Addendum A

TasNetworks transmission repex addendum to Arup's Final Draft Report

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A1 Introduction

Arup were engaged by the Australian Energy Regulator (AER) in April of 2018 to deliver analysis on TasNetworks' proposed capital expenditure (capex) for the 2019-24[1] regulatory control period.

The AER has undertaken analysis concurrent to Arup's report suggesting that 13 programs/projects in TasNetworks' transmission repex forecast can be deferred or partly deferred beyond the 2019-24 regulatory control period.

The AER has requested that Arup review its project assumptions for the 13 programs/projects, in regards to the reasonableness and appropriateness of the assumptions against TasNetworks' initial proposal.

Arup's findings are delivered in this addendum to the main report containing Arup's view of TasNetworks' proposed capex titled *Review of TasNetworks' proposed capital expenditure for the 2019-24 regulatory control period*.

[1] For clarity, 2019-24 is the period FY2020-24, so 1 July to 30 June in FY terms.

A2 Transmission repex

TasNetworks has proposed an increase in transmission repex over the forecast proposal period with the aim of ensuring that current performance is maintained and safety and reliability risk is managed. The total expenditure on transmission repex has increased from $154.5m in the current period to $204.5 in the forecast period. This addendum focuses on the NPV assumptions across 13 programs/projects in transmission repex.

A2.1 NPV assumptions

TasNetworks' Net Present Value (NPV) analyses are a key consideration in its investment governance process. The tables below represent Arup's view on the AER's assessment of TasNetworks' NPVs for 13 transmission repex programs/projects identified by the AER to include potentially inappropriate assumptions.

For a full discussion on TasNetworks' investment governance process, see Section 3.5 of *Review of TasNetworks' proposed capital expenditure for the 2019-24 regulatory control period*.

A2.1.1 Lines

Table 1 Transmission line projects with Arup comments on TasNetworks and AER proposed capex ($FY19)

Project	TasNetworks FY2020-24	AER suggested FY2020-24	AER comments	Arup comments
George Town – TEMCO 110kV transmission line replacement	$5,572,229	$2,228,892	AER modelling suggested maintain existing line provide least cost as well as investment flexibility (i.e. 60% cost reduction in the 2019-24 period).	Arup modelling and analysis suggested that refurbishment and maintenance, (i.e. Option 2) will provide the most economically efficient solution. Option 2 reduces consequences of stranded assets and mitigates risks with regards to unserved energy due to failures. The AER suggested capex for the FY2020-24 period is in line with Arup's analysis.
Burnie – Waratah H Pole replacement program	$4,569,041	$2,284,521	AER believes that the assumption that all 87 wood pole to fail their serviceability criteria is unreasonable. Comparison with other NSPs shows that a deterministic age of 58 years is very conservative. We expect at least half will not fail their condition assessment during the 2019-24 period.	TN policy for wooden poles is an economic life of 45 years, with wood pole cores tested every 3 years and poles with insufficient sound wood to be condemned and replaced within 3 months (refer IES project 01425). 87 wood poles remain on this 110kV line aged 51 years and "will be condemned in the 2019-24 regulatory period due to poor condition and end of life." The TN 2018 TAPR indicates the replacement MEA is "spun concrete pole" (Table 6.12, page 82). Arup notes the 110kV line to Waratah Tee can be supplied from Farrell Substation or Burnie (via Hampshire) Substation. The unserved energy analysis should include the effect of N-1 on this line for Savage River mine and small township loads.

Project	TasNetworks FY2020-24	AER suggested FY2020-24	AER comments	Arup comments
				The options considered for pole replacement appear restricted, and additional options would assist the analysis, e.g. similar frequency of condition assessment as is needed for a full deferral for FY2020-24, but a targeted replacement on poor condition using half of the proposed capex allowance. Arup has used its preferred VCR value of $21,400 per MWh and re-run TasNetworks' model with full condition inspection costs identified by TasNetworks, but half the capex allowance proposed and found a lower NPV, than the Option 1 chosen by TasNetworks. Arup's analysis therefore supports the AER comments. Further a budget around half that proposed by TasNetworks to replace the wooden poles on this line in the FY2020-24 period and the other half in the FY2025-29 or following period should be considered as an option in TasNetworks analysis.

