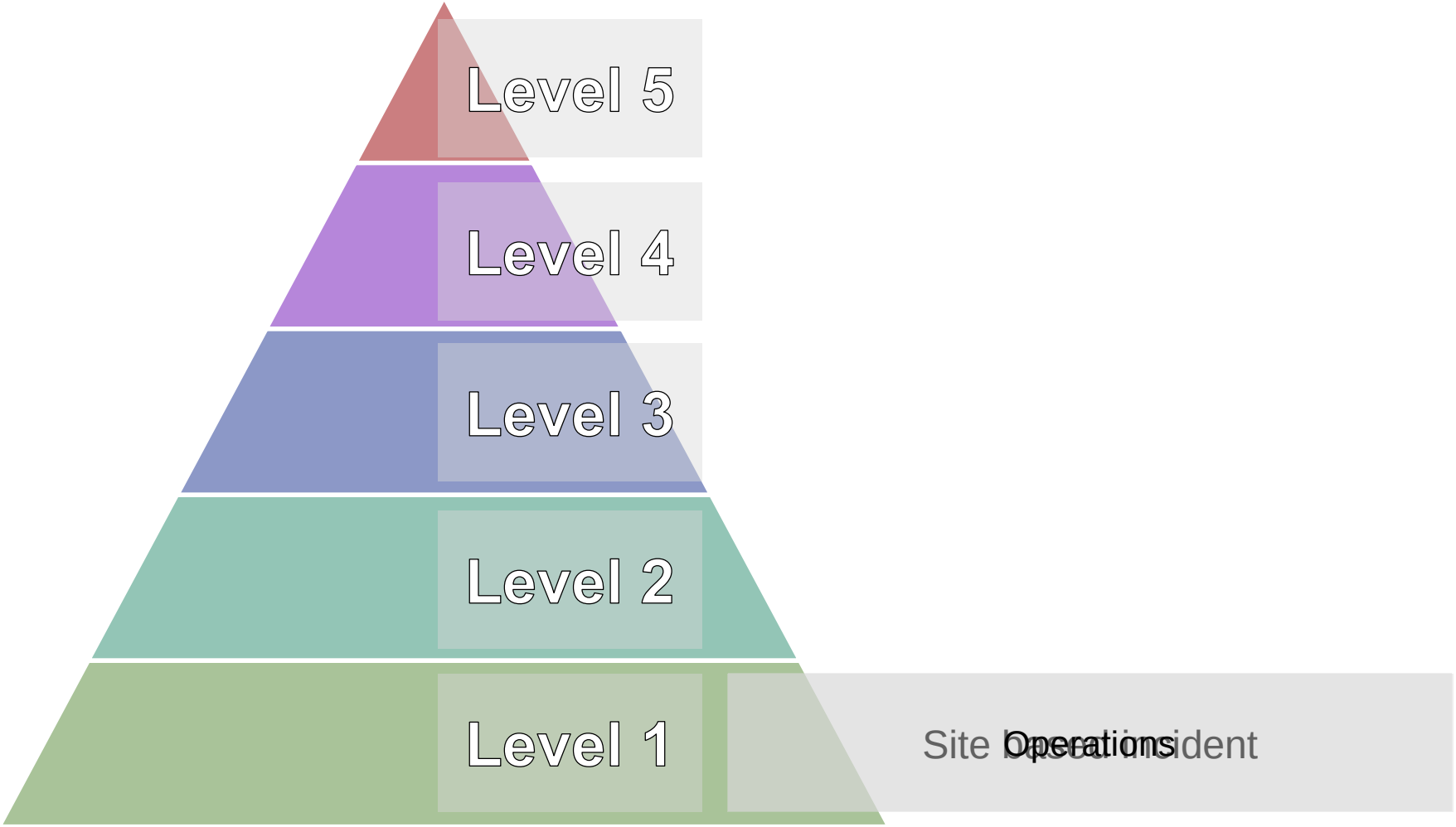
GAS EMERGENCY PROTOCOL

Wholesale Market System Security Procedures

Emergency Procedures Gas

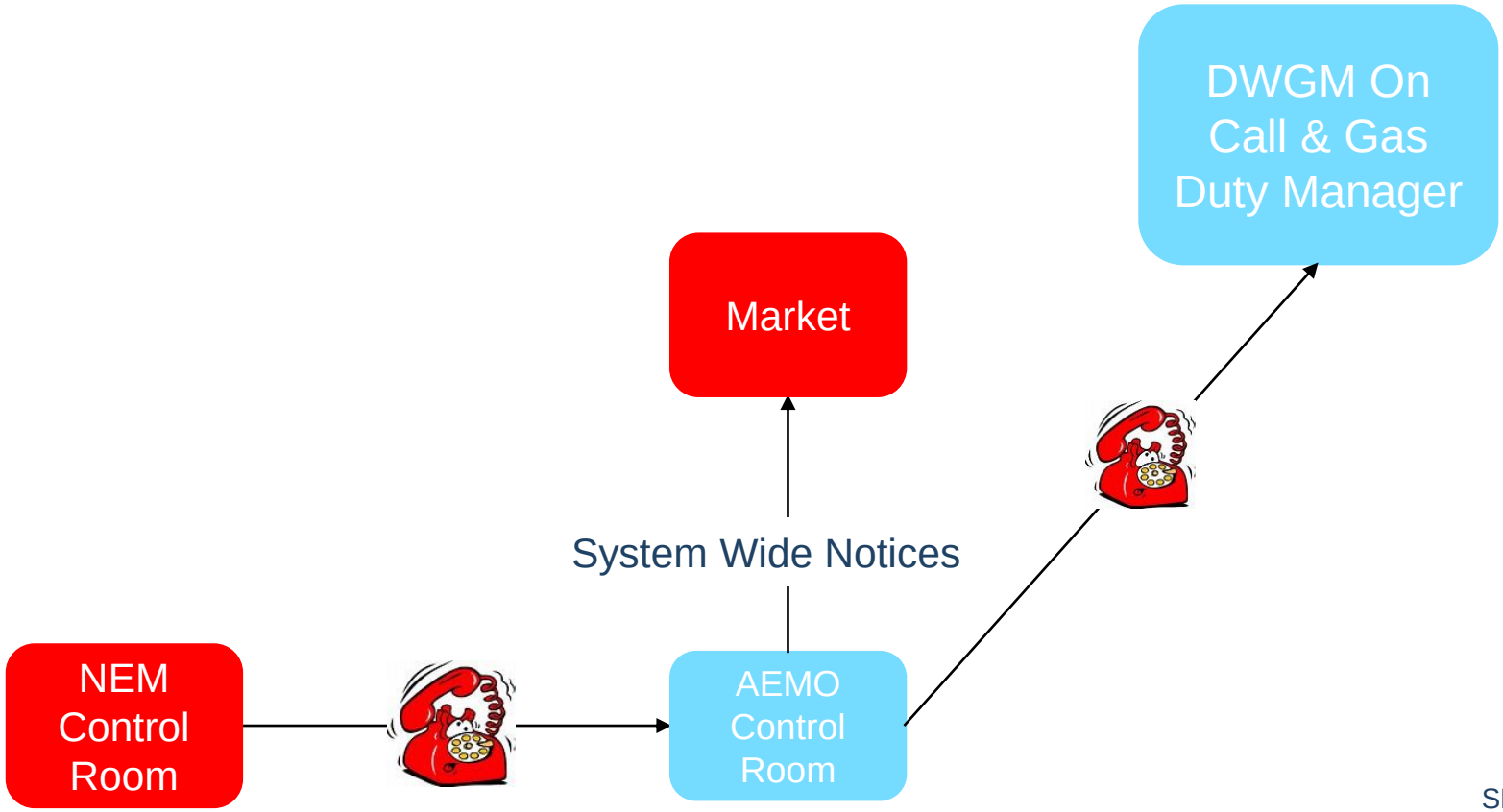


EMERGENCY PROCEDURES GAS
GAS EMERGENCY LEVELS



Note: Threat to System Security may be declared at any level

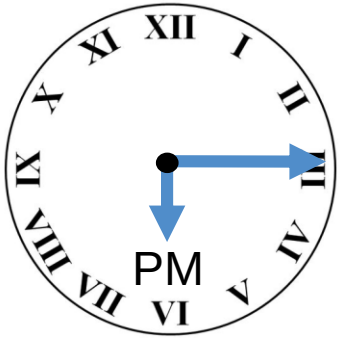
COMMUNICATIONS - RESPONSE STRUCTURE



OUT OF MERIT ORDER GAS – NEXT SCHEDULE

- Schedule commences at 6PM
- Additional market called gas
- Some operational response LNG injected
- Pressures start to recover

SUPPLY REDUCTION



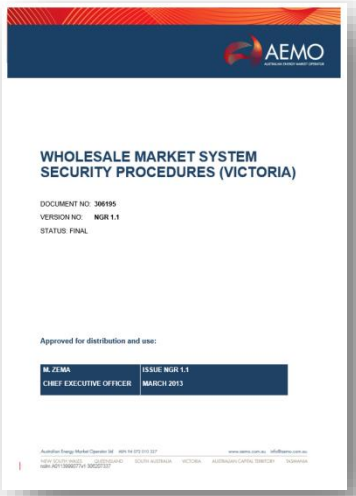
- One of the plants at a major production facility trips
- High GPG and reduced supply
- Now what?
- Run a model!

