ACIL ALLEN

Memorandum			
To	Australia Energy Regulator	**Date**	25 June 2024
From	ACIL Allen	**Ref**	J1505
Subject	Humelink gross market benefits - Draft 2024 ISP and 2022 ISP		

1.1 Background

TransGrid has investigated options for reinforcing the New South Wales (NSW) Southern Shared Network to increase transfer capacity to the state's major load centres of Sydney, Newcastle and Wollongong. In 2021, TransGrid submitted its Project Assessment Conclusions Report (PACR) - representing the final stage in the RIT-T consultative process.

The PACR identified Option 3C (known as Humelink), comprising a new 500 kV lines in an electrical 'loop' between Maragle, Wagga Wagga and Bannaby, provided the greatest net benefit of all options across a number of scenarios. The estimated cost of this option at the time was $3.3 billion. Option 2C was identified as the second-best option. The key difference of Option 2C, compared with 3C, is that both two 500 kV lines between Maragle and Bannaby are via the Wagga Wagga Substation, whereas in Option 3C one of these lines is direct.

TransGrid engaged the services of EY to undertake the market modelling of the options and estimation of the gross market benefits. EY used their internal long term planning model of the NEM coupled with the 2022 ISP assumptions and scenarios to complete the analysis.

In 2024, TransGrid submitted a material change in circumstance assessment (MCCA) that presented an updated analysis taking into account an increase in capital costs of Humelink. The revised estimated cost of the option is currently $4.88 billion. Transgrid engaged EY again to complete the analysis of gross market benefits, but this time using the updated Humelink cost estimate and the Draft 2024 ISP assumptions and scenarios.

The MCCA also identified option 3C as the preferred option, as well as noting an increase in gross market benefits compared to the PACR.

1.2 Brief

The Australia Energy Regulator (AER) engaged ACIL Allen to assess the increase in gross benefits between the PACR and MCCA and assess the differences between methodologies for estimating the gross benefits. Specifically, ACIL Allen has undertaken the following scope items:

1. Estimate gross market benefits of Option 3C Humelink under the Draft 2024 ISP Step Change scenario and the 2022 ISP Step Change scenario.
    a) Provide a summary of the reasons for the key difference in the total gross market benefits for Option 3C using the Draft 2024 ISP Step Change scenario, inputs and assumptions.
2. Estimate gross market benefits of Option 2C Humelink under the Draft 2024 ISP Step Change scenario and the 2022 ISP Step Change scenario.
    a) Provide a summary of the reasons for the key difference in the total gross market benefits for Option 2C using the Draft 2024 ISP Step Change scenario, inputs and assumptions.

This report provides a summary of the findings from the scope items above.

1.3 Estimating the gross market benefits of Option 3C

1.3.1 Approach – gross market benefits modelling

To estimate the gross market benefits of Humelink Option 3C, ACIL Allen ran the following 4 NEM scenarios:

- *Draft 2024 ISP Step Change Base case* in which no Humelink is built/commissioned
- *Draft 2024 ISP Step Change Option 3C* in which Humelink is commissioned 1 July 2026
- *2022 ISP Step Change Base case* in which no Humelink is built/commissioned
- *2022 ISP Step Change Option 3C* in which Humelink is commissioned 1 July 2026

The exclusion of Humelink in the Base case is characterised by changing the following assumptions within PLEXOS:

- Remove the addition of 2,200 MW of import/export capacity on the intra-regional line 'SNSW-CNSW' (which represents Humelink)
- Constrain Snowy 2.0 to 660 MW for the entire projection period
- No increase in N6 Wagga Wagga REZ network capacity.

Given the gross market benefits of Humelink are being assessed, VNI West (an actionable ISP project) has not been excluded from the Base case, even though Humelink is characterised as a prerequisite for VNI West in the ISP. We think this is appropriate given the MCCA does not appear to include the cost of VNI West in its analysis, and follows the CBA guidelines.

ACIL Allen modelled the NEM using the PLEXOS model in long-term/central planning mode to assess the gross market benefits, consistent with the RIT-T Guidelines. The classes of market benefit included in the analysis are aligned with the key classes[1] assessed under the PACR, including:

- Avoided generation and storage costs comprising:
  - Generator and storage capital deferral
  - Fixed and variable operating and maintenance (FOM and VOM) cost savings
- Fuel cost savings
- Avoided cost of unserved energy (USE) and energy curtailment (demand side participation)

