Winter 2020 – Victorian Gas Operations Outlook

5 May 2020

Agenda

2020 Gas Operations Winter Outlook

Date	Tuesday 5 May 2020
Time	10:00am – 12:00
Location	Your Computer

Time	Session	Presenter
10:00	Introduction	Luke Garland
10:15	2019 Year in Review	Mark Pollock
10:30	System demand forecasts and profiles	Robert Dickie
10:55	GPG demand forecast and supportability	Patrick Chan
11:20	AEMO's hierarchy of response to events	Alice McLaren
11:45	Q&A	All

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Introduction

Luke Garland

Winter Strategy – Implementation

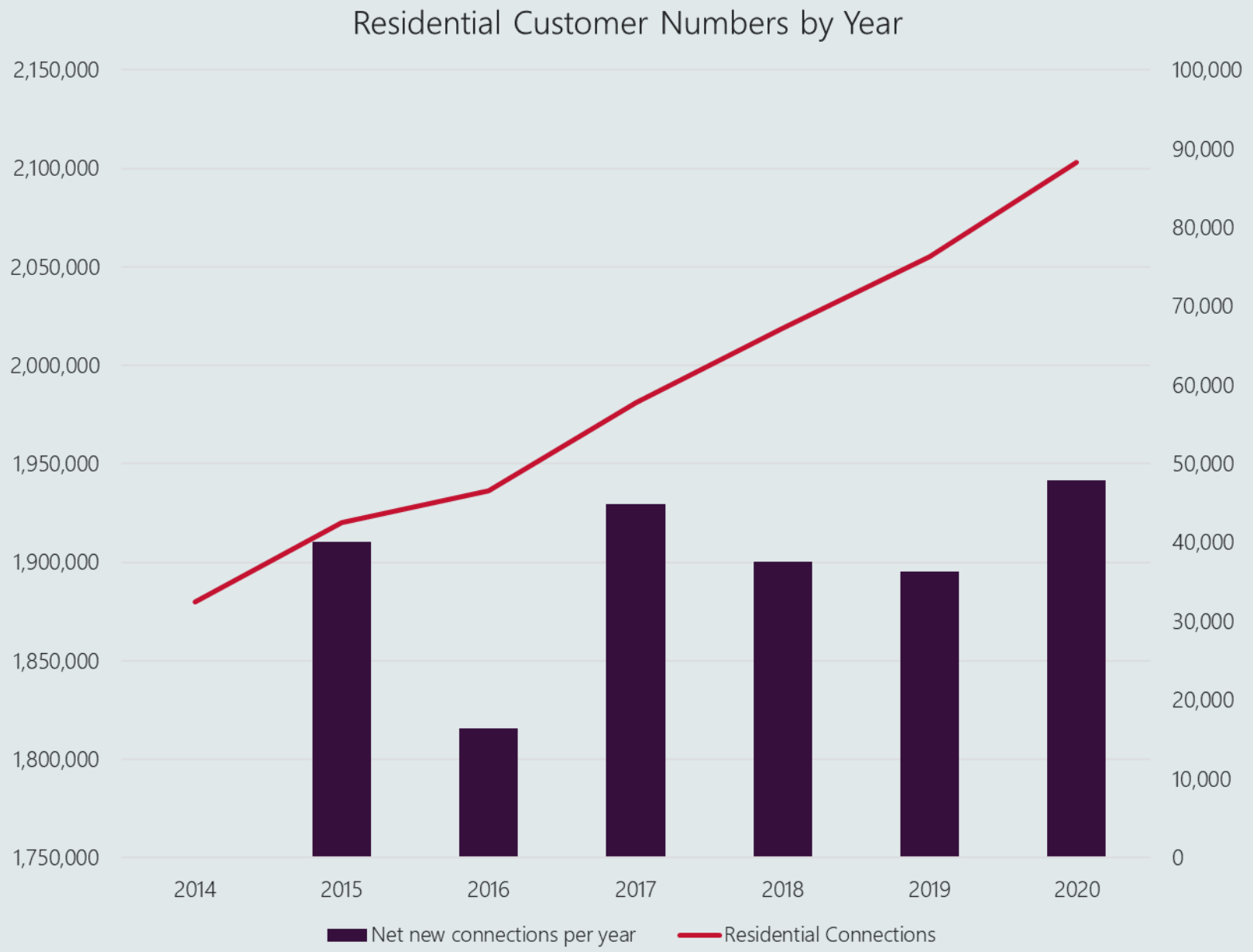
- Analysis of changes
  - Supply source
  - Demand
  - Network
  - Regulatory
- Preparation and Training
  - AEMO Gas Operations Engineers
  - Information for Industry Participants

Winter Strategy – Changes

Supply Changes	Demand Changes	Regulatory Changes	Network Changes
Some BAU items such as facility contracts and maintenance coordination	Large increase in residential consumption in the Cranbourne/Clyde region	From April 2020, DTS withdrawal constraints are included in the Pricing Schedule (PS)	Warragul looping completed
APA's Culcairn expansion and Lochard's Iona projects	Reducing industrial consumption	CPT reduced to $1,400 from 1 July 2020	Control system changes/upgrades
COVID – 19 impacts			

Number of residential connections supplied by the DTS

Average net increase of 38,000 new residential connections per year



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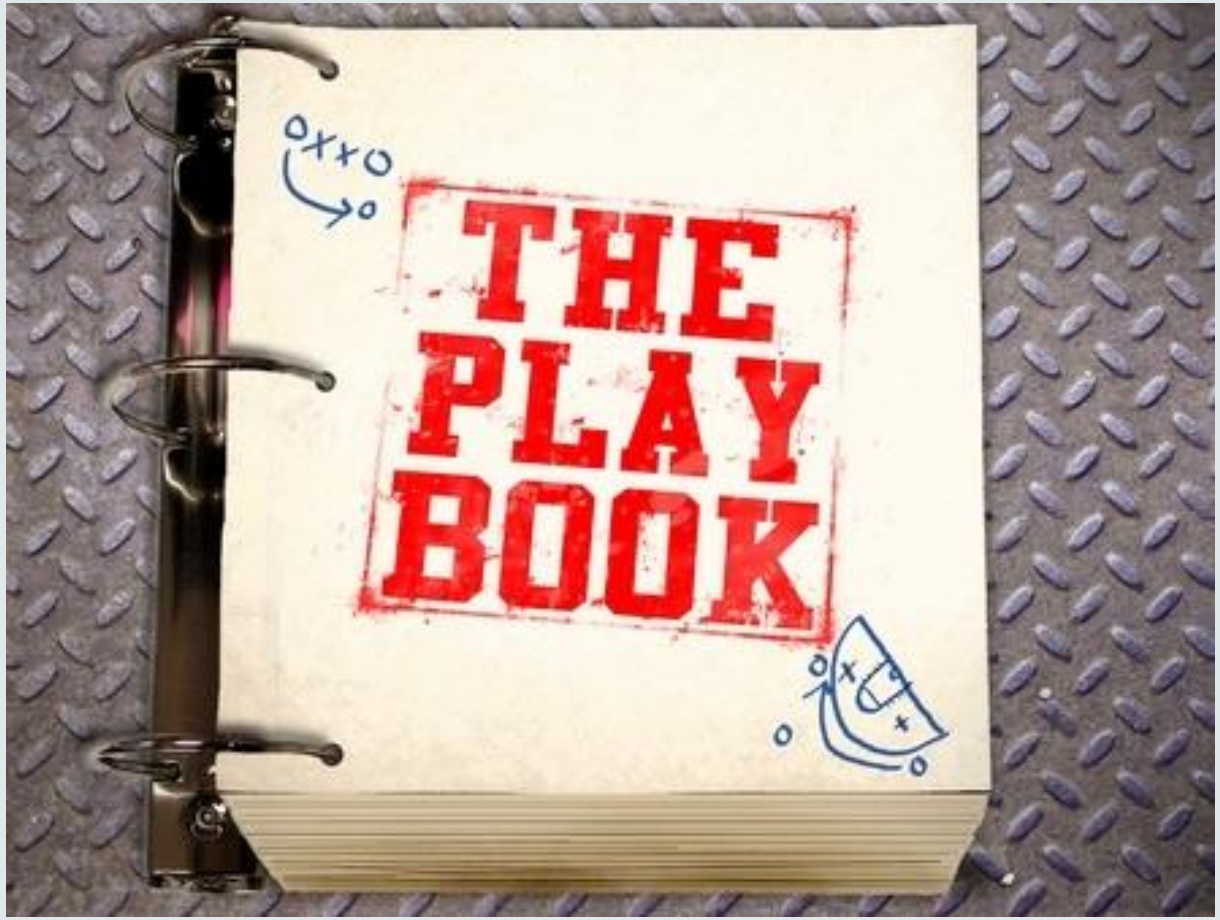
Winter Strategy – COVID-19 impacts

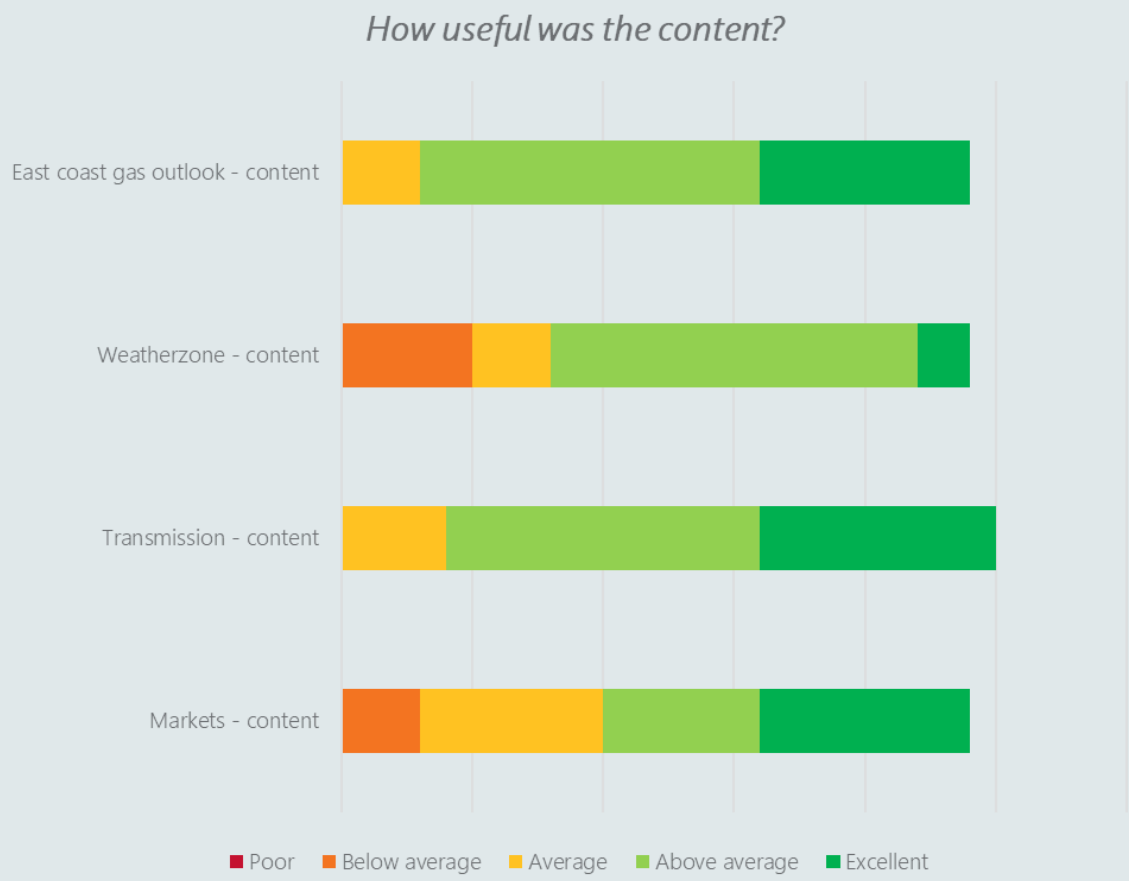
- Gas System Demand changes (will be covered in detail later)
- NEM demand
  - In NSW and Queensland, reductions have been observed varying between 3% to 10% depending on time of day, weekday or weekend
  - Some indications of some demand reductions being observed since Easter in Victoria and South Australia
    - day-to-day variability in the weather means it cannot conclusively be attributed to Covid-19.
- Reduced NEM demand could reduce GPG
  - lower gas prices may partially offset some of this anticipated reduction
- Separation of day and night shifts in control rooms
  - AEMO currently operating multiple control rooms from different locations

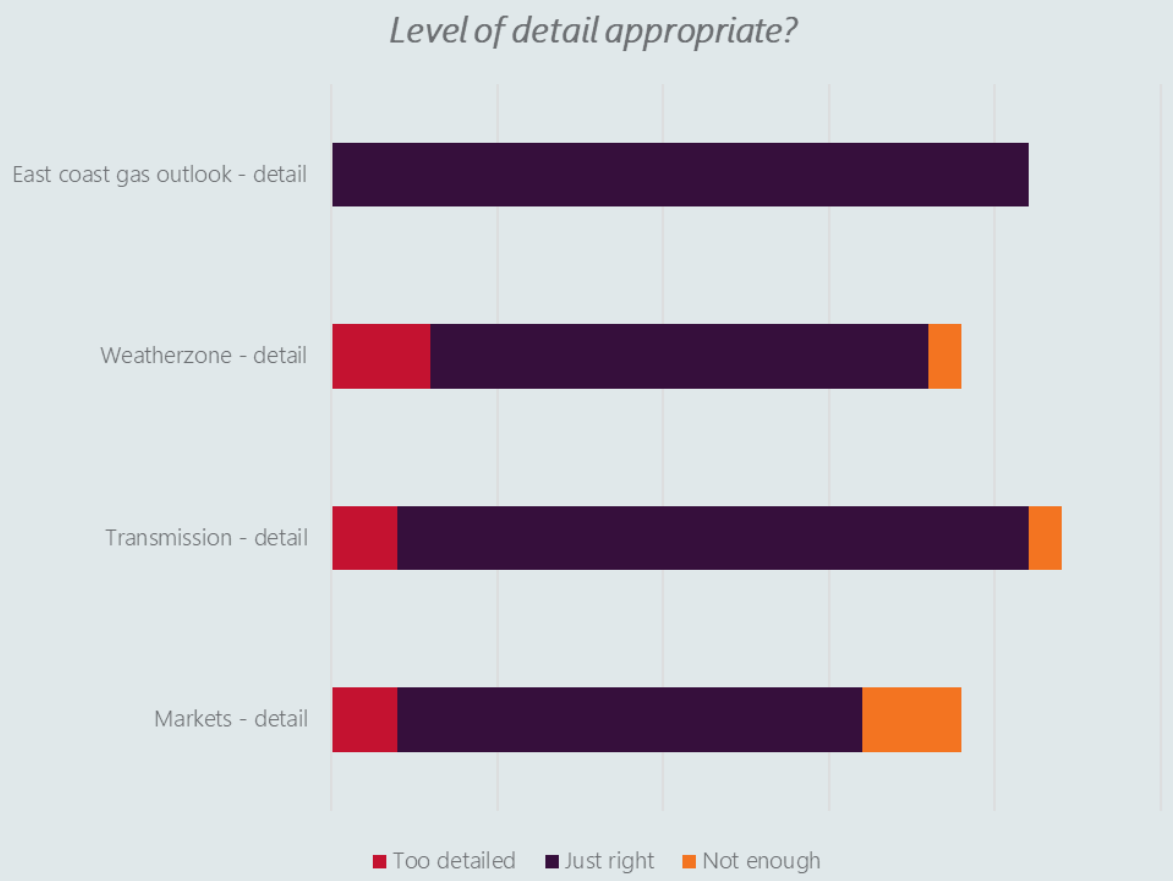
Winter Strategy – Benefits

- Provides participants with information about;
  - Changes in AEMO's operations or 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



Winter Strategy – 2019 Feedback





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Winter Strategy – 2019 Feedback

Summarised feedback on new presentation topics

- Gas and electricity interactions and supporting GPG
- Emergency scenarios and their management
- Demand profiles

- Gas market and gas transmission system interactions
- Management of Gas Quality

What future topic do you want AEMO to present on?

Topic	Votes
Interactions between gas and electricity systems	15
Emergency management	9
Responding to gas quality events	8
Market and Transmission system interactions	8
Gas powered generation supportability	8
Demand profiles	8
Market and transmission emergency scenarios	7
Facility Deviations (QDIFF)	1
Demand override methodology	1

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2019 in Review

Mark Pollock

Manager, Gas Real Time Operations

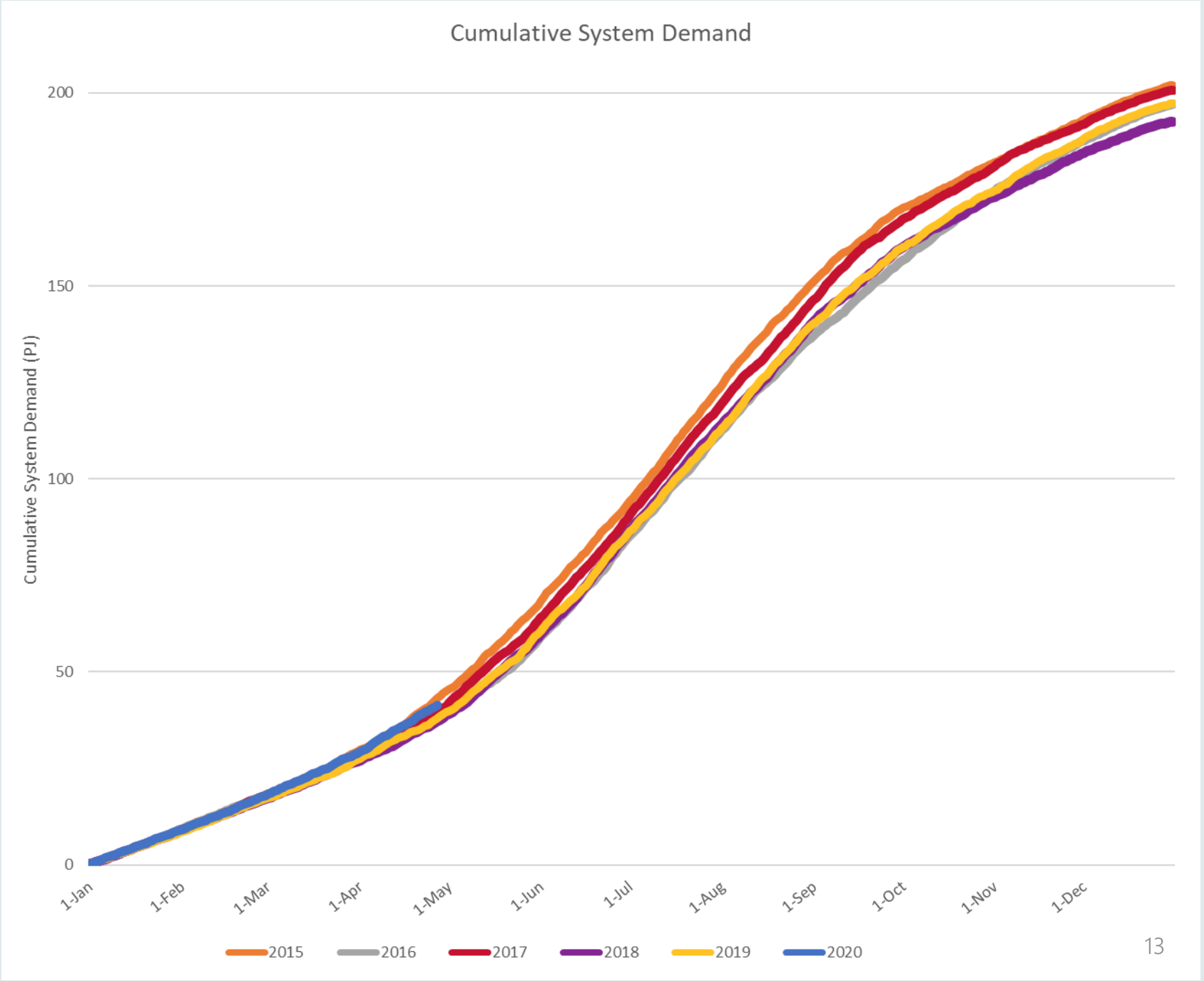
Reflecting on winter 2019

- How cold was it on average?
- How much GPG did we use?
- How cold were the coldest days?
- Where did the gas come from?
- What happened to storage levels?

