

WINTER 2016 – VICTORIAN GAS OPERATIONS OUTLOOK

3 May 2016

AGENDA

1:00 - 2:30

Session 1

- Introduction
- 2015 Review and 2016 Overview
- 2016 Weather Outlook
- DTS Augmentations
- Transmission Operations

3:00 - 3:30

Afternoon tea

3:30 - 5:00

Session 2

- Market Operations
- Peak Day – Case Study
- Emergency Management
- Announcement and Q & A

5:00 - 6:00

Networking

INTRODUCTION

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

- **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

- **Analysis of transmission system changes**
 - 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



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**

AEMO OPERATION OF THE APA TRANSMISSION SYSTEM

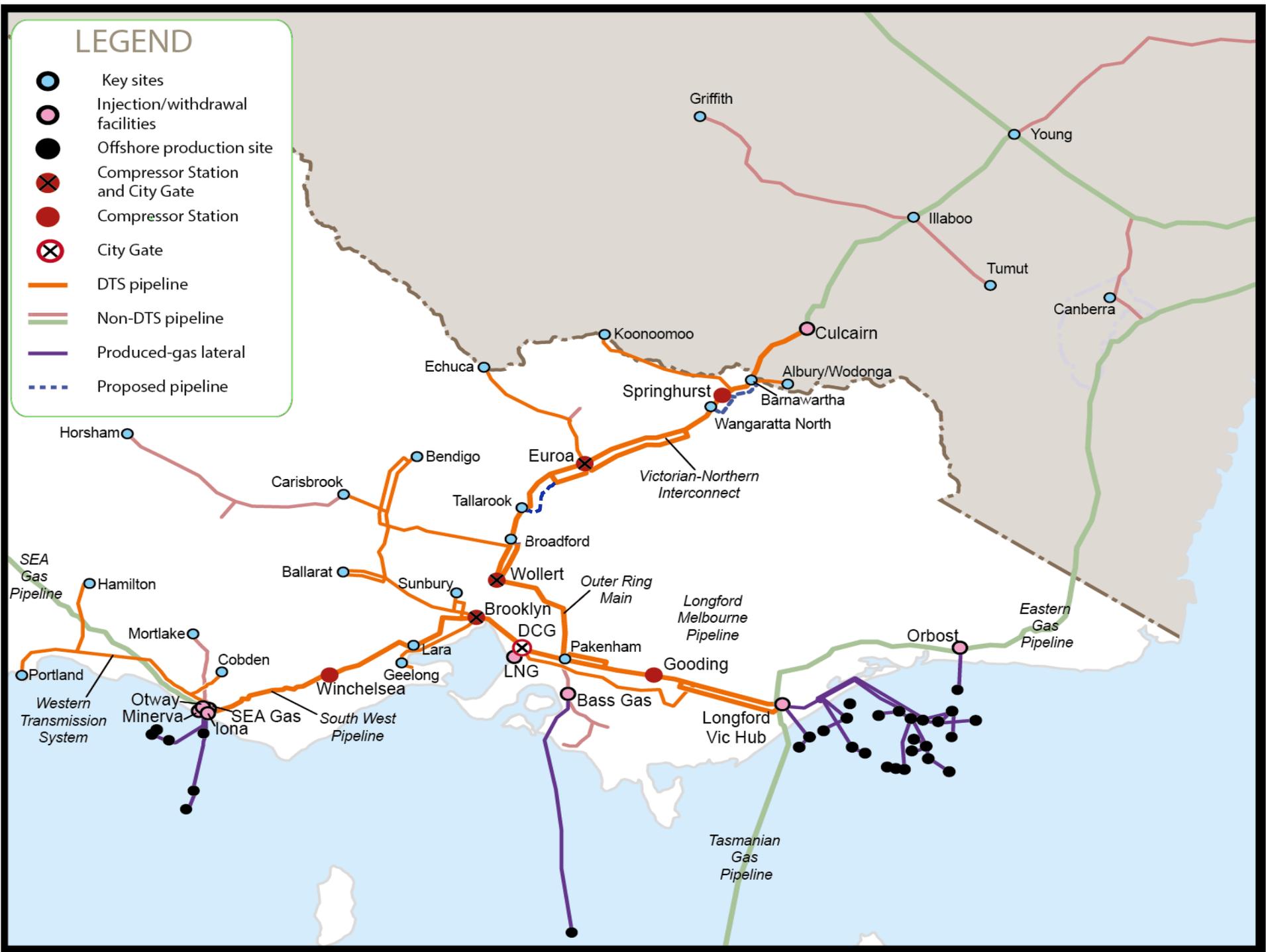


- **Operate the DTS per the Service Envelope Agreement (SEA)**
 - Agreed operations and reliability standards
 - Incident review and continuous improvement
- **AEMO Releases APA Assets for Maintenance**
 - Manage APA asset outages to maintain supply
 - Victorian Gas Maintenance Coordination process
-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

- **Gas Demand Forecasting**
 - Market participant forecasts adjusted against actual flow
 - Demand Override Methodology
 - Direct Call to Weather Forecasting Service
- **Monitoring GPG via 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

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



HOW THE VICTORIAN DTS IS DIFFERENT



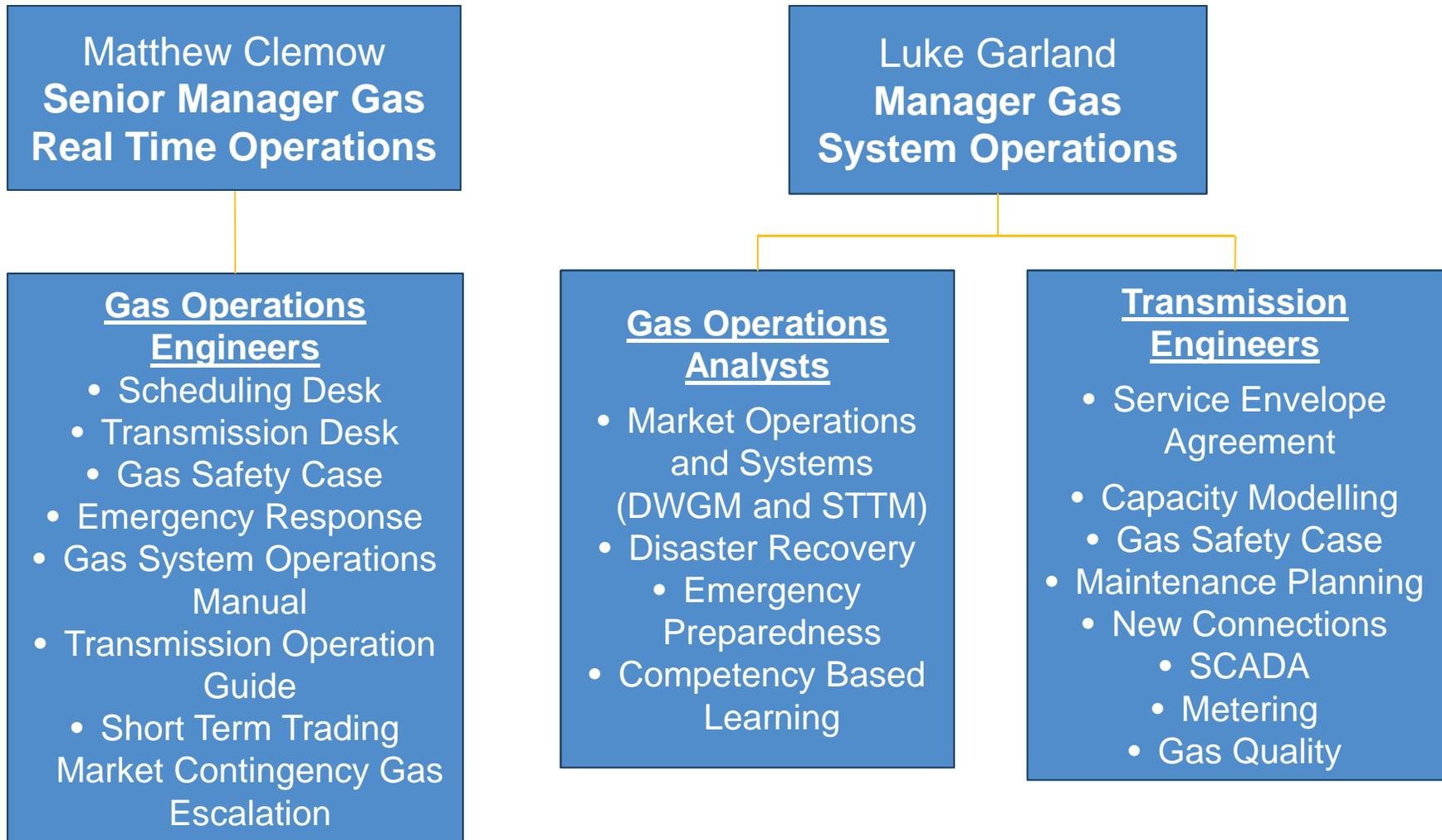
- The Victorian DTS is complex and different
 - Three main transmission pipelines – two are bi-directional – with interactions between these.
 - Pipeline pressure and linepack variations are significant
- The main supply sources – Longford and the Port Campbell facilities are approx. 200 km from to Melbourne
- Sydney and Adelaide are each supplied by two pipelines that are 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

- **AEMO is the market operator not the system operator**
 - Pipeline owners continue to operate and schedule 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

- **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 OPERATIONS STRUCTURE



AEMO GROUP MANAGER CONTACTS



AEMO Group	Function	Group Manager
Real Time Operations	NEM and Gas Control Rooms, Emergency Management, Victorian Gas Planning Report	Damien Sanford
Forecasting	National Gas Forecasting Report	Craig Price
Planning	Gas Statement of Opportunities	Nicola Falcon
Market Management	Settlements, Prudentials, Metering	Chin Chan
Market and System Change	Market performance, rules and procedures	Joe Spurio
Market Enhancement	Market analysis and design	Violette Mouchaileh
Stakeholder Relations	Registration, consultative forums, market training	Sandra McLaren

WINTER 2015 REVIEW AND WINTER 2016 OVERVIEW

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

- Melbourne's coldest winter in 26 years (since 1989)
- 18 days with a maximum temperature of less than 12°C
- Demand throughout July, was particularly high with the DTS recording:
 - Nine consecutive days, and a total of 14 days, when the system demand exceeded 1,000 TJ/d.
 - Average system demand of 977 TJ/d, which was the highest monthly demand on record.
 - The highest average daily injections into the SWP at the Iona Gas Storage facility on record, at 206 TJ/d.
 - Average daily flow to New South Wales via the VNI of 62.9 TJ/d, which was the highest on record during a winter month.
- Total gas consumption for June-September was 104.6 PJ, 9.8% higher than the 95.3 PJ for winter 2014

- Winter 2015 peak gas demand day for Victoria occurred on Tuesday 14 July 2015
- Total demand was 1,177 TJ (system demand 1,162 TJ and GPG demand 15 TJ).
- Culcairn exports to New South Wales were 58 TJ, so the total DTS withdrawals were 1,235 TJ.
- The total amount of gas injected into the DTS was 1,193 TJ because the beginning-of-day linepack was above target
- The highest total demand day in Winter 2014 was 1,211 TJ on 1 August (also the highest demand day for the last eight years).
- This was 34.0 TJ more than 14 July 2015, however Culcairn imports were 65 TJ.

- First winter of Winchelsea compressor operation, which was commissioned in early 2015:
 - Increased the SWP capacity from 367 TJ/d to 429 TJ/d
 - Provided additional gas from SWP linepack during the evening demand peak
 - SWP capacity constrained at 6PM and 10PM on 12 July 2015
- No DTS pressure breaches during winter 2015
 - Modified operation of the DTS enabled Warragul pressure to be maintained (pressure breach on 22 July 2014)
- No Notices of a Threat to System
 - None of the 2,505 tonnes (112 TJ) of LNG scheduled for injection during winter 2015 was for peak shaving purposes (which is LNG scheduled to maintain system pressure during periods of very high gas demand)

BROOKLYN COMPRESSOR STATION



BROOKLYN COMPRESSOR STATION



- Second largest supply point for Melbourne after Dandenong
 - SWP / BLP from Port Campbell
 - BCP to Geelong, BBP to Ballarat
- Major compression site
 - Three large “Centaur” units (10,11, 12)
 - Two smaller “Saturn” units (8, 9)
- Compression used for:
 - Winter peak day supply to Ballarat
 - Peak day overnight supply to Geelong
 - Supply SWP, BLP and WTS demand when no injections at Port Campbell
 - Transportation to Port Campbell for Iona Gas Storage refilling
 - Support Laverton North gas powered generation



BROOKLYN COOLER REPLACEMENT PROJECT



- Project to replace Unit 10 and 11 Cooling Tower was originally scheduled for October 2015 to January 2016 (4 months)
- AEMO required APA to have two large compressors available for system security, as well as Iona Gas Storage and Laverton North Power Station supply
- APA procured a temporary cooling tower
- Both compressor coolers were found to be leaking, resulting in only one large compressor being available (Unit 12)
- APA advised that repairs were not feasible and accelerated the replacement project
- Market Notice was issued on 21 October 2015 and AEMO held an Industry Conference Call to inform participants

BROOKLYN ISOLATION VALVE REPLACEMENT PROJECT



- Project to replace the Pipeline Isolation Valves on the three pipelines into the Brooklyn Compressor Station
- Safety requirement to replace these original valves. Similar to the LNG Facility valve replacement in January 2014
- Injections at Port Campbell required to support SWP, BLP and WTS demands. Industry Conference call held.
- Scheduled for April during the Autumn shoulder period
 - Compressors required during summer and winter
 - Originally coincided with a Longford Gas Plant outage
 - Injections at Port Campbell more probable in April than summer
 - However April 2016 was 2°C warmer than average

AEMO MAINTENANCE COORDINATION PROCESS



- As the independent system operator, AEMO coordinates major outages for DTS connected Gas Plants, Storage Facilities, and Interconnected Pipelines, as well as APA's DTS pipeline assets
- AEMO hosts three meetings during the year that are attended by the Facility Operators and APA
- Outages are reviewed and threats to supply are identified, enabling outage timings to be adjusted
- AEMO continues to monitor and risk assess facility outages, and APA maintenance activities as schedules change
- AEMO will issue a direction to a Facility Operator if there is a threat to gas supply

AEMO MAINTENANCE COORDINATION MARCH – MAY 2016



- A number of outages are scheduled during shoulder periods – outside of winter heating and summer GPG demand windows
- March to May 2016 has required detailed coordination:
 - Otway Gas Plant outage during March followed by Iona
 - Longford outage after Iona outage completed
 - Brooklyn station outage when Iona, Otway and Minerva available
 - Springhurst compressor upgrade (impacts supply from NSW via Culcairn) when Longford and Iona available
 - LNG Vaporiser C outage when Springhurst returned

GAS BULLETIN BOARD MEDIUM TERM CAPACITY OUTLOOKS



- Medium Term Capacity Outlooks are available on the Natural Gas Services Bulletin Board

Layers / Legend + Expand

Demand Zone	TJ	+	- Collapse
Sydney	197.4	+	
ACT	13.8	+	
Vic DTS (Net)	591.1	+	
Curtis Island	2870.0	+	
Adelaide	167.0	+	

GAS BULLETIN BOARD MEDIUM TERM CAPACITY OUTLOOKS



- Medium Term Capacity Outlooks are available on the Natural Gas Services Bulletin Board

The screenshot shows the AEMO Natural Gas Services Bulletin Board website. The page title is "Natural Gas Services Bulletin Board". The navigation menu includes Home, Reports, Capacity Listing, Bulletin Board Information, Emergency Protocols, Market Prices, Planning Reports, and About GBB. The "Reports" section is active, displaying a list of reports. The "Medium Term Capacity" report is highlighted with an orange circle and an arrow. The table below shows the details of the reports.

Report	Category	Actions
Capacity Outlook (INT 922)	Capacity	✉ ★ ⬇
Standing Peak Capacity Adequacy (INT 921)	Capacity	✉ ★ ⬇
Medium Term Capacity	Capacity	✉ ★
Standing Capacities (INT 920)	Capacity	✉ ★ ⬇
Registered BB Contacts (INT 931)	Contacts	✉ ★ ⬇
BB Facilities (INT 901)	Facilities	✉ ★ ⬇
Actual Flow (INT 924, INT 925)	Flow	✉ ★ ⬇
Forecast Pipeline Flows (INT 923)	Forecast	✉ ★ ⬇
Standing Peak Day Demand Forecasts (INT 912)	Forecast	✉ ★ ⬇
Registered BB Participants (INT 933)	Participants	✉ ★ ⬇
BB Zones (INT 902)	Zones	✉ ★ ⬇

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GAS BULLETIN BOARD MEDIUM TERM CAPACITY OUTLOOKS



Medium Term Capacity

From 8 January 2015, GBB Facility operators are required to provide Medium Term Capacity Outlooks for their facilities to AEMO to be published on the GBB, where this is defined in the National Gas Rules (NGR) as:

Medium term capacity outlook for a BB facility means information that the operator of that facility issues to relevant BB shippers about matters expected to affect the daily capacity of the facility for an outlook period extending beyond the current short term capacity outlook provided by the relevant operator and includes any updates to information previously issued.

This capacity outlook information is provided to AEMO via email, and is then published on the GBB website. Note that AEMO does not standardise this information into a single report, AEMO publishes medium term capacity notices as provided by GBB facility operators. For more information, see [Section 5.9 Medium Term Capacity Outlook](#) of the Natural Gas Services Bulletin Board Procedures v5.0. Please note, AEMO will periodically remove outdated Medium Term Capacity Notices from this page and put them into the Archive reports page [here](#).

Key Documents

Show entries

Report	Category	Description	Size	Format	Last Updated
MTCO - 20151212-20160519 - Longford	Report	Longford - Longford Production Facility Maintenance - 12 Dec 2015 - 19 May 2016	117 kb	pdf	9/12/2015
MTCO - 20160312-0721 - RBP	Report	RBP - Corrective Maintenance requiring reduction of Operating Pressure - 12 March-21 July 2016	136 kb	pdf	22/01/2016
MTCO - 20160312-0731 - RBP	Report	RBP - Corrective Maintenance requiring reduction of Operating Pressure - 12 March-31 July 2016	136 kb	pdf	25/01/2016
MTCO - 20160330-0511 - CGP	Report	CGP - Unplanned maintenance works for Morney Tank Compressor - 30 March - 11 May 2016	138 kb	pdf	30/03/2016
MTCO - 20160331-0401 - EGP	Report	EGP - Maintenance Horsley Park Meter Station - 31 March-1 April 2016	170 kb	pdf	22/03/2016
MTCO - 20160401-0412 - SWQP	Report	SWQP - Wallumbilla unit 3 24000 hour service and Unit 6 Duplex Filter repairs - 1-12 April 2016	137 kb	pdf	11/03/2016
MTCO - 20160401-0413 - MSP Update	Report	MSP - Wilton Flow Straightener Inspection and Repair Run 2 will be unavailable although this run is not used with the current demand Capacity will be 235 TJ per day - 01-13 April 2016 Update	137 kb	pdf	1/04/2016
MTCO - 20160402-0406 - Iona Gas Storage Update	Report	Iona Gas Storage - Planned maintenance - 2-6 April 2016 Update	271 kb	pdf	4/03/2016
MTCO - 20160402-0407 - Iona Gas Storage Update	Report	Iona Gas Storage - 6 day shut down scheduled - 2-7 April 2016	227 kb	pdf	5/02/2016
MTCO - 20160402-0415 - Iona Gas Storage	Report	Iona Gas Storage - 14 day shut down tentatively planned - 2-15 Apr 2016	104 kb	pdf	15/12/2015

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2016 VICTORIAN GAS PLANNING REPORT (VGPR) UPDATE



- Victorian Gas Planning Report (VGPR) Update published on 29 February 2016. Usually published biennially (last in 2015).
- The following changes and issues in the DTS triggered this VGPR Update report:
 - A further increase in the VNI capacity to NSW that will increase capacity by 25%, to 148 TJ/d during Q3 2016.
 - SWP capacity limitation from Melbourne to Port Campbell that will limit flows to South Australia via SEA Gas Pipeline and may impact refilling of the Iona Gas Storage reservoirs.
 - Iona Gas Storage expansion plans that may require a further increase in the SWP capacity toward Melbourne
 - Increased demand at Warragul that may require augmentation to maintain the contractual pressure at this connection point.

<http://www.aemo.com.au/Gas/Planning/Victorian-Gas-Planning>

2016 VICTORIAN GAS PLANNING REPORT (VGPR) UPDATE

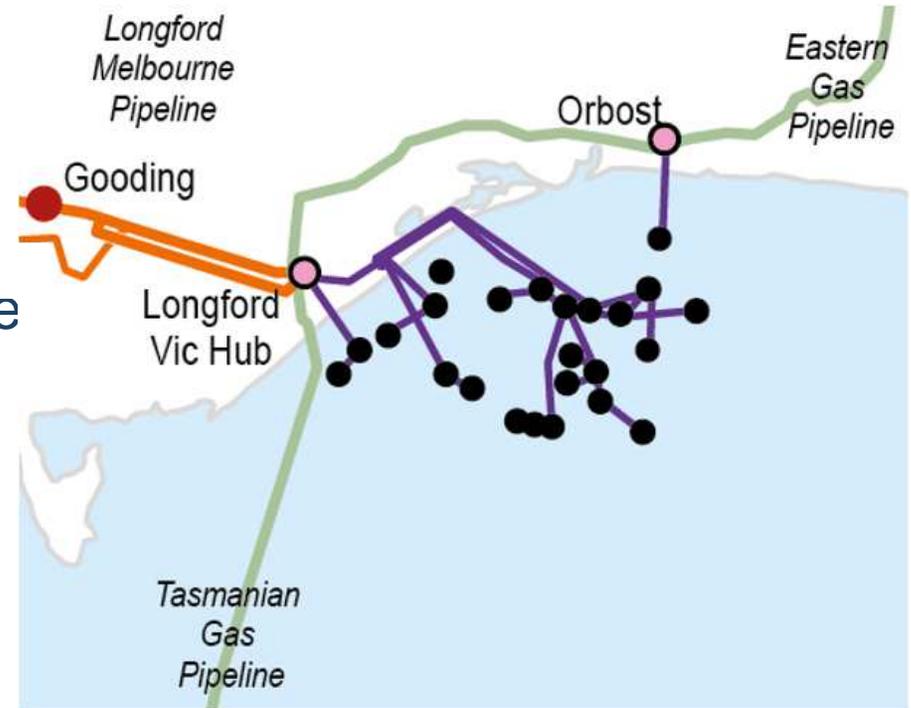


- The 2016 VGPR Update includes options for increasing the SWP capacity from Melbourne to Port Campbell using the existing BCS compressors
- From 17 February (when two BCS compressors were available) through to 18 April (when the BCS outage started), SWP withdrawals were constrained on 83% of days (excluding the 2-6 April Iona outage)
- The 2016 VGPR Update also includes an analysis of options for increasing the SWP capacity towards Melbourne
- AEMO is not the System Planner for the Victorian gas DTS
- Market Participants need to reach an agreement with APA to enable the SWP capacity to be increased

EAST COAST SUPPLY – DEMAND OBSERVATIONS



- December 2015 Longford Outage – Capacity 410 TJ/d
- AEMO implemented DTS operational changes to increase SWP capacity (not possible during winter)
- Friday 18 December:
 - Longford 128 TJ
 - VicHub 50 TJ
 - Iona Gas Plant 167 TJ
- Indicates that the EGP flow to NSW is being base loaded and flexible injections are used to supply the DTS
- EGP capacity increased by 20% in January 2016 following the commissioning of two new compressor stations



EAST COAST SUPPLY – BASSLINK OUTAGE



- The Basslink electricity interconnector between Victoria and Tasmania became unavailable on 20 December 2015
- Basslink current return to service date is mid-June
- Gas flows from Longford to Tasmania via the TGP increased to supply the Tamar Valley Power Station in January
- There is sufficient transmission capacity in south-east Australia to transport gas from Queensland if required to satisfy demand
- AEMO does not expect this to result in gas supply shortfalls for Victoria – however pricing and supply may tighten

2016 WINTER OVERVIEW



- The AEMO 2015 National Gas Forecasting Report (NGFR), published in December 2015 forecasted the Winter 2016 DTS peak day system demands to be:
 - 1,194 TJ for a 1-in-2 system demand day
 - 1,304 TJ for a 1-in-20 system demand day
- The supply capacity of the DTS is expected to remain materially unchanged for winter 2016 at 1,450 TJ/d

2016 WINTER OVERVIEW



- Expected Supply
 - 1,351 TJ on a 1-in-20 system demand day

Supply source	Peak demand day (TJ)
Longford and VicHub	850
BassGas	55
Port Campbell (SWP and WTS)	446
Total	1,351

- Additional supply available from LNG and VNI Imports

Supply source	Peak demand day (TJ)
LNG	87
VNI Imports	125

- Supply capacity is sufficient for a peak demand day

QUESTIONS?



TRANSMISSION OPERATIONS

Presented by Mark Pollock

Gas Operations Engineer, AEMO Gas Real Time Operations





OVERVIEW



- Operations Overview
- Fundamentals
- Strategies

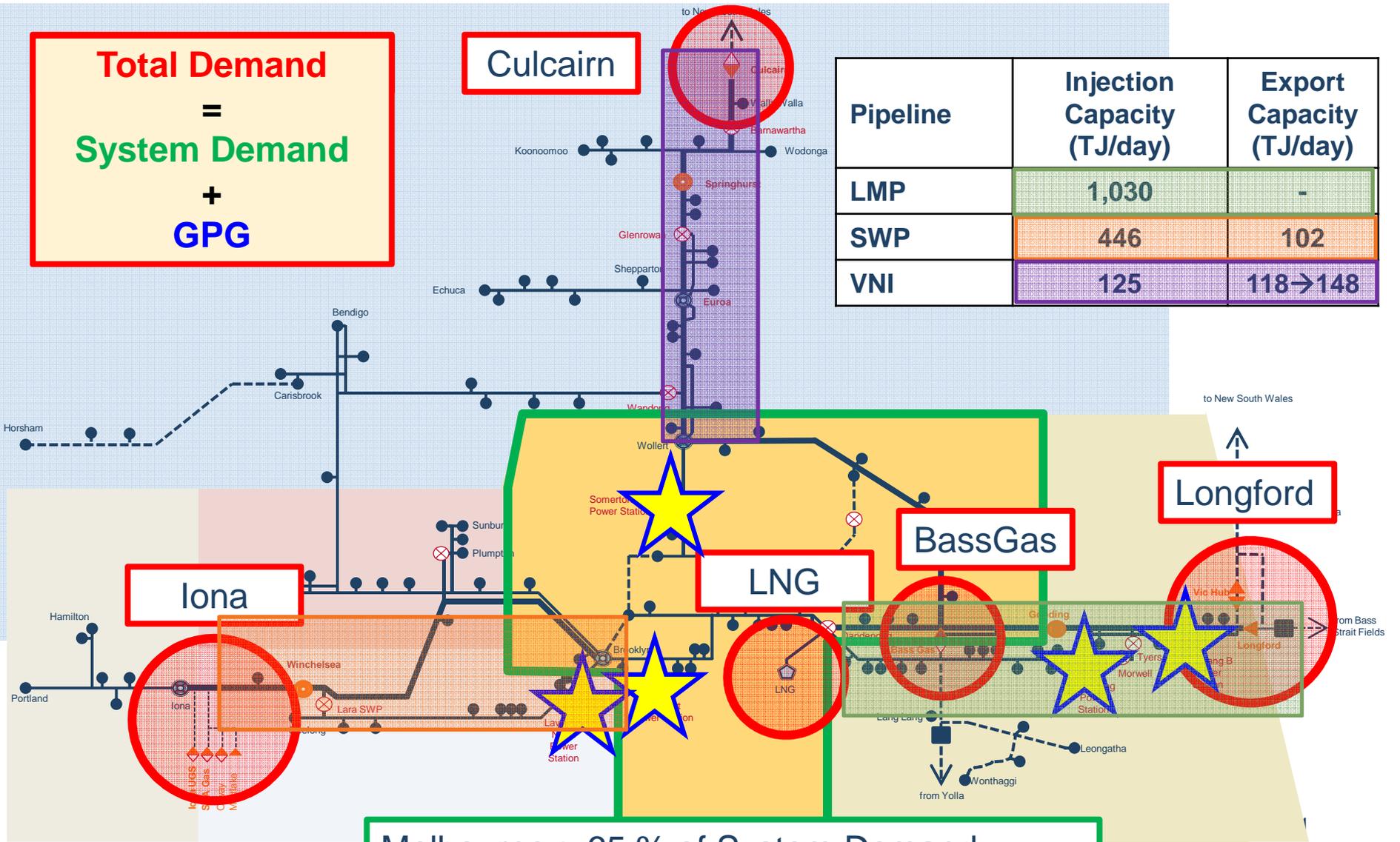
OPERATIONS OVERVIEW: DECLARED TRANSMISSION SYSTEM



$$\text{Total Demand} = \text{System Demand} + \text{GPG}$$

Culcain

Pipeline	Injection Capacity (TJ/day)	Export Capacity (TJ/day)
LMP	1,030	-
SWP	446	102
VNI	125	118→148



Melbourne ≈ 65 % of System Demand

TYPES OF PHYSICAL SYSTEM CONSTRAINTS



- Transportation capacity
 - Can we move enough gas?
- Storage / linepack
 - How much gas can I store in the system?
- Supply capacity
 - Do we have enough gas available?

TYPES OF PHYSICAL CONSTRAINTS: PIPELINE CAPACITY & STORAGE



A transmission pipeline is two things

1. Storage Tank
2. Transportation System

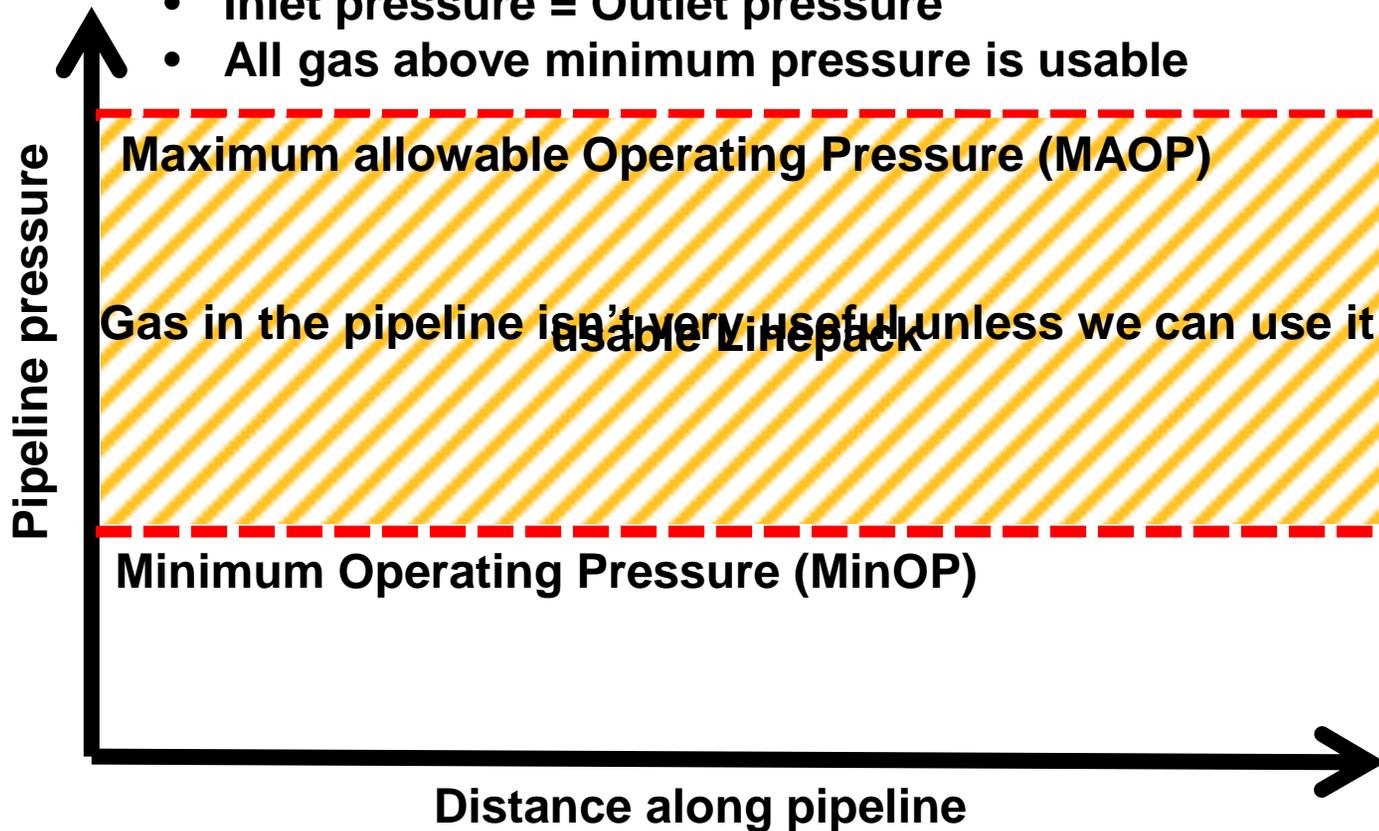
TYPES OF PHYSICAL CONSTRAINTS: PIPELINE CAPACITY



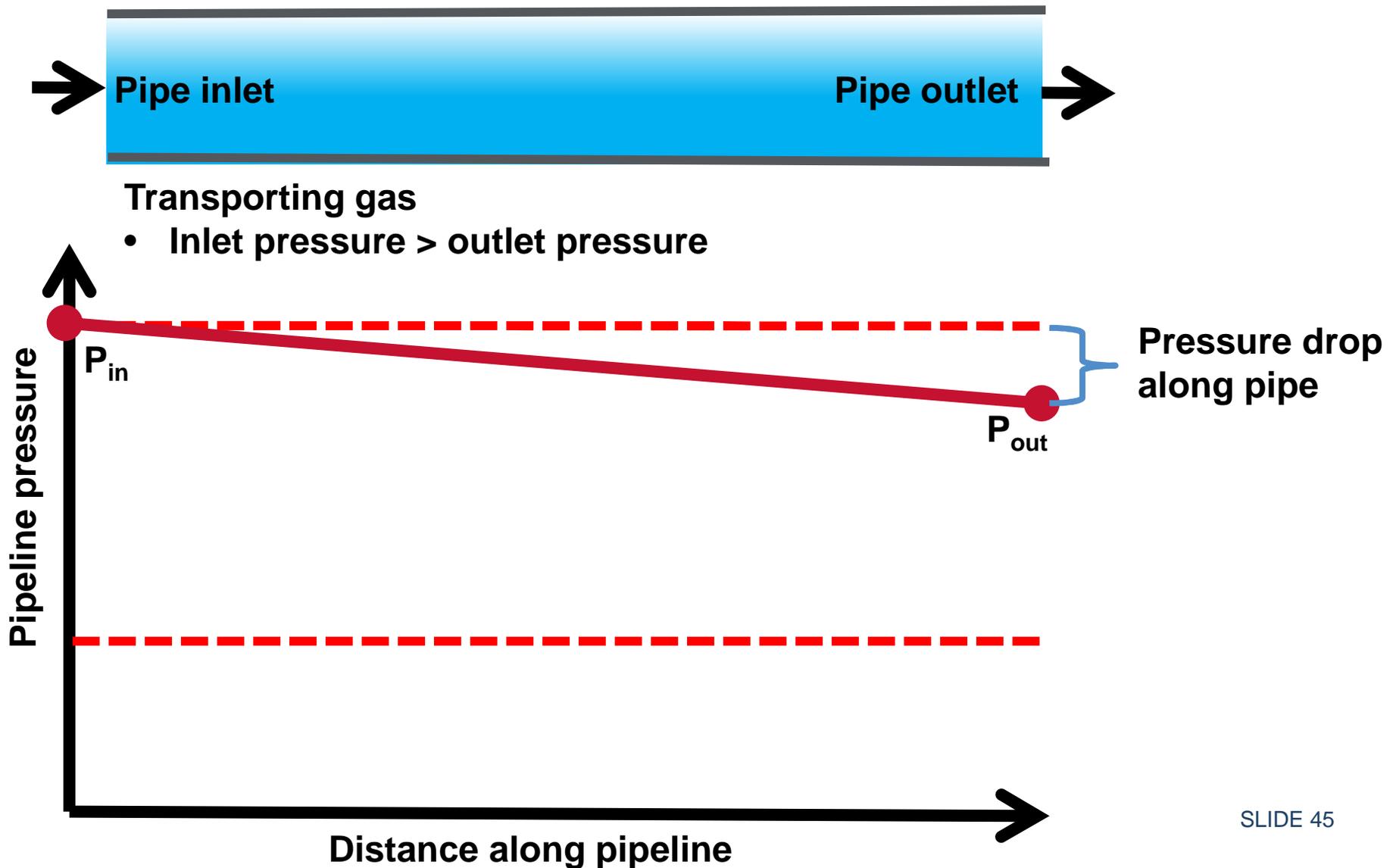
“Storage tank”

No flow

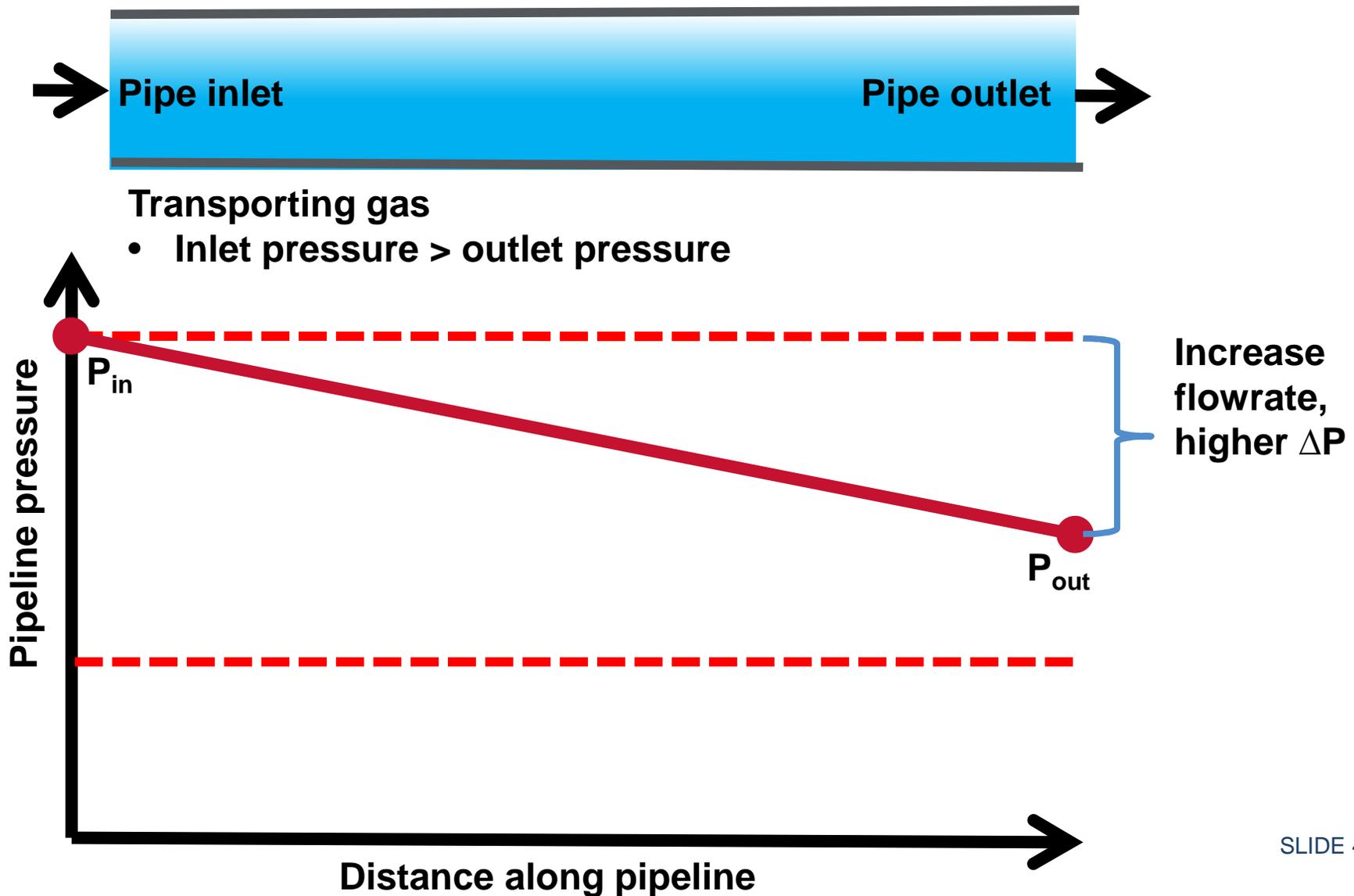
- **Inlet pressure = Outlet pressure**
- **All gas above minimum pressure is usable**



