22 November 2024

Australian Energy Market Operator (AEMO)

Submitted via email (ISP@aemo.com.au)

Dear AEMO ISP Team,

**2026 Integrated System Plan (ISP) Methodology – Issues Paper**

Hydro Tasmania appreciates the opportunity to respond to the Australian Energy Market Operator's (AEMO) Issues Paper for the *2026 Integrated System Plan (ISP) methodology*.

The Integrated System Plan (ISP) is an essential tool to provide transparent planning information and strategic guidance to the energy market, along with underpinning the efficient transition of the National Electricity Market (NEM). Improvements to the ISP methodology, along with iterative updates to core inputs and assumptions, are critical to maintaining and improving confidence in the ISP.

The development of the ISP is a complex, multi-year endeavour. We commend AEMO on their efforts to consult throughout the process and their continued focus on improving their highly detailed model. Hydro Tasmania has been an active contributor to the ISP discussion since the inception of the plan in 2018 and we look forward to continuing our engagement with AEMO through the development of the 2026 ISP.

**In general, Hydro Tasmania supports the methodological changes proposed** by AEMO in the consultation paper. The challenges associated with the assumption of perfect foresight is an issue Hydro Tasmania has raised in many ISP consultations and we appreciate AEMO addressing this now with methodological changes. Perfect foresight is likely to significantly overstate the effectiveness of storage assets (particularly short duration energy storage) in responding to supply-demand imbalances, resulting in the under-forecasting of the need for flexible resources (storage, gas-powered generation, demand response and interconnection) for a given reliability level. We support AEMO's proposed changes in this area and have provided further analysis in Attachment B on recent NEM battery earnings (modelled vs actual) to support our views.

Whilst analysis shows renewable energy firmed by clean dispatchable storage to be the cheapest long-term energy solution for Australia, Hydro Tasmania recognises that gas will continue to have a

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role in Australia energy mix for years to come. In principle, we support the methodology proposals on including gas in the ISP. However, we consider there are further refinements to be made to the methodology to ensure gas forecasting in the ISP is robust and realistic.

These are discussed in Attachment A, along with more detailed responses to other consultation questions. Attachment B presents further analysis on recent NEM battery earnings (modelled vs actual).

Hydro Tasmania looks forward to engaging with AEMO throughout the process of developing the 2026 ISP. If you wish to discuss any of the above in more detail, please contact Dani Williams at danielle.williams@hydro.com.au.

Yours sincerely,

Colin Wain
Manager Policy Development

## ATTACHMENT A – Hydro Tasmania response to the Issues Paper for the 2026 Integrated System Plan (ISP) Methodology

### Inclusion of Gas

Hydro Tasmania believes that the methodology proposed by AEMO is mostly appropriate to reflect additional gas analysis within the ISP and create a more holistic energy plan, with several exceptions covered below.

We support AEMO's proposal to develop a gas supply expansion model and to develop at least one gas development projection per ISP scenario. However, when different electricity sector development paths have material differences in gas-powered generation (GPG), developing more than one gas development projection would provide better analysis of gas development.

Inclusion of gas costs in the cost-benefit analysis (CBA)

AEMO proposes to not include costs associated with the gas sector and different gas supply pathways when assessing different development paths and the benefits of electricity transmission. AEMO suggests that this approach is consistent with the AER's Cost Benefit Guidelines and with the definition of *net economic benefit* in the National Electricity Rules (NER).

We note that under this proposed approach, development pathways that are more reliant on GPG and associated gas market developments would not incur additional modelling costs (other than for using more gas for electricity). While we recognise gas sector costs are outside the scope of the ISP, futures requiring a higher level of gas market development would require higher end user costs and prices, particularly for those end users necessitating the investment (for example, GPG). As such, we recommend that if development paths have material differences in the level of GPG (and associated gas market developments), then AEMO applies a gas price uplift to GPG to account for these additional costs. It is important that industry is consulted on the application and level of this uplift.

