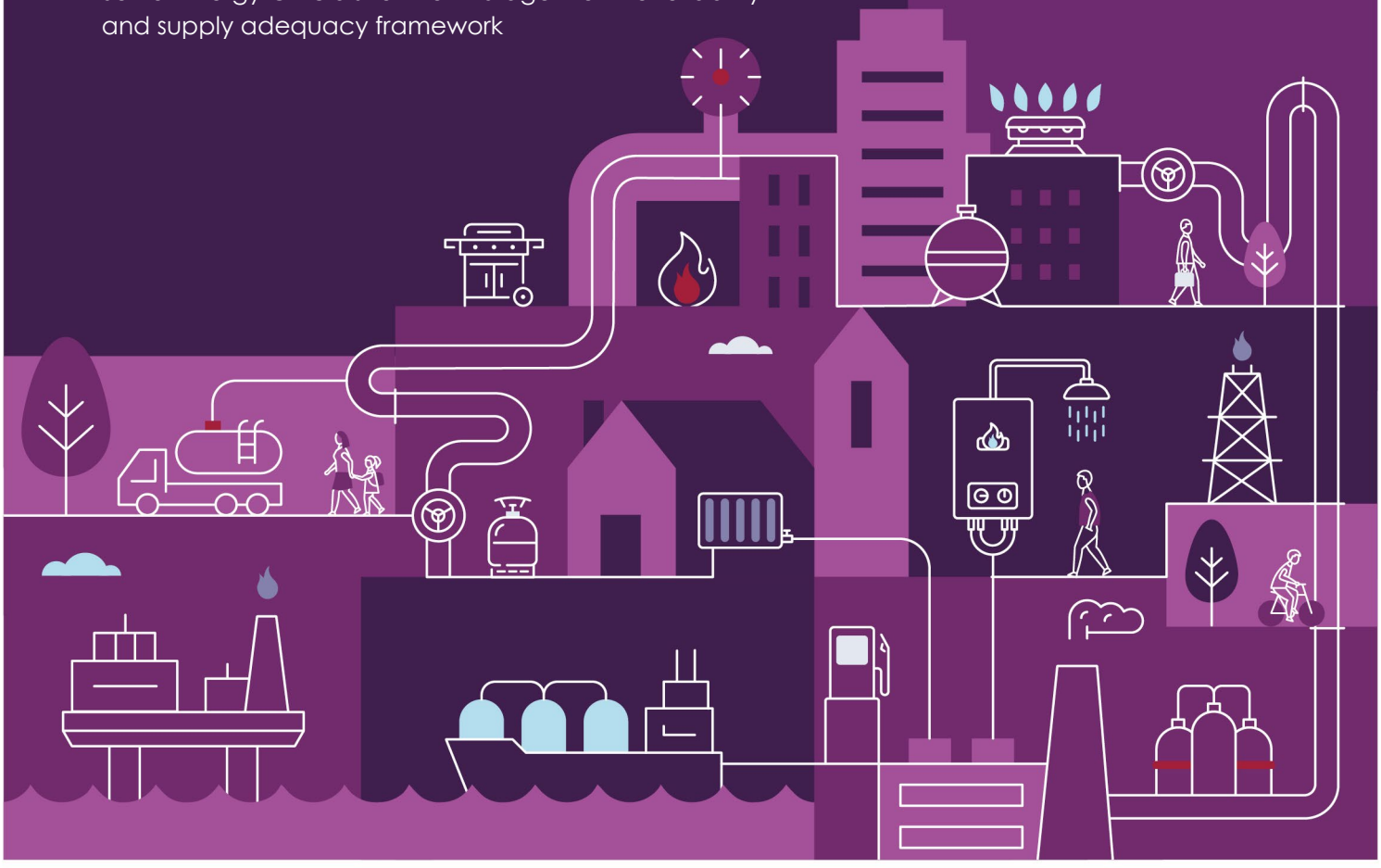
Developing a projected assessment of system adequacy (PASA) for the east coast gas system

October 2024

AEMO's assessment of the requirements for a short and medium term PASA

A report for Energy Ministers and jurisdictional energy Senior Energy Officials to inform Stage 2 of the reliability and supply adequacy framework



We acknowledge the Traditional Custodians of the land, seas and waters across Australia. We honour the wisdom of Aboriginal and Torres Strait Islander Elders past and present and embrace future generations.

We acknowledge that, wherever we work, we do so on Aboriginal and Torres Strait Islander lands. We pay respect to the world's oldest continuing culture and First Nations peoples' deep and continuing connection to Country; and hope that our work can benefit both people and Country.

'Journey of unity: AEMO's Reconciliation Path' by Lani Balzan
AEMO Group is proud to have launched its first Reconciliation Action Plan in May 2024. 'Journey of unity: AEMO's Reconciliation Path' was created by Wiradjuri artist Lani Balzan to visually narrate our ongoing journey towards reconciliation - a collaborative endeavour that honours First Nations cultures, fosters mutual understanding, and paves the way for a brighter, more inclusive future.

Important notice

Purpose

AEMO has prepared this report for Energy Ministers and jurisdictional energy Senior Energy Officials (Officials), following a direction given to AEMO by Energy Ministers pursuant to 91C of the National Gas Law on 29 April 2024. This report is AEMO's assessment of what will be required to produce a short term (ST) and medium term (MT) projected assessment of system adequacy (PASA) for the east coast gas system (ECGS).

This information has been prepared by AEMO using information available as at 1 September 2024, unless otherwise indicated.

Disclaimer

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Executive summary

The Australian Energy Market Operator (AEMO) has undertaken an assessment of the requirements for developing and implementing a short term (ST) and medium term (MT) projected assessment of system adequacy (PASA) for the east coast gas system (ECGS). This report presents AEMO's findings, analysis and recommendations, as requested by Energy Ministers to inform Stage 2 of the ECGS reforms.

On 29 April 2024, Energy Ministers requested AEMO undertake an internal assessment of what would be required to produce a ST and MT PASA for the ECGS. The purpose of the assessment is to identify the inputs, processes and outputs for both a gas ST PASA and gas MT PASA, and to assess the adequacy of the information currently available to AEMO to produce a gas PASA. It is intended that this assessment will inform a subsequent rule change proposal to be provided to the AEMC by Energy Ministers to develop a gas ST PASA and gas MT PASA.

AEMO's assessment reviews existing data sources, identifies gaps and issues with existing data, and proposes changes to support the effective implementation of the PASA. Key findings include:

- Existing data as provided under Part 18 (the Gas Bulletin Board), Part 19 (the Declared Wholesale Gas Market (DWGM)), Part 20 (the Short Term Trading Market (STTM)) and Part 27 (east coast gas system reliability and supply adequacy) of the National Gas Rules (NGR) is largely sufficient. However, some enhancements are needed to address specific data gaps and quality issues.
- Significant development will be required in AEMO's internal forecasting models, systems and data interfaces to support a PASA. This includes enhancements to demand forecasting capabilities, integration of supply adequacy modelling, and establishment of new visualisation and reporting tools.
- The diverse characteristics of the ECGS, including regional variations in demand profiles, supply sources, and infrastructure, will require careful consideration in the design of the PASA. This includes the definition of appropriate regional boundaries, treatment of gas-powered generation (GPG) demand, and representation of key operational constraints.

AEMO's recommendations in this report encompass:

- Recommended changes to the NGR as part of the PASA rule change.
- Proposed inputs, methodology and outputs for the ST PASA and MT PASA.
- Proposed options for regional definitions that balance the granularity of reporting against operational feasibility and efficacy.
- Proposed PASA publication timelines, updates and run frequency.
- Implementation considerations including system development, testing and alignment with the reliability standard rule change.

A key part of the request to AEMO was to identify potential rule changes following its desktop analysis for consideration by the Australian Energy Market Commission (AEMC). Table 1 below provides a concise overview of AEMO's key recommended NGR changes across the major areas covered in the report. The recommendations aim to establish a clear and consistent framework for data provision, information disclosure, and PASA implementation, while balancing the needs for data quality and transparency, and minimising the burden on industry to the extent practicable.

Table 1 Summary of AEMO's recommended NGR changes

Input	Rules reference	Recommendation
Demand forecasts		
Market demand	Part 19, Part 20	Extend existing rules to require demand forecast submissions out to seven days for the DWGM and STTM to support the ST PASA.
Non-market, non-GPG demand	Part 18	Enhance rules to require submission of forecast nominations, from shippers, out to seven days for non-market, non-GPG demand to improve data quality and granularity for the ST PASA.
Liquefied natural gas (LNG) export demand	Part 27	Amend rules to require LNG exporters to provide a daily demand forecast out to 12 months, to inform the MT PASA and ST PASA.
Supply and capacity		
Supply capacity	Part 18	• Clarify definition of 'daily capacity' to ensure consistency and accuracy of reporting for the ST PASA and MT PASA. • Ensure obligations on Bulletin Board (BB) shippers to provide daily nominations and forecasts of the use of the BB facilities to improve the accuracy of facility-provided daily nominations. • Change obligation from ad hoc reporting of medium term capacity outlooks of the BB facility to daily capacity numbers.
Transportation capacity	Part 18, Part 27	Harmonise transportation capacity reporting requirements across Part 18 and Part 27, to provide a unified view for the PASA.

This report also identifies matters for further consideration, including the treatment of GPG in the PASA, the potential of intraday updates of the ST PASA, and processes for managing data quality and publication issues.

With respect to gas demand forecasts for GPG, AEMO suggests that a modelled approach be taken, with AEMO developing forecasts based on available information. The alternative would be to have every generator[1] in the National Electricity Market (NEM) develop its own demand forecast out to seven days, and AEMO's analysis[2] indicates there would continue to be significant error margins with this approach. The GPG forecasts are a significant input into the PASA and this matter of how best to model GPG requires careful consideration.

AEMO's analysis suggest that the implementation of the PASA will be a significant undertaking, requiring material changes to systems and processes. As such, AEMO expects there will need to be a reasonable timeframe allowed following the AEMC's final determination, to allow for the development of procedures and guidelines for the new PASAs as well as comprehensive system development and testing, including a staged approach from AEMO receiving the new inputs to the first publications of the new PASAs.