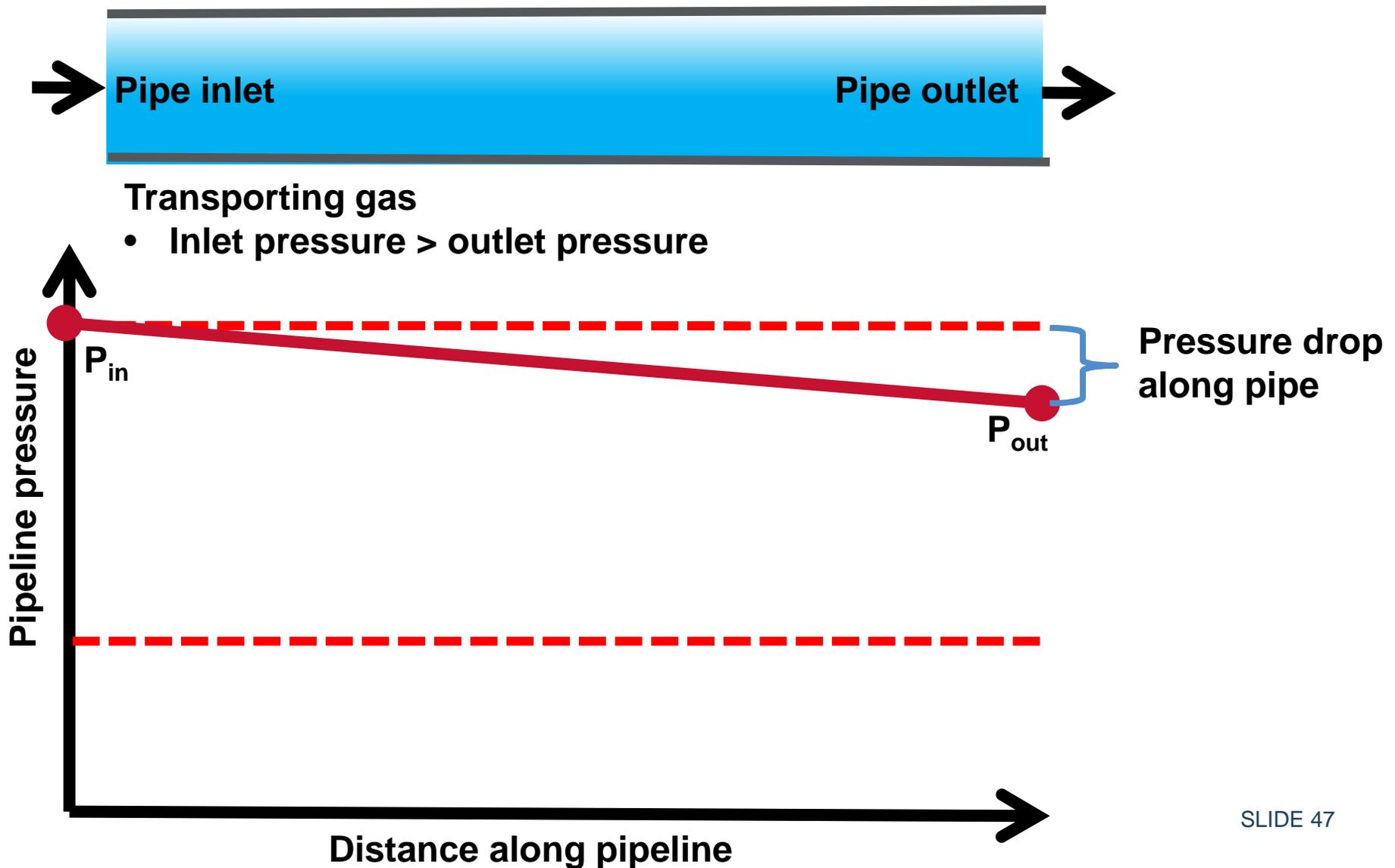
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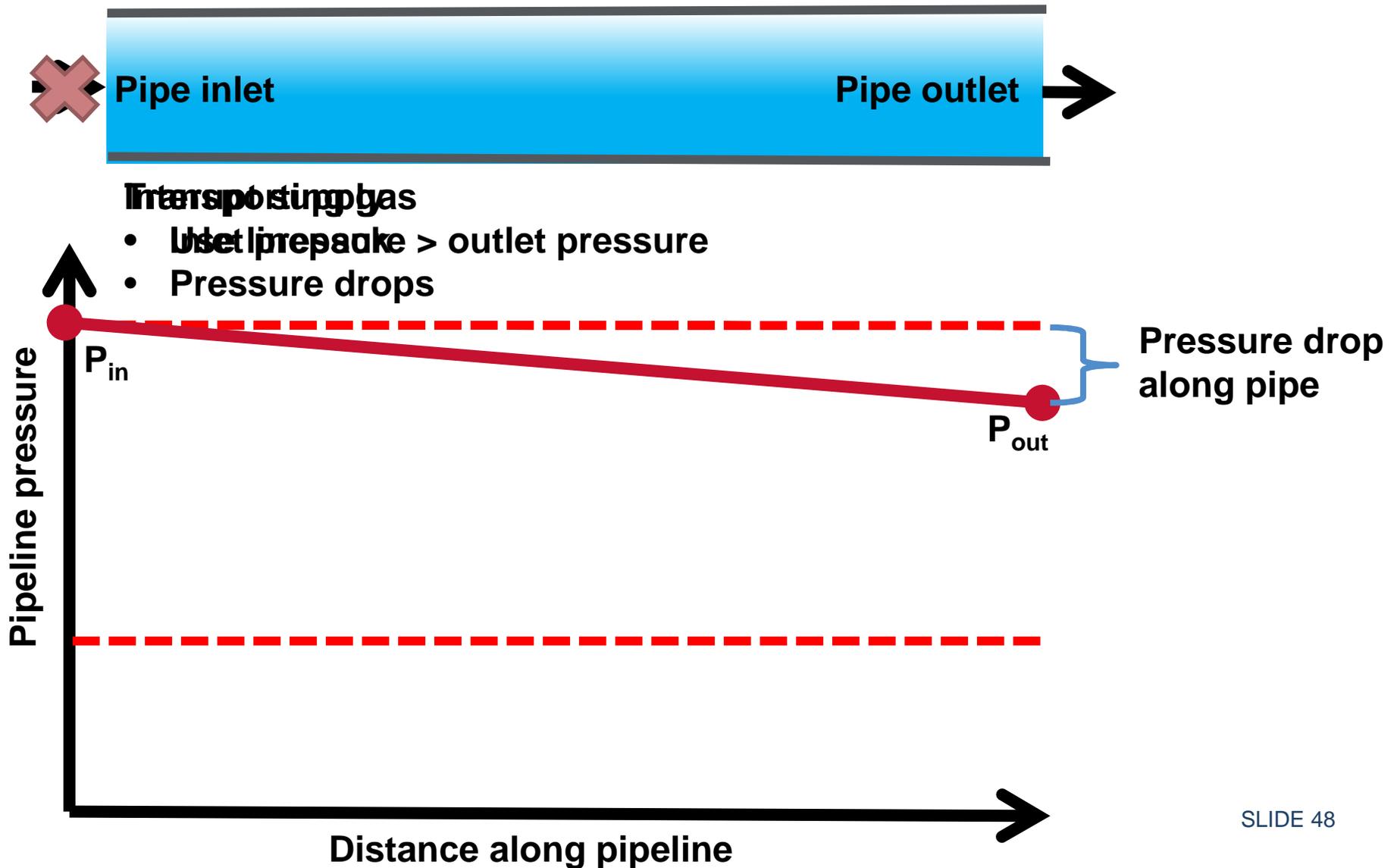
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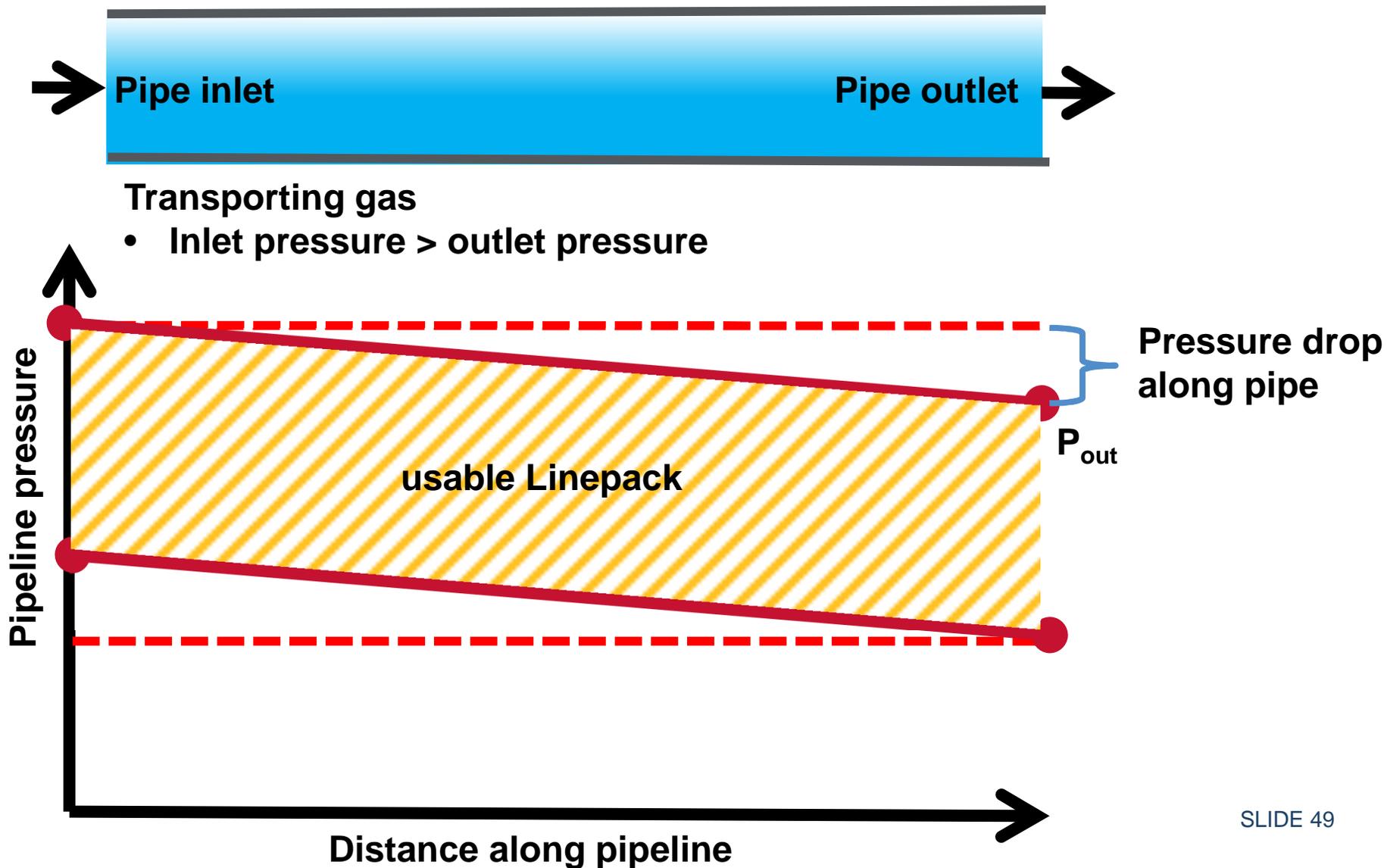
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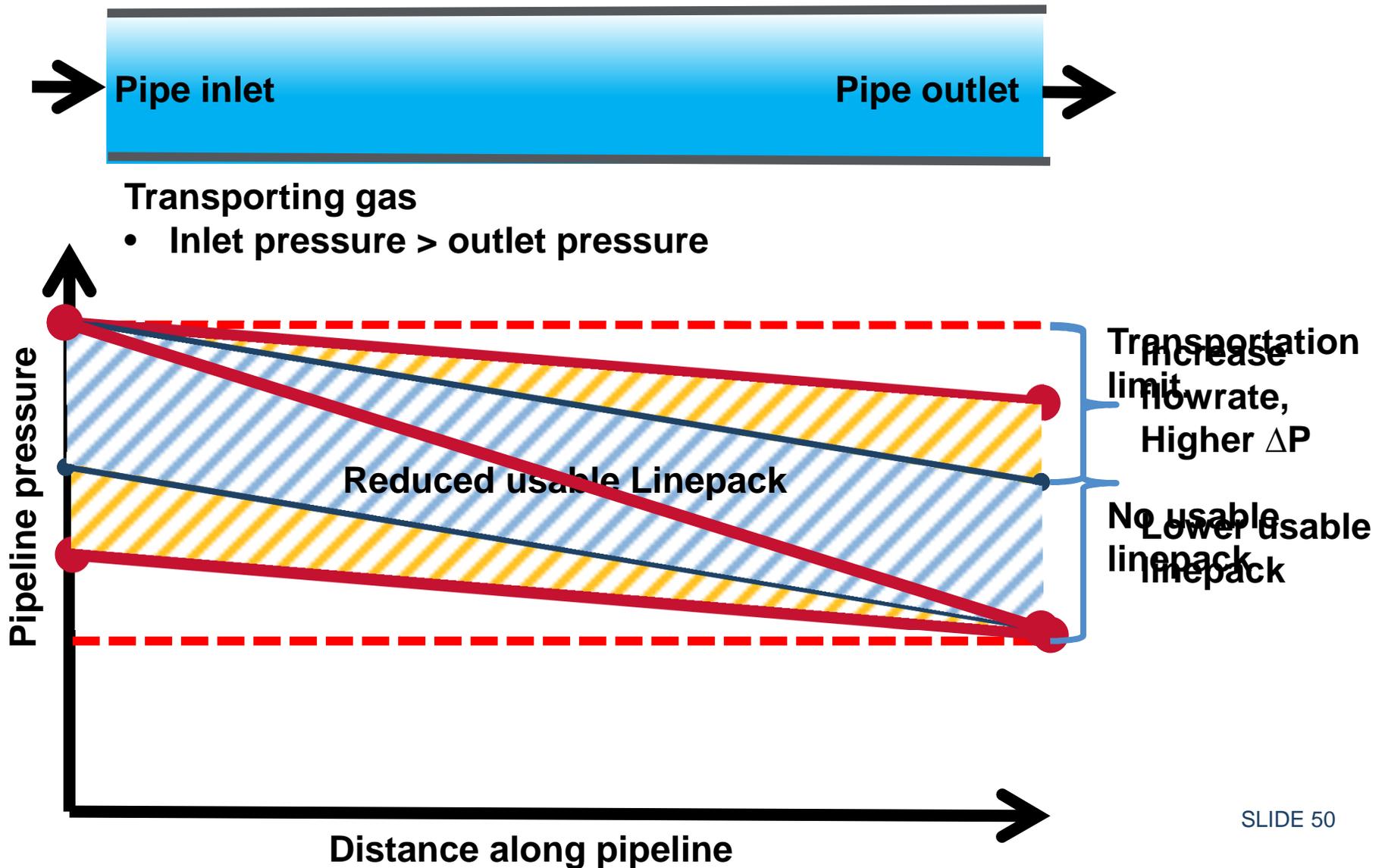
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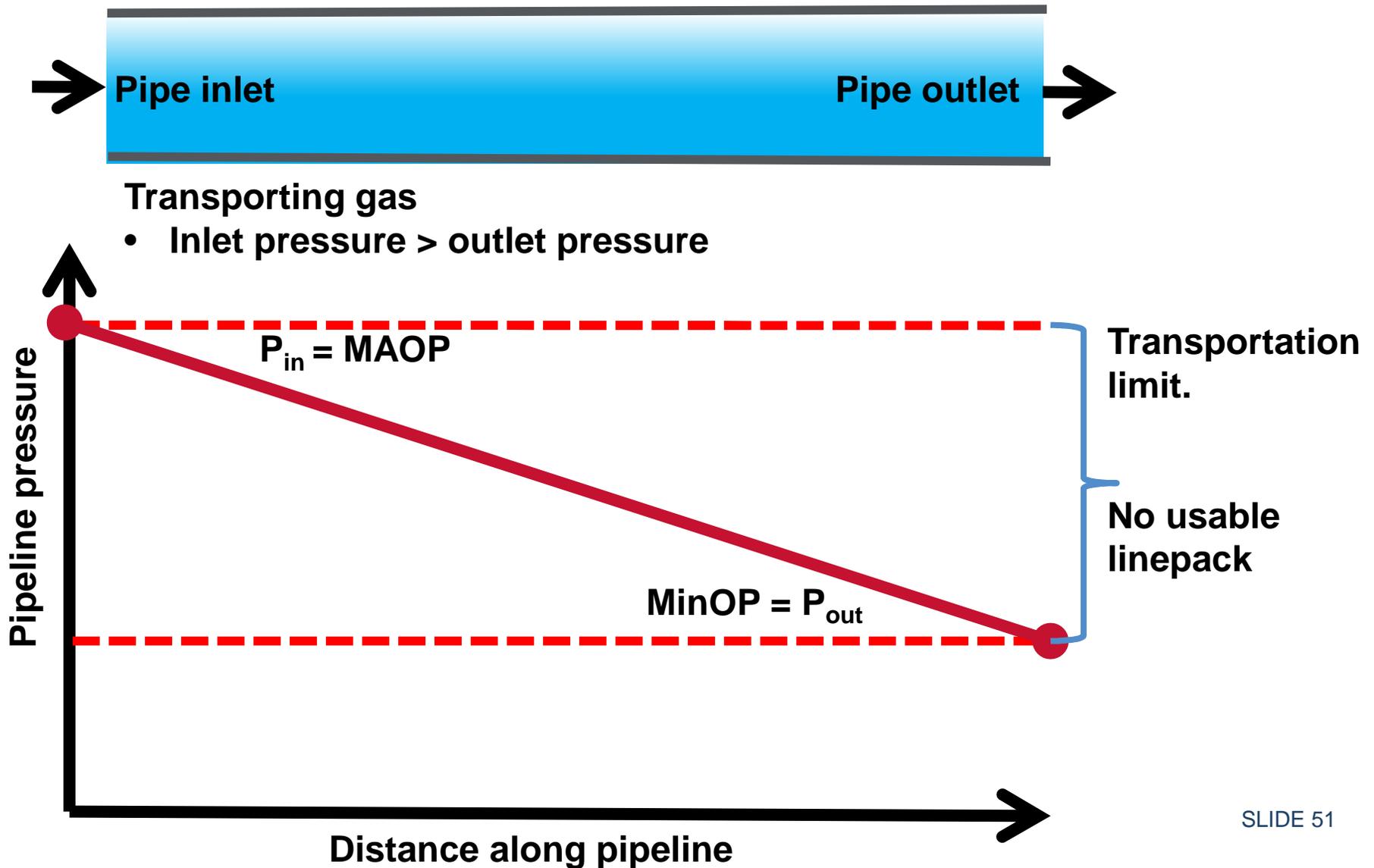
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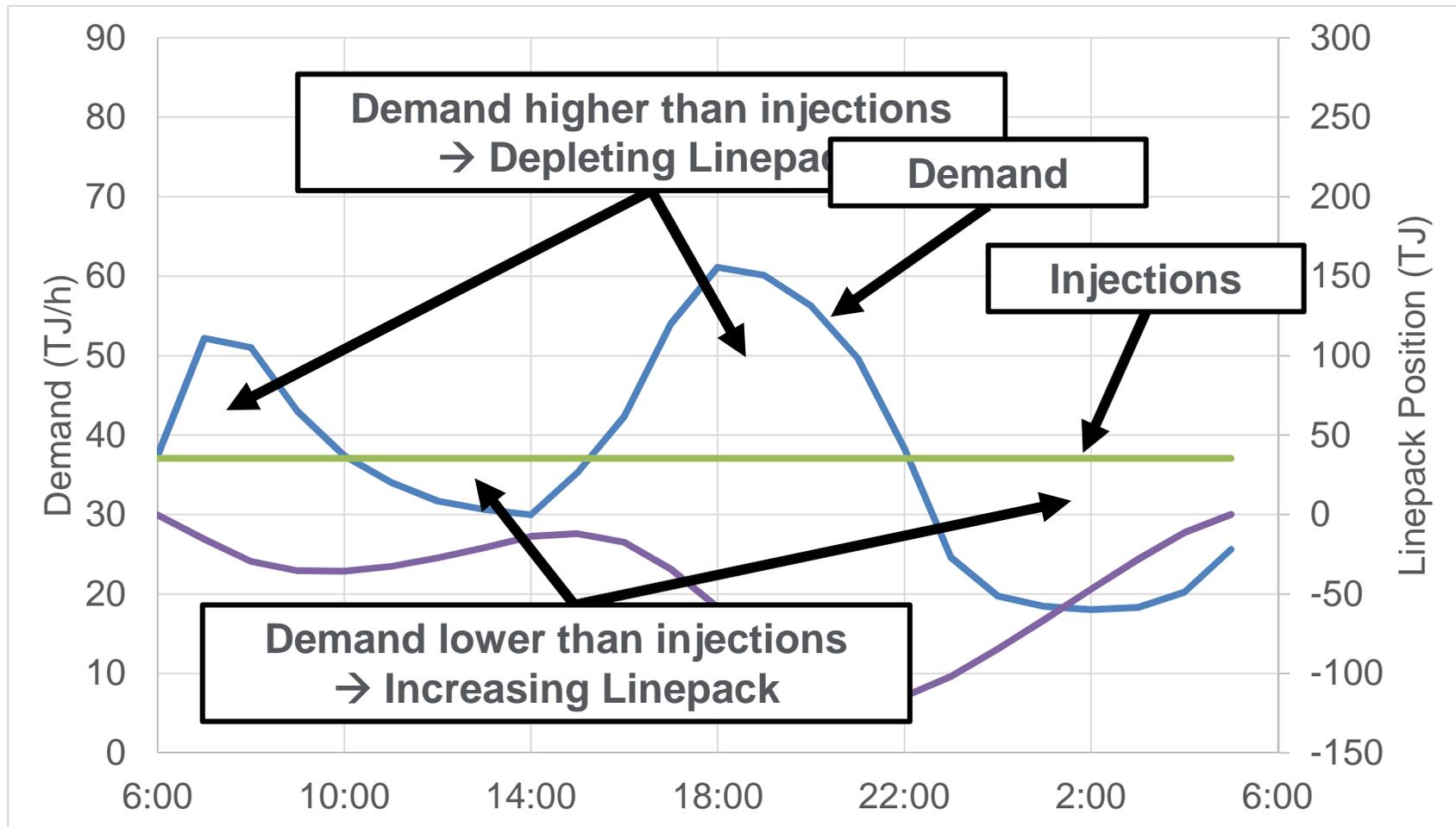
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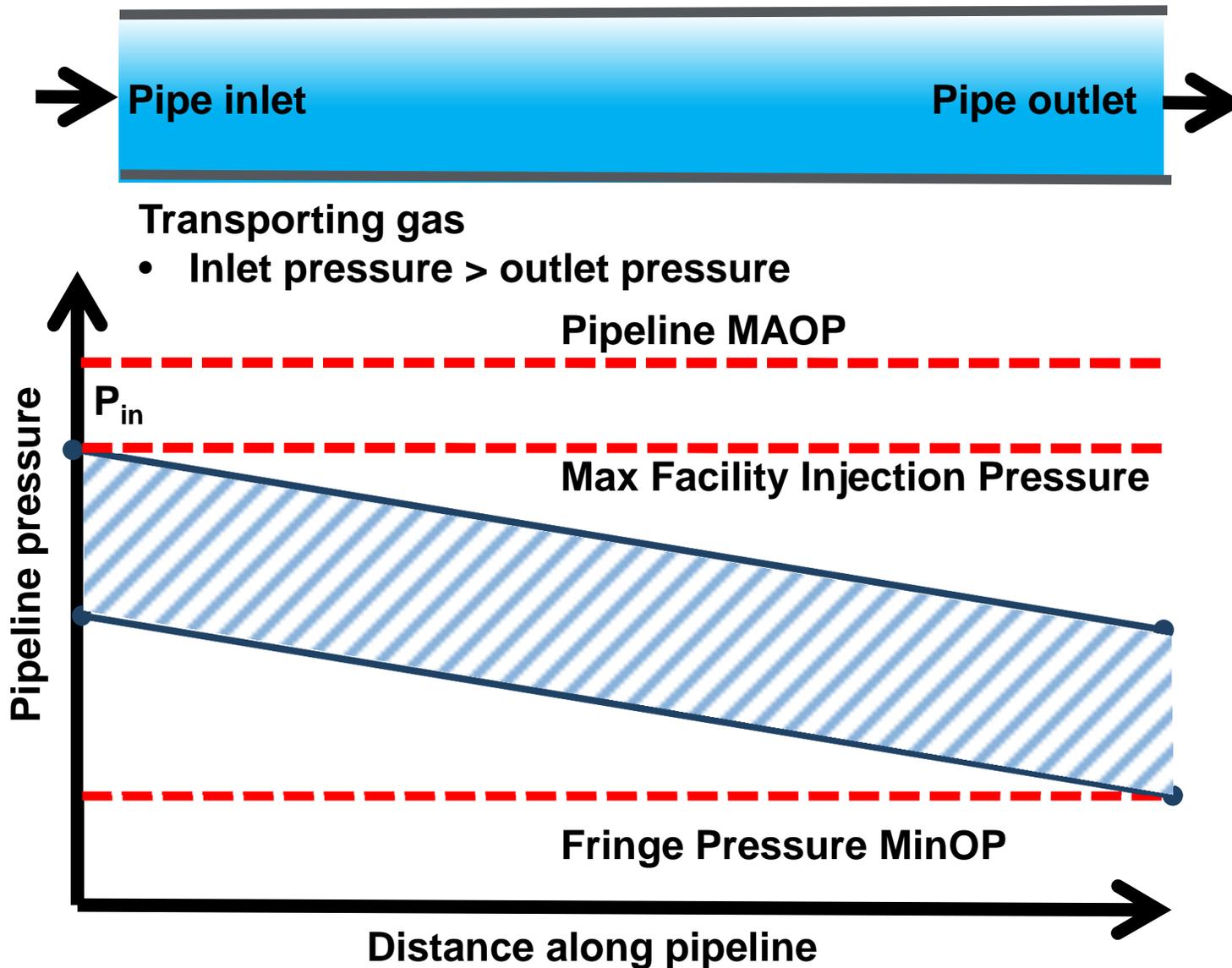
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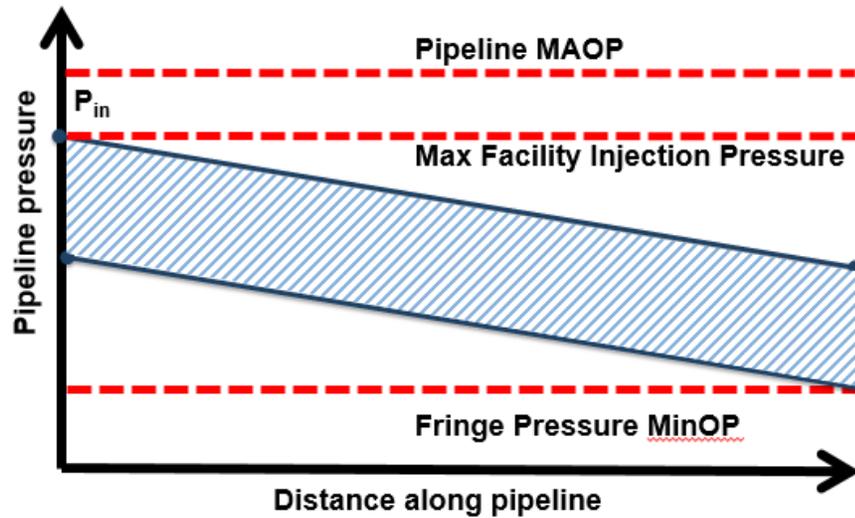


FUNDAMENTALS: DEMAND PROFILE

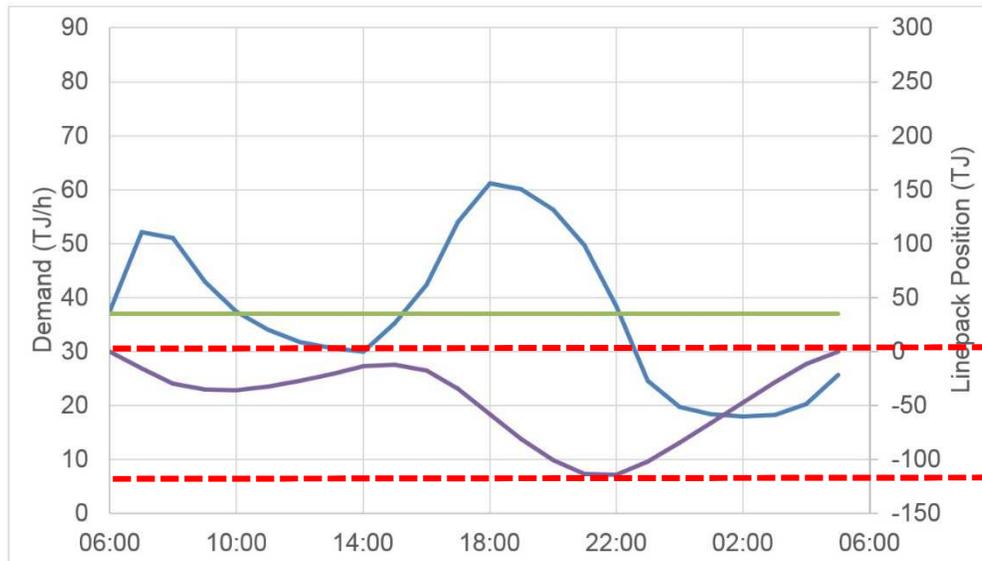


TYPES OF PHYSICAL CONSTRAINTS: PIPELINE CAPACITY





- Need enough usable linepack in the system, to support the variation in linepack expected on a peak demand day.



TYPES OF PHYSICAL SYSTEM CONSTRAINTS



- Pipeline capacity
 - South West Pipeline constrained for some peak demand days
- Supply / plant capacity
 - Longford pipeline supply not historically scheduled at pipeline capacity.

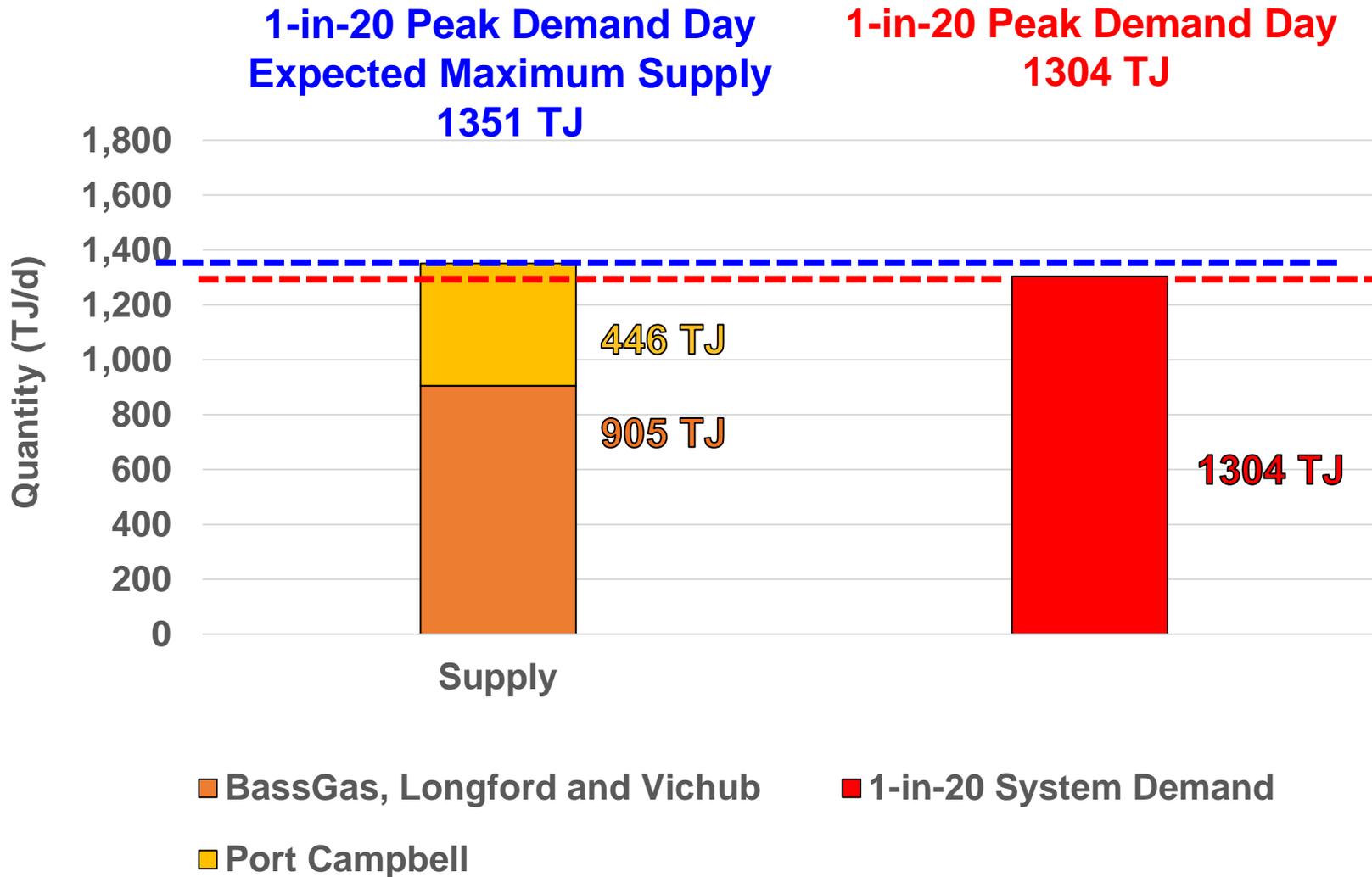
PIPELINE CAPACITIES VS EXPECTED SUPPLY



Major Pipelines	Injection Points	Pipeline Capacity (TJ)	Expected Peak Day Supply (TJ)
Longford to Melbourne Pipeline	Longford / VicHub & Bass Gas	1,030*	905
South West Pipeline	Port Campbell (Otway, Mortlake, Iona, SEA Gas)	446	446
Victorian Northern Interconnect	Culcairn injection / withdrawal	198* / 148	
Total Expected peak day Supply			1,351

* Longford pipeline and VNI injection supply is typically below pipeline capacity.

