# WINTER 2016 – VICTORIAN GAS OPERATIONS OUTLOOK

3 May 2016

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

# 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 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**
  - 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

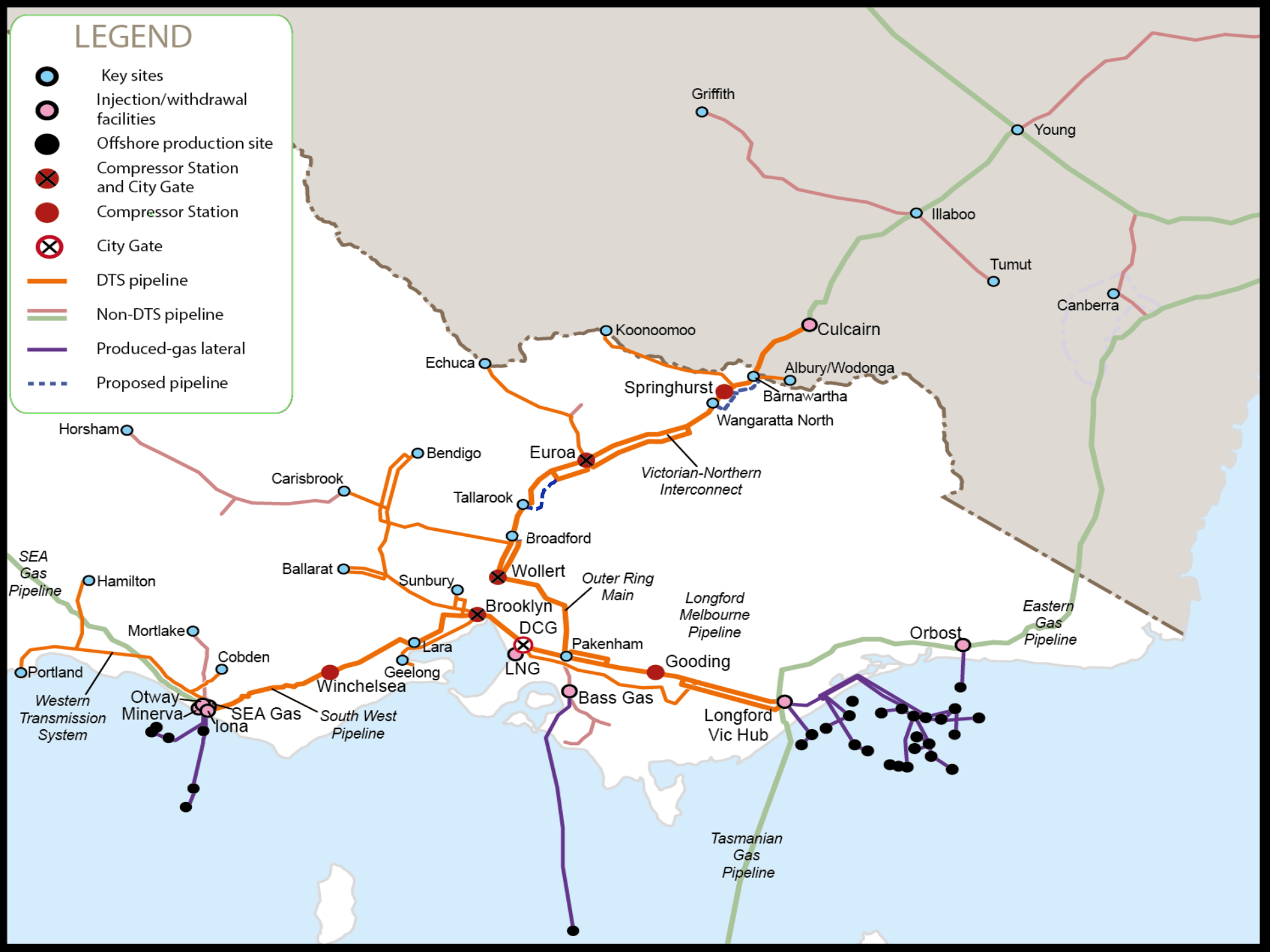
- **Maintain System Security**
  - Manage pipeline gas flows using the AEMO Gas SCADA
  - Operating strategies to maintain pipeline pressures
  - Adapt based on expected scheduled injections
  - Engineering modelling tools including Gregg Model
  - Threats to System Security
- **Emergency Management**
  - 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

# MARKET OPERATIONS

- **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
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

# 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

# SHORT TERM TRADING MARKET (STTM)

- **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

# 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 OPERATIONS STRUCTURE

Matthew Clemow
**Senior Manager Gas Real Time Operations**

**Gas Operations Engineers**
- Scheduling Desk
- Transmission Desk
- Gas Safety Case
- Emergency Response
- Gas System Operations Manual
- Transmission Operation Guide
- Short Term Trading Market Contingency Gas Escalation

Luke Garland
**Manager Gas System Operations**

**Gas Operations Analysts**
- Market Operations and Systems (DWGM and STTM)
- Disaster Recovery
- Emergency Preparedness
- Competency Based Learning

**Transmission Engineers**
- Service Envelope Agreement
- Capacity Modelling
- Gas Safety Case
- Maintenance Planning
- New Connections
- SCADA
- Metering
- Gas Quality

# 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*

# WINTER 2015 REVIEW

- 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 DAY REVIEW

- 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.

# WINTER 2015 PERFORMANCE

- 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$^{o}$C warmer than average

# AEMO MAINTENANCE COORDINATION PROCESS

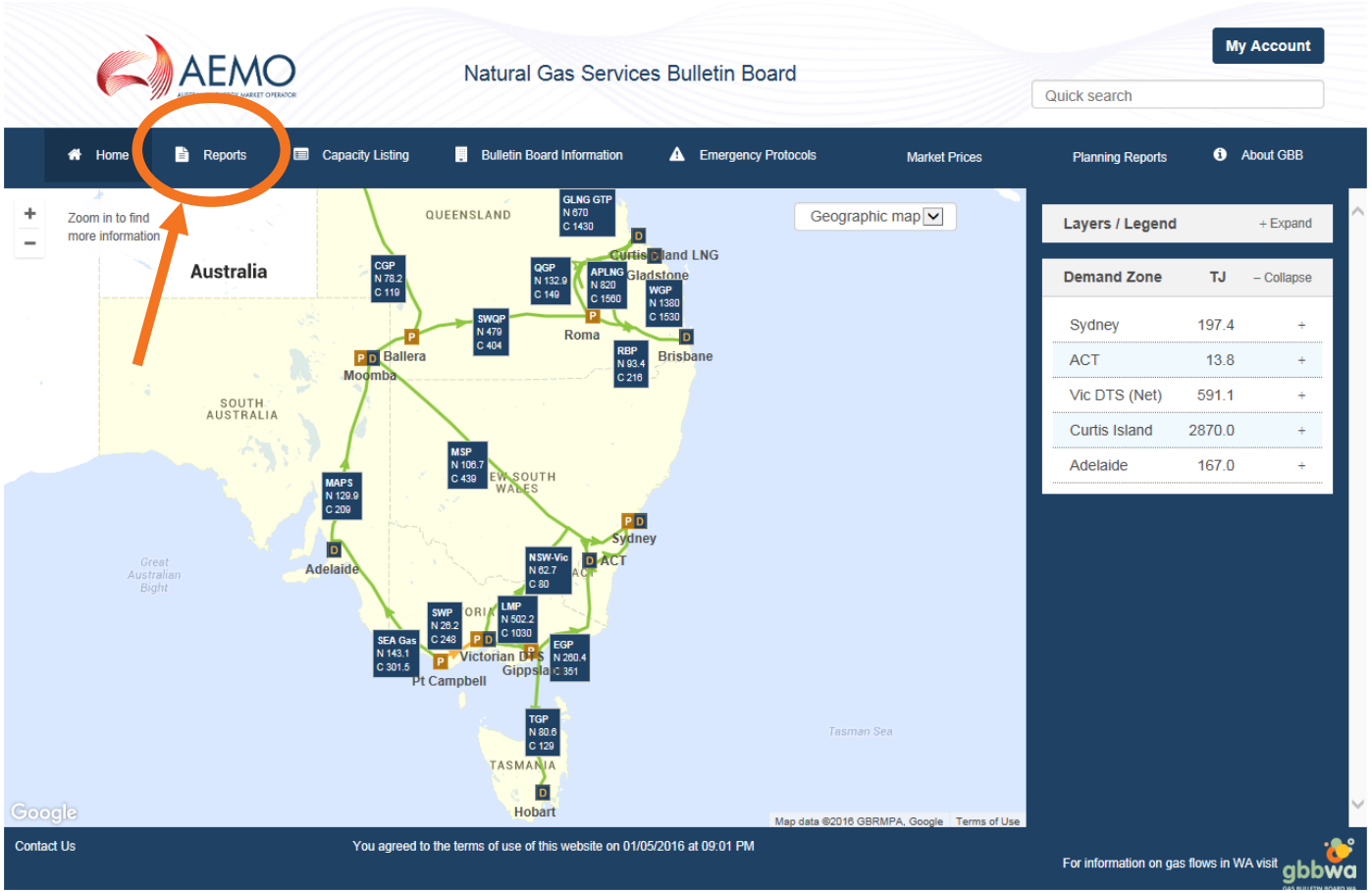
- As the independent system operator, AEMO coordinates major outages for DTS connected Gas Plants, Storage Facilities, and Interconnected Pipelines, as well as APA's DTS pipeline assets
- AEMO hosts three meetings during the year that are attended by the Facility Operators and APA
- Outages are reviewed 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



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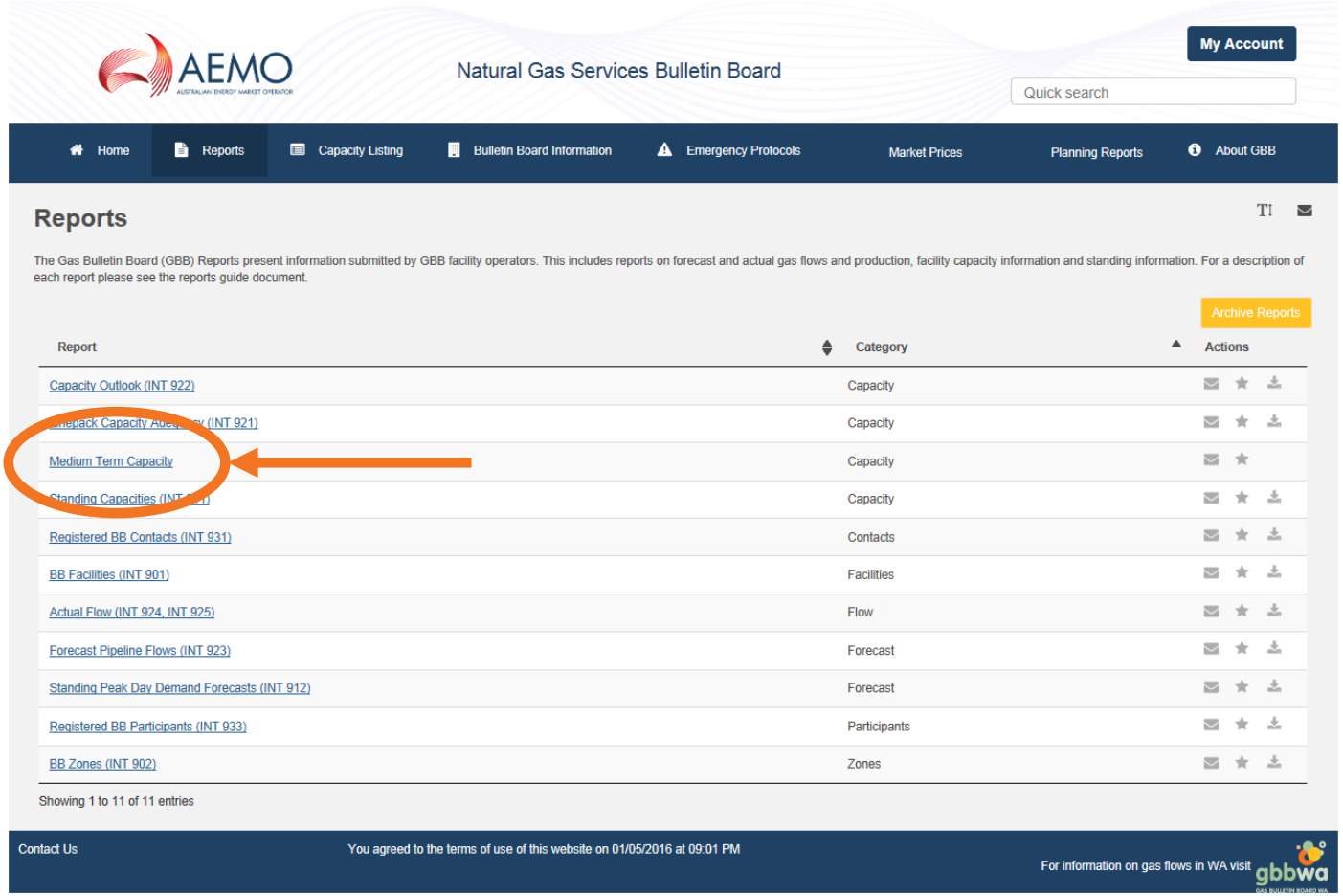

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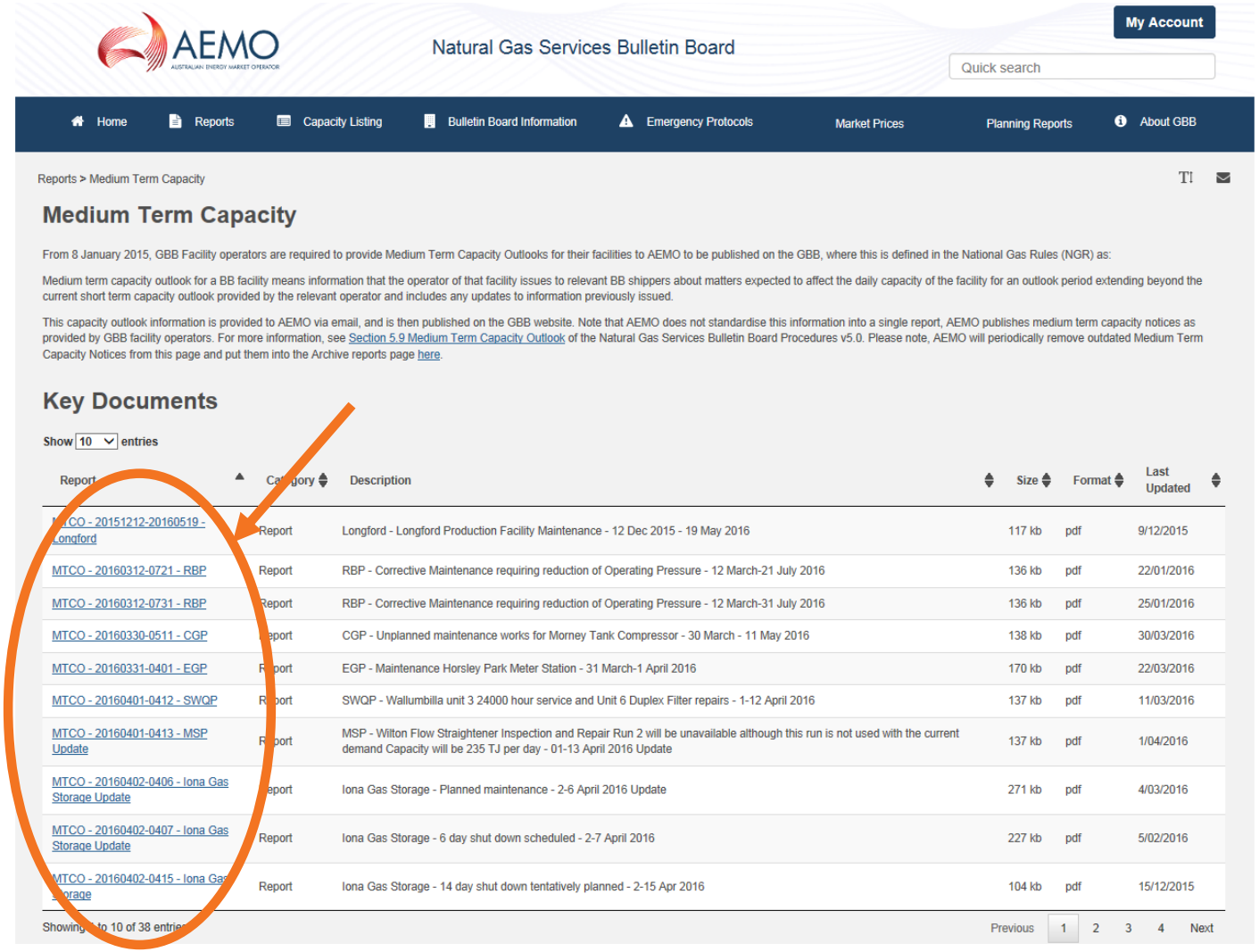


# 2016 VICTORIAN GAS PLANNING REPORT (VGPR) UPDATE

- 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.

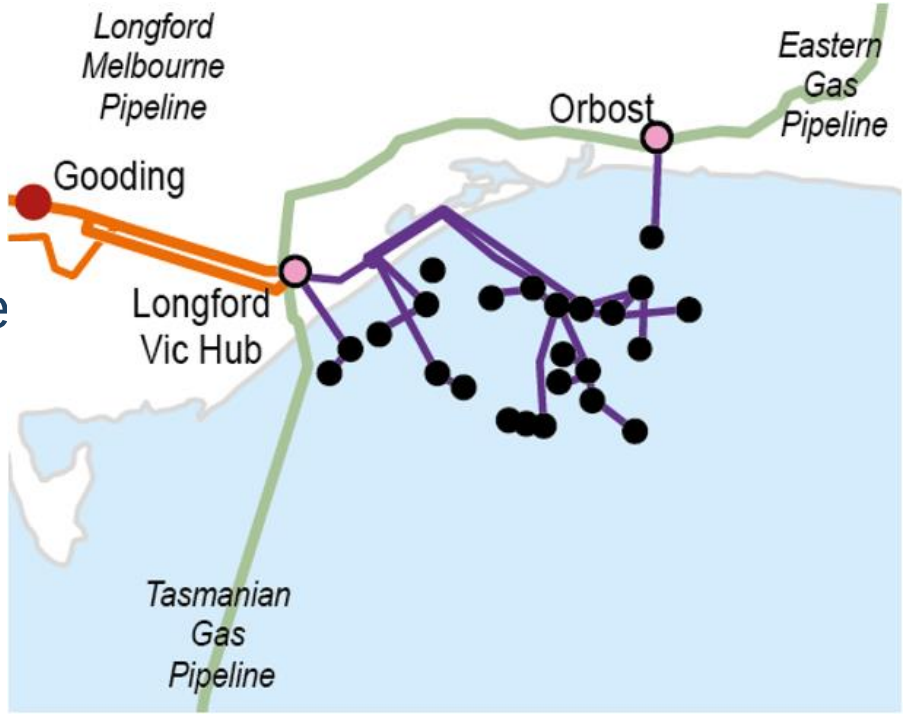
http://www.aemo.com.au/Gas/Planning/Victorian-Gas-Planning

# 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*


Jongeneel

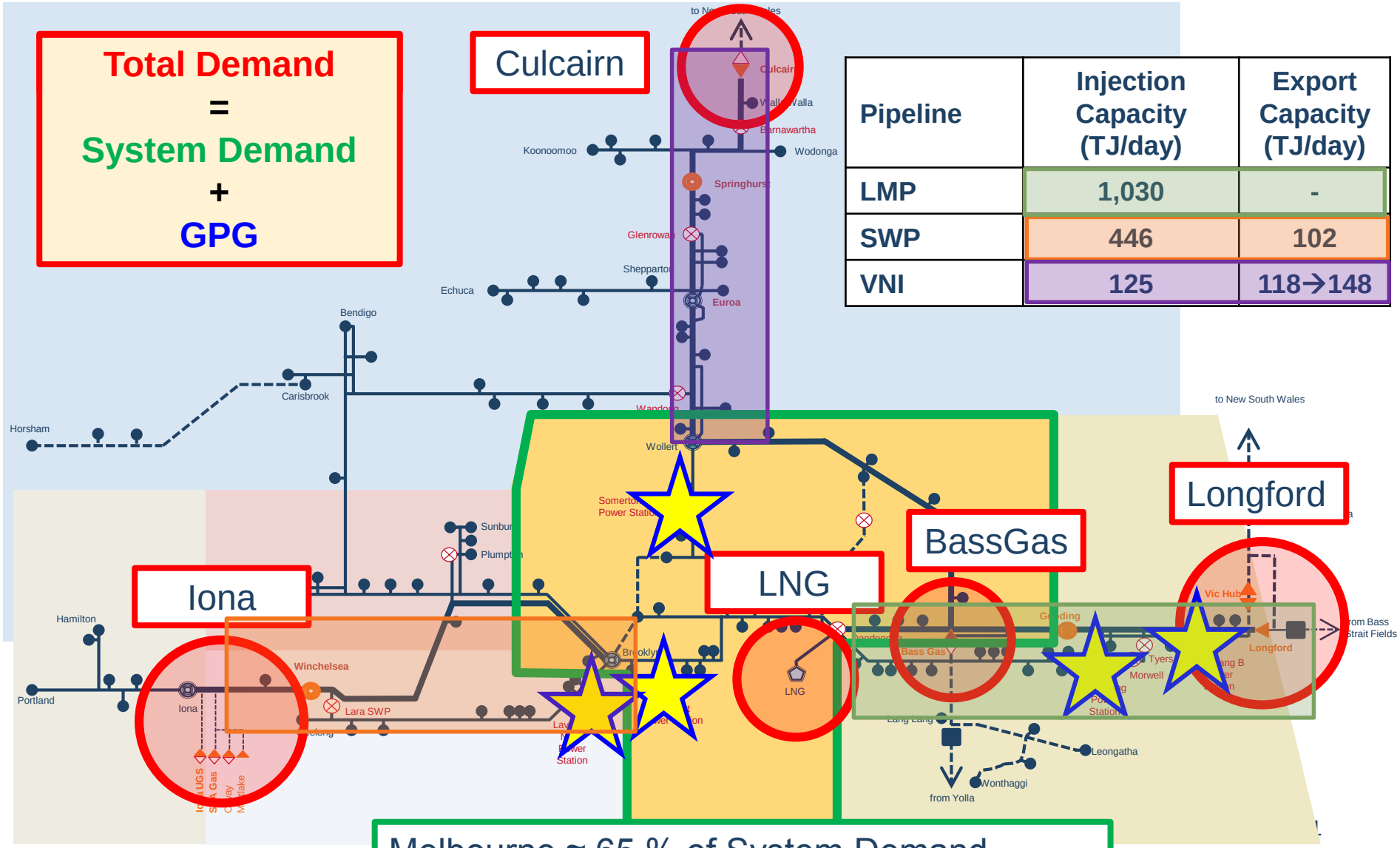
# OVERVIEW

- Operations Overview
- Fundamentals
- Strategies

# OPERATIONS OVERVIEW: DECLARED TRANSMISSION SYSTEM

**Total Demand**
**=**
**System Demand**
**+**
**GPG**

| 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

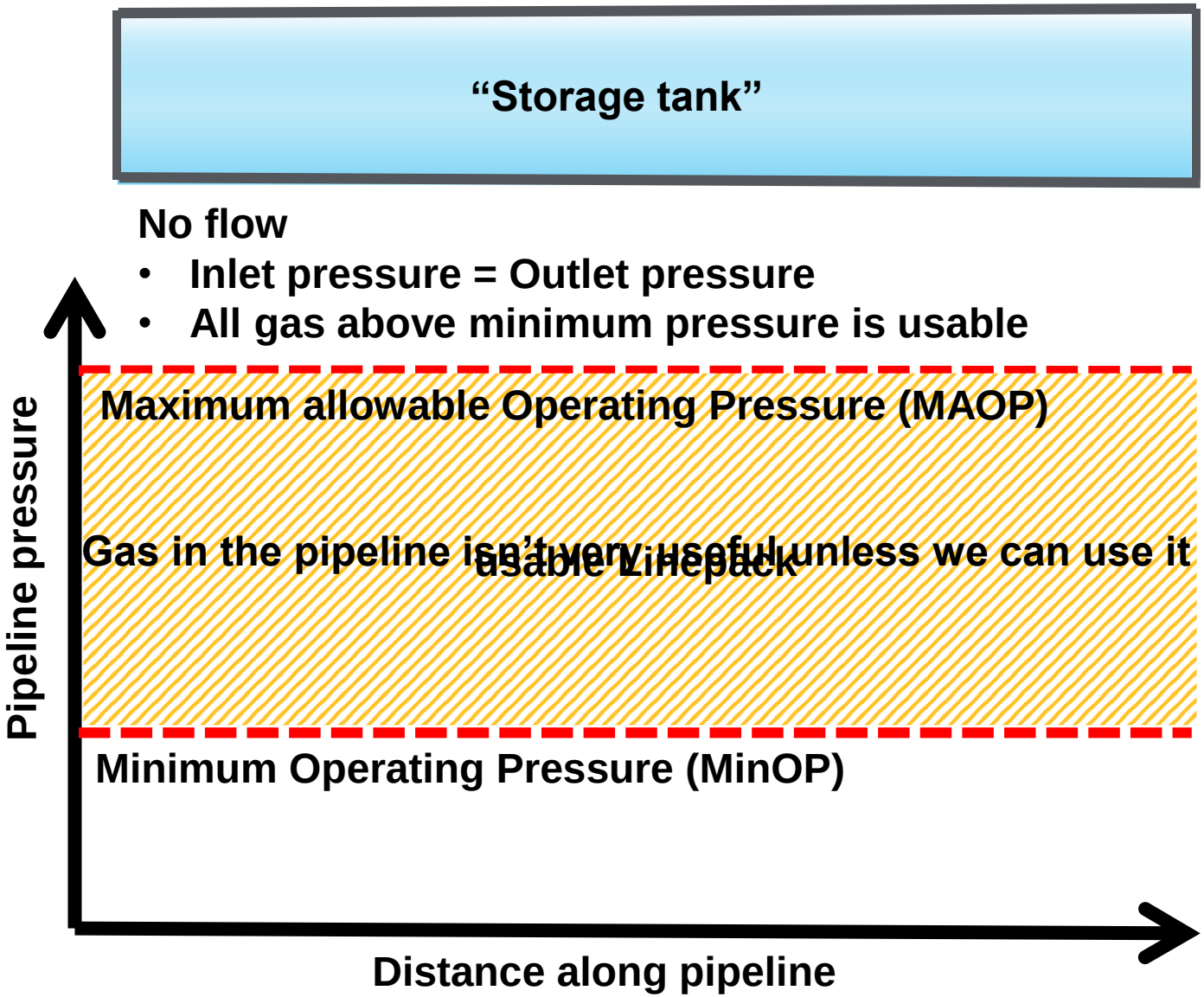
- Transportation capacity
  - Can we move enough gas?
- Storage / linepack
  - How much gas can I store in the system?
- Supply capacity
  - Do we have enough gas available?

# TYPES OF PHYSICAL CONSTRAINTS: PIPELINE CAPACITY & STORAGE

A transmission pipeline is two things

1. Storage Tank
2. Transportation System

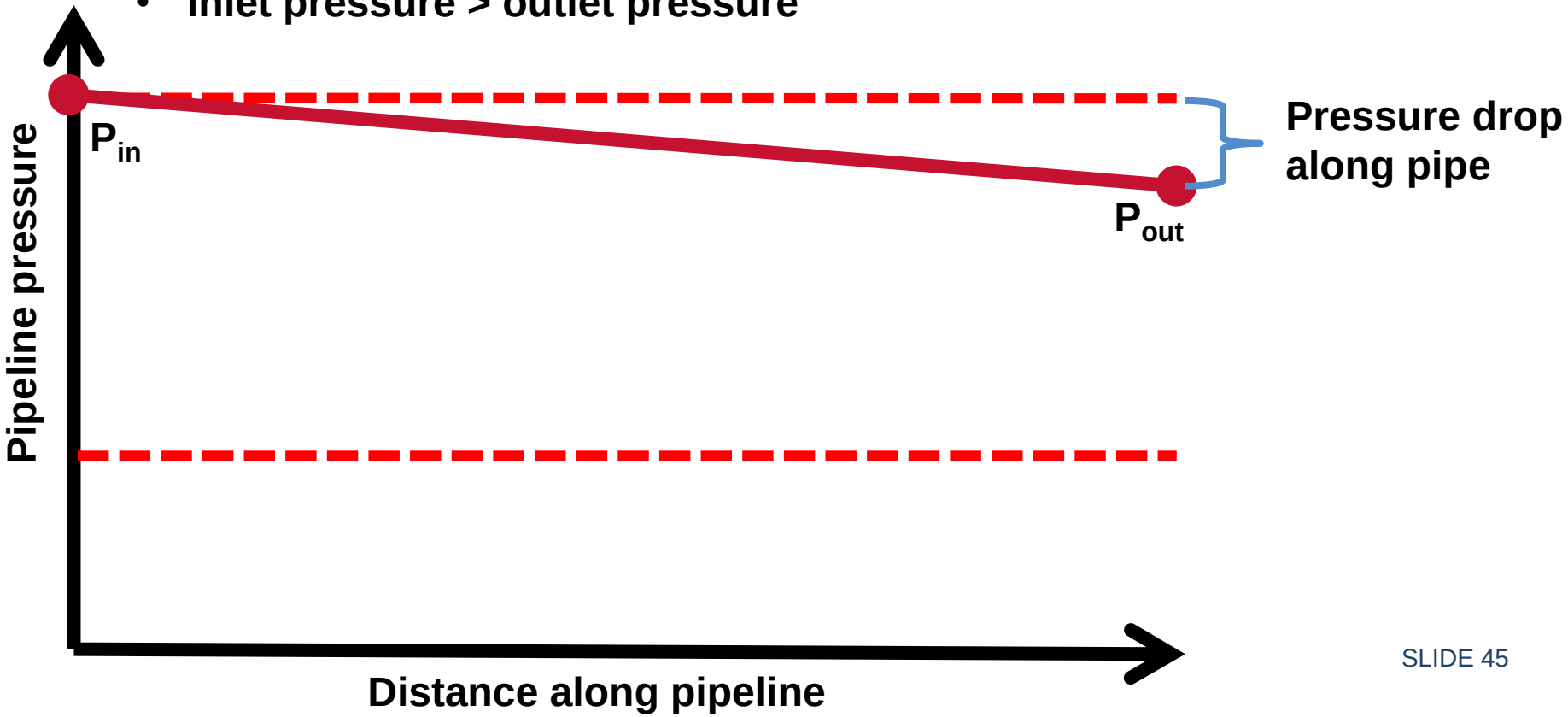
# TYPES OF PHYSICAL CONSTRAINTS: PIPELINE CAPACITY



# TYPES OF PHYSICAL CONSTRAINTS: PIPELINE CAPACITY


**Transporting gas**

- **Inlet pressure > outlet pressure**



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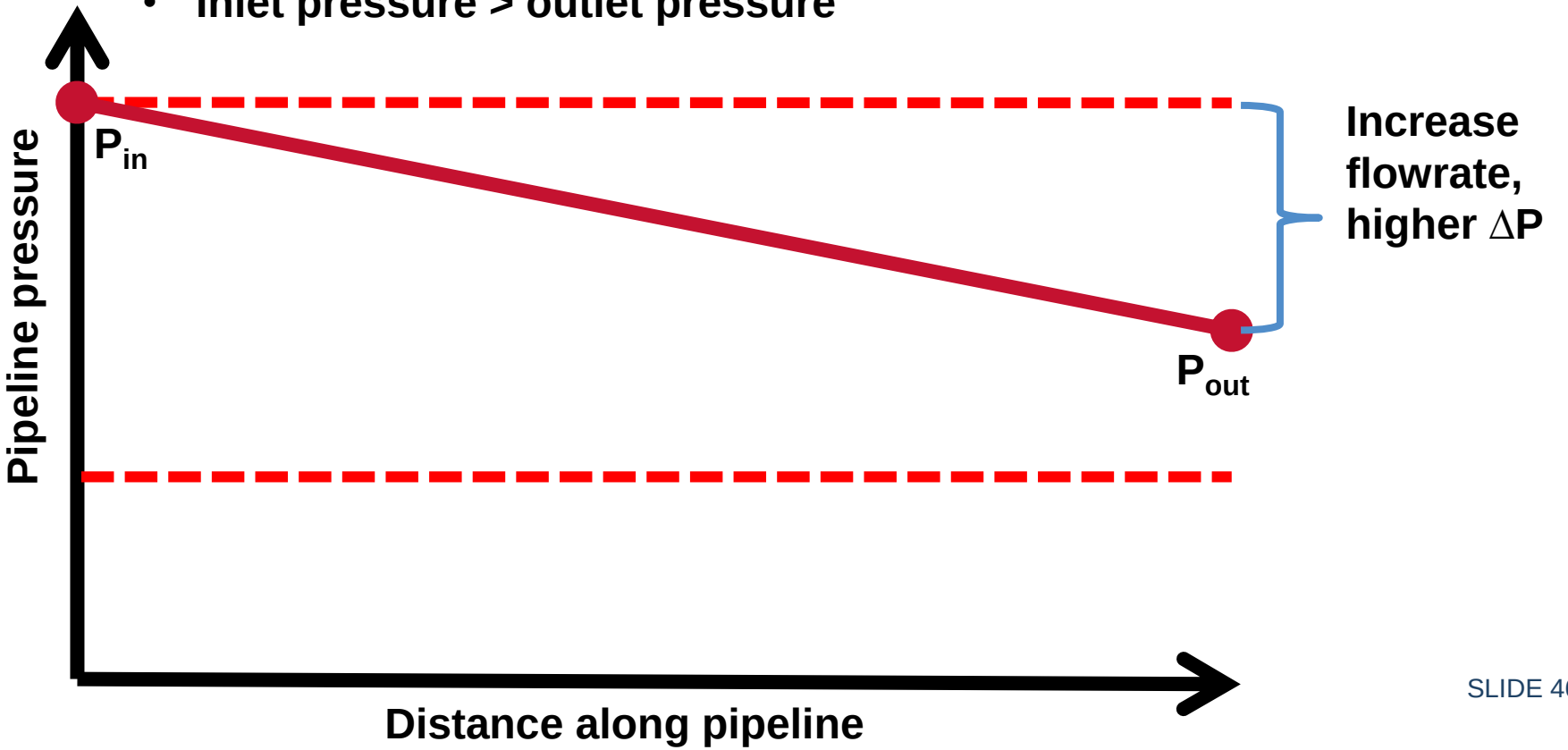

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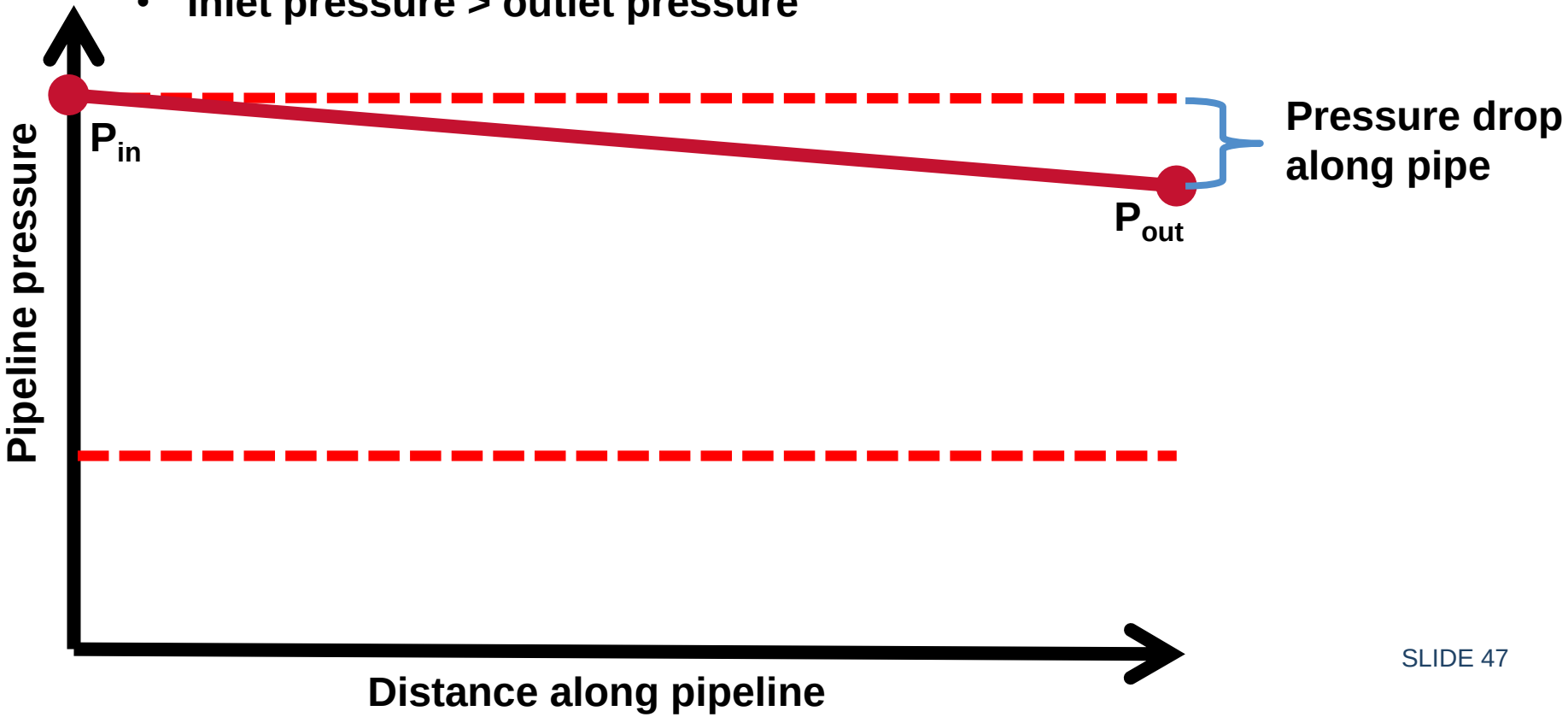
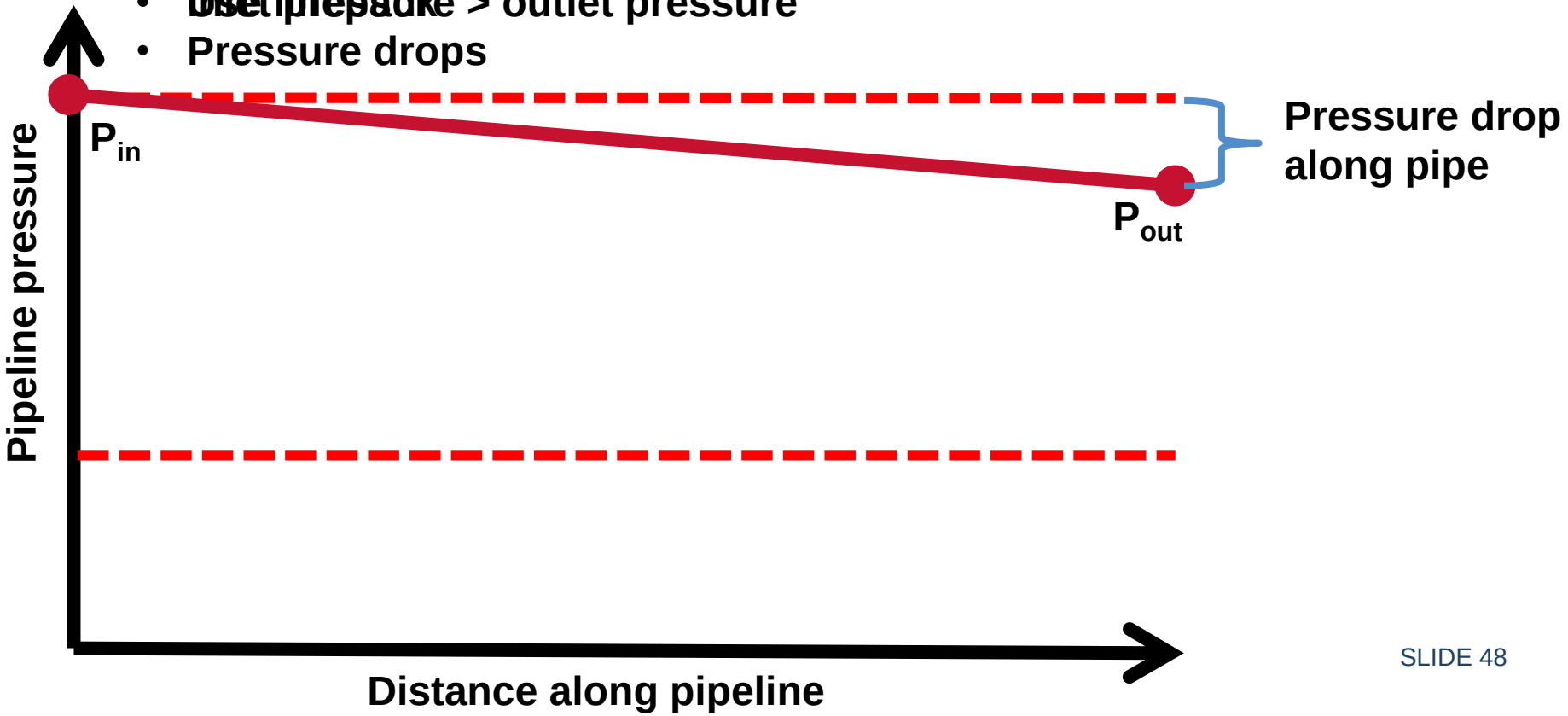