Availability of secondary fuels

Hydro Tasmania welcomed AEMO's changed approach to modelling GPG between the draft and final 2024 ISP, specifically the switching to liquid fuel when gas supply capacity limits are breached, additional capital costs for new GPG to enable dual fuel operation, and a new build limit of 1 GW per year for GPG. We support retention of these changes in future ISPs with several clarifying comments below.

One point that requires clarification in the methodology is availability of secondary fuels for existing GPGs. Our understanding is that there are several existing GPGs that are dual-fuel capable, including Torrens Island, Tallawarra and Pelican Point, but many GPGs are not dual-fuel capable. We suggest that retrofitting existing units with dual-fuel capability is likely to be cost prohibitive and that AEMO should not allow these units to use a secondary fuel in the event of modelled gas-supply shortages.

In addition, we suggest AEMO further considers its assumption that all new gas units will be dual-fuel capable. While this may be the case for some new investments, we believe that cost and environmental considerations will be prohibitive to the across-the-board uptake of this option. In some cases, a gas supply shortage should be binding; that is, it cannot be completely solved by the availability of liquid fuel and necessitates either a greater level of alternative investments, or greater

level of unserved energy in the modelling. We also consider that the use of liquid fuel should be capture in AEMO's emissions budgets (if this is not already the case).

## Distribution Networks and Consumer Energy Resources (CER)

Hydro Tasmania strongly supports AEMO's proposal to include distribution network capabilities and their impact on consumer energy resources (CER) in the ISP, and notes that this will be a challenging modelling task that iteratively improves over time. We have consistently highlighted in previous consultations that AEMO's assumptions are both exogenous and extremely material to ISP outcomes, and that improvements should be made to the way CER is modelled. The emerging issue of minimum system load (MSL) in some regions of the NEM clearly demonstrates the impact of CER can have NEM wholesale outcomes. It is vital that there is ongoing consideration of both CER forecasts and trends and their inclusion in the model. Additionally, distribution costs are a highly material part of the cost to consumers and need to expand or adapt distribution systems should not be ignored due to treatment of CER as purely exogenous.

## Hydrogen

Hydro Tasmania supports AEMO's proposed changes to improve the hydrogen electrolyser load modelling in the ISP. Hydrogen facilities running at low-capacity factors will markedly increase the production costs of hydrogen, a factor not previously included in AEMO forecasts. However, developing minimum utilisation factors that reflect economic investment requirements will assist in improving this issue. It is expected that hydrogen facilities are unlikely to have any more than one to two days of storage, which is far below the levels assumed previously by AEMO.

The level of flexibility of hydrogen production assumed in the 2024 ISP was very high, resulting in reduced forecasts for storage, gas-fired generation, and interconnection. It is Hydro Tasmania's view that AEMO's proposed methodological changes in this space will greatly improve the accuracy of hydrogen modelling.

## Actionable Windows

Hydro Tasmania supports the proposed approach of testing for actionability at the proponent's timing and the 'restart timing'. It is important that there is a strong feedback loop between different ISPs, as well as two-way dialogue between project proponents and AEMO. Leveraging existing work conducted by project proponents and jurisdictions on earliest in-service represents efficient communication and we appreciate that the restart parameter will be consulted on through the development of the Network Expansion Options Report.

## Perfect foresight

Hydro Tasmania broadly supports AEMO's proposal to refine its approach to modelling storage assets. Storage will play an increasingly important role in the energy market and ensuring that its modelled behaviour more closely reflect real world behaviour and constraints is highly important for forecasting, planning and policy making decisions.

Hydro Tasmania considers AEMO's proposed approach to include headroom/footroom energy reserves to be reasonable in helping to reduce the perfect foresight issue. Whilst this should apply to all types of storage, it is our view that higher requirements should be applied to short-duration energy storage (less than 8 hours). As these assets have smaller energy reserves, they are more likely to show deviations from modelled outcomes as small mis-timings of charging and discharging decisions can quickly exhaust energy reserves for more critical periods compared to assets with more storage.

