Powering Sydney's Future
Project Assessment Conclusions Report Summary

This is the third stage of the formal RIT-T process for 'Powering Sydney's Future'.

This Project Assessment Conclusions Report (PACR) represents the third step in a formal Regulatory Investment Test for Transmission (RIT-T) process undertaken jointly by TransGrid and Ausgrid with a focus on alleviating the increasing risk to the supply of electricity to consumers from ageing electricity infrastructure in the Inner Sydney area.

The overall RIT-T process is designed to directly engage with parties on the problem and proposed options being considered, both network and non-network, to address it, test the market for alternate and more efficient solutions, and set out clearly the basis on which the preferred option has been selected.

Publication of the Project Specification Consultation Report (PSCR) in October 2016 marked the first stage of the consultation process. The PSCR set out in detail the need for TransGrid and Ausgrid to take action to ensure security of supply to Inner Sydney.

Release of the PSCR represented a formal recommencing of the Powering Sydney's Future project that TransGrid and Ausgrid consulted on extensively during 2014 and, ultimately, decided to defer in light of decreasing maximum demand forecasts at the time. A number of factors have contributed to this project being re-evaluated and this RIT-T commencing, including:

- fluid-filled cables in Inner Sydney will be nine years older, and consequently less reliable, when the project is delivered;
- derating of a major cable supplying Inner Sydney following a comprehensive testing program of the thermal resistivity of backfill and bedding materials;
- an observed rebound in summer peak demand for Inner Sydney, with near record demand in 2017 and a forecast increase in demand from heightened economic activity expected within Inner Sydney; and
- a change in the externally imposed transmission reliability standard – from 1 July 2018, away from the modified N-2 deterministic transmission reliability standard towards a reliability standard that explicitly undertakes a cost benefit assessment of network investments.

The Project Assessment Draft Report (PADR), released in May 2017, represented the second stage of the RIT-T process and identified the preferred option for investment by TransGrid and Ausgrid, taking into account feedback from stakeholders on the PSCR. The PADR presented the results of the RIT-T economic assessment, which demonstrated that the preferred option involved the following:

- the use of non-network solutions before a network project, as well as to defer network build by one year from when it would need to be commissioned without this support;
- installing two 330 kV cables at the same time with commissioning in time for the 2022/23 summer;
- operating Cable 41 at 330 kV with rating of 426 MVA; and
- decommissioning Ausgrid's cables in one stage.

This report, the PACR, discusses the issues raised by stakeholders in submissions to the PADR and how they have been incorporated in the final RIT-T assessment. Key issues raised and responded to include the range of demand forecasts considered, failure rates of existing fluid-filled cables and how non-network solutions

can help manage the risk of supply outages to Inner Sydney. This PACR also responds to a range of points raised by the Australian Energy Regulator (AER) in relation to the Powering Sydney's Future project in its Draft Decision on TransGrid's regulatory proposal for the 2018-23 regulatory control period. While this is a separate process to the RIT-T, TransGrid and Ausgrid consider it useful to address points raised by the AER in this PACR to provide further insight into the robustness of the conclusions of the RIT-T process.

The PACR presents an assessment of the costs and benefits of a number of credible options in addressing the risk to supply in Sydney going forward, as well as the methodologies and assumptions underlying these results, and identifies the preferred way forward by TransGrid and Ausgrid. This assessment has been updated since the PADR in light of both submissions received and points raised by the AER.

Ten credible options have been assessed, covering a range of network and non-network technologies, including a new option introduced since the PADR

TransGrid and Ausgrid have considered a range of options and their ability to address the risk of supply disruption for consumers. Both network and non-network solutions have been considered as potential credible options for this RIT-T analysis – in particular:

- a range of **network options** has been included in the RIT-T assessment; and
- **non-network option components** have been incorporated into the assessment of all network options identified, to manage the supply risk prior to commissioning of the network component
    - in addition, two 'deferral' options (Option 7 and Option 8) have been included in the assessment to determine whether non-network components can efficiently defer the timing of network investment.

The credible network options considered differ principally based on:

- whether two new 330 kV cables are built together, or in stages;
- whether Cable 41 is remediated, operated without remediation (including at a lower voltage), or retired; and
- whether Ausgrid's existing fluid-filled cables are decommissioned in one stage, or two.

Option 8 has been introduced since release of the PADR and reflects feedback from customers, the AER and the Consumer Challenge Panel, as part of the separate regulatory review process for TransGrid, that supported a staged network option for the reasons that it reflects lower initial capital costs and provides 'optionality' (ie, the flexibility to defer the second cable if circumstances change).

The table below summarises the credible options identified and assessed as part of this RIT-T.