# TYPES OF PHYSICAL CONSTRAINTS: PIPELINE CAPACITY


- Inlet pressure > outlet pressure
- Pressure drops



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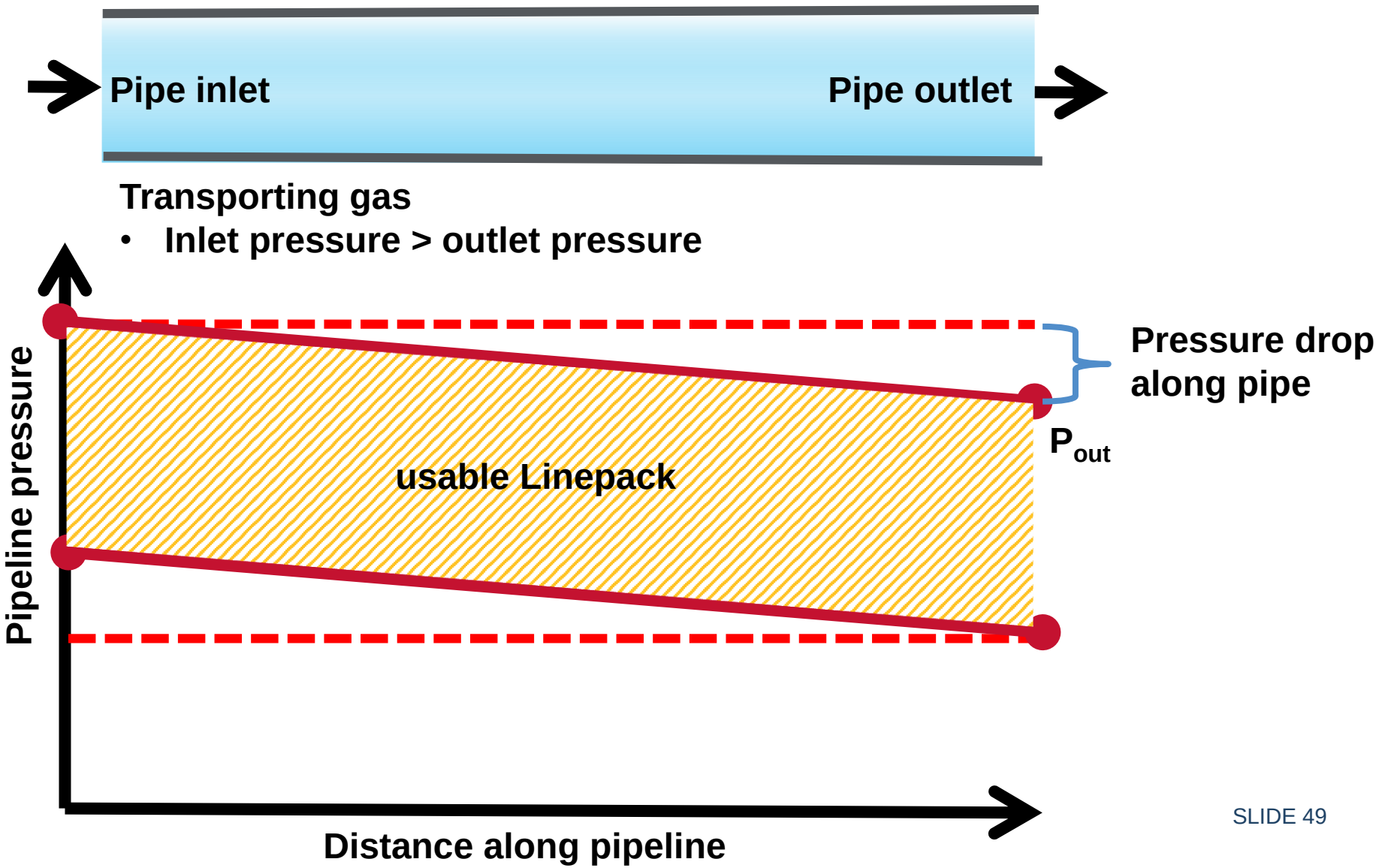

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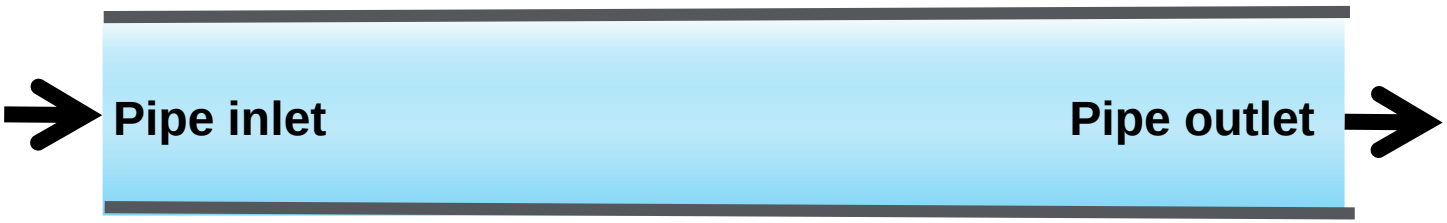


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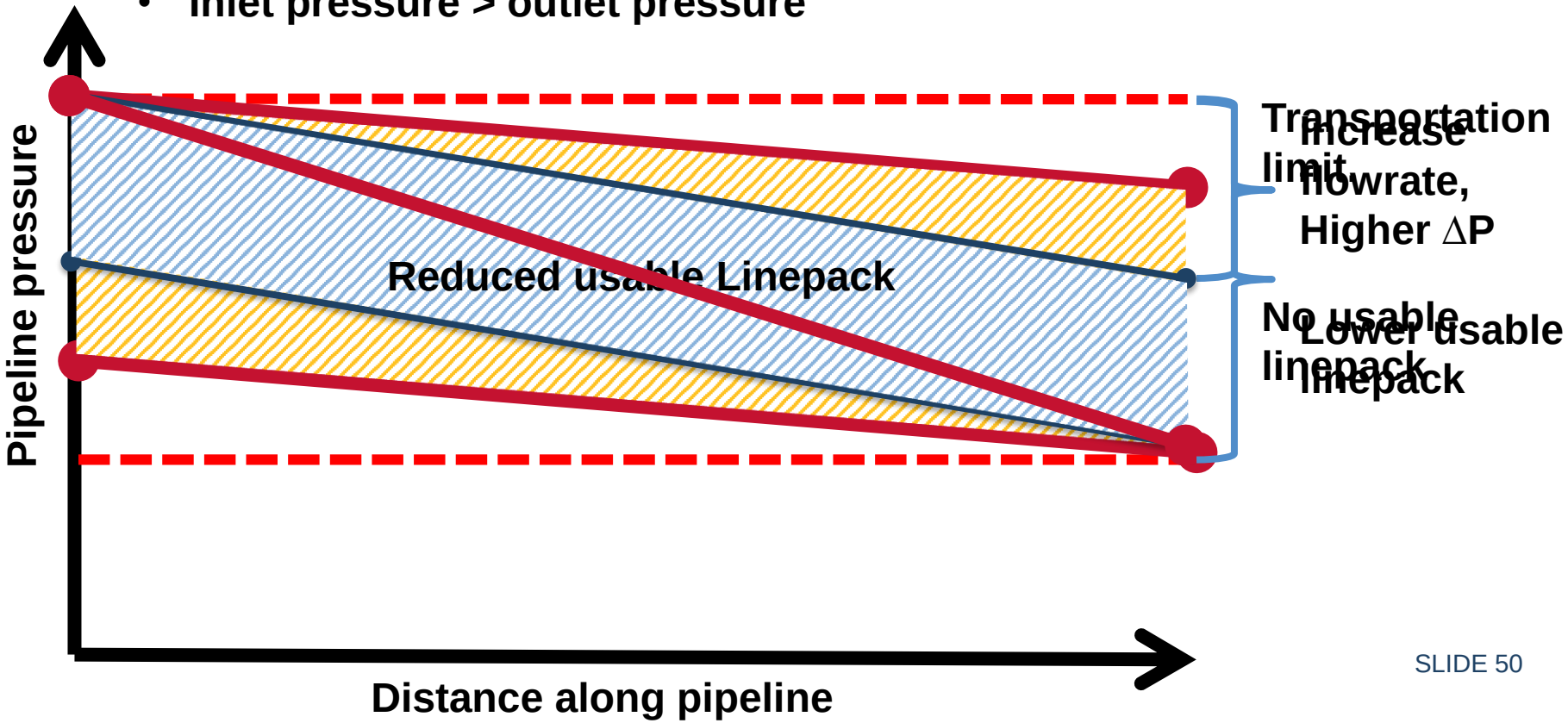

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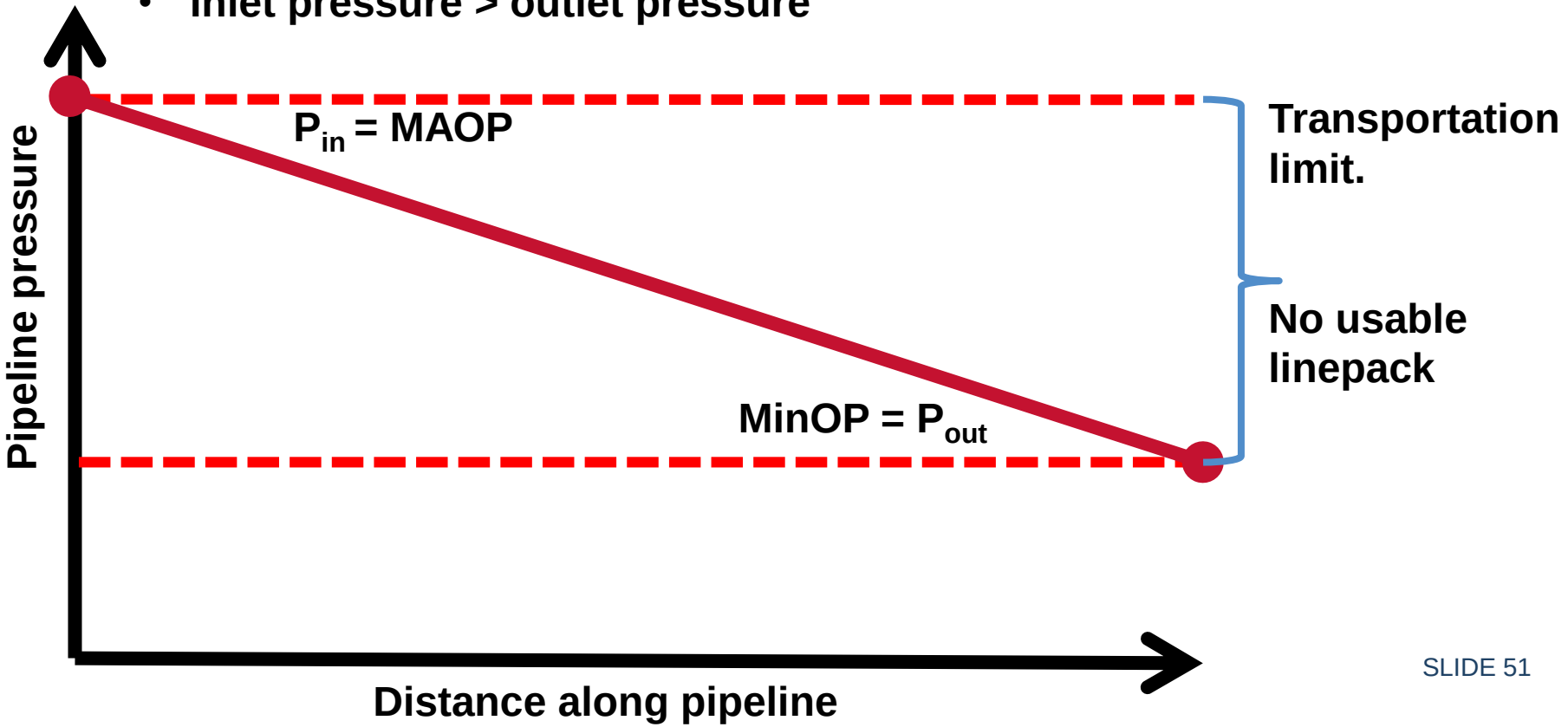
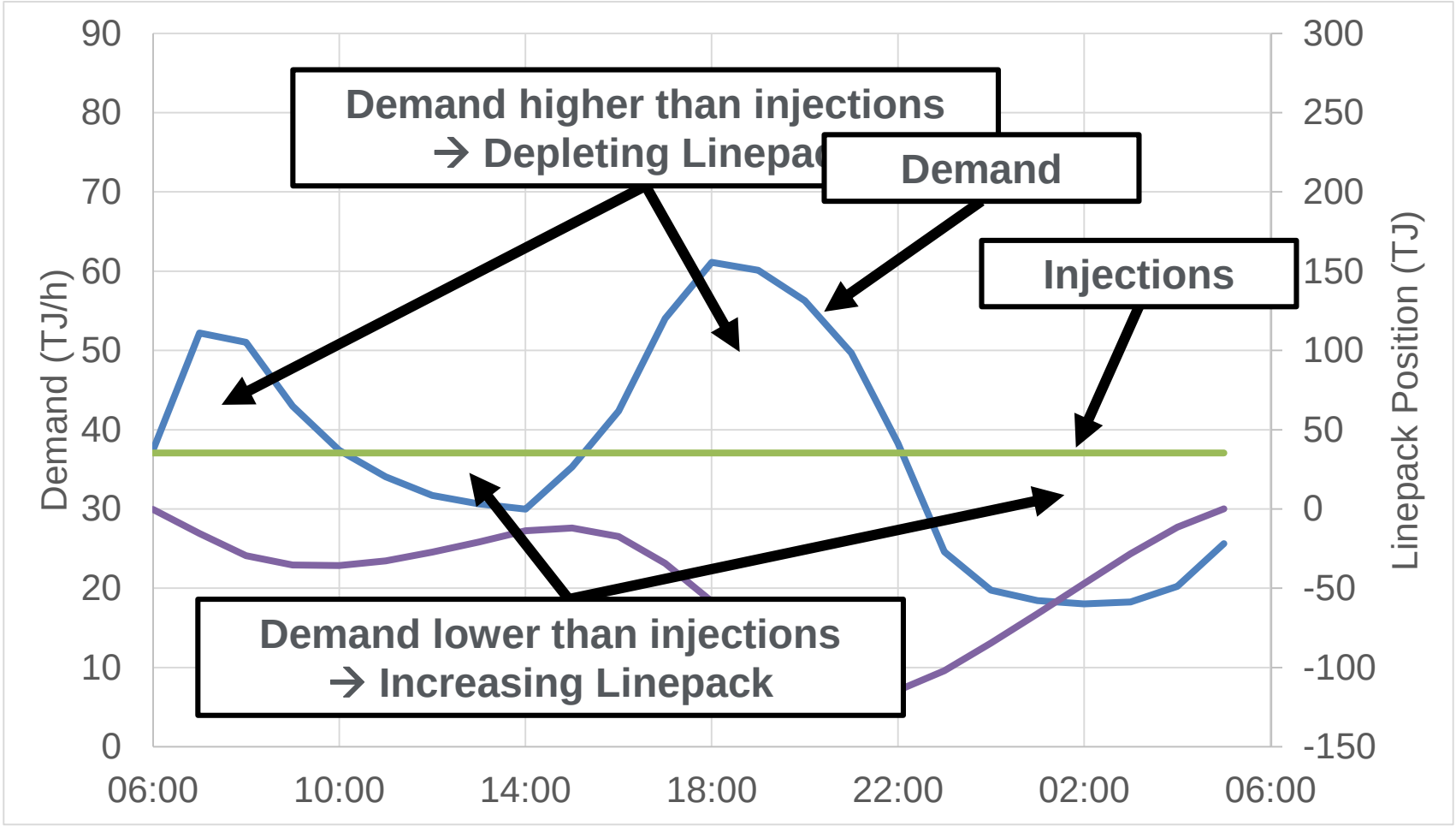


# FUNDAMENTALS: DEMAND PROFILE



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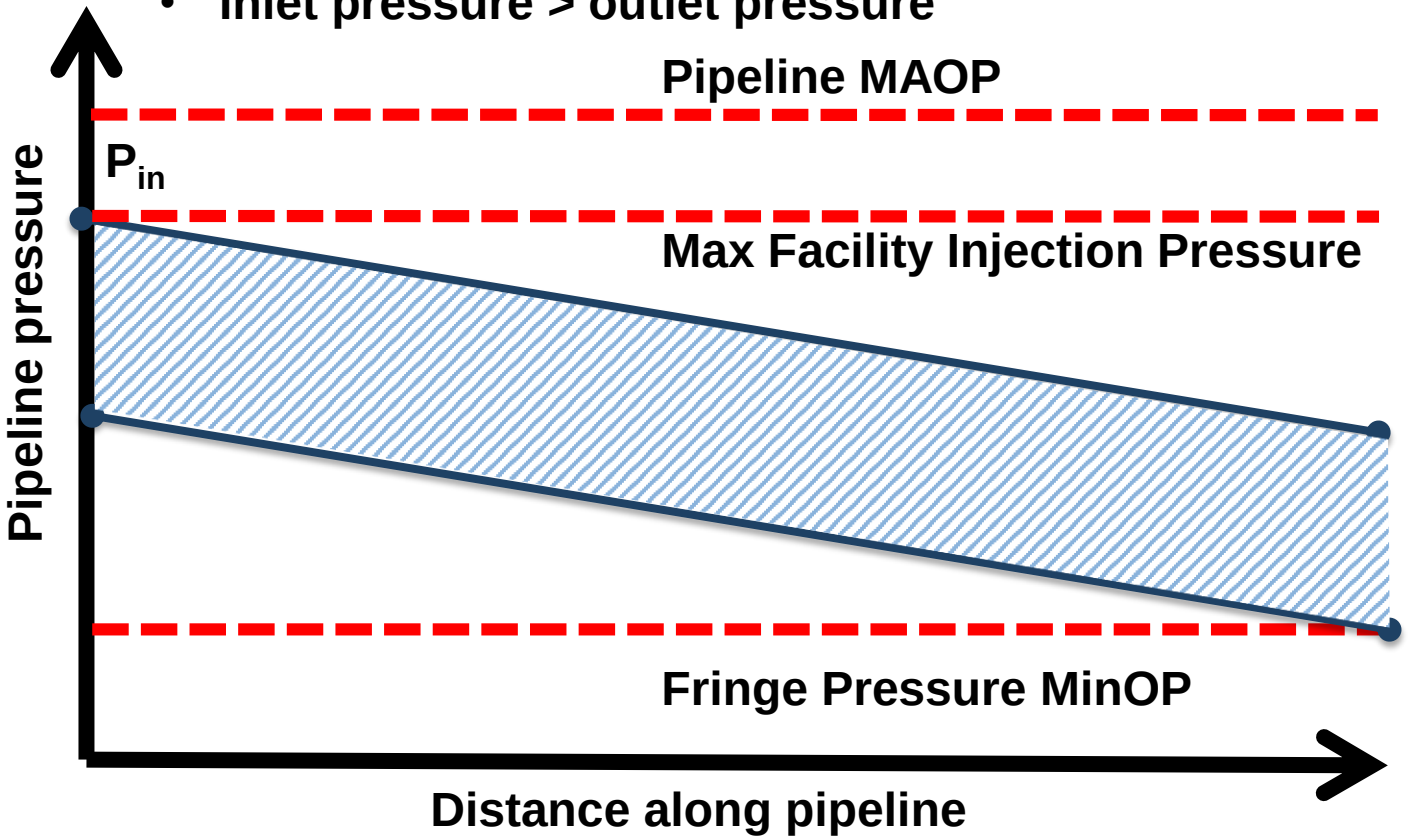
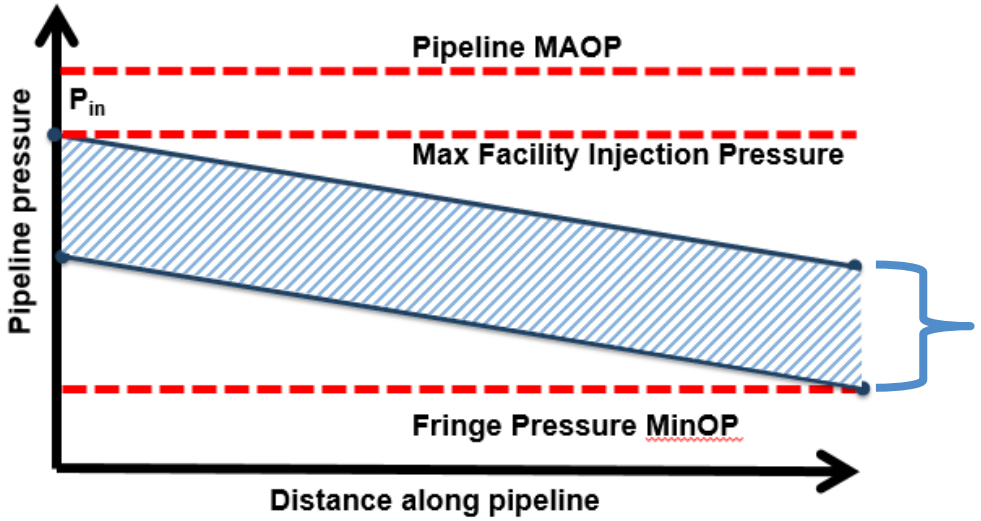
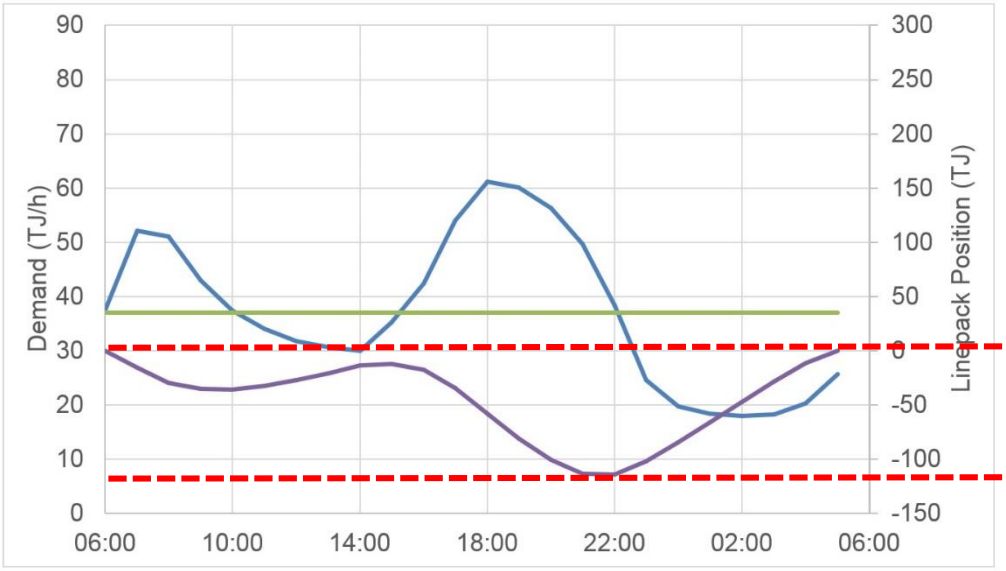





- Need enough usable linepack in the system, to support the variation in linepack expected on a peak demand day.

# TYPES OF PHYSICAL SYSTEM CONSTRAINTS

- Pipeline capacity
  - South West Pipeline constrained for some peak demand days

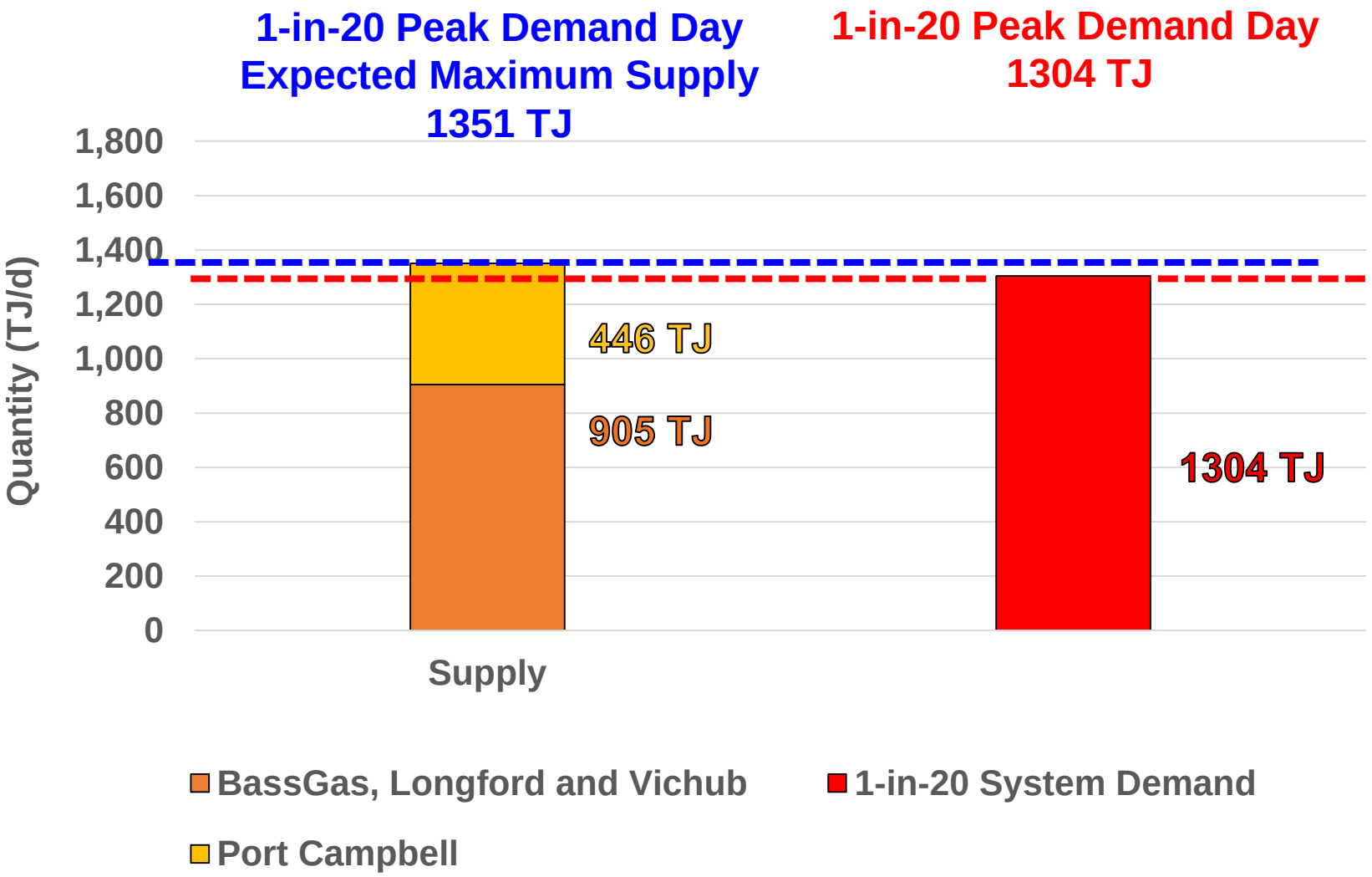
- Supply / plant capacity
  - Longford pipeline supply not historically scheduled at pipeline capacity.

# 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



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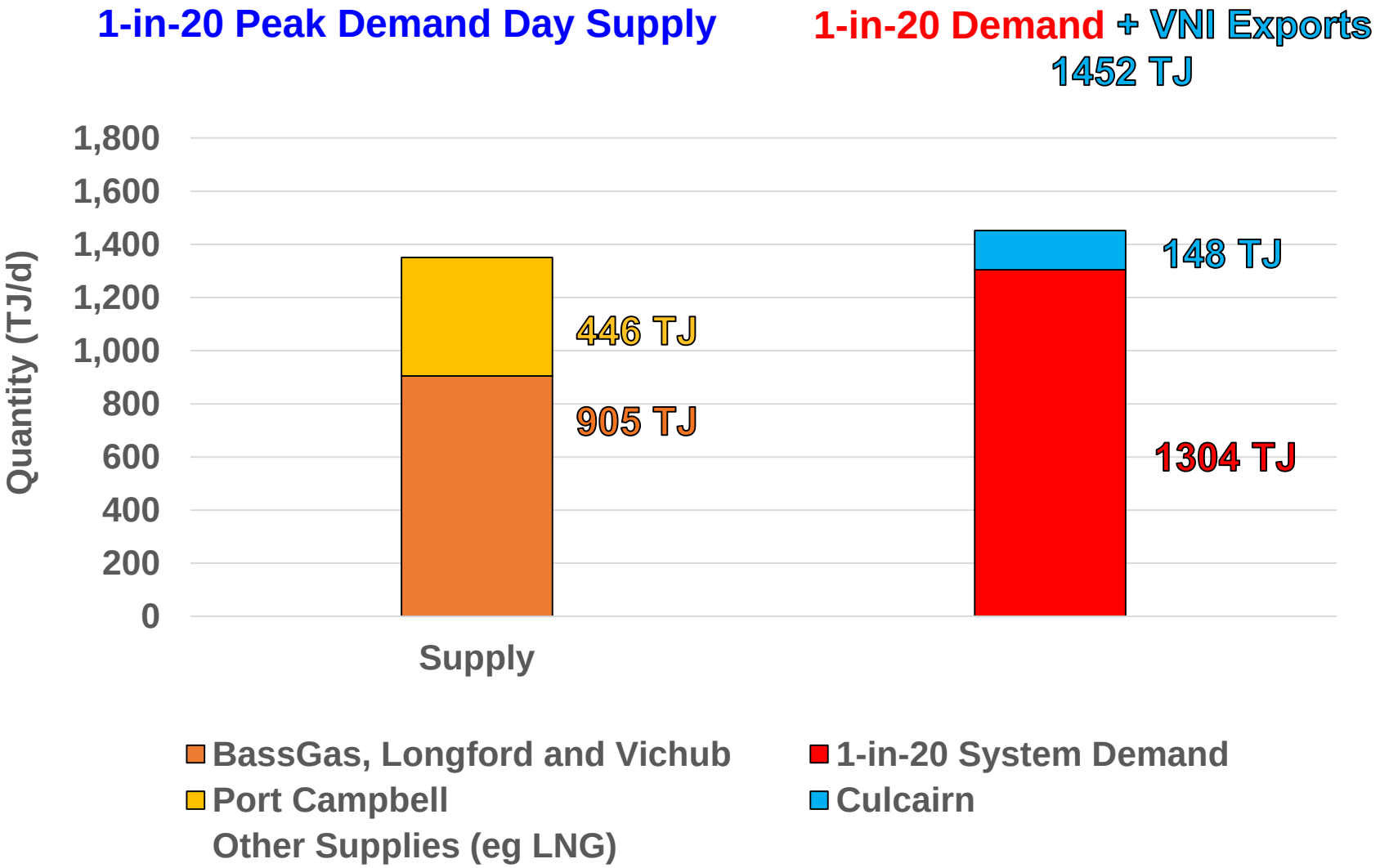
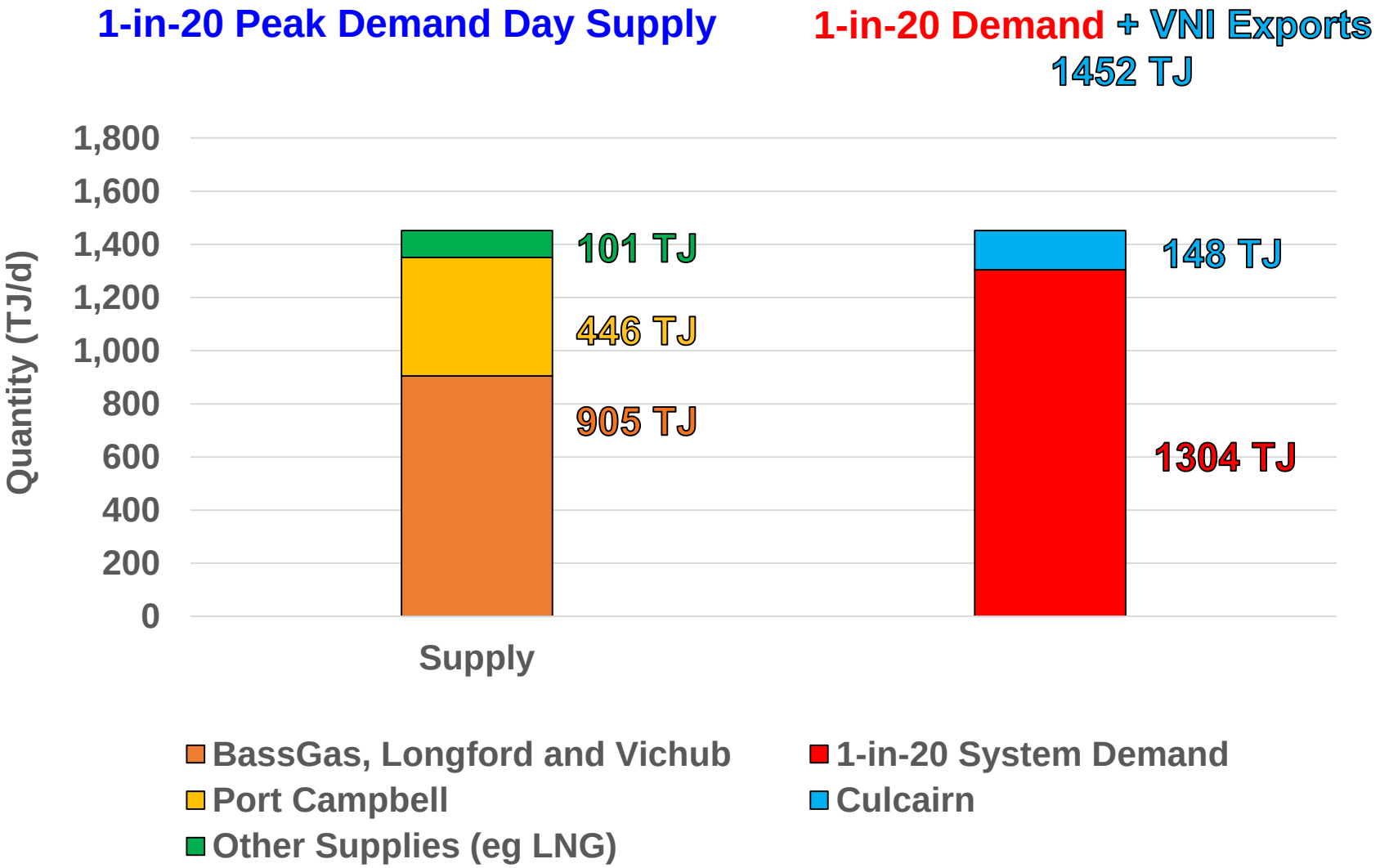
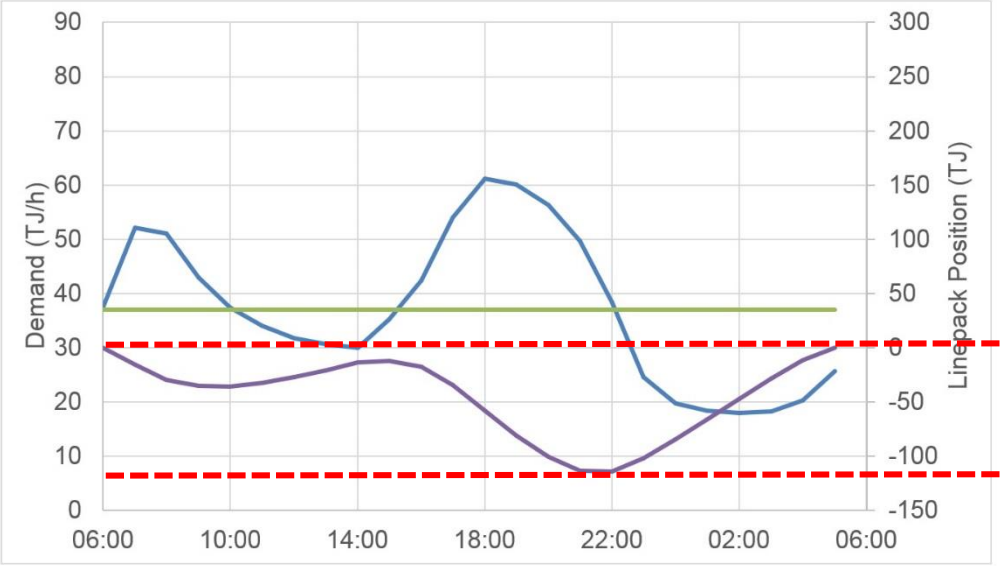