AD-HOC

- Modelling indicates that additional LNG is required from 7pm.
- The next schedule isn’t until 10pm
- Ad-Hoc schedule is required with additional LNG schedule from 7pm.

GAS EMERGENCY PROTOCOL

Wholesale Market System Security Procedures



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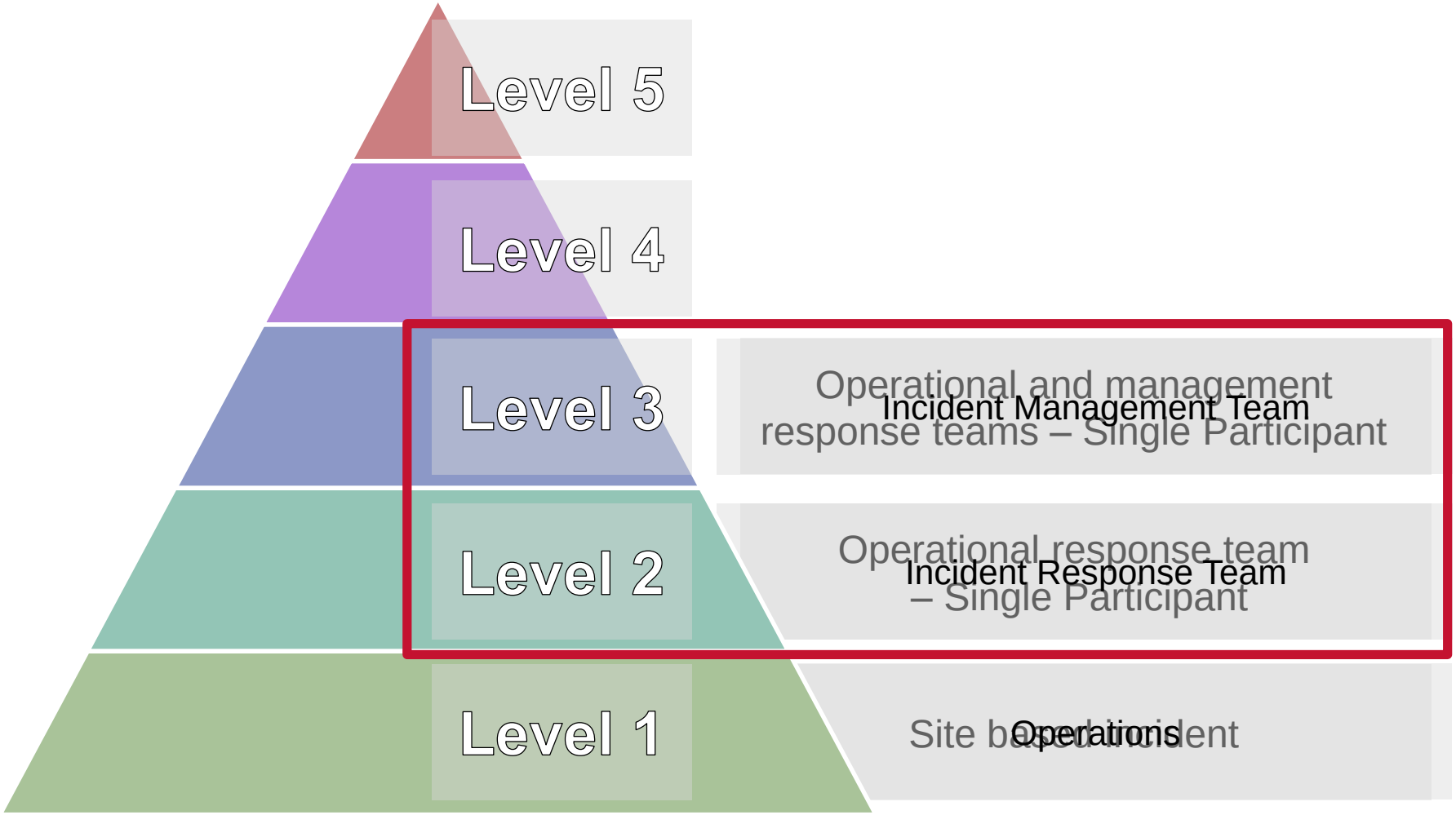
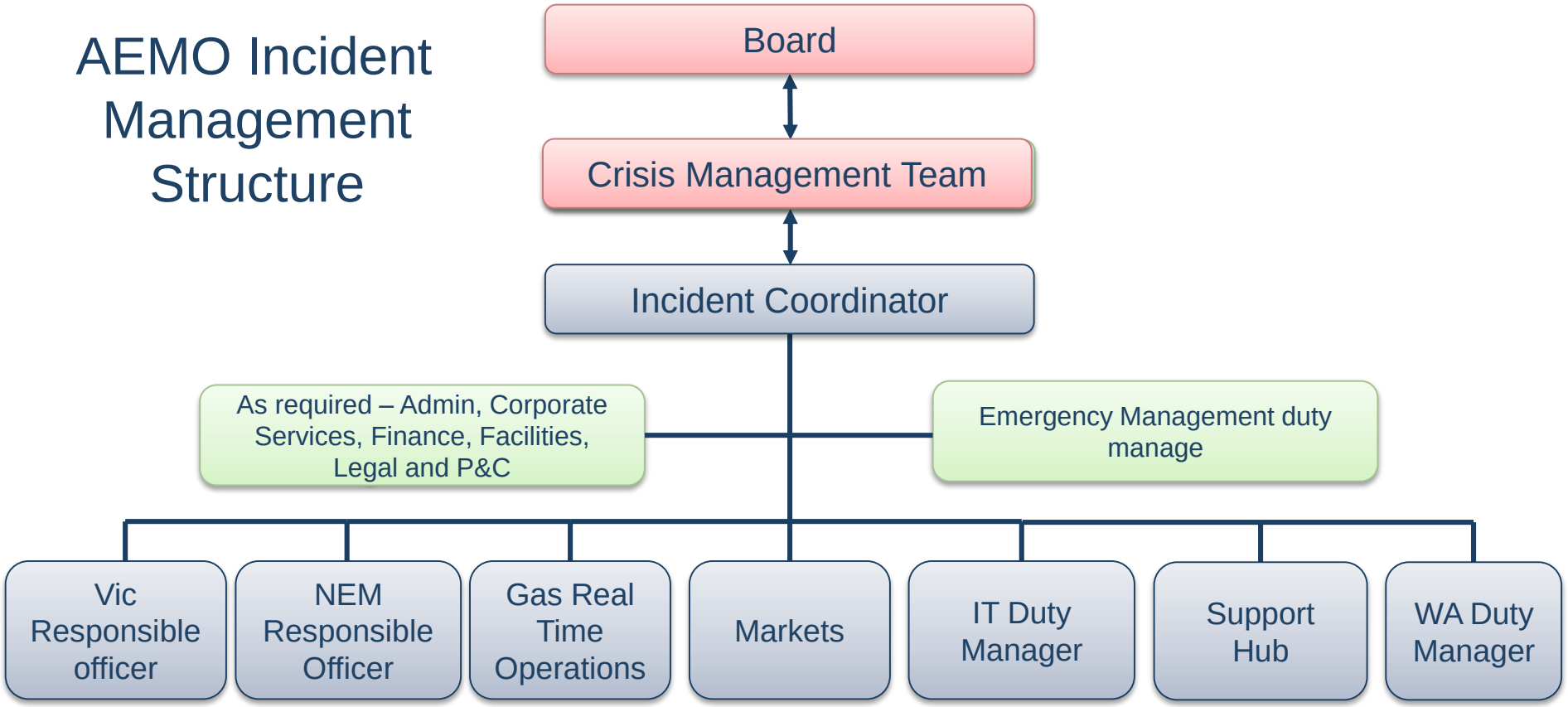
EMERGENCY PROCEDURES GAS
GAS EMERGENCY LEVELS