OPERATIONS OVERVIEW: 1-IN-20 PEAK DAY SUPPLY AND DEMAND

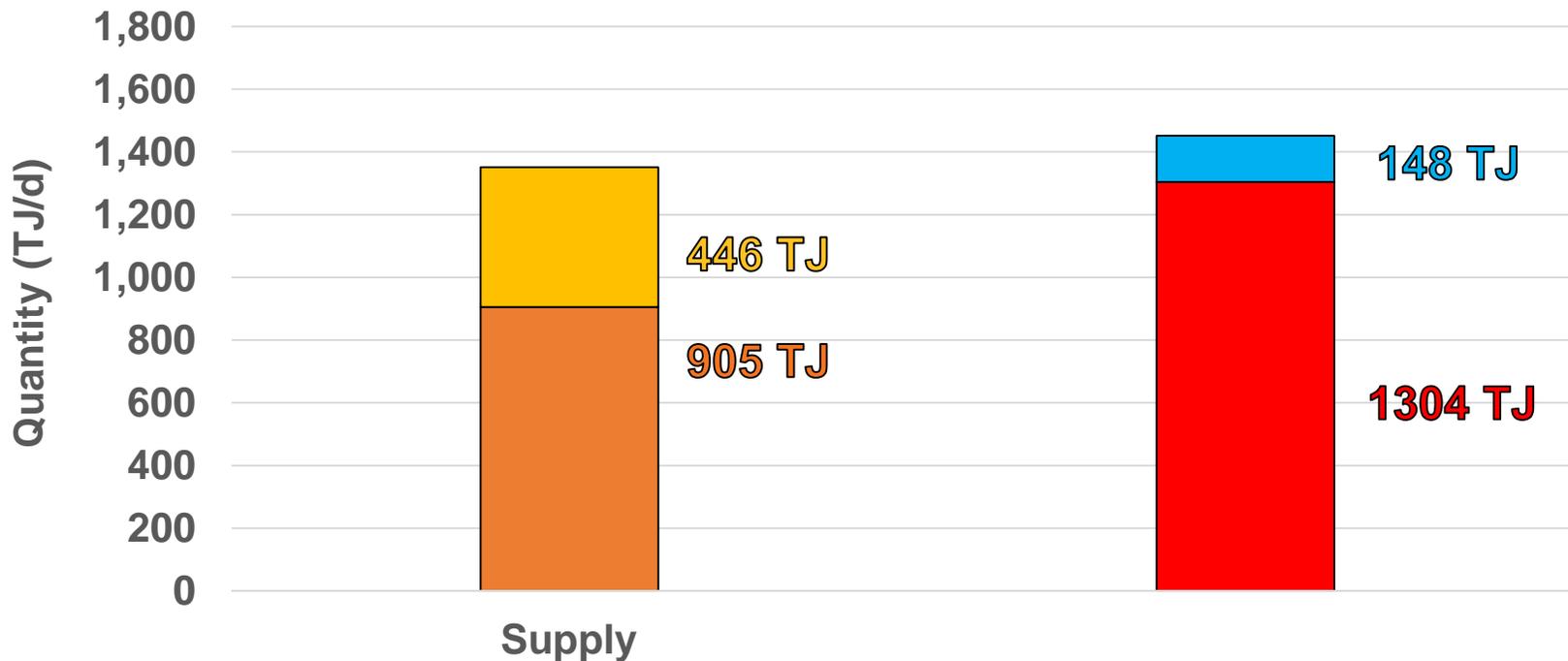


OPERATIONS OVERVIEW: 1-IN-20 PEAK DAY SUPPLY AND DEMAND



1-in-20 Peak Demand Day Supply

**1-in-20 Demand + VNI Exports
1452 TJ**



- BassGas, Longford and Vichub
- Port Campbell
- Other Supplies (eg LNG)

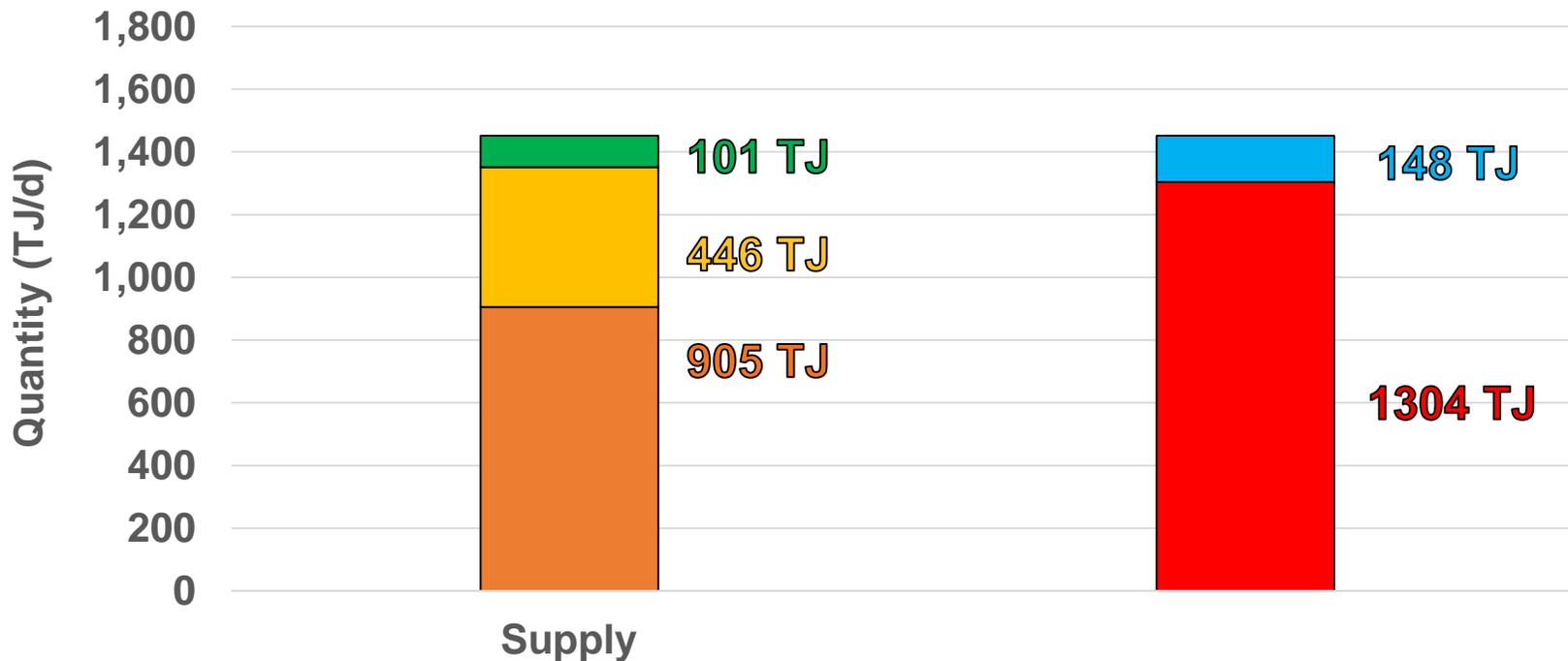
- 1-in-20 System Demand
- Culcairn

OPERATIONS OVERVIEW: 1-IN-20 PEAK DAY SUPPLY AND DEMAND



1-in-20 Peak Demand Day Supply

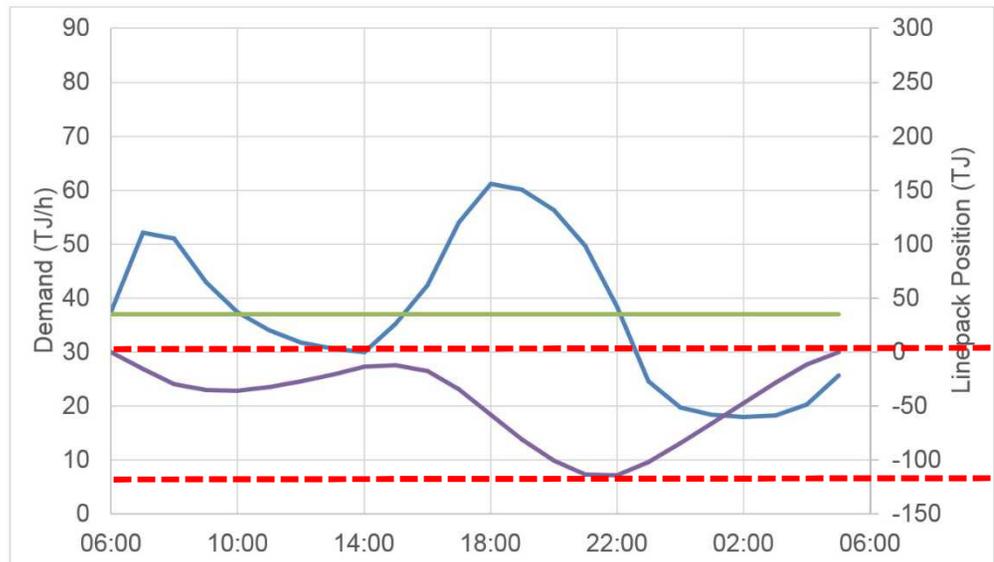
1-in-20 Demand + VNI Exports 1452 TJ



- BassGas, Longford and Vichub
- Port Campbell
- Other Supplies (eg LNG)

- 1-in-20 System Demand
- Culcairn

- Sufficient supply capacity expected for a peak day
 - LNG may be required for VNI
- Sufficient system capacity
- Uncertainties increase linepack deficit



FUNDAMENTALS: REDUCING UNCERTAINTY



Uncertainties

- Demand forecast
- Demand profile
- Supply source variation
- Facility deviation

Proactive Risk Management

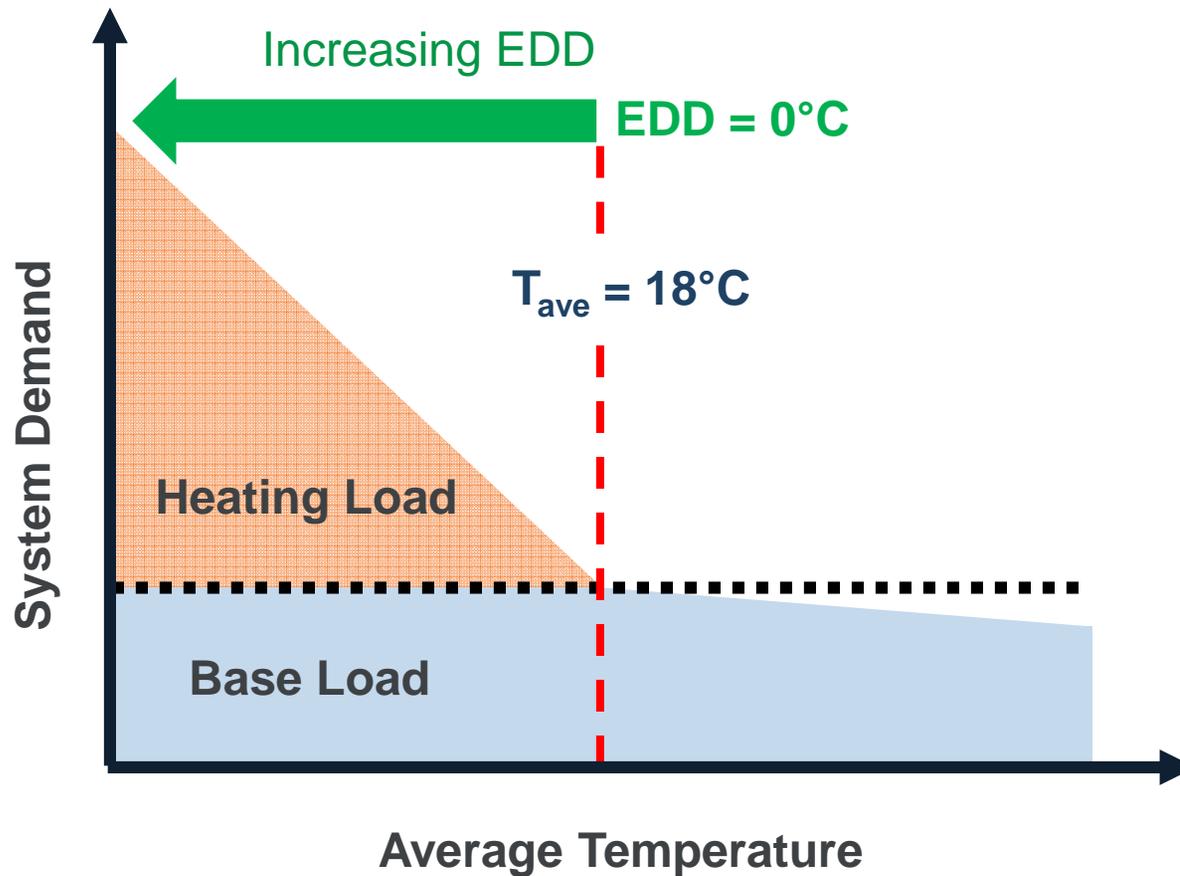
- Procedures
 - Demand Forecasts & Overrides
 - Facility quantity confirmation
 - LNG
- Appropriate linepack target
- Anticipating market variation
- Communication
 - Stakeholders
 - NEM Control Room

FUNDAMENTALS: DEMAND FORECAST



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

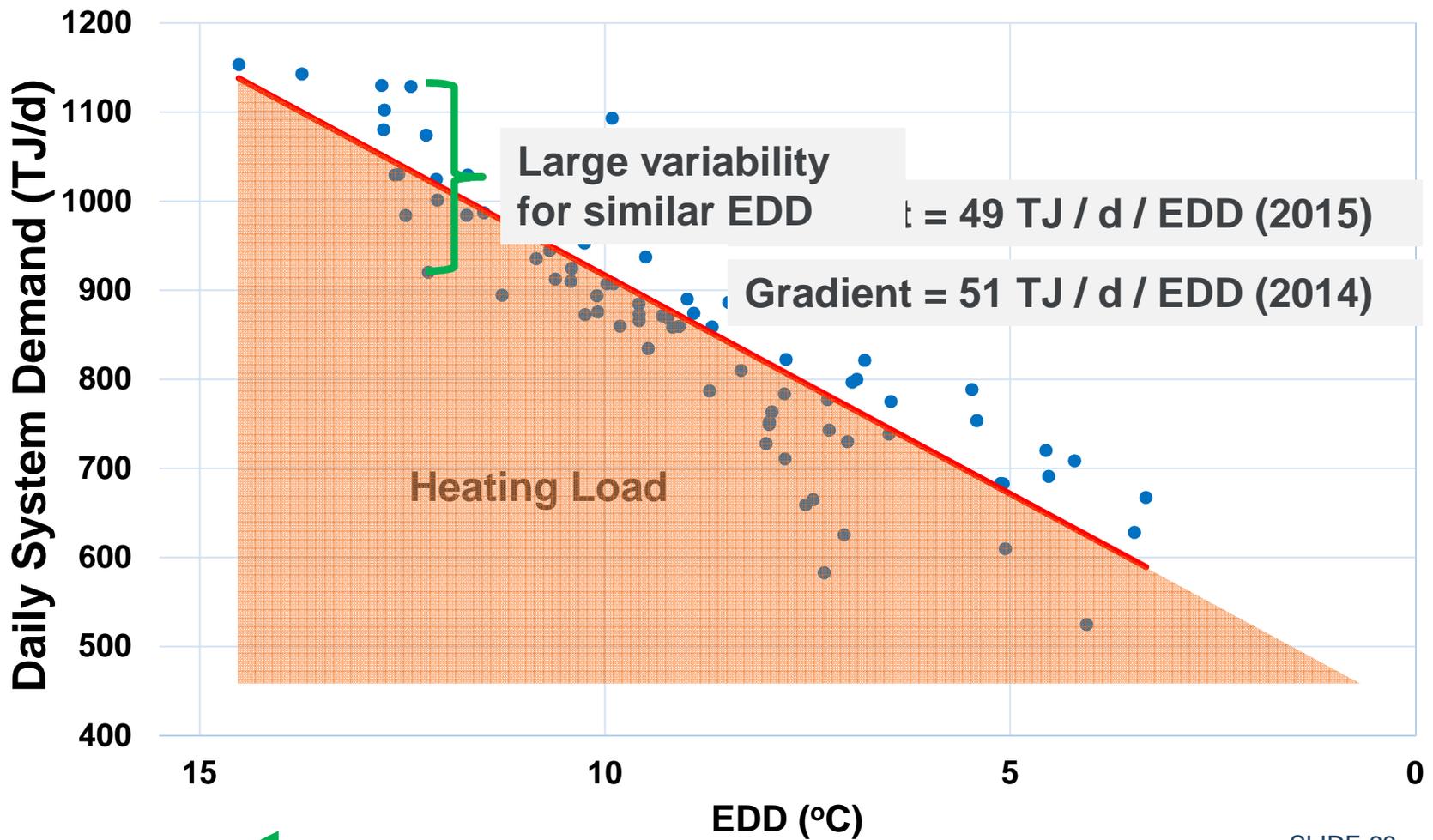
Inverse magnitude to Average Temperature



FUNDAMENTALS: DEMAND FORECAST



System Demand and EDD - Winter 2015

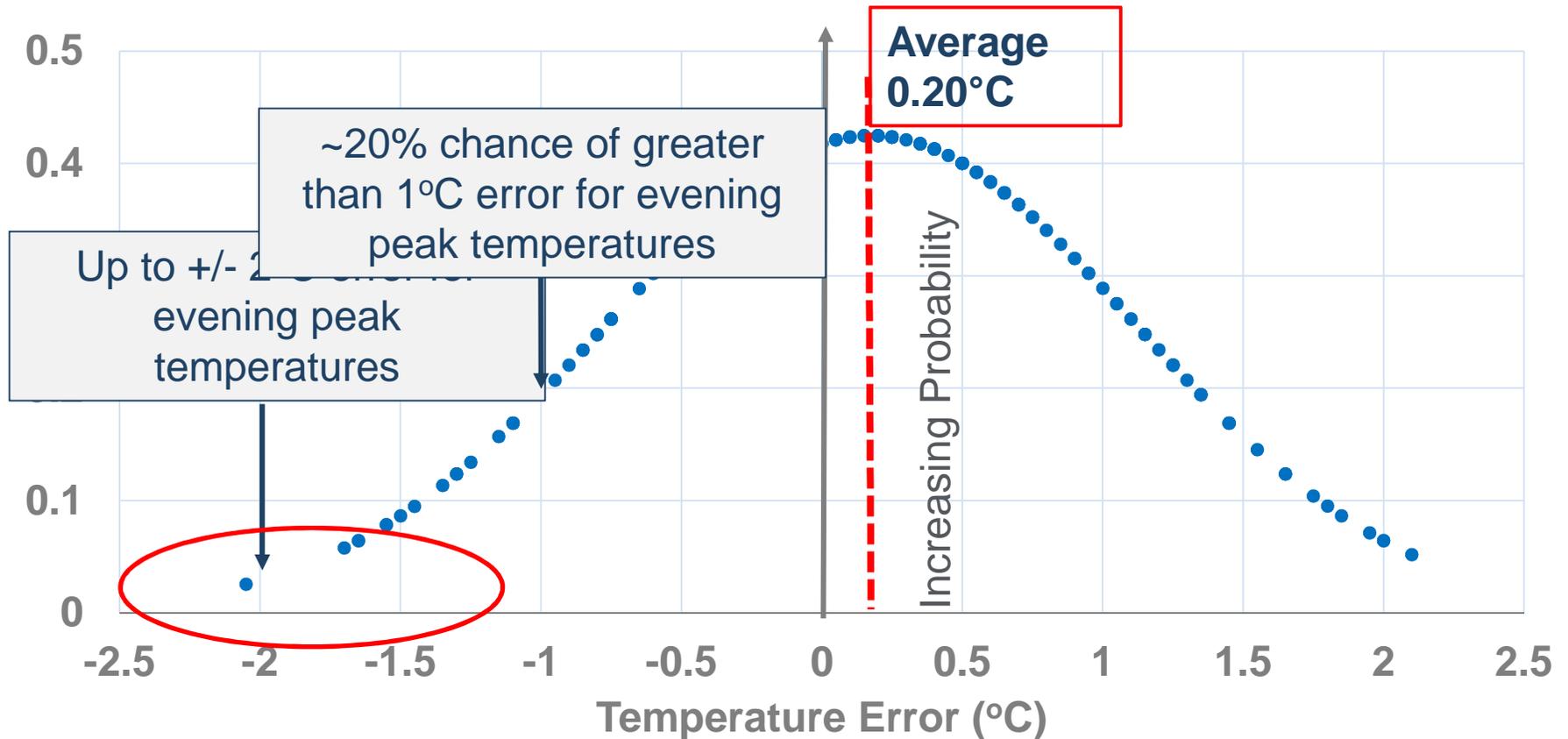


- High variability in forecasting daily demand.
 - EDD considers wind speed, sunshine hours, average temperature.
 - Melbourne temperature used to represent demand state wide.

FUNDAMENTALS: DEMAND FORECAST



Melbourne Winter 2015 6-9PM Average Temperature Forecast Error



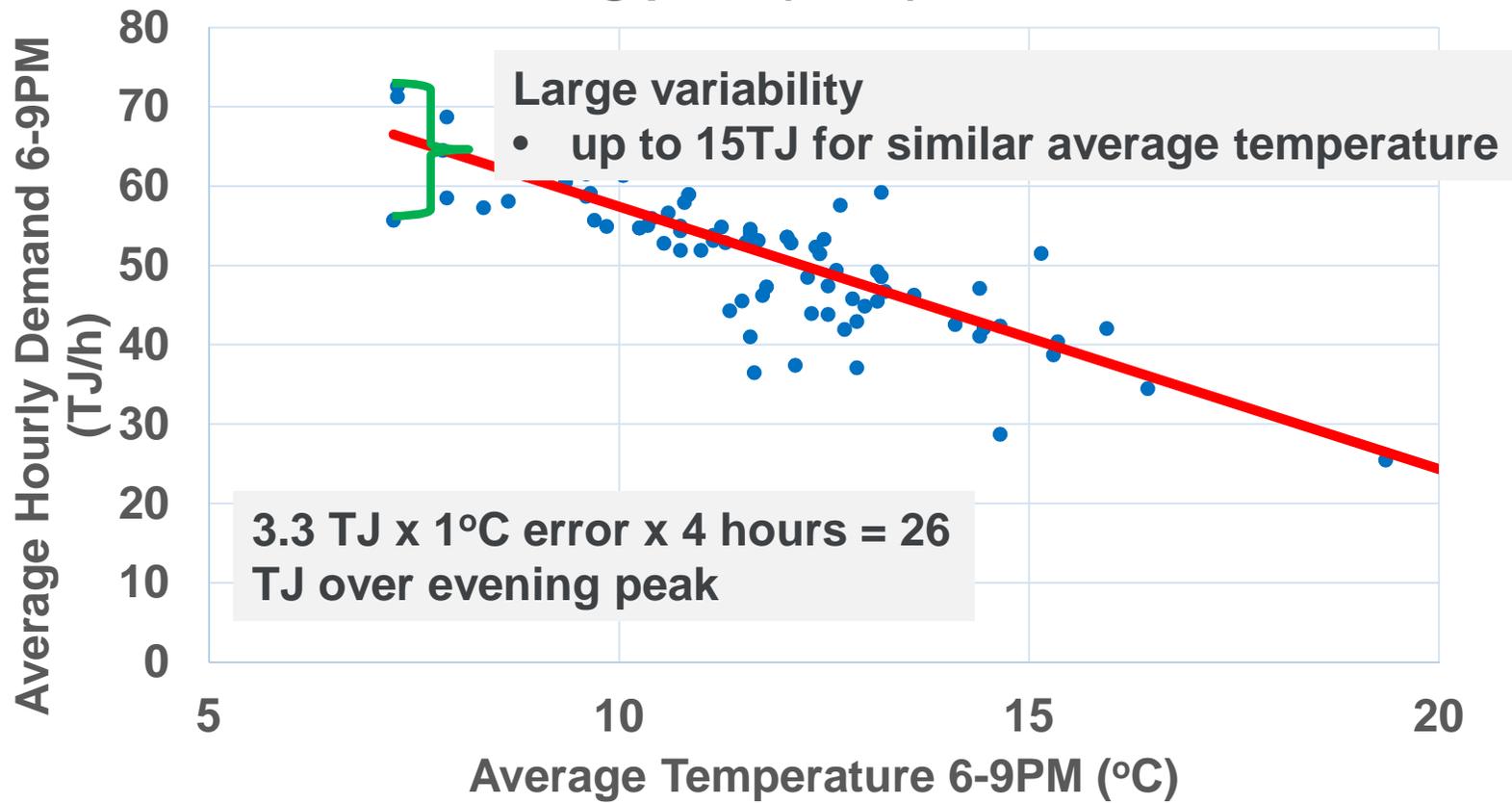
Actuals Lower than Forecast

Actuals Higher than Forecast

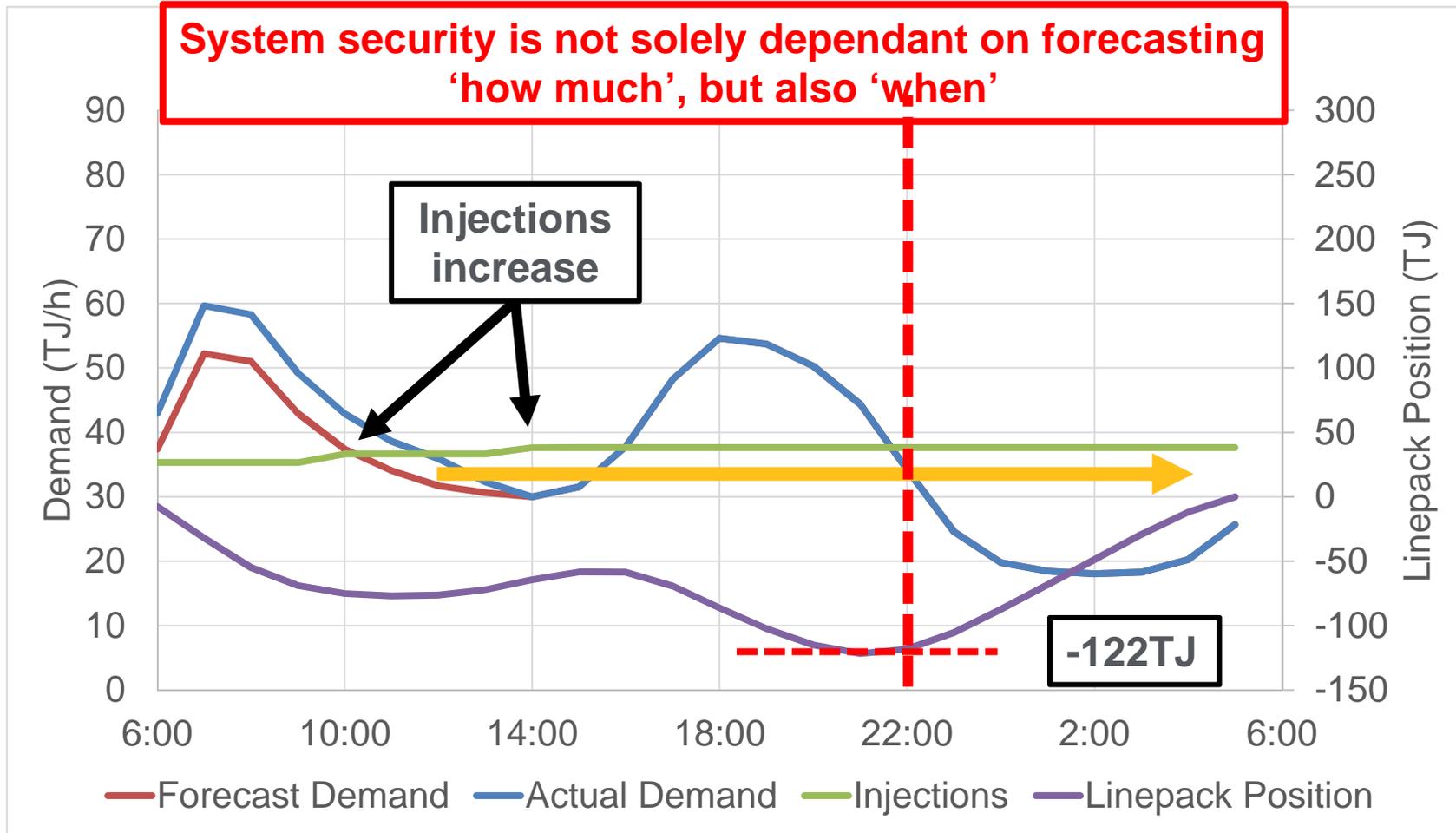
FUNDAMENTALS: DEMAND FORECAST



Temperature and System Demand across the evening peak (2015)

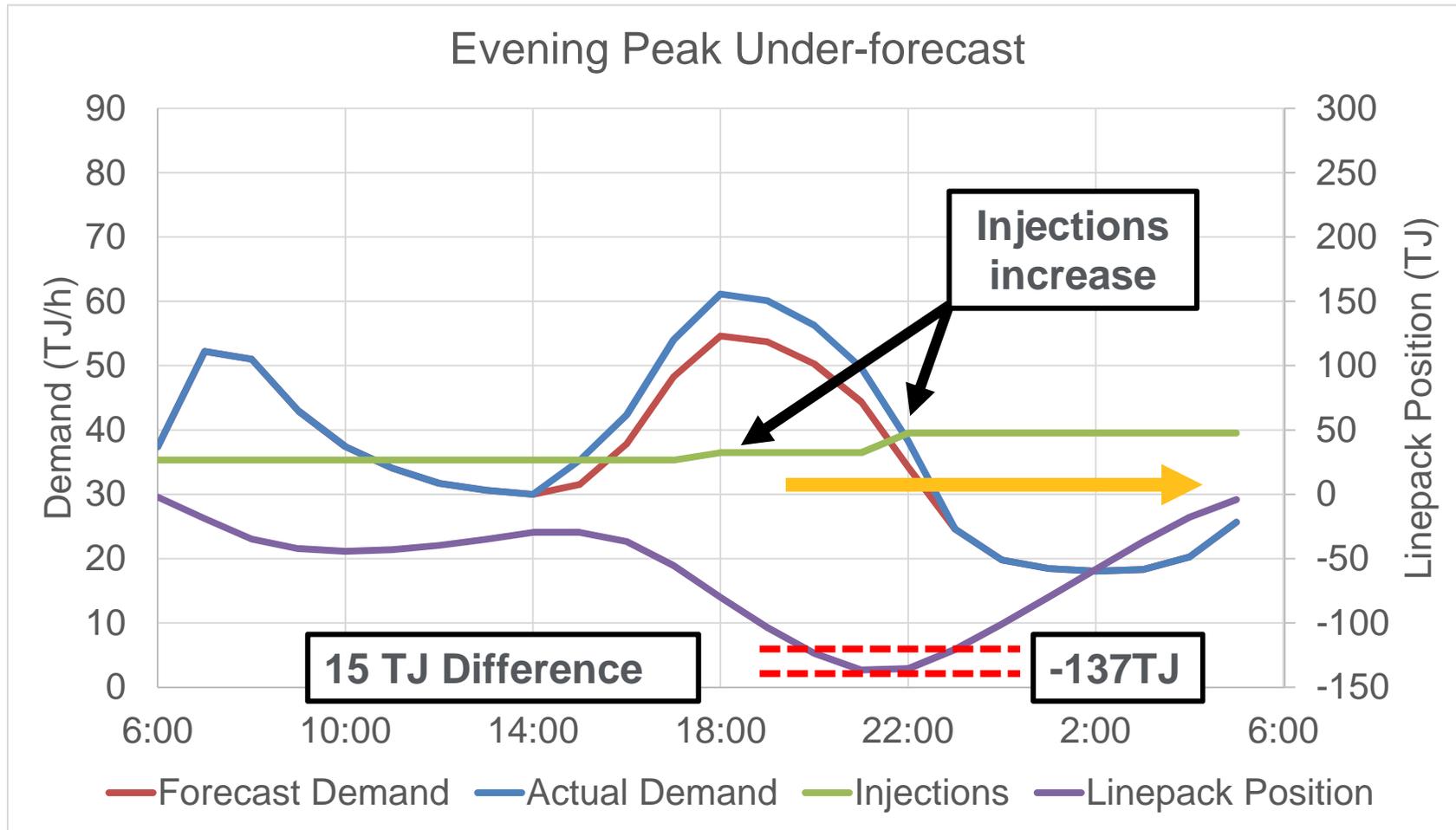


FUNDAMENTALS: DEMAND PROFILE



Daily demand under-forecast by 5% - all in the morning peak

FUNDAMENTALS: DEMAND PROFILE

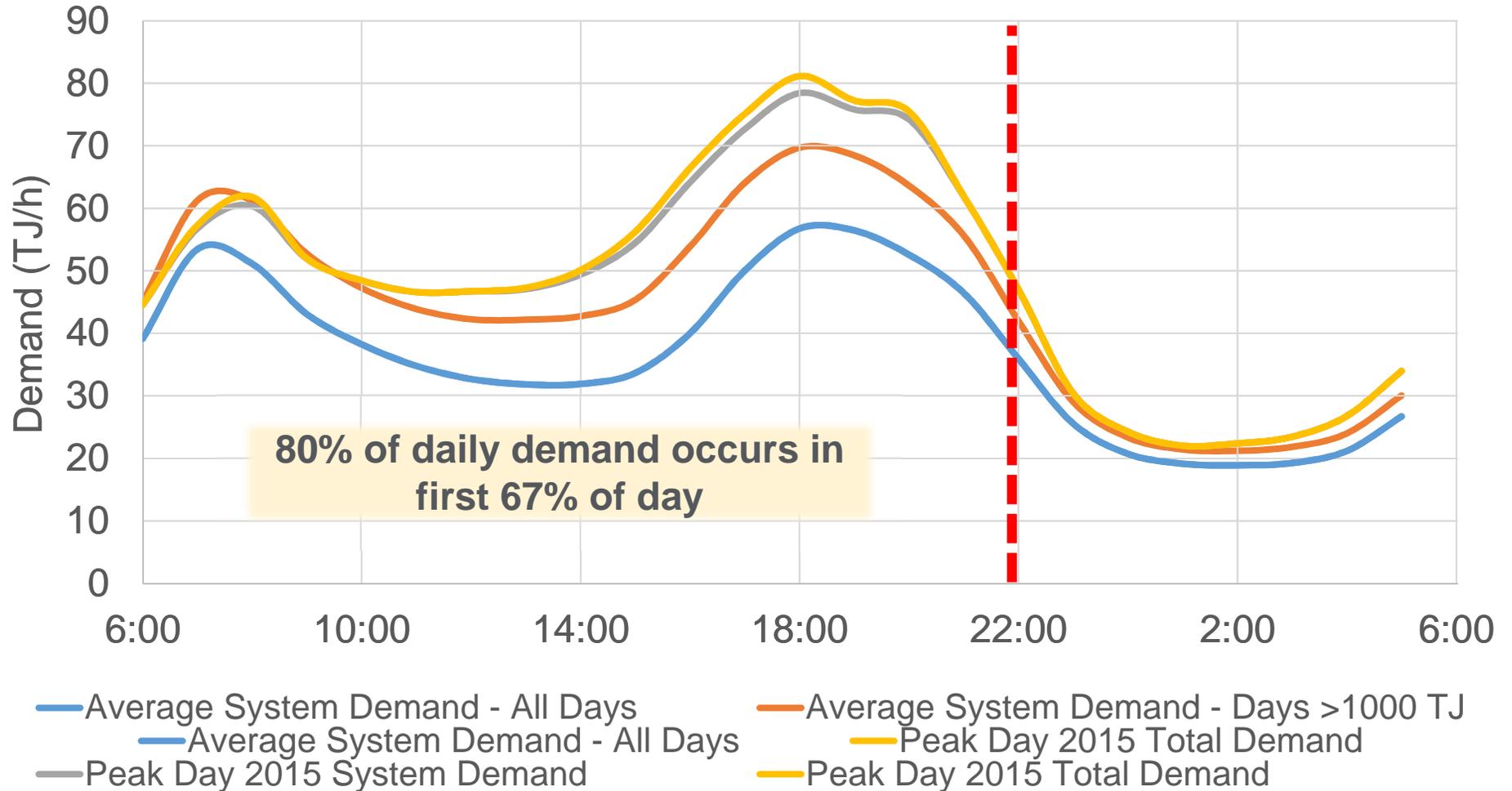


Daily demand under-forecast by 5% - all in the evening peak

FUNDAMENTALS: DEMAND PROFILE



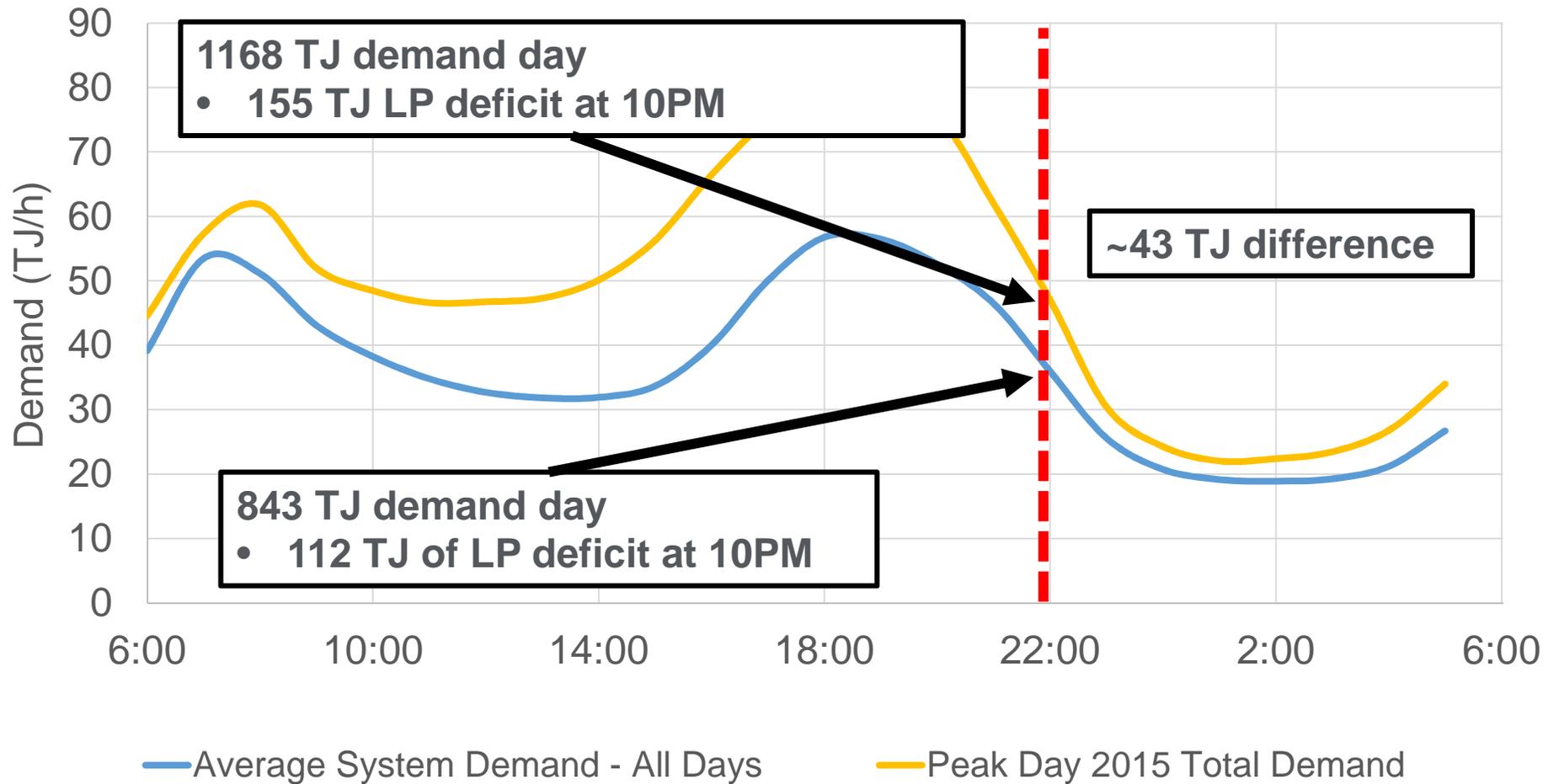
Winter 2015 Demand Profiles (June, July, August)



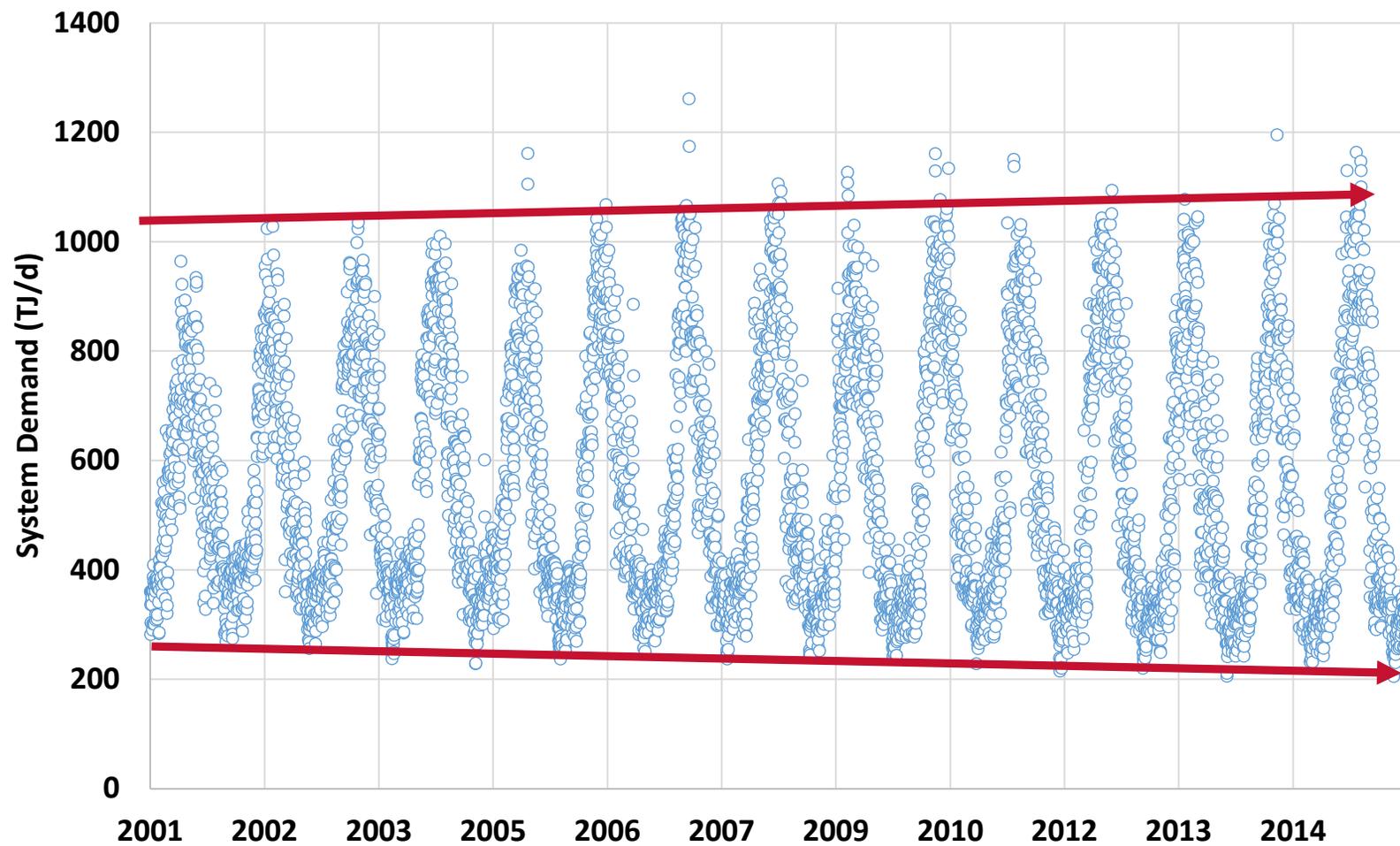
FUNDAMENTALS: DEMAND PROFILE

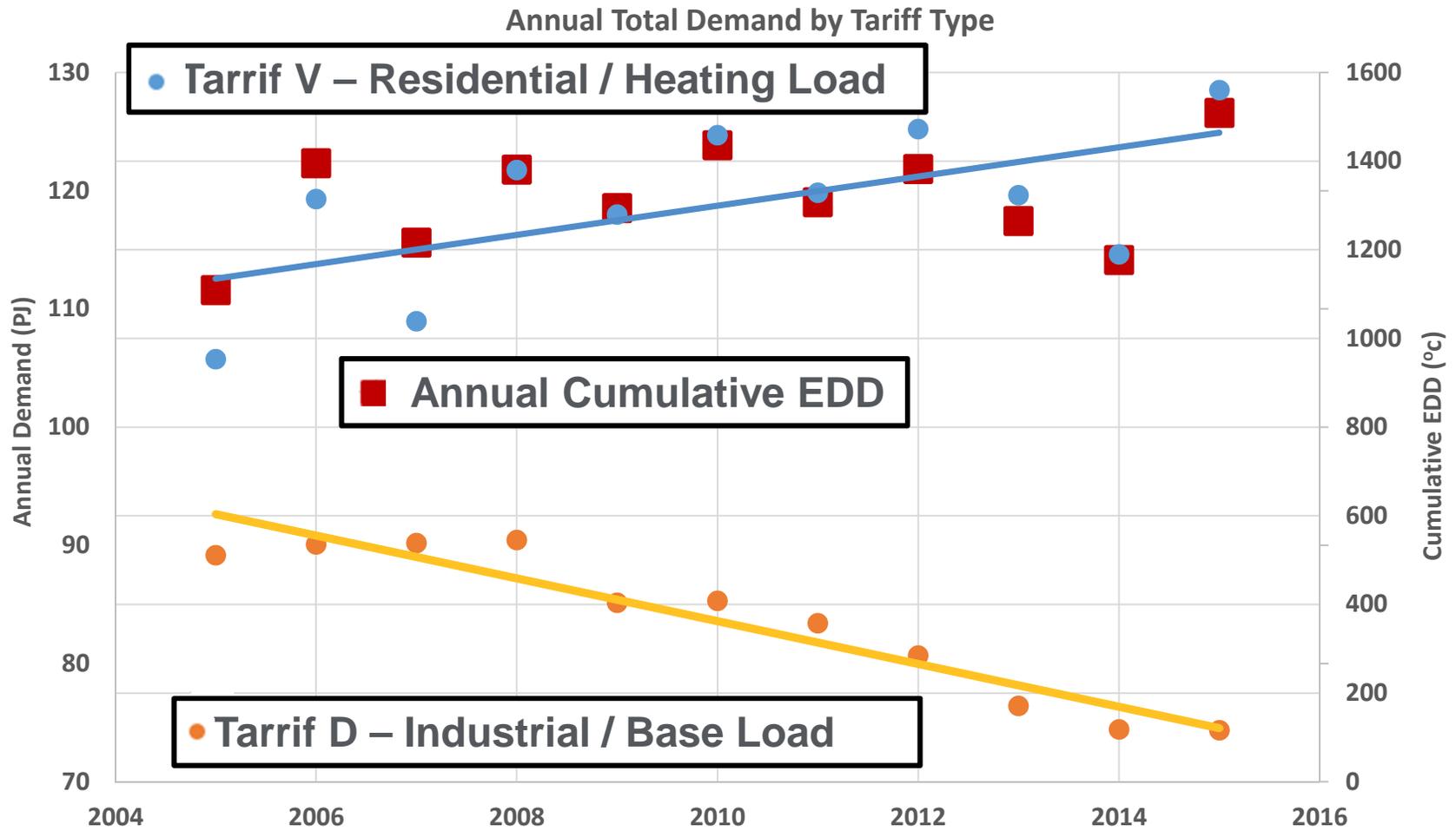


Winter 2015 Demand Profiles (June, July, August)