How cold was it on average?

Cumulative Demand

- Cumulative System Demand was similar to Winter 2016
- Winter 2015 was the coldest for 26 years



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How cold was it on average?

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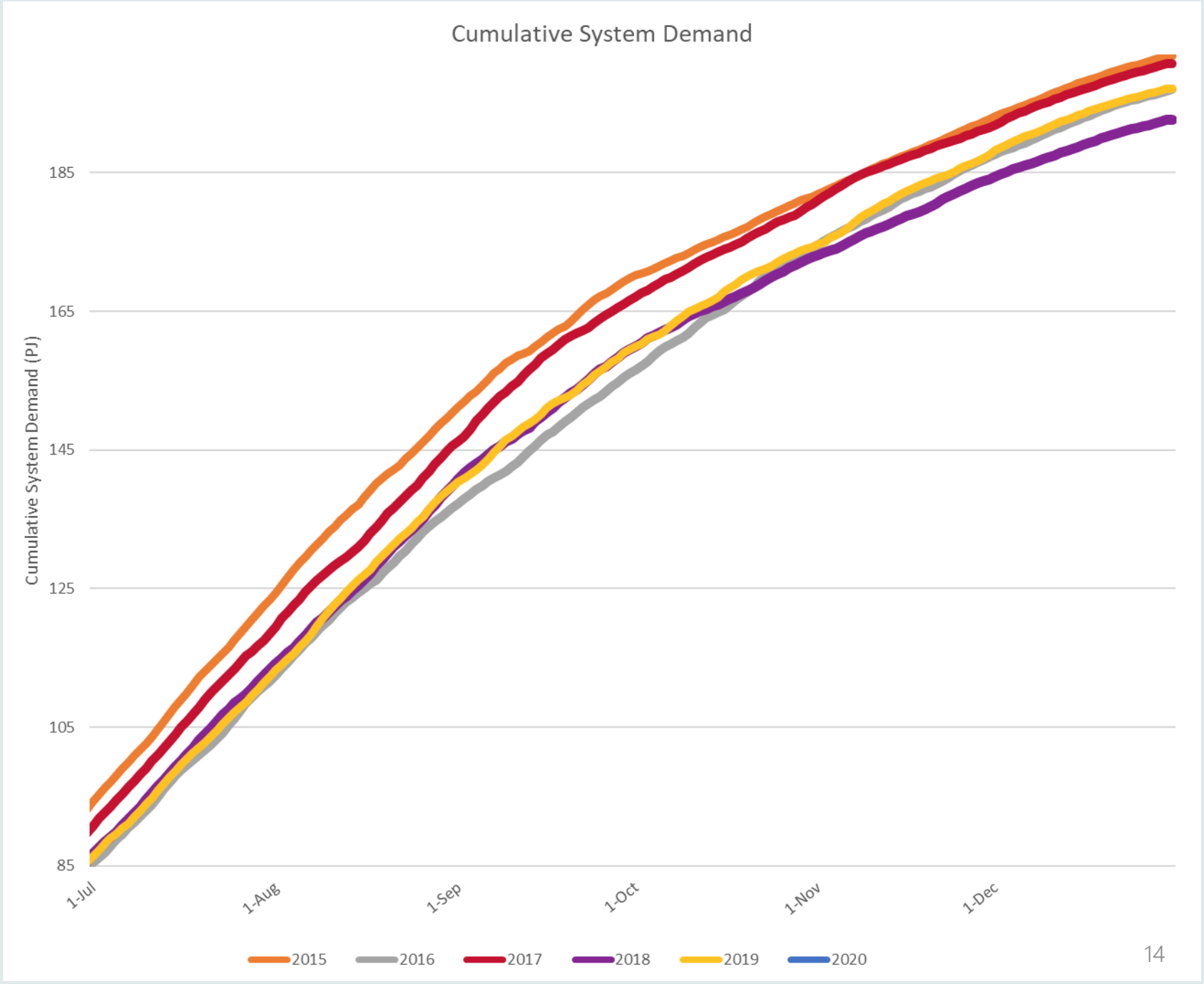

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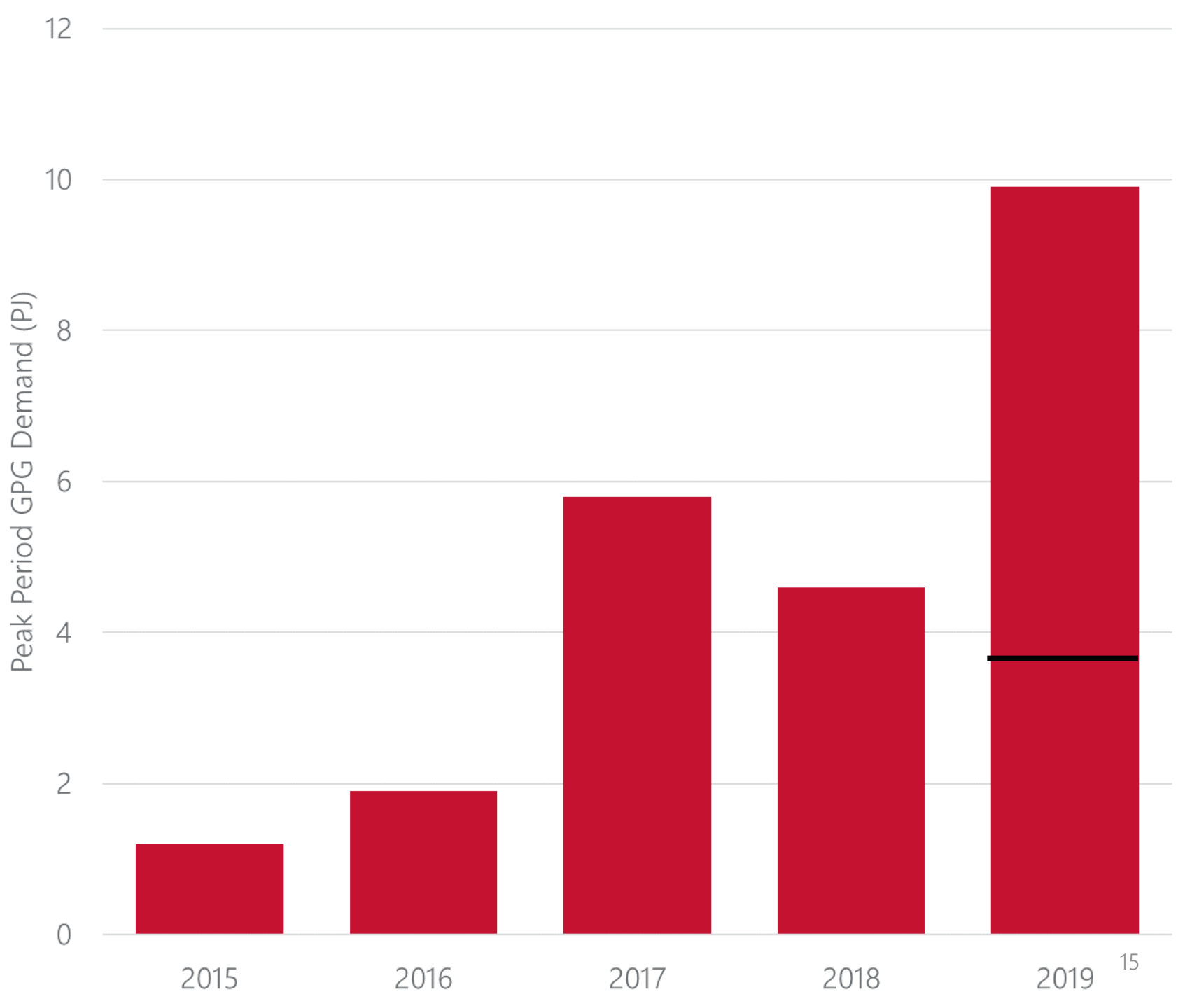
Victorian DWGM Gas Powered Generation

- GPG during peak period (1 May – 30 September) was forecast to reduce in 2019, but didn't. This was due to a 16% reduction in Brown Coal generation.
- Likelihood of GPG and the average quantity of gas consumed increases for colder weather



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How cold were the coldest days?

- Peak days had much higher demand than 2018
- There were eight consecutive days where the total demand exceeded 1,000 TJ (in comparison to two on two occasions in 2018)

2019 Highest Demand Days

Gas Day	EDD	System Demand (TJ)	GPG Demand (TJ)	Total Demand (TJ)
9/08/2019	15.0	1199	109	1308
20/06/2019	12.8	1088	179	1268
19/06/2019	11.5	1041	189	1230
24/06/2019	11.7	1088	72	1159

- Operational response LNG injected on 3 occasions:
  - 20 TJ on 27/5/19
  - 12 TJ on 29/5/19
  - 12 TJ on 19/6/19
- Longford profiling was utilised on the 9th and 10th of August 2019.
- There was no operational response LNG injections or Longford profiling in 2018.

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How cold were the coldest days?

- Demand on 9th of August was a total demand record (1,307 TJ). Previous record was in 2007 (1,282 TJ).
- 19th and 20th of June also saw high total demand, with significant GPG consumption.

Highest Demand Days Ever

Gas Day	EDD	System Demand (TJ)	GPG Demand (TJ)	Total Demand (TJ)
9/08/2019	15.0	1199	109	1308
17/07/2007	16.8	1258	24	1282
3/08/2017	13.4	1139	129	1268
20/06/2019	12.8	1088	179	1268
12/08/2008	12.1	1072	164	1236
19/06/2019	11.5	1041	189	1230

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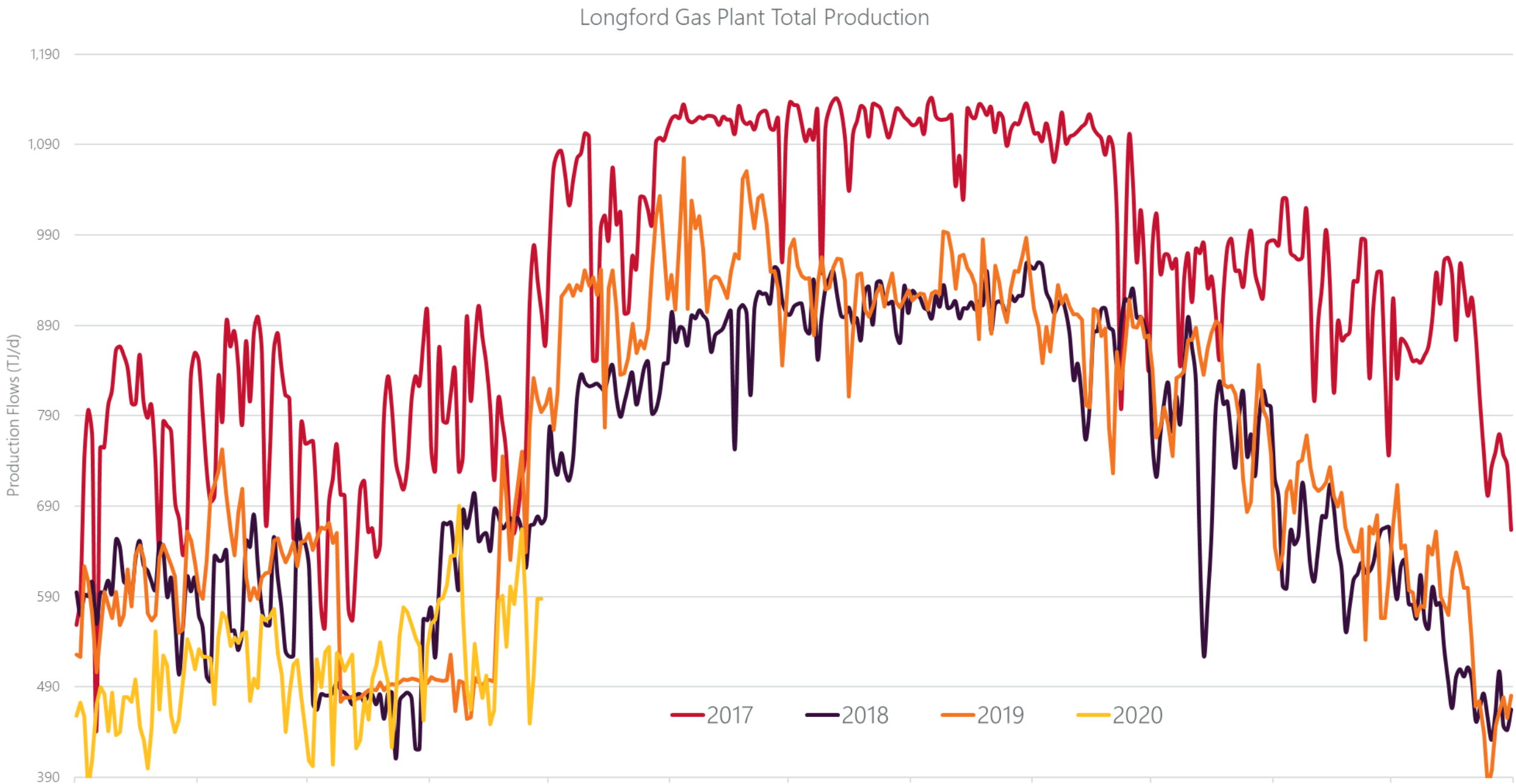
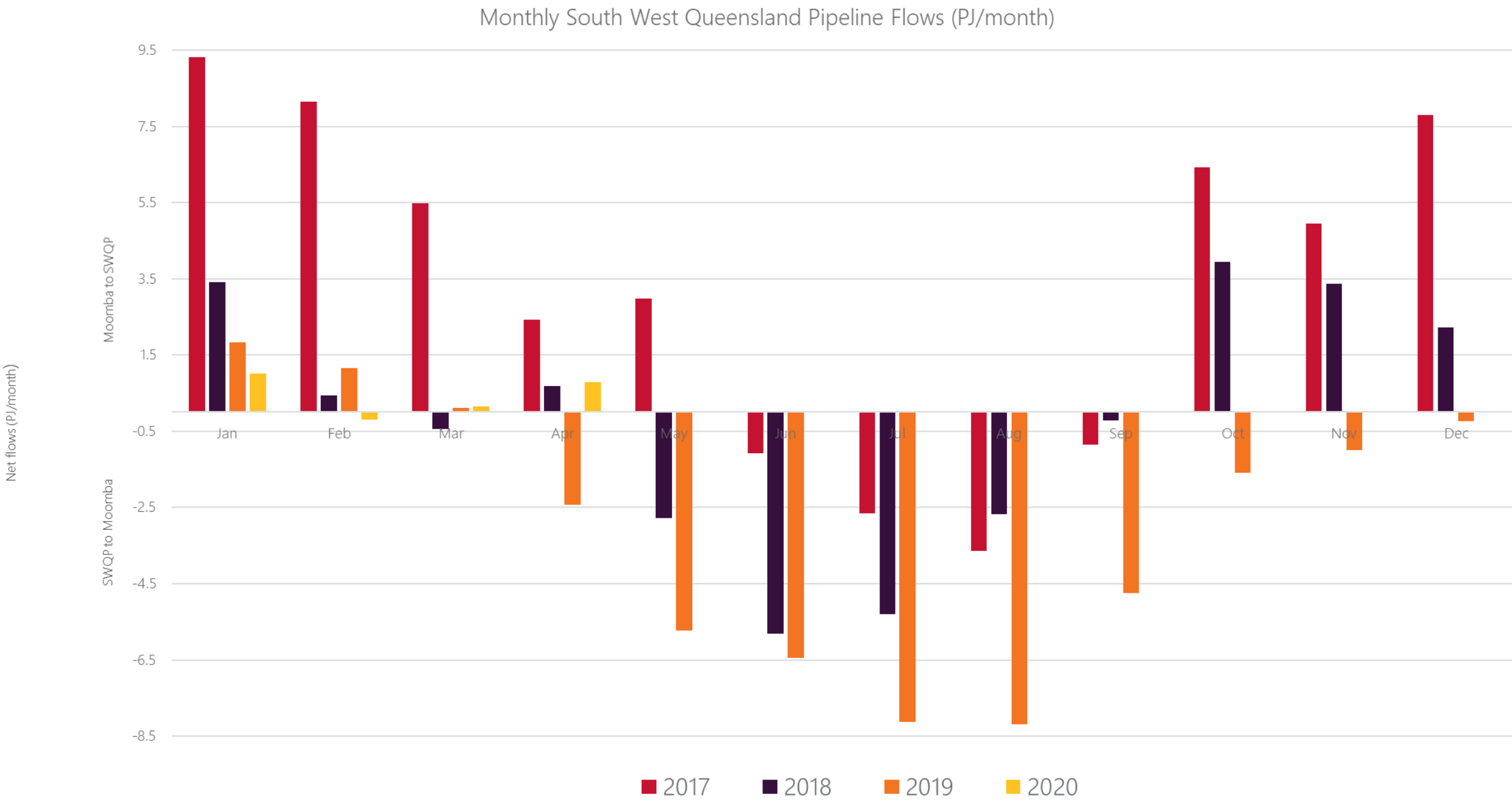
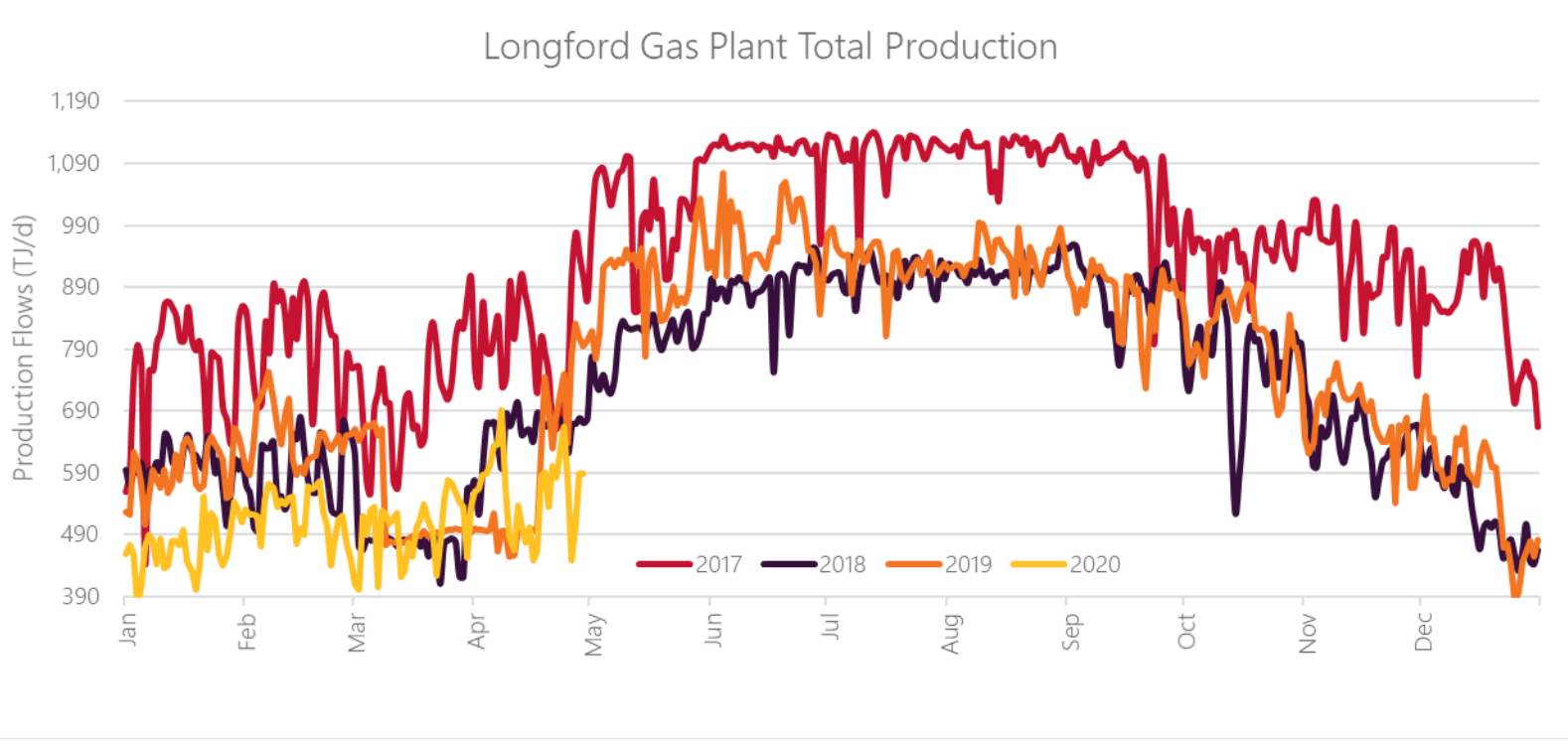
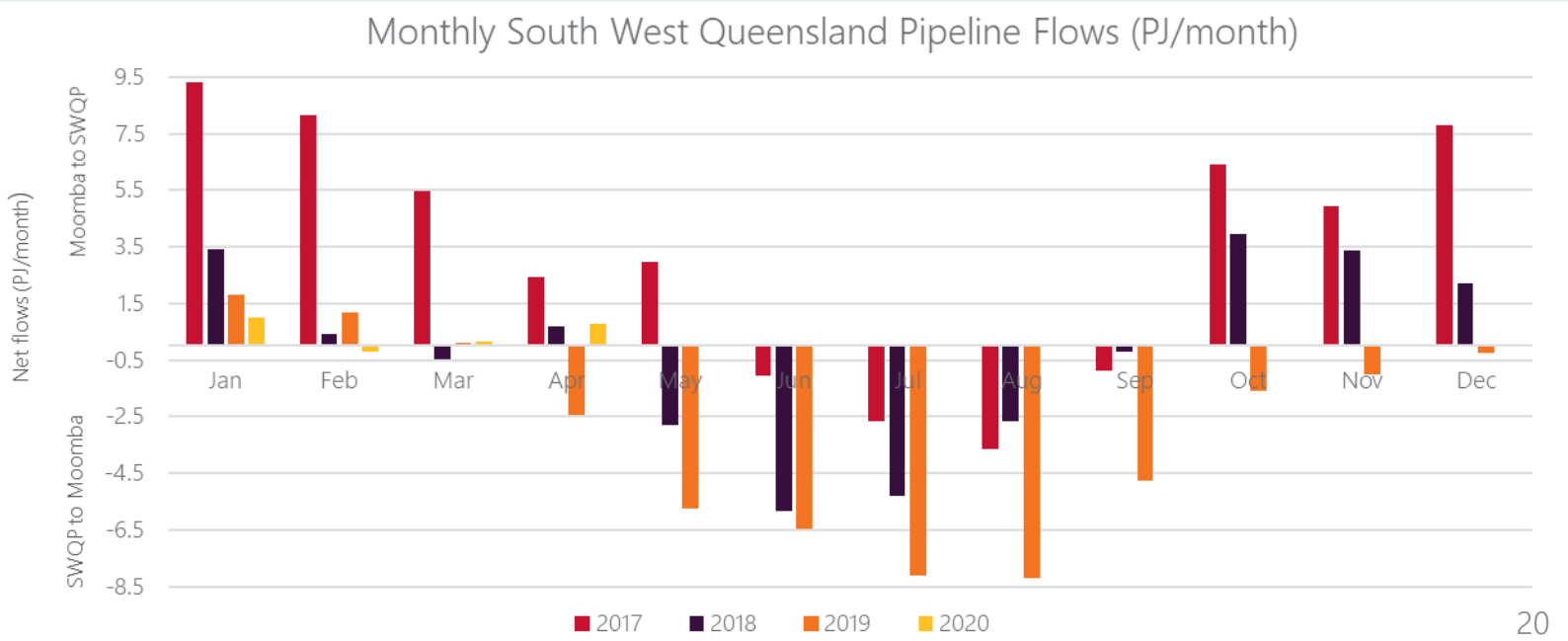



