TransGrid's Response to AER Request for Information- HumeLink

Date received:	21 September 2021
Date responded	5 October 2021
Topic	HumeLink (PEC) RIT-T
RFI	2.0

Questions

Upon reviewing the information in TransGrid's response[1], we believe that TransGrid has not expressly provided all of the information requested in our initial information request. To assist our assessment of the Humelink RIT-T dispute and ensure timely resolution of the dispute, we seek information on the following:

1. **Methodology and breakdown of biodiversity costs for preferred option and other credible options.**

   Our initial information request sought further details on the breakdown of biodiversity offset costs. However, TransGrid's response did not provide details on how these costs were derived for preferred and other credible options. We understand that biodiversity costs form a substantial portion of the overall capital cost of the credible options, including preferred option, and hence it is important to understand how these costs were factored in the cost benefit analysis in the PACR.

   a) Please provide details on the assumptions and methodology to determine the biodiversity costs assumed for preferred and all credible options, including whether these are probability weighted estimates and if so the methodology for deriving these estimates.

Approach and methodology for the determination of biodiversity offset costs

- Spatial information for each of the PACR options was provided to professional consulting firm, Eco Logical Australia, to determine the biodiversity offset costs under the *Biodiversity Conservation Act 2016* and using the Biodiversity Offset Payment Calculator (BOPC).
- Indicative routes with the following easement widths were applied:
  - 60m for 330kV single or double circuit
  - 70m for 500kV double circuit
  - 80m for 500kV single circuit
- Data on plant community types (PCTs) and threatened flora and fauna species was based on desktop research previously undertaken for the project as well as field survey information collected up to the time of the PACR preparation
- Credit prices for PCTs and threatened species were derived from the published BOPC prices in February and March 2021
- Average PCT and species BOPC costs for PCTs 888 and 999, which have no assigned credit costs, were adopted
- No credit costs were assigned to five species protected under the *Environment Protection and Biodiversity Conservation Act 1999* but not listed as threatened in NSW (and with no associated credit price in the BOPC)
- For two species that did not have credit prices in the BOPC, credit prices for similar species was applied
- BOPC prices are indicative and may be an under or over estimate for certain species compared to market trades

[1] TransGrid, Response to AER information request- Humelink RIT-T dispute, 1 September 2021

- Administration costs in the BOPC were applied per credit
- No indirect impacts were included in the credit calculations as this is not required by the Biodiversity Assessment Method
- An initial set of worst case assumptions was applied to determine ecosystem credits and species credits before a sensitivity analysis was undertaken, adjusting a number of factors to determine reasonable offset costs, including habitat integrity and threatened species occupancy. A 50% habitat integrity and 25% threatened species occupancy factor was applied. A description of further assumptions is outlined below:
  - Where PCTs are treed vegetation (i.e. > 4 m high), it was assumed the easement would be fully cleared
  - PCTs identified as treeless do not include any tree canopy species and vegetation is < 4m in height
  - For treeless PCTs, it was assumed 25% of the easement would be cleared (for the tower footprint (0.58ha), spacing between towers is 350m, construction pad (55m x 105m), and access tracks (4m wide))
  - Clearing for ancillary facilities (such as construction laydown areas, worker accommodation camps, site offices) and off-easement access tracks were not included
  - A fixed number of biodiversity credits required per hectare were assumed since BAM vegetation integrity plots have not been carried out across the entire project area
  - Where the same PCT had varying credit prices in the BOPC, the highest cost was adopted
  - Species recorded in BioNet within 5km of the indicative routes were assumed present in all available habitats associated with that species within the easement
  - A bilateral agreement would apply so that offset costs generated would cover both the State and Commonwealth offset requirements
  - All offset obligations would be met by paying into the Biodiversity Conservation Fund
- TransGrid's contingency modelling tool, The Hollmann model (refer Appendix A) was applied to the project costs, which included the biodiversity costs, to produce an integrated probabilistic output for each of the options.

2. Cost assumptions for options 2C and 3C (preferred)

Our initial information request sought further details on the indicative route assumed for the preferred option and other credible options. We understand that detailed route specifics may be determined in post-RIT-T processes; however, it is important for us to understand the cost assumptions assumed in the PACR assessment.

We also understand that TransGrid has used 'P50' capital cost estimates for credible options in its PACR i.e. they have a 50 per cent expected probability of a cost underrun or overrun. However, the PACR also states that the cost estimates for the credible options identified in the PACR are "class 4" estimates with cost certainty ranging between -30 per cent and +50 per cent.

a) *Please provide details on cost assumptions used to derive total capital costs for option 3C and option 2C, including whether these options are probability weighted and if so the details used to determine these probability weights relevant to deriving the estimated capital costs of both options. In addition, explain how uncertainty regarding different routes assumed for the purposes of estimating the capital costs between options 2C and 3C may impact the cost benefit assessment and hence, the ranking of these credible options assessed in the PACR.*

The costs assumptions in the PACR for both options can be summarised as follows:

- Equivalent 500kV tower weights for both options
- Desktop assessment of geotechnical conditions for each of the options
- Preliminary line route
- Tension and suspension tower quantities based on preliminary concept design
- Desktop assessment of the access and clearing requirements for each of the line routes

TransGrid's contingency model, The Hollmann model (refer Appendix A) was applied to the project costs for all HumeLink Options. The TransGrid contingency toolset integrates the following risks:

- Systemic (Parametric) risks, and
- Project Specific risks

Systemic Risk is the predominant risk during the early stages of project development, as the project matures and the risks become more defined the project specific risks will start to dominate. For the PACR submission the Systemic Risk accounts for circa 80% of the total project risk.