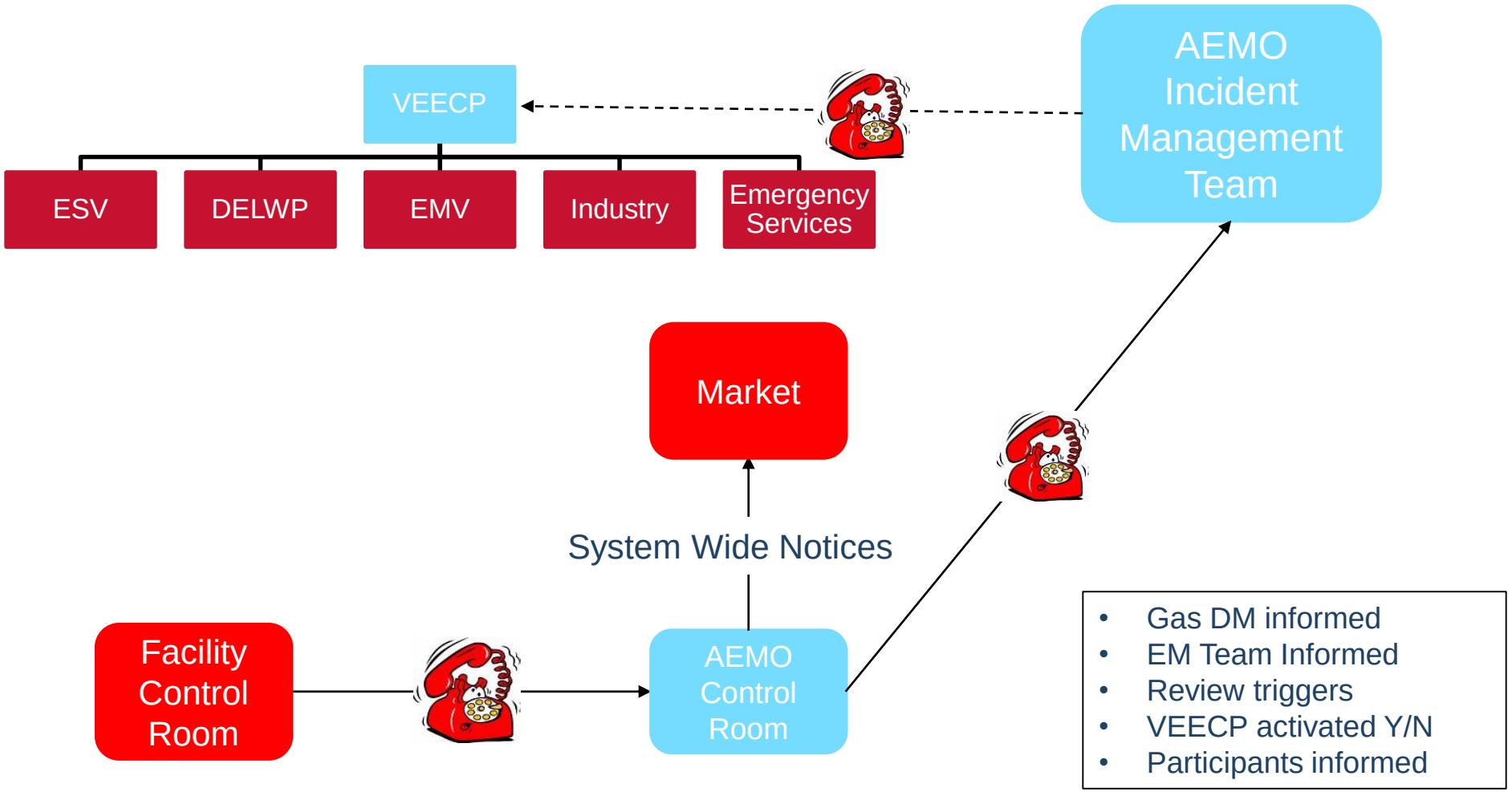


EMERGENCY PROCEDURES GAS MANAGEMENT STRUCTURES

AEMO Incident Management Structure



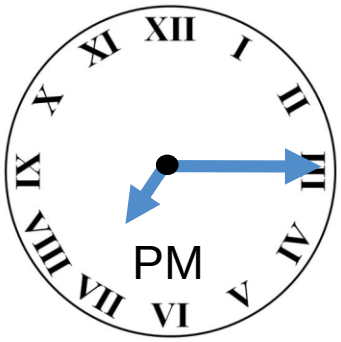
COMMUNICATIONS - RESPONSE STRUCTURE



AD-HOC

- Additional injections & LNG injected from 7pm
- The next schedule isn’t until 10pm so an Ad-Hoc schedule is run, with additional LNG schedule from 7pm
- This additional LNG begins to stabilise the pressure

SCENARIO CONTINUED

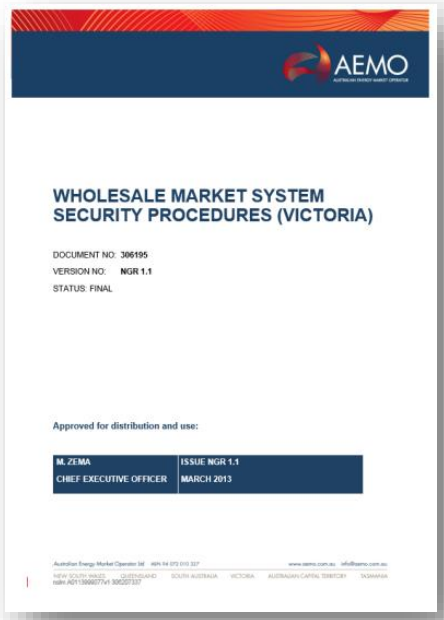


- Additional LNG from 7PM
- Pressures look okay
- At 7:15 PM the entire plant trips, not returning for 3 days.