We seek further guidance from AEMO on how it will apply the second aspect of its proposal, the modelling of imperfect energy targets. While Hydro Tasmania supports the idea in theory, the proposal has the potential to introduce undue complexity into the modelling with an uncertain benefit. An alternative approach, which we have adopted at Hydro Tasmania, is to constrain the proportion of a NEM region's storage capacity that can generate or store load in each dispatch interval. For example, while a perfectly optimised modelled outcome may see 100% of storage generate into a peak evening period, the reality is likely to be much lower. This is due to a variety of factors including lack of charge, imperfect forecasts, portfolio considerations and/or optimising outcomes for other markets and services. We recommend AEMO consider adopting a similar constraint in its updated methodology as it would be simpler to implement and provide a more transparent and calibrated means of addressing the perfect foresight issue.

Our analysis of NEM battery behaviour and earnings (included in Attachment B) supports the long-held view that modelling storage devices with perfect foresight is likely to significantly overstate its effectiveness at responding to supply-demand imbalances. We have compared perfectly optimised modelled energy revenues to actual revenues for a variety of battery energy storage systems (BESS), including Wallgrove BESS and Hazelwood BESS and found that modelled revenues are closely correlated but substantially higher than actual revenues across most months. Over the analysis period Wallgrove BESS earned about 54% of the modelled revenue ($265,938 compared to the modelled $490,191 per MW) and Hazelwood BESS earned 62% of the modelled revenue ($83,969 compared to the modelled $134,456 per MW).

We also examined battery earnings on a recent high price day and found both Wallgrove BESS and Hazelwood BESS mistimed the peak hourly price. While both batteries were able to capture large amounts of the high price period throughout the day, Wallgrove BESS earned only 53% of modelled revenue ($1,198 compared to the modelled revenue of $2,240), whilst Hazelwood BESS was able to outearn the modelled battery on this day due to cycling more than once.

These examples demonstrate how the assumption of perfect foresight included within the ISP can lead to under-forecasting of the need for storage for a given reliability level. We commend AEMO for listening to stakeholder feedback in this area and proposing methodological changes to address this long-standing issue. Hydro Tasmania looks forward to working with AEMO on this issue throughout the ISP consultation.

## System Security and Strength

Hydro Tasmania supports AEMO's proposal in representing system security services within the ISP. As thermal generators retire, methods and costs for procuring system security services within the NEM will change; it is vital that the ISP considers the effect this will have on the costs of the transition. We support AEMO's proposal to provide further detail on unbundling the costs for meeting the different system strength requirements over the modelling horizon.

## Wind representation in REZs

Hydro Tasmania supports the proposed approach for considering wind resources in REZs. Utilising a third tranche for geographically large REZs will allow more accurate representation of wind resources in those areas without adding excess complexity to the analysis.