This report is intended to provide a robust foundation for the rule change and the detailed design and implementation of the PASA. AEMO looks forward to further collaboration with policy-makers, the AEMC and stakeholders to develop and refine the PASAs' design to ensure effective delivery in support of Stage 2 of the ECGS reforms.

[1] All generators, not just gas-powered, would need to submit their bids and offers for AEMO to determine all dispatch across the NEM. AEMO would then derive the gas associated with forecast dispatch of GPG units. This extended NEM pre-dispatch approach was used for the Gas Supply Guarantee and was analysed as part of this review.

[2] AEMO analysed both the NEM extended pre-dispatch and the BB connection point nominations relating to accuracy of GPG forecasts.

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Glossary

Terms defined in the National Gas Law (NGL) and the National Gas Rules (NGR) have the same meanings in this document unless otherwise specified this document. Terms defined in the NGL and NGR are intended to be identified in this document by italicising them, but failure to italicise a defined term does not affect its meaning.

In addition, the words, phrases and abbreviations in the table below have the meanings set out opposite them when used in this document.

Term	Definition
BB	Gas Bulletin Board
BB infrastructure facilities	Refers jointly to *BB production facilities*, *LNG import facilities*, *blend processing facilities*, *BB pipelines*, *BB compression facilities* and *BB storage facilities*.
BB supply facilities	Refers jointly to *BB production facilities*, blend processing facilities, *BB storage facilities* and *LNG import facilities*.
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DWGM	The Declared Wholesale Gas Market in Victoria
ECGS	east coast gas system
ECMC	Energy and Climate Change Ministerial Council
GPG	gas-powered generation
GSOO	Gas Statement of Opportunities
LCA	linepack/capacity adequacy
LNG	liquefied natural gas
LOLP	loss of load probability
LRC	low reserve condition
LOR	lack of reserve
MT PASA	medium term projected assessment of system adequacy
MTCO	medium term capacity outlook
ST PASA	short term projected assessment of system adequacy
STTM	The Short Term Trading Market hubs in Adelaide, Brisbane and Sydney.
System demand	System demand includes gas demand for residential, commercial and industrial users, and does not include demand for gas-powered generation.
Wholesale gas markets	The Declared Wholesale Gas Market in Victoria and the Short Term Trading Market hubs in Adelaide, Brisbane and Sydney.

1 Overview

1.1 Background

On 12 August 2022, Energy Ministers agreed to take a range of actions to support a more secure, resilient and flexible east coast gas system (ECGS)[3]. These actions included the development of a reliability and supply adequacy framework to better enable AEMO and industry participants to identify and respond to reliability and/or supply adequacy threats.

The reliability and supply adequacy framework has been split into two stages:

1. Stage 1 was implemented ahead of winter 2023 and expanded AEMO's powers under the National Gas Law (NGL) and National Gas Rules (NGR) to better manage gas supply adequacy and reliability risks; and
2. Stage 2 is currently being progressed and is focussed on those elements of the framework that are required to:
   - Guide and frame how AEMO approaches its new functions, complementing the Stage 1 reforms with more effective tools to monitor, communicate and respond to threats.
   - Facilitate timely and efficient market-led responses by providing industry participants with greater transparency and predictability.

Following public consultation on Stage 2, completed in mid-2023, Energy Ministers instructed Officials to submit a rule change request to the Australian Energy Market Commission (AEMC) to, as part of a suite of measures, provide for the development of a gas projected assessment of system adequacy (PASA). To support that rule change, Energy Ministers requested AEMO undertake an internal assessment of what would be required to produce a ST and MT PASA for the ECGS.

1.2 Scope of report

Under s91C of the NGL, Energy Ministers requested AEMO undertake an internal assessment of what would be required to produce a ST and MT PASA for the ECGS.

The purpose of the assessment is to identify the inputs, processes and outputs for both a gas ST PASA and gas MT PASA, and to assess the adequacy of the information currently available to AEMO to produce a gas PASA. It is intended that this assessment will inform a subsequent rule change proposal to be provided to the AEMC by Energy Ministers to develop a gas ST PASA and gas MT PASA.

This report does not assess AEMO's capacity to use the ST PASA and MT PASA to identify short- to medium-term threats to security and adequacy of gas supply through back-casting analysis given the information deficiencies identified in AEMO's review of existing data sources.

[3] An interconnected gas grid connecting Australia's eastern, northern and southern states and territories.

This report is informed by AEMO's desktop assessment. The analysis, conclusions and recommendations outlined in this report have been supported by a comprehensive review of the existing data sets relevant to a gas PASA. This analysis can be found in the separate Supporting data document published alongside this report.

This report covers:

- A review of the information that is currently available to AEMO, including an assessment of:
  - The adequacy of that information and how any data issues may be addressed.
  - Overlaps or duplication in the information being reported and potential for the reporting burden on participants to be reduced.
  - Any potential confidentiality issues and how these could be resolved.
- An investigation of what would be required for AEMO to develop its own demand forecasts.
- Consideration of timing and frequency for publication of PASA information.
- Consideration of the potential regions that could be used for the PASA.
- Any other methodological and other matters relevant to the development and/or publication of a ST PASA or MT PASA.
- Implementation considerations.

1.3 Objective of a gas ST PASA and MT PASA

AEMO's existing ECGS functions include monitoring trends that may affect the reliability and adequacy of supply in the ECGS and communicating any risks or threats, so industry has an opportunity to respond.

A PASA framework is intended to complement this function by providing market participants with access to a more regular and systematic intra-year assessment of the reliability and adequacy of supply and enable potential breaches of the reliability standard to be identified and responded to in a more timely and efficient manner[4]. Combined with an objective signalling framework a PASA provides industry, AEMO and policy makers with transparency of the level of response required to address potential issues ahead of time.

A PASA is a supply and infrastructure capacity adequacy assessment that accounts for the supply and the available capacity of infrastructure used in the supply of gas (Gas Bulletin Board (BB) supply facilities[5]) to meet forecast demand for a given period in a defined region, and any reliability requirements determined to be applied[6].

The PASA is intended to support, among other objectives, the following:

- Inform east coast gas stakeholders – including AEMO, industry participants and governments – of the adequacy of supply in the ECGS, supporting more timely and efficient decision-making about the provision

[4] Department of Climate Change, Energy, the Environment and Water. June 2023. https://www.energy.gov.au/sites/default/files/2023-06/Consultation%20Paper%20-%20Stage%202%20of%20the%20Reliability%20and%20Supply%20Adequacy%20Framework.pdf. Viewed: 4 October 2024.

[5] BB supply facilities includes production facilities, liquefied natural gas (LNG) import facilities, blend processing facilities, pipelines, compression and storage facilities.

[6] To be determined by the ECGS Reliability standard and associated settings rule change. AEMC. July 2024. https://www.aemc.gov.au/rule-changes/ecgs-reliability-standard-and-associated-settings. Viewed: 4 October 2024.

and use of gas and infrastructure services. This would effectively provide for a level of automation in AEMO's monitoring function as required by 91AD(1)(a) of the NGL.

- Allow for industry participants to make timely decisions over the short to medium term about gas supply and demand and enable a market-driven response to reduce the need for AEMO intervention.
- Provide an objective basis for the identification of any potential breaches of the reliability standard and any decision by AEMO to exercise its east coast gas system direction or trading functions.
- Support more effective planning for seasonal and peak demand conditions in the east coast gas system, including any impacts on the regulated gas markets, and the National Electricity Market (NEM).

1.4 Rules terminology and data types

The following table provides a summary of the NGR and the various Parts where there are provisions for data to be made available to AEMO, the type of information that is made available and whether it is aligned to a ST or MT outlook, and geographical coverage of that data set.

Table 2 Summary of regulatory instruments discussed in this report

National Gas Rules	Rules section	Acronym	ECGS coverage	Type of information that may be suited to a PASA
Part 15D	Gas Statement of Opportunities	GSOO	Northern Territory, Queensland, New South Wales, Australian Capital Territory, Victoria, South Australia and Tasmania.	MT demand forecasts
Part 18	Gas Bulletin Board	BB	Northern Territory, Queensland, New South Wales, Australian Capital Territory, Victoria, South Australia and Tasmania.	ST demand and supply capacity forecasts ST and MT capacity outlooks
Part 19	Declared Wholesale Gas Market	DWGM	A majority of Victoria	ST demand forecasts
Part 20	Short Term Trading Market	STTM	Hubs located around Sydney, Adelaide and Brisbane	ST demand forecasts
Part 27	East coast gas system reliability and supply adequacy	ECGS	Northern Territory, Queensland, New South Wales, Australian Capital Territory, Victoria, South Australia and Tasmania.	ST demand forecasts MT capacity outlooks MT demand forecasts
N/A	National Electricity Market	NEM	Excludes Northern Territory and some remote gas-powered generation (GPG)	GPG information including: • ST demand forecasts • ST and MT capacity outlooks

2 Short term PASA (ST PASA)

2.1 Approach to a gas ST PASA

The ST PASA is proposed to provide a rolling seven-gas-day snapshot of the supply-demand balance across the ECGS. Its primary purpose is to inform the market about the expected level of available supply and infrastructure capacity to meet forecast demand, subject to BB supply facility constraints or reductions in capacity and potential sensitivities in the demand forecast. By identifying potential shortfalls in supply or infrastructure capacity or low system resilience[7] in the short term, the ST PASA aims to enhance market transparency and enable participants to make more informed and efficient decisions about demand, supply and the operation and use of infrastructure involved in the supply of gas.

ST PASA process and scenarios

While the NEM ST PASA provides an assessment of regional low reserve conditions (LRC) and assessment of regional lack of reserve (LOR), the gas ST PASA will undertake similar assessments tailored to the gas context. The exact triggers and levels are also being considered as part of the *East coast gas system Reliability Standard and Associated Settings* rule change.

