



# **SA ENERGY TRANSFORMATION RIT-T**

**Basis of Estimate**

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## Purpose of document

This document describes methods, assumptions, cost basis and other inputs into capital spend (CAPEX) estimates used to inform the preparation of the Project Assessment Draft Report (PADR).

### 1. Basis of Estimate

This basis of estimate serves to clearly define the design basis, planning basis, cost basis, risk basis, assumptions informing the capital cost estimates together with exclusions to the capital cost estimates.

#### 1.1 Design Basis

The scope of the works are as outlined in the PADR plus scope documentation prepared for the SAET RIT-T.

#### 1.2 Planning Basis

Contracting strategies for engineering, design, procurement, construction, resourcing and project execution plans, project schedule and key milestone dates are, at the time of writing, not fully established.

However, ElectraNet has developed a preliminary project plan and a high level schedule, including preliminary planning as part of the PADR preparation.

#### 1.3 Cost Basis

The source of all pricing used in the estimate is from a range of cost intelligence resources including our own corporate cost database, industry vendors, industry subject matter experts in infrastructure and utilities sector cost modelling, and our own capital infrastructure pricing experience.

Prices are based on 4Q17 costs for labour, materials and equipment and no allowance for future price changes is included in the price estimate.

#### 1.4 Risk Basis

No allowance has been made for any risk related cost elements or contingency amounts.

#### 1.5 Class 4 Estimate

In line with AACE International Recommended Practice and Estimate Classification this estimate is classified as Class 4, as it is preliminary in nature.

Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for concept studies, project screening, determination of feasibility, concept, evaluation, and preliminary budget approval. Typically, engineering design is from 1% to 15% complete. Capacities are

preliminary. Plant location is approximate. Soils/hydrology/ground condition data not developed or assessed. Project plans are preliminary. Project schedule is preliminary. Work Breakdown Structure (WBS) is preliminary or not existing. However, contracting strategy is stated – such as separate design and construct contracts, turnkey design and construct contracts.

The degree of Project scope definition is 1% to 15% of full project definition.

End Usage: Class 4 estimates are prepared for a number of purposes, such as: concept studies; strategic planning; project screening at more developed stages; alternative scheme analysis; undertaking of economic and/or technical feasibility analysis; and preliminary budget approval.

Estimating Method: Class 4 estimates generally use stochastic estimating methods such as equipment factors (building blocks and schedules of rates), and other parametric and modelling techniques. We have engaged with industry partners for budget costing and verification of our estimates.

Expected Accuracy Range: Typical accuracy ranges for Class 4 estimates are -15% to -30% on the low side, and +20% to +50% on the high side, depending on the complexity of the project, level of uncertainty of e.g. ground conditions, exchange rates, equipment/contractor availability and appropriate reference information. Accuracy ranges could exceed those indicated in unusual circumstances.

## **1.6 Costs from 3<sup>rd</sup> parties**

Costs included from 3rd parties, in particular Jurisdictional Planning Bodies' (JPBs) costs are included in good faith. A response is pending following an ElectraNet query regarding statement of inclusions in costs supplied. Response from JPBs could change the costs.

## **1.7 General Project Data**

- Level of project definition is estimated at 15%
- Capacity of facility – preliminary
- Plant location – approximate
- Line routes - preliminary
- Soil & hydrology – assumed
- Project Plan – preliminary
- Project schedule – preliminary
- WBS - none
- Preliminary single line diagram and layout used
- Contracting Strategy - assumed

## 1.8 General Pricing Assumptions

- All costs are based on 4Q17 prices for labour, materials and equipment hire
- The following approvals and/or agreements are envisaged to be in place at project commencement:
  1. necessary State and Commonwealth environmental approval for the project
  2. necessary land access or easement agreements are in place with landholders or other third parties
  3. necessary heritage agreements with traditional owners for access are in place and no Native Title issues
- Medium footings
- Reasonable ground conditions – exact site locations TBA
- No access problems – exact site locations TBA
- Competitive tender process
- Reasonable market conditions
- Reasonably level sites
- Selected sites are close to roads say not more than 200 m distant
- Assumed very lean delivery methods - pending Project Manager's detailed estimate for each option – outcomes from this could change the costs.