## ATTACHMENT B – NEM battery behaviour and earnings analysis

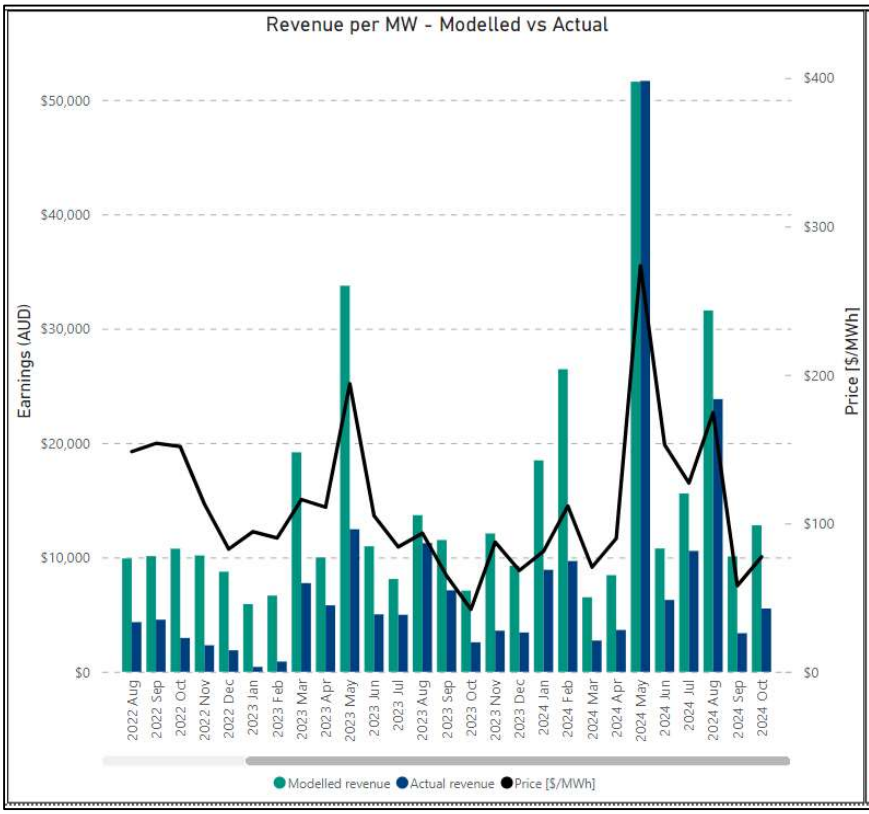
Our analysis of battery behaviour and earnings supports the long-held view that the modelling storage devices with perfect foresight is likely to significantly overstate its effectiveness at responding to supply-demand imbalances. This would lead to under-forecasting of the need for storage for a given reliability level.

Our analysis involves using a linear optimisation model for storage device earnings (and equivalently, its charging/discharging behaviour) with perfect foresight and comparing the results with actual earnings from batteries currently operating in the NEM. The key details of the modelling are in the table below:

| No. | Modelling detail | Value |
|---|---|---|
| **1** | Cycling per day | 1 cycle per day |
| **2** | Perfect foresight horizon | 1 day ahead |
| **3** | Round trip efficiency | 84.5% |
| **4** | Price data granularity | 5min data |
| **5** | Sources of revenue | Spot market only |
| **6** | Battery specifications | 1MW / 1MWh<br>1MW / 1.5MWh<br>1MW / 2MWh |

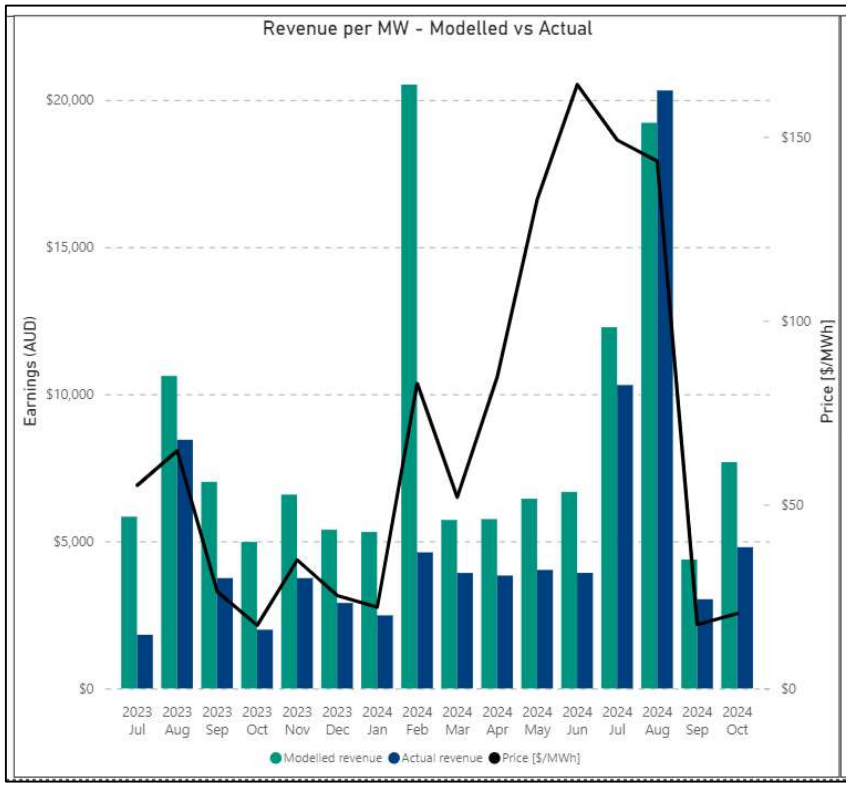
The revenue results for Wallgrove BESS between January 2022 to October 2024 and for the recently commissioned Hazelwood BESS between July 2023 to October 2024 are shown in the charts below (expressed on a per MW basis). The charts compare Wallgrove BESS with a modelled 1MW / 1.5MWh battery and a modelled 1MW/1MWh battery for Hazelwood BESS (which is aligned with the actual batteries' specifications).