# OPERATIONS OVERVIEW:
# 1-IN-20 PEAK DAY SUPPLY AND DEMAND



- 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

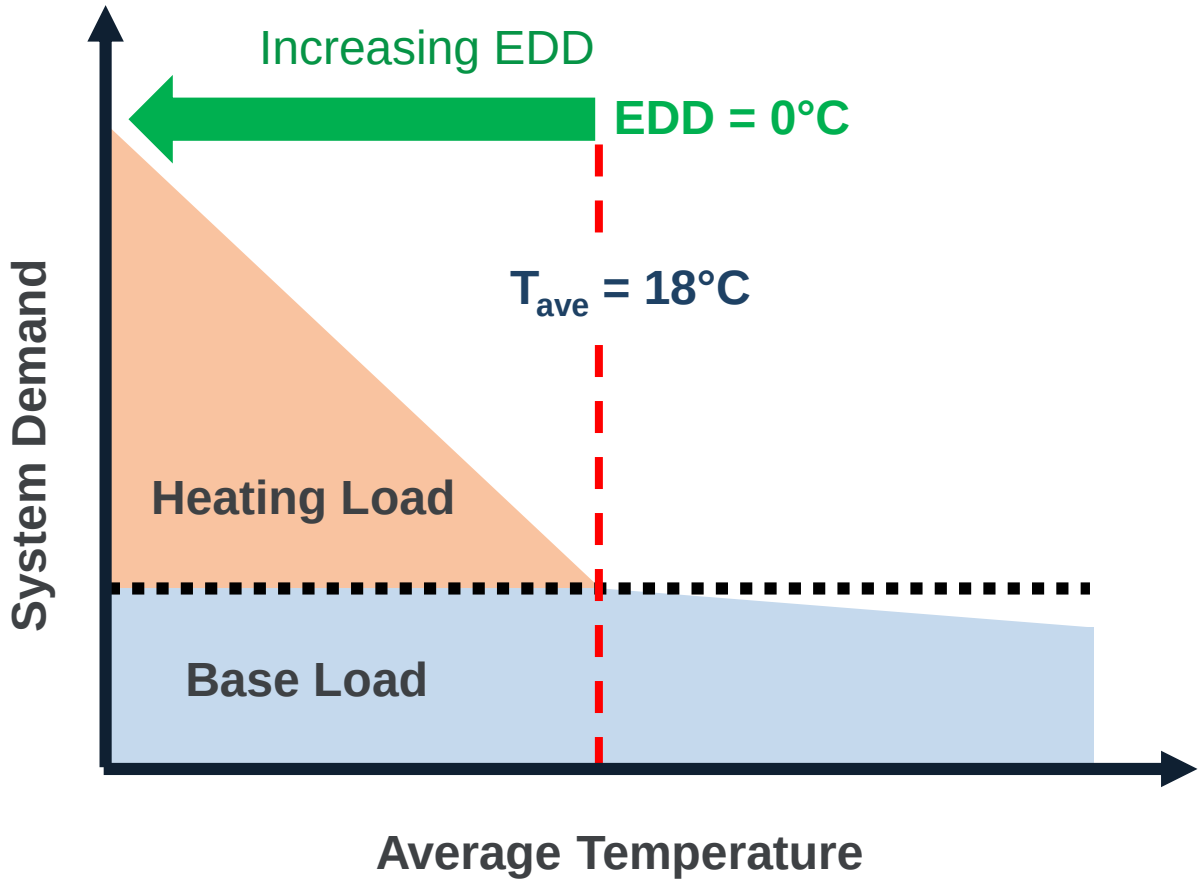
## Proactive Risk Management

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

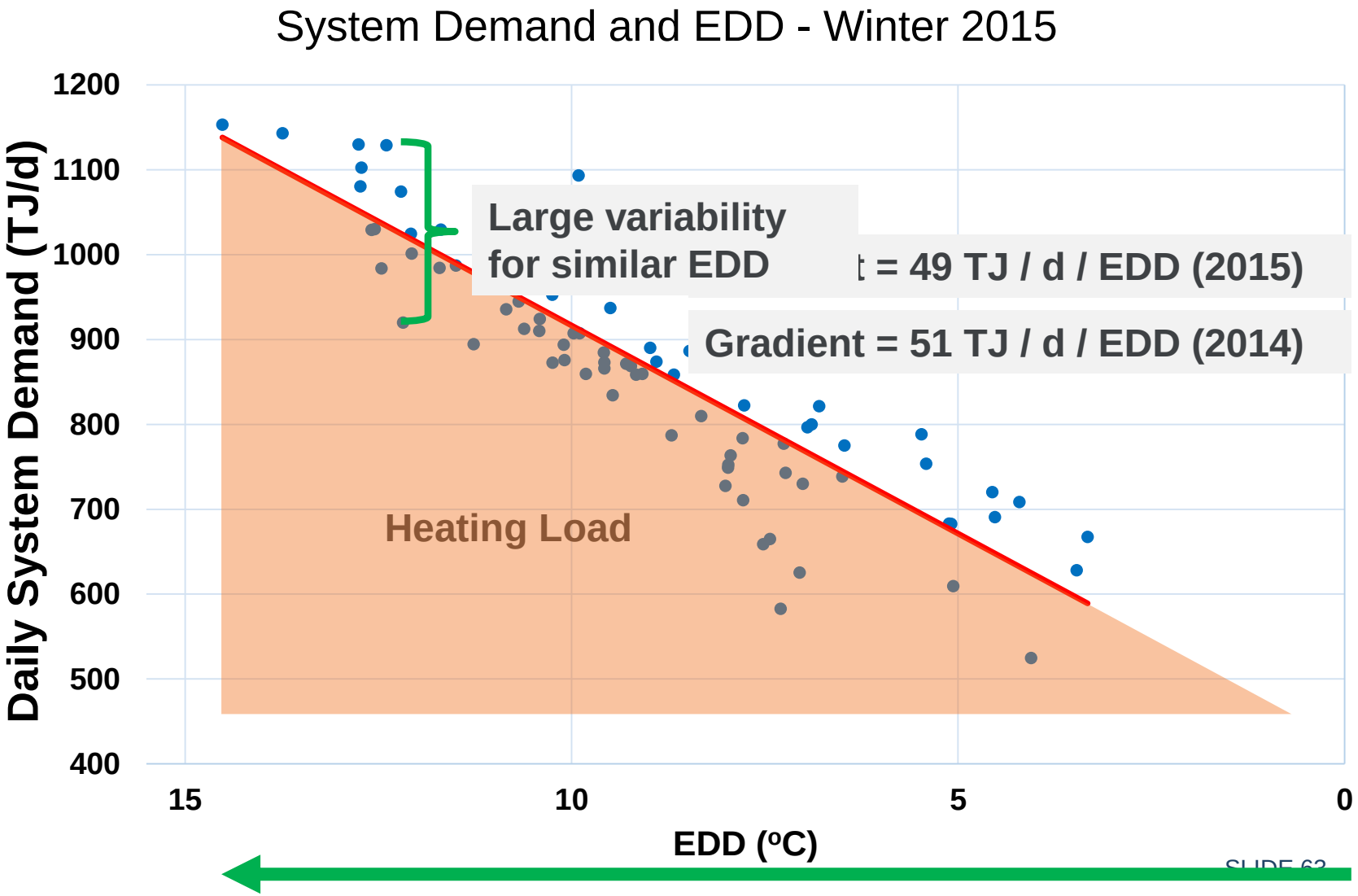
# FUNDAMENTALS: DEMAND FORECAST

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

Inverse magnitude to Average Temperature



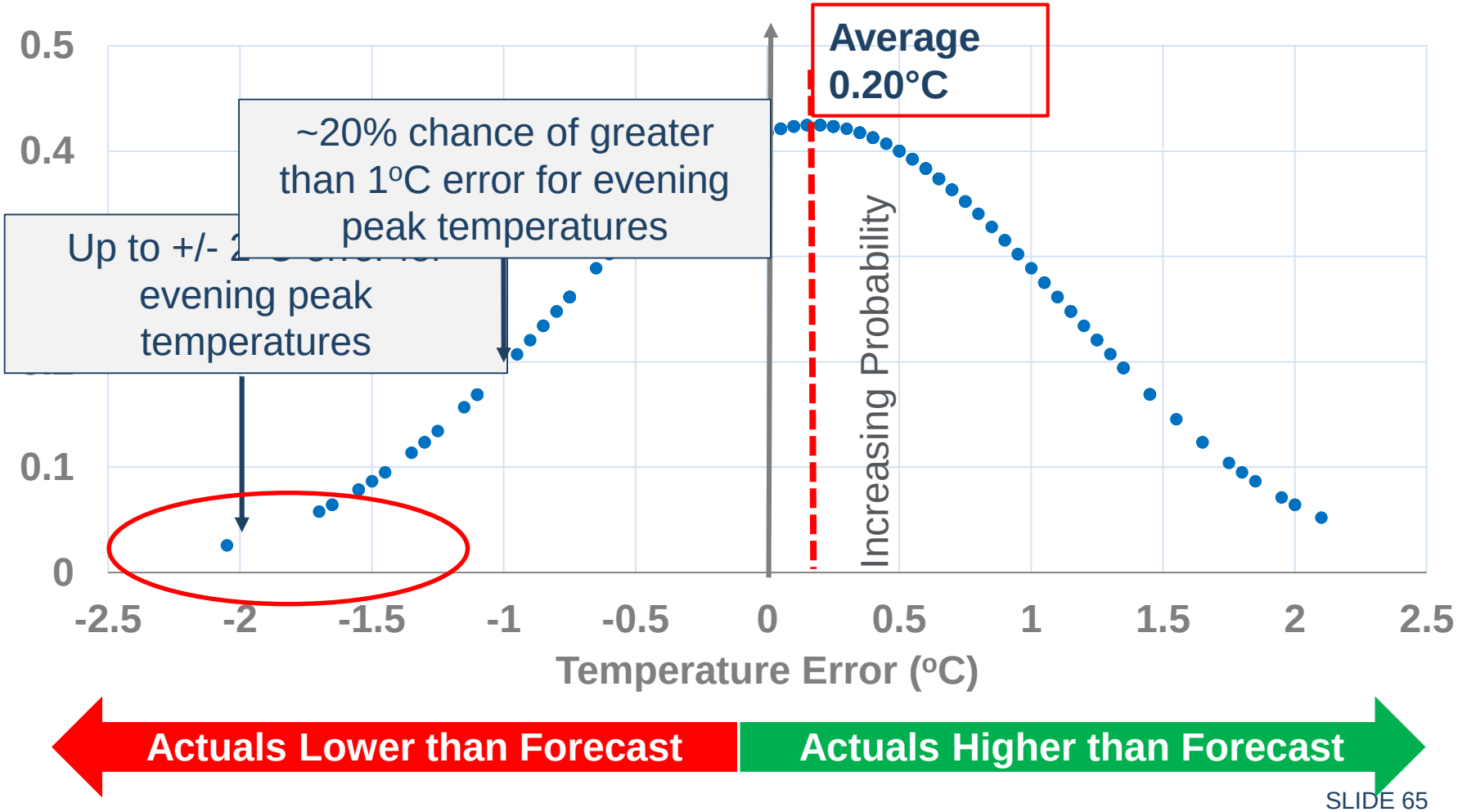
# FUNDAMENTALS: DEMAND FORECAST



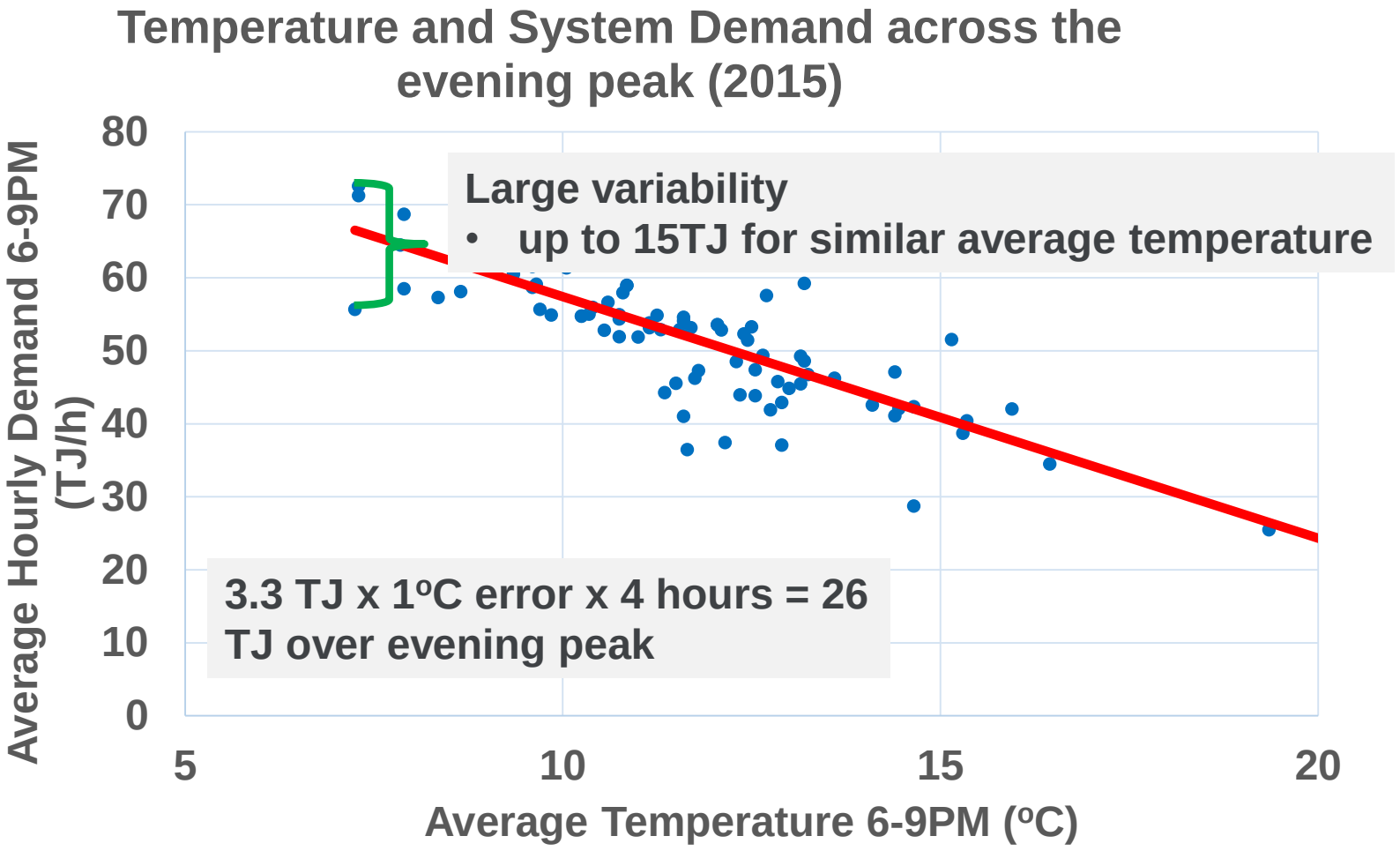
- High variability in forecasting daily demand.
  - EDD considers wind speed, sunshine hours, average temperature.
  - Melbourne temperature used to represent demand state wide.

# FUNDAMENTALS: DEMAND FORECAST

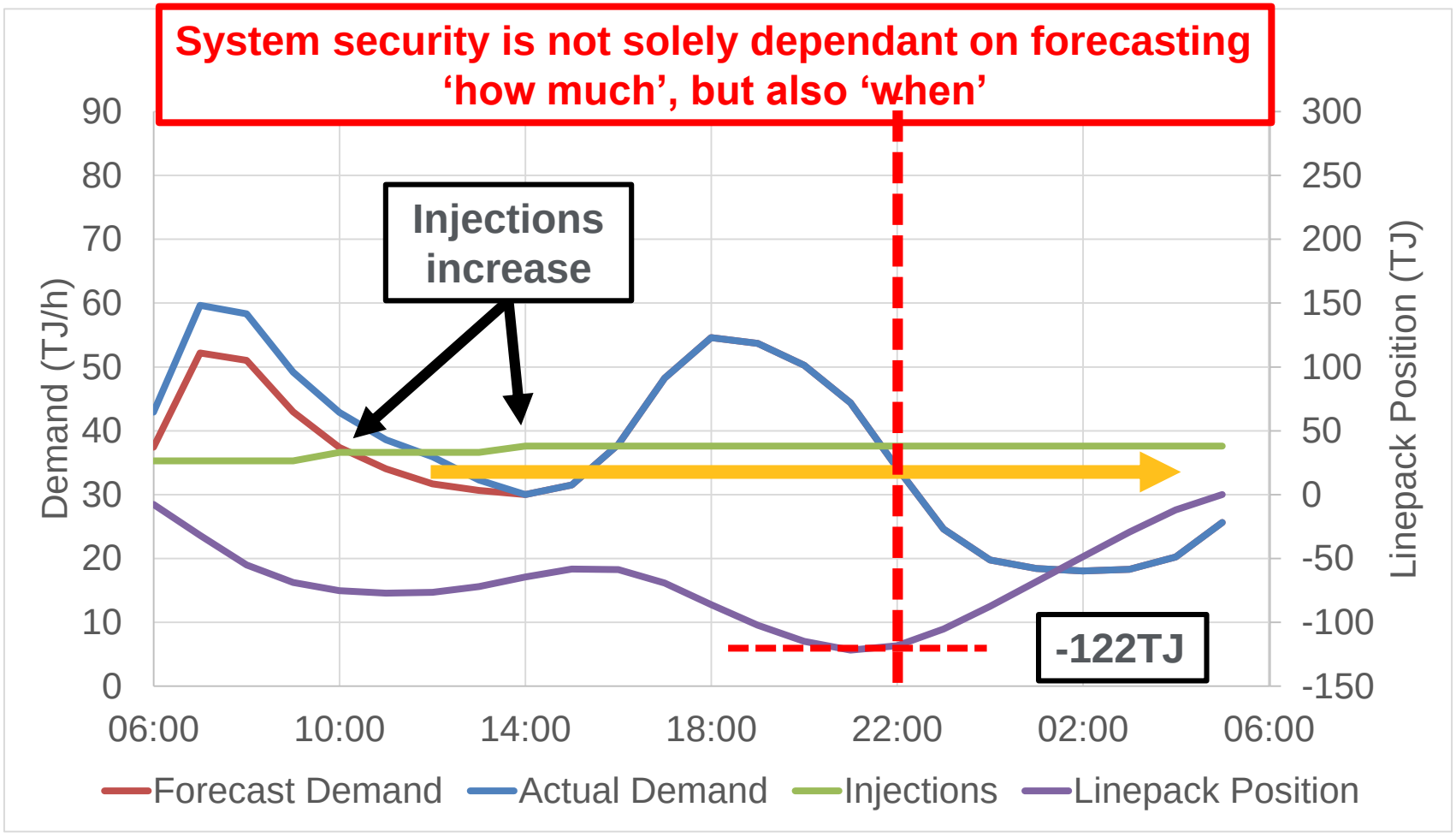
## Melbourne Winter 2015 6-9PM Average Temperature Forecast Error



# FUNDAMENTALS: DEMAND FORECAST

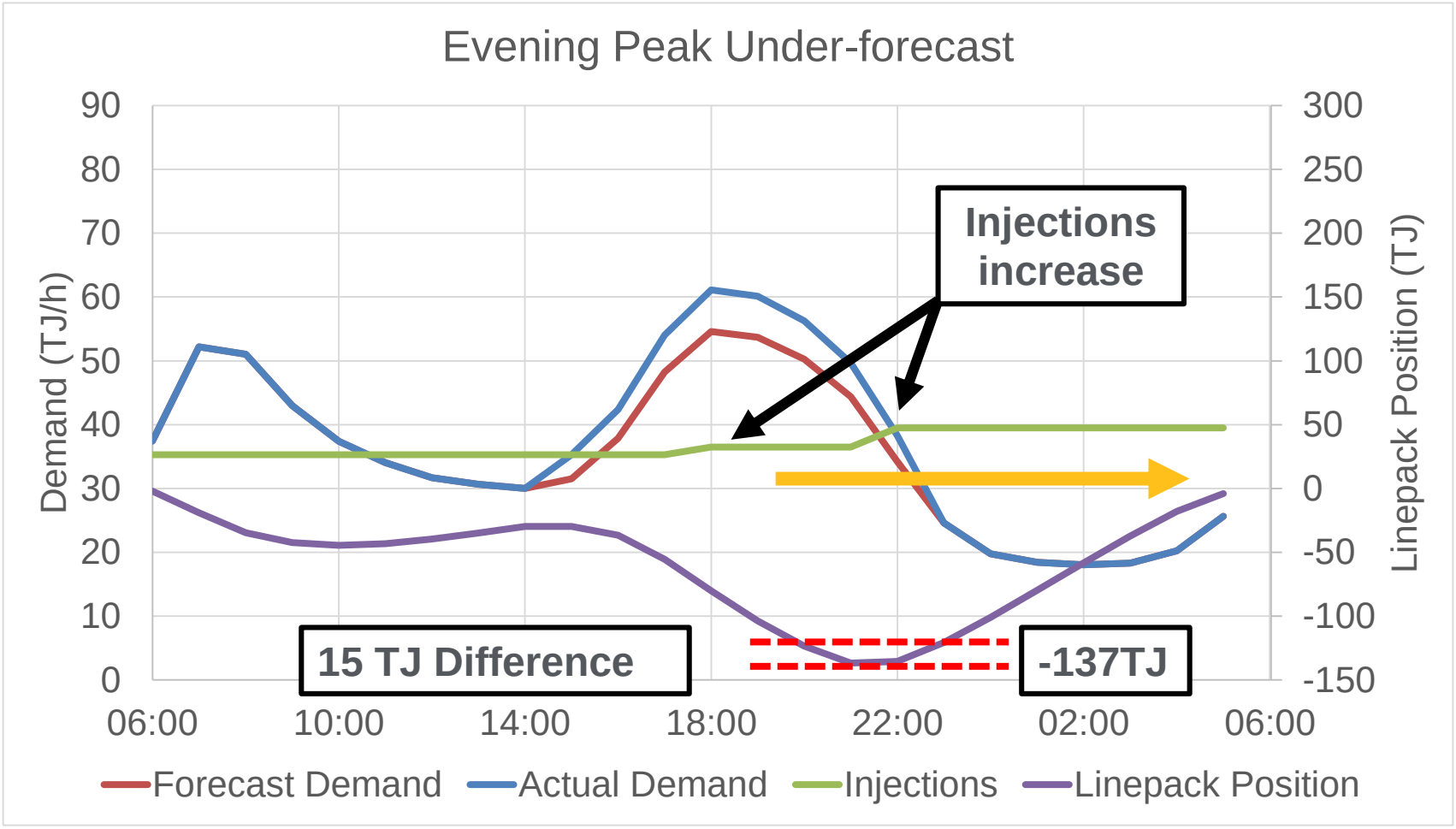


# FUNDAMENTALS: DEMAND PROFILE



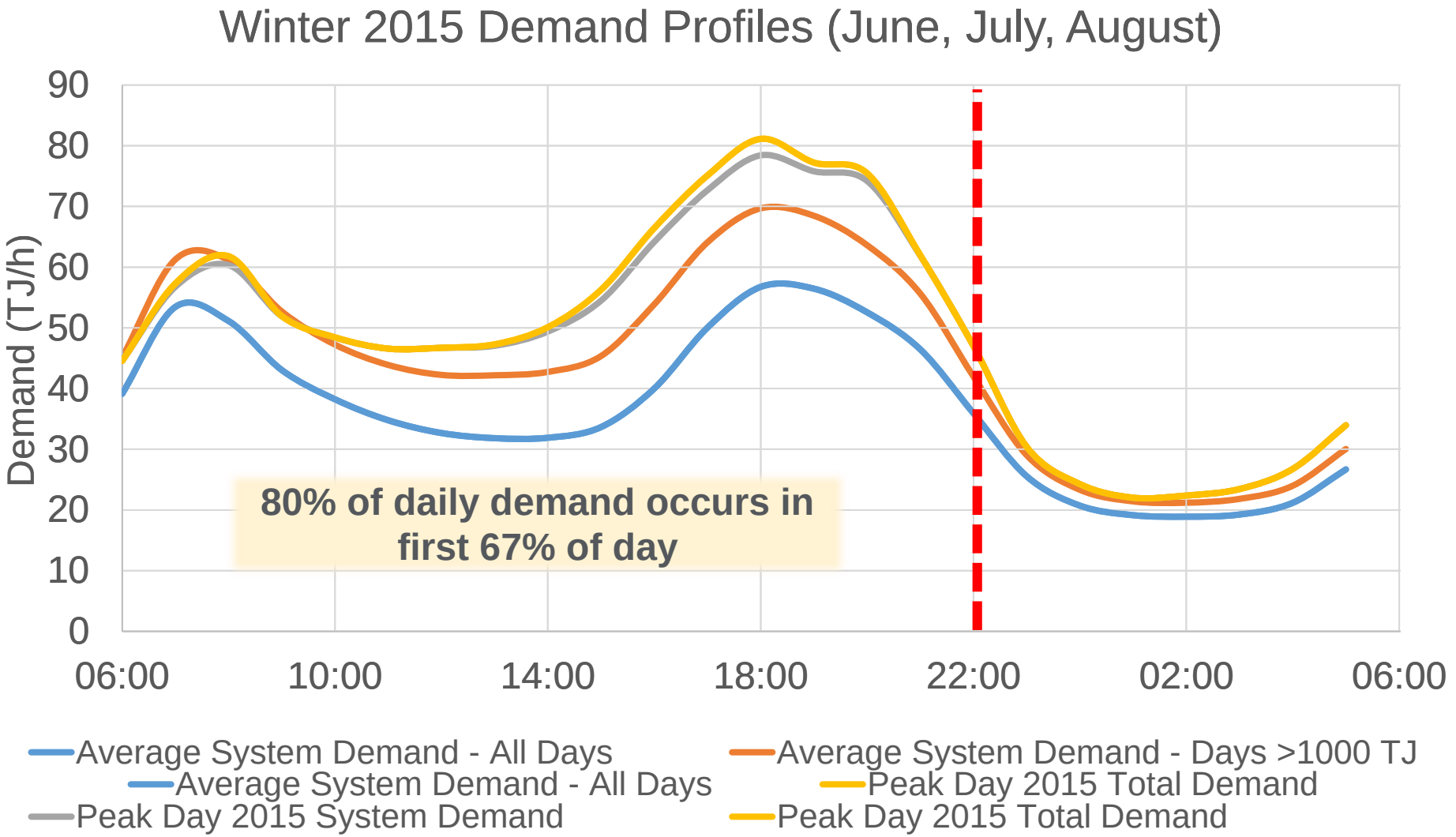

**Daily demand under-forecast by 5% - all in the morning peak**

# FUNDAMENTALS: DEMAND PROFILE

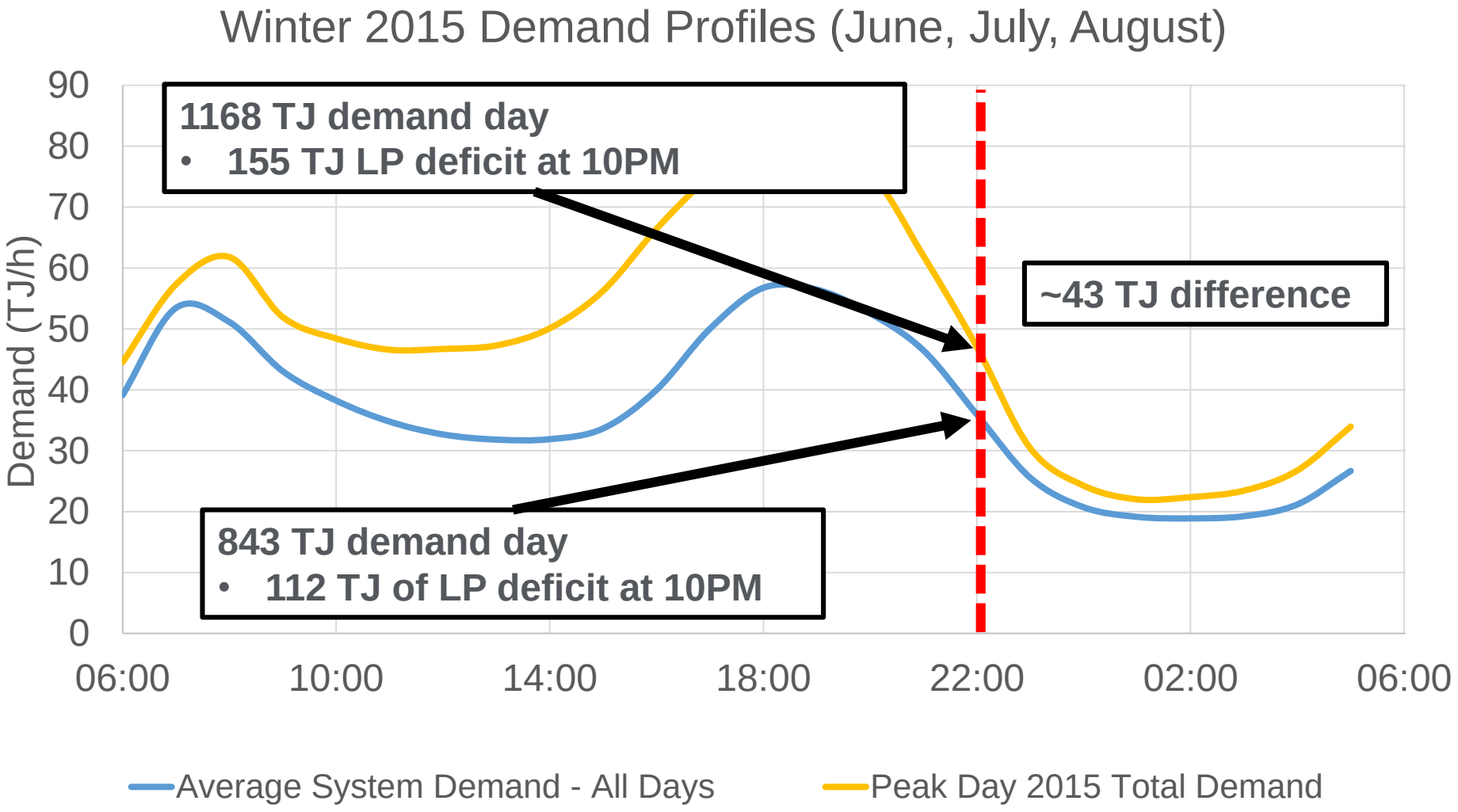


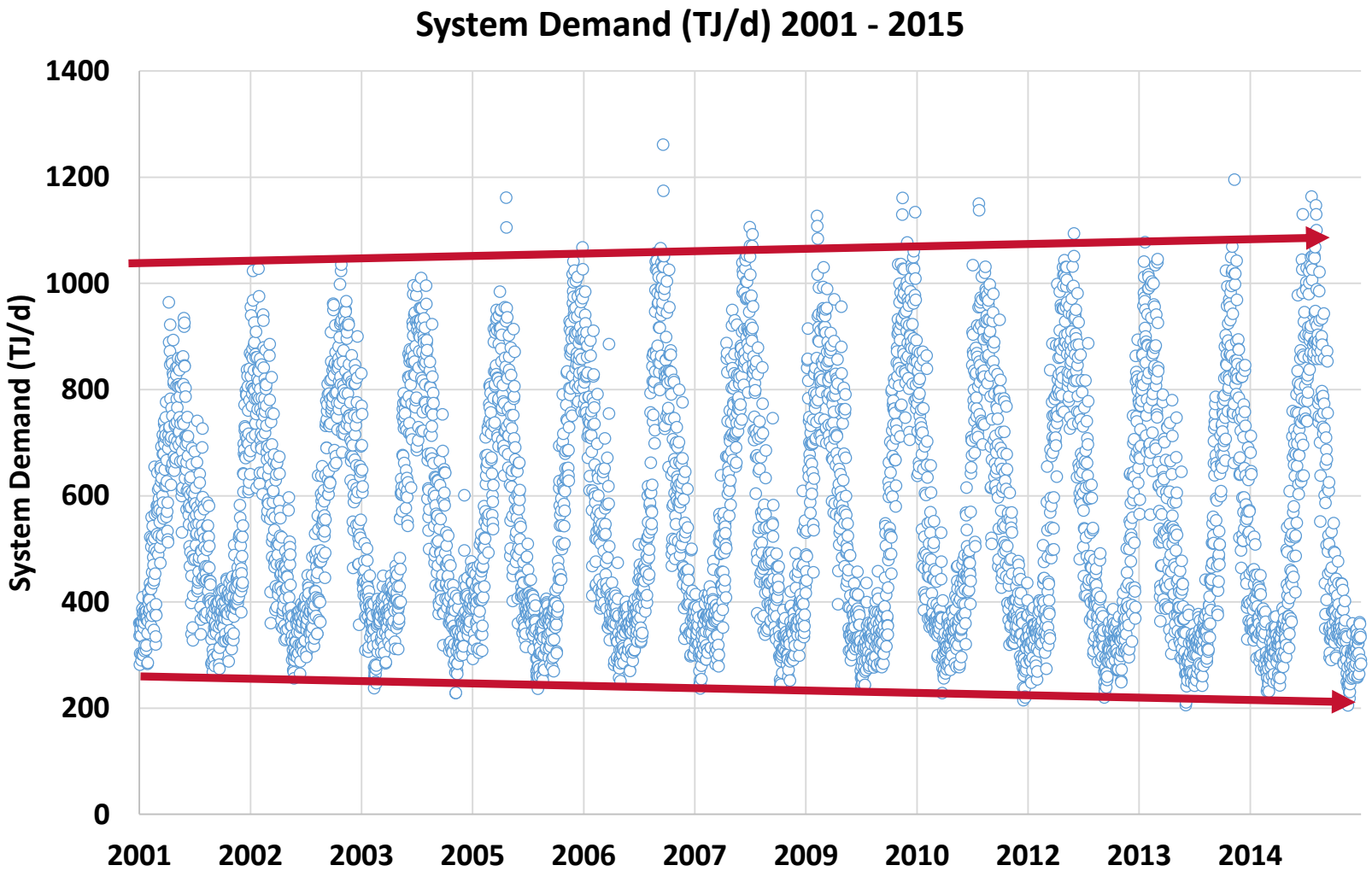

**Daily demand under-forecast by 5% - all in the evening peak**

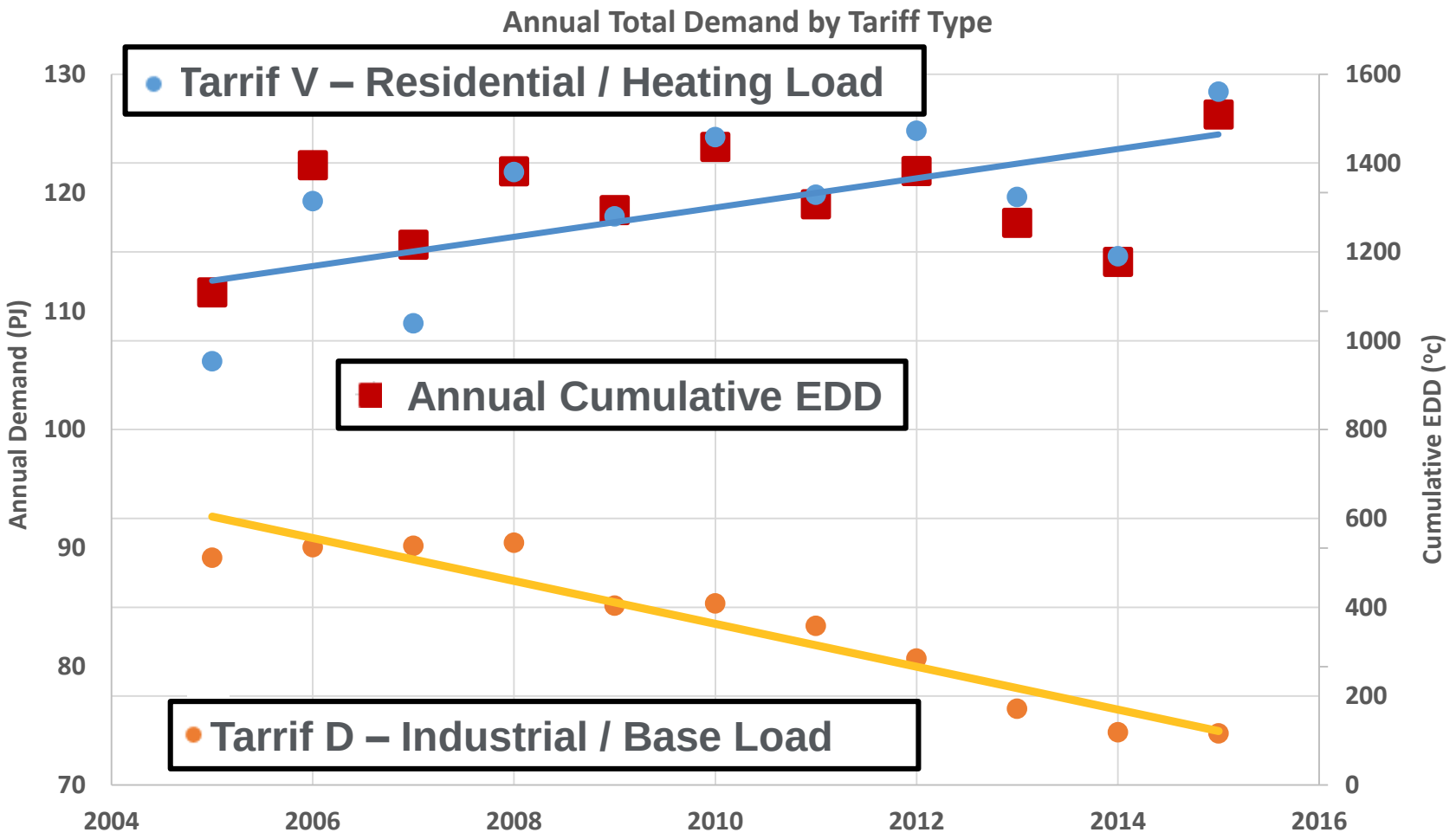
# FUNDAMENTALS: DEMAND PROFILE



# FUNDAMENTALS: DEMAND PROFILE



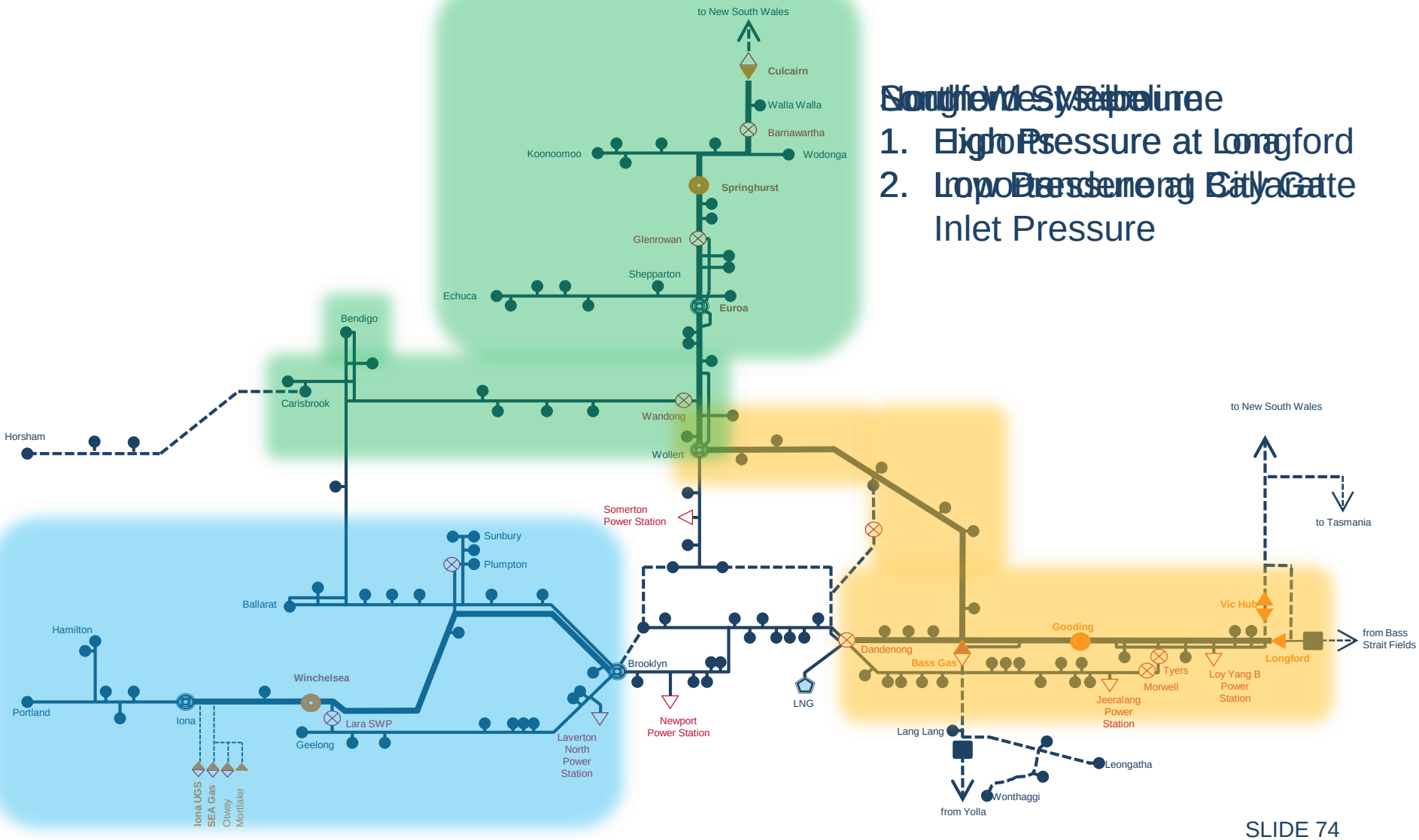

System Demand (TJ/d) 2001 - 2015
System Demand (TJ/d)
1400
1200
1000
800
600
400
200
0
2001
2002
2003
2005
2006
2007
2009
2010
2012
2013
2014