System Demand (TJ/d) 2001 - 2015



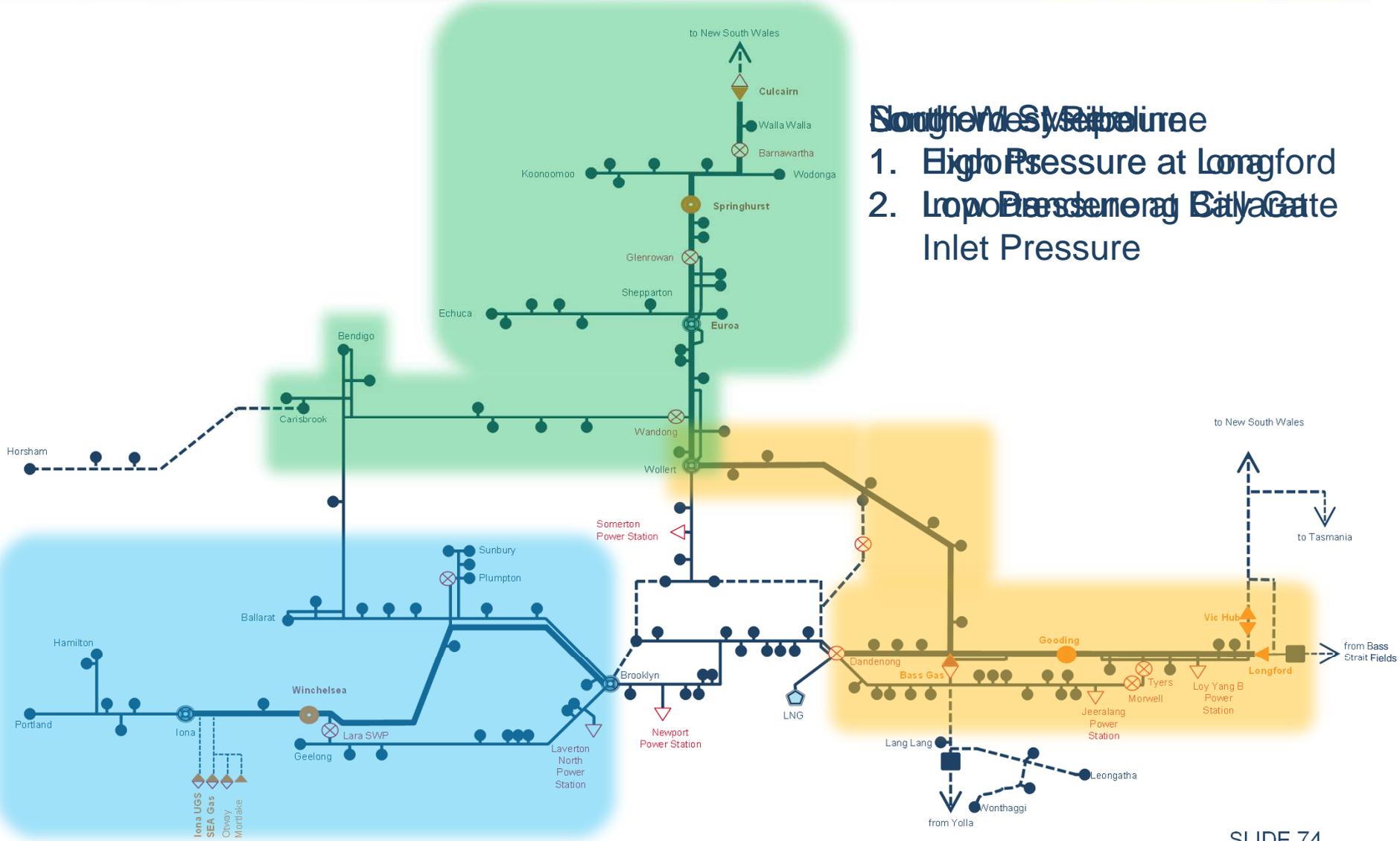


SUMMARY



- Expected supply capacity sufficient to meet peak demand.
- Transportation capacity of the DTS is sufficient to move gas from supply points to the demand points.
- Linepack allows for variation in demand throughout the day.
- Linepack deficit is increased by;
 - High system demand
 - Demand uncertainties

OPERATIONAL STRATEGIES



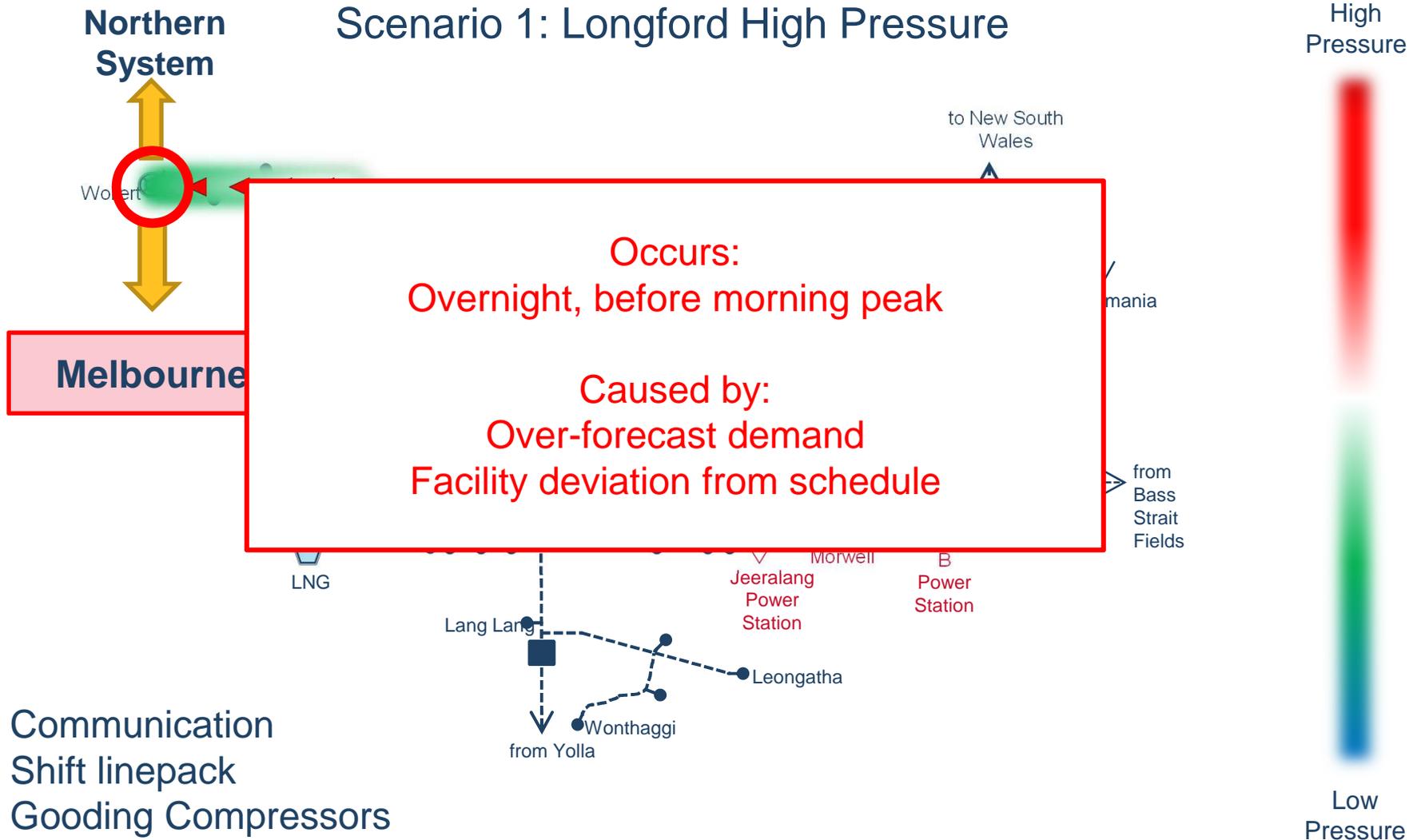
South West Gas Pipeline

1. High Pressure at Longford
2. Low Pressure at Somerton Bypass Inlet Pressure

OPERATIONAL STRATEGIES: LONGFORD PIPELINE



Scenario 1: Longford High Pressure

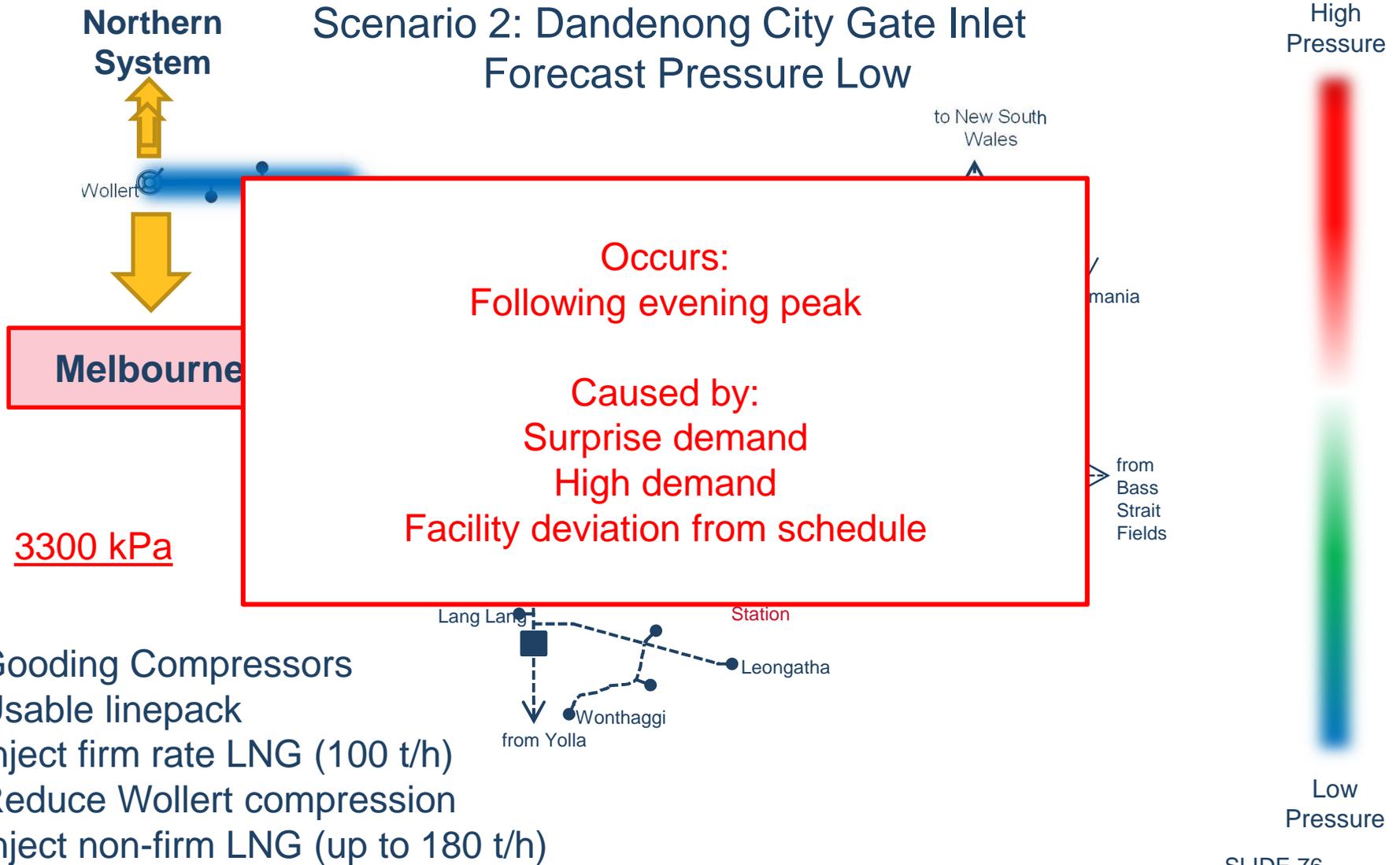


1. Communication
2. Shift linepack
3. Gooding Compressors

OPERATIONAL STRATEGIES: LONGFORD PIPELINE



Scenario 2: Dandenong City Gate Inlet Forecast Pressure Low



1. Gooding Compressors
2. Usable linepack
3. Inject firm rate LNG (100 t/h)
4. Reduce Wollert compression
5. Inject non-firm LNG (up to 180 t/h)

OPERATIONAL STRATEGIES: SOUTH WEST PIPELINE



Typical flow path on a high system demand day



OPERATIONAL STRATEGIES: SOUTH WEST PIPELINE



Scenario 2: Low Pressure at Ballarat



Hamil

Portland

Sunbury

Occurs:
Overnight, before morning peak

Caused by:
Over-forecast demand
Large unanticipated schedule change
Facility deviation from schedule

Brooklyn

Barton
North
Lower
Station

Iona UGS
SEA Gas
Otway
Mortlake

1. Shift linepack
2. Winchelsea Compressor

1. Brooklyn Compressor

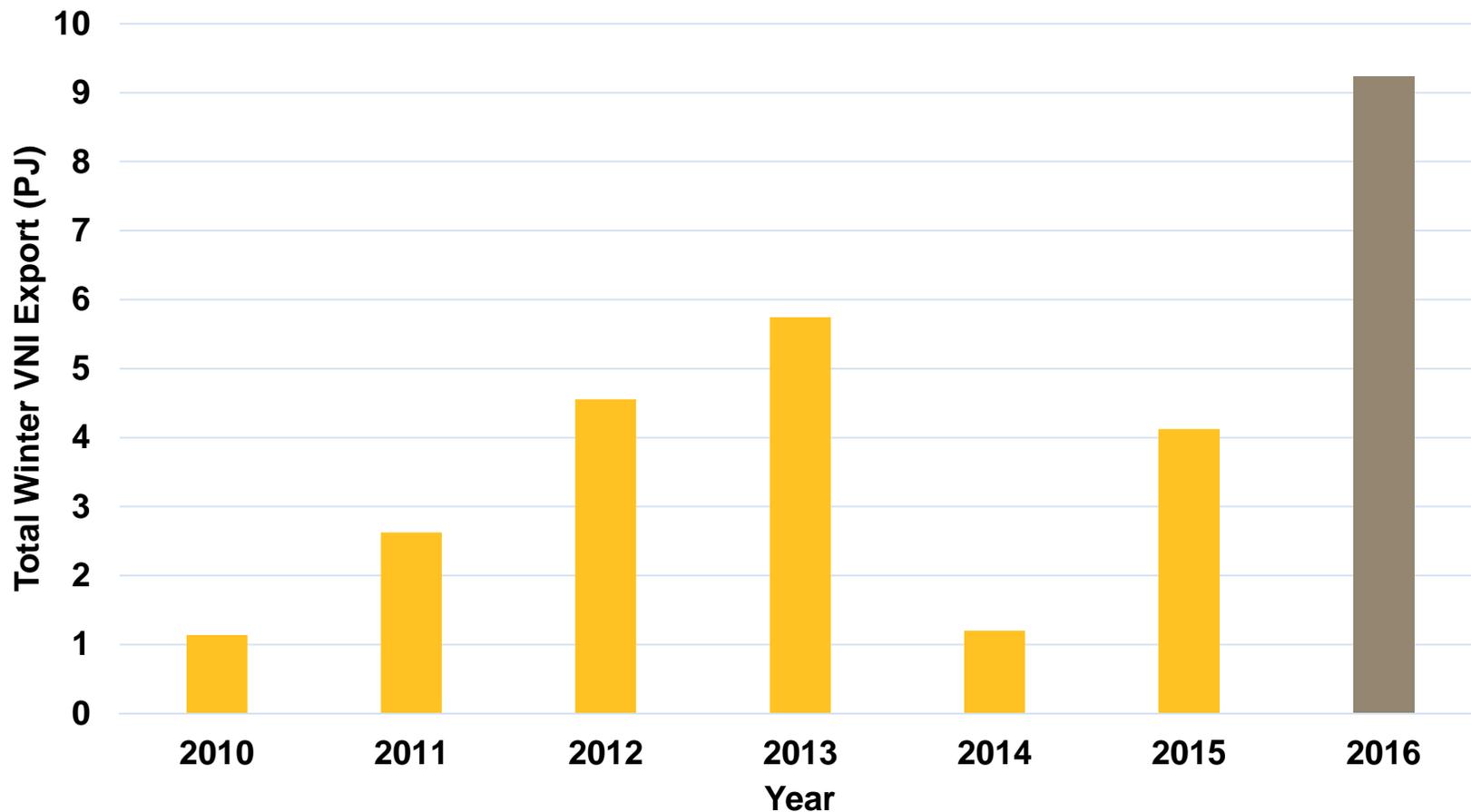
High Pressure

Low Pressure

OPERATIONAL STRATEGIES: NORTHERN PIPELINE



- Exports forecasted to increase in 2016*
- Highly dependant on markets outside Victorian Declared Wholesale Gas Market

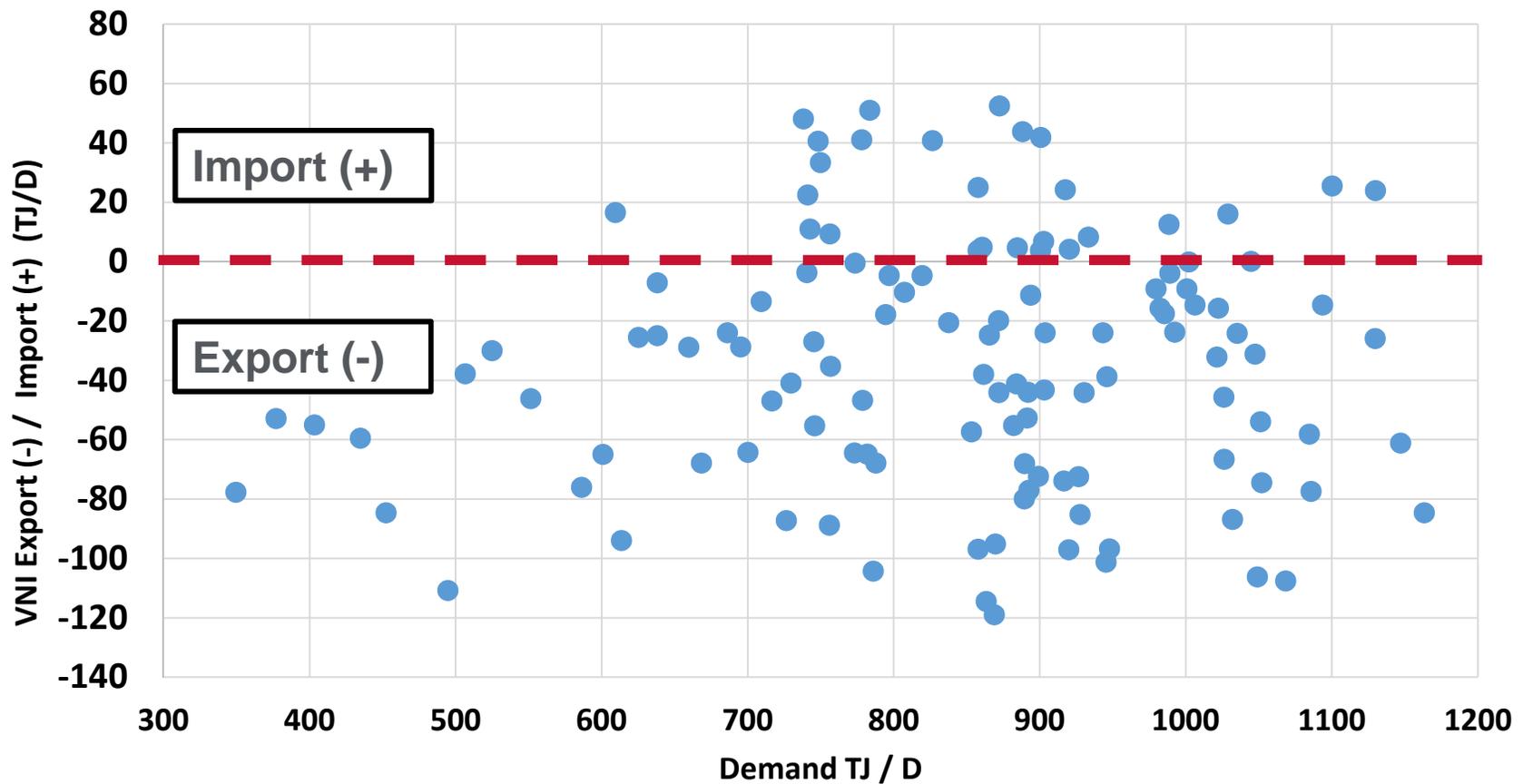


* 2016 - Gas Statement of Opportunities

OPERATIONAL STRATEGIES: NORTHERN PIPELINE

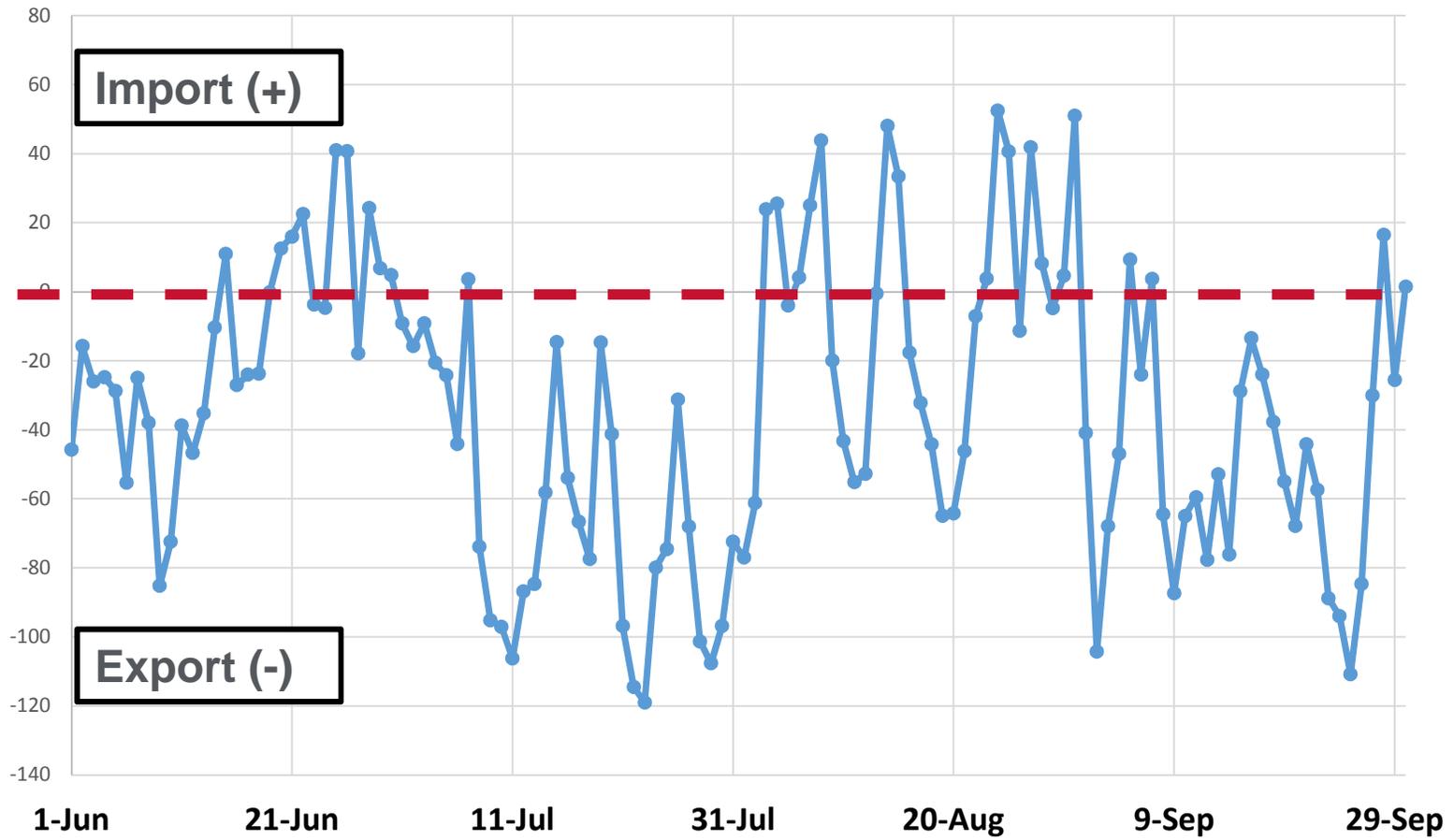


VNI Import / Export Vs Daily Demand (Winter 2015)



Culcairn Import / Export Vs Time of Year (Winter 2015)

VNI Export (-) / Import (+) (TJ/D)

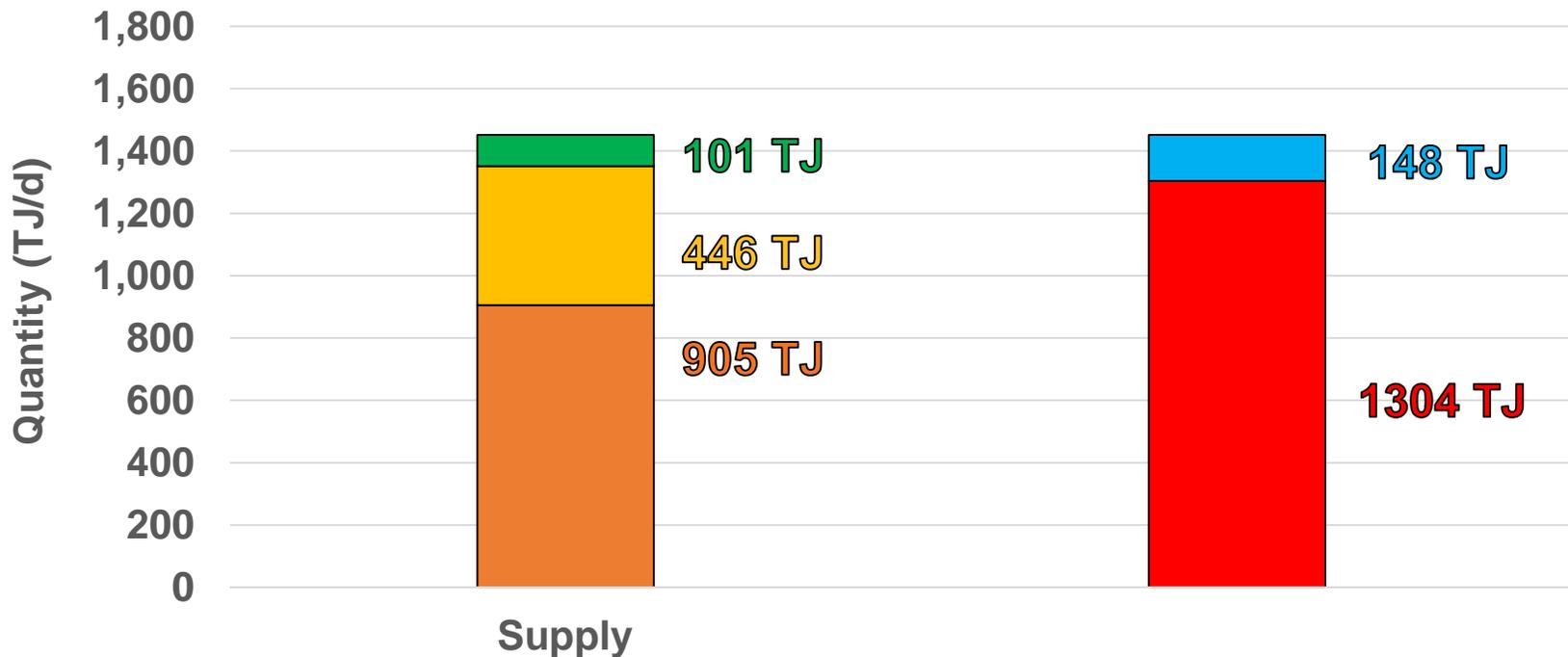


OPERATIONS OVERVIEW: 1-IN-20 PEAK DAY SUPPLY AND DEMAND



1-in-20 Peak Demand Day Supply

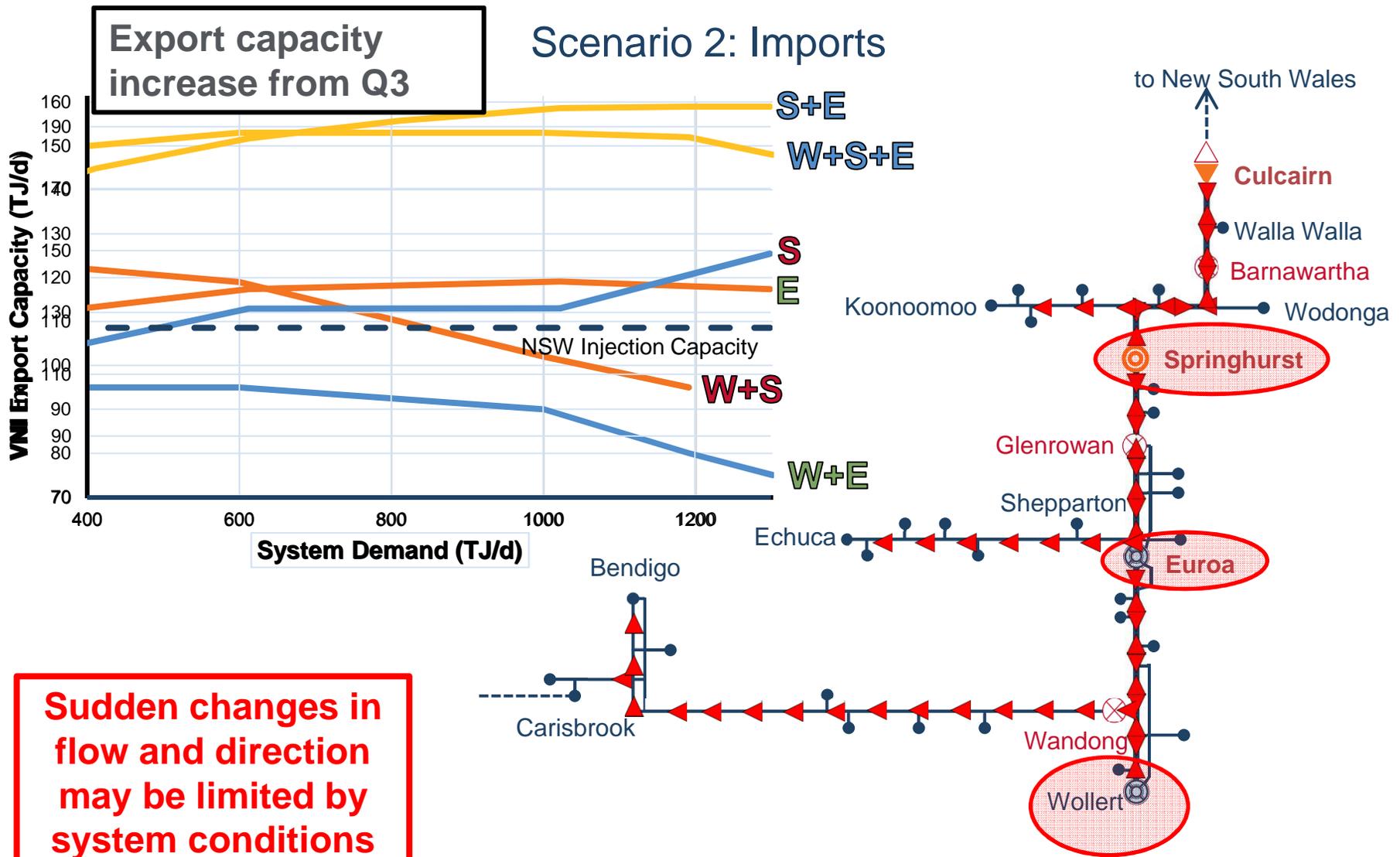
**1-in-20 Demand + VNI Exports
1452 TJ**



- BassGas, Longford and Vichub
- Port Campbell
- Other Supplies (eg LNG)
- 1-in-20 System Demand
- Culcairn

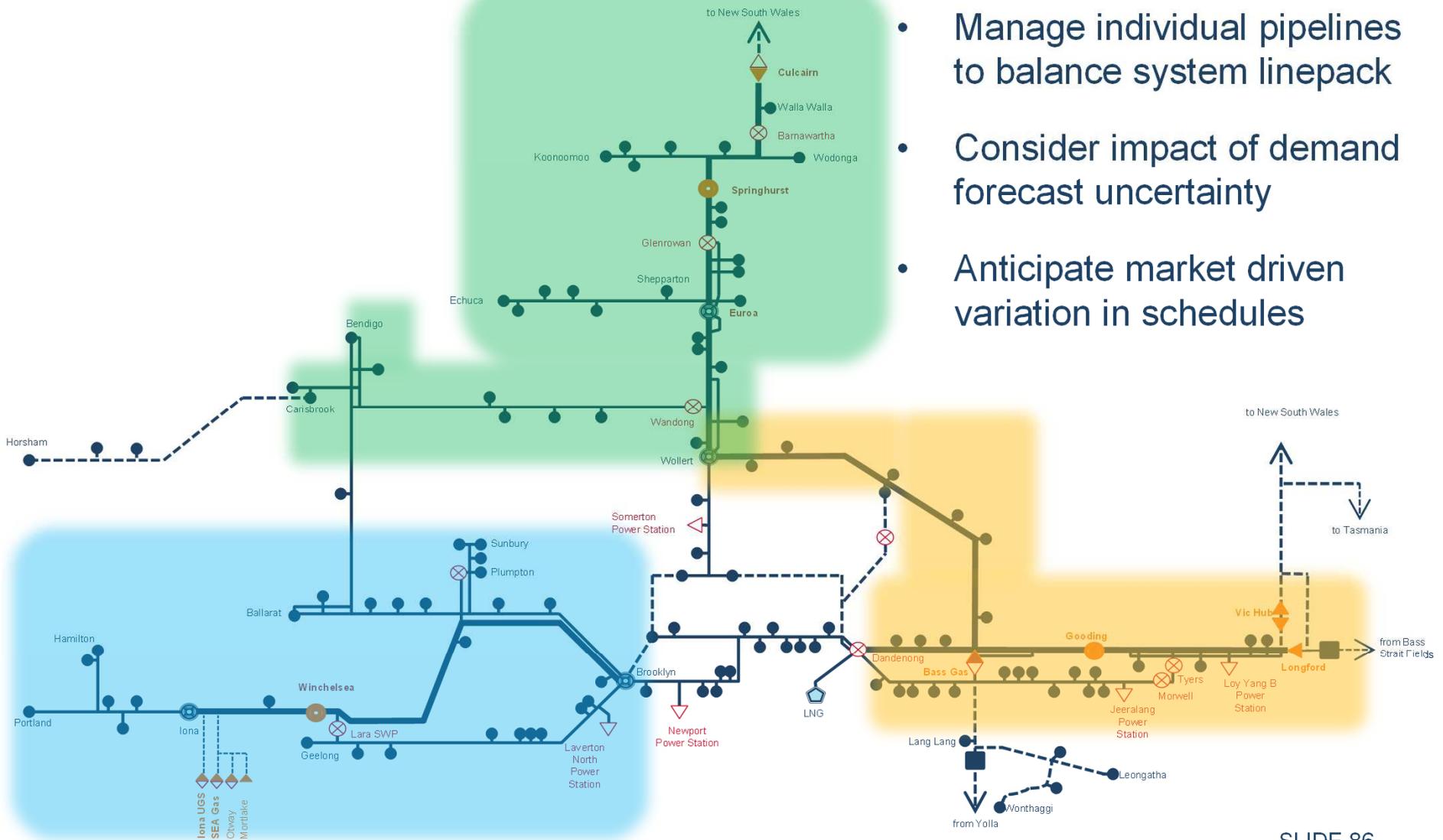
- Sufficient Victorian gas supply capacity to support 148 TJ/d on a 1-in-20 system demand day.
- LMP and the SWP flowing at maximum expected capacity, LNG injections are also required.

OPERATIONAL STRATEGIES: NORTHERN PIPELINE



- More pipe → more linepack
- Increased withdrawals
- Little correlation between system demand and VNI export bid behaviour

OPERATIONAL STRATEGIES: SUMMARY



- Manage individual pipelines to balance system linepack
- Consider impact of demand forecast uncertainty
- Anticipate market driven variation in schedules

SUMMARY



- Sufficient capacity to meet forecast demand
- System security, influenced by:
 - linepack balance
 - demand forecast
 - demand profile
- Specific pipeline strategies

QUESTIONS?