Table E-1 Summary of the credible options assessed as part of this RIT-T

Option & direct cost* ($m, NPV)	Use of non-network solutions before network commissioning	Use of non-network solutions to defer network build by one year	Two new 330 kV cables built		Cable 41				Decommissioning of Ausgrid fluid-filled cables	
			In stages	At once	Operate at 132 kV	Operate at 330 kV with rating of 426 MVA	Remediate to ~ 575 MVA	Retire	In stages	At once
1 – $224m	✓	-	✓	-	-	-	-	✓	✓	-
2A – $221m	✓	-	✓	-	✓	-	-	-	✓	-
2B – $250m	✓	-	✓	-	-	✓	-	-	-	✓
3A – $246m	✓	-	-	✓	-	-	-	✓	-	✓
3B – $247m	✓	-	-	✓	-	✓	-	-	-	✓
4 – $263m	✓	-	✓		-	-	✓	-	-	✓
5 – $273m	✓	-	-	✓	-	-	✓	-	✓	-
6 – $257m	✓	-	-	✓	-	-	✓	-	-	✓
7 – $234m	✓	✓	-	✓	-	✓	-	-	-	✓
8 – $212m	✓	✓	✓	-	✓	-	-	-	✓	-

** Note that the direct costs are shown for the 'central' scenario. The direct costs of each option are comprised of the network capital investment costs, non-network costs and cable decommissioning costs. Please also note that the timing of later investment stages (and hence the NPV of the cost) depends on the forecast demand scenario.*

All options will deliver significant net benefits due to their ability to avoid substantial unserved energy to Inner Sydney going forward

The RIT-T NPV assessment shows that all credible options can be expected to deliver significant net market benefits, when compared to the 'do nothing' option. The net benefits expected from each option have been tested over a range of different scenarios, which capture differences in key drivers of these benefits.

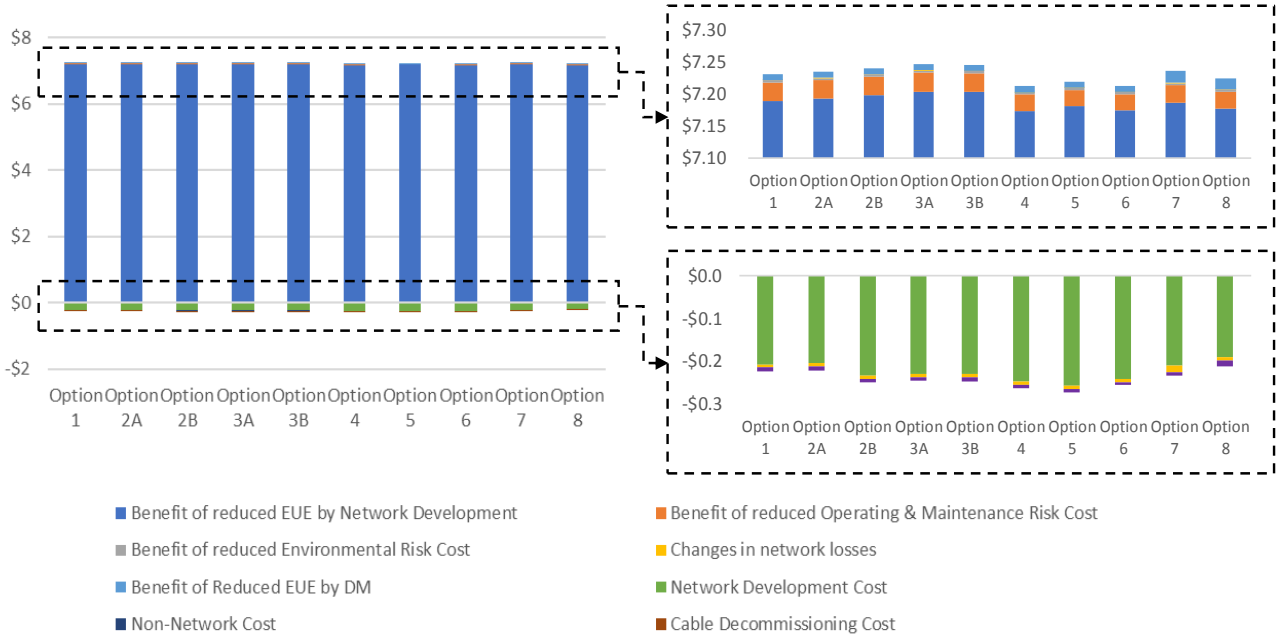
Table E-2 Reasonable scenarios assumed

Key variable/parameter	Scenario 1 – Low	Scenario 2 – Central	Scenario 3 – High
The value that customers place on reliable electricity supply (known as the Value of Customer Reliability – 'VCR)	AEMO VCR Value	The VCR used by IPART in its recent review of the NSW transmission reliability standards ($90/kWh)	$170/kWh for the Sydney CBD and $90/kWh for Inner Sydney (ie, the 'central' assumptions in the PADR)
Demand	Low	Medium	High
Discount rate	8.78%	6.13%	3.48%