Annual Total Demand by Tariff Type
Tarrif V – Residential / Heating Load
Annual Cumulative EDD
Tarrif D – Industrial / Base Load
Annual Demand (PJ)
Cumulative EDD (°c)
130
120
110
100
90
80
70
1600
1400
1200
1000
800
600
400
200
0
2004
2006
2008
2010
2012
2014
2016

# 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

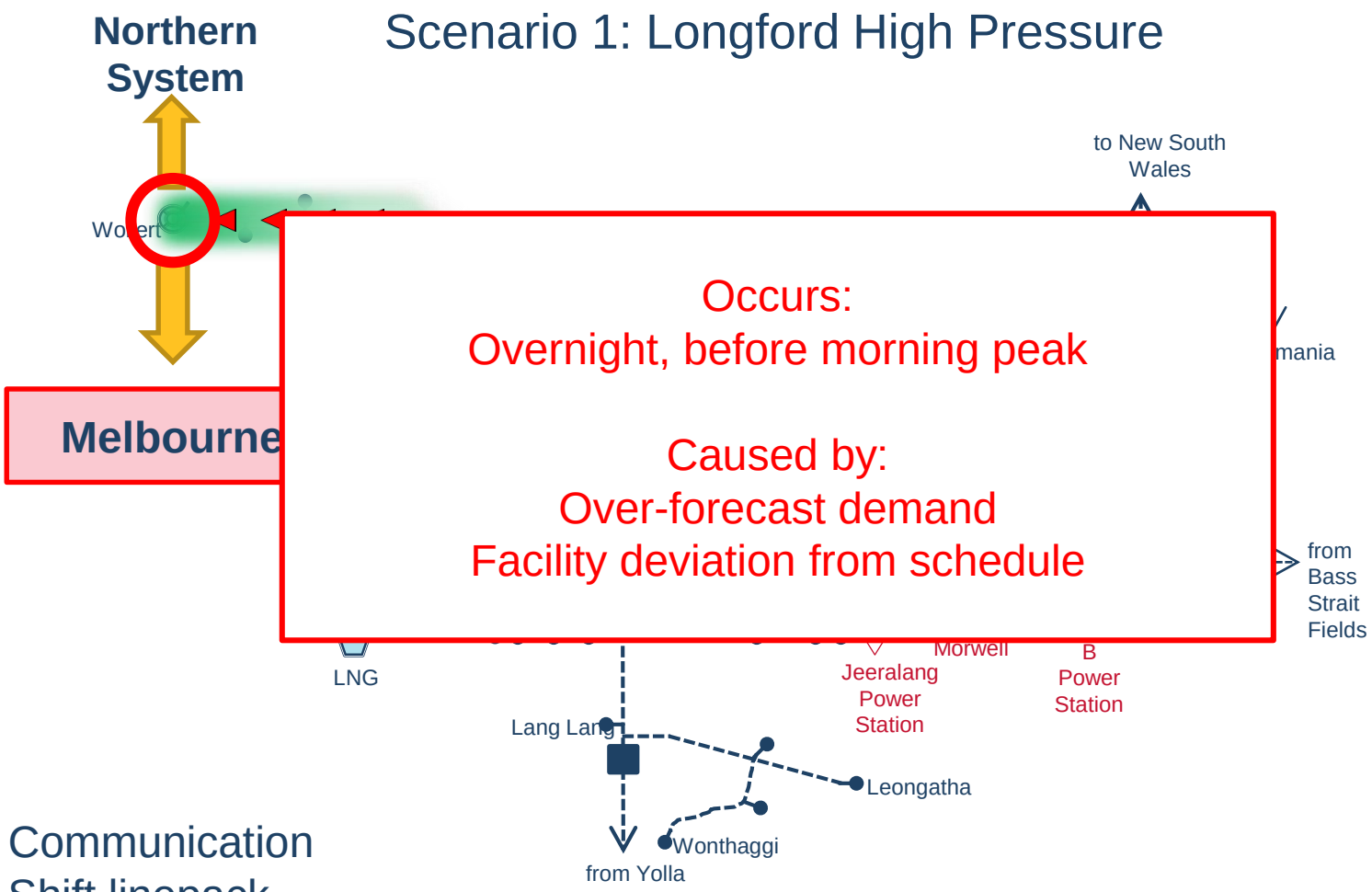
# OPERATIONAL STRATEGIES




1. [illegible]
2. [illegible]

# OPERATIONAL STRATEGIES: LONGFORD PIPELINE

## Scenario 1: Longford High Pressure



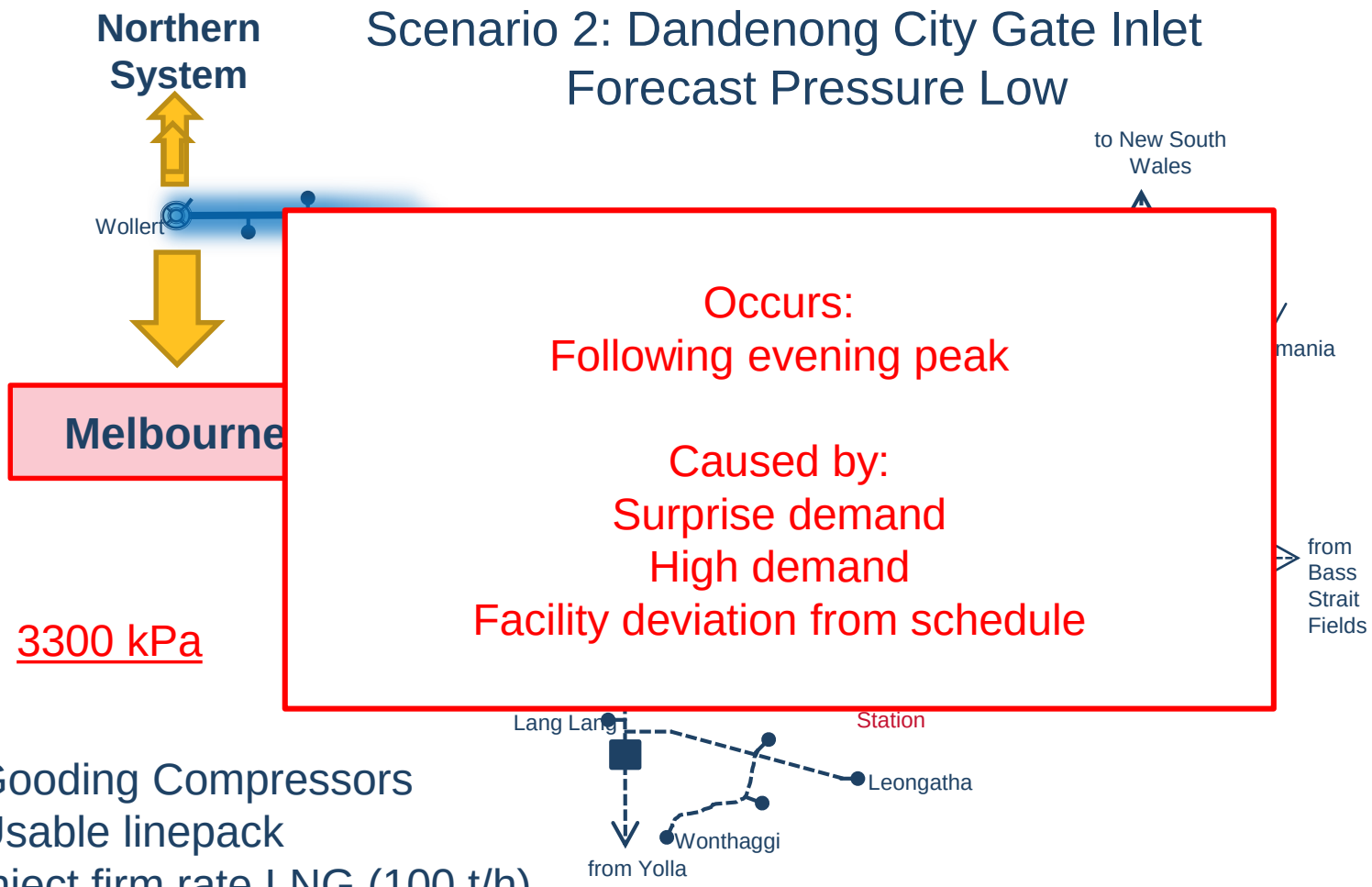

1. Communication
2. Shift linepack
3. Gooding Compressors

High Pressure

Low Pressure

# OPERATIONAL STRATEGIES: LONGFORD PIPELINE

## Scenario 2: Dandenong City Gate Inlet Forecast Pressure Low



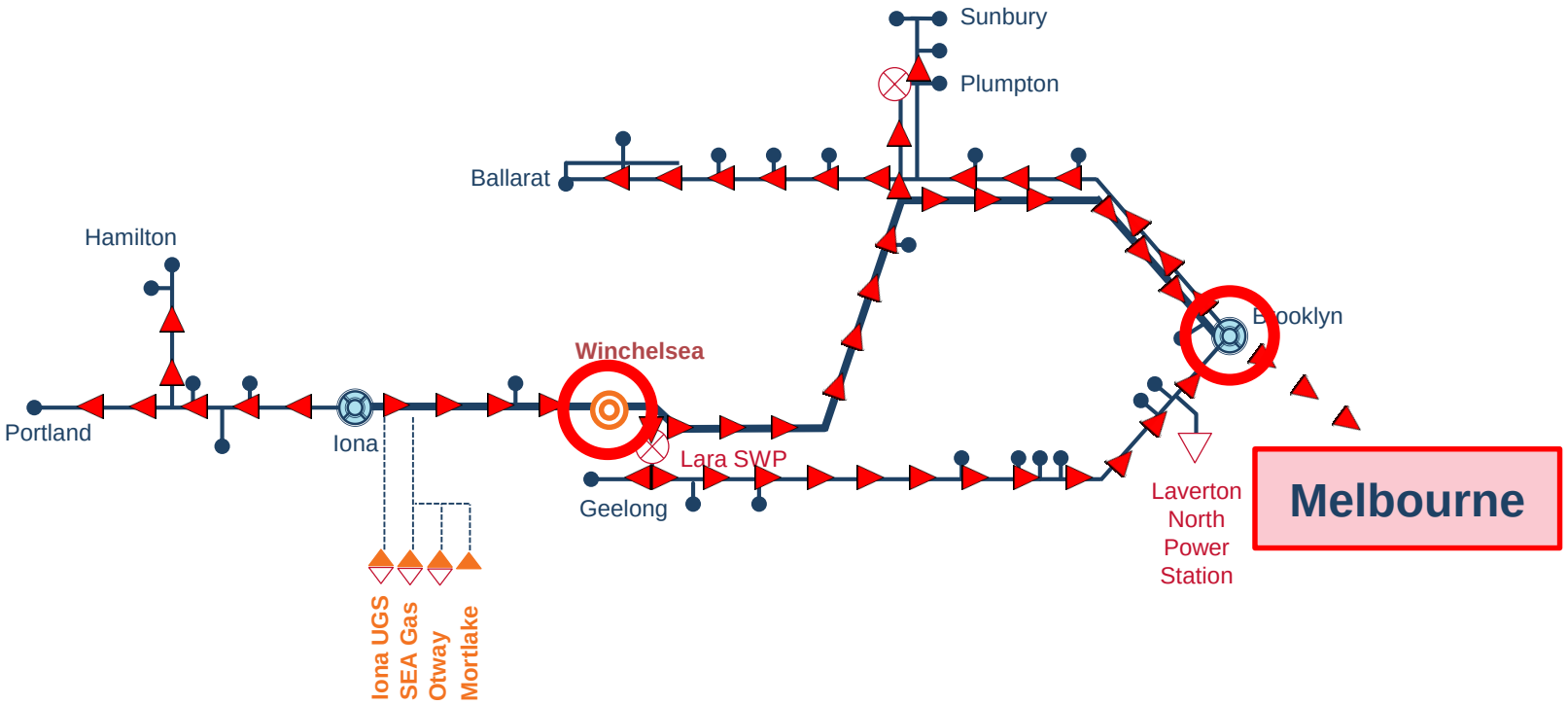

1. Gooding Compressors
2. Usable linepack
3. Inject firm rate LNG (100 t/h)
4. Reduce Wollert compression
5. Inject non-firm LNG (up to 180 t/h)

High Pressure

Low Pressure

# 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

Occurs:
Overnight, before morning peak

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

1. Shift linepack
2. Winchelsea Compressor

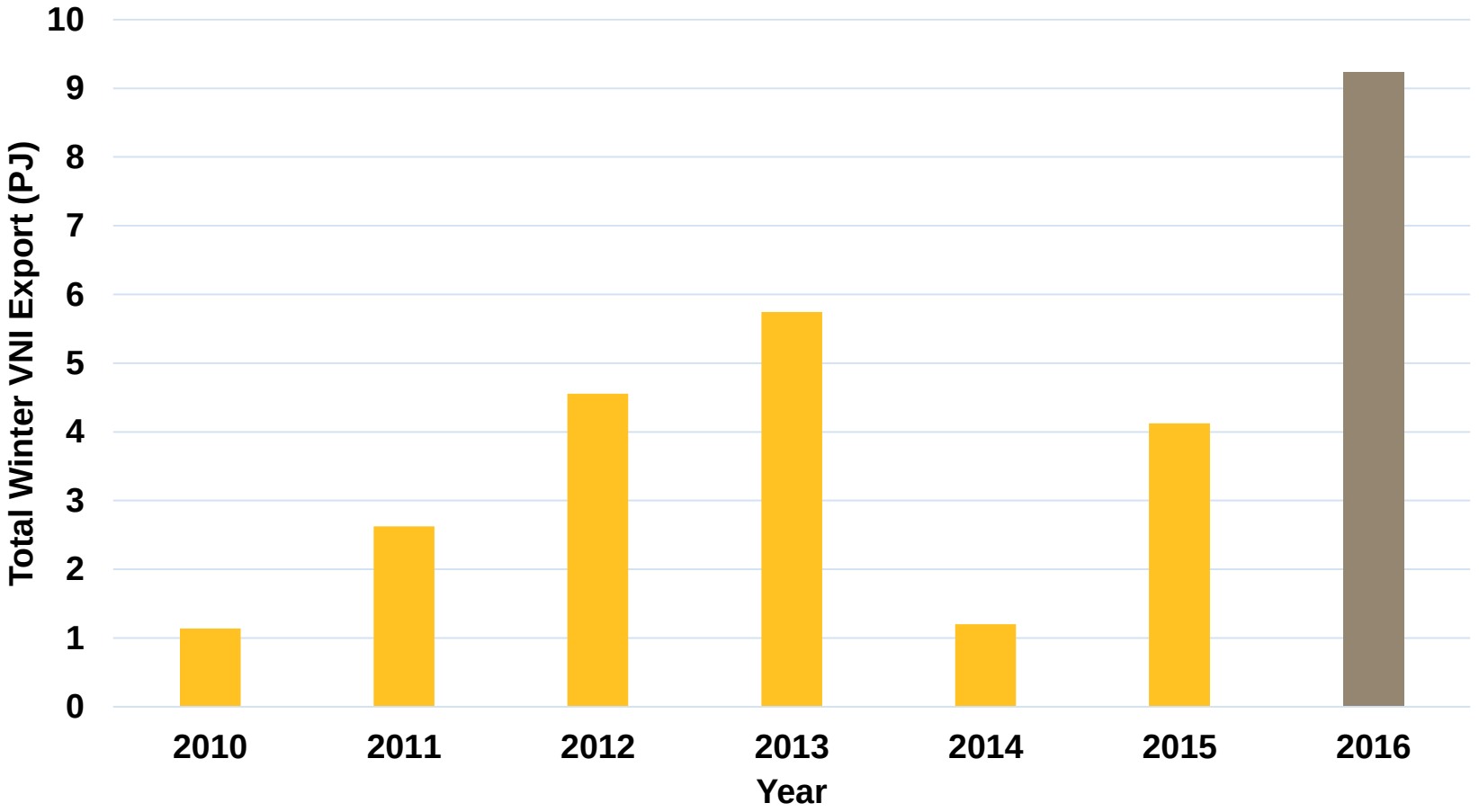
1. Brooklyn Compressor

High Pressure

Low Pressure

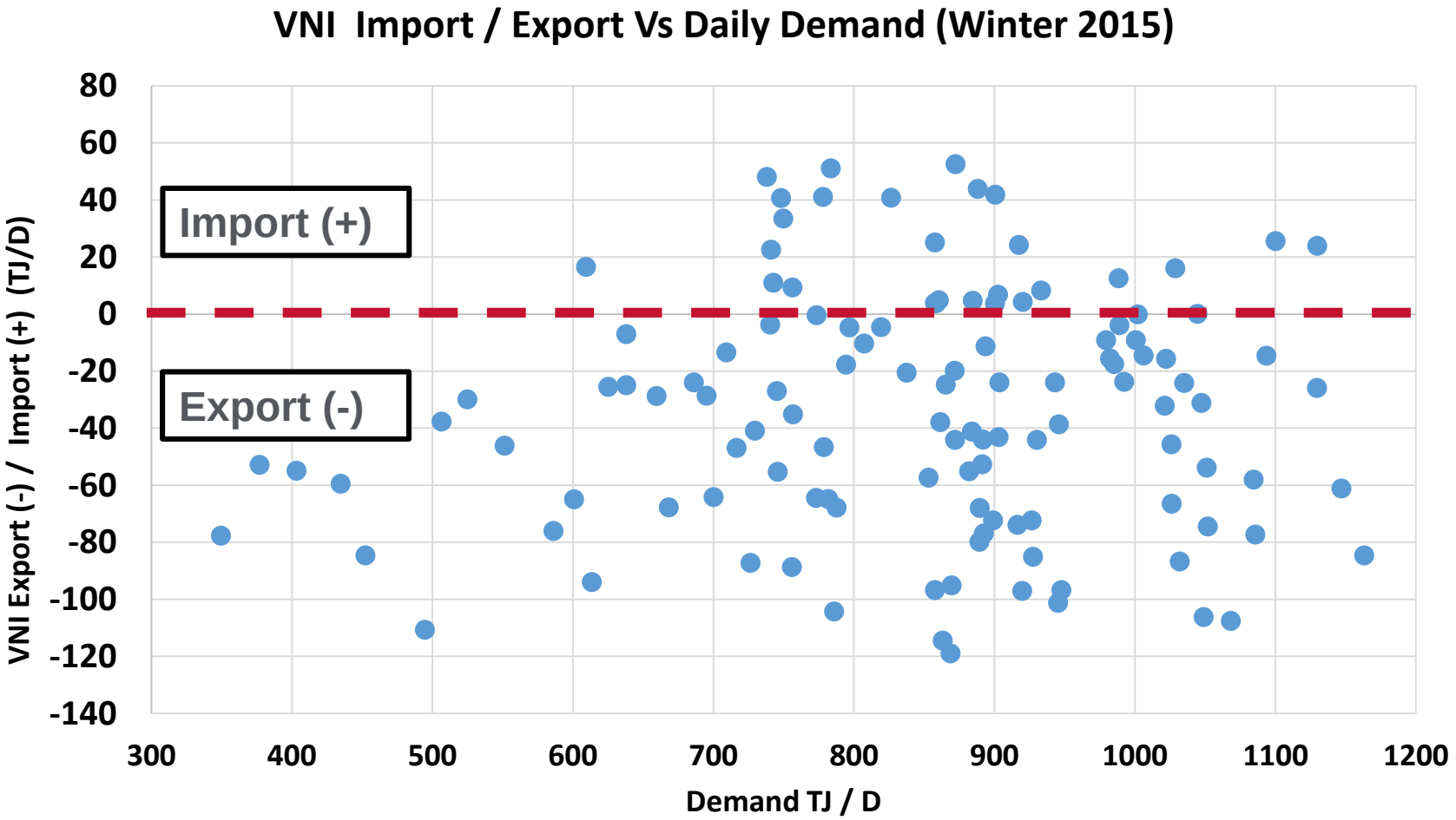
# OPERATIONAL STRATEGIES: NORTHERN PIPELINE

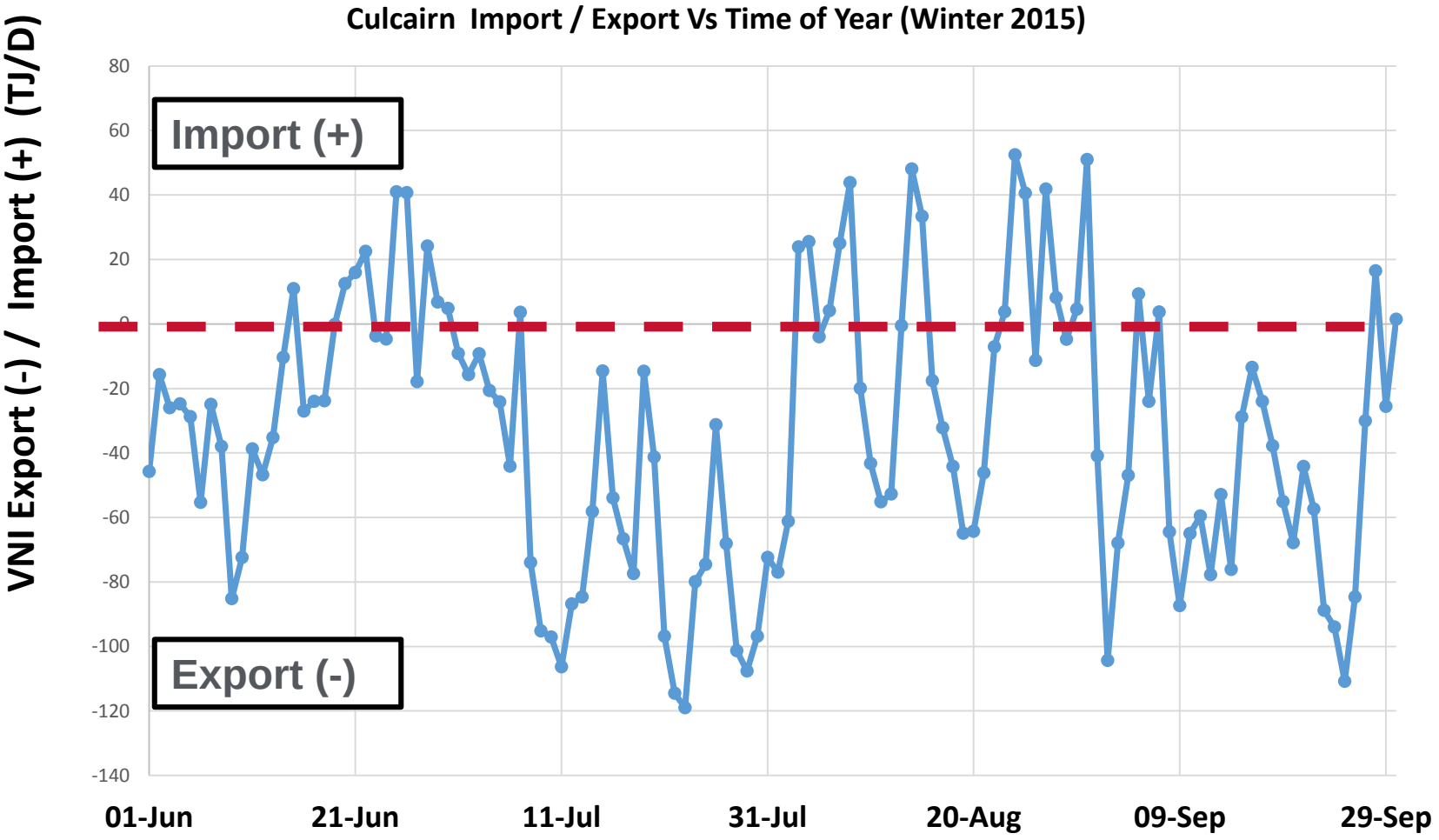
- Exports forecasted to increase in 2016*
- Highly dependant on markets outside Victorian Declared Wholesale Gas Market



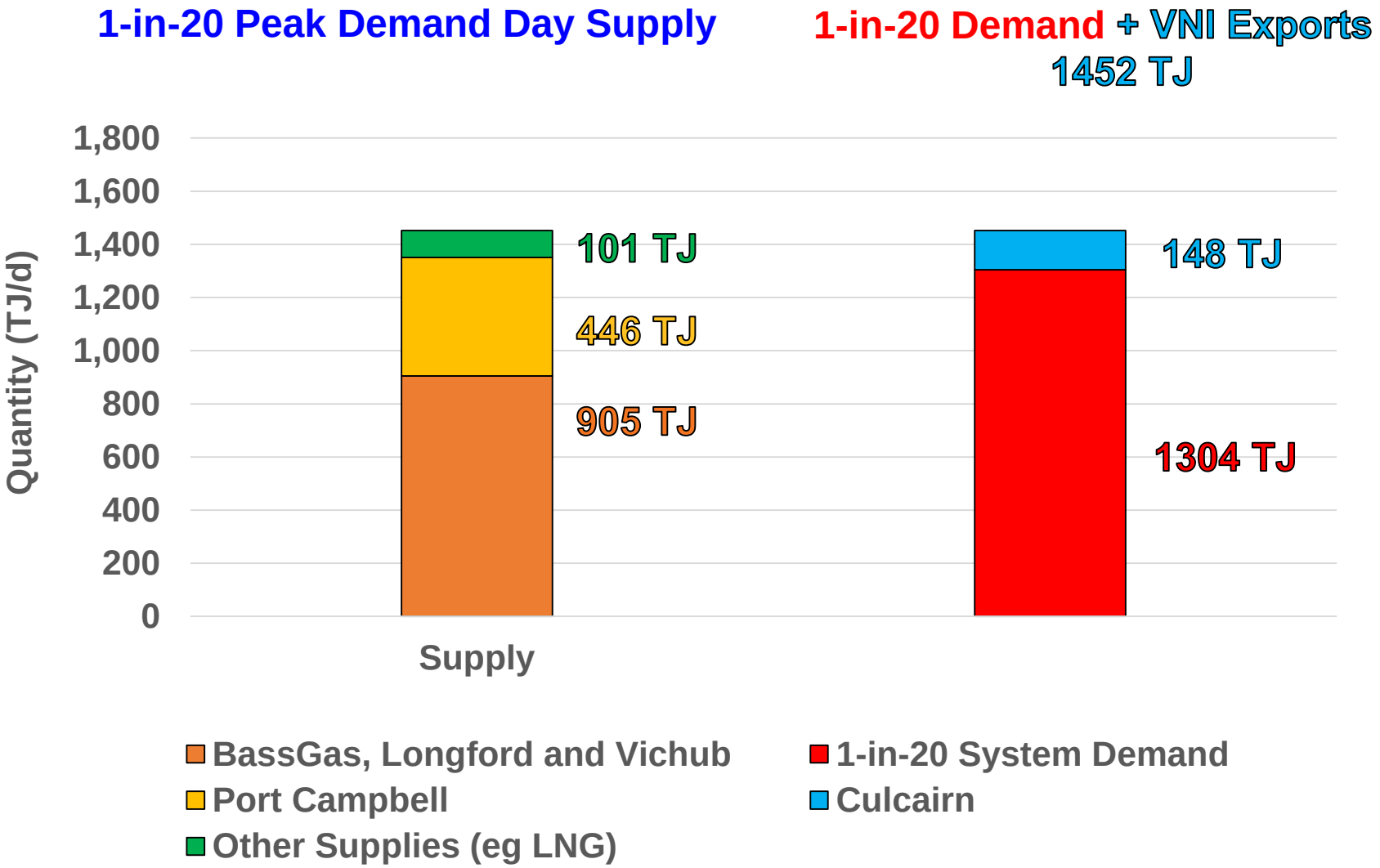

* 2016 - Gas Statement of Opportunities

# OPERATIONAL STRATEGIES: NORTHERN PIPELINE




Culcairn Import / Export Vs Time of Year (Winter 2015)
VNI Export (-) / Import (+) (TJ/D)
Import (+)
Export (-)
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
01-Jun
21-Jun
11-Jul
31-Jul
20-Aug
09-Sep
29-Sep

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



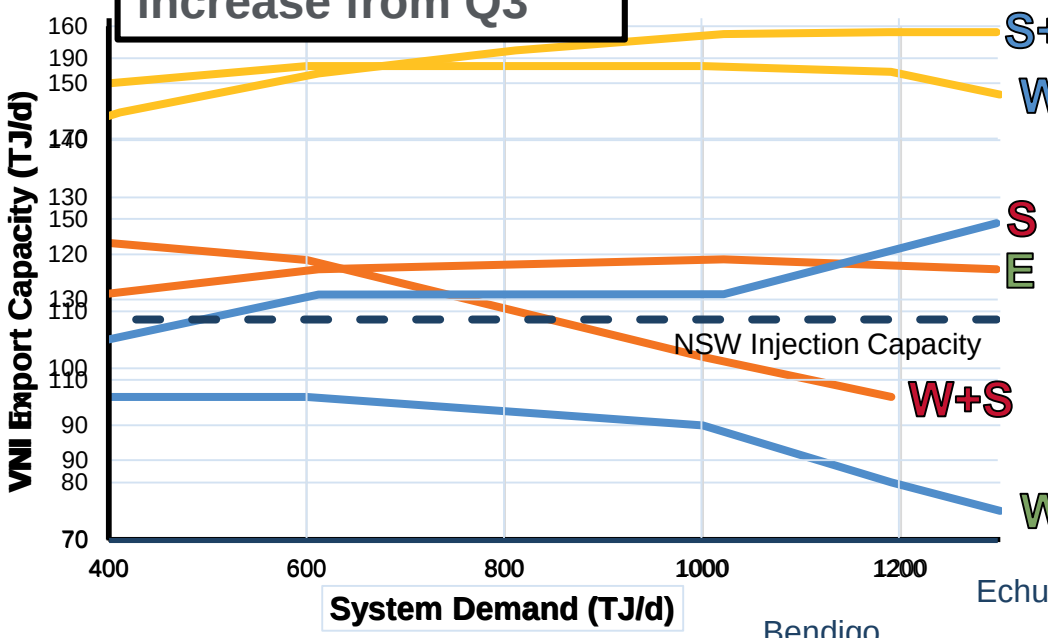
- Sufficient Victorian gas supply capacity to support 148 TJ/d on a 1-in-20 system demand day.

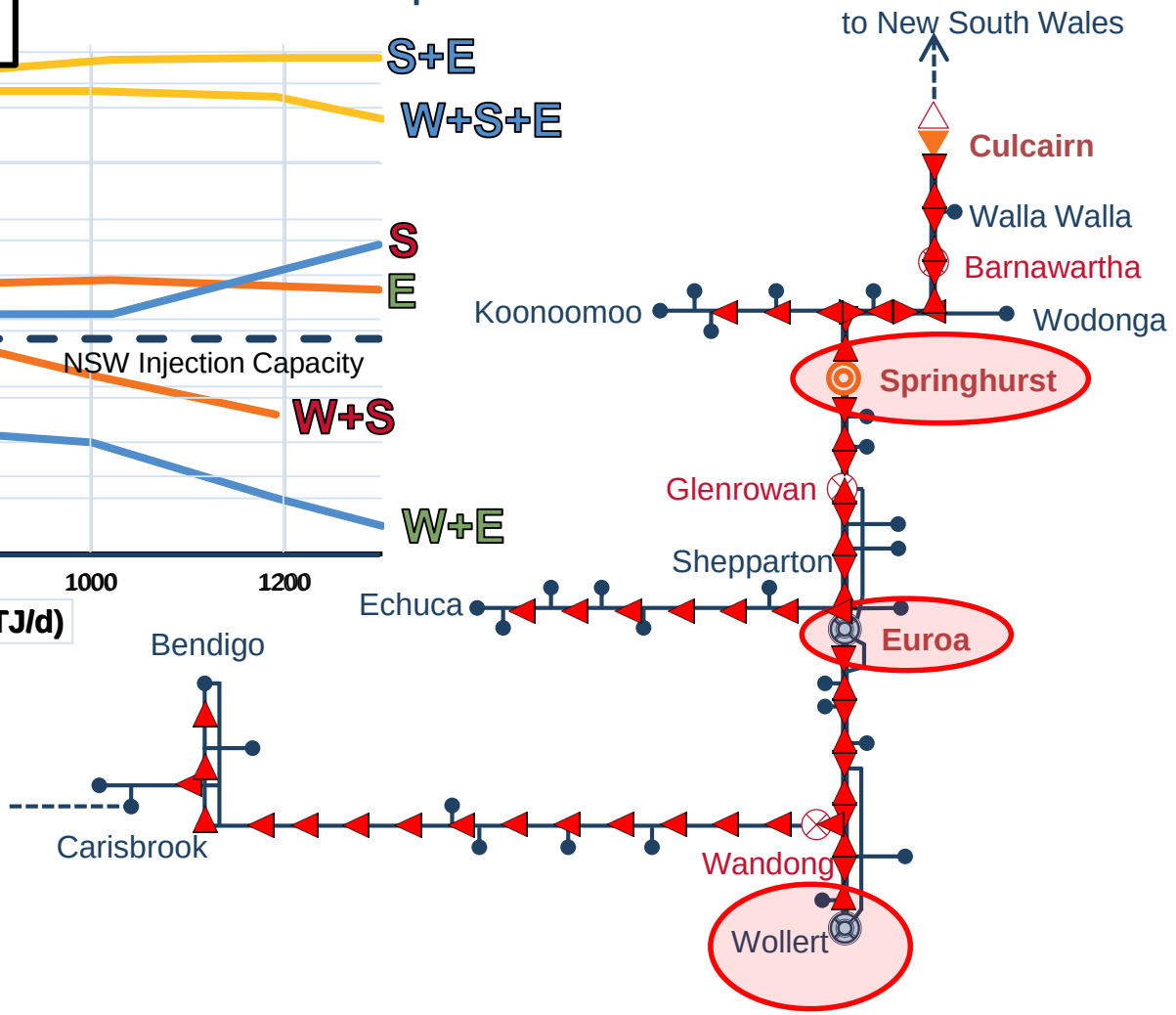
- LMP and the SWP flowing at maximum expected capacity, LNG injections are also required.

