Explanation of net market benefits calculation using a shortened study period

1 Background and overview

Basslink Pty Ltd and the Tasmanian Small Business Council (TSBC) have each made submissions in response to Marinus Link's PADR, which raise concerns regarding the financial modelling approach. In particular, the submissions comment that the project's net market benefits were calculated over a shorter period than the expected lives of Marinus Link assets. The submissions noted that less than half of the project's total capital expenditure was reflected in the net market benefit assessment. This has raised concerns that the cost-benefit analysis has not been properly conducted.

Whilst Basslink and TSBC are correct that our analysis is based on only part of the project costs, this is because the study period has been limited to 30 years from 2020/21 to 2049/50, while the HVDC and AC assets have lives of 40 and 60 years respectively. The shortening of the study period is a standard approach, which has been adopted in other recent RIT-Ts.

As explained in the PADR, there are good reasons to expect that the project will continue to provide benefits beyond the end of the study period that exceed the residual costs of the assets. On this basis, if the study period were extended, the conclusions in the PADR would be unchanged. The benefit of limiting the study period is that we substantially reduce the modelling requirements without affecting our conclusions.

The remainder of this note explains the different methods for assessing the costs and benefits of a project with long lived assets, such as Marinus Link. It concludes with a brief discussion of recent practice in RIT-T applications.

2 Explanation of methodology

To ensure that the net market benefits of all options are compared on a like-for-like basis, the evaluation of long-lived capital projects can be undertaken in one of three ways:

A. Examine the costs and benefits over the entire life of the project.

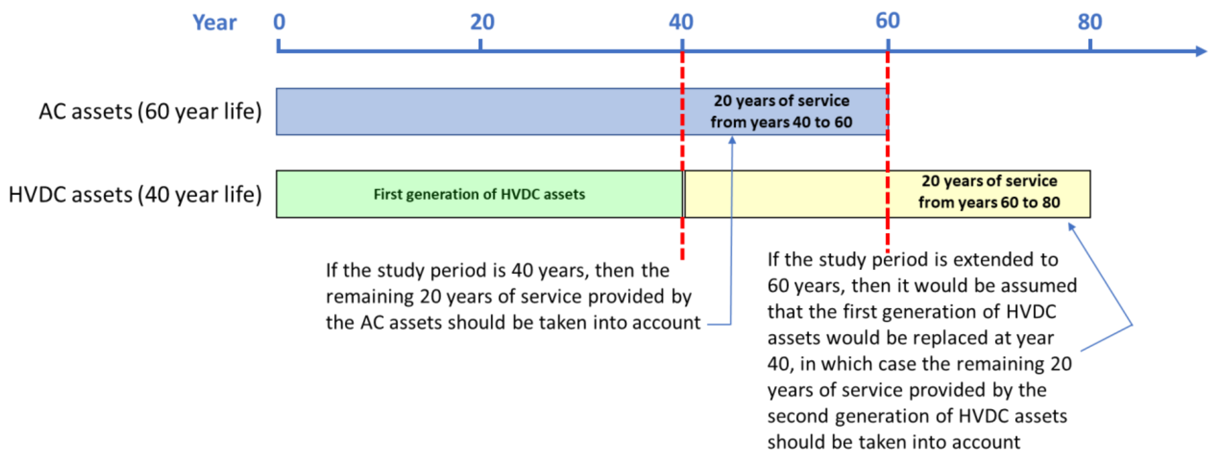
B. Adopt a shorter study period, say 30 years, and attribute a terminal value to the assets at the end of the period.

C. Adopt a shorter study period, say 30 years, recognising the annualised cost of the assets employed.

As explained below, each of these methods properly applied would provide the same decision signal as to whether or not to proceed with the project.