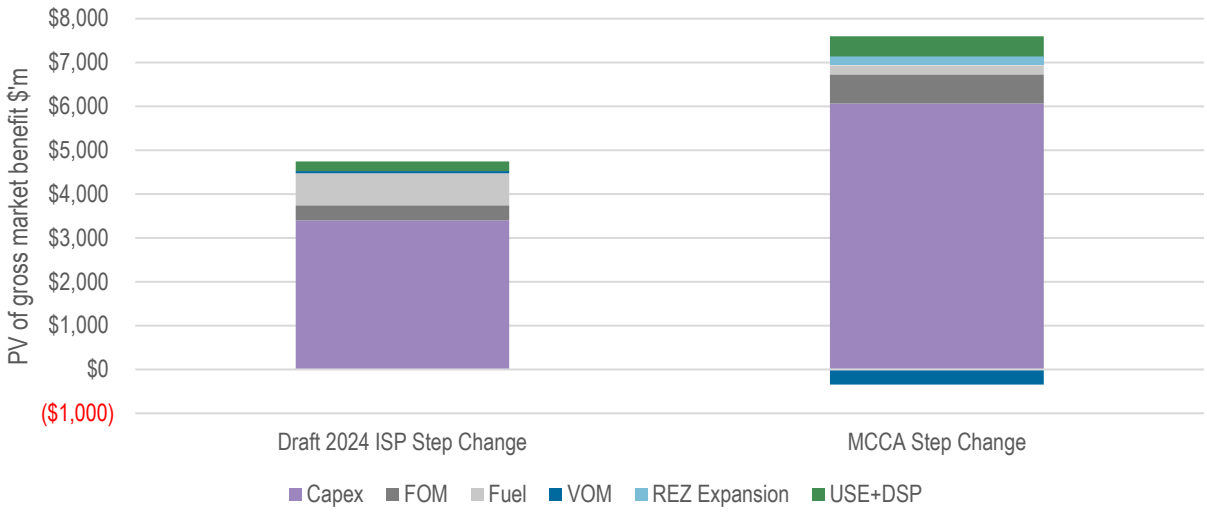
The following sections summarise the key results from ACIL Allen's modelling of Humelink market benefits and compares it to the analysis undertaken in the MCCA and PACR.

[1] Due to time constraints, this analysis does not include market benefits from avoided REZ expansion and focused on market benefits classes with the highest present value such as avoided generation and storage costs.

1.3.2 Results – Draft 2024 ISP Step Change

Estimated gross market benefits of Humelink Option 3C commissioned in July 2026 is approximately $4,740 million, which is $2,514 million (or 35%) lower than the MCCA's estimate of $7,254 million, as shown in Figure 1.1.

Figure 1.1 Gross market benefits ($'m, PV) of Humelink Option 3C delivered in July 2026 – Draft 2024 ISP Step Change scenario vs MCCA Step Change scenario



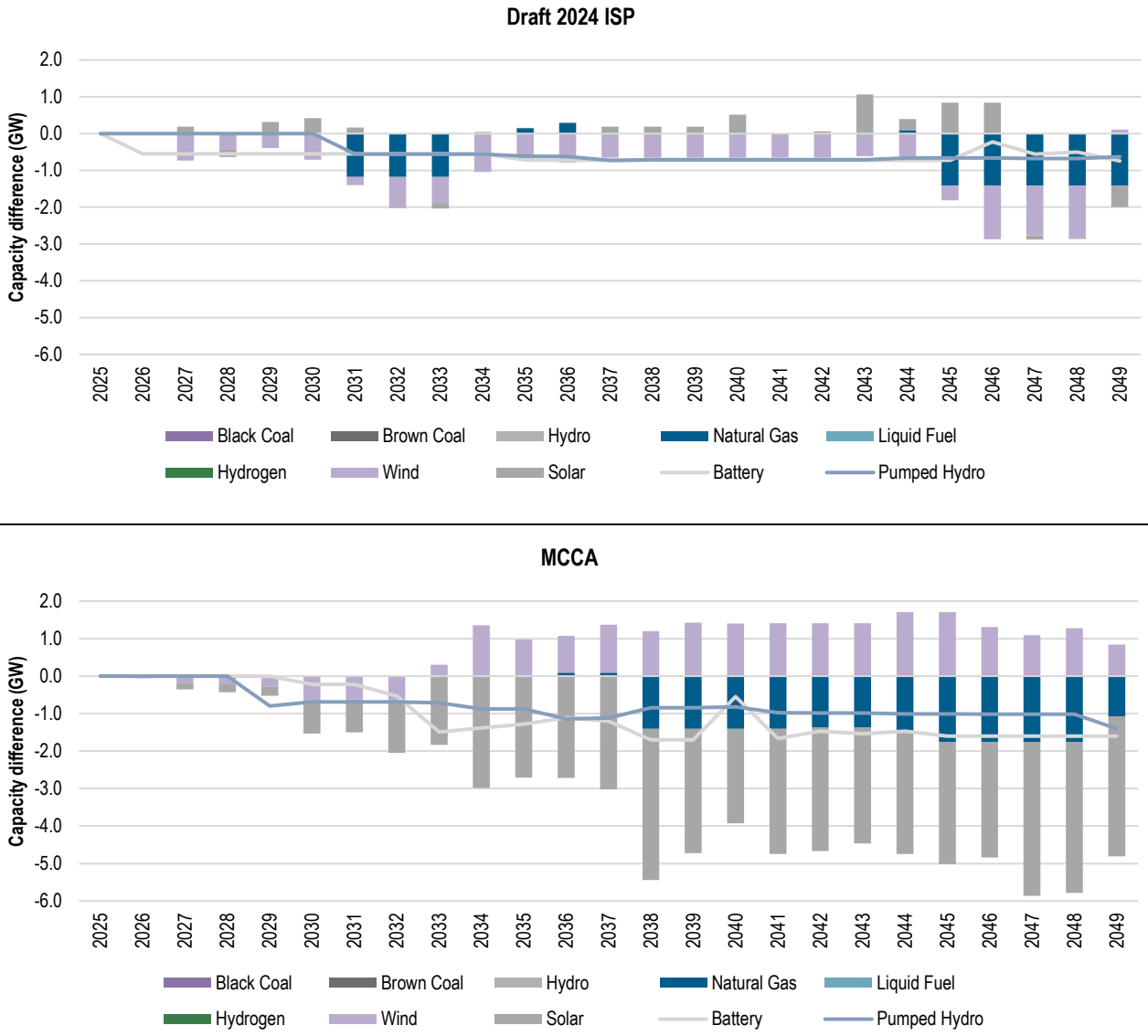
Source: ACIL Allen analysis; MCCA analysis

