EMCa

energy market consulting associates

Transgrid HumeLink project

ASSESSMENT OF PROPOSED EXPENDITURE FOR CPA2

Public Version

Report prepared for:

AUSTRALIAN ENERGY REGULATOR

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Preface

This report has been prepared to assist the Australian Energy Regulator (AER) with its determination of a potential adjustment to the appropriate revenues to be applied to the prescribed transmission services of Transgrid from 1 July 2023 to 30 June 2028, consistent with rules and guidelines that apply for consideration of Contingent Projects in the NEM. The AER's determination is conducted in accordance with its responsibilities under the National Electricity Rules (NER).

This report covers a particular and limited scope as defined by the AER and should not be read as a comprehensive assessment of proposed expenditure that has been conducted making use of all available assessment methods. This report relies on information provided to EMCa by Transgrid and other parties. EMCa disclaims liability for any errors or omissions, for the validity of information provided to EMCa by other parties, for the use of any information in this report by any party other than the AER and for the use of this report for any purpose other than the intended purpose. In particular, this report is not intended to be used to support business cases or business investment decisions nor is this report intended to be read as a legal interpretation of the NER or other legal instruments.

EMCa's opinions in this report include considerations of materiality to the requirements of the AER and opinions stated or inferred in this report should be read in relation to this over-arching purpose.

Except where specifically noted, this report was prepared based on information provided by AER staff prior to 26 April 2024 and any information provided subsequent to this time may not have been taken into account. Some numbers in this report may differ from those shown in Transgrid's regulatory submission or other documents due to rounding.

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ABBREVIATIONS

Abbreviation	Definition
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
capex	Capital Expenditure
CPA	Contingent Project Application
CPA1	Contingent Project Application for Stage 1
CPA2	Contingent Project Application for Stage 2
CSE	Community Stakeholder and Engagement
D&C	Design and Construct
EBA	Enterprise Bargaining Agreement
ECI	Early Contractor Involvement
EIS	Environmental Impact Statement
EOI	Expression of Interest
EOT	Extension of Time
ESOO	Electricity Statement of Opportunities
FID	Financial Investment Decision
FTE	Full Time Employees
IR	Information Request
ISP	Integrated System Plan
ITC	Incentivised Target Cost
JV	Joint Venture
KRA	Key Result Area
LD	Liquidated Damages
LLE	Long Lead-time Equipment
MCC	Material Change of Circumstances
NEM	National Electricity Market
NER	National Electricity Rules
NSW	New South Wales
NTP	Notice to Proceed
NTP2	Notice to Proceed 2
ODP	Optimal Development Plan
OEM	Original Equipment Manufacturer
OPGW	Optical Ground Wire

P10, P50, P70, P90	Represent the confidence level of a cost not being exceeded. A P50 value has a 50% probability that it will not be exceeded, whereas, a P90 only has a 10% probability of being exceeded (i.e. a 90% probability that it will not be exceeded).
PAV	Pre-agreed Values
PEC	Project Energy Connect
PTRM	Post Tax Revenue Model
PTT	Powering Together Tomorrow
QSRA	Quantitative Schedule Risk Analysis
RCP	Regulatory Control Period
RIT-T	Regulatory Investment Test for Transmission
SPP	Service Partner Panel
TNSPs	Transmission Network Service Providers
Vic	Victoria

EXECUTIVE SUMMARY

Introduction and context

1. AER has engaged EMCa to advise on the cost allowance that Transgrid has submitted for its second stage Contingent Project Application for HumeLink (CPA2). The scope of our review excludes amounts that Transgrid proposed for biodiversity offset costs, social licence costs and for equity raising.
2. We have reviewed each of the components of the cost allowance that Transgrid has submitted, taking account of information provided in its Principal Application and including associated reports and workings that Transgrid provided, together with Transgrid's responses to information requests. We also held an onsite review meeting with Transgrid on 15 March 2024, and this was of considerable assistance in clarifying certain key aspects of Transgrid's proposal.
3. Commencement of our review (in early December 2023) was initially hindered by a lack of complete information from Transgrid. While there are significant challenges in providing information on such a large and complex project, over the course of our review Transgrid reissued some documents several times with updates and corrections and retracted and qualified some information initially provided. We also found that some information was 'not current' by the time it was provided to us; for example, some aspects of the CPA2 submission relied on information from periods around June to October 2023 and which had been superseded by the time it was formally submitted in late February 2024.
4. By agreement with AER, we commenced our formal review in early March 2024 and, as at the time of completing this report, we have shared the substance of our findings with AER.

Project overview and status

Transgrid has proposed an allowance of $4.3 billion for HumeLink Stage 2, based on target delivery in 2026.

5. AER determined Contingent Project Application allowances for 'early works' and for the purchase of Long Lead Time Equipment (LLE), under CPA1 Parts 1 and Part 2, and Transgrid has been undertaking works to date based on these allowances. Transgrid has now submitted its application, referred to as CPA2, for the remaining design and construction of the project with a proposed allowance of $4.3 billion (in $2023).
6. Transgrid's CPA2 project plan assumes target delivery dates of July 2026 for the Eastern section of the project and for the Western section to its interface with the Eastern section. Transgrid's plan assumes a delivery date of December 2026 for the final part of the Western section to the substation that the connection to Snowy 2.0 is being built to.

The project is currently behind schedule, however Transgrid considers that its target delivery date is achievable.

7. Status information that Transgrid has provided suggests that it is currently behind schedule with the pre-construction works and with land and easement agreements that it has been undertaking as part of 'Stage 1'. Transgrid also anticipates a delay in achieving environmental approvals, relative to the plan that is its basis for CPA2, and this will result in a delayed commencement of construction. However, Transgrid states that it is seeking to manage resourcing and prioritisation in an effort to realise its target delivery dates, which it considers remain achievable.

Our assessment of main review topics

Review Topic 1: Project timing

Transgrid claims that HumeLink is required by 2026, however this is in advance of its demonstrated need. Transgrid's attribution of this timing requirement to AEMO is circular as this is a timeline that Transgrid has advised to AEMO.

8. Transgrid's CPA2 submission is based on delivering HumeLink in 2026. Transgrid asserts that this is consistent with AEMO's ISPs and with Snowy 2.0 requirements.

9. Transgrid's claimed 'required' timing is in advance of its demonstrated need, both with respect to AEMO ISPs and with respect to the expected timing of Snowy 2.0. While AEMO has provided feedback loop confirmation of the need to proceed with the project, it has done so based on costs and timings that Transgrid has advised to it. AEMO's latest draft ISP gives optimal timings for HumeLink delivery of 2029/30 and 2030/31, depending on the AEMO scenario, but maintains an 'actionable window' for the project which encompasses these dates.

Transgrid's stated timeline is not consistent with its proposed cost allowance, which comprises a significant allowance for the assumed cost of delays.

10. As we discuss further in section 4, Transgrid's proposed cost allowance includes delay-related risk-costs which it quantifies as $272 million that transpires are based on a P70 assessment of a range of risk-based timing delays.[1] In other words, while maintaining that its proposal is based on achieving delivery dates in July and December 2026, the regulatory cost allowance that it has proposed to AER is based on significant delays relative to these delivery dates. As at the date of this report, Transgrid has not advised us of the aggregate project timing impact of the individual risk-based delays that it has assumed.

Transgrid's proposed costs are overstated because it has assumed the need for an accelerated timeline with elevated risk-costs that do not align with its stated timeline.

11. Our finding is that Transgrid's proposed costs are overstated due to an assumed need for an accelerated timeline and misaligned assumptions regarding the 'required' project timing and its deliverability of the project to its stated schedule. We consider that Transgrid has exposed itself to a higher level of delay costs than was necessary by proceeding to enter into construction contracts based on accelerated timeframes that it knew to be unlikely to achieve. Despite currently seeking to mitigate its own delay-related costs, we consider that Transgrid has also exposed itself to higher levels of labour and indirect costs by basing its resourcing assumptions on achieving a July/December 2026 completion that similarly does not align with its own assessment of the likelihood of delays.

12. In section 4 we discuss what we consider to be an unwarranted level of risk-cost that results from these assumptions, and which have resulted in Transgrid's proposed CPA2 allowance being higher than a reasonable and prudent level.

Transgrid has not advised an aggregate project delay that would be consistent with its proposed risk-cost allowance, but it appears that it can deliver HumeLink within AEMO's actionable ISP window.

13. While Transgrid has not provided its assessment of an aggregate project timing delay consistent with its proposed risk-cost allowance, we consider that delayed delivery dates consistent with a reasonable risk-cost allowance are nevertheless likely to deliver HumeLink

[1] As we also describe in Section 4, we find that in Transgrid's analysis, the aggregate risk-cost of time delay-related risks is somewhat greater than Transgrid has stated.

within the AEMO actionable ISP window and would appear to be in time to assist with relieving constraints on Snowy 2.0 output.

Review Topic 2: Proposed risk-cost allowance

Transgrid has proposed a risk-cost allowance of $599 million, based largely on certain risks leading to project delays.

14. As part of its proposed CPA2 expenditure allowance, Transgrid has included a risk-cost allowance of $599 million, which it refers to as 'Other Construction Costs'. Transgrid has quantified the probabilities and consequences of specific risks that it has identified and its proposed allowance results from Monte Carlo simulation of these probabilistic cost distributions. Most of the proposed risk-cost allowance results from Transgrid's assumptions regarding various risks that would result in project delay.

15. We have considered the evidence provided by Transgrid at an individual project risk level for each of its 74 risks, focussing on the top 25 risks that account for 90% of the risk-cost allowance and its modelling of the aggregate risk-cost allowance.

Transgrid's application of its risk-cost estimation methodology has led to an overstatement of its required cost allowance.

16. The principle of including a probability-weighted allowance for risks that are likely to occur, above those included in the base case estimate, is reasonable. However, we consider that Transgrid's application of this methodology results in an overstatement of the risk-cost allowance that it proposes for the HumeLink project.

17. We consider that Transgrid has not taken satisfactory account of the AER guidance material available to it, nor has it adequately drawn from AER's interpretation of this guidance in recent determinations regarding matters such as the allowable inclusion of certain risks nor for its estimate of costs associated with these risks. Transgrid also has not adequately considered mitigation of identified risks including from management of its own costs, from contract management and incentive mechanisms and contractor contingencies that it has presented to us. These issues are further exacerbated by Transgrid's adoption of the 'P70' value of its aggregated risk-cost, meaning that its proposed allowance represents a value that it has a 70% probability of not exceeding, rather than an 'expected' value. We consider its proposed risk-cost allowance also results to an extent from the accelerated timeline that it has adopted.

Based on assumptions that were provided by AER consistent with our assessment of specific risk-costs, Transgrid has advised an alternative aggregate risk-cost estimate that is over 40% less than its CPA2 proposal.

18. AER asked Transgrid to produce risk-cost outcomes for a range of scenarios with an alternative set of risks and risk-cost assumptions to generate alternate aggregate risk-cost allowances. Except for the specific alternative assumptions, this modelling otherwise reflects Transgrid's assumptions and methods used in its Monte Carlo modelling. The scenario that most closely reflects the findings of our report indicates a P50 risk-cost allowance of $339 million.[2] This is 43% less than Transgrid has proposed and represents 7.9% of its proposed aggregate project cost.

19. This alternative risk-cost allowance would still be higher than benchmarks we have identified. However, we consider that a higher allowance around this level is consistent with the higher risk that Transgrid has retained through its contracting model, and against which it claims to have achieved lower base contract costs.

[2] Includes biodiversity offset and social licence-related risk-costs of around $40m, that were not in our review scope.

Review Topic 3: Proposed labour and indirect costs

Transgrid has proposed an allowance of over $400 million for labour and indirect costs.

20. Transgrid has included an allowance of $205 million for its own labour resources and $203 million for indirect costs to deliver the project. These allowances are for project management resources and for a range of insourced and outsourced technical and other specialist resources.

Transgrid's proposed allowance for labour and indirect costs is reasonable but is not consistent with the high level of risk-costs also allowed for.

21. We consider the proposed capex allowance for labour and indirect costs reflects a reasonable estimate of the cost of delivering the HumeLink project for the purposes of the CPA2 submission. However, as we note in section 4, Transgrid has proposed a significant risk-cost allowance that does not reflect the risk management and risk mitigation outcomes that should be achievable from the high level of project management and specialist resources that it has allowed for, especially under an incentivised contracting model. We consider that there is an element of double-counting in allowing for a higher labour and indirect cost allowance than under a standard contracting model, and also a significantly higher risk-cost allowance and this contributes to our finding in section 4 that Transgrid's proposed risk-cost allowance is overstated.

22. Further, components of Transgrid's proposed risk-cost allowance are to allow for what is in effect a risk-cost premium on its own labour and indirect costs. As discussed in section 4, we consider that this is not justified and that Transgrid should be able to manage its own resources within the labour and indirect cost allowance that it has proposed.

The profile of Transgrid's proposed labour and indirect costs is not consistent with the delay assumptions embodied in its proposed risk-cost allowance.

23. As we have noted in section 3, Transgrid's proposed cost allowance assumes project delays relative to its stated July/December 2026 delivery targets. As with other components of its proposed CPA2 allowance, the profile of Transgrid's proposed labour and indirect costs is based on its delivery target timeline and is therefore not consistent with the delayed timeline implied by its proposed risk-cost allowance. We consider it likely that the labour and indirect costs profile will be prolonged relative to what Transgrid has proposed, but that Transgrid should be able to profile its resource utilisation accordingly.

Review of other proposed cost allowances

Allowance for tendered works

Transgrid's proposed allowance of $2,604 million for tendered works, which comprise the main design and construction work packages, is reasonable.

24. The information provided to us, which includes independent reviews, indicates that Transgrid has adopted a sound procurement process for its principal works and accordingly, we consider that its proposed cost allowance is reasonable. The procurement process has placed significant emphasis on collaboration, based on adopting an Incentivised Target Cost (ITC) model that includes components of fixed and reimbursable costs.

25. The adoption of this model is appropriate for the scope and complexity of HumeLink and is an emerging model for similar projects across Australia and internationally. Adoption of this model requires additional risk allocation to Transgrid, and which Transgrid claims has

resulted in higher allowances for owner's risk and owner's cost. We review these claims, and the reasonableness of the proposed costs in section 4 and section 5 respectively.

Aspects of the tendered woks agreements, including misalignment with the likely project timeline, appear likely to result in an inefficiently high cost exposure.

26. The contractual agreements reached for the principal tendered work packages are based on project timing that is inconsistent with the delay assumptions that Transgrid's has applied in deriving its proposed owner's risk and which we have reviewed in sections 3 and 4. While we have not had access to the tendered works contracts themselves, there are indications in Transgrid's advice to us on risks and associated costs that this inconsistency may have resulted in an elevated cost exposure which has contributed to the level of risk-costs that Transgrid has proposed. We also found evidence of costs that have been included for Stage 2, that were included in the Stage 1 allowance, and which Transgrid has acknowledged to be an error.

Allowances for land and easements and LLE

Transgrid's proposed allowances for land and easement acquisition, and for LLE, are reasonable.

27. We consider that Transgrid's proposed allowance for land and easement acquisition costs within Stage 2 is reasonable, as are the remaining costs for the procurement of LLE. Potential risks associated with the supply, transport and installation of LLE and remaining uncertainties for land and easement acquisition are allowed for in Transgrid's proposed risk-cost allowance, which we review in section 4 .

Observations on other matters

From the information that Transgrid has provided, its cost uncertainty range would appear to be 'fit for purpose'.

28. Transgrid provided AEMO with a cost uncertainty range on its total HumeLink cost (i.e. comprising stages 1 and 2) of -5%/+12%. While that estimate is now 29% higher in real terms than its original estimate, Transgrid's stated uncertainty range would be consistent with one of the objectives of Stage 1 which was to improve the level of certainty of its cost estimate. AEMO has provided feedback loop confirmation of the need for the project based on that cost and the advised cost uncertainty range.

Transgrid's reference to information from external reviews is selective and in places misleading, but we have not had regard to the 'savings' that Transgrid claims in its submission.

29. Transgrid provided a number of external reviews in support of its CPA2 submission. While these reviews provide useful information, we consider that some claims made on the basis of these reviews are selective and potentially misleading. These include claims made for savings arising from its Powering Tomorrow Together (PTT) program, which we find to be targets set across multiple projects rather than realised savings attributable to the HumeLink project, and savings claimed from adopting the ITC contracting model. However, we have not had regard to the claimed savings in our review.

We consider it appropriate that Transgrid has not accounted in its CPA2 submission for the possibility of Liquidated Damages.

30. In response to an information request, Transgrid advised of provisions for Liquidated Damages (LDs) against the contractors if they fail to reach practical completion by the contracted dates. Transgrid has not accounted in its CPA2 submission for the possibility of obtaining LDs. We similarly consider that it would be problematic to do so, noting that (1) contracted completion dates are adjusted under contract provisions, (2) the contractors each have their own delay contingency allowances within their contracts and (3) accounting for LDs, even on a probabilistic basis, would assume non-delivery by the contractors.

Conclusion

Transgrid's proposed cost is overstated.

31. We conclude that Transgrid's proposed cost allowance for CPA2 is overstated. We consider that the primary source of overstatement is a misalignment between Transgrid's challenging target timeline for the project and assumptions that it has made, and which are supported by its advisers, that a range of risk factors are likely to lead to delays. These in turn drive a significant proportion of the $599 million risk-cost allowance that Transgrid proposes.

32. We consider that a risk-cost allowance for this project is reasonable in principle, and that it is likely to be higher than for other similar projects, reflecting the higher 'owner's risk' associated with the principal contracting model that Transgrid has adopted. However, the proposed risk-cost allowance is greater than its 'expected' cost and we consider that significant components of this allowance are not justified and not consistent with AER's guidelines on such allowances.

33. Taking account of the elements that we have reviewed, we consider that Transgrid's proposed risk-cost allowance is overstated by around 40%. We consider that other CPA2 allowances that it has proposed are reasonable, on the basis that our finding on the proposed risk-cost allowance effectively represents a holistic assessment of all proposed allowances.

The profile of Transgrid's proposed expenditure is not consistent with the likely project timeline.

34. While a project timeline consistent with an alternative assessment of risk-cost is unclear, it is highly likely to be somewhat longer than the 'target' timeline that Transgrid has based its CPA2 expenditure profile on. A realistic cost allowance would be based on a longer cost profile, that would embody a later start to the major expenditure phases than Transgrid has adopted.

1 INTRODUCTION AND CONTEXT

AER has engaged EMCa to advise on the cost allowance that Transgrid has submitted, for its second stage Contingent Project Application for HumeLink (CPA2).[3]

We have reviewed each of the components of the cost allowance that Transgrid has submitted, taking account of information provided in its Principal Application and including associated reports and workings that Transgrid provided, together with Transgrid's responses to information requests. We also held an onsite review meeting with Transgrid on 15 March 2024, and this was of considerable assistance in clarifying certain key aspects of Transgrid's proposal.

Commencement of our review was initially hindered by a lack of complete information from Transgrid. While there are significant challenges in providing information on such a large and complex project, over the course of our review Transgrid reissued some documents several times with updates and corrections and retracted and qualified some information initially provided. We also found that some information was 'not current' by the time it was provided to us; for example, some aspects of the CPA2 submission relied on information from periods around June to October 2023 and which had been superseded by the time it was formally submitted in late February 2024.

By agreement with AER, we commenced our formal review in early March 2024 and, as at the time of completing this report, we have shared the substance of our findings with AER.

Following a brief overview of the HumeLink project and its current status (section 2) we provide the substance of our review in three sections of this report, where we have focused on the three issues that we consider to be of greatest significance:

- Review Topic 1: Transgrid's assumptions regarding project timing (section 3)
- Review Topic 2: Transgrid's proposed risk-cost allowance (Other Construction Costs) (section 4), and
- Review Topic 3: Transgrid's proposed allowance for labour and indirect costs (section 5).

We cover our review and findings on other cost components in section 6, and provide some observations on other matters in section 7.

1.1 Purpose of this report

35. The purpose of this report is to provide the AER with advice to assist it with assessing Transgrid's Contingent Project Application for Stage 2 (CPA2) of the proposed HumeLink project. This stage of the project is to design and construct the transmission works and comprises a major part of the overall proposed project expenditure.

36. The assessment contained in this report is intended to assist the AER in its own analysis of the capex allowance as an input to a determination on Transgrid's proposal to provide for the costs of this stage of the project to be recovered commencing with an increase in its revenue requirement for the remainder of the current Regulatory Control Period (RCP).

[3] The scope of our review comprises all proposed costs, except biodiversity, social licence and equity raising.

1.2 Scope of requested work

37. THE AER's initial definition of the required work is reproduced in Figure 1.1 below.

Figure 1.1: AER's definition of the scope of required work (from RFQ issued early October 2023)

AER's detailed statement of work

The consultant's services will cover the following two phases:

- Draft HumeLink Stage 2 CPA – preparation of IRs to TransGrid to ensure it has provided sufficient information for the formal assessment
- Formal HumeLink Stage 2 CPA – identification of material differences to the draft Stage 2 CPA, assist the AER with its assessment of the project.

The scope of the consultant's assessment for HumeLink are expected to include the following:

- Delivery partner costs – transmission lines, substations, preliminaries
- Long lead equipment – conductors, transformers and reactors
- Land and property – compensation for private and public land, valuation and acquisition costs
- TransGrid internal costs – labour and non-labour, insurance, legal
- Contingency costs[4]
- Biodiversity – species impact mitigation strategy and costs (optional - consultant to price separately)
- Social license – activities to gain community acceptance of the project (not included within the scope of this contract).

38. As part of its award of the work, the AER advised that it did not require us to advise on the proposed biodiversity costs. As noted above, costs relating to social licence were also not included in our review scope. Some aspects of the risk-costs ('Other Construction Costs') that Transgrid has proposed arise from biodiversity offset and social licence cost risks and, therefore, for the same reasons, our review does not incorporate consideration of these elements of Transgrid's proposal.

39. At the time that it issued its RFQ, the AER envisaged receiving a draft application from Transgrid that would enable commencement of our review in early December 2023. Transgrid provided a draft of its Principal Application and associated annexures on 21 December 2023. However, on review of these documents it was agreed with the AER that this was not sufficiently complete to enable commencement of a productive review and, other than assisting the AER in defining Information Requests (IR), we paused further review.

40. Transgrid provided an updated version of its Principal Application and associated annexures on 7 February 2024 and some further revised versions on 27 February 2024. By agreement with the AER, we commenced our formal review in early March 2024 based on the version of the Principal Application provided at that time, together with responses to IRs that Transgrid had provided in late February.

41. Transgrid provided further information at the onsite meeting held on 15 March 2024 and we assisted AER in drafting a further IR early in the following week. Transgrid responded with most of the requested information by 10 April 2024, and this enabled us to undertake the substance of the review recorded in this report.

[4] In Transgrid documentation and in our report, these are sometimes referred to as 'Other Construction Costs' and as 'Risk Costs'. We use these terms interchangeably.

1.3 Our review approach

1.3.1 Approach overview

42. In undertaking our review, we:

- completed a desktop review of the information provided to us by the AER;
- assisted the AER in preparing requests for information to Transgrid, and reviewed the information provided by Transgrid (via the AER); and
- undertook an onsite meeting with Transgrid on 15 March 2024, with the objectives of helping to ensure that we correctly understood elements of the project as proposed and the basis on which Transgrid has developed its proposed cost estimate.

43. As a technical review, we undertook this review based on relevant requirements of the National Electricity Rules (NER) and relevant AER guidelines that the AER has prepared and which are relevant to assessing the proposed expenditure for a contingent project. We have not sought, nor is it within our scope, to assess:

- the overall economics of the project, or its role in the National Electricity Market (NEM);
- Transgrid's Material Change of Circumstances (MCC) statement, nor the merits (or otherwise) of reopening the Regulatory Investment Test for Transmission (RIT-T), other than to note Transgrid's finding that its preferred option remains the same as previously; or
- the merits or otherwise of past decisions, including the decision to 'stage' the project and the decision taken in Stage 1 (with the AER's agreement) to proceed with purchase of Long Lead-time Equipment (LLE).

44. We do, however, comment on some of the matters above to the extent that they are relevant to Transgrid's CPA2 cost estimate, or to the extent that the cost estimate may be relevant to those considering these matters.

1.3.2 Sources of information

45. Our principal source of information for review is the suite of documents and models that Transgrid provided in support of its Contingent Project Application (CPA). This list is reproduced in Appendix A. Of particular significance are:

- The Principal Application (document A.1)
- The Direct Capex Forecasting Methodology (A.2)
- Labour and Indirect Costs Report (A.3)
- Risk and Contingency Report
- ECI Cumulative Risk Model
- HumeLink Resource Management Plan
- Land Easement and Acquisition Cost Estimate Report (20230830).

46. For context on the project and, in particular, the relevance of the Stage 2 cost estimate in decision-making, we referred to the Australian Energy Market Operator (AEMO) draft 2024 Integrated System Plan (ISP), including document A.6 of the ISP (Cost Benefit Analysis), the AEMO feedback loop analysis report (May 2023) and AEMO's ISP feedback loop notice on HumeLink (issued 21 December 2023).

47. Our assessment draws on the AER's Guidance Note on Regulation of actionable ISP projects (March 2021)[5].

[5] https://www.aer.gov.au/system/files/AER%20-%20Final%20Guidance%20note%20-%20Regulation%20of%20actionable%20ISP%20projects%20-%20March%202021%20-%20FINAL%20FOR%20PUBLICATION%2812129318.1%29.pdf

48. We were provided with a range of Transgrid IR responses dated 20, 22 and 28 February 2024. Following our onsite meeting with Transgrid on 15 March 2024, we were provided with material that Transgrid had presented, and we received a further and final set of IR responses (IR05) on 8 and 10 April 2024 and IR06 on 26 April. We also received an email qualifying Transgrid's response to IR06 on 1st May.[6]

49. We observe that the information that Transgrid provided along with the first draft of its CPA2 Principal Application in December 2023, was incomplete and in places contradictory. Successive reissues of the Principal Application and associated annexures, and the provision of information referenced in the Principal Application and annexure documents but not initially provided, progressively resolved inconsistencies and revealed the methods and assumptions that Transgrid had applied in determining its proposed cost. A set of information sufficient to enable our review, was not available until Transgrid's response to IR05 in mid-April 2024 and further information was provided through to 1 May.

50. In this report, we refer to information that is most relevant in presenting the basis for our review findings. Absence of reference to particular documents or particular statements in those documents should not however be construed as implying that this material was not considered.

1.3.3 Rules and guidelines relevant to our review

51. The principal guiding documents for our review are as follows:

- NER, in particular the capex objectives and capex criteria and those parts that refer to contingent projects
- AER contingent project guideline
- AER's guideline on regulation of actionable projects.

1.4 This report

1.4.1 Report content

52. In section 2, we provide an overview of aspects of the HumeLink project that are most relevant to our assessment.

53. In sections 3, 4 and 5 we provide our assessment of those aspects that we consider to be of greatest significance, being:

- Transgrid's proposed timing and its implications for the proposed cost (section 3);
- the risk-cost allowance (referred to as 'Other Construction Costs' in Transgrid's CPA2 submission), and which comprises a proposed allowance of $599 million (section 4); and
- Transgrid's proposal for labour and indirect costs, which total over $400 million (section 5).

54. In section 6 we provide our assessment of other aspects within the scope of our assessment, but which on preliminary assessment we considered to be either largely reasonable or relatively immaterial. This comprises the proposed cost allowances for:

- the 'tendered works' for the detailed design and construction of the project;
- Land and easements; and
- Long Lead-time Equipment (LLE).

55. In section 7 we provide some observations that provide further context for our findings.

[6] Transgrid's response to IR05 contained responses to 28 questions, of which 26 responses were provided by 10 April.

56. Humelink is a large and complex project and our review has necessarily involved reviewing a considerable amount of information, which we list in Appendix A, while in Appendix B we summarise our consideration of specific risks costs that are referred to in section 4.

1.4.2 Basis for numbers

57. Transgrid has presented its CPA2 submission in FY $2023 and, unless otherwise noted, costs referred to in this report are denominated in these terms. Where costs were denominated in other terms, such as for Stage 1, we have adopted the conversions to FY $2023 that Transgrid has applied.

2 OVERVIEW OF HUMELINK PROJECT STATUS

HumeLink is a major 500kV transmission project that will strengthen the transmission system in southern NSW. It will strengthen connection to the NSW termination of the interconnector to South Australia (Project EnergyConnect (PEC)) that is currently under construction, the substation to which Snowy 2.0 is to be connected and the NSW transmission hub south of Sydney, and is intended to be linked to a new Victorian interconnector (VNI West).

AER determined Contingent Project Application allowances for 'early works' and for the purchase of Long Lead Time Equipment (LLE), under CPA1 Parts 1 and Part 2, and Transgrid has been undertaking works to date based on these allowances. Transgrid has now submitted its application, referred to as CPA2, for remaining design and construction of the project with a proposed allowance of $4.3 billion (in $2023).

Transgrid's CPA2 project plan assumes target delivery dates of July 2026 for the Eastern section of the project and for the Western section to its interface with the Eastern section. Transgrid's plan assumes a delivery date of December 2026 for the final part of the Western section to the substation that the connection to Snowy 2.0 is being built to.

Status information that Transgrid has provided suggests that it is currently behind schedule with the preconstruction works and with land and easement agreements that it has been undertaking as part of 'Stage 1'. Transgrid also anticipates a delay, relative to the plan that is its basis for CPA2, in achieving environmental approvals and this will result in a delayed commencement of construction. However, Transgrid states that it is seeking to manage resourcing and prioritisation in an effort to realise its target delivery dates, which it considers remain achievable.

2.1 Project overview

58. HumeLink is the designation for the proposed project by Transgrid to develop a 500kV transmission system in southern NSW. The project comprises establishment of:

- around 365km of 500kV transmission line; and
- new or upgraded infrastructure at Gugaa, Wagga Wagga, Bannaby and Maragle substations.

59. The transmission development will provide an additional point of connection between Bannaby substation in southern NSW[7], Project Energy Connect (PEC) which links to South Australia, VNI West which will strengthen links to Victoria and Snowy Hydro generation (including the Snowy 2.0 pumped storage scheme that is currently under construction).[8] In summary, the role of HumeLink is perceived as being to strengthen these various interconnections.

[7] A separate project, Sydney Ring 500kV, is intended to strengthen supply from Bannaby to the greater Sydney region.

[8] For clarity, the HumeLink development is separate from the transmission development required to connect Snowy 2.0 to the existing Transgrid substation at Maragle.

60. While HumeLink is nominally described as a 500kV project, and will be constructed to this voltage, Transgrid advises that the works at Wagga Wagga and Gugaa will be operated at 330kV, until the VNI West project is delivered.

61. The Humelink line route is shown in Figure 2.1, with the northern/eastern section coloured purple and the southern/western section coloured yellow. As we discuss in section 6.2, Transgrid has tendered these two sections separately.

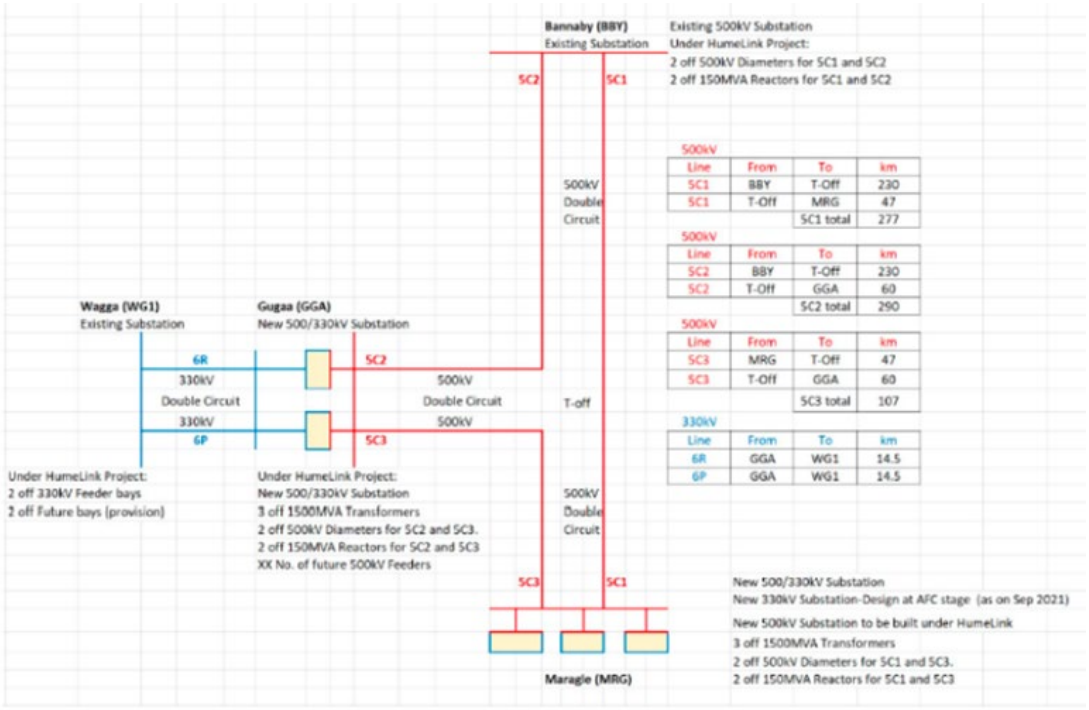
Figure 2.1: Line route for proposed HumeLink project

Source: Transgrid project overview (provided from 15 March 2024 onsite presentation)

62. HumeLink is referred to as a staged 'actionable ISP' project, in that AEMO has included the project as an 'actionable' development in its ISPs since 2020. At that time, the project was defined as staged in that a 'Stage 1' would refine the design and expected cost, undertake some preliminary works with a view to reducing subsequent project risks and timeframes if the project was to proceed, and to provide optionality to confirm (or otherwise) its need and timing.

63. The electrical arrangement (as planned in 2022) is shown in Figure 2.2 below.

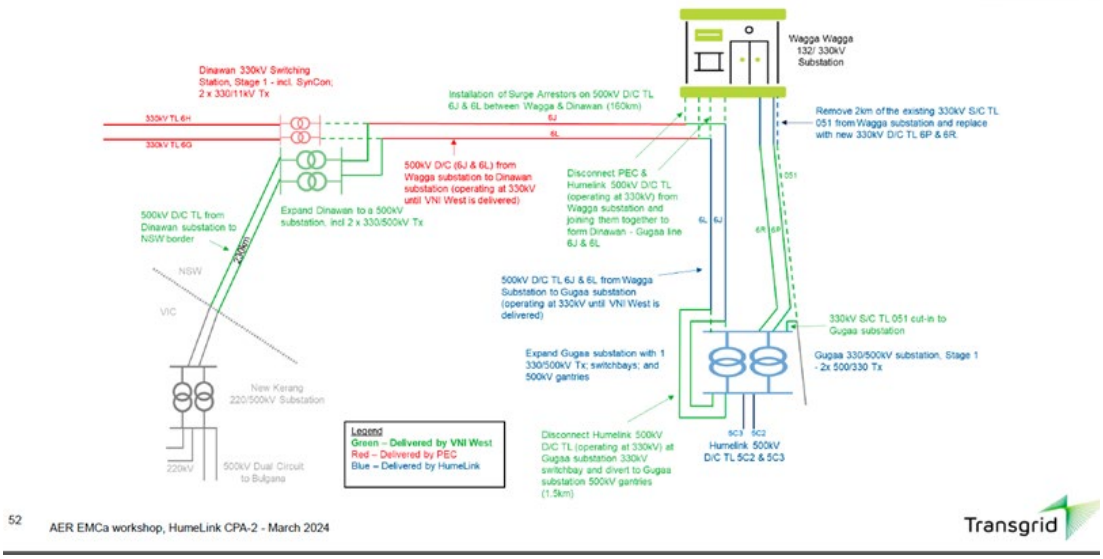
Figure 2.2: HumeLink: electrical arrangement



Source: GHD review

64. The specifics of the arrangements between the new Gugaa substation and Wagga Wagga highlight the complex interactions between PEC, Humelink and VNI-west projects. Specifically, lines between Dinawan, Wagga Wagga and Gugaa are to be built at 500kV and operated at 300kV. At such time VNI-West has been delivered, the lines will be reconfigured at the substation ends and operated at 500kV.

Figure 2.3: HumeLink: electrical arrangement for Wagga Wagga and Gugaa substations



Source: Transgrid presentation to AER and EMCa 'AER EMCa CPA2 Review - Major Project - Humelink', 15 March 2024, slide 52

2.2 Project staging

65. HumeLink is designed as a two-stage project, with a decision point between Stages 1 and 2.

66. Transgrid has now completed a significant proportion of Stage 1. In this process, Transgrid has:

- identified a preferred route for the line, and which differs for part of that route from the originally assessed alignment;
- undertaken a range of preliminary works, including activities intended to assist with social licence for the project and including geotechnical studies;
- undertaken and submitted an Environmental Impact Statement (EIS), which is currently under assessment;
- obtained tenders from two Design and Construction consortia, which, subject to the next Notice to Proceed (NTP2), will respectively construct the 'east' and 'west' sections of the development;
- progressed land and easement option agreements and acquisitions; and
- developed a resource plan and updated cost estimate for the CPA2 submission that is the subject of our review.

67. As part of Stage 1, Transgrid also purchased significant LLE. This equipment was purchased following a 'Stage 1 Part 2' application by Transgrid to the AER to approve inclusion of the cost of this equipment in its regulated tariffs for the current RCP.

68. On 21 December 2023, AEMO provided Transgrid with a Feedback Loop Notice, that confirmed that:[9]

- *'the HumeLink project addresses the relevant identified need and aligns with the ODP specified in the most recent ISP; and*
- *the total cost of the project, $4.88 billion ($2022-23), does not change the status of the actionable ISP project as part of the ODP specified in the most recent ISP.'*

69. On 29 February 2024, Transgrid published an MCC assessment of the HumeLink project. In summary, Transgrid concludes in that assessment that its proposed option ('Option 3C') '*continues to be the preferred option and so an MCC has not occurred*'.[10]

2.3 Overview of Transgrid's project cost estimate

2.3.1 Stage 1

70. Transgrid's originally approved allowance for Stage 1 of the project was $380.39 million.[11] The AER subsequently approved a further $227.9 million for the purchase of LLE, so that a total of $608.29 million was approved as Stage 1.

2.3.2 Stage 2

71. Transgrid's CPA2 submission is for the Design and Construction of HumeLink, including costs for land and easement acquisition and biodiversity offset costs. Transgrid proposes a total of $4,279.14 million[12] for this stage of the project, as shown in Table 2.1.

9 AEMO ISP Feedback Loop Notice – HumeLink - 21 December 2023.

10 Our scope does not include consideration of Transgrid's MCC assessment and we report Transgrid's conclusions on this for the record only. For the purpose of our review, we have considered only the costs as Transgrid has proposed in CPA2, and which are solely for option '3C'.