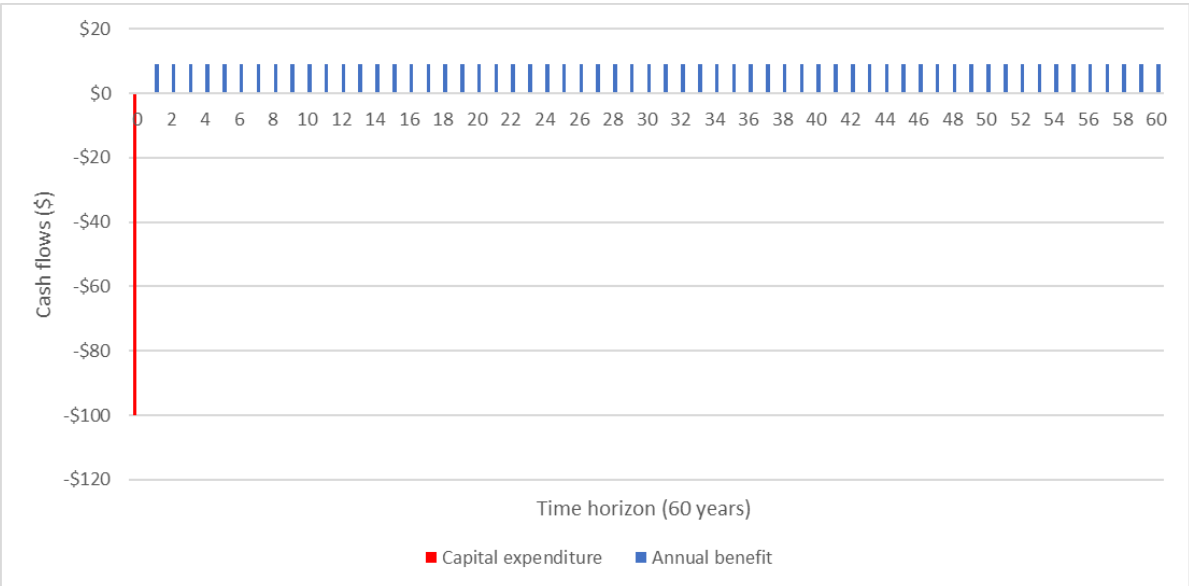
Whilst method A may appear to be the most straightforward, it is not clear how the 'project life' should be defined, as Marinus Link comprises a mix of assets with different lives. Figure 1 below illustrates this issue, showing the combination of HVDC and AC assets.

Figure 1: Illustration of 'project life' and remaining asset lives



It follows from the above figure that it will be necessary to estimate the terminal value of either the AC assets or HVDC assets, depending on whether a 40 year or 60 year project life is assumed. In addition, method A requires forecasts of wholesale electricity market and transmission system development over a very long study period. It is doubtful whether extending the analysis over such a long period is worthwhile, given the additional computational effort and the inherent uncertainty in forecasting such outcomes over 40 or 60 years. Moreover, most forecasts in the ISP dataset that underpin the PADR market modelling are for a period of 30 years from 2020 to 2050, thereby providing a natural ceiling to the modelling horizon. The capital expenditure and annual benefits for method A are outlined in figure below.

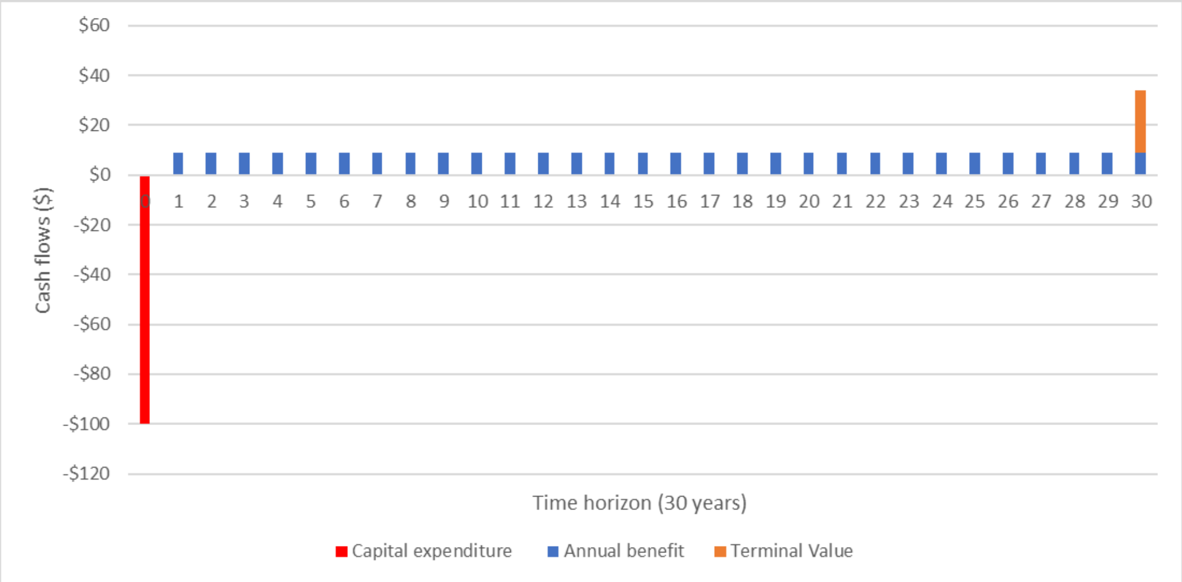
Figure 1: NPV evaluation with capital expenditure and benefits for the entire life of project (method A)