SESSION 2

3:00 - 3:30

Afternoon tea

3:30 - 5:00

Session 2

- Market operations
- Peak day – case study
- Emergency management
- Announcements and Q & A

5:00 - 6:00

Networking

MARKET OPERATIONS

Presented by Christine Kang
Senior Analyst, AEMO Gas System Operations

What my friends think I do



MARKET OPERATIONS



MARKET OPERATIONS



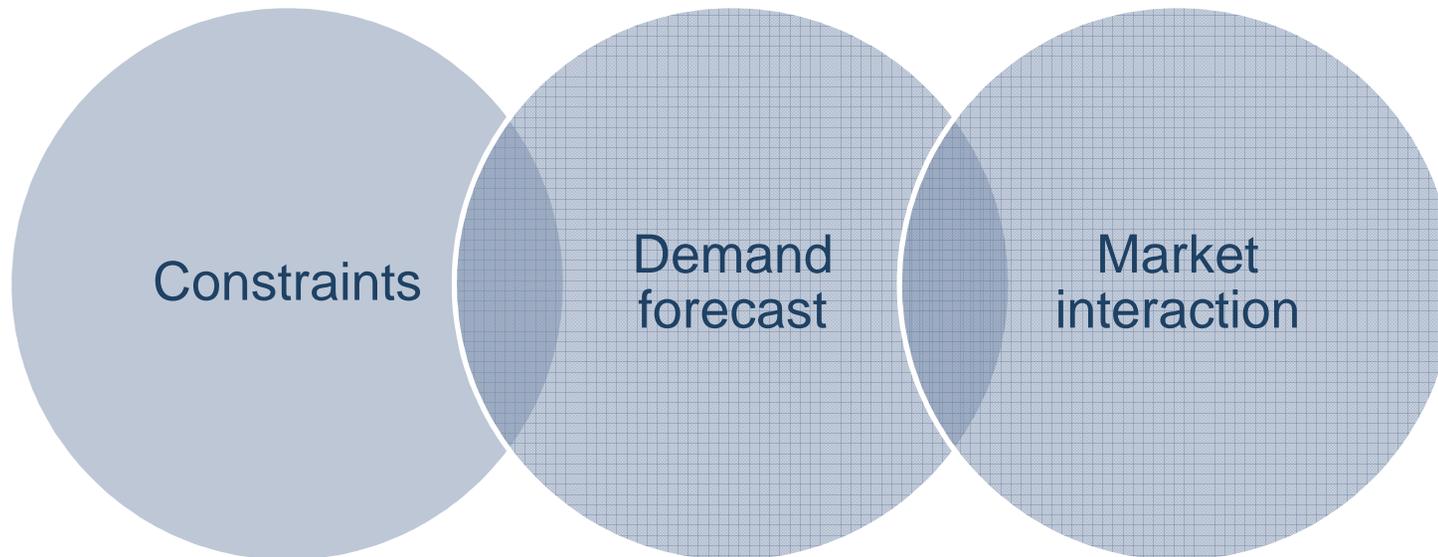
What we really do



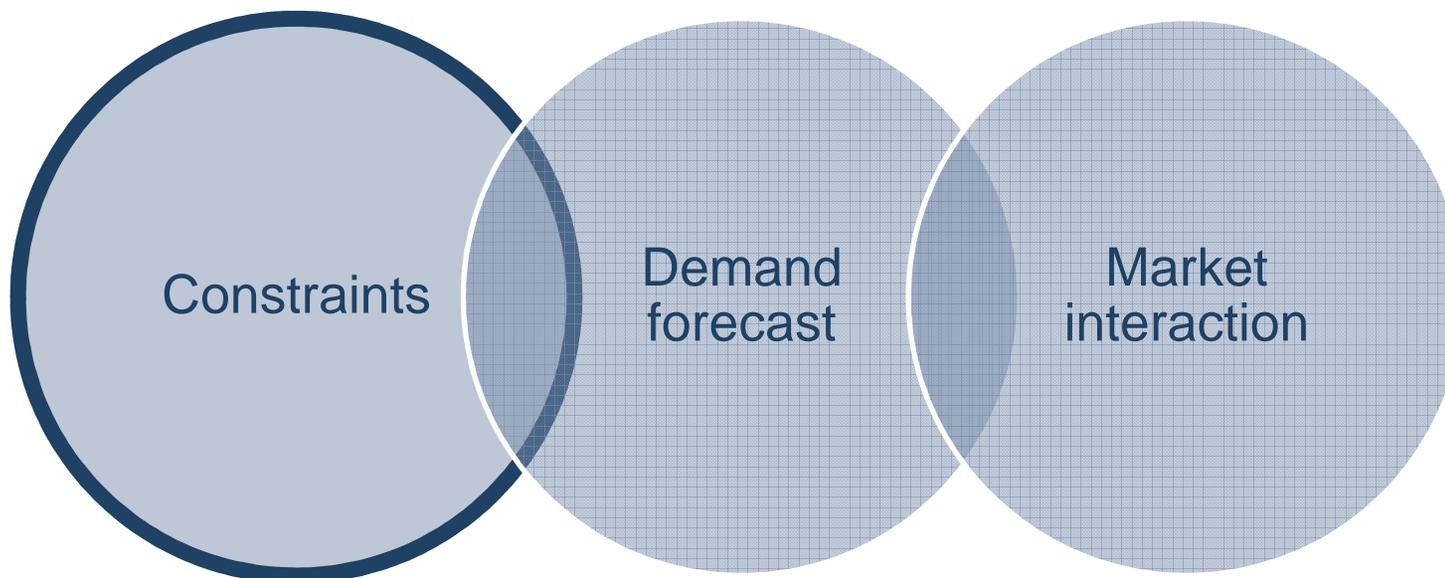
Pipeline
operations

Scheduling
operations

MARKET OPERATIONS



CONSTRAINTS



CONSTRAINTS



SDPC

- Supply demand point constraint

DFPC

- Directional flow point constraint

NFTC

- Net flow transportation constraint

SSC

- Supply source constraint

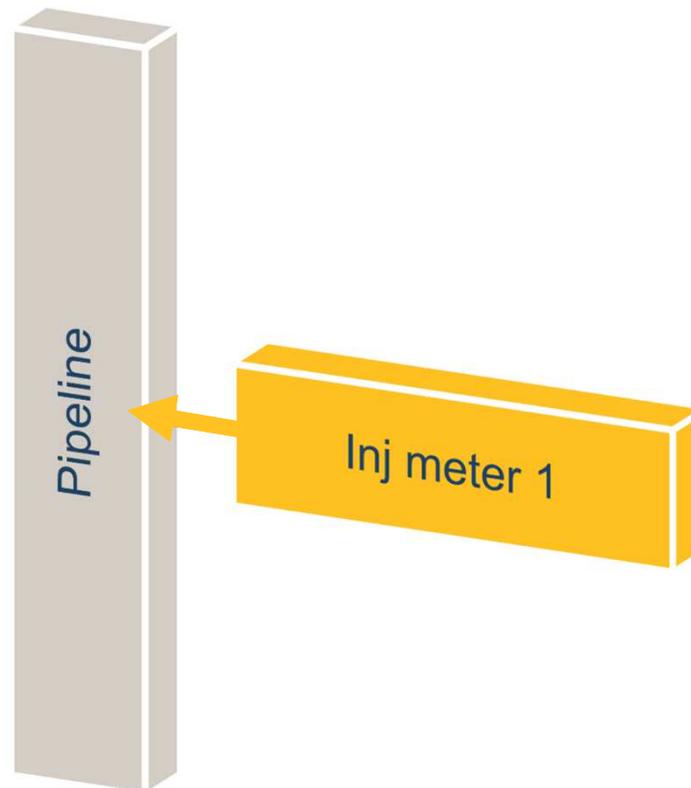
CONSTRAINTS

Supply Demand point
Constraint (SDPC)

DFPC

NFTC

SSC



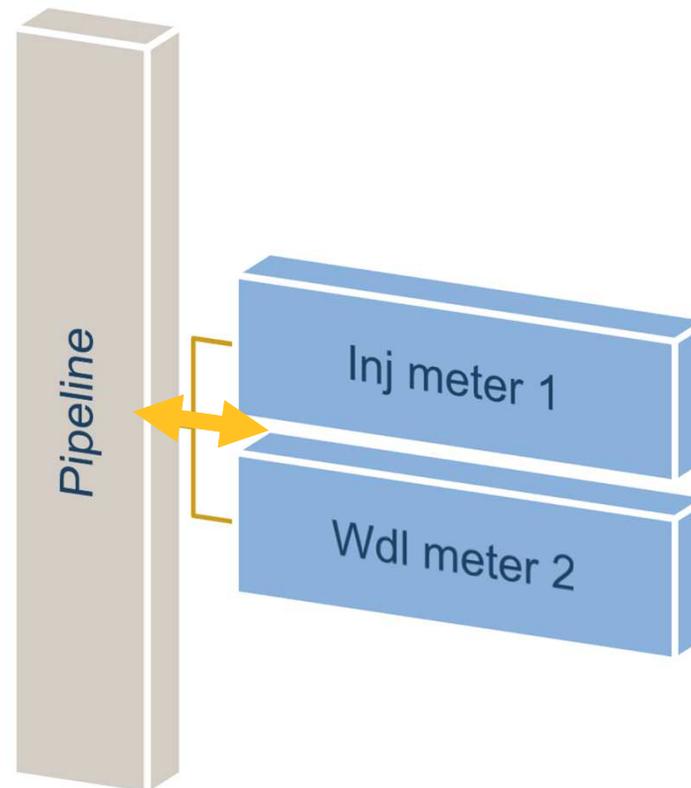
CONSTRAINTS

SDPC

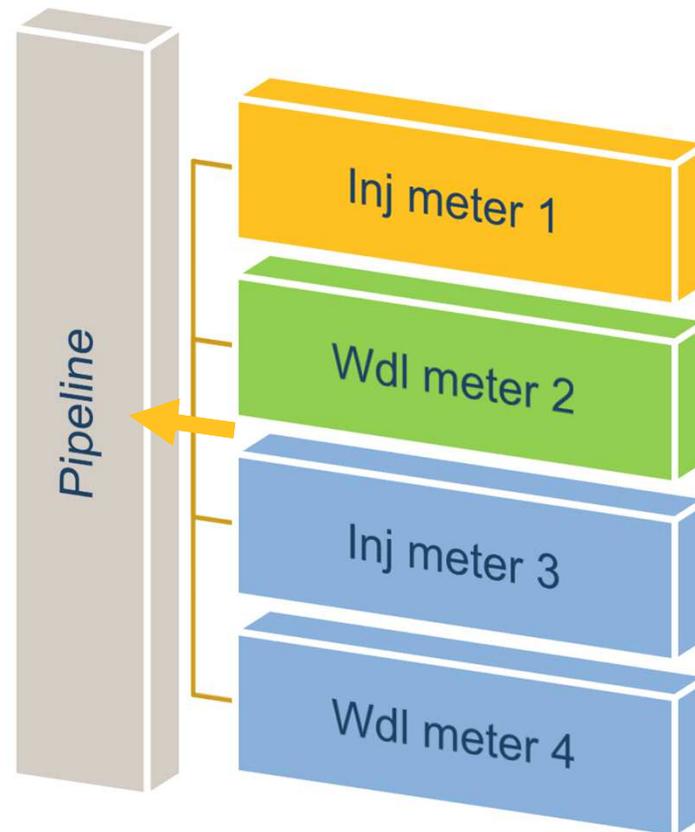
**Directional Flow Point
Constraint (DFPC)**

NFTC

SSC

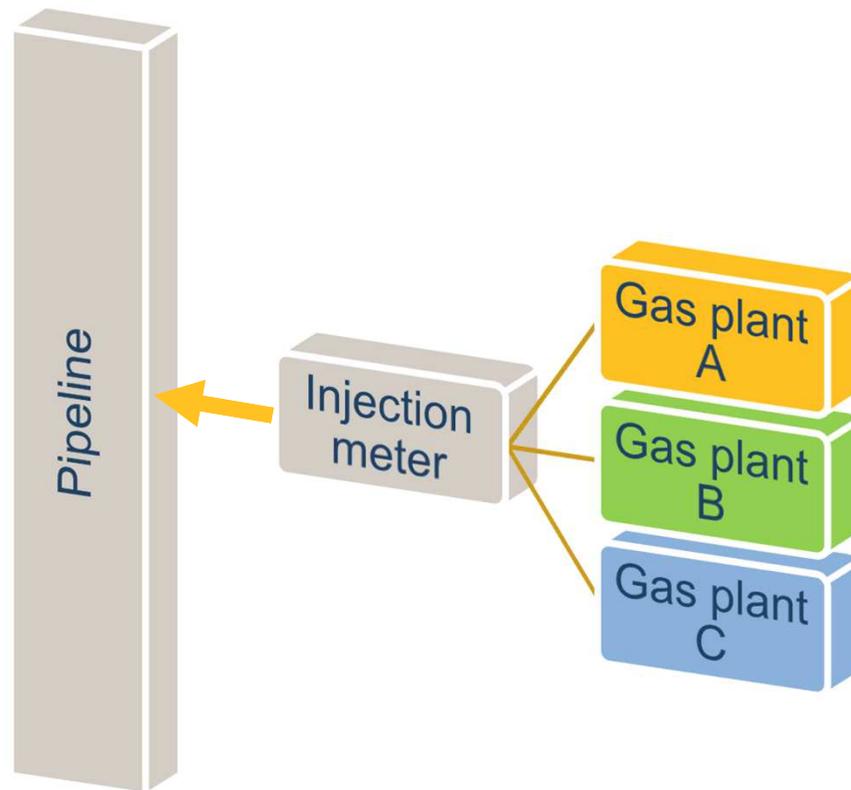


CONSTRAINTS



CONSTRAINTS

- SDPC
- DFPC
- NFTC
- Supply Source Constraint (SSC)



CONSTRAINTS – EXAMPLE 1



- **Longford injection** is supply constrained due to a plant issue
 - Constraint of 650 TJ is requested by the facility operator
 - SDPC of 650 TJ is applied to both OS and PS
- **Available Longford injection bids:**

Participant	Bid qty (TJ)	Bid price (\$/GJ)	AMDQ	Bid share (%)	OS qty (TJ)	PS qty (TJ)
A	400	0.00	Yes	44	289	289
B	300	0.00	Yes	33	217	217
C	200	0.00	Yes	22	144	144
D	80	0.00	No			
E	20	3.00	Yes			
Total	1,000	-	-	100	650	650

CONSTRAINTS – EXAMPLE 2



- **Culcairn withdrawal** is constrained due to VGPR transport limit
 - Constraint is initiated by AEMO
 - NFTC of 119 TJ is applied to OS only
- **Available Culcairn withdrawal bids:**

Participant	Bid qty (TJ)	Bid price (\$/GJ)	AMDQ	OS qty (TJ)	PS qty (TJ)
A	60	800	Yes	60	60
B	35	800	No	35	35
C	15	800	Yes	15	15
D	19	20	Yes	9	19
Total	129	-	-	119	129
			Longford inj	660	670

CONSTRAINTS – EXAMPLE 3



- **South West Pipeline’s injection** capacity is constrained due to VGPR transport limit
 - Constraint is initiated by AEMO
 - NFTC of 390 TJ is applied to OS only
- **Available South West Pipeline injection bids:**

Participant	Bid qty (TJ)	Bid price (\$/GJ)	AMDQ	Bid share (%)	OS qty (TJ)	PS qty (TJ)
A	205	0.00	No	56	196	205
B	160	0.00	No	44	154	160
C	40	0.00	Yes	-	40	40
D	15	6.00	Yes	-	0	15
Total	405	-	-	100	390	420
				Price	\$7.00/GJ	\$6.10/GJ

Constraint application

Facility operator

- calls AEMO to request

AEMO

notifies market
applies
constraint

[← Messages](#) **AEMO DWGM ALERT** [Details](#)

Sat, 9 Apr, 1:34 PM

OS only constraint revised at SWP wdl meters to 4250 GJ/h from 14:00 on 09/04/16 due to VGPR transport limit

Operating Schedule injection confirmation

AEMO

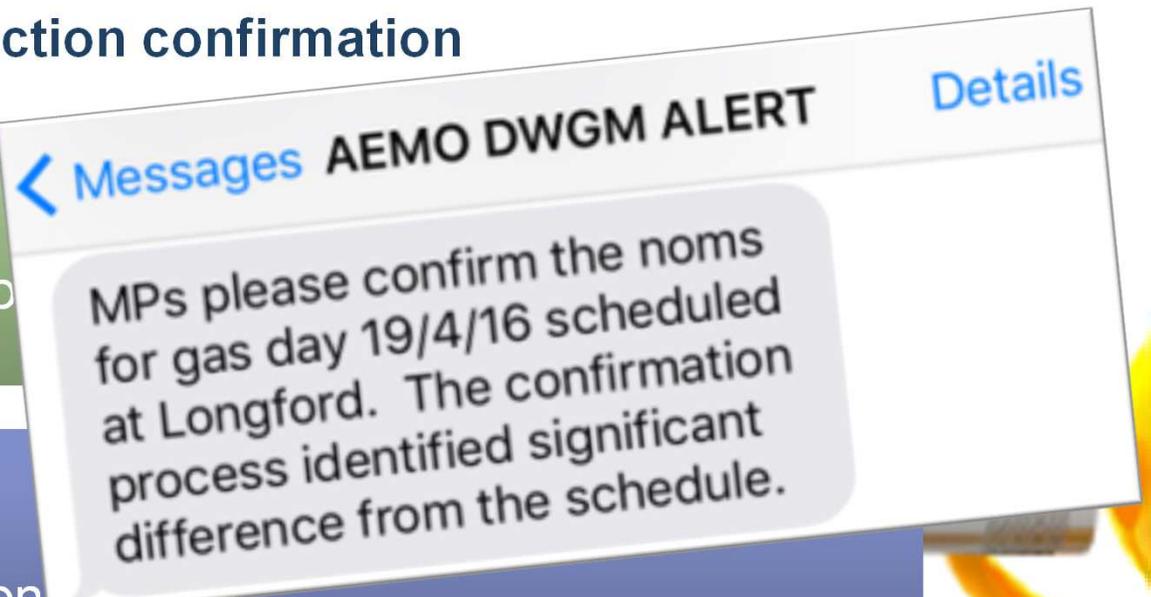
- Sends OS confirmation

Facility operator

- Confirms injection quantity

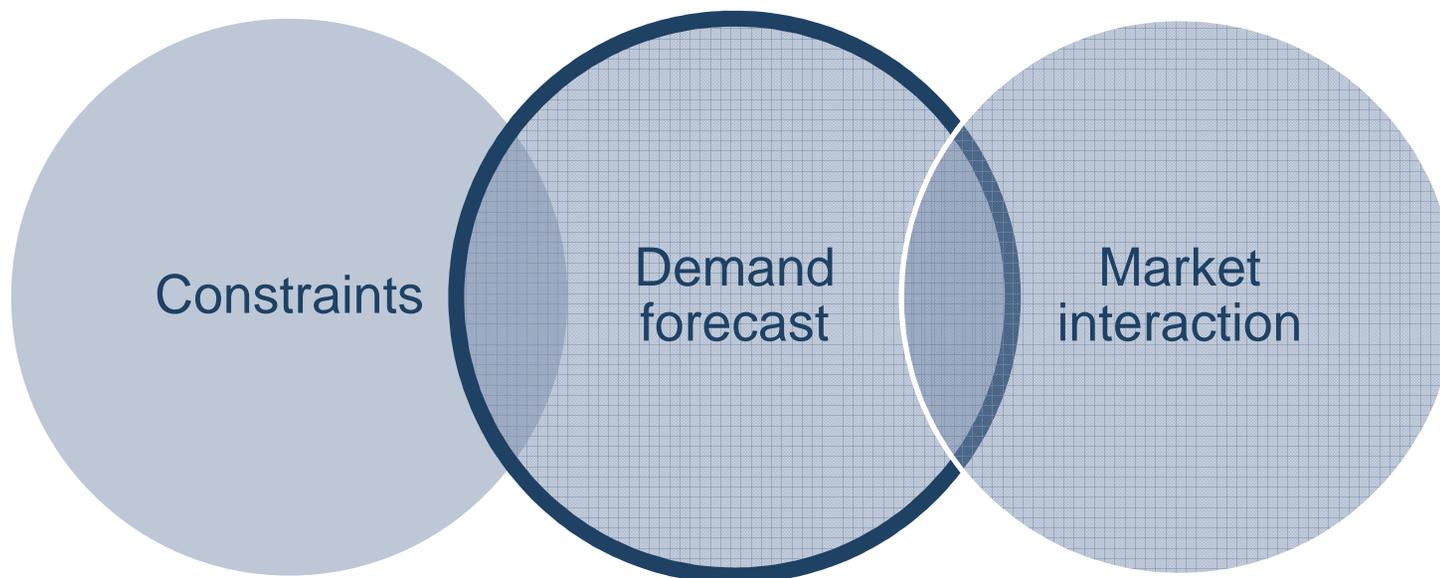
AEMO

- Notifies market if confirmed quantity and scheduled quantity difference is too large

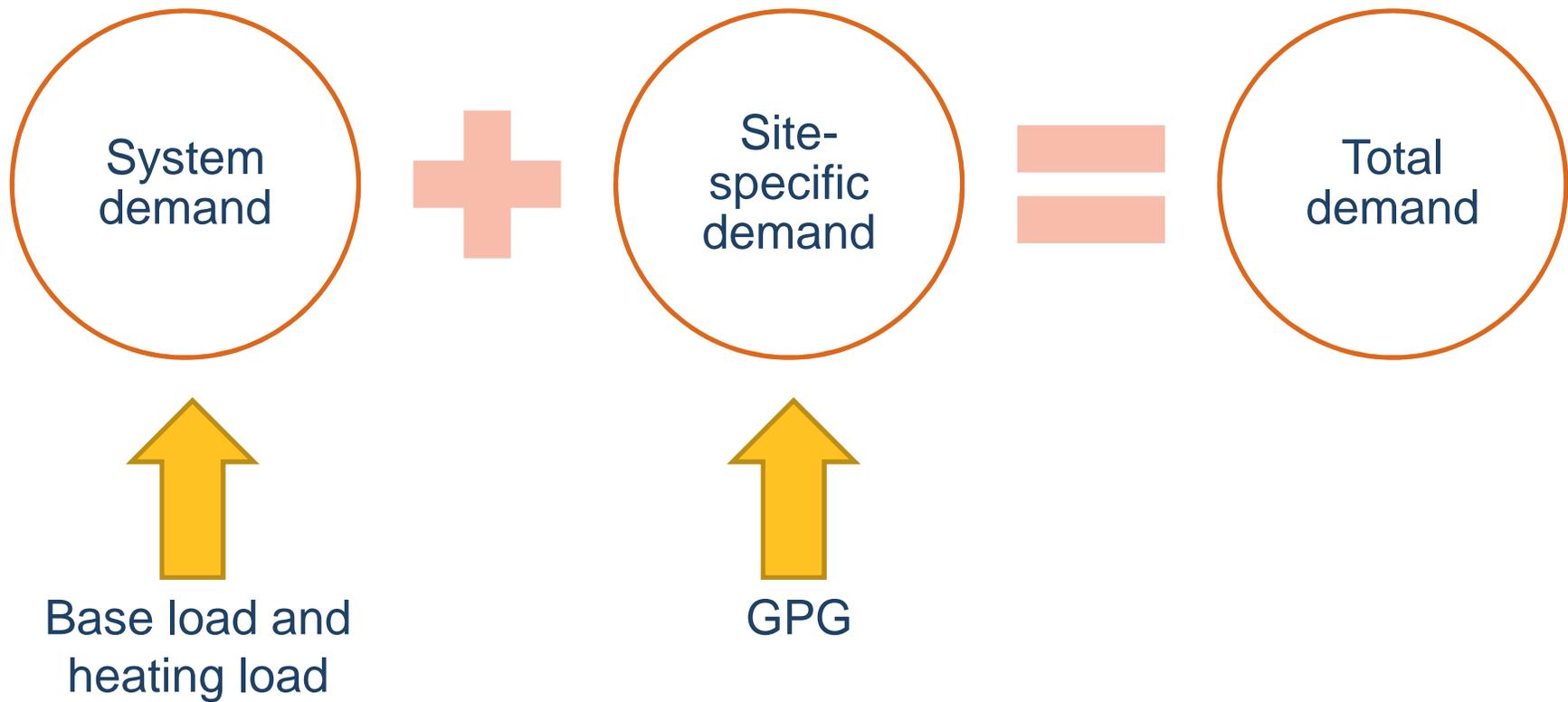




DEMAND FORECAST



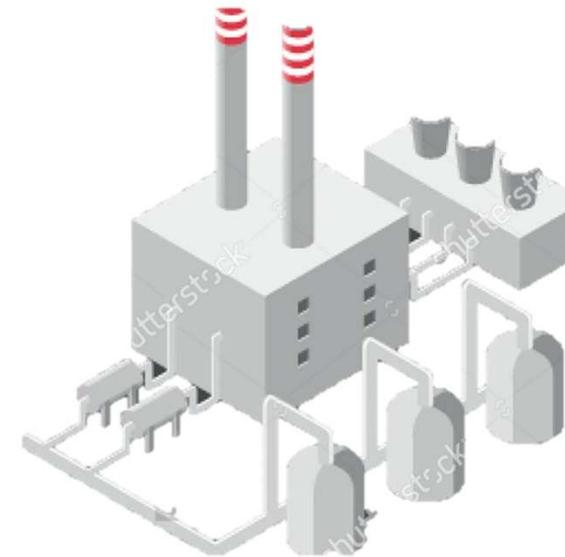
DEMAND FORECAST



DEMAND FORECAST MANAGEMENT



Forecast uncertainties:

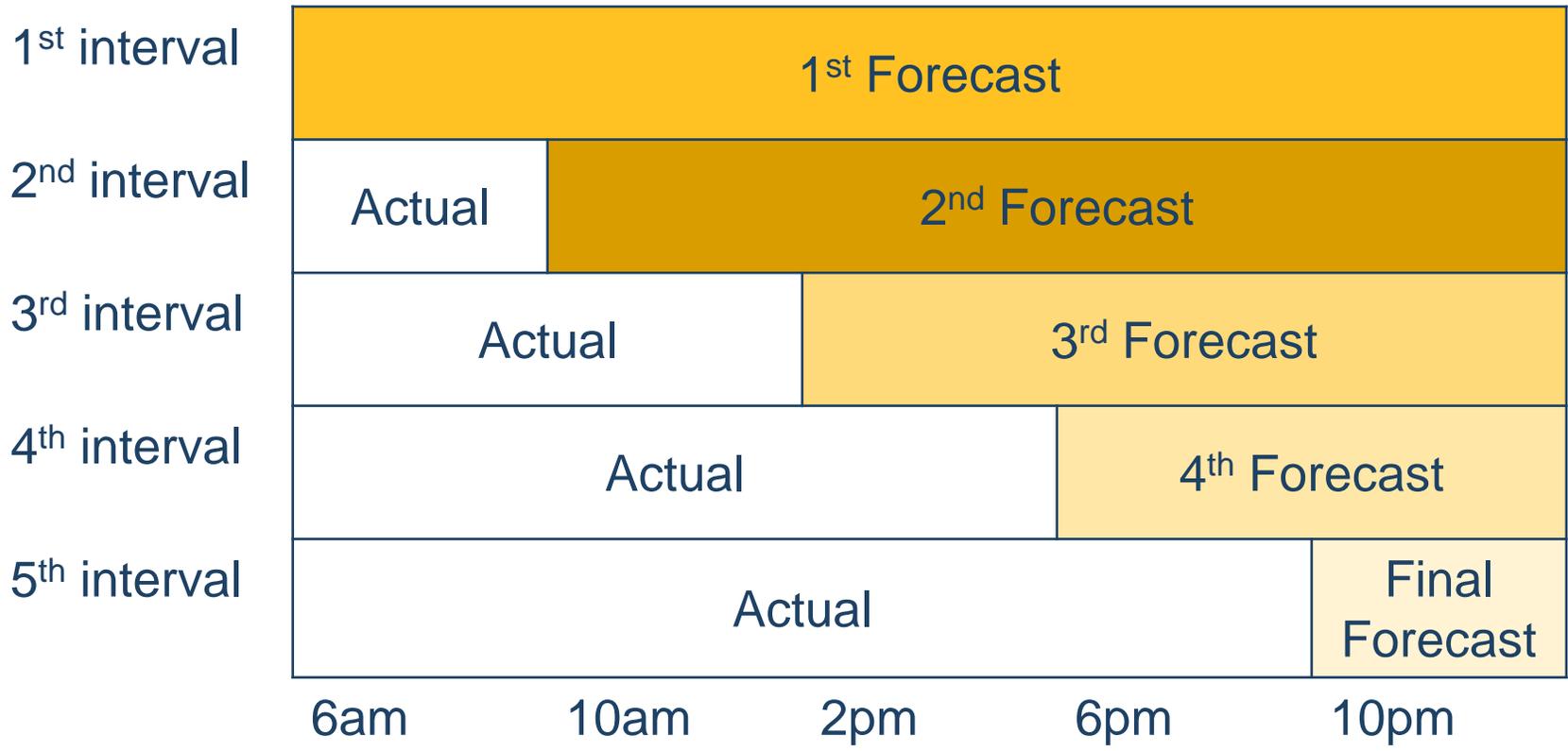


Intraday scheduling



End of Day linepack target

INTRADAY SCHEDULES



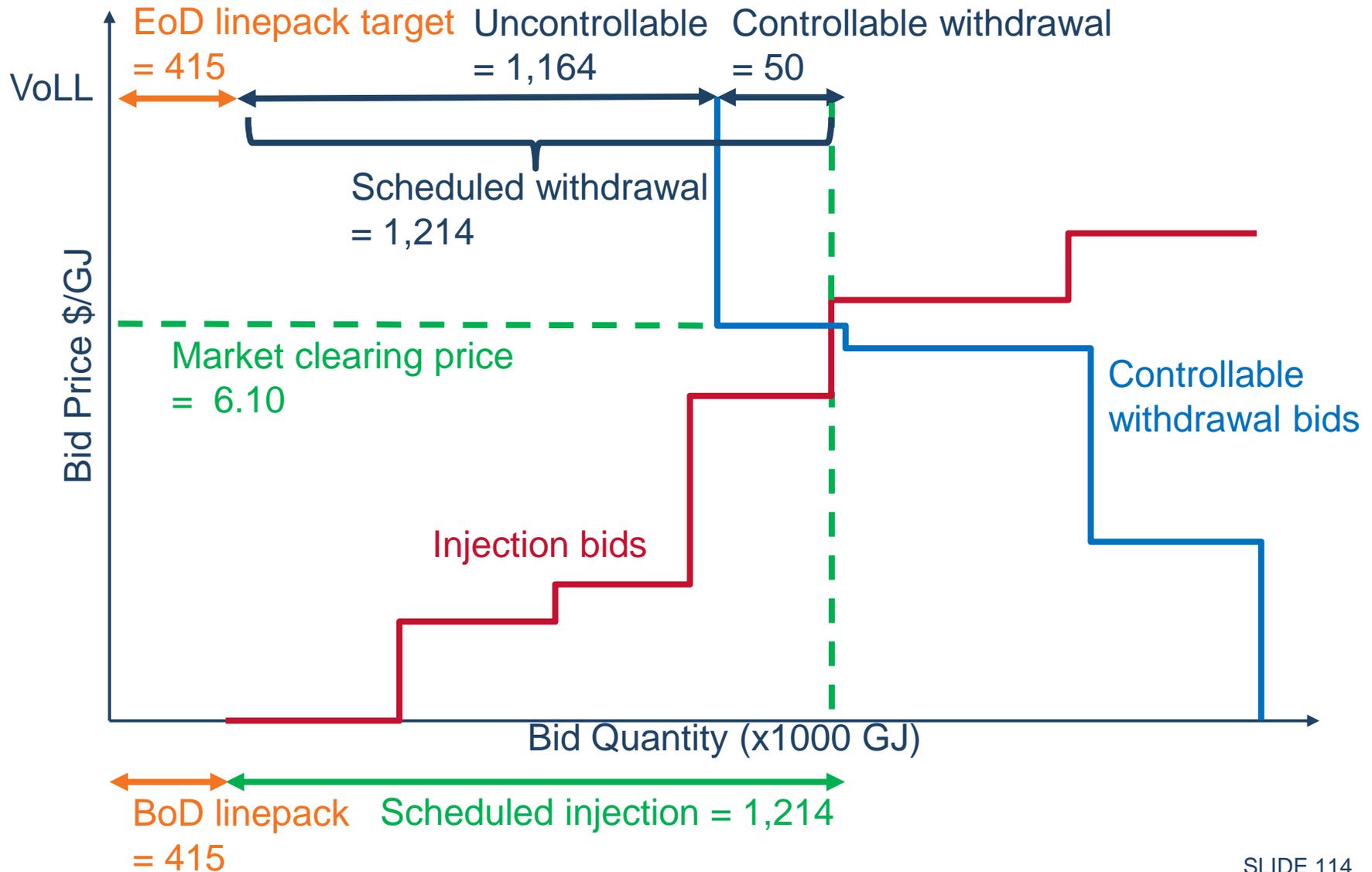
Market participants

- Demand forecast
- Bids
- Injection hedge nomination
- Agency injection hedge nomination
- AMDQ nomination
- Accreditation

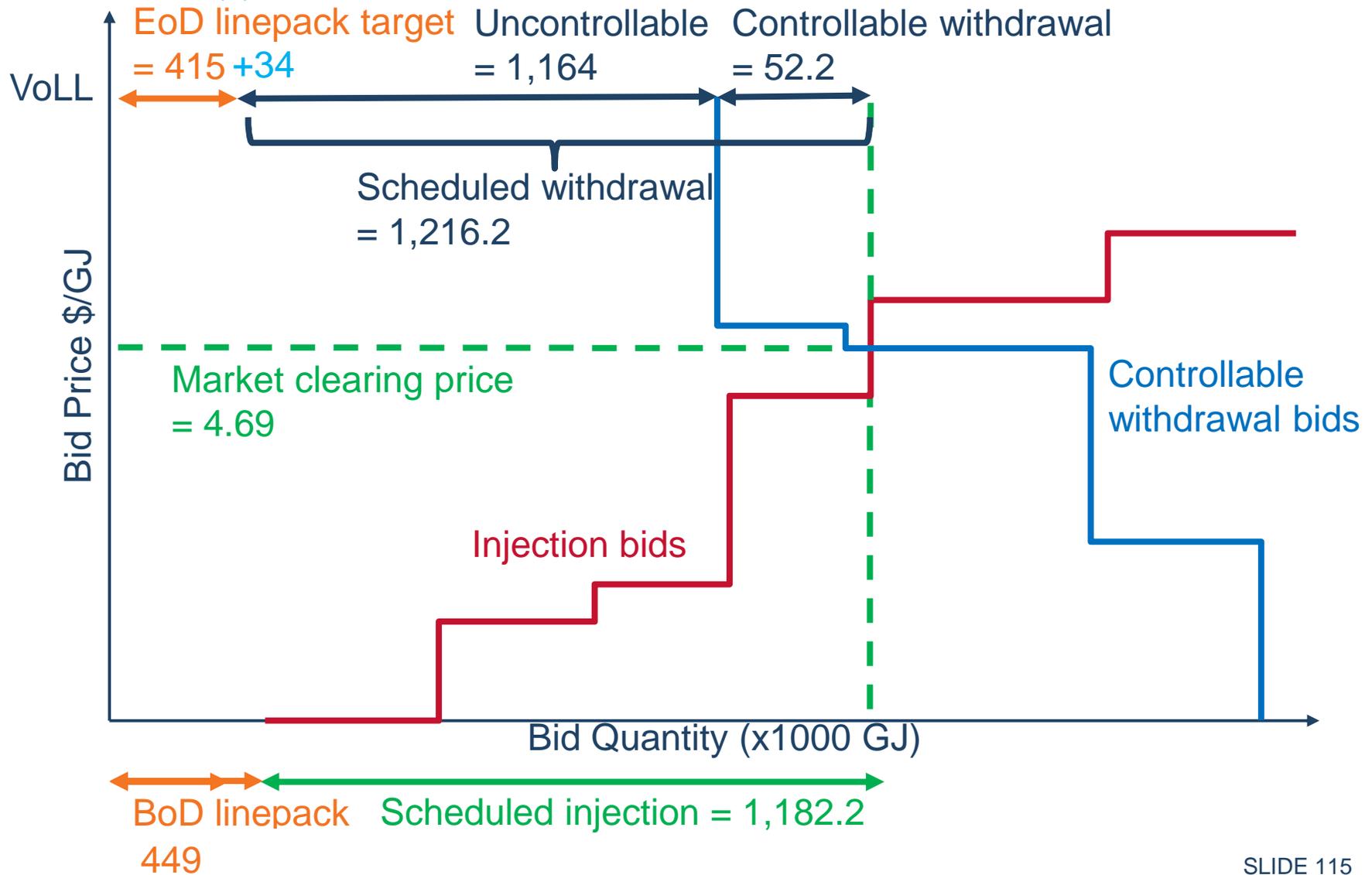
AEMO

- Demand forecast override
- Constraints
- QDIFF
- Compressor commitment
- Nodal pressures
- MCE reference data
- End of Day linepack target