Net benefits are greatest in the central and high scenarios, where options are estimated to deliver between $7 billion and $75 billion of net benefits, in PV terms, respectively. Under the low scenario, net benefits for all options are found to be marginally negative.[1] Overall, expected net benefits (ie, on a weighted-basis across all three scenario) are positive and estimated to be in the order of $27 billion for all options.

Benefits to the market arise primarily due to the fact that all credible options avoid substantial costs to consumers from disruption of electricity supply to Inner Sydney (ie, avoided expected unserved energy – or 'EUE'). Figure E.1 below shows the breakdown of costs and benefits estimated for the central scenario.

Figure E-1 Breakdown of benefits and costs estimated - Central scenario ($bn 2017/18)



TransGrid and Ausgrid have undertaken extensive sensitivity testing to test the robustness of the RIT-T assessment to assumptions about key variables.

In particular, we have undertaken two tranches of the sensitivity testing – namely:

- Stage 1 – testing the sensitivity of the optimal timing of the project ('trigger year') to different assumptions in relation to key variables; and
- Stage 2 – once a trigger year has been determined, testing the sensitivity of the total NPV benefit associated with the investment proceeding in that year, in the event that actual circumstances turn out to be different.

In Stage 1, TransGrid and Ausgrid have undertaken sensitivity analysis to first determine the optimal timing of the project, to conclude that a particular year represents the 'most likely' date at which the project will be needed.

In short, key takeaways from this first stage of sensitivity testing are as follows:

- the optimal timing of the project is found to be invariant to the following assumptions:

[1] For clarity, the 'low scenario' has been constructed from a particularly adverse set of assumptions, which have all been selected to lower estimated market benefits, such as using the AEMO VCR value, low demand forecasts and a high discount rate.

- 25 per cent higher or lower capital costs for the network options;
- an assumed 20-year life for Cable 41 (as opposed to 10-years);
- adopting a higher VCR value of $170/kWh for customers in the Sydney CBD (consistent with the HoustonKemp report);
- a higher assumed discount rate (8.78 per cent); and
- shifting 60 per cent of the assumed corrective failure maintenance to shoulder periods.[2,3]

- the optimal timing of the project is brought forward under the assumption of a lower discount rate (3.48 per cent) and high load growth;[4]
- the optimal timing of the project is found to be delayed when a low load growth forecast is used in conjunction with a low VCR (ie, adopting AEMO's VCR values).

As outlined in this PACR, TransGrid and Ausgrid consider that the central Ausgrid demand forecasts are appropriate and reflect renewed economic activity in Inner Sydney, including of a number of significant infrastructure and redevelopment projects that are already effectively committed.[5] Moreover, TransGrid and Ausgrid note that the 2017 Ausgrid load forecasts for Inner Sydney continue to show a rebound in peak electricity demand for the area, consistent with the central forecasts used in this PACR.

In addition, TransGrid and Ausgrid note that assuming the standard AEMO VCR for the types of wide-spread and prolonged outages being considered for the PSF project are widely seen as inappropriate (including by AEMO). A low VCR is also inconsistent with the basis on which IPART has recently determined the transmission reliability standard for the Inner Sydney area.

On balance, TransGrid and Ausgrid consider that the identification of the central trigger years for all options has been robustly determined and tested.

Having assumed to have committed to the first stage of the project by this date, under Stage 2 of the sensitivity testing, TransGrid and Ausgrid have also looked at the consequences of 'getting it wrong'. This is consistent with how the RIT-T is designed to operate. That is, if demand turns out to be lower than expected, for example, what would be the impact on the net market benefit associated with the first stage of the project continuing to go ahead on that date. For options with two stages, this includes a deferral of the second stage of the project.

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2 As outlined in section 4.3, TransGrid and Ausgrid have investigated a lower assumed corrective failure rate in response to a query by the AER in its Draft Decision for TransGrid. The results of this investigation show that a shift of 60 per cent of corrective failures from summer to shoulder periods (shoulder period failure rate increase by 25 per cent) does not change 2021/22 as the practical need year for Options 1 to 6 and 2022/23 for Option 7 and Option 8.