AEMO expects that as part of the PASA rule change and its implementation, consultation will be required on the conditions and scenarios that can be used to actively signal issues. These scenarios will likely be based on the probability of curtailment (or shortfalls) and AEMO interventions, reflecting the amount of spare supply and capacity relative to forecast demand. The levels should serve as indicators of the ECGS' resilience and the reliability and/or adequacy of supply.

AEMO considers that a process similar to the probability of exceedance (POE) demand forecasts used in the NEM with the addition of a supply-side POE could be useful in determining the likelihood of shortfalls (that is, threats to the reliability or adequacy of supply). The approach in the NEM involves modelling the likelihood that electricity demand will exceed specific thresholds, helping identify the various levels used to identify issues in the network. The potential addition of a supply-side POE would model the probability that gas supply capacity falls below certain thresholds under specific scenarios.

A key consideration for a gas PASA will be how to treat gas-powered generation (GPG) demand in any demand forecasts, and it may be beneficial to forecast various levels of GPG for different scenarios based on their availability. Section 4.4 discusses how the variability of NEM GPG demand forecasts could undermine the PASA's usefulness in providing clear signals on potential shortfalls.

2.2 Inputs into the development of an ST PASA

The ST PASA will need to develop a forecast of supply, supply capacity and demand subject to any constraints or maintenance over the short term for each region. AEMO proposes to use a combination of participant-provided forecasts and AEMO modelled forecasts. This approach will leverage the expertise and unique information that

[7] Refers to the ability of the system to limit the extent, severity and duration of any reliability or supply adequacy event.

market participants have for near-term forecasts, while allowing AEMO-modelled forecasts to fill gaps and ensure consistency in forecasting.

The table below summarises the information expected to be required to generate ST PASA forecasts and recommended sources for this information. The proposed approach relies on existing datasets, with some enhancements, supplemented by AEMO's own forecasts to minimise the reporting burden on participants. As a result of these recommendations, there are consequential rule changes that can be implemented to reduce some reporting obligations.

Table 3 Inputs to the ST PASA

Input	Description	Source	Comments
Demand			
Wholesale gas market demand	A reflection of system demand in the STTM and DWGM	Participants – NGR Part 19: DWGM demand forecasts Participants – NGR Part 20: STTM Price taker bids	The DWGM demand forecasts and STTM price taker bids could provide the core demand forecasts for the market-based components of the ST PASA. These inputs are critical for capturing the expected demand in the key demand centres. Challenges include ensuring participants provide accurate and timely bids, and managing any gaps or issues with bid data.
Non-market demand	A reflection of system demand outside of the wholesale gas markets	Participants – NGR Part 18: BB pipeline nominations	The forecast nominations submitted to the BB are used to capture the demand outside the DWGM and STTM. Data quality and completeness of the nominations is a key issue to manage. This non-market demand is a critical input to get a full picture of total expected demand.
GPG	A forecast of GPG demand, including GPG within wholesale gas markets	NEM connected GPG: AEMO – utilising NEM generation availabilities and other NEM forecast information. Other GPG: Participants – NGR Part 18: BB pipeline nominations	Forecasting GPG demand is challenging given the various dependencies (such as electricity demand, renewable generation, and outages). AEMO will need to develop robust methodologies for projecting GPG demand based on NEM data. The GPG forecasts will also be available through the Part 18 BB pipeline nominations and within the wholesale gas market demand forecasts.
Storage	A forecast of withdrawals into storage	Participants – NGR Part 18 forecast nominations	Forecast demand into storage facilities based on BB data. This is an important input for the supply-demand balance but has challenges around data quality and completeness similar to the non-market demand.
Export demand	A forecast of Queensland LNG export demand	Participants – NGR Part 18 – BB pipeline nominations	Forecast pipeline connection point demand for each of the Queensland *LNG export facilities*. This information represents a material demand in the ECGS and is a key input for the supply/demand balance in the PASA. Having the LNG participants continue to provide their forecast demand over the seven-day horizon provides the best data for the PASA.
Supply and availability			
Supply capacity	Expected supply capacity based on plant capacity and any limiting factors.	Participants – NGR Part 18	A critical input to determine supply availability, including the deliverability from BB supply facilities. This information is provided in the capacity outlooks with maintenance information incorporated into the outlook.
Transportation capacity	Transportation capacity and availability subject to maintenance	Participants – NGR Part 18	A critical input to determine supply availability. Transportation capacity into a region* will be a key input.
Linepack/capacity adequacy flags	Linepack/capacity adequacy indicators	Participants – NGR Part 18 – BB pipelines and BB compression facilities	This information will support early notification of potential pipeline and compression facility issues.

Input	Description	Source	Comments
Linepack forecasts	Linepack forecasts	Participants – NGR Part 27 – BB pipelines, proposed Part 18 obligation.	An input to the modelling of available supply, particularly where a risk or threat has been identified.

* The regions are likely to be defined through the rule change consultation process and subsequent procedure consultation processes, as discussed in Section 4.1.

Proposed approach and regulatory changes

- Extend demand forecast obligation on Declared Wholesale Gas Market (DWGM) and Short Term Trading Market (STTM) participants from two-three days to seven days into the future. This can be further supported by the implementation of an ECGS demand forecasting system developed by AEMO.
- For all states and territories, introduce an obligation on *BB shippers*, through the BB Rules, to provide a seven-day forecast of their projected use of these BB facilities to facility operators on a daily basis.
- Clarify the definition of *daily capacity* so it is clear that it accounts for all constraints and limitations applicable to different facility types. AEMO recommends that the definition of *daily capacity* is clarified and moved from the NGR to the BB Procedures. There can be a notable difference between a facility's nameplate rating and the volume of supply or capacity that it can make available on a particular gas day, given the nameplate rating relates to maximum capacities under normal operating conditions and hence does not account for constraints and other limitations*. The short- and medium-term capacity outlook is tied to the definition of *daily capacity* in the BB and in its current form may be confused with nameplate capacity.
- Consistency between BB and ECGS pipeline capacity outlook reporting obligations, with a preference for this reporting to be a BB reporting obligation and reported by pipeline segment – to be defined in the BB Procedures.
- Removal of the ECGS obligations on *Part 27 retailers*, *BB large users* and *LNG export projects*[8] to provide daily demand forecasts out to seven days, given this information will be reported through other mechanisms.

* For example, production facilities where the output of the processing plant is reliant on the field deliverability, even though the plant may be capable of higher rates of production.

2.3 Publishing the ST PASA

The ST PASA results should be published daily (on gas day D-1), covering the seven-day outlook period (gas days D to D+6). A daily resolution aligns to the approach adopted within the gas industry where gas is typically transacted at a daily resolution, and is consistent with the data sets generally available to AEMO. Publishing a seven-day outlook aligns with many of the existing input datasets that are received by AEMO, and aims to minimise changes to regulatory obligations.

Key considerations in determining the timing and publication frequency include:

- Alignment with input nomination cut-off times – the ST PASA could be published after the nomination cut-off when the input data is finalised, but with sufficient time for participants to respond to the information. A review of the submission nomination cut-off times is required to balance the inputs coming in with enough certainty and being able to publish the ST PASA with sufficient time for participants to be able to act.
- Market and operational use – the frequency needs to balance providing regular updates to the market with the operational feasibility and value of re-running the PASA. It should align with existing market processes in the

[8] Rules 687-688 with the exception of 688(3) as discussed in Section 3.4.

DWGM and STTM, including consideration of the timing of market scheduling and the treatment of demand forecasts in the ST PASA.

- Consistency and clarity – having a set daily publication time will provide predictability to participants on when they can expect to receive the updated PASA information.

The detailed design phase will need to confirm the specific timing, considering operational processes, IT system considerations and participant feedback. These interactions will need to be worked through during the implementation phase to ensure the ST PASA integrates smoothly with existing market systems and processes.

Key information to be reported could include:

- The demand for gas.
- The supply of gas (including supply from production facilities, storage facilities and *LNG import facilities*).
- The aggregate daily capacity of BB supply facilities.
- Any reductions in the capacity of infrastructure involved in the supply of gas that may affect the volume of gas supplied.
- Assumed level of GPG demand used in the forecasts.
- Actual or potential risks or threats to the reliability or adequacy of the supply of *covered gas*.

This information should be published on AEMO's website and made available to participants through existing data interfaces. Notifications should be available to be subscribed to by participants when the ST PASA is published or updated.

In the event of threat levels (still to be defined) being triggered, AEMO may release additional updates and consider more frequent ST PASA runs to closely monitor the situation. Market notices would be issued to advise participants of any forecast issues and the actions being taken to address them under regular regulated market (STTM contingency gas or DWGM threat to system security) and ECGS mechanisms.

3 Medium Term PASA (MT PASA)

3.1 Approach to a gas MT PASA

For the purpose of this report, AEMO has assumed that a gas MT PASA will function in a similar way to the NEM MT PASA, with the final design dependent on the outcome of the rule change. The MT PASA is expected to provide an intra-year assessment of reliability and adequacy of supply capacity in each region and enable potential breaches of the reliability standard to be identified and responded to in a timely manner. AEMO understands feedback from the consultation[9] was to introduce a 12-month outlook; this is discussed further in Section 3.4.

The MT PASA should provide a view of whether supply and infrastructure capacity is sufficient to meet forecast demand, at a daily resolution, subject to:

- Forecast supply availability (including any forecast maintenance).
- Forecast transportation capacity (including any forecast maintenance).
- Forecast storage availability.

Scenarios and runs

In the NEM, the MT PASA is carried out using two different runs:

- Reliability Run – to identify and quantify potential reliability standard breaches and assess aggregated constrained and unconstrained capacity in each region, system performance and network capability.
- Loss of Load Probability (LOLP) Run – to assess days most at risk of load shedding.

While a gas MT PASA will also likely require multiple runs under different scenarios, these runs will differ due to the unique characteristics of the gas system. Potential runs could include:

- Reliability Run – similar to the NEM, a new run could be developed that accommodates the proposed dual reliability standard to assess the probability of the standard being breached.
- Peak run/worst case run – analogous to the LOLP run, this would assess days at the highest risk of curtailment based on factors such as a maximum GPG forecast demand and contingent high weather-related demand and may also include probabilistic modelling of outages or capacity reductions.