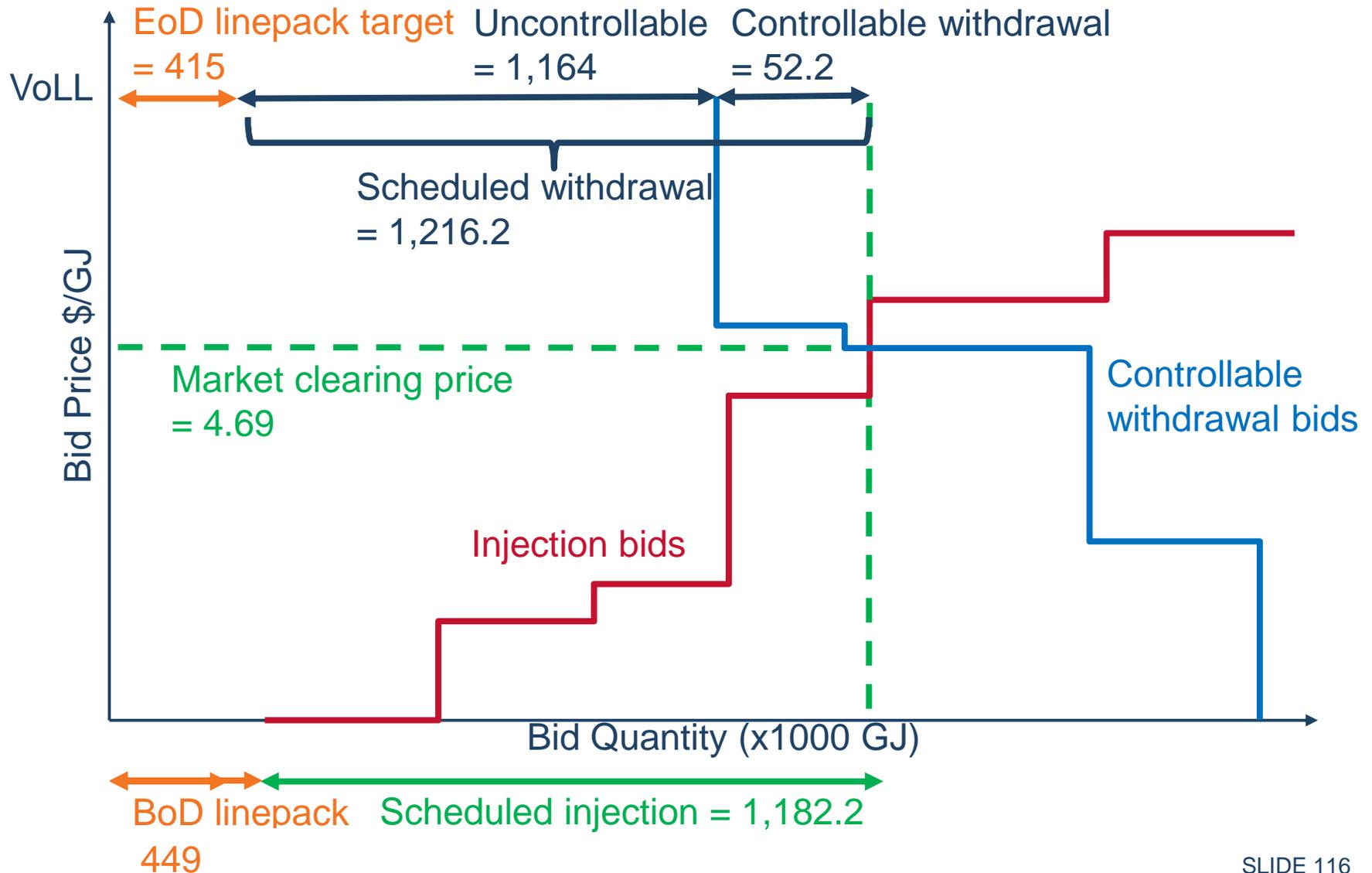
BID STACK – 6AM



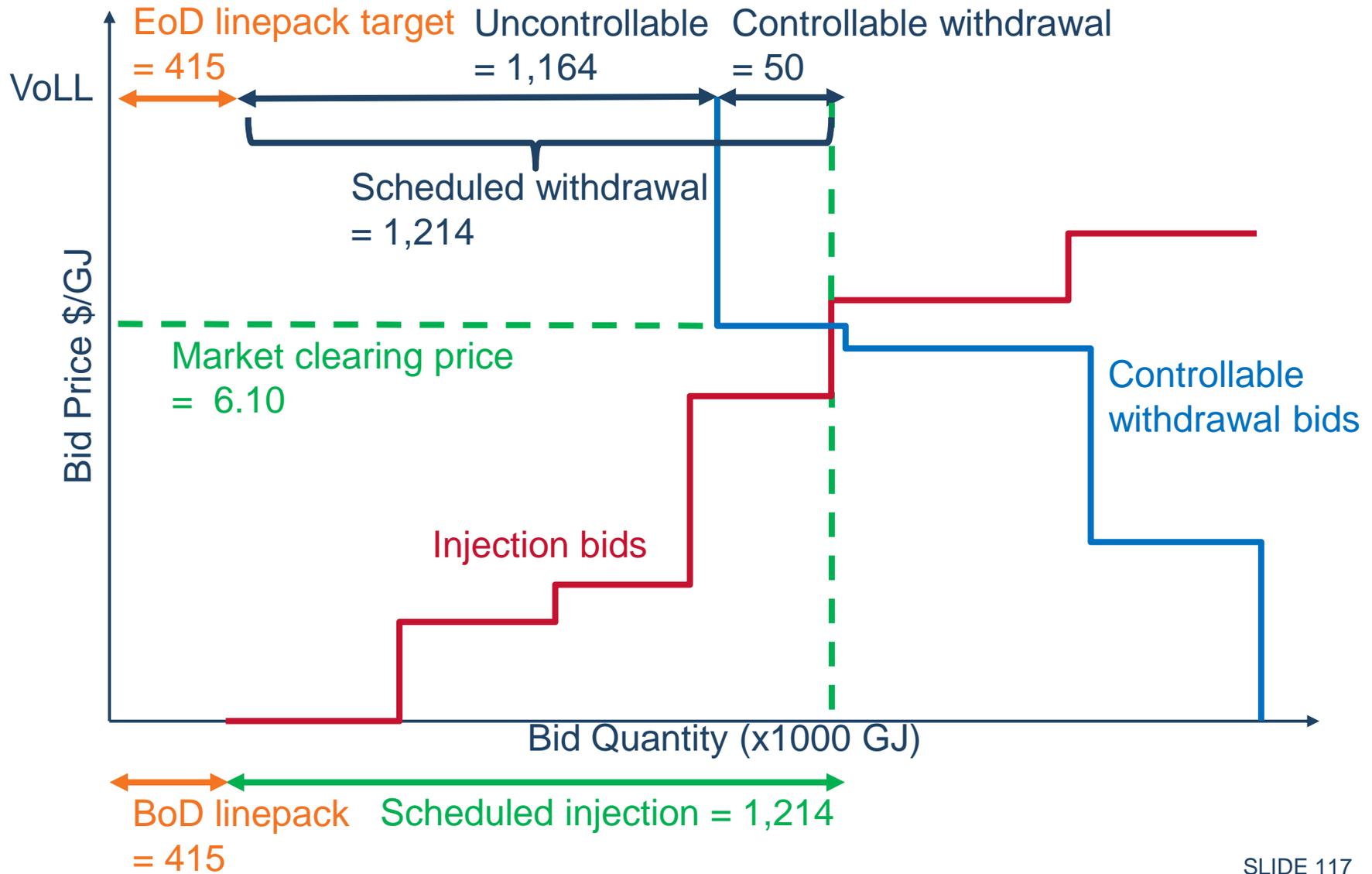
BID STACK – 6AM 14 JULY 2015



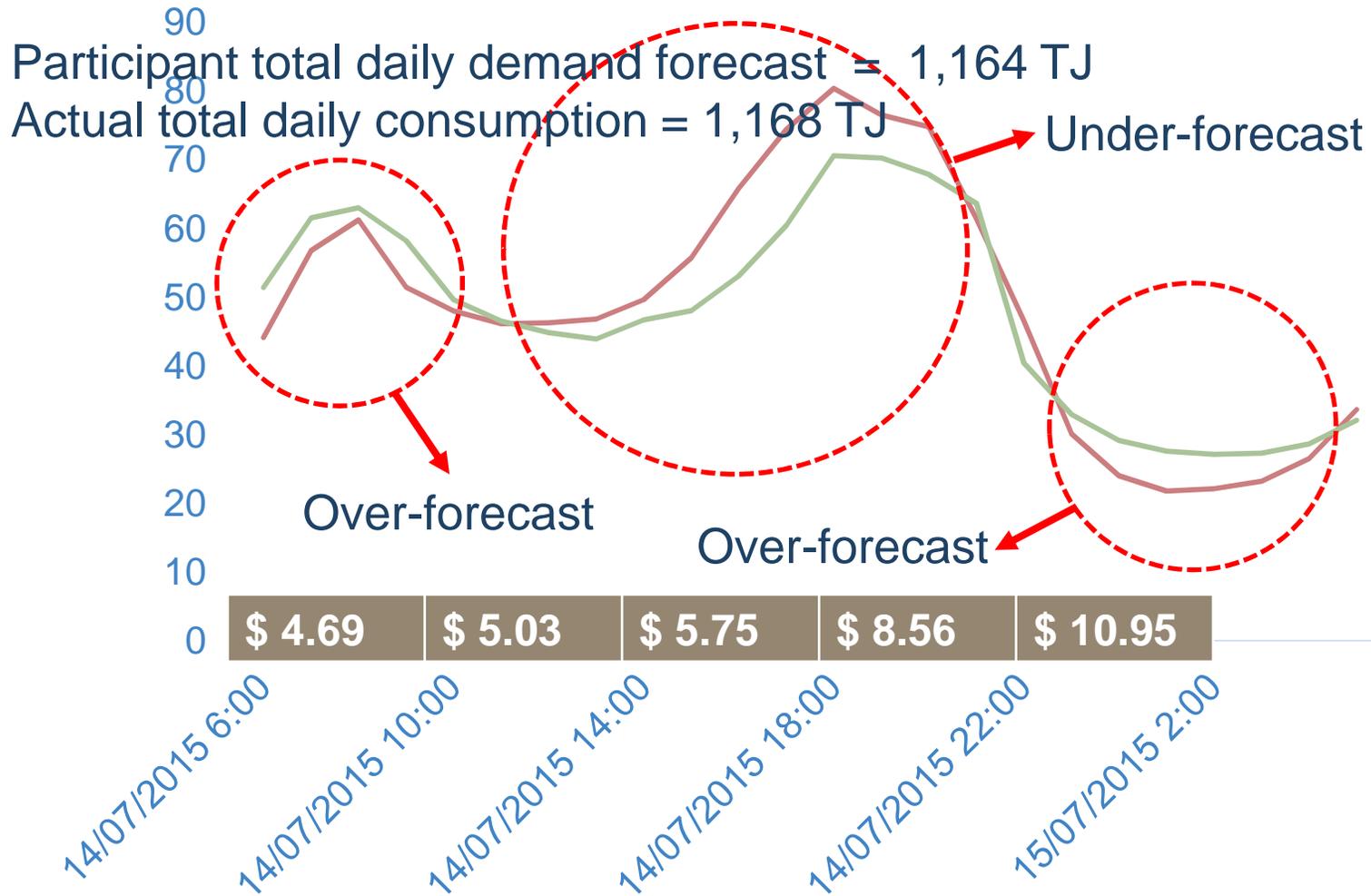
BID STACK – 6AM 14 JULY 2015



BID STACK – 6AM 14 JULY 2015

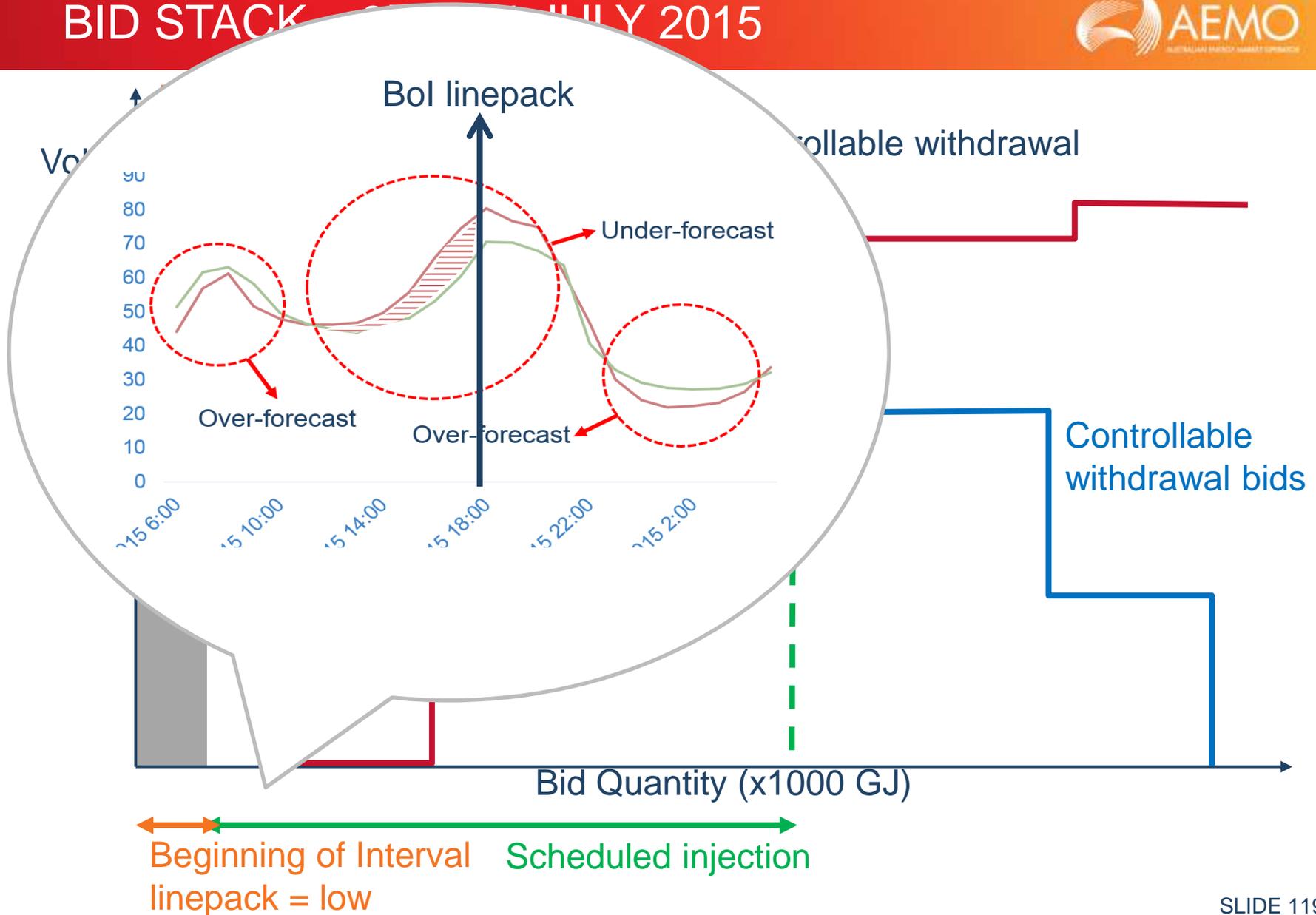


DEMAND PROFILE - 14 JULY 2015



— Actual demand — Market participants' forecast demand

BID STACK JULY 2015



COMMUNICATION - DEMAND FORECAST



High demand:

- Communication is triggered when the total demand forecast exceeds 1,150 TJ/d.
- AEMO will send an email notification at the 06:00, 10:00, 14:00 and 18:00 scheduling intervals

Weather and AEMO Gas Demand Forecast

Gas Day: Friday 01/08/2014

Weather Forecast				Total Demand Forecast (System + GPG)
Maximum	Minimum	Sunshine Hr	EDD	
10.3	5.8	1	15.2	1225.7 TJ

Intra Day Demand / Supply Linepack Shortfall Likelihood Chart

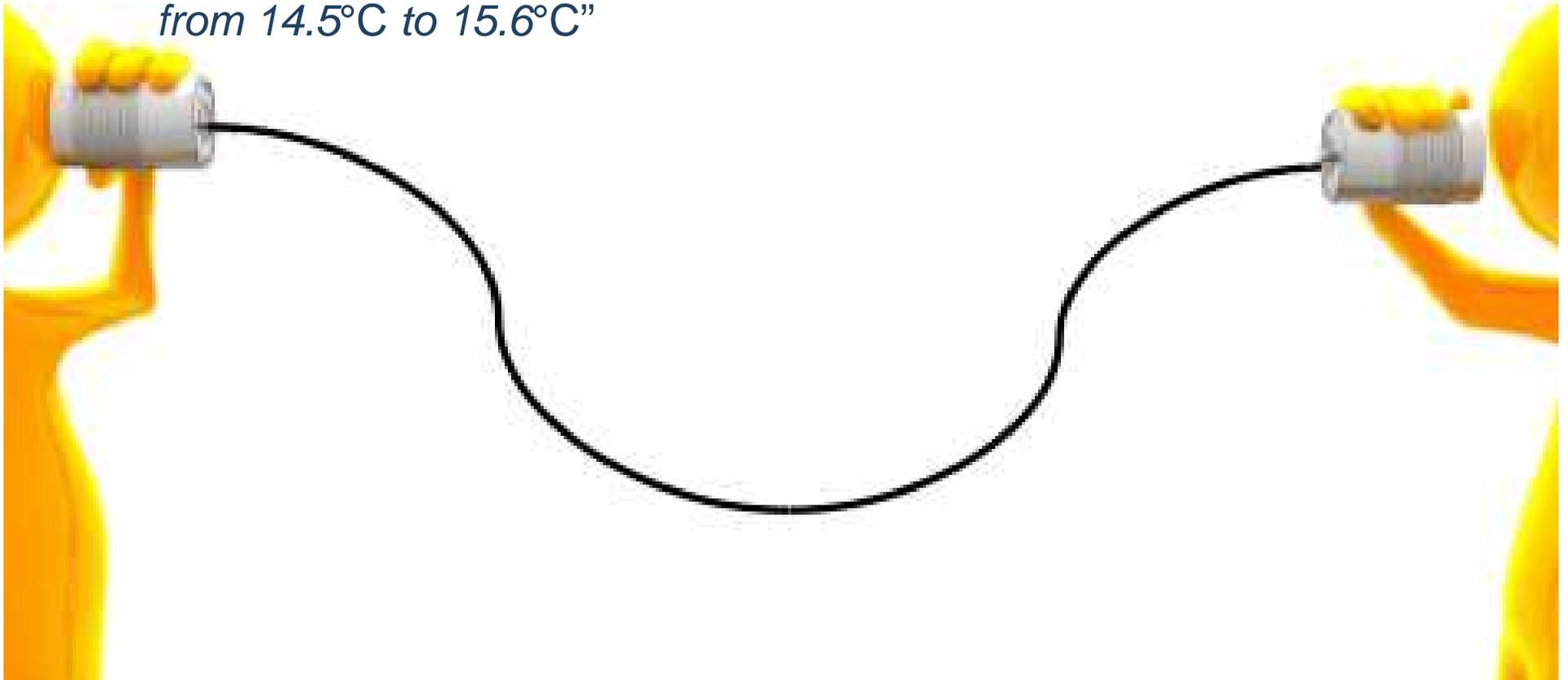


Last Update: 14:00 hrs 01/08/14

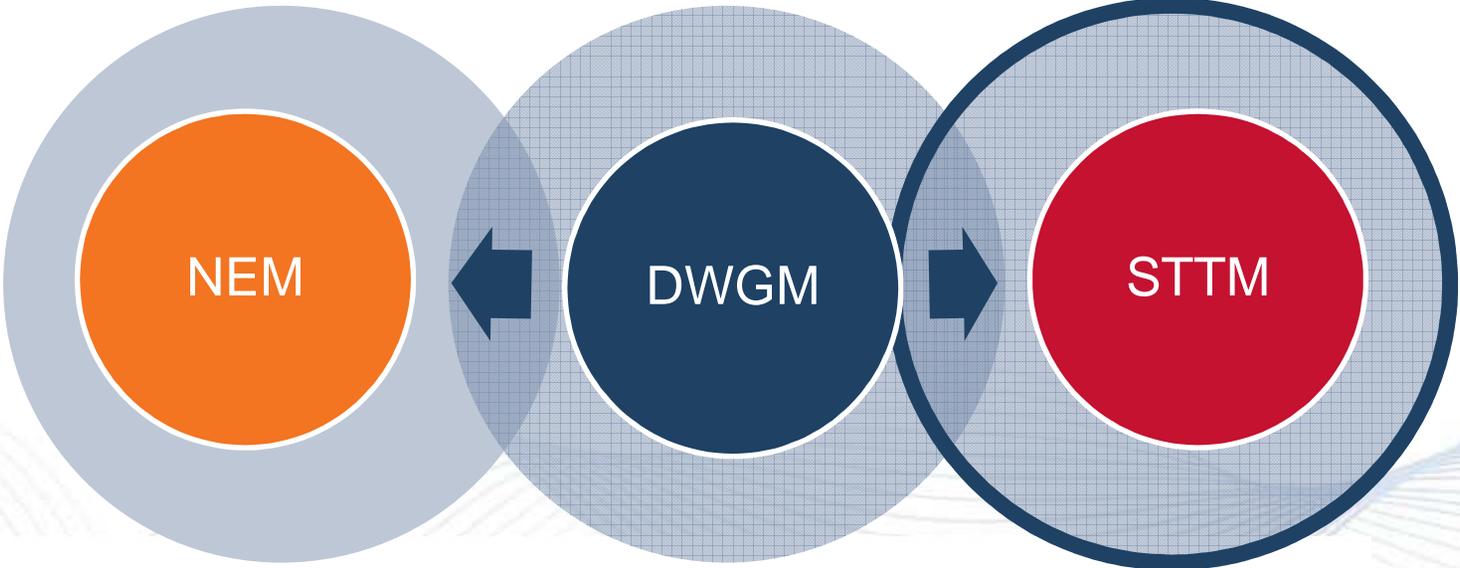
High EDD

- Changes between schedules
- For example, EDD >14.0 °C and increases by 1.0 °C:

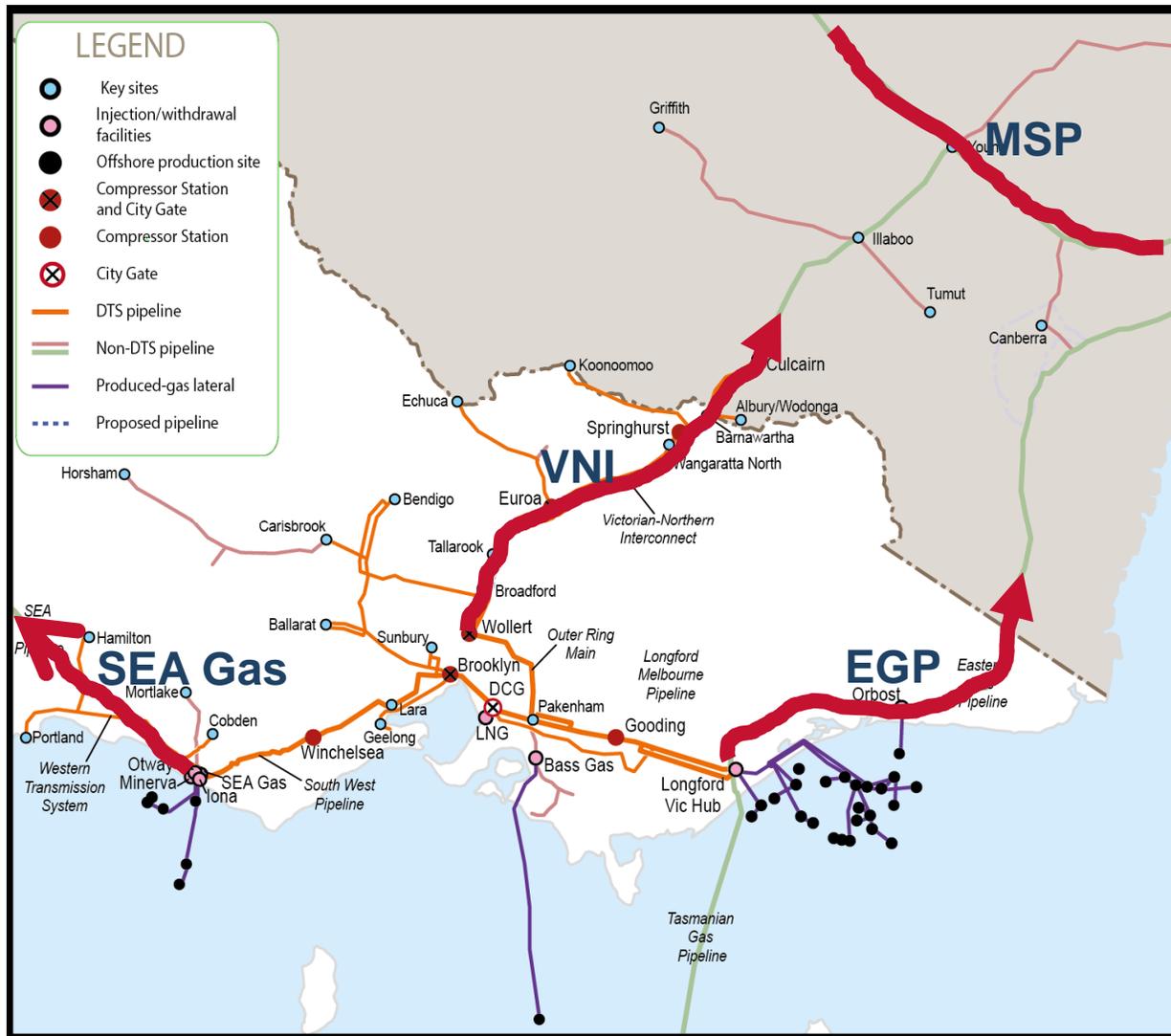
“EDD increase alert, since the last schedule the EDD has increased from 14.5°C to 15.6°C ”



MARKET INTERACTION



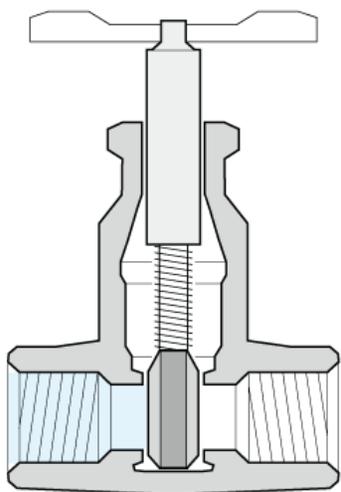
MARKET INTERACTION - STTM



STTM:

- Sydney hub
- Adelaide hub
- Brisbane hub

Contingency Gas on 22 July 2015



MSP valve



CG trigger

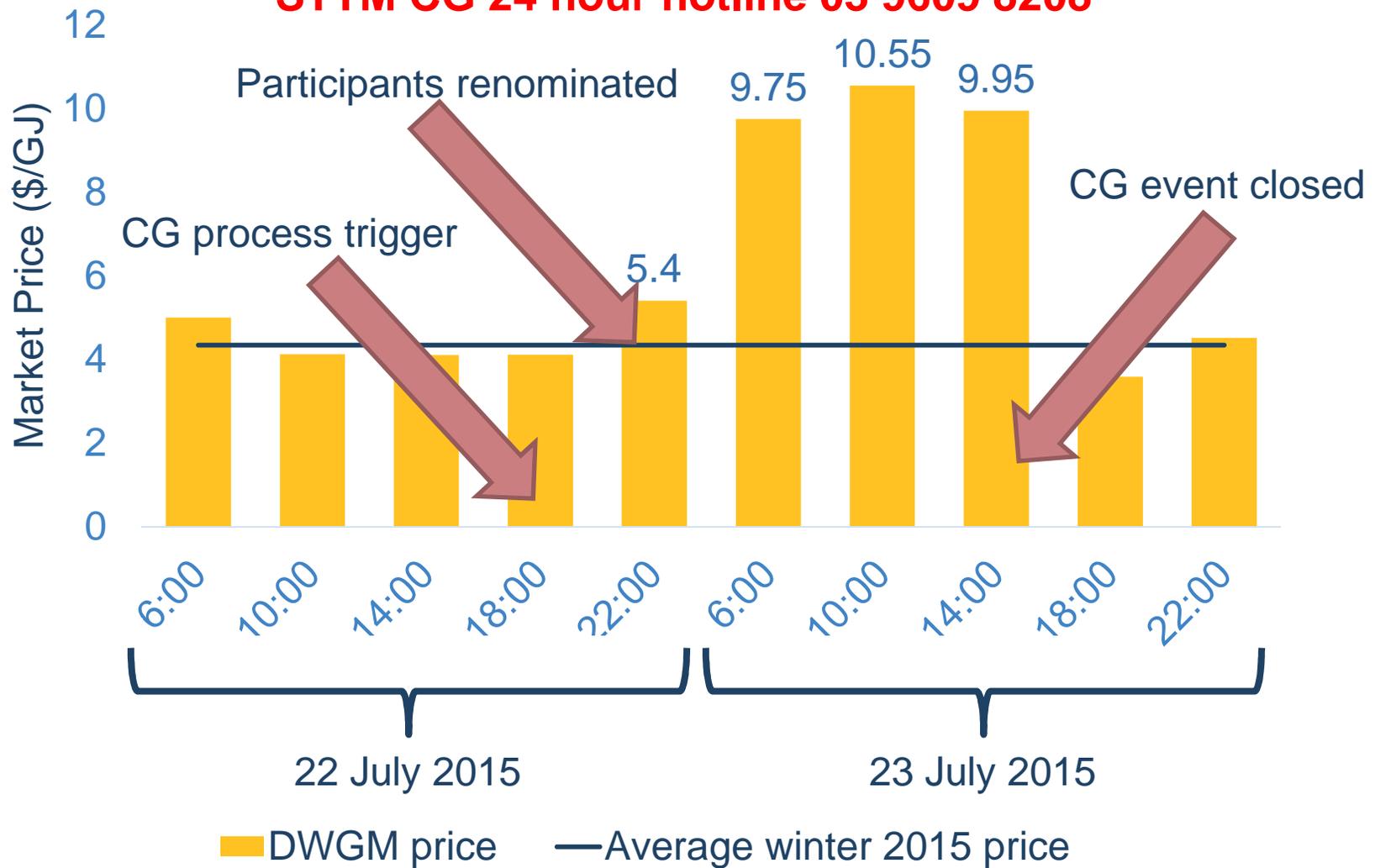


Renomination

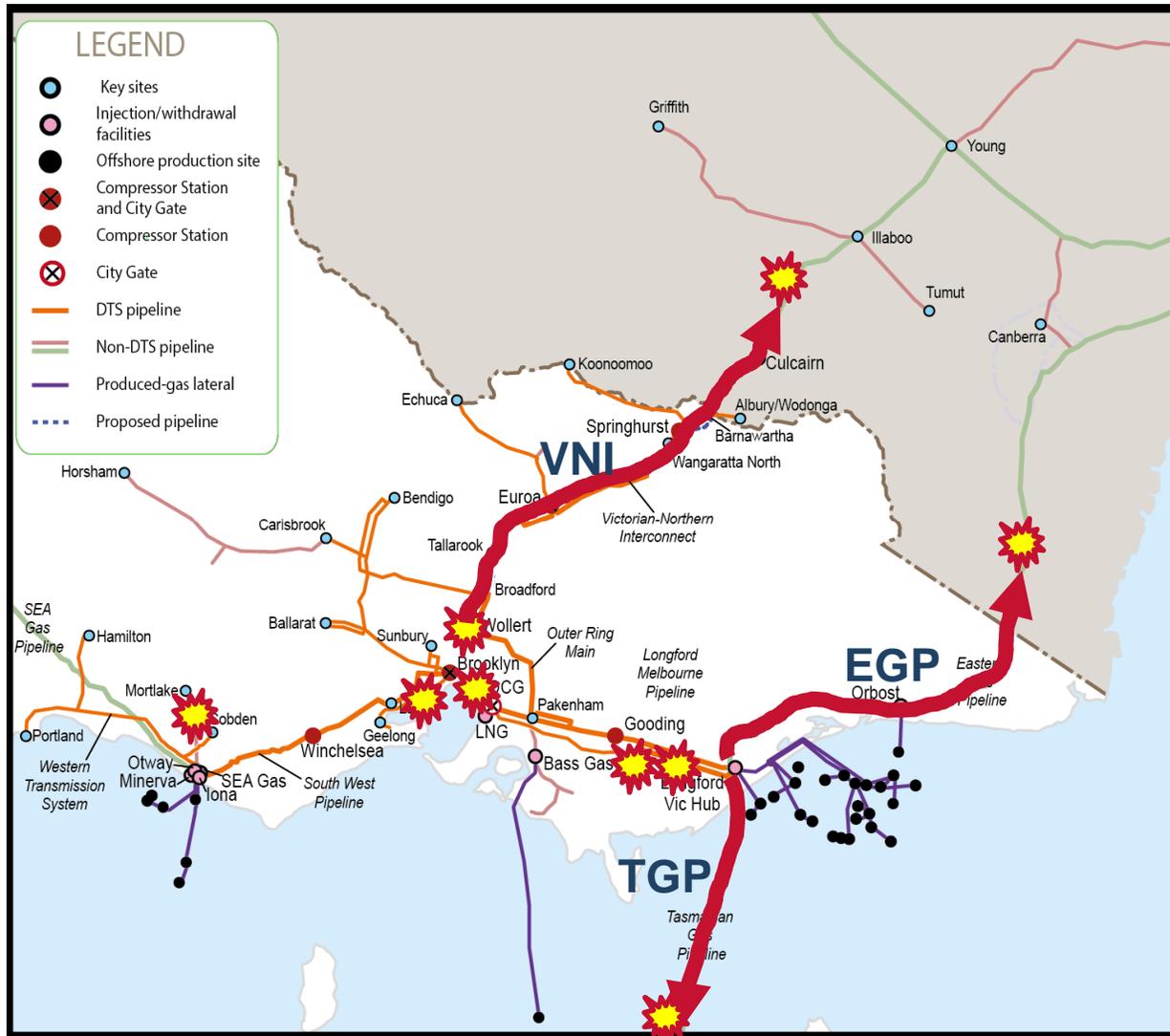
MARKET INTERACTION – STTM CG



STTM CG 24 hour hotline 03 9609 8208



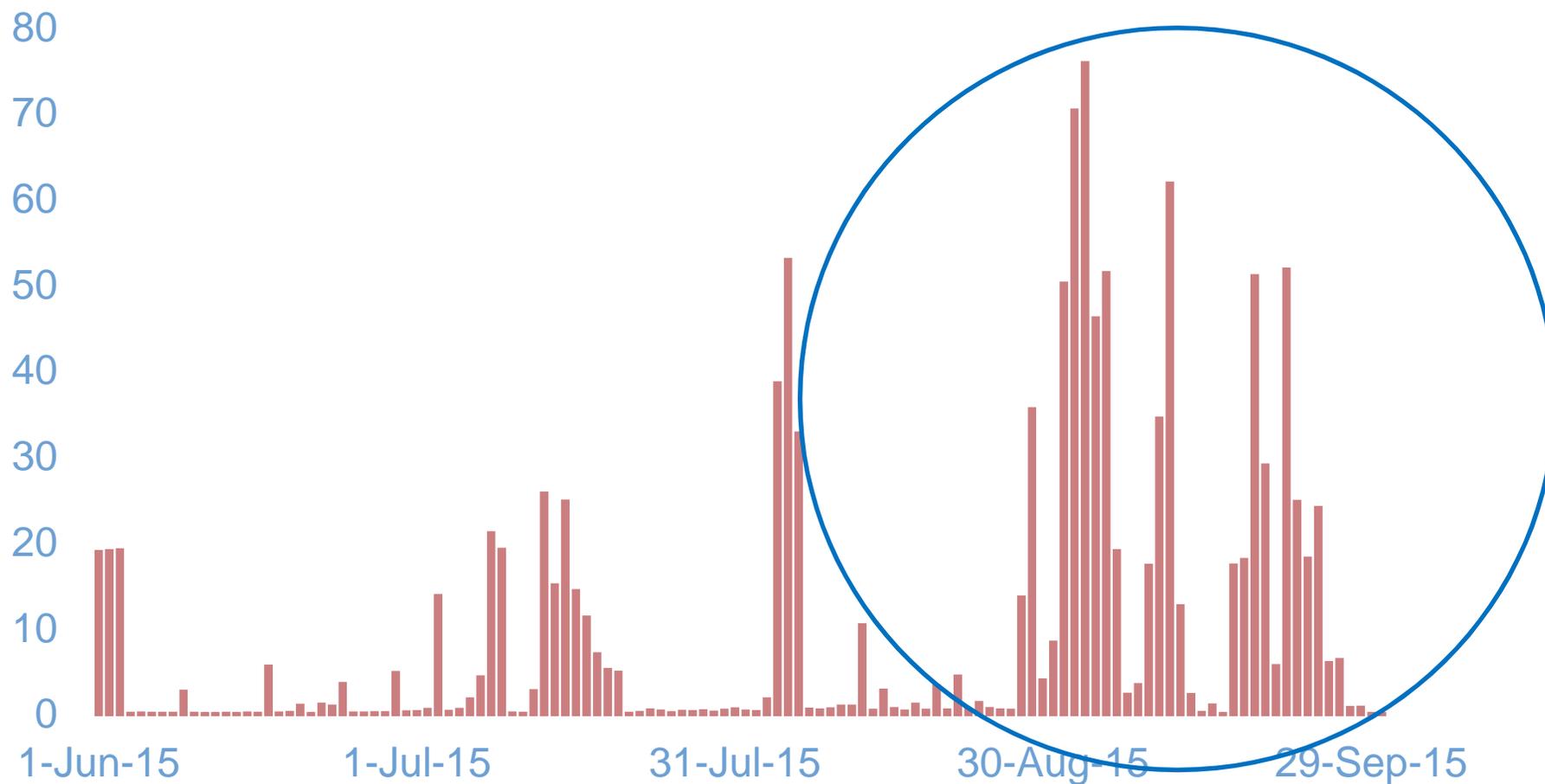
MARKET INTERACTION – NEM GPG



NEM:

- Victoria
- New South Wales
- Tasmania

DTS GPG consumption during winter 2015 (TJ)



STTM Contingency Gas conferences

- Conference chair
- DTS pipeline operator

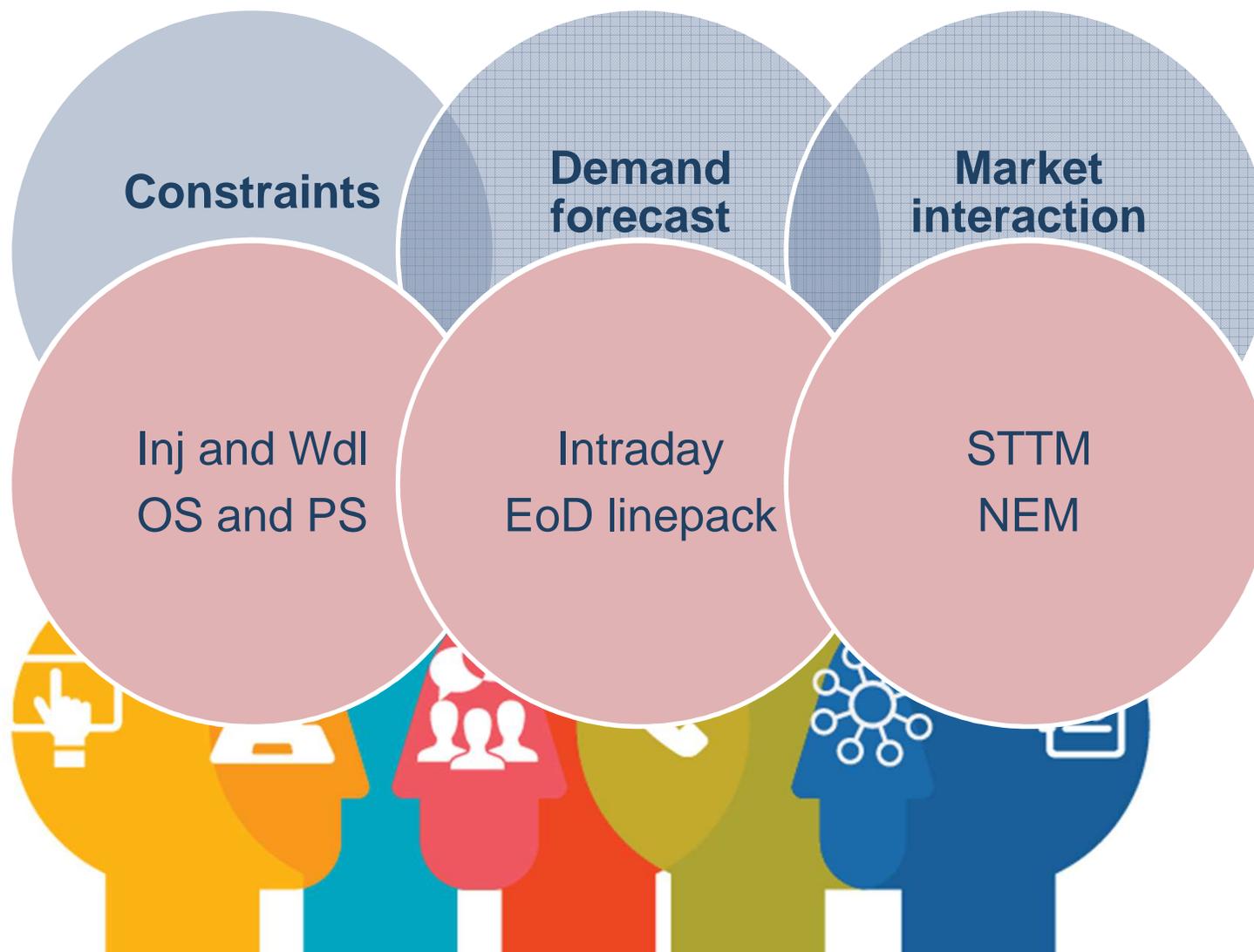
Communication

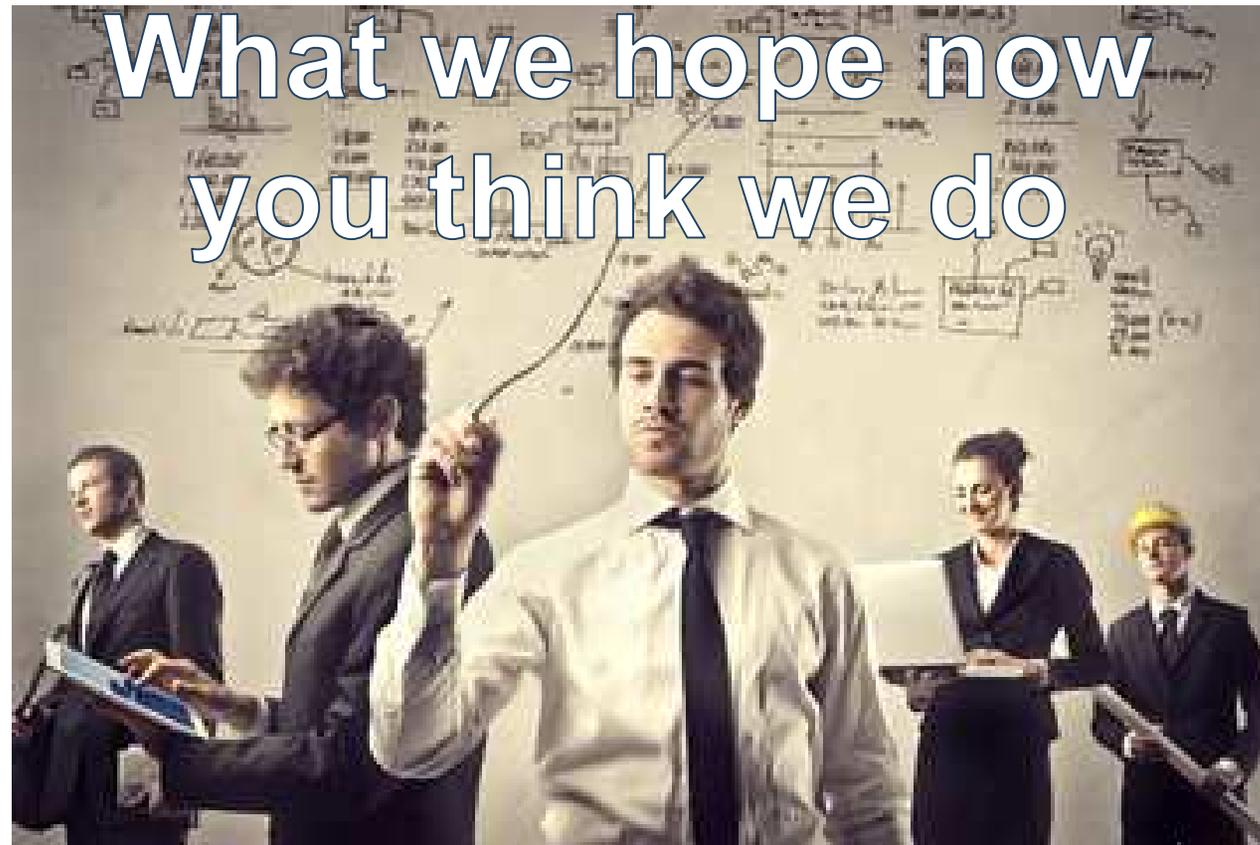
- Gas Bulletin Board
- System wide notices