The difference in gross market benefits is driven by much larger avoided generator and storage capacity in the MCCA analysis. This is shown in Figure 1.2, which compares the difference in capacity installed under the Draft 2024 ISP modelling (top panel) and the MCCA analysis (bottom panel).

Under the Draft 2024 ISP analysis, capacity deferral benefits arise from avoiding around 1-2 GW annual investment in Battery Energy Storage Systems (BESS) in NSW and Queensland, pumped hydro energy storage (PHES) in NSW and Tasmania, and natural gas-powered generation in NSW, South Australia and Victoria. Benefits also arise from avoiding up to 1 GW annual investment in wind capacity in most regions. This analysis assumes that Humelink facilitates an increase in utilisation of Snowy 2.0 – constrained to 660 MW in the Base case and increasing to 2,200 MW with Humelink. As a result, commissioning Humelink results in slightly more solar capacity investment in NSW (on average 0.3 GW annually) due to the higher pumping load during daylight hours.

Under the MCCA analysis, modelled capacity deferral benefits arise from avoided investment in grid-scale solar PV (up to 4 GW annually), natural gas power generation (around 1.5 GW annually), PHES and BESS (each around 1 GW annually). Including Humelink, the MCCA analysis builds more wind (around 1 GW annually) - mainly in Victoria, and to a lesser extent NSW and South Australia. This suggests the MCCA analysis excludes VNI West in the Base case, which we recommend the AER confirms with TransGrid. That is, by including Humelink, and hence VNI West, the amount of wind generation from Victoria increases noticeably as part of the least cost solution.

Figure 1.2 Difference in capacity installed (MW) with and without Humelink Option 3C, for Draft 2024 ISP (top panel) and the MCCA analysis (bottom panel)



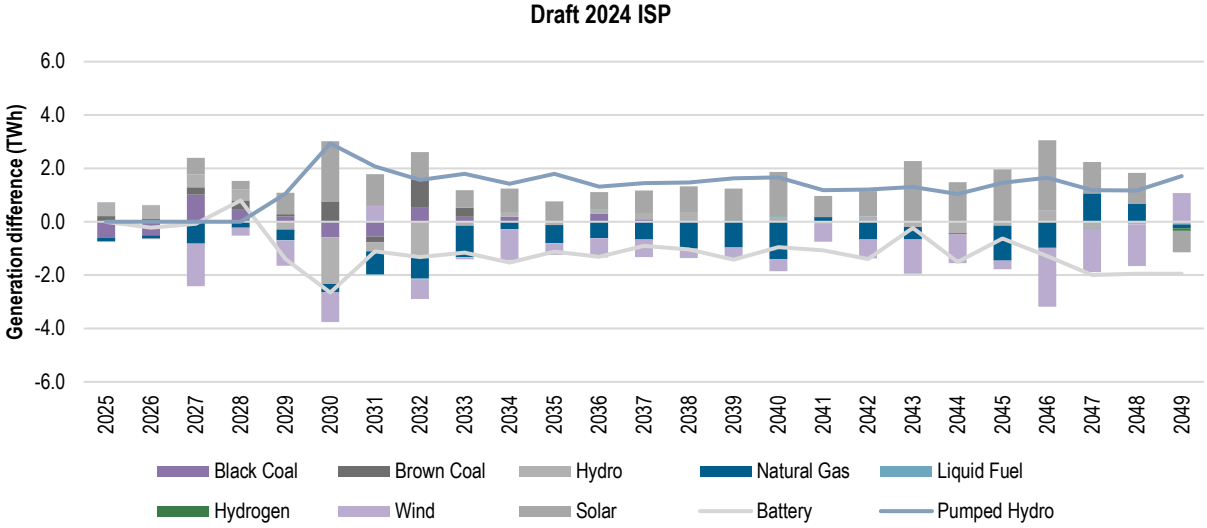
Source: ACIL Allen analysis; MCCA modelling outputs