# OPERATIONAL STRATEGIES: NORTHERN PIPELINE

**Export capacity increase from Q3**

## Scenario 2: Imports



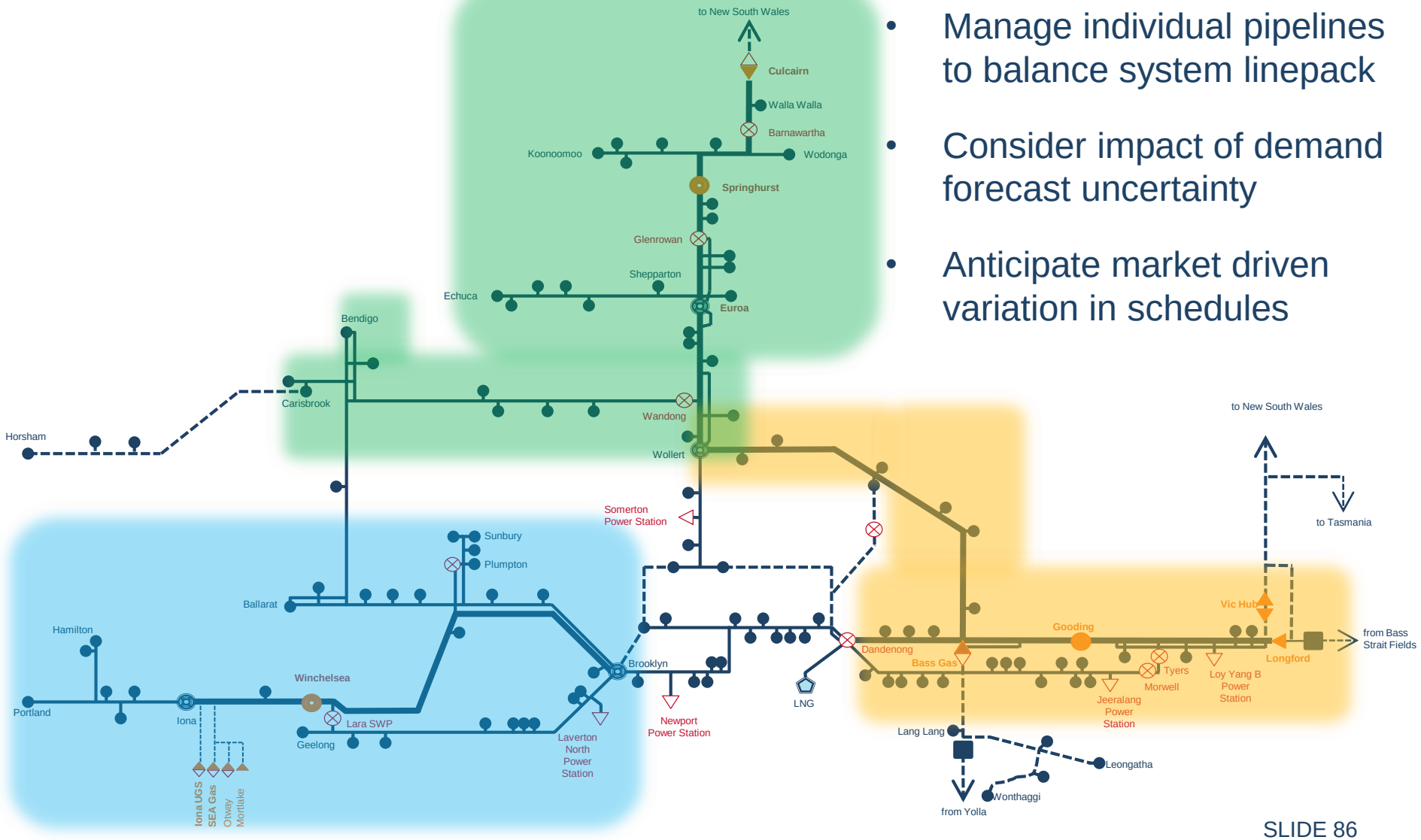




**Sudden changes in flow and direction may be limited by system conditions**

# NORTHERN STRATEGY SUMMARY

- 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*

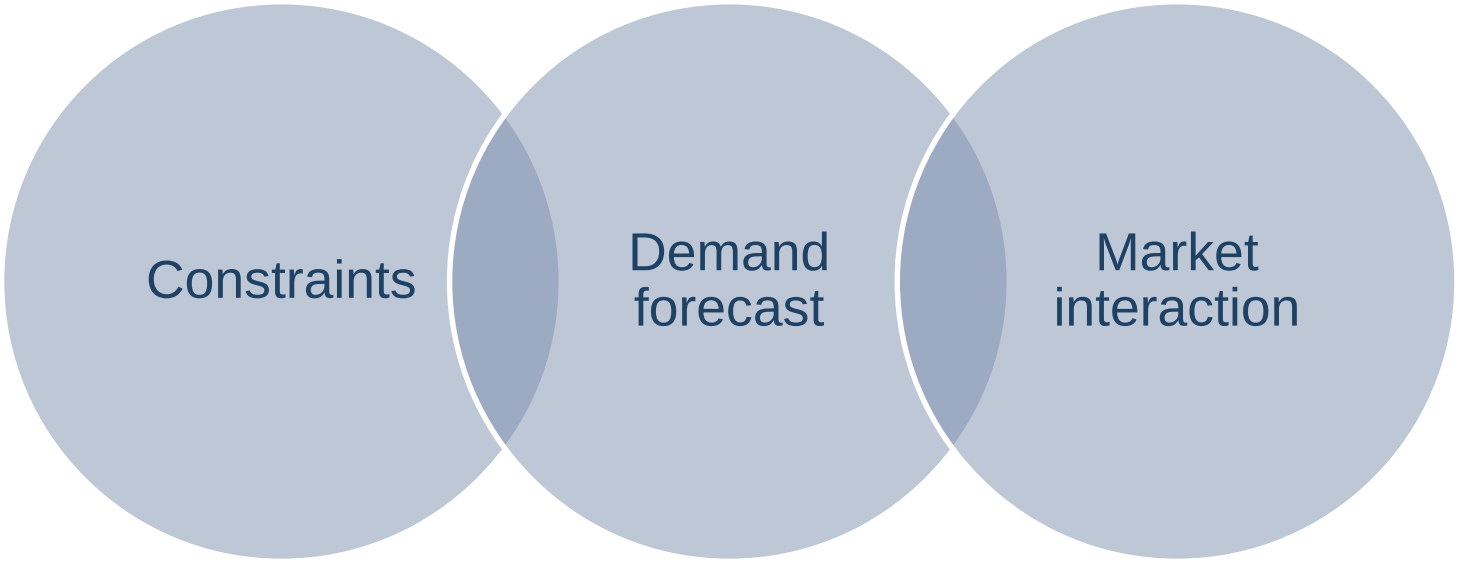

What my friends think I do


What I think I do

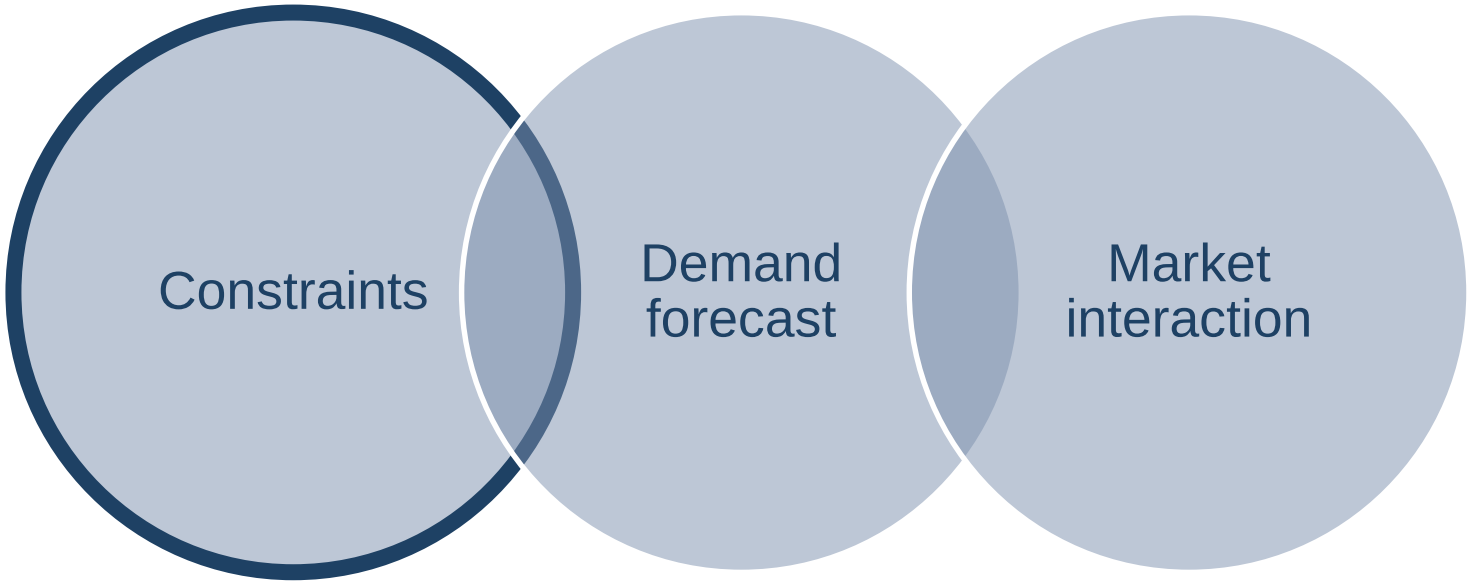

SWN
What participants think we do

# MARKET OPERATIONS

# MARKET OPERATIONS




# CONSTRAINTS




# CONSTRAINTS

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

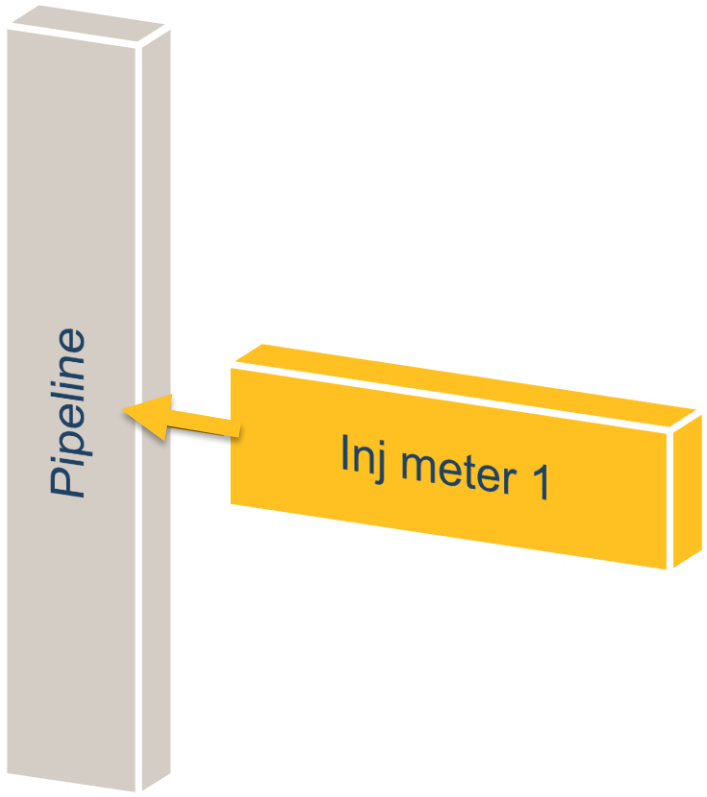
# CONSTRAINTS

**Supply Demand point Constraint (SDPC)**

**DFPC**

**NFTC**

**SSC**



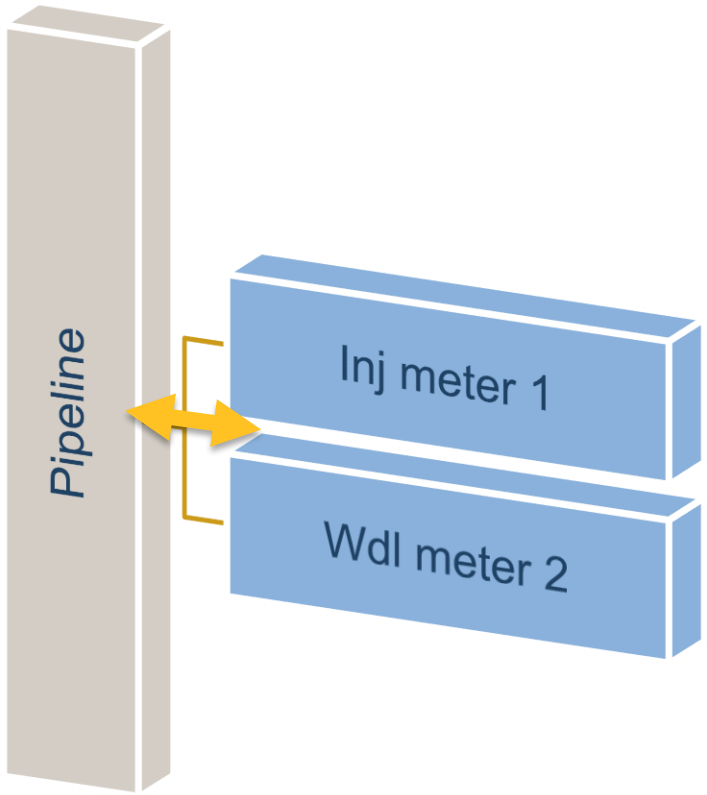
# CONSTRAINTS

**SDPC**

**Directional Flow Point Constraint (DFPC)**

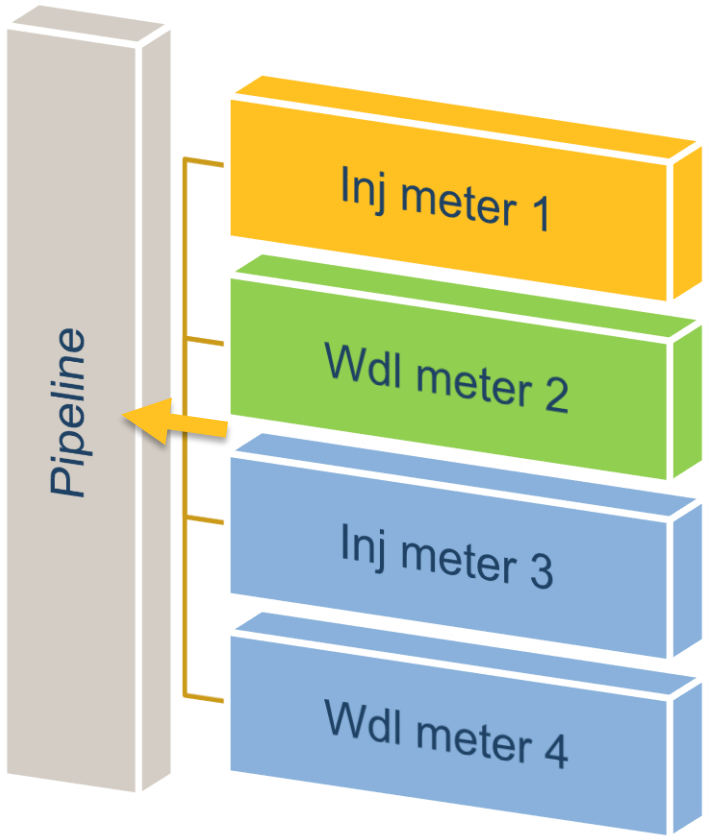
**NFTC**

**SSC**



# CONSTRAINTS

- **SDPC**
- **DFPC**
- **Net Flow Transportation Constraint (NFTC)**
- **SSC**



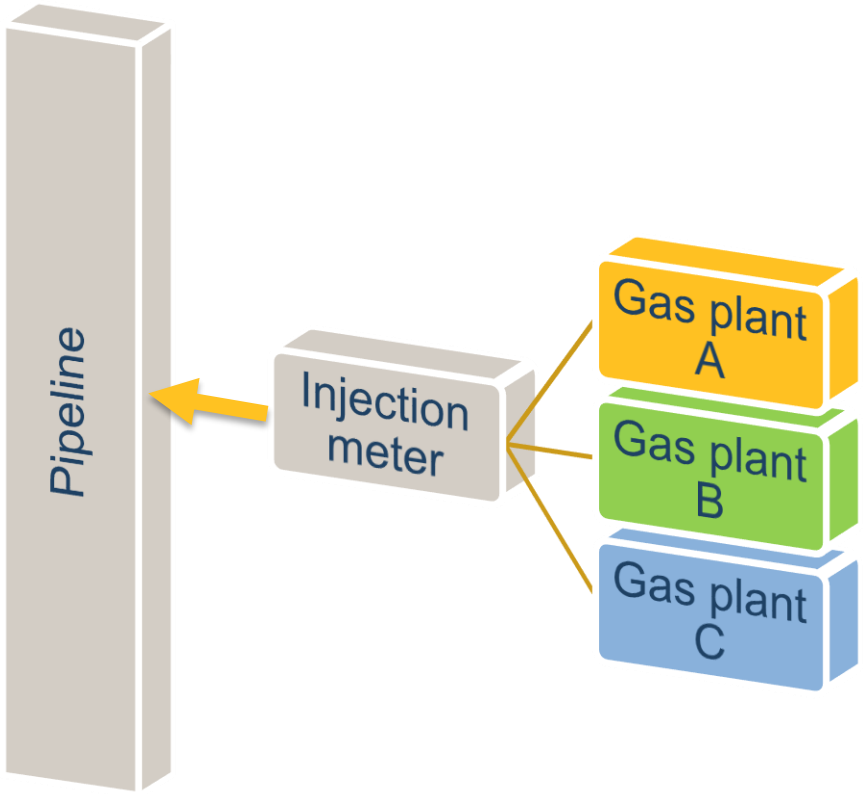
# CONSTRAINTS

**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** |

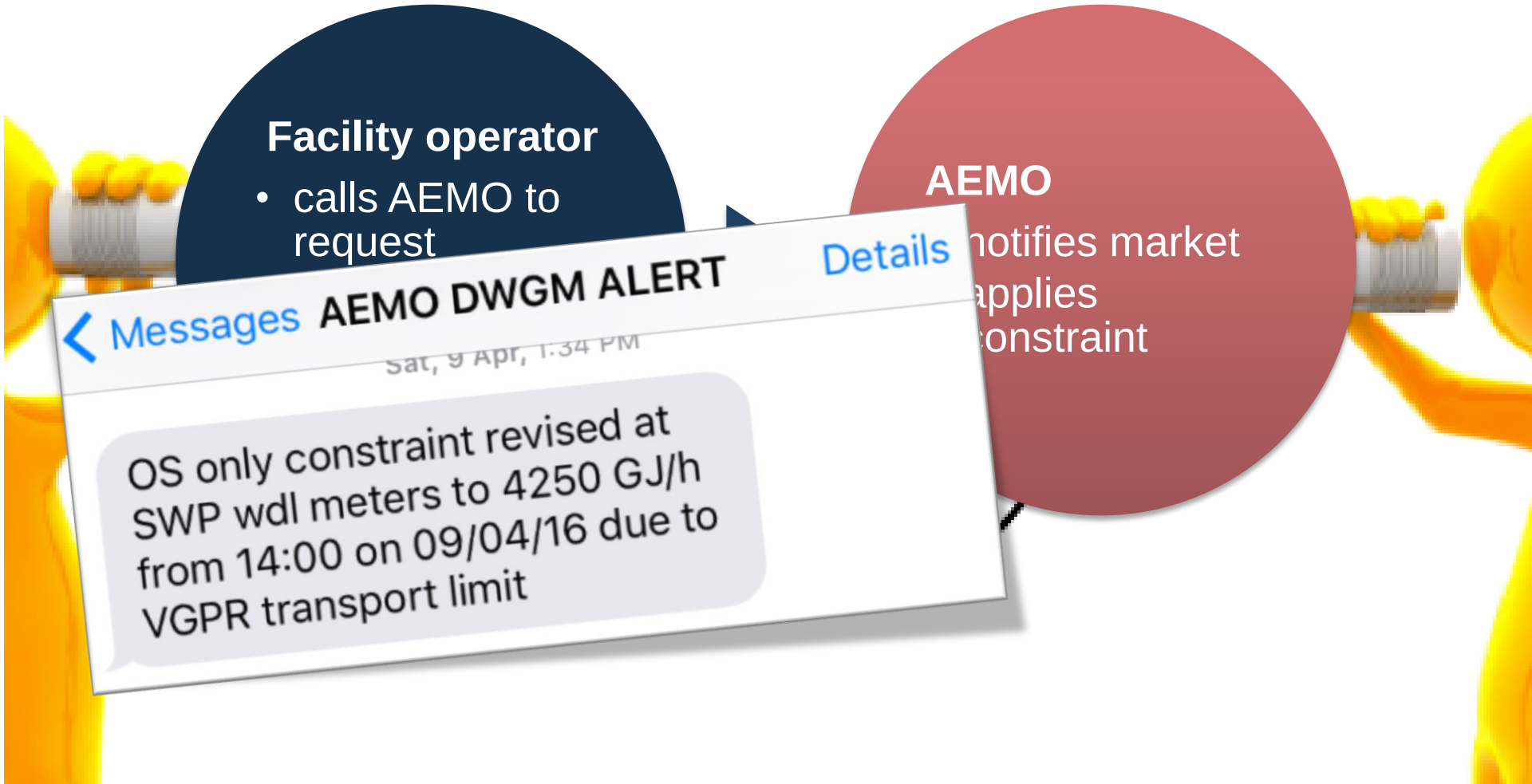
# CONSTRAINTS – EXAMPLE 3

- **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 |

# COMMUNICATION - CONSTRAINTS

## Constraint application

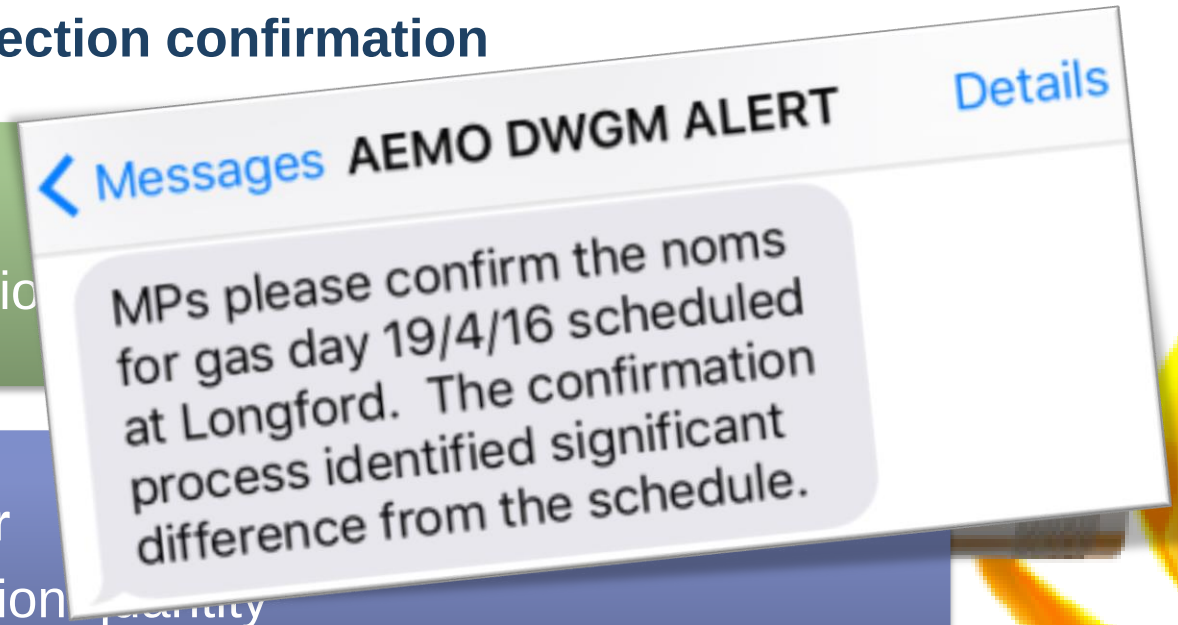


# COMMUNICATION - CONSTRAINTS

## Operating Schedule injection confirmation

**AEMO**

- Sends OS confirmatio




**Facility operator**

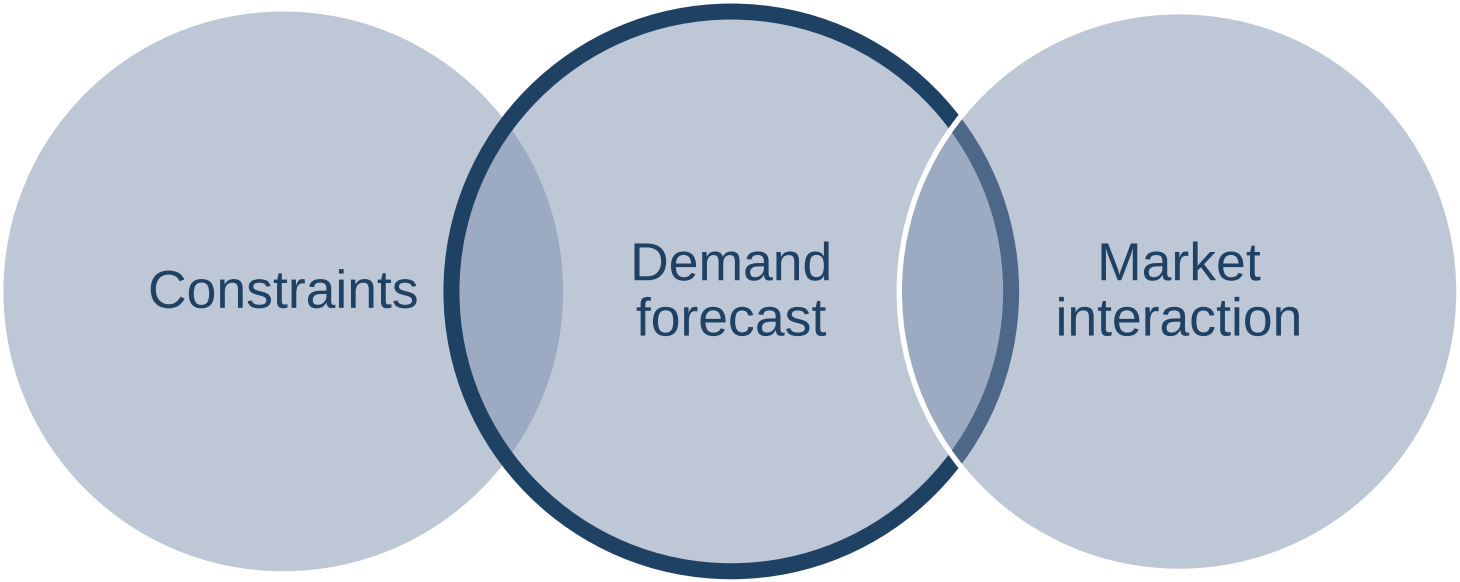
- Confirms injection

**AEMO**

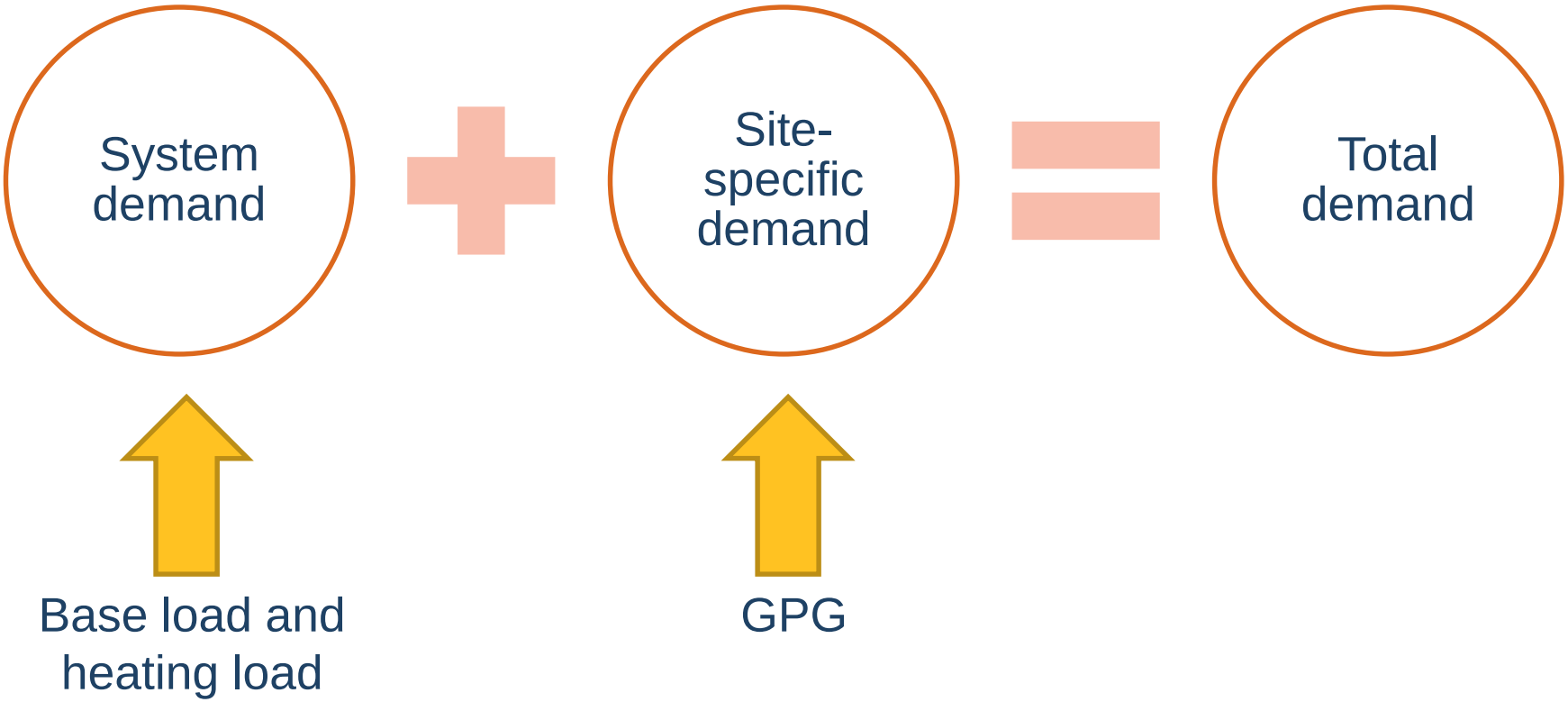
- Notifies market if confirmed quantity and scheduled quantity difference is too large


YEAH... IF YOU COULD START CONFIRMING
YOUR OS QUANTITIES
THAT'D BE GREAT

# DEMAND FORECAST

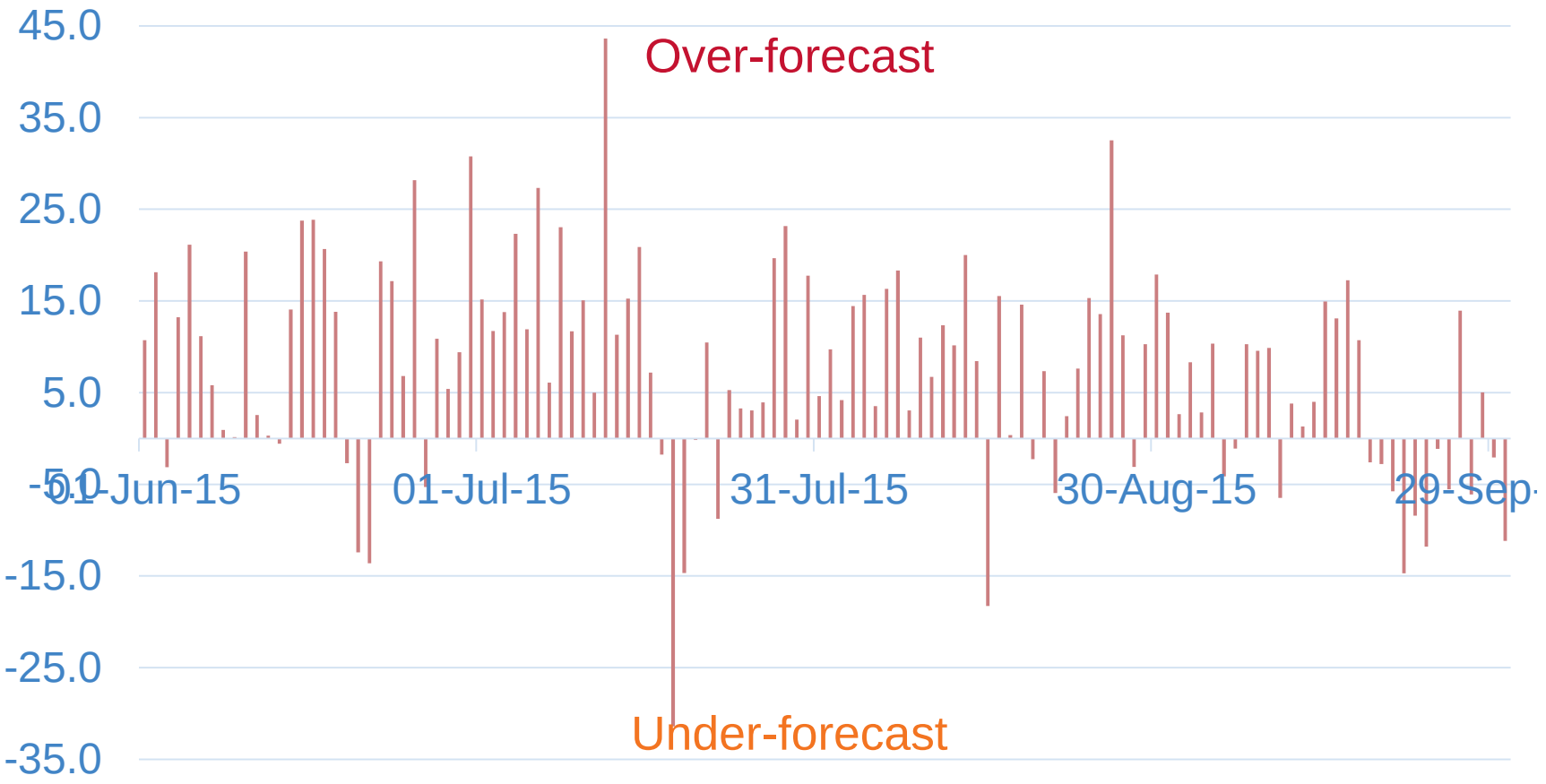



# DEMAND FORECAST



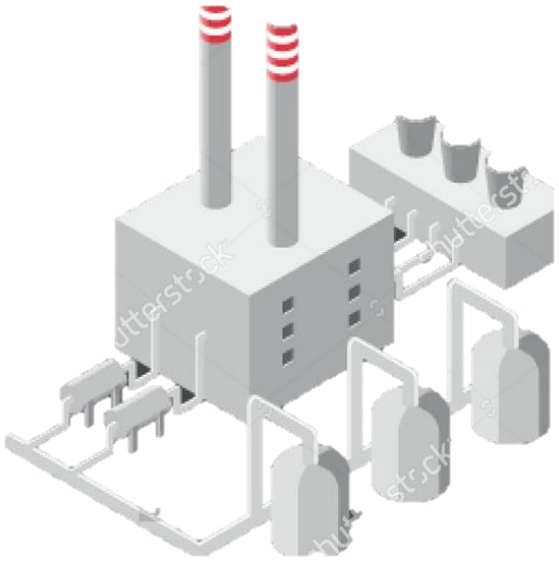
# DEMAND FORECAST MANAGEMENT

Differences between market participants' forecast and actual demand in winter 2015 (TJ) at 10pm



