NOVEMBER 2024

Addressing System Strength Requirements in Queensland from December 2025

Summary Project Assessment Draft Report

Preface

Powerlink Queensland is a Transmission Network Service Provider that owns, develops, operates and maintains Queensland's high-voltage electricity transmission network. The network transfers bulk power from Queensland generators to electricity distributors Energex and Ergon Energy (part of the Energy Queensland Group), and to a range of large industrial customers.

This Summary Project Assessment Draft Report (PADR) has been prepared in accordance with version 217 of the National Electricity Rules (NER), and the Regulatory Investment Test for Transmission (RIT-T) Instrument (August 2020) and RIT-T Application Guidelines (October 2023). The RIT-T Instrument and Application Guidelines are made and administered by the Australian Energy Regulator.

The NER requires Powerlink to carry out forward planning to identify future reliability of supply requirements, which may include replacement of network assets or augmentations of the transmission network. Powerlink must then identify, evaluate and compare network and non-network solutions (including, but not limited to, generation and demand side management) to identify the preferred option which can address future network requirements at the lowest net cost to electricity customers.

Powerlink also has obligations under the NER to address power system security requirements identified by the Australian Energy Market Operator in its annual System Security Reports.

The main purpose of this document is to summarise the identified need, credible options, and the technical and commercial feasibility of the preferred option. More detail on these and other aspects of the RIT-T analysis is available in the full PADR document, available on Powerlink's website.

This document also provides customers, stakeholders and communities with information on the potential investment(s) (network and non-network) that are required in the near-term to meet an identified need, and offers the opportunity to provide input into the future development of the transmission network in Queensland.

More information on the RIT-T process and how Powerlink applies it to ensure that safe, reliable and cost-effective solutions are implemented to deliver better outcomes to customers is available on Powerlink's website.

A copy of this summary report will be made available to any person within three business days of a request being made. Requests should be directed to the Manager Portfolio Planning and Optimisation, by email (networkassessments@powerlink.com.au) or phone ((07) 3860 2111).

This summary PADR does not include references to published documents and reports that have been used to inform the report. The full PADR document includes all relevant references.

Powerlink acknowledges the Traditional Owners and their custodianship of the lands and waters of Queensland and, in particular, the lands on which we operate. We pay our respect to their Ancestors, Elders and knowledge holders and recognise their deep history and ongoing connection to Country.

Key Points

- System strength is a measure of the ability of the network to maintain and control voltage both during steady state operation and in response to network disturbances. The transition to renewable energy means that system strength services are less freely available due to the changing operation and retirement of synchronous generation, and so must be planned for and delivered by other means.
- Powerlink is responsible for ensuring sufficient system strength services are available to maintain the stability of the Queensland power system. Powerlink is applying this Regulatory Investment Test for Transmission (RIT-T) to assess options to meet the system strength requirements determined by the Australian Energy Market Operator (AEMO) from 2 December 2025.
- Powerlink received close to 80 unique non-network solutions from more than 20 proponents in response to the Project Specification Consultation Report (PSCR) and the accompanying proforma for non-network solutions. Based on these responses, Powerlink developed and assessed five different credible option portfolios for meeting the requirements as part of this Project Assessment Draft Report (PADR).
- Powerlink developed a 'Balanced Technology' portfolio that includes investing in or contracting with a range of different technologies for meeting the system strength requirements, as well as four additional portfolios that each assume a greater use of a particular technology for meeting the minimum system strength requirements.
- While the five portfolios differ in terms of how they meet the minimum requirements, each portfolio includes the same quantity (2.15 gigawatts) of new and currently connected grid-forming Battery Energy Storage Systems (BESS) for the efficient stable voltage waveform requirements (on account of their relatively low costs and speed of delivery).
- Portfolio 2 (Synchronous Condensers), which includes nine synchronous condensers across Central Queensland and Southern Queensland by 2033/34, is found to be the top-ranked option under the RIT-T at this stage. However, this is sensitive to the project status of other potential solutions, such as clutched gas turbines.
- This PADR also shows that there are additional 'low regret' non-network solutions for Southern Queensland that provide prudent insurance against more accelerated coal retirement going forward, and Powerlink considers that these should also form part of the preferred option. Powerlink proposes to commit to these additional solutions to avoid the adverse consequences for consumers in Southern Queensland of under-investing in system strength solutions.
- The preferred option recommended in this PADR recognises that action needs to be taken now, but also retains flexibility to refine the specific solutions committed in the future (if optimal). While Powerlink will immediately commit to investing in or contracting with up to three synchronous condensers in Central Queensland by 2028/29, additional investment in up to six further synchronous condensers by 2033/34 can be avoided if alternate solutions reach committed or anticipated status under the RIT-T in the next few years.
- To facilitate this flexibility, Powerlink propose a number of reopening triggers for this RIT-T which, if activated, would alter the make-up of the preferred option and allow us to pivot to alternate solutions over time. This includes evidence emerging that grid-forming BESS are technically feasible for contributing to minimum system strength requirements (and proposals reaching committed or anticipated status).
- Powerlink invites submissions and comments on the material presented in this PADR. Submissions are due by **Friday, 20 December 2024** and should be emailed to networkassessments@powerlink.com.au.