In the NEM, the MT PASA identifies LRC when the expected value of unserved energy exceeds the reliability standard under all scenarios. The development of actual scenarios for a gas MT PASA will occur following the AEMC's final determination and as part of AEMO's implementation. However, AEMO recommends that the rule framework be designed in a way that is flexible enough to allow for the development and implementation of additional scenarios as needed overtime through procedures.

[9] DCCEEW, June 2023. Consultation paper on Stage 2 of framework development. At https://www.energy.gov.au/sites/default/files/2023-06/Consultation%20Paper%20-%20Stage%202%20of%20the%20Reliability%20and%20Supply%20Adequacy%20Framework.pdf. Viewed: 9 September 2024.

3.2 Inputs into development of an MT PASA

A gas MT PASA will need to develop a forecast of demand and supply capacity subject to any constraints or maintenance over the medium term. AEMO proposes to model supply capacity and demand forecasts using a combination of AEMO modelling supplemented with participants submissions. The supply capacity forecasts will use existing capacity outlook information provided by participants as an input to reflect supply availability. By leveraging participant-provided information and AEMO's Gas Statement of Opportunities (GSOO) modelling, AEMO can incorporate comprehensive insights into medium-term forecasts while minimising the administrative burden on participants. The approach will also support consistency between the GSOO and MT PASA outlooks, enhancing transparency and data interpretation.

Some data, such as liquefied natural gas (LNG) export outlooks, will still be required from industry, given the challenges in modelling this information in isolation. AEMO also expects that it will need to undertake some internal system and modelling development to develop the inputs and forecasts that an MT PASA is expected to require. However, this approach should be less data-intensive for industry than a bottom-up forecasting approach that could require each participant to provide individual supply capacity and demand forecasts.

Table 4 below summarises the information that is expected to be required to generate MT PASA forecasts, and recommended sources for this information. AEMO expects that the MT PASA can be developed using mostly existing BB and ECGS information provided by participants, coupled with medium-term demand forecasts modelled by AEMO.

Table 4 Inputs to the MT PASA

Input	Description	Source	Comments
Demand			
Wholesale gas market demand	Expected demand forecasts for the DWGM and STTM.	AEMO forecast	AEMO to determine medium-term forecasts using modelling.
Non-market demand	Demand outside the DWGM and STTM.	AEMO forecast	AEMO to determine medium-term forecasts using modelling.
GPG	Medium term gas demand for power generation forecasts.	AEMO forecast	AEMO to determine medium-term forecasts using modelling.
Storage	Medium term forecasts of storage availability	AEMO forecast	Likely to use GSOO modelling of pipeline flows to determine expected withdrawals in combination with participant storage refill forecasts from the Victorian Gas Planning Report (VGPR).
Export demand	A medium term forecast of Queensland LNG exports (including feed gas)	Participants – NGR Part 27	A measure of expected physical withdrawals from the east coast gas market.
Supply and availability			
Supply capacity	Facilities expected capacity to supply based on plant capacity, field deliverability and any other constraints.	Participants – medium term capacity outlooks (MTCO), NGR Part 18	Used to determine expected maximum supply availability. Currently submitted on an ad hoc basis within a 24-month outlook.
Supply capacity	Facilities expected capacity to supply based on plant capacity, field deliverability and any other constraints.	Participants – Extended Daily Capacity Outlook NGR Part 27	Used to determine expected maximum supply availability. Currently submitted as a daily capacity within a six-month outlook. Includes recall times for the 24-month outlook period.
Transportation capacity	Transportation capacity and availability subject to maintenance	Participants – MTCO, NGR Part 18	Used to determine transportation constraints and limitations.

Input	Description	Source	Comments
Storage capacity	Storage injection capacity (possibly subject to expected inventory level)	Participants – MTCO, NGR Part 18	Injection capacity as a proxy for available supply capacity. May be used to forecast storage levels across outlook periods.

Proposed approach and regulatory changes:

- The existing BB *medium term capacity outlook* (MTCO) reporting obligation requires outlooks to contain the expected start and end dates of the matters expected to affect the daily capacity of the BB facility and the expected daily capacity of the BB facility during the period it is affected. The ECGS Rules introduced an extended daily capacity outlook out to six months, and the reporting of MTCO recall times. AEMO recommends the integration of capacity outlooks into the BB Rules and that the obligation is to provide a daily capacity for the 24-month outlook period. The reporting of daily capacities would simplify the reporting of maintenance activities and capacities, ensuring that a capacity is always available for a day, with commentary and recall times only necessary to be included when a maintenance activity is being carried out.
- The extended daily capacity outlook could be removed from the ECGS Rules, on the basis of the BB Rules MTCO being reported at a daily granularity, with the exception of the obligation in r689(4) where participants are required to notify AEMO of an event or circumstances relating to the BB facility of which the BB reporting entity becomes aware that affects, will affect or may affect the reliability of gas supply, including equipment failure, which should be maintained.
- Consistent with the ST PASA proposed changes, AEMO recommends consistency between BB and ECGS pipeline capacity outlook reporting obligations, with a preference for this reporting to be a BB reporting obligation and reported by pipeline segment – to be defined in the BB Procedures.
- AEMO recommends the quantity of gas that an *LNG export project* expects to export be extended to align with the MT PASA reporting horizon (expected to be 12 months) and be reported at a daily resolution. For consistency with other reporting requirements AEMO proposes this obligation be incorporated into the BB Rules with aggregation of the data to be applied when incorporating in the MT PASA.

3.3 Publishing the MT PASA

The MT PASA is expected to provide a rolling 12-month outlook of the supply-demand balance for each region. The key information to be reported could include:

- The demand for gas.
- The aggregate capacity of BB supply facilities.
- Forecast transportation capacities and storage levels.
- A reliability forecast that includes AEMO's assessment of whether or not the reliability standard is likely to be breached and the expected size, timing, duration and location of the forecast breach.
- Key assumptions used in the modelling (such as facility/pipeline outage rate, generator forecasts, weather forecasts, and LNG export assumptions).

The information may be published in a variety of formats to cater to different user needs, and will potentially include:

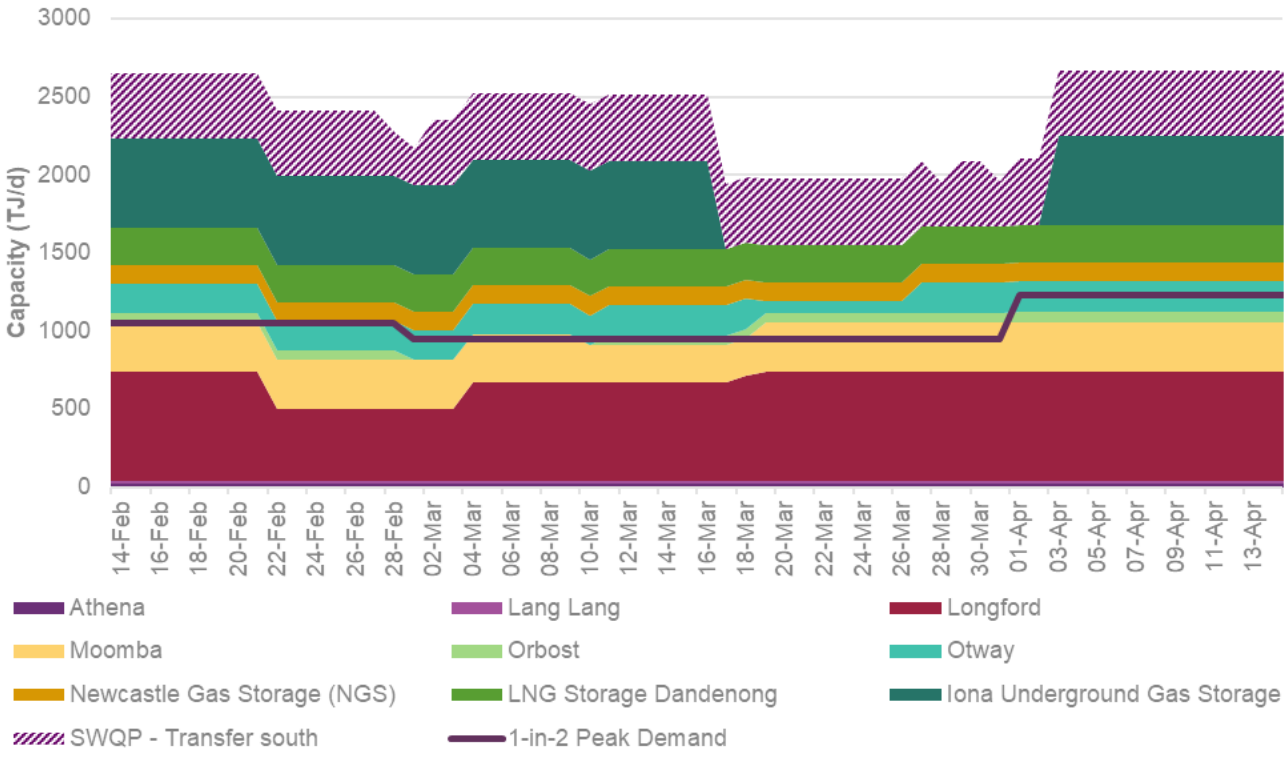
- A summary report highlighting key findings and any forecast shortfalls.

- Medium-term storage refill analysis.
- Detailed data tables with daily supply capacity/demand forecasts for each scenario.
- Visual dashboards and charts to illustrate the outputs.
- Datasets available for download.

AEMO will develop and consult on the exact form of publications for the MT PASA as part of implementation.

The supply capacity/demand balance approach for an MT PASA can be illustrated using a stacked chart for supply capacity, with vertical lines used to demonstrate various demand forecasts. This is shown in the chart below, which is provided for illustrative purposes. A potential gap or issue may be shown where one of the demand forecast lines exceeds the available supply.