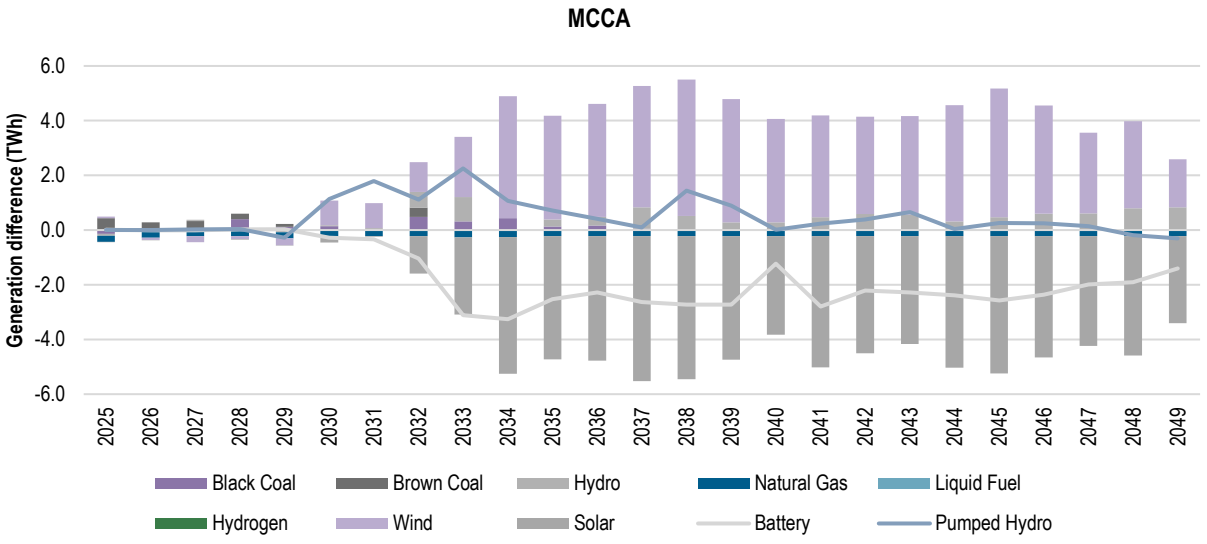
Figure 1.3 shows the difference in dispatch under the Draft 2024 ISP modelling (top panel) and the MCCA analysis (bottom panel).

Under the Draft 2024 ISP analysis, changes in dispatch broadly reflect the difference in capacity for BESS, wind and solar. The increase in PHES dispatch is a result of the increased utilisation of Snowy 2.0 with Humelink, which also displaces natural gas dispatch.

Similarly, the MCCA analysis shows that dispatch differences reflect capacity differences for solar, wind and BESS. The MCCA analysis shows an increase in dispatch from PHES as a result of the removal of the Snowy 2.0 constraint and displacement of natural gas dispatch in the early part of the projection period.

Figure 1.3 Difference in dispatch (TWh) with and without Humelink Option 3C, for Draft 2024 ISP (top panel) and the MCCA analysis (bottom panel)





Source: ACIL Allen analysis; MCCA modelling outputs

Points of comparison

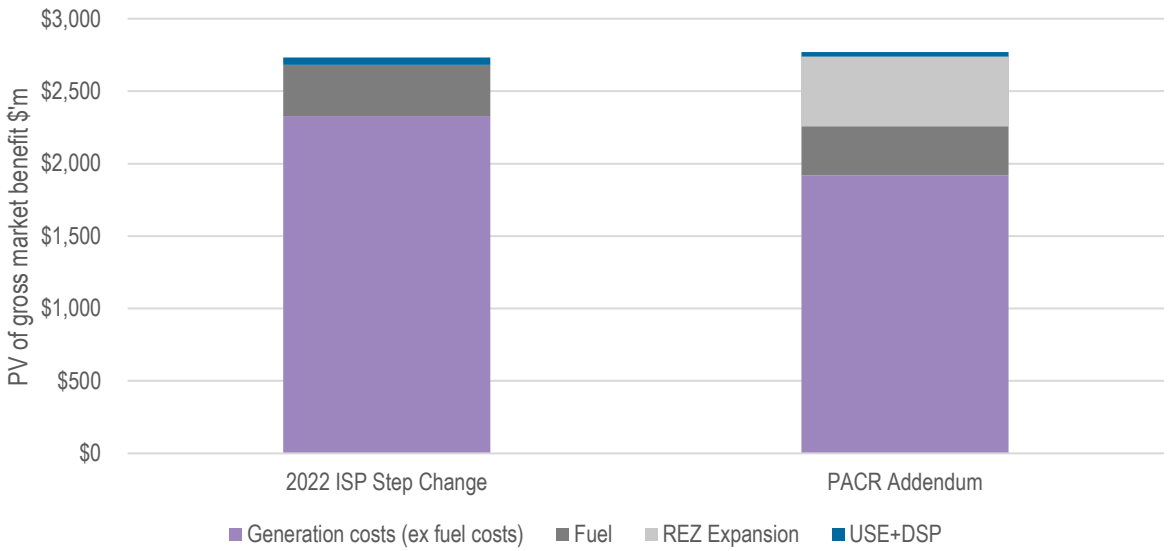
The key change in the network constraints when including Humelink is the freeing up of Snowy 2.0 – from 660 MW to 2,200 MW – an increase of 1,540 MW of capacity.