A2.1.2 Switchgear

Table 2 Transmission switchgear projects with Arup comments on TasNetworks and AER proposed capex ($FY19)

Project	TasNetworks FY2020-24	AER suggested FY2020-24	AER comments	Arup comments
Replace 220kV Sprechur and Schuh HPF live tank circuit breakers	$6,809,354	$3,404,677	No unserved energy cost provided (i.e. likely N-1 which makes reactive and defer investment more attractive). Did not consider replacing enough to free up spare parts to prolong life of remaining fleet. We expect at least half can be replace in the 2024-29 period (i.e. maintaining existing fleet is relatively low cost if spares are available)	Arup agrees with the AER comments. It appears to be more cost effective to replace half the fleet in the FY2020-24 period and the other half in the FY2025-29 period. The NPV analysis for the options for this project suggests an operate as normal or defer investment approach as the most cost effective options, yet it is noted that the associated risks have not been costed. The circuit breaker replacement program presented by Transend in 2011 identifies the replacement at 2023. The approach suggested by AER would allow for a controlled replacement, provision of spares and partial deferral of investment.
Replace 110kV ASEA HLD live tank breakers	$5,724,515	$2,862,257	No unserved energy cost provided (i.e. likely N-1 which makes reactive and defer investment more attractive). Did not consider replacing enough to free up spare parts to prolong life of remaining fleet. We expect at least half can be replace in the 2024-29 period (i.e. maintaining existing fleet is	Arup agrees with the AER comments. It appears to be more cost effective to replace half the fleet in the FY2020-24 period and the other half in the FY2025-29 period. The NPV analysis for the options for this project suggests an operate as normal or defer investment approach as the most cost effective options, yet it is noted that the associated risks have not been costed.

Project	TasNetworks FY2020-24	AER suggested FY2020-24	AER comments	Arup comments
			relatively low cost if spares are available)	The circuit breaker replacement program presented by Transend in 2011 identifies the replacement at 2023. The approach suggested by AER would allow for a controlled replacement, provision of spares and partial deferral of investment.
Chapel St 11kV HV switchgear replacement	$3,808,262	$0	AER modelling suggested early 2029-34 period as optimum timing for replacement	Arup analysis concluded that the unserved energy calculation needs further justification and rework in-line with its report recommendations. Using Arup assumptions within TasNetworks model suggests that option 2 provides the most cost-effective solution and that the option for replacement should be re-evaluated by TasNetworks for the FY2025-29 period. It is noted that the optimum time for replacement/commissioning based on Arup modelling was 2035. The later time compared to the AER model is primarily due to reducing the VCR value to $21,400 per MWh. Therefore, on Arup's analysis it supports the AER suggested capex for this project of $0 for the FY2020-2024 period.
Ulverstone 22kV HV switchgear replacement	$2,032,446	$0	AER modelling suggested late 2024-29 period as optimum timing for replacement	Arup analysis concluded that the unserved energy calculation needs further justification and rework in-line with its report recommendations. Using Arup assumptions within TasNetworks model suggests that option 2 provides the most cost-effective solution and that the option for replacement should be re-evaluated by TasNetworks for the FY2025-29 period. It is noted that the optimum time for replacement/commissioning

Project	TasNetworks FY2020-24	AER suggested FY2020-24	AER comments	Arup comments
				based on Arup modelling was 2032. The later time compared to the AER model is primarily due to reducing the VCR value to $21,400 per MWh. Therefore, on Arup's analysis it supports the AER suggested capex for this project of $0 for the FY2020-2024 period.
Knights Rd 11kV HV switchgear replacement	$2,027,025	$0	AER modelling suggested early 2029-34 period as optimum timing for replacement	Arup analysis concluded that the unserved energy calculation needs further justification and rework in-line with its report recommendations. Using Arup assumptions within TasNetworks model suggests that option 2 provides the most cost-effective solution and that the option for replacement should be re-evaluated by TasNetworks for the FY2025-29 period. It is noted that the optimum time for replacement/commissioning based on Arup modelling was 2031. The later time compared to the AER model is primarily due to reducing the VCR value to $21,400 per MWh. Therefore, on Arup's analysis it supports the AER suggested capex for this project of $0 for the FY2020-2024 period.
Railton 22kV HV switchgear replacement	$1,986,055	$695,119	AER modelling suggested early 2024-29 period as optimum timing for replacement	Arup analysis concluded that the unserved energy calculation needs further justification and rework in-line with its report recommendations. Using Arup assumptions within TasNetworks model suggests that option 2 provides the most cost-effective solution and that the option for