Monthly South West Queensland Pipeline Flows (PJ/month)
Net flows (PJ/month)
Moomba to SWQP
SWQP to Moomba
9.5
7.5
5.5
3.5
1.5
-0.5
-2.5
-4.5
-6.5
-8.5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2017
2018
2019
2020

What has changed?

- Longford Production decreased by ~200 TJ/d from 2017 to 2018 and 2019
- Longford 2019 production 4 PJ higher than 2018
- Queensland supply to the southern states increased during winter 2019
- Continued flow south through the year until February 2020





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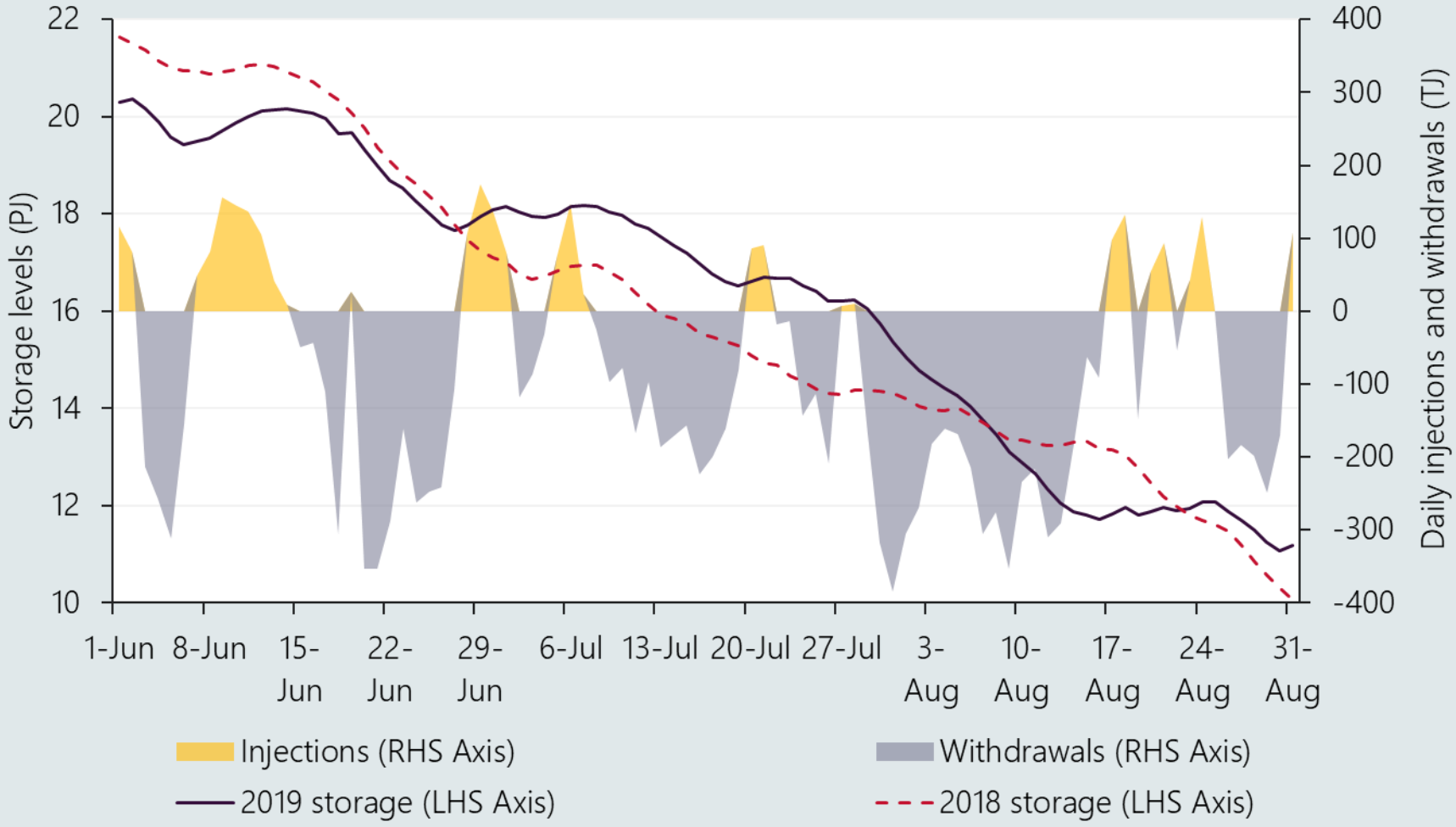
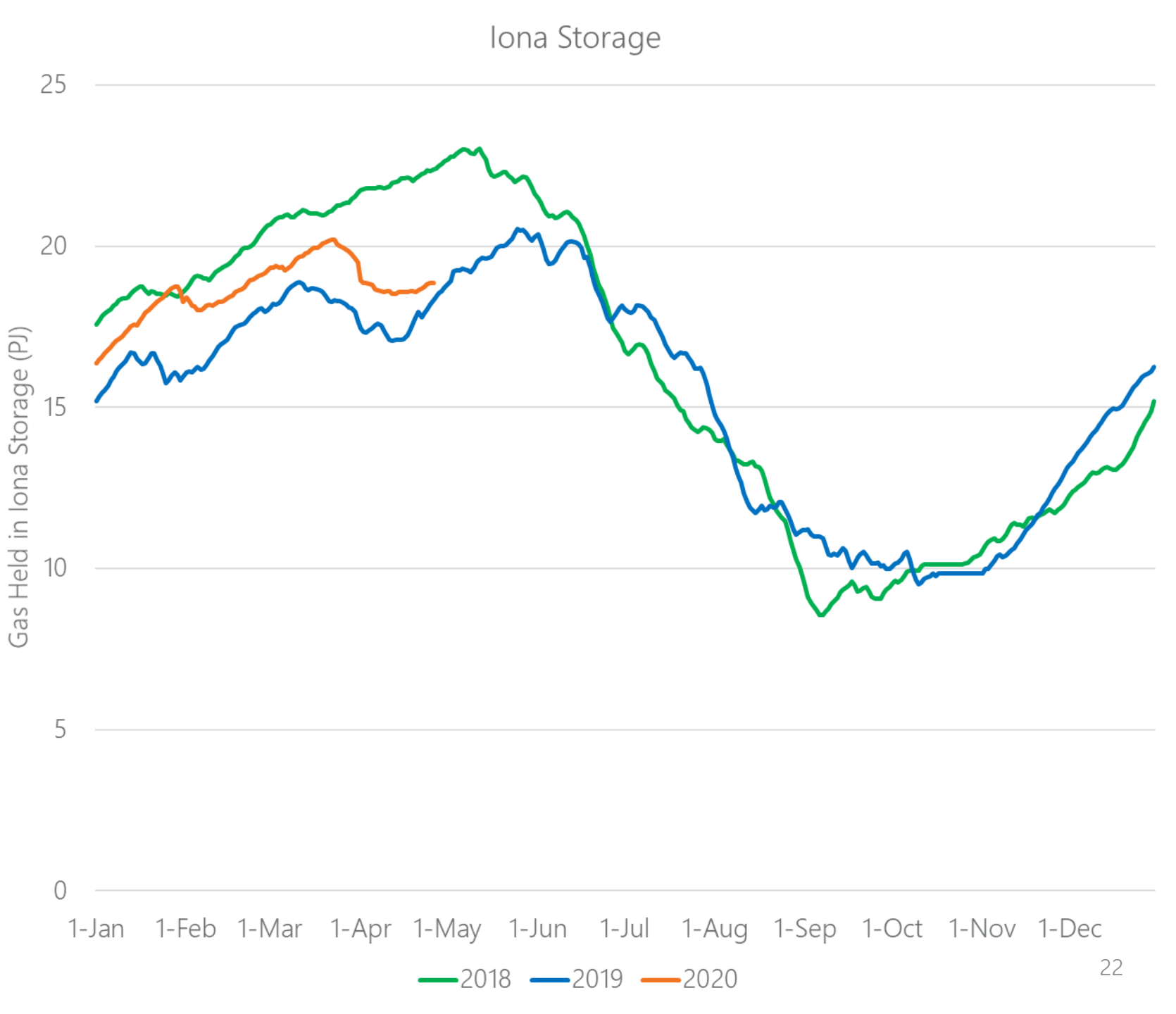
Iona Gas Storage

- Iona supplied 2.8 PJ less than 2018
- Main reasons are lower SEA Gas and SWP flows due to increased supply from Queensland and Northern Territory
- Minerva supply(~50 TJ/d) ceased 3 September



Iona Underground Gas Storage

- Less gas in storage at beginning of 2019 winter than 2018 winter.
- Reliance on gas from Queensland resulted in a similar minimum storage level in 2019 to 2018.
- Current storage level similar to 2019 (19 PJ).



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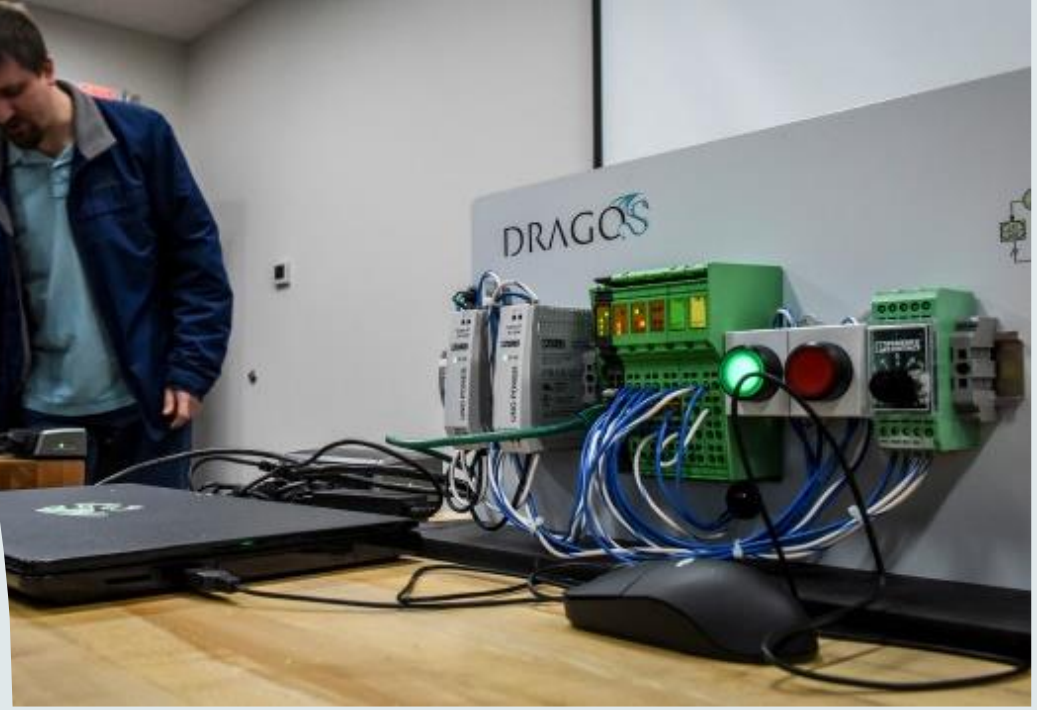
Emergency Exercise Overview

2019 Emergency Exercises

- Exercise Everett - National Combined NGERAC / NEMEMF Exercise
  - Objective:
    - Test Interruption to Supply Process (ITSP) & NEM Power System Emergency Management Plan (PSEMP)
- Exercise Venn - GEMCF Exercise
  - Objective:
    - Promote awareness of roles and responsibilities in a gas emergency
    - Exploring the adequacy of the arrangements that comprise gas emergency management in Victoria.

Exercise Everett

- Conducted over four days (Thursday 15 August – Tuesday 20 August)
- Cyber security flavour
- Escalated from social media hack (media response) to Operational System Interruptions



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Exercise Venn

- Single day desktop exercise
- Inspired by the Aliso Canyon gas leak (a U.S. Underground Storage Facility)
- Involved all Victorian Agencies (Vic Police, SES, MFB, EMV, DEWLP, ESV, AEMO etc.)
- Large scale safety, environmental and supply processes tested.

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Summary

- System Consumption for 2019 was average
- There were a number of cold snaps during the Winter
- August 9 2019 had the highest total demand recorded (1,308 TJ)
- Greater supply from Queensland in winter 2019 compared to 2018.
- 2019 saw large GPG consumption.

Covid-19 Demand Forecast

Presented by Robert Dickie

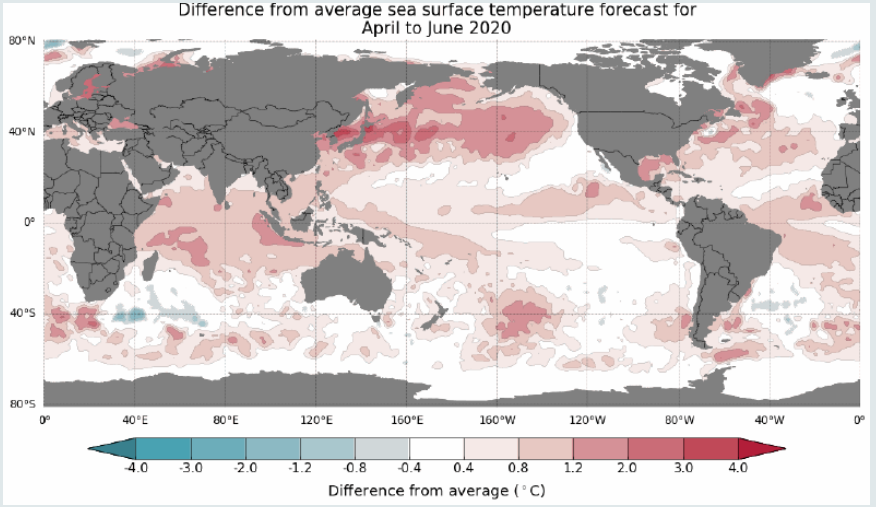
Agenda

1. Weather outlook
2. COVID-19 demand modelling
3. Operating challenges
4. Risk management strategies

Weather Outlook

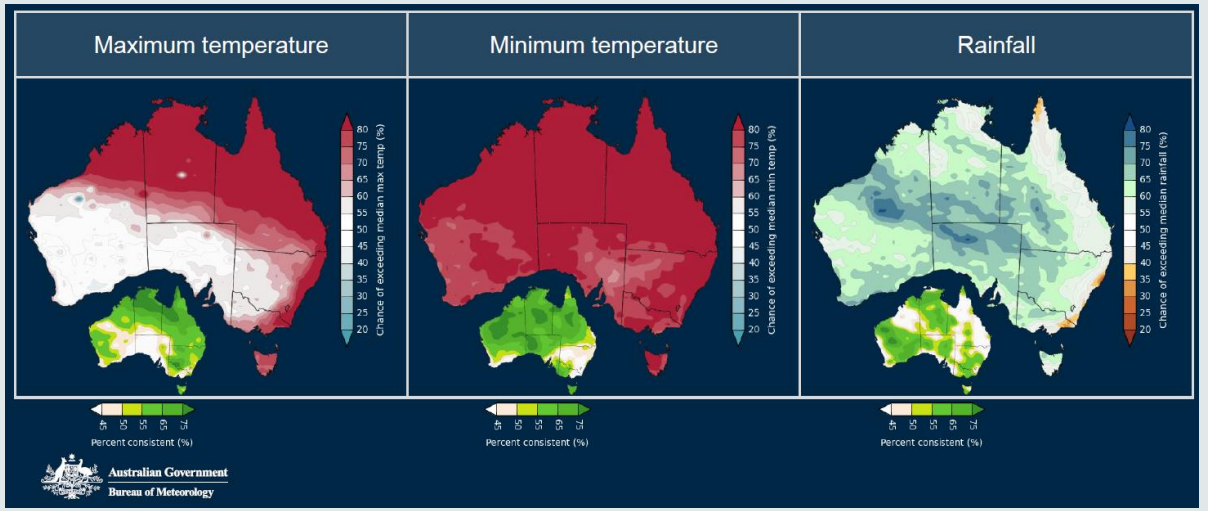
Climate Drivers

- Indian Ocean Dipole - neutral
- El Nino Southern Oscillation – neutral
- Southern Annular Mode - neutral