Introduction

System strength is a measure of the ability of the network to maintain and control the voltage both during steady state operation and in response to a network disturbance, such as a sudden change in generation or load, or fault on the network. This includes resisting changes in the magnitude, phase angle, and shape of the voltage waveform. If a transmission network location is:

- 'strong', the change in voltage at that location will be relatively unaffected by a nearby disturbance; or
- 'weak', the voltage at that location will be relatively sensitive to a system disturbance, that could result in a more widespread prolonged voltage recovery.

The Queensland energy system has historically comprised synchronous generation such as coal-fired generators, gas turbines and hydro-electric plants. These large synchronous generators have also provided various services as a by-product of their dispatch for energy, including system strength, to enable the power system to operate stably. The transition of the energy system to renewable energy, particularly solar and wind generation, means that certain system services are less freely available and must be planned for and delivered by other means.

The Australian Energy Market Operator (AEMO) and Powerlink are responsible for the planning and delivery of power system security services in Queensland. These arrangements were fundamentally revised following the Efficient Management of System Strength on the Power System Rule (System Strength Rule), made by the Australian Energy Market Commission (AEMC) in October 2021.

AEMO's annual System Security Reports consider the need for services in Queensland, and other regions of the National Electricity Market (NEM). For each of Queensland's five system strength nodes, AEMO's 2023 System Strength Report identified expected three phase fault levels, and forecasted the level and type of inverter-based resources (IBR) over the 11-year period from 2023/24. The first date by which Powerlink must have arrangements in place to address system strength requirements in Queensland is 2 December 2025.

This Regulatory Investment Test for Transmission (RIT-T) is a key part of Powerlink's implementation of the System Strength Rule. Powerlink commenced the System Strength RIT-T in March 2023 with publication of a Project Specification Consultation Report (PSCR), which invited proposals from proponents who considered they could offer potential non-network solutions that were both technically and economically feasible by 2030. To assist proponents in preparing submissions, Powerlink subsequently released a proforma for non-network solutions in June 2023.

In response to the PSCR and proforma, Powerlink received close to 80 unique non-network solutions from more than 20 proponents. Powerlink thanks proponents for their engagement in the RIT-T process, and for their responses to the information request that further informed and shaped the technical analysis and market modelling for this Project Assessment Draft Report (PADR).

This PADR was prepared before the Australian Energy Regulator (AER) published draft guidance on the System Strength Rule in October 2024. The final guidance from the AER will be considered as part of the Project Assessment Conclusions Report (PACR), if published by the AER sufficiently ahead of when the PACR (and analysis feeding into it) is finalised.

Submissions

Powerlink invites submissions and comments from market participants, AEMO, potential non-network providers, and any other interested parties, on this PADR and the draft preferred option presented. While a number of areas have been flagged in the PADR as key topics Powerlink is seeking stakeholder feedback on, importantly, these are not the only issues Powerlink is seeking feedback on. Parties making a submission should review and consider all issues in this summary, and the full PADR document, that they consider require comment.

Submissions are due to Powerlink by **Friday, 20 December 2024** and should be emailed to Powerlink via networkassessments@powerlink.com.au, with 'System Strength RIT-T PADR Submission: <name of submitter>' in the subject field of the email. Details on how to mail a submission to Powerlink are in the full PADR document, available on the System Strength RIT-T page of Powerlink's website.

Identified need

The identified need in this RIT-T is to make system strength services available to AEMO to meet the following requirements in each year from 2 December 2025:

- Maintain the minimum three phase fault level specified by AEMO at each system strength node for the relevant year (**minimum level**); and
- Achieve stable voltage waveforms for the level and type of IBR and market network service facilities projected by AEMO at each system strength node for the relevant year in steady state conditions, and following a credible contingency event or protected event (**efficient level**).

The investment in system strength services is to ensure Powerlink's compliance with clause S5.1.14 of the National Electricity Rules (NER). This RIT-T is therefore considered a reliability corrective action under the NER.