Systemic risks are driven by the level of maturity of the project development. The maturity of development of the PACR Options 2C & 3C is similar and therefore the % contingency applied to each of these options due to systemic risk will be similar.

The cost estimates were developed based on the shortest corridor route lengths for each of the PACR options.

Uncertainty associated with the corridor routes is captured using the Hollmann model contingency toolset. This toolset, in conjunction with a Monte-Carlo Simulation program, uses a combination of Systemic (Parametric) and PACR option specific cost and schedule risk analysis to develop a probability weighted (P50) contingency.

Following the RIT-T market modelling, the NPV modelling uses the P50 cost estimates to determine the total market benefits by comparing the key outputs under the base case with each option.

b) Please clarify whether the capital cost estimates provided in the PACR are P50 estimates or 'class 4' estimates. If so, please provide details on the basis of these estimates.

The capital cost estimates provided in the PACR are Class 4 estimates as defined by the ACCE (Association for the Advancement of Cost Engineering) classification system. For these Class 4 estimates TransGrid has provided the P50 value (50% probability of underrun).

The estimate class is determined by the level of maturity of the project definition deliverables, which in the case of HumeLink was determined to be Class 4. Refer Table 1 below which demonstrates the Classes a project moves through as the project definition deliverables matures (extract from 96R-18: Cost Estimate Classification System – As applied in Engineering, Procurement, and Construction for the Power Transmission Line Infrastructure Industries):

	Primary Characteristic	*Secondary Characteristic*		
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges at an 80% confidence interval
Class 5	0% to 2%	Concept screening	Cost/length factors, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Cost/length, factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

Table 1 – Cost Estimate Classification Matrix for the Power Transmission Line Infrastructure Industries

The TransGrid contingency toolset combines Systemic (Parametric) and Expected Value (Expected Value or EV using Monte-Carlo Simulation) tools for integrated cost and schedule risk analysis and contingency estimating. TransGrid uses the Hollmann model to determine the Integrated Probabilistic output range of the cost estimate. See figure below which demonstrates the Hollmann model process.