Weather Forecast

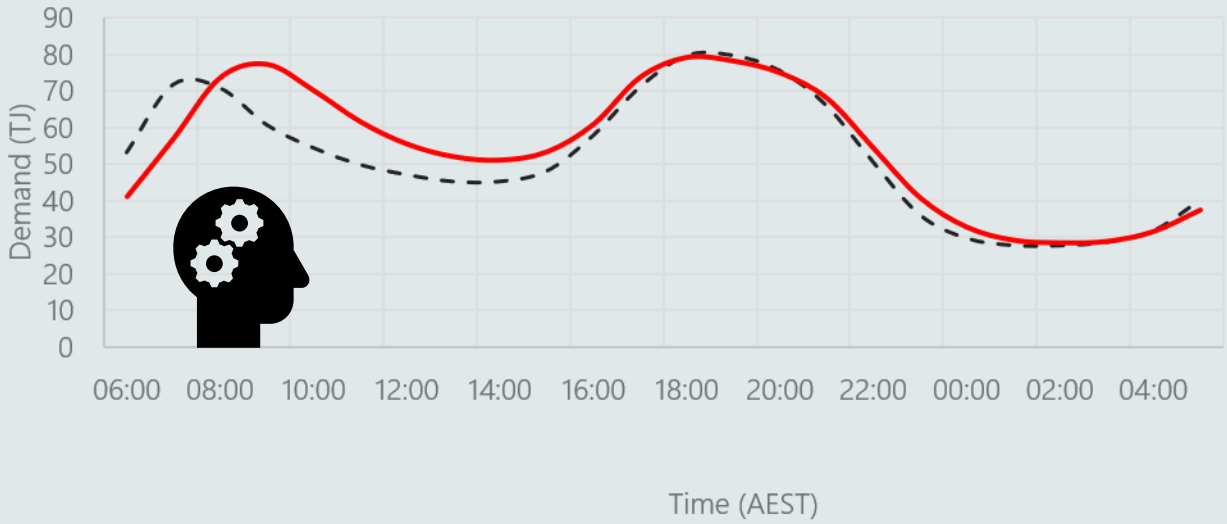
- Wetter than average
- Warmer days
- Warmer nights



Climate update provided by Bureau of Meteorology, April 2020

COVID-19 modelling methodology

1. VGPR 2020 demand forecast as a base case
2. Identify COVID-19 demand influencing factors
3. Generate demand model
4. Validate against actual demand observations
5. Apply to winter 2020

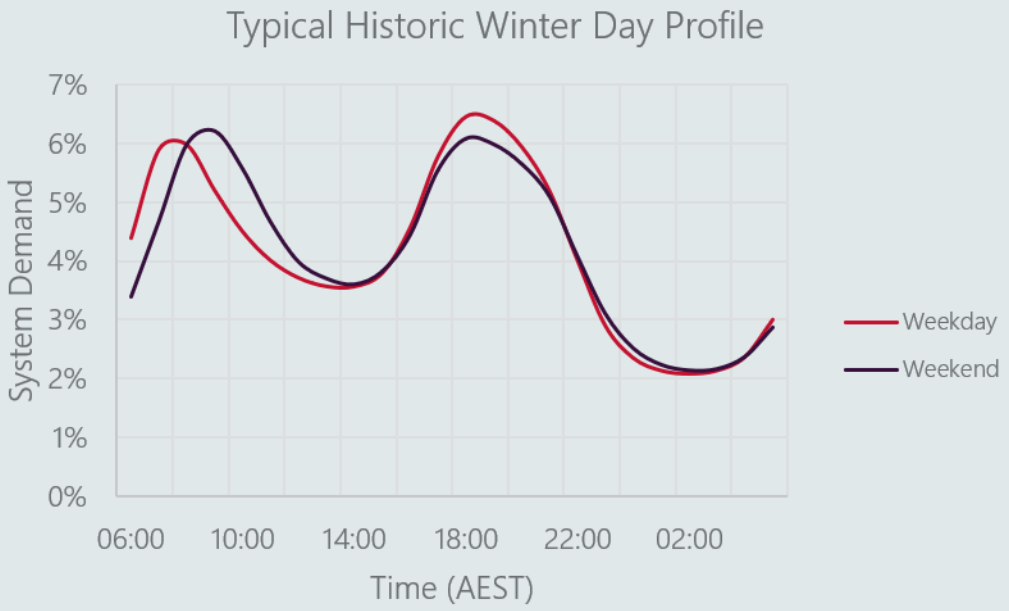


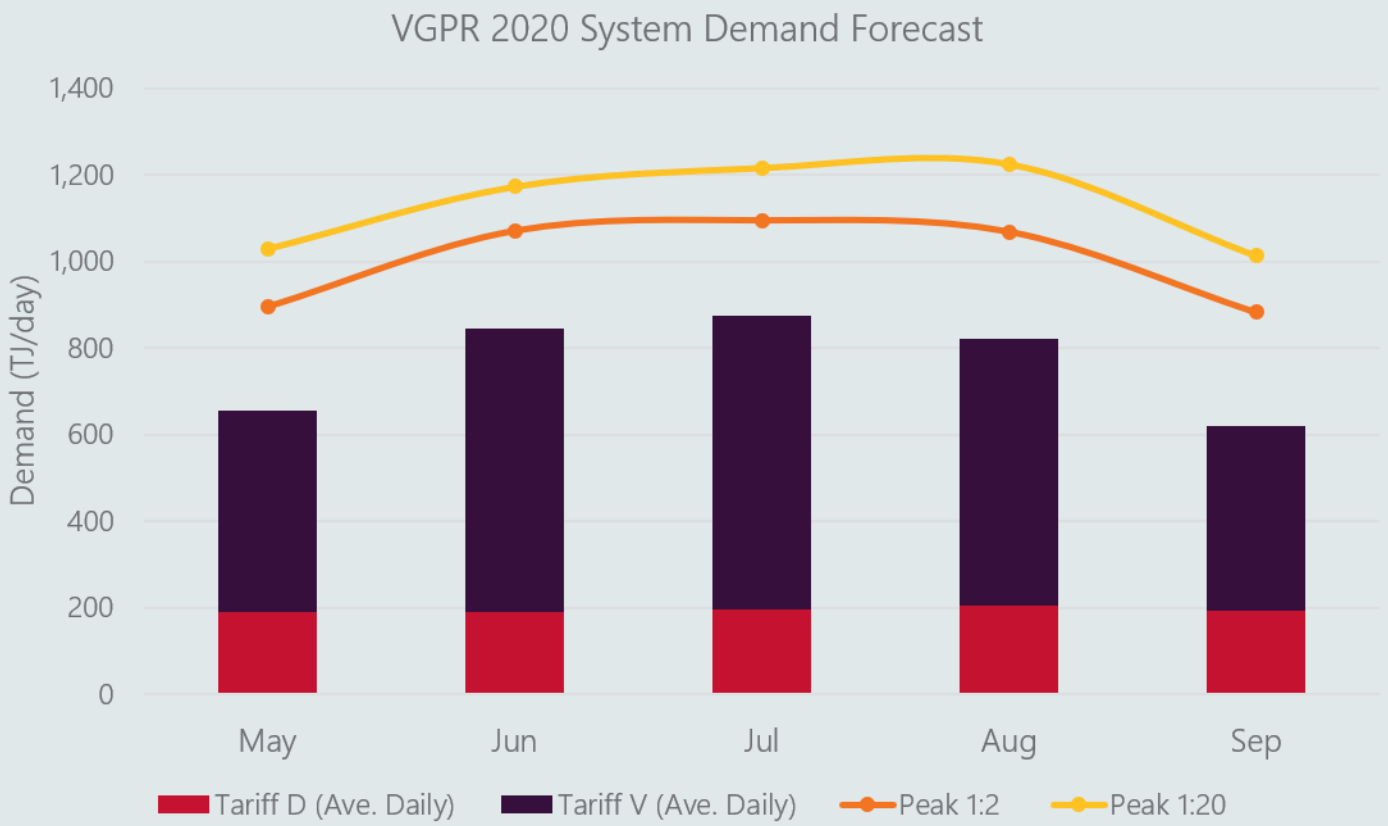
COVID-19 Forecast Basis

- COVID-19 stage 3 restrictions introduced 31 March 2020
- Excludes medium to long term economic impact of restrictions

VGPR 2020 Demand Forecast

- Neutral climate driver conditions
- Prior to COVID-19 restrictions





Heavy Industry modelling

Considerations:

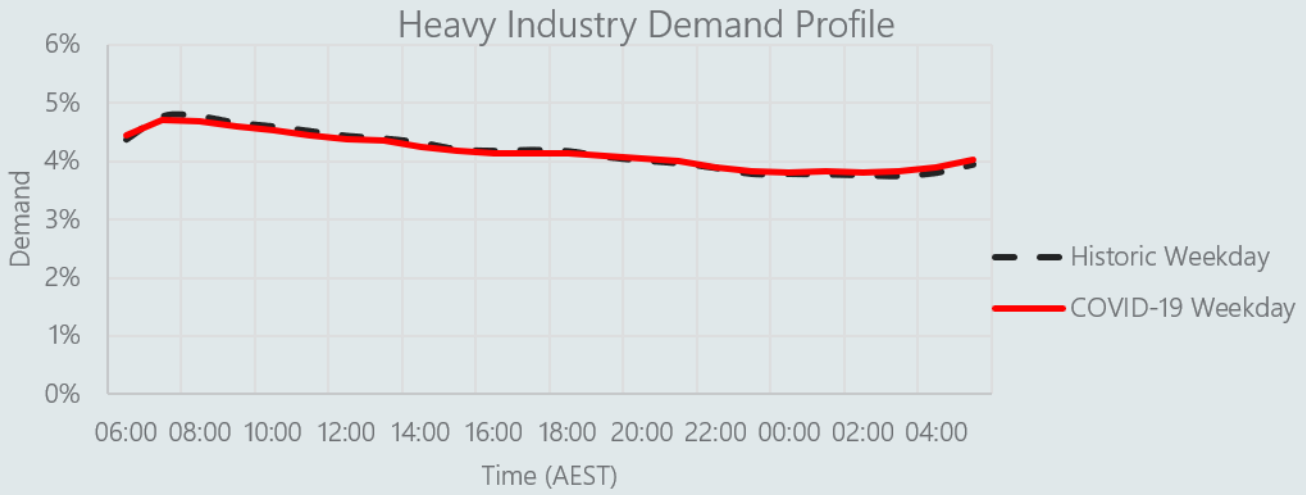
- Reduction in industry operating hours.
- Short term consumer product stockpiling.
- Economic downturn.

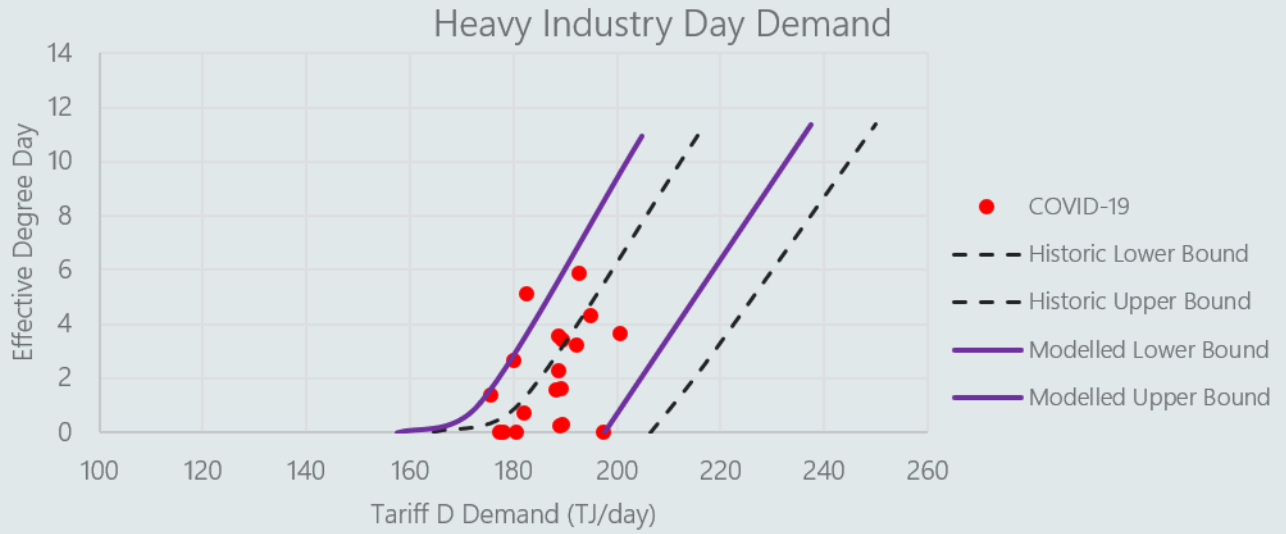
Early trends:

- Hourly profile is unchanged from typical.
- Indications of a 5% reduction in demand.

Modelling:

- Historic hourly demand profile
- Continued 5% reduction in tariff D demand.





Commercial / Light industry & Residential modelling

Considerations - Light industry and commercial:

- Similar drivers to heavy industry
- Heavy restrictions in the service industry

Considerations - Residential:

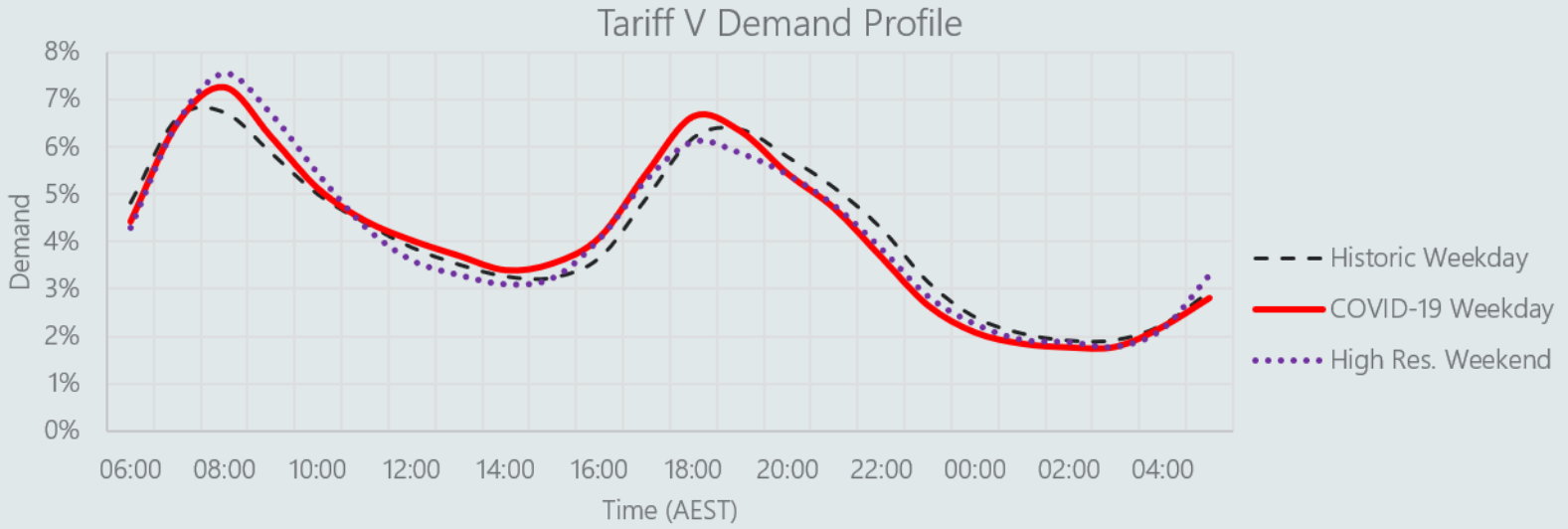
- Stay at home restrictions

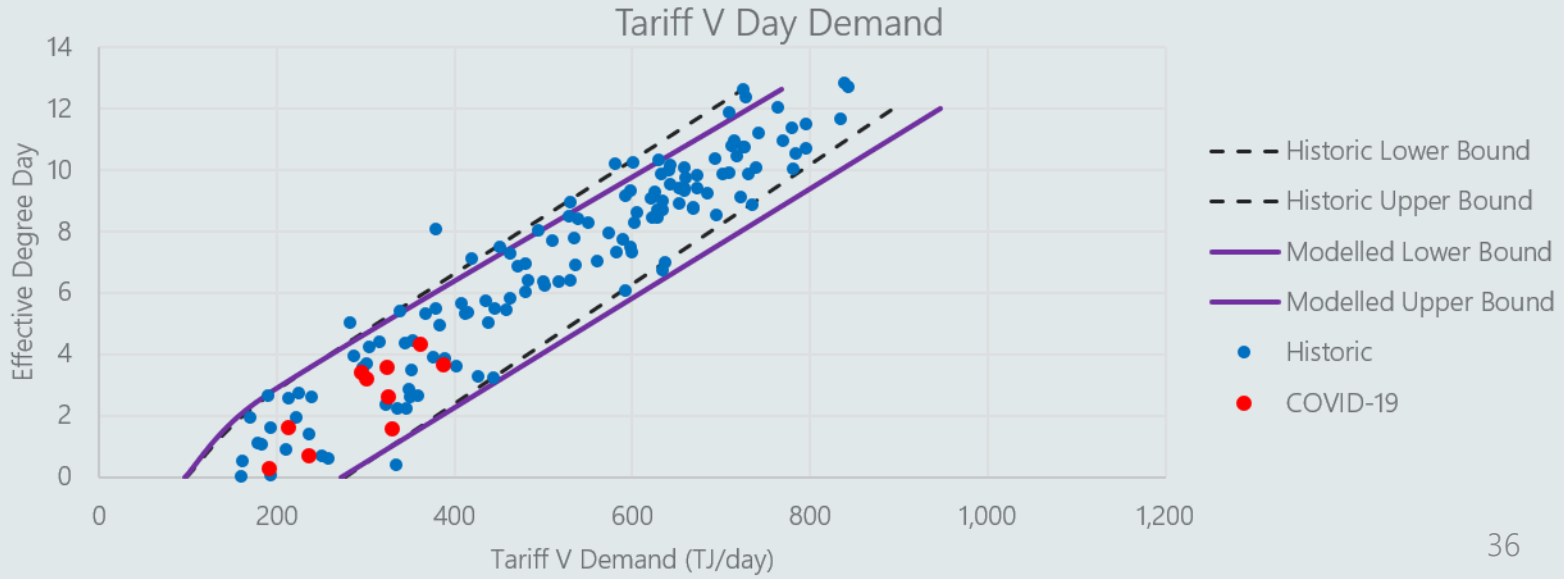
Early trends:

- Later and higher morning peak.
- Demand (TJ/day) remains within the bounds of the historic range.