Powerlink is required to use reasonable endeavours to make system strength services available to AEMO. AEMO's declaration of system strength shortfalls is (currently) based on when AEMO forecasts system strength services will fall below the minimum requirements for less than 99% of the time under typical dispatch patterns. Powerlink considers that this approach aligns with the reasonable endeavours standard, and has therefore adopted this approach in developing the credible options for this RIT-T.

The level of coal generation in Queensland over the period December 2025 to December 2030 is the primary consideration for Powerlink's ability to meet minimum fault level requirements. While AEMO's Integrated System Plan (ISP) and System Strength Reports are central to Powerlink's assessment of the identified need, the coal generation projections across the reports are not directly comparable, and the 2023 System Strength Report suggests a more accelerated retirement profile for coal generation in Southern Queensland than the profile Powerlink infers from the 2024 ISP, and compared to the 2022 System Strength Report. Given the importance of forecasts of the operation and retirement of coal plants for Powerlink's ability to meet minimum fault level requirements, Powerlink has taken different forecasts into account in considering the options for this RIT-T.

Five credible portfolio options have been assessed

Using responses to the PSCR and the accompanying proforma as a base, Powerlink has adopted a portfolio formation approach to develop five different credible options to address the system strength requirements in Queensland from December 2025. Each of the portfolios meets both the minimum fault level requirements and the stable voltage waveform efficient requirements.

Powerlink developed a 'Balanced Technology' portfolio (Portfolio 1) that includes investing in or contracting with a range of different technologies for meeting the minimum fault level requirements going forward, such as existing synchronous generation (including hydro generators), adding clutches to existing and future gas generating units and synchronous condensers. Four additional portfolios each assume a greater use of a particular technology for meeting the minimum requirements.

The approach of having portfolios assume a greater use of a particular technology for meeting the minimum requirements enables the PADR assessment to test the relative expected economic benefits of, and interactions between, the different technologies that are able to assist with meeting the minimum system strength requirements.

The outcome of the portfolio formation process is that the portfolios *differ* in terms of the following solutions for meeting the minimum fault level requirements.

Table 1: Key differences between the five portfolios[1]

Portfolio	Solutions for minimum requirements
1 (Balanced Technology)	Six new synchronous condensers in Central Queensland. Two future clutched gas turbines in Central Queensland.
1A (Balanced Technology: BESS in Minimum)	Five new synchronous condensers + one (large) grid-forming BESS in Central Queensland. Two future clutched gas turbines in Central Queensland.
2 (Synchronous Condensers)	Eight new synchronous condensers in Central Queensland.
3 (Clutched Gas Turbines)	Four new synchronous condensers in Central Queensland. Four future clutched gas turbines in Central Queensland.
4 (Pumped Hydro Energy Storage)	Three new synchronous condensers in Central Queensland. Two future clutched gas turbines in Central Queensland. Three planned pumped hydro energy storage units in Central Queensland.

Each portfolio also includes a number of *common* solutions for meeting both the minimum and efficient system strength requirements, as summarised in the table below.

Table 2: Solutions common to all five portfolios

Requirements	Solutions
Minimum fault level	One new synchronous condenser in Southern Queensland. Non-network contracts with existing, expected and potential future gas and hydro projects in Southern and Northern Queensland. Powerlink's solution to the system strength shortfall declared by AEMO (in 2021) at the Gin Gin system strength node (being an existing non-network solution for the installation of a clutch at the Townsville Power Station). A non-network contract with an existing (small) synchronous condenser.
Efficient stable voltage waveform	Each portfolio includes the same quantity (2.15 gigawatts) of grid forming BESS.

For all portfolios, all assumed investment in and or contracting with solutions is complete by 2033/34. That is, no portfolio involves any new solutions beyond this point.

A key issue for Powerlink (and the industry more broadly) is the extent to which grid-forming BESS can be relied on to contribute to minimum fault level requirements. A minimum level of system strength is required to support a number of critical system services, including (but not limited to) maintaining the stability of IBR, satisfactory operation of protection systems, and stable switching of voltage control devices. Powerlink does not have sufficient knowledge or experience of how the power system would behave if grid-forming BESS replace the existing synchronous generators to meet minimum system strength requirements in the near term. As a result, Powerlink does not consider them to be technically feasible for this application at this time. This current

[1] While Powerlink has used shorthand labels for each portfolio (such as 'Synchronous Condensers' for Portfolio 2), each portfolio includes a number of solutions, across a range of technologies. The shorthand label has been selected for brevity and to highlight the key difference in focus for each portfolio, compared to Portfolio 1.