Project	TasNetworks FY2020-24	AER suggested FY2020-24	AER comments	Arup comments
				replacement should be re-evaluated by TasNetworks for the FY2025-29 period. It is noted that the optimum time for replacement/commissioning based on Arup modelling was 2028. The later time compared to the AER model is primarily due to reducing the VCR value to $21,400 per MWh. Therefore, Arup's analysis using a lower VCR value suggests a reduction in expenditure allowance, as proposed by the AER, is warranted. Using Arup's assumptions and analysis suggests a $0 allowance for the FY2020-2024 regulatory period. The AER's approach reduces expenditures across the FY2020-2024 regulatory period to a lesser extent which should allow TasNetworks to identify more critical condition switchgear and prioritise its replacement.
Sorell 22kV HV switchgear replacement	$1,910,155	$0	AER modelling suggested mid 2024-29 period as optimum timing for replacement	Arup analysis concluded that the unserved energy calculation needs further justification and rework in-line with its report recommendations. Using Arup assumptions within TasNetworks model suggests that option 2 provides the most cost-effective solution and that the option for replacement should be re-evaluated by TasNetworks for the FY2025-29 period. It is noted that the optimum time for replacement/commissioning based on Arup modelling was 2029. The later time compared to the AER model is primarily due to reducing the VCR value to $21,400 per MWh.

Project	TasNetworks FY2020-24	AER suggested FY2020-24	AER comments	Arup comments
				Therefore, on Arup's analysis it supports the AER suggested capex for this project of $0 for the FY2020-2024 period.

A2.1.3 Transformers

Table 3 Transmission transformer projects with Arup comments on TasNetworks and AER proposed capex ($FY19)

Project	TasNetworks FY2020-24	AER suggested FY2020-24	AER comments	Arup comments
St Marys supply transformers	$4,148,127	$0	"Oct 2017 Transformer Asset Management Plan have identified St Marys transformers in acceptable physical and electrical condition. We don't expect these transformers to deteriorate materially from within the 2019-24 period. The report did indicate that the transformers might be subject to upgrade from capacity increase	Arup's analysis supports the AER comments and suggested FY2020-24 capex of $0. The Oct 2017 Power Transformers Asset Management Plan excerpt: "The condition assessment report for St Marys T1 and T2 has identified the units are in acceptable physical and electrical condition." The plan also mentions potential relocation of the St Marys T1 transformer further confirming its acceptable condition.

Project	TasNetworks FY2020-24	AER suggested FY2020-24	AER comments	Arup comments
			but this is not to considered under Repex."	
Boyer T13 & T14 supply transformers	$3,916,237	$0	Oct 2017 Transformer Asset Management Plan have identified Boyer T13 & T14 transformers in acceptable condition. We don't expect these transformers to deteriorate materially from within the 2019-24 period. In addition, a suitable spare has been purchased that facilitates emergency recovery of any major transformer outages on this site.	Arup's analysis supports the AER comments and suggested FY2020-24 capex of $0. The Oct 2017 Power Transformers Asset Management Plan excerpt: "The condition assessment report of Boyer T13 and T14 identifies that these units are in acceptable condition"… "At this time there is no direct replacement for this transformer should a replacement be required however a suitable spare has been purchased which will be available by June 2018." TasNetworks should consider the storage location of the spare transformer.
Port Latta supply transformers	$3,818,511	$1,909,256	Oct 2017 Transformer Asset Management Plan have identified Port Latta transformers in acceptable electrical condition and marginal physical condition but is fit for service for at least 5 more years. We believe an allowance for one transformer is reasonable in the 2019-24 period	Arup's analysis supports the AER comments and suggested FY2020-24 capex of $1,909,256. The Oct 2017 Power Transformers Asset Management Plan excerpt: "All the reports summarise that the units: • Are 50 years old; • Have no major inherent design deficiencies except the bolted tank lids; • Are in marginal physical condition (oil leaks); • Are in acceptable electrical condition; and • Are expected to be fit for service for at least 5 years"