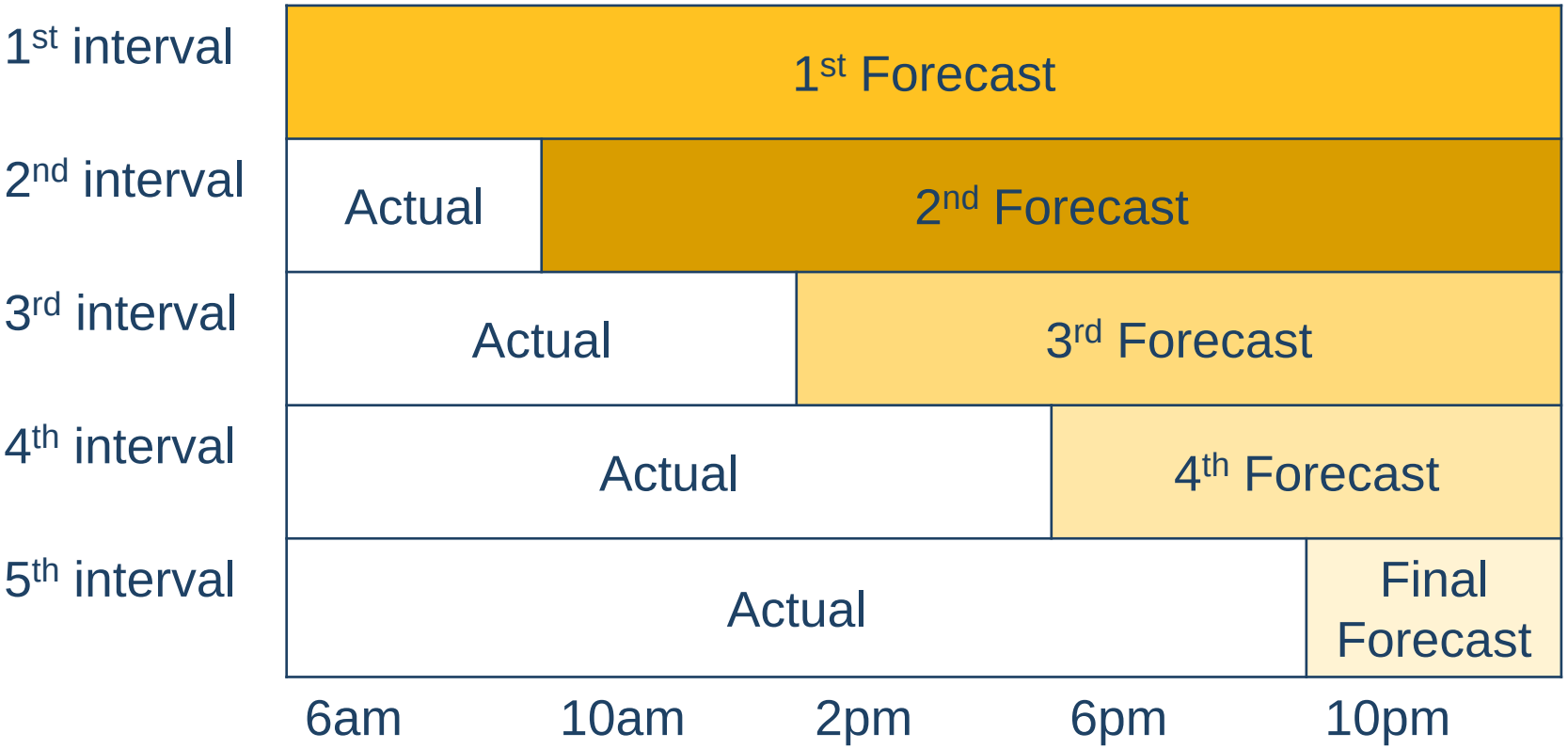
# DEMAND FORECAST MANAGEMENT

## Forecast uncertainties:



- Intraday scheduling
- End of Day linepack target

# INTRADAY SCHEDULES



# SCHEDULING INPUTS

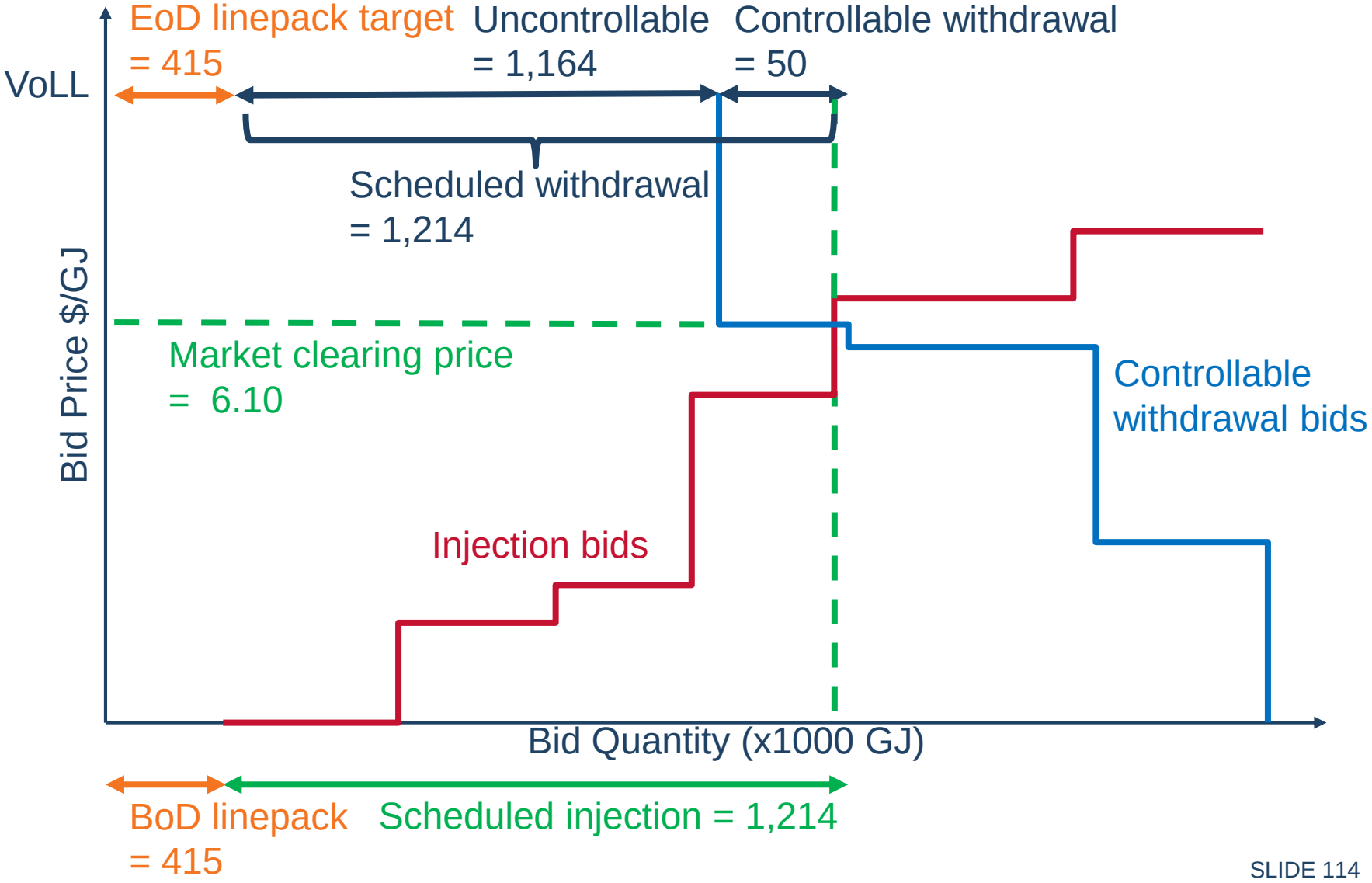
**Market participants**

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

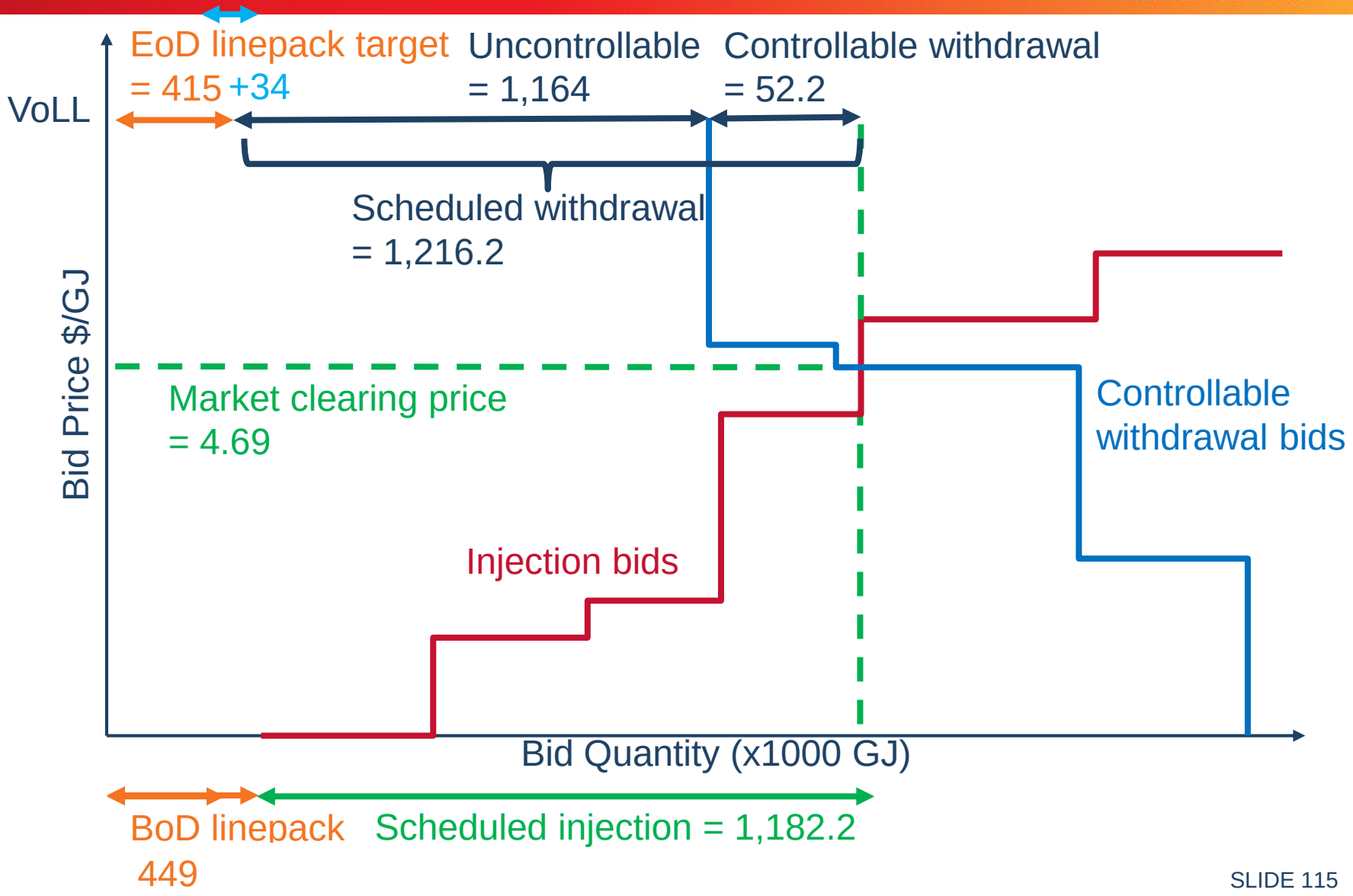
**AEMO**

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

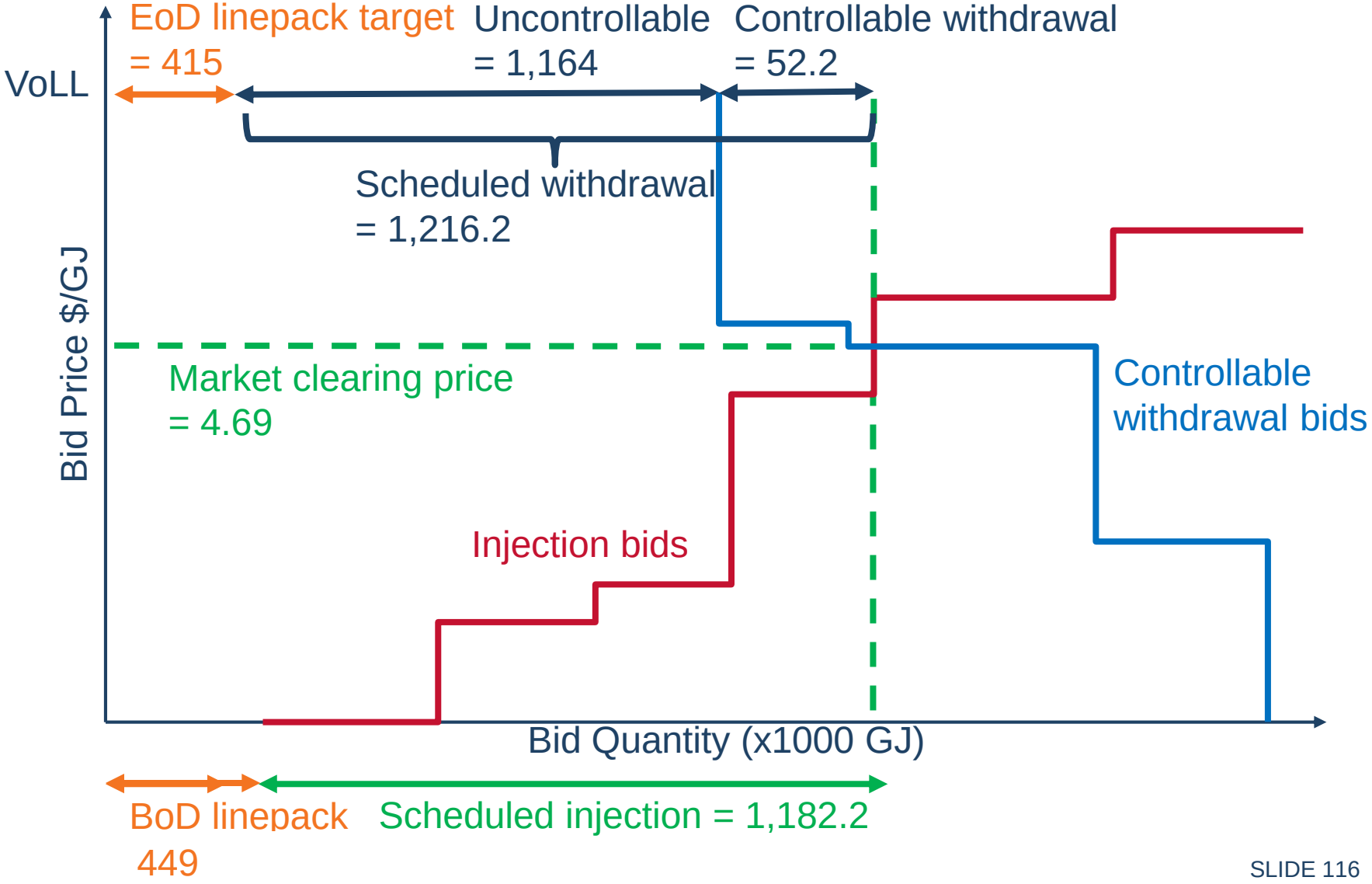
# BID STACK – 6AM



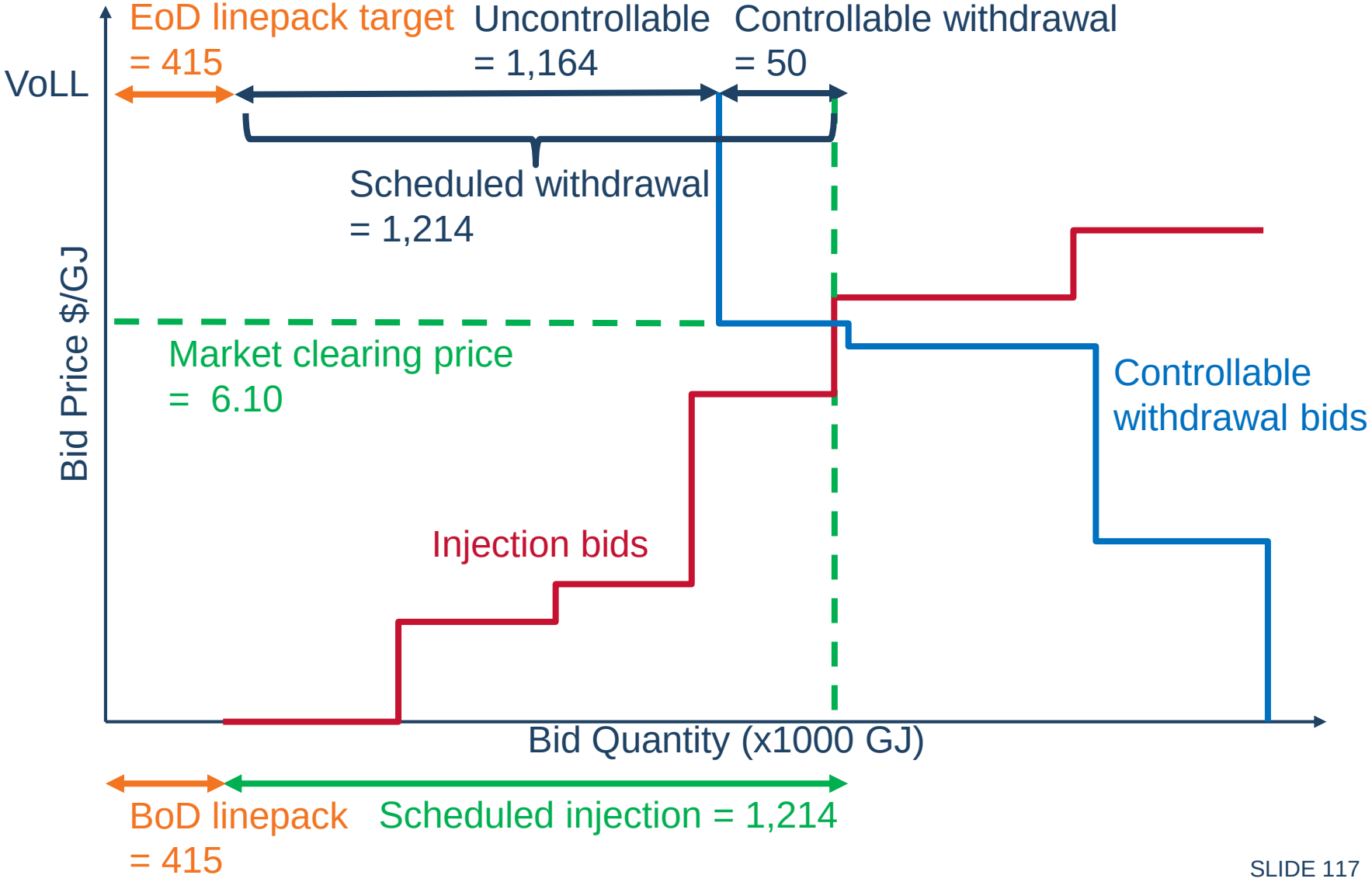
# BID STACK – 6AM 14 JULY 2015



# BID STACK – 6AM 14 JULY 2015

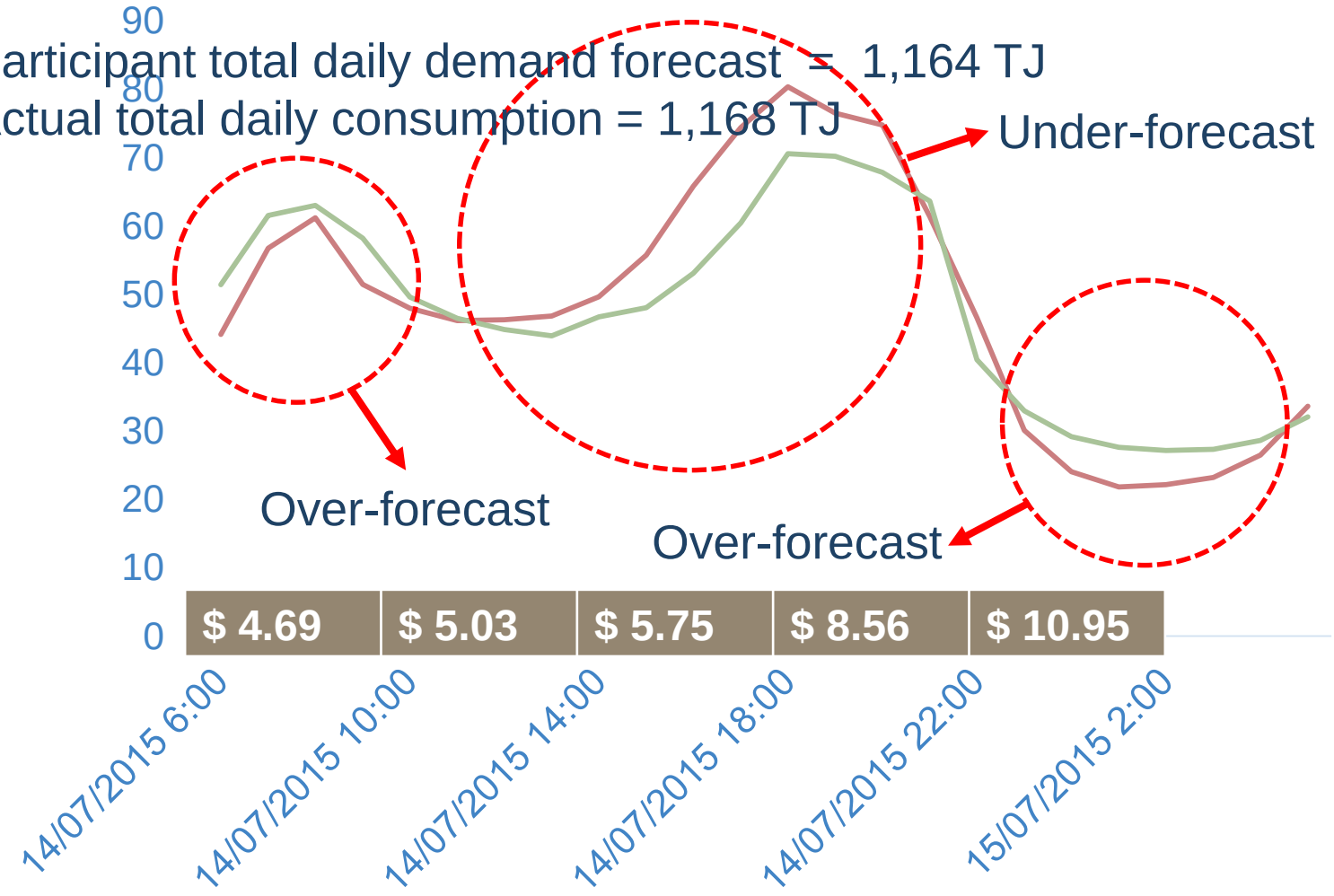


# BID STACK – 6AM 14 JULY 2015

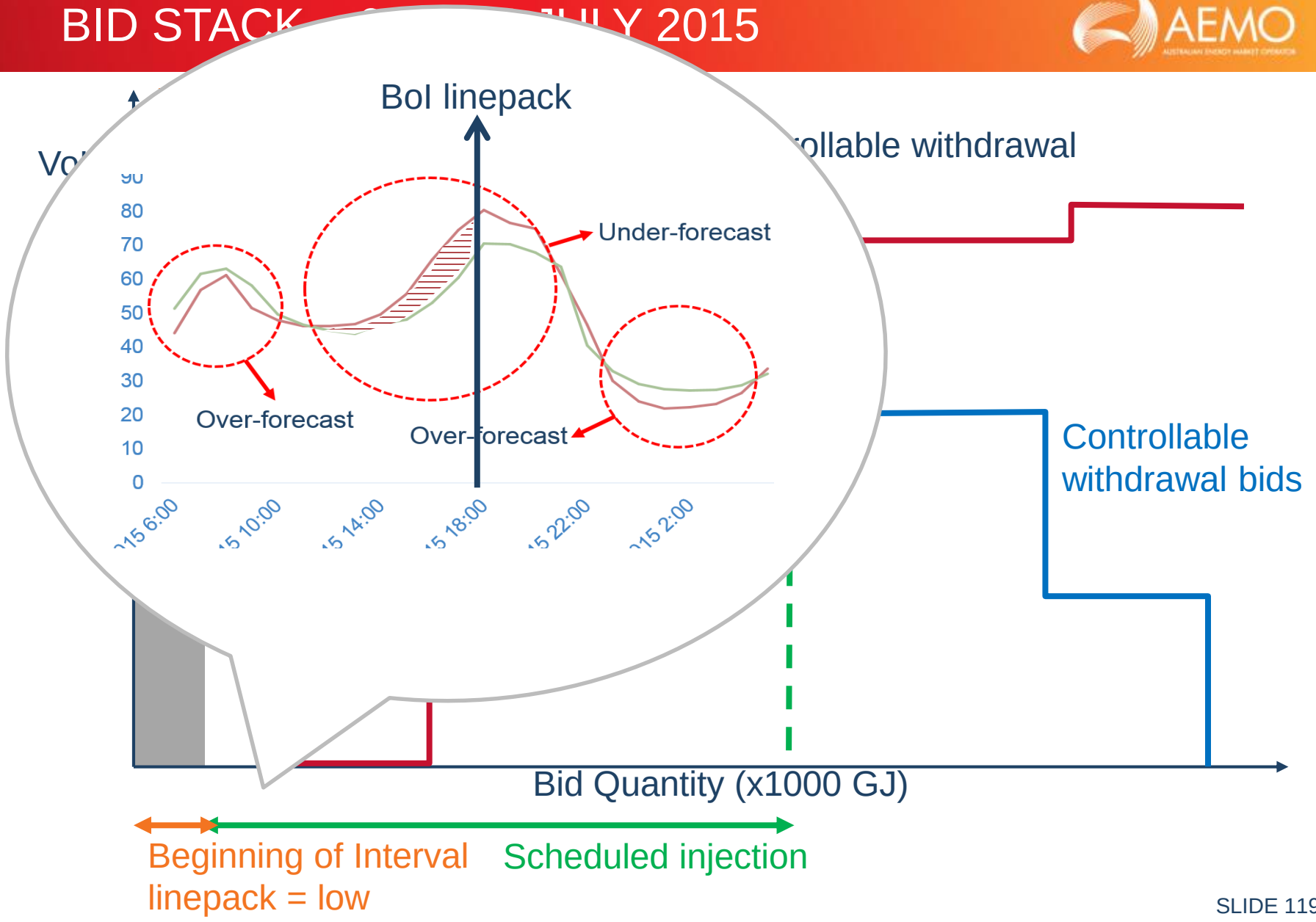


# DEMAND PROFILE - 14 JULY 2015

Participant total daily demand forecast = 1,164 TJ
Actual total daily consumption = 1,168 TJ



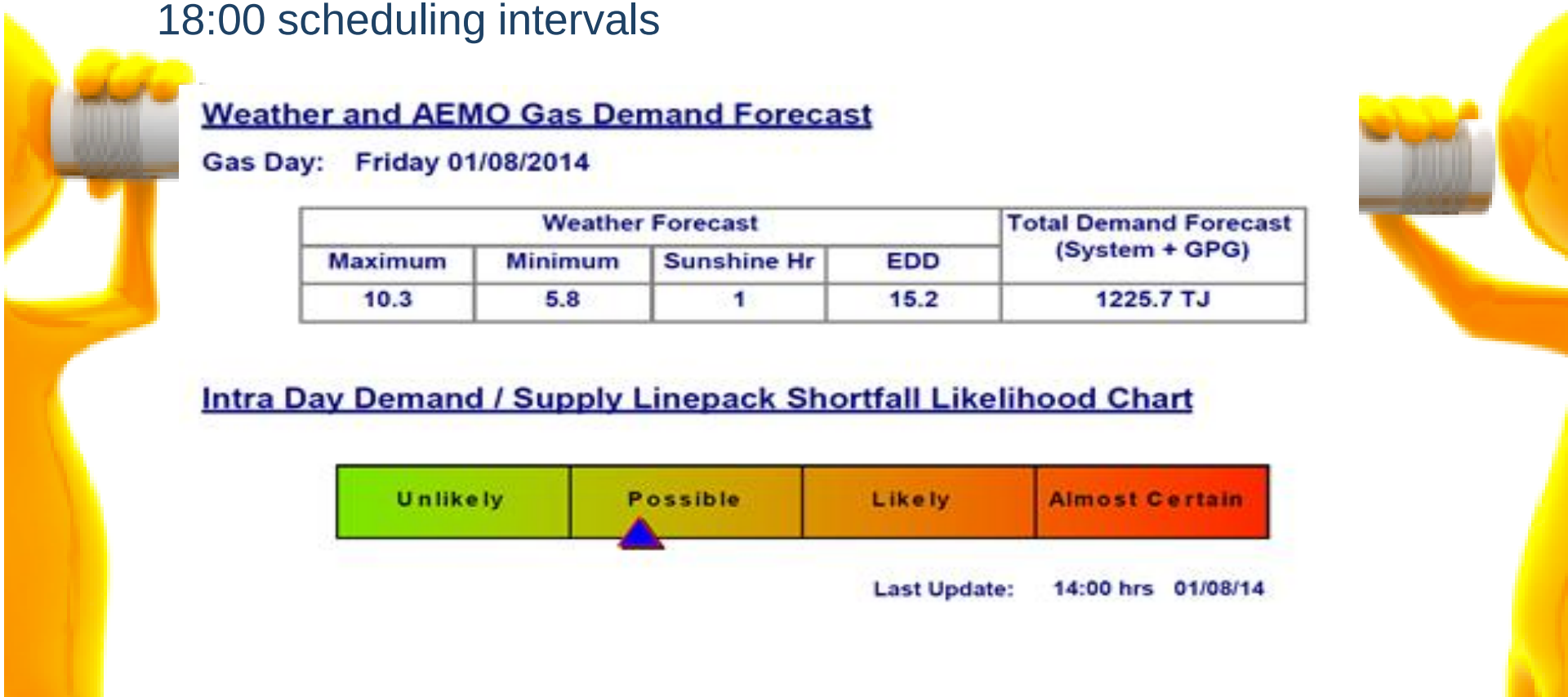
# BID STACK [illegible] JULY 2015



# 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**



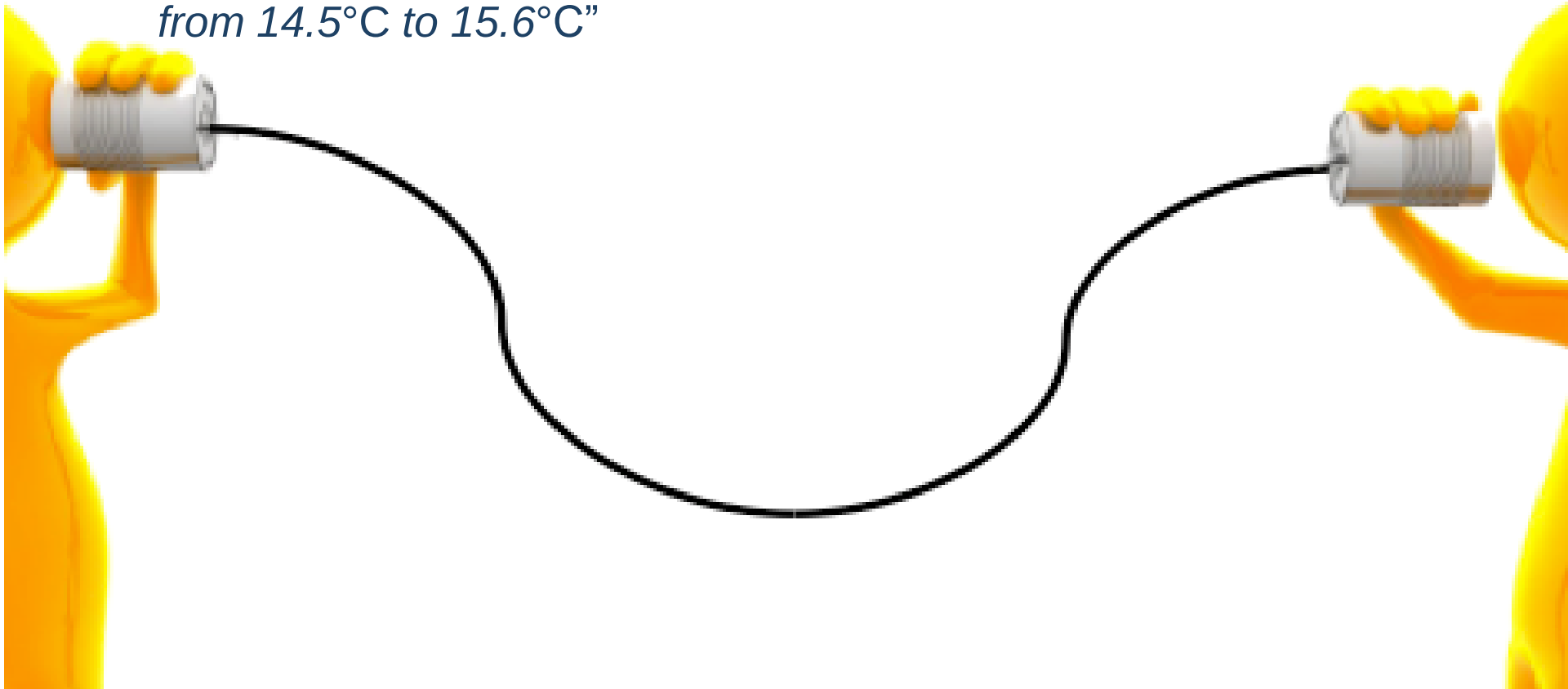

**Last Update: 14:00 hrs 01/08/14**

# COMMUNICATION - DEMAND FORECAST

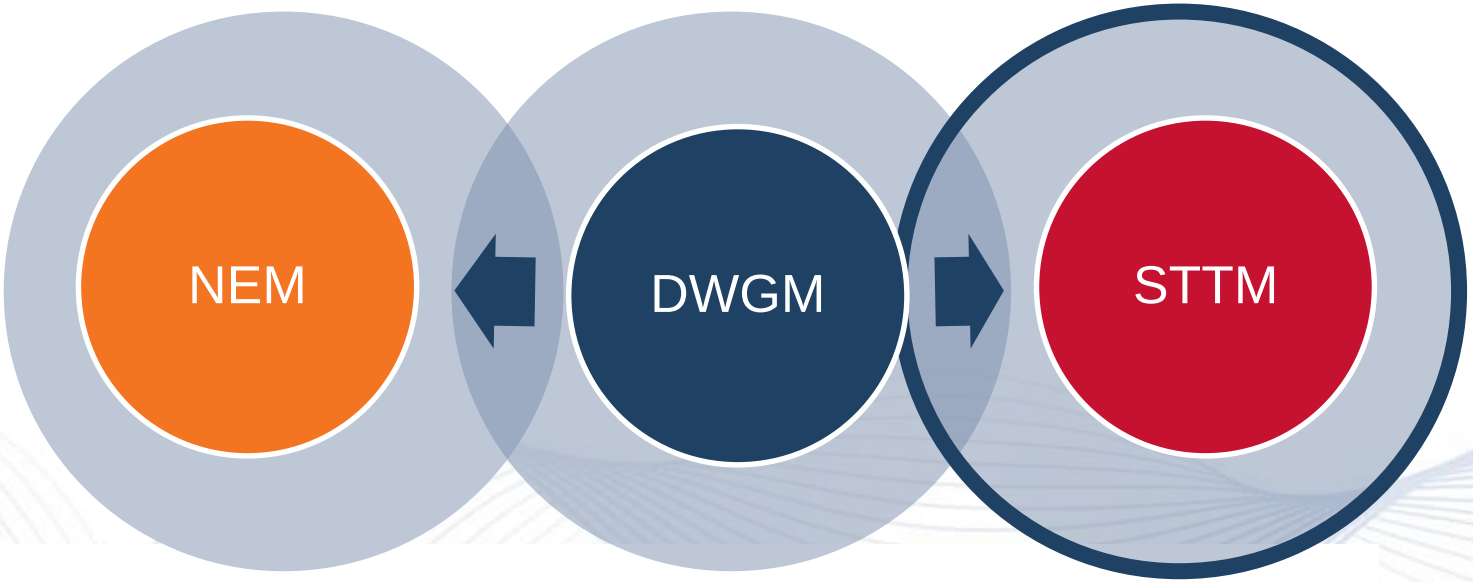
**High EDD**

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

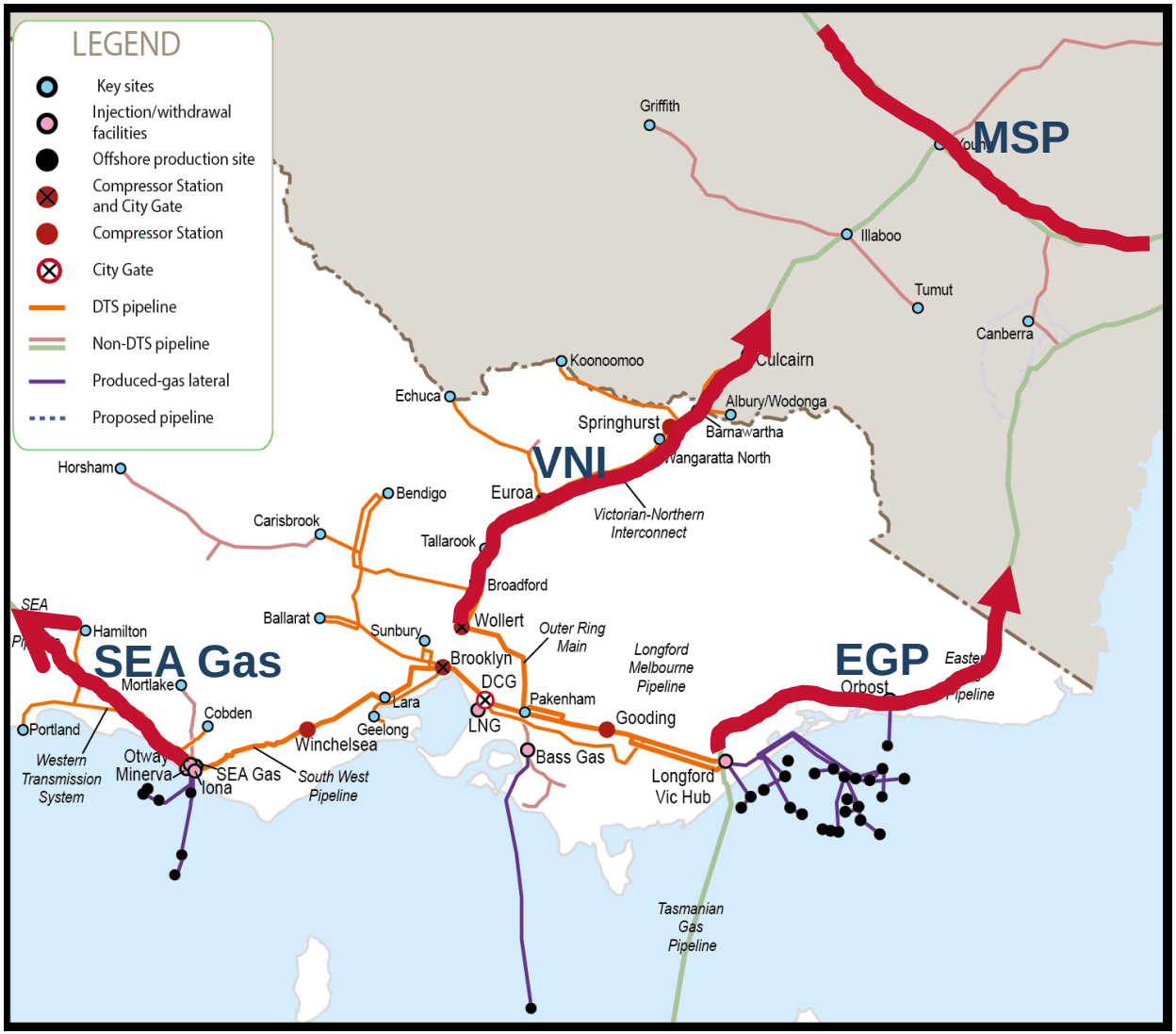
  *“EDD increase alert, since the last schedule the EDD has increased from 14.5°C to 15.6°C”*