uncertainty is the basis for developing Portfolio 1A, which tests how including grid-forming BESS to assist with the minimum fault level requirements would fare, relative to the other technology choices, *if it is found to be technically feasible.*

The portfolios do not differ in terms of how the minimum system strength requirements are met for:

- Southern Queensland, due to:
  - AEMO's 2024 ISP assumptions regarding coal retirement suggesting that there will be sufficient system strength in Southern Queensland over the period December 2025 to December 2030; and
  - proposed non-network contracts with existing, expected and potential future gas and hydro projects being relatively low cost under the RIT-T (meaning that only one new synchronous condenser is assumed to be required in addition to these contracts, as outlined in Table 2 above).
- Northern Queensland, due to the dependency of Northern Queensland on Central Queensland for system strength (meaning that these two regions can effectively be considered as one).

Given that the BESS proposals considered to meet the efficient requirements are independent of the solutions to meet the minimum requirements, each portfolio includes the same capacity (2.15 gigawatts) of grid-forming BESS to meet the efficient system strength requirements. This common capacity of grid-forming BESS included in each portfolio is made up of both:

- proposals from committed and anticipated BESS – these represent relatively low-cost solutions under the RIT-T given they are also assumed in the base case and it is only incremental costs, if any, that are included in the portfolios; and
- additional proposals from BESS proponents (both new-build and the conversion of existing) that do not currently meet the RIT-T criteria for committed or anticipated projects – these have been included due to their relatively low costs compared to alternate solutions (such as synchronous condensers). Powerlink is also interested in proposals from other non-network proponents who could also contribute to meeting the efficient level of system strength (as discussed in the full PADR).

The project status of each solution has been determined by Powerlink using information provided by proponents, AEMO's Generation Information data, and publicly available information for government-backed projects. If a solution is deemed not to meet the RIT-T criteria for committed or anticipated projects at this point in time, then its full cost is included in the assessment, consistent with the RIT-T Application Guidelines. This means, for instance, that the full capital cost of BESS that are not existing, committed or anticipated projects is included in the analysis even though the projects would be used to provide services other than just system strength.

Powerlink acknowledges that potentially cost-effective solutions, such as grid-forming BESS and clutched gas turbines, may reach committed or anticipated status irrespective of this system strength RIT-T and have suggested a reopening trigger to leverage these solutions if they become available.

Estimation of benefits

Powerlink engaged Ernst and Young (EY) to undertake wholesale market modelling to evaluate the following seven categories of market benefit under the RIT-T for this PADR:

- changes in involuntary load curtailment;
- changes in costs for other parties in the NEM;
- changes in fuel consumption in the NEM arising through different patterns of generation dispatch;
- changes in Australia's greenhouse gas emissions;
- changes in unrelated network expenditure;
- changes in voluntary load curtailment; and

- changes in network losses.

Drawing on the hourly market modelling dispatch data from EY, Powerlink also undertook two post-processing modelling exercises to capture two additional sources of market benefit in the assessment:

- the avoided involuntary load shedding under the base case from there being insufficient system strength under the base case; and
- the impact of synchronous condenser losses on Australia's greenhouse gas emissions and NEM fuel costs.

Both of these effects were not captured in the wholesale market modelling undertaken by EY.

Portfolio 2 (Synchronous Condensers) is the top-ranked option

The Net Present Value (NPV) results find that Portfolio 2 (Synchronous Condensers) has the greatest expected net benefit over the assessment period. Portfolio 2 is found to deliver approximately $128 million greater net benefits than the second ranked option (Portfolio 1).

Table 3: NPV of the portfolio options (2023 dollars, millions)