## Revenue per MW - Wallgrove BESS vs modelled result




| YearMonth | Modelled | Actual revenue |
|---|---|---|
| 202201 | $3,011 | $299 |
| 202202 | $4,995 | $1,164 |
| 202203 | $4,640 | $1,288 |
| 202204 | $8,391 | $5,499 |
| 202205 | $34,368 | $24,840 |
| 202206 | $24,816 | $14,427 |
| 202207 | $19,686 | $10,859 |
| 202208 | $9,903 | $4,338 |
| 202209 | $10,110 | $4,553 |
| 202210 | $10,761 | $2,959 |
| 202211 | $10,161 | $2,315 |
| 202212 | $8,748 | $1,877 |
| 202301 | $5,922 | $424 |
| 202302 | $6,659 | $892 |
| 202303 | $19,189 | $7,751 |
| 202304 | $9,995 | $5,809 |
| 202305 | $33,754 | $12,460 |
| 202306 | $10,974 | $5,019 |
| 202307 | $8,107 | $4,982 |
| 202308 | $13,693 | $11,243 |
| 202309 | $11,519 | $7,120 |
| 202310 | $7,092 | $2,577 |
| 202311 | $12,089 | $3,590 |
| 202312 | $9,269 | $3,433 |
| 202401 | $18,480 | $8,914 |
| 202402 | $26,454 | $9,681 |
| 202403 | $6,513 | $2,729 |
| 202404 | $8,446 | $3,652 |
| 202405 | $51,593 | $51,664 |
| 202406 | $10,781 | $6,275 |
| 202407 | $15,588 | $10,564 |
| 202408 | $31,593 | $23,840 |
| 202409 | $10,083 | $3,369 |
| 202410 | $12,805 | $5,529 |
| **Total** | **$490,191** | **$265,938** |