Figure 1 Example of a stacked chart for supply showing Southern Zone adequacy



In this example, there is sufficient capacity expected to meet a 1-in-2 peak day demand in the southern zone with less available supply capacity in March and early April.

In the event of a forecast shortfall or other significant finding, AEMO will release a notice to advise participants and may convene industry conferences under the ECGS Rules as required.

As with the ST PASA, the MT PASA outputs will be a key input into AEMO's operational planning and decision-making. Participants are expected to use the information to inform their own gas supply and contracting decisions over the outlook period. AEMO also anticipates that the MT PASA will inform longer-term planning decisions by participants and policy-makers.

3.4 MT PASA other matters

Publication outlook, resolution and frequency

The Stage 2 Consultation Process[10] proposed an MT PASA that could be published on a monthly basis and provide for a rolling 6-, 12- or 24-month outlook. AEMO understands that the majority of industry supported a 12-month outlook period for the MT PASA, as an intra-year assessment of reliability and adequacy of supply capacity, with annual static updates being provided by the GSOO.

Inputs such as the *Medium Term Capacity Outlook* (MTCO), and GPG availabilities from the NEM MT PASA, will be available out to 24 months. This makes it possible for the MT PASA's outlook period to be expanded if beneficial, noting that the outlook period for other data provision requirements should remain consistent with the MT PASA outlook period, to produce a consistent MT PASA across the required horizon. However, beyond the 12-month period, data is likely to be less reliable and more subject to change[11], noting that a 12-month PASA does not limit the capacity outlook information that is available to industry, and does not limit AEMO's ability to act where a potential risk or threat is identified beyond the 12-month outlook period.

AEMO has recommended the MTCO be submitted at a daily granularity, consistent with NEM reporting. This change in reporting of MTCO will provide for a greater level of transparency than the current reporting framework, given the complexity required for users to be able to manipulate the existing data sets to form a view of the available capacity across BB infrastructure facilities. For the 12-month outlook period, AEMO expects that a daily resolution is most appropriate. This aligns with the proposed granularity of data provision and will also ensure that any shortfalls are identified on a gas day basis.

AEMO proposes the MT PASA be carried out at least weekly to align with when the NEM MT PASA is run, also consistent with the MTCO updates provided by BB infrastructure facilities. AEMO expects that there will also be some flexibility in the framework to publish ad hoc changes if there is a material change in circumstances.

Proposed approach and regulatory changes

- AEMO recommends that the rule change process test these options for publication of an MT PASA including:
  - An outlook period of 12 months.
  - Reporting at a daily granularity.
  - Weekly publication.

Unplanned outages

Unlike the ST PASA, where near-term unplanned outages that can materially impact the supply-demand balance will be provided by participants as an input as they occur, the MT PASA may need to take a probabilistic approach to longer-term unplanned outages. Historical outage rates could be used to adjust the expected capacities in the model rather than trying to predict specific unplanned outage events. This is similar to the NEM's MT PASA and

[10] DCCEEW, December 2023. At https://www.energy.gov.au/energy-and-climate-change-ministerial-council/working-groups/gas-working-group/gas/consultation-stage-2-reliability-and-supply-adequacy-framework-east-coast-gas-market. Viewed: 9 September 2024.

[11] This data is also likely more subject to change than the NEM equivalent. Gas market/system demand which includes residential and commercial and industrial demand is more predictable beyond the 12-months which is similar to the NEM. However, the overlay of GPG (see section 4.4) and LNG export demand which is more sensitive to international market conditions, results in higher variability in gas demand beyond the 12-month period.

would form part of the assumptions that would be published as part of implementation and be incorporated into MT PASA runs/scenarios as appropriate.

Maintenance

Capacity reducing maintenance, on the supply side, will be automatically incorporated into the MT PASA through a reduction in capacity outlook information provided, which will then flow through to the MT PASA's supply capacity forecast. The ECGS Rules empower AEMO to take actions where such maintenance is contributing to a potential risk or threat.

On the demand side, AEMO currently receives maintenance outlooks for *LNG export facilities*, through both BB and ECGS Rules, and for large user facilities, through ECGS Rules. While not likely to be a direct input into the MT PASA, a significant change in maintenance information such as an extended outage of a large user facility may result in an update to longer term demand forecasts that are incorporated into the MT PASA. This information may be useful when assessing a potential risk or threat. For example, overlaying large user maintenance schedules (represented by lower demand) against a forecast potential risk or threat may show that there is sufficient gas available for this lower level of demand forecast.

Proposed approach and regulatory changes

- For consistency with other BB reporting requirements, AEMO sees a benefit in all reporting obligations across the ECGS and BB being incorporated into the BB Rules. This could be extended to the medium-term maintenance outlooks for the LNG export and large user facilities (noting the duplication that exists currently between ECGS and BB for the reporting that applies to *LNG export facilities*).

4 Other matters

4.1 Regional definitions and groupings

The ST PASA and MT PASA will be undertaking assessments on a regional basis. The ECGS covers a wide geographic area and encompasses a diverse range of gas supply capacity and demand characteristics.

Three distinct approaches to this regional segmentation have been considered:

- **North/South Regions (based around Moomba).**
  - North would comprise Queensland and Northern Territory.
  - South would comprise New South Wales, Australian Capital Territory, Victoria, Tasmania and South Australia.

  This is a simple approach and divides the ECGS into two broad regions, North and South of Moomba. The division focuses on the distinct demand and supply characteristics of each region, such as the North having large production facilities that are export focussed and the South that now depends on supply from the North to meet winter peak day and seasonal gas supply needs due to declining production.

  The limitation of this approach is that these regions may be too large – potential localised gas supply adequacy and reliability issues may not be identified with the necessary granularity.
- **Pipeline-linked regions.**
  - Queensland and Northern Territory would be based around these key pipelines: South West Queensland Pipeline, Roma to Brisbane Pipeline, Northern Gas Pipeline, Carpentaria Gas Pipeline, Queensland Gas Pipeline and *LNG export project* pipelines. These regions have geographical proximity and shared pipeline infrastructure. A common demand trend is that both states have relatively lower system demand, are linked to LNG export demand and can have relatively high levels of GPG demand.
  - New South Wales, Australian Capital Territory, Victoria and Tasmania would consider the Moomba to Sydney Pipeline, Eastern Gas Pipeline, the Tasmanian Gas Pipeline and the Victorian Declared Transmission System. These regions have similar demand profiles with high levels of gas demand during winter and variable levels of GPG demand.
  - South Australia is served by two pipelines: Port Campbell to Adelaide, and Moomba to Adelaide Pipeline System. It is a distinct region due to its high GPG demand and increasing reliance on GPG during winter, with its supply from Victoria potentially subject to demand in the NSW, ACT, Victoria and Tasmania region discussed above.

  This approach groups regions based on their major transportation interconnections, reflecting the physical flow constraints. It provides more granularity and a more nuanced division than the broad North/South split, allowing for more targeted analysis of regional issues. There can be interdependencies on these regions which allows for a PASA run to account for this in the modelling approach adopted.
- **Demand/state based regions.**
  - Queensland has large amounts of supply available and associated LNG exports, variable levels of GPG.

- Northern Territory has smaller requirements driven primarily by GPG and some large industrial. LNG export demand is supplied by offshore gas fields[12] and the NT *LNG export projects* are exempt[13] from the NGR framework.
- New South Wales/Australian Capital Territory has residential, commercial and industrial demand, including GPG. Reliant on supply from other states.
- Victoria has large residential demand, with commercial, industrial and GPG. Declining Longford production, which impacts overall southern supply.
- South Australia has smaller residential, commercial and industrial demand, but relatively high GPG demand. Supply from Victoria and Moomba/Queensland.
- Tasmania has a relatively low demand, but relatively high GPG demand when running, and depends on supply from Victoria.

This approach focuses on the dominant demand drivers in each region and the associated supply and demand dynamics. It provides the most granularity, but may result in more complex reporting. One potential advantage is alignment between gas PASA regions and NEM regions as well as providing jurisdiction-specific analysis that may feed into jurisdictional responses. However, it is not clear how beneficial this would be given it is important to acknowledge the level of interconnection and interdependence of gas supply capacity that typically occurs between states.

The approach to segmenting regions for the reporting of gas ST PASA and MT PASA should be set out in the East Coast Gas System Procedures, and the Rules framework should be flexible enough to enable the approach to evolve over time while still meeting the objectives of the PASA. Factors to consider in consultation on development of regions or zones will include:

- Alignment with existing regional definitions used in the gas market and NEM.
- How the regions align with potential AEMO interventions under ECGS Rules.
- How the regions align with the new reliability standard framework.
- Data availability and granularity to support the chosen regions.
- Ability for market participants and policy-makers to use the regional information.
- Interaction with transportation capacity and other operational constraints.
- Implications for PASA modelling complexity.

AEMO considers that choice of regional model would benefit from stakeholder input as part of the implementation process. This consultation will help ensure that the defined regions are appropriate and useful for industry.

4.2 Data quality and validation

The accuracy and completeness of the data inputs is critical to the reliability of the PASA outputs. AEMO will need to establish robust data validation processes to ensure the integrity of the input data. This may include:

[12] This offshore supply can be delivered to the domestic market to support shortfalls in gas supply. This is on a contractual basis.

[13] NT *LNG export projects* are currently exempt from the NGR framework. This can limit the benefit of a PASA in the NT, given the reliance on emergency gas connections to provide gas supply where there is a shortfall.

- Clear and specific data reporting requirements with automated checks on data format, completeness, and consistency.
- Plausibility checks based on historical data and sensitivities.
- Participant confirmation processes for key data inputs.
- Spot checks on participant data.

Clear processes will also be needed for managing any data quality issues identified, including:

- Procedures for notifying participants of data issues.
- Timeframes for participants to correct or confirm data.
- Processes for AEMO to estimate or substitute data if necessary.
- Criteria for delaying or re-running PASA if data quality is compromised.