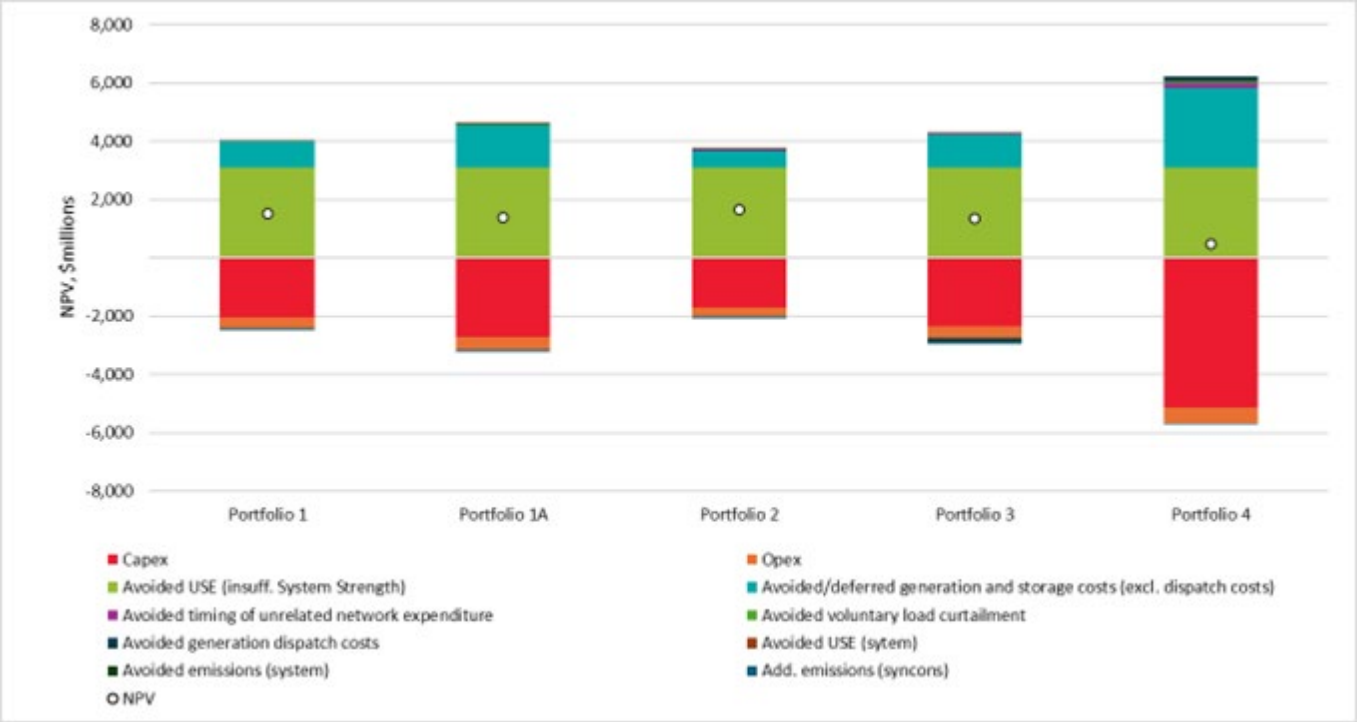
Portfolio	Description	Costs		Gross economic benefits			Net economic benefit	Rank
		Capex	Opex	Wholesale Market Benefits + emissions	Avoided USE*	Syncon Losses**		
1	Balanced Technology	-$2,047	-$363	$917	$3,090	-$66	$1,532	2
1A	Balanced Technology (BESS in Min.)	-$2,712	-$445	$1,508	$3,090	-$60	$1,381	3
2	**Synchronous Condensers**	**-$1,720**	**-$282**	**$636**	**$3,090**	**-$65**	**$1,660**	**1**
3	Clutched Gas Turbines	-$2,336	-$433	$1,089	$3,090	-$64	$1,347	4
4	Pumped Hydro Energy Storage	-$5,149	-$530	$3,111	$3,090	-$50	$473	5

** This avoided unserved energy (USE) reflects the post-processing assessment by Powerlink of the avoided USE during periods of insufficient system strength under the base case (and has been capped in the analysis). It is separate from the general system USE estimated by EY in the wholesale market modelling (which is immaterial).*

*** This captures the value of the additional emissions from the use of units in synchronous condensers mode due to the energy they consume. It has been estimated via the post-processing assessment by Powerlink, as opposed to as part of the wholesale market modelling undertaken by EY. The value of the additional fuel costs associated with the use of synchronous condensers has been included in the opex column (and is immaterially different between the portfolios).*

While Portfolio 2 has the lowest estimated gross economic benefits, it has significantly lower costs than all other portfolios, which is the key differentiator between the portfolios at this point in time.