Including Humelink in the Draft 2024 ISP analysis shows a deferral in investment of BESS and PHES of about 1-2 GW (as well as some temporary deferral in natural gas) – which is broadly in line with the freeing up of the Snowy 2.0 capacity. Whereas the MCCA analysis defers about 2.5 GW (plus 1.5 GW of natural gas investment from 2038 onwards). The deferred capacity is about 67% - 150% greater than the freed up Snowy 2.0 capacity. This level of change in capacity may suggest that the MCCA analysis excludes VNI West in the Base case.

1.3.3 Results – 2022 ISP Step Change

Estimated gross market benefits of delivering Humelink Option 3C in July 2026 under 2022 ISP Step Change assumptions is approximately $2,733 million, which is $36 million (or 1%) lower than the PACR Addendum estimate of $2,769 million, as shown in Figure 1.4.

Figure 1.4 Gross market benefits ($'m, PV) of Humelink Option 3C delivered in July 2026 – 2022 ISP Step Change scenario vs PACR Addendum Step Change scenario



Source: ACIL Allen analysis; PACR Addendum modelling outputs

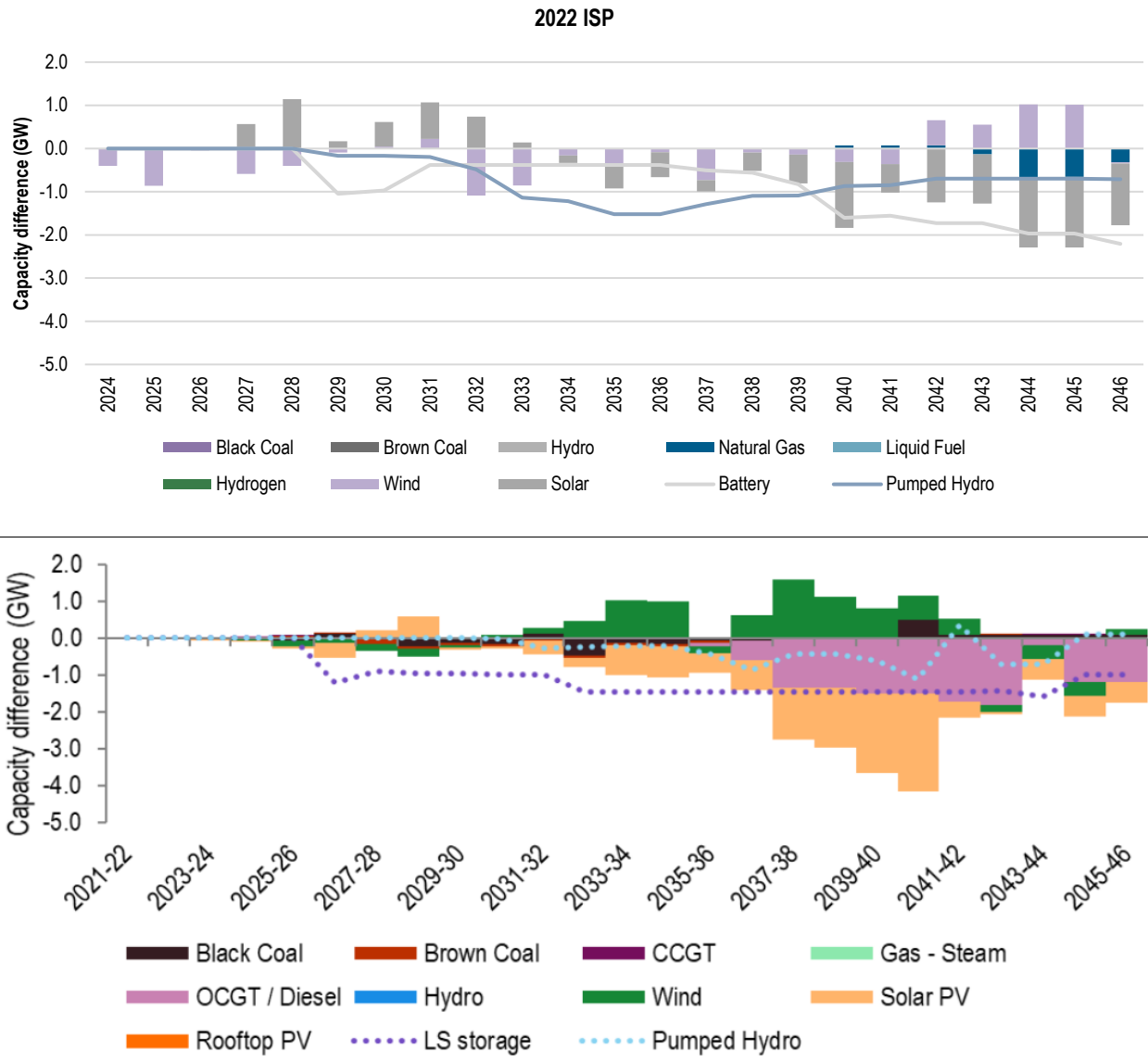
The difference in benefits from avoided generation costs (the purple bars) is probably the result of the treatment of Snowy 2.0. In ACIL Allen's modelling using 2022 ISP assumptions, Snowy 2.0 is constrained to 660 MW without Humelink, increasing to 2,200 GW with Humelink, whereas the PACR does not include this constraint.