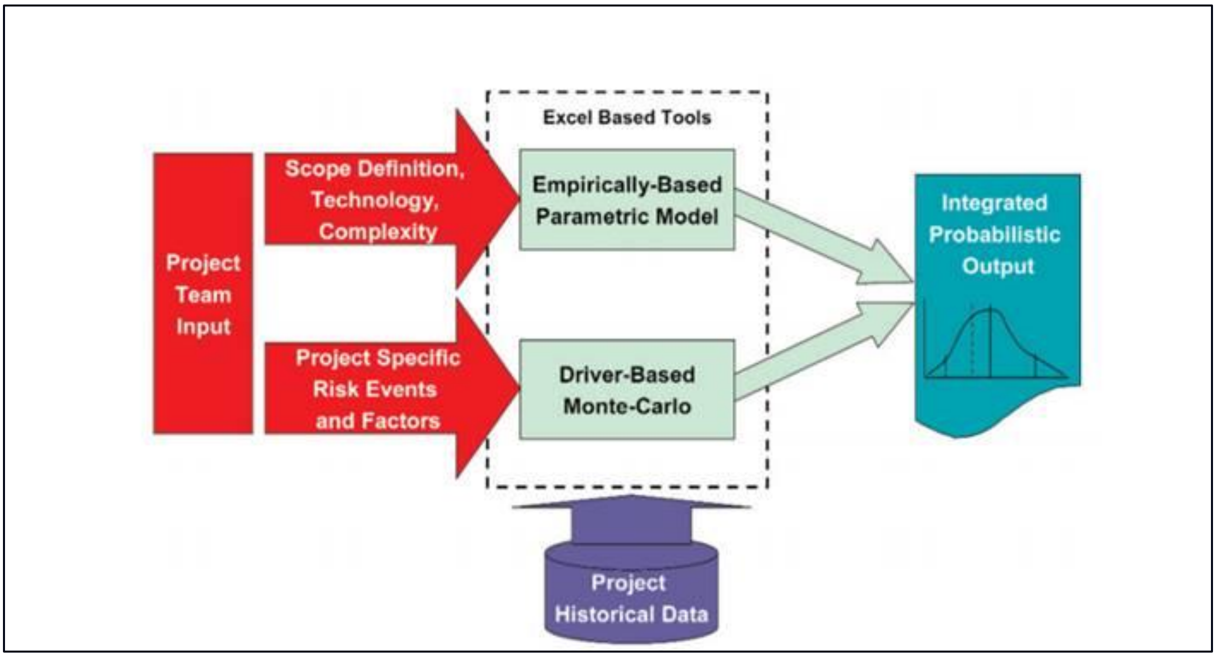

Figure 1 – Hollmann model process

John Hollmann (refer Appendix A) has developed input fields in his parametric spreadsheet model in which such inputs can be assigned rating points which drive the level of uncertainty incorporated in the parametric outputs. The systemic risk is quantified using parametric models based on historical data on project performance, correlated to known drivers of project outcomes. The rating schemes are designed to assure objectivity and are combined with project specific risk events to provide an integrated probabilistic output.

c) We also request you to provide the following data:

Credible options assessed in PACR	Line Segment	Segment Configuration (single or double circuit)	Indicative length assumed (include latitude/longitude or provide geographic map)	Total Cost of segment ($real FY20) ($M)	Breakdown of biodiversity costs associated with the route ($real FY20) *($M)*
Option 3C	*500kV D/C Bannaby Gobarralong TL*	*Double Circuit*	*168*	*$1,392*	*$626*
	500kV D/C Gobarralong to MRG TL	*Double Circuit*	*115*	*$890*	*$169*
	500kV D/C Blowering Dam to Gugaa TL	*Double Circuit*	*61*	*$407*	*$103*
	330kV D/C Gugaa - Wagga Line	*Double Circuit*	*15*	*$46*	*$2*
Option 2C	*500kV D/C Bannaby to Gugaa TL*	*Double Circuit*	*261*	*$1,976*	*$671*
	500kV D/C Gugaa to Maragle TL	*Double Circuit*	*109*	*$778*	*$108*
	330kV D/C Gugaa - Wagga Line	*Double Circuit*	*15*	*$45*	*$2*

Appendix A Hollmann method background

A1. The Hollman Method

TransGrid's Cost and Schedule Contingency Estimating Tool was developed with John Hollman. The TransGrid's contingency toolset combines Systemic (Parametric) and Expected Value (Expected Value or EV using Monte-Carlo Simulation) tools for integrated cost and schedule risk analysis and contingency estimating.

The Systemic tool can be used by TransGrid for any power generation, substation, transmission or distribution project at any phase or AACE Estimate Classification. However, it is calibrated for large capital investment projects. These are typically projects that have dedicated core project teams and a cost of over $20M.

The systemic tool may be used alone (no project-specific risk analysis) for project estimates at the earliest phases (e.g., Class 5) or in combination with the EV tool, for later phases. This systemic tool is a parametric model in an Excel-based spreadsheet that provides a Risk Factor Questionnaire (input parameters) and probability distribution curves and p-tables (outputs) for cost and schedule. The curves are derived from a historical validated lognormal base model for larger sustaining or strategic capital projects. By answering the questions in the five categories of the Risk Factor Questionnaire (the model parameters), the tool will calculate the cost and schedule duration distributions from which contingency can be determined that aligns with management's desired level of confidence in underrun[1,2].

For rating project scope definition, the user can toggle between two alternate sets of scope definition questions for Station (or Plant if generation) and Transmission projects; each has its own deliverable "maturity matrix". These matrices are based in part on AACE International estimate Classifications which align with most industry phase-gate scope definition processes. It also provides an indication of potential execution phase schedule slip (execution is from sanction to mechanical completion)

The system is designed to provide probabilistic cost output while making risk analysis simple, repeatable and reliable.

For more information about the general methodologies, and the empirical research behind them, refer to the text "Project Risk Quantification" by John Hollmann

A2. John Hollman – AACE Fellow and Honorary Life Member.

In addition to many committee and Board roles over the years, John is the primary author of AACE's technical foundation text, the "Total Cost Management Framework". Most recently he led development of AACE's Decision and Risk Management Professional (DRMP) certification program.

A3. Relevant Papers/ Books by John Hollman

a) 2020 AACE Technical Paper - Variability in Accuracy Ranges: A Case Study in the US and Canadian Power Industry

b) Variability in Accuracy Ranges (paper): A case study in the Canadian Power Transmission Industry

c) Project Risk Quantification – Book by John Hollmann

[1] The tool is based on process industry research (e.g., RAND, IPA, CII). However, later research (see next footnote) has shown that power generation and transmission projects have similar cost and schedule growth outcomes. Tool "calibration" factors can be used if study shows TransGrid's risk profile is more or less accurate than industry.

[2] Reference: 3 case study papers by Hollmann, et.al., "Variability in Accuracy Ranges: A Case Study in the Canadian Hydropower Industry" (AACE 2014), "in the Canadian Power Transmission Industry" (AACE 2017) and "in the US and Canadian Power Industry" (AACE 2020).