# MARKET INTERACTION




# MARKET INTERACTION - STTM

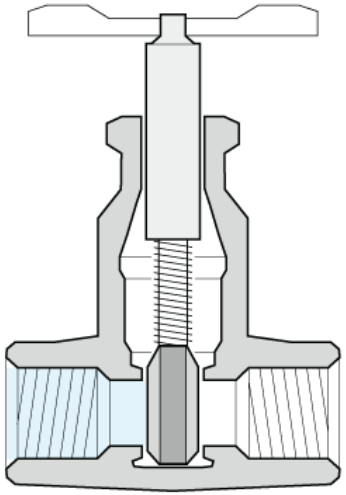



**STTM**:

- Sydney hub
- Adelaide hub
- Brisbane hub

# MARKET INTERACTION – STTM CG

## **Contingency Gas** on 22 July 2015

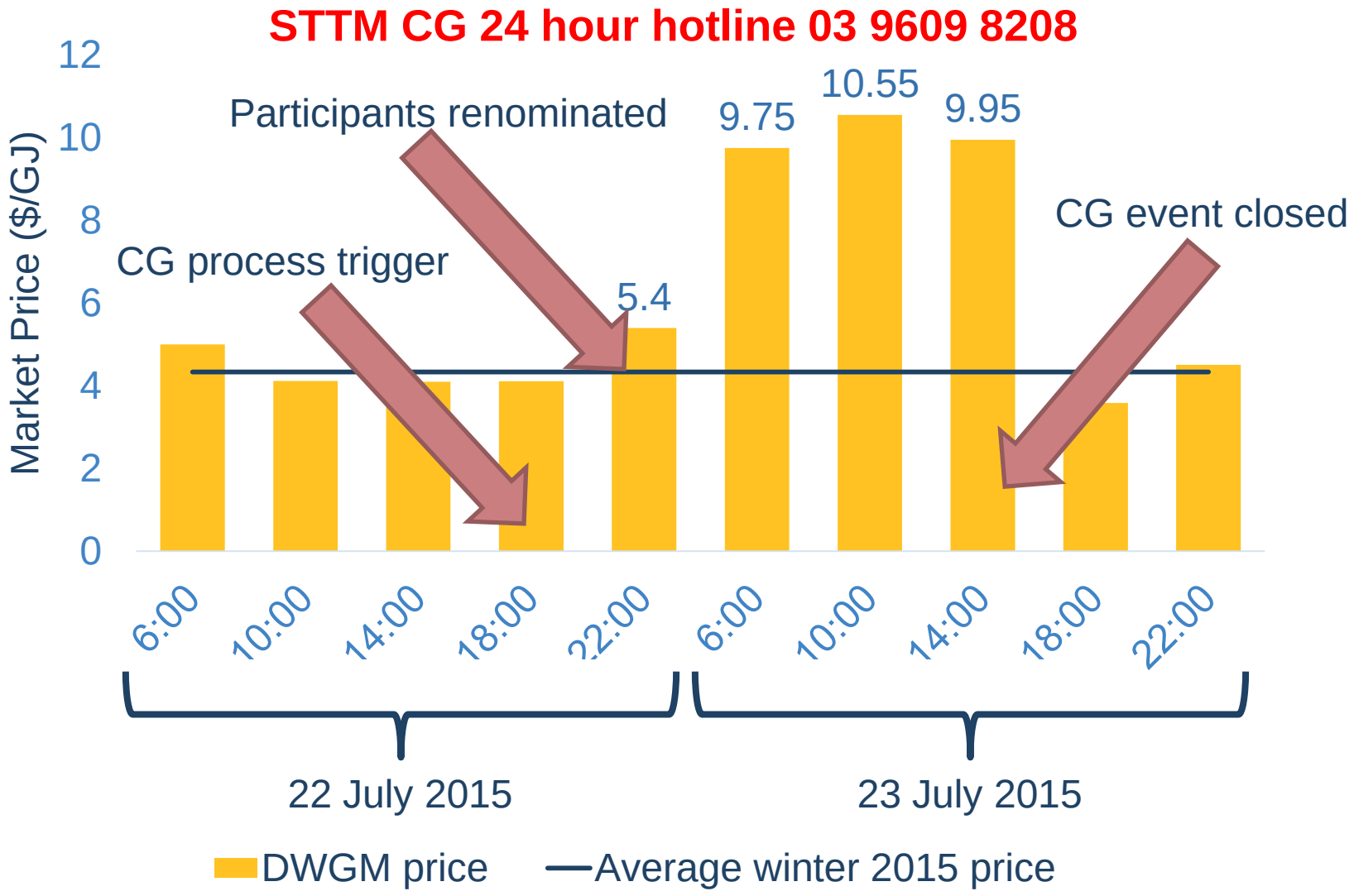


**MSP valve**

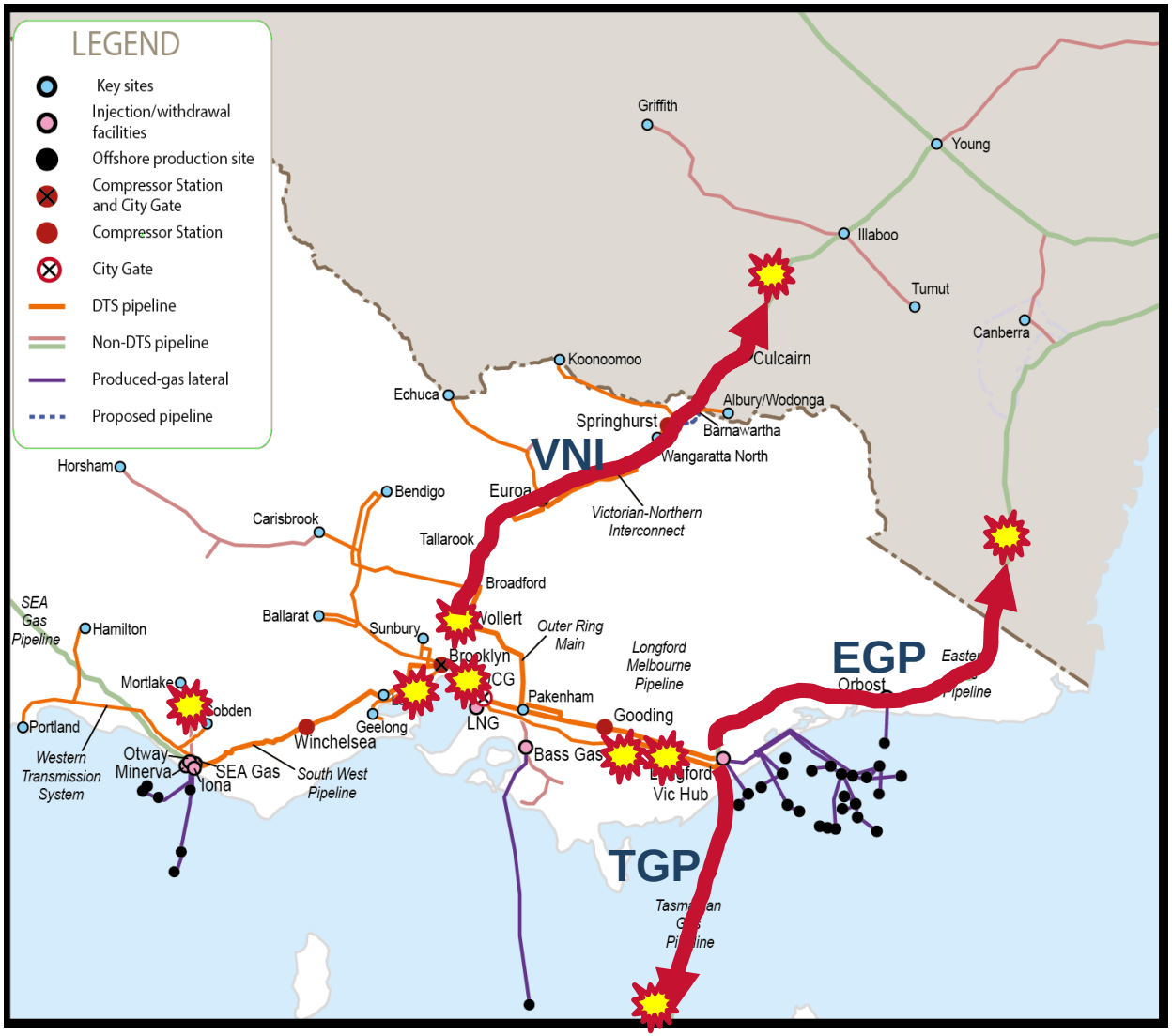

**CG trigger**

**Renomination**

# MARKET INTERACTION – STTM CG



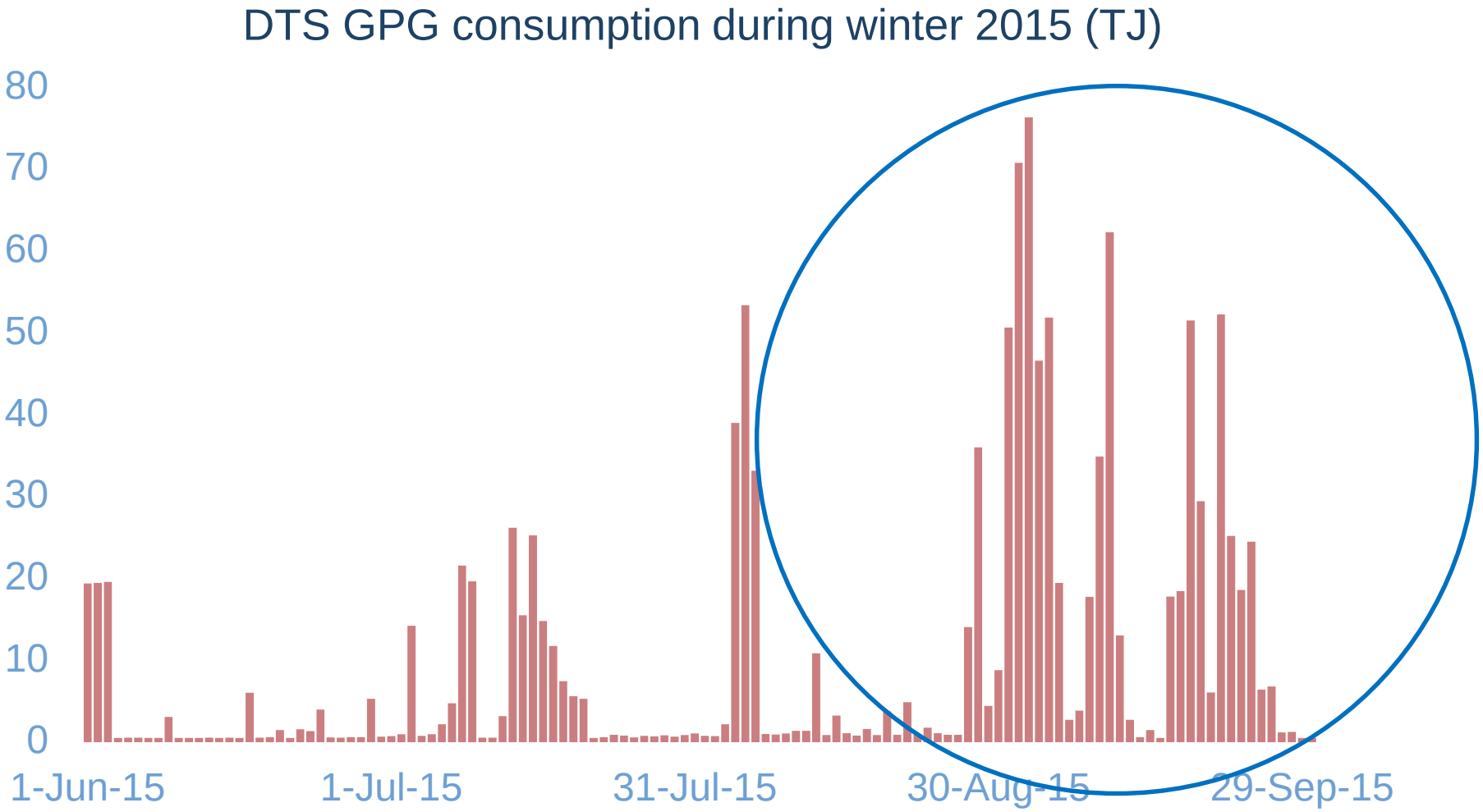
# MARKET INTERACTION – NEM GPG




**NEM**:

- Victoria
- New South Wales
- Tasmania

# MARKET INTERACTION – NEM GPG



# MARKET INTERACTION

## STTM Contingency Gas conferences

- Conference chair
- DTS pipeline operator

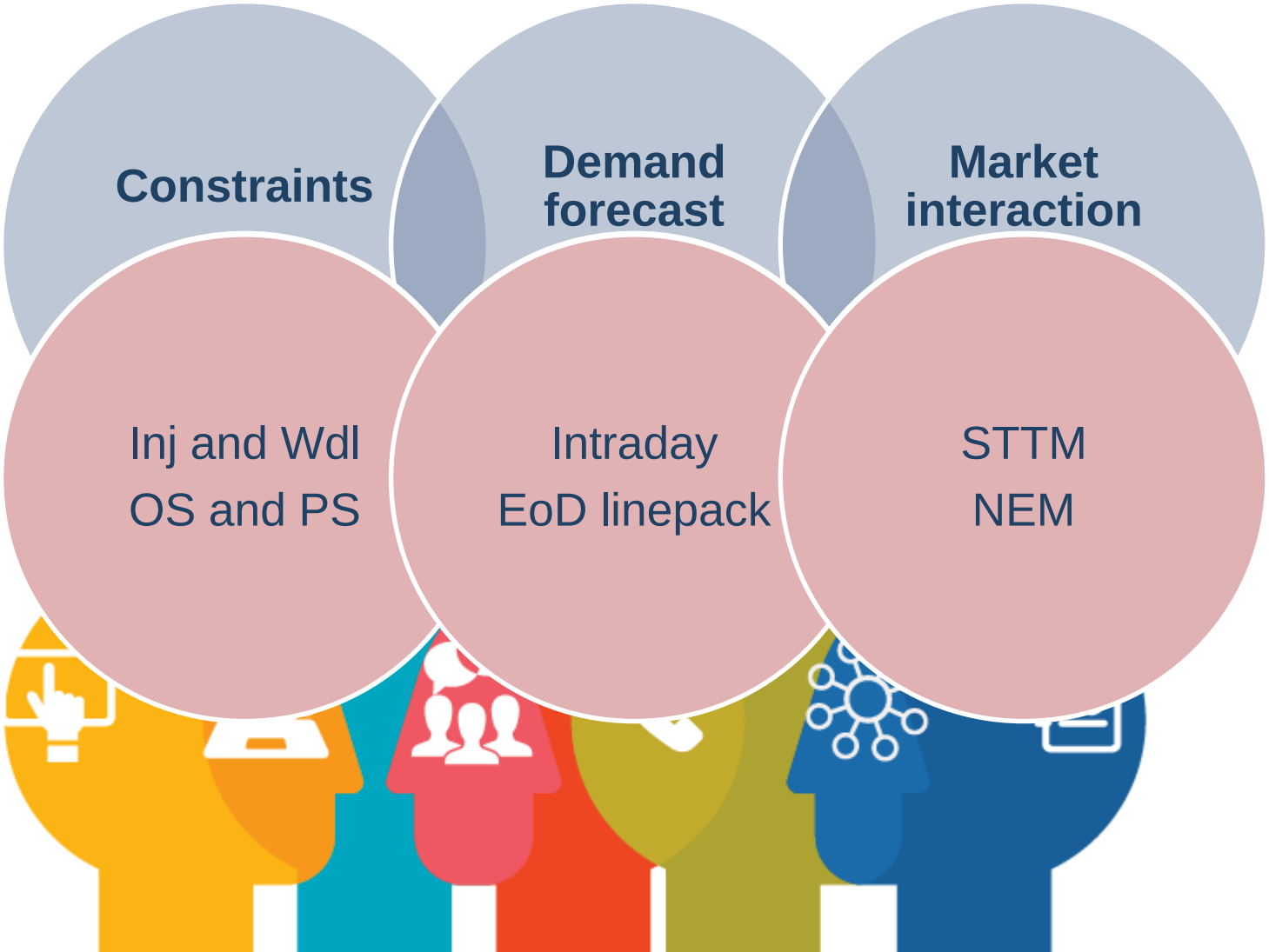
## Communication

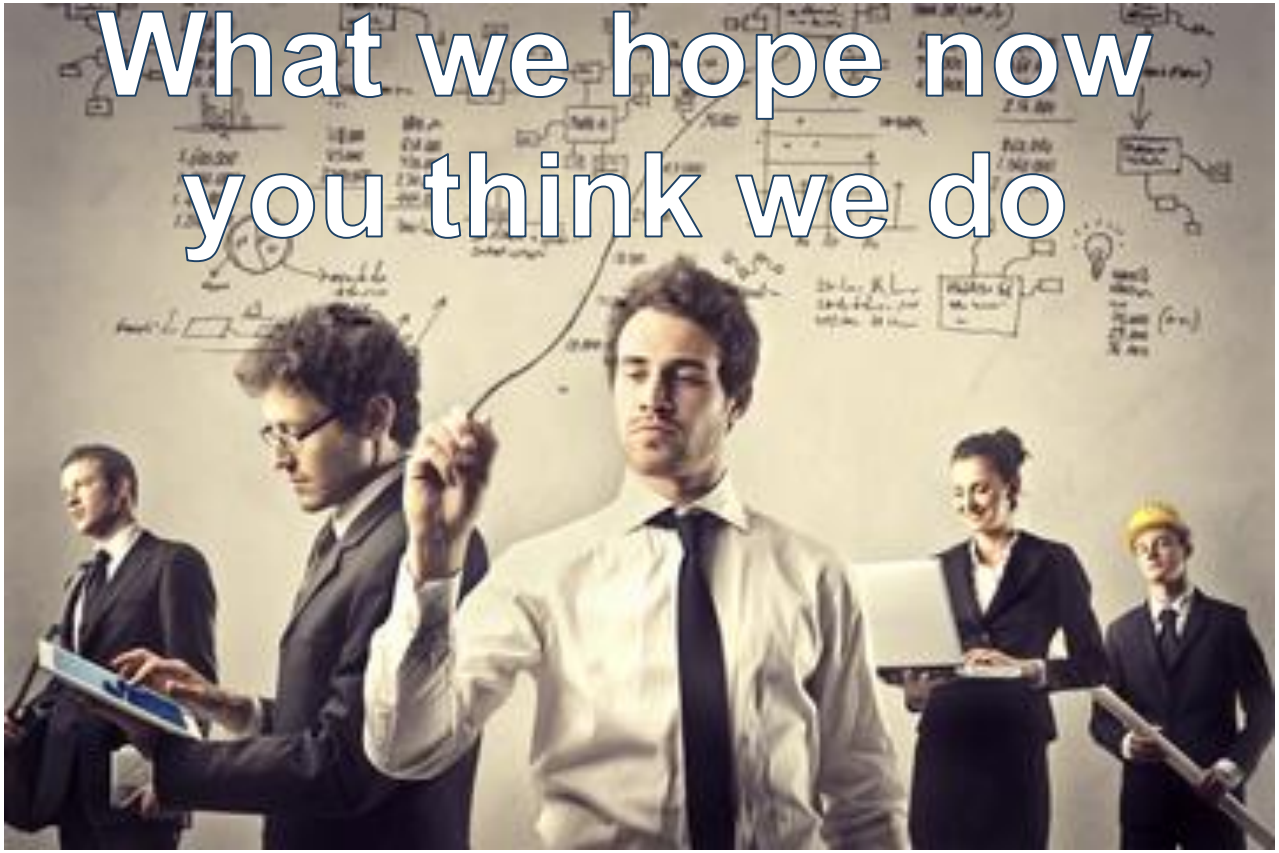
- Gas Bulletin Board
- System wide notices

## Preparedness

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

# MARKET OPERATIONS – CONCLUSION




What we hope now
you think we do

# PEAK DAY MANAGEMENT

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

# TOOLS FOR PEAK DAY MANAGEMENT

- Prior to a forecast peak day
  - Injection profiling.

- On a peak day
  - Notice of a threat to system security
    - Allows responses not otherwise available