3 Sensitivity analysis has also been undertaken to test the robustness of shifting more (or less) of corrective failure maintenance from summer to shoulder periods. The sensitivities undertaken were moving 70 per cent of corrective failure maintenance to shoulder periods and moving 50 per cent. Both sensitivities found minimal effect on the optimum investment timing, with no change for most options and only up to one year's difference for options 2B, 3A and 3B.

4 Although the evaluation shows some stages are needed as early as 2018/19, due to the complexity and scope of the project, the earliest practical completion year is 2021/22. It is therefore expected that non-network options will be used to manage the risk of unserved energy, where it is economic to do so, until a network option can be commissioned. All economic cost-benefit analysis presented in this report is based on the practical Stage 1 completion year of 2021/22 at the earliest (with the exception of Option 7 and Option 8, which assume a one year deferral of the costs of Option 3B and Option 2A, respectively, and apply a commissioning year of 2022/23).

5 These New South Wales government initiatives have now 'broken ground' and are now well underway. For more information on the progress of each project (and how these projects are all well-underway), can be accessed from their respective websites: https://westconnex.com.au/; and https://www.sydneymetro.info/images-and-video.

Specifically, TransGrid and Ausgrid have conducted extensive sensitivity analysis on the overall NPV of the net market benefit, based on the assumed option timing, including:

- a 25 per cent increase/decrease in the assumed network costs;
- alternate forecasts of maximum demand growth, based on POE10 (high) and POE90 (Low);
- both a lower and a higher VCR value;
- a lower discount rate of 3.48 per cent, as well as a higher rate of 8.78 per cent; and
- a longer service life for Cable 41.[6]

This second stage of the sensitivity analysis reaffirms the finding that all options are expected to have very high gross benefits, due to the significant unserved energy reduction when compared to the 'do-nothing' option for the next twenty years. For example, even assuming a low load growth forecast, which would effectively mean that major NSW government infrastructure developments in Sydney that have already commenced are abandoned, it is expected that all options will generate approximately $200-250 million in net market benefits.[7]

Overall, the range of assumptions embodied in these various scenarios and sensitivities ensures that the credible options are robustly tested across a reasonable number of future outcomes.

Submissions to the PADR queried a range of underlying assumptions, including demand forecasts and fluid-filled cable failure rates. TransGrid and Ausgrid have responded to each point raised in this PACR and included additional sensitivity tests, where relevant.

We continue to recommend that non-network solutions are used to defer network investment but now also recommend that network investment is staged over time

The analysis in this PACR continues to identify the prospect of deferring network expenditure, using non-network solutions, by one year as part of the preferred option. This was a key conclusion at the PADR stage of this RIT-T.

However, the ultimate *network* component of the preferred option has changed since release of the PADR. In particular, Option 8 in this PACR is now the preferred option for implementation by TransGrid and Ausgrid and involves:

- the use of non-network solutions before network commissioning;
- use of non-network solutions to defer network build by one year from when it would need to be commissioned without this support (ie, from 2021/22);
- installing two 330 kV cables in two stages, with commissioning of the first cable in time for the 2022/23 summer;
- operating Cable 41 at 132 kV; and

[6] A major assumption in this PACR is that Cable 41 has a remaining service life of 10 years. However, TransGrid notes that there is a possibility that the service life of Cable 41 may extend to beyond 10 years provided that additional periodic maintenance works are carried out and the temperature of the hottest spots along the cable route are carefully monitored to avoid any over-temperature events. We have therefore also undertaken a sensitivity based on a service life of 20 years for Cable 41.

[7] Please note that these estimates relate to the low demand sensitivity (shown in Table 5-4 below) and not the 'low scenario' – for clarity, the 'low scenario' has been constructed from a particularly adverse set of assumptions, which have all been selected to lower estimated market benefits, such as the low demand forecasts but also using the AEMO VCR value and a high discount rate.

- decommissioning Ausgrid's cables in two stages.

The key difference between the conclusion in this PACR and that of the earlier PADR is the *network* component of the preferred option. In particular, the PADR recommended installing the two new 330 kV cables *in one stage* on account of minimising the inconvenience and disruption on the community and environment,[8] while this PACR recommends these cables are installed in two stages.

TransGrid and Ausgrid note that there is a balance between minimising wider community disruption[9] and having a lower initial capital cost as well as the 'optionality'/flexibility that comes with installing the two cables in two stages.

In addition, subsequent to the issue of the PADR, the AER and the Consumer Challenge Panel (CCP) expressed concern, through the separate regulatory review process relating to TransGrid, relating to a lack of flexibility with the preferred option at that stage. We therefore reviewed the options to consider the appropriate balance between retaining optionality, decreasing the initial capital cost and minimising community disruption and, consequently, developed Option 8. We also sought the views of customers and stakeholders in our TransGrid Advisory Council, who expressed support for a two-stage option.