Project	TasNetworks FY2020-24	AER suggested FY2020-24	AER comments	Arup comments
			given that spares are available for this site.	The designated spare is also in marginal condition located at Emu Bay substation. Given the condition and spare availability Arup agrees with the AER comment regarding allowance of one replacement in the FY20-24 period. TasNetworks should consider refurbishing the existing spare when the new spare is available.
Burnie supply transformers	$3,588,581	$1,794,291	Oct 2017 Transformer Asset Management Plan have identified Burnie transformers in acceptable condition but is fit for service for at least 7 more years. We believe an allowance for one transformer is reasonable in the 2019-24 period given that spares are available for this site.	The Oct 2017 Power Transformers Asset Management Plan excerpt: "The condition assessment report for T6 and T7 [Burnie transformers T6 and T7] has highlighted that these units are presently in acceptable condition"… "These units are expected to be fit for service for another 7 years for T6 and 12 years for T7 according to CBRM results." The Burnie transformers also have a spare available in acceptable condition at Creek Road. Without further justification from TasNetworks, Arup questions whether there should be any allowance for replacement of the Burnie T6 and T7 transformers in the FY2017-24 period and would suggest this be reassessed and justified by TasNetworks for the FY2024-29 period.

A2.2 Governance

Arup has found that there are some common issues with the NPV analysis which should be picked up in the governance and capital approvals process improvement and highlight the following for further consideration for TasNetworks approvals process:

- NPV analysis key assumptions have not been appropriately justified – these include failure rates, recovery times, VCR, and failure modes. Justification of the values used would make TasNetworks' analysis more robust and transparent.
- A number of key reasons to support projects to go ahead identified by TasNetworks have not being factored into the NPV analyses on a $ value basis (e.g. safety risk, bushfire risk, network condition). In a number of instances this has resulted in the decision to go ahead with a project when a full analysis including a numerical risk assessment may lead to an alternative option and a more robust economic decision. This is apparent in the power transformer replacement plans – The Asset Management Plans have assessed a number of transformers to be in acceptable condition yet the decision for replacement has still been made. The risks being addressed are not always quantified, leading to on /off rather than proportionate decision making.
- There has been an inconsistent approach to the calculation of unserved energy in the NPV analyses. This is apparent in the Chapel St switchgear replacement project compared to other switchgear replacement projects. A transparent statement of, and a more uniform application of approach to unserved energy would assist the AER's review.
- The NPV analysis for the switchgear replacement projects should not be an options based approach but should rather be conducted with the aim to determine the optimum time for replacement/commissioning. This is because there is no difference between the options other than the time for replacement.
- In a number of instances there is an incomplete or reduced set of options identified (e.g. Burnie – Waratah H Pole replacement program). Better identification of available options would better serve the customer preferences which TasNetworks has identified, in particular keeping the network costs low and at current reliability levels.

A3 Conclusion

Arup's analysis of the 13 projects outlined in this addendum generally support the methodology, comments and suggested FY2020-24 expenditures presented by AER:

- Arup supports the AER comments and suggested expenditure for 12 of the 13 projects presented.
- Burnie Supply transformer: TasNetworks justify this expenditure on these transformers using its Oct 2017 Transformer Replacement Plan. Without further justification from TasNetworks, Arup questions whether there should be any allowance for replacement of the Burnie T6 and T7 transformers in the FY2020-24 period and would suggest this be reassessed and justified by TasNetworks for the FY2025-29 period.

TasNetworks needs to provide further justification, evaluation and assessment for the proposed projects to the AER to warrant its proposed expenditure.