# PEAK DAY – INJECTION PROFILING

**Trigger**

- > 1,150 TJ/day

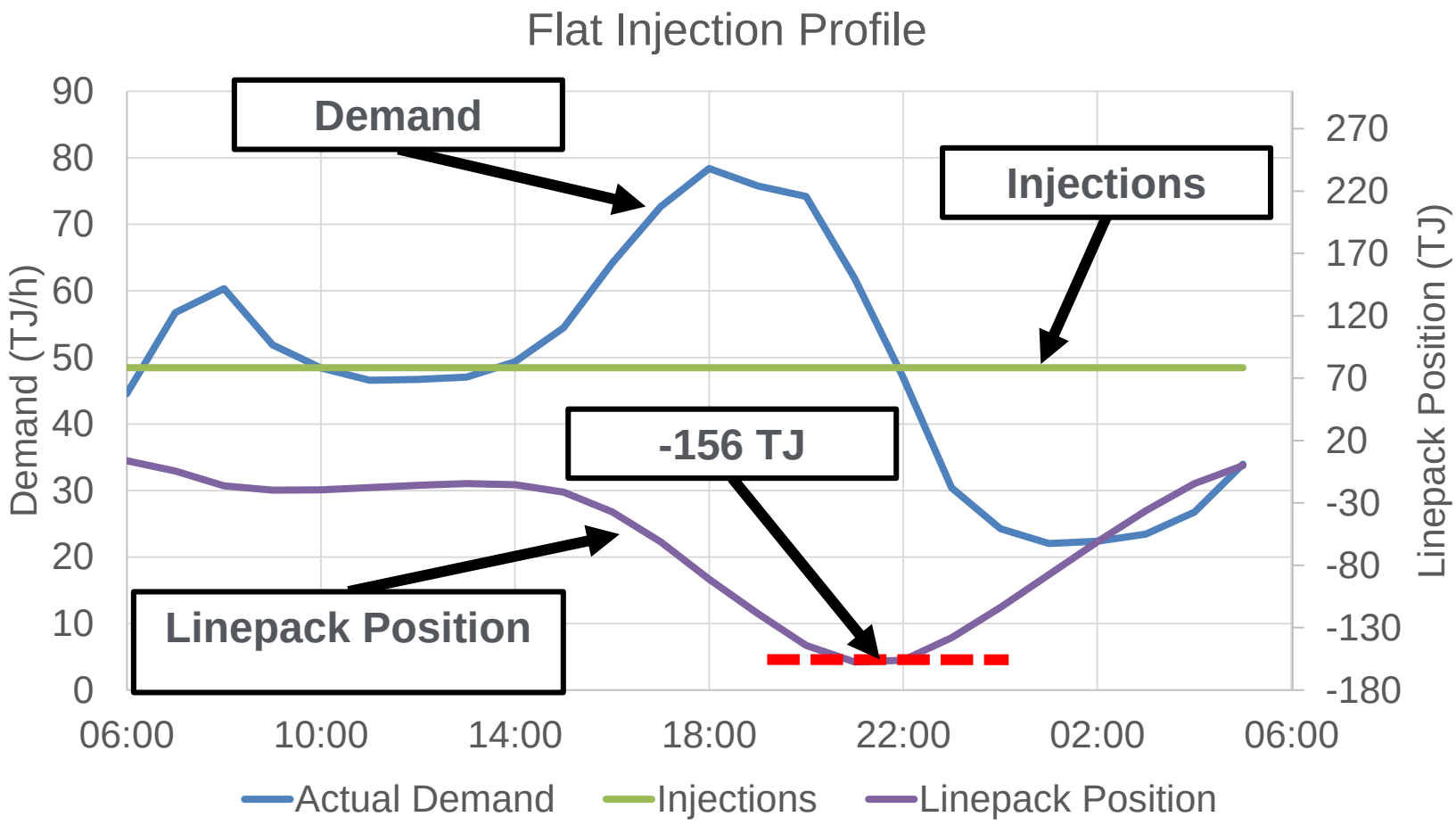
**Process**

- Consult
- SDPC

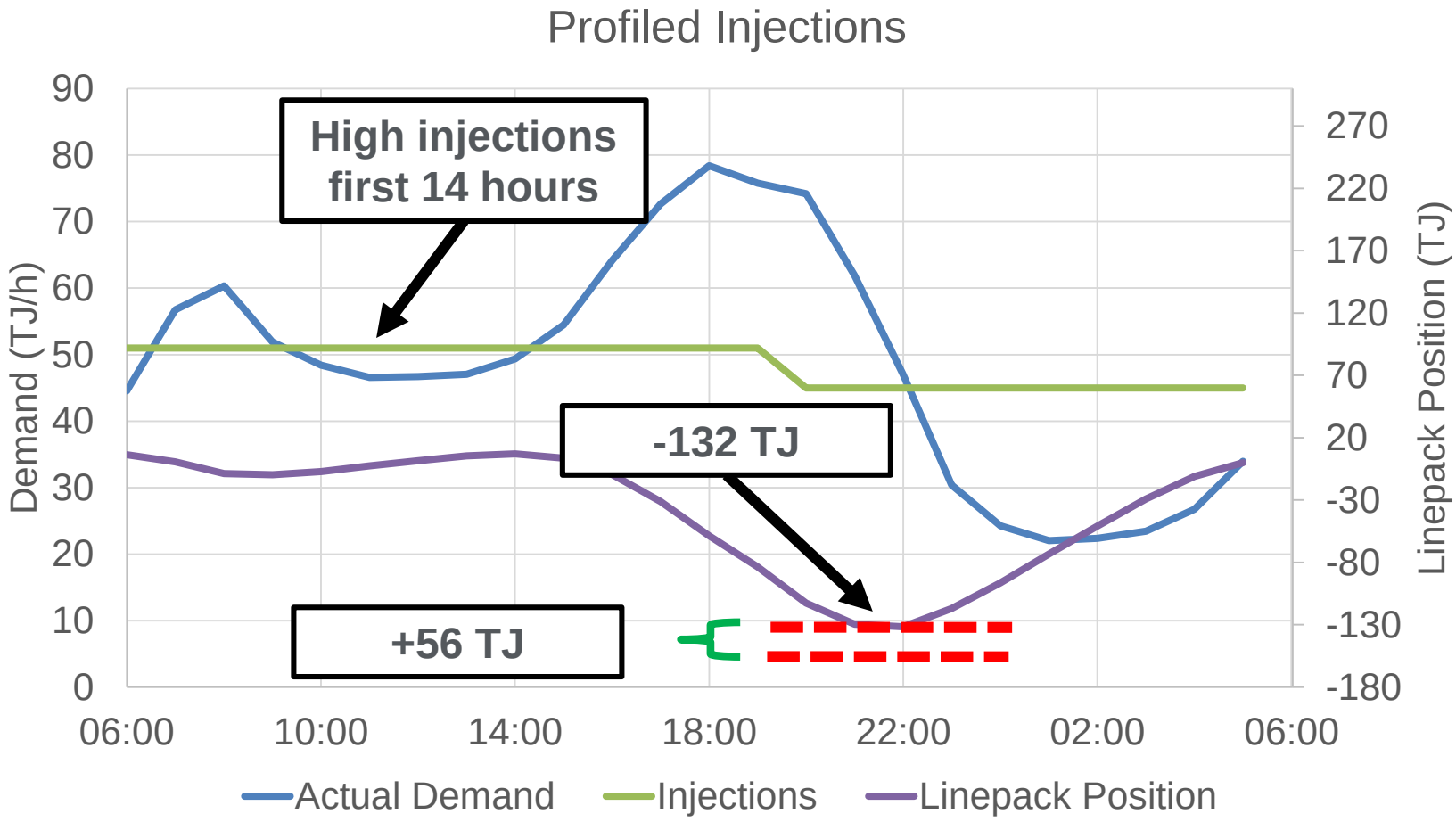

**Impacts?**

- System
- Market

# INJECTION PROFILING



# INJECTION PROFILING



# 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 … edures and breache… by AEMO;

b) in AEMO…

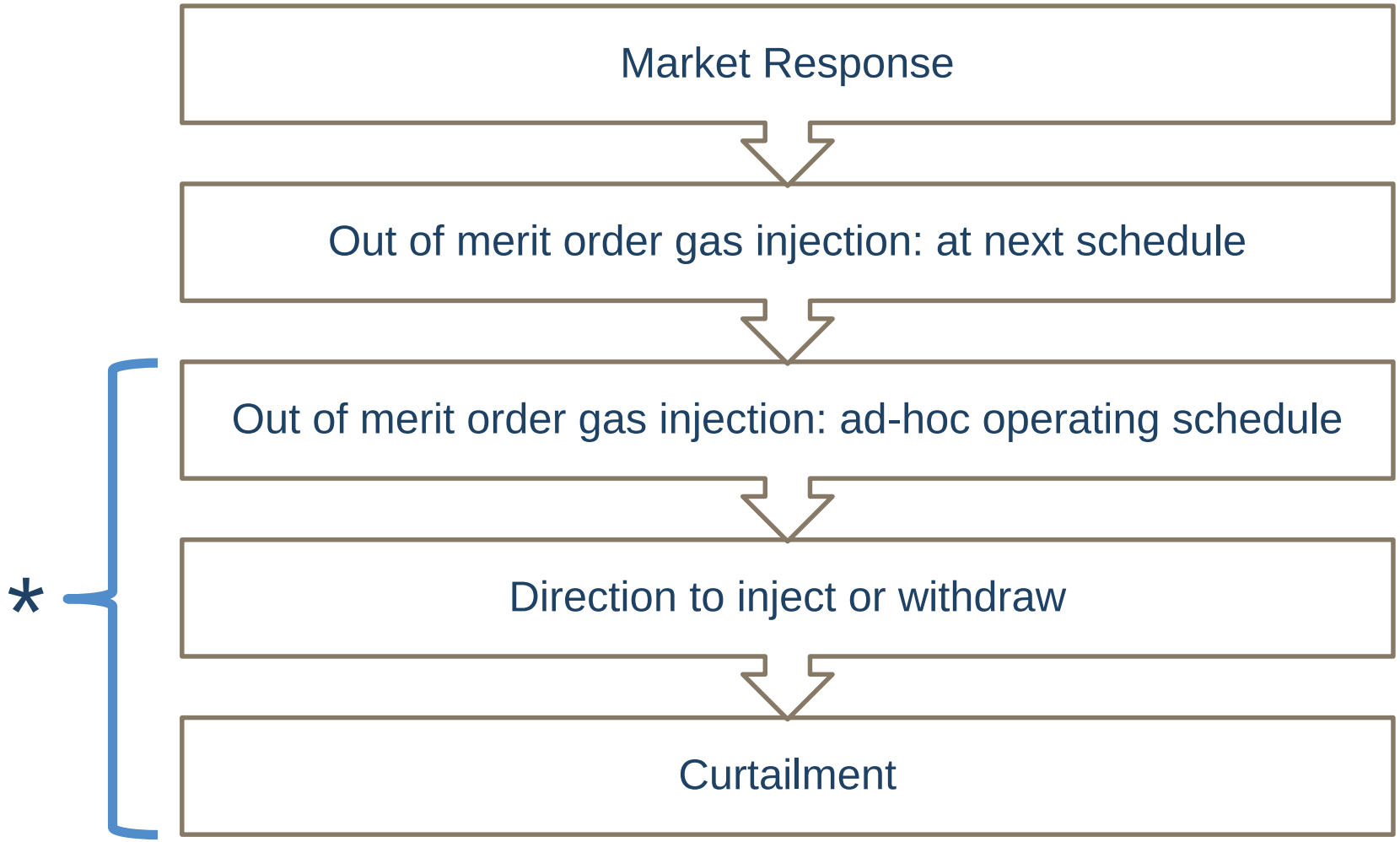
c) in AEMO… to custome…

d) system … agreed operatin…

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

MCE

Mass Balance

Pressure decline at DCG

Gregg Model

# PEAK DAY MANAGEMENT - LNG

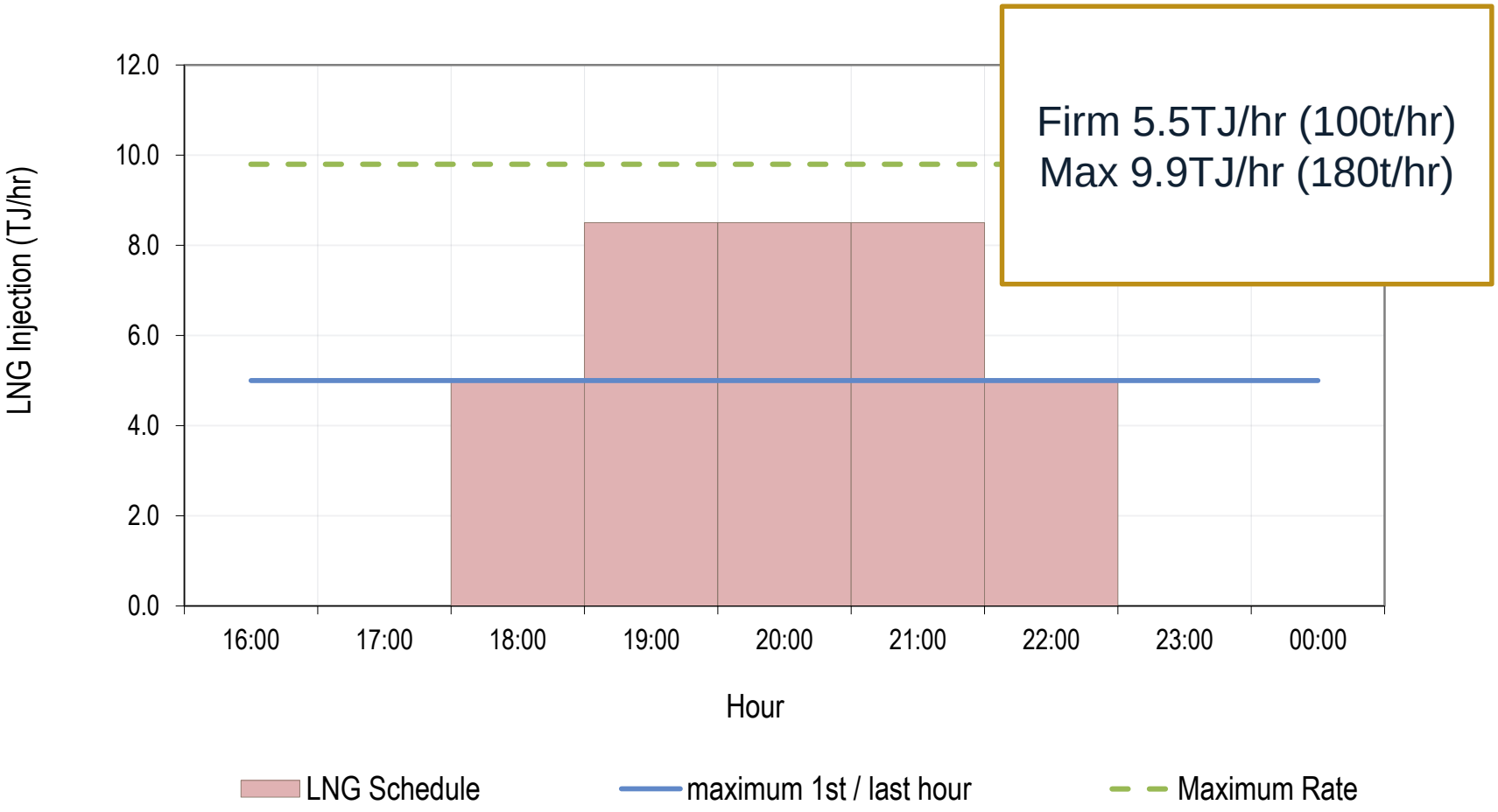
## Operational Response LNG

- 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



# PEAK DAY - COMMUNICATION

**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*

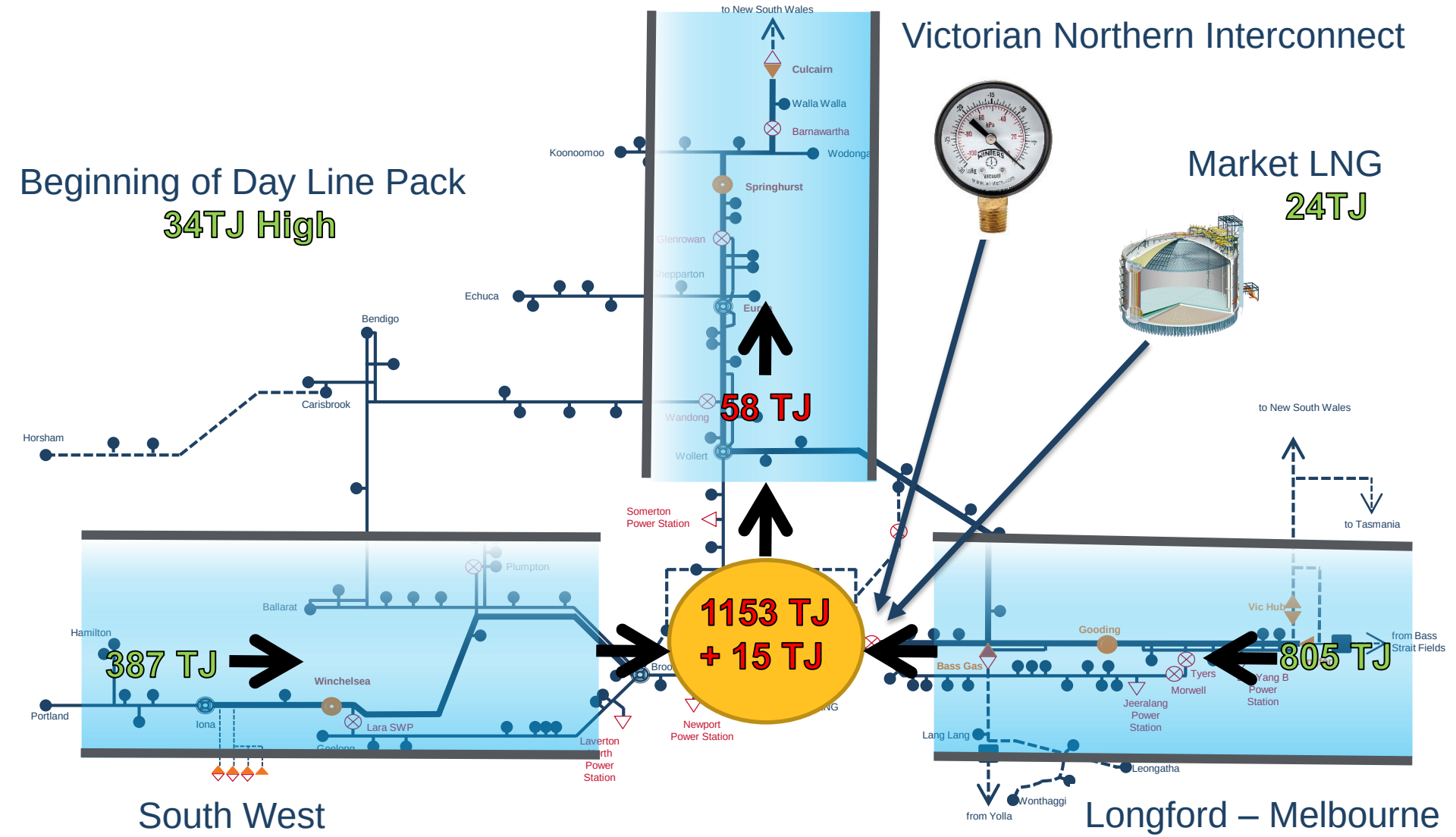
## Green

- *Priority GREEN – Supply Reserves Manageable – No LNG requested*

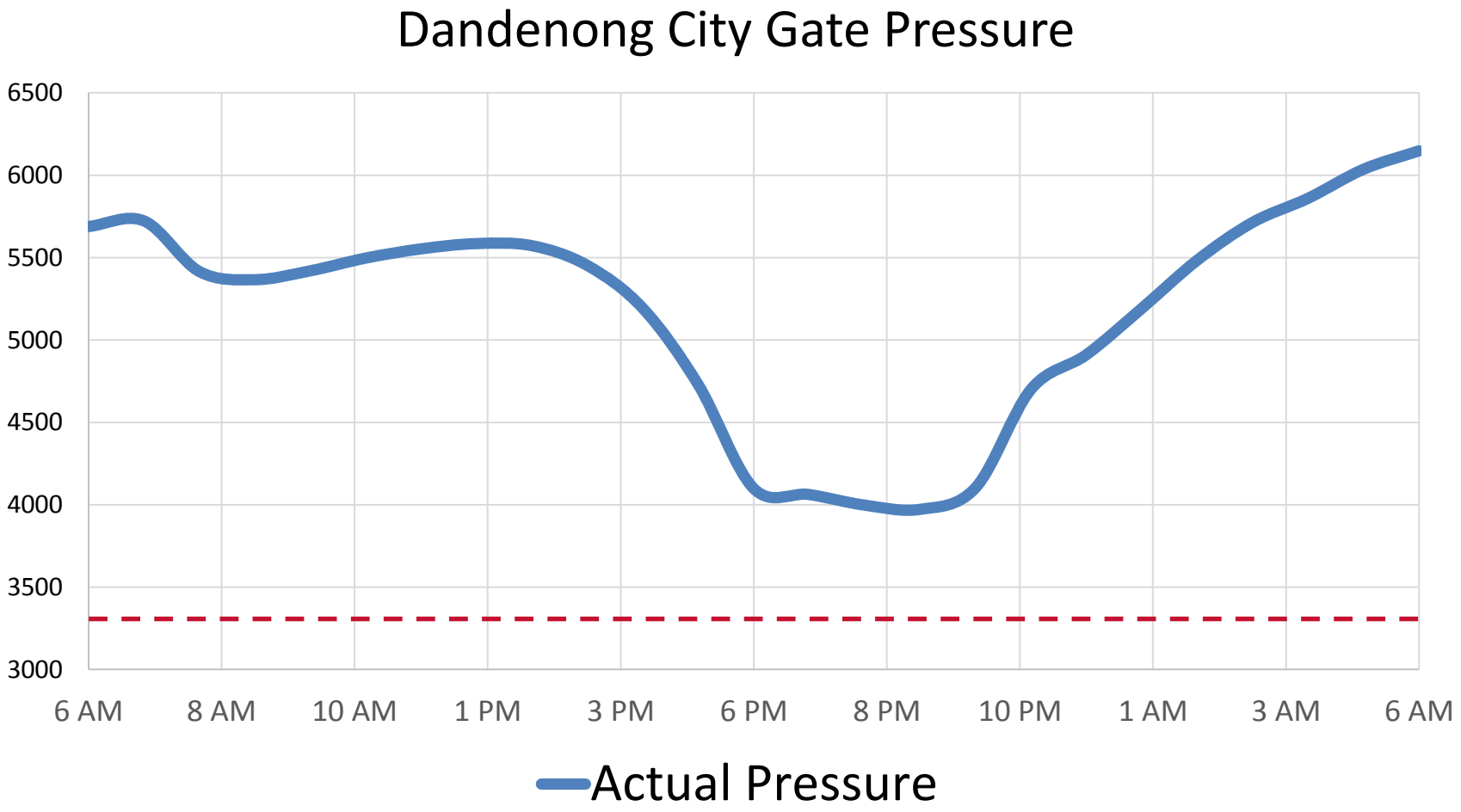
**100t/hr = 5.5TJ/hr (approx.)**

# CASE STUDY

# TUESDAY 14TH JULY 2015



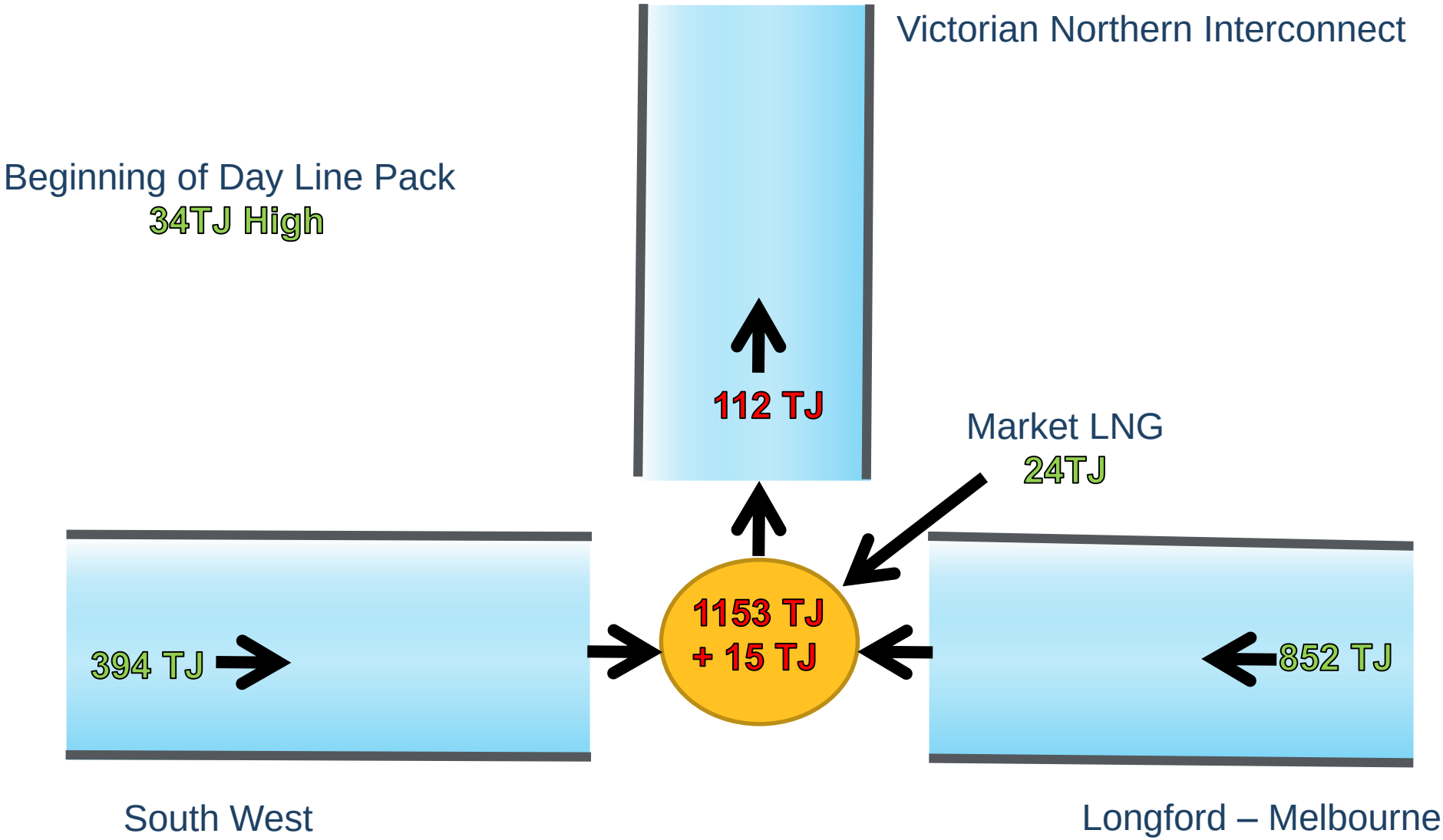
# TUESDAY 14TH JULY 2015



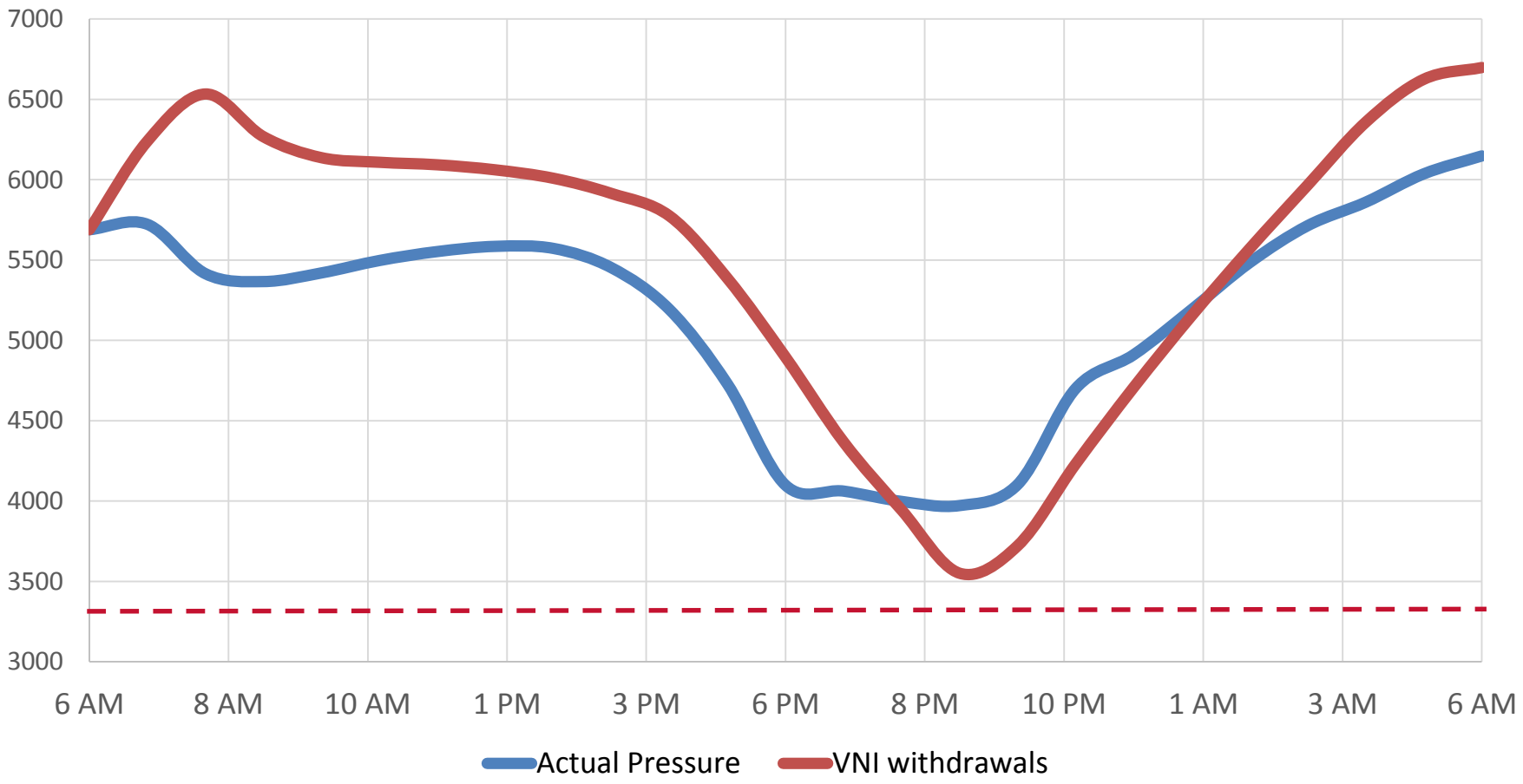
# TUESDAY 14TH JULY 2015

- What if……
  - High VNI exports scheduled?

# 4TH AUGUST 2015 – ACTUAL 1130 TJ DEMAND 10PM



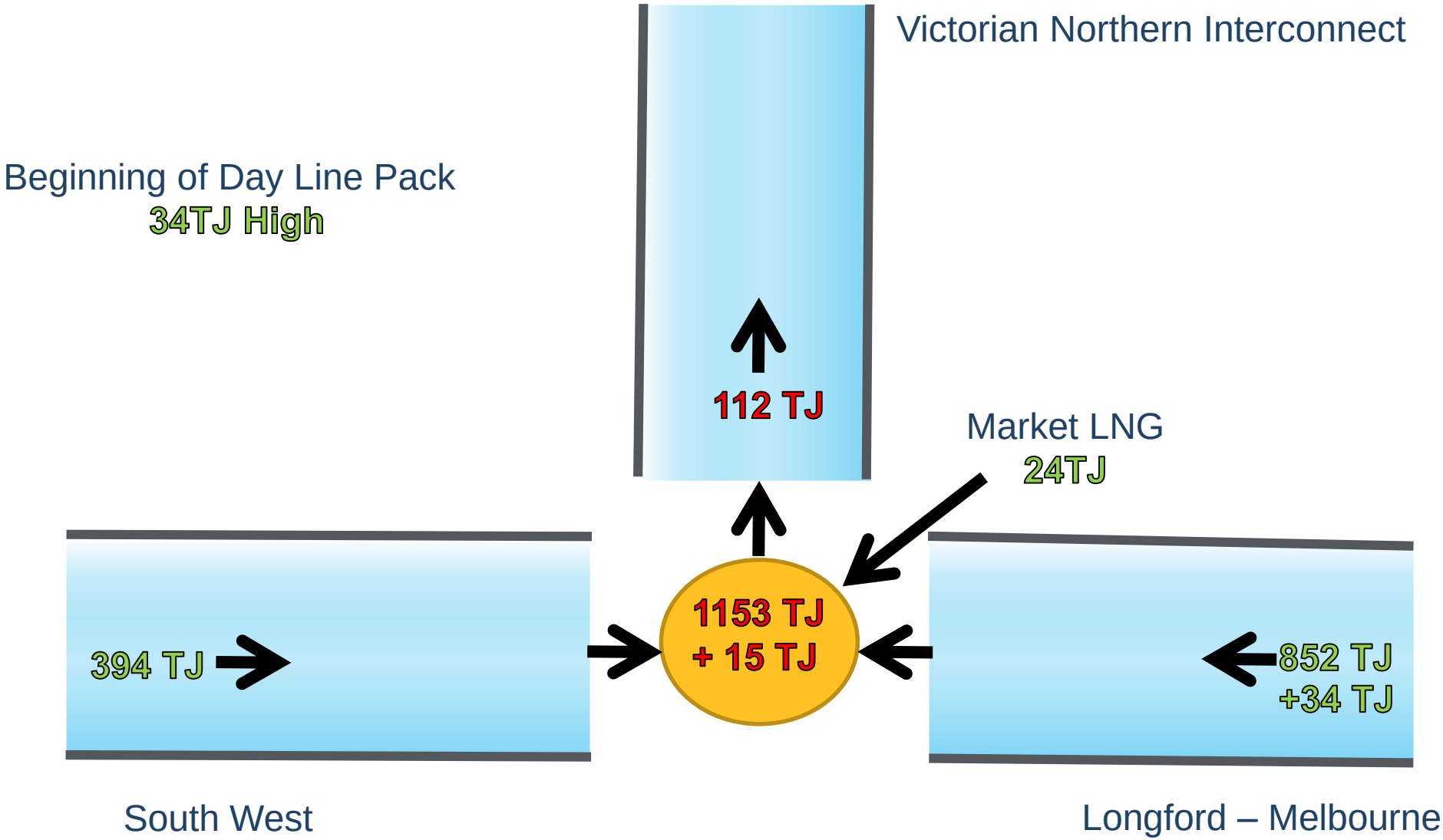
# Dandenong City Gate Pressure



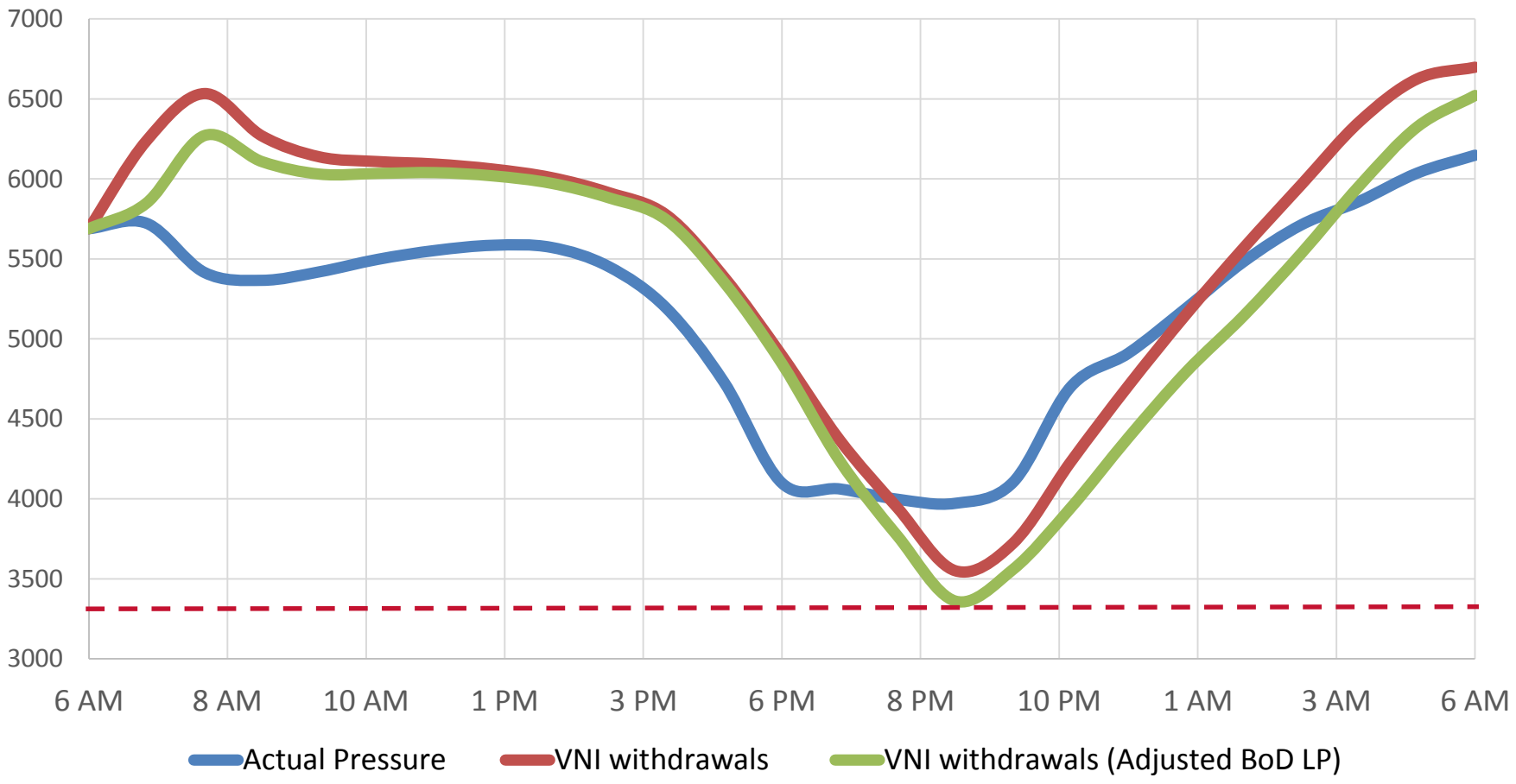
# TUESDAY 14TH JULY 2015

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

# 4TH AUGUST 2015 – ACTUAL 1130 TJ DEMAND 10PM



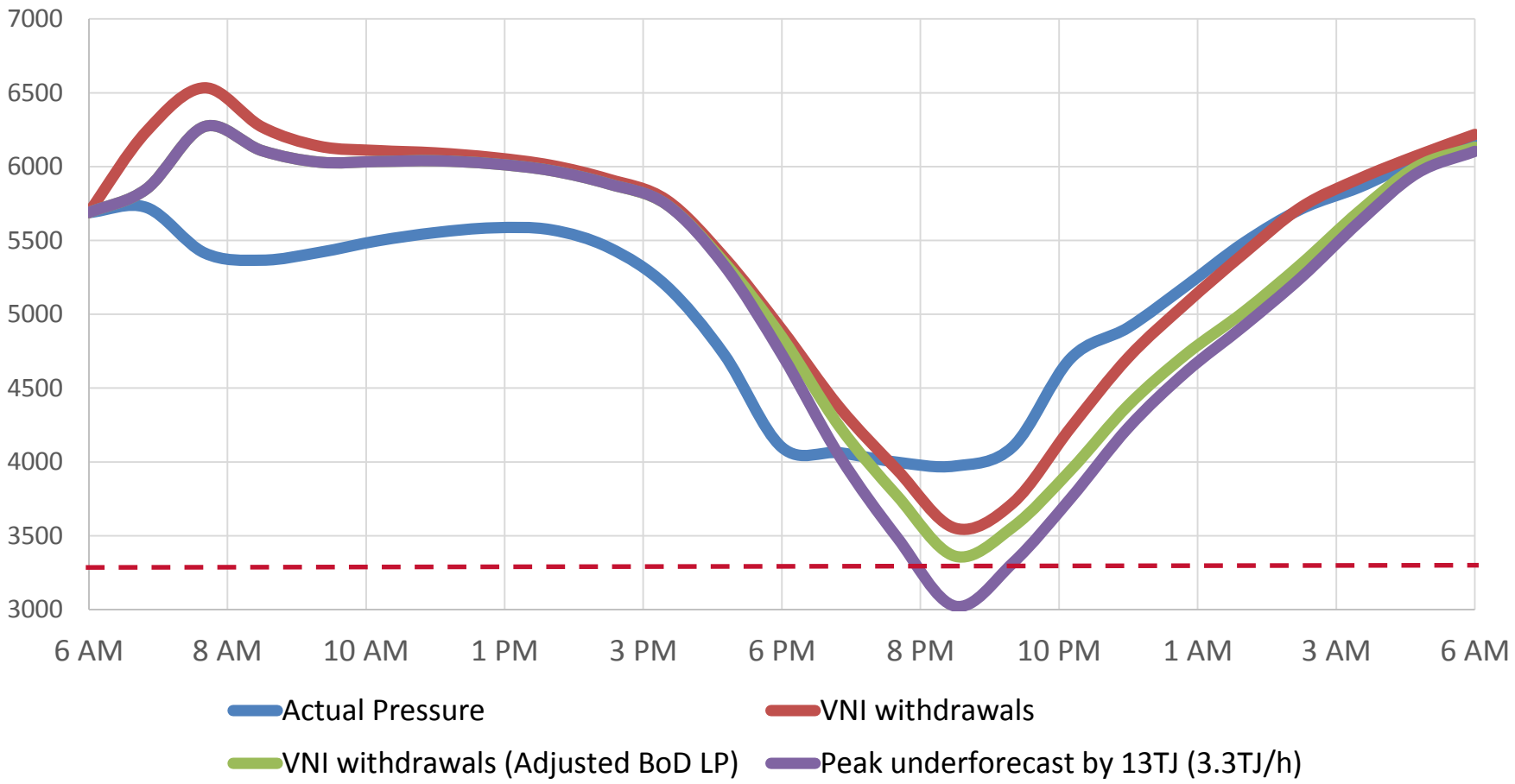
# Dandenong City Gate Pressure



# TUESDAY 14TH JULY 2015

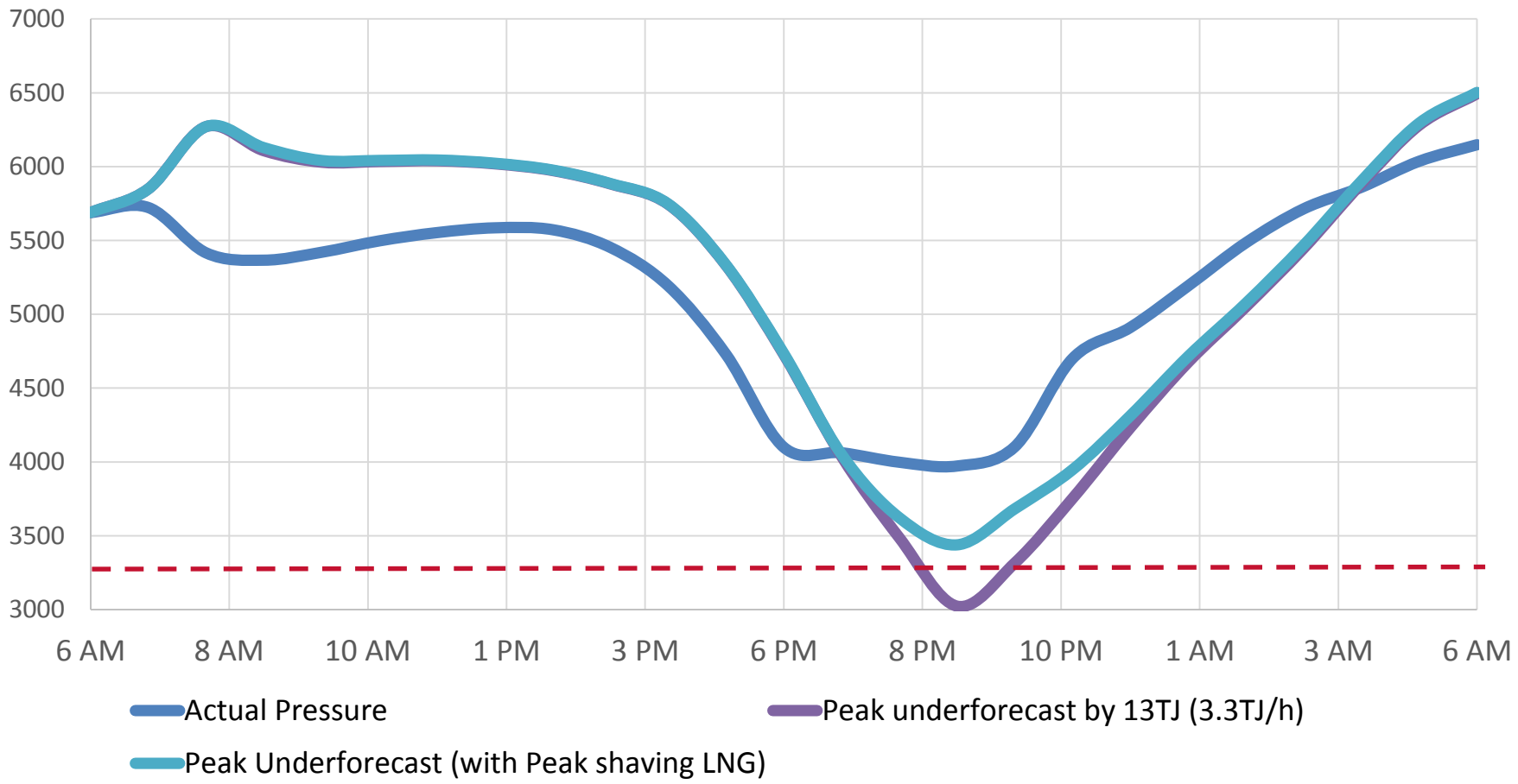
- What if……
  - High VNI exports scheduled?
  - BoD Linepack was on target (instead  34 TJ of high)?
  - Demand was higher over the evening peak?
    - Average temperature 6pm to 9pm 1$^{o}$C lower than forecast
    - ~3.3 TJ / $^{o}$C / hr

# 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

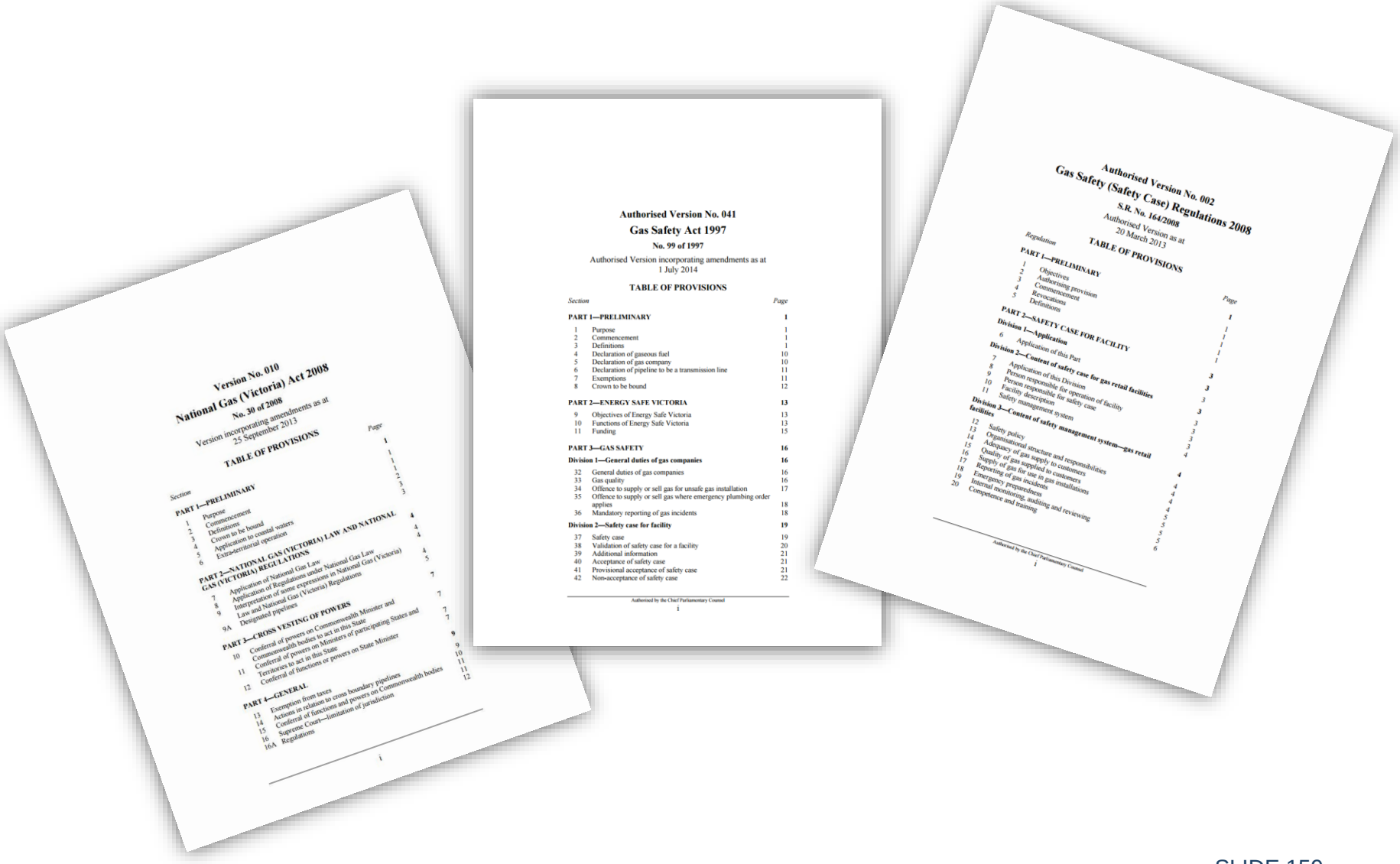
# EMERGENCY MANAGEMENT

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

# SCOPE

- 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

# LEGISLATION



Version No. 010
National Gas (Victoria) Act 2008
No. 30 of 2008
Version incorporating amendments as at
25 September 2013

TABLE OF PROVISIONS

Authorised Version No. 041
Gas Safety Act 1997
No. 99 of 1997
Authorised Version incorporating amendments as at
1 July 2014

TABLE OF PROVISIONS

Authorised Version No. 002
Gas Safety (Safety Case) Regulations 2008
S.R. No. 164/2008
Authorised Version as at
20 March 2013

TABLE OF PROVISIONS

# GAS PROTOCOL

# GAS PROTOCOL

- 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

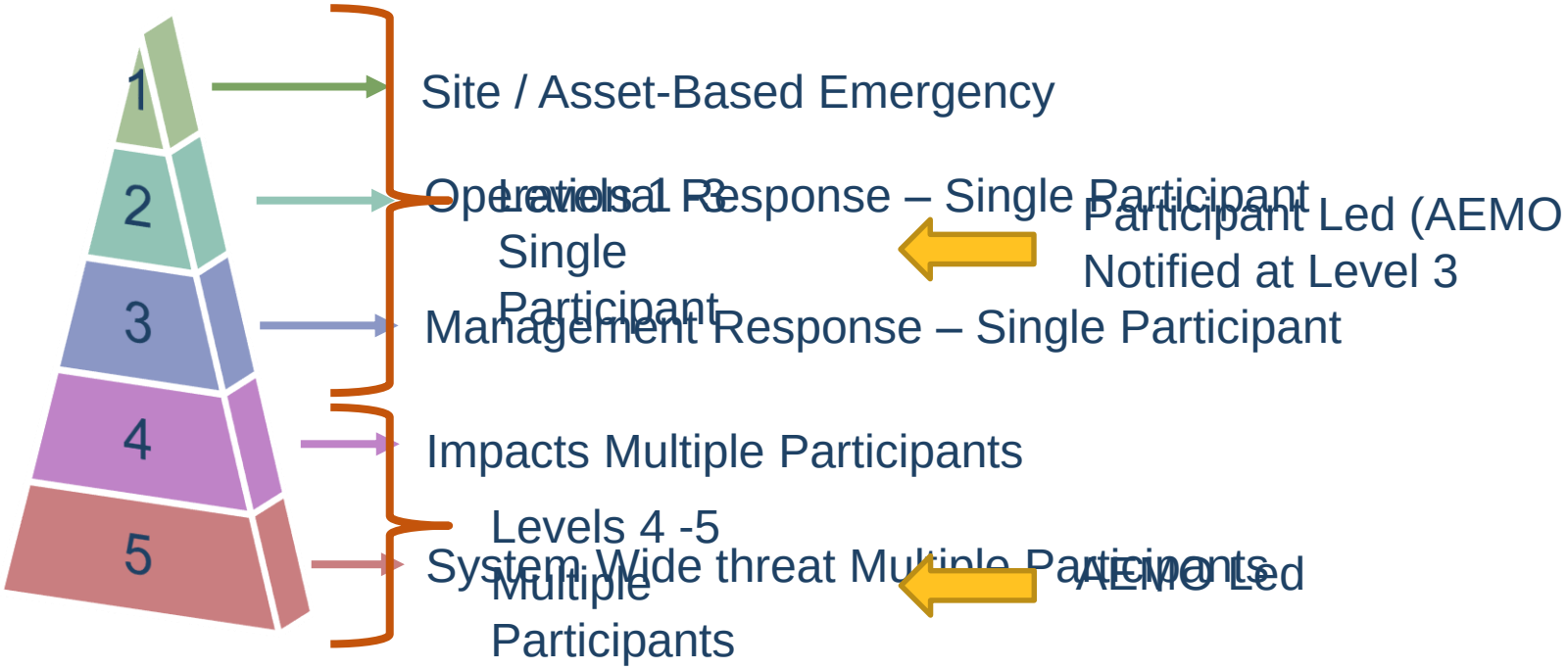
- But also
  - AEMO can declare an emergency
  - or at the direction of the Government or ESV

# 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



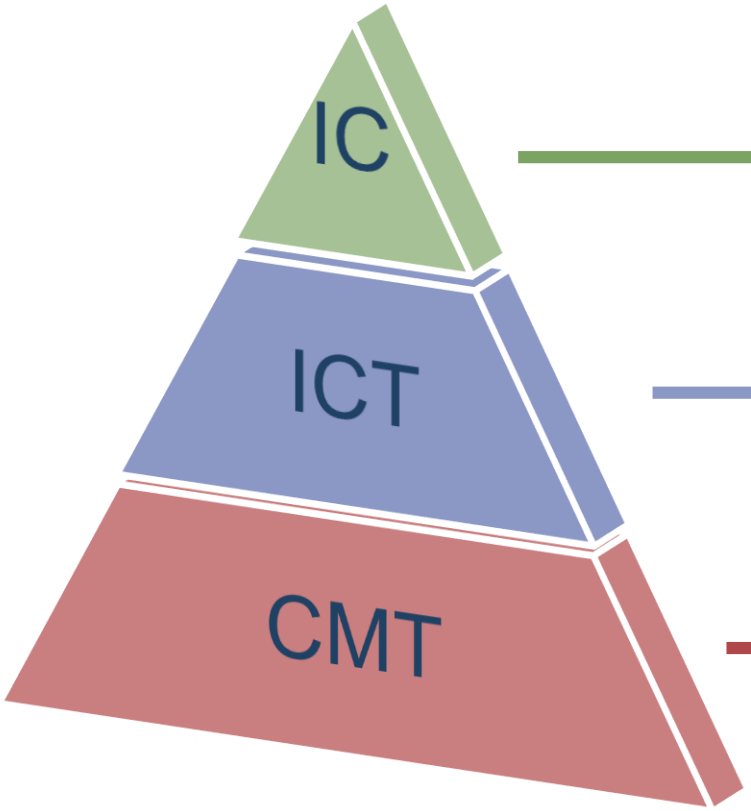
# THREATS TO SYSTEM SECURITY

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

# MANAGEMENT STRUCTURES

- **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



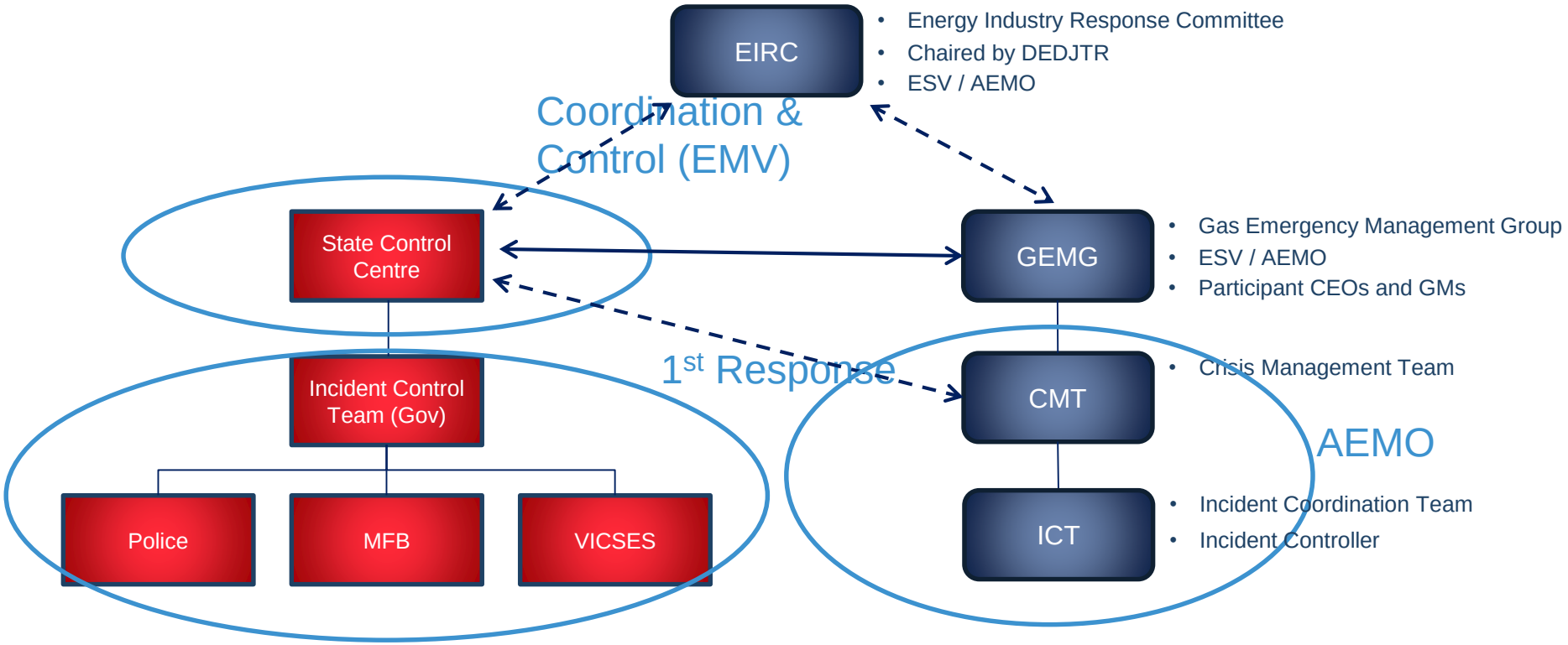

Incident Controller
deals with level 1 - 2

Incident Coordination Team
deals with level 3

Crisis Management Team
deals with level 4 - 5

# RESPONSE STRUCTURE

- Level 5?



# HOW WE COMMUNICATE AND COORDINATE IN AN EMERGENCY

- Victorian Energy Emergency Communications Protocol (VEECP)

| Gas | |
|---|---|
| **Actual** | **Forecast** |
| • Natural disaster<br>• High profile event<br>• External security threat<br>• Significant equipment failure that may affect supply | • Potential off supply > 100 customers<br>• Forecast supply shortfall<br>• Extreme weather event:<br>  • Two consecutive extreme cold days <12 degrees<br>  • 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

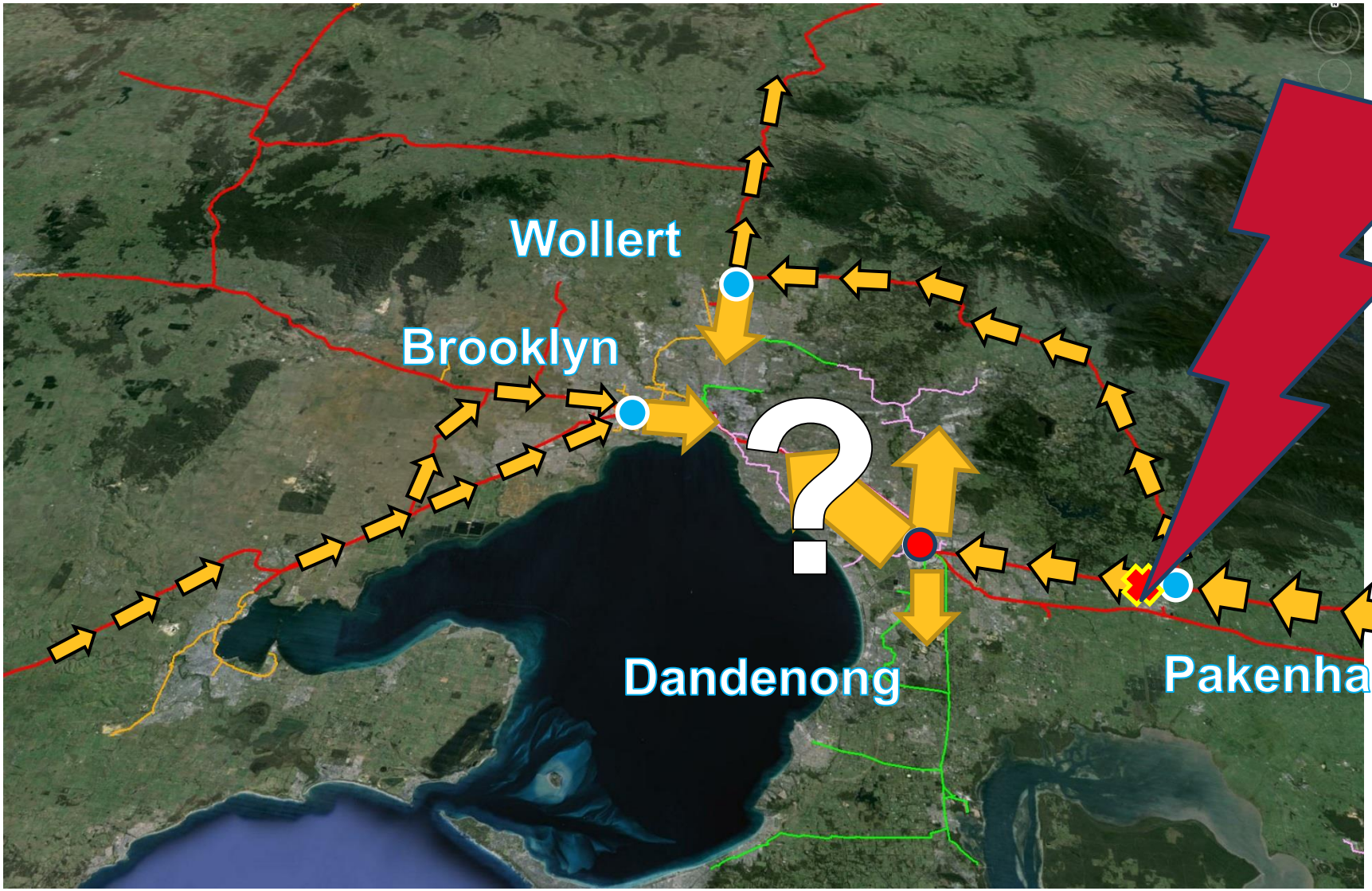
- Chief Executive Officer
- Chief Operating Officer
- Gas Duty Manager

- 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



# EXAMPLE– OPERATIONAL RESPONSE

# EXAMPLE- RESPONSE STRUCTURE

# EXAMPLE– OPERATIONAL RESPONSE

# 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