A compliance framework is already in place in the NGR for BB and ECGS data. However, ongoing monitoring and reporting of data quality metrics will be an important aspect of the ongoing framework to identify any systemic issues and drive continuous improvement of the gas PASA.

4.3 Developing AEMO-produced demand forecasts

A key component of developing an effective and reliable PASA is developing robust short-term and medium-term demand forecasts to underpin the PASA. AEMO currently produces demand forecasts for the GSOO and the Victorian Gas Planning Report (VGPR), but primarily utilises data provided by market participants for the STTM, DWGM, BB, and short-term ECGS functions. While this approach leverages the expertise and commercial experience of industry stakeholders, it does have some limitations, such as:

- Inconsistency and variability in the assumptions and methodologies used by participants to model and forecast demand.
- Challenges in aggregating individual forecasts to accurately determine a whole-of-system forecast, including compliance monitoring to ensure all forecasts are received.
- Administratively burdensome for some stakeholders who would otherwise have very little interaction with AEMO systems.

AEMO is in the early stages of the development of a seven-day ECGS system demand[14] forecasting system which will likely be used to uplift demand forecasting accuracy. This forecasting system would leverage the forecasting technology used in AEMO's current DWGM demand forecasting system. The costs of implementation have been defined with a likely implementation lead time expected to be between 12 and 18 months.

It is important to note that a new AEMO forecasting capability is expected to complement rather than replace industry's own planning and forecasting activities. Industry participants will continue to play an important role in providing input data and it is expected that AEMO's forecasts may be validated against participants' own operational experience via consultation where appropriate.

As discussed in section 4.4, a gap in the current demand forecast data that may be enhanced by an AEMO-modelled forecast is gas usage for GPG. GPG demand forecasts in the NEM are inherently challenging, however an AEMO GPG forecast can be tested to assess results. A potential AEMO forecast of aggregate GPG demand

[14] The current development is only looking at system demand forecasts, and not GPG or LNG exports.

would involve building up an electricity demand forecast for each region, making assumptions around variable renewable energy forecasts, the likely running profile of coal power stations, dual-fuel units and other dispatchable generation, and assigning the residual to GPG[15].

It is not expected that an AEMO-modelled NEM GPG demand forecast will be able to accurately forecast actual gas demand for GPG as it is likely to need take on a probabilistic approach. However, this approach aims to minimise placing any additional burden on industry, a burden that it is unlikely to result in any benefit. It also ensures a consistent and transparent approach is applied to forecasting gas usage for GPG in the NEM. It may also allow for multiple different GPG demand sensitivities to be used to test different scenarios.

To create this functionality of an AEMO-modelled NEM GPG demand forecast for the ECGS, AEMO expects it will need to develop comprehensive methodologies, processes and systems to generate forecasts both for the ST PASA and the MT PASA. This may involve engaging with stakeholders on the inputs and the assumptions used in developing a comprehensive forecasting process. It will be a significant undertaking to develop this new functionality (particularly given the challenges in forecasting GPG demand), but a useful GPG demand forecast is critical to the long-term success of the PASA reform. Given the complexities involved, AEMO expects the development of its own forecasting models will necessarily be iterative and evolve over time to incorporate learnings after the PASA is implemented.

AEMO also notes the associated rule change request from Energy Senior Officials relating to ECGS Reliability Standard and Associated Settings[16], which proposes governance arrangements including:

- The Australian Energy Regulator (AER) to be responsible for preparing Gas Forecasting Best Practice Guidelines to guide AEMO's reliability forecasts.
- AEMO to develop Gas Reliability Standard and Forecasting Guidelines outlining how it will implement the AER's best practice guidelines.

4.4 Demand forecast analysis

A considerable amount of gas demand forecast information is available to AEMO through the BB, the new ECGS disclosure obligations, the STTM, the DWGM and the NEM. In addition, AEMO has its own forecasting and modelling. This section provides an overview of the assessments of the data available to AEMO, whether it is appropriate for use in a gas PASA, and any gaps (or duplication) in the information framework. Further information is found in the separate Supporting data document published alongside this report.

Wholesale gas market demand

Aggregate system demand forecasts, provided for the STTM and DWGM, were generally more accurate[17] than BB and ECGS demand forecasts, with the ECGS forecast being the least accurate. There appear to be two primary

[15] Noting many of these inputs are already developed by AEMO.

[16] At https://www.aemc.gov.au/rule-changes/ecgs-reliability-standard-and-associated-settings. Viewed: 27 August 2024.

[17] The Supporting document shows that on the gas day, the absolute variance between the BB nominations and BB actuals data is more accurate than the variance between the DWGM market data and DWGM actuals. The reason for this is because the on-the-day comparison takes the DWGM forecast at the 6am schedule, however takes the latest forecast for the BB nomination. This reflects the accuracy of the BB pipeline deliveries as the DWGM market is scheduled. However, leading up to the day, the DWGM forecasts is still the best source of demand forecast information. It should be noted there is also a difference between the BB actuals and the DWGM actuals, as the BB data reflects all gas flows in and out of the DWGM, and the DWGM actuals was an assessment of the system demand only.

drivers for the more accurate system demand forecast data reported through the STTM and DWGM reporting obligations:

- Financial implication, maturity and coverage of reporting requirements – the requirement for market participants to submit demand forecasts in the ECGS is a relatively new obligation that does not provide coverage of all gas demand. While the BB obligations have been in place for some time, the obligation is on the facility operators to effectively pass through information that has been received, with some extension of this obligation introduced in 2023[18]. However, demand forecasts for the DWGM and STTM have been in place for many years, leading to a high degree of familiarity and expertise among industry participants in forecasting demand, given there are financial implications of incorrect forecasts. Over time, this has allowed industry participants to refine their forecasting models, resulting in more reliable and accurate data submissions. Furthermore, these reporting obligations have been enforced by the AER[19] given the potential for negative market outcomes.
- Timing of BB nominations relative to market schedules – when using the BB data to determine the demand forecast into an STTM hub or into the DWGM, the net pipeline nominations at the boundaries of the market are used to assume the demand within the market (for example, if there are 400 terajoules (TJ) of gas flowing into the Sydney hub, it is assumed that the demand in Sydney is 400 TJ). For each participant, the amount of gas that will be injected to, or withdrawn from, the market is determined by the market clearing results[20] and is dependent on a number of factors including bids, offers and the clearing price. Prior to the publication of this market clearing information, the BB is not a good indicator of gas flows into the market given the uncertainty of nominations that will be required from each participant. Prior to the market clearing outcome, it is challenging for many shippers to have a firm view of their pipeline nominations, into an STTM hub or the DWGM, more than one day in advance of a gas day.

Of the data available to AEMO, extending the obligation on participants in the DWGM and STTM to provide rolling seven-day demand forecasts is likely to be the best external source of demand forecast for the wholesale gas markets. This approach has a low burden on participants given the business practices and models are already in place and allows for AEMO to monitor and investigate potential issues with data submissions more easily.

Non-market demand

This includes gas used by residential, commercial and industrial users outside of the wholesale gas markets. In most cases, the non-market system demand is attributable to larger industrial loads on one or two transmission pipelines in each state. AEMO has two potential sources of information for the short-term demand outlook:

- BB pipeline connection point gas flows.
- ECGS demand forecast submissions by retailers and large users.

The BB forecasts had a higher level of accuracy than the ECGS forecasts. As expected, the BB forecasts did improve closer to the gas day, however it did appear that forecasts out to seven days were based on relatively static submissions (placeholder nominations from shippers[21]) or were not yet submitted. The information

[18] The measures to improve transparency in gas markets placed an obligation on facility operators to provide forecasts where possible, noting that the forecast for some facility operators would be the nominations that have been received.

[19] AER. Compliance Bulletin, November 2023. At https://www.aer.gov.au/system/files/Gas%20Markets%20Demand%20Forecasting%20Compliance%20Bulletin.pdf.

[20] In the STTM this is day-ahead, and in the DWGM this is first determined at the 6.00 AM schedule on the day. There are schedules leading up to this final schedule, however these only provide an indication of what may happen.

[21] The idea of a placeholder nomination is where an initial submission has been made to the pipeline operator, but it has not been updated to reflect current forecasts.

provided to the BB by pipeline operators is only as good as the nominations submitted by each of the shippers, noting there is no mandatory obligation in the NGR for shippers to provide rolling seven-day nominations. By introducing a mandatory obligation on shippers, AEMO notes there is minimal additional burden being created given there are already obligations on shippers to provide this information to facility operators.

In assessing the most suitable data source, AEMO has access to the BB connection point nominations and forecasts, and the BB actual gas flows which allow a like-for-like comparison of the data. In the ECGS, the retailers and large users provide forecasts for demand zones, but do not provide the actual flows. That means AEMO is not able to clearly identify the cause of errors in demand forecasts relating to ECGS forecasts, similar to the way AEMO cannot identify BB nominations from individual shippers given the pipeline operator submission is an aggregate at the connection point.

An obligation on shippers to provide nomination to facility operators seven days ahead is likely to improve the quality of the BB non-market demand forecasts given the accuracy of these forecasts relies on input nominations. This will require ongoing monitoring to ensure gaps in data are being addressed in a timely manner.

Gas-powered generation

GPG is playing an increasing role in the energy transition, with long-term forecasts indicating a greater capacity requirement for GPG but with lower utilisation. The role that GPG plays in the energy mix contributes to increased variability in gas demand, impacting the accuracy of both the short- and medium-term gas forecasts.

Electricity demand in the NEM, which operates on a five-minute market basis, is affected by the time of day, consumer behaviour, seasonal temperature variations and the level of rooftop solar contributing to meeting demand. On the generation supply side, dispatch of GPG will be impacted by a range of factors including network constraints, competitor behaviour, gas input costs and availability, and each GPG operator's portfolio considerations across gas and electricity contracts.