Modelling:

- High residential connection weighted, weekend demand type profile
- 2% increase during mild weather conditions (shoulder)
- 7% increase on peak (very cold) demand days



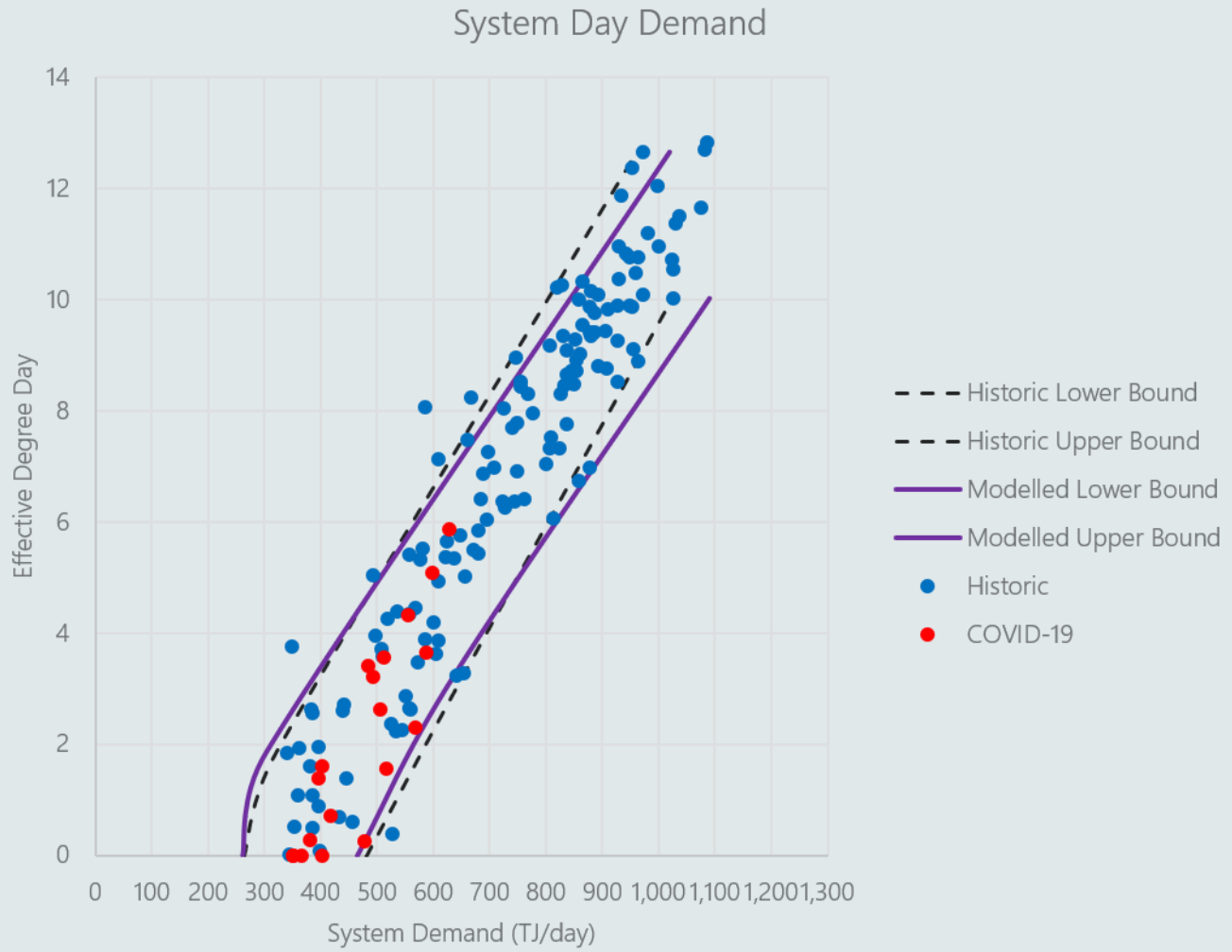


COVID-19: System day demand

Modelling:

- Negligible decrease for mild weather conditions (shoulder)
- 5% increase on peak (very cold) demand days

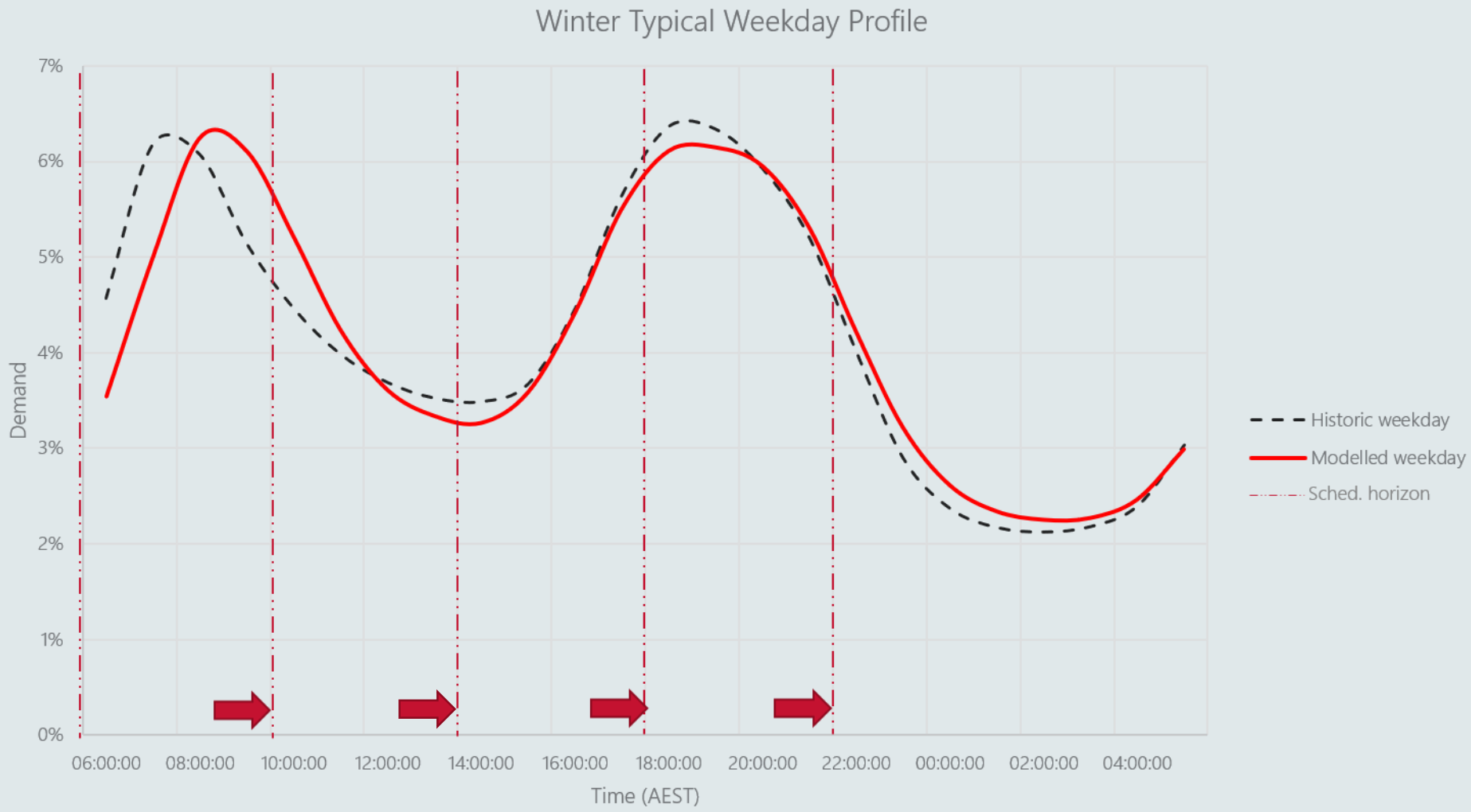
	1-in-2	1-in-20
VGPR 2020 (TJ/day)	1,136	1,249
COVID-19 (TJ/day)	1,199	1,319
COVID-19 Peak Hourly (TJ/hr)	70	78



COVID-19: System demand profile

Demand profile changes:

- Later and longer morning peak.
- Demand remaining high through late morning.

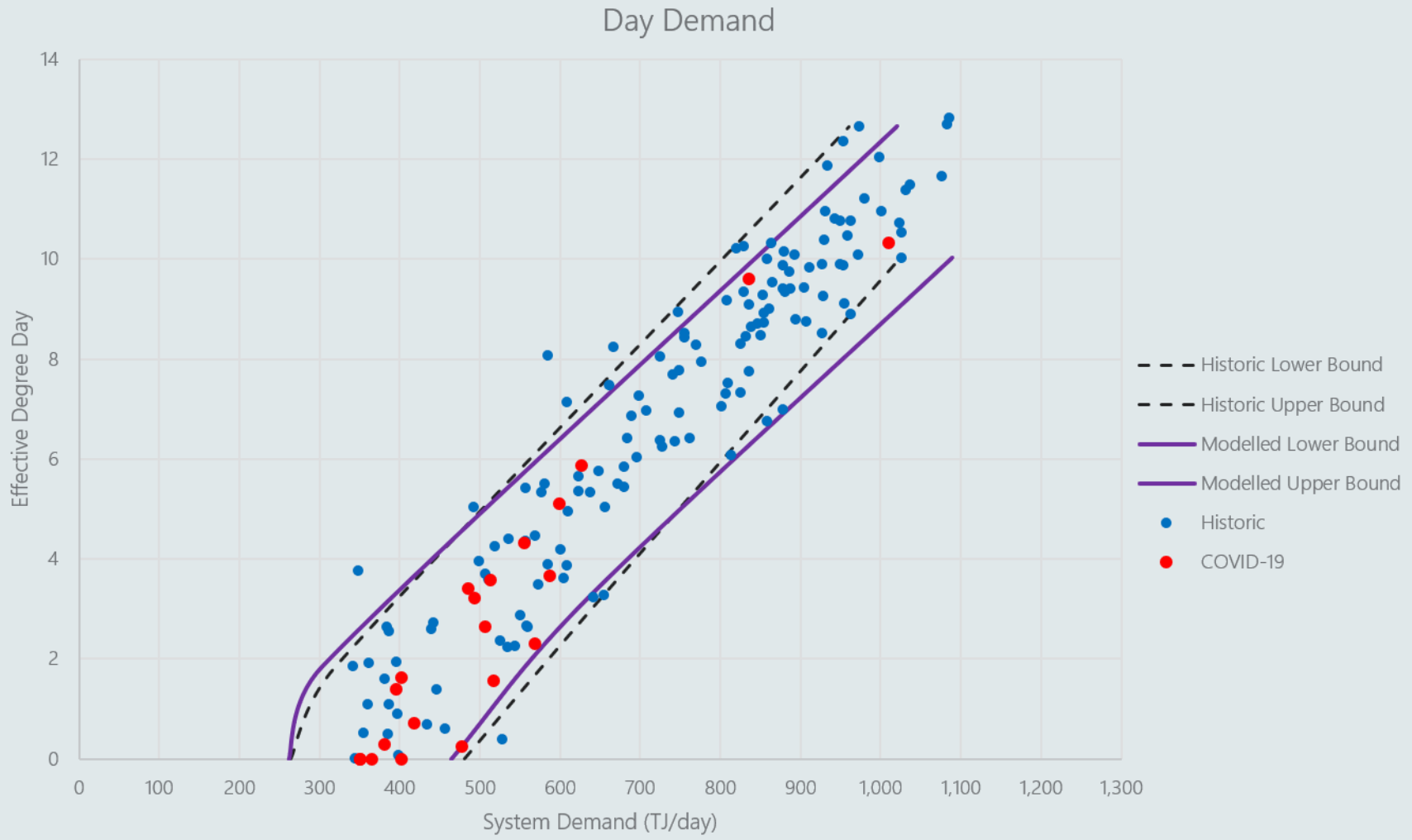


Forecast Vs Actual Day Demand

Early "winter" day, Friday 1 May 2020:

- EDD: 10.4
- System Demand: 1,010 TJ
- Peak 1-in-20 day demand for April

Good alignment with forecast demand.



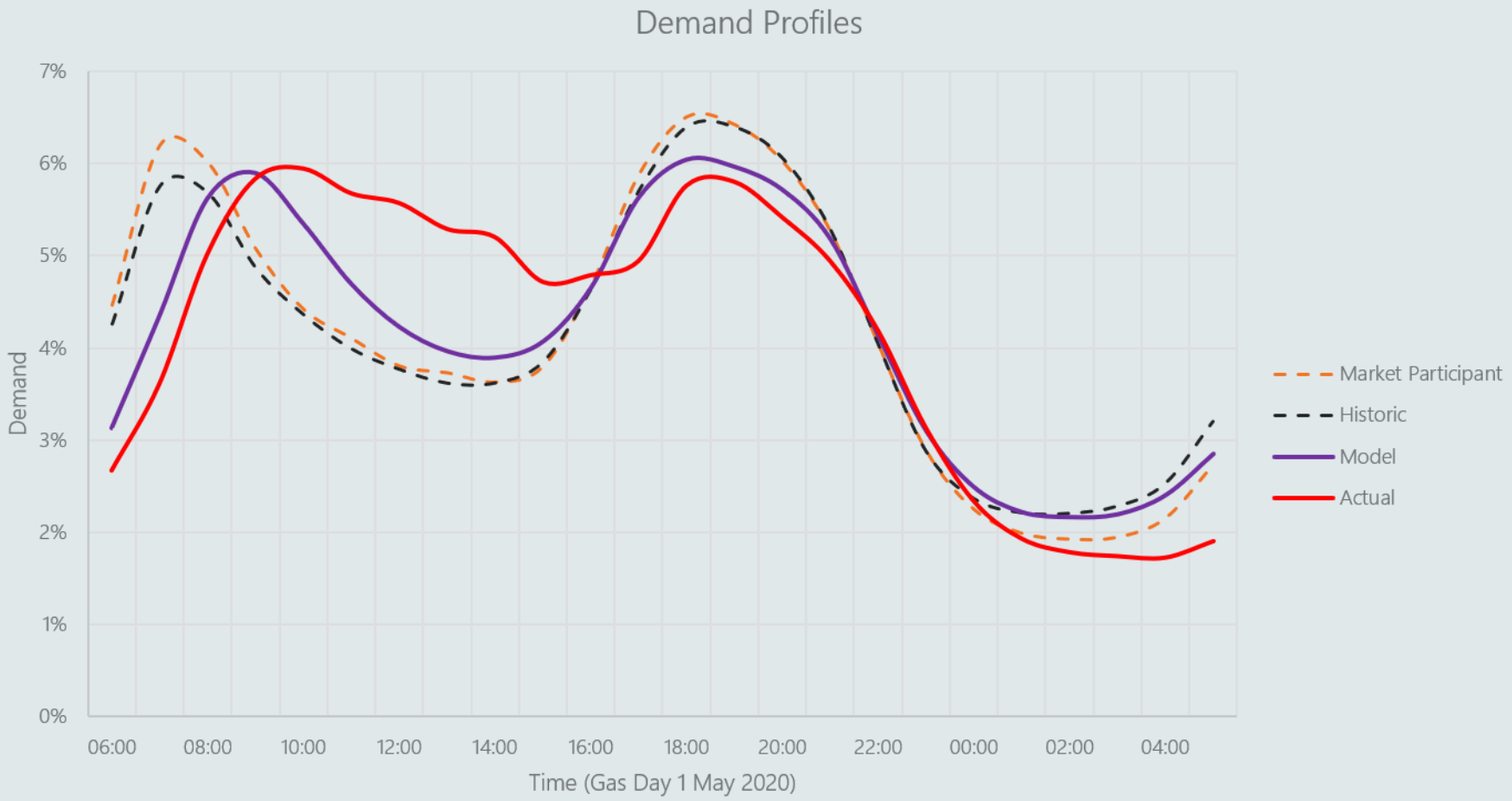
Comparison of demand profiles - 1 May 2020

Very good alignment for morning peak;

Discrepancy midmorning/early afternoon indicates:

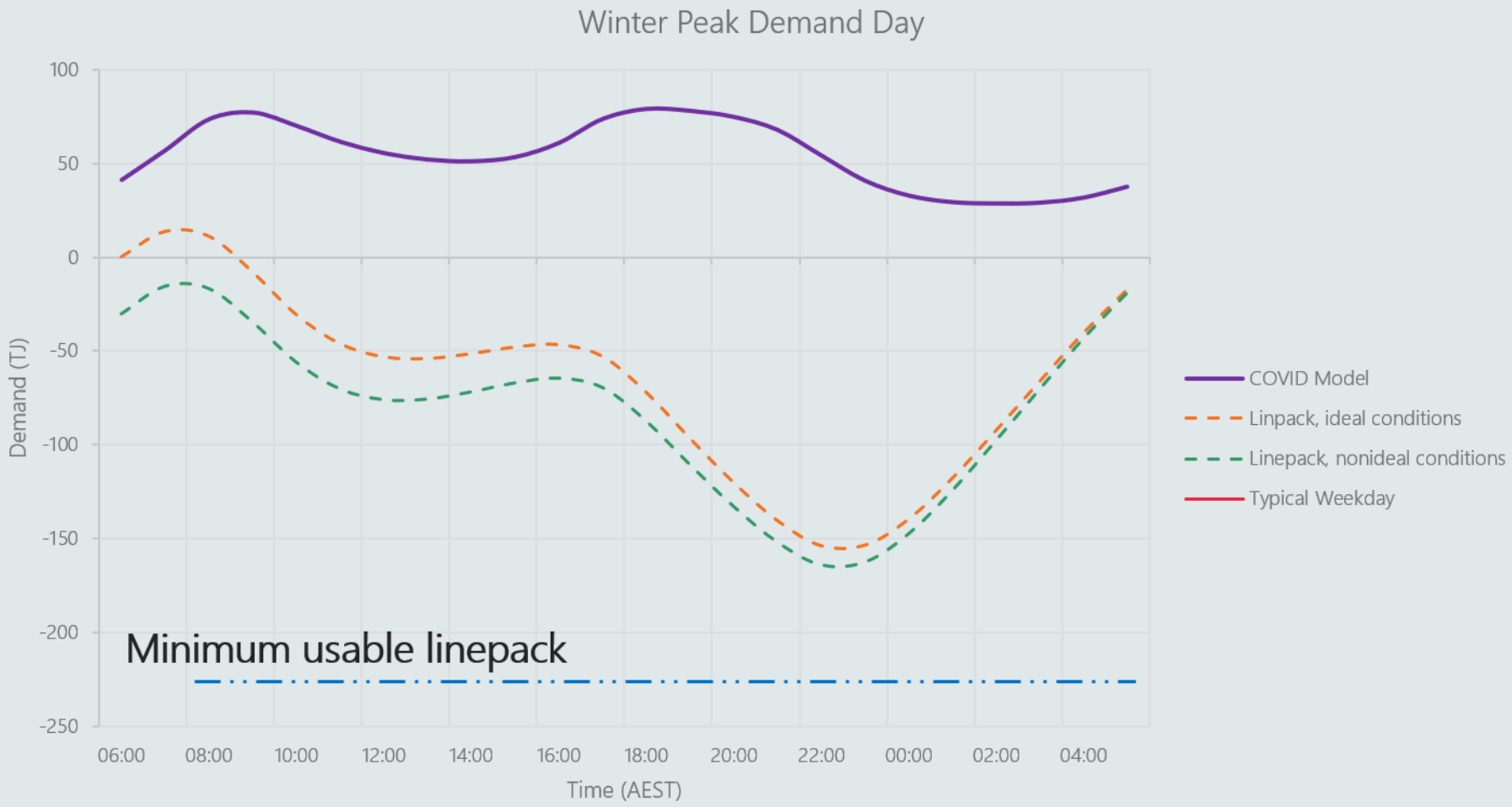
- Typical day profile relative to day specific characteristics.
- Potentially higher than modelled demand over midday.

Overnight error attributed to lead into weekend.



Operating challenges

- Start of day forecasting
- Linepack management
- Demand volatility



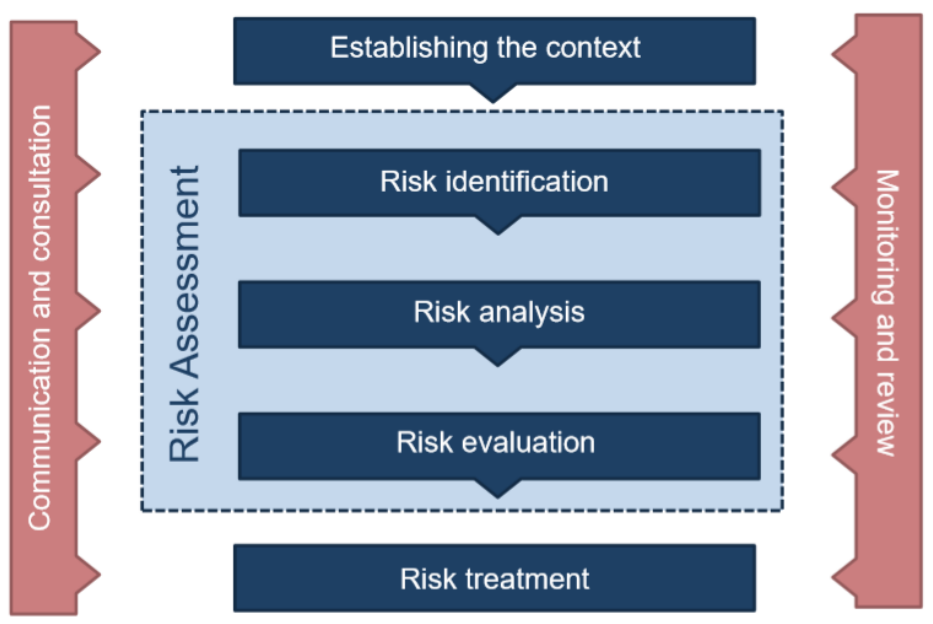
COVID-19: Risk management

Risk management options:

1. Start of day and intraday demand overrides as necessary
2. Profiling injections
3. Scheduling injection from Dandenong LNG facility

Additional risk management actions:

- Continued analysis of system demand.
- Training of AEMO Gas Operations.



Key Takeaway

- Hourly demand profile has changed.
  - Later and longer morning peak.
  - Demand remaining high through late morning.
- Anticipate a 5% increase in peak day demand.
- Increased sensitivity to weather events.
- Risk managed broadly through existing operating strategies.