Figure 1.5 compares the difference in capacity installed under the 2022 ISP modelling (top panel) and the PACR Addendum analysis (bottom panel).

Under the 2022 ISP analysis, avoided capacity benefits arise from avoiding 1-3 GW of annual investment in BESS, PHES, and natural gas-powered generation. Benefits also arise from avoiding up to 1 GW of annual investment in wind and solar capacity. Commissioning Humelink and the associated removal of the Snowy 2.0 constraint results in slightly more solar capacity investment in the first half of the projection period (on average 0.5 GW annually).

Under the PACR Addendum analysis, the commissioning of Humelink results in avoided investment in BESS, PHES, natural gas and VRE. The avoided capacity appears to be concentrated in the latter half of the projection period – probably due to the treatment of Snowy 2.0 - which reduces the present value of these market benefits.

Figure 1.5 Difference in capacity installed (MW) with and without Humelink Option 3C, for 2022 ISP (top panel) and the PACR Addendum analysis (bottom panel)



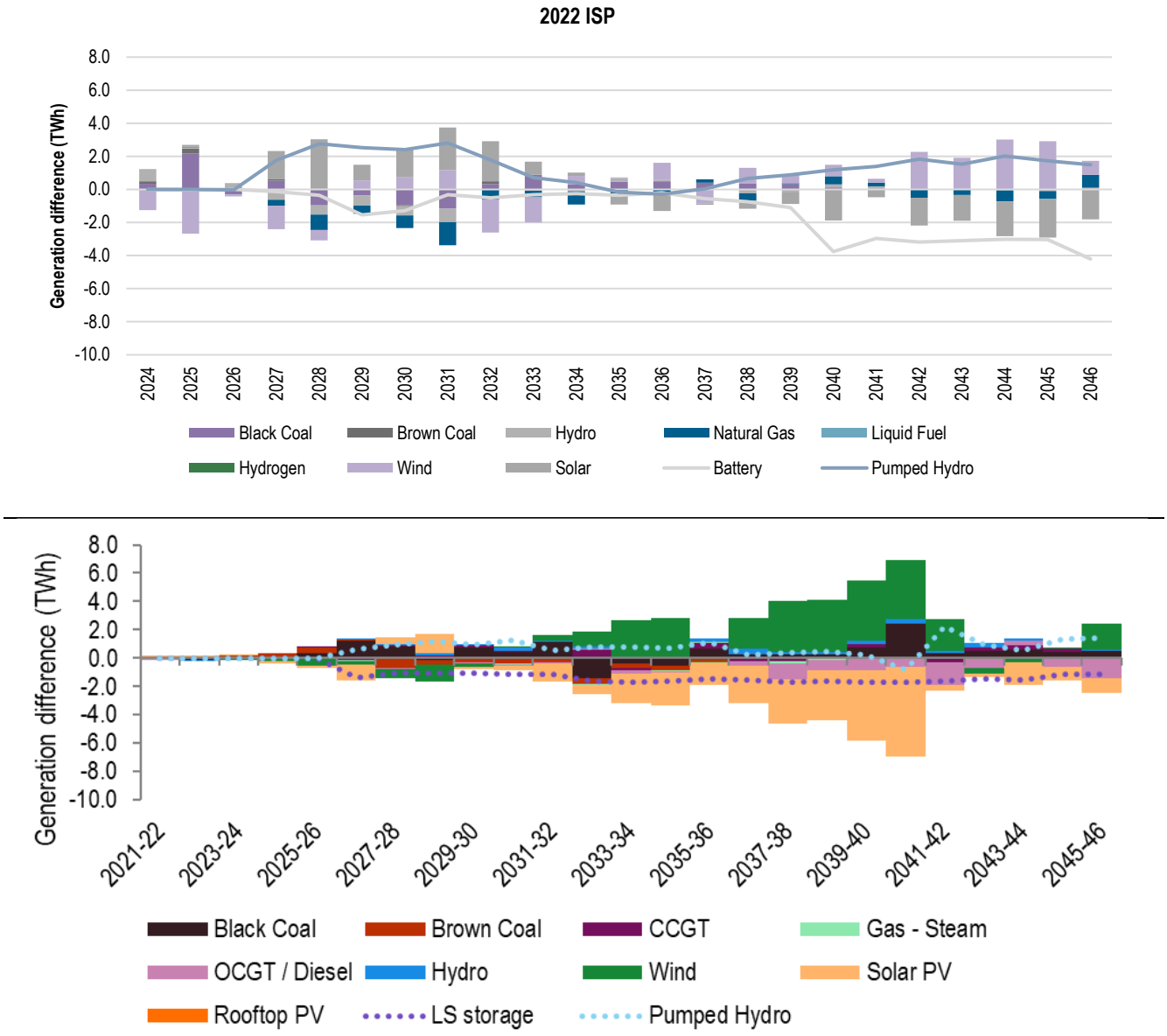
Source: ACIL Allen analysis; PACR Addendum