Method B, therefore, has the advantage of limiting the modelling effort over a more practical study period. The method requires an estimate of the terminal value of the assets at the end of the study period. The use of terminal values ensures that options with differing asset lives (and different mixes of capital and operating expenditure) are assessed on the same basis. The AER's RIT-T Guidelines state that material terminal values should be included within RIT-T assessments, where appropriate.

The calculation of a terminal value requires a choice to be made about the depreciation model to be applied. Several different approaches might be applied; for instance, a straight line model assumes a linear decline in the asset's service potential over its life, while the annuity depreciation model assumes the asset delivers the same level of service in each year over its life, regardless of its age[1].

Figure 2: NPV evaluation over a shorter period and terminal value calculation (method B)

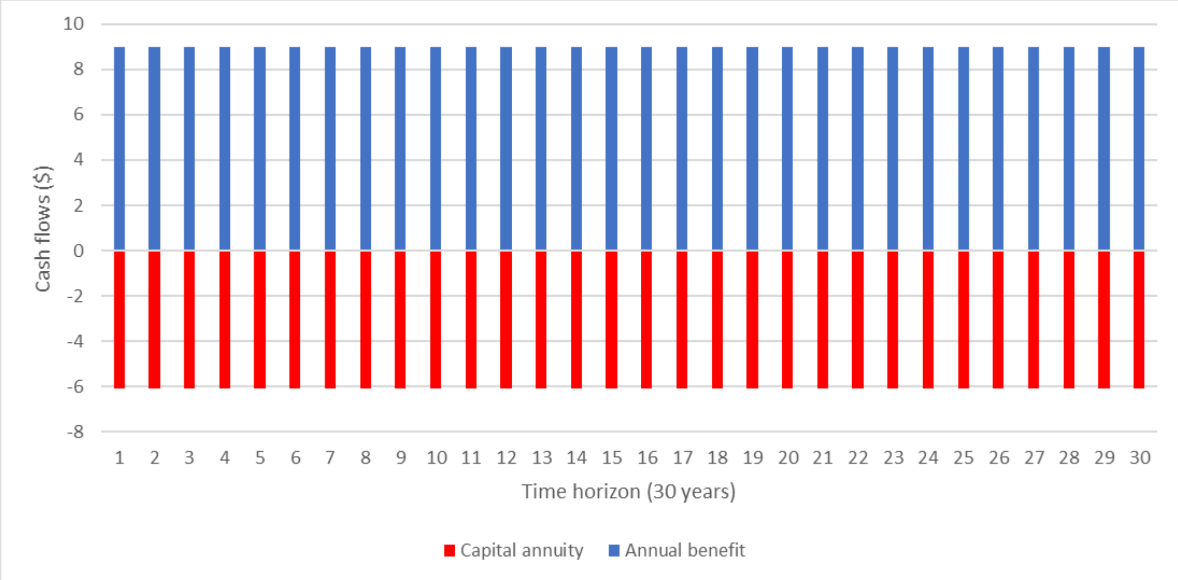


Method C obviates the need to derive a terminal value for in-service assets by recognising the annualised cost of the assets employed. Under this approach, the capital expenditure for each asset class is converted to an annualised cost (or capital annuity) over the life of the asset, using an appropriate real discount rate.