Preparedness

- Supply and demand balance
- *Gas Wholesale Consultative Forum*
- *Working groups*
(*2014 Energy Markets for a Changing Environment*)

MARKET OPERATIONS – CONCLUSION





PEAK DAY MANAGEMENT

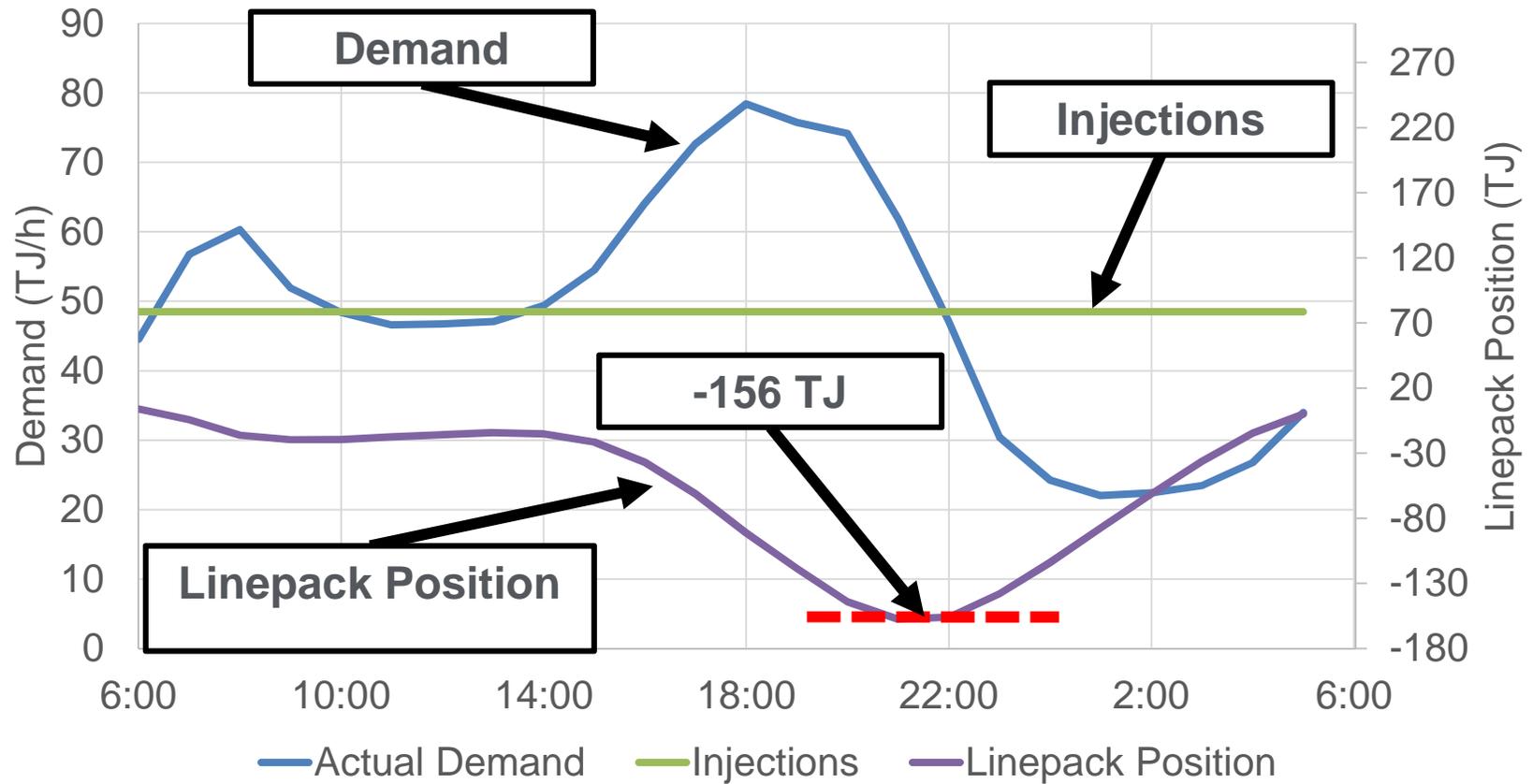
Presented by Mark Pollock
Gas Operations Engineer, AEMO Gas Real Time Operations

- Prior to a forecast peak day
 - Injection profiling.
- On a peak day
 - Notice of a threat to system security
 - Allows responses not otherwise available

INJECTION PROFILING



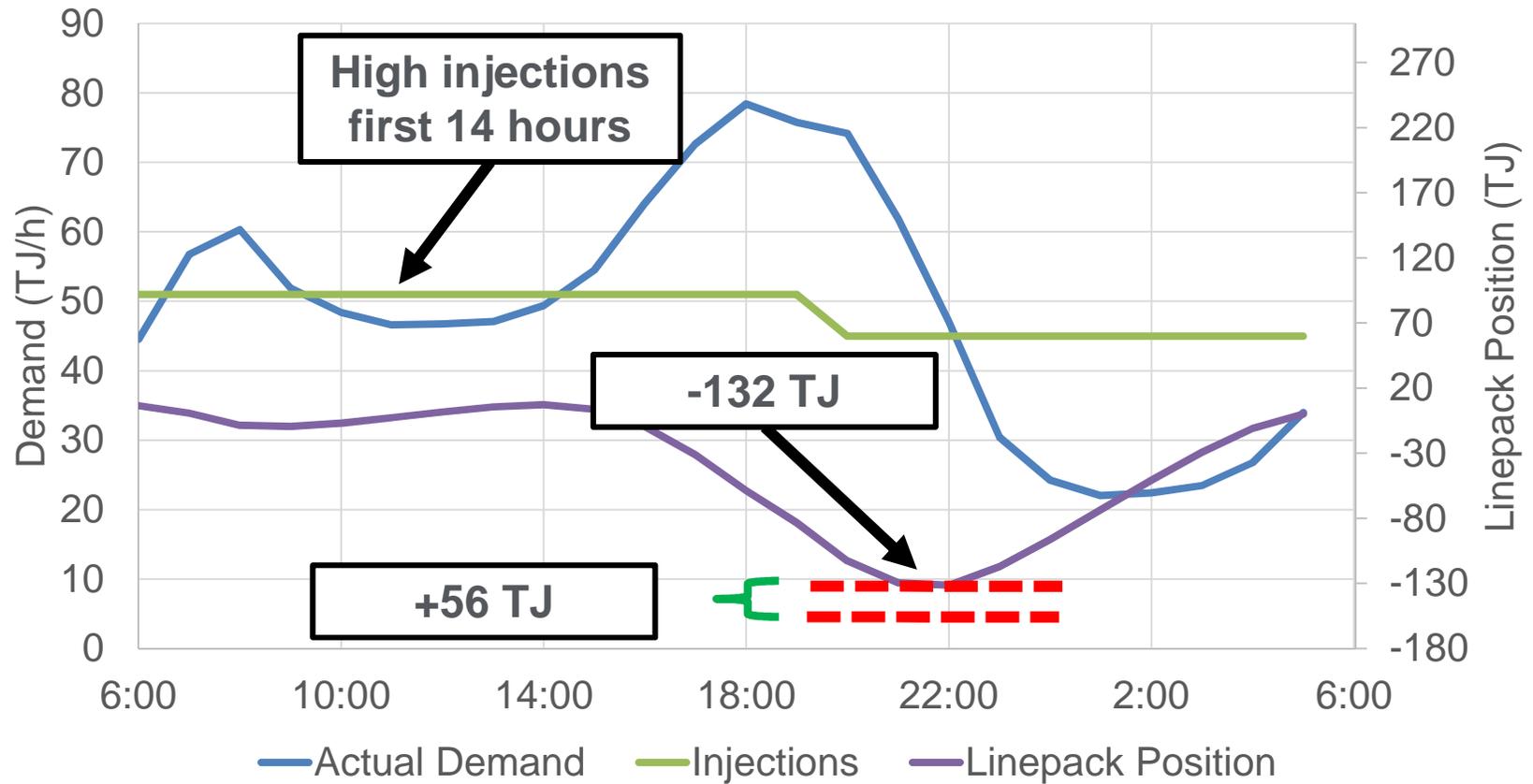
Flat Injection Profile



INJECTION PROFILING



Profiled Injections



PEAK DAY MANAGEMENT - THREAT



- AEMO monitors the system to identify operational conditions that lead to a threat to system security.
 - Increasing demand
 - Reduction in supply

FUNDAMENTALS: SYSTEM SECURITY



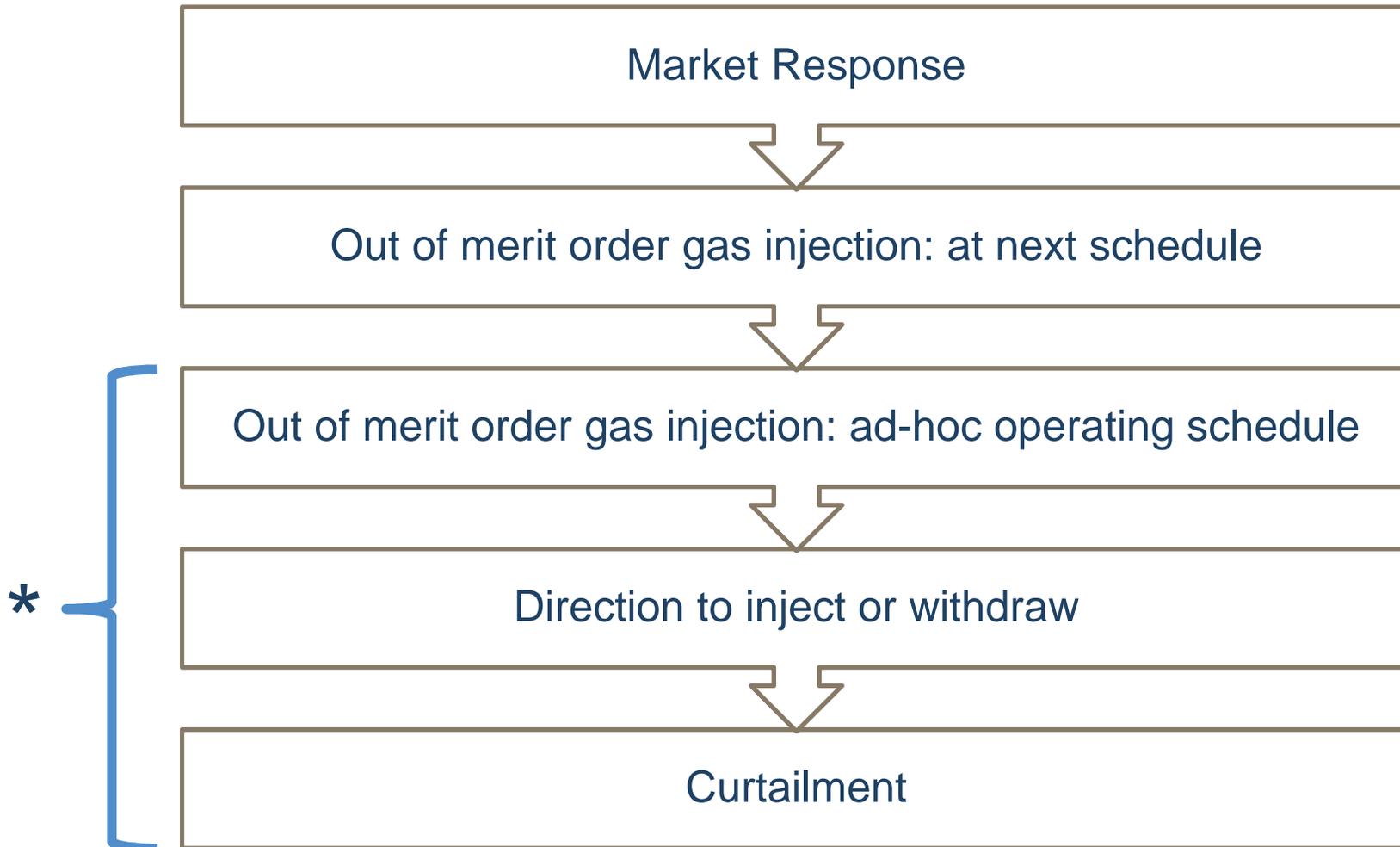
Normal Operating State

- a) the DTS breached procedures and by AEMO;
- b) in AEMO
- c) in AEMO to customer
- d) system operating agreed

**Enough gas, in the right place,
at the right time.**

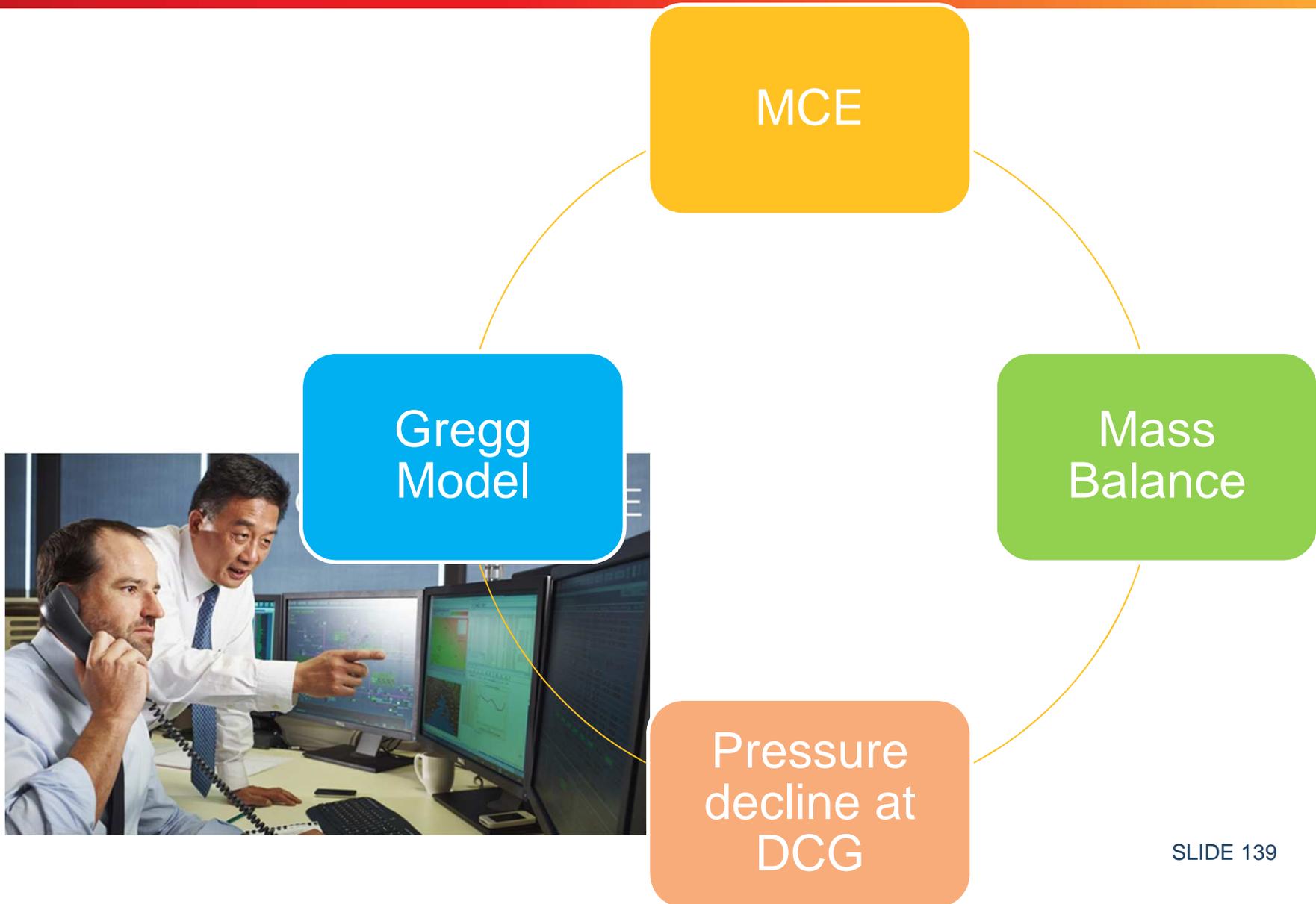
AEMO – Wholesale Market System Security Procedures (Victoria)

PEAK DAY MANAGEMENT – RESPONSES TO A THREAT



* Market interventions

PEAK DAY MANAGEMENT - LNG



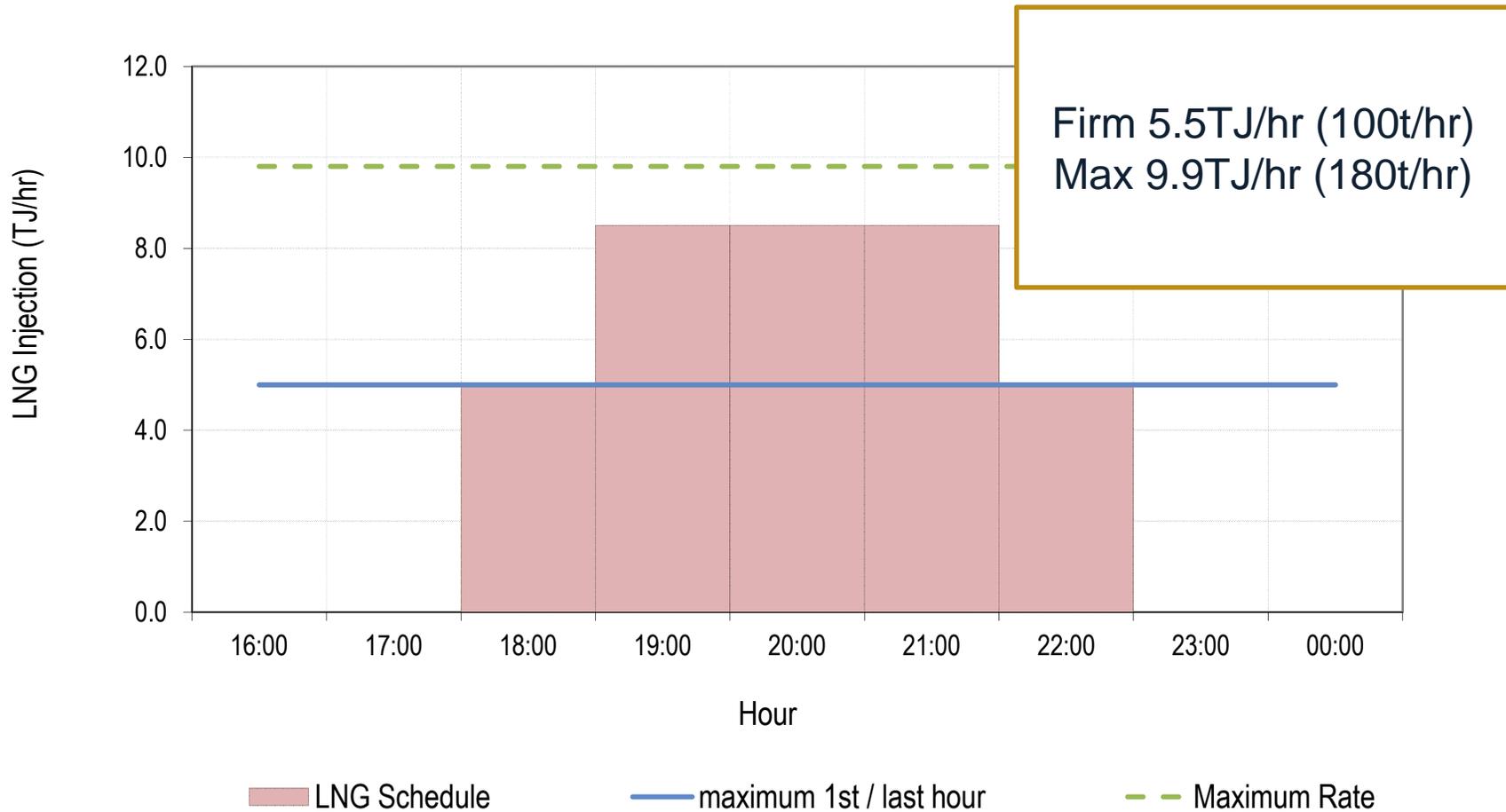
Operational Response LNG

- Scheduled to prevent pressure breach
- OS only SDPC used

Market Response LNG

- Scheduled at a constant rate
- Scheduled in merit order same as any injection facility

PEAK DAY MANAGEMENT – OPERATIONAL RESPONSE LNG



Operational LNG notice and Gas Bulletin Board

Amber

- CRITICAL - OS only constraint applied to LNG meter, Priority AMBER, LNG requested up to 100 t/hr at 18:00 on 10/06/13 due to system security

Red

- CRITICAL - OS only constraint applied to LNG meter, Priority RED, 180t/hr of requested LNG unavailable, 110 t/hr available for supply at 18:00 on 10/06/13

Red

- CRITICAL - OS only constraint applied to LNG meter, Priority RED, LNG requested above 100 t/hr at 18:00 on 10/06/13 due to system security

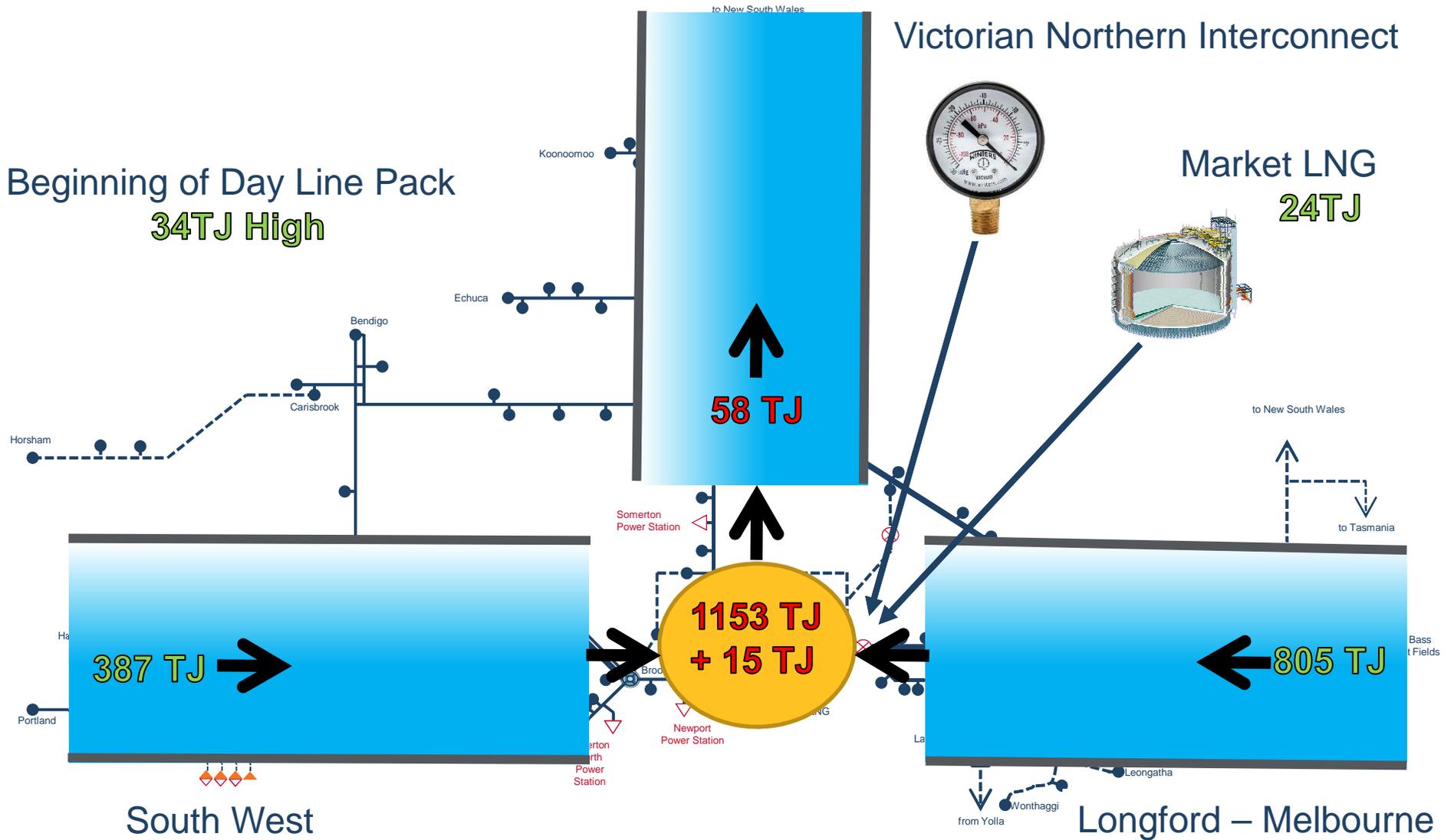
Green

- Priority GREEN – Supply Reserves Manageable – No LNG requested

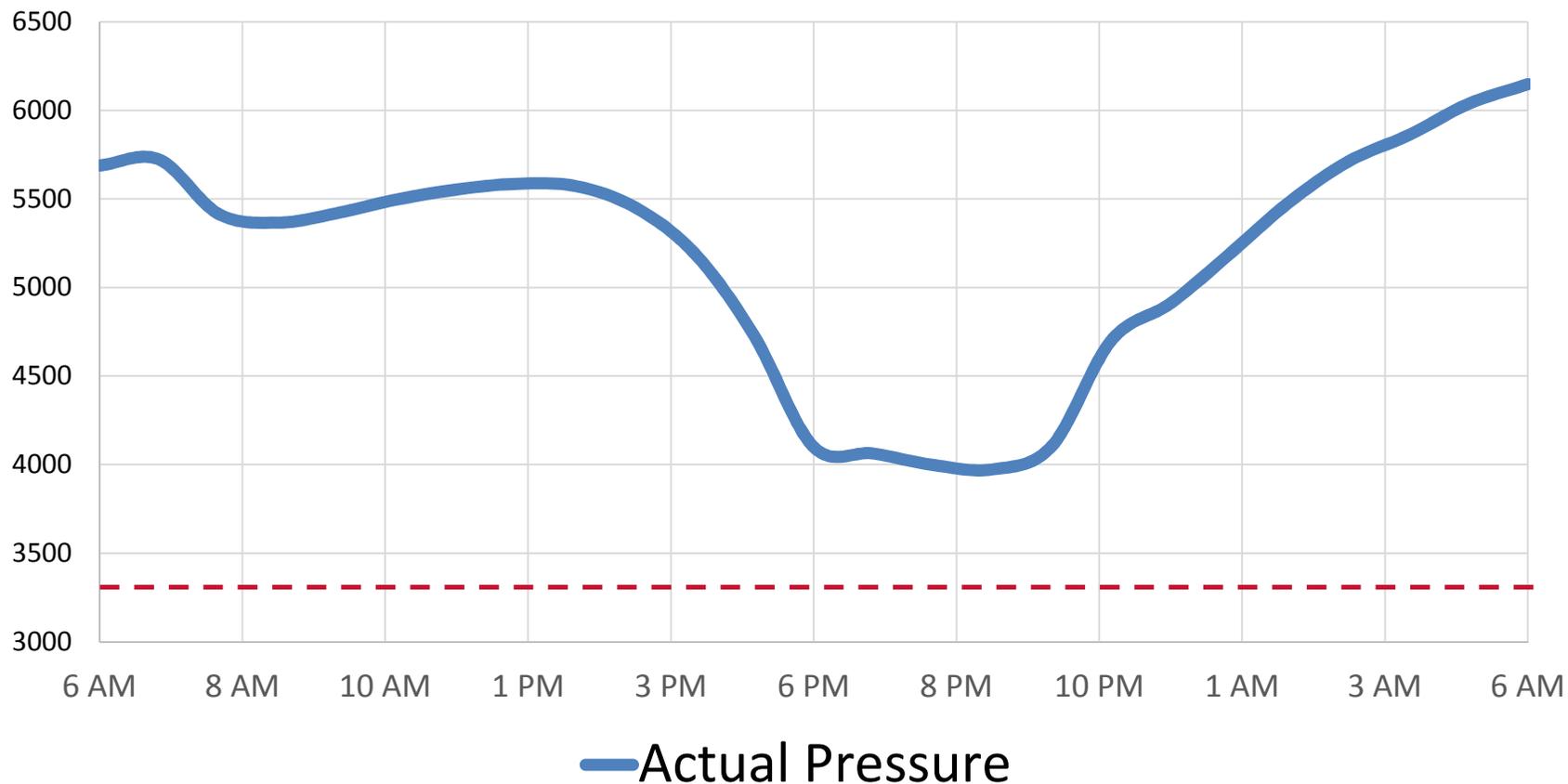
100t/hr = 5.5TJ/hr (approx.)

CASE STUDY

TUESDAY 14TH JULY 2015



Dandenong City Gate Pressure

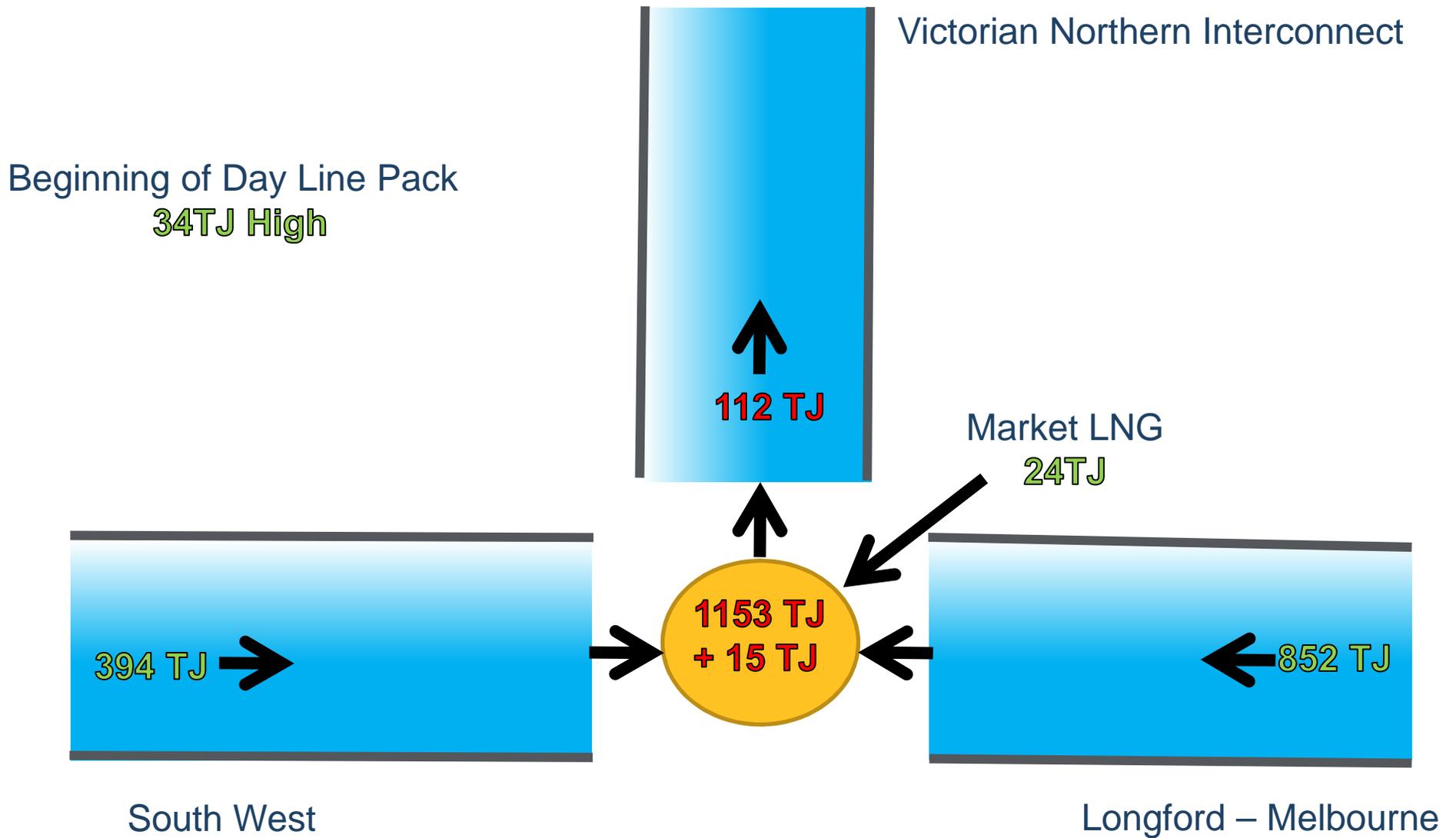


TUESDAY 14TH JULY 2015

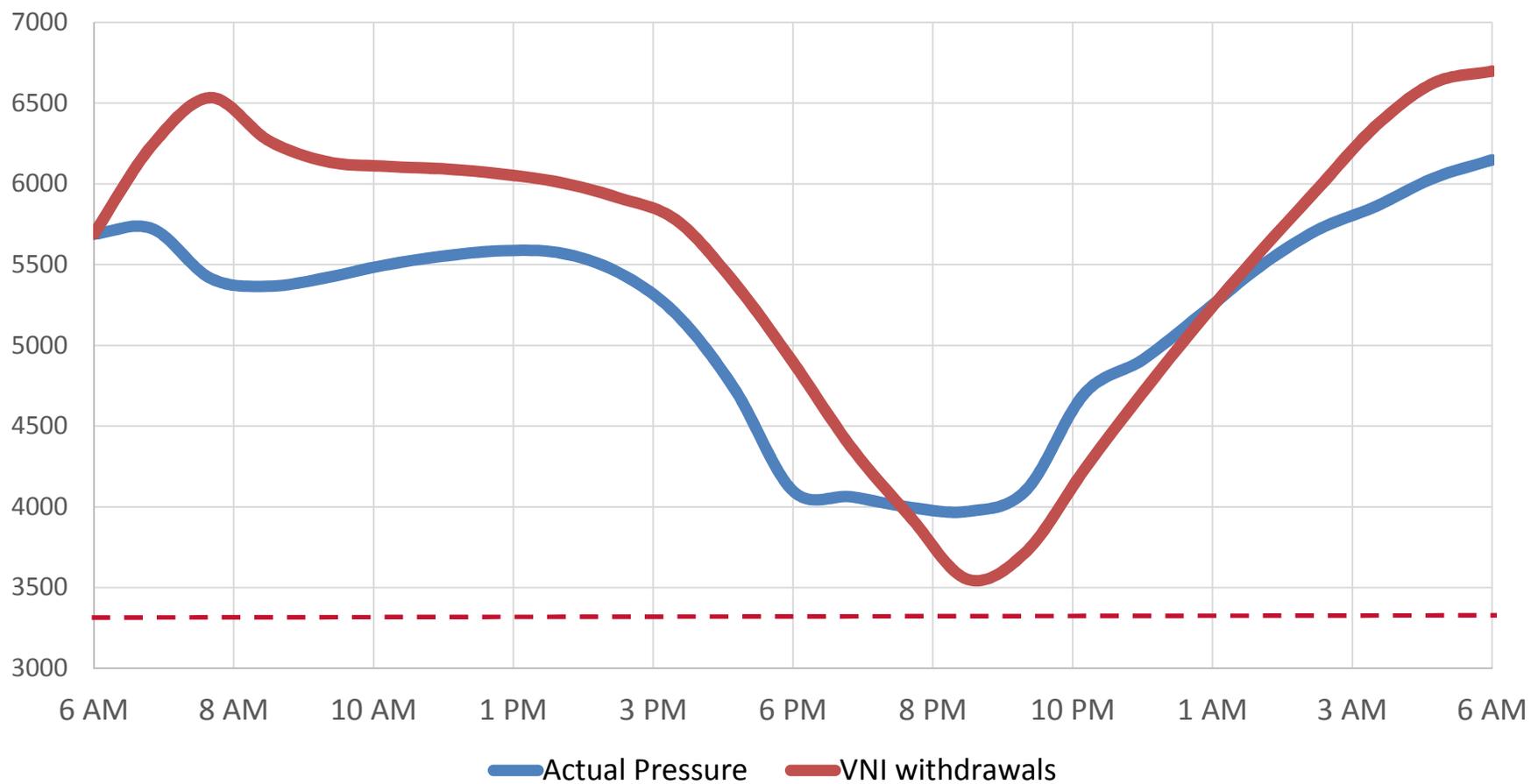


- What if.....
 - High VNI exports scheduled?