## Revenue per MW - Hazelwood BESS vs modelled result

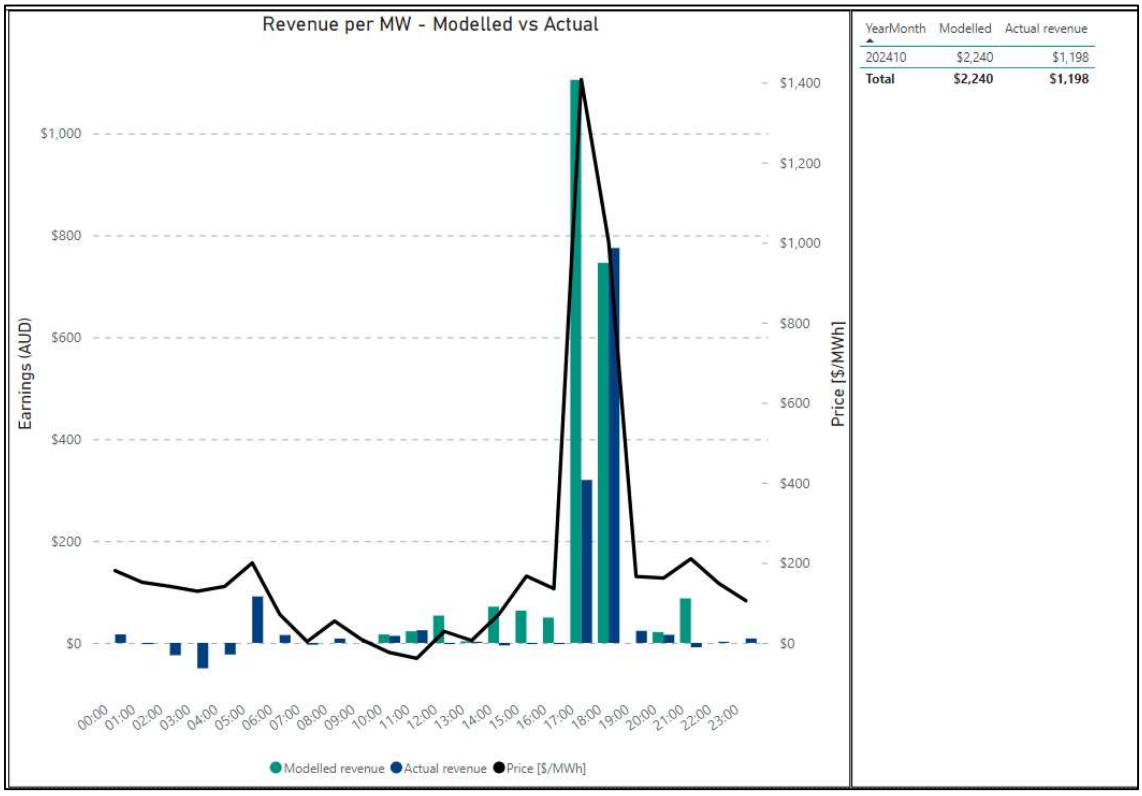



| YearMonth | Modelled | Actual revenue |
|---|---|---|
| 202307 | $5,837 | $1,824 |
| 202308 | $10,620 | $8,452 |
| 202309 | $7,022 | $3,751 |
| 202310 | $4,978 | $1,996 |
| 202311 | $6,588 | $3,750 |
| 202312 | $5,392 | $2,905 |
| 202401 | $5,318 | $2,483 |
| 202402 | $20,520 | $4,624 |
| 202403 | $5,726 | $3,924 |
| 202404 | $5,755 | $3,838 |
| 202405 | $6,447 | $4,028 |
| 202406 | $6,681 | $3,927 |
| 202407 | $12,276 | $10,311 |
| 202408 | $19,225 | $20,322 |
| 202409 | $4,381 | $3,033 |
| 202410 | $7,691 | $4,800 |
| **Total** | **$134,456** | **$83,969** |

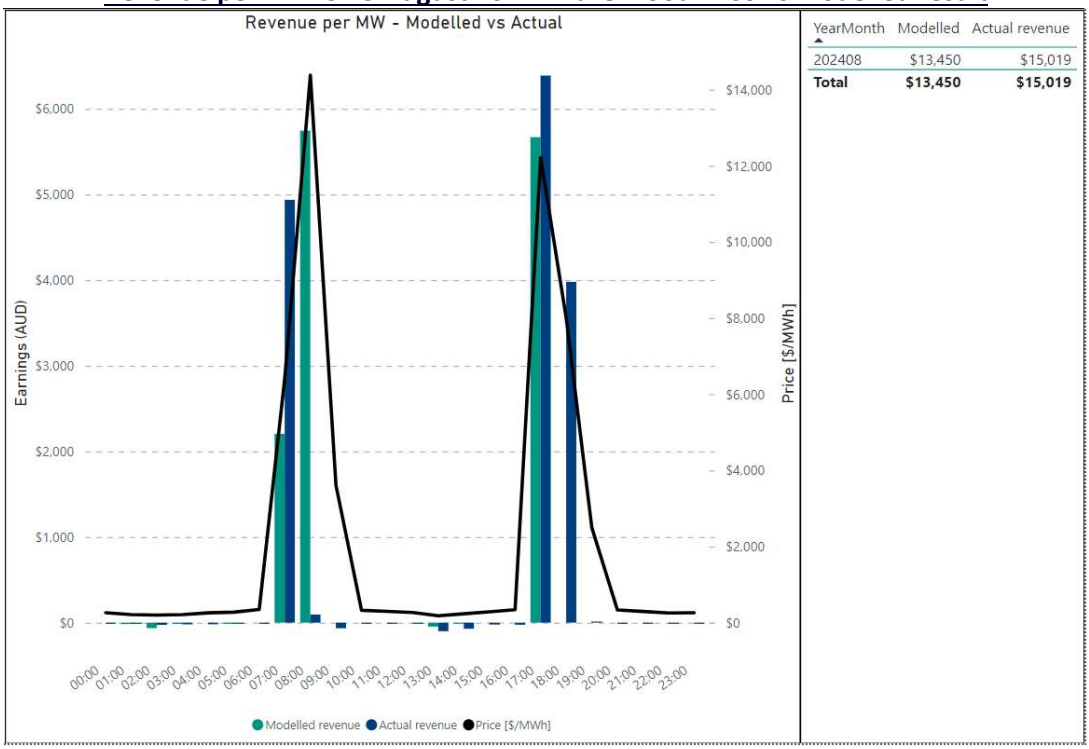
The tables next to the charts shows that Wallgrove earnt about 54% of the modelled revenue ($265,938 compared to the modelled $490,191 per MW) and Hazelwood earnt 62% of the modelled revenue ($83,969 compared to the modelled $134,456 per MW). The charts show that modelled revenues are closely correlated but substantially higher than actual revenues across most months. Hazelwood BESS earned more than the modelled battery in August 2024, as did Wallgrove BESS in May 2024, but this can be attributed to the actual batteries cycling more than once per day during those months.

The two charts below show the revenue for these batteries on days where there were high prices – 23 October 2024 for Wallgrove BESS and 5 August 2024 for Hazelwood BESS.

**Revenue per MW on 23 October 2024 – Wallgrove BESS vs modelled result**



**Revenue per MW on 5 August 2024 - Hazelwood BESS vs modelled result**




| YearMonth | Modelled | Actual revenue |
|---|---|---|
| 202408 | $13,450 | $15,019 |
| **Total** | **$13,450** | **$15,019** |

Wallgrove BESS discharged less than the model during the day's peak hourly price of $1,400/MWh at 5pm but captured most of the still relatively high hourly price of $1,000/MWh at 6pm. This small mistiming of discharge contributed to its lower revenue on this day of $1,198 compared to the modelled revenue of $2,240. Hazelwood also mistimed its decisions where it discharged most of its energy at 7am when the price averaged $6,400/MWh before the much higher prices at 8am of $14,400/MWh. However, Hazelwood BESS was able to outearn the modelled battery on this day due to cycling more than once.

Hydro Tasmania considers that deviations between actual and modelled behaviour of storage devices may also be driven by organisations operating these assets as part of a broader portfolio. In this case, actual behaviour would support profit-maximising decisions across the portfolio rather than behaviour by an asset operating in isolation. In addition, actual storage assets may also be co-optimising their earnings across both energy and FCAS markets.