Figure 1: Breakdown of the NPV of the portfolio options (2023 dollars, millions)



The key findings from the NPV assessment of each option portfolio are:

- The cost differences across the portfolios are a key driver of the portfolio rankings, and total capital and operating costs vary between $2.0 billion and $5.7 billion, in present value terms, across the portfolios.
    - Under the RIT-T framework, the full capital and operating costs of solutions is included in the cost-benefit analysis when solutions are not committed/anticipated, or already in service.
    - Given the criticality of the project status of proposals to how the costs of solutions are assessed in the RIT-T, Powerlink has investigated a sensitivity that assesses whether the overall preferred portfolio changes if the commitment status of clutched gas turbines changes going forward (discussed below).
- The avoided involuntary load shedding under the base case from there being insufficient system strength, estimated via the post-processing process, is the largest category of benefit for all portfolios, estimated to be *at least* $3 billion for each portfolio.[2]
- Avoided/deferred generation and storage costs (excluding dispatch costs) are the largest category of benefit estimated via the wholesale market modelling for all portfolios, making up between $0.6 billion and $2.7 billion, in present value terms, across the portfolios.
    - This is driven by the additional storage, gas and/or pumped hydro energy storage (PHES) units (as part of the portfolios) reducing the need to build more capacity to meet demand.
    - The wholesale market modelling finds that under Portfolio 2 wind capacity is primarily deferred or replaced by grid-forming BESS, solar and open-cycle gas turbines.

[2] Note that 'at least' is used here, and throughout the full PADR document, on account of the approach taken to capping the avoided unserved energy in the assessment to allow for a meaningful comparison across options. If the full unserved energy is added to the analysis, the expected net benefit of all portfolios would be significantly greater.

- All other categories of benefits are found to be immaterial in the analysis (as shown in Figure 1 above).

The conclusion that Portfolio 2 is the top-ranked option is found to be robust to a range of sensitivity tests, including delay to the completion of the Borumba PHES (which affects the amount of system strength required to be procured under the portfolios), changes to the assumed cost of gas, changes to the capital costs of BESS, changes to the capital cost of synchronous condensers and alternate commercial discount rate assumptions.

Portfolio 3 (Clutched Gas Turbines) is preferred if proposals become committed (or anticipated)

Powerlink has also investigated whether the overall preferred portfolio would change *if the project status of proposed clutched gas turbines changes going forward*; that is, assuming that currently proposed projects become committed or anticipated in the future. This would significantly decrease the cost of these proposals from the perspective of the RIT-T.

Under these assumptions, Powerlink finds that Portfolio 3 (Clutched Gas Turbines) becomes the preferred option overall. Specifically:

- Portfolio 3 is found to have estimated net benefits of $2.53 billion (in present value terms), which are $388 million more than the second-ranked portfolio under this sensitivity (Portfolio 1) – Portfolio 2 falls to fourth overall and is ranked behind Portfolio 1 (and 1A) due to it involving less clutched gas turbines than those two portfolios.
- This outcome is driven by the costs of the clutched gas turbine component of the options falling significantly if they are considered committed or anticipated – for example, in present value terms the total capital cost of Portfolio 3 falls from approximately $2.34 billion to $1.34 billion.

Given this finding, Powerlink intends to closely monitor the development of the proposed gas turbines, and has proposed reopening triggers in this PADR that would allow us to pivot to these solutions (from synchronous condensers), if they reach committed or anticipated status under the RIT-T.

While Powerlink has not investigated a similar sensitivity for Portfolio 4 (PHES) as part of the PADR, a similar conclusion may hold if these proposals are assumed to become committed or anticipated in the future. However, confirming this position will require significant additional market modelling (which has not been able to be accommodated for the PADR) and so Powerlink intend to investigate it further as part of the PACR, if appropriate to do so.

Similarly, Powerlink has not investigated this type of sensitivity for Portfolio 1A (where grid-forming BESS are assumed to be technically feasible for assisting with the minimum requirements) as part of the PADR, and we intend to consider this further in the PACR.

There are ‘low regret’ Southern Queensland solutions that provide prudent insurance against more accelerated coal retirement

While the core PADR analysis aligns its assumptions with those in AEMO’s 2024 ISP, Powerlink has also investigated a sensitivity that relies on the assumptions relating to coal generation operation and retirement from the AEMO’s 2023 System Strength Report.

Under these assumptions, contracting with existing and anticipated hydro and gas turbine projects is strongly justified in Southern Queensland to avoid the significant amount of unserved energy that would otherwise occur there. The details about which specific projects are assumed to be contracted with have been redacted to preserve confidentiality and to protect commerciality.

The solutions included for Southern Queensland would not differ by portfolio and are considered independent to the other solutions included for Central and Northern Queensland; that is, their inclusion in the portfolios would not offset any other solutions. The inclusion of these solutions will therefore not affect the ranking of the options. Powerlink also notes that these solutions are relatively low-cost (both outright and on a dollars per megavolt amperes basis) and only increase the estimated total cost under the RIT-T (which excludes network support costs) by approximately 4.3% for Portfolio 2 in present value terms.