Further, there are additional challenges that exacerbate the variability of GPG demand in the NEM, which can make forecasting GPG demand more challenging:

- The increasing integration of renewable energy sources such as solar and wind, which are intermittent and variable by nature, adds to the complexity of forecasting demand for GPG. As renewables become a larger part of the energy mix, the role of GPG to provide a firming service becomes more crucial yet harder to predict, with long-term forecasts indicating a greater need for GPG but with low overall utilisation.
- Coal-powered generators continue to provide a majority of the baseload power generation throughout the NEM, and GPG can be called on at short notice and for extended periods to provide cover for both planned and unplanned outages of coal generation.
- The availability and price of gas affects the physical and economic feasibility of running GPG units. Given the forecast tightening of the gas supply-demand balance, increases in the cost of gas production, and linkages to international LNG and oil markets and geopolitical events, gas prices are unlikely to pull back to previously seen lower levels, resulting in GPG being relatively uncompetitive against other technologies in the NEM. Further, the availability of gas can be affected by pipeline constraints, particularly on those pipelines bringing gas south during peak demand in winter.

All of these complexities result in an inherent difficulty in being able to accurately forecast when or how much GPG will be required in the NEM; it is difficult to forecast for both the operator of GPG and for AEMO. There are a number of GPG units outside of the NEM in the Northern Territory and Queensland, where GPG units play a

larger role in the energy mix in those locations. AEMO analysed relevant BB pipeline nominated and forecast flows and observed some inaccuracies with the BB forecast. AEMO's proposal for *BB shippers* to have a mandatory obligation to provide rolling seven-day nominations to pipeline operators will likely improve these BB forecasts given the accuracy of the forecast either improved as the gas day approached, or a relatively consistent error was observed.

Analysis of the following short-term GPG forecast demand data was undertaken to understand the inherent challenges associated with forecasting NEM-connected GPG demand:

- NEM extended (seven-day) pre-dispatch[22] – the Extended Pre-dispatch report contains indicative regional reference prices, interconnector flows, binding constraint information, and a projection of aggregate daily fuel use by GPG in the NEM. The report was developed to support the identification of a potential gas supply shortfall in the NEM as per the Gas Supply Guarantee Guidelines.
- NEM 40-hour pre-dispatch – this forecasts dispatch of GPG up to 40 hours ahead and is updated every 30 minutes to take into account expected changes in weather, demand patterns, network constraints, generator bids and availability.
- ECGS expected daily gas demand – this includes a seven-day outlook of expected demand by GPG units.
- BB pipeline nominated and forecast flows – this is a seven-day outlook of the nominations for each connection point on a pipeline, with these connection points being mapped to each GPG unit.

All of the forecasts had high levels of inaccuracy in them, with the BB pipeline nominated and forecast flows and ECGS expected daily gas demand providing the most accurate forecast leading up to the day. The two sources of data had similar results and provide a valuable 7-day outlook however only one source of data is needed given it is duplicated information. The BB pipeline 7-day outlook is more accurate than the NEM 40-hour pre-dispatch with the exception of 30-minute pre-dispatch. This is to be expected given the NEM pre-dispatch window operates closer and up to real time and has the following information available to it:

- Firm bids[23] and availability from all generators, with re-bidding provisions for generators to be able to adjust their positions as required.
- NEM demand forecasts for each region.
- Wind and solar generation forecasts for each region.

Outside of the pre-dispatch timeframe, any forecast gas demand for GPG is subject to a high degree of variability given the potential for rapid changes in NEM conditions. Placing obligations on all generators (not just GPG) to submit NEM bids out to seven days to support an extended pre-dispatch could be considered as an option, but would be a significant burden on the industry, without clarity that any improvement in forecast could be achieved.

AEMO's proposal for *BB shippers* to have a mandatory obligation to provide rolling seven-day nominations to pipeline operators will apply to all shippers, including those supplying gas to GPG. However, it is expected there may still be quality issues with these forecasts further out from the gas day given the uncertainty associated with forecasting these nominations. This obligation will allow AEMO to monitor accuracy in the gas pipeline forecasts for GPG, given this information is the expectation of gas usage at a pipeline connection point.

[22] At https://aemo.com.au/-/media/Files/Electricity/NEM/Emergency_Management/2017/Guide-to-Extended-Predispatch-Report.pdf.

[23] Outside of the pre-dispatch window, bids and offers are not subject to rebidding rules.

An AEMO-modelled GPG forecast is possible but is not without cost and risk. AEMO may be in a position of building complex and costly systems only to find that a modelled GPG forecast is no better than what is currently available to AEMO, undermining the value of a PASA.

GPG is a significant component of the demand mix in the ECGS, one that is difficult to forecast over both the short and medium term given the dependence on so many external and other factors. Despite the difficulty in being able to forecast GPG demand, it is important that a transparent and consistent approach be adopted to be used in the context of both an ST PASA and MT PASA.

Proposed approach and regulatory changes

- AEMO proposes that the ECGS Procedures provide for a modelled approach to forecasting GPG demand, with sufficient guidance and information requirements set out in the NGR.
- NEM and BB data will be key inputs into the modelled approach for the forecast of NEM-connected GPG, however the existing NEM extended pre-dispatch data and the BB data are not suitable as a standalone deterministic forecast for GPG demand. For the forecast of GPG outside of the NEM, *BB pipeline* nominations and forecasts may be adequate given AEMO's proposal for *BB shippers* to have a mandatory obligation to provide rolling seven-day nominations to pipeline operators.
- AEMO proposes that the AEMC consult on this as part of the rule change process, to seek industry feedback on how to best develop a modelled approach that incorporates different sensitivities of GPG demand, to ensure AEMO has access to the right level of information to support the development of this modelled approach. This method acknowledges the complexities and challenges in achieving accurate GPG demand forecasts to provide for a range of possible outcomes in different market scenarios rather than a single deterministic forecast that yields material errors.

LNG export demand

LNG export demand[24] is the largest source of demand in the ECGS, but its impact on the domestic system can vary significantly due to planned and unplanned outages of gas production and *LNG export facilities* and can range from significant to minor based on how each *LNG export project* and their facilities are operating. Demand forecasts for the *LNG export facilities* will be dependent on long-term contracts, international market conditions influencing pricing for shorter-term contracts, maintenance activities and other factors that are best placed to be determined by the *LNG export projects* themselves.

Given the size of the LNG export sector and its interlinkage with the domestic market, it has the potential to act as a major source of net demand or supply, depending on the dynamics. There is generally a low variance between forecast and actual gas demand for the *LNG export projects*, resulting in the BB data being an adequate input into the ST PASA. However, the daily BB forecasts and nominations that AEMO receives do not extend to more than seven days ahead, meaning that additional LNG export demand information is required for the MT PASA.

[24] References to LNG export demand are specific to Queensland, as the Northern Territory *LNG export projects* do not currently source gas from facilities directly connected to the ECGS.

Proposed approach and regulatory changes

- AEMO recommends including the definition of *LNG export project* in the BB rules to ensure consistency across the different Parts within the NGR.

4.5 Gas supply capacity forecasts and infrastructure availability

Supply-side inputs for the relevant outlook period will be required to develop a gas ST PASA and MT PASA, including:

- Capacity outlooks for BB supply facilities. For storage facilities this would also include an assessment against a point-in-time storage level. The use of a supply capacity outlook assumes the definition of capacity is aligned to the maximum production forecast for a gas day and, in the case of production facilities, accounting for any gas field limitations and not just the capacity of the facility.
- Transportation capacity outlooks incorporating limitations imposed by maintenance activities and operational conditions to allow assessment of the ability for gas to be transported from the gas supply points to the demand points within the ECGS. Given the interconnection of transmission capacity across the ECGS, there is a need to view these capacity outlooks in the context of constraints into, or out of, a region.

There are a number of factors in determining the amount of supply that is available to meet demand – whether it is in the right location, constraints in transporting the gas, and whether there is sufficient gas in the ground (or storage) that can be extracted. AEMO has access to a number of different data sources, with the most important being the capacity outlooks for BB supply facilities. AEMO's primary source of information for short-term supply is from the BB, with supplementary information provided on linepack information through the ECGS function.

Supply capacity outlooks

Existing BB obligations require daily short-term capacity outlooks to be provided by facility operators seven days ahead and weekly MTCOs for an outlook period of 24 months. AEMO also receives weekly extended daily capacity outlooks out to six months and weekly MTCO recall times two years ahead under the ECGS Rules. However, shortcomings in the current NGR framework have been identified.

There is a benefit in moving the definitions of *daily capacity* from the NGR to the Procedures. This will allow AEMO to ensure updates can be made, with appropriate consultation, and that the right level of information is provided in the capacity outlooks. This is particularly relevant to production facilities where the output of the facility can be impacted by the deliverability of the gas fields and upstream *lateral gathering pipelines*, even though the facility itself may be capable of higher rates of production.

The MTCO is a by-exception submission provided with a start and end date of any maintenance activities with associated capacity outlooks provided. In the absence of an MTCO submission, it is assumed that each facility is capable of achieving its nameplate capacity, even though this may not be the case[25]. The implementation of the MTCO submission has resulted in a high level of complexity, to allow for the updating of MTCO submissions[26].

[25] Nameplate capacities are required to be updated annually, or where a change in capacity is likely to impact the BB facility for more than one year.

[26] AEMO is not able to determine whether an MTCO submission is intended to update an existing submission or is reflective of a new submission, therefore each MTCO submission for a facility must include all future dates including those that have been previously submitted.

The introduction of a daily capacity submission to the MTCO horizon will result in an easier to interpret dataset for users as well ensuring a mandatory obligation on facility operators to provide these submissions[27].

LNG exporter domestic supply forecast

LNG exporters' net available gas volume to supply to the domestic market is an important aspect of the total gas supply available to the market on a given gas day and over the medium-term outlook. *LNG export projects* currently provide the quantity of gas that the project expect to supply to the domestic market[28]. The expected supply is based on each project's expectations, rather than being based on a particular metric such as contracted domestic supply, or available for domestic supply. This information has been of limited use to AEMO in its ECGS monitoring.