Figure 1.6 shows the difference in dispatch under the 2022 ISP modelling (top panel) and the PACR Addendum analysis (bottom panel).

Under the 2022 ISP analysis, changes in dispatch reflect the difference in capacity for BESS, wind and solar. The increase in PHES dispatch reflects the increased utilisation of Snowy 2.0. With Humelink, natural gas generation is displaced by dispatch from Snowy 2.0 and VRE in the first half of the projection period.

The PACR Addendum also shows an increase in dispatch from PHES (resulting from increased utilisation of Snowy 2.0), but the difference is not as large, due to the absence of the Snowy 2.0 constraint in the Base case.

Figure 1.6 Difference in dispatch (TWh) with and without Humelink Option 3C, for 2022 ISP (top panel) and the PACR Addendum analysis (bottom panel)



Source: ACIL Allen analysis; PACR Addendum

Points of comparison

Compared with the 2024 analysis, there is much better agreement between the 2022 ISP analysis and the PACR Addendum.

It is not immediately clear whether VNI West is included in the Base case in the PACR Addendum – but there is some language in the EY PACR report to suggest VNI West was included. If VNI West was included in the Base case then this would explain the higher degree of agreement with ACIL Allen's modelling outcomes, when compared with the updated analysis.

And ACIL Allen also notes that the PACR relies on the 2022 ISP which was yet to include the more ambitious state and federal renewable energy and emissions reduction targets. This would likely have resulted in less investment in VRE in the first part of the projection period which in turn 'hides' any regional differences in VER investment in the Base case and Option 3C case.

1.5 Estimating the gross market benefits of Option 2C

1.5.1 Approach – gross market benefits modelling

To estimate the gross market benefits of Humelink Option 2C, ACIL Allen ran the following 2 additional NEM scenarios:

— *Draft 2024 ISP Step Change Option 2C* in which Humelink is commissioned 1 July 2026

— *2022 ISP Step Change Option 2C* in which Humelink is commissioned 1 July 2026

The projected outcomes of these two additional scenarios were then compared against their respective Base cases (which were modelled as part of the Option 3C analysis).

As with Option 3C, given the gross market benefits of Humelink Option 2C are being assessed, ACIL Allen has not excluded VNI West (an actionable ISP project) from the Base case, even though Humelink is characterised as a prerequisite for VNI West in the ISP. ACIL Allen thinks this is appropriate given the MCCA does not appear to include the cost of VNI West in its analysis, and follows the CBA guidelines.