Given the uncertainty surrounding the retirement, and the decreased operation during times when it is uneconomic, for coal generators in Southern Queensland, Powerlink considers the addition of these solutions to the ultimately preferred option to be a 'low regrets' decision. Powerlink propose to commit to these additional solutions as part of this RIT-T to avoid the adverse consequences for consumers in Southern Queensland of under-investing in system strength solutions.

The preferred option at this stage recognises that action needs to be taken now, but also retains flexibility to refine in the future

The top-ranked option, Portfolio 2 (Synchronous Condensers), involves the following by 2033/34:[3]

- For the **minimum fault level requirements**:
  - nine synchronous condensers across Central Queensland and Southern Queensland; and
  - contracting with a range of other synchronous units in Southern and Northern Queensland.
- For the **stable voltage waveform efficient requirements**, contracting for:
  - 550 megawatts of grid-forming BESS in Southern Queensland; and
  - 1,600 megawatts of grid-forming BESS in Central Queensland/Northern Queensland.

Powerlink does not consider it optimal to plan to procure up to nine synchronous condensers for commissioning by 2033/34, particularly as proposals involving adding clutches to gas generating units or PHES solutions could become committed or anticipated in coming years. Powerlink will immediately commit to investing in or contracting with up to three synchronous condensers in Central Queensland by 2028/29, in order to meet the minimum standard. This approach takes account of the expected contracting and procurement lead times, with additional synchronous condensers not expected to be required until later. Powerlink will also take into account any additional information between now and the completion of the PACR that could affect this position.

In addition to the three synchronous condensers in Central Queensland from 2028/29, Portfolio 2 also includes the following six synchronous condensers:

- three in Central Queensland by 2029/30;
- one in Southern Queensland by 2029/30;
- one in Central Queensland by 2032/33; and
- one in Central Queensland by 2033/34.

Powerlink is not intending to commit to contracting for the delivery of these additional six synchronous condensers at this time. The assessment in this PADR has shown that the preferred option in this RIT-T would change if alternate solutions became committed or anticipated. Powerlink considers it prudent to allow the opportunity for these alternative solutions to emerge.

However, it is of the utmost importance that Powerlink meets its system strength requirements, as failing to do so could result in material outages for consumers, and there are significant and lengthening lead times associated

[3] Note that these are subject to developers seeking system strength services from Powerlink and not choosing to self-remediate. Powerlink has included a reopening trigger (below) to accommodate for developers choosing to self-remediate.

with procuring synchronous condensers. Powerlink considers that there are 'cut-off' points for alternate technologies being available to avoid future synchronous condenser investment, and intends to make clear as part of the PACR what we expect these to be for each of the four tranches of synchronous condensers investment outlined above.

Should third-party proponents be able to show credible evidence of their solutions reaching committed or anticipated status ahead of these cut-off points, then Powerlink expects that synchronous condenser investment can be avoided and, instead, procure these alternate solutions. Powerlink has proposed reopening triggers in this RIT-T to allow us to pivot to these alternative solutions, should they become available.

The pathway set out in this RIT-T recognises that action needs to be taken now to meet the system strength requirements in the near-term, but retains flexibility to pivot to future solutions depending on the project status of proposals, and their (economic) cost under the RIT-T framework. Overall, this will result in the best outcome for electricity consumers and avoid Powerlink needing to undertake a new RIT-T, which would require significant time to complete and jeopardise Powerlink's ability to address system strength requirements in Queensland. It also supports the development of non-network solutions in being able to provide system strength services.

To provide a potential pathway for the future inclusion of grid-forming BESS into the portfolio of solutions to contribute to minimum fault level requirements, as part of the PACR Powerlink intends to investigate:

- a variant of Portfolio 2, and potentially Portfolio 3, that includes a grid-forming BESS for meeting the minimum system strength requirements (akin to how Portfolio 1A in the PADR is a variant of Portfolio 1); and
- a sensitivity that assumes, not only that grid-forming BESS are proven as technically feasible for assisting with the minimum requirements, but also that one or more reach committed or anticipated status. This will enable Powerlink to assess whether that affects the overall preferred option for this RIT-T (akin to the sensitivity where the project status of proposed clutched gas turbines changes going forward).

To be clear, the additional analysis regarding grid-forming BESS being able to assist with the minimum requirements expected for the PACR is intended to be *economic-only* in nature, and Powerlink is not proposing to present any technical assessment of this potential function at that stage. While Powerlink plans to undertake significant work, and gain general learnings through practical operational experience, to assess and determine the technical feasibility of grid-forming BESS being able to assist with the minimum requirements going forward, we do not expect to be able to comment on this as part of the PACR as these efforts and learnings will be ongoing.