Under Option 8, the installation of the second 330 kV cable could be delayed if demand growth is slower than forecast and/or a higher quantity of lower cost non-network options emerges as part of the formal RFT process TransGrid will shortly commence (outlined below). The opposite could also occur and this option would allow TransGrid to respond with a second cable earlier than planned should that become necessary.

Overall, the strength and quality of submissions and interest from non-network proponents to this RIT-T has driven this exciting result. There has been a very strong response from non-network proponents in response to the PSCR and PADR and TransGrid and Ausgrid have assessed proposals from these parties in detail and consider that there is scope for deferring the commissioning of network through the use of non-network solutions. As far as TransGrid and Ausgrid are aware, this is one of the largest capital expenditure deferrals by non-network solutions in Australia to-date.

Important information for non-network proponents looking to be a part of Powering Sydney's Future going forward

TransGrid and Ausgrid consider that there is a strong role for non-network solutions in reducing the risk of unserved energy to consumers in Sydney going forward – both through potentially deferring the

[8] In particular, the proposed cable route for all network options will pass through the highly developed Inner Sydney area and it is expected that the project construction works will have a significant impact to the community and environment, including the inconvenience caused by traffic disruption, increased noise due to excavation works etc. Installing the two 330 kV cables in one go minimises these impacts, compared to other network options that construct these two cables in two stages.

[9] While TransGrid and Ausgrid note that the benefit to the wider community from avoiding this disruption and cost cannot be included in the RIT-T economic assessment, an indication of the number of parties that are likely to be affected by digging up the proposed cable route helps to illustrate the inconvenience and wider community costs from installing the two 330 kV cables in two stages (eg, under Option 2A). A current New South Wales government traffic counter that corresponds to one section of the proposed cable route records that approximately 27,000 vehicles of which 1,600 relate to 'heavy vehicles' (ie, trucks), pass that section on average each day – this implies that approximately 820,000 vehicles will be affected through traffic disruption and congestion for every month that particular section of road is under construction (sourced from the New South Wales government Roads and Maritime Services Georges River Road traffic station, which corresponds to one section of the proposed route –see Station ID 7275 at http://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=13&lat=-33.90921191659774&lon=151.0794010162358&id=7275&tb=1&hv=1). We note that this is a very narrow estimate of the wider effects. eg, it only focuses on one particular section of the proposed route (ie, where there is a NSW government traffic counter currently located) and excludes additional inconvenience caused through noise due to excavation works and pollution. It has been included to help demonstrate the magnitude of this wider disruption on the community from installing the cables in two stages.

commissioning of a network project, as well as in managing the risk of unserved energy between now and when these cables can be commissioned. Since release of the PADR, TransGrid and Ausgrid have had a number of meetings with non-network proponents to further discuss and clarify the role that such solutions can play.

TransGrid is currently in the process of preparing a formal two-stage RFT for non-network proponents to respond to for non-network solutions. The two-stage process allows TransGrid to flexibly procure more demand management should demand forecasts or cable conditions change, and to procure more efficient lower cost solutions should the demand management market further improve with more non-network providers. In addition, the second stage would allow non-network proponents to learn from the first stage, and to refine their solutions to assist with deferral.

The first stage will seek approximately 40-60 MW of non-network capacity over a four-year program (based on the preferred Option 8) from 2018/19 summer to 2021/22 summer, and include binding contracts for the provision of non-network solutions that will be entered into. This RFT will be released after the AER provides certainty that funding is available to TransGrid to pursue non-network solutions, which is expected to align with the timing of its final determination on the revenue proposal in April 2018.

The second stage is a 'top-up' round (ie, in addition to the first stage) that will seek approximately 20-40 MW from 2020/21 summer to 2021/22 summer (a two-year program). A necessary precondition for any network deferral to occur is the procurement of appropriate non-network support from the market by TransGrid, sufficiently before the date at which the network component would otherwise need to be committed. To provide the necessary lead time, TransGrid anticipate that the second RFT will be released around September 2018.

TransGrid considers that the date of 31 January 2019 reflects the date at which TransGrid would need to enter into a contract for the cabling required *should a network project not be deferred using non-network solutions*. This effectively reflects the latest date that TransGrid can decide whether to commit to a network project for commissioning during 2021/22, or to commit to deferring the network project by a year using non-network solutions. Should sufficient non-network contracts *not be entered into* by this date, TransGrid may proceed with procuring the necessary cabling contracts and other arrangements in order to commission a network project before the summer of 2021/22.