GPG demand and supportability

Presented by Patrick Chan

Agenda

1. GPG trend
2. GPG forecast
3. Significant GPG events
4. GPG supportability

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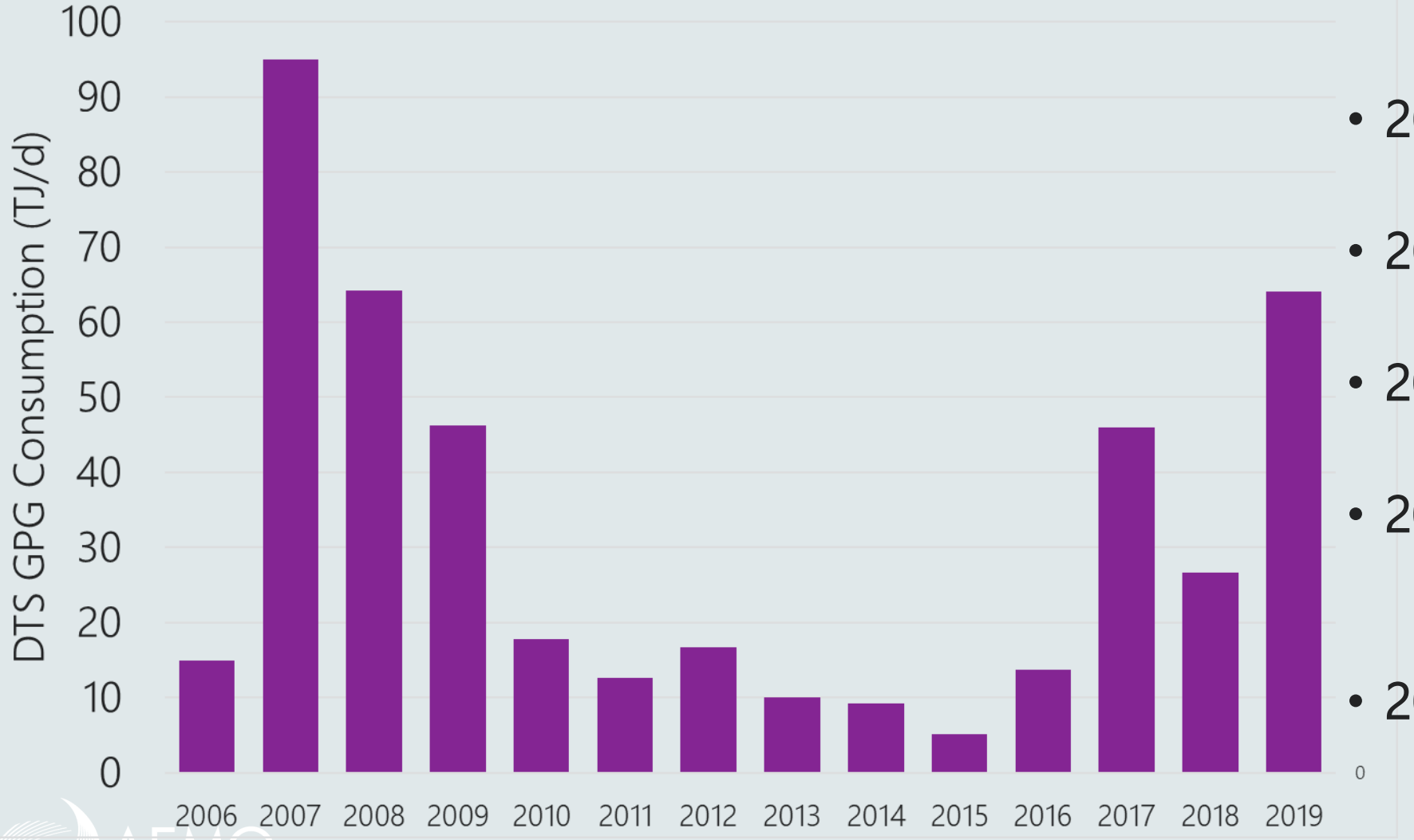
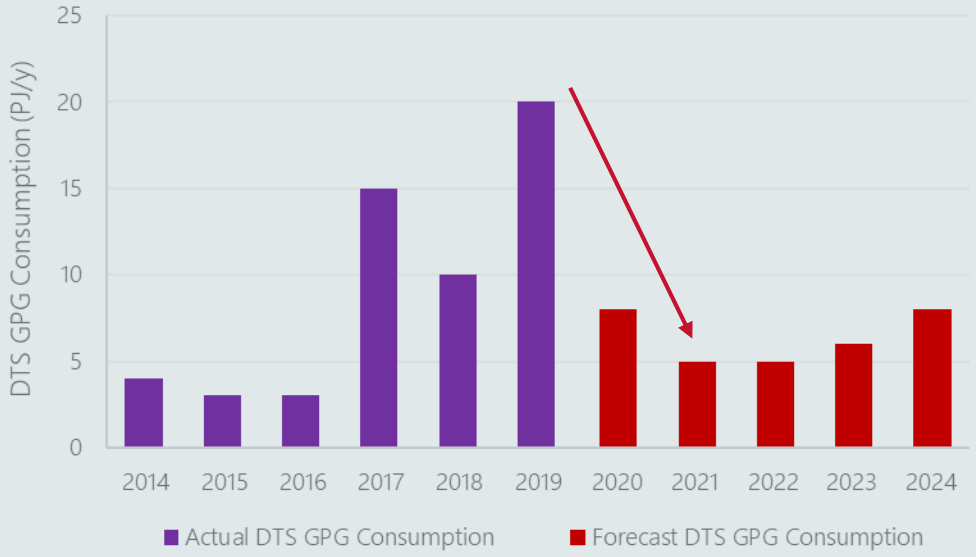
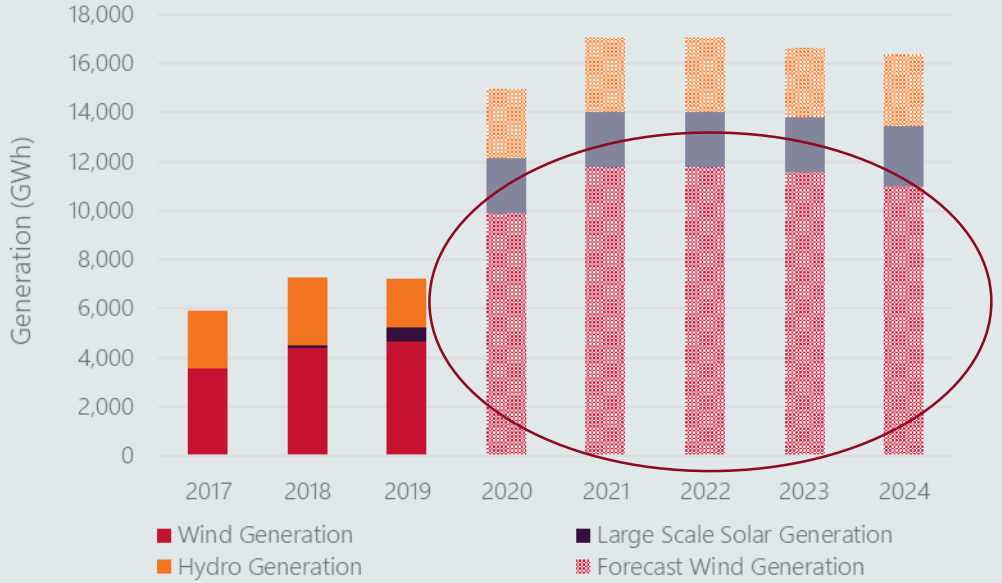
DTS GPG Consumption (2006-2019)



- **2007** - Drought
- **2009** – Drought ended
- **2017** – Hazelwood Closure
- **2019** – Extended generator outages
- **2020** - ??

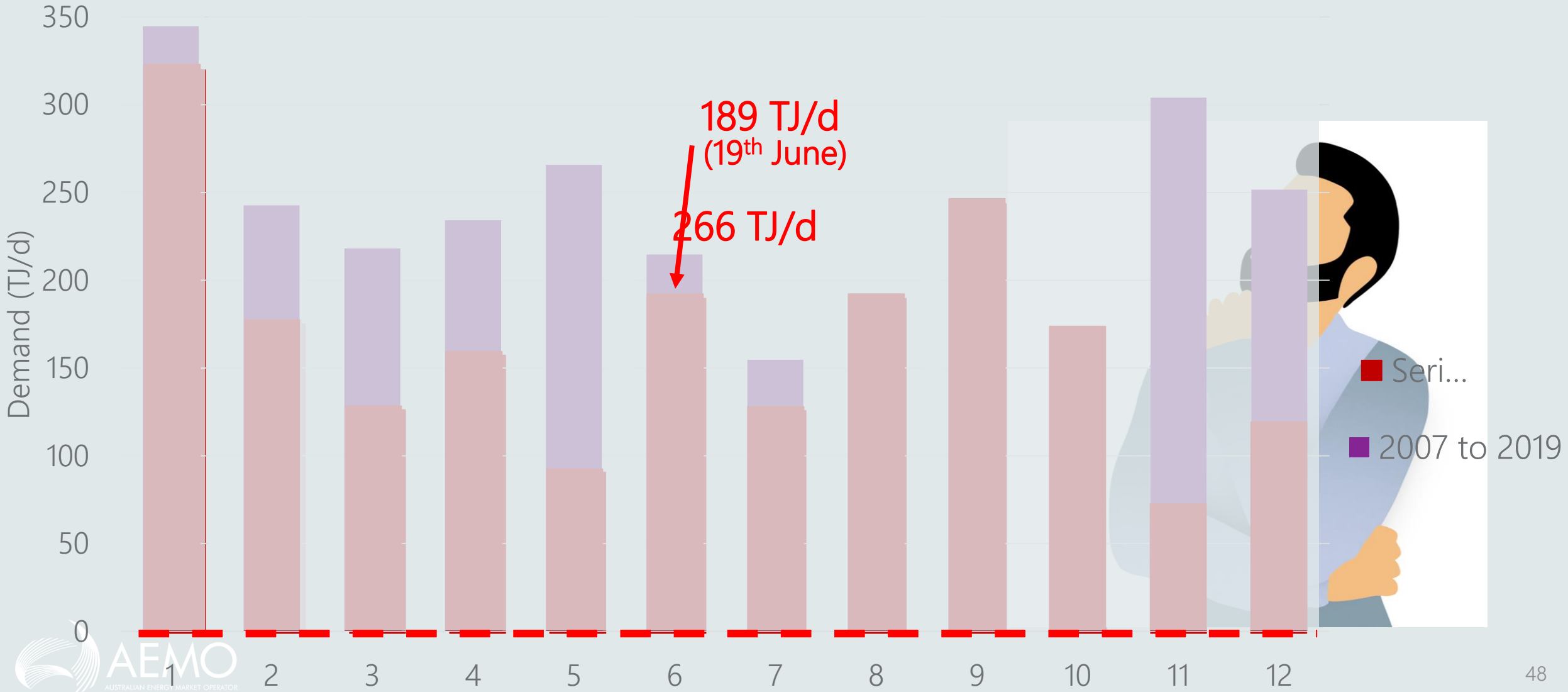
VGPR 2020 Update – GPG forecast





- GPG forecast assumptions have changed
  - Reduction in Energy Demand
  - Lower commodity prices (Oil/LNG)
  - Investment interest towards renewable generation
- AEMO is preparing its operational strategy with the expectation demand may be higher than forecast in the VGPR

Max. Daily GPG Demand (2010 - 2020)



Highest GPG Demand (2019)

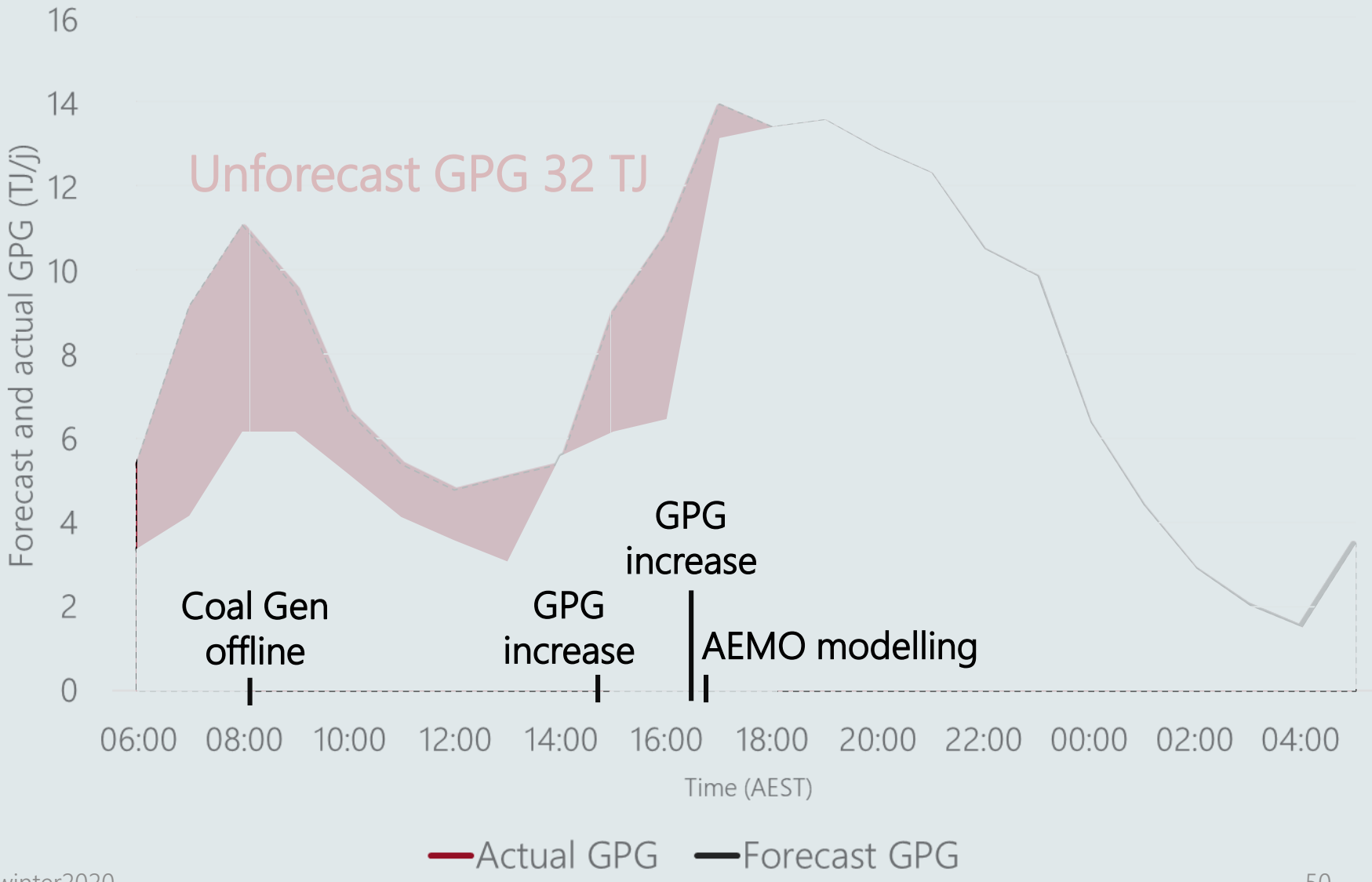
19th June 2019 (Wednesday)

- Maximum 12 deg.C, low wind
- EDD 11 deg.C, System Demand: **1041 TJ**
- LNG Injection: **12TJ**

GPG demand uncertainty

Forecast GPG **160 TJ**
Actual GPG **189 TJ**

Chronology
08:30 – Coal Gen offline
15:00 – Increased GPG
16:35 – Increased GPG
16:45 – AEMO modelling

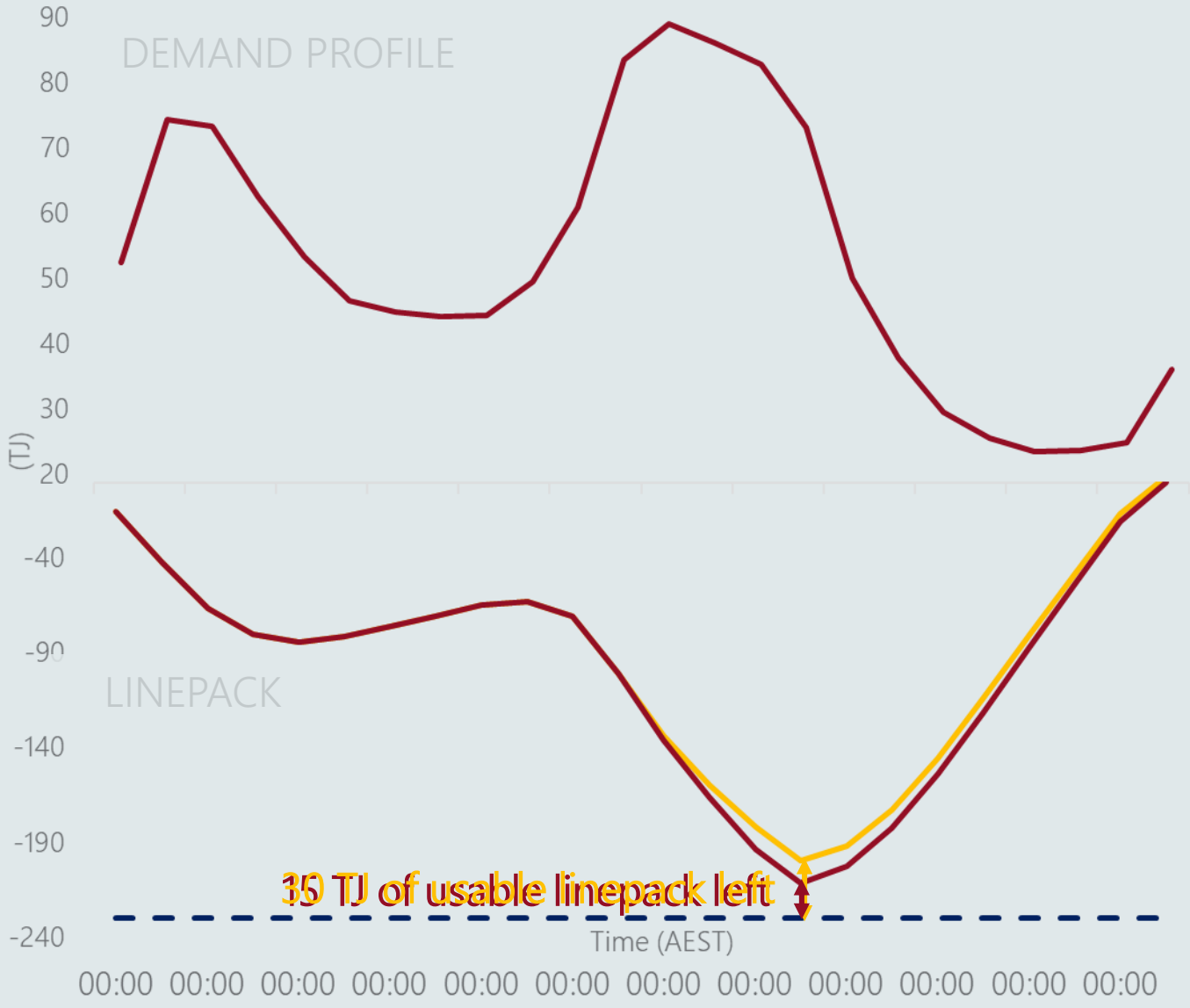


Highest GPG Demand – Modelling

Forecast Demand

Potential pressure breach

Inject LNG



Highest Demand Day (2019)