While not likely to be a direct input into the MT PASA, the volume of gas for domestic consumption may be able to be used to understand the level of contracting in place, or volume of gas available, for the domestic market. As per AEMO's recommendation to receive a daily demand forecast out to 12 months for the *LNG export facilities*, combined with the BB supply facility capacity outlooks (also recommended to be at a daily resolution), AEMO can form a view of the residual net supply that is available within the ECGS. The *LNG export projects* expectation of supply to the domestic market could provide an additional level of information regarding the possibility for supply to be diverted to export markets.

Reviewing the definition of the expectation to supply to the domestic market for consumption may be beneficial to providing better quality data that can be used by AEMO. The quantity of gas that the project is expecting to supply to the domestic market does not link this expectation to supply from its own facilities. As an example, it's possible for one *LNG export project* to be selling gas to a retailer assuming this is for domestic consumption (and including this volume of gas in its submission), and that retailer then selling a similar volume of gas to another *LNG export project*. This is the very nature of contracts once they have been sold to a third party, and why it may be best for AEMO to be only looking at the supply-demand balance and using its information gathering powers on an exception basis where an actual or potential risk or threat has been identified. Any adjustment of the definition would need to test whether better quality information would be made available, or whether it is creating an unnecessary regulatory burden with information that has limited use.

Proposed approach and regulatory change

- AEMO proposes for the rule change process to explore the definition of expected supply to the domestic market for consumption. To the extent this obligation continues, AEMO can see benefit in including this information in the BB Rules, for consistency in having all data reporting obligations in one place, with confidentiality provisions on this information. If this information is retained, it would also be of benefit to have this information provided at a daily granularity out to 12 months in line with the MT PASA horizon.

Transportation capacity outlooks

Short-term transportation capacity outlooks are an important input into the gas PASA, given the need to identify potential constraints in the gas supply network and allow proactive measures to ensure gas supply reliability. Risks to gas reliability increase in winter during peak gas demand, and there is a risk that gas supply to GPG may be limited by pipeline infrastructure constraints if gas and electricity demands peak simultaneously.

[27] Currently, in the absence of receiving an MTCO submission, AEMO is not able to ascertain whether this is because there is not maintenance worked planned or if it is a gap in the data set that requires follow up.

[28] Subrule 691(1)(a)

AEMO receives daily short-term capacity outlooks for *BB pipelines* out to seven days, by *pipeline segment*, under the ECGS Rules[29]. The BB Rules also require *BB pipelines* to submit capacity outlooks, and AEMO has recommended for the definitions of *pipeline segments*, and reporting of, to be incorporated into the BB Rules. This will ensure effective reporting, particularly with regard to constraints in and out of the regions.

Linepack/capacity adequacy (LCA) flags and linepack forecasts

AEMO receives *LCA flags* from *BB reporting entities* for each *BB pipeline* and *BB compression facility*[30]. This information provides an indicator of pipeline and compression facility adequacy for gas days D to D+2, supporting early notification of potential pipeline and compression facility issues. However, further investigation is required to ensure consistent and meaningful reporting of the *LCA flags*.

BB pipelines are also required to report forecast amounts of *linepack* in a *linepack zone* and the expected daily capacity for each *pipeline segment* seven days ahead[31], which are inputs to the modelling of available supply, particularly where a risk or threat has been identified.

Proposed approach and regulatory changes

- To ensure consistent and meaningful reporting of *LCA flags* and notification of changes in *LCA flags* in the BB Procedures, AEMO recommends that the *LCA flags* be reported for each *pipeline segment* for more granularity when assessing capacity adequacy along each *pipeline segment*.
- AEMO also proposes that the *linepack* forecasts are incorporated into the BB Rules, and to the extent these are used as an input to the ST PASA there may be a benefit in publishing this information. To ensure AEMO is able to check the quality of the data and follow up on potential gaps[32], AEMO also proposes that each day the actual *linepack* data is provided for each *linepack segment* for the previous day.

[29] Subrule 690(b)

[30] Subrule 179(2)

[31] Rule 690

[32] This data will help identify any forecasting errors or patterns that might need to be addressed.

5 Implementation considerations

5.1 High level system impacts

A comprehensive system impact analysis will be required to fully understand the scope of changes and costs needed to AEMO's systems and processes to implement the PASA. At a high level, the systems and areas listed below are likely to be significantly impacted.

System/area	Impacts and changes
BB systems	• Enhancements to data inputs and validation processes to accommodate new and modified PASA inputs. • Modifications to reporting and data publication. • Modification of the MTCO submission process to capture daily outlooks.
Demand forecasting systems	• Development or enhancement of models and methodologies for producing detailed AEMO demand forecasts, including regional breakdowns and GPG modelling. • Integration of new data inputs and assumptions into forecasting processes.
PASA calculation engine	• Design and development of a new system to perform the core PASA supply-demand balance calculations. • Implementation of algorithms and models to apply reliability standards and identify shortfalls. • Integration with input data sources and output publication systems.
Notification and alerting systems	• Establishment of new processes to monitor PASA outcomes and trigger alerts based on defined thresholds. • Development of notification templates and distribution lists for PASA-related communications. • Potential integration with existing market notification channels and participant portals.
Data validation and quality control	• Enhancement of existing data validation rules and processes to accommodate PASA-specific requirements. • Development of data quality monitoring and reporting capabilities if necessary.
Reporting and visualisations	• Design and development of new report templates and visualisations for PASA outputs.
Operational processes and interfaces	• Establishment of new operational procedures and processes for conducting PASA runs.

5.2 Implementation timing and other considerations

The implementation of the PASA will require careful planning and coordination to ensure a smooth execution. Key factors that will influence the implementation timing include:

- Process and procedures development – depending on the balance between obligations and design in the Rules and procedures, AEMO may be required to undertake significant design work for the implementation of the PASA. This will include developing procedures, guidelines and processes to meet the intent of the Rules framework. This could be a substantial piece of work if AEMO is required to develop new concepts and consult with participants.
- Participant testing and verification – a critical step in the implementation process will be the testing of participant data inputs and PASA outputs. This will involve:
  - Establishing a testing environment and approach.

- Developing detailed test cases and data sets.
- Coordinating testing activities with participants.
- Verifying the accuracy and completeness of participant data.
- Validating the PASA calculations and outputs against expected results.

Sufficient time will need to be allocated for thorough end-to-end testing and resolution of any issues identified. This may require an extended testing and analysis phase prior to the final implementation, which should be factored into the overall implementation timeline.

- Reliability standard rule change – the design and implementation of the PASA is closely linked to the proposed ECGS Reliability Standard and Associated Settings rule change. The reliability standard will be a key input into the MT PASA calculations and will drive the triggering of any supply adequacy/threat actions. As such, the timing of the reliability standard rule change will have a material impact on the PASA implementation. It is important to consider that proceeding with the publication of a MT PASA without the inclusion of a finalised reliability standard may limit its utility.
  AEMO's preference would be for the reliability standard and PASA rule changes to progress in parallel, with sufficient flexibility built into the PASA design to accommodate any final changes to the reliability standard as part of the implementation process. This approach could delay the PASA implementation, with the alternative being to have a staged approach to the PASA, noting this is likely to lead to higher costs of implementation and incremental improvements being made to the MT PASA but will potentially allow for an earlier implementation of other key aspects of the PASA framework. This would allow the core PASA development to proceed while still ensuring alignment with the final reliability standard.

  One approach that could deliver this would be to implement in the following order:

  1. Data collection and verification for up to three months from commencement of the Rules;
  2. Publication of the ST PASA;
  3. Ongoing development of MT PASA inputs including participants submissions and verification;
  4. Reliability standard and associated settings rule commencement (AEMC-dependent);
  5. Incorporation of reliability forecasts and development of MT PASA; and
  6. Publication of MT PASA with reliability run.

Based on the initial assessment, AEMO considers the PASA implementation to be a significant undertaking that will require substantial enhancements and uplifts to existing AEMO systems and processes. A dedicated program of work will be required, with significant time and resources including technology development, testing, and change management efforts. AEMO will develop detailed cost estimates as part of the implementation planning process, but initial indications are that this will be a material expense reflecting the scale and complexity of the changes required.

AEMO will consult with participants as part of design and development to ensure the final systems meet their needs and will work with the AEMC on system implementation timeframes.

Proposed approach and regulatory change

- AEMO proposes that the AEMC, as part of the rule change process, explore a potential staged approach to the publication of initial PASA reports, such that the Rules set an effective date for submissions from participants and a later date for the ST and MT PASA (which could be on different timetables). This will allow for AEMO to review inputs and to follow up with industry to resolve potential data gaps, leading to a more successful uptake and confidence in the new PASA reports.

5.3 Viability of early publication

Based on the limited high-level system impact analysis above, AEMO's strong view is that it would not be viable or advisable to seek to publish a PASA ahead of the completion of the full Rules framework, design, build and testing process.

While it may be theoretically possible to produce a very simplified version of the PASA using existing data and systems, such a report would have severe limitations:

- **Data gap and quality issues** – as identified in this report, there are several key data gaps and quality issues that need to be addressed through rule and procedure changes before a robust PASA can be produced. Publishing on incomplete or unreliable data risks misleading the market.
- **Lack of full methodology** – the PASA methodology involves modelling and calculations of the supply capacity demand balance that need to be carefully designed, implemented and tested. A simplified early version would not be able to fully replicate the intended outcome of the rule change proposal, leading to potentially inaccurate or inconsistent results.
- **Limited usefulness for decision-making** – the value of the PASA lies in providing a comprehensive, reliable, transparent and actionable outlook for the gas supply-demand balance. A partial or indicative PASA may not provide a sufficient basis for operational (or commercial) decisions by either AEMO or market participants.
- **Reputational risk to the reform** – publishing an incomplete or unreliable PASA may undermine confidence in the reform and damage the long-term credibility of the PASA before it has even full commenced.

In AEMO's view, attempting to publish a PASA ahead of the implementation of the support Rules, frameworks, systems and processes would be counter-productive and potentially undermine the overall reform objectives.

It is unlikely that an early PASA would provide significant additional value beyond AEMO's existing BB reporting and market notification and alert functions. The focus should be on developing and implementing a high-quality gas PASA that delivers a robust reporting and signalling framework from day one.