AEMO'S RESPONSIBILITIES & POWERS

Section 53, National Gas (Victoria) Act 2008

Wholesale Market System Security Procedures



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EMERGENCY PROCEDURES GAS
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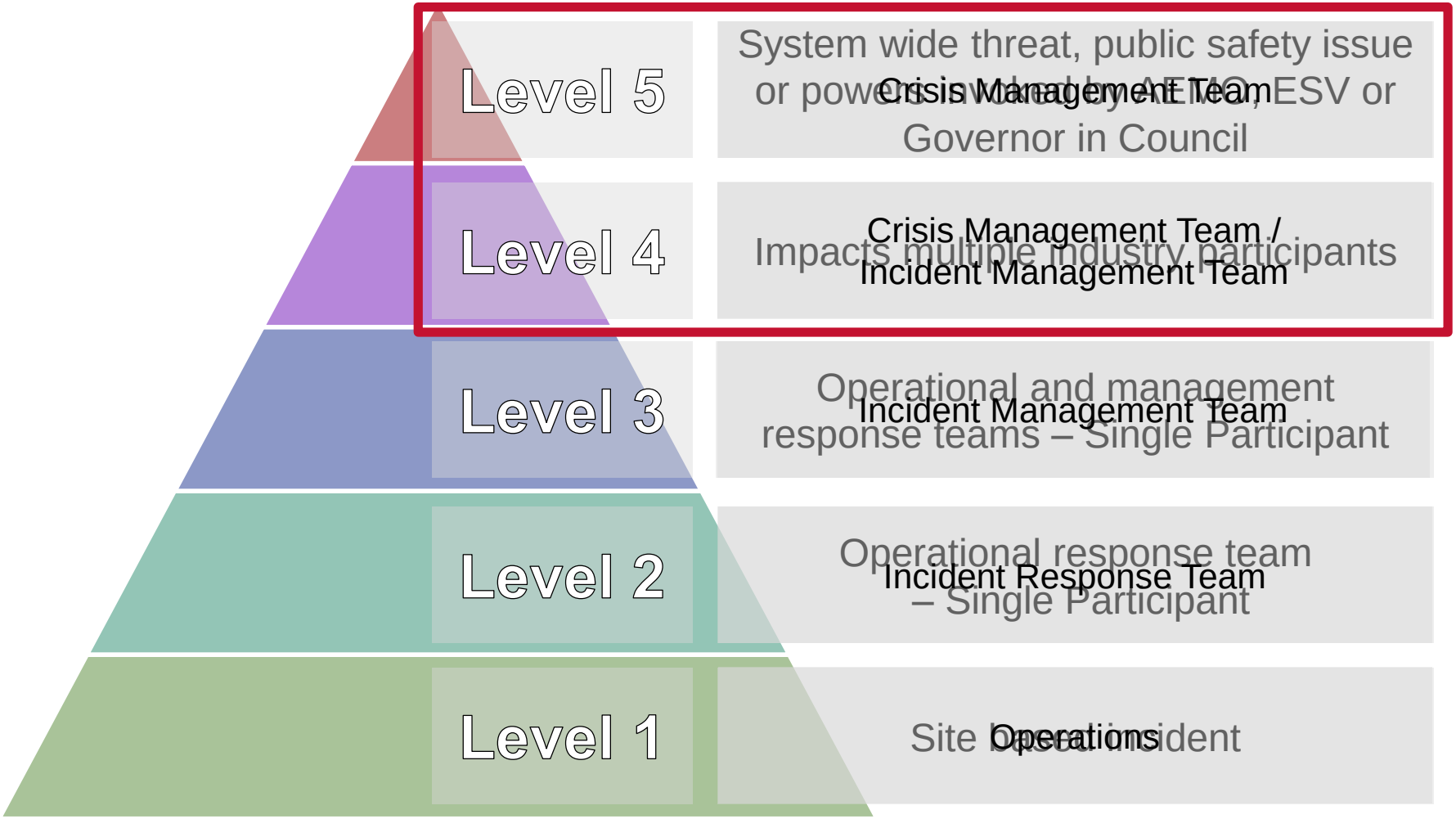
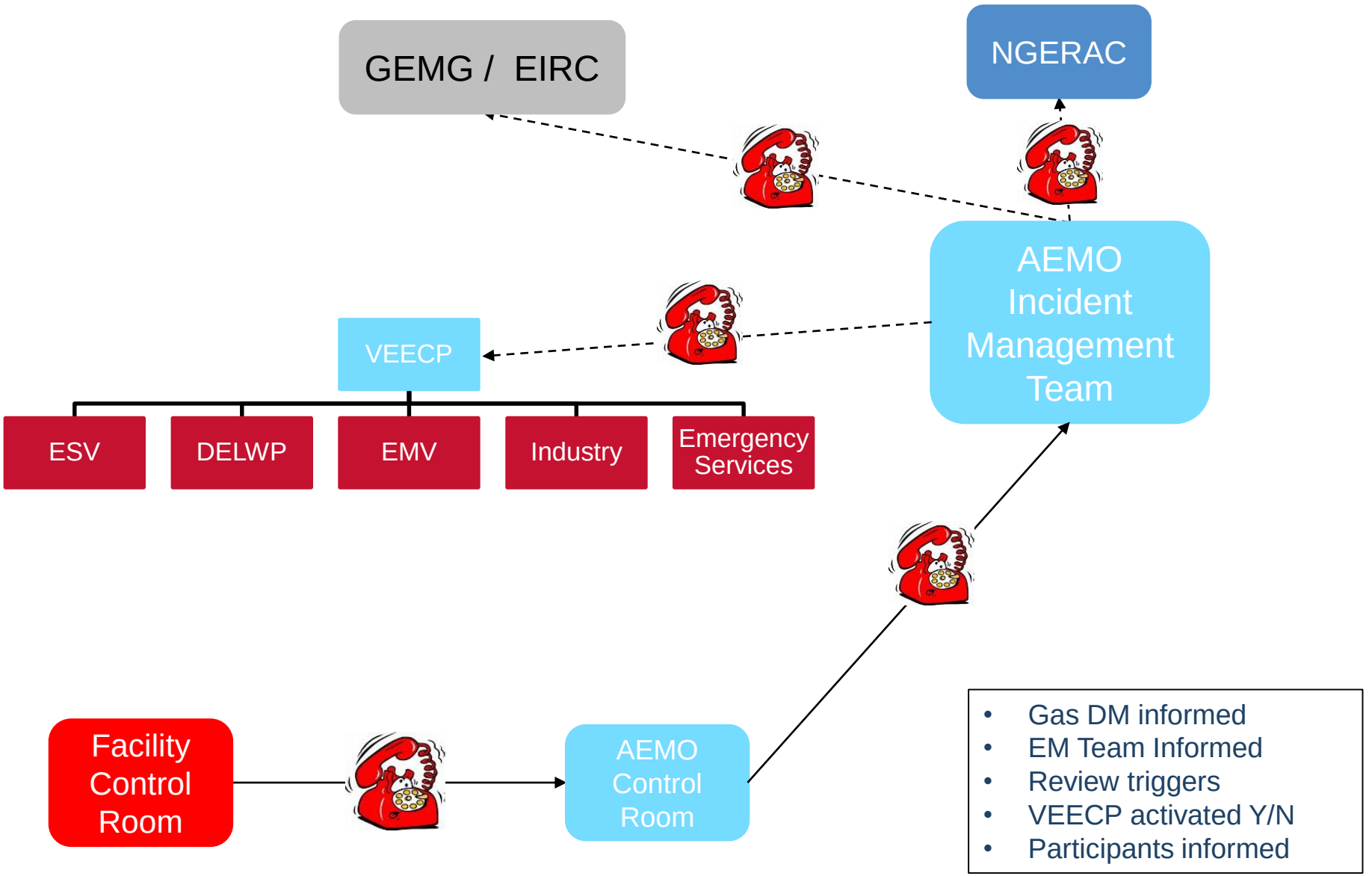