## 1.9 Cost escalations

- The Jurisdictional Planning Bodies agreed that requisite cost escalations to take Q417 prices to be based upon the Consumer Price Index (CPI)

## 1.10 Land & Easement costs

- ElectraNet engaged a consultant to provide indicative costs for land & easement acquisition for each of the proposed route options.

## 1.11 Exclusions

The following are excluded from the cost estimates:

- GST
- Future cost escalation
- Deep network augmentation
- Unexpected poor ground conditions (no geotechnical tests/analysis has been conducted)
- Cost of decommissioning and site rehabilitation at end of life



- Civil works / trenching through rock
- Staging costs (assumed each project option carried out in one continuous effort)
- Control schemes (unless otherwise stated)
- Generation support (unless otherwise stated)
- System/critical spares (unless otherwise stated)
- Risk allowance
- Maintenance costs (i.e. costs presented are CAPEX only)

## 2. Summary estimates approach – Network Options

The following works in support of estimates have been undertaken for the various RIT-T (Regulatory Investment Test – Transmission) options. Where costs were obtained they may have been used to inform an interpolation approach for alternative capacities/ratings:

1. Transmission lines
  - a) ElectraNet developed a high level specification for potential interconnector solutions – namely:
    - (i) double circuit 275 kV AC;
    - (ii) double circuit 330 kV AC; and
    - (iii) 400 kV HVDC.
  - b) The high level specifications were discussed / agreed with relevant JPBs, in accordance with proposed interconnector links between South Australia and respective eastern states;
  - c) High level estimates (indicative prices) were sought from reputable Australian companies with proven experience and capabilities for building transmission lines;
  - d) The high level estimates received from external parties were reviewed by ElectraNet and some additional allowances were included in the overall RIT-T costs for transmission lines.
  - e) Additionally, ElectraNet obtained conceptual cost estimates for each of the route options from the relevant host TNSPs (TransGrid & Powerlink), as well as from AEMO for the option through Victoria.
  - f) In order to derive an appropriate cost rate that broadly captures the construction market price for the key transmission lines of 400 kV HVDC; 330 kV AC double circuit and the 275 kV AC double circuit lines, Monte Carlo i.e. probabilistic simulations have been conducted using the construction data as inputs. The data comprise indicative vendor costs received including the relevant TNSP conceptual cost estimates. The derivative probability of exceedance 50% (P50) unit rates forms the basis for the overall cost estimate for the relevant transmission lines.
  - g) The Monte Carlo simulations approach and use of P50 estimates has been endorsed by the JPB.
  - h) The resultant P50 rate/km for the various route options are as follows:

### Overall P50 Result:

EC.14171 – Summary of Transmission Line \$ Rate/km P50 Values		
		P50 \$M/km
NSW Option	330kV DC AC Line	1.013
Victoria Option	275kV DC AC Line	0.891
QLD Option	400kV HVDC Line	0.716



The various vendor/TNSP costs received are as follows:

NSW – 330kV Option

<b>300kV Double Circuit Line</b>		
<b>TNSP/Vendor</b>	<b>\$m/km</b>	<b>Comments</b>
TransGrid	1.080	
Vendor 1	0.700	
Vendor 2	1.051	
Vendor 3	1.113	
<b>P50 Rate</b>	<b>\$1.013/km</b>	Rate excludes internal delivery costs & Land/easement costs

QLD 400kV HVDC Option

<b>400kV HVDC Line</b>		
<b>TNSP/Vendor</b>	<b>\$m/km</b>	<b>Comments</b>
Powerlink	0.550	
Vendor 1	0.695	
Vendor 2	0.763	
Vendor 3	0.832	
<b>P50 Rate</b>	<b>\$0.716/km</b>	Rate excludes internal delivery costs & Land/easement costs

\*ElectraNet has collaboratively worked with Powerlink to identify and implement opportunities to optimise initial vendor's prices, particularly through rationalising key design assumptions. There is mutual agreement that even though vendor costs are higher than Powerlink's conceptual cost estimates, the derived P50 cost broadly aligns with an accuracy level of +/-30% i.e. the P50 value just exceeds +30% of Powerlink's estimate.