11 FY $2023, excluding equity raising costs.

12 FY $2023, excluding equity raising costs.

Table 2.1: Transgrid's proposed capex for CPA2 ($million, real FY $2023)

Cost category	23/24	24/25	25/26	26/27	TOTAL
West - Design, substations, and transmission lines including access track		560.31	714.42	72.91	1,347.63
East - Design, substations, and transmission lines including access track		662.56	588.15	5.79	1,256.50
LLE (excluding towers)		17.90	10.02	1.67	29.59
Other construction costs		282.51	299.46	17.11	599.07
Total - Tendered works		**1,523.27**	**1,612.04**	**97.48**	**3,232.80**
Easement acquisition		197.29	0.00	0.00	197.29
Biodiversity offset costs		218.73	218.73	0.00	437.47
Total - Easement and biodiversity offset costs		**416.02**	**218.73**	**0.00**	**634.76**
TOTAL Direct Costs		**1,939.30**	**1,830.78**	**97.48**	**3,867.55**
Labour costs	31.14	69.46	71.64	32.42	204.66
Indirect costs	11.53	89.67	85.94	15.34	202.48
TOTAL - Labour and indirect costs	**42.67**	**159.13**	**157.58**	**47.77**	**407.14**
Real input escalators	0.12	1.18	2.06	1.08	4.44
TOTAL CAPEX (Excluding equity raising costs)	**42.79**	**2,099.61**	**1,990.42**	**146.33**	**4,279.14**
Equity raising costs					33.14
TOTAL CAPEX					**4,312.28**

Source: EMCa analysis, using data from 'A.5 Humelink (CPA 2) Capex Forecast Model'[13]

2.3.3 Total project cost estimate

72. As shown in Table 2.2 and in Figure 2.4, Transgrid's total project cost estimate is now $4.89 billion (excluding equity costs), which is a 48% increase compared with the 2020 estimate that Transgrid originally provided to AEMO and which was the basis for its Stage 1 CPA. After allowing for inflation since its 2020 estimate, Transgrid presents the total cost of $4.92 billion (FY $2023, including equity raising costs) as a 29% increase in the 'real' cost of the project.[14]

[13] Cost category totals and annual capex totals align with tables 0.1 and 0.2 of 'A.1 Humelink – Stage 2 (Delivery) – Contingent Project Application – Principal application document, Transgrid, 21 December 2023'.

[14] A.1 HumeLink - Stage 2 (Delivery) - Contingent Project Application - Principal application document, Transgrid, 21 December 2023, page 10.

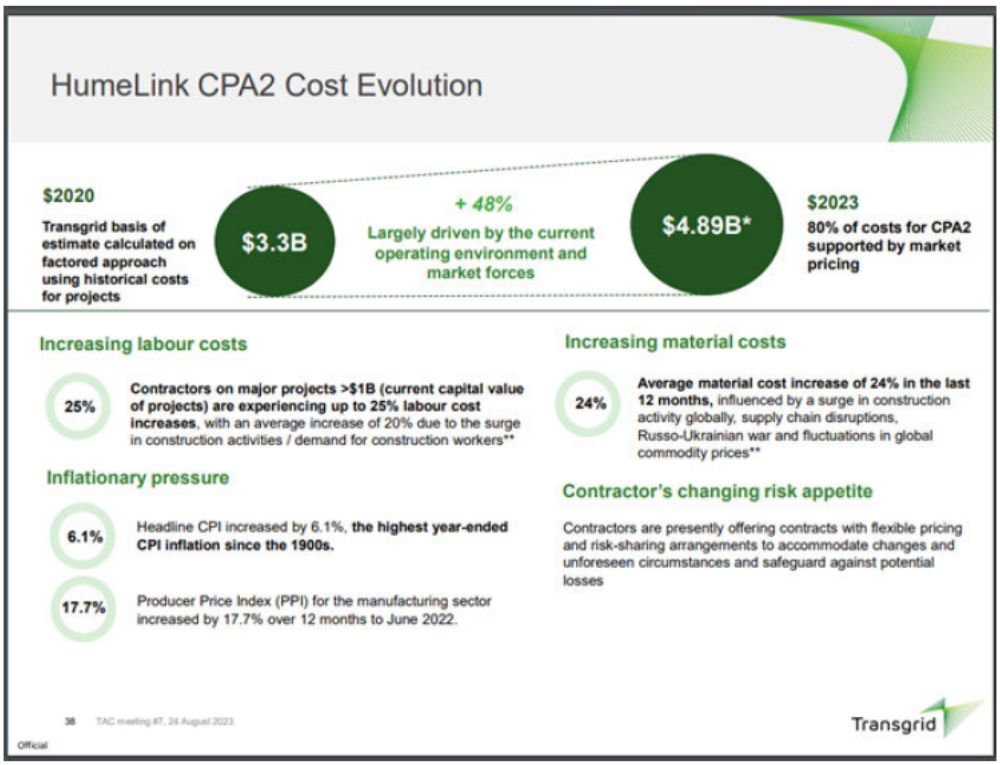
Table 2.2: Transgrid's estimate of the total Humelink project cost ($million, FY $2023)

Stage 1 Part 1 (Preliminary works)	380.39
Stage 1 Part 2 (LLE)	227.90
Stage 2 (Transgrid's CPA2 submission)	4,279.14
Transgrid's current Humelink total project cost estimate	**4,887.43**
Equity raising costs	33.14
TOTAL PROJECT COST ESTIMATE	**4,920.57**[15]

Source: EMCa analysis, using data from 'A.5 Humelink (CPA 2) Capex Forecast Model' (Stage 2) and

73. Transgrid presents its explanations for the cost increases that have occurred in Figure 2.4.

Figure 2.4: HumeLink CPA2 cost evolution



Source: Transgrid information provided at onsite meeting, 15 March 2024

2.4 Summary of project delivery model, project plan and project status

2.4.1 Transgrid's delivery model

74. Transgrid has contracted for the detailed design and construction work. This followed a process that it undertook in Stage 1, in which it shortlisted and worked initially with three tenderers before ultimately selecting two, awarding them 'east' and 'west' sections of the project.

[15] Total project cost aligns with page 10 of 'A.1 Humelink – Stage 2 (Delivery) – Contingent Project Application – Principal application document, Transgrid, 21 December 2023'.

75. Transgrid has structured the contracts with these parties to comprise a fixed (lump sum) component and a 'reimbursable' component. The reimbursable component includes a pain/gain sharing mechanism, a program incentive for delivery ahead of the target date, and performance incentives. There is also provision for liquidated damages to be paid by the contractors in the event of breaches or contractor delays. Transgrid claims that the structure of the contracts that it has entered into provide incentives to mitigate the impact of cost increases, whether cause by delays or other reasons.

76. The two design and construction contracts comprise the majority of Stage 2 costs, and we consider the implications of the structure of these contracts for the proposed Stage 2 cost throughout this report.

77. During Stage 1, Transgrid also procured the majority of LLE required for the project and we understand that this is currently in process of being manufactured for delivery to the site in Phase 2. Some remaining LLE is required for Phase 2, and transport and storage activities are required in Stage 2.

78. In Stage 1, Transgrid has progressed land and easement acquisition and option agreements, has submitted its EIS for assessment and consideration and has progressed a range of social licence activities.

79. Transgrid is undertaking overall management of the project, with a combination of internal and external resources, and also incurs a range of indirect expenses such as for legal and specialist technical services. Transgrid's proposed resourcing from July 2024 is of the order of 150 to 170 Full Time Employees (FTE) over its assumed core two-year design and construction campaign, as discussed in section 5.

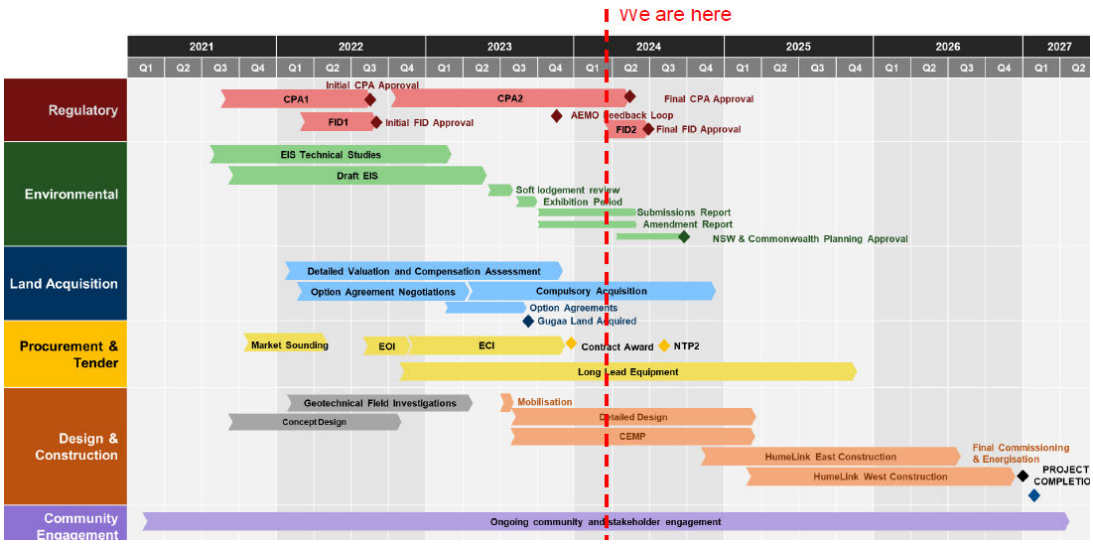
80. HumeLink is one of several major projects that Transgrid is supporting through its Powering Together Tomorrow (PTT) program. Transgrid claims that this program is assisting procurement of LLE '*while driving costs down through economies of scale and scope*.'[16]

2.4.2 Current project status

GANTT chart and status summary

81. At our onsite meeting with Transgrid on 15 March 2024, Transgrid provided the GANTT chart overview of the project plan shown in Figure 2.5. As we discuss in section 4, we find that the construction time allowances include time delay contingency allowances for each of the design and construction tenderers.

Figure 2.5: Project GANTT chart as at 15 March 2024



[16] A.1 HumeLink - Stage 2 (Delivery) - Contingent Project Application - Principal application document, Transgrid, 21 December 2023, page 10

Source: Transgrid presentation to AER and EMCa 'AER EMCa CPA2 Review - Major Project – HumeLink', 15 March 2024, slide 7[17]

82. Transgrid summarised project status at that time as follows:[18]

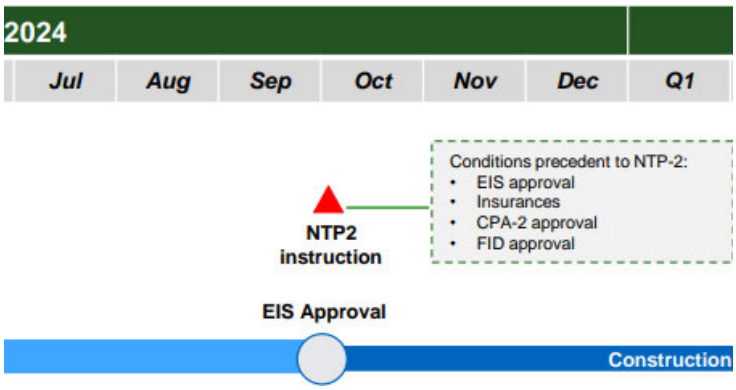
- *'Route locked in*
- *Planning Approval submission (with approval anticipated in Q3 2024)*
- *Significant community engagement*
- *D&C contractors secured*
- *LLE production slots secured*
- *Land:*
  - *160 (62%) of land agreements in place*
  - *86 Option Deeds fully executed*
  - *81 applications with DCCEEW*[19]
- *20% design complete.'*

Delays and current critical path approval

83. The GANTT chart indicates delays that have already occurred or are now almost certain to occur relative to the plan provided with CPA2, in particular with regard to environmental approvals, and also to the construction contract award.

84. EIS approval is on the critical path, and Transgrid stated its then-current expectation that this will be granted by the end of September 2024. Transgrid's plan is to be able to issue 'Notice to Proceed 2' (NTP2) as soon as it receives this approval, allowing construction to proceed from October 2024. We note that this positions NTP2 around 2 months later than shown on the GANTT chart but is consistent with timings shown in a separate diagram in Transgrid's 15 March presentation, as shown in Figure 2.6.

Figure 2.6: Humelink approvals and critical path



Source: Excerpt from Transgrid presentation to AER and EMCa 'AER EMCa CPA2 Review - Major Project – HumeLink', 15 March 2024, slide 8

85. Transgrid's current assumption that it will receive EIS approvals by the end of September 2024 is not consistent with CPA2, which assumed that it would be able to issue NTP2 in July 2024. At our onsite meeting, and subsequently, Transgrid described a range of time delay and cost increase management measures that it is applying to mitigate both time

17 In response to our query, Transgrid identified an error in the chart, that should have shown the East and West constructions starting at the same time.

18 Transgrid presentation to AER and EMCa 'AER EMCa CPA-2 Review - Major Project – HumeLink', 15 March 2024, slide 7.

19 NSW Department of Climate Change, Energy, the Environment and Water.

delay and cost risk. We discuss these, and the implications both for the project cost and for the project timing, in section 3.

Staggered completion

86. A result of the construction tendering process is that Transgrid has now identified that commissioning and energisation of the east and west sections will now be staggered, with the plan showing the east section being commissioned in July 2026 and the west section in December 2026. This differs from earlier plans, which had both sections being completed at the same time (July 2026) but is consistent with the information that Transgrid provided to AEMO as reflected in the AEMO Feedback Loop Notice.[20]

2.5 Relationship between stages 1 and 2

2.5.1 Stage 1, Part 1

87. We sought information from Transgrid to understand the boundaries between work that it was undertaking as part of Stage 1 (and for which it already had approved allowances from the AER) and the work included in its proposed CPA2 allowance.

88. Transgrid claims essentially that it will achieve the intended outcomes of Stage 1 and will have spent amounts that are very close to the allowances. As shown in Table 2.3, Transgrid's actual / forecast costs are very close to the AER allowances for every line item, except for labour and indirect costs. For these Transgrid explains in its response that it relied more on consultants (and which is classified as indirect costs) to fill roles that had been budgeted as internal labour, and therefore there is effectively a substitution between these categories.

Table 2.3: Transgrid's reporting of Stage 1 Part 1 actual and forecast costs, compared with allowance ($m FY $2023)

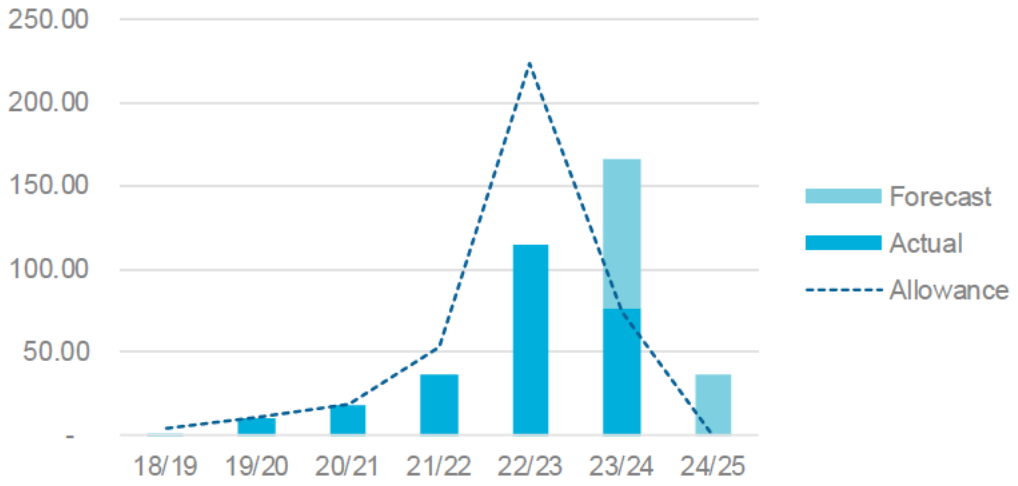
Cost category	Allowance	Actual / Forecast
Pre-construction development	96.77	98.12
Tower assembly, prototype and design	5.18	5.29
LLE	21.80	22.58
Property and easements	26.17	24.03
Environmental offset costs	-	-
Labour costs (including labour escalation)	89.27	69.57
Indirect costs	141.20	159.79
Equity raising	3.53	3.53
Total	**383.92**	**382.91**

Source: EMCa analysis, using data from Transgrid response to IR05, Question 9, workbook 'PCR0.9 Q7 forecast stage 1'

89. When we compare Transgrid's actual and forecast costs with the AER allowance by year, as shown in Figure 2.7, we observe that Transgrid spent materially less than its allowance in 2021/22 and 2022/23 and (to date in 2023/24) has spent an amount approximately equal to the allowance for this year. Transgrid's forecast total spend for Stage 1 is based on a forecast overspend of $91 million in 2023/24 (relative to the allowance for that year) and from Stage 1 expenditure of $37 million in 2024/25 that had not been allowed for in that year.

[20] The Feedback Loop Notice refers to 'northern circuit' and the 'southern circuit' but we understand these references to be consistent with Transgrid's description of the two work packages as 'east' and 'west' respectively.

Figure 2.7: Stage 1 Part 1: Comparison of costs with AER allowance ($m FY $2023)



Source: EMCa analysis from Transgrid response to IR05, Question 7 (workbook PCR0.9)

90. We provide some observations on the potential relevance of Transgrid's Stage 1 costs for its CPA2 submission in section 3.5, where we observe the delays apparent in Transgrid's 'pre-construction' works and in section 6.3 where we refer to the implications of its delay in achieving land and easement agreements.

91. Transgrid has proposed one item of expenditure in CPA2, being $15m for ECI costs, that was covered under its Stage 1 allowance. Transgrid has acknowledged this as a duplication, that should be removed from its CPA2 costs.

92. Transgrid has stated that:

> *'(t)he funding for CPA-1 Part 1 was forecast to be fully committed by 30 June 2024, and require off-ramps to be enacted by 1 June 2024 to ensure the approved expenditure limit of CPA-1 Part 1 is not exceeded.' These off-ramps include suspending Delivery Partners at the conclusion of the NTP1 period at 19 July 2024, standing down project resources and retaining minimal key project personnel until FID is reached.'*

93. This hard date-based cut-off appears to contradict the expenditure information that Transgrid provided in its response to IR05, Question 7, which showed a further $37m of Stage 1 expenditure in 2024/25 including from delays with pre-construction activities, and information that we refer to in our discussion on land and easements (section 6.3), which shows continuing work through to at least November 2024.

2.5.2 Stage 1, Part 2

94. As a supplement to its original 'Stage 1' CPA, Transgrid submitted a 'Stage 1, Part 2' application to AER, for purchase of Long Lead Time Equipment (LLE). AER determined an allowance for this and has placed orders for this equipment.

95. In Table 2.4, we summarise Transgrid's expenditure allowances for Stage 1, its proposed allowance for Stage 2 and purchase orders issued to date.

Table 2.4: Transgrid's estimates and current status of orders for LLE ($m FY $2023)

	Stage 1 (Part 1 and 2)	Stage 2	LLE Funding Requested	Purchase Orders issued to-date
Transmission Line LLE				
Conductor	[redacted]	[redacted]	[redacted]	[redacted]
Steel Purchase	[redacted]	[redacted]	[redacted]	[redacted]
Substation LLE				
Transformers	[redacted]	[redacted]	[redacted]	[redacted]
Reactors	[redacted]	[redacted]	[redacted]	[redacted]
Total	**254.8**	**29.6**	**284.4**	[redacted]

Source: Transgrid response to IR02, Question 36

96. We refer further to Transgrid's LLE expenditure and Stage 2 forecasts in section 6.4.

3 REVIEW TOPIC 1: PROJECT TIMING ASSUMPTION AND ITS IMPLICATIONS

Transgrid's CPA2 submission is based on delivering HumeLink in 2026. Transgrid asserts that this is consistent with AEMO's ISP and with Snowy 2.0 requirements. A nuance that becomes apparent on reading the various submission documents is that its CPA2 submission is based on a staggered delivery plan, with the east section delivered in July 2026 and the west section in December 2026.

Transgrid's claimed 'required' timing is in advance of its demonstrated need, both with respect to the AEMO ISP and with respect to the expected timing of Snowy 2.0. While AEMO has provided feedback loop confirmation of the need to proceed with the project, it has done so based on costs and timings that Transgrid has advised to it. AEMO's latest draft ISP gives optimal timings for HumeLink delivery of 2029/30 and 2030/31, depending on the AEMO scenario, but maintains an 'actionable window' for the project which encompasses these dates.

As we discuss further in section 4, Transgrid's proposed cost allowance includes delay-related risk-costs which it quantifies as $272 million that it transpires are based on a P70 assessment of a range of risk-based timing delays.[21] In other words, while maintaining that its proposal is based on achieving delivery dates in July and December 2026, the regulatory cost allowance that it has proposed to AER is based on significant delays relative to these delivery dates. As at the date of this report, Transgrid has not advised us of the aggregate project timing impact of the individual risk-based delays that it has assumed.

Our finding is that Transgrid's proposed costs are overstated due to an assumed need for an accelerated timeline and misaligned assumptions regarding the 'required' project timing and its deliverability of the project to its stated schedule. We consider that Transgrid has exposed itself to a higher level of delay costs than was necessary by proceeding to enter into construction contracts based on accelerated timeframes that it knew to be unlikely. Despite currently seeking to mitigate its own delay-related costs, we consider that Transgrid has also exposed itself to higher levels of labour and indirect costs by basing its resourcing assumptions on achieving a July/December 2026 completion that similarly does not align with its own assessment of the likelihood of delays.

In section 4 we discuss what we consider to be an unwarranted level of risk-cost that results from these assumptions, and which have resulted in Transgrid's proposed CPA2 allowance to be higher than a reasonable and prudent level.

While Transgrid has not provided its assessment of an aggregate project timing delay consistent with its proposed risk-cost allowance, we consider that delayed delivery dates consistent with a reasonable risk-cost allowance are nevertheless likely to deliver HumeLink within the AEMO ISP actionable window and would appear to be in time to assist with relieving constraints on Snowy 2.0 output.

[21] As we also describe in Section 4, we find that in Transgrid's analysis, the aggregate risk-cost of time delay-related risks is somewhat greater than Transgrid has stated.

3.1 Introduction

3.1.1 Purpose

97. We examined Transgrid's assumed timing for HumeLink primarily to assess the extent to which this may have influenced the cost allowance that it has proposed. There are two dimensions to this:

- The first consideration is when the project is required, on the basis that the project delivery timing should be related to the technical and economic drivers that define the need for the project. Implicit in this consideration is a view that, once a deliverable timeframe is determined, it is more efficient to execute the delivery promptly than to prolong it. Unnecessarily accelerated and unnecessarily prolonged timeframes are both likely to be more costly than a delivery time that is prudently planned to meet the defined need.
- The second consideration is the deliverability of the project – that is, considering the project plan and the feasibility of delivering it in the planned timeframe.

98. There is a clear relationship between project timing and project cost, which Transgrid makes clear in the risk-cost component of its proposed CPA2 allowance. Transgrid also states the project has significant risk and associated risk, because of the timeframe that it is seeking to deliver it in. An example of such a statement is as follows:

> *'Facilitating the project to adhere to the accelerated timelines set by AEMO (July and Dec 2026) poses significant risks of potential delays and associated costs.'*[22]

99. We have sought to consider whether the accelerated timelines that Transgrid refers to are externally driven and, to the extent that they are not, whether they might be resulting in a higher cost than a prudent operator would reasonably incur.

100. As a secondary consideration, the expenditure timing of the project determines the project expenditure profile, which is an input to the Post Tax Revenue Model (PTRM). The timing of expenditure therefore influences the increase in 'allowable revenue' that Transgrid is asking the AER to determine for the remainder of the current RCP (to 2027/28).

3.1.2 Qualifications on timing considerations

101. Humelink is a large and complex project that is intended to meet several needs, which in themselves have uncertain timing. In considering assumed project timing, our perspective is as follows:

- While AEMO has defined 'Optimal Development Paths' that provide optimum delivery dates for HumeLink under different scenarios, we consider it likely that such economic optima are relatively 'shallow' and would not preclude delivery either side of such dates. This is consistent with AEMO defining an 'actionable window' within which delivery of the project is considered to be net beneficial.
- Secondly, the size and complexity of HumeLink necessarily means that the delivery timeframe is uncertain. It would not be prudent to plan for a 'just-in-time' expected delivery date for a project of this nature and it is prudent to allow for some contingency in timing.
- Thirdly, the current state is that the project has commenced, certain expenditure is 'sunk' and the project has a degree of momentum. On the assumption that the project is required within the actionable window, as AEMO has confirmed, we consider that it would be both risky and more costly to pause the project and we have not further contemplated this scenario.

102. With these factors in mind, we caution against applying unwarranted precision in defining either the timing need or the delivery timing feasibility for the project. Nevertheless, it is

[22] Transgrid response to IR02, Question 13.

necessary for us to consider the possibility that project planning and project costing may be misaligned to an extent that the cost is 'unreasonable'. Our objective in this section is to consider whether, and if so to what extent, this might be the case.

103. In this section, we first describe the timing that Transgrid has proposed, and which is inherent in its CPA2 submission. We then consider:

- Transgrid's statements regarding the timing need for the project and the influence that this has had on Transgrid's project plan.
- The deliverability of the project in the timeframe that Transgrid has proposed and which is inherent in Transgrid's CPA2 submission;
- The extent (if any) to which Transgrid's assumed timing need and its project plan may have resulted in an unreasonable cost estimate.

3.2 What Transgrid has proposed

3.2.1 Clarifying the delivery date

104. In its Principal Application, Transgrid makes the following statement on project timing:

> *For the purpose of this Stage 2 Application, the applicable dates for starting and completing Stage 2 activities, pending timely approval, are:*
>
> – *date for commencement – June 2024*
> – *anticipated date for completion – July 2026.*
>
> *The proposed timing in this Application reflects a realistic assessment of the required dates for the Stage 2 activities to meet the target delivery date of July 2026. The Stage 2 completion date is consistent with the timeframes in AEMO's 2022 ISP.* [23]

105. Transgrid also states:

> *We are committed to meeting the delivery date for Humelink of July 2026 as determined in AEMO's 2022 ISP. AEMO recently highlighted the importance of delivering Humelink, and other actionable transmission projects in the 2022 ISP, on time if reliability risks are to be avoided. Delivering Humelink by July 2026 will ensure that its benefits arrive as soon as possible at the lowest sustainable cost to consumers, supporting a reliable supply and facilitating significant access to renewable energy.* [24]

106. In summary, Transgrid asserts in its Principal Application that HumeLink is required to be delivered by July 2026, and that Transgrid is realistically able to deliver the project by this date.

107. July 2026 is consistently stated as being the 'delivery date' for the project in the Principal Application. However, the delivery schedule in figure 3-1 of Transgrid's Principal Application shows the east section construction being completed by this date, but with the west section being completed by December 2026. These staggered completion dates are what Transgrid provided to AEMO in its feedback loop confirmation request.[25] In response to an IR, Transgrid responded:

> *The Contractors confirmed, during the procurement process, that it is not possible to complete both sections by July 2026. Accordingly the construction program and section*

[23] A.1 HumeLink - Stage 2 (Delivery) - Contingent Project Application - Principal application document, Transgrid, 21 December 2023, page 35.

[24] A.1 HumeLink - Stage 2 (Delivery) - Contingent Project Application - Principal application document, Transgrid, 21 December 2023, page 9.

[25] Letter from Transgrid to AEMO, 18 December 2023.

completion dates have been optimised to achieve completion of the northern section in July 2026, followed by the southern section in December 2026.[26]

108. Other documentation provided by Transgrid in the course of our assessment similarly confirms that Transgrid's CPA2 submission is based on these staggered commissioning dates. In the course of our onsite, Transgrid confirmed that while construction of these two sections would start at the same time, the west / southern section involves more difficult terrain and more challenging winter climate conditions and that this had led Transgrid to accept the longer construction period for this section.

109. Transgrid's statements referring without caveats in its Principal Application to delivery by July 2026 are misleading. Transgrid's plans, and its 'reference point' timing for its CPA2 submission, are based on seeking to achieve delivery of the northern/eastern section, in conjunction with the southern/western section to its interface point with the eastern section, by July 2026. And to complete the southern/western section (from the interface point to Maragle) by December 2026.

3.3 Timing – external need

3.3.1 Humelink timing requirements derived from AEMO ISP

Transgrid's attribution of timing need to AEMO

110. Transgrid repeatedly refers to the timing that it is seeking to achieve as being driven by AEMO. In a letter to AER, Transgrid states that:

The expected delivery date for Option 3C remains 2026/27, as early works have already been largely completed for this option and therefore this date remains achievable.

Transgrid is committed to meeting this delivery date, which aligns with that in the 2020 and 2022 ISPs. AEMO's draft 2024 ISP comments that maintaining the Project's momentum is in consumers' long-term interest. Further, delivery of HumeLink in July 2026 is necessary to support the sequence of commissioning works required to connect Snowy 2.0 and relieve network constraints in southern NSW. AEMO highlights in the draft 2024 ISP that that the sooner firmed renewables are connected, the more secure the energy transition will be, and that any delay to the ODP will increase risks to the energy transition and its benefits.[27]

111. Transgrid's attribution of the required timing to AEMO is somewhat circular, as AEMO attributes these timings to Transgrid. For example, in table 1 of the 2024 Draft ISP, AEMO refers to the July / December 2026 timing for HumeLink as *'in service timing as advised by the proponent'*.

112. AEMO has consistently referred to HumeLink (and other actionable network project) timings using terminology such as '*earliest in-service date*' and '*in service timing advised by proponent*'. Consistent with this, Transgrid's feedback loop notice indicates the timings of July and December respectively for the HumeLink sections, and attributes these timings to those stated in Transgrid's feedback loop request.[28]

Humelink timing relative to AEMO Optimal Development Plan (ODP)

113. The timings of July/December 2026 that Transgrid's CPA2 submission are based on are in advance of the optimal timings that AEMO has consistently determined. For example, in its

[26] Transgrid response to IR02, Question 5 (21 February 2024). We observe that the 'northern' section is sometimes referred to as the 'eastern' section and the southern section as the 'west' section.

[27] Transgrid letter of 14 February 2024. The letter is addressed to the Australian Energy Market Operator, but the email address and salutation are to [redacted] AER.

[28] AEMO Feedback loop notice – Humelink – 21 December 2023.

2022 ISP AEMO found that the optimal timing for Humelink ranged from 2027-28 to 2037-38, depending on its scenario, with an optimal timing of 2028-29 for the 'step change' scenario.[29]

114. In AEMO's 2024 draft ISP, AEMO states clearly that the in-service date that Transgrid has offered is in advance of the optimal timing that AEMO has determined:

> *'Transgrid estimates completion of early works by 2024 with implementation by December 2026. This timeline is ahead of optimal delivery (2029-30 in Step Change and Green Exports, 2030-31 in Progressive Change).'* [30]

AEMO actionable window

115. In its ISP methodology, AEMO defines an 'actionable window' for each project, and which would appear to be 6 years for Humelink.[31] On this basis, AEMO has confirmed in its feedback loop notice that Humelink remains actionable based on the timings that Transgrid has advised.

116. We conclude that Transgrid's attribution to AEMO of a 'required' delivery date of 2026 is not supported by the evidence and is a Transgrid internal target. AEMO's ISP requires that Humelink is delivered in the window between July 2026 and July 2032.

3.3.2 Timing requirements in relation to Snowy 2.0

Snowy 2.0 timing and its connection to the Transgrid transmission system

117. Connection of Snowy 2.0 to the Transgrid NSW transmission system, is to be through a 330kV connection to Maragle substation, with upgraded substation infrastructure.[32] This connection is being undertaken as part of the Snowy 2.0 project and is not within the scope of the Humelink project.

118. In AEMO's 2022 Electricity Statement of Opportunities (ESOO), Snowy 2.0 was to be completed by '2025-26'.[33] However, in AEMO's 2023 ESOO, the expected timing of Snowy 2.0 is defined as 'December 2029'[34] and Transgrid refers to this timing in its CPA2 submission.[35]

119. In response to an IR, Transgrid also advised that it understands that the first Snowy 2.0 generating units are expected to start commissioning in July 2027[36], and this is broadly consistent with the Snowy 2.0 project website (as of 19 April 2024) which states that '*first power is expected in the second half of 2027*'.

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29 AEMO 2022 ISP, table 8 (page 80).

30 AEMO 2024 Draft ISP, Appendix 5 Network Investments, December 2023 (page 23).

31 AEMO describes the actionable window as being 4 years from the Earliest In Service Date, plus 2 years for each previous ISP in which the project was declared as actionable. For example, in AEMO 2024 draft ISP (December 2023), Appendix A6, pages 15 and 16.

32 A.1 HumeLink - Stage 2 (Delivery) - Contingent Project Application - Principal application document, Transgrid, 21 December 2023, page 44

33 AEMO ESOO 2022, August 2022, page 10.

34 AEMO ESOO, August 2023, page 8.

35 A.1 HumeLink - Stage 2 (Delivery) - Contingent Project Application - Principal application document, Transgrid, 21 December 2023, page 30. As at 19 April, however, the Snowy project website states that '*the target date for commercial operation of all units is December 2028'*.

36 Transgrid response to IR02, question 5(b).

Role of Humelink in relieving a constraint that would otherwise appear to severely limit Snowy 2.0 generation

120. In its MCC report[37], Transgrid states that a '*change in estimating market benefits of Humelink since the PACR addendum'* is that there would be 'a *660 MW constraint on generation export from Snowy 2.0 in the base case where Humelink does not proceed*.'

121. It is not clear from Transgrid's statement whether this constraint would exist at all times or only under certain circumstances, and neither is it within our scope to examine this matter, to the extent that this constraint applies. The apparent implication of Transgrid's statement is that Snowy 2.0 operation would be significantly constrained, given its capacity of more than 2 GW, if HumeLink is not present. At our meeting with Transgrid on 15 March, Transgrid also stated that this constraint would inhibit Snowy commissioning.

122. At our onsite meeting, Transgrid confirmed that this constraint has been advised to AEMO and that it is incorporated in AEMO's CBA assessments for its draft 2024 ISP. We would expect that a constraint of this magnitude limiting Snowy 2.0 generation would manifest on exploratory CBA as indicating a strong linkage between Snowy 2.0 timing and the timing requirement for HumeLink and this can be inferred from AEMO's analysis which suggests optimal timing for HumeLink from 2029/30, around or shortly after Snowy 2.0 is currently expected to be fully commissioned.

123. In its MCC assessment, Transgrid reports CBA results assuming that HumeLink is commissioned in 2026. We asked Transgrid if it had undertaken timing sensitivity in its MCC analysis, for scenarios in which HumeLink might be delivered later, up to and including the ODP dates in AEMO's draft 2024 ISP. Transgrid advised that it had not considered any timing scenarios in its MCC analysis, other than its target date of 2026. Given its lack of alternative scenario testing, the statement that Transgrid makes that '*MCC analysis shows that delivering Option 3C by 2026 delivers the highest net benefit to consumers*'[38] cannot be interpreted as a finding with regard to timing, but rather, only as Transgrid's finding on the selected option.

124. We consider that it would have been prudent for Transgrid to have considered alternative timing scenarios for three reasons:

- As we describe in section 3.4, Transgrid's own risk analysis and the advice from its consultants, place an extremely low probability on delivering HumeLink by July/December 2026.
- Given that AEMO's ODP dates for HumeLink are around 3 years later than this, we would have expected Transgrid to explore the economic implications of HumeLink being delivered after 2026, up to the ODP dates in the AEMO ISP.
- Thirdly, we observe that while AEMO finds that HumeLink has an NPV of the order of $1 billion,[39] for what Transgrid claims to be the same principal assumptions, Transgrid derives an NPV of $4.19 billion in its MCC analysis.[40] In answer to our query at the onsite meeting, Transgrid stated that it was in discussion with AEMO to try to understand why there is such a large difference, but had yet to determine the reasons.

125. We consider that alternative timing scenario economic analyses would provide Transgrid with useful insights into the economic implications of different delivery timings and their relationship with the timing of Snowy 2.0. We expect that this would also include reconciling differences in outcomes to AEMO's analysis at least sufficiently to provide a degree of confidence in their validity. This understanding would help inform decisions Transgrid is

37 Reinforcing the NSW Southern Shared Network to increase transfer capacity to demand centres (HumeLink) - Material change in circumstance assessment - Region: Southern New South Wales, Transgrid, 29 April 2024.

38 Transgrid presentation to AER and EMCa 'AER EMCa CPA-2 Review - Major Project - Humelink', 15 March 2024, page 11.

39 AEMO draft 2024 ISP, Appendix 6, table 20. Scenario 11 is ranked number 1 with weighted net market benefits of 17.45 billion and includes Humelink project. Scenario 5 excludes Humelink and provides weighted net market benefits $1 billion lower, at $16.43 billion.

40 Transgrid MCC, page 3 (option 3C weighted NPV).

inevitably required to make throughout the project when considering options to mitigate timing risks, each of which will have associated cost implications.

Transgrid's consideration of Snowy 2.0 timing in its planned timing for HumeLink

126. The relationship between the required timing for delivery of HumeLink and the expected timing of Snowy 2.0 is only loosely defined in CPA2. For example, after referring to the delay of Snowy 2.0, the Transgrid proposal states only that it '*…expect(s) the analysis in the draft 2024 ISP to confirm that [Humelink] continues to provide net benefits to the market and remains a key component of the ISP Optimal Development Path (ODP)*.'[41] While Transgrid refers frequently in its documentation to the importance of HumeLink to Snowy 2.0, Transgrid's development plans for HumeLink are firmly anchored to delivering the two sections by July and December 2026 respectively; that is, around three years before the expected full commissioning of Snowy 2.0.

The relationship between HumeLink timing and the commencement of commissioning of Snowy 2.0

127. Transgrid's statement on the relationship between Snowy 2.0 timing and the timing of HumeLink is made most clearly in its MCC report, where it states the following:[42]

> *Further, delivery of HumeLink in July 2026 is necessary to support the sequence of commissioning works required to connect Snowy 2.0 and relieve network constraints in southern NSW. These works include establishing a substation, 500kV connections and associated works that align with the first expected power flows from Snowy 2.0, from July 2027 onwards. Any delay of HumeLink beyond 2026/27, would forgo market benefits as it risks constraining Snowy 2.0 (i.e. limiting its dispatch to 660 MW) and delay its full connection to the transmission system.*

128. We find this statement unconvincing. As we have noted above, while a commissioning window for HumeLink is required, connection of Snowy 2.0 to the Transgrid system does not in itself require HumeLink to be commissioned since a separate project is providing Snowy 2.0 with its required connection to Maragle substation. Transgrid stated in our meeting that relief of the constraint is required for the commencement of Snowy 2.0 commissioning, though we have not seen this corroborated in any other source, and this need does not appear to be recognised in AEMO's ODP.

129. Transgrid's statement that delivery beyond 2026/27 would forgo market benefits by risking constraining Snowy 2.0 appears to be inconsistent with the AEMO ODP, which is based directly on AEMO's assessment of the timing of expected benefits. Further, we would not expect the loss of market benefits from constrained access of Snowy 2.0 to be material until full output from Snowy 2.0 is achieved (i.e. in late 2028 or 2029 according to the current schedule) and this view is consistent with AEMO's ODP which finds that the optimal timing for HumeLink (under any scenario) is by 2029/30.

130. We consider that Transgrid is misleading in seeking to justify the need for '*delivery of Humelink in July 2026*' based on the timing of Snowy 2.0. Moreover, the latter part of Transgrid's statement somewhat undermines this claimed timing requirement by referring to loss of market benefits if HumeLink is delayed beyond July 2027 – i.e. up to a year later than Transgrid's plan.

131. From the information provided, we can only conclude that a possible Snowy 2.0 timing driver for HumeLink arises possibly from sometime in late 2027 and becomes more compelling through 2028 and 2029.

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41 A.1 HumeLink - Stage 2 (Delivery) - Contingent Project Application - Principal application document, Transgrid, 21 December 2023, page 11.

42 Transgrid Material Change in Circumstances (MCC) report, February 2024, page 6.

3.4 Project timing achievability

3.4.1 Overview

132. In documentation that Transgrid has provided to us, there are numerous statements and analyses of project delivery timing risks and resulting implications for project delivery dates. This is as we would expect in planning and managing a project of this nature.

133. While the analyses and advisory reports tend to differ quantitatively, the reasons are largely understandable as they tend to have been made at different times and would therefore take account of some risks that may have been retired and other risks for which new information has been taken into account. However, the common theme is a minimal likelihood of achieving delivery by July/December 2026 and an expectation of significant delays relative to these reference dates.

3.4.2 Transgrid's delay risk output from its risk-cost Monte Carlo analysis

134. In its risk modelling (which we describe further in section 4) Transgrid models delay risk using its Monte Carlo risk assessment model and, as we show in that section, this forms the basis for a significant portion of the 'risk-cost' allowances that Transgrid includes in its CPA2 submission.

135. Given the extent to which Transgrid's modelling of delays drives its proposed risk-cost allowance, we asked Transgrid to advise the aggregate project delay resulting from the Monte Carlo model that it was using to determine the proposed risk-costs. We show Transgrid's responses in Table 3.1.

Table 3.1: Probabilistic delay-days that Transgrid has assumed for its proposed risk-cost allowance

	Delay (days) in Transgrid's Monte Carlo risk-cost analysis	
Probability (of exceedance)	IR05 response	IR06 response
P10	201	411
P50	334	597
P70	392	674
P90	477	784

Source: Transgrid response to IR05, Question 1, and response to IR06 Question 1, workbook for Scenario 1, sheet Time Delay Scenario_1

136. In its first response on this (IR05) Transgrid advised that its model determined an aggregate estimate of the P50 mid-point[43] of 334 days delay.[44] Transgrid confirmed in its response that the time delays reflected project prolongation, which it had '*…assessed through the Schedule Risk Analysis for time impacts*'. Transgrid also confirmed that the '*milestone used for project prolongation is the Residual energisation dates.*' This appeared to indicate that the delay days were interpreted as overall project delay days, associated with the equivalent probability of exceedance-related risk-costs.

137. In its second response (IR06), Transgrid provided much higher delay days associated with each probability level. On inspection, we found that this essentially resulted from having now corrected a previous spreadsheeting anomaly resulting from a risk-cost assumption that had been hard-coded.

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43 The P50 value is the number of days for which there is an equal probability that the delay will be less or more. Strictly speaking, this is not necessarily the 'expected' value, since the distribution may not be perfectly symmetrical. However, Monte Carlo outputs on risk-cost that Transgrid provided show close alignment between the mean and median values and we therefore colloquially refer to the P50 values as 'expected' values.

44 Transgrid response to IR0-5, Question 1

138. We queried the significant difference between Transgrid's IR05 and IR06 responses. This led Transgrid to advise that '*…the output pertaining only to Time Delay in IR#05 is inaccurate and should be discounted*'.[45] Transgrid now also advised that '*the Monte Carlo assessment is undertaken for calculating cost contingency only*' and that '*calculating time delay costs using Monte Carlo method is not in line with the process adopted by Transgrid in developing risk contingency*.'

139. We consider that Transgrid's statements do little to clarify the timing-related implications of its delay-related risk-cost analysis, which transparently calculates a significant portion of its proposed risk-cost allowance as a function of delays. We do not see how it is credible for Transgrid to propose an aggregate risk-cost calculated on the basis of probabilistic project delays, yet not acknowledge the implied probabilistic project delay itself. Further, Transgrid has explained that individual delay risks will only affect the project cost to the extent that they result in a delay or prolongation of the project itself and this is a factor that we consider in our findings in section 4 on the level of its proposed risk-cost allowance.

140. We consider it to be an inescapable conclusion that the risk-cost allowance that Transgrid has proposed relies on assumptions that overall project delivery will be delayed, but that the project schedule that Transgrid has submitted and has used to profile its proposed CPA2 cost allowance does not account for such delays.

Transgrid's claim to deliver on time and within budget

141. Transgrid claims that its CPA2 submission reflects what is '*required to deliver Humelink on time and within budget'*.

142. We consider this statement is disingenuous:

- If '*within budget'* means 'for the cost proposed in CPA2', then this would not deliver the project on time, because it is based on assumed delays which appear to be significant.
- If '*on time*' is defined as July/December 2026, then Transgrid's CPA2 submission does not deliver this for a budget that would be consistent with this delivery timing, as Transgrid has presented its budget as allowing $272 million of risk-costs for time delays that essentially would not be required if the project was delivered to this timeline.

143. In summary, there is an intrinsic and significant inconsistency in Transgrid's CPA2 submission, between its claims on project timing and its proposed expenditure allowance.

3.4.3 Commissioned reports

144. We sought information from Transgrid on a Quantitative Schedule Risk Analysis (QSRA) that initial documentation indicated Transgrid had commissioned. In response to an information request, Transgrid provided a report by a consultancy firm, TBH that was dated 7 September 2023.[46] Transgrid described the scope of the assessment as being to:

  – *'develop an appropriate time contingency allowance for the project that accounts for both Transgrid and the contractor;*
  – *validate the probability of meeting the deterministic finish dates for key milestones;*
  – *Identify the high-risk areas or opportunities; and*
  – *recommend alternative options and measures to aid in achieving the desired objectives and outcomes of the project.'*[47]

145. The report provides a relatively detailed project schedule analysis, focusing on assessment of the timing the key project milestones, through to final commissioning of the project. Dates are ascribed to each milestone with P10, P50 and P90 probabilities. As Transgrid summarises in its response, the 'best case', representing a one in ten scenario, was

45 Transgrid email clarification to AER re information request #06, 1 May 2024

46 Transgrid's response to IR05, Question 10. Transgrid provided the report by TBH '*HumeLink – CPA2 Stage Time Contingency Repo*rt', (7 September 2023) as PCR0.10.

47 Response to IR05, Question 10

assessed as an overall project delay of 2.6 months, with a most likely scenario being 8.2 months and a 'P90' worst case delay of 11 months. Transgrid refers in its response to the P50 completion date for 'Commissioning – Residual Power' as determined in the TBH assessment, as 27 September 2027. For the project as a whole, TBH states that at the time of its assessment the '*earliest finish date of 30 July 2026 …has a very low probability of being met*[48] and in its IR response, Transgrid refers to the range of outcomes from the analysis resulting in less than a 1% chance of the 'base date' being achieved.

146. While the TBH QSRA report is the only independent assessment provided for the overall project schedule, it has been superseded by events. For example, the TBH assessment predated signing of the Tendered Works contracts, which were themselves delayed and, we assume for this reason, assumes a single delivery date for the east and west sections, rather than the July/December staggered commissioning dates subsequently contracted.

147. The TBH report also assumed NTP2 would be issued by 29 July 2024 (on a P50 basis), whereas Transgrid has advised, as of mid-March 2024, that it is currently planning on being able to issue this at the end of September 2024, i.e. a further 2-month delay. Other factors have also changed since TBH's report was provided, as is inevitable. While informative, it therefore does not provide a project schedule assessment that aligns with Transgrid's CPA2 submission.

148. We asked Transgrid to advise whether the profile of expenditure that it has proposed in CPA2 reflects the delayed schedule indicated in the QSRA assessment, or any other delay scenario. Transgrid advised that '*no such analysis has been undertaken and the capex profile is uniformly forecasted*.' We take this to mean that Transgrid's CPA2 expenditure profile is based on its targeted July/December 2026 completion timing.

149. Transgrid also commissioned an Independent Verification and Assessment by GHD, to undertake a bottom-up assessment of evidence that supports the forecast cost elements, as well as a top-down assessment.[49]

150. GHD comments on project duration in Appendix A of its report, presumably from its review of Transgrid documentation including the QSRA report referred to above, that '*The likelihood of achieving the deterministic base date is less than 1%*'.[50] It is not clear from GHD's report whether, or to what extent, it took this timing into account in its assessment.

151. While current risk-based assessments of the overall project schedule and expected delivery dates for the east and west sections are therefore currently unclear, these commissioned reports provide further evidence that the schedule and expenditure profiles presented in Transgrid's CPA2 submission are not consistent with reasonable and likely estimations of the project timeline.

3.4.4 Factors for which Transgrid has identified potential delays

Context for delay risk information

152. The material in this section is intended to provide an indicative window to the factors that Transgrid has identified as potential causes of delays. As we have stated previously, Transgrid has provided delay information that it has applied in determining its proposed risk-cost allowance, and we have assessed that specifically in section 4. Delay risk information has also been used in assessing project schedule milestones and overall project timing, as described in section 3.4.3, however this is not always consistent with the assumptions applied in Transgrid's risk-cost analysis.

153. While the information in this section directly reports from source information that Transgrid provided, it should be read as providing an indication of the key delay-risk factors that

48 Humelink – CPA2 Stage Time Contingency Report, TBH, 07 September 2023, page 21.

49 Humelink CPA2, Independent verification and assessment, GHD. This report was originally dated 30 November 2023. An updated version was provided dated 16 April 2024.

50 Ibid, Appendix A, page 61.

Transgrid foresees, not as a definitive assessment of either current delay risk, or delay risk consistent with Transgrid's CPA2 submission.

Planning and statutory approvals

154. Transgrid's plan included a 'deterministic date' of 19 July 2024 for environmental approvals.[51] The largest delay risk that Transgrid accounted for in the risk-cost assessment that it based its CPA2 submission on, is a delay in environmental approvals, for which it placed a P10 risk of 1 month, a P50 delay of 3.6 months (108 days) to 4 November 2024 and a P90 delay risk of 8.5 months.[52]

155. In response to an IR, Transgrid provided an updated listing of time delay assumptions. This list shows impacts of:

- 124 days for '*delay and cost claims from the Contractors due to delay in receiving planning approval*'
- An additional 82 days '*delay and cost claims from the Contractors due to delay in receiving planning approval modification for the Greenhills option*'.[53]

156. Transgrid defines these delays as 'pre-construction' suggesting that, for environmental approvals, it is expecting delays of the order of 200 days, or approximately 8 months. We comment further on these and other specific risk-cost assumptions in section 4.

157. We also asked Transgrid to advise any material updates to the timing/delay risk assumptions relative to its CPA2 risk-cost analysis. Transgrid responded as follows:

> *'Since the CPA2 submission to the AER, Transgrid has incurred a 10-week delay to the planning approval (EIS) date. Our submitted register has allowed for 3-point estimate of 1,4,8 months (for Best, most likely, worse case), however this delay has required us to reassess this risk to be 2.5, 5, 8 to be more reflective as a result of the recent delay.'*[54]

158. Relative to the deterministic date of 19 July 2024, Transgrid's current 'most likely' assumption therefore appears to be a 5-month delay, implying mid-December 2024.[55]

Construction

159. From its Monte Carlo assessment information, we observe that the next largest delay factor relates to construction productivity. [redacted]

Interface

160. Transgrid identifies a delay risk with a P50 value of 72 days, for interface issues that it expects to arise at Wagga Wagga and Gugaa, due in part to the flow-on effects of a 1.5-year delay to PEC and which involves work at the same substations. [redacted]

Other risks where a time delay has been used to determine a risk cost

161. Other delay risks that Transgrid identifies have P50 values of less than a month and include:

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51 Transgrid presentation to AER and EMCa 'AER EMCa CPA-2 Review - Major Project - Humelink', 15 March 2024, page 41.

52 Ibid. We note that the P10 environmental risk date is stated as 20 August 2025 as it is later than both the P50 and P90 dates. We assume that this is in error and is intended to read 20 August 2024.

53 Transgrid response to IR05, question 1, including document PCR0.4: Breakdown of Aggregate Project Delay, Transgrid, April 2024.

54 Transgrid response to IR05, Question 1

55 Document PCR0.4, as above

- scope variations due to Transgrid changes to its manuals or requirements;
- manufacturing and shipping delay risks;
- potential delay risks relating to Aboriginal land claims or discovery of heritage artefacts;
- delay risks due to loss of social licence, and
- severe or protracted weather-related delay risks (beyond the 'normal' weather-related contingencies already allowed for).

Other observations

162. Transgrid has undertaken a process to identify potential causes of delay and has sought to apply a mix of evidence-based and experience-based parameters in defining these risks and their probabilistic delay impact. We have not exhaustively assessed the reasonableness of these parameters, though we take note of the 'workshop' processes that Transgrid has utilised and the independent reports that it commissioned. These substantially support the likelihood that the project will be delayed relative to Transgrid's reference delivery dates.

163. In section 4, we consider specific risks that Transgrid has allowed for, by reference to AER's Guidelines, and we seek to broadly align those findings on risk-costs with implications for delay risk.

3.5 Transgrid's consideration of the project's timeline at key decision points

Relevant decision points

164. The ability to mitigate delay costs is highest before delay-costs have occurred and before Transgrid has made commitments on the basis of plans that differ from those that eventuate. We have considered the cost implications of delay by reference to two milestones that we consider to be most relevant:

- Milestone 1: The time at which Transgrid committed design and construction tenderers
- Milestone 2: The time at which Transgrid commits to labour resourcing to manage design and construction.

Design and construction timing

165. Transgrid has explained that its design and construction tenders are based on the delivery dates that we have referred to above: namely, that east section will be delivery by July 2026 and west section will be delivered by December 2026.

166. In our onsite meeting, Transgrid presented a schematic that showed the two contracts being awarded in early October 2023.[56] However Transgrid's project website announces the award of these contracts on 4 December 2023, and we understand this to be the case.[57] This was shortly before Transgrid provided its CPA2 submission to the AER.

167. In an IR, we asked Transgrid when it concluded that it would be unable to exercise NTP2 by 20 July 2024, as it had planned. Transgrid responded that it was aware of this *'on or around 27 February 2024 at which point an instruction was issued to the Contractors advising of a likely 10-week delay'*.[58]

168. Evidence suggests that Transgrid had identified in July 2023 what it referred to as '*a significant risk of delay costs that have a high likelihood of occurring*', as we show in Figure

[56] Transgrid presentation to AER and EMCa 'AER EMCa CPA-2 Review - Major Project - Humelink', 15 March 2024, page 22.

[57] *Transgrid Announces Construction Partners for Nation-Critical HumeLink Project* | Transgrid.

[58] Transgrid response to IR05, Question 6.

3.1. At that time, Transgrid had identified a scenario delay of 6 months and a consequent cost increase of [redacted] million.

[redacted]

169. Transgrid's knowledge of delays well before this time is also evident in the progress of its pre-construction design in Stage 1. Its Stage 1 plan had anticipated the short-listed design and construction tenderers undertaking the majority of what it referred to as '*pre-construction development*' in 2022/23. However, as shown in Table 3.2, Transgrid incurred no expenditure in 2022/23, and the majority of such expenditure is to occur in the latter part of 2023/24 and continuing in 2024/25.

Table 3.2: Pre-construction development: Actual/forecast compared with Stage 1 allowance

	22/23	23/24	24/25
Stage 1 Allowance	***87.97***	***8.80***	***0.00***
Actual / Forecast:			
Actual (to February 2024)	0.00	42.48	-
Forecast (from March 2024)	0.00	39.95	15.69
Transgrid's current Total (Actual / Forecast)	**0.00**	**82.42**	**15.69**

Source: EMCa analysis, using data from Transgrid response to IR05, question 7, 'PCR0.9 Q7 forecast stage 1'

170. In other words, by the time that Transgrid awarded the principal design and construction contracts in December 2023, Transgrid's progress with pre-construction design was already significantly delayed compared with the timing that it had assumed for Stage 1.

171. At our onsite meeting with Transgrid on 15 March 2024, Transgrid advised that it was already in discussion with its design and construction consortia on the 'additional costs' resulting from delayed progress, relative to its reference plan and was seeking to mitigate

these additional costs. But by contracting design and construction in December 2023, with target completion dates of July and December 2026, we consider that Transgrid exposed itself almost immediately to delay-related risk-costs with its contractors.

Commitment of labour resources

172. Given the information that Transgrid had provided showing that its likely delivery date would be considerably later than the targets that its CPA2 proposal is based on, we asked Transgrid whether this might have implications for its labour resource plan. We were particularly interested in understanding whether Transgrid might have considered it prudent to schedule its labour resourcing based on a construction campaign of around the period that its risk assessment was indicating (indicatively, July/December 2027 completion). And if so, whether this might result in a lower cost than planning to July/December 2026 targets but then incurring 'delay costs' if (as all indicators suggested) it did not achieve those target dates.

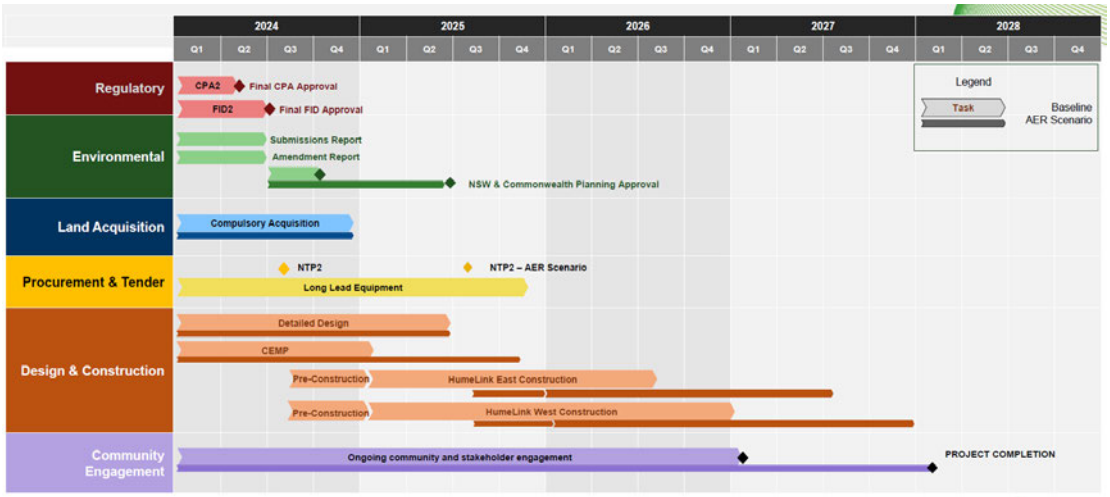
173. While we understand the value of a momentum mentality in driving to achieve a project such as this, a finding that a particular approach is prudent and efficient requires consideration of alternative approaches.

174. We found that Transgrid had not formally considered modifying its resourcing plan around a 2027 completion and considered that it would be lower cost to resource on the basis of achieving July/December 2026 delivery, and then to incur 'delay costs' to the extent that it did not achieve this delivery date. We nevertheless asked Transgrid to assess this option.

175. Transgrid provided the analysis shown in Figure 3.2, together with some explanatory notes. As shown, Transgrid's overall assessment is that the cost would be around $100 million higher than its CPA2 submission. We find it surprising that it would cost more to plan to deliver HumeLink in accordance with an expected delivery timeframe than to commence the design and construction stage with an accelerated plan that Transgrid's own advisers say has only a 1% probability of being achieved, but then to incur delay-related risk-costs.

176. As part of its response Transgrid provided the GANTT chart that we reproduce in Figure 3.3. Despite us seeking to define the scenario in effect as a prolongation of the delivery time from 2 years to 3, it appears that Transgrid considered a scenario in which there is effectively a one-year pause before commencing the same two-year pre-construction and construction campaign as it has included in its current plan.

Figure 3.3: Transgrid GANTT chart illustrating its assumptions for a one-year delayed completion scenario



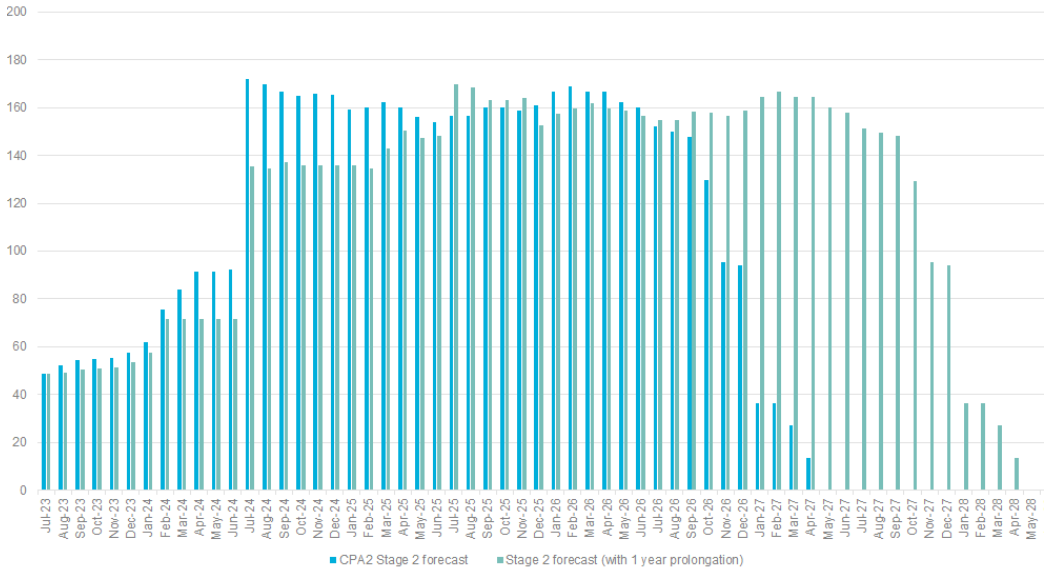
Source: Transgrid response to IR05, questions 2a and 2d, 'PCR0.11 AER Q2 Response', page 8

177. As part of our scenario query, we also asked Transgrid to provide an indicative resourcing plan to support the ''alternative project management" scenario. Transgrid provided such a plan, with monthly FTEs.

178. As is shown in Figure 3.4, Transgrid's scenario resourcing plan has only slightly lower FTEs in the ramp up phase but reaches the same level as in its accelerated plan, despite the longer construction campaign and then has a one-year prolongation overhang at this same level. Transgrid's resourcing assumptions for this scenario therefore go a significant way towards explaining why Transgrid's estimated cost under this scenario is higher than under its CPA2 proposal.

179. As we have stated in section 3.1, we consider that prompt execution of a project plan to a deliverable timeframe will result in the most efficient cost. However, for a given deliverable timeframe, we are not convinced that it is more efficient to commence a project by resourcing and contracting to an accelerated but highly unlikely timeframe, then incurring 'delay' costs.

Figure 3.4: Transgrid resourcing plan for CPA2 submission timing, and alternative resourcing plan for delivery one year later.



Source: EMCa analysis, using data from Transgrid's response to IR05, question 2b, 'PCR0.11 AER Q2 Response', and submission document 'A.7 - Humelink CPA 2 - Labour and Overhead Costs'

3.6 Implications for proposed cost

3.6.1 Transgrid's expected cost of delays

180. Transgrid states that it has included a cost allowance of $272 million for the risk-cost of delays, in its CPA2 submission. This amount is part of the overall allowance of $599 million for 'Other Construction Costs that we consider in section 4. However, as we describe in section 4, we find that the risk-costs resulting from assumptions regarding timing delays sum to considerably more than $272 million and that project timing-related risks dominate the proposed risk-cost allowance.

3.6.2 Conclusions on timing

181. Our conclusions on project timing are as follows:

Transgrid's target timing of July/December 2026 is self-determined

182. Transgrid states that its target is to deliver HumeLink by 2026 and it has developed its CPA2 schedule on this basis. Transgrid states that this is an AEMO requirement, however AEMO states that Transgrid has provided this as its 'earliest in service dates'. Depending on AEMO's scenario, this is around three years before the Optimal Development Path requirement for HumeLink and at the beginning of the AEMO 'actionable window' for this project.

183. We also find that Transgrid has not provided evidence sufficient to conclude that HumeLink is required by 2026 to facilitate connection of Snowy 2.0, noting that Snowy 2.0 commissioning is currently not scheduled to commence until late 2027. It is not clear from information provided at what point the lack of connection to HumeLink might become an impediment to Snowy 2.0 commissioning, but we note that full power from Snowy 2.0 is currently expected by late 2028 or 2029.

Transgrid is highly unlikely to be able to deliver HumeLink by July / December 2026

184. Transgrid's own delay-risk assessment indicates that it is highly unlikely to deliver HumeLink by the July and December 2026 target dates that it has stated in its CPA2 submission as its scheduled delivery dates, respectively, for the east and west sections. Transgrid's external advisers similarly define a minimal likelihood of achieving the 2026 target dates and likely delivery timeframes in 2027.

Transgrid's CPA2 cost is based on delivering HumeLink later than July/December 2026

185. Transgrid has proposed a CPA2 cost allowance that it has calculated consistent with a P70 achievable delivery date that is significantly later than its target July/December 2026 target dates and includes $272 million of what it describes as delay-related risk-costs in its 'time' risk category.

186. As we discuss in section 4, we find that the components of Transgrid's proposed risk-cost allowance that are based on assumed delays sum to more than the $272 million that it has referred to and assume a significant overall project delay. We further consider the validity of specific delay-related risks in section 4, where we conclude that a lower allowance for risk-costs is warranted.

Aspects of Transgrid's planned timing are likely to have led to costs that are higher than a reasonable and prudent level

187. While an expeditious project plan is most likely to deliver an efficient outcome, we consider that Transgrid has added an inefficient level of risk-cost to this project by planning to an accelerated delivery date that is unlikely to be achieved. We consider that it is more likely that HumeLink would cost less if Transgrid was to work to a plan that is based on a timeline that its own assessment and that of its advisers, finds to be realistic. Transgrid may by now have already partly foregone that opportunity through the terms now embedded in its

principal contracts with its two design and construction partners though Transgrid has also advised that it is already working to seek to mitigate additional costs that are already being claimed.

188. With pre-construction apparently delayed, as well as environmental approvals, we consider that there are likely opportunities for Transgrid to assign labour and possibly some indirect costs more efficiently by reconsidering and taking account of the likely and realistic project delivery timeframe. As we discuss in sections 4 and 5, we consider that by doing so, the extent of risk-cost that Transgrid has proposed based on this delivery timeframe should be less than it has proposed. Moreover, Transgrid has advised that it is already taking such actions and its current project resourcing is less than it had assumed in its CPA2 submission.

The profile of the CPA2 expenditure allowance should be aligned with the expected timing

189. The expenditure profile that Transgrid has proposed for CPA2 does not align with the project timing that is built into its proposed cost allowance through its risk-cost allowance.

190. The total cost allowance should align with a P50 estimate of the project's timing, and the expenditure profile should similarly align with that timing. In approximate terms, this would stretch the allowed budget over a period to 2027/28, rather than to 2026/27 as Transgrid has proposed. Since it seems likely that construction, which was timetabled to commence in January 2025 will now be delayed until quite late in the 2024/25 FY, we would expect a re-profiled expenditure allowance to result in a significant reduction in the required expenditure in that financial year.

4 REVIEW TOPIC 2: PROPOSED RISK COSTS

As part of its proposed CPA2 cost allowance, Transgrid has included a risk-cost allowance of $599 million, which it refers to as 'Other Construction Costs'. Transgrid has quantified the probabilities and consequences of specific risks that it has identified and its proposed allowance results from Monte Carlo simulation of these probabilistic cost distributions. Most of the proposed risk-cost allowance results from Transgrid's assumptions regarding various risks that would result in project delay.

We have considered the evidence provided by Transgrid at an individual project risk level for each of its 74 risks, focussing on the top 25 risks that account for 90% of the risk-cost allowance and its modelling of the aggregate risk-cost allowance.

The principle of including a probability-weighted allowance for risks that are likely to occur, above those included in the base case estimate, is reasonable. However, we consider that Transgrid's application of this methodology results in an overstatement of the risk-cost allowance that it proposes for the HumeLink project.

We consider that Transgrid has not taken satisfactory account of the AER guidance material available to it, nor has it adequately drawn from AER's interpretation of this guidance in recent determinations regarding matters such as the allowable inclusion of certain risks nor for its estimate of costs associated with these risks. Transgrid also has not adequately considered mitigation of identified risks including from management of its own costs, from contract management and incentive mechanisms and contractor contingencies that it has presented to us. These issues are further exacerbated by Transgrid's adoption of the 'P70' value of its aggregated risk-cost, meaning that its proposed allowance represents a value that it has a 70% probability of not exceeding, rather than an 'expected' value. We consider its proposed risk-cost allowance also results to an extent from the accelerated timeline that it has adopted.

AER asked Transgrid to produce risk-cost outcomes for a range of scenarios with an alternative set of risks and risk-cost assumptions to generate alternate aggregate risk-cost allowances. Except for the specific alternative assumptions, this modelling otherwise reflects Transgrid's assumptions and methods used in its Monte Carlo modelling. The scenario that reflects the findings of our report indicates a P50 risk-cost allowance of $339 million.[59] This is 43% less than Transgrid has proposed and represents 7.9% of its proposed aggregate project cost.

This alternative risk-cost allowance would still be higher than benchmarks we have identified. However, we consider that a higher allowance around this level is consistent with the higher risk that Transgrid has retained through its contracting model, and against which it claims to have achieved lower base contract costs.

For the reasons that we have outlined in section 3, the assumed project delivery timeline should be consistent with the risk-cost allowance. However, without access to the time-dependency relationships that Transgrid has relied upon we are not able to assess the implied aggregate project delay and at time of drafting this report, this information has not been provided by Transgrid.

[59] Includes biodiversity offset and social licence-related risk-costs of around $40m, that were not in our review scope.

4.1 Introduction

191. In this section we present our assessment of the risk-cost allowance that Transgrid has proposed for inclusion into its CPA2 capex forecast for HumeLink. The risk-cost allowance is intended to address the remaining risk and uncertainty associated with the final construction phase of the project, having completed the early works associated with CPA1, also referred to as Stage 1, comprising Part 1 and Part 2.

192. We have assessed Transgrid's proposed project risk-cost allowance by a number of methods:

- Bottom-up assessment including:
  - examining the individual risk items included within its allowance against the AER guidance, and previous AER decisions; and
  - review of the methodology for calculating the probability and financial impact of each individual risk. Here we also considered whether there were offsetting factors such as duplication between risk items or symmetrical likelihood of risks relating to both cost increases as well as cost savings.
- Top-down assessment of the risk-cost allowance against previous AER decisions and Transgrid's own advisors.

193. Our review has focussed on the methodology followed by Transgrid, and the application of reasonable inputs consistent with that methodology. We have not sought to independently develop a risk-cost allowance for this project using all inputs known to Transgrid, but rather undertake a review of the information provided by Transgrid to support the composition of the risk-cost allowance proposed as a part of CPA2.

4.2 What Transgrid has proposed

4.2.1 Overview

194. Transgrid has included $599 million as a risk-cost allowance in its CPA2 capex forecast, comprising 14% of the CPA2 capex forecast, and 12% of the total project cost of $4,892 million. Transgrid refers to this as a risk-cost allowance and as the 'other construction costs' in the submission.

195. Transgrid describes the inclusion of the risk-cost allowance as:

> *'The risk contingency required for this major project must appropriately reflect the complexity, uncertainty, contract model selection and large variety of risks the Project has exposure to, and to ensure successful delivery for consumer benefit.'* [60]

196. Transgrid's risk-cost allowance comprises 74 risks,[61] with the top 25 risks accounting for $537 million (or 90%)[62] of the total Other Construction costs of $599 million.[63]

60 Risk and Contingency Report, Transgrid, page 8.

61 Some individual risks were included at zero value.

62 CPA1.

63 Risk and Contingency Report, Transgrid, page 5.

Table 4.1: Summary of included risk-cost allowances by risk category

Transgrid Risk category	Proposed risk-cost ($m)
Reimbursable	60.6
Variation	[redacted]
Time	272.5
Land and Easement risk	-0.6
Biodiversity risk	[redacted]
Inherent	[redacted]
Total	**599.1**

Source: HumeLink CPA2 – ECI Cumulative Risk Model and QRA Register

4.2.2 Methodology

Summary of methodology adopted by Transgrid

197. Transgrid describes its methodology in its Risk and Contingency Report, including:

> *'Risks have been identified and qualified through a series of risk workshops attended by internal and independent subject matter experts (SMEs) and risk specialists from different disciplines...*
>
> *For each risk identified, a qualitative assessment has been undertaken within the workshops to determine the risk's potential causes, consequences, scenarios, mitigation measures, controls and rating using the predefined scales to assess probability and impact of risk…'* [64]

198. We summarise the methodology from Transgrid's submission as:

- Identify individual risks in a cumulative risk-cost model, 'HumeLink RA Register' for the Project. In developing the register, Transgrid included input from E3 Advisory, fission and Broadleaf Capital and its nominated delivery contractors.
- For the prolongation risk, Transgrid applied the results of an assessment of the schedule delay risk, based on the schedule risk analysis developed by its advisors TBH.
- For each risk, Transgrid applied a 3-point estimation based on best case, most likely and worst case estimates of cost (and time delay where appropriate), and determining a deterministic P50 value using the Beta (or PERT) distribution.[65] The cost estimate is in many cases based on the cost of delay. The best and worst cases are determined based on a 1 in 10 type of outcome (to remove distortion of distribution driven by extreme events) based on assessment by SMEs. Transgrid has recorded the rationale for each risk.
- Transgrid combines this information in a Monte Carlo probability analysis. For this purpose, Transgrid applied a combination of correlation factors for risks that have the same drivers of uncertainty, and adjustments to account for pain/gain share mechanism.

199. In presenting its risk model, Transgrid has also included a risk-cost value associated with the P55.2 distribution value for each risk. We understand that this value is based on reverse engineering each individual risk value using the distribution for the aggregate risk, such that the individual risks total the P70 value across all risks.

200. Transgrid describes the results of its probability distribution analysis as: [66]

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64 Risk and Contingency Report, Transgrid, page 13.

65 Using the formula Beta Distribution (PERT): E = (o + 4m + p) / 6, where o = optimistic or best case; m = most likely; and p = pessimistic or worst case.

66 HumeLink CPA-2 Risk Report Confidential, page 14, Transgrid

'A probability distribution represents the likelihood that an indefinite quantity will take on any value within the range of values that can arise. We have adopted Trigen distribution to remove distortion of distribution driven by extreme events (absolute best and worst cases). The data was developed for each risk item by considering a plausible best and worst cases, (P90 and P10 equivalents).

The Monte Carlo analysis also considers risks that are likely to occur together and other risks that are unlikely to occur together. Our model considers correlations for risks that have the same drivers of uncertainty.'

201. Transgrid sought expert advice for the development of its risk register, and individual risk items which it has relied upon in developing its proposed risk-cost allowance.

Consideration of Transgrid versus contractor risks

202. Transgrid states that it has identified the risks that are owned by Transgrid, and those owned by the contractor. The contracts developed for the project provide an adjustment mechanism for risk events that cause delays, that are owned by Transgrid, including the following:

- Site access delays
- Acts of prevention (by Transgrid, Landholders or Interface Contractors)
- Planning Approval delays
- Native title and Cultural Heritage (artefact find) delays
- Unforeseeable Utilities
- Changes in Law
- Inclement Weather exceeding the allowances in the Contract (evidence-based)
- Failure to provide Employer Supplied Materials
- Failure to provide track possessions or Outages; and
- Force Majeure events. [67]

203. Transgrid has similarly identified those risks for which the contractor is also entitled to claim cost.

Biodiversity risk and loss of social licence risk-cost are not within our scope of review

204. In accordance with the scope of our review, we have not considered biodiversity risk (also referred to as environmental offset risk in prior AER decisions), nor have we considered risks associated with loss of social licence.

4.3 Transgrid's methodology for determining risk-costs

205. We consider that many of the risks and uncertainties identified by Transgrid for the HumeLink project are reasonable. Our assessment focusses on the issues that we have identified and the impact of those issues on the determination of a prudent and efficient risk-cost allowance.

4.3.1 Management of risk in project allowance

Process and methodology adopted by Transgrid is reasonable

206. It is reasonable to include a risk-cost allowance based on the risk and uncertainty of delivering the project scope. In Figure 4.1 below, we show a typical breakdown of a project budget that includes provision for risk-cost allowance.

[67] Risk and Contingency Report, Transgrid.

Figure 4.1: Breakdown of a typical project cost estimate

Source: Risk, time, cost and contingency - Identifying, quantifying and managing risk, time, cost and contingency, CM REF: D21/163352, figure 5 and figure 8, Victoria Department of Treasury and Finance

207. In Figure 4.1 above, the authors refer to the base risk estimate as:[68]

> *'the amount estimated for project risk, uncertainty, and escalation with a 50 per cent confidence level. Combined with the base cost estimate, this equals the P50, denoting a 50 per cent probability that the cost estimate will not be exceeded. It is not the sum of all identified project risks and may be higher than the most likely project outcome.'*

208. We consider the representation in Figure 4.1 above instructive, as it reflects a risk-cost allowance in the project cost estimate based on a P50 probability, and an additional risk-cost allowance that extends the project cost contingency retained for other purposes including project funding. In addition, this figure is contained within broader guidance by the Victorian government, relevant to the delivery of mega projects including contracting models adopted by Transgrid for HumeLink.

209. We explore that basis of the estimated risk-cost in later sections of this report. In general, we consider that Transgrid has following a methodology and process to develop a probability weighted risk-cost that is logical and, depending on the soundness of judgement used to determine inputs and risk tolerance levels, should calculate a reasonable aggregated risk position.

Assessment of risk ratings is not compelling

210. We have focussed our assessment on the quantitative assessment proposed by Transgrid, and which leads to the risk-cost allowance. As part of its risk register, Transgrid also includes a qualitative risk assessment, using a traditional risk matrix, for ratings of uncontrolled risk (before risk treatments) and controlled risk (after risk treatments and existing controls).

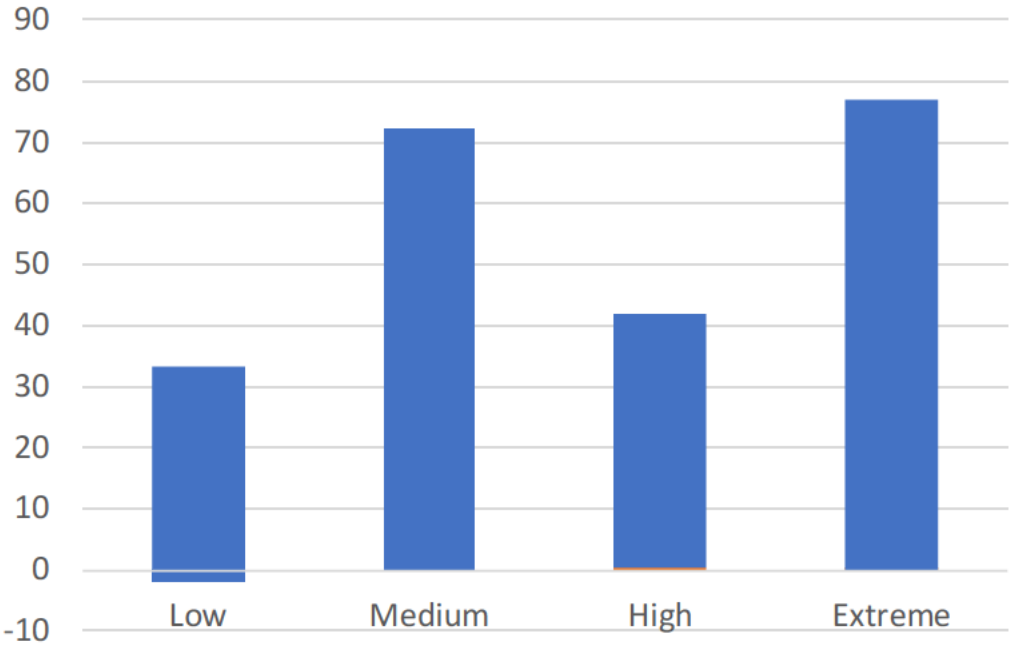
211. Overall, Transgrid has included 5 extreme risks, 9 high risks, 42 medium risks and 17 low risks. A further risk does not have a rating.

212. We would expect a clear relationship between the higher value risks and those rated high and extreme using Transgrid's risk ratings. If we consider the risk consequence categories of cost and time, a major consequence is considered for financial values of $20 million to $200 million, and milestone over-run of 3-6 months, and catastrophic beyond these values. Based on our assessment presented earlier, many of the identified risks in the top 10 had values greater than $20 million, however were not all considered as a high or extreme risk. Similarly, there are five extreme risks where the financial value did not exceed $200 million.

[68] Risk, time, cost and contingency - Identifying, quantifying and managing risk, time, cost and contingency, CM REF: D21/163352, page 25, Victoria Department of Treasury and Finance

213. On closer examination there did not appear to be a strong relationship between the financial values and risk ratings. We show the range of risk values against risk ratings in Figure 4.2 below. We repeated this assessment for time delays and found similar issues.

Figure 4.2: Range of risk values by risk rating, $m



Source: EMCa analysis, using data from 'HumeLink CPA2 - ECI Cumulative Risk Model and QRA Register'

214. When we reviewed the individual risks, we consider the existing controls and risk treatments are reasonable, however the relationship to the assessment of controlled (residual risk) was not always evident. Accordingly, we did not place any weight on these ratings in our assessment.

Guidance note is instructive on provisions for risk-cost allowances for contingent projects

215. The AER guidance note[69] accepts provision for project risk allowances where it can be determined to be an efficient cost to address the residual risk. The AER states:

> *'We expect TNSPs to comprehensively and transparently identify and assess the different project risks for which It is seeking a cost allowance.'*[70]

216. We summarise the AER's expectations of Transmission Network Service Providers (TNSPs) as captured in its guidance note for proposing risk-cost allowances[71] as follows:

- Risk will be allocated to the party that is best placed to manage that risk
- TNSP to clearly identify the risk events for which it seeks a risk-cost allowance
- It is only prudent to allow for residual risks that affect the cost of the project and cannot be efficiently transferred, avoided or mitigated
- TNSP to demonstrate how its risk assessment represents reasonable and realistic expectations of risks that could be realistically encountered
- TNSP to demonstrate the outcomes of each risk assessment

69 AER Final Guidance note – Regulation of actionable ISP projects, March 2021.

70 Ibid, page 16.

71 AER Final Guidance note – Regulation of actionable ISP projects, March 2021.

- TNSP to explain where and why it has transferred risks to contractors as part of its scope of work
- TNSP to identify, establish and maintain a risk management framework for all project risks.

217. AER guidance specifies considerations where a risk-cost allowance would not be provided. These include that:

- it would not provide a project risk allowance that completely covers the eventuality of all consequential costs being incurred; and
- a risk allowance would not be allowed for risks that are reasonably under, or should reasonably be under, the TNSP's control or form part of its business-as-usual practices.

218. We have taken account of the above factors, and of decisions made by the AER in recent determinations when applying these factors in our assessment.

Transgrid claims to have applied the AER guidance note

219. We asked Transgrid to describe how it has met the requirements of the AER guidance note[72] for the development / presentation of risk provisioning. In response to our request, Transgrid provided statements in its submission in relation to the following references to AER's guidance note:

- Section 2.6: 'AER can accept a project risk allowance …'
- Section 2.6.2: 'Consequential cost adjusted to reflect likelihood of occurrence.… accounting for the presence of any controls or mitigations.'
- Section 2.6.3, 'Risk management, requires a robust risk management framework.'
- Section 2.7.1 Basis of cost estimates, The guidance note requires estimates that: 'are not overly conservative….and should be realistic.'[73]

220. In its response, Transgrid also refers to the project having '*been audited and reviewed on several occasions against the frameworks, procedures and plans also by other external consultants, against what they consider is best practice.*'[74] We consider this further in the following section.

221. As we detail in our assessment, we have found evidence of individual risks that are not consistent with the AER guidance note, and advice that is not by Transgrid's description evidence of an audit or extensive review of its proposed risk-cost allowance.

Transgrid has involved contractors in developing its risks

222. During our onsite discussion, we were presented with a summary of the stakeholders involved in developing the risk register. Initially, we did not see sufficient consideration of the contractors in these workshops, such that the risks may overstate the likely costs having not adequately considered the provisions made by the contractor or mitigations of those risks. Following further enquiry, including an IR, Transgrid confirmed that:

- Each contractor participated in 4 risk workshops during the Early Contractor Involvement (ECI) period (8 total including below).
- In ECI Stage 1, each Tenderer together with the Transgrid Project Team attended one risk workshop to review, identify and discuss the top 30 risks and opportunities.
- In ECI Stage 2, each Tenderer together with the Transgrid Project Team attended three risk workshops.

223. We remain concerned that the costs estimated by Transgrid may overstate the level of risk that may incur.

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72 Ibid.

73 Transgrid's response to IR02, question 26.

74 Ibid.

224. We also understand from the report by fission that the risk and uncertainty contingencies identified by each of the contractors were included in the cost estimates in CPA2 and importantly were included in the Transgrid risk report.[75] However, we have not seen sufficient evidence to convince us that risk and contingency costs included by the contractors have not also been included in Transgrid's risk-cost allowance.

225. Based on the fission report, which appears to be based on an earlier version of the estimated target cost, the risk and contingency amounts included by the contractors in the tendered costs total approximately $165 million. Whilst the contractors arguably have responsibility for a different set of risks, the associated risk and contingency allowances have the potential to overlap with the risks identified in Transgrid's risk register. However, based on these provisions, and additional float time included in the project schedule[76], we consider that the mitigated risk values should be considered in the residual risk register, rather than the inherent or unmitigated risks. We tested each of the individual risk events and contingencies to determine the degree to which Transgrid had taken account of possible risk mitigations.

P50 is the appropriate metric for assessment of the risk-cost allowance

226. We consider that adoption of a P50 probabilistic risk-cost allowance, rather than the P70 that Transgrid has chosen, is required. We base this on the following:

- P50 has been adopted in recent AER decisions,[77] including for PEC.[78]
- In its compliance claims to the AER Guideline requirements in its CPA2 submission, Transgrid claims that the '*[r]isk-costs in this Stage 2 Application have been considered for each activity and the associated costs are based on a qualitative approach to determining the mid-point (i.e., P50) estimate of the forecast costs*.'[79]
- Transgrid has required that its contractors base their assessment of risk and uncertainties on a P50 basis.[80]
- P50 is supported by Infrastructure Australia and included in its guidance material[81] including material developed by state governments that feed into this process as sighted by EMCa.

227. Transgrid claims that it is 'typical' to apply probability levels of P80 as a basis for its selection of P70, however in our opinion this results in a material overstatement of the risk-cost allowance.

Some considerations in the AER guidance have not been adequately considered

228. The AER guidance material includes considerations such as:

- Inclusion of project risks and efficiencies that lead to cost reductions. Of the risk-cost allowance of $599 million, Transgrid has identified risk and uncertainty events leading to cost reductions totalling $1.8 million.
- The AER determination is not intended to completely de-risk a project. Whilst it cannot be determined whether or not Transgrid's intention is to completely de-risk the project from the information available, the inclusion of a 12% risk-based contingency is high relative to other projects.
- It may not be efficient to fully identify and mitigate all project risks. Transgrid has identified 74 risks, of which the top 25 account for 90% of the proposed risk-cost

75 Transgrid response to IR05, Humelink Project Independent Review of Contractors Cost Estimate, fission, March 2024.

76 As included in the project Gantt chart and confirmed in discussion with Transgrid.

77 Final decision - TransGrid transmission determination 2018 to 2023, Attachment 6 – Capital expenditure, AER

78 Project Energy Connect, Cost Estimate Report, ElectraNet

79 Principal Application document, table 7-2: Compliance to AER Guidelines, Transgrid. 21 December 2023 (and which was removed in the subsequent draft submitted on 7 February).

80 HumeLink Project Independent Review of Contractors Cost Estimate, Fission, March 2024.

81 Assessment Framework 2021 Guide to economic appraisal, Infrastructure Australia

allowance. This suggests to us that Transgrid has included less material risks in the risk register, and which may bias the risk allowance to a higher than prudent level. We tested this in our review of individual risk-costs. As noted in the AER guidance, it may be efficient to accept some risks where the cost of mitigation measures exceeds the expected cost impact should the risk eventuate.

- Not all project risks need a separate allowance in the contingent project determination. Other than adoption of its Monte Carlo analysis, which had the result of increasing the risk-cost allowance relative to the deterministic P50 value, we have not seen adequate evidence of consideration of the inter-relationship of individual risk items, and relationship with other incentive/penalty provisions in the governing commercial model for this project.

229. We see evidence that Transgrid has applied elements of the AER guidance in determining a probability weighted risk-cost allowance. However, we do not consider that Transgrid has adequately taken account of other factors in the AER guidance in preparation of its risk register and proposed risk-cost allowance, included those presented above. When these other factors are taken into account, a prudent risk-cost allowance is likely to be lower than Transgrid has proposed.

4.3.2 Dealing with uncertainties

Assumptions adopted by Transgrid tend to have an upward bias on identified risk allowances

230. Whilst Transgrid has sought to apply three-point estimates using a trigen distribution, and then adopting Monte Carlo analysis to all risks, we find that this analysis has generally resulted in an increase to the proposed risk-cost allowances relative to the individual line items. This is shown in Table 4.2 below.

Table 4.2: Comparison of risk-cost allowance values provided by Transgrid

Item	Risk-cost allowance ($m)
Sum of most likely values	436.8
Sum of P50 deterministic values	481.1
Transgrid P50 (Monte Carlo)	521
Proposed Transgrid P70 risk-cost allowance	599.1
Transgrid P50 risk-cost allowance	521
Transgrid P70 (Monte Carlo)	602.2

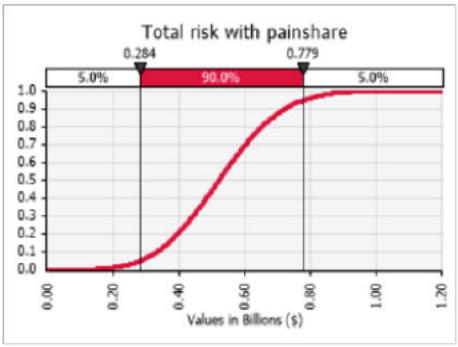
Source: EMCa analysis, using data from 'HumeLink CPA2 - ECI Cumulative Risk Model and QRA Register'

231. The P70 value of $602 million is based on the Monte Carlo analysis undertaken for all risks as shown in Figure 4.3 below,[82] which when reverse engineered for each individual risk and then summed, totals the slightly lower value of $599.1 million that Transgrid has proposed.

232. We understand that the 'P70' equivalent value of $599 million that Transgrid has proposed, is taken from this distribution. However, the P50 value which is the mid-point of the distribution, using this same Monte Carlo analysis, results in a lower value of $521 million.

[82] We consider that the values assigned to a probability of P70 referred as $602 million and $599 million are materially the same. A slightly different result will be generated from each simulation using Monte Carlo, and the results of the distribution provided to us occurred after the simulation used by Transgrid to generate the risk-cost allowance.

Figure 4.3: Probability distribution of proposed risk-cost allowance



Percentiles

Percentile	Value
10%	$332,575,655.35
20%	$394,453,806.69
30%	$442,267,780.47
40%	$482,923,085.93
50%	$521,051,313.73
60%	$558,817,022.95
65%	$579,867,631.75
70%	$602,219,393.30
75%	$624,435,575.78
80%	$649,586,382.28
90%	$720,448,916.93
99%	$878,923,794.68

Source: Transgrid's response to IR05, 'PCR0.6 Report-HumeLink CPA2_ECI Cumulative Risk Model', worksheet '14b.i Output_ w Painshare'

233. In Table 4.3 below, we show the breakdown of the risk values derived from Transgrid's 3-point estimate, a deterministic analysis of the P50 and then the P70 Monte-Carlo analysis (deriving an individual P55.2 value).

Table 4.3: Categorised risk-costs from Transgrid's analysis

Total risk category	Total most likely value	Total deterministic P50 (expected value)	Proposed risk-cost allowance Total Cost P55.2
Reimbursable	46.0	49.2	60.6
Variation	[redacted]	[redacted]	[redacted]
Time	225.5	238.4	272.5
Land and Easement risk	0.8	-0.7	-0.6
Biodiversity risk	[redacted]	[redacted]	[redacted]
Inherent	[redacted]	[redacted]	[redacted]
Total	**436.8**	**481.1**	**599.1**

Source: EMCa analysis, using data from 'HumeLink CPA2 - ECI Cumulative Risk Model and QRA Register'

234. The risk value included in the risk-cost allowance based on Monte Carlo analysis of P70 increased relative to the P50 deterministic value for each risk category. The risk values for the biodiversity and inherent risk categories are more sensitive to the Monte Carlo analysis than other risk categories.

Uncertainty arising from the modelling method does not appear to have been adequately considered

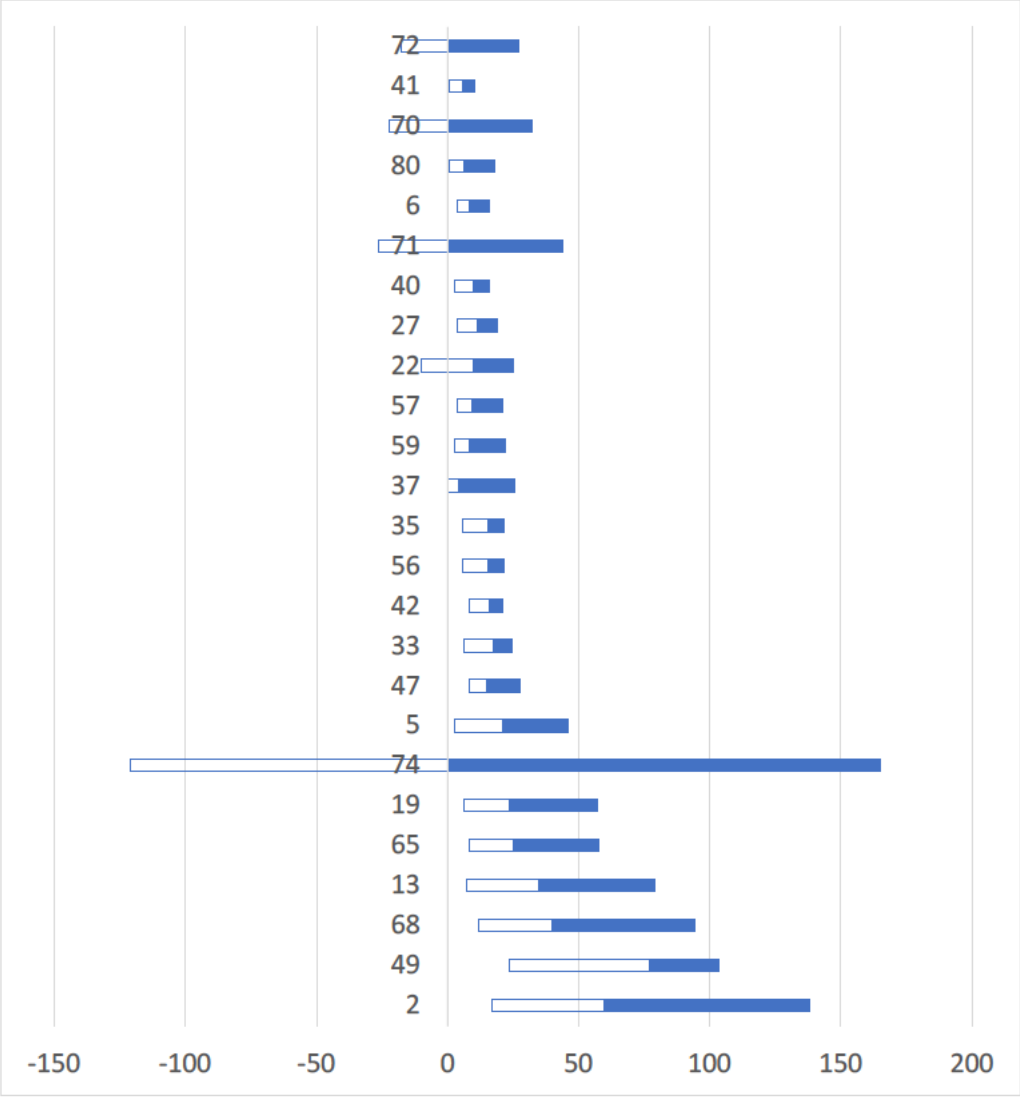
235. Transgrid has developed a risk register of individual risk events and uncertainties. Modelling on this basis may not adequately account for underlying uncertainties that affect multiple risks or uncertainties in a similar way. According to Transgrid's own risk advisors,[83] this may include market conditions, design detail, weather or project duration.

236. The analysis provided in Table 4.3 above indicates a potential upward bias of cost estimation. We reviewed the range of estimated costs for each of the top 25 risks. As shown in Figure 4.4 below, with the exception of risk ID 74 (uncertainty of biodiversity offsets) the remaining risks all have three-point estimates as positive numbers, with the most likely value, in general, greater than $20 million. Of the top 25 risks, only 4 have a

[83] https://broadleaf.com.au/resource-material/correlation-in-quantitative-risk-analysis/

range of estimates that span positive and negative values, with a most likely value of zero. This indicates to us that, in general, Transgrid considers that the identified risks on a probabilistic basis are more likely to add cost to base case estimate for the project.

Figure 4.4: Best case, most likely and worst case risk-cost estimates of top 25 risks estimates by risk id - ranked from highest to lowest ($m)



Source: EMCa analysis, using data from 'HumeLink CPA2 - ECI Cumulative Risk Model and QRA Register'

237. As the cost estimate used for many risks has been based on a cost of delay to the contractor (delay days multiplied by daily delay cost), the corresponding delays assumed in this formula can be aggregated. On a P50 basis, Transgrid has advised that this amounts to 597 days, as shown in Table 3.1.[84] Transgrid has used these delay days (at an individual risk level) to calculate its proposed risk-cost allowance..

238. We understand from Transgrid that (i) the contractor has to provide evidence of a delay, and cost incurred, (ii) there are provisions in the contract and commercial model that allow for early mitigation of any delay and costs to the contractor, and (iii) there is existing contingency held in the program. The delay days referred to above would be potentially valid as a basis for a risk-cost estimate to the extent that the delays were assumed not to be able to be mitigated or otherwise absorbed in project delay contingencies, and therefore led

[84] Transgrid provided this information to us immediately before this report was prepared. We calculated the deterministic sum of the 'most likely' individual risk cost delays from the original risk-cost information that Transgrid provided in its risk model, as 437 days.

to overall project delays. However, Transgrid did not provide us with an estimate of any overall project delay and did not acknowledge the implication that costed individual risk-based delays imply some aggregate project delay.

239. Whilst Transgrid has now provided us with P10, P50 and P90 risk-cost estimates, we consider that the potential mitigation options at Transgrid's disposal have not been sufficiently accounted for in its analysis, which has overstated the likely delay and therefore proposed risk-cost allowance.

Absolute level of risk-cost allowance should have higher levels of certainty than has been proposed given investment in CPA1

240. We compare the risk-cost allowance proposed for HumeLink with recent projects, based on publicly available information, as presented in Table 4.4 below.

Table 4.4: Summary of factors included in AER guidance for contingent project risk-cost allowance

Attribute	PEC (ElectraNet)	PEC (Transgrid)	PEC (Total)	Eyre Peninsula (ElectraNet)	HumeLink (Transgrid)
AER determination date	2020	2020	2020	2020	2024 (planned)
Capital cost ($m)	457	1,818	2,275	280	4,892
Risk cost allowance ($m) excluding line route deviations and environmental offsets	15.4	43.7	59.1	12.7	570
Risk cost allowance (percent of total)	3.4%	2.4%	2.6%	4.5%	11.7%
Approx. line length (km)	-	-	860	272	365

Source: EMCa analysis, using data from AER draft and final decisions for PEC and Eyre Peninsula

241. Whilst the details of the risk-cost allowance for the Eyre Peninsula project are not transparent, we anticipate that there is a provision for line route deviation and environmental offsets. When accounting for these components in the risk-cost allowance, we estimate the percentage of the total reduces to approximately 4%.

242. A ratio of around 4% of the total cost for HumeLink would correspond with a risk-cost allowance of around $200 million, on a similar basis to other recent projects (e.g. excluding biodiversity risk). We accept that a direct comparison of HumeLink with recent projects is not a reasonable indicator, however we consider that this provides a reference to review the basis for differences that may be applicable for HumeLink, including the following:

- The projects have differing scopes, despite the overall line length for HumeLink being similar to PEC. The line route and associated environmental conditions are also very different and add to scope and delivery uncertainty.
- The accelerated project timing discussed in section 3, has introduced uncertainty of project approvals which primarily impact the commencement of the construction phase of the project and are reflected in higher risk-cost allowances.
- The input costs applicable for HumeLink have increased significantly since pre-covid times, due to general economic, market and inflationary factors, and which result in an

asymmetrical increase to the project cost and risk-cost allowances. This is further impacted by cost uncertainty in many areas of the project.

- The proposed risk-cost allowance for HumeLink uses risk-sharing mechanisms within collaborative contracting arrangements which result in a higher owner's risk-cost, which we would expect. As discussed in section 6, the selected commercial model seeks to reduce the overall risk and uncertainty of the project, and which should result in a lower overall cost of the project. We accept that whilst the commercial model is becoming commonplace in Australia for megaprojects, it remains new for electricity infrastructure, and therefore the experience in its application is developing. Additionally, there is additional complexity associated with the scope and timing of HumeLink, that may impact the risk provisioning.

243. Accordingly, the comparison to past projects cannot be directly applied to HumeLink.

4.3.3 Accounting for the commercial model and governance structure

244. Transgrid describes its owners risk, or provision for other construction costs, as:

> *'This element of the risk contingency is required for the shared risks Transgrid retains under the D&C ITC contract which fall under the reimbursable component of the payment model'*[85]

245. In terms of the out-turn contact cost for the reimbursable items, Transgrid also states:

> *'Delivery Partners are incentivised via the painshare gainshare regime to drive contractor and subcontractor performance of the reimbursable cost elements within the target cost allowance to avoid paying in the overrun for these costs which would unnecessarily increase capex and reduce the margin fee they earn for the project.* [86]

246. Accepting this is a feature of the commercial model, we expect that the same pressures are applied to Transgrid in driving the cost elements within the target cost.

247. We expect that the proposed risk-cost allowances should not act against the incentive provisions that already exist in the commercial model to encourage transparency and innovation, such that these and other items may result in costs that are lower than those included in the base estimate for target cost and not all above. For that reason, we would suggest that costs proposed that are not consistent with the adopted commercial model and are not prudent and efficient. We explore these issues further in our review of specific risks, and specifically for the included reimbursable risks costs.

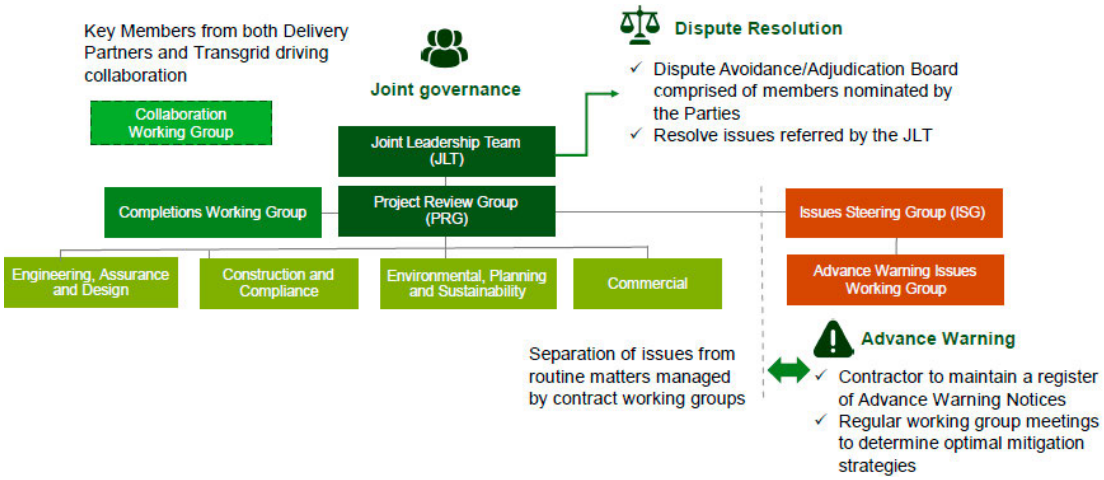
Early resolution of issues is a feature of the governance structure

248. Transgrid has established a contract-level governance structure aimed at early resolution of identified issues as shown in Figure 4.5 below.

85 Risk and Contingency Report, Transgrid, page 12.

86 Ibid.

Figure 4.5: Contact management governance structure



Source: Transgrid response to IR05, 'PCR0.3 HumeLink Board workshops (compiled)'

249. In addition to the incentive provisions, and governance structure provisions, Transgrid has formalised a collaborative working arrangement as a part of the commercial model for HumeLink to assist deliver the project on budget and on time.

4.3.4 Level of external review

Transgrid has engaged external advice for review of its risk analysis

250. In Table 4.5 we summarise the scope of the reviews by GHD, Beca and fission as they relate to the 74 risks included by Transgrid in its risk register.

251. We have been provided with a copy of a further review of the cost estimated by fission, where it concludes that the target cost is considered to represent reasonable value-for money / efficient pricing. fission refers to the contractor risk contingency for the east package, and using the similar words for the west package as being:

> *'..based on sound risk qualitative and quantitative assessment and commensurate for the West Package noting the transmission line scope is administered under a reimbursable cost model'*[87]

252. In regard to the Transgrid risk contingency, fission concludes that the '*Transgrid risk register is considered robust and prudent, and cross references the respective JV Contractor risk registers to minimise risk gaps*.'[88] It appears to base its view on, amongst other things, its own benchmarking analysis.

253. Whilst fission refers to Transgrid's risk register, we did not see direct commentary on the risk-cost allowances for individual risks relied upon by Transgrid in its analysis, or the reasonableness of the risk-cost allowance in aggregate other than when used as a percentage in its benchmarking analysis as below:

> *'Transgrid risk contingency at (~P70) correlates to 21.9% of the combined Packages TC. fission consider this risk contingency falls within Class 3 AACE Estimate (10% to 40% project definition). Noting that the Substations are lump sum, the Transgrid provision is considered reasonable. '*[89]

87 Humelink Project Independent Review of Contractors Cost Estimate, fission, March 2024.

88 Humelink Project Independent Review of Contractors Cost Estimate, fission, March 2024.

89 Humelink Project Independent Review of Contractors Cost Estimate, Fission, March 2024, page 18.

Table 4.5: Summary of external reviews

Item	GHD review[90]	Beca review[91]	fission review[92]
Scope of review	Requested to undertake independent review of the validation and verification of the owners risks cost.	Requested to undertake peer review of specific risks identified by Transgrid, and comment on whether they appear reasonable.	fission has participated in several risk qualification and quantification workshops with Transgrid.
Number of risks identified in its review	21	7	n/a
Total risk-cost allowance reviewed	$417 million (P50 deterministic) or $484 (P70 Monte Carlo)	n/a	n/a
Other comments	GHD's review was done on the P50 deterministic risks. We noted that several of the identified risks in GHD's report differed in value from Transgrid's risk model. GHD did not comment on the reasonableness of the risk values adopted by Transgrid.	Beca concluded that it was reasonable to include most of the specified risks. Beca did not comment on the reasonableness of the risk values adopted by Transgrid.	fission considers the process being implemented to be robust and consistent with general industry risk management practice. fission has not reviewed the actual risk modelling process, but understand @Risk using Monte Carlo risk simulations has been used to model the overall risk analysis.

Source: EMCa analysis, using data from 'GHD, HumeLink CPA2 Independent Verification and Assessment' and Transgrid Risk artefacts ID.01 and ID.02

254. We observe two issues with the presentation of this advice, which impact the level of reliance that can be placed on the conclusions drawn from this analysis:

- Firstly, if the contractor contingency of approximately $163 million had been included in this analysis, the total project contingency is closer to 28% of the combined packages target cost, as applied by fission.
- Secondly, the estimate for the tendered packages is considered by Transgrid to be at accuracy Class 2, corresponding to -15% to +20%, and not Class 3 as suggested by fission.

255. Correcting for these factors, a project contingency of 28% may be considered high, when measured against the project definition as presented here.

External reviews primarily focussed on the process applied by Transgrid

256. In relation to the independent review of the validation and verification of the owners' risks cost claimed by Transgrid in its submission, we sought clarification of the scope of this review. Transgrid directed us to its submission, and to Appendix A of GHD's report which includes GHD's assessment of the other construction cost provisions, and GHD's finding that it:

90 HumeLink CPA2 Independent Verification and Assessment, GHD Advisory.

91 Refer risk artefact ID.01.

92 Refer risk artefact ID.02.

'considers alignment with AER guidance notes on risk provisioning.' [93]

257. Transgrid further clarified in response to a separate IR that GHD had not in fact reviewed the individual risks as it first claimed:

> *'In general, GHD has not undertaken a review of individual risk, rather the process with which risk assessment and quantification has been conducted, should some of these risks be provisioned, and how it compares if estimated using class 4/5 estimate.'* [94]

258. When considered alongside other limitations of scope for review of the risks proposed by Transgrid identified in Table 4.5 above, we consider that the external review of the individual identified risks, and the resulting risk-cost allowance included in the CPA2 submission was limited.

4.4 Consideration of specific risk-costs

259. We have focussed our assessment on the top 25 risks, as they account for 90% of the risk-cost allowance. We undertook a targeted review of the remaining lower value risks, based on the issues we identified, and found that these issues similarly exist in these remaining risks.

260. We present the outcomes of our review on an issues basis below, and have summarised this for the top 25 risks in Appendix B. Where we state specific risk-costs, we are referring to P55.2 amounts that Transgrid has provided, and which sum to the $599 million that Transgrid has proposed.

4.4.1 Risk-costs that result from assumed delays relative to Transgrid's accelerated timeline

261. As discussed in section 3, Transgrid's project plan reflects an accelerated timeline and Transgrid's assessment, corroborated by that of its external advisers, indicates that there is a minimal chance that the project plan will be met. Transgrid has therefore proposed a number of risk-costs that represent Transgrid's assessment of additional costs based on a timeframe that it has a higher probability of achieving, and which reflect the impact of 'delays' relative to this accelerated timeline. This includes probabilistic allowances for planning, approval and construction delays.

262. Transgrid states in its risk report,[95] that the risk-costs that are required to deliver HumeLink form part of the overall cost of the project and reflect the probability-weighted calculation of 'expected costs.'

263. Transgrid has further grouped its risk-costs into three categories: (i) reimbursable risk-costs, (ii) variation risk-costs; and (iii) time (delay) risk-costs. Transgrid describes the time (delay) risk-costs as relating to timing delays that may emerge during the delivery phase because of planning or secondary approval delays and construction delays, which result in additional labour resources and corporate overhead costs.

264. In its risk model, Transgrid presents the time (delay) risk-cost (within the overall risk-cost allowance of $599 million) as $272 million.[96] However, in reviewing individual risks, we find a somewhat higher total of $385 million risk-costs that Transgrid has calculated from an assumed time delay. This higher value is the sum of those risks where Transgrid has relied on a time delay as the basis for the estimated risk-cost, rather than attribution to the "Time" risk category as Transgrid has presented.

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93 Transgrid response to IR05, question 8.

94 Transgrid response to IR05, question 9.

95 HumeLink CPA-2 Risk Report, Transgrid, page 16.

96 Humelink CPA2 – ECI Cumulative Risk Model and QRA Register, Transgrid.

265. Transgrid claims to have accounted only for delays that it retains accountability for (that is, excluding contractor-caused delays) and has applied what it considers to be realistic costs for delays, noting that these vary at different stages of the project. In our review we have considered the basis that Transgrid describes for each delay, and how Transgrid has ascribed a cost to that delay.

266. We have focussed on the estimated risk-cost allowance rather than the time delay that is indicated by the risk-cost. Whilst a probability is assigned to each risk, it is not clear to us how Transgrid has determined the aggregate time delay, for example how it accounts for delays that may be concurrent, or that may be mitigated by other contingent provisions, rescheduling or re-prioritisation of works (despite the potential to incur additional costs).

Planning and approval delays are based on an 'upper limit' of possible costs

267. Transgrid has included a risk that relates to delay and cost claims from the contractor due to a Transgrid delay in receiving statutory planning approval, that it describes as Risk ID 2 at a cost of [redacted] (P55.2). The contractor is entitled to cost and time relief under the contract where there is a failure of Transgrid to obtain an EIS approval by July 2024, and is delayed in issuing NTP2 under the contract.[97]

268. Transgrid has estimated the risk-cost allowance from the results of the QSRA (as discussed in section 3) and moderating daily delay rates provided by the contractors for delay cost per day during its ECI process, which Transgrid refer to as Pre-Agreed Values (PAV). We consider that the estimate of time delay measured in days used for the calculation of this risk are reasonable at the time the assessment was undertaken, with a likelihood of 90%. As explained in section 3, this equates to a P50 approval around November 2024 whereas based on our discussions during the onsite meeting Transgrid is planning for approval at the end of September 2024.

269. From discussions with Transgrid, we also understood that the PAVs were provided as indicative delay costs during the ECI process and are not in fact agreed by both parties, nor do they form a part of the contract.

270. In advice provided by its independent cost estimator, fission, on the contractor rates to be used in development of its risk register,[98] it concluded that only 80% of the delay rates are '*time-phased.*' We infer this means 20% of the rates are fixed, and the remaining 80% vary with time for the duration of the project. fission made allowance for a fixed proportion of these costs as evidenced by the derivation of its 'full delay prelims cost (per day)':

[redacted]

271. In response to our IR, Transgrid clarified that it expects that the PAVs are an 'upper limit' or 'unmitigated', and that actual costs are likely to be much lower. Transgrid's response refers to the advice from fission.[100] Our review of this advice suggests that the moderation of the PAV rates for fixed versus 'time-phased' costs is different to consideration of the potential costs after mitigation, in consideration of 'upper limits.' We agree with Transgrid that accepting the delay rates in the contract, would remove the requirement on the contractor to implement mitigating actions, and may result in higher costs. Notwithstanding that there may be a fixed portion to these costs, as suggested by fission, we expect that the variable costs once mitigated would be materially lower than the adjusted PAVs applied by Transgrid.

Actual costs of the delay may be lower due to mitigation actions by all parties

272. As noted above, a delay to the commencement of the project is considered highly likely, based on the progress of discussions with government regarding its EIS approval. A delay

97 Humelink CPA-2 Risk Report, Transgrid, page 18.

98 Transgrid risk artefact ID02 TG RO Technical memo.

99 Transgrid Project risk artefact, ID0.2 TG RO Technical Memo v02.

100 Transgrid's response to IR05, question 15.

to EIS approval has a consequential impact to NTP2, and which under the contract provides an extension of time to the contracted end date.

273. In anticipation of the delay, Transgrid has provided early notice to the contractor, and stated that it is working collaboratively with the contractor to actively mitigate the time delay and cost of delay to the project. This includes bringing forward some preliminary and preparation works, resequencing works to occur in parallel rather than in series, and deferring commencement of other works. We consider this a prudent response, and a key element of the adopted commercial model for the HumeLink project.

274. Whilst the contractor is entitled to a claim for costs and Extension of Time (EOT) for delay to NTP2, the actual costs of any delay are based on actual audited costs, after any mitigation actions which primarily impact the delay costs as the time delay is fixed. It follows that the actual costs of any delay, are likely to be lower than those assumed by Transgrid in its CPA2 submission.

The contractor is entitled to further cost relief for escalation

275. As a consequence of any delay, it would be expected that the consequential costs would reflect any changes in market costs, including the impact of inflation for any contract extension. Transgrid has included an additional risk-cost of [redacted] (P55.2) for Risk ID 68 which it describes as contractor repricing arising from an employer driven delay to NTP2. However, based on the information provided above, the assumptions used for the derivation of this cost are based on pricing described as PAVs. As stated above, we consider that these values are likely to similarly overstate the likely cost impact of escalation for any delay.

Associated prolongation costs for Transgrid's internal costs are materially over-stated, and could reasonably be removed

276. As opposed to additional costs provided for the contractor to hold its resources following delay, Transgrid has included a further risk that relates to Transgrid's internal costs, largely associated with staffing. Transgrid refers to this risk as Risk ID 49, relating to an increase of owner's costs due to an extension in the project's duration at a cost of [redacted] (P55.2).

277. It is unclear why Transgrid would incur the extent of costs (if any additional costs) identified by this risk for any contract extension arising from planning and approval delay, and not re-prioritise and re-apportion its resources between major projects, or though other contracting provisions. We see evidence that Transgrid has effectively done this through CPA1 and is already taking action to re-profile its resourcing based on the expected delay to NTP2. It would also be expected by consumers that Transgrid employs controls that it has at its disposal to ensure the most efficient delivery of this project, including by re-prioritising and re-sequencing works for HumeLink. Given the advance notice of the delay, resourcing plans could be deferred, which Transgrid has already commenced.

4.4.2 Risk costs that result from time delay other than approval

278. Transgrid has included seven additional risks its time delay risk grouping other than for planning and approvals totalling [redacted] P55.2), being:

- Risk ID 5 being for delays to and claims by the contractor due to being unable to access the site, at a cost of [redacted] (P55.2)
- Risk ID 6 being for variation claims by the contractor due to changes in substation reliance information included in the contract, at a cost of [redacted] (P55.2)
- Risk ID 27 being for exceptional events such as lockdowns, war, terrorism or natural disaster, at a cost of [redacted] (P55.2)
- Risk ID 35 being for delays to Transgrid being supplied reactors and transformers due to delayed overseas manufacturing and shipping timeframes, at a cost of [redacted] (P55.2)

- Risk ID 37 being for project loses support (social licence) that results in disruptions such as blockades, protests, legal challenges and other means of obstruction including councils, at a cost of [redacted] (P55.2)[101]
- Risk ID 56 being for delays to Transgrid being supplied conductor and optical ground wire (OPGW) from delayed overseas manufacturing and shipping timeframes, at a cost of [redacted] (P55.2)
- Risk ID 80 being for insolvency of Joint Venture (JV) member, at a cost of [redacted] (P55.2).

279. For the risks that we have assessed, we consider the risks are reasonable to include. We present our assessment of these risks below.

Inclusion of risk event associated with restrictions on site access should be considered alongside other risks to delay

280. Transgrid is required to provide site access to the contractor by the times listed in the Site Access Schedule, and at all times after that date. Whilst the contractor is required to mitigate delay as part of Extension of Time (EOT) test, the contractor is entitled to a cost claim. Based on the supporting information provided, we consider that the likelihood of access restrictions through the actions of private landowners, landowner activities or other unplanned events to include Risk ID 5.

281. Delays to and claims by the contractor due to being unable to access the site may overstate the probability of occurrence given the large investment in stakeholder consultation, land acquisition and access being undertaken by this project. Transgrid has informed its assessment from sentiment maps, for which the purpose is to identify land for compulsory acquisition and not access, and its experience in other projects.

282. We suggest that whilst there is a real risk of restricted access for some sites, the probability of the time delay to the project and associated costs appears high and should be considered alongside other related drivers for potential delay and mitigation methods available to the contractor. Whilst we consider this risk should be included, the resultant cost and time delay should be considered alongside other risks.

283. As a further example, Transgrid has included a risk of delay and cost claims from the contractors due to delay in receiving planning approval modification for Greenhills option. Greenhills is the preferred line route option. We understand from our discussions with Transgrid that it now has agreement for the land and has reflected that in a zero cost for this risk. However, a P50 time delay of 50 days is still included in Transgrid's time delay analysis.

Provision for exceptional and extreme events is reasonable

284. Transgrid has included Risk ID 27 for exceptional events which are as defined in the delivery contract to include war, terrorism, riot or disorder, state/nationwide lockout, encountering explosives, natural catastrophes such as earthquake, hurricane, bushfires and delay to critical plant and equipment as a result of the Russo Ukrainian war, epidemic or pandemic.

285. Transgrid consider that the most likely exceptional event that will occur on the project is a bushfire given the project location and large geographic spread, and scenarios included by Transgrid are based on this type of event.

286. Transgrid has included a low likelihood of this risk at 5%. The cost allowance is based on the several events resulting in damage to the constructed facilities that require 6 months in total to procure the equipment and materials and rectify the damage. A delay allowance has been used as Transgrid considers the majority of damage caused by these events are likely covered by insurance. We have not reviewed the insurance cover to determine whether this risk could be further mitigated by insurance and are guided by Transgrid's assessment.

[101] Consideration of this risk is not within our scope of review.

287. On balance we consider that this is an acceptable risk for inclusion.

Inclusion of risk of reliance information is reasonable

288. Transgrid has identified a risk that some of the reliance information provided at contract execution will be inaccurate or would have changed from what is shown on the drawings by the time construction starts, or that the interaction of multiple projects at substation sites (e.g. Wagga Wagga) may lead to changes.

289. Considering the supporting information, we consider it is reasonable to include this risk.

Inclusion of risks due to manufacturing and shipping delay of strategic items is reasonable

290. Notwithstanding that the procurement costs should be known where determined as part of Stage 1 and orders placed, there remains uncertainty around the delivery of equipment. Transgrid has included two risks for delays associated with the supply of its equipment:

- Risk ID 35 being for delays to Transgrid being supplied reactors and transformers due to delayed overseas manufacturing and shipping timeframes, at a cost of [redacted] (P55.2)
- Risk ID 56 being for delays to Transgrid being supplied conductor and OPGW from delayed overseas manufacturing and shipping timeframes, at a cost of [redacted] (P55.2).

291. As a rule, transport of equipment is not within the control of Transgrid, and despite extensive coordination and planning with the OEM, is subject to risk and uncertainty. As Transgrid points out in its supporting information, some of this equipment has not been transported in the terrain within the HumeLink project previously. It is therefore reasonable to consider risks of delay from the supply and transportation of equipment.

292. During the onsite discussion we heard that Transgrid was taking steps to bring forward the delivery of some plant to assist mitigate some of the risk of time delay to the project, however this would be offset by greater storage costs, and planning and coordination of delivery to site from the storage location. Delay from the manufacturer, shipping and ports remain variables outside of Transgrid's control.

Insolvency risk for tier 1 contractors reflects a low probability event

293. Whilst we consider the risk of insolvency of a tier 1 contractor included in Risk ID 80 to be a very low probability event given the extensive procurement and review process undertaken by Transgrid, it is not beyond precedent. Recent experience indicates that the risk in the current economic climate is present, albeit at a low likelihood of occurring. We consider that the inclusion of this risk at a likelihood of 5% as assigned by Transgrid is reasonable.

4.4.3 Risk costs that result from assumed cost uncertainties for reimbursable items for reasons other than approval delay

294. In accordance with the AER guidance, and supported by recent AER determinations, risks that are considered within the reasonable level of control of Transgrid cannot be accepted as a risk-cost allowance.

295. Transgrid, like other NSPs, has mechanisms to manage the prioritisation and sequencing of costs associated with decisions within its control, and these are not costs that should be borne by consumers. Furthermore, while Transgrid has accounted only for the risk of additional costs, we have considered in our review the extent to which these cost uncertainties are likely to be symmetrical; to the extent that this is the case, then it is important to see the symmetrical nature of these risks adequately accounted for in the derivation of an aggregate risk-cost allowance.

296. Transgrid has included five risks in its reimbursable risk grouping totalling $57.1 million (P55.2), being:

- Risk ID 40 being for an increase in contractor reimbursable labour costs above Enterprise Bargaining Agreement (EBA) for Transmission Line Works, at a cost of [redacted] (P55.2)
- Risk ID 41 being for additional Local Area Works during construction leads to increase in reimbursable costs, at a cost of [redacted] (P55.2)
- Risk ID 42 being for reimbursable plant and equipment costs above estimate for Transmission Line Works, at a cost of [redacted] (P55.2)
- Risk ID 47 being for productivity less than planned, increase in rework, below plan productivity of tower foundations, unskilled and skilled stringers, riggers, electricians, etc at a cost of [redacted] (P55.2)
- Risk ID 57 being for design refinement and growth of towers occurring during detailed design at a cost of [redacted] (P55.2).

297. We present our assessment of these risks below.

Contractors have included risk and contingency provisions in the target cost

298. In a report for Transgrid, fission detail the components of the package price from contractors as including contingency, described as:

> *'Contingency – includes Contractor's risk and opportunity, design growth and schedule risk analysis (SRA). Risks include inherent and contingency risks.'*[102]

299. The report also identifies the contingency costs nominated at the time of their review as shown in Figure 4.6 below.

300. We note that the final tendered package prices included in Figure 4.6 vary slightly from those included in CPA2, and which we consider relate to further negotiation as the

102 Humelink Project Independent Review of Contractors Cost Estimate, Fission, March 2024.

differences are not material. The contingency and risk values equate to 5.6% of the total tendered package price (east and west).

301. The report from fission goes on to detail that each of the contractors has presented a detailed risk register with their cost estimate submission with 61 project risks developed for the east package, and a further 90 for the west package. fission considers the process adopted by each contractor[103] has been robust and prudent:

> *'fission consider an industry benchmark for contingency is between 5% to 10% of TC. UGL/CPB contingency risk falls at the lower end of the risk range however is offset with several price qualifications, and potentially high base cost estimates as noted above. The transmission line works is also administered on a cost reimbursable model; hence results in a reduced risk profile to the JV Contractor.*
>
> *fission note Transgrid has developed their Owners Risk Register in part incorporating the AG risk assessment. This is considered a prudent approach to managing risk between UGL/CB and Transgrid.' [104]*

302. These statements are mirrored for the AG contingency risk for the east package.

303. The report does not elaborate on the degree of integration, or potential for overlap between Transgrid's risk register and those of its contractors, other than to note a close correlation between the two:

> *'Transgrid has developed a detailed risk register comprising [74] itemised risks. fission has participated in several risk workshops with Transgrid and relevant Subject Matter experts (SME). fission has also provided base cost data from which the risks are quantified.*
>
> *In developing their risk register, Transgrid closely reviewed both the East and West Package Risk registers to ensure close correlation between JV Contractor risk contingency and Transgrid risk contingency.'*
>
> *fission consider the risk qualification and quantification approach used by Transgrid complies with AS/NZS ISO 31000:2009 Risk Management Principles and Guidelines.*
>
> *Transgrid risk contingency at (~P70) correlates to 21.9% of the combined Packages TC. fission consider this risk contingency falls within Class 3 AACE Estimate (10% to 40% project definition). Noting that the Substations are lump sum, the Transgrid provision is considered reasonable.' [105]*

304. We observe fission's comments relate to 10 to 40% project definition, which we consider understates the scope of this project as discussed earlier in our report and follows the completion of Stage 1 works. Whilst the estimate class may be 2/3 (depending on the scope item) we would expect a much higher level of scope definition, and therefore lower cost uncertainty and corresponding contingency amount that applies to the target cost, to which Transgrid has stated is considered to be Class 2.

305. We saw evidence of similar contractor contingency amounts presented to the Transgrid Board as shown in Figure 4.7 below. We were not able to confirm from the CPA2 submission material the final contingency values as they were combined with other components of the target cost for the contractor packages. The values provided here may differ to the final values, however, are of a similar order to those relied upon by fission in its analysis to which Transgrid has relied.[106]

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103 The application of Monte Carlo simulations to develop a P50 risk probability varies between contractors

104 Humelink Project Independent Review of Contractors Cost Estimate, Fission, March 2024.

105 Humelink Project Independent Review of Contractors Cost Estimate, Fission, March 2024.

106 PCR0.3 HumeLink Board workshops, Transgrid, July 2023.

306. If the contractor contingency of approximately $163 million is included in the analysis by fission, the project contingency would be closer to 28% of the target cost, for an estimate considered to be Class 2, corresponding to -15% to +20%, and not Class 3 as is claimed.

Information presented to the Transgrid Board places primary focus on the draw down of contractor contingency

307. We also asked Transgrid to explain the extent to which the Transgrid Board's attitude towards a CPA2 risk allowance, or the quantum of risk-cost to be allowed for in the CPA2 submission, materially changed over the course of its engagement, and the extent to which the Board was advised on and took account of 'delay' risks. In response, we were provided with summary presentation materials provided to the Board, and which detailed the process followed by Transgrid. We were not provided with details of decisions or directions from the Board regarding its determination of the risk allowance, or its risk appetite. Transgrid did state that:

> *'There were several risk workshops held with the Board and security-holders to explain and consider the key risk areas for the project, how they were allocated and then valued. The respective contingency allowances that were developed to accommodate the Transgrid retained risks were then a key area of focus.'* [107]

308. In its discussions, we understand that the Transgrid Board considered the relationship between the contractors' risk allowance and that held by Transgrid. We were provided a copy of a slide used for a Board meeting that discusses the application of contingency, as shown in Figure 4.8 below.

[107] Transgrid response to IR05, question 12.

309. The application of contingency shown above, is as we understand how the contract is intended to apply, and we would expect these mechanisms to be taken into account in setting the risk-cost allowance. Transgrid further states that:

> *'The discussions with the Board were robust. There was a desire to present a total contingency budget that was efficient and justifiable without being excessive.'* [108]

310. Whilst we understand that the detailed risk register was shared with the Transgrid Board, we have not been able to determine the level of scrutiny applied by the Board at this level of detail.

311. We also note that Transgrid provided the advice provided from fission that we refer to above, that concluded that the risk-cost allowance when measured as a percentage of target cost given the estimate accuracy class is reasonable.[109] As we discuss, above, we consider that the presentation of the contingency in this way may be misleading.

Reimbursable risks do not adequately take into account contractual provisions and contingency already included

312. We note in Transgrid's description of the reimbursable category of risk-costs, that they are attributable to the target cost including:

> *- transmission line works – the costs for labour, plant and equipment associated with access tracks, clearing, tower foundations, steel towers and stringing*
>
> *- provisional sum items – the cost for unknown contamination, substation noise mitigation, architecture acoustic treatment works, post-practical completion support, unforeseen landholder costs, cultural heritage works, registered Aboriginal party costs, community options, local area works and insurance top ups.'* [110]

313. On the basis of this description, and the presentation of contractor contingencies as noted above, we expect that the contractor has already made allowances for these items in the base cost estimate included in the target cost and included cost contingency. Whilst there may be some further uncertainty in the cost, above that included by the contractor, this is more likely symmetrical in nature with a likely value of zero. Accordingly, we consider that the proposed reimbursable costs associated with Risk ID 40, and 42 are likely to be adequately addressed by existing allowances included in the target cost, or by the additional

108 Transgrid response to IR05, question 12.

109 PCR0.3 HumeLink Board workshops, Transgrid, July 2023.

110 A.1_Humelink CPA-2_Principal Application, Transgrid, 21 December 2023, page 53.

contractor risk contingency where uncertainty remains, and further risk provision is not necessary.

314. Issues with labour shortages have been well publicised across the Australian construction industry, and the energy sector is not immune to similar labour supply pressures. This may, in some cases, result in contractors retaining lower skilled workers, which brings additional risks than having construction experience. These workers may require additional supervision and support, and therefore suffer a lower level of productivity.

315. The current challenges with access to and provision of labour is known to Tier 1 firms. We expect these firms will have the requisite systems and processes to ensure the development of capability, performance and strong safety culture.

316. For the local area works included in Risk ID 41, the requirements are determined by local councils. Transgrid indicates that these works were not sufficiently scoped at the time the contracts were finalised and may be subject to provisions in addition to those in the contract due to higher-than-expected requirements of councils. We consider that based on Transgrid's previous project experience and the complexity of HumeLink (including access), the likelihood assumed by Transgrid is reasonable, and the inclusion of the risk-cost allowance reasonable.

Additional risks for productivity are similarly included within existing contingency provisions

317. Impacts to labour productivity associated with the contracted (or internal) labour force are expected to have been covered by existing uncertainty provisions in the base case estimate including tendered works, and not required to be covered by additional risk events. Accordingly, we do not consider that Transgrid has demonstrated why an additional risk provision proposed as Risk ID 47 is reasonable to include in the risk-cost allowance.

318. Contractual incentives also exist to ensure that innovation and efficiency improvements are made throughout the project, that may offset any additional costs through loss of productivity. It is important that these incentives are preserved through the life of the project.

319. Additionally, Transgrid has calculated this risk-cost as a function of time delays and which we assume are also reflected in Transgrid's assessment of the overall project delay as discussed in section 3. On the basis that it is not prudent to include an additional risk provision on a cost basis, it is similarly not prudent to include a time delay of approximately 2 months (on a P50 deterministic basis).

Provision for refinement during detailed design of towers is reasonable

320. Transgrid's provision for additional costs as a result of refinement of detailed design identified as Risk ID 57 is reasonable. Transgrid has based the estimate of this risk-cost on the likelihood of an increase in steel and shipping costs, which are based on advice from GHD and fission.

321. The supporting information provided by Transgrid, and discussions during the onsite support the inclusion of this risk, as the tower designs are refined from the preliminary design stage to detailed design, including taking into account loading requirements specific to the alpine and sub-alpine regions.

4.4.4 Risk costs that result from assumed inherent risks

Inherent risks included for cost uncertainty reflect aspects within Transgrid's control

322. Transgrid has included three risks in the inherent risk-costs associated with the uncertainty of the cost item estimated or the duration of an activity in the schedule,[111] rather than a risk event. The inherent risks total [redacted] (P55.2) including:

[111] Risk and contingency report, Transgrid, page 14.

- Risk ID 70 being for the uncertainty in the estimate of owner's non-labour costs for support, travel, legal, etc, at a cost of [redacted] (P55.2)
- Risk ID 71 being for the uncertainty in the estimate of owner's costs for labour and consultants, at a cost of [redacted] (P55.2)
- Risk ID 72 being for the uncertainty in the cost of OEM transformers, reactors and conductor at a cost of [redacted] (P55.2).

323. All risks are rated as low and have a most likely cost estimate of $0, with symmetrical best and worst-case cost estimates. We consider that these risks are within Transgrid's reasonable control and should not be included in risks cost allowances to be paid for by consumers, as Transgrid has identified in its inputs.

324. The estimates should be informed by Stage 1 activities, and within a reasonable level of control available to Transgrid for internal costs, the external OEM costs should be known with a high degree of confidence. Accordingly, any cost uncertainty is likely to be adequately addressed by existing allowances included in the base cost estimate, and further risk provision is not necessary.

4.4.5 Risks costs for treatment of variations

325. Transgrid has included seven risks in its top 25 within the variation risk category, totalling [redacted]

- Risk ID 13 being for claims for delay due to exceeding the inclement weather allowance in Contract Plus disputes over what is inclement weather and what sites were impacted at a cost of [redacted] P55.2)
- Risk ID 19 being for claims for variations due to changes in scope due to changes in design and construction manuals or Transgrid requirements, at a cost of [redacted] (P55.2)
- Risk ID 22 being for an increase in supply cost for fabricated steel, at a cost of [redacted] (P55.2)
- Risk ID 33 being for the lack of coordination with interface contractors (OEM, East/West) resulting in design delays, construction delays, scope gaps, responsibility gaps and additional costs, at a cost of [redacted] (P55.2)
- Risk ID 59 being for changes to the conditions of approval being more onerous than the baseline conditions assumed, at a cost of [redacted] (P55.2)
- Risk ID 65 being for an increase in costs associated with tower footings due to geotechnical conditions being substantially different from the conditions expected following investigation works leading to increased costs and adjustment event under the Delivery Contract, at a cost of [redacted] (P55.2)
- Risk ID 68 being for contractor repricing arising from an employer driven delay to NTP2, which we discuss in section 4.4.

326. We present our assessment of these risks below.

An additional provision for delays resulting from extreme events is reasonable

327. Transgrid has taken the step of including provisions for inclement weather in the target cost based on its research of probable delays due to weather. In addition, it is prudent to consider the likelihood of extreme weather causing a delay to the project where those events are likely to exceed the provisions in the contract. Accordingly, Transgrid has included Risk ID 13 for claims for delay due to exceeding the inclement weather allowance in Contract plus disputes over what is inclement weather and what sites were impacted, at a cost of [redacted]

328. The cost estimate is based on a 50% likelihood of a delay exceeding the existing weather allowance, which is estimated using a most likely value of 23 days. We note that the cost allowances are based on advice from fission and consider an extreme event to impact the

entire project (equally impact east and west). The contractors have an obligation to mitigate delays, where possible, including through the use of planning and contingency provisions. We therefore consider that there may be further opportunity to reduce the risk-cost allowance, through greater consideration of potential mitigation plans, however on balance consider that the risk-cost allowance for this risk is likely to be reasonable.

Changes of standards is within Transgrid's management control and should not be included

329. Transgrid has also included claims for variations due to changes in scope due to changes in design and construction manuals or Transgrid requirements identified as Risk ID 19 at a cost of [redacted] (P55.2). Modifications to the standards for design and construction that are likely to have a material impact to the project should be reasonably known at the time of the base estimate or already included within existing cost forecasting accuracy. The passage of law or regulation, which creates an external requirement imposed on and beyond the control of Transgrid, may also result in a change to a standard, however this too should be known. We did not see evidence of any potential changes to regulation or law that Transgrid consider may impact the HumeLink project. There remains a low probability that changes to taxes and duties may have an impact, however the impact of taxes and duties has been considered separately to this risk.[112]

330. Making further changes to standards for design and construction is within the reasonable control of Transgrid, and therefore the definition of this risk does not meet the AER guideline. Furthermore, Transgrid has included provision for innovation to drive improvements rather than incur additional costs, both in its proposed allowance for labour and indirect costs and the commercial model for design and construction packages.

331. We note that there are additional risks for changes to reliance information, tower design and footings included as a part of separate risks, and which we comment on separately.

Inclusion of risk of increase in cost of fabricated steel is reasonable

332. Changes in the material rate costs for fabricated steel for the estimated tonnage also remains uncertain where this remains subject to final detailed design. Transgrid has included Risk ID 22 for an increase in supply cost for fabricated steel at a cost of [redacted] (P55.2). We note that whilst this risk is described as an inherent risk 'with a range from possible cost reduction to cost increases' the resulting risk-cost allowance aligns with a most likely value of [redacted] reflecting a [redacted] increase in supply cost based on current pricing volatility.

333. We considered the arguments presented by Transgrid, including recent project experience, competition on a global market and consideration of movement in fabrication costs above that of material price.[113] We also understand that this risk is an adjustment event under the contract such that Transgrid is exposed to the rise and fall of fabricated steel between the execution date and the steel commitment date. On balance, we consider it more likely than not that there will be additional costs associated with the movement in steel price, and that this risk is reasonable to include.

Interface risk is reasonable to include

334. Risk ID 33 being for the lack of coordination with interface contractors (OEM, East/West) resulting in design delays, construction delays, scope gaps, responsibility gaps and additional costs, at a cost of [redacted] (P55.2).

335. The inclusion of Risk ID 33 for lack of coordination or delays on either the east or the west side resulting in delays as first presented to us focussed on coordination of construction of the interface tower and which may result in an increase in costs as a result of project delays. We initially formed the view that this was likely to be within Transgrid's reasonable control, supported by the high level of owner's costs.

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112 We note that an additional risk-cost allowance is included in a lower order risk, outside of the top 25, for changes to law.

113 For example, the GHD review notes that the steel billet index forecasts indicate a flat trend, but this does not represent the fabrication costs.

336. Following further enquiry of this risk, we now understand that this risk relates primarily to risks to OEM supply and installation that require close supervision and coordination, to work alongside the contractors and coordination with the PEC contractor at Wagga. In regards to the OEM risk, we understand that Transgrid has shifted accountability for installation services from the contractor to the OEM, and now holds the risk of on-time delivery. Similarly, there is no contractual relationship between the HumeLink contractor and the PEC contractor.

337. At Wagga Wagga, Transgrid has a complex arrangement that allows for temporary connection at 330kV and subsequent upgrading to 500kV. Coordination of the works including outages will be complex, and impacted by the timing of the PEC enhancement works. Whilst this could be considered to be mitigated within project controls, and therefore catered for within Transgrid owners cost, the performance of un-related contractors including the OEMs is outside of the contractual relationship with HumeLink contractors for mitigation of project delay, should the risk event arise.

338. We understand that the works at Maragle has been somewhat de-risked by using contractors already present at these sites for other works. We are satisfied with the explanations provided to us that this risk is reasonable to include. The assumed substation delay of 4 months based on a 60% likelihood of a PEC driven delay at Wagga, suggests to us that the existing mitigation measures are not considered effective, and once included may result in a lower resultant risk-cost.

Risk of changes to baseline conditions is reasonable

339. Transgrid has included a risk that changes to the Conditions of Approval from the baseline conditions are more onerous, Risk ID 59.

340. Transgrid has based the assessment of the risk on changes requiring field work to advise existing studies / reports, and the resulting approval time resulting in an overall 1-month delay. Transgrid estimates the likelihood as 50%, due to the more sensitive areas HumeLink is transversing that additional conditions will be placed on the project relative to PEC which was used as the source of the baseline conditions.

341. We consider inclusion of this risk is reasonable.

Risk of change in footing designs has already been realised

342. Transgrid has included provision for increase in costs associated with tower footings with Geotechnical conditions being substantially different from the conditions expected following investigation works, and which leads to an increase in costs identified as Risk ID 65. This is an adjustment event under the contract.

343. Whilst we would expect that this risk should be symmetric, we understand that the geotechnical information provided to contractors, and which was used as the basis of the tendered works, was considered preliminary. Transgrid is currently undertaking review of the footing designs based on investigation works being undertaken by the contractor. Transgrid's assessment of preliminary footing designs and limited information provided to contractors suggest a cost increase above the base case estimate is certain.[114]

344. In discussions during our onsite meeting, Transgrid stated that it considers that this risk had already been realised as a result of geotechnical information and assumptions being updated since issued at time of ECI.

345. This is an acceptable risk for inclusion.

[114] Refer Transgrid project risk artefacts see ID65.2 to ID65.6.

4.5 Implications for proposed cost

Transgrid has not taken sufficient account of interdependencies in its modelling approach

346. We consider that the Monte Carlo simulation methodology that Transgrid has utilised, and the process by which it has sought to identify and to quantify individual risks and their associated costs, is reasonable. However, many of the proposed risks and uncertainties for which Transgrid has claimed a risk-cost allowance are not independent and, because of the influence of compounding uncertainty factors, the aggregate risk-cost is more likely than not to result in an overstatement of requirements. In our assessment, we found evidence of:

- assumptions for time delay and cost that have been applied by Transgrid that are overstated due to the ability to effect mitigations for the identified risk; and
- risk and contingency allowances included where provision was included or is expected to be already included in the target cost.

347. However, we also cannot rule-out additional risks eventuating, and our assessment should not be read as forming a definitive position on the exact risks and contingencies that may be incurred by the project. Rather, Transgrid has not demonstrated that what it has proposed is resulting in a prudent and efficient aggregate forecast.

Application of Transgrid's methodology results in an overstated risk-cost allowance

348. We have considered the reasonableness of the inputs and assumptions underlying each individual risk item proposed by Transgrid and find evidence that many of the risks considered by Transgrid are reasonable and reflect identification of risk events and uncertainty consistent with good practice. However, we have also identified some specific risk-cost allowances that should not be included in a regulatory allowance, or which overstate the likelihood and/or cost impact of specific project risks. We base this assessment on AER guidance, recent AER decisions, consideration of the ITC model that Transgrid has adopted including risk and contingency provisions in those contracts, and on industry good practice.

349. To complement our bottom-up assessment we also considered the proposed risk-cost allowance from other metrics, including:

- adoption of a P50 probabilistic assessment, rather than the P70 estimate that Transgrid has proposed;
- deficiencies in the extent to which interdependencies and interactions between risks have been accounted for, including opportunities for risk and cost mitigation and cost efficiencies;
- consideration of risk-cost allowance as a percentage of the total project cost; and
- consideration of risk-cost allowance in context of other proposed costs.

350. Importantly, adoption of a risk-cost allowance on a P70 basis is higher than a prudent level for regulatory purposes. It overstates the expected risk-cost and is not consistent with recent AER decisions.

351. Based on the other metrics we have reviewed, a higher risk-cost allowance relative to prior projects is reasonable. However, in considering this higher risk-cost allowance we have also considered the higher level of labour and indirect costs that Transgrid has proposed, in part, to assist evaluate and mitigate potential cost increases associated with claims, and which give rise to some of the identified risk-costs. In these instances, we consider that it is not reasonable to propose a higher owner's cost and also to retain the proposed level of risk-cost.

Consequential time delays identified in the risk-cost allowance are similarly overstated, but are not necessarily additive

352. We have focussed our assessment of the risk-cost allowance on the reasonableness of the proposed risks, and associated cost allowances. We comment more generally on the time delay in section 3 of this report.

353. Transgrid has used time delays as the basis for estimating the risk-costs for 38 of the included 74 risks, which results in a probabilistic estimate of time delay for 36 risks.[115] On a P50 deterministic basis, this totals over 473 days and is higher than its stated "Time" risk category of 261 days. There are similar differences to the P70 risk-cost which varies from $288 million to the lower value of $272 million, related to its "Time" risk category.

354. We consider that the probabilistic time delay (in days) and the P50 deterministic value are both likely to overstate the actual time delay. We consider these values do not adequately account for delays that may be concurrent, or that may be mitigated by other contingent provisions or by rescheduling or re-prioritisation of works. This is despite the possibility that the risk event may incur additional costs (or that the contractor is entitled to a contractual provision for cost relief).

355. Transgrid presents its risk-cost analysis as being the outcome of its Monte Carlo analysis, and the issues we have identified in relation to the costs as an outcome of this analysis (including use of the P70 rather than a P50 value) are also relevant to consideration of any assessment of time delays. We also note that the "Time" risk category is a subset of the risks where time delay is used as the basis of the estimate of risk-cost.

356. For the reasons stated above, we consider that the addition of the time delay estimates used in the risk register is unlikely to result in an accurate assessment of the likely time delay for the project overall.

Adjustment for the issues we have identified results in an estimated risk-cost allowance scenario that is approximately 40% lower than Transgrid has proposed

357. We estimate a risk-cost allowance scenario after adjusting for the issues we have identified in this section, which indicates a 40% lower allowance than Transgrid has proposed, when calculated from the values that Transgrid provided to align with its 'P70' probabilistic aggregate risk-cost allowance.

358. We provide a summary of our assessment in Table 4.6 below, and the results of our assessment for each of the top 25 risks in Appendix B of this report.

Table 4.6: Results of our assessment based on Transgrid's proposed risk-cost allowance using P70

Assessment	Proposed by Transgrid	Proposed adjustment
Assume retained	230.3	0.0
Assume removed	197.9	-197.9
Assume overstated	129.6	-25.9
Sub-total (assessed risks)	**557.7**	**-223.8**
Percentage of total		***-40%***
Out of scope	41.4	
Total Risk cost allowance (P70)	**599.1**	

Source: EMCa analysis of 'HumeLink CPA2 - ECI Cumulative Risk Model and QRA Register'

359. These results do not consider the coincident and correlation factors that we understand have been modelled by Transgrid in its Monte Carlo analysis. We therefore assisted in

[115] Risk ID49 and Risk ID5 have used time delay as the basis of the estimate, however, do not include a P50 time delay estimate in days.

defining a scenario that correlated with our assessment, and which AER then requested Transgrid to model. We report Transgrid's advice on this scenario below.

Application of a risk-cost allowance on a P50 basis[116]

360. The risk-cost allowance should be the expected value on a P50 basis, rather than the value that Transgrid has proposed and which it estimates to have a 70% probability of achieving. For the same set of individual risk-costs that it has proposed in its CPA2 submission, Transgrid has provided a P50 estimate of $521 million.

361. An aggregate risk-cost estimate with an 'alternative' set of risks included, can be determined by making use of Transgrid's Monte Carlo modelling, and which therefore ensures that other factors remain as Transgrid has proposed. The AER asked Transgrid to determine such an alternative, providing Transgrid with input assumptions that align with the findings presented in this section.

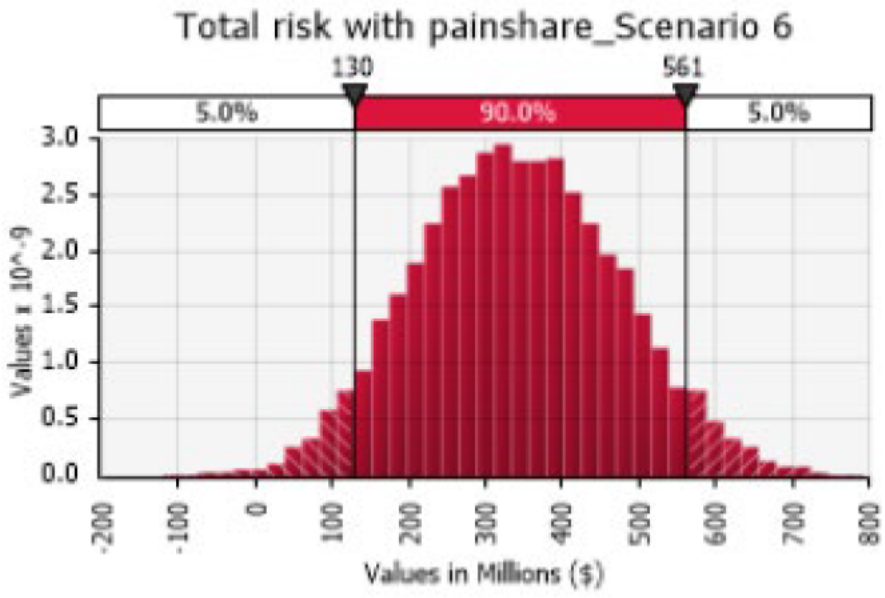
362. Transgrid's response is shown in Table 4.7, and is illustrated by the probability distribution shown in Figure 4.9.

Table 4.7: Estimate of risk-cost allowance, with alternative scenario as defined in this report

Probability of exceedance	Risk-cost ($m)
P10	173
P30	270
P50	339
P70	412
P90	512

Source: Transgrid response to IR06, scenario 6 (sheet 'Total w Painshare_Scenario 6)

Figure 4.9: Probability distribution for risk-cost allowance, with alternative scenario as defined in this report



Source: Transgrid response to IR06, scenario 6 (sheet 'Total w Painshare_Scenario 6)

116 The information presented in this section is from Transgrid's response to IR06, including the Excel workbook provided.

363. Using Transgrid's calculation of an alternative estimate based on our findings, would result in a P50 aggregate project cost of $4,632 million.[117] This corresponds to a risk cost allowance of 7.9% of the aggregate cost, being higher than the benchmarks shown in Table 4.4. We consider that a higher risk-cost allowance around this level is consistent with the higher risk that Transgrid has retained, and against which it claims to have achieved lower base contract costs.[118]

Claims by Transgrid arising from scenario analysis are not adequately supported

364. In response to the AER's request to complete a range of scenarios using the P50 estimates, Transgrid states that it:

> *'maintains that the contingency requirement of $599 million is critical for ensuring the successful delivery of HumeLink project, aligning with AEMO's ISP program and within the context of the current market challenges.'* [119]

365. As noted in section 3, we consider that adoption of an accelerated timeframe by Transgrid should not result in a higher cost to consumers, than would otherwise be the case. In its response, Transgrid refers to risks that it describes as being 'in motion' and indicative estimates from its contractors for 'non-linear' delays to the project totalling [redacted] based on a 9-month delay. Transgrid presents this information as evidence to approve the risk-cost allowance as it has proposed and states that it is considering re-submission of CPA2. Transgrid has not provided sufficient information to consider the basis for these additional costs, over and above what is proposed in its CPA2 submission, and we have necessarily reviewed only the CPA2 submission that Transgrid has provided to the AER.

366. In the same response, Transgrid refers to a 3-month delay to obtaining planning approval as currently being mitigated by the Project Team and which is consistent with what we heard during our onsite discussions. This is as we would expect. Accordingly, we have looked at the proposed CPA2 cost allowance in its entirety and have considered the proposed 'Other Construction Cost' allowance in accordance with AER guidance and regulatory precedents in order to advise an indicative prudent total regulatory cost allowance for the project.

Delays to Financial Investment Decision (FID) or funding should not be a cost incurred by consumers

367. Delays that may be experienced by Transgrid, including for FID and funding approval, and which result in a risk for delay and cost claims from the contractors need to be considered in the context of other planning and approval related risks that result in cost and time delay claims. Any such costs appear to be a result of Transgrid's decisions to accelerate the program, and our interpretation is that they would not be considered to be prudently incurred costs consistent with AER guidance.

368. During the onsite meeting discussions, Transgrid stated that it expects that NTP2 will follow directly from EIS approval, and that no further delays are anticipated. We would expect that Transgrid would ensure there is no further delay to funding approval.

Implied project time delays are less than Transgrid has assumed

369. Without access to the time-dependency relationships that Transgrid has relied upon in its Monte Carlo assessment, we are not able to assess the implied timeline for the project that is consistent with our assessment of the proposed risk-cost allowance. Not all risk-costs are timing related, although the majority of those that we consider should not be allowed, are timing related.

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117 $4,892 million total project cost, less $599 million risk-cost as proposed, plus $339 million alternate P50 risk-cost = $4,632 million.

118 This calculation does not account for any positive or negative adjustments that may be made to items that were not included within our scope or review

119 Transgrid's response to IR006, Question 1.

370. For the reasons that we have outlined in section 3, the assumed project delivery timeline should be consistent with the risk-cost allowance. We are not able to confirm a revised time delay estimate from the alternative scenario provided by Transgrid however it further supports our view that Transgrid has not sufficiently considered realistic project timing in its analysis, and specifically to support delivery of the project by the July/December 2026 delivery dates as proposed. This would also imply that some re-profiling of the allowed expenditure may be required.

5 REVIEW TOPIC 3: PROPOSED LABOUR AND INDIRECT COSTS

Transgrid has included an allowance of $205 million for its own labour resources and $203 million for indirect costs to deliver the project. These allowances are for project management resources and for a range of insourced and outsourced technical and other specialist resources.

The novel contracting and collaborative arrangements embodied in Transgrid's commercial model for this project require a higher level of technical and other specialist resourcing compared with recent projects, to ensure adequate contract governance and risk management. Our review of good practice and advice that Transgrid has relied on all recognise higher owner's costs, included as a labour and indirect cost allowance for HumeLink, in delivering megaprojects using the Incentivised Target Cost (ITC) commercial model that Transgrid has adopted.

Higher owner's costs should be directed at ensuring efficient overall delivery costs, including mitigation of identified risks. The intention, and Transgrid's claim, is that the higher owner's costs, when considered alongside the risk provisions and construction costs, deliver the project at a lower overall cost compared with other delivery models.

We consider the proposed capex allowance for labour and indirect costs reflects a reasonable estimate of the cost of delivering the HumeLink project for the purposes of the CPA2 submission. However, as we noted in section 4, Transgrid has proposed a significant risk-cost allowance that does not reflect the risk management and risk mitigation outcomes that should be achievable from the high level of project management and specialist resources that it has allowed for, especially under an incentivised contracting model. We consider that there is an element of double-counting in allowing for a higher labour and indirect cost allowance than under a standard contracting model, and also a significantly higher risk-cost allowance and this contributes to our finding in section 4 that Transgrid's proposed risk-cost allowance is overstated.

Further, components of Transgrid's proposed risk-cost allowance are to allow for what is in effect a risk-cost premium on its own labour and indirect costs. As discussed in section 4, we consider that this is not justified and that Transgrid should be able to manage its own resources within the labour and indirect cost allowance that it has proposed.

As we have noted in section 3, Transgrid's proposed cost allowance assumes project delays relative to its stated July/December 2026 delivery targets. As with other components of its proposed CPA2 allowance, the profile of Transgrid's proposed labour and indirect costs is based on its delivery target timeline and is therefore not consistent with the delayed timeline implied by its proposed risk-cost allowance. We consider it likely that the labour and indirect costs profile will be prolonged relative to what Transgrid has proposed, but that Transgrid should be able to profile its resource utilisation accordingly.

5.1 Introduction

371. In this section we present our assessment of the proposed labour and indirect costs that Transgrid has proposed for inclusion into its CPA2 capex forecast for HumeLink.

372. As we have noted in section 4, there is an inter-relationship between these costs and Transgrid's proposed risk-cost allowance, which includes risk-costs related to labour and indirect costs. We address the risk-cost element of labour and indirect costs in section 4. Our assessment in the current section is for the 'base' amount only but therefore needs to be read in conjunction with our assessment in section 4.

5.2 What Transgrid has proposed

5.2.1 Labour and indirect cost overview

373. Transgrid has provided document *A.3 Labour and indirect forecasting methodology*, which is the principal source material for our review.

374. Transgrid has proposed a labour and indirect capex allowance of $407.1 million comprising:

- $204.7 million for labour related to internal resource requirements, and
- $202.5 million for indirect non-labour capex, relating to a wide range of professional and consulting services, as well as tender payments and associated facilities costs.

375. The proposed cost is further separated into six streams as shown Table 5.1.

Table 5.1: Labour and indirect cost streams

Stream	Description	Cost estimate ($m)
Commercial, project management and project controls	Costs relating to labour and related costs for commercial oversight of the D&C contracts and LLE as well as project management and oversight required to successfully achieve the Projects' objectives. The activities include integration management, governance, cost control and risk management and mitigations.	80.1
Community Stakeholder and Engagement (CSE)	Costs relating to labour and related costs to consult with the community and our stakeholders about the Project. The activities will be guided by our HumeLink Engagement Strategy. CSE activities are crucial to gain and maintain our social licence, undertake media and communications management, deliver community partnership programs and lead the community strategy and activities.	37.9
Land and property	Costs relating to the labour and related costs required to process the compulsory acquisitions, negotiate landowner settlements, settle disputes and ensure ongoing compliance with option deed terms.	8.1
Design and construction	Costs relating to the labour and related costs needed to manage contractor design as well as pre-construction and construction activities. These activities include on site investigations, assessing claims and site supervision. Indirect costs include heavy haulage, road remediation and drone technology investment	97.7
Corporate support	Costs relating to HSE, regulatory, insurance and legal functions. Key activities include safety and environmental project assurance, obtaining environmental planning approvals, legal advice in relation to environmental, property, commercial matters and disputes and insurance coverage for construction risk up to commissioning	142.2

Stream	Description	Cost estimate ($m)
Major projects initiatives	Costs relating to labour supporting our PTT program, which been established to accelerate the delivery of transmission infrastructure and reduce costs through economies of scale and scope.	41.2
Total		**407.1**

Source: Submission document 'A.1 HumeLink - Stage 2 (Delivery) - Contingent Project Application - Principal application document', page 56

5.2.2 Forecast labour cost

376. Transgrid describes the proposed Stage 2 labour and indirect capex by workstream, as comprising:[120]

- $143.3 million (or approximately 35 per cent) for labour and labour-related costs
- $263.9 million (or approximately 65 per cent) for indirect costs.

377. In aggregate, as shown in Table 2.1, Transgrid includes $61.4 million for the proportion of labour and labour-related costs associated with its indirect costs in its labour costs, bringing the total to 204.7 million, and reducing the indirect cost total accordingly.

378. The forecast labour capex is based on a bottom-up build of costs from 1 July 2023 to 30 April 2027. The labour resource requirements for Stage 2 are:

- Internal labour comprising 574 roles or 121.80 FTEs;
- Outsourced contractors comprising 33 roles or 7.83 FTEs.

379. The proposed labour cost is separated into the six streams as shown in Table 5.2.

Table 5.2: Summary of roles, FTE and outsourced labour by sub-category

	Internal labour			Outsourced labour			Direct labour related	TOTAL Capex
Sub-cat.	*No. of roles*	*Avg FTE*	**Capex ($m)**	No. of roles	Avg FTE	**Capex ($m)**	**Capex ($m)**	($m)
Commercial, project mgt and project controls	*89*	*31.5*	**31.2**				**0.9**	**32.1**
Corporate support	*21*	*9.35*	**12.3**				**0.9**	**13.2**
Community, stakeholders and engagement	*50*	*15.6*	**15.5**				**0.1**	**15.6**
Land and property	*34*	*5.9*	**5.5**				**0.2**	**5.6**
Project design and construction	*187*	*46.4*	**47.0**	*33.0*	*7.8*	**9.0**	**7.3**	**63.3**
Major project initiatives	*193*	*13.1*	**13.4**				**0.1**	**13.5**
Total	*574*	*121.8*	**124.7**	*33.0*	*7.8*	**9.0**	**9.6**	**143.3**

Source: Submission document 'A.3 Labour and Indirect Capex Forecasting Methodology', table 3-1

120 Submission document 'A.3 Labour and Indirect Capex Forecasting Methodology', page 6

5.3 Transgrid's management of its labour and indirect costs

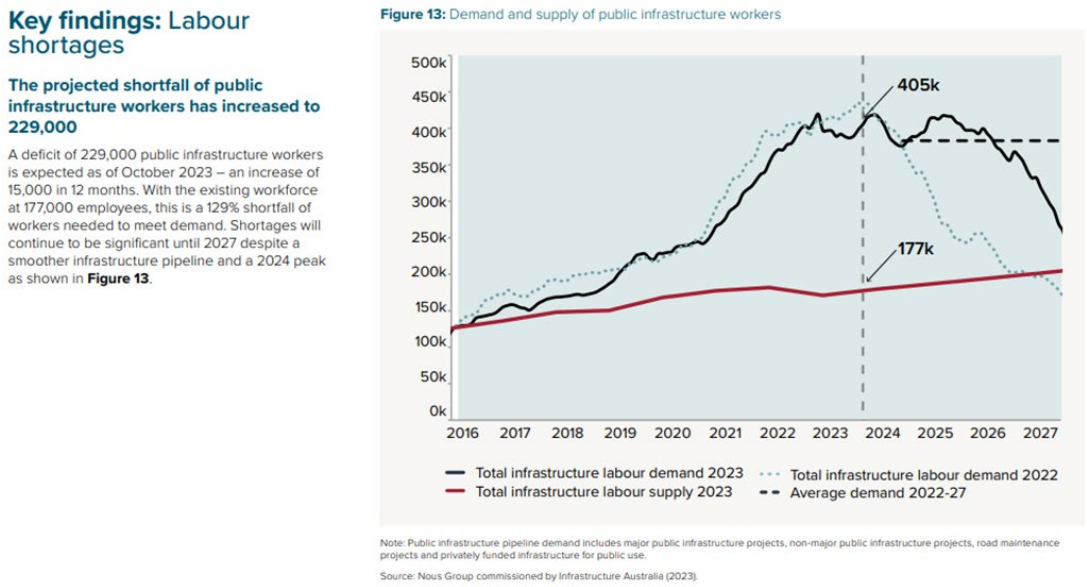
5.3.1 Impact of current market conditions

380. There has been a recent boom in infrastructure projects in Australia, extending beyond the electricity infrastructure sector and placing pressure on the supply of local resources including skilled labour. In terms of the forecast period, key insights from the most recent Infrastructure Market Capacity 2023 Report include:

> *'Whilst demand is softening overall, energy sector demand continues to grow rapidly in response to the energy transition. Labour remains the top capacity constraint, indicating longer-term structural barriers'* [121]

381. Accordingly, we consider that the resourcing strategy is a critical ingredient for project success. The outlook for labour shortages as published in the Infrastructure Market Capacity 2023 Report is provided in Figure 5.1 below.

Figure 5.1: Market conditions highlighting labour shortages



Source: Infrastructure Market Capacity 2023 Report, Infrastructure Australia

382. In its CPA2, Transgrid similarly refers to strong demand for labour in the development of its resource plan, citing Infrastructure Partnerships Australia (IPA):

> *'The IPA forecasts that the infrastructure labour force in NSW will be required to grow by 56 per cent by 2024 to deliver the pipeline of infrastructure projects across NSW and Australia.* [122]

383. Access to and retention of labour to deliver mega projects remains a challenge and has been a focus of our review of the CPA2 submission.

5.3.2 Resource management plan

384. Transgrid has provided a resource management plan dated May 2023. The plan considers the central elements of a robust plan, that considers the need, timing and assumptions to

121 https://www.infrastructureaustralia.gov.au/sites/default/files/2023-12/IA23_Market%20Capacity%20Report.pdf

122 A.1_Humelink CPA-2_Principal Application, Transgrid, 21 December 2023, page 50

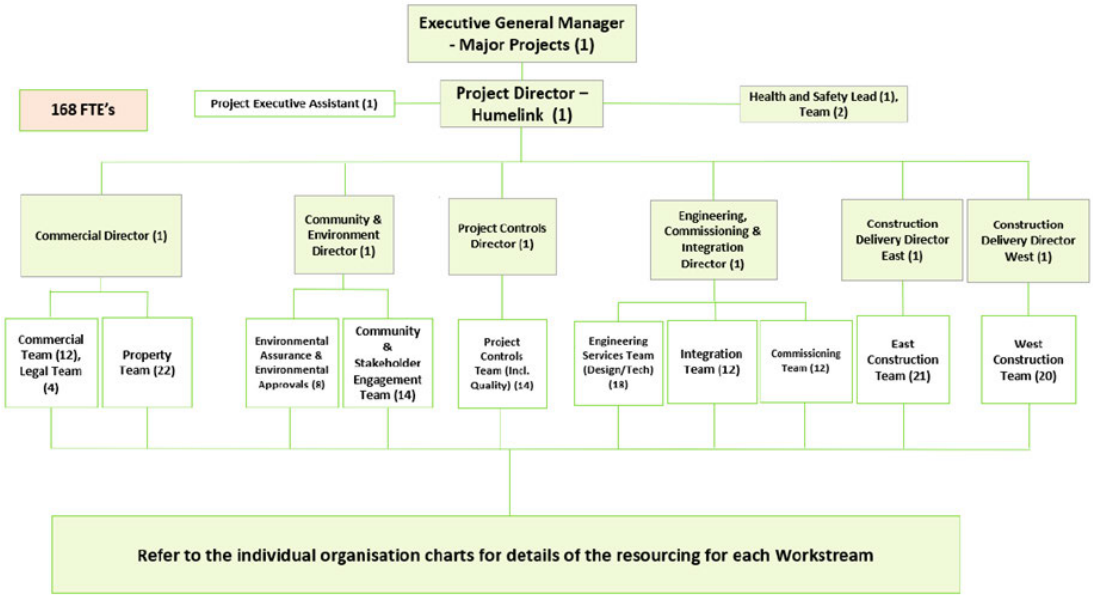
meet project success, and resourcing considerations to ensure efficient on-boarding of the requisite skills.

385. We observe differences in the detail of the number of FTEs, duration and staging between the resource management plan and the labour assumptions included in CPA2 and which we infer is due to timing differences in this material. We have relied on the information provided in the CPA2 submission, that supports the labour and indirect capex forecast.

Project organisation is reasonable

386. The resource management plan includes the organisation chart and summary of positions included in Figure 5.2 below.

Figure 5.2: Organisation chart



Source: Submission document 'HumeLink Resource Management Plan', Appendix A

Comparison of benchmark projects supports Transgrid's proposal

387. In its Resource management plan Transgrid has provided a comparison of benchmark projects, including a percentage of owner's cost that ranges from 8% to 17%, with HumeLink at 11.9%[123]. After adjusting for updated costs, the owner's cost as a percentage of the total cost is now 8%.

388. An applicable rule-of-thumb in construction is the larger the project, the smaller the labour and indirect costs for delivering the project should be as a percentage of the total project cost; this is because larger projects can spread fixed overhead costs over a larger capital base. However, this does not account for differences in project delivery, that may result in shifting provisions (e.g. risk) between the contracted cost and the owner. Reference projects can therefore only be used as a guide.

389. We observe that HumeLink is at the lower end of Transgrid's own analysis, despite the increase in owner's cost and total project cost relative to when its analysis was undertaken.

390. We have seen evidence of increases to the labour and indirect assumptions, such as those included in table 16 of Appendix G, that reflect Transgrid's learnings from PEC incorporated into HumeLink as summarised in Table 5.3 below.

123 Transgrid, Resource Management Plan, Appendix G, table 16. This is based on an owners cost of $321.7 million and total construction cost of $2.7 billion.

Table 5.3: Key learning outcomes

Key learnings	
Rates are not aligned to current market trend	• Market is very competitive. • Competitive rates are required to attract capable talent
Interface management role upfront	• Identifies and escalates interface issues ahead of time. • Ensures issues are promptly and effectively addressed. • Helps avoid project delays
"Lean Client" model management structure	• PEC implemented a single EPC contracting approach. – High performance reliance on EPC contractor • HumeLink to implement "active client" model management. – Owners Management Team oversees project. – Ensures delivery partners achieve milestones and deadlines. – Allows issues to be resolved quickly
Commercial / Legal expertise too light to respond to complex commercial and legal issues	• PEC commercial team was under-resourced. • HumeLink to ensure commercial team is adequately resourced
Health & safety team too light to respond to project issues	• HumeLink to ensure safety team is adequately resourced.
Increase site presence by senior management	• Improves understanding of operations • Improves communication. • Increases morale. • Identifies potential risks

Source: Submission document 'HumeLink Resource Management Plan', Appendix G table 18

391. Whilst we have not done a review of each resource type, we consider that the in-principal differences that Transgrid has identified between HumeLink and other comparator projects, including PEC, appear reasonable.

Labour cost assumptions are largely maintained

392. Transgrid has stated that its forecasting method is consistent with the methodology applied in its previous applications for HumeLink Stage 1 and its WSB (non-contestable) Revenue Proposal.[124] On review of the AER's determination for that project, the AER accepted the labour and indirect cost forecast proposed by Transgrid.

393. Transgrid has assumed that 70% of its forecast labour and labour related costs are direct, which AER stated was consistent with Transgrid's historical allocation of capitalised labour and labour related costs. AER found that Transgrid's forecasting method, consistent with prior decisions for HumeLink was reasonable.[125] No changes were applied for labour in its final decision.

394. We note that in the review of PEC, Transgrid had assumed that 65% of its forecast labour and labour related costs are direct.

395. We find that the forecasting method is consistent with CPA1, other than a 0.5% increment to superannuation which flows into increased on-costs.

124 We understand that this refers to the Waratah Super Battery

125 AER - Transgrid 2024-29 - Draft Decision - Waratah Super Battery project (Non-contestable) - September 2023_1.pdf

5.3.3 Resource management profile

Recruitment strategy appears sound

396. A project of the scale, complexity, profile and duration of HumeLink requires specialist expertise to manage it through the development and delivery phase and it is unlikely that Transgrid has the personnel currently on staff with the requisite skills to successfully undertake all critical project management roles.

397. We asked Transgrid to provide details as to how Transgrid plans to resource this requirement. Transgrid states that it is currently actively recruiting in the market and pursuing internal promotions and development opportunities from the BAU programs as a feeder to HumeLink. Internal recruitment will be supplemented from its Service Partner Panel (SPP) resourcing strategy which is a program level strategy (through the Major Projects Portfolio) comprising:

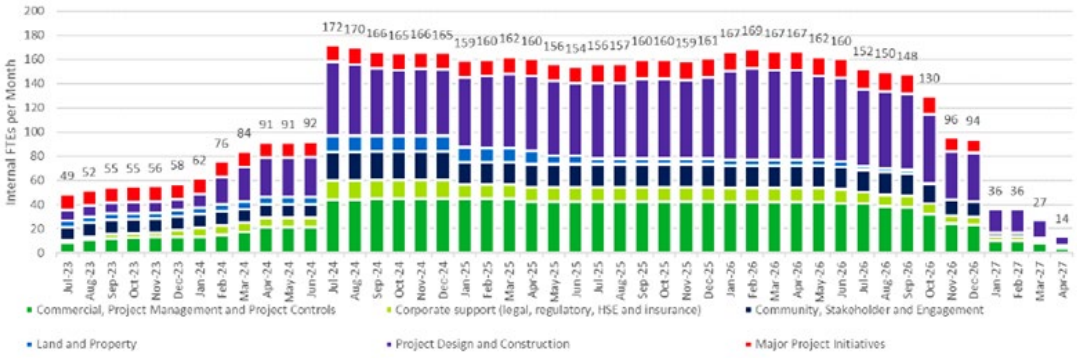
- the SPP Service Partners;
- Transgrid directly engaged personnel; and
- other specialist contractors from external organisations will supplement the project team on an as-required basis.

398. We consider that the additional recruitment avenues developed by Transgrid are likely to assist with meeting the recruitment needs for HumeLink and provide flexibility for changes in prioritisation or mobilisation/de-mobilisation of phases of the project.

Overall, once CPA1 and CPA2 are considered together, the resource profile looks reasonable

399. Transgrid provided the resource profile for its CPA2 submission as shown in Figure 5.3 below.

Figure 5.3: HumeLink - Forecast monthly FTEs (1 July 2023 to 30 April 2027)



Source: Submission document 'A.3 Labour and Indirect Capex Forecasting Methodology', figure 2-2

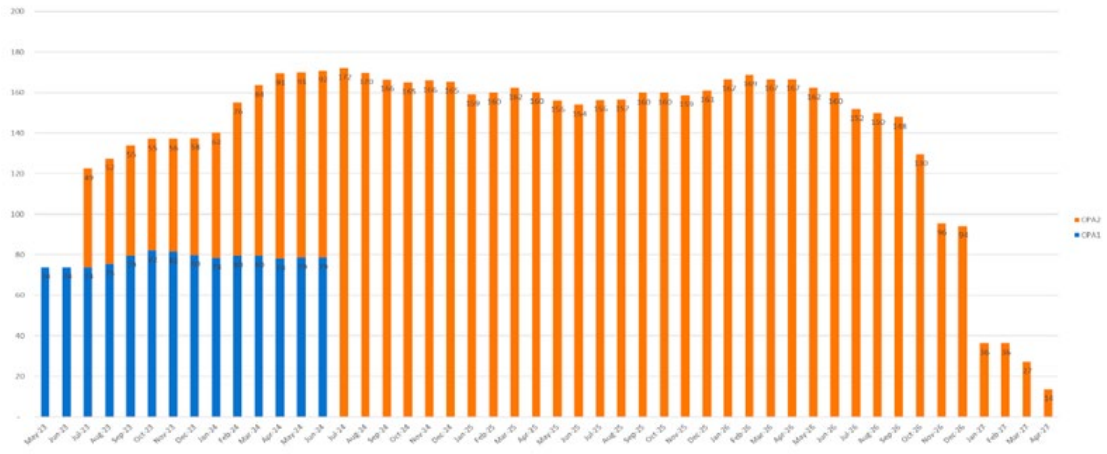
400. The labour profile shows a large step-increase in forecasted labour commencing in July 24, which coincides with the proposed commencement of CPA2. In absence of better information, this step-up in resourcing seems implausible.

401. We asked for clarification from Transgrid, and strategies in place to explain this profile and to achieve the proposed increase.

402. Transgrid advised, that this chart was not an accurate representation clarifying that the step up from 92 FTEs in Jun-24 to 172 FTE in Jul-24 relates to existing FTE resources allocated to CPA1. Transgrid advised that the hiring process for Stage 2 has commenced with 20+ FTEs to be hired by end of FY24. In addition, a key focus is to utilise the SPP to accelerate hiring of resources.

403. To illustrate this, Transgrid provided the diagram in Figure 5.4, which shows Stage 1 resourcing (blue) in conjunction with Stage 2 resourcing (orange).

Figure 5.4: Resource profile (CPA1 and CPA2)



Source: Transgrid presentation to AER and EMCa 'AER EMCa CPA2 Review - Major Project – HumeLink', 15 March 2024, slide 71

404. This profile more closely matches the profile provided in the resource management plan. Based on this updated profile, we observe the step increase evident in Jul-23 and again in Feb-24. We reviewed the models provided by Transgrid and confirmed that the representation of this profile is consistent with its submission which similarly shows Stage 2 expenditure commencing in 2023/24[126] and Stage 1 labour expenditure ceasing from the beginning of 2024/25[127]. .

Resourcing changes between CPA1 and CPA2 support the program included in the submission

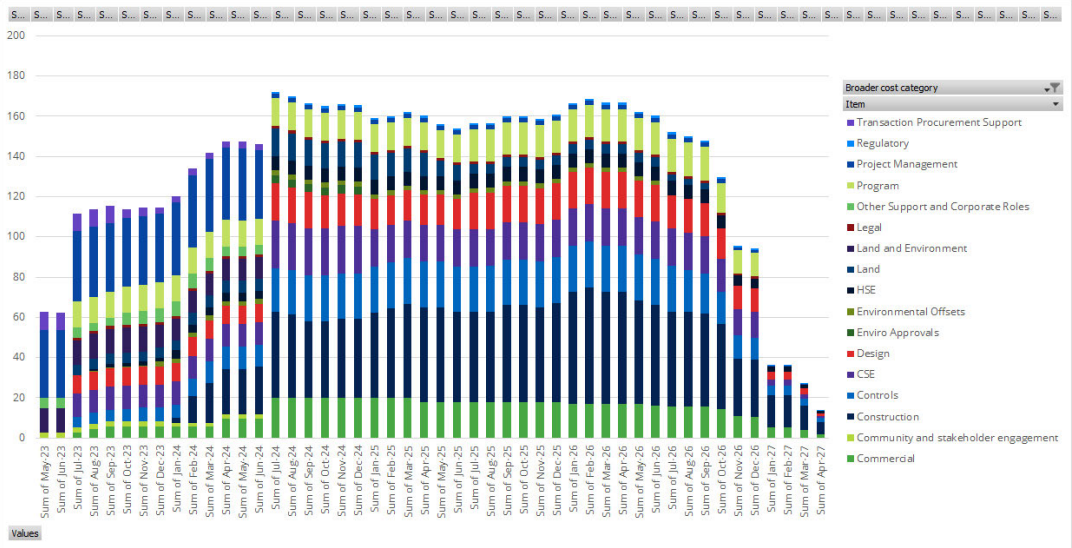
405. The proposed labour and indirect capex for CPA2 includes $42.7 million for historical labour and indirect capex that Transgrid has or intends to incur during the 2023-24 financial year.

406. In absence of a consolidated resource chart from Transgrid, to better understand the changes to the resourcing, we stitched together the labour and indirect model provided with CPA1 and the equivalent model in CPA2 to derive the overall resource profile as shown in Figure 5.5 below. The resultant profile follows a similar shape. In doing so we noticed that Transgrid had re-classified several of its cost categories, which complicated our review across the two CPA submissions.

126 $43 million, as shown in Table 2.1

127 Transgrid's response to IR05, Question 7 a to d, workbook *PCR0.9 Q7 forecast stage 1 CONFIDENTIAL*

Figure 5.5: Estimated FTEs – CPA1 and CPA2



Source: EMCa analysis of estimated resources provided at CPA1 and CPA2

407. We find that the increases evident in 2023 and again in 2024 are generally consistent with Transgrid's proposed program of key milestones, the commencement of the delivery contract, and resultant activities as it has proposed. The largest change in resources at the time of July 2024 coincides with Transgrid's CPA2 assumed timing of NTP2 and appears to be an increase in Transgrid's construction-related resources. However, as we have discussed in section 3, this timing is no longer valid, and Transgrid has provided information showing that its current FTE level is below that shown in its CPA2 submission and based on a revised forecast, is not required to 'step up' in July 2024 to the extent shown.

408. While noting the change in profile, we have sought to assess the aggregate labour and indirect cost allowance that Transgrid has proposed, noting that we have considered timing implications in section 3 and the extent to which timing delays affect labour and indirect costs in our review of risk-costs, in section 4.

The proposed resource profile over time will differ as a consequence of an 'accelerated' program and delayed start

409. As discussed in section 3, Transgrid is experiencing a delay to its program driven by delays that it has incurred in Stage 1 and by a delay to EIS approval being a condition precedent to NTP2. During the onsite discussion Transgrid informed us that it had already sought to mitigate the impact of approval delays by prudently deferring recruitment.

410. With regard to labour resource planning, we asked Transgrid to provide the total FTEs as at the end of February 2024 for the HumeLink project versus the estimate included in CPA2, for Stage 1 and separately for Stage 2.

411. In its response,[128] Transgrid stated that as at February 2024, there are 33.3 fewer internal labour and contract FTEs compared for forecast for Stage 1 (Part 1) and Stage 2. Transgrid explains the variation as being due to the following factors:

- *'Slower ramp up of resources to original estimate due to delayed funding timeline.*
- *The slower ramp up over the last few months has been supplemented by contracted labour to progress activities.*
- *We have been adverstising [sic] and recruiting for varoius [sic] roles, and these will continue to ramp up our FTEs from March to June-24.*
- *We have the expectation that after April-24, following AER determination, our current recruitment plan will be even more aggressive and we will fill a large number of roles in*

128 Transgrid's response to IR05, question 24.

readiness for our construction program. We will use our Stratgeic [sic] Partner Panel from the PTT group to agressively [sic] fill these positions.

- *We forecast to bridge the gap through additional contracted labour to mitigate delays, especially for CEMP approvals.*
- *Since the estimate we have further lessons from the most recent experience on PEC, and hence have added a few extra required roles for health, safety and environmental management during the construction program.'*

412. We have not relied on the analysis that Transgrid provided of the estimated roles for CPA1 and CPA2 as we found it did not reconcile with the information we had from other sources. We consider this is most likely due to Transgrid's decision to include only roles that 'directly' contribute to the HumeLink project in its response and to ignore some 'part' roles provided from other parts of the business.

413. As noted in an earlier section of this report, however, Transgrid's lower level of labour resourcing is somewhat offset by an increase in indirect, external service costs. This provides evidence of Transgrid's ability to manage its resource profile to meet the needs of the project. As noted in section 2 of this report, Transgrid is not forecasting overspend in CPA1, however it is more likely that any variance to CPA1 will be offset by a commensurate variance to the resource profile during CPA2.

414. Whilst in aggregate the required resourcing is considered reasonable, the profile of resourcing over time may differ from the program as proposed by Transgrid, depending on the project timeline.

5.4 Consideration of specific cost items

415. We queried the basis of a number of the large cost items included in both the labour and indirect cost categories. We are generally satisfied with the responses provided by Transgrid that the costs are based on a reasonable methodology and reasonable cost estimates that where possible are drawn from internal systems or market tested processes. However, there are exceptions, which we highlight below.

Adoption of commercial model has implications for higher labour and indirect cost

416. Our review and findings of Transgrid's proposed labour and indirect capex also considered the interaction between Transgrid's costs and contractor costs in executing the HumeLink project under an ITC D&C contract model, and our findings relative to those areas of our review.

417. Given the novel contracting and collaborative arrangements included in the ITC model and the need for close supervision and monitoring, there is benefit for Transgrid to invest in building capability. Transgrid has also recognised the need for improvements relative to its delivery of PEC project, noting the different contracting model, and which have been adopted for the HumeLink project.

Higher commercial and project management costs are expected

418. From Table 5.2, approximately 20% of Transgrid's forecast labour and indirect costs are for commercial, project management and project controls. Based on our review of benchmarks provided for recent projects,[129] the proposed cost is higher than those benchmarks. We consider that this is associated with the higher requirements of commercial and projects controls required of a collaborative contracting model relative to an EPC model, and which make up a large proportion of these costs.

419. The perfect storm of un-precedented mega project delivery, uncertain market conditions (including for labour) and application of a new commercial model for the HumeLink project

[129] Including GHD's benchmarking assessment indicates that Transgrid's forecast project management costs as a percentage of total project costs for WSB (11.3%) aligns with comparative projects such as the QNI contingent project (11.4%).

are more likely than not to require a higher level of supervisory and management support systems and capability, and which increases the cost estimate relative to other projects for these functions.

Major projects related initiatives apply an additional overhead to delivery costs

420. Transgrid has established a centralised Major Projects Portfolio team focused on delivering Major Projects-specific benefit to Transgrid's actionable ISP projects, including HumeLink. Transgrid states that the creation of this team recognises the complexity, risk profile and scale of ISP projects. We understand that it may be more effective and efficient to in-source this capability to be applied across multiple major projects, however this reflects an overhead to carry over the duration of the project delivery for each major project and appears at some level to duplicate the related internal and external advisory services that Transgrid has also included in its cost estimate.

Cost efficiencies do not appear to be included in the CPA2 aggregate estimate

421. We also do not see sufficient evidence of cost efficiencies being included in the project, that would normally be anticipated by the introduction of additional capabilities such as those being proposed by the major project initiatives relative to the counterfactual, including in the development of prudent risk-cost allowances.

422. Transgrid states that:

> *'A major component of the program savings is derived through the Incentive Target Cost (ITC) contracting model over the more traditional Engineering, Procurement and Construction (EPC) model. We note that the substantial savings to be gained by the ITC model have already been factored into the HumeLink costs.'* [130]

423. We have not seen explicit reference to how program savings have been factored into the proposed CPA2 capex forecast, other than those which remain 'potential' savings in the commercial model or incentives for delivery against the target cost. Transgrid has made reference to savings throughout its CPA2 submission, and which we consider have oblique references to HumeLink, with many of the benefits not clearly identifiable from the CPA1 or CPA2 submissions, and which we review separately in section 7.3.

Higher corporate support costs relative to comparison projects are explainable

424. We reviewed a number of the specific line items, including examples where the cost items appeared high. We are satisfied with the reasoning offered by Transgrid in these instances.

425. For example, corporate support costs total approximately 35% of total labour and indirect costs and are higher than the same benchmarks. However, we consider this primarily relates to the higher legal and insurance costs associated with HumeLink relative to the benchmark projects, and higher provision for safety and environmental project assurance.

5.5 Implications for proposed cost

The proposed cost and resource profile appears reasonable, if Transgrid's project timing was assumed

426. For the labour and indirect costs, we have reviewed the resource types and costs in Transgrid's model and by reference to the external advice. We also took account of Transgrid's own comparative analysis of similar sized contingent projects, adoption of learnings from its PEC project and discussion of drivers of movements in resources relative to earlier projects.

130 Transgrid response to IR05, question 26.

427. We were satisfied in Transgrid's responses as to the allocation of costs to HumeLink separate to other contingent projects.

The higher proposed cost for labour and indirect relative to other projects should lower the likelihood or consequence of some of the proposed risks

428. As noted in section 4, we accept the need for a relatively high level of labour and indirect resources in response to the commercial model that Transgrid has adopted for its principal design and construction contracts and the complexity of the HumeLink project. However, Transgrid has not only proposed the high level of labour and indirect resources described in this section but has also proposed a significant risk-cost allowance, much of which is for risk items that are within Transgrid's control. We would expect the proposed resources to be applied to manage these risks and, in accepting the proposed labour and indirect cost allowance as reasonable, we do not consider that an aggregate risk-cost allowance is warranted to the level that Transgrid has proposed for these items.

The cost profile is likely to be both deferred and prolonged

429. As we have discussed in section 3, the project is already delayed and Transgrid's probabilistic assessment is that it is likely to be prolonged relative to the target dates that its CPA2 submission is based on. Transgrid has already reflected these realities by deferring some of the planned increase in labour resources relative to its CPA2 profile, and the expected outcome of certain risks that it has accounted for will likely lead to a longer project construction phase.

430. As has been the case to date (including in Stage 1), prudent management of labour and indirect costs that reflects needs will reflect the timing of different aspects of the project. To the extent that this is delayed relative to Transgrid's CPA2 timeline, labour and indirect costs (in concert with all project costs) are likely to follow a similarly delayed and longer profile.

6 OUR REVIEW OF OTHER PROPOSED ALLOWANCES

Transgrid has proposed allowances of:

- $2,604 million for Tendered Works, which comprises the main design and construction packages for the principal works;
- $197 million for land and easement acquisition and associated costs; and
- $30 million for remaining LLE purchase, including storage and transport.

The information provided to us, which includes independent reviews, indicates that Transgrid has adopted a sound procurement process for its principal works and, accordingly, we consider that its proposed cost allowance is reasonable. The procurement process has placed significant emphasis on collaboration, based on adopting an ITC model that includes components of fixed and reimbursable costs.

In principle, the ITC model provides for flexible pricing and risk-sharing arrangements to accommodate changes and unforeseen circumstances and provides additional protections for the contractors. The adoption of this model is appropriate for the scope and complexity of HumeLink and is an emerging model for similar projects across Australia and internationally. Adoption of this model requires additional risk allocation to Transgrid, and which Transgrid claims has resulted in higher allowances for owner's risk and owner's cost. We review these claims, and the reasonableness of the proposed costs in section 4 and section 5 respectively.

However, the contractual agreements reached for the principal tendered work packages are based on project timing that is inconsistent with the delay assumptions that Transgrid's has applied in deriving its proposed owner's risk and which we have reviewed in sections 3 and 4. While we have not had access to the tendered works contracts themselves, there are indications in Transgrid's advice to us on risks and associated costs that this inconsistency may have resulted in an elevated cost exposure which has contributed to the level of risk-costs that Transgrid has proposed. We also found evidence of costs that have been included for Stage 2, that were included in the Stage 1 allowance, and which Transgrid has acknowledged to be an error.

We consider that Transgrid's proposed allowance for land and easement acquisition costs within Stage 2 is reasonable, as are the remaining costs for the procurement of LLE. Potential risks associated with the supply, transport and installation of LLE and remaining uncertainties for land and easement acquisition are allowed for in Transgrid's proposed risk-cost allowance, which we reviewed in section 4 .

6.1 Introduction

431. In this section we consider the proposed costs included in the CPA2 submission for:

- tendered works for design and construction;
- land and easement; and
- LLE.

6.2 Tendered works for design and construction

6.2.1 Introduction

432. In this section we present our observations on the tendered works for the contract design and construction proposed for inclusion in Transgrid's CPA2 capex forecast. We refer to the direct cost components of design and construction as 'Tendered Works'. In its CPA2 submission, Transgrid also refers to tendered works as comprising LLE and Other construction costs; however we have provided our assessment of these components in section 6.4 and section 4.

6.2.2 What Transgrid has proposed

433. Transgrid has proposed a total of $2,604.1 million for its tendered works for design and construction, comprising $1,256.5 million for the east package and $1,347.6 million for the west package. The pricing is an outcome of the competitive two-stage ECI tender process undertaken by Transgrid.

434. Transgrid describes the Stage 2 forecast capex, as being informed as follows:

> *'More than 61 per cent of our Stage 2 forecast capex is based on market prices obtained through competitive tender processes. We have also relied on pricing from suppliers and independent specialists. Our Stage 1 activities have resulted in a Stage 2 capex forecast in line with an AACE class 2 to 3 cost estimate, providing cost certainty that consumers will not be over- or under-investing in the Project.'* [131]

6.2.3 Review observations

Work packages have been split geographically

435. Transgrid has split the works into east and west, based on results of its ECI process. Transgrid describes this decision as follows:

> *'We have adopted a packaged approach to deliver HumeLink, splitting the Project into two geographic packages of similar sizes that will be delivered by two separate delivery contractors. This approach:*
>
> – *provides a more manageable scope for contractors, aligned with market sounding feedback*
>
> – *allows us to select contractors with capabilities best suited to the varied works required.'* [132]

436. The two contract packages are:[133]

- **HumeLink East:** This consists primarily of the transmission line works from the interface point to the eastern HumeLink terminus at Bannaby. This package spans a greater geographical area, with double the length of HV transmission lines (compared to the HumeLink West package), while the substation works are relatively small (and predominately civil works rather than electrical works).
- **HumeLink West**: This consists of the lines from the interface point south to the Snowy 2.0 connection at Maragle, and west to the HumeLink western terminus at Wagga Wagga. This package involves more substation works, including interfaces at brownfield sites and constructing a new substation near Wagga Wagga, named Gugaa. The route involves more works within alpine regions, state forests and national parks.

131 A.1_Humelink CPA-2_Principal Application, Transgrid, 21 December 2023, page 44.

132 A.1_Humelink CPA-2_Principal Application, Transgrid, 21 December 2023, page 48.

133 A.1_Humelink CPA-2_Principal Application, Transgrid, 21 December 2023, page 48.

437. The packages are shown in Figure 6.1 below, reflecting the preferred route (green hill alignment).

Figure 6.1: Overview of the HumeLink alignment and contract packages

Source: Submission document 'A.1_HumeLink CPA2_Principal Application', figure 4-1

Procurement process was fit for purpose

438. Transgrid has outlined its procurement process in its Capex Forecasting Methodology.

439. Transgrid has undertaken a multi-stage procurement process, comprising four phases:

- Phase 1 – Market sounding from April 2022 to July 2022
- Phase 2 – Expression of Interest (EOI) from August 2022 to October 2022
- Phase 3 – Early Contractor Involvement (ECI) Stage 1 October 2022 to February 2023, and
- Phase 4 – ECI Stage 2 March 2023 to August 2023.

440. Transgrid's objective of adopting a collaborative procurement process was to:

> *'mitigate[s] delivery risk by addressing upfront points of commercial engineering and operational tension between us and the D&C contractors.'* [134]

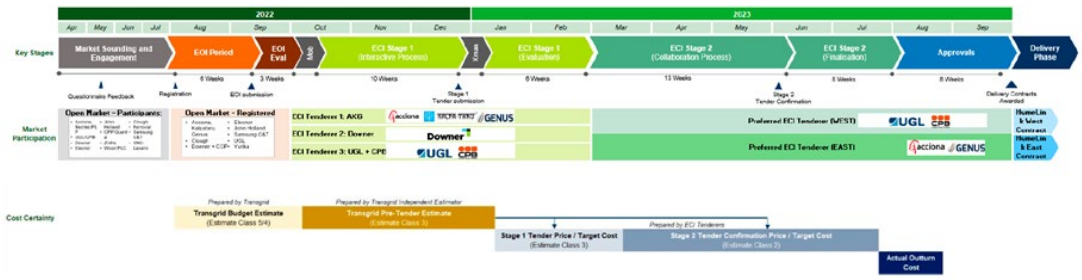
441. Transgrid engaged an independent cost estimator, fission, to independently verify the D&C contractor costs. The procurement process was overseen by an external transaction manager and external probity adviser.

Selection of contractors has followed a robust process

442. The market engagement process is shown in Figure 6.2 below.

[134] A.1_Humelink CPA-2_Principal Application, Transgrid, 21 December 2023, page 54.

Figure 6.2: Market engagement for HumeLink – ECI Stages 1 and 2



Source: Transgrid presentation to AER and EMCa 'AER EMCa CPA2 Review - Major Project – HumeLink', 15 March 2024, slide 22

443. Transgrid states that ECI Stage 2 resulted in delivery contracts being awarded for HumeLink East and HumeLink West in December 2023, and which differs from the diagram above. Earlier versions of this diagram have dates that vary from June 2023 to August 2023 (A.2 figure 3-4) for this process.

444. Transgrid provided a summary of the rationale for the selected contractors as shown in Figure 6.3 below.

[redacted]

445. We have not identified any material issues of concern with the process undertaken by Transgrid to determine the tendered costs.

Transgrid's selection of commercial model is reasonable for the scale and complexity of HumeLink

446. Transgrid states that increases in real construction costs are likely to intensify due to a surge in committed projects, which will compete for increasingly scarce resources. In response to the uncertainties in the operating market, Transgrid states that:

> *'…contractors are presently offering contracts with flexible pricing and risk-sharing arrangements to accommodate changes and unforeseen circumstances and safeguard against potential losses. This will assist to mitigate their own risk exposure given the significant uncertain operating environment'.* [135]

135 A.1_Humelink CPA-2_Principal Application, Transgrid, 21 December 2023, page 50.

447. These trends are apparent based on our own review of a sample of recent mega projects across Australia and overseas. This has led to an increase in the adoption of target cost, or incentivised target cost models over typical fixed price EPC D&C contracts both within Australia and overseas. As an example of this, the NSW and VIC Governments have responded to these market changes by committing to use of more collaborative forms of contract.[136]

448. Transgrid describes its commercial model as follows:

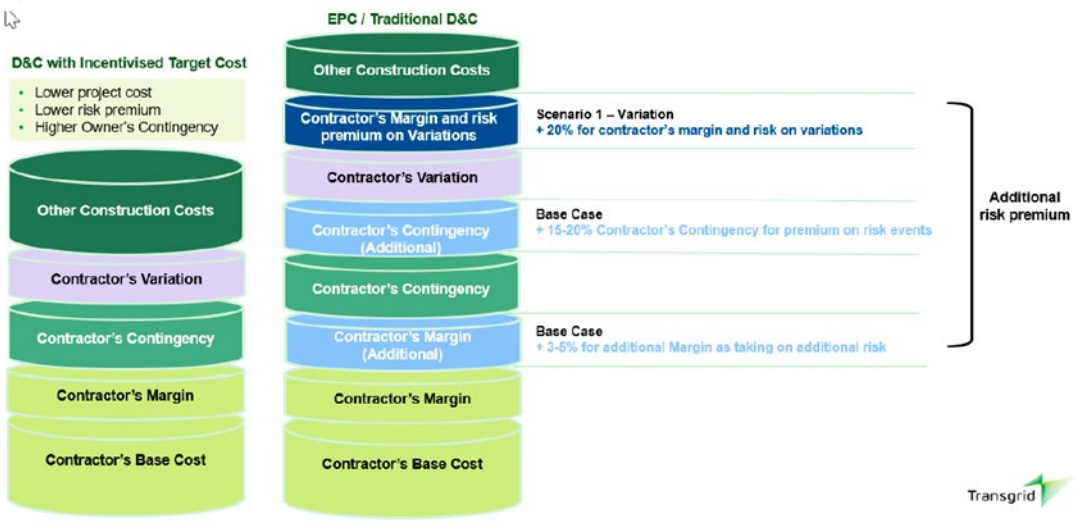
> *'The HumeLink contracts are an amended form of the FIDIC Silver Book EPC contract (2nd Edition, 2017), a standard form of contract for EPC projects, which includes standard design and construction obligations and with amendments made to incorporate the Incentivised Target Cost commercial model. The FIDIC standard form of contract is used internationally and in Australia - examples include PEC and Snowy 2.0.*
>
> *The amendments to include an Incentivised Target Cost (ITC) commercial model reflect the issues with lump sum being experienced by Contractors, such as the insolvency of Clough (which affected both PEC and Snowy 2.0).'*[137]

449. In proposing an ITC D&C commercial model for HumeLink, Transgrid states that:

> *'The ITC D&C commercial model achieves an appropriate balance between:*
>
> – *fixed pricing, for components that are well defined and have high cost certainty*
>
> – *reimbursable pricing with shared risk, for components with scope and cost uncertainty.'*[138]

450. The ITC D&C model allows the contractor to offer a lower contract price than it otherwise would if it was required to price in all risk-costs though a fixed price D&C contract. Transgrid illustrates this as shown in Figure 6.4 below.

Figure 6.4: D&C ITC vs traditional D&C contract model



Source: Submission document 'A.1_Humelink CPA2_Principal Application', figure 4-2

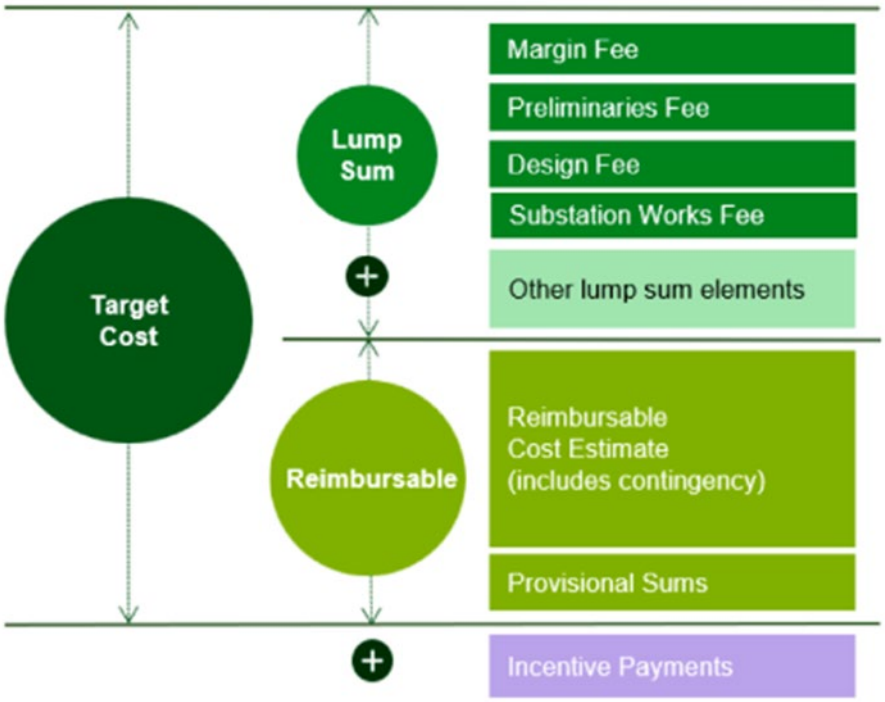
The ITC D&C model comprises a fixed and reimbursable component as shown in Figure 6.5 below.

136 For example, NSW Government Action Plan

137 Transgrid response to IR02, question 12.

138 CPA-2 A.1 Humelink – Stage 2 (Delivery) – Contingent project application, page 51

Figure 6.5: ITC D&C contract model



Source: Submission document 'A.1_Humelink CPA2_Principal Application', figure 4-3

451. For our review, we place considerable weight on the contract review and negotiation process and expert review process that Transgrid has undertaken in arriving at the contract model. In a letter to Transgrid, its advisors E3 advisory state:

> *'E3 Advisory considers the final commercial framework to be appropriate for the Humelink project as:*
>
> *• the cost model and risk allocation will support an efficient cost outcome; and*
>
> *• it has achieved commercial alignment between Transgrid and the delivery contractors which, together with the embedded collaborative approach of the delivery contracts, will support effective resolution of commercial issues that may arise in in delivery, given the nature, size and complexity of the project.'* [139]

452. We note that the features of the ITC model (relative to a typical D&C contract) typically result in:

- lower project cost overall;
- lower risk premium added by the contractor;
- higher owner's risk;
- open book transparency and actual costs for change events; and
- introduces greater level of collaboration to manage risks (advance warning and joint resolution).

453. We looked for evidence of these features in the build-up of the cost estimate.

Incentive provisions are included in the commercial model

454. The reimbursable component in Transgrid's contracts for the Tendered Works includes an agreed target cost with incentive arrangements to encourage collaborative behaviours to

139 Transgrid's response to IR05, Attachment COME30.1 Commercial framework letter CONFIDENTIAL

drive contractor performance and to help ensure the successful delivery of the Project. Transgrid describes the incentive structure of the ITC model as including:

- a cost incentive, known as a pain-share/gain-share mechanism whereby the contractor shares the risk of total costs being lower (gain-share) or higher (pain-share) than the total target cost, with the contractor risk capped at its margin fee;
- a program incentive up to 2.5 per cent of the total contract cost, payable where practical completion is achieved ahead of the target date;
- Key Result Area (KRA) incentives up to 1 per cent of the total contract cost for achievement of key performance indicators in safety, retention of key personnel, and community/stakeholder outcomes; and
- standardised design, contract and commercial structures to achieve efficiencies across the program that are internationally recognised and used in Australia.

455. The incentive provisions and how they are intended to operate are adequately explained by Transgrid. For example:

- the cost incentive operates at a rate of 75/25% pain/gain by Transgrid/contractor, with any pain to the contractor capped at its margin fee. The percentages are calculated by reference to Target Cost (i.e. while they apply only to reimbursables, the percentages are relative to Target Cost). We observe that the DTF guidance in place in Victoria has a higher share percentage of 85% (rather than 75%)
- The construction end date for incentive purposes moves out only insofar as NTP2 is delayed (relative to 20 July 2024). This incentive is not affected by 'delay days' claims. We observe a 'dead band' region is created whereby construction before NTP2 time-shifted construction end dates earns an incentive, and construction beyond NTP2 time-shifted end dates + delay day claims are subject to LDs.

6.2.4 Further considerations in adopting an ITC model

456. The usual approach to risk management in contract procurement is that 'risk should be allocated to the contracting party best able to manage the risk.' The traditional approach to risk allocation in construction contracting is that the delivery risk is best allocated to the contracted party responsible for delivery, which means it is included in the contingency provisions of a typical D&C contract.

457. Insights from research, and more recent experience in contracting mega projects on this basis has been problematic.

> *'In theory, it creates clear divisions of responsibility between the employer and contractor and in that sense it creates a structure which should deliver certainty of outcome. In seeking to obtain the best possible deal, procuring bodies may try to squeeze the contractor's contingencies through competitive tendering, except where this is not possible because the supply chain is shallow.*
>
> *However, it pre-supposes that all risks can be identified and their impacts assessed, that the supply chain is willing to take on the risks allocated, there is sufficient depth of resource and expertise in the supply chain for the employer to select the contractor willing to take on most risk at the lowest price, that the contingency for risk-taking that the contractor charges is considered to be economic and represents value for money and that ultimately the contractor's balance sheet is sufficiently strong to bear the costs if the risks materialise without going into insolvency.'* [140]

458. Target cost contracts usually operate by comparing the actual outturn cost of works (ignoring certain categories of disallowed cost) against an agreed target cost and dividing the benefit and burden of any cost savings or overruns between the employer and the contractor in accordance with pre-agreed share ranges. The underlying philosophy is that

[140] Herbert Smith Freehills, Collaborative Contracting for Major Infrastructure Projects accessed at https://www.herbertsmithfreehills.com/insights/2019-08/collaborative-contracting-for-major-infrastructure-projects

the contractor will be incentivised to beat the target cost as its return will be boosted by its share of any achieved saving. Cooperation is encouraged to share the gains.

459. For this model, insights from research suggest that whilst improved relative to a traditional contracting model, there are considerations to be mindful of:

> *'Even if the target cost has been accurately assessed and fixed at the outset of the contract, a claims culture can still therefore be prevalent in target cost contracts.*
>
> *Incentive-based contracts are generally set up on a cost reimbursable basis where the contractor has limited downside exposure. The contractor is paid the actual cost incurred to complete but only profit, or a proportion of profit, is put at risk.*
>
> *The basic premise is that successful delivery of the project is most likely to be achieved where there is a close alignment between the commercial interests of the employer and the contractor, so that they work together for the benefit of the project, rather than against one another because they have different commercial objectives.'* [141]

460. During our onsite discussions Transgrid advised that collaboration provisions have been included in the contract, and that it has adopted an ITC model which should go some way to achieving greater collaboration. It will be critical that both parties act in this way, and to the extent that commercial interests can align, that any costs (or efficiencies) can be realised that are in the best interest of consumers.

6.2.5 Stage 1 activities and costs

461. Transgrid included activities and costs in Stage 1 to support activities needed to engage the contract market through the ECI process, including provision for payments for contractors to cover the costs of the ECI process.

462. These activities were included to:

- *'promote competition and innovation to lower costs including costs for risks for the construction works in Stage 2, and*
- *enable the successful contractors undertake detailed design and other pre-construction activities in to ensure construction can start as soon possible following approval of our Stage 2 Application to meet the 2026/27 completion date.'* [142]

463. Transgrid has made adjustments to the tendered price for each contractor to appropriately remove costs from CPA2 that had been included in the CPA1 approval part 1 and 2 costs comprising:[143]

- substation and transmission line pre-development;
- tower design;
- prototype and testing; and
- supply and transport of steel structure galvanize.

464. These deductions total $188.7 million across both contractors.

465. We don't have visibility of all tendered work components; however we note that the breakdowns provided by Transgrid also identify costs for participation in the ECI process totalling [redacted] (nominal) for UGL (west package) and [redacted] (nominal) for AKG (east package).[144] In response to our request to confirm the treatment of these costs,

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141 Herbert Smith Freehills, Collaborative Contracting for Major Infrastructure Projects accessed at https://www.herbertsmithfreehills.com/insights/2019-08/collaborative-contracting-for-major-infrastructure-projects

142 A.2 Humelink – Stage 2 (Delivery) – Capex Forecasting Method, Transgrid, page 30

143 A.6 - Humelink CPA 2 - Direct Non-Labour Model – CONFIDENTIAL. Transgrid.

144 On review of Transgrid's A.6 Direct non-labour model, we found that Transgrid presented the composition of the contractor costs in varying ways and had minor variances between totals. However, we don't consider this variance to be material to our conclusions on the treatment of the ECI costs.

Transgrid confirmed that these costs were allowed for in CPA1 and have been incorrectly included in its CPA2 submission.[145]

6.2.6 Implications for proposed cost

466. We consider that Transgrid's methodology and process for determining the cost for its tendered D&C works is reasonable. Therefore, it is reasonable to assume this to have resulted in an overall allowance that reasonably reflects an efficient market cost.

467. In assessing Transgrid's procurement practices, we considered whether the tender process provided sufficient competitive constraint to enable market tested and efficient prices. We are satisfied that the procurement process was appropriate and that the prices are an outcome of a market tested process, with reasonable allocation of risk.

468. We have considered the reasonableness of the cost build-up model that Transgrid has provided and find evidence that cost line items are reasonable and have been allocated according to Transgrid's documentation. However, we found evidence of ECI costs already provided for in the Stage 1 application, and presumably paid (or will be paid) to successful tenderers in that period. These costs totalling [redacted] (real June 23) should be removed from the CPA2 cost estimate.

469. We also found evidence in Transgrid's supporting documentation that supports the assessment of costs in other sections of this report, relating to:

- the level of cost certainty afforded to the cost estimate;
- the interaction of the selected ITC D&C model with other parts of the cost estimate; and
- scope and scale of the contractor contingency.

470. Apart from the ECI cost referred to above, we consider that Transgrid's Tendered Cost allowance for the east and west design and construction packages has followed a reasonable process, and therefore is likely to be a reasonable estimate. However, we have noted in previous sections of our report that:

- there is inconsistency of assumptions in relation to the timing that has been assumed by the project, and written into contracts and which is an outworking of Transgrid's planning assumptions which we reviewed in section 3;
- all owners' risks associated with the works packages are included in what Transgrid has described as 'Other Construction Costs' which we reviewed in section 4; and
- the commercial model requires collaborative working and negotiation of actual costs and assumed delays for reimbursable works. This may be at a different rate than Transgrid has assumed in the derivation of its risk-cost allowances, presented as 'Other Construction Costs', which we reviewed in section 4.

471. For these reasons, our conclusions on Tendered Works cost allowance must be read in conjunction with our findings in sections 3 and 4.

6.3 Land and easement values

6.3.1 Introduction

472. An objective of Stage 1 was for Transgrid to secure the land and easements needed to be able to commence construction in Stage 2, without this being either an impediment to commencement of construction or a significant project cost risk. Transgrid identified certain sites that it would acquire, while for other sites and for easements it would obtain option agreements which it would then exercise in the construction stage.

473. In reviewing what Transgrid has proposed for Stage 2, we have considered the progress that Transgrid made in Stage 1 in achieving its objectives, the consequences that this has

[145] Transgrid response to IR05, question 21

for its Stage 2 cost estimate and the reasonableness of its proposed Stage 2 expenditure allowance.

6.3.2 What Transgrid has proposed

Stage 2 proposed expenditure

474. For Stage 2, Transgrid has proposed an allowance to complete the necessary land and property acquisitions and to provide compensation for easements, and associated costs including for construction of camps and laydowns. Transgrid's proposed CPA2 expenditure allowance is shown in Table 6.1, and is as advised to Transgrid in a report from JLL Infrastructure Advisory.[146]

Table 6.1: Transgrid's proposed allowance for land and acquisition costs in CPA2

Cost item	Estimated cost[147]
Agreed compensation	[redacted]
Private landholders – Forecast compensation	[redacted]
Subtotal: Compensation for private landowners	[redacted]
Government landholders – Forecast compensation	[redacted]
Stamp duty	6.3
Timber	[redacted]
Substitute forest land	[redacted]
Disturbance cost	9.0
Construction camps and laydowns	3.0
Statutory fees, valuations and legal costs	10.2
Total forecast capex	**197.3**

Source: Submission document 'A.2_HumeLink CPA2 Direct Capex Forecasting Methodology', 21 December 2023, table 8.3.8

Status of land and easement acquisitions

475. In its CPA2 submission, Transgrid presents status information as of 30 June 2023, which showed that it had not agreed or not yet made valuation offers to nearly 60% of landowners.[148] It had agreed compensation of [redacted] to private landowners at that time but for a further [redacted] of its proposed requirement for Stage 2 it relied on valuation advice from its adviser, and which assumes [redacted].[149]

476. In Table 6.2 we show Transgrid's expenditure on land and easements in Stage 1 and its proposed Stage 2 expenditure, on an annual basis. Whereas for Stage 1 Transgrid planned to incur almost all pre-construction expenditure on land and easements in 2022/23, its actual expenditure was less than a quarter of its planned expenditure in that year. Transgrid is incurring the largest portion of its proposed Stage 1 expenditure in the current year and,

146 Humelink CPA2 Land and easement acquisition cost estimate, report from JLL, (PRP 2); August 2023. Table15.

147 This is based on the Green Hills route that Transgrid has now selected.

148 A.2 Humelink – Stage 2 (Delivery) – Capex Forecasting Method, Transgrid, table 8.2. (Figures are for the Green Hills route that was subsequently selected) 55.56% not agreed + 3.6% not yet offered = 59.2%

149 A.2 Humelink – Stage 2 (Delivery) – Capex Forecasting Method, Transgrid, tables 6-2 and 8-6. These figures and the basis for them appear in CPA2 document PRP2, a report to Transgrid from JLL Infrastructure Advisory (4 August 2023)

whereas it had planned to have completed its pre-construction activity in FY23/24, it now forecasts incurring a further $6.74 million in FY24/25.

477. Transgrid's CPA2 submission is to incur all Stage 2 expenditure in 2024/25.

Table 6.2: Expenditure: Stage 1 allowance, actual and remainder forecast and Stage 2 proposal

suLand and easements	20/21	21/22	22/23	23/24	24/25	TOTAL
Stage 1 Allowance	**0.00**	**2.01**	**23.12**	**1.04**	**0.00**	**26.17**
Stage 1 Actual / Forecast:						
Actual (to February 2024)	0.13	0.38	5.65	6.01		
Forecast (from March 2024)			0.00	5.12	6.74	
Stage 1 Total (Actual / Forecast)	**0.13**	**0.38**	**5.65**	**11.13**	**6.74**	**24.03**
Proposed Stage 2:						
Easement acquisition					197.29	
Stage 2 proposal (CPA2)					**197.29**	**197.29**

Source: EMCa analysis, using data from Transgrid response to IR05 Q7 'PCR0.9 Q7 forecast stage 1' and submission model 'A.5 - Humelink CPA 2 - Capex Forecast Model'

478. Transgrid's expenditure profile for Stage 1 is indicative of its delayed progress in achieving its pre-construction objectives of achieving land and easement purchases and option agreements, and therefore the reliance of its CPA2 submission on forecasts from its advisors.

6.3.3 Updated status

479. We were concerned that Transgrid had not made the progress that it had planned in Stage 1 in achieving land and easement acquisition agreements and, therefore, the extent to which its proposed CPA2 cost allowance relied on forecasts extending from the status as at 30 June 2023. We therefore sought an update.

480. As shown in Figure 6.6, as at March 2024 Transgrid had either firm option agreements or agreements in principle with 161 (62%) of the required 259 private landowners, with agreed compensation of [redacted].[150] The diagram indicates completion of the process in FY25 and this would be consistent with its updated expenditure information showing Stage 1 pre-construction expenditure on land and easement acquisitions continuing in FY25.

481. In CPA2, Transgrid states that as of June 2023 it expected to submit 110 easement applications for compulsory acquisition, and we presume that the 98 outstanding applications as of March 2024 will be resolved in this way. It is not clear why Figure 6.6 shows only 220 landowners compensated by November 2024 at the current run rate. This seems to imply either a quickening of the run-rate or that the agreement requirements will not be met until after November 2024.

[150] We observe some discrepancies in the number of private landowners involved, and which we have not sought to reconcile. A figure of 270 landowners is in table 8-2 in CPA2, A.2. In its presentation of 15 March (pages 61 to 63) Transgrid refers to 259 private landowners, of which it has agreements with 161, with agreements outstanding for 98.

6.3.4 Assessment of proposed expenditure

482. In its March 2024 update, Transgrid provided the information shown in Table 6.3, showing the Transgrid and landowner valuations for the 98 outstanding agreements. The CPA2 estimate of [redacted] lies between the Transgrid and landowner valuations and we consider that it can be considered to be a reasonable current estimate for this component of the proposed Stage 2 allowance.

483. For the remaining components of the proposed land and easement cost allowance, Transgrid has relied on JLL's report. We consider these to be reasonable estimates on the basis of the evidence of its advisor.

6.3.5 Implications for CPA2 allowance

484. We consider that Transgrid's proposed allowance for land and easement acquisition costs is reasonable. As with other elements of Transgrid's proposal, cost risk for land and easements is compiled in the risk-cost allowance which we have assessed in section 4.

151 TG is Transgrid valuation. LO is Landowners valuation

6.4 Long lead-time equipment

6.4.1 What Transgrid has proposed

485. Transgrid has proposed a total of $29.6 million for LLE for transformers, reactors and conductors in stage 2. These costs relate to delivering, storing and installing the equipment, which was secured in Stage 1.

486. The forecast capex comprises:

- [redacted] for reactors;
- [redacted] for power transformers; and
- [redacted] for conductors.

487. The procurement of equipment for HumeLink largely formed part of CPA1 Part 2. We understand that the costs associated with Part 2 relate to:

- *For reactors and transformer – storage, transportation/mobilisation (i.e., delivery) and installation costs, and*
- *For conductor – procurement and transportation of earth-wire and securing land for a laydown facility location for all conductors.* [152]

488. The proposed Stage 2 capex is additional to $249.7 million approved by the AER for LLE in its Stage 1 Decisions[153], which covered the bulk of LLE costs that Transgrid expects to incur for HumeLink.

6.4.2 Update: Current status information

489. Since the Stage 1 Part 2 application, Transgrid made a number of changes that contributed to the additional costs relating to its power transformer and reactor procurement, including:

- the preferred equipment suppliers to also oversee equipment installation and commissioning rather than the contractors.
- change of the port of entry to Australia from Melbourne to Newcastle.
- Additional storage costs due to arrival in Australia earlier to mitigate potential for project delays.

490. We asked Transgrid to reconcile the scope and cost of items that were identified as LLE in Stage 1 Part 1, with those now purchased under Stage 1 part 2, and those now envisaged as part of Stage 2. The information that Transgrid provided is reproduced in section 2 (

491. In Table 2.4, we summarise Transgrid's expenditure allowances for Stage 1, its proposed allowance for Stage 2 and purchase orders issued to date.

492. Table 2.4:).

493. We are satisfied with Transgrid's responses that orders have been placed or are committed to payment milestones. The remaining provisions for Stage 2 are allocated to design adjustments, delivery, storage, and testing.

494. We note that the responsibility for Tower Steel procurement is with the contractors and has been included in the forecast target cost of the tendered works for CPA2.

6.4.3 Review observations

495. Based on the global competition for materials, and in particularly power equipment we consider that it was prudent for Transgrid to take early action to secure the manufacture and supply of equipment for HumeLink as it has done.

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152 A.2 Humelink – Stage 2 (Delivery) – Capex Forecasting Method, Transgrid, page 39

153 This was determined by AER in Part 2 of Transgrid's Stage 1 application

496. Transgrid has applied its Powering Tomorrow Together (PTT) program, which involves the integrated delivery of Energy Connect, HumeLink and VNI West to assist deliver the efficient cost and delivery time for its key items. We comment further on the role of this program in Transgrid's proposed labour and indirect costs during the life of the HumeLink project.

6.4.4 Implications for proposed cost

497. We find that Transgrid's methodology and process for its remaining LLE costs is reasonable and, on this basis, we consider that its proposed allowance reasonably reflects an efficient market cost.

498. Changes to the procurement of LLE, including scope of installation, highlights potential risks associated with the supply, transport and coordination with Transgrid's contractors in the delivery of the HumeLink project, that previously Transgrid had sought to transfer to the contractor.

7 OBSERVATIONS ON OTHER MATTERS

In this section, we provide observations on the level of project cost uncertainty, external reviews and benchmarks and provision for Liquidated Damages.

Transgrid provided AEMO with a cost uncertainty range on its total HumeLink cost (i.e. comprising stages 1 and 2) of -5%/+12%. While that estimate is now 29% higher in real terms than its original estimate, Transgrid's stated uncertainty range would be consistent with one of the objectives of Stage 1 which was to improve the level of certainty of its cost estimate. AEMO has provided feedback loop confirmation of the need for the project based on that cost and the advised cost uncertainty range.

Transgrid provided a number of external reviews in support of its CPA2 submission. While these reviews provide useful information, we consider that some claims made on the basis of these reviews are selective and potentially misleading. These include claims made for savings arising from its PTT program, which we find to be targets set across multiple projects rather than realised savings attributable to the HumeLink project, and savings claimed from adopting the ITC contracting model. However, we have not had regard to the claimed savings in our review.

In response to an information request, Transgrid advised of provisions for Liquidated Damages against the contractors if they fail to reach practical completion by the contracted dates. Transgrid has not accounted in its CPA2 submission for the possibility of obtaining LDs. We similarly consider that it would be problematic to do so, noting that (1) contracted completion dates are adjusted under contract provisions, (2) the contractors each have their own delay contingency allowances within their contracts and (3) accounting for LDs, even on a probabilistic basis, would assume non-delivery by the contractors.

7.1 Introduction

499. In this section, we provide observations on three matters that may be of relevance to AER in considering aspects of its determination or which are 'general' in nature, but which do not directly affect our principal findings on Transgrid's proposed CPA2 cost allowance. These matters are:

- consideration of the range of cost uncertainty and its relationship to the economics of HumeLink, as derived by AEMO and by Transgrid;
- external reviews and other analyses that Transgrid has relied on to support its proposed cost allowance; and
- provisions for liquidated damages to be payable by the principal contractors, and which we have become aware of in the course of our review.

7.2 Project cost uncertainty

7.2.1 Introduction

500. In this section we have considered information on the cost uncertainty range of Transgrid's CPA2 estimate, and the consequent uncertainty range for the total HumeLink project (i.e. considering Stages 1 and 2.

501. It was not within our scope to undertake an independent assessment of the uncertainty range for Transgrid's project cost. Accordingly, the analysis and information that we provide in this section either reports information provided directly by Transgrid or is derived from information that Transgrid provided. Where our analysis is derived from Transgrid information, we have provided the relevant calculations.

7.2.2 Contextual relevance of the cost estimate uncertainty range

502. An objective of staging HumeLink, and specifically of Stage 1, was to produce an improved cost estimate with reduced cost uncertainty. This was to provide improved confidence in the economics of the project as an assumed key input to AEMO's feedback loop advice, which was precursor to AER's consideration of Transgrid's Stage 2 proposal.

503. As we report in section 2.2, AEMO provided feedback loop confirmation to Transgrid in December 2023, based on Transgrid's advised total project cost of $4.88 billion. AEMO refers in its feedback loop notice to a cost uncertainty range of -5% to +12%, and which Transgrid has confirmed it provided to AEMO.

504. As we note in section 3.3.1, in its draft 2024 ISP, AEMO has estimated that HumeLink has an NPV of approximately $1.0 billion, while Transgrid has estimated an NPV of $4.19 billion. Taking the AEMO NPV, this would imply that the project would remain economic if the Stage 1 cost is taken as 'known' and the Stage 2 is up to around 25% higher than Transgrid's current estimate.

7.2.3 What Transgrid has claimed

505. In the course of undertaking our review of Transgrid's Stage 1 proposal, Transgrid provided information that it was targeting the class estimates shown in Table 7.1. In this table, we compare these targets with Transgrid's claimed level of certainty for its CPA2 submission.

Table 7.1: Claimed class accuracy of CPA2 compared with Transgrid's Stage 1 target

Category capex	Description	Stage 1 target for Stage 2	Transgrid's claimed certainty for its CPA2 submission
Direct capex			
Procurement	Substations and transmission lines	Class 3/2	Delivery Partner costs: Class 2
	Long-lead time equipment – Substation transformers and reactors	Class 2	OEM supply: Class 2
Land acquisitions	Acquisition costs	Class 3	Property and easement: Class 1/2
	Environmental 'offset' costs	Class 2	Environmental offset: Class 4
Labour and indirect capex			
Project team resources	Labour and corporate support for project management, procurement, land and environmental activities	Class 2	Owner's costs: Class 2/3.
Project development	Development, engineering, legal and economic support	Class 2	
Land and environment	Fees, labour and indirect costs	Class 2	Unclear: Combination of Property and easement and environmental offset costs.
Procurement	N/A		

Source: Stage 1 target: Transgrid response to IR, Transgrid EUAA Humelink Stage 1 (Early Works) CPA 26 May 2022 sent to AER, table 2. CPA2 claimed certainty as given in 15 March 2024 presentation, page 55.

506. In its Principal Application, Transgrid makes the summary statement that:

> *'Our Stage 1 activities have resulted in a Stage 2 capex forecast in line with an AACE6 class 2 to 3 cost estimate. This provides cost certainty that consumers will not be over- or under-investing in the Project.'*

507. The statement that its CPA2 submission is a Class 2 to 3 estimate is supported by Transgrid's claimed estimate classes at the capex category level. We observe that its 'substation and transmission lines' class estimate is lower (i.e. more certain) than it had targeted, while its owner's costs are less certain. This is directionally consistent with the way that Transgrid has attributed risk in its CPA2 submission, with cost uncertainty relating to the Tendered Works presented as a 'risk-cost' as described in section 4.

7.2.4 Observations on the claimed level of cost certainty

Further analysis of the claimed uncertainty range

508. A class 2 to 3 estimate could be interpreted as having an uncertainty of up to +20% or +30%. We therefore sought further information that might inform a view on the uncertainty range of -5% to +12% that Transgrid advised to AEMO for the purpose of its feedback loop assessment application.

Uncertainty analysis based on Transgrid's information on line-item uncertainties

509. We asked Transgrid to advise the uncertainty range that it placed on its Stage 2 cost estimate, and Transgrid provided the range percentages for line items that we have reproduced in Table 7.2, down to the 'uncertainty range subtotal' row. We have aggregated these, to account for the respective weightings of each line item and we find that this aggregates to a range of +5.9% to +21.6% for these line items.

510. While unclear in Transgrid's response, we infer from the separate and significant uncertainty ranges that Transgrid has placed on its Delivery Partner and Labour and indirect costs, that these uncertainty ranges reflect uncertainties that are otherwise presented as 'risk-costs'. On this assumption, and so as not to double-up, we have treated the CPA2 Other Construction Cost amount as a known amount.

511. For the purpose of this assessment, we have also assumed that Transgrid's Stage 1 costs are 'known' and equal its allowances (for Parts 1 and 2). We consider this to be a reasonable assumption, noting that Transgrid's forecast Stage 1 costs are relatively close to its allowances, and are now largely incurred or committed.

512. As shown in table 7.2, this analysis suggests an aggregate uncertainty range for the total project (i.e. Stages 1 and 2) of +4.4% to +16.3%.

Table 7.2: Derived aggregate project cost uncertainty

	CPA1 and CPA2 cost	Range			
		Lower		Upper	
Stage 2 cost items:					
Delivery Partners (East and west)	2,604.13	13%	2,942.67	20%	3,124.95
LLE	29.59	-6%	27.82	18%	34.92
Easement acquisition	197.29	-9%	179.53	4%	205.18
Biodiversity offset costs	437.47	-28%	314.98	38%	603.71
Labour and indirects	411.59	5%	432.17	23%	506.25
Uncertainty range subtotal	**3,680.07**		**3,897.16**		**4,475.01**
Implied aggregate uncertainty			*5.9%*		*21.6%*
plus Other construction costs	599.07				
Total Stage 2	**4,279.14**				
Stage 1 Part 1	380.39				
Stage 1 Part 2	227.9				
Total project	**4,887.43**		**5,104.52**		**5,682.38**
Implied aggregate uncertainty			*4.4%*		*16.3%*

Source: EMCa analysis from CPA2 and CPA 1 proposals, with ranges ascribed to line items as provided in Transgrid's response to IR02, Q13(b)

Alternative uncertainty analysis based on Transgrid's Monte Carlo assessment

513. We undertook an alternative analysis, utilising the cost ranges for the proposed $599.1 million for Other Construction Costs that Transgrid provided from its Monte Carlo uncertainty analysis. We assumed that all CPA2 cost uncertainty is inherent in Transgrid's proposed allowance for Other Construction Costs. As with the previous analysis, we assumed no further uncertainty arising from Stage 1 costs.

514. The alternative analysis indicates a much narrower range of uncertainty, with an absolute span of only 7.9%. It is also biased towards a lower cost, because (as we have noted in section 4) Transgrid's proposed Other Construction Costs allowance is a P70 estimate, therefore closer to P90 than to P10.

Table 7.3: Alternative estimate of project cost uncertainty

		P10	P90
CPA2 cost as proposed, excluding Other Construction Costs	3,680.07		
Other Construction Costs	599.07	332.56	717.13
Total Stage 2	4,279.14	4,012.63	4,397.20
Stage 1 Part 1	380.39		
Stage 1 Part 2	227.90		
Total project	4,887.43	4,620.92	5,005.49
Implied aggregate uncertainty		*-5.5%*	*2.4%*

Source: EMCa analysis, using data from CPA1 and CPA2 submissions. P10 and P90 cost estimates for Other Construction Costs are from Transgrid's response to IR06, workbook IR06.1, worksheet 'Total w Painshare_Scenario 1'

7.2.5 Observations and implications of cost uncertainty

515. We consider that Transgrid's uncertainty range advice to AEMO, and assessments of aggregate project cost uncertainty that we have derived from Transgrid information, all

provide ranges that appear undeservedly narrow. Each of these quantitative assessments provides a narrower range than would be suggested by what Transgrid, in our view more realistically, describes as a class 2/3 estimate.

516. On the other hand, we do not consider that Transgrid's depiction of its CPA2 submission as providing a class 2/3 CPA2 cost estimate justifies its claim that this provides '*cost certainty that consumers will not be over- or under-investing in the Project.*' A class 2/3 estimate could be considered to provide an upper bound estimate of the order of 25%. In substance, this would now apply only to the Stage 2 costs, and so at the upper end would add around $1 billion to the proposed cost.

7.3 External reviews and benchmarks relied upon by Transgrid

7.3.1 External advice relied upon

Transgrid has referred to a range of advice in its CPA2 submission

517. Transgrid has engaged independent advice in specific areas of its CPA2 submission as identified in Figure 7.1 below. We have referred to the reports from these firms as provided by Transgrid as required in our review of the proposed costs.

Figure 7.1: List of external advisers for advice

Component	External support or validation
Legal advisors	Corrs Chambers Westgarth
Commercial advisors and resource capacity	E3 Advisory
Transaction management	Connell Griffin
Probity Advisors	OCM
Contract management advisory	Investructure
Independent Estimating services	Fission
Risk & contingency development	Broadleaf
Scheduling development and review	TBH
Regulatory advice	Cutler Merz and Houston Kemp
Property valuations and support services	JLL and TSA
Community and stakeholder management services	Aurecon
Design and engineering, environmental management services	Beca and GHD
Biodiversity offset strategy	Niche and WSP
Environmental Impact Assessment development	Aurecon
Geotechnical investigations	Douglas Partners

Transgrid

Source: Transgrid response to IR05 'PCR0.3 HumeLink Board workshops (compiled)'

Transgrid has incorporated external review and use of benchmarking

518. Transgrid has engaged independent advice to undertake reviews and benchmarking of specific areas of its CPA2 submission as identified in Figure 7.2 below.

Figure 7.2: List of external advisers for review and benchmarking

Cost Category	Artefacts/Benchmark
Delivery Partner Costs	**Fission benchmark and external review**
UGL	
AG	
Diff in Reg 2023$ conversion from Nominal$	
Land and Property (excl Labour)	**Jones Lang LaSalle**
Environmental Offsets	**Niche & WSP**
Long Lead Equipment (excl towers)	**Hyosung, Hitachi & ZTT**
Owners Risk	**TBH QSRA**
Owners Costs	
Labour	**E3 Benchmark**
Non-Labour	**BECA, Sol Solutions, Lewis Woolcott, Aurecon, WSP, E3 Advisory, GHD, Knight Frank, Acconex**
Legal Fees	**Corrs**
Insurance	**AON**
CSE Investment	**ANU Benchmark**

Source: Transgrid response to IR05, 'PCR0.3 HumeLink Board workshops (compiled)'

519. GHD was engaged to undertake an independent engineering verification and assessment of the scope of Transgrid's Stage 2 activities and its Stage 2 capex forecast. Transgrid states that:[154]

> *'Overall, GHD Advisory considers that the contracting approach adopted detailed below and capital forecast developed to be prudent and efficient having regard to current market conditions, and are required to achieve project timeframes, reduce the final projects costs, and / or reduce schedule and cost risks.'*

520. Our review of the report provided by GHD indicates that its benchmarking analysis has not considered the total project cost:

- In providing its assessment of the total project cost, GHD has not taken into account the costs associated with LLE included in Stage 1 Part 2, in arriving at a total project cost of $4,659.9 million.[155]
- In applying AEMO's transmission cost database (TCD) as a top-down check, the exclusion of the Stage 1 Part 2 costs appears to lead to a different conclusion on the efficiency of the total project cost. We acknowledge the limitations of using the TCD in this way, however this undermines the value as a top-down assessment that GHD has relied upon in its assessment when it concludes that the[156] '*overall cost for the project and the level of risk provisioning is supported by benchmarking against the TCD, with variances within the level of AACE expected accuracy range for a TCD generated estimate.'*

521. In the context of using the TCD for benchmarking, GHD also states:

> *'HumeLink also has an accelerated schedule that would not be necessarily reflected in these past ISP projects and this requires higher risk provisioning.'* [157]

522. We considered project timing in earlier sections of this report, where we considered the extent to which an accelerated schedule is warranted, and the extent to which this is in fact driving higher risk provisioning and therefore a higher cost. GHD's statement aligns with our findings in sections 3 and 4, except to the extent that it assumes that the accelerated

154 A.2 Humelink – Stage 2 (Delivery) – Capex Forecasting Method, Transgrid.

155 GHD independent assessment report, page i

156 GHD independent assessment report, page vi

157 GHD Humelink independent verification and assessment, page 6

timeline is an external requirement rather than a project delivery choice that Transgrid has made.

523. In response to our questions of Transgrid, we were provided with an updated version of GHD's report on 17 April to address the issues we identify above, and which states:

> *'There are potentially some risk provisions that are justifiable for HumeLink that may not be present in the TCD benchmarking sources. In addition, there are some financial risk provisions that could fall away over a short period of time if the conditions for their trigger are effectively managed.'* [158]

524. GHD has included updated benchmarking results, to take account for additional risk provisioning in its benchmark. We calculate that the TCD benchmark is 25% lower than Transgrid's estimate, using GHD's assumptions and not 20% as GHD suggests. Noting the limitations of using the TCD, including its wide error band (associated with low cost forecasting accuracy), we consider that there is little reliance that can be placed on this analysis.

External review of labour and indirect costs identifies areas for AER review

525. In providing summary conclusions on the reasonableness of the labour and indirect costs, GHD states that:

> *'Project control costs potentially include approximately $16M of costs that have already been claimed in the VNI West CPA1 submission.'* [159]

526. On review of GHD's report, this relates to indirect costs associated with Wagga Wagga training centre, Wagga Wagga hub, In8 and P6 licencing and integration, PTT functions and benchmarking. GHD also states that the:

> *'VNI West CPA1 submission already includes this cost noting that the cost does not specifically relate to either VNI West or HumeLink, but rather major projects generally.'* [160]

527. Review of the VNI West CPA1 submission is beyond our scope of review and we suggest that AER confirms that there is no duplication of costs.

528. During our discussions with Transgrid, we were concerned by the lack of evidence of benefits of the large 'major project initiatives' to be recovered over the HumeLink project, including those associated with the PTT costs which appeared to us as being directed to the formative phases of the project. Transgrid advised that the major project initiatives including PTT are apportioned to the three major projects – PEC, HumeLink and VNI west – and that benefits accrue throughout the project. We discuss this further as a part of our assessment of major project initiatives in section 5.4.

529. As shared costs, the justification of these costs across all projects to improving Transgrid's social licence by providing local training to communities impacted by construction and addressing skills shortages[161] should be reviewed.

7.3.2 Inclusion of cost savings in CPA2

530. As a part of its CPA2 submission, Transgrid refers to $412 million of cost savings across Stage 1 and 2 of the Project, comprising:[162]

- $85 million in savings for securing LLE through our PTT program (Stage 1 forecast capex);

158 GHD Humelink independent verification and assessment 1504 2024 provided with IR05

159 GHD, Humelink independent verification report, page 60

160 GHD, Humelink independent verification report, page 58

161 AER EMCa workshop, HumeLink CPA-2 - March 2024, slide 68

162 CPA-2 A.1 Humelink – Stage 2 (Delivery) – Contingent project application, page 44

- $237 million in savings from adopting a variable ITC D&C contract rather than a fixed price D&C contract to deliver the design and construction of substations and transmission lines, including access tracks (Stage 2 forecast capex); and
- $90 million in savings for undertaking the Gugaa integration as part of VNI West Stage 1 activities.