9th August 2019 – Severe weather conditions

- Maximum 10 deg.C
- Snow,
- Apparent temp 2 deg.C, EDD 15 deg.C

Temperature at 1pm

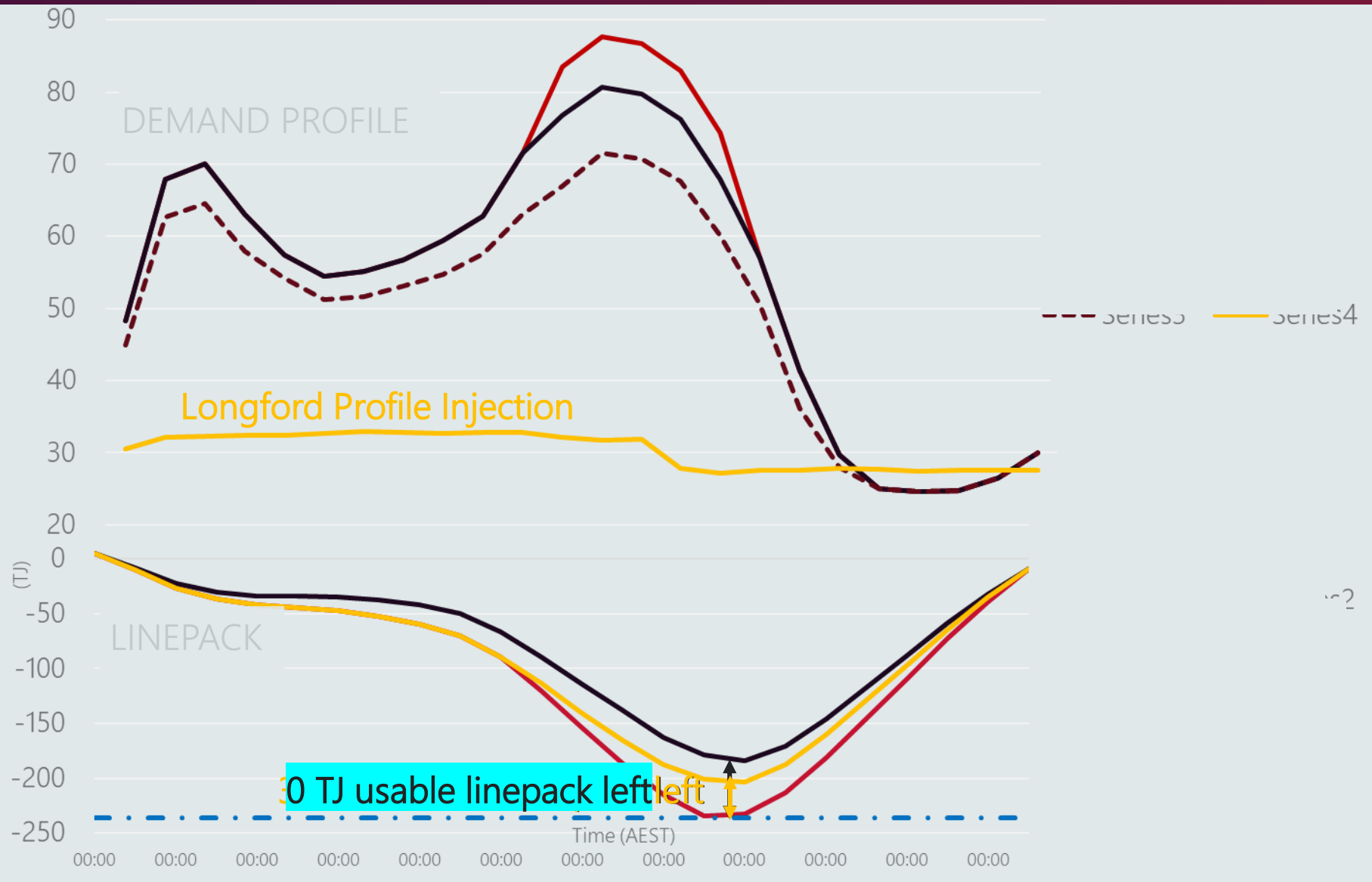
Falls creek – 47cm snow fall

Brighton Beach boxes

Brighton, pathway

Why Profile Injections

- System Demand 1198TJ (1 in 2 day)



Modelling GPG demand

System Demand of 1080 TJ (1 in 2 Demand Day)

Scenario 1: PEAK

- Peak Winter GPG demand
- GPG Demand of 178 TJ/d

Scenario 2: SEVERE

- Event Driven Flooded mines
- GPG Demand of 263 TJ/d

Key Takeaway

- GPG Demand could track higher than forecast depending on a range of variables
- DTS is capable of supporting high GPG demand on high demand day
- Accurate forecasting underpins high GPG supportability

AEMO's hierarchy of response to events

Alice McLaren

Agenda

1. Hierarchy of response
2. Winter scenarios

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Hierarchy of Response

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AEMO hierarchy of response

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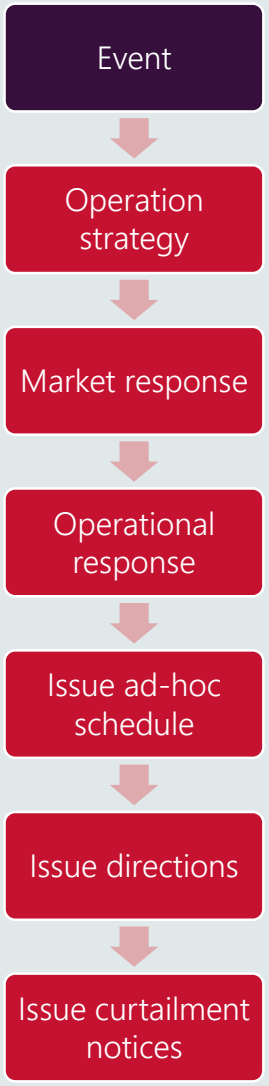
What is an event?

Examples of types of events:

- DTS pipeline incident
- DTS asset unplanned outage
- Gas supply facility incident
- Gas quality incident
- Unexpected change in weather
- Large increase in GPG demand
- Supply shortfall



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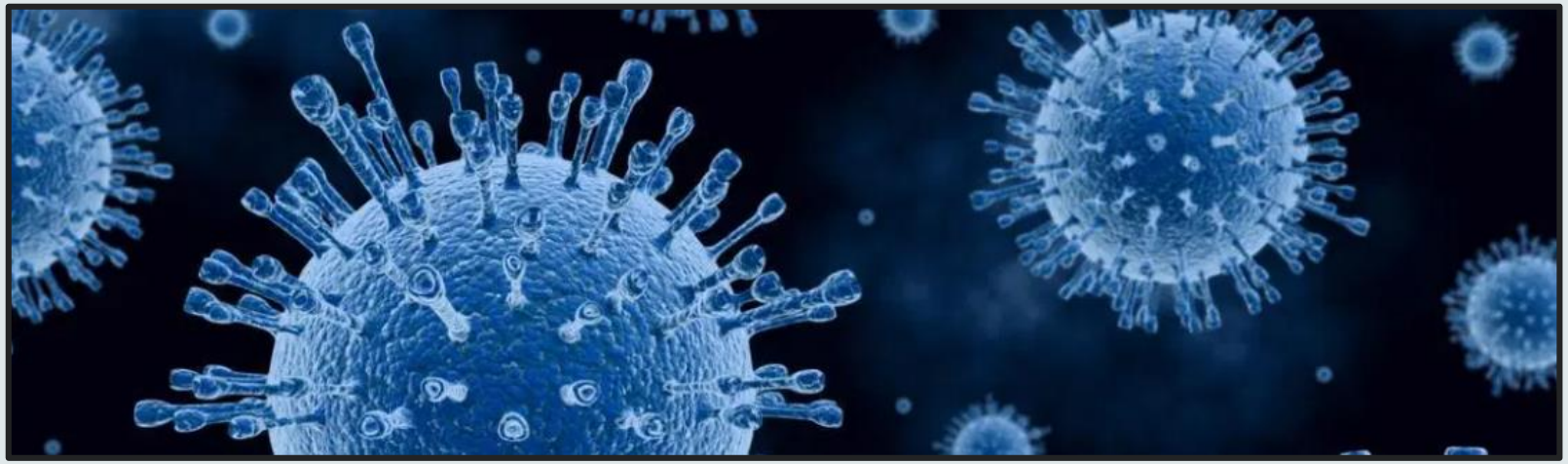
Increased risks due to COVID-19

- Reduced staffing at facilities
- Reduced staffing at NEM facilities impacting GPG demand
- Delays in return to service of assets due to lack of personal
- Delays in return to service of assets because of lack of parts



Event

Operation strategy

Market response

Operational response

Issue ad-hoc schedule

Issue directions

Issue curtailment notices

Operation strategy

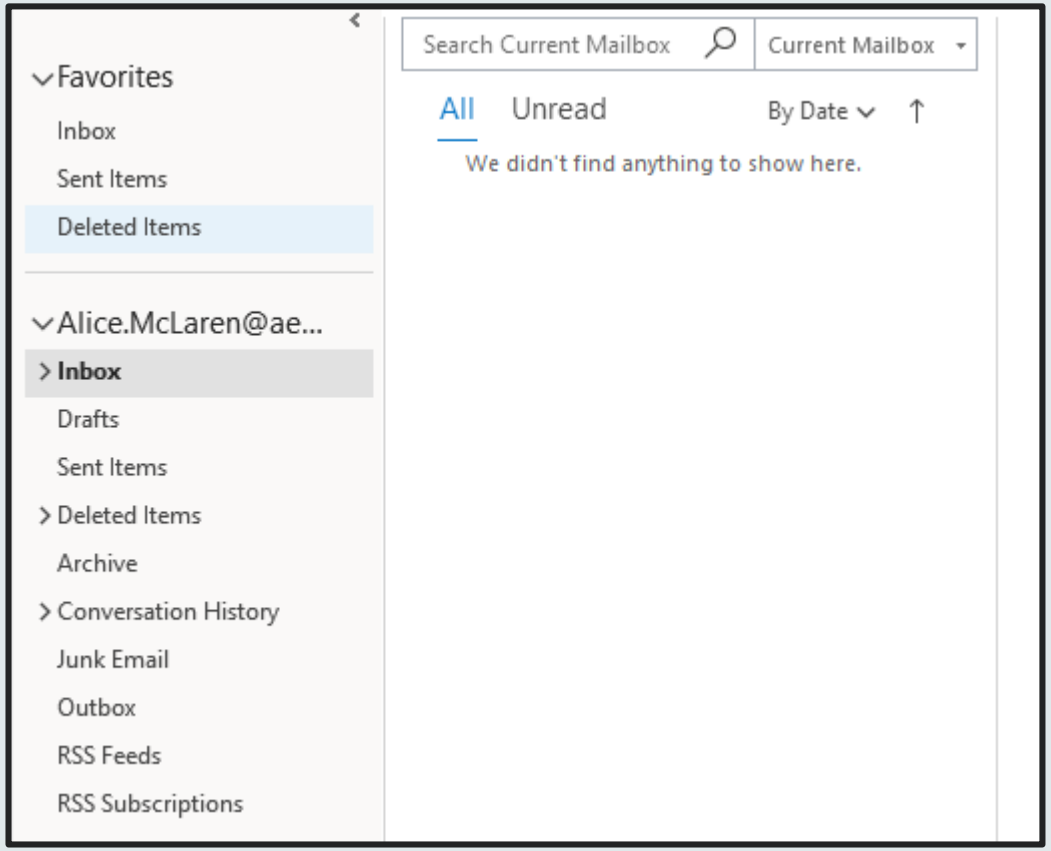
- Quantify the impact of the event
- Increase communications with facilities
- Manage linepack and direction of gas flows
- Apply constraints (SDPC, DFPC or NFTC)
- Update and potentially override total demand forecast

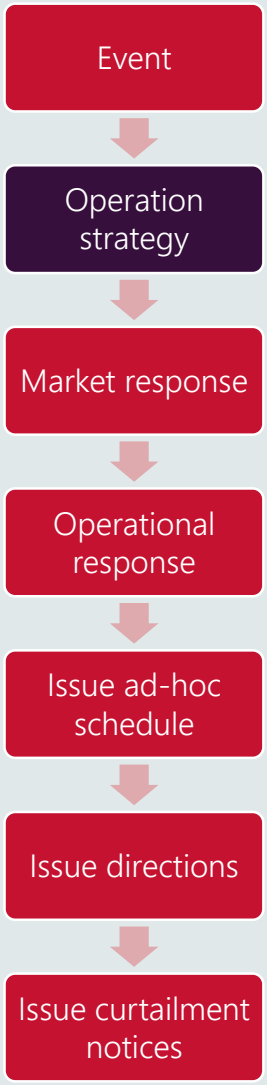
Event
Operation strategy
Market response
Operational response
Issue ad-hoc schedule
Issue directions
Issue curtailment notices

What do participants see?

- Will see:

- Might see:
  - Gas quality SWN
  - Constraint SWN
  - Nothing





Market Response

- AEMO seeks a response from participants *at the next schedule*, so there must be enough time for this option to be considered
- Participants respond by:
  - Re-bidding to source additional gas
  - Revising their demand forecast

Event
Operation strategy
Market response
Operational response
Issue ad-hoc schedule
Issue directions
Issue curtailment notices

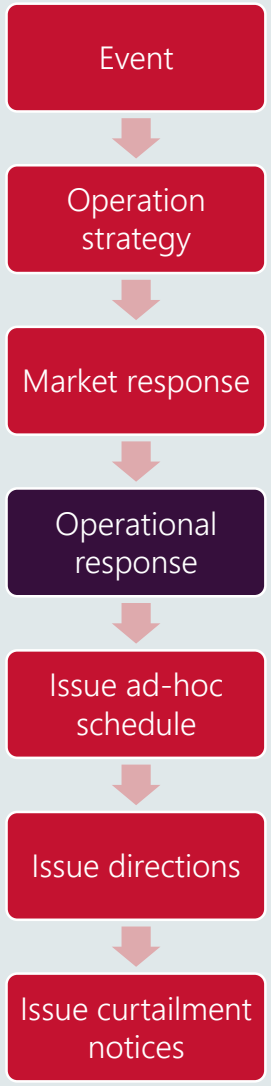
What do participants see?

- Will see:
  - Threat to System Security notification (SWN and MIBB notice)
  - Request for market response (SWN and MIBB notice)
  - Response SWN
  - Threat ended SWN
- May see:
  - Industry conference

Event
Operation strategy
Market response
Operational response
Issue ad-hoc schedule
Issue directions
Issue curtailment notices

Operational Response

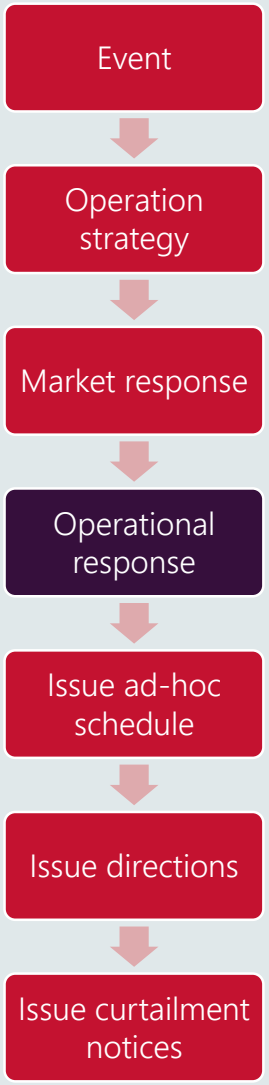
- Continue to this step if:
  - Insufficient time for market response
  - No market response
  - Market response was insufficient
- AEMO increases injections by scheduling:
  - Out-of-merit-order injections at any injection point
  - Peak shaving LNG
- AEMO schedules an operational response *at the next schedule*, so there must be enough time for this option to be considered



What do participants see?

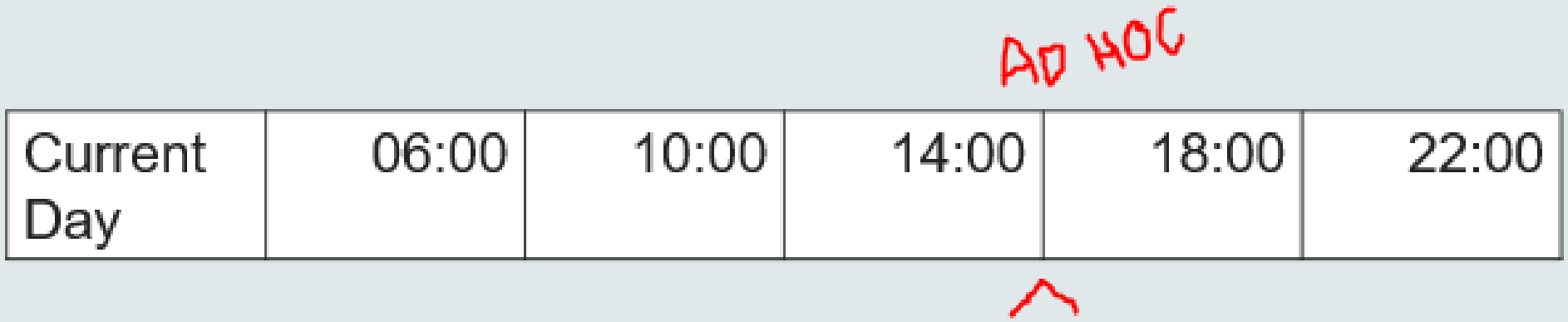
- Will see:
  - Threat to System Security notification (SWN and MIBB notice)
  - Response SWN (SWN and MIBB notice)
  - Threat ended SWN
  - Intervention report (technically not an intervention per NGR)

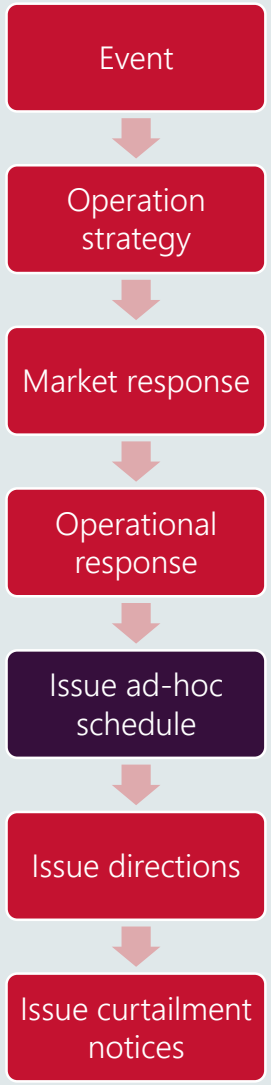
- May see:
  - Industry conference
  - Constraint SWN
  - No longer required SWN



Ad-hoc schedules

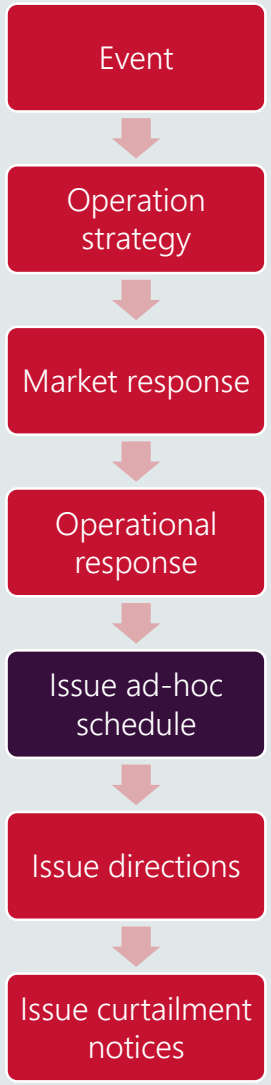
- Continue to this step if:
  - Insufficient time for operational response
  - Operational response was insufficient
- AEMO publishes a schedule outside the normal times
- May include out-of-merit-order injections or non-firm gas





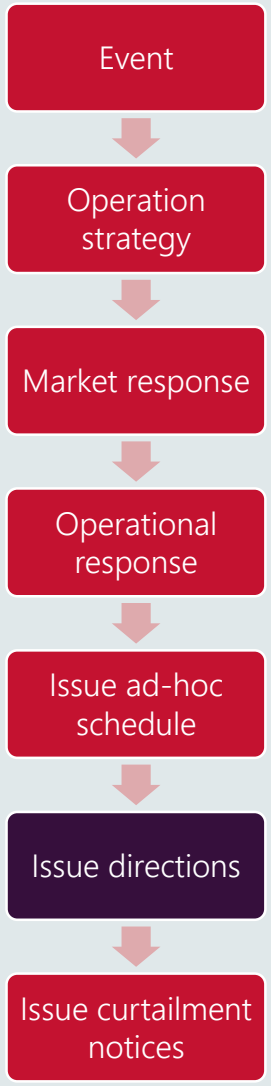
What do participants see?