VIC - 275kV Option

<b>275kV Double circuit Line</b>		
<b>TNSP/Vendor</b>	<b>TNSP/Vendor</b>	<b>TNSP/Vendor</b>
AEMO	0.810	
Vendor 1	0.710	
Vendor 2	1.000	
Vendor 3	1.016	
<b>P50 Rate</b>	<b>\$0.891/km</b>	Rate excludes internal delivery costs & Land/easement costs

- i) Estimates for transmission line components of different voltage level or configuration were provided by the relevant JPB. These components constitute a smaller portion of the overall estimate than the transmission line component.
- 2. Substations
  - a) Each JPB defined technical requirements / high level specifications for substations required to be configured in their networks;
  - b) Costs for substations were estimated by each JPB for their networks, with the respective costs then included in the overall estimate of each considered RIT-T option.
- 3. Special purpose equipment
  - a) Static VAR Compensators (SVCs)
    - (i) Each JPB defined the size of SVCs required for their networks (where needed) and sought high level estimates from reputable suppliers;
    - (ii) The associated costs were included in the overall estimate for the relevant RIT-T options.
  - b) Shunt reactors / shunt capacitors
    - (i) Each JPB defined the size of shunt capacitors / shunt reactors required for their networks (where needed) and sought high level estimates from reputable suppliers;
    - (ii) The associated costs were included in the overall estimate for the relevant RIT-T options.
  - c) Synchronous condensers
    - (i) ElectraNet defined the size of synchronous condensers required for the South Australian network and sought high level estimates from reputable suppliers;
    - (ii) The associated costs were included in the overall estimate for the relevant RIT-T options.
  - d) Series compensation
    - (i) ElectraNet could estimate the cost of series capacitors based on its recent experience with the series capacitors installed at Black Range; however, to date, there has been no need to estimate series capacitors. Series compensation is likely to be considered as additional options going forward;
  - e) Phase shifting transformers
    - (i) AEMO and TransGrid defined the size of phase shifting transformers required for their networks (Vic, NSW) and sought high level estimates from reputable suppliers;
    - (ii) The associated costs were included in the overall estimate for the relevant RIT-T options.

- f) Power transformers / auto-transformers
  - (i) Each JPB defined the size of power transformers / auto-transformers required for their networks (where needed) and sought high level estimates from reputable suppliers;
  - (ii) The associated costs were included in the overall estimate for the relevant RIT-T options.
- g) HVDC terminal stations
  - (i) Powerlink defined the size of HVDC terminal stations and sought high level estimates from reputable suppliers, with same costs assumed to be applicable both for Qld and South Australia;
  - (ii) The associated costs were included in the overall estimate for the relevant RIT-T option.
- h) System Protection Schemes
  - (i) ElectraNet defined the scope and requirements for Special Protection Schemes and sought high level estimates from constructors

### 3. Summary estimates approach – Non-Interconnector Option

Estimates for the Non-interconnector option were compiled from:

- Submissions by non-network proponents to the Project Specification Consultation Report (PSCR)
- Entura consultancy
- Information obtained via other processes, e.g. ElectraNet's work to address system strength limitations





# APPENDICES

## Appendix A Estimates of PADR options

The table below lists the cost estimates used for the PADR assessment.

Option	Description	CAPEX Cost (\$M)
A1	Non- Interconnector Option	\$830 NPV
B1	HVDC from Northern SA to QLD	\$1,790
C1	DC link to NSW ('Murraylink 2')	\$810
C2	275kV line from mid North SA to Western NSW	\$1,040
C3	330kV line from mid North SA to Western NSW	\$1,440
C3i	330kV line from mid North SA to Western NSW (including series compensation on the line in both SA as well as NSW)	\$1,480
C4	330kV line from mid North SA to Central NSW	\$1,280
C5	500kV line Northern SA to East NSW	\$2,860
D1	275kV Central SA to VIC interconnector	\$1,200
D1i	275kV Central SA to VIC interconnector (including series compensation on the line)	\$1,230