Proposed reopening triggers

Powerlink is required to set out in the PADR, for consultation and confirmation in the PACR, reopening triggers for this RIT-T. Powerlink's proposed reopening triggers include:

- Credible evidence of proposals for synchronous condenser operation of gas turbines (such as adding a clutch) or PHES solutions reaching committed or anticipated status (as defined under the RIT-T).
- Credible evidence emerging that grid-forming BESS are able to be relied on to contribute to minimum fault level requirements, and proposals reaching committed or anticipated status (as defined under the RIT-T).
- Credible evidence that the cost (as considered under the RIT-T) of adding clutches to gas turbines is going to be sufficiently greater than commissioning synchronous condensers that it changes what is considered optimal in Southern Queensland to meet the minimum requirements.
- Credible evidence of expected real synchronous condenser costs increasing by approximately 75% compared to those used in the RIT-T analysis.
- Credible evidence of commercial discount rates falling materially below the boundary value (2.15%) identified in this RIT-T.

- Credible evidence of the demand for system strength requirements for projected IBR plants significantly reducing due to self-remediation and technological advancements in equipment.
- Delayed availability of, and/or inability to conclude contracts with, proposed solutions to meet the minimum requirements.

In relation to the last trigger, Powerlink intends to include further sensitivity analysis in the PACR on the impact of not being able to contract with key non-network solutions of the preferred option.

Similarly, if Queensland coal-fired units are to be repurposed into synchronous condensers, as indicated in the current Queensland SuperGrid Infrastructure Blueprint, this may also form an additional potential reopening trigger at the PACR stage.

Powerlink does not consider that a material change in the location and/or timing of reduced coal generation in Southern Queensland to form a reopening trigger for this RIT-T. As outlined, Powerlink proposes to commit to additional, relatively low-cost solutions in Southern Queensland in light of the uncertainty surrounding the retirement/de-commitment of coal generators, and the adverse consequences for consumers of under-investing in system strength solutions.

Powerlink has revised its commercial framework

In December 2023, Powerlink published a commercial parameters document to provide proponents of non-network solutions with example terms and conditions for system strength contracts that Powerlink will negotiate with proponents. Alongside this PADR, Powerlink has issued an updated commercial parameters document, which is available on the System Strength RIT-T page of Powerlink's website, and is included as an appendix in the full PADR document.

Powerlink considers that the revised commercial parameters represent an appropriate allocation of risks between Powerlink and proponents of non-network solutions. To facilitate future negotiations for system strength contracts, Powerlink invites input on the parameters from stakeholders and, in particular, proponents of non-network solutions.

New and updated proposals from proponents of non-network solutions

This RIT-T is not a tender process. In response to this PADR, Powerlink requests proponents of non-network solutions provide their best cost proposals to meet the geographical and technical requirements of relevant solution(s). An information request is included as an appendix in the full PADR document, and a copy of the request will be emailed directly from Powerlink's Network Assessments team to proponents who submitted a proposal in response to the PSCR.

Powerlink is particularly interested in receiving new/updated proposals from non-network proponents for near-term solutions expected to be required – namely existing, expected and potential future gas and hydro projects, and grid-forming BESS.

Powerlink would also be interested to hear from proponents of longer-term potential solutions (such as adding clutches to gas turbines and PHES solutions) as to whether the project status of their proposals has progressed to meet the definition of committed or anticipated under the RIT-T (along with supporting evidence). If so, this could support some, or all, of the otherwise expected investment in a further six synchronous condensers between 2029/30 and 2033/34 being avoided.

Powerlink also invites proposals from proponents of non-network solutions who did not respond to the PSCR, and/or have responded to the provision of system strength element of the identified need for the Gladstone Project Priority Transmission Investment.

Information requests can be requested from, and once completed should be emailed to, Powerlink via networkassessments@powerlink.com.au, with 'System Strength RIT-T PADR Proposal: <name of proponent>' in the subject field of the email.

Responses to the information request are due by **Friday, 20 December 2024**.

Next steps

The table below lists Powerlink's target milestones for completing this RIT-T.

Table 4: Powerlink System Strength RIT-T Milestones

Milestone	Target Date
Publish PADR	4 November 2024
PADR webinar	Late November 2024
Submissions on PADR due	20 December 2024
Contract negotiations	January to April 2025
Publish PACR	30 June 2025
PACR Dispute Period ends	31 July 2025
AEMO Final Security Enablement Procedures	31 August 2025
Contract execution	By 30 September 2025
Delivery of system strength services to AEMO	From 2 December 2025

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