This approach greatly simplifies the calculations because it enables the "lumpy" capital costs of long-lived assets (which, as noted above, may have lives of different lengths) to be expressed on a common and consistent basis - that is, real annual capital costs. The period of the analysis can be shorter than the lives of the assets being modelled because the annualised costs of investments and the associated benefits that arise after the end of the study period are excluded from the analysis. Implicitly, in case of equal cash flows over the study period, this method assumes that the terminal value of the assets is consistent with Method B if an annuity depreciation model were adopted. This approach tends to be more conservative, in case of uneven cash flows where annualised benefits exceed costs in the latter years of the study period, since the annualised approach assumes that costs are equal to benefit for the remainder of evaluation period.

1 OECD, Measuring Capital: OECD Manual on Measurement of Capital Stocks, Consumption of Fixed Capital and Capital Services, 2001.

Figure 3: NPV evaluation over a shorter period and annualised capital expenditure and benefits (method C)



The Marinus Link analysis in the PADR applies the annualised cost approach (method C). In this regard, section 4.7 of the PADR explained:

> "Our market modelling assumes that the annualised costs are incurred from when the option is commissioned through to the end of the modelling period in 2050. Costs beyond 2050 are excluded from the analysis, on the basis that the associated benefits are also excluded.
>
> An alternative modelling approach would be to extrapolate benefits to the end of the asset life. Our modelling indicates that annual benefits of Marinus Link and supporting transmission exceed annual costs during the final years of the modelling period, hence this benefit extrapolation approach, if employed, would increase the net market benefit of the project."

We have modelled the results of applying methods A, B and C in the accompanying spreadsheet, which adopts a simplifying assumption that the project has a single asset with a 60 year life. Although as noted above, Marinus is more complex, this does not affect the validity of the comparison of the three methods. The results of the comparison are summarised in the table below.

Method	PV cost	PV benefits	NPV	PV ratio of benefits to costs
A. Full 60 year cost-benefit analysis	100	148	48	1.4765
B. 30 year analysis including upfront capex and a residual capital value	85	125	40	1.4765
C. 30 year analysis using annualised capital costs	85	125	40	1.4765

The table shows that truncating the analysis over a 30 year study period using an annualised capital cost approach (method C) produces exactly the same decision signal as the full 60 year analysis (method A). Methods B and C, which both apply a shortened analysis period deliver the same net present value (NPV) results. All three methods deliver exactly the same present value ratio of benefits to costs.

The results set out above also show that using a shorter study period means that in this example, the present value of the capital costs (85) is less than the total project costs (100), but this does not affect the decision signal. This finding is consistent with the observation of Basslink Pty Ltd that the present value costs of Marinus Link in the PADR analysis are substantially less than the total undiscounted project cost. Basslink Pty Ltd's observation reflects two factors:

1. As already explained, the use of a 30 year study period will result in the exclusion of some costs and benefits from a project with longer lived assets, without affecting the decision signal.

2. For Marinus Link, the first tranche of investment occurs in year 9 of the 30 year study period. This means that the present value of the project costs will be substantially lower than the undiscounted costs, but this does not affect the decision signal[2].

The conclusion of the analysis outlined in this paper and to further elaborate on the explanation in the PADR, the annualised discounting methodology adopted for Marinus Link PADR is conservative since across all scenarios the annualised benefits exceed cost in the latter years of the evaluation period.

In the next section, we consider recent examples of study periods that have been adopted in RIT-Ts and the AER's consideration of the terminal value issue.

3. Recent practice in RIT-Ts

On the question of the suitable modelling period, section 3.12 of the AER's RIT-T Application Guidelines states:

> "The duration of modelling periods should take into account the size, complexity and expected life of the relevant credible option to provide a reasonable indication of the market benefits and costs of the credible option. This means that by the end of the modelling period, the network is in a 'similar state' in relation to needing to meet a similar identified need to where it is at the time of the investment.
>
> It is difficult to provide definitive guidance on how to implement this principle. However, it is unlikely that a period of less than 5 years would adequately reflect the market benefits of any credible option. In the case of very long-lived and high-cost investments, it may be necessary to adopt a modelling period of 20 years or more. Moreover, RIT–T proponents should also include any relevant and material terminal values into their discounted cash flow analysis, where appropriate."