Note: Threat to System Security may be declared at any level

EXAMPLE - RESPONSE STRUCTURE



CURTAILMENT

- Modelling indicates a response is required before 8pm
- Immediate response, not time for Ad-Hoc schedule
- Supply capacity isn’t sufficient to meet demand
- A demand side response is required

ISSUE DIRECTIONS

- NGR 343 (1)

Intervention due to system security threat

If AEMO reasonably considers that a threat to system security is unlikely to subside without intervention, AEMO must intervene in the Market by taking any measures it believes are reasonable and necessary to overcome the threat to system security, including (without limitation) injecting gas from AEMO's LNG reserve or making the following directions under section 91BC of the *NGL*:

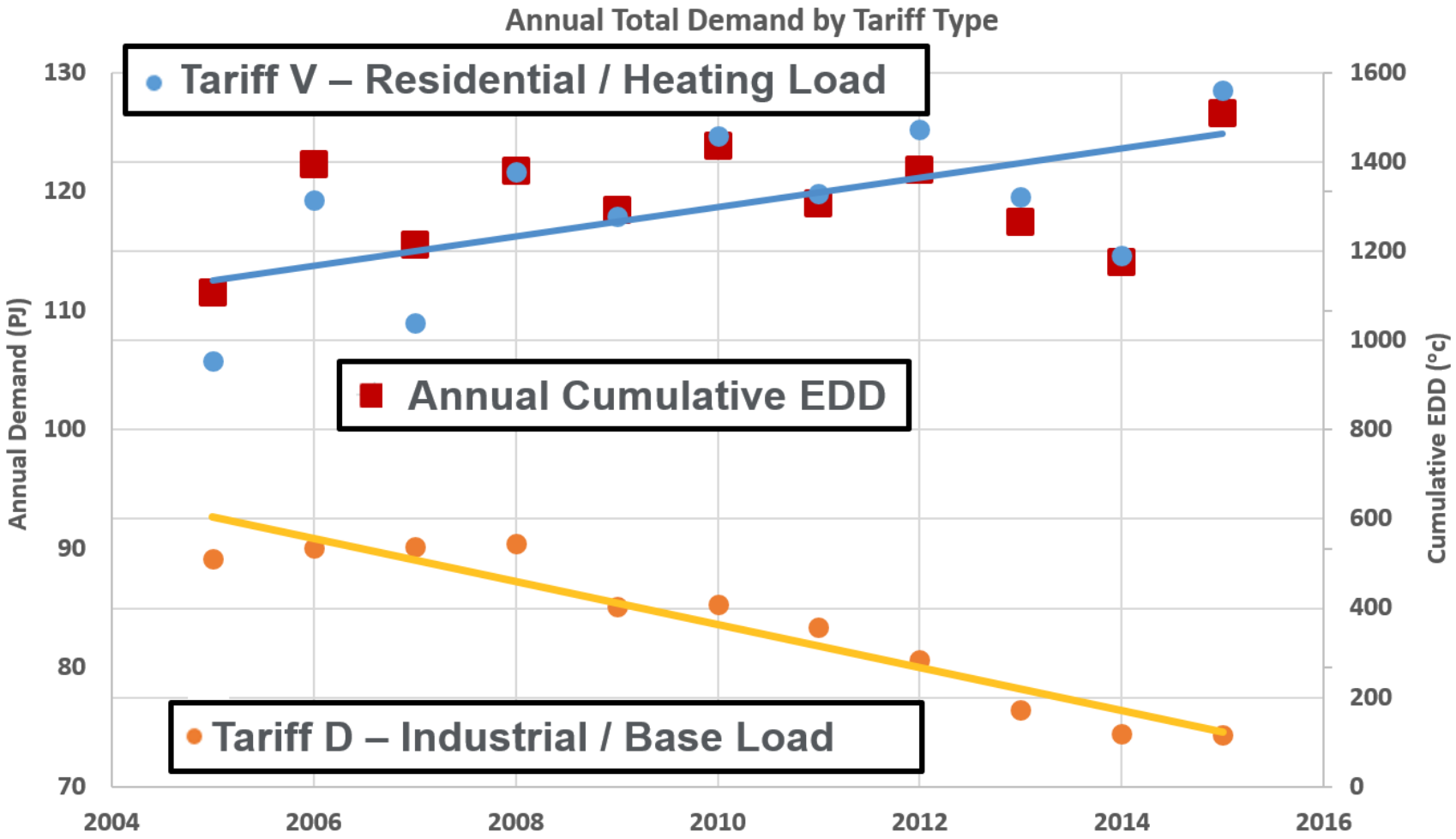
DIRECTIONS & CURTAILMENT

- AEMO issues direction to injectors
- Level of demand reduction that is required determined through modelling
- Curtailment tables determine which gas users are curtailed

CURTAILMENT, GAS RATIONING & RECOVERY GUIDLINES

Large	Table 0	Unauthorised loads
	Table 1	Authorised Sites (by size)
	Table 2	
	Table 3	
	Table 4	
	Table 5	
	Table 6	
	Table 7	
	Table 8	
	Table 9	
Small	Table 10	Small gas sites (Heating and Balance of load)
Priority	Table 11	Priority gas sites (Critical and Essential Services)

DECLINING TARIFF D LOAD



VOLUNTARY CURTAILMENT

- Reducing Industrial Load
  - Reduced Impact of Table 0 – Table 9 curtailment

- High Residential Load in Winter
  - Potential for quick response from public voluntary curtailment

INCIDENT RECOVERY

- When supply is restored the market is notified that the threat has ended
- Emergency response teams stand down and return to BAU or manage recovery
- Commencement of incident reporting and lessons learned

CLOSING POINTS

- Likelihood of abnormal conditions is increasing
  - Tightening gas supply
  - Tightening base load electricity → increased GPG
- Familiarity with procedures essential
  - Review update and practice
- Adapt to the changing energy landscape

THANK YOU

Questions?

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR