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Project EnergyConnect – NSW/Victoria Component

REVIEW OF ASPECTS OF TRANSGRID'S CONTINGENT PROJECT APPLICATION

Report prepared for:

AUSTRALIAN ENERGY REGULATOR

December 2020

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ABBREVIATIONS

Term	Definition
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
BAFO	Best and Final Offer
Application	Contingent Project Application
D&C	Design and construct
ECI	Early Contractor Involvement
EIS	Environmental Impact Statement
EPC	Engineer, Procure, Construct
FID	Final Investment Decision
EIS	Environmental Impact Statement
EOI	Expression of Interest
FID	Final Investment Decision
ISP	Integrated System Plan
km	kilometre
LSE	Large Specialised Equipment
NEM	National Electricity Market
NSW	New South Wales
PACR	Project Assessment Conclusions Report
PEC	Project EnergyConnect
PERT	Program Evaluation and Review Technique
PST	Phase Shift transformer
PT	Power Transformer
RCP	Regulatory Control Period
RFP	Request for Proposal
RFT	Request for Tender
RIT-T	Regulatory Investment Test – Transmission
SA	South Australian
SC	Synchronous Condensers
SCB	Shunt Capacitor Bank
SISC	System Integration
SPS	Special Protection Scheme
VIC	Victoria

EXECUTIVE SUMMARY

Project overview

1. TransGrid submitted a Contingent Project Application (Application) to the AER on 30 September 2020 for the New South Wales and Victorian components of Project EnergyConnect (PEC). This followed a determination by the AER in January 2020 that PEC satisfied the requirements of the Regulatory Investment Test for Transmission (RIT-T).
2. PEC forms a central feature of the roadmap for the transition of the power system developed by the Australian Energy Market Operator (AEMO) in its 2020 Integrated System Plan (ISP). The primary purpose is to enhance system security, provide net market benefits and support the transition of the energy market to a lower carbon emissions future.
3. PEC involves the construction of a new 900km, 330kV transmission line connecting Robertstown in SA to Wagga Wagga in NSW via Buronga in NSW, with an added connection to Red Cliffs in north west Victoria.
4. The component to which the Application relates, includes a new 330 kV double circuit line from the South Australian (SA) border with NSW to Buronga to Dinawan to Wagga Wagga, new transformers at Buronga, augmentation works at the existing Buronga, Wagga Wagga and Red Cliffs substations, a new 330 kV switching station at Dinawan, a new double circuit 220 kV line from Buronga to Red Cliffs in Victoria, static and dynamic reactive plant at Buronga and Dinawan, and other works.

Project scope

5. The AER has requested that EMCa review two aspects of TransGrid's capital cost forecast to support its determination of the prudency and efficiency of the estimated project cost:
   - the transmission lines and substations cost as determined by competitive tender; and
   - the reasonableness of aspects of TransGrid's Indirect Costs.

Basis for our assessment

6. Since submitting its Application to the AER, TransGrid has provided a revised cost forecast to the AER which includes the results of its competitive tender assessment process, which concluded with selection of a preferred tenderer based on its Best and Final Offer (BAFO). We refer to this as the 'BAFO capex forecast' and the capex forecast submitted with the Application in June 2020 as the 'Application capex forecast.'
7. At the direction of the AER, we have based our assessment on the supplementary 'BAFO capex forecast'. In addition to the relevant information provided by TransGrid with its Application, and supplementary information following its selection of the preferred tenderer, we have taken into account information provided by TransGrid in response to questions asked of TransGrid by the AER and ourselves as part of this review.

Summary of our assessment of TransGrid's procurement process

8. We have reviewed TransGrid's procurement process used to derive the forecast costs for the transmission line, substation works, and large specialist equipment (LSE) that are largely to be delivered by TransGrid's preferred contractor (Contractor) under its project delivery model.
9. As part of its process, TransGrid selected a single contractor Engineer Procure Construct (EPC) delivery model as the best approach to satisfying its project objectives, after considering a number of alternative models. Based on the information provided, we consider the EPC delivery model to be appropriate for TransGrid's component of PEC.
10. TransGrid used a five-stage process to agree a fixed price EPC contract with the preferred tenderer. The process afforded the opportunity for both parties to negotiate competitive

costs for the transmission line, substation, LSE, and related components of the PEC with an acceptable balance of risk between TransGrid and the Contractor.

11. We consider that the tender evaluation process followed industry practice in allowing a fair comparison of price and non-price elements pertaining to the responses of experienced and capable tenderers.

12. The preferred tender for the transmission line and substation-related work was superior overall to that from the other short-listed tenderer on non-price dimensions and its price was marginally higher than the other shortlisted tenderer.

13. The capex forecast included in the Application was much higher than the forecast used in the Project Assessment Conclusions Report (PACR capex forecast) because of the simplified approach to the scope and specification at that time.

14. TransGrid's tender process resulted in a BAFO from the preferred tenderer including refinements to the line route, more cost-efficient line design and construction options, and lower costs for the LSE than TransGrid could achieve. Collectively this resulted in a material reduction of the capex forecast at the BAFO stage compared with the cost estimate submitted as a part of the Application.

Summary of our assessment of TransGrid's transmission line, substation, and Large Specialist Equipment cost estimates

15. We have reviewed the development of TransGrid's transmission line, substations, LSE, and related construction costs included in TransGrid's BAFO capex forecast. We have taken into account the changes in the scope and responsibilities between TransGrid and its proposed Contractor over the various stages of procurement and development of the EPC contract.

16. The BAFO capex forecast for the components of direct cost we have been asked to review for the AER is 20% lower than the equivalent estimate in the Application capex forecast.

17. We conclude that:

- The scope of works is prudent;
- The BAFO capex forecast for the lines and substations work are reasonable other than TransGrid has overstated the quantum of the provisional sum for costs associated with a possible 330kV line deviation of the Dinawan to Wagga Wagga line section; and
- The BAFO capex forecast for the LSE requirement is reasonable.

Summary of our assessment of TransGrid's Other construction costs

18. 'Other construction costs' are those costs that TransGrid expects to incur in the construction of PEC, but which were not currently included in the tender prices received in response to its initial tender stage ('Phase A'). The Other construction costs which are included in the BAFO capex forecast are in aggregate 80% lower than the estimate in TransGrid's Application capex forecast.

19. TransGrid's provisions for Other construction costs are based on tendered prices but include an assessment of the cost and likelihood of the consequences from certain adverse events which TransGrid must cover under the terms of its contract.

20. Of the components of the Other construction costs proposed by TransGrid, we consider that all but one is a reasonable amount. We consider that TransGrid has overstated the likelihood of an extreme weather event impacting the project.

Summary of our assessment of aspects of Indirect Costs

21. We have reviewed aspects of TransGrid's forecast labour and labour-related Indirect Costs to manage the remainder of the delivery of its component of the PEC. Specifically, we reviewed TransGrid's forecast capex ascribed to Project development, Works delivery, Land and development, and Stakeholder and community engagement resource categories.

22. Based on a bottom-up analysis of TransGrid's forecast labour and labour-related indirect cost within these four resource categories, we consider the capex forecast to be reasonable.

Implications of our findings

23. Based on information provided we consider that:

- The transmission lines and substations capex forecast of $1,270.2m is likely to be reasonable, with the exception of the $32.6m provisional sum for a possible line route deviation, which we consider to be overstated by 25% (-$8.2m) to 50% (-$16.3m);
- The Large Special Equipment capex forecast of $140.2m is likely to be reasonable;
- The Other Construction Costs capex forecast of $58.2m is overstated by $8.3m; and
- The forecast capex of $87.1m for the aspects of Indirect Costs that we reviewed is likely to be reasonable.

1 INTRODUCTION

1.1 Scope

24. TransGrid submitted a Contingent Project Application (Application) for the NSW and Victorian components of Project Energy Connect (PEC) to the Australian Energy Regulator (AER) in June 2020. As discussed in the following section, by agreement with the AER, TransGrid submitted a revised capex forecast (and supporting documentation) following the completion of its tender process '*to ensure that our forecast capex for the Project, and therefore our adjusted revenues and prices, reflects the best available view of the market-tested costs*.'[1]

25. The AER has requested EMCa to provide advice and assistance in determining:

- Whether the proposed costs represent a reasonable forecast of the capex required for undertaking the contingent project, both overall and in each year in the current regulatory control period;
- A substitute forecast, in the event that the proposed costs do not represent a reasonable forecast; and
- Whether the information provided in the Application is sufficient to make the above determination/s, and if not, what additional information the AER should request from TransGrid.

26. By agreement with the AER, we focussed on two areas of the cost forecast:

- The transmission lines, substation, and related capital costs, as determined by competitive tender; and
- The reasonableness of aspects of Indirect Costs forecast by TransGrid.

27. The purpose of this report is to provide AER with our assessment of the aspects of expenditure set out above, and the basis for our findings.

28. We have not been asked to review the proposed opex, or other components of the forecast capex costs including:

- Actual incurred costs to date;
- Costs associated with land access, environment approvals and Environmental Impact Statement (EIS) approvals; and
- Costs associated with inter-network testing.

29. References are included in relation to the above where we have identified an issue or concern that is likely to be material and which we consider warrant closer examination by the AER as part of its separate review of the proposed costs.

1.2 TransGrid's capex forecasts

30. At the time of submitting its Application, TransGrid was part way through its competitive tender process for its component of PEC. The capex forecast in its Application for the period 1 July 2018 to 30 June 2023 was based on:[2]

- Outcomes from the Request for Tender (RFT) Phase A, received in November, 2019;
- Quotations from suppliers for the LSE;

[1] TransGrid, A.5A Supplementary Capex Forecasting Method – BAFO, page 1

[2] TransGrid, A.5A Supplementary Capex Forecasting Method – BAFO, page 1

- Independent expert reports on property and easement costs and environmental offset costs which were based on the initial proposed line route; and
- A bottom-up build of indirect costs based on TransGrid's actual costs and its forecast of additional resources required.

31. We refer to this as TransGrid's 'Application capex forecast'. We refer to the capex forecast applicable to the preceding Project Assessment Conclusions Report (PACR) as the 'PACR capex forecast'.

32. TransGrid submitted updated information to the AER on 30 September 2020, which included a revised capex forecast which is considered as part of its Application. The updated capex forecast is based on:

- The prices from the final stage of its tender process, being the Best and Final Offer (BAFO) stage received from the BAFO tenderer that we received on 1 September 2020 in this document;
- Updated information on Other construction costs;
- Updated expert reports on property and easement costs and environmental offset costs, which reflect the new PEC route via Dinawan, and other changes; and
- Updated Indirect Cost forecasts, which reflect actuals to 31 July 2020 and other minor revisions.

33. We consider the information provided in support of the Application capex forecast and compare it with the relevant information provided in the PACR and BAFO capex forecasts.

34. We have not undertaken a review of the reasonableness of the cost estimate included in the PACR, nor of the technical basis for the transmission lines, substations, and LSE underpinning the PEC PACR. Our focus is on the reasonableness of the cost given the significant uplift in forecast capex from the PACR level.

1.3 Structure of this report

35. In section 2 we provide an overview of the PEC and the expenditure that we have been asked to assess. We first present an overview of the PEC comprising the South Australian (SA), New South Wales (NSW) and Victorian components, thereafter all references to PEC refer to the NSW and Victorian components only, as included in the Application submitted by TransGrid.

36. In subsequent sections, we provide our assessment of the three aspects areas of scope:

- In section 3, we provide our assessment of TransGrid's procurement process and commercial arrangements used to achieve what it claims to be efficient price from an external service provider for the transmission line, substation and related works;
- In section 4, we provide our assessment of TransGrid's proposed capital cost of line, substations, and related works; and
- In section 5, we provide our assessment of TransGrid's proposed labour-related Indirect Costs.

1.4 Presentation of expenditure amounts

37. Expenditure is presented in this report in $2017/18 dollar terms, unless stated otherwise.

1.5 TransGrid provided information to inform our review

1.5.1 Contingent Project Application

38. In addition to the Contingent Project Application document, TransGrid has provided additional information and data to the AER which we have drawn from for our review of aspects of the project cost estimate.

1.5.2 Information requests

39. The AER and ourselves have sought further information from TransGrid through written information requests. TransGrid provided responses to each of the information requests and we have taken relevant information into account in our assessment. This information included:

- Responses to our questions;
- Supporting worksheets containing cost and resource information; and
- Other supporting information relating to reviews, reports, and tender-related documents.

1.5.3 Initial review workshop with TransGrid

40. We held a virtual meeting with TransGrid to discuss specific issues that we considered had not been adequately covered in the information and documentation provided. TransGrid engaged positively in the discussions and provided additional material that we requested to support the explanations given at the meeting.

2 BACKGROUND INFORMATION

In this section we provide an overview of PEC, then the scope of the TransGrid component of PEC, including the proposed capital expenditure included in TransGrid's Application.

2.1 Project overview

2.1.1 Project drivers

42. PEC forms a central feature of the roadmap for the transition of the power system developed by the Australian Energy Market Operator (AEMO) in its 2020 Integrated System Plan (ISP). The ISP classified PEC as an 'actionable ISP project' which will deliver net market benefits and support energy market transition through:[3]

- Lowering dispatch costs, initially in SA, through increasing access to supply options across regions;
- Facilitating the transition to a lower carbon emissions future and the adoption of new technologies, through improved access to high quality renewable resources across regions; and
- Enhancing security of electricity supply in SA.

2.1.2 Project scope of works

43. As depicted in the figure below, PEC involves the construction of a new 900km, 330kV transmission line connecting Robertstown in SA to Wagga Wagga in NSW via Buronga in NSW, with an added connection to Red Cliffs in north west Victoria.

Figure 2.1: Line route for Project EnergyConnect

Source: TransGrid, PEC Contingent Project Application Final, Figure 2, modified by EMCa

44. We understand that the SA and NSW Governments have provided support for ElectraNet and TransGrid to progress preliminary work for the PEC to allow the interconnector to be

[3] AEMO, 2020 Integrated System Plan, July 2020

delivered sooner if it is approved by the AER.[4] The preliminary work was initially focused on narrowing the route corridor.

45. Since that time the nature of the early works arrangements for ElectraNet and TransGrid has diverged, and which is reflected in the SA and NSW components of the PEC being at differing stages of development at the time of this Application.

2.1.3 Project delivery

46. PEC will be delivered by ElectraNet and TransGrid as the respective transmission network operators in SA and NSW, subject to receiving all necessary environmental and regulatory approvals.

47. As the final step in the regulatory approval process, a Contingent Project Application has been submitted to the AER by ElectraNet and TransGrid for their respective scopes, and which seeks approval of the capital expenditure and revenue required.

48. The capital costs have been updated since the time the RIT-T assessment was undertaken in January 2020, to reflect the outcomes of detailed project planning and competitive procurement processes undertaken to date.

2.2 TransGrid's component of PEC

2.2.1 Overview

49. The capital expenditure forecast for the TransGrid component of PEC as set out in its Application is $2,271m (not including equity raising costs). Competitive market pricing makes up a large component of the cost. As discussed below, TransGrid has concluded its tender process since submitting its Application and has updated its cost based on the best and final offer (BAFO) from its preferred tenderer. The supplementary 'BAFO capex forecast' is $1,894.6m (not including equity raising costs).

2.2.2 Project scope of works

50. The scope of works for TransGrid's component includes:[5]

- New 330 kV Phase Shifting Transformers at Buronga and 330/220 kV transformers;
- Augmentation works at the existing Buronga, Wagga Wagga and Red Cliffs substations;
- Establishment of a new 330 kV switching station at Dinawan;
- A new double circuit 220 kV line from Buronga to Red Cliffs in Victoria, including decommissioning and removal of the existing 220 kV line;
- Static and dynamic reactive plant at Buronga and Dinawan; and
- Associated commissioning works and testing.

2.2.3 Project timing and status

51. TransGrid's Application identifies the following milestones:[6]

- 1 July 2018 - commencement of the contingent project; and
- June 2023 - anticipated date for completion of TransGrid's component.

52. TransGrid has recently completed its tender process with selection of the best and final offer from its preferred tenderer and signing a Commitment Deed for an EPC Contract to be

[4] TransGrid A.1 PEC Contingent Project Application Final, page 1

[5] TransGrid A.1 PEC Contingent Project Application Final, page 8

[6] TransGrid, A.1 PEC Contingent Project Application, 29 June, Final, page 15

executed once the TransGrid Board has made its Final Investment Decision (FID). The timing of the FID is dependent on the timing of the AER's Decision.

2.2.4 Forecast capital expenditure

53. The table below summarises the major components of the PEC capex forecast (not including equity raising costs) showing the progression from the PACR capex forecast to the Application capex forecast to the BAFO capex forecast. We discuss the reasons for the changes in 'Tendered Works' and forecast labour-related Indirect Capex in sections 4 and 5, respectively.

Table 2.1: TransGrid's capex forecasts, not including equity raising costs - $m, 2017/18

Type	Item	PACR capex Forecast	Application capex forecast	BAFO capex forecast
Tendered works	Substations and transmission lines [1]	816.1	1,315.2	1,270.2
	Large specialist equipment	153.0	216.3	140.2
	Other construction costs	-	295.3	58.2
Property capex	Property and easement acquisition	24.3	109.5	121.5
	Environmental offset costs	-	74.7	127.4
Indirect capex	Actual costs	133.8	17.1	27.8
	Forecast costs	-	105.3	108.0
Risk events	Environmental offset risk cost	22.9	122.1	38.2
Real input escalators	Real labour cost escalation	-	15.5	3.2
Total		**1,150.1**	**2,271.0**	**1,894.6**

Sources: TransGrid, PEC Application, page 21; A5.A Supplementary Capex Forecasting Method for Project Energy Connect – BAFO, pages 15-16; [1] includes access tracks [2] does not include equity raising costs of $19.9m

54. The table below summarises the cost estimate by year for the current Regulatory Control Period (RCP), excluding equity raising costs ($19.9m), based on the BAFO capex forecast.

Table 2.2: TransGrid's BAFO capex forecast – including overheads - $m 2017/18

	2018-19	2019-20	2020-21	2021-22	2022-23	Total
Total capex	3.5	23.2	222.5	914.8	730.5	1,894.6

Source: A.6 TransGrid PEC Capex Forecast Model – CONFIDENTIAL, excluding equity raising costs

3 ASSESSMENT OF TRANSGRID'S TENDER PROCESS AND PROJECT DELIVERY MODEL

We have reviewed TransGrid's procurement process used to derive the costs for the transmission line, substation, and LSE components of the PEC that are largely to be delivered by TransGrid's preferred contractor (Contractor) under its project delivery model.

TransGrid selected a single contractor Engineer Procure Construct (EPC) delivery model which we consider to be appropriate for TransGrid's component of PEC.

We consider that the tender evaluation process followed industry practice in allowing a fair comparison of price and non-price elements pertaining to the responses of experienced and capable tenderers.

The preferred tender for the transmission line and substation-related work was superior overall to that from the other short-listed tenderer on non-price dimensions and its price marginally higher than the other shortlisted tenderer.

TransGrid's approach to signing the EPC contract with the preferred tenderer provided the opportunity to refine the scope, specification, and cost progressively and negotiate responsibilities and cost. The result was a material reduction of the capex forecast at the BAFO stage compared with the Application capex forecast.

3.1 Introduction

55. In this section we consider TransGrid's procurement process used to establish an efficient transmission line and substations delivery cost from TransGrid's selected supplier ('the Contractor') and the commercial model established by TransGrid to enable project delivery.

3.2 TransGrid's procurement process

3.2.1 Overview of TransGrid's procurement process

Project objectives

56. TransGrid identifies four objectives for delivery of PEC, which it states are aligned with its corporate vision and values.[7] It also identifies a 'primary objective' of the tender process,[8] as summarised below. TransGrid has applied the project objectives to, among other things, guide its tender evaluation process and selection of its commercial model with its preferred tenderer.

57. The objectives are summarised as follows.

[7] TransGrid, Capex Forecasting Methodology for Project Energy Connect, page 14

[8] TransGrid, EnergyConnect Tender Evaluation Report Phase B, page 11, and TransGrid, Project EnergyConnect – Contingent Project Application, AER – EMCa Workshop, Oct 2020, slide 17

PEC delivery objectives

- Deliver value for money;
- Effectively manage risk to prudently and efficiently deliver PEC;
- Deliver a fit for purpose asset that can be safely and efficiently operated over its design life, and
- Continue a strong focus on safety.

PEC tender process objectives

- Determine the most suitable (best value for money) Proposal and Tenderer to deliver the project;
- Ensure that the evaluation process is undertaken in an efficient and equitable manner consistent with the Evaluation Plan, the Transaction Management Plan and the RFT-B documents; and
- Conduct an Evaluation Process that is defensible and auditable.

Selection of the project delivery model

58. TransGrid assessed three procurement project delivery models:[9]
    - EPC;
    - Alliance; and
    - Multiple packages with high level of TransGrid technical input.
59. TransGrid selected and is applying the EPC delivery model incorporating a fixed price established through competitive tender. Within the EPC delivery model, four packaging options were considered. The 'single contract' option was selected.

TransGrid's procurement steps

60. TransGrid's procurement process was carried out in five main stages[10]
    1. Pre-tender preparation:
        a. establish a procurement team
        b. engage a probity adviser
        c. develop a Tender Evaluation Plan
        d. establish a Tender Evaluation team (including external observers)
        e. market scanning and engagement;
    2. Request for Tender – Phase A:
        a. invite interested parties to participate in Phase A
        b. assess each tenderer's proposed solution and capability, experience and capacity to deliver the works;
    3. Request For Tender - Phase B:
        a. invite three shortlisted bidders from Phase A to participate
        b. assess value for money and non-price factors;
    4. BAFO - the two lowest cost bidders from Phase B were invited to submit a BAFO; and
    5. Execution of a Commitment Deed with the preferred tenderer (the 'Contractor').

[9] TransGrid, PEC – Project Energy Connect Project Implementation Plan, page 21

[10] TransGrid, A5.A Supplementary Capex Forecasting Method for Project Energy Connect – BAFO, page 7

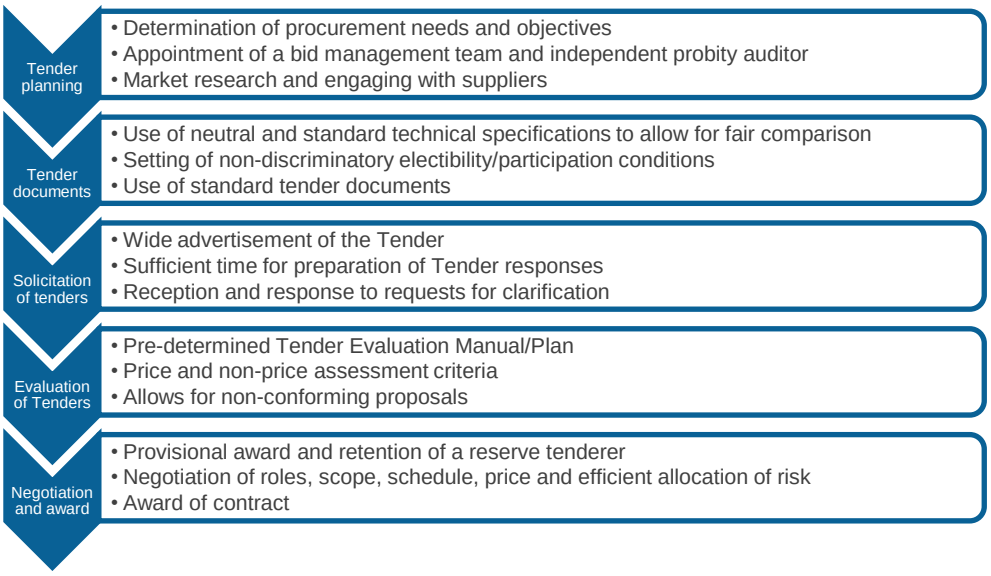
61. The Prices received from RFT Phase A were used as the basis for the original cost estimate included in TransGrid's Application. TransGrid has subsequently updated the capex forecast based on the BAFO of the preferred tender, referred to as the BAFO capex forecast.

3.2.2 Our assessment

Features of a competitive tender we looked for

62. In assessing the competitiveness of the tender process and the likelihood that the tendered price is market competitive, we applied the framework in the figure below.

Figure 3.1: EMCa's competitive tender assessment framework



Source: Based on Government of South Australia, State Procurement Board, Acquisition Planning Policy v10.8

Tender Planning

TransGrid's procurement objectives are appropriate

63. We found several descriptions of TransGrid's project and procurement objectives, however the common theme is achievement of the lowest sustainable whole-of-life cost to maximise benefits for customers.[11] TransGrid sought to achieve the overarching objective by focussing on value for money (a combination of price and non-price criteria) by applying an efficient, equitable, defensible, and auditable process.[12]

64. We consider the procurement objectives to be appropriate.

65. A question we explore in subsequent sections is whether TransGrid's procurement process appropriately balanced the cost and risk-related objectives.

TransGrid created a balanced bid management team and a Probity Adviser

66. TransGrid established a governance framework for the tender evaluation illustrated in the figure below. In our opinion, the tender evaluation governance structure has an appropriate balance of technical and commercial personnel, senior managers, and independent advisers for the size and complexity of the project. Reasons for our finding include:

- The Evaluation Panel comprises members of TransGrid's senior management team plus an independent member;

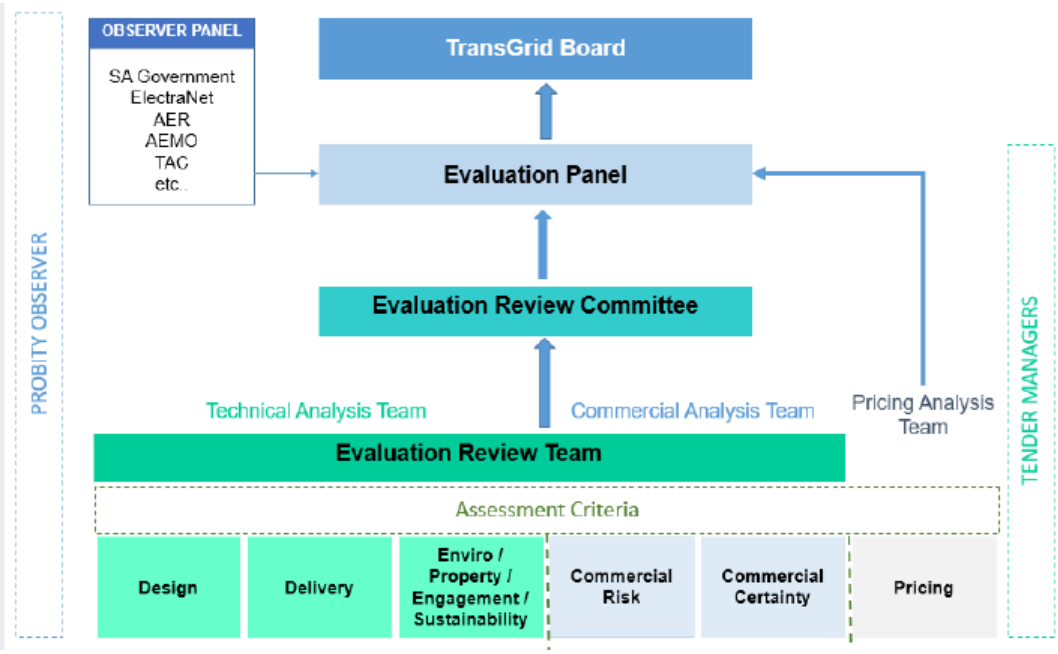
[11] TransGrid, A5.B Capex Forecasting Method for Project Energy Connect, page 3

[12] TransGrid, EnergyConnect Tender Evaluation Report Phase B, page 11

- The Evaluation Review team comprises TransGrid subject matter experts, an Owners Engineer, and consultants;
- An Observer Panel was included, comprised of interested and informed stakeholders; and
- A Probity Adviser (consultant, also referred to as the Probity Observer) was appointed to oversee the evaluation process.

67. The combination of expertise, independence, and transparency is in our opinion capable of achieving the project and evaluation objectives.

Figure 3.2: TransGrid's Tender evaluation governance structure



Source: TransGrid, AER EMCa PEC Application Workshop – final, slide 15

TransGrid engaged widely

68. TransGrid advised that its early market scanning exercise was undertaken in early 2019, with engagement in September 2019 comprising 22 meetings with potential suppliers. This process led to 19 invitations to tender. Based on the quality (capacity, experience, relevancy) of the potential suppliers TransGrid engaged with,[13] we consider the process to have led to sufficiently wide engagement.

TransGrid's choice of the single-supplier EPC delivery model is likely to be appropriate

69. TransGrid advised that it evaluated the relative merits of the three delivery model options '*using an assessment framework that looked at cost certainty, risks, timeliness, revenue adjustment mechanisms and other 'value drivers'*.[14] The summary of its analysis is shown in the table below. TransGrid advised that it selected the EPC approach because of its '*risk appetite, cost certainty, potential for innovation, and single point interface.'*[15]

[13] TransGrid, Project EnergyConnect – Contingent Project Application, AER – EMCa Workshop, Oct 2020, slide 15

[14] TransGrid, A.5B Capex Forecasting Methodology for PEC – RFT Phase A, page 26

[15] TransGrid, Project EnergyConnect – Contingent Project Application, AER – EMCa Workshop, Oct 2020, slide 11

Table 3.1: Summary of procurement models considered by TransGrid

Procurement model	Pros	Cons
EPC (with design & construct contract)	Cost certainty Revenue adjustment mechanisms are not required	Higher price than others to reflect risk TransGrid has limited incentive to realise savings
Alliance	Project cost could be lower and/or quicker to complete Certainty of program	Less cost certainty than EPC Risk/reward mechanism may not be supported by stakeholders Adjustment mechanisms may be complex Little downside protection for TransGrid
BAU Plus (multiple packages)	Consistent with existing TransGrid processes Attractive to existing suppliers Smaller packages approach is aligned with initial TransGrid market engagement	Market innovation limited High level of interface and coordination risk Requires high TransGrid capability to manage High client overhead

Source: based on TransGrid, EnergyConnect Project Implementation Plan, Table 7, page 22

70. TransGrid's EPC contract is modelled on the *FIDC Silver Book*[16], an internationally recognised framework for EPC/Turnkey construction contracts in which the 'employer' is not engaged in the Contractor's design and construction, only providing the Contractor with detailed requirements.[17]

71. TransGrid considered four packaging options within the EPC model, as follows:[18]

- Single contract – civil, lines, substations, and LSE;
- Two contracts – (i) civil, lines, and substations, and (ii) LSE;
- Two contracts – (i) transmission lines, (ii) substations + LSE; and
- Two contracts – geographical split (east and west) at Buronga.

72. TransGrid emphasised the importance of minimising interface and integration risks and as a result selected the single contract option. TransGrid advised that the benefit of this approach was confirmed when the shortlisted prospective EPC contractors were able to reduce overall cost compared to the Application capex forecast by optimising the line and substation designs and construction.[19]

73. TransGrid advised that the procurement process itself offered the opportunity for capturing a broad range of prospective national and international participants and to progressively test tenderer capability, capacity, and experience relating to the scope of work and services required. It retained competitive tension throughout the process, and tested the commercial model and risk allocation.

74. We consider that the delivery model selected by TransGrid is a conservative approach to contracting because:

- It is a fixed time, fixed price, turnkey contract which transfers the majority of design, procurement and construction risk to the contractor;

[16] Fédération Internationale Fédération Internationale des Ingénieurs-Conseils (International Federation of Consulting Engineers)

[17] FIDC EPC/Turnkey Contract 2nd Edition (2017 Silver Book)

[18] TransGrid, Project EnergyConnect – Contingent Project Application, AER – EMCa Workshop, Oct 2020, slide 11

[19] TransGrid A.5A Supplementary Capex Forecasting Methodology for Project Energy Connect – BAFO, page 19

- This in turn is likely to have led to a higher BAFO cost than if TransGrid was bearing more of the project delivery risk, but this is not equivalent to concluding that the transfer of risk proposed is inefficient - we discuss risk transfer to the Contractor in section 4;
- The procurement risk of the LSE is fully wrapped into the EPC contract – we discuss this in section 4;
- It does not involve any risk/gain-sharing mechanism – instead the process has allowed opportunities for TransGrid and the preferred tenderer to each reduce their design and delivery risk through a collaborative approach; and
- The selected approach reduces TransGrid's overhead and aspects of technical and commercial risk in dealing with more than one principal contractor. We discuss aspects of TransGrid's Indirect Costs in section 5.

75. Based on the information provided, the selected single-contractor fixed-price EPC delivery model appears to satisfy TransGrid's project objectives better than the alternatives considered. The five stage approach[20] to signing the Commitment Deed with the preferred tenderer offers the potential to deliver the project at an efficient cost with an acceptable balance of risk between TransGrid and the EPC Contractor.

76. The EPC delivery model is well suited to what TransGrid describes itself as a relatively inexperienced buyer[21] for a project of this nature, facing the complexities of PEC, which include:

- Long line length, with commensurate supply and coordination challenges in managing on multiple work fronts;
- The high number of skilled resources, plant and equipment required to be procured for line and substation design, construction and energisation;
- The combination of large scale electrical and civil works;
- The procurement and commissioning challenge of the various elements of the LSE; and
- The management of multiple interfaces between states, utilities (principals), and contractors.

Tender Documents

77. In section 4 we consider the development of the transmission line costs and substation costs through the course of the tender process. Here we consider the approach TransGrid deployed to develop and promulgate its tender documentation to ensure that the best possible competitive price offers were received.

78. We have reviewed the comments by TransGrid, its Probity Adviser, and its technical consultants, in relation to the:

- Use of neutral and standard technical specifications to allow for fair comparison;
- Setting of non-discriminatory electability and participation conditions; and
- Use of standard technical standards.

79. The tender documents provided for the RFT Phase A and for the RFT Phase B are delineated in TransGrid's Tender Evaluation Report.[22] The key specification document is the Employers Technical Requirements v8.0, which identifies the geographic requirements and description, general and specific asset requirements (e.g. lines and substations) and the applicable technical standards. The LSE specifications are generally performance-based and aspects of the designs were preliminary at the time of tender, which provides both opportunity for improvement by the tenderers, but creates some cost uncertainty.

80. We note that the Probity Adviser found that, among other things, TransGrid had taken adequate activities and risk mitigation strategies to ensure the fairness and impartiality of

[20] Pre-tender (selection of the delivery model) , RFT-A, RFT-B, BAFO, and Commitment Deed

[21] TransGrid, EnergyConnect Tender Evaluation Report Phase B, page 9

[22] TransGrid, EnergyConnect Tender Evaluation Report Phase B, pages 12-13

the process – including through the clarity in the specification documentation, and via supporting interactive sessions with the tenderers.[23]

81. We consider that TransGrid has progressively developed and refined the tender documents to support a fair tender process and a competitive outcome, including enabling pricing to a sufficiently progressed specification.

Solicitation of Tenderers

82. Based on the information provided by TransGrid, we consider that its early market engagement, followed by '*intensive market sounding'* was successful in its '*objective of broadening the group of potential contractors and building interest for the PEC outside of the contractors [it] typically uses*.'[24] From the potential tenderers invited to respond to the RFT, five Phase A proposals were received, which we consider represents a sufficient number to provide competition and quality.

83. We also note that the Probity Adviser found that, among other things, TransGrid:

- Provided adequate RFT timeframes, including by granting extensions of times when reasonably requested; and
- Allowed non-conforming proposals (with certain conditions) - but none were received.

Evaluation of Tenders

Good tender evaluation practices appear to have been followed

84. Key components of the process included:

- EnergyConnect Tender Evaluation Plan;
- EnergyConnect Tender Evaluation Report;
- An independent Project EnergyConnect Tender Evaluation Report (by Rider Levell Bucknall); and
- A Probity Report (for Phase B) (O'Connor Marsden & Associates).

85. From our review of these documents, it is apparent to us that good tender evaluation practices were followed. The tender evaluation process resulted in three of the five proposals being shortlisted for Phase B RFTs and subsequently two tenderers being invited to participate in the BAFO phase.

86. We note that TransGrid (and its advisers) took appropriate steps to normalise the tenders where required to '*broadly align with the core scope assumptions and therefore represent the full costs of constructing PEC.'*[25] This is appropriate practice.[26]

The Tender Evaluation Plan considered price and non-price criteria, which is consistent with good practice

87. The non-price RFT-Phase B and BAFO evaluation criteria were: Project solution, Project delivery, Environmental, property, engagement, and social sustainability, Commercial risk, and Commercial certainty.[27] We consider these to be appropriate criteria.

88. In the BAFO stage, TransGrid:

- Provided the opportunity to the two shortlisted tenders to revise their proposals in select areas (including cost) having been briefed by TransGrid on areas of their original proposal that must be addressed; and

[23] Probity Adviser's Report: Project Energy Connect - Procurement Approach – Request for Tender Phase B, pages 6-16

[24] TransGrid, A.5B Capex Forecasting methodology for PEC – RFT Phase A, CONFIDENTIAL, page 26

[25] TransGrid, A.5A Supplementary Capex Forecasting Methodology for Project Energy Connect – BAFO, page 19

[26] Noting that the two BAFO proposals were developed on a consistent basis and did not require normalisation (TransGrid, A.5A Supplementary Capex Forecasting Methodology for Project Energy Connect – BAFO, page 20)

[27] TransGrid, Project EnergyConnect – Contingent Project Application, AER – EMCa Workshop, Oct 2020, slide 20

- Undertook risk adjustments for omissions in scope or submission and departures to the TransGrid-designated EPC Deed which impacted on risk allocation, both of which we consider to be appropriate adjustments for equitable comparison.

89. The risk adjusted total prices for evaluation in both the RFT-Phase B and BAFO phases resulted in minor separation between the two shortlisted tenderers. The tenderers were ultimately separated by non-price factors, for which there was clear distinction.

90. Noting the comments and conclusions by TransGrid, its Probity Adviser, and its technical consultants, we consider that the tender process has achieved TransGrid's process objectives.

Negotiation and Award of Contract

Split of responsibilities is designed to allocate risk efficiently

91. The outcome of the BAFO process was a negotiated landing on the apportionment of responsibilities (and the concomitant costs and risks) for the items shown in the table below.

Table 3.2: Split of responsibilities between TransGrid and the Contractor

TransGrid	Contractor
Environmental approvals	Design of all works
Property access	Procurement
Interfaces and integration (ElectraNet & AEMO)	Construction
Network access	Health, safety, and environmental management
Asset acceptance and energisation	Testing and pre-commissioning

Source: TransGrid, Project EnergyConnect – Contingent Project Application, AER – EMCa Workshop, Oct 2020, slide 27

92. All of the TransGrid responsibilities in the table above are outside of our scope of review. We note that one of TransGrid's prime objectives in negotiations was to ensure an efficient allocation of risk and an efficient price.

3.3 Summary of our findings

93. We consider that TransGrid's procurement objectives and the selection of the fixed-price, fixed term EPC model are appropriate for TransGrid in achieving its objectives in managing its component of the PEC.

94. The tender evaluation process followed common industry practice in allowing a fair comparison of price and non-price elements pertaining to the responses of two experienced and capable short-listed tenderers. The preferred tender for the transmission line, substation, and LSE work was superior overall to the other tenderer on non-price criteria and marginally higher on price. The preferred tenderer received unanimous support from the Evaluation Team and was endorsed by the TransGrid Board.

95. Overall, we consider that the BAFO achieved from TransGrid's tender process is an outcome of an adequate competitive tender process.

4 ASSESSMENT OF THE COST OF TENDERED WORKS

We have reviewed the development of TransGrid's transmission line, substations, LSE, and related construction costs through to the latest 'BAFO capex forecast' proposed to the AER in November 2020 as an update to its Application. We have taken into account the changes in the scope and responsibilities between TransGrid and its proposed Contractor over the five stages of procurement of the EPC contract.

The BAFO capex forecast for the components of direct cost we have reviewed for the AER is significantly lower than the estimate in the Application capex forecast.

Based on our assessment, we conclude that the resultant scope of work is prudent and that the BAFO capex forecast for lines and substations is reasonable, with the exception of the provisional sum for costs associated with a possible 330kV line deviation which we consider to be overstated.

We consider that the forecast LSE capex is reasonable.

We consider the forecast for the Other construction costs category is overstated.

4.1 Introduction

96. In this section we provide a summary of the forecast capital expenditure included for the transmission lines, substations, LSE, and related construction works and provide the results of our assessment of the forecast expenditure.

97. We refer to these direct cost components as 'Tendered Works', because this is the label ascribed to them by TransGrid in is *Supplementary Capex Forecasting Methodology for PEC – BAFO* document submitted to the AER in November 2020. We refer to the forecast costs therein as the 'BAFO capex forecast'.

4.2 Changes to the electrical arrangement from PACR to Application and BAFO

4.2.1 Optimised line route

98. The figure below shows the base case transmission line route used in developing the PACR capex forecast and the 'southern alternative route' that has been selected as the basis for the Application capex forecast and for the BAFO capex forecast.

Figure 4.1: Transmission line alignment optimisation

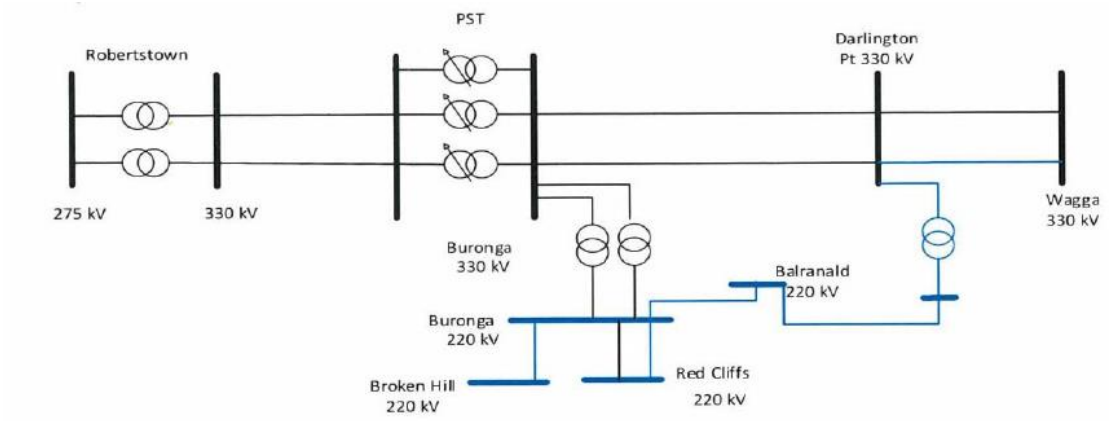
Source: EMCa modified version of Figure 3.4, TransGrid A.4 Specification and Scope 29 June 2020

99. In summary, TransGrid's assessment concluded that the southern alternative route would be cost neutral when compared with the forecast cost of a route through Darlington Point and offered a lower risk profile and greater connectivity potential.[28] We discuss this further below.

4.2.2 Revised electrical arrangement

100. The electrical arrangement of the initial project specification used for the PACR is shown in the figure below, noting that TransGrid is responsible for the works to the east of the South Australian border (between Robertstown and Buronga).

Figure 4.2: PACR PEC electrical arrangement[29]



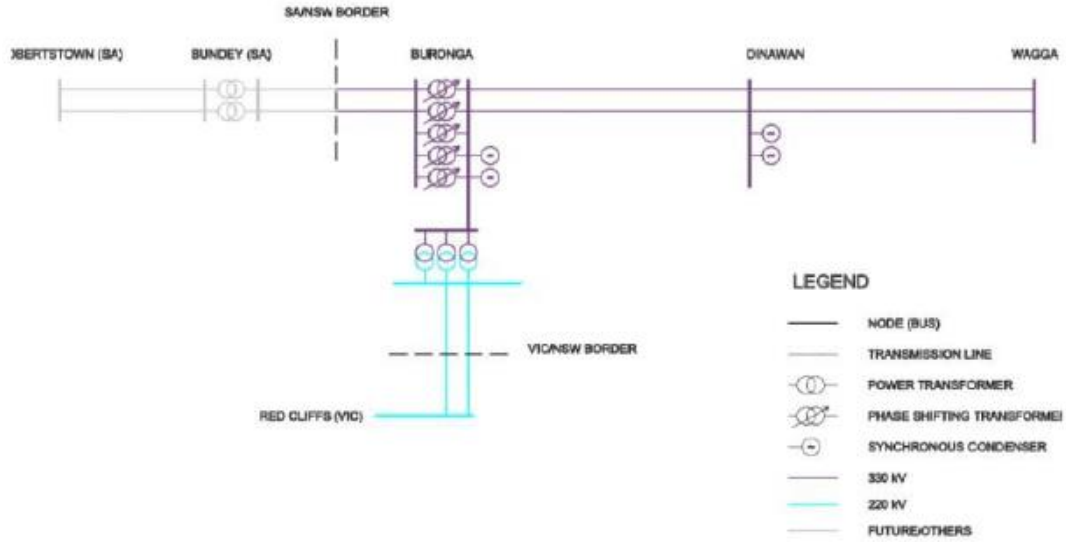
Source: TransGrid, A.4 PEC Specification and Scope 29 June 2020, page 6

101. The figure below shows the revised electrical arrangement following (i) the selection of the southern alternative, (ii) further system planning studies, and (ii) identification of limitations with the initial specification. Note that TransGrid is responsible for the works to the east of the South Australian border (between Robertstown and Buronga).

[28] TransGrid, A.4 PEC Specification and scope Final, page 11

[29] TransGrid is responsible for the works to the east of the South Australian border (between Robertstown and Buronga)

Figure 4.3: Revised PEC electrical arrangement applicable to the Application capex and BA FO capex forecast[30]



Source: TransGrid, A.4 PEC Specification and Scope 29 June 2020, page 12

Transmission line route changes

102. The table below summarises the changes from the initial transmission line route that was used as the basis for the PACR to the now-current 'alternative southern route' via Dinawan rather than via Darlington Point. The route changes primarily resulted from geotechnical and environmental studies that revealed project cost and delivery risks with the initial 330kV line route through Darlington Point shown schematically in Figure 4.2.

Table 4.1: Transmission line routes – PACR and updated scopes applicable to Application and BAFO

PACR scope [1]	Application and BAFO scope [2]
SA border to Buronga, 140 km of 330 kV double circuit line strung both sides with twin Mango conductor providing a capacity of 800 MVA each circuit	SA border to Buronga, 135 km of 330 kV double circuit twin Mango conductor providing a capacity of 800 MVA each circuit
Buronga to Darlington Point, 399 km of 330 kV double circuit line strung both sides with twin Mango conductor providing a capacity of 800 MVA each circuit	Buronga to a new Dinawan switching station, 383 km of 330 kV double circuit twin Mango conductor line providing 800MVA capacity each circuit
Darlington Point to Wagga Wagga, 152 km of 330 kV single circuit line strung with twin Mango conductor providing a capacity of 800 MVA	Approximately 160 km of 330 kV double circuit twin Mango conductor line a new Dinawan switching station and Wagga Substation in NSW providing a capacity of 800 MVA
Buronga to Red Cliffs in Victoria, 24 km of 220 kV double circuit line strung one side only with twin Lemon conductor to match the existing line providing a capacity of 417 MVA	24 km of 220 kV double circuit line between Buronga in NSW and Red Cliffs in Victoria of twin Paw Paw conductor strung on both sides of a structural steel transmission line to provide 800MVA transfer capacity

Source: [1] TransGrid, A.4 PEC Specification and Scope BAFO, page 5, [2] GHD PEC Scope Independent Verification and Assessment, Table 10

[30] TransGrid is responsible for the works to the east of the South Australian border (between Robertstown and Buronga)

Substation configuration changes

103. The table below summarises the differences between the initial substation characteristics as applied in the PACR and the updated substation characteristics applicable to the Application and BAFO capex forecasts

Table 4.2: Substation characteristics – PACR and updated scopes applicable to Application and BAFO

PACR scope	Application and BAFO scope
Buronga substation, including: • three 330 kV 400 MVA phase-shifting transformers (PST) rated to ±30 degrees phase shifting and automatic on-load MW control capability • two 330/220 kV transformers • two 100 MVAr synchronous condensers, two 50 MVAr shunt capacitor banks and two 50 MVAr reactors	Buronga substation including: • five 330 kV 200 MVA new phase shifting transformers. Rated to ±40° phase shifting and automatic on-load MW control capability • 330 kV and augmentation of the existing 220 kV switchyard at Buronga substation • three 330/220 kV transformers each with 200 MVA capacity at Buronga substation to interface with the existing 220 kV connections to Broken Hill and Red Cliffs • two 100 MVAr new synchronous condensers at Buronga 330 kV bus • Shunt capacitor banks two 50 MVAr at Buronga 330 kV bus and two 50 MVAr 330 kV reactors
Darlington Point substation, including: • two 100 MVAr synchronous condensers • two 50 MVAr shunt capacitor banks • two 60 MVAr line shunt reactors	S2 Construction of a new 330 kV Dinawan switching station consisting of: • 330 kV bays to terminate and switch the new incoming and outgoing transmission lines • two 100 MVAr synchronous condenser at Dinawan 330 kV bus • Capacitor Banks two 50 MVAr at Dinawan 330 kV bus and four 50 MVAr shunt reactors
Augmentation of the existing 330 kV Wagga substation to connect the new single circuit transmission lines	Augmentation of the existing 330 kV Wagga substation with double circuit bays to connect the new double circuit transmission lines.
Augmentation of Red Cliffs 220kV Substation for the new dual circuit transmission line (one circuit added)	Augmentation of Red Cliffs 220kV Substation for the new replacement dual circuit transmission line

Source: TransGrid, A.4 PEC Specification and Scope BAFO, page 5

104. We discuss the changes in specification and the impact on capex in sections 4.3 and 4.4.

4.3 Changes between the PACR and the Application capex forecasts for Tendered Works

Overview of the changes in capex forecast

105. TransGrid advised that the initial project specification on which the PACR capex forecast was based contained several simplifying assumptions, including:[31]

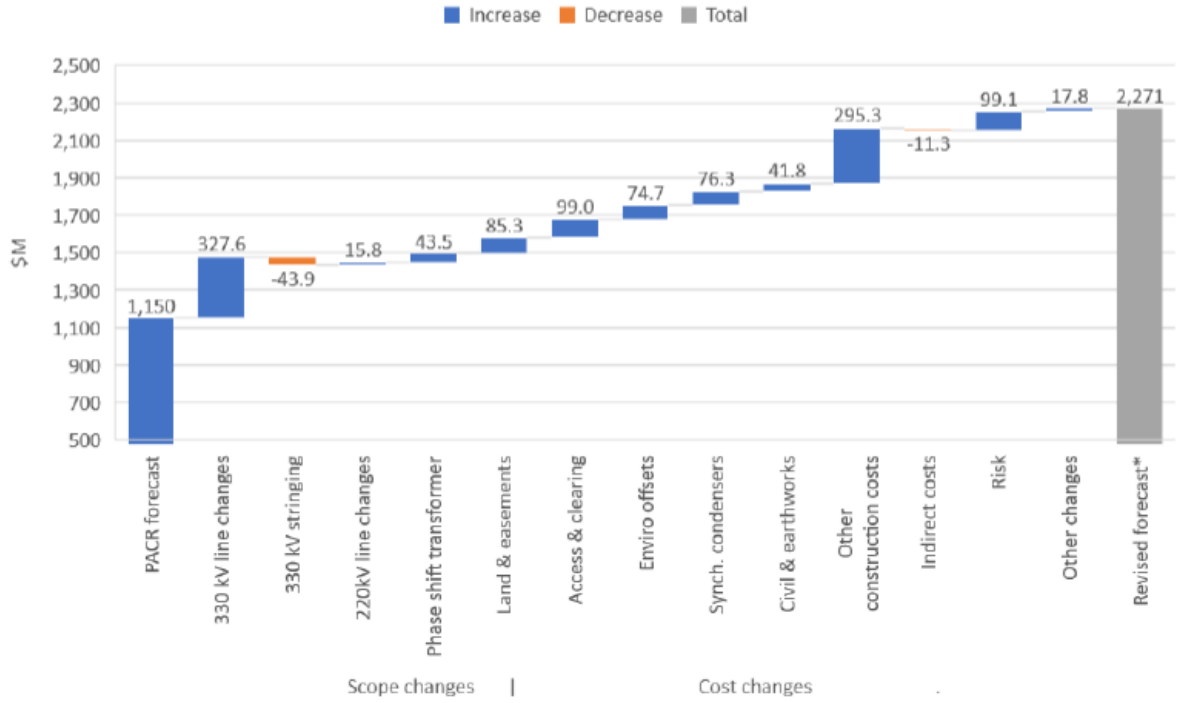
- *'The specification of the new 330 kV line was based on a straight-line estimate of line length, ignoring any land use and other constraints, the impact of which could not be estimated with the information available at the time.*

[31] TransGrid, A.4 PEC Specification and Scope BAFO, page 6

- *The specification of the 220 kV line was based on a scaled down 330 kV tower design, as we had no recent information on the installation of 220 kV assets.*
- *The specification of reactive compensating equipment (phase shifting transformers at Buronga and synchronous condensers) was derived from manufacturers' price lists.'*

106. The figure below shows the key changes from the $1,150.1m PACR capex forecast and the $2,271.0m Application capex forecast. The figure shows elements of the cost increase which are in addition to the Tendered Works which we are reviewing in this section.[32]

Figure 4.4: Main changes between RIT-T PACR capex forecast and Application capex forecast, $m 2017/18



Source: TransGrid A.5B Capex Forecasting Methodology for PEC – RFT Phase A CONFIDENTIAL, page 8; excludes equity raising costs of $19.9m

107. In Table 4.3 we summarise the drivers of each of the direct cost changes that are within the scope of our review.

[32] Indirect costs are considered in section 5; Environmental offsets, Risk and other changes are not within our review scope

Table 4.3: Changes to forecast capex: PACR to Application capex forecast (elements of Tendered Works only)

Driver of change	Change	Description
Changes to the specification	330 kV transmission line +$327.6m	Straight line route length from SA border to Buronga reduced from 140km to 135km
		More precise estimate of line route deviations led to 5% more suspension structures
		Tower design in accordance with AS700:2016, requiring taller towers
		Taller towers required proportionately larger foundations
		Tower spans in specification increased from 400m to 500m enabled by taller towers and heavier foundations
	330kV tower stringing -$43.9m	Increase in suspension span reduced line stringing costs
	220kV tower structure +$15.8m	220kV monopole design compliant with AS7000:2016 rather than scaled-down 330kV design used for the PACR
	330/220kV Phase Shift Transformers +$43.5m	Configuration changed from 3 x 400MVA 3-phase to 9 x single-phase transformers due to transport limitations
Updated cost information	Synchronous condensers +$76.3m	Cost estimate updated based on quotes from specialist suppliers
	Civil and earthworks cost +$41.8m	Refined estimates for (i) Buronga and Darlington Point substations (+$16.9m) and (ii) the civil works associated with the PST and synchronous condensers (+$26.6m)
	Other construction costs +$295.3m	Introduced in Application capex forecast to cover costs that will be borne by TransGrid in the delivery stage (subject to negotiation with its preferred tenderer). Refer to section 4.4

Source: TransGrid, A.5B Capex Forecasting Methodology for PEC – RFT Phase A CONFIDENTIAL, pages 12-13

4.3.2 Our assessment

Transmission Lines costs

The changes to the line route appear to be prudent and cost neutral

108. The change to the southern alternative route (via Dinawan rather than Darlington Point) reduced the line route length by 9 km line as shown in the table above. The line route change to the southern alignment not only reduces the line route length, it '*avoids negotiating suitable easements and access rights through the intensive irrigation zones around Darlington Point township'*.[33]

[33] TransGrid, A.4 PEC Specification and Scope BAFO, page 8

109. The 5% line deviation-driven increase in suspension structures is '*to avoid terrain undulations and sub-optimal location of angle points due to route constraints.*'[34] The line route was estimated to be 702km for the RFT Phase A.

110. TransGrid advises that it expected the route change to be cost neutral because whilst the line route is shorter and easement costs are lower, cost savings are '*largely offset by an increase in access costs and the additional costs of land acquisition and construction of a new switching station at Dinawan (with reactive control equipment) rather than expanding the existing Darlington Point substation.*'[35]

111. Whilst TransGrid's expectation about cost neutrality seems reasonable, ultimately, the final tender price will reflect these changes. Given the risk mitigation benefits of the new alignment, it appears that the southern alternative route is the prudent choice.

Changes to the line design to comply with AS/NZS7000:2016 were necessary and the changes to reduce the cost impact were reasonable

112. TransGrid advised that its standard 330kV transmission line design that it had applied in developing the PACR capex forecast was based on an earlier version of AS/NZS7000 – Overhead line design, and is not compliant with the current version AS/NZS7000:2016. Ensuring compliance required updating its Scope and Specification document (SSD). The relevant change was to the conductor clearance requirements, which TransGrid advised in turn required wider and higher towers with larger footings (i.e. to cope with the increased loading).

113. Partially offsetting the cost increase arising from the tower design changes were:

- The increase in the 330kV line span length, discussed further below; and
- The 330kV tower stringing cost, which was reduced by $43.9m as a result of the longer spans simplifying the stringing process.

114. The additional weight and height of the towers meant that the '*average suspension tower design span has been increased from 400 to 500 metres, resulting in a reduction in the number of spans required*'.[36] Alternative conceptual tower designs were included in the updated SSD with even longer spans.[37]

115. We consider that compliance with the latest version of AS/NZS7000 is required and the changes to span length and stringing are prudent measures to mitigate the cost impact of this change through the tender process.

The 220kV transmission line cost forecast is reasonable

116. The proposed 24km double circuit 220kV line from Buronga to Red Cliffs substation is to replace a single circuit 220kV line.

117. The PACR cost estimate for the proposed new 220kV line was based on (i) 417MVA transfer capacity, (ii) a straight-line estimate of line length ignoring any land use and other constraints, (iii) a scaled down 330 kV tower design, and (iv) a design that was not compliant with AS7000:2016.[38]

118. The Application capex forecast incorporates a scope change to a double circuit 800MVA 220kV line to provide additional net market benefits over the single circuit configuration - TransGrid reports that this change was agreed with AEMO. The design of the 220kV towers also changed to ensure compliance with AS/NZS7000:2016, leading to monopole structures and a further $15.8m cost increase (based on tendered prices).[39]

[34] GHD PEC Scope Independent Verification and Assessment, page 29

[35] TransGrid, A.5B Capex Forecasting Methodology for PEC – RFT Phase A CONFIDENTIAL, page 10

[36] TransGrid, A.5B Capex Forecasting Methodology for PEC - RFT Phase A – CONFIDENTIAL, page 9

[37] GHD, Report for Transgrid - PEC - Scope Independent Verification and Assessment, page 31

[38] GHD, Report for Transgrid - PEC - Scope Independent Verification and Assessment, page 43

[39] TransGrid, A.5B Capex Forecasting Methodology for PEC - RFT Phase A – CONFIDENTIAL page 9

119. Again, we accept that compliance with the latest version of AS/NZS7000 is required and the cost impact appears to be commensurate with the line length. Based on the information provided, the basis for the increased cost appears to be reasonable.

Substations costs

120. The civil and earthworks cost was increased from the PACR capex forecast following further review in preparation for the RFT Phase A procurement stage. TransGrid concluded that (i) additional land would be required at Buronga and Dinawan to '*accommodate future extensions of the substations to allow for new connections'*[40] and (ii) a cut and fill approach to establishing the substations would not be adequate.[41] In response to our request, TransGrid advised that the estimated incremental cost of the additional land is $0.35m.

121. Whilst we consider that the provision for future developments may be prudent, provision for future developments is not directly related to delivering the PEC. It is, however, a relatively immaterial amount.

Large Specialist Equipment costs

122. As described in Table 4.3 the costs of LSE increased for the following reasons:

- Optimising the size of the phase shifting transformers (PST) and synchronous condensers (SC), and
- TransGrid used an average of tendered prices for the SCs to determine an average LSE bundled cost of $216.3m (i.e. an increase of $76.3m).

123. We consider that the cost forecasting methodology is appropriate for the stage of the procurement process. The cost increase and the cost appear to be reasonable for this stage of the procurement process.

4.4 Cost change between the Application and BAFO capex forecasts for Tendered Works

4.4.1 Changes to the specification

124. Changes to the PEC specification since the time of the RFT - Phase A (as used as the basis for the Application cost forecast), include:[42]

- *'a revised 330 kV line route between Buronga and Wagga Wagga via Dinawan, and*
- *a change to the 220 kV scope to include a double circuit line rather than a single circuit.*
- *replacing nine single phase transformers with five 200 MVA 3-phase transformers.'*

125. These changes are reflected in the BAFO capex forecast.

4.4.2 Overview of the changes in capex forecast

126. The table below shows the movement in costs from the Application capex forecast to the BAFO capex forecast, which shows that a reduction of $358.2m (-20%) was achieved.

[40] TransGrid, A.4 PEC Specification and Scope - Final, page 14

[41] TransGrid, A.4 PEC Specification and Scope – Final, page 8

[42] TransGrid, A.5B Capex Forecasting Methodology for PEC - RFT Phase A – CONFIDENTIAL page 10

Table 4.4: Changes to forecast capex: Application to BAFO for Tendered Works, $m 2017/18

Item		BAFO capex forecast	Application capex forecast	Change
Tender costs	Lines and substations [1]	1,270.2	1,315.2	-45.0
	Large Special Equipment	140.2	216.3	-76.1
Other construction costs		58.2	295.3	-237.1
Total		**1,468.6**	**1,826.8**	**-358.2**

Source: A.5A Supplementary Capex Forecasting Method BAFO CONFIDENTIAL, page 15, not including equity raising costs; [1] includes $2.6m SPS and Balance of Works

4.4.3 Our assessment

Overview

127. TransGrid identifies that the net cost reduction for the transmission and substation line works when comparing the Application capex forecast to the accepted BAFO was $45m. This cost reduction arises from incorporating a more efficient transmission design and construction approach.

128. The LSE cost was reduced by $76.1m (-35%) during the BAFO stage, with TransGrid accepting that the preferred tenderer was able to procure the equipment much more cost effectively than its own estimate.

129. Other construction costs were reduced by $237.1m (-80%) by transferring much of the risk to the preferred bidder through the BAFO negotiation.

130. We assess the reasonableness of each of the three components of the Tendered Works below.

Transmission Lines

Guyed towers reduce capex lines capex by $60m which is offset by $1.4m p.a. opex increase

131. TransGrid identifies that a $60m cost reduction for transmission lines was achieved from the Application capex forecast by the accepted BAFO tenderer from (i) introducing guyed towers in place of the specified suspension towers (-$55m), and (ii) substitution of 'CIGRE foundations' for the specified foundation design (-$5m).[43] TransGrid accepted the application of guyed towers to the majority of the 330kV line.

132. Whilst not within our scope of review, we note that TransGrid has estimated that the additional maintenance cost from deploying guyed towers is $1.4m pa or a Present Value of $34.4m over the assumed 40 year life of the assets. TransGrid has determined that adding this to the accepted BAFO amount renders it 1.4% higher than the non-preferred tenderer's price. TransGrid argues that this difference is small and selected the preferred tenderer on the basis of non-price factors.[44]

The preferred tenderer's design has shorter span lengths than nominated in its SSD

133. As shown in the table below, the span lengths of the preferred tenderer average 461m over the total transmission line length. This is lower than the 500m nominated by TransGrid which were a feature of the AS7000:2016 compliant suspension tower configuration in TransGrid's updated SSD.

[43] TransGrid, AER EMCa PEC Application Workshop – Final, slide 24

[44] The PV has been estimated using a discount rate of 2.23 per cent; TransGrid A.5A Supplementary Forecasting Method BAFO CONFIDENTIAL, pages 20-21

Table 4.5: Transmission line characteristics – basis for BAFO capex forecast, $m 2017/18

Line segments	Route length (km) [1]	Average span length (km) [1]	BAFO line costs ($) [2]	Line unit cost ($/km)	Total # structures [1]	# strain/ guyed/ suspension
330kV SA border - Buronga	135	461	172.2	1.28	293	41/200/52
330kV Buronga - Dinawan	376	471	446.9	1.19	799	83/650/66
330kV Dinawan - Wagga [3]	159	450	241.4	1.59	353	54/151/148
220kV Buronga – Red Cliffs	24	382	46.1	1.92	62	11/0/51
Total	**694**	**461**	**906.7**	**1.31**	**1,507**	

Source: [1] TransGrid A.4 PEC Specification and Scope, pages 17-19; [2] GHD Report for Transgrid - PEC - Scope Independent Verification and Assessment, Table 17, which does not include an allocation of 'Other Construction Costs [3] There is an additional line cost allowance included in the line cost shown, but the extra 20km of line route for which it is provided is not included in the line route length for the Dinawan-Wagga segment

134. The table above indicates that:

- The unit cost of the 330kV line segments appears to be high relative to the reference cost of $1.1m/km;
- The unit cost of the Dinawan to Wagga line segment is much higher than the average of the other two 300kV line segments;
- The unit cost of the longer line segment between Buronga and Dinawan is $90,000/km cheaper than the shorter SA border - Buronga line segment, possibly as a result of economies of scale; and
- The 220kV line appears to be relatively expensive, given that we would expect the 220kV double circuit line unit cost to be cheaper per km than a 330kV double circuit line.

135. We discuss these points further, below.

The average 330kV transmission line unit cost is higher than the reference cost but it has been established through a competitive tender

136. TransGrid's competitive procurement process has resulted in a double circuit 330kV transmission line unit cost of $1.28m/km. This is higher than the 330kV double circuit transmission line reference cost prepared for ElectraNet of $1.1m/km. However, this reference cost does not take into account the specific line route, line deviation, topographical, geotechnical, and other factors that can influence the line cost.

137. A significant change between the Application capex forecast and the BAFO capex forecast was the transfer of approximately $240m worth of Other construction cost from TransGrid to the tenderers. A significant proportion of this is likely to be reflected in the BAFO 330kV transmission line cost. It is unlikely that the reference cost of $1.1m would reflect these cost factors.

138. As a test of whether all avenues for cost reduction have been explored and/or included in the best and final offer by the preferred tenderer, we asked TransGrid whether deploying helicopter stringing techniques had been contemplated during the procurement phase by any of the tenderers as a means of reducing the transmission line cost. We were advised that:

> *'… Due to a helicopter fatality in SA in 2019, we have made changes to our work practices on the use of helicopters around towers. We have introduced a ban on the use of helicopters to string conductors, to improve the safety for our staff, service providers and the general public. This ban applies to PEC. We are currently undertaking a review of our policies and procedures around aerial stringing and tower erection.*
>
> *We recognise that the potential efficiencies from using aerial stringing for PEC could provide a strong driver for this review to be expedited, provided the appropriate safe*

work methods and procedures are developed and implemented to ensure the safety of staff, contractors and customers. Our RFT Phase B procurement documentation, provided bidders with the opportunity to propose the use of helicopters for construction activities, accompanied by demonstrated work methods and procedures to provide assurance that the appropriate systems were in place for the work to be performed safely.

None of the Bidders included helicopter use in their main offers, indicating that the market did not consider this would provide a material cost advantage.

One unsuccessful bidder did include use of helicopters for aerial stringing as an option, indicating a potential five per cent reduction in overall stringing costs (approximately $4 million across the project). This bidder did not however allow for the development of safe work method procedures, any requirements for risk mitigation (including co-pilots, spotters, enhanced HSE supervision) or programme risk.

As an alternative to the use of helicopters, the successful contractor will undertake aerial stringing using drones as an innovation on the project.'

139. It appears that helicopters were considered by the tenderers and rejected and that instead the preferred tenderer has built the use of drones into its offer, which may have helped achieve a lower effective cost per km than otherwise would be the case.

140. We note that the Contractor has further opportunity to refine its transmission design and construction approach as part of its EPC contract,[45] however (i) it is not possible for us to say with certainty that further design optimisation is technically prudent or will be more cost efficient than its BAFO position, and (ii) any other cost reductions the Contractor identifies will be retained by it under the EPC contract.

TransGrid has proposed a provisional sum for unexpected 330kV line costs which is over-estimated

141. TransGrid advises that it has included a $32.6m provisional sum to the EPC contract to cover an estimated additional 20km of line route length, to account for uncertainty in the line section between Dinawan and Wagga Wagga:[46]

'The route selection process for the Dinawan – Wagga Wagga section is far less advanced than the other PEC line route sections. Community consultation, landholder negotiations, ecological and heritage surveys are all in preliminary stages. This section of the route is also the most complex, as the alignment encroaches closest to populated areas and semi-urban land uses as it comes towards Wagga Wagga.'

We are in the final stages of approval for a detailed route selection study for the first portion of this route, which can be provided once approved.

In this report, we have considered multiple alignments which range in distance from 90.9km (as represented in the BAFO submission) through to 101.5km for the portion of this route from Dinawan substation through to the town of Lockhart – an overall potential increase of 12%. Extrapolated across the entire route length of 160km, this would equate to 19.2km, which has been rounded to 20km.

It should be noted that a similar or potentially greater allowance would have been required had the RIT-T PACR solution of Darlington Point been retained. This is due to the subsequent identification of the ADF Facility at Morundah as a sensitive receiver to the project. This would have prevent[ed] co-location of the PEC circuit with the existing Darlington Point 330kV line for much of this route as per the PACR solution.'

[45] For example, by increasing span lengths

[46] TransGrid response to AER Information Request, 30 October 2020

142. This has had the effect of increasing the cost of the Dinawan to Wagga Wagga section above the average of the other two 330kV sections, as shown in the table above. We consider TransGrid's explanation of inclusion of a provisional sum in the EPC contract to be reasonable, given that TransGrid is waiting for conclusion of its detailed route selection study. However:

- TransGrid has not satisfactorily explained why it has assumed an effective unit cost of $1.70m/km for the provisional extra line length, which is well above the average for the other 330kV line segments;
- Its provisional sum is based on the high end of the estimated range of possible route deviation line lengths, with no accounting for the likelihood that this outcome may not be needed; and
- TransGrid's updated SSD does not appear to account for the extra 20km line length.

143. We consider that TransGrid should have applied a probability weighting to the likelihood that the route deviation is required. Whilst we note TransGrid's comments regarding the unknowns regarding the Dinawan to Wagga Wagga line section route, portions of that line section run along an existing line route and TransGrid has already taken measures to minimise the need for route deviations in selecting the southern alternative route.

144. Given that the unit cost applied is 25% higher than the PEC average, and given the steps already taken to reduce the likelihood of a significant deviation being required, we consider the provisional sum should be reduced to between 25% to 50% of the proposed amount (i.e. by between $8.2 to $16.3m).

220kV line unit cost is relatively high due to extra costs imposts

145. The unit cost of a double circuit 220kV transmission line would normally be lower than the unit cost of a double circuit 330kV transmission line, however at $1.92m/km it is 40% higher. We note that TransGrid's 'verifier', GHD, initially estimated the 220kV line segment using a unit cost of $1.20m/km. GHD subsequently adjusted its estimate to account for underestimation of the following cost elements, which when adjusted for, resulted in a cost estimate close to the BAFO tendered price:[47]

- The size of the 220kV monopoles and the cost of supply and installation;
- The number of steel poles which was 24% lower than assumed in the BAFO design due to a shorter average span length;
- Brownfield uplift costs, including 60 additional temporary poles and construction of '*an additional bypass line to provide enough space between the old and new lines for the work to be carried out with the existing lines energised*;' and
- Allowance for dismantling the existing line.

146. In our opinion, these cost imposts are likely to adequately explain the relatively high 220kV line unit cost compared to the 330kV line cost. Ultimately, it has been established by what we consider to be a competitive tender process, and we consider that it is likely to be a reasonable forecast.

Substations cost

Trade-off between line cost and substation cost appear to be reasonable

147. TransGrid refers to a trade-off in the concept design developed by both BAFO tenderers, with increased costs in the substations area enabling reduced transmission lines costs:[48]

> *'Trade-off examples include route alignment to avoid adjacent line outages, and optimising line entries to substations at a higher cost in order to gain a more efficient substation layout. Observing tenderers making these trade-offs to minimise the total*

[47] GHD, Report for Transgrid - PEC - Scope Independent Verification and Assessment, pages 57-58

[48] TransGrid, A.5A Supplementary Capex Forecasting Method BAFO CONFIDENTIAL, page 19

project cost validates our decision to select a single tenderer to provide all tendered works.'

148. On this basis, the achievement of the net cost reduction of $45m (3.5%) appears to justify the increased substations expenditure of approximately $15m.

Large Special equipment

149. It is not within the scope of our review to assess the technical specifications of the LSE. We were however asked by the AER to consider:

- Whether TransGrid is likely to have achieved an efficient price for the LSE; and
- Whether all the LSE was required for the purposes of operating the PEC or whether some additional capacity was provided for speculative future-proofing.

150. We consider these topics below.

The LSE cost was established through competitive tender and is likely to reflect a reasonable cost

151. LSE comprises a significant part of the overall project cost, particularly the Synchronous Condensers and PSTs. Our understanding is that TransGrid's preferred position in the Phase A RFT was that tenderers would procure the specified LSE from an approved supplier as part of a binding bid. TransGrid also reserved the right to separately procure LSE and free issue to the Contractor. TransGrid also received quotes from suppliers of the LSE. The scope and specification did not change for the BAFO.

152. GHD observes that the LSE specifications are performance-based and allow and encourage innovation in some areas. For example:[49]

- PSTs - whilst the required firm capacity is 800 MVA at the Buronga 330 kV substation, the tenderer was able to propose an alternative to the concept design subject to the feasibility of transporting larger PSTs; and
- Synchronous condensers - whilst the ratings of this equipment are '*… aligned with the highest end of the electrical ratings possible… there is allowance for innovation…'*

153. In response to an information request, TransGrid confirmed that all the LSE designated for the TransGrid component of PEC are required to meet the power transfer, security and reliability requirements of the interconnector such that no provision is included for 'future proofing' within the LSE scope. It further advised that:[50]

'Synchronous condensers have always formed part of the PEC solution in NSW in order to maintain voltage stability under credible and non-credible contingency scenarios – most notably a double circuit trip of Heywood. This is set out in the SAET PACR.'

154. In the BAFO, TransGrid's preferred tenderer *'identified an alternative manufacturer with significant cost savings'* compared to TransGrid's supplier quotes.[51] TransGrid subsequently decided to include LSE procurement and installation in the EPC contract.

155. We consider that TransGrid obtained a reasonable range of market tested pricing for the LSE, including delivery logistics, construction, and installation costs.

Other Construction Costs

156. 'Other construction costs' are those costs that TransGrid expects to incur in the construction of PEC, but were not currently included in the tender prices received in response to the RFT Phase A. These include:[52]

[49] GHD, Report for Transgrid - PEC - Scope Independent Verification and Assessment, pages 37-38

[50] TransGrid response to Information Request 4 November 2020 final

[51] TransGrid, A.5A Supplementary Capex Forecasting Method BAFO CONFIDENTIAL, page 17

[52] *Ibid,* pages 12-13

- *'Scope Development - design, development and specification risk of large specialist equipment (synchronous condensers and phase shift transformers)*
- *Remote area operation and logistics*
- *Adverse geotechnical conditions*
- *Tower spotting and micro-alignment*
- *Ecology, Indigenous and non-indigenous cultural heritage*
- *Contaminated soils*
- *Land access delays and disputes*
- *Commissioning and interface risks*
- *International Labour Mobilisation and Training.'*

157. Other construction costs were estimated to be $295.3m in the Application capex forecast.

The majority of the risk and cost originally associated with 'Other construction costs' were transferred to the preferred tenderer in the BAFO stage

158. Five areas of other construction costs identified in the list above were subsequently incorporated into BAFO prices: (i) scope development, (ii) remote area operations and logistics, (iii) adverse geotechnical conditions, (iv) commissioning and interface risks, and (v) international labour mobilisation and training. The transfer of risks and costs to the preferred tenderer has reduced the 'Other construction costs' to $58.2m.[53]

159. TransGrid has grouped the remaining other construction costs under nine sources, seven of which are essentially risk allowances – that is, costs associated with events that may or may not arise, but if they do will be to TransGrid's cost.

TransGrid's forecasting method for risk-based costs could be improved

160. TransGrid's forecasting methodology for quantifying the seven risk-costs is to determine what it considers to be the most likely combination of likelihood and monetised consequence for the respective negative events. In determining what it considers to be the most likely likelihood and cost TransGrid has applied a combination of:

- costs derived from the competitive tender process (e.g. the unit cost of delay to the construction program), where they are available;
- input assumptions from its consultants; and
- its own experience.

161. We provide our assessment of the application of TransGrid's forecasting methods applied to each component of the Other construction costs in Table 4.6 below.

Table 4.6: EMCa assessment of TransGrid's 'Other Construction Costs', $m 2017/18

Other construction costs	Cost	Assessment
Commissioning	11.9	The capex is to cover TransGrid's costs to undertake commissioning activities in accordance with the preferred tenderer's commissioning schedule. TransGrid advises that (i) the cost will be incurred to release interconnector capacity into the market, (ii) the timing and requirements for commissioning are controlled by the SISC and (principally) AEMO, and (iii) the cost estimate consists of $1.9m of TransGrid's internal costs and 50% of the identified shared costs for impacts to generators being $10m for TransGrid. Given TransGrid's advice that the majority of the forecast capex is nominated by SISC/AEMO, we consider that the quantum is likely to be reasonable.

[53] TransGrid A.5A Supplementary Capex Forecasting Method BAFO CONFIDENTIAL, page 21.

Safety & quality assurance program	4.7	The capex is to provide for independent safety and quality assurance to meet Board and stakeholder expectations. TransGrid advised that it has allowed $0.8m (nominal) for its PEC safety program and has based its quality assurance program cost of $4.2m (nominal) on: • market advice to use a blended rate of $37.5k/month/FTE (nominal) • a resourcing plan comprising 112 person months, peaking with a team of 3.5 FTE between Q1 2022 and Q3 2023. TransGrid has allowed for two part-time safety resources, and no dedicated QA resources in its Indirect Costs (refer to section 5). On this basis, inclusion of the roles designated for a safety & quality assurance program are prudent for a project of the scale/complexity/duration of PEC. The assumed resource profile appears to be reasonable. However the $450k p.a. (nominal) allowed for in the blended rate is at the upper end of what we would consider to be a reasonable rate, including consideration of labour type, travel and other allowances.
Environmental Impact Statement (EIS) planning approval delay	11.9	TransGrid's preferred tenderer provided its BAFO based on minimum EIS approval timeframes. TransGrid believes the most likely outcome is a delay of 2 months and it has '*sought to mitigate this risk by engaging early and often with both state and federal approval agencies and by agreement of a Project Approvals Plan.'* Based on our experience, it is prudent to allow for a delay above the minimum approval times. We consider that TransGrid should have applied a probabilistic approach to estimating the risk cost, including by considering a range of possible delays in accordance with the AER's risk approach, applied for other risk allowances. However, based on our experience, allowing for 2-month delay is within the reasonable bounds of a 'likely outcome' in this case. The cost is based on a negotiated price for mobilisation delay which is incorporated into the EPC deed and appears to be reasonable for a project of this scale.
Unforeseen environmental approval requirements	8.1	The BAFO tender price assumes baseline environmental approval conditions. TransGrid is responsible for any approval conditions more onerous than the baseline. TransGrid has based the quantum of its risk on its environmental consultant's advice: 10% reduction in productivity for 25% of the workforce from a BAFO base labour cost of $347.6m (nominal). We would expect that if there is any unforeseen environmental condition placed on the line route it would be confined to a relatively small area (i.e. a portion of one line segment, due for example to a flora issue). TransGrid has already taken steps to avoid such issues (e.g. through stakeholder engagement, by diverting the line from Darlington Point). In this context the 10% productivity impact to 25% of the workforce informed by an environmental consultant appears to be at the upper end of a reasonable estimate.
COVID-19	8.0	The BAFO tender price assumes current COVID-19 restrictions and a continuation of international travel quarantine restrictions until 31 December 2021 as the baseline. The allowance covers actions by the Australian government or international government of LSE manufacturers that TransGrid advises its Contractor was not willing to bear. The cost is based on a 5 day delay to supply chain. We concur with TransGrid that there is little precedence for determining the likelihood and impact of COVID-19 related risks. Given the current state of COVID-19 spread in the US and Europe, we consider it is reasonable to assume some risk of disruption to supply from these two regions may occur. Given that the Contractor was not willing to take on the risk as part of its BAFO, we consider it prudent to make some allowance. We consider that TransGrid should have applied a probabilistic approach to estimating the risk cost, including by considering a range of possible delays in accordance with the AER's risk approach, applied for other risk allowances. The amount of 6% of the cost of the LSE as a risk provision does not appear to be excessive, however it is difficult to predict a likely outcome given the unknowns associated with the pandemic. We note that TransGrid has suggested a pass-through mechanism may be more appropriate for this risk. This is a regulatory matter for the AER to consider.

Extreme weather	10.7	The BAFO tender price does not include an allowance for extreme weather events. TransGrid has identified extreme weather event to be a 1-in-100 year flood and advised that: • due to the extreme length/size of the project, the probability of an event occurring across the project is increased; • it has included in the cost an estimate of the most likely impact on the project of a delay for one of its 9 separable portions by 6 weeks • the cost is determined from the daily delay rate (provided by the preferred tenderer) x 42 days x 9/100. We accept that 100-year flood events are likely to significantly affect the works if they occur. We consider that TransGrid's approach to calculating the cost of a 6 week delay ($118.9m) is reasonable. However, we consider that TransGrid has overestimated the probability of a flood delaying construction. We consider the likelihood of delay is 2% and therefore the risk cost should be $2.4m. Our rationale is: • Per TransGrid modelling, we also assume there are nine sections to the line and a 1:100 year flood event causes a 6 week construction delay to one section only; • Assuming two construction crews are working on the line at the same time but at different locations, only the section being worked on and the next section to be worked on (which we assume to be the next section down the line) is at risk of delay at any time. Once a section is constructed it is no longer at risk of delay. If a section is flooded but construction is complete or is not scheduled to commence within 6 weeks, then there will be no delay to the project; • If the flood occurs within the last 6 weeks of construction on a particular section, then commencement of construction on the next/adjoining section will also be delayed, but the total delay is still 6 weeks; and • Therefore the 9/100 likelihood of occurrence assumed by TransGrid is reduced by a factor of 2/9 (i.e. only 2 out of nine sections are prone to delay at any time) and the likelihood of 6 week delay is (1/100)*9*(2/9) = 2%, not 9% as determined by TransGrid
Other	2.9	TransGrid has added 'small allowances' to address three issues that its preferred tenderer did not address: (i) unanticipated planning conditions ($0.9m); (ii) delays to gaining access to construction sites ($0.5m); and (iii) tower micro-siting alignment issues ($1.5m). TransGrid has not provided the basis for the quantum of each allowance. Whilst we had expected to be provided with a description of how TransGrid has determined that the quantities are reflective of a reasonable and prudent level, we consider that the amounts appear to be reasonable (based on our engineering judgement) and are relatively small amounts in the context of the PEC.
Total	**58.2**	

Source: TransGrid, A.5A Supplementary Capex Forecasting Method BAFO CONFIDENTIAL, pages 21-26 and TransGrid, response to AER Information Request, 30 October

162. We consider that all but one of the elements of the 'Other construction costs' are appropriate provisions, albeit costed with a bias towards the high end of what we consider to be an acceptable range. We also consider that TransGrid has overestimated the provision for the Extreme weather risk by 75%, or $8.3m. On this basis, we believe a more reasonable provision for Other construction costs is $49.9m.

4.5 Summary of our findings

163. In this section we have considered whether the application of TransGrid's procurement process (as discussed in section 3) has led to a reasonable capex forecast for the transmission lines, substations, LSE, and 'Other construction costs' for TransGrid's component of PEC. TransGrid refers to the four cost elements as 'Tendered Works', however the 'Other construction costs' included in the referred to Tendered works are TransGrid-derived cost estimates.[54]

[54] BAFO-tendered prices are used as one input assumption in some cases

The drivers of the capex increase from the PACR to the Application forecast capex appear to be reasonable

164. We have reviewed the reasons underpinning the $756.4m cost increase between the PACR cost forecast and the Application capex forecast related to 'Tendered Works'.

165. The PACR was based on a scope and specification with a number of simplifying assumptions, which were refined by TransGrid through to the RFT Phase A, providing a more realistic basis for the Application capex forecast.

166. The primary drivers of cost increase were the changes to the specification (+$343.0m) and updated cost information (+$413.4m). The biggest single driver of cost increase was the changes to the transmission specification to comply with the current version of the Australian Standard for overhead line design ($327.6m), closely followed by the identification of $295.3m of 'Other construction costs' not included in the PACR.

167. We note that the competitive tender process was not complete at this stage and there was an expectation that the cost would be reduced through to the best and final offer.

The transmission line, substations and Other construction costs in the BAFO are 18% lower than in the Application

168. The BAFO process has resulted in a $358.2m reduction compared to the Application capex forecast for Tendered Works. The reductions were achieved from a $45.0m (3%) reduction in the combined transmission lines and substations cost, a $76.1m (35%) reduction in the LSE cost, and a $237.1m (80%) reduction in Other construction costs. The latter is the result of redistributing the majority of the responsibility for other construction costs to the preferred tenderer.

The transmission line cost is reasonable

169. The line cost and the substation cost have been traded-off to some extent, with the lower line cost (Application compared to BAFO capex forecast) coming at the expense of a higher substations cost. The 3% cost reduction in the transmission lines cost was achieved (i) despite the transfer of significant costs from the 'Other construction cost' category and (ii) by including guyed towers and alternative footings at a $60m lower capex cost.

170. The BAFO capex forecast includes (i) 330kV double circuit line costs/km which are higher than a reference cost estimate, and (ii) 220kV line unit costs that are also higher than we would expect. Nonetheless, the specification appears reasonable, there are project-specific factors which add to the unit cost, and the BAFO capex cost has been established through what we consider to be a rigorous competitive tender process. We have considered the impact of several factors which have influenced or have possibly influenced the cost and conclude the average line unit cost is reasonable, noting our comments regarding the provisional sum, below.

171. We conclude therefore that the BAFO capex from the preferred tenderer is a good outcome.

172. We also conclude that whilst there *may* be further opportunities to improve the transmission line cost, this is by no means certain and, regardless, the net benefit of any improvements after the EPC Contract is executed will accrue to the Contractor, and not to TransGrid.

The provisional sum for a possible line route diversion is overstated

173. In addition to the transmission line cost, TransGrid has allowed for a provisional sum to the EPC contract to account for the possibility of a line deviation. Whilst we consider that it is reasonable for TransGrid to provide for the possibility of a line route deviation given some uncertainty with respect to the Dinawan to Wagga Wagga section route, in our view TransGrid has (i) not justified the relatively high line unit cost, nor (ii) application of what appears to be an unlikely outcome (i.e. without moderation). On this basis, we consider the provisional sum should be reduced by between 25%-50% (by $8.2m to $16.6m) of TransGrid's proposed amount.

Substation costs are reasonably derived

174. The BAFO capex forecast for substations resulted from changes to the substation scope and specification compared to the Application capex forecast. The shortlisted bidders were given the opportunity to optimise the substation designs and construction techniques. The BAFO process resulted in a $15m increase compared with the Application capex forecast for substation works. This is because of (i) a trade-off in costs between transmission line and substation costs for a net lower outcome, and (iii) apportionment of what were formerly Other construction costs to the preferred tenderer and to the substations component.

175. We consider this outcome to be reasonable when taken in context of the cost reductions achieved in other areas.

LSE cost is reasonable

176. The LSE cost comprises a significant part of the overall PEC cost at $140.2m, which is lower than included in the Application capex forecast of $216.3m. This is primarily due to the preferred tenderer being able to secure better supplier pricing than TransGrid had assumed.

177. We consider that TransGrid's BAFO forecast LSE cost is reasonable.

Other construction costs are overstated

178. TransGrid's Other construction costs were identified in the period between the PACR and the Application cost estimate and were costed at $295.3m using a top down forecasting method. The items included in the original scope of this expenditure category are consistent with what we would expect to see for a project with PEC's characteristics.

179. TransGrid has negotiated the transfer of the majority of the responsibilities for the elements within the category to the preferred tenderer as part of the BAFO negotiations, requiring that $58.2m be included in the Other construction costs by TransGrid. We conclude that all but the provision for Extreme weather allowance are reasonable estimates of TransGrid's cost exposure. We consider that the Extreme weather provision should be reduced from $10.7m to $2.4m.

5 ASSESSMENT OF ASPECTS OF INDIRECT COSTS

We have reviewed TransGrid's forecast labour-related Indirect Costs to manage the remainder of the delivery of its component of the PEC. Based on bottom-up analysis of the indirect costs included with the adjusted BAFO capex forecast, we consider that the forecast labour and labour-related indirect cost is reasonable.

5.1 Overview

180. In this section we review TransGrid's forecast labour and labour-related[55] Indirect Costs included in its Application and BAFO capex forecasts that it maintains is required to manage its project responsibilities throughout the remainder of PEC. Note that the Indirect Costs are included in what TransGrid refers to as its BAFO capex forecast but the costs were not established as part of the tender process.

5.2 TransGrid's proposed Indirect Cost

5.2.1 Overview

181. TransGrid's Application capex forecast for Indirect Costs was $122.4m (including actual costs incurred) or $105.3m excluding actual costs incurred. In Table 5.1, we show the variance between the Application capex forecast and the BAFO capex forecast. TransGrid advised that the majority of the changes are from correcting for updated actual incurred costs, and this is evident from the table.

Table 5.1: Indirect cost estimates - $m, 2017/18

	Application capex forecast	BAFO capex forecast	Variance
Actual costs incurred	**17.1**	**27.8**	**10.7**
Forecast costs:			
Project development	41.3	40.6	-0.7
Works delivery	20.2	19.9	-0.3
Land and environment	15.9	18.4	2.5
Stakeholder and community engagement	8.5	8.2	-0.3
Insurance	6.9	8.6	1.7
Procurement bidders' payments	12.5	12.3	-0.2
Sub-Total forecasts costs	**105.3**	**108.0**	**2.7**
Total	**122.4**	**135.8**	**13.4**

Source: TransGrid A.7 Corporate and network overhead for PEC – BAFO – CONFIDENTIAL, page 4; excludes taxes except for Payroll tax which is included in labour on-costs

[55] Labour-related costs include sustenance, travel, training, recruitment, IT, office lease

182. TransGrid advised that the Indirect Capex:[56]

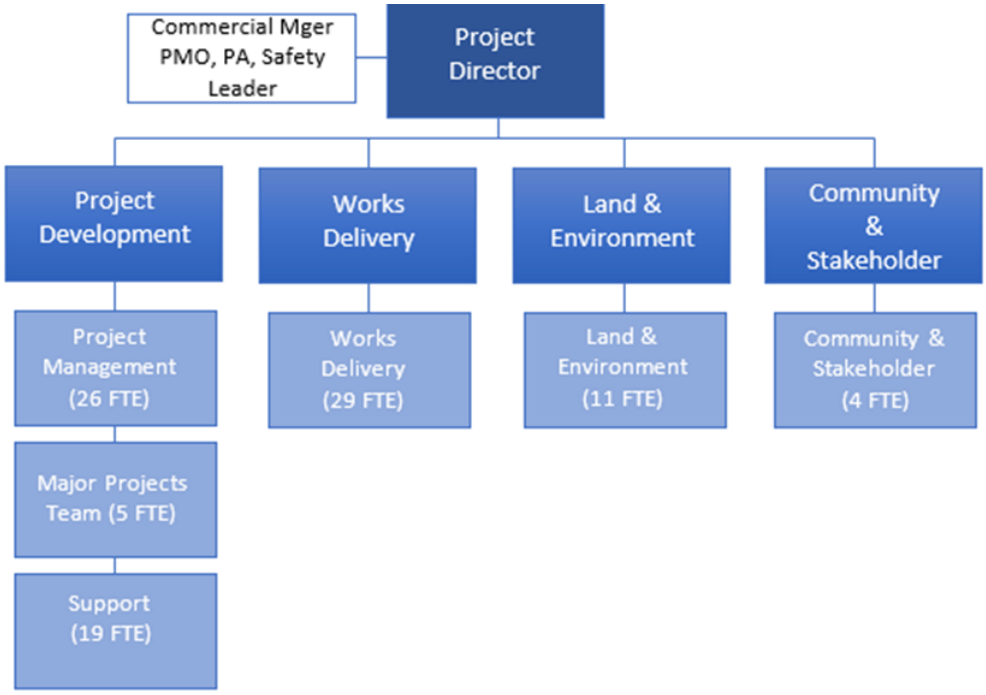
- Is incremental to business-as-usual capex and would not be incurred if it did not proceed with PEC;
- Relates to the duration of the project, which is expected to achieve final completion in June 2024; and
- Includes 'post-commissioning' capex that it expects to incur during the period from July 2023 to June 2024.

183. We provide our assessment of the labour and labour-related Indirect Costs in the following sections. The assessment of the actuals incurred to date is beyond the scope of our review.

5.2.2 Project organisation

184. TransGrid has established a project organisation as shown in the figure below, with sub-ordinate roles and the number of FTEs as denoted.

Figure 5.1: TransGrid PEC project team organisation chart



Source: EMCa, based on Project Team Structure diagram, slide 39, TransGrid PEC Application AER-EMCa Workshop 26 Oct 2020

5.2.3 Forecasting method

185. TransGrid's Indirect Costs have been forecast from a bottom-up build of resource requirements for the duration of the project, being labour and non-labour components.

5.3 Our assessment

186. In this section 5.3, we assess the forecasting method that TransGrid applied to each of the four labour-related categories (i.e. Program Development, Works Delivery, Land and Environment, and Stakeholder & Community Engagement).

187. In assessing the efficiency of the labour-related indirect costs, we looked at two perspectives:

[56] TransGrid, A.7 Corporate and network overhead for PEC – BAFO – CONFIDENTIAL, page 7

- The efficiency of the assumed labour costs - specifically the unit rates and composition of the unit rates (remuneration, on-cost and overheads). Our assessment is based on review of the estimated labour unit costs (i.e. cost per FTE) proposed by TransGrid in the provided resource estimate,[57] including information provided in response to our request for information on the on-cost and overheads rates; and
- The efficient level of resourcing - specifically the size of the project team, scope, and organisation of the proposed roles.

188. We based our assessment on the description of roles provided by TransGrid, which was supplemented with our own experience where information was not provided to adequately support the role or proposed unit rate.

189. We describe each of these perspectives in the sections that follow.

5.3.1 Assessment of the efficiency of assumed labour costs

The labour rate methodology and the labour rate components for TransGrid employees are both reasonable

190. TransGrid advised in response to an Information Request[58] that:

- Labour rates are sourced from actual rates, with the data extracted from TransGrid's payroll system by the HR remuneration and benefits team;
- Actual labour rates are used to calculate the average rate for each labour category to determine the base rate;
- Every employee and contractor is assigned a labour resource code upon commencement of their role based on the nature of the work performed within their role:
  - the resource code is assigned by HR;
  - the resource code is amended if a person's role changes;
  - there are separate resource codes for employees on individual contracts and employees on the Enterprise Agreement; and
- Once the average labour cost rate is calculated, on-costs are applied to the rates as shown in the table below.

Table 5.2: TransGrid labour assumptions – on-costs

Labour rate component of on-cost	Contract officer	Enterprise Agreement
Annual leave	10%	10%
Long service leave	7%	7%
Payroll tax	7%	7%
Superannuation	[included in base rate]	16%
	24%	**40%**

Source: TransGrid, response to AER Information Request, 4 November 2020

- The support cost rate of 1.02 is:[59]

  '*…worked out at the time of the budget based on the total support pool (overhead costs) as the denominator and the labour costing (as agreed with the AER as the allocating factor) as the numerator. A true up of support costs occurs at the end of financial year if required. A true up was not required for FY18 or FY19'; and*

[57] A.8 TransGrid - PEC - Corporate and Network Overhead Forecast - CONFIDENTIAL adjusted

[58] TransGrid, response to AER Information Request, 4 November 2020

[59] A.8 TransGrid - PEC - Corporate and Network Overhead Forecast - CONFIDENTIAL adjusted

Both the labour costing rate methodology and output and the support cost methodology and output are reviewed by internal audit and our external auditors (PWC).'

191. We consider that:

- The process for determining the labour rates is reasonable;
- The oncosts, at 24% and 40%[60] for contract officers and employees on enterprise agreements respectively, are also reasonable; and
- The calculation methodology and the rate ascribed to support costs is reasonable, noting that TransGrid's Major Projects Division includes support staff (e.g. regulatory, finance, and human resource roles) – we comment on this further below.

192. The table below shows other labour cost input assumptions applied by TransGrid on a role-specific basis. We consider these assumptions to be reasonable based on our industry experience.

Table 5.3: Labour-related cost input assumptions, $ 2017-18

Indirect cost component	Assumption
Recruitment fees:	
• Recruitment fee as a % of annual salary	15%
• Roles recruited using external recruiter	50%
Training costs p.a.	$1,500
Travel rates:	
• Cost per return flight to PEC sites	$1,000
• ATO rates for accommodation and meals	$294
IT hardware cost p.a. per FTE	$2,650
Direct cost assumptions:	
• Share of labour costs that are direct	65%
• Share of labour-related costs that are direct	65%
• Share of non-labour costs that are direct	0%

Source: A.8 TransGrid PEC Corporate and Network Overhead Forecast – CONFIDENTIAL adjusted.xls

193. The table below shows the application of these labour-related cost components to the roles throughout the duration of the project in the four labour-related categories.

[60] We note that the TransGrid Corporate and Network Overhead Forecast spreadsheet applies 41% oncost to Enterprise Agreements, not the 40% indicated in the response to our Information Request

Table 5.4: TransGrid's allocations of labour-related costs - PEC (% of total category cost)

	Project Development	Works Delivery	Land & Environment	Stakeholder & Communications
Recruitment	2.5%	1.6%	1.6%	
Training	0.4%	0.5%	0.4%	
Office lease	4.1%			
Travel & expenses	10.8%	0.4%	7.7%	17.5%
Sustenance		2.6%		
IT & hardware		0.2%		
Total (incl travel)	**17.7%**	**5.2%**	**9.7%**	**17.5%**
Total (ex-travel)	**6.9%**	**5.1%**	**2.1%**	**0%**

Source: EMCa analysis of A.8 TransGrid PEC Corporate and Network Overhead Forecast – CONFIDENTIAL adjusted.xls

194. Excluding travel, the labour-related costs additional to the base salary, on-costs, and support costs range from 0% to 6.9%. We consider the magnitude of these allocations to be reasonable. We observe from the bottom-up build that the travel expenses appear to have been reasonably allocated.

The costs of consultants are at the high end of an acceptable range

195. Our understanding of TransGrid's resourcing spreadsheet following discussions with TransGrid, is that of the 99 FTEs indicated in Figure 5.1: [61]

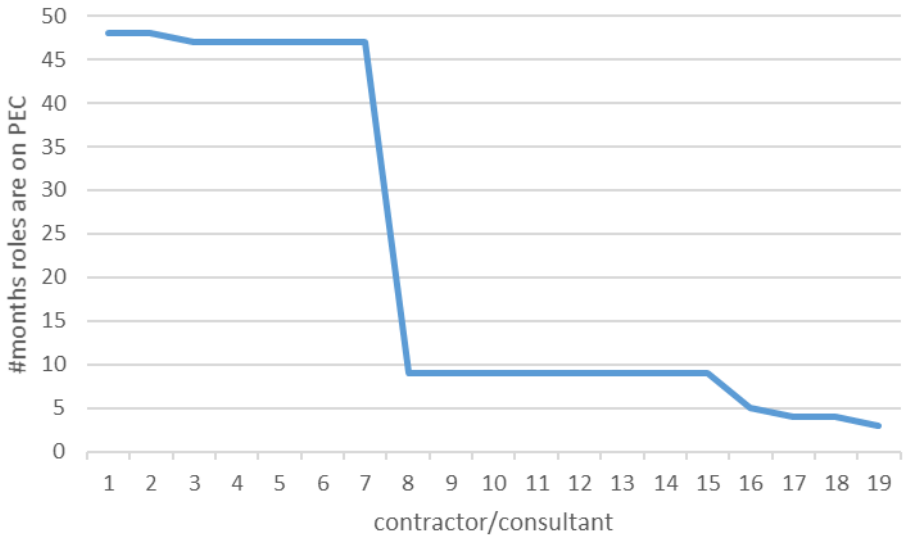
- TransGrid has or will employ consultants on day rates for nine positions in its Project Management Team (eight Program Delivery roles and one Land & Environment role);
- TransGrid has or will employ contractors for 10 positions in its Project Management Team (nine Program Delivery roles and one Land & Environment role); and
- The consultants and contractors are paid on consultant day rates and their time is booked 100% to PEC.

196. Therefore, approximately 20% of the TransGrid PEC Project Team are consultants of contract durations of between 4 months and 45 months.

197. The distribution of the duration for which each consultant/contractor is employed on the PEC is shown in the figure below.

[61] A.8 TransGrid PEC Corporate and Network Overhead Forecast – CONFIDENTIAL adjusted.xls

Figure 5.2: Duration of consultants and contractors on TransGrid's PEC Project Team



Source: EMCa analysis of A.8 TransGrid PEC Corporate and Network Overhead Forecast – CONFIDENTIAL adjusted.xls

198. Paying consulting day rates leads to a relatively high annualised remuneration charged to the project, with over $13m (12%) forecast to be charged to the project in aggregate for these roles. The median contractor/consultant payment is $460k pa with several consultants paid over $600k p.a. Some of these consultants are dedicated to the project for over 40 months.

199. We acknowledge that a project of the scale, complexity, profile and duration of PEC requires specialist expertise to manage through the development and delivery phase and that it is unlikely that TransGrid has the personnel currently on staff with the requisite skills to successfully undertake all critical project management roles.

200. Whilst we would have expected TransGrid to be able to negotiate a lower median cost overall for the consultants/contractors given the average contract duration of 22 months (i.e. via a significant discount to their daily charge-out fees), we accept that:

- The specialist resources are likely to be in demand during the reported construction up-swing in the eastern states of Australia, and therefore
- It is likely to be a 'seller's market' for the target skill sets.

201. Furthermore, the impact of about 50% of the highest remunerated individuals on the PEC forecast is somewhat mitigated by the relatively short duration of their tenure.

202. We asked TransGrid to explain its recruitment strategy: [62]

> *'After consideration with HR, external consultants and Management it was determined a thin client model was the most efficient model for the project, with only strategic key roles retained in house. The mix of internal and external roles was determined based on our existing skills profile. Where expertise wasn't internally available and recruitment of that skill would only be required for a fixed duration, we have appointed consultants or contractors with the available skills.'*

203. Having considered this, in our opinion the 12% of project labour and labour related cost associated with consultants and contractors is at the high end of an acceptable range.

There are additional roles with unreasonable remuneration levels but the impact is relatively small

204. In addition to our comments regarding the high consultant/contractor remuneration above, we have identified apparently excessive base annual costs included for several contract

[62] TransGrid, response to AER Information Request, 4 November 2020

officer roles. For example, after deducting superannuation, on-costs (including super for Enterprise Agreement roles) and support costs:

- Three Stakeholder & Communications Officers are on approximately $360k salaries. This level appears excessive given their role description[63] and is higher than the Stakeholder & Communications Managers (to which we understand that these roles report); and
- Several property management roles have base salaries close to $300k or more, which appear to be excessive.

205. Overall the impact of these apparently excessive salaries on the PEC indirect cost forecast is somewhat mitigated in aggregate because much less than 100% of their time is, on average, attributable to PEC.

5.3.2 Assessment of the efficient level of resourcing

TransGrid's creation of a Major Projects Division is a reasonable approach

206. TransGrid has established a Major Project Division to manage the delivery of TransGrid's four major projects: PEC, Hume Link (Snowy 2.0), Queensland Interconnector, and Powering Sydney's Future (PSF).[64] The Major Projects division has been set up with its own management team and support functions for which 46% of each role is allocated to PEC.[65] The 24 roles include:
    - Executive, Assistant, PMO, Safety Leader, Commercial Manager
    - Regulatory manager, Finance Business Partner, HR Payroll and Recruitment
    - Learning and Development, Audit, Risk management, Workshops and Modelling; and
    - Procurement management.

207. Strategically, given the major projects to be managed by TransGrid in addition to what might be regarded as business-as-usual and the profile and importance of PEC and the other three projects, establishing a dedicated division is a reasonable approach. In our opinion, the enhanced prospect of effective and efficient management of PEC, including managing the Contractor and project risks from having a well-resourced and (largely) dedicated Major Projects team, is likely to outweigh possible resource inefficiencies.

208. The current resource profile for each role is flat from month 1 to month 45, whereas in practice this may not represent an efficient allocation based on project need. However it is a reasonable approximation for the purposes of the estimate at this stage of project development.

The labour resourcing forecast extends from August 2020 to April 2024

209. As shown in the figure below, practical completion for the whole interconnector (330kV transmission lines from Buronga to Wagga and 330kV substation works at Buronga, Dinawan, and Wagga) is scheduled for December 2023, with energization (commissioning) in early 2024 and post-commissioning continuing through to June 2024 (Final Completion).[66]

[63] TransGrid, A.7 Corporate and network overhead for PEC – BAFO – CONFIDENTIAL, Appendix A

[64] TransGrid, A.7 Corporate and network overhead for PEC – BAFO – CONFIDENTIAL, page 13

[65] The remaining time is allocated 46% to Snowy 2.0, 5% to QNI and 2% to VNI

[66] *Ibid*

Figure 5.3: Project milestones pertinent to the resource profiling for TransGrid labour cost forecasting

Source: EMCa analysis based on advice in TransGrid, response to AER Information Request, 4 November 2020

210. TransGrid's forecast labour costs commence in August 2020, with all roles in its model[67] concluding by April 2024 at the latest. The major interim project milestone is provision of 'First Power' to South Australia via the 220kV networks in North West Victoria and South Western New South Wales:[68]

> *'This work includes the transmission lines between Buronga and the SA Border and Buronga and Red Cliffs, as well as substation works at Red Cliff and Buronga.*
>
> *The contractor is scheduled to reach Practical Completion (pre-commissioning) on this portion by November 2022. Work is structured such that energization (including commissioning of the new assets) can occur in Dec 2022. Post-commissioning activities for first power (to allow inter-network power flow between Victoria, NSW and SA) are being co-ordinated by AEMO, ourselves and ElectraNet via the System Integration Steering Committee (SISC).'*

211. We have taken the milestone timing and activity into account in reviewing the efficiency of the number and type of resources proposed by TransGrid over time.

212. For each of the four nominated resource categories, TransGrid's resourcing model includes:

- A title of each role;
- The cost forecast to be incurred per role per month from months 1 (August 2020) to month 45 (April 2024); and
- The number (including fractions) of FTEs attributed to each role each month.

213. This information has enabled us to develop resource profiles, which we discuss below.

Resource profile for Program Development is acceptable

214. The indirect costs attributable to the Project Development category comprises $40.6m or around 38% of the total forecast indirect capex. TransGrid has used the following sub-categories in its model:

- Project Management Team – 26 roles undertaking or providing project management functions such as Project Director, Data Room Manager, Project Estimator;
- Major Projects – five roles comprising the core management team of the division, including the Executive, PMO, and Commercial Manager; and
- Major Projects – 19 roles comprising engineering roles such as design inputs and approvals, testing, commissioning, system planning, etc and Support roles such as regulatory, financial, and HR services for the Division.

215. The Project Development category resource profile is shown in the figure below. The salient points are:

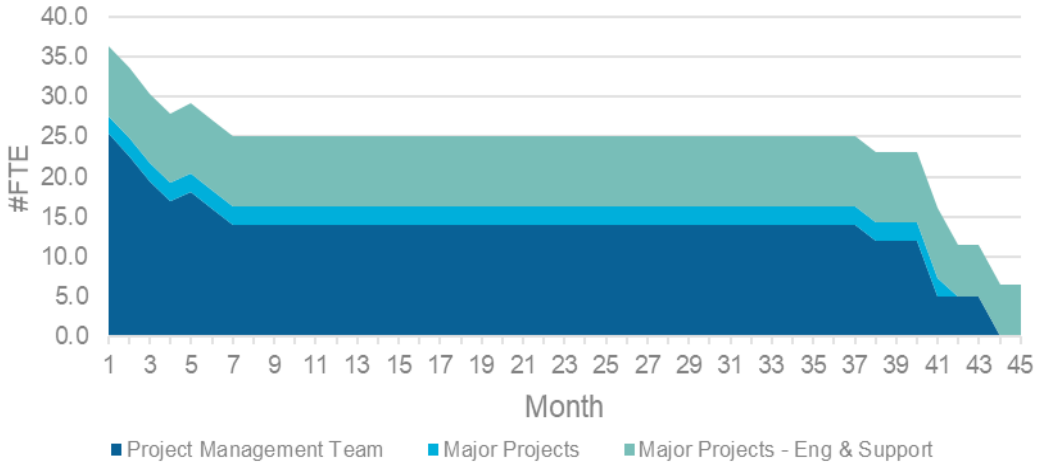
- 12 of the Major Projects Team are scheduled to have completed their work on the project by March 2021 (month 8), which is when TransGrid assumes most of the project establishment work has been completed;

[67] A.8 TransGrid PEC Corporate and Network Overhead Forecast – CONFIDENTIAL adjusted.xls

[68] TransGrid, response to AER Information Request, 4 November 2020

- The balance of the 26 Major Projects Team continue booking their time to the project until late 2023, with all FTEs off the project by the penultimate month; and
- The full complement of 24 Major Projects, and Major Projects – Engineering & Support FTEs are scheduled to book 46% of their time through to the last few months of the project.

Figure 5.4: Project development - profile of resource effort by function grouping, FTE/month, Aug 20 – Apr 24



Source: EMCa analysis of A.8 TransGrid PEC Corporate and Network Overhead Forecast – CONFIDENTIAL adjusted.xls

216. From our assessment of the Project Development roles and the attribution of the roles to the PEC, we consider that:

- The roles are reasonably required given the requirement of the project and the construct of the Major Projects Division, however we see some potential for reduction in roles – for example, we do not consider that six procurement roles are likely to be required for a minimum of 40 months; and
- The flat resource profile between month 8 and month 40 is unlikely to be required in practice, however it is a is by-product of establishing the Division – it is possible that TransGrid may be prudently able to reduce staffing numbers over time.

217. We conclude that the Program Delivery resource requirement is a reasonable approximation for the purposes of an estimate at this stage of the project.

Resource profile for Works Delivery appears to be reasonable

218. The Works Delivery category comprises $19.9m or around 18% of the total forecast indirect capex. Thirty roles are forecast by TransGrid to be required to undertake or provide the following functions in the Works Delivery phase:[69]

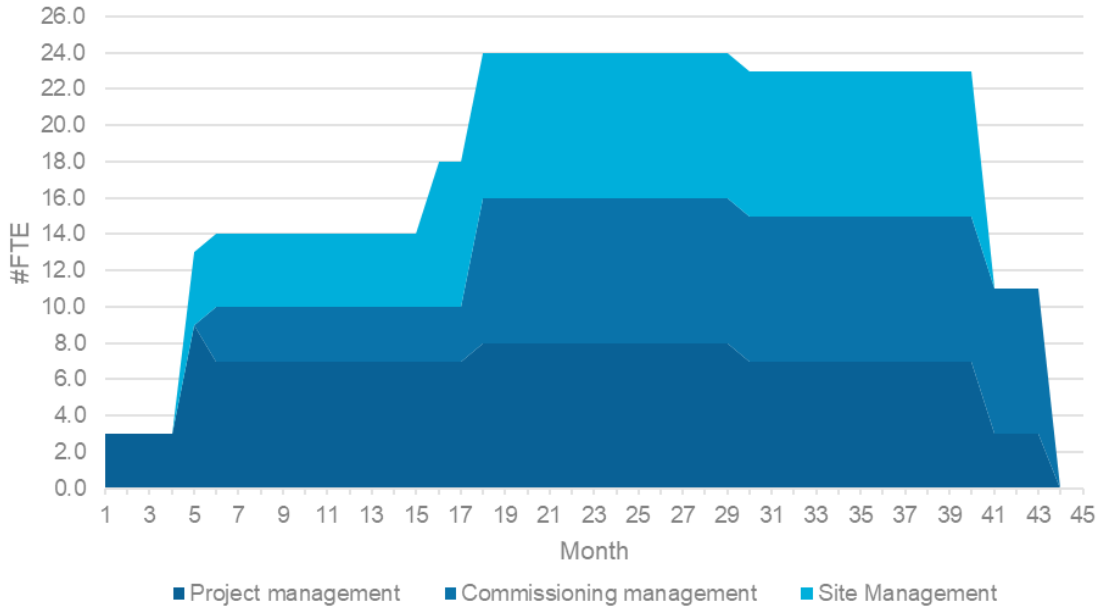
- Project and contract management and project control functions;
- The role of Principal Contractor for all brownfield substation construction;
- Civil, electrical, environmental and safety inspections;
- High voltage equipment outage coordination;
- Power system safety rules qualified staff to provide safe access areas;
- Oversight of contractors for pre-commissioning checks and in-service commissioning activities of new equipment; and
- Qualified staff to manage interfaces between exiting equipment and systems with the new equipment and systems.

[69] TransGrid, A.7 Corporate and network overhead for PEC – BAFO – CONFIDENTIAL, page 9

219. In Figure 5.5 we show the resource profile we have aggregated into three resource functions. The salient points are:

- Resource effort for the Project Management roles apply to the project immediately, increasing to a sustained level of about 8 FTEs through to February 2024 (month 43);
- Commissioning management roles commence from late 2020, stepping up to a peak of 8 FTEs December 2021 (month 17) and maintain at this level almost to the completion of the project; and
- Site management roles commence from late 2020, stepping up to a peak of 8 FTEs two months earlier than the commissioning management personnel.

Figure 5.5: Works Delivery - profile of resource effort by function grouping , FTE/month, Aug 20 – Apr 24



Source: EMCa analysis of A.8 TransGrid PEC Corporate and Network Overhead Forecast – CONFIDENTIAL adjusted.xls

220. We discussed the Works Delivery resourcing profile at our workshop with TransGrid, including, for example, on understanding why three commissioning management FTEs were required relatively early in the project. We were satisfied that their roles incorporate more than the traditional commissioning functions and that the functions are likely to be required from December 2020 onwards. We consider the profile of the other Works Delivery functions to also be reasonable.

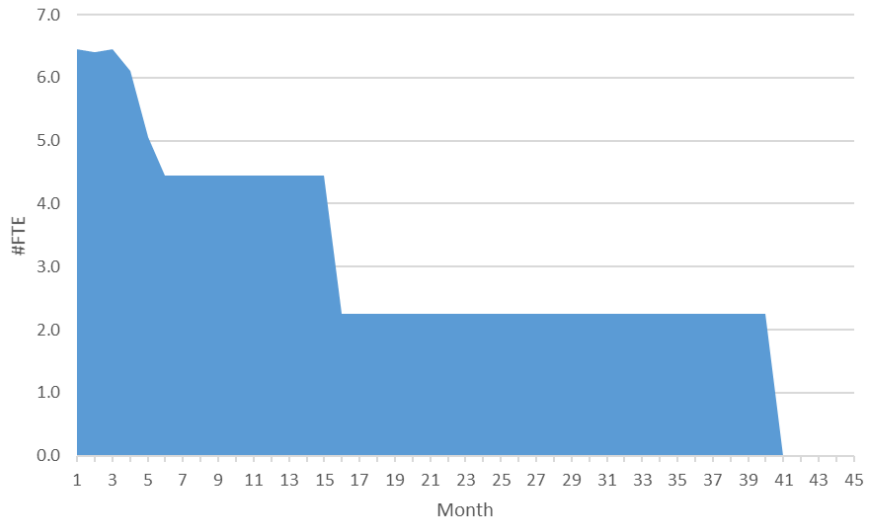
Resource profile for Land & Environment appears to be reasonable

221. The Land and Environment category comprises $18.4 million or around 17% of the total forecast indirect capex. TransGrid forecasts the need for eleven additional FTEs over the course of the project to assist with land acquisition, environmental impact studies, and resolution and property administration.[70]

222. As shown in the resource profile figure below, TransGrid forecasts that these activities will be required the most at the commencement of the project. Not all of the FTEs are allocated 100% to PEC meaning that the peak FTE number is 6.45 in August 2020. The number of FTEs drops in two stages, early 2021 and late-2021. Based on the description of the responsibilities and activities to be undertaken along such a long line corridor, we consider the resourcing profile to be reasonable.

[70] TransGrid, A.7 Corporate and network overhead for PEC – BAFO – CONFIDENTIAL, page 23

Figure 5.6: Land & Environment - profile of resource effort , FTE/month, Aug 20 – Apr 24

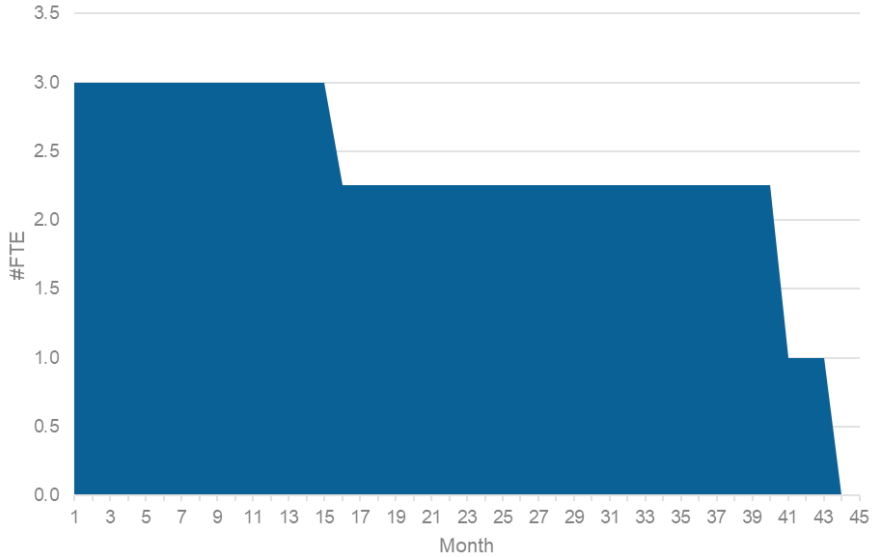


Source: EMCa analysis of A.8 TransGrid PEC Corporate and Network Overhead Forecast – CONFIDENTIAL adjusted.xls

Resource profile for Stakeholder & Community Engagement appears to be reasonable

223. The Stakeholder and community engagement category comprises $8.2 million or around 8% of the total forecast indirect capex. The labour costs for stakeholder and community engagement are based on four additional FTEs that are required for PEC and one FTE to work across the Major Projects Division.[71] We would expect the resource profile to show the majority of the effort in this function to be most intense at the beginning of the project and being maintained at a lower level for the remainder of the project, as shown in the figure below. Based on the description of the responsibilities and activities to be undertaken along such a long line corridor, we consider the resourcing profile to be reasonable.

Figure 5.7: Stakeholder & Community Engagement - profile of resource effort , FTE/month, Aug 20 – Apr 24



Source: EMCa analysis of A.8 TransGrid PEC Corporate and Network Overhead Forecast – CONFIDENTIAL adjusted.xls

Comparative analysis

224. Whilst top down-analysis of TransGrid's forecast of indirect costs is not within our scope of work, we offer the following observations:

[71] TransGrid, A.7 Corporate and network overhead for PEC – BAFO – CONFIDENTIAL, page 28

- TransGrid's Indirect Cost forecast of $87.1m (excluding insurance and bidder payments) is 6.1% of the BAFO forecast capex;
- The Project Delivery Cost forecast for ElectraNet's recently-approved Eyre Peninsular Contingent Project Application is equivalent to the Indirect Costs we have considered for PEC and is 8.9% of the total project costs;[72]
- The Project Delivery Cost forecast included in ElectraNet's Amended Contingent Project Application for the ElectraNet component of PEC is 7.3% of the total project costs;[73]
- An applicable rule-of-thumb in construction is that the larger the project, the smaller the 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; and
- TransGrid's component of PEC is a much larger project than the two ElectraNet projects referred to above, and therefore its Indirect Cost/Project Delivery Cost as a percentage of the total project cost should be lower than both, and is, by considerable margins.

5.4 Summary of our findings

225. TransGrid's labour-related Indirect Cost is 6.1% of the BAFO capex forecast.

226. We have reviewed the forecast capex from a bottom-up perspective considering both the labour costs for the individual roles in TransGrid's project team and the resource profile (number of resources, type of resources and duration of resources over the project lifecycle).

227. The on-costs, overhead rate, and other labour related costs are both reasonable and appropriately allocated. Some aspects of the labour rates appear to be at the high end of an acceptable range, however:

- Whilst the costs of consultants and contractors appear to be high, this is likely to be reflective of the market for the senior and experienced resources TransGrid has secured or will secure; and
- Whilst there are some apparently high remuneration for some PEC personnel, in aggregate they have a relatively minor impact.

228. Some resource profiles appear to be slightly biased towards overstatement of actual needs, but overall we consider the resource profiling to be a reasonable approximation for the purposes of an estimate.

229. Overall, we consider that the labour and labour-related indirect costs forecast by TransGrid of $87.1m is a reasonable estimate.

[72] EMCa, Project Energy Connect – South Australia component - Review of Aspects of ElectraNet's Contingent Project Application, Table 4.4

[73] EMCa, Project Energy Connect – South Australia component - Review of Aspects of ElectraNet's Contingent Project Application, Table 4.4