531. Transgrid also claims further cost savings of $787 million of investment synergies from concurrent investment in HumeLink, PEC and VNI West, and which is claimed to be in addition to $500 million savings from adopting the PTT model.[163] These savings also include the $90 million in savings for undertaking the Gugaa integration as part of VNI West Stage 1 activities as noted above.

532. We examine each of these below.

Securing LLE through its PTT program is unlikely to be a saving from the CPA2 base cost estimate

533. We asked Transgrid to substantiate the basis of the $85 million LLE savings, to which it stated it comprises:[164]

- $60 million savings from transformers, reactors and conductors through early procurement of LLE; and
- Circa $20-25 million associated cost avoidance, to which Transgrid has adopted the higher end of the range for labour and what Transgrid refers to as 'inflationary savings' that result from the early procurement activities.

534. In its response Transgrid states that the savings for LLE are derived from the difference between its budget assumptions and negotiated contract prices for equipment across the HumeLink and VNI West projects. The values are not identifiable for each project, nor is the relationship to the CPA1 assumptions provided for HumeLink. Based on the information provided, it is therefore not possible to determine the basis from which this saving has been measured or realised.

535. The early procurement of LLE was a feature of approval of the early works by the AER in its CPA1 determination, to ensure timely delivery of LLE and to lock in reasonable costs. We did not see evidence of further savings reflected in the CPA2 forecast.

Whilst savings are likely from an ITC model, the analysis provided for HumeLink is not holistic and cannot be relied upon for this purpose

536. Transgrid states that if D&C contractors were required to offer a fixed price contract, then the D&C contract cost would be expected to be by around $237 million or 8 per cent higher.

537. We asked Transgrid to substantiate the basis of the $237 million from a variable construction contract, to which it stated:

> *'The likely cost of a classic EPC contract was identified as $3.117B compared with the cost of a corresponding ITC contract of $2.88B, giving rise to a $237M cost saving on this basis'.*[165]

538. We understand that this value is based on analysis undertaken by its cost estimator fission.[166] Whilst the literature suggests that an ITC form of contract is more likely to provide a lower cost than traditional approaches, including an EPC D&C contract, we find that the analysis presented by fission is not sufficient to support the claimed saving. For example:

- The total cost assumed by fission of $2,880.4 million for the target cost for the ITC contract is much lower than has been assumed in the CPA2 submission at a total level

163 CPA-2 A.1 Humelink – Stage 2 (Delivery) – Contingent project application, page 25

164 Transgrid response to IR02, question 15

165 Transgrid response to IR02, question 15

166 COMF1 Humelink ITCvsEPCv02 provided in response to IR02

and is more likely representative of the ITC D&C contract cost of $2,604.1 million proposed by Transgrid, after excluding some elements of the cost for comparison purposes.

- The analysis did not attribute the higher proposed owner's costs, included as part of the Other Construction Costs, which are recognised as a feature of ITC (offset by lower contractor contingency). The analysis focussed on contractor contingency only.
- The analysis did not attribute the higher proposed labour and indirect costs for supervision of the contract by Transgrid.

539. For these reasons, we consider that the analysis does not adequately account for the many differences between an EPC D&C and the proposed ITC D&C model that Transgrid has proposed, in a meaningful way that could support Transgrid's claimed savings from its approach. To selectively include and exclude components is misleading.

Undertaking the Gugaa integration whilst the substation is under construction is likely to lead to a more efficient cost

540. The Gugaa substation will be constructed as part of the HumeLink project, and in doing so provides for the connection to VNI West via the PEC enhancement works at 500kV.

541. Transgrid advised that the Gugaa saving is based on market pricing received on HumeLink for the pre-agreed variation for the Gugaa augmentation works,[167] with adjustments for additional costs if conducted via VNI-West for preliminaries and allowance for brownfield works (conducting works in an existing substation).

542. Delivery of the Gugaa extension works via the HumeLink project, when the HumeLink contractor is already onsite and familiar with the substation construction is likely to lead to a more efficient cost. We are not convinced that the costs for Transgrid will differ by 20% under the two options. We have not been provided the detailed assumptions to verify the accuracy of the assumptions that underpin the calculated saving.

Additional savings claimed from investment synergies are not real

543. Of the remaining component of the claimed $787 million in savings, Transgrid claims the PEC enhancement works are expected to achieve cost savings of approximately $697 million.

544. We asked Transgrid to substantiate the basis of the $787 million of investment synergies from concurrent investment in HumeLink, PEC and VNI West, to which it stated:

> *'The savings of PEC enhancement are calculated by subtracting the cost of PEC Enhancement being constructed by the PEC contractor from the equivalent cost if this same scope were constructed using current market pricing.'* [168]

545. Transgrid supplied analysis that shows that the estimated cost of construction of the Dinawan to Wagga Wagga 500kV double circuit transmission line using the existing PEC contractor is expected to cost approximately $570 million. However, on the basis of updated market rates provided by the HumeLink contractors, the same line would be expected to cost $1,267 million. On that basis, Transgrid has claimed that the delivery model for this line section reflects a cost saving.

546. In presenting cost savings, it is important to be clear on the basis to which the cost saving is being measured. In this case, there is no obvious cost saving relative to the PEC project.

547. In making comparisons between projects, it is important to adjust for different market conditions, contractors and project considerations (design, construction methods, easements and land access etc) between the two projects. In response to an IR, Transgrid acknowledges major differences between the projects:[169]

167 Transgrid response to IR02, question 15

168 Transgrid response to IR02, question 15

169 Transgrid response to IR05, question 18

'Transgrid has identified market costs as they pertain to current project delivery partners rather than historical costs associated with other projects. Current costs are more reflective of current, post-pandemic market conditions. Transgrid has – and continues to – test the market to ensure efficient and prudent cost assessments for Humelink and other ISPs underway. Transgrid has taken lessons learnt from PEC and increased owner's team size to reflect what is appropriate to delivery mega projects and mitigate risks, to ensure efficient delivery '

548. In the analysis provided, there does not appear to be an attempt to correct for these factors.

Statements around $500m savings from PTT program are targets across multiple projects

549. We asked Transgrid to substantiate the cost saving of $500 million claimed as having been achieved from the PTT program and the relationships to the $322 million saving claimed for HumeLink.[170]

550. HumeLink stated that its Powering Tomorrow Together (PTT) program is focused on achieving $500 million in cost benefits through a 24-month overall program acceleration, including delivery of HumeLink and VNI West by 2028. The cost savings attributable to the ITC commercial model and LLE totalling $322 million are included in the $500 million.[171] In its response Transgrid stated that:

'Transgrid aims to achieve this through the four PTT principles of 1. increased optionality; 2. enhanced project delivery; 3. commercial savings; and 4. security of supply.'[172]

7.3.3 Implications for proposed cost

551. We have not identified any implications for the proposed cost estimate. However, we observe that, if the claimed savings have been measured relative to Stage 1 estimates, then it is difficult to reconcile them with the 48% nominal / 29% real increase in the Stage 2 cost.

7.4 Provisions for Liquidated Damages

7.4.1 Introduction

552. In this section we provide observations on the Liquidated Damages (LD) framework that applies to the HumeLink project.

7.4.2 The LD framework in Transgrid's principal contracts

553. During the onsite discussion with Transgrid, we were provided information that liquidated damages provisions (LDs) are included in the commercial agreements for the principal design and construction works (the Tendered Works), however the details were not explained in Transgrid's application. We asked Transgrid to confirm the quantum and design of the liquidated damages included in the ITC model for exceeding the delivery date for each contractor and to describe how these damages interact with the incentive provisions of the ITC model including the pain-share provision.

554. Transgrid stated that:

'There are liquidated damages of up to $500,000 per day if the Contractor does not achieve Practical Completion of Sections or of the full Works by the date for Practical Completion. These are capped at 10% of the Target Cost.

170 Principal Application document, page 25

171 Specifically that the $500 million cost savings includes $237 million variable construction contract and $85 million for LLE.

172 Transgrid response to IR02, question 33

The contract provides positive incentives to achieve on-time or early completion through both the Program Incentive and the Cost Incentive. The two regimes are separate, however together provide a strong incentive for the Contractors to complete the project at the most efficient time and cost. '[173]

7.4.3 Observations

555. While we were not provided a copy of the contract itself, we see evidence of the LDs in the liability cap provisions included in the contract schedule included in advice from Transgrid's legal advisers, Corrs Chambers Westgarth.[174] We understand that the LDs are activated if the practical completion date (as adjusted in accordance with the contract provisions) is not achieved, and therefore do not interfere with the incentives for on-time or early delivery. Rather, they appear to act to reinforce delivery within the contract term.

556. The Contractor may be entitled to an extension of time (EOT) for a nominated delay event under the contract and must demonstrate an impact to a critical path activity, and that the Contractor has actually been delayed in meeting Practical Completion. We understand this requires evidentiary support for an actual incurred delay, for review after the event before such a claim is approved.

557. Importantly, Transgrid recognises the need for the contractor to actively mitigate any extension of time or cost of delay:

'the entitlement for EOT is reduced to the extent a delay is a concurrent delay, including with delays that would not entitle the contractor to an EOT, or where the Contractor has not avoided, minimised or mitigated the delay, including by resequencing, to the extent it was able to.' [175]

558. We consider that this is a key feature of a collaborative contract model and acts to ensure efficient delivery of the project. Accordingly, we looked for evidence that this feature was present in the determination of relevant risk-cost allowances. As we discuss in section 4, we consider that the risk-cost allowance that Transgrid has proposed does not adequately account for such cost minimisation or mitigation and this contributes to our finding that Transgrid's proposed risk-cost is overstated.

559. We also observe a delay damages cap that exists during the contract term, and prior to the practical completion date, of $500,000 per day for the east and west package. A separate damages cap of $200,000 per day has also been established for the works between the T-point and Maragle substation applied to the West contractor only. We note that Transgrid has generally used lower aggregate values than indicated by this cap, and that LDs (if they apply) could to an extent offset additional owner costs of prolongation of the project.

7.4.4 Implications for proposed cost

560. Other than through their interaction with the proposed risk-cost allowance, as stated above we have not identified any additional implications for the proposed cost estimate.

173 Transgrid's response to IR05, question 20

174 Transgrid Project risk artefacts, ID0.3 – Humelink – Legal sign-off letter

175 Transgrid's response to IR05, question 22

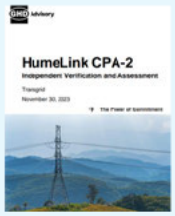
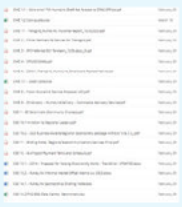
APPENDIX A – SUMMARY OF INFORMATION RELIED UPON

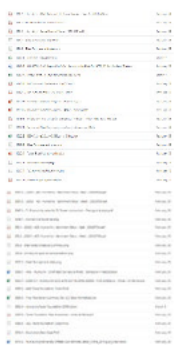
561. Our principal source of information for review is the suite of documents and models that Transgrid provided in support of its CPA. Transgrid provided some further documents in response to IRs and at presentations to AER and to one on-site meeting with EMCa.

562. The list of documents and models relied upon is provided in the tables below. Some but not all of the documents were reference catalogued, and we have therefore provided cover 'snips' to assist with identifying the documents.

A.1 Documents and models provided at project initiation

	File Name	Document Name	Author	Date	Title Page
1	A.1_Humelink CPA2_Principal Application - Confidential 07-02-24	A.1 HumeLink – Stage 2 (Delivery) – Contingent Project Application Principal application document	Transgrid	21 Dec 23	
2	A.2_HumeLink CPA2 Direct Capex Forecasting Methodology - Confidential - 27-02-24	A.2 Humelink – Stage 2 (Delivery) – Capex Forecasting Method Humelink Contingent Project Application – Stage 2 (Delivery)	Transgrid	21 Dec 23	
3	A.3_HumeLink CPA2_Labour_and_indirect costs 27-02-24 - Confidential	Labour and Indirect Capex Forecasting Methodology Humelink Stage 2 Contingent Project Application	Transgrid	8 Dec 23	
4	A.4 HumeLink CPA2 Opex Forecasting Methodology_21 December Confindential_07-02-24 - Confidential	Opex Forecasting Methodology Humelink Stage 2 Contingent Project Application	Transgrid	21 Dec 23	
5	HumeLink CPA 2- Revenue Proposal - Document Register 8 Jan 24	HumeLink CPA 2 - Revenue Proposal Document Register	Transgrid	Nil	

	File Name	Document Name	Author	Date	Title Page
6	HumeLink Independent Verification and Assessment 0102 2024 V2 - Confidential	HumeLink CPA2 Independent Verification and Assessment	GHD Advisory	30 Nov 23	
7	210723 HumeLink Engagement Strategy - V2.3_1_Public	HumeLink Engagement Strategy	Transgrid	Jun 23	
8	HumeLink CCEP_August 2023 PUBLIC	HumeLink Community Communication and Engagement Plan	Transgrid	Mar 23 – Aug 23	
9	HumeLink Governance and Assurance Plan Rev 1.0 Confidential	HumeLink (P0016465) Governance and Assurance Plan	Transgrid	Nov 23	
10	HumeLink Resource Management Plan - CONFIDENTIAL	P0016465 HumeLink Resource Management Plan	Transgrid	May 23	
11	PRP 2 - TGD-HML-CPA2-Land Easement and Acquisition Cost Estimate 20230830 - CONFIDENTIAL	Humelink Contingent Project Application 2 Land & Easement Acquisition Cost Estimates for Project Implementation	JLL Infrastructure Advisory	4 Aug 23	[Contains confidential Information]
12	Miscellaneous Labour Indirect Artifacts	NA	NA	NA	

	File Name	Document Name	Author	Date	Title Page
13	Miscellaneous Project Risk Artifacts	NA	NA	NA	
14	HumeLink CPA2 - ECI Cumulative Risk Model and QRA Register Snapshot 4-9-23 CONFIDENTIAL	HumeLink CPA2 - ECI Cumulative Risk Model and QRA Register	Transgrid	Snapshot 4 Sep 23	[Contains confidential Information]
15	HumeLink CPA2 Risk and Contingency Report 12.01.24 Confidential	Risk and Contingency Report HumeLink Stage 2 Contingent Project Application	Transgrid	Nil	
16	HumeLink CPA2 Risk Report Confidential - 07 Feb 2024 Confidential	Risk and Contingency Report HumeLink Stage 2 Contingent Project Application	Transgrid	Nil	
17	ey-results-workbook-humelink-green-energy-exports	HumeLink Market Modelling Outcomes Green Energy Exports	Ernst & Young	28 Feb 24	
18	ey-results-workbook-humelink-progressive-change	HumeLink Market Modelling Outcomes Progressive Change Scenario	Ernst & Young	28 Feb 24	

	File Name	Document Name	Author	Date	Title Page
19	ey-results-workbook-humelink-step-change	HumeLink Market Modelling Outcomes Step Change Scenario	Ernst & Young	28 Feb 24	
20	gross-market-benefit-assessment-of-humelink-report-2024-02-29a	Gross market benefit assessment of HumeLink	Ernst & Young	28 Feb 24	
21	humelink-material-change-circumstance-mcc-assessment-report-feb-24	Reinforcing the NSW Southern Shared Network to increase transfer capacity to demand centres (HumeLink) Material change in circumstance assessment Region: Southern New South Wales	Transgrid	29 Feb 24	
22	transgrid-humelink-mcc-npv-model-public	HumeLink MCC RIT-T assessment	Transgrid and HoustonKemp	Nil	

A.2 Documents relating to procurement

	File Name	Document Name	Author	Date	Title Page
23	ECI RFT - Volume A - ECI Interactive Process Guideline - Public	Appendix A - ECI Interactive Process Guidelines HumeLink	Transgrid	Oct 22	

	File Name	Document Name	Author	Date	Title Page
24	ECI Stage 1 Tender Evaluation Report, February 2023 - Confidential	HumeLink ECI Stage 1 Tender Evaluation Report	Transgrid	Feb 23	
25	EOI Evaluation Plan - August 2022 - Public	EOI Evaluation Plan HumeLink	Transgrid	Aug 22	
26	EOI Evaluation Report, October 2022 - Confidential	HumeLink Expression of Interest (EOI) Evaluation Report	Transgrid	Oct 22	
27	HumeLink - ECI Stage 1 Evaluation Plan - Public	HumeLink ECI Stage 1 – Tender Evaluation Plan Final (Approved Version)	Transgrid	Nil	
28	HumeLink Transaction Management Plan, August 2022 - Public	Transaction Management Plan HumeLink	Transgrid	Aug 22	
29	O'Connor Marsden & Associates, Probity Report, March 2023 - Public	Probity Advisor Report HumeLink ECI Stage 1 Request for Tender (RFT)	O'Connor Marsden & Associates	Mar 23	

	File Name	Document Name	Author	Date	Title Page
30	Procurement Strategy - Confidential	Procurement & Contracting Strategy Conductor & OPGW	Transgrid	Nil	
31	Supplier letter - confidential	Advice to TransGrid on 500kV Major Projects Equipment Deliveries	Siemens Energy	10 Jan 23	[Contains confidential Information]
32	Transgrid, Market Sounding Report, May 22 - Public	HumeLink Market Sounding Report	Transgrid	May 22	

A.3 Models

	File Name	Model Name	Author	Date	Title Page
33	A.1 - Transgrid - Humelink CPA 2 - PTRM - _21_December_2023 - PUBLIC	TNSP Post-Tax Revenue Model (PTRM) v5.1 HumeLink	Transgrid	Nil	
34	A.5 - Humelink CPA 2 - Capex Forecast Model - CONFIDENTIAL (working formulas)	Humelink (CPA 2) Capex Forecast Model	Transgrid	28 Nov 23	
35	A.5 - Transgrid - Humelink CPA 2 - Capex Forecast Model - _21_December_2023 - CONFIDENTIAL	Humelink (CPA 2) Capex Forecast Model	Transgrid	28 Nov 23	
36	A.6 - Humelink CPA 2 - Direct Non-Labour Model - CONFIDENTIAL (working formulas)	Humelink CPA 2 Direct Non-Labour Model	Transgrid	Nil	[Contains confidential Information]
37	A.6 - Transgrid - Humelink CPA 2 - Direct Non-Labour Model - _21_December_2023 - CONFIDENTIAL	Humelink CPA 2 Direct Non-Labour Model	Transgrid	Nil	[Contains confidential Information]

	File Name	Model Name	Author	Date	Title Page
38	A.7 - Humelink CPA 2 - Labour and Overhead Costs - CONFIDENTIAL (working formulas)	Labour and overhead costs for HumeLink Stage 2	Transgrid	Nil	
39	A.7 - Transgrid - Humelink CPA 2 - Labour and Overhead Costs_21_December_2023 - CONFIDENTIAL	Labour and overhead costs for HumeLink Stage 2	Transgrid	Nil	
40	A.8 - Transgrid - Humelink CPA 2 - Opex Forecast Model_21_December_2023_CONFIDENTIAL	HumeLink CPA2 Opex Forecast Model	Transgrid	Jan 24	

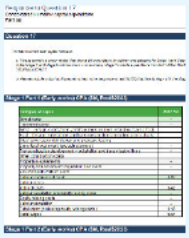
A.4 Presentations relating to the 15 March 2024 onsite meeting with Transgrid

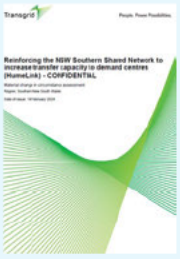
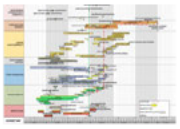
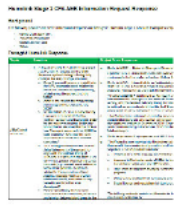
	File Name	Document Name	Author	Date	Title Page
41	AER Social Licence Meeting 7 March 24_0.1	Presentation: AER HumeLink CPA2 Transgrid response to Social Licence RFIs	Transgrid	7 Mar 24	
42	HumeLink AER EMCa Review 15 March 24	Presentation: AER EMCa CPA2 Review Major Project - HumeLink	Transgrid	15 Mar 24	

A.5 Response to IRs

A.5.1 Response to Information Request 02 (IR02) - Received 20 February

	File Name	Document Name	Author	Date	Title Page
43	COMF1 Humelink ITCvsEPCv02	Memo - HumeLink ITC vs EPC D&C Costs	fission	14 Sep 23	

	File Name	Document Name	Author	Date	Title Page
44	CORP1 – Forecast and actual costs Stage 1 parts 1 and 2 and Stage 2	Response to Q17 – consolidated Humelink capital expenditure	Transgrid	Nil	
45	CSEI1 - Photographer Receipt	Receipt Photographer	NA	29 Jul 22	NA
46	CSEI2 - Mental Health Initiative Outcomes	RFQ – Provision of mental health and community capacity building activities	NA	22 Jan 24	NA
47	CSEIBP1 HumeLink Community Investment Plan V2.6-DEC	HumeLink **Community Investment and Benefits Plan**	Transgrid	Dec 23	
48	CSEP1 - HumeLink Engagement Strategy	**HumeLink Engagement Strategy 2022 – 2026**	Transgrid	Jun 23	
49	CSEP2 - HumeLink CCEP	**HumeLink Community Communication and Engagement Plan March 2023 – August 2023**	Transgrid	Nil	
50	ENVO1 HumeLink Bank Guarantee for Biodiversity Offsets	**HumeLink Bank Guarantee Cost Estimate**	Transgrid	Sep 23	
51	LLR01 PEC Lessons Learned Review Report v0.1	**P0016502 HumeLink PEC Lessons Learned Review Report**	Transgrid	Sep 23	

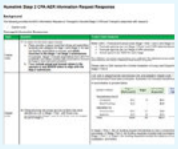
	File Name	Document Name	Author	Date	Title Page
52	MCC1 HumeLink CPA2 - MCC Assessment Feb '24	Reinforcing the NSW Southern Shared Network to increase transfer capacity to demand centres (HumeLink) - CONFIDENTIAL Material change in circumstance assessment Region: Southern New South Wales	Transgrid	14 Feb 24	
53	MCC2 24213 Letter to AER HumeLink CPA2 - MCC Assessment	Letter to AER - HumeLink CPA2 Material Change in Circumstance (MCC) Assessment - Draft Report	Transgrid	14 Feb 24	
54	PCGC1 20231201 HL Complete Programme DD24Nov2023	PCGC1 Humelink Master Programme - Status as at 24 Nov 2023	Transgrid	24 Nov 23	
55	PCGC2 20231201 HL Summary Programme DD24Nov2023	PCGC2 Humelink Master Programme - Status as at 24 Nov 2023	Transgrid	24 Nov 23	
56	Q37 Corporate Support	Response to Q37 - Corporate support cost substantiation	Transgrid	Nil	
57	Transgrid Humelink Response #2 21Feb24	Humelink Stage 2 CPA AER Information Request 02 (IR02) Response – Batch #1	Transgrid	20 Feb 24	

A.5.2 Response to Information Request 02 (IR02) - Received 22 February

	File Name	Document Name	Author	Date	Title Page
58	Q37 Corporate Support	Response to Q37 - Corporate support cost substantiation	Transgrid	22 Feb 24	

	File Name	Document Name	Author	Date	Title Page
59	Transgrid Humelink Response Batch #3	Humelink Stage 2 CPA AER Information Request 02 (IR02) Response – Batch #3	Transgrid	22 Feb 24	

A.5.3 Response to Information Request 02 (IR02) – Received 28 February

	File Name	Document Name	Author	Date	Title Page
60	CORP1 - Forecast and actual costs Stage 1 Parts 1 and 2 and Stage 2	Response to Q17 (Consolidated Humelink capital expenditure) & Q36 (LLE Expenditure)	Transgrid	28 Feb 24	
61	Transgrid Humelink Response Batch #4	Humelink Stage 2 CPA AER Information Request 02 (IR02) Response – Batch #4	Transgrid	28 Feb 24	

A.5.4 Response to Information Request 05 (IR05) – Received 8 & 10 April

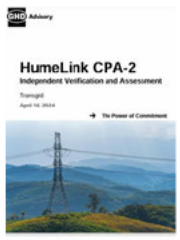
	File Name	Document Name	Author	Date	Title Page
62	Transgrid Humelink AER#5 Response Batch 1	Humelink Stage 2 CPA AER Information Request 05 (IR05) Response – Batch #1	Transgrid	8 Apr 24	
63	Transgrid HumeLink Response #5 (Batch 2)	Humelink Stage 2 CPA AER Information Request 05 (IR05) Response – Batch #2	Transgrid	10 Apr 24	
64	COME30.1 Commercial Framework letter CONFIDENTIAL	Delivery Contract Commercial Framework	E3 Advisory	8 Aug 23	

	File Name	Document Name	Author	Date	Title Page
65	COMF0.3 Humelink fission AER report CONFIDENTIAL	Humelink Project Independent Review of Contractors Cost Estimate	fission	Mar 24	
66	FBL0.1 Transgrid to AEMO_Humelink CPA2 Final Feedback Loop Request CONFIDENTIAL	Letter to AEMO - Feedback Loop confirmation HumeLink Stage 2 CPA	Transgrid	18 Dec 23	
67	FIN0.1 Q27 Labour Rates CONFIDENTIAL	Response to Q27 – Labour Rates	Transgrid	Nil	[Contains confidential Information]
68	ID0.1 - HumeLink - Risk Register High Level Review - Rev A - 20230904 CONFIDENTIAL	HumeLink - Risk Register High Level Review	Beca	4 Sep 23	
69	ID0.2 - TG RO Technical Memo v02 CONFIDENTIAL	Technical Memo – HumeLink Project Risk Register Rates	fission	21 Aug 23	
70	PCL0.1 Q24 Forecast FTE - Bar charts and roles	Response to 24a – FTE	Transgrid	Feb 24	
71	PCR0.10 - Humelink ECI Stage 2 QSRA Final Report V1.2 CONFIDENTIAL	HumeLink – CPA 2 Stage Time Contingency Report	TBH	7 Sep 23	

	File Name	Document Name	Author	Date	Title Page
72	PCR0.11 AER Q2 Response CONFIDENTIAL	IR05 Q2 (a,b,d,e) - Alternative Project Management Scenario	Transgrid	Apr 24	
73	PCR0.12 Humelink CPA 2 - Labour and Overhead Costs - One Year Delay CONFIDENTIAL	Labour and overhead costs for HumeLink Stage 2	Transgrid	Nil	
74	PCR0.3 HumeLink Board workshops (compiled) CONFIDENTIAL	Presentation: HumeLink Construction Risk Board Workshop #1	Transgrid	Jul 23	
75	PCR0.4 Breakdown of Aggregate Project Delay CONFIDENTIAL	HumeLink IR05 Q1a. Breakdown of aggregate project delay outcomes	Transgrid	Apr 24	
76	PCR0.5 HumeLink CPA2_Probabilities of Delay CONFIDENTIAL	HumeLink CPA2 Probabilities of Delay	Transgrid	Nil	
77	PCR0.6 Report-HumeLink CPA2_ECI Cumulative Risk Model CONFIDENTIAL	HumeLink CPA2 ECI Cumulative Risk Model	Transgrid	Nil	
78	PCR0.7 HumeLink CPA2_ECI Cumulative Risk Model_No Correlations CONFIDENTIAL	HumeLink CPA2 ECI Cumulative Risk Model - No Correlations	Transgrid	Nil	
79	PCR0.8 HumeLink CPA2_1 Year Extension Scenario CONFIDENTIAL	HumeLink CPA2-1 Year Extension Scenario	Transgrid	Nil	

	File Name	Document Name	Author	Date	Title Page
80	PCR0.9 Q7 forecast stage 1 CONFIDENTIAL	Q7 forecast stage 1	Transgrid	Nil	

A.5.5 Response to Information Request 05 (IR05) – Received 17 April

	File Name	Document Name	Author	Date	Title Page
81	HumeLink Independent Verification and Assessment 1604 2024 CONFIDENTIAL	HumeLink CPA2 Independent Verification and Assessment	GHD Advisory	16 Apr 24	
82	Transgrid HumeLink Response #5 (Batch 3)	Humelink Stage 2 CPA AER Information Request Response #5	Transgrid	Nil	

A.5.6 Response to Information Request 06 (IR06) – Received 26 April

	File Name	Document Name	Author	Date	Title Page
83	CONFIDENTIAL_ Scenario 1	Nil	Nil	Nil	[Contains confidential Information]
84	CONFIDENTIAL_ Scenario 2	Nil	Nil	Nil	[Contains confidential Information]
85	CONFIDENTIAL_ Scenario 3	Nil	Nil	Nil	[Contains confidential Information]
86	CONFIDENTIAL_ Scenario 4	Nil	Nil	Nil	[Contains confidential Information]
87	CONFIDENTIAL_ Scenario 5	Nil	Nil	Nil	[Contains confidential Information]
88	CONFIDENTIAL_ Scenario 6	Nil	Nil	Nil	[Contains confidential Information]
89	CONFIDENTIAL_ Scenario 7	Nil	Nil	Nil	[Contains confidential Information]

	File Name	Document Name	Author	Date	Title Page
90	CONFIDENTIAL_ Scenario 8	Nil	Nil	Nil	[Contains confidential Information]
91	CONFIDENTIAL_ Scenario 8	Nil	Nil	Nil	[Contains confidential Information]
92	IR06.1 - HumeLink CPA2 Risk cost scenarios 26 April 2024	Nil	Nil	Nil	
93	Transgrid HumeLink Response #6 26 April 24	Humelink Stage 2 CPA AER Information Request Response #6	Transgrid	Nil	

APPENDIX B – ALTERNATE SCENARIO FOR RISK-COST ALLOWANCE

Table B.1: Alternative scenario of top 25 risks

Risk ID	Risk Description	Controlled Risk Rating	Risk category	Cost category	P70 Monte Carlo (P55.2 value)	Basis for estimate	EMCa assessment		
							Summary	EMCa comment	Alternate estimate (based on P70 value)
	Time – NTP2								
2	Delay and cost claims from the contractors due to delay in receiving planning approval	Extreme	Time	Delivery Partner Costs	[redacted]	time delay	Assume overstated	This is an acceptable risk for inclusion. Costs are overstated based on unmitigated PAV costs, suggest that the actual out-turn costs will be much lower (adjust 20% for potential overstatement / mitigation opportunities)	[redacted]
49	Transgrid owner's costs increase due to project duration extension. Note: contractor costs dealt with in specific risks.	Medium	Time	Owners Costs	[redacted]	time delay	Assume removed	Transgrid should be able to manage within its contractor by prioritising / re-sequencing works with advance notice. Risk artefact ID49.1 shows bulk of estimated monthly prolongation cost is labour followed by insurance (assuming FY26 burn rate). LDs also not considered in analysis	[redacted]
	Time - other								
5	Delays to and claims by the contractor due to being unable to access the site	Extreme	Time	Delivery Partner Costs	[redacted]	time delay	Assume retained	This is an acceptable risk for inclusion. Based on assessment of landowners preventing access, given past experience and attitudes towards project	[redacted]
6	Variation claims by contractor due to changes in substation reliance information included in the contract e.g. (general arrangements, single line	High	Time	Delivery Partner Costs	[redacted]	time delay	Assume retained	This is an acceptable risk for inclusion.	[redacted]

Risk ID	Risk Description	Controlled Risk Rating	Risk category	Cost category	P70 Monte Carlo (P55.2 value)	Basis for estimate	EMCa assessment		Alternate estimate (based on P70 value)
							Summary	EMCa comment	
	diagrams, existing assets, geotech substation sites UGL)								
27	Exceptional events such as lockdowns, war, terrorism or natural disaster	Medium	Time	Delivery Partner Costs	[redacted]	time delay	Assume retained	This is an acceptable risk for inclusion. Industry practice, and based on reasonable evidence	[redacted]
35	Delays to Transgrid supplied reactors and transformers due to delayed overseas manufacturing and shipping timeframes	Medium	Time	Delivery Partner Costs	[redacted]	time delay	Assume retained	This is an acceptable risk for inclusion. There is potential for greater mitigation, given steps being taken for earlier delivery (however this may impact storage costs). The impact on realised time delay from any approval delays may not be realised	[redacted]
37	Project loses support (social licence) that results in disruptions such as blockades, protests, legal challenges and other means of obstruction including councils	Medium	Time	Delivery Partner Costs	[redacted]	time delay	n/a	No EMCa assessment - Out of scope	[redacted]
56	Delays to Transgrid supplied conductor and OPGW from delayed overseas manufacturing and shipping timeframes	Medium	Time	Delivery Partner Costs	[redacted]	time delay	Assume retained	This is an acceptable risk for inclusion. There is potential for greater mitigation, given steps being taken for earlier delivery (however this may impact storage costs). The impact on realised time delay from any approval delays may not be realised	[redacted]
80	Insolvency of JV member		Time	Owners Costs	[redacted]	cost variation	Assume retained	This is an acceptable risk for inclusion. There is potential to decrease likelihood from 5% to 2% due to tier 1 contractors	[redacted]

Risk ID	Risk Description	Controlled Risk Rating	Risk category	Cost category	P70 Monte Carlo (P55.2 value)	Basis for estimate	EMCa assessment		
							Summary	EMCa comment	Alternate estimate (based on P70 value)
	Variation								
13	Claims for delay due to exceeding the inclement weather allowance in Contract Plus disputes over what is inclement weather and what sites were impacted	High	Variation	Delivery Partner Costs	[redacted]	time delay	Assume retained	This is an acceptable risk for inclusion. There is potential for greater mitigation as a major event is unlikely to impact whole project (equally impact east and west) at same time, and reduce realised time delay	[redacted]
19	Claims for variations due to changes in scope due to changes in design and construction manuals or Transgrid requirements	High	Variation	Delivery Partner Costs	[redacted]	time delay	Assume removed	Changes to standards and design requirements are within Transgrid's control, and any further modifications should be known at the time of the base estimate or already included within existing cost forecasting accuracy. There are also risks for changes to reliance information, tower design and footings included as a part of separate risks	[redacted]
22	Increase in supply cost for fabricated steel (Evaluated as an inherent risk with a range from possible cost reduction to cost increases)	Low	Variation	Delivery Partner Costs	[redacted]	cost variation	Assume retained	This is an acceptable risk for inclusion.	[redacted]
33	Lack of coordination with Interface Contractors (OEM, East/West) resulting in design delays, construction delays, scope gaps, responsibility gaps and additional costs.	Medium	Variation	Delivery Partner Costs	[redacted]	time delay	Assume retained	This is an acceptable risk for inclusion. There are specific risks relating to OEM supply and installation that require close supervision and coordination. Whilst this could be considered within project controls, the performance of	[redacted]

Risk ID	Risk Description	Controlled Risk Rating	Risk category	Cost category	P70 Monte Carlo (P55.2 value)	Basis for estimate	EMCa assessment		Alternate estimate (based on P70 value)
							Summary	EMCa comment	
								OEMs is outside of the contractual relationship with contractors	
59	Changes to Conditions of Approval from the baseline conditions are more onerous	Medium	Variation	Delivery Partner Costs	[redacted]	time delay	Assume retained	`	[redacted]
65	Increase in costs associated tower footings with Geotechnical conditions being substantially different from the conditions expected following investigation works leading to increased costs and adjustment event under the delivery contract	Low	Variation	Delivery Partner Costs	[redacted]	cost variation	Assume retained	This is an acceptable risk for inclusion. Whilst this risk should be symmetric, Transgrid's assessment of prelim footing designs and limited info provided to contractors suggest a cost increase is certain above the base case estimate, see ID65.2 to 65.6 (particularly 65.5) In discussions with AER/EMCa Transgrid state that risk already being realised as a result of based on geotech assumptions being updated since issued at time of ECI.	[redacted]
68	Contractor repricing arising from an employer driven delay to NTP2	Medium	Variation	Delivery Partner Costs	[redacted]	cost variation	Assume overstated	This is an acceptable risk for inclusion. Costs are overstated based on unmitigated PAV costs, suggest that the actual out-turn costs will be much lower (adjust 20% for potential overstatement / mitigation opportunities)	[redacted]
	Reimbursable								
40	Increase in contractor reimbursable labour costs above EBA for transmission line works	Medium	Reimbursable	Delivery Partner Costs	[redacted]	cost variation	Assume removed	Considered to form part of provisions already included in contractor contingency (see artefact ID0.2)	[redacted]

Risk ID	Risk Description	Controlled Risk Rating	Risk category	Cost category	P70 Monte Carlo (P55.2 value)	EMCa assessment			
						Basis for estimate	Summary	EMCa comment	Alternate estimate (based on P70 value)
41	Additional Local Area Works during construction leads to increase in reimbursable costs. High construction road use could result in damage and repair requirements and issues in dealing with councils and non-project contractors	Medium	Reimbursable	Delivery Partner Costs	[redacted]	cost variation	Assume removed	Considered to form part of provisions already included in reasonable base estimate (on a probabilistic basis) in tendered works	[redacted]
42	Reimbursable plant and equipment costs above estimate for transmission line works	Medium	Reimbursable	Delivery Partner Costs	[redacted]	cost variation	Assume removed	Considered to form part of provisions already included in contractor contingency (see artefact ID0.2)	[redacted]
47	Productivity less than planned, increase in rework, below plan productivity of tower foundations, unskilled and skilled stringers, riggers, electricians, etc	Medium	Reimbursable	Delivery Partner Costs	[redacted]	time delay	Assume removed	Considered to form part of provisions already included in contractor contingency (see artefact ID0.2)	[redacted]
57	Design refinement and growth of towers occurs during detailed design	Medium	Reimbursable	Delivery Partner Costs	[redacted]	cost variation	Assume retained	This is an acceptable risk for inclusion.	[redacted]
	Inherent risks								
70	Uncertainty in the estimate of owner's costs for labour and consultants	Low	Inherent	Owners Costs	[redacted]	cost variation	Assume removed	As a symmetrical risk/opportunity this should not be included. Within Transgrid's reasonable control as a part of works already completed	[redacted]
71	Uncertainty in the estimate of owner's non-labour costs for support, travel, legal, etc.	Low	Inherent	Owners Costs	[redacted]	cost variation	Assume removed	As a symmetrical risk/opportunity this should not be included. Within Transgrid's reasonable control as a part of works already completed	[redacted]

Risk ID	Risk Description	Controlled Risk Rating	Risk category	Cost category	P70 Monte Carlo (P55.2 value)	EMCa assessment: Basis for estimate	EMCa assessment: Summary	EMCa assessment: EMCa comment	EMCa assessment: Alternate estimate (based on P70 value)
72	Uncertainty in the cost of OEM Transformers, reactors and conductor	Low	Inherent	OEM Supply	[redacted]	cost variation	Assume removed	As a symmetrical risk/opportunity this should not be included. Within Transgrid's reasonable control as a part of works already completed	[redacted]
	Biodiversity				[redacted]				
74	Uncertainty of the final biodiversity offset costs	Low	Biodiversity risk	Environmental Offset	[redacted]	cost variation	n/a	No EMCa assessment - Out of scope	[redacted]
	Total top 25 risks				**537.1**				**34.4**
	Total all risks				**599.1**				**375.3**