- Will see:
  - Threat to System Security notification (SWN and MIBB notice)
  - Ad-hoc schedule SWN (SWN and MIBB notice)
  - Schedule MIBB reports and confirmation notices
  - Threat ended SWN
  - Intervention report
- May see:
  - Constraint SWN



Directions

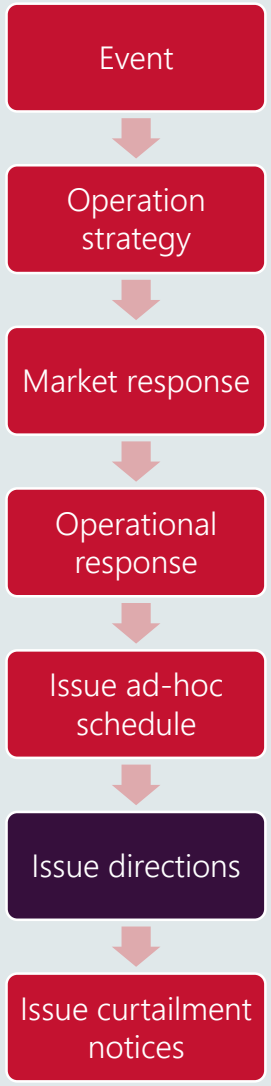
- Continue to this step if:
  - Insufficient time for ad-hoc schedule
- AEMO can direct a facility under 91BC of the NGL to:
  - Increase injections
  - Inject off-spec gas
  - Inject non-firm gas
  - Increase withdrawals
  - Make changes within the DTS (eg open a demarcation valve)
  - Do anything else that may affect the safety, security or reliability of the DTS or a declared distribution system.



What do participants see?

- Will see:
  - Threat to System Security notification (SWN and MIBB notice)
  - Response SWN (SWN and MIBB notice)
  - Threat ended SWN
  - Intervention report

- May see:
  - Industry conference
  - Constraint SWN
  - Information request SWN
  - No longer required SWN



Curtailment

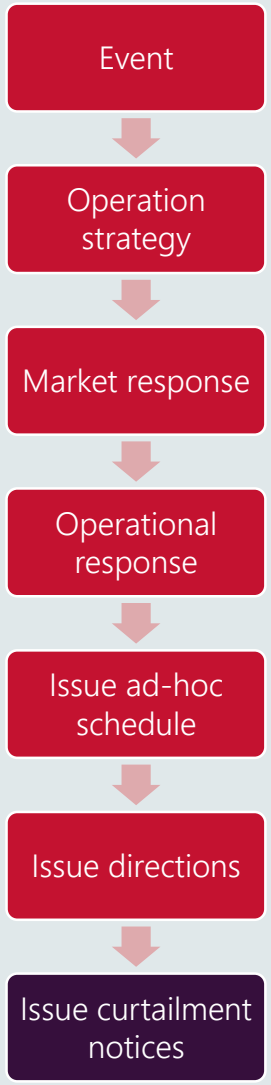
- Continue to this step if:
  - All other methods cannot alleviate the threat
- AEMO will curtail Tariff D demand in accordance with the curtailment tables
- May be localised, zonal or system wide

Event
↓
Operation strategy
↓
Market response
↓
Operational response
↓
Issue ad-hoc schedule
↓
Issue directions
↓
Issue curtailment notices

What do participants see?

- Will see:
  - Threat to System Security notification (SWN and MIBB notice)
  - Curtailment SWN (SWN and MIBB notice)
  - Gas BB linepack flag RED
  - Industry conferences (including VGECP)
  - Threat ended SWN
  - Intervention report

- May see:
  - Directions to GPG
  - Directions to controllable withdrawals
  - Request for voluntary curtailment
  - Intervention no longer required SWN
  - Further escalation



Winter scenarios

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Winter scenarios

- Facilities and pipelines
  - Longford Gas Plant
  - Iona Underground Storage
  - Longford to Melbourne Pipeline
  - South West Pipeline
- Modelling
  - Variety of demands and GPG levels
  - Indicative only
  - Actual event highly dependent on system conditions

Scenario 1	Low	784	Shortfall met elsewhere	Required
	High	110	Shortfall met elsewhere	Required
Scenario 2	Low	852	Shortfall met elsewhere	Required
	High	920	Shortfall met elsewhere	Required
Scenario 3	Low	950	Shortfall met elsewhere	Required
	High	1,018	Shortfall met elsewhere	Required

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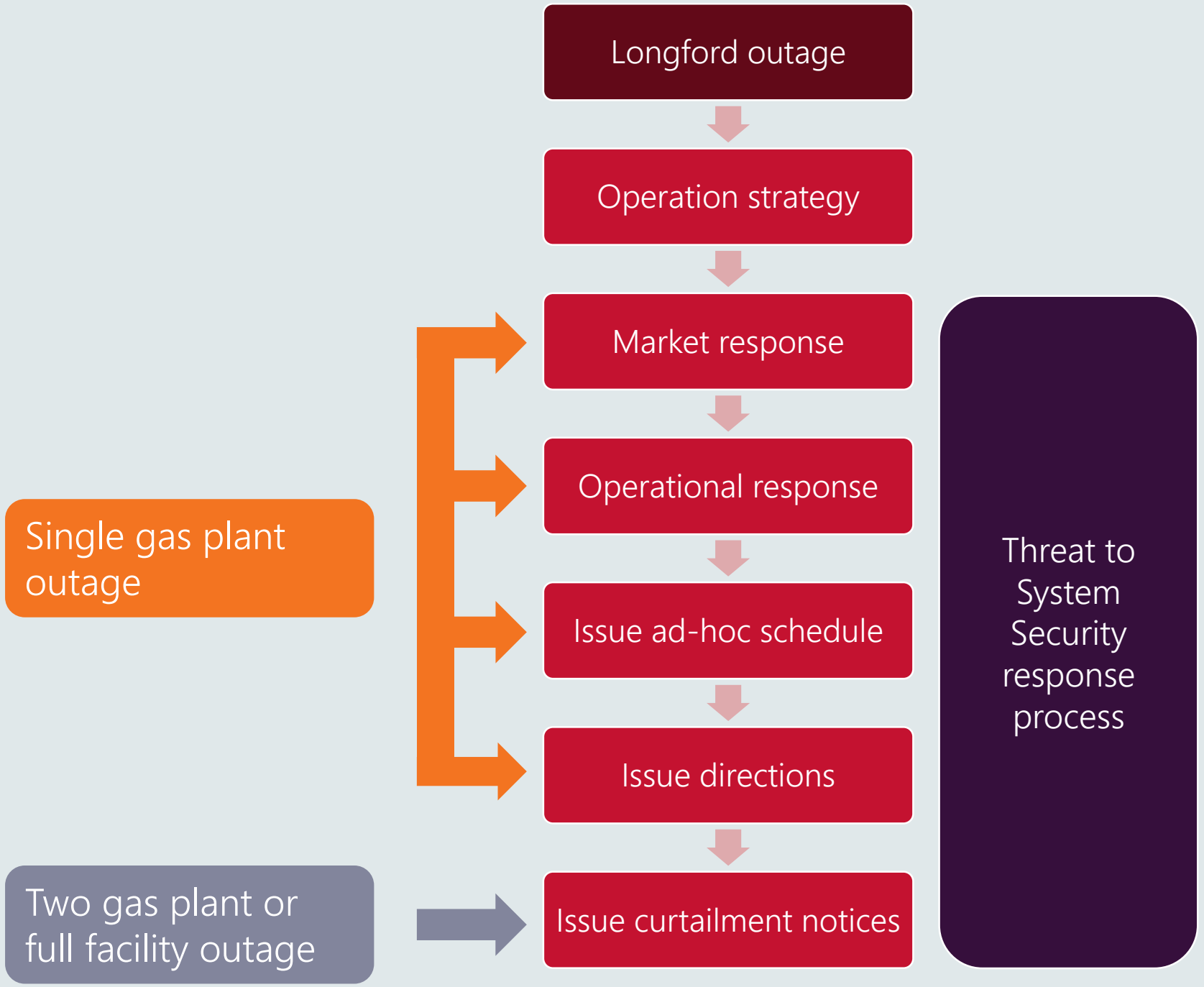
Supply disruption - Longford Gas Plant

Response	Single plant outage	Two plant outage	Full facility outage
Threat to System Security	Yes		
Peak shaving LNG	Injection at maximum rate		
Alternative supply	Increase Iona UGS, VNI and SWP flows where achievable		
Curtailment	Unlikely	Localised within Gippsland or potentially some in Melbourne	Most likely in Gippsland, Northern and Melbourne regions

Supply Disruption - Longford Gas Plant



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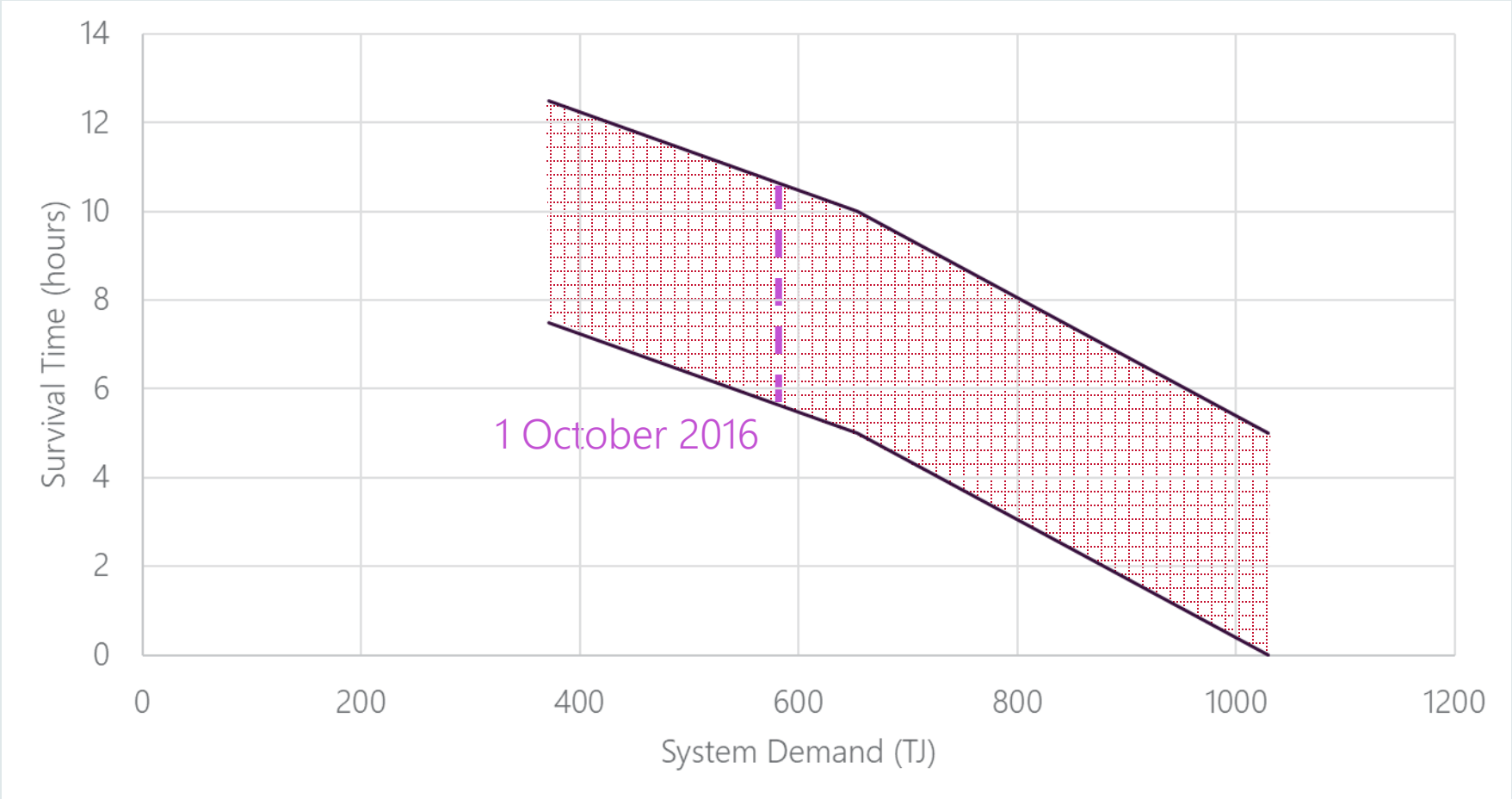
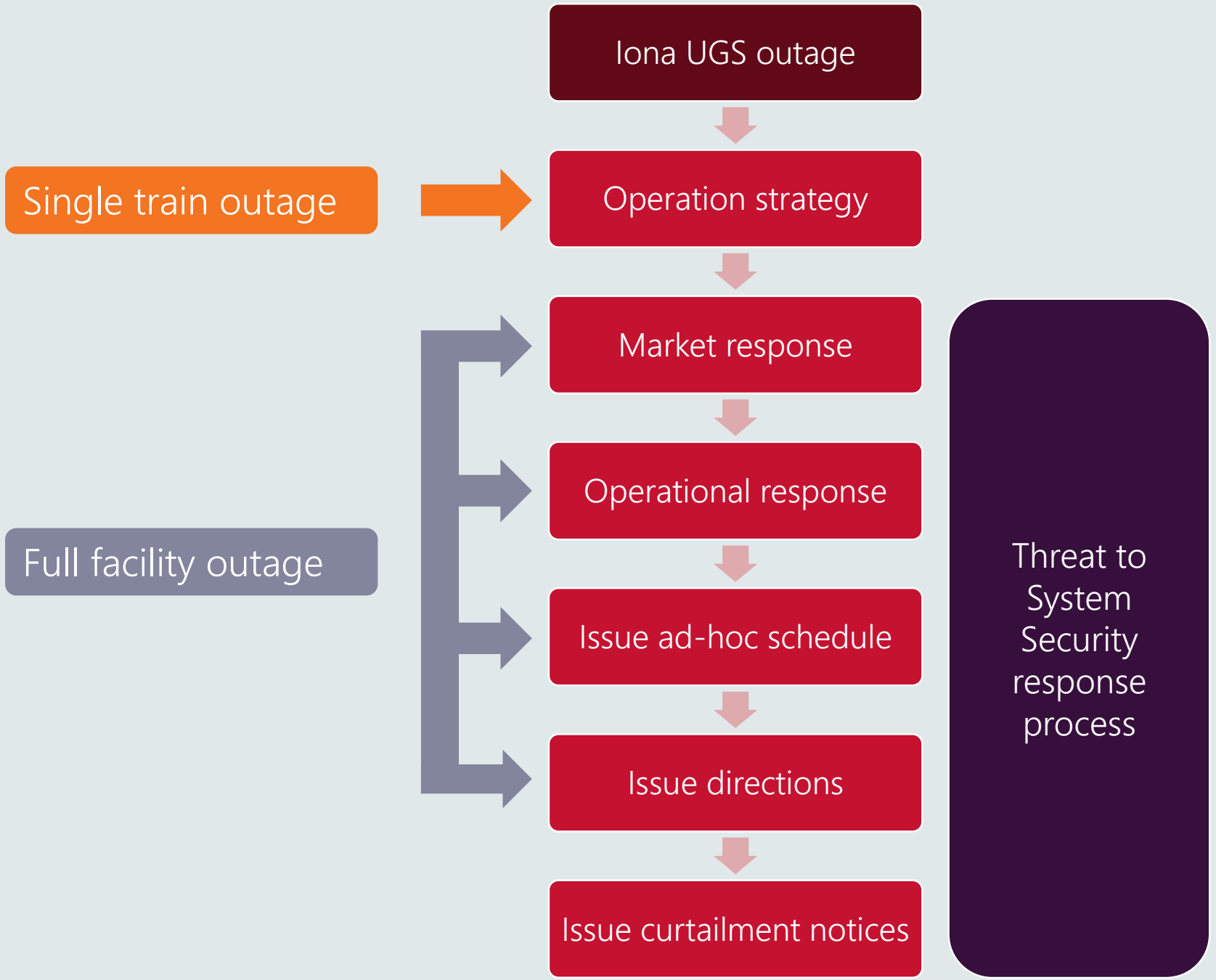
Supply disruption - Longford Injection Hub



Supply disruption - Iona Underground Storage

Response	Single train outage	Full facility outage
Threat to System Security	Possibly on high GPG demand days	Yes
Peak shaving LNG	Possibly on high GPG demand days	Injection at maximum rate
Alternative supply	Balance of supply	Increase LMP and VNI flows where achievable
Curtailment	Unlikely	

Supply Disruption - Iona UGS



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Transmission disruption - Longford to Melbourne Pipeline

Loss of capacity – full outage of Gooding CS

- Pipeline capacity reduced from 1,030 TJ/d to 700 TJ/d
- Threat to System Security requiring peak shaving LNG but no curtailment

Pipeline Isolation

- Survival time is with no action taken
- Not definitive, more of an indicator of usable linepack in that part of the network

Location	Survival Time (hours)
Longford	3
Dandenong City Gate	1

Transmission disruption – South West Pipeline

Loss of capacity – 50% reduction

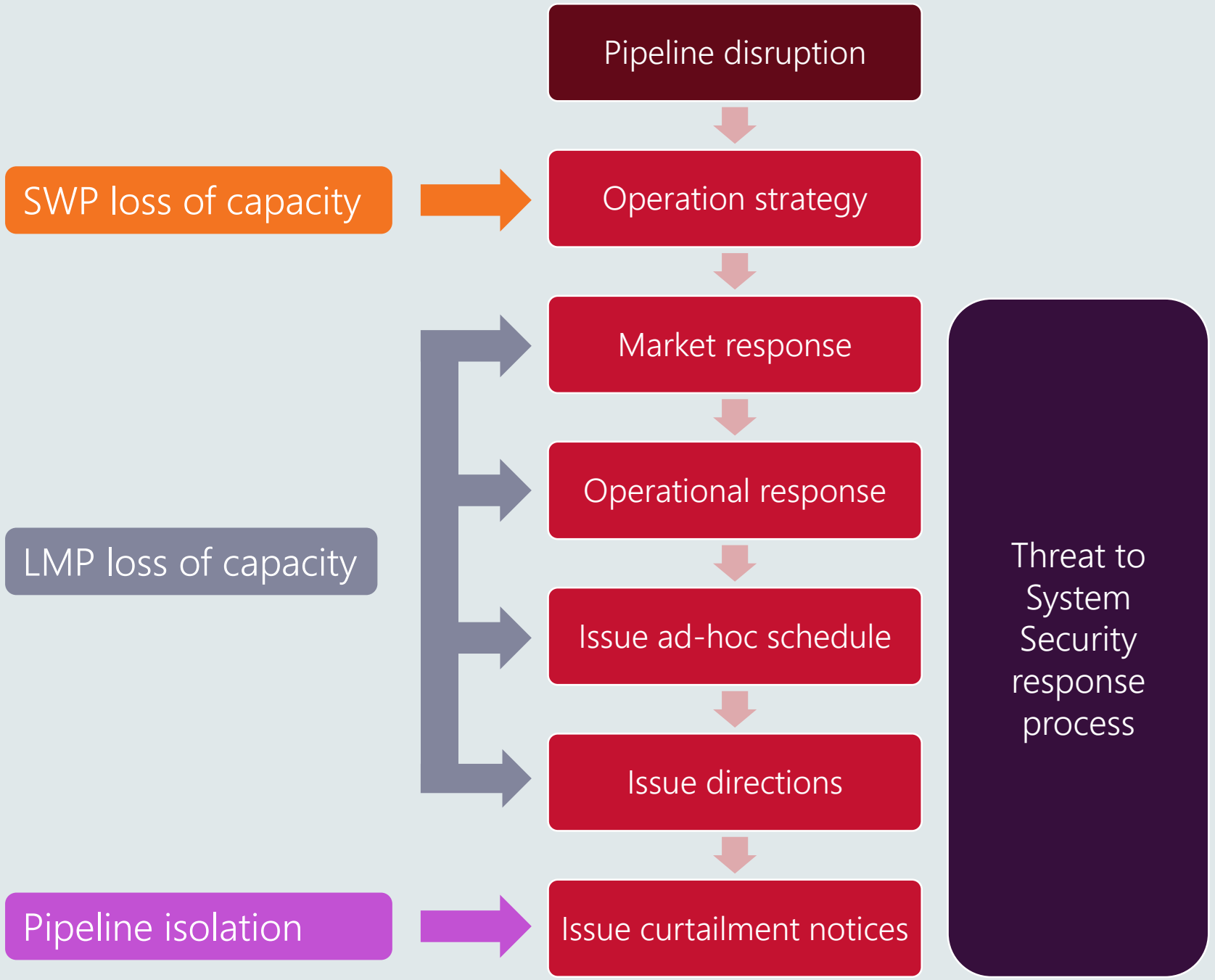
- Pipeline capacity reduced from 414 TJ/d to 207 TJ/d
- No anticipated Threat to System Security

Pipeline Isolation

- Survival time is with no action taken
- Not definitive, more of an indicator of usable linepack in that part of the network

Location	Survival Time (hours)
Port Campbell	4
Brooklyn City Gate	0.25

Pipeline Disruption



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AEMO hierarchy of response

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Q&A

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