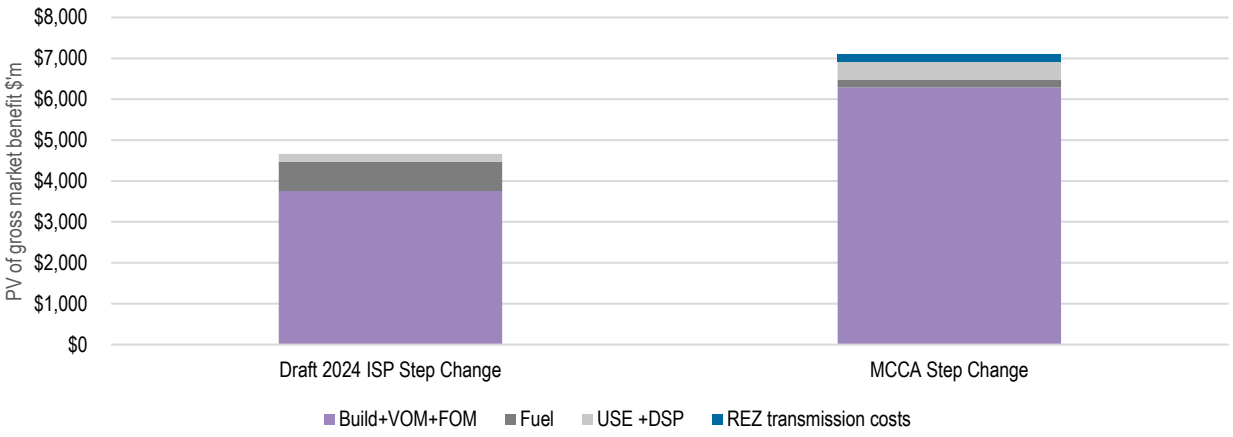
The key difference of Option 2C, compared with 3C, is that both two 500 kV lines between Maragle and Bannaby are via the Wagga Wagga Substation, whereas in Option 3C one of these lines is direct. This is characterised in the Plexos modelling by a slight increase in the capacity of the Canberra/Yass-Bannaby cut-set of 330 MW.

1.5.2 Results

Given that Option 2C is not the preferred option, there is less detail available on the resulting gross market benefits provided in the TransGrid and EY reports and accompanying spreadsheets.

Using the Draft 2024 ISP, the estimated gross market benefits of Humelink Option 2C commissioned in July 2026 is approximately $4,666 million, which is marginally lower than that of Option 3C. Further, the gross market benefits of Option 2C are $2,434 million (or 34%) lower than the MCCA's estimate of $7,101 million, as shown in Figure 1.7. The differences in the estimates based ACIL Allen's analysis and that of the MCCA are consistent between the two options. This also may suggest the exclusion of VNI West in the MCCA Base case.

Figure 1.7 Gross market benefits ($'m, PV) of Humelink Option 2C delivered in July 2026 – Draft 2024 ISP Step Change scenario vs MCCA Step Change scenario

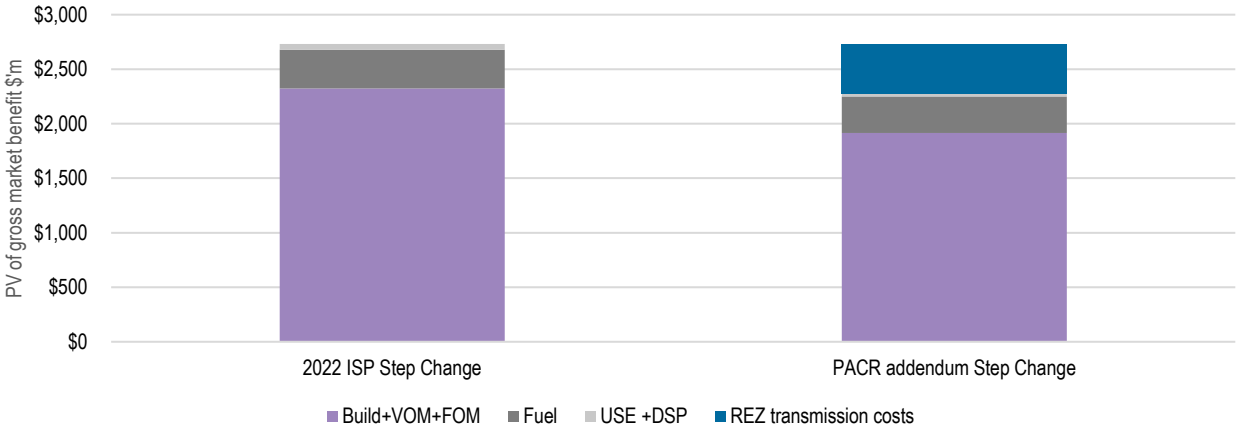


Source: ACIL Allen analysis; MCCA analysis

Using the 2022 ISP, the estimated gross market benefits of Humelink Option 2C commissioned in July 2026 is approximately $2,731 million, which is marginally lower than that of Option 3C. Further, the gross market benefits of Option 2C are $2 million (or less than 1%) lower than the PACR Addendum estimate of $2,733 million, as shown in Figure 1.8 .

The difference in benefits from avoided generation costs (the purple bars) is probably the result of the treatment of Snowy 2.0. In ACIL Allen's modelling using the 2022 ISP assumptions, Snowy 2.0 is constrained to 660 MW without Humelink, increasing to 2,200 GW with Humelink, whereas the PACR does not include this constraint.

Figure 1.8 Gross market benefits ($'m, PV) of Humelink Option 2C delivered in July 2026 – 2022 ISP Step Change scenario vs PACR Addendum Step Change scenario



Source: ACIL Allen analysis; PACR Addendum modelling outputs