The Marinus Link evaluation complies with this guidance, and with the practices employed in other recent RIT-T assessments. For instance, the AER's January 2020 decision on ElectraNet's RIT-T for the South Australian Energy Transformation (SAET) project considered the issue of terminal values in the context of the 21 year study period adopted by ElectraNet. The AER concluded that ElectraNet's application satisfies the requirements of the RIT-T, and made the following comments in relation to the terminal value[3]:

> "We reviewed ElectraNet's approach to estimating a terminal value in the economic analysis given the magnitude of these benefits (estimated value of $280 million). As noted by ElectraNet, the RIT-T application guidelines state that relevant and material terminal values should be included in a RIT-T where appropriate. The PACR modelling has included a terminal value. The inclusion of a terminal

[2] Basslink Pty Ltd notes that the present value costs of Marinus Link in the PADR are approximately 45% of the total undiscounted project cost. The majority of this difference arises because of factor (2). The accompanying spreadsheet shows that at a discount rate of 5.9% real, $1 of investment in year 9 has a present value of 60 cents. The remainder of the difference reflects the impact of factor (1).

[3] AER, South Australian Energy Transformation, Determination that the preferred option satisfies the regulatory investment test for transmission, January 2020, page 82.

value in the analysis is reasonable given the modelling period is only 21 years and benefits will extend beyond the end of the modelling period given the proposed interconnector is assumed to have an asset life in excess of 40 years.

In estimating the terminal value to capture costs and benefits beyond the modelling period, ElectraNet assumed the remaining benefits are equal to costs. In particular, ElectraNet applied a terminal value that assumes the remaining benefits reflect the depreciated cost of the proposed interconnector at the end of the modelling period."

It is worth highlighting the following points from the AER's review of ElectraNet's approach:

- ElectraNet adopted a 21 year study period compared to Marinus Link's 30 year period. Importantly, both approaches adopt a study period that is shorter than the asset lives. The AER has concluded that this approach is reasonable and justifies the inclusion of a terminal value, as proposed by ElectraNet. As discussed above, our annuity approach is equivalent to the inclusion of a terminal value.

- ElectraNet's approach assumes that benefits beyond the study period are equal to the terminal value of the assets. The AER also concluded that this approach is reasonable. The approach in Marinus Link's PADR is comparable because we have also assumed that the benefits beyond the end of the study period are equal to the remaining costs.

The AER's most recent RIT-T determination (on the QNI expansion project) found that TransGrid's and Powerlink's economic assessment of the project satisfied the requirements of the RIT-T[4]. The QNI RIT-T analysis spans a 26-year assessment period from 2019/20 to 2044/45[5], and includes transmission assets with lives of up to 50 years[6]. The proponents explained that[7]:

"Where the capital components of the credible options have asset lives extending beyond the end of the assessment period, the NPV modelling includes a terminal value to capture the remaining asset life. This ensures that the capital cost of long-lived options over the assessment period is appropriately captured, and that all options have their costs and benefits assessed over a consistent period, irrespective of option type, technology or asset life."

The approach applied in the Marinus Link PADR is comparable to that applied by TransGrid and Powerlink in the RIT-T of the QNI expansion project.

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4 AER, Expanding NSW-QLD transmission transfer capacity: Determination that the preferred option satisfies the regulatory investment test for transmission, March 2020, page 4.

5 TransGrid and Powerlink, Expanding NSW-QLD transmission transfer capacity RIT-T – Project Assessment Conclusions Report, December 2019

6 QNI RIT-T PACR Excel model, https://www.powerlink.com.au/expanding-nsw-qld-transmission-transfer-capacity

7 TransGrid and Powerlink, Expanding NSW-QLD transmission transfer capacity RIT-T – Project Assessment Conclusions Report, December 2019, page 85.