4TH AUGUST 2015 – ACTUAL 1130 TJ DEMAND 10PM



Dandenong City Gate Pressure

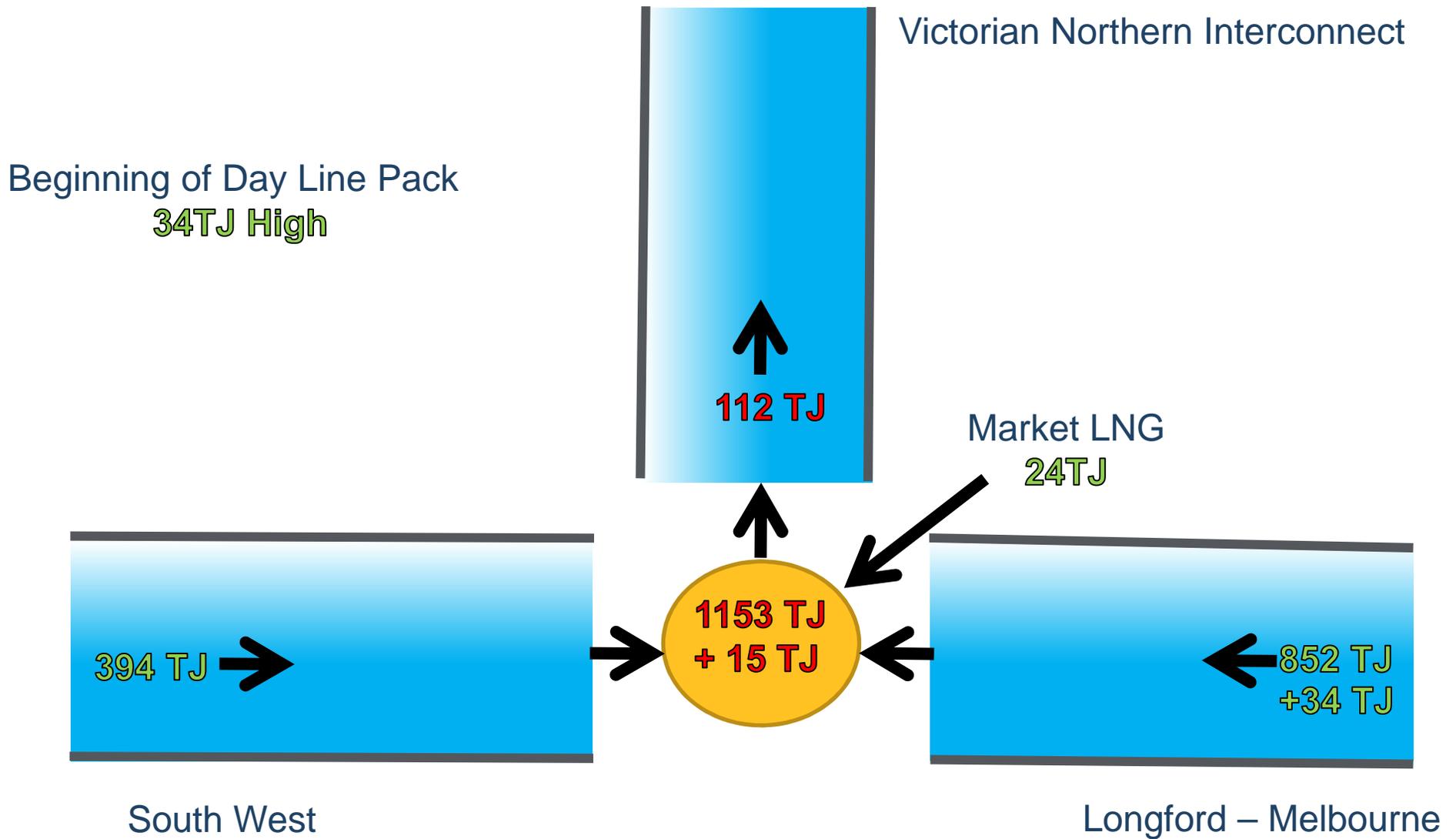


TUESDAY 14TH JULY 2015

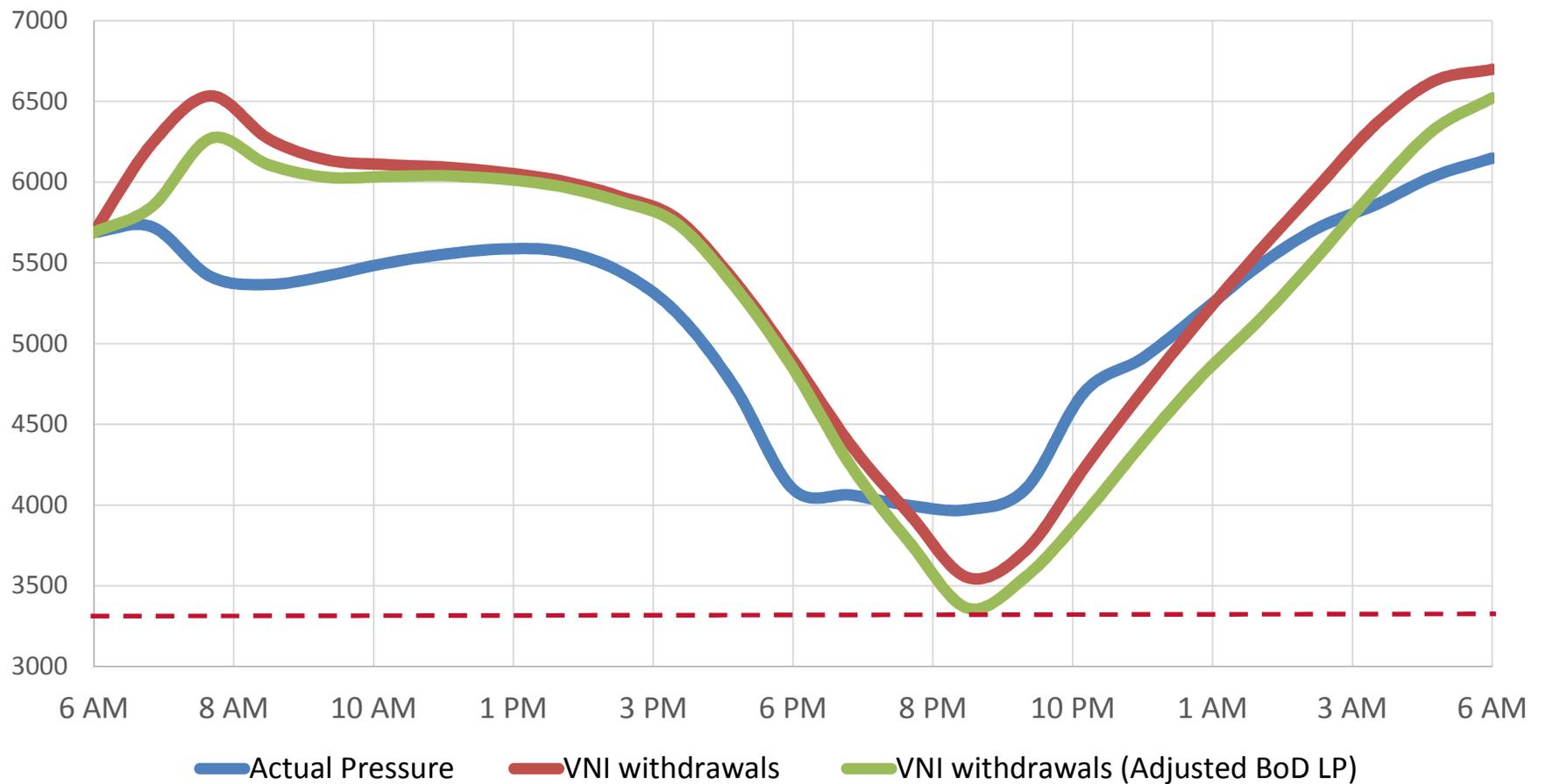


- What if.....
 - High VNI exports scheduled?
 - BoD Linepack was on target (instead 34 TJ of high)?

4TH AUGUST 2015 – ACTUAL 1130 TJ DEMAND 10PM

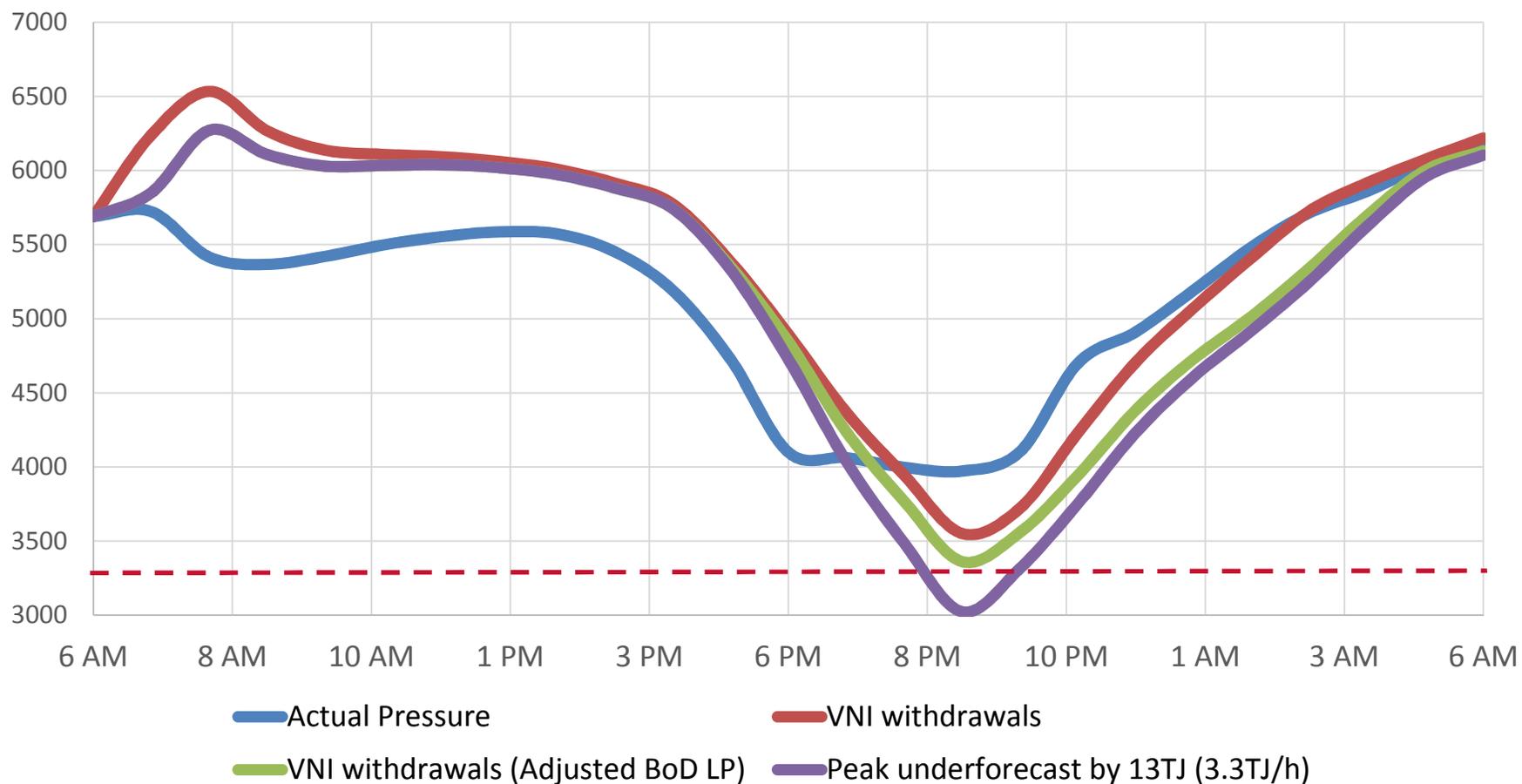


Dandenong City Gate Pressure



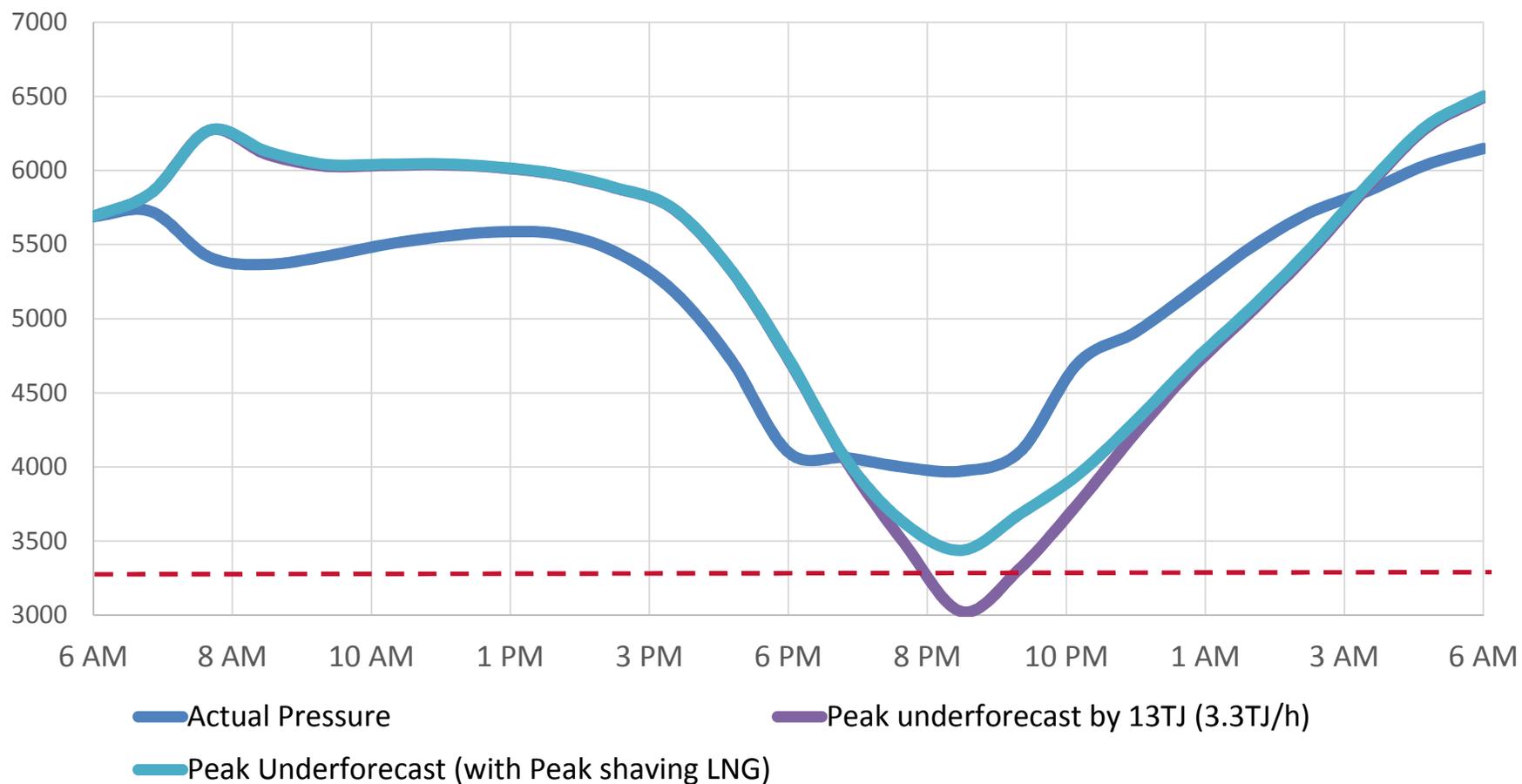
- What if.....
 - High VNI exports scheduled?
 - BoD Linepack was on target (instead 34 TJ of high)?
 - Demand was higher over the evening peak?
 - Average temperature 6pm to 9pm 1°C lower than forecast
 - ~3.3 TJ / °C / hr

Dandenong City Gate Pressure



- Peak shaving LNG required
 - 15.5 TJ of LNG would required to prevent DCG pressure breach
 - 5 TJ – 8pm
 - 5.5 TJ – 9pm
 - 5 TJ – 10pm
 - 11.8 TJ for peak shaving
 - some market called injections were already scheduled on the day

Dandenong City Gate Pressure (kPa)



TUESDAY 14TH JULY 2015



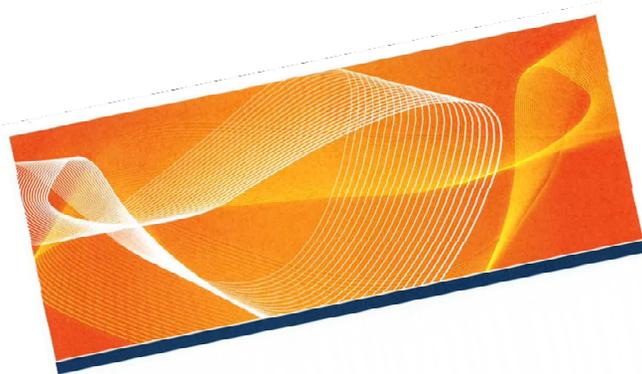
- Conclusions
 - System capacity is sufficient for 1-in-2 demand day
 - LNG required for 1-in-20 demand day
 - Accuracy of forecasting is critical

EMERGENCY MANAGEMENT

Presented by Derek Sonogan
Gas Operations Engineer, AEMO Gas Real Time Operations

- Lets talk about the Act and the Emergency Protocol
- What are the different classifications of emergencies?
- What emergency structures does AEMO use?
- Communicating
- Authority to notify
- Example

GAS PROTOCOL

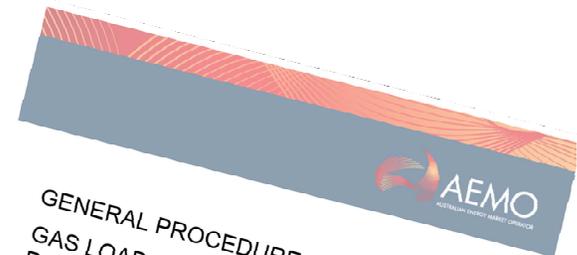


WHOLESALE MARKET SYSTEM SECURITY PROCEDURES (VICTORIA)

PREPARED BY: AEMO Gas System Operations
DOCUMENT REF: 306195
VERSION: NGR 1.1
EFFECTIVE DATE: 16 December 2016
STATUS: FINAL

Approved for distribution and use by:
APPROVED BY: Matt Zema
TITLE: Managing Director and Chief Executive Officer, AEMO

SIGNED: / / 20
DATE:



GENERAL PROCEDURE GAS LOAD CURTAILMENT AND GAS RATIONING AND RECOVERY GUIDELINES

PREPARED BY: Planning
DOCUMENT REF: Project 23-254
VERSION: 8
DATE: 13 May 2010
FINAL

EMERGENCY PROCEDURES (GAS)

PUBLISHED: FEBRUARY 2015



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NEW SOUTH WALES QUEENSLAND SOUTH AUSTRALIA VICTORIA AUSTRALIAN CAPITAL TERRITORY TASMANIA

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- So What?



Participants must comply with the Gas protocol

WHAT IS AN EMERGENCY?



- A situation that may threaten:
 - Reliability of gas supply
 - System security
 - Public safety
- But also
 - AEMO can declare an emergency
 - or at the direction of the Government or ESV

WHAT DOES THIS MEAN TO PARTICIPANTS?



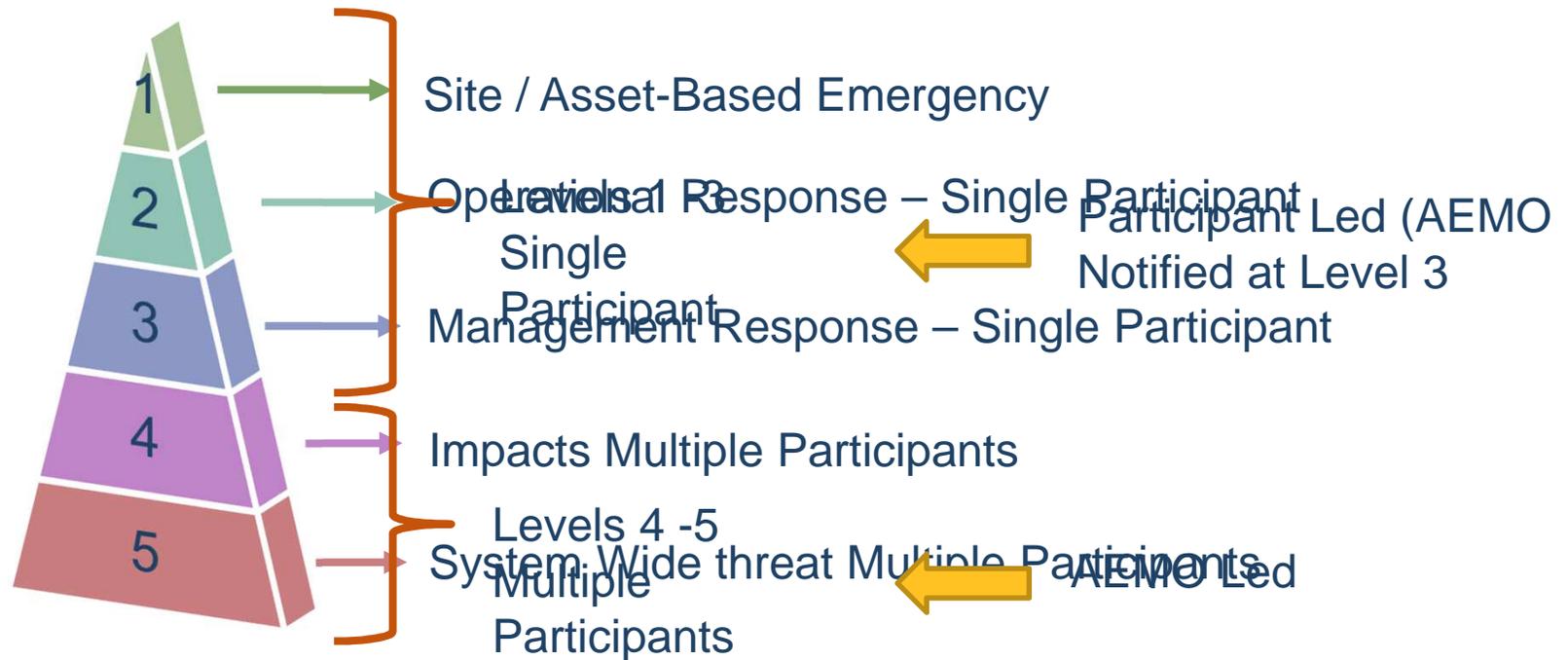
- Participants have obligations under the Act
- Updating your details with AEMO
 - Check details on MIBB
 - Send revised contacts to AEMO Support HUB



LEVELS OF EMERGENCY



- 5 Levels



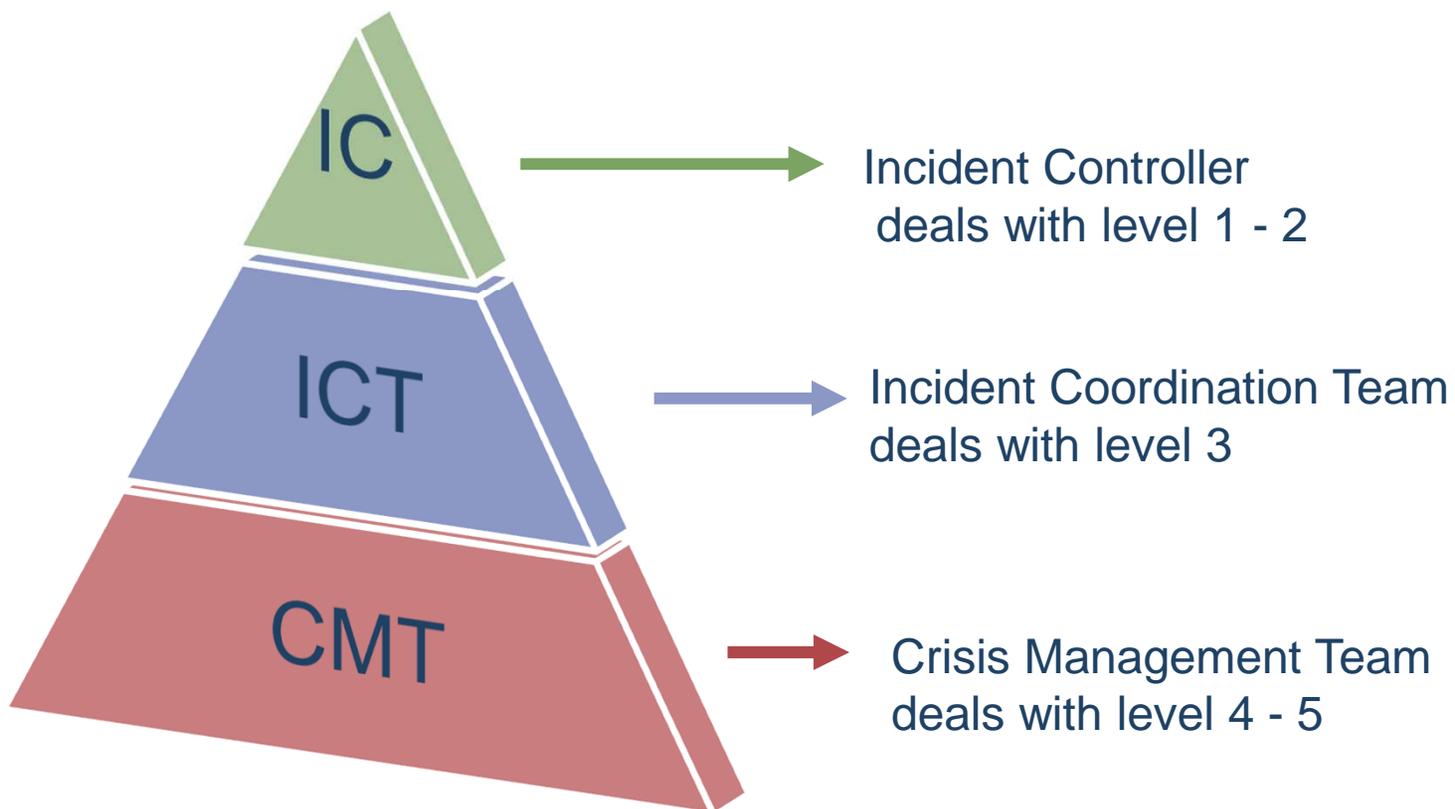
THREATS TO SYSTEM SECURITY



- AEMO can notify participants of a threat to system security without an emergency being declared

- **Government**
 - Security and Emergency Management Cabinet Committee
 - Emergency Management Victoria
- **Preparedness**
 - Gas Emergency Management Consultative Forum
- **Response**
 - National Gas Emergency Response Advisory Committee
 - Energy Industry Response Committee
 - Gas Emergency Management Group

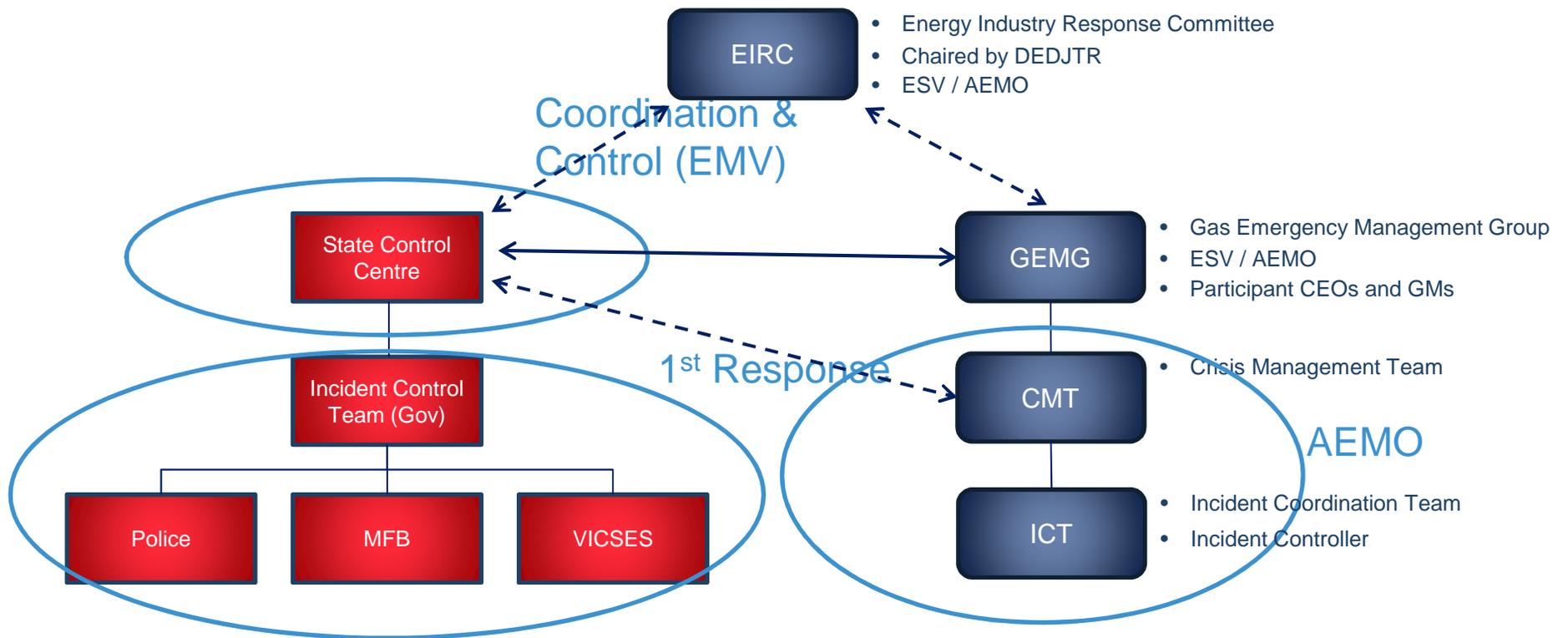
AEMO STRUCTURE



RESPONSE STRUCTURE



- Level 5?



HOW WE COMMUNICATE AND COORDINATE IN AN EMERGENCY



- Victorian Energy Emergency Communications Protocol (VEECP)

Gas	
Actual	Forecast
<ul style="list-style-type: none">• Natural disaster• High profile event• External security threat• Significant equipment failure that may affect supply	<ul style="list-style-type: none">• Potential off supply > 100 customers• Forecast supply shortfall• Extreme weather event:<ul style="list-style-type: none">• Two consecutive extreme cold days <12 degrees• Flood warnings/Flood watch

SINGLE INDUSTRY SPOKESPERSON



- Participants normally handle their own media relations levels 1-3
- AEMO has a specific role if a level 4/5 emergency is declared
- When a unified industry communication or key message is required the SIS will be activated

AUTHORITY TO DECLARE EMERGENCIES



- Chief Executive Officer
- Chief Operating Officer
- Gas Duty Manager

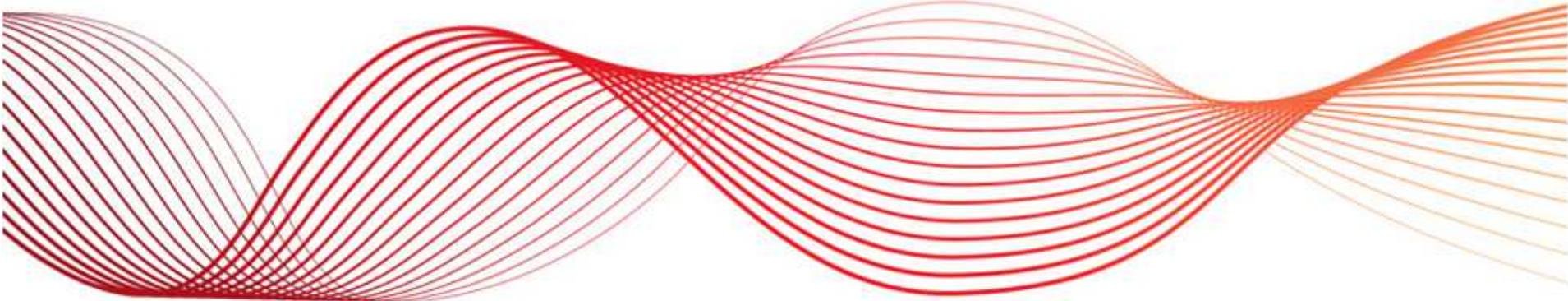


- Director of energy Safety, ESV may issue a direction Under the Gas Safety Act 1997

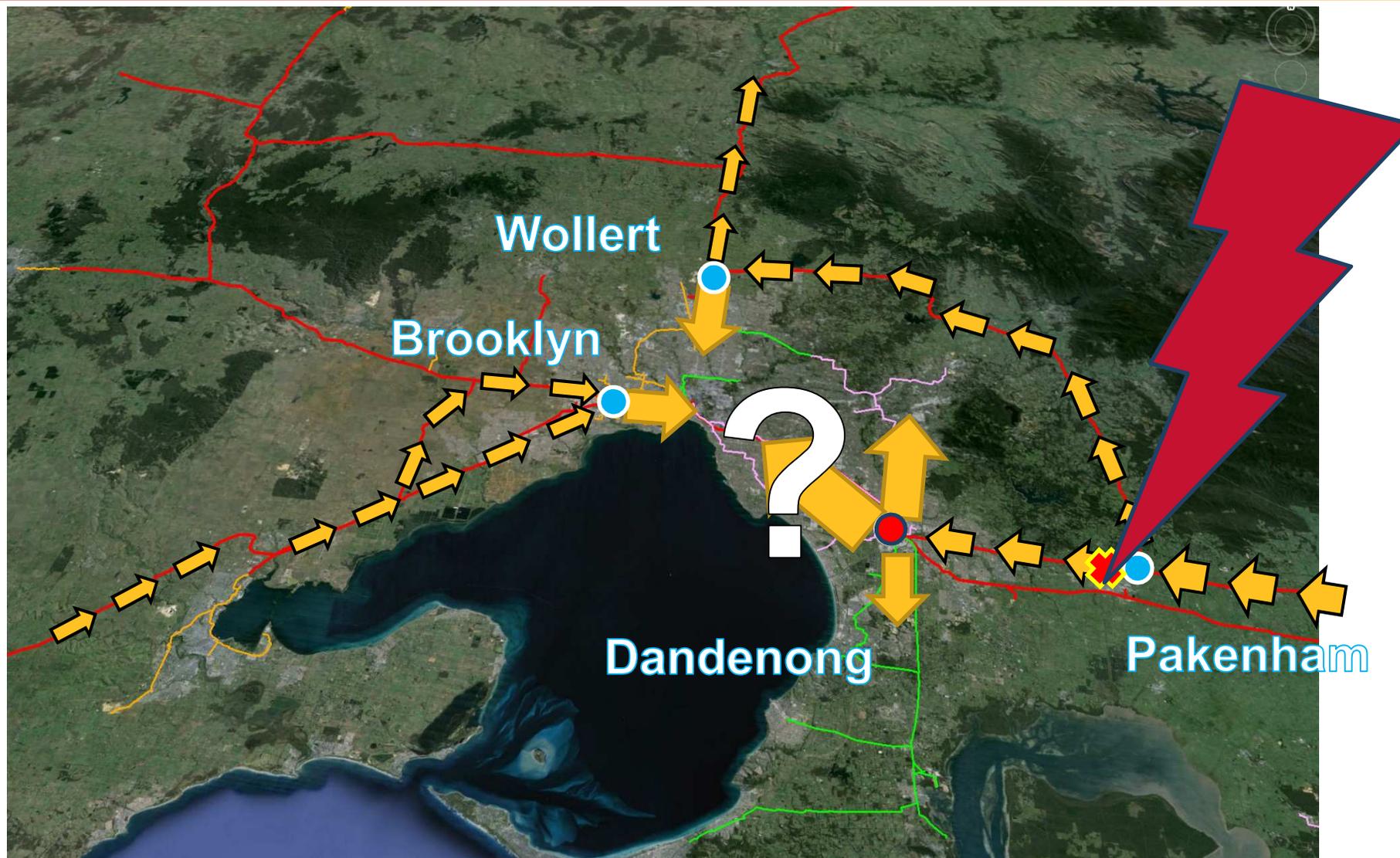


- Governor in Council may declare under the Gas Industry Act 2001 on advice from EIRC

EXAMPLE



EXAMPLE- INCIDENT



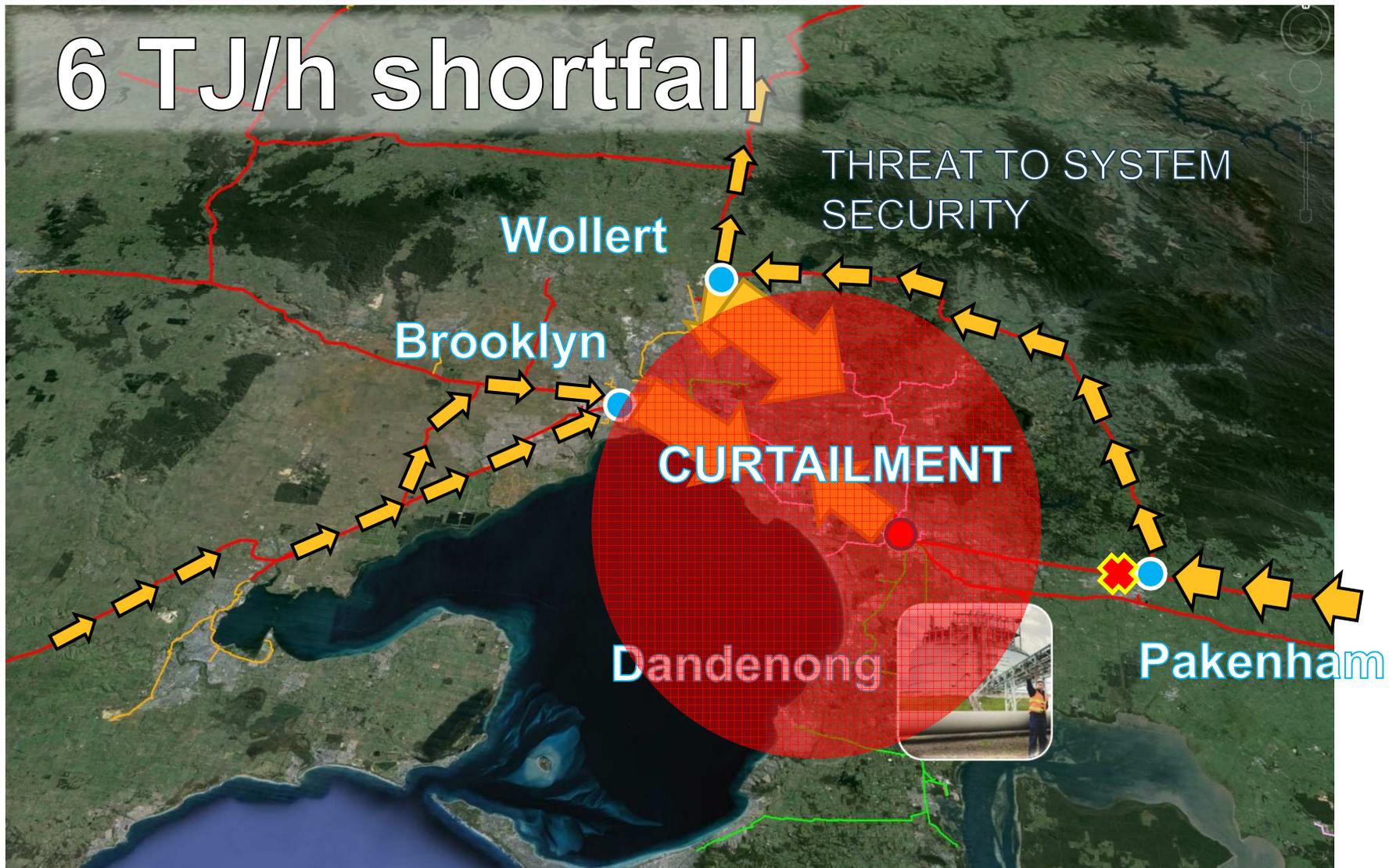
6 TJ/h shortfall



EXAMPLE- RESPONSE STRUCTURE



6 TJ/h shortfall



IN SUMMARY



- Threat to system security declared
 - Response from AEMO
 - Market intervention
- Level 5 emergency
- CMT formed
- Communications protocols enacted
- Market continues operating unless situation changes

Q&A



ANNOUNCEMENT



- *2016 Gas Statement of Opportunities:*
<http://www.aemo.com.au/Gas/Planning/Gas-Statement-of-Opportunities>
- *2016 Victorian Gas Planning Report Update:*
<http://www.aemo.com.au/Gas/Planning/Victorian-Gas-Planning>
- *2015 National Gas Forecasting Report:*
<http://www.aemo.com.au/Gas/Planning/Forecasting>

AEMO ADDITIONAL RESOURCES



- DWGM procedures: <http://www.aemo.com.au/Gas/Policies-and-Procedures/Declared-Wholesale-Gas-Market-Rules-and-Procedures>
- STTM Contingency Gas: <http://www.aemo.com.au/Gas/Policies-and-Procedures/Short-Term-Trading-Markets/Contingency-Gas>
- Gas market guides (tech guides and overview): <http://www.aemo.com.au/About-the-Industry/Resources/Market-Overviews>

NETWORKING

