Review of the Integrated System Plan Framework: Discussion Paper

Submission to Australian Energy Market Commission

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Executive Summary

Energy Consumers Australia (ECA) is the national voice for household and small business energy consumers. We advocate for a fair, affordable and reliable energy system – one that meets everyone's needs and leaves no one behind on the journey to net zero.

Thank you for the opportunity to provide feedback on the discussion paper *Review of the Integrated System Plan framework*. The Integrated System Plan (ISP) and the derived Optimal Development Path (ODP) play a critical role in guiding the future of Australia's electricity system, and in shaping the costs and opportunities available to consumers. We support any efforts that will allow for the ISP to positively impact consumers.

In this submission, the most relevant discussion paper areas to ECA have been grouped together into the following sections:

- The Purpose of the ISP
- Evolution of the ISP
- Co-optimisation of Resources
- Robustness and Transparency

Our core recommendations to this Review are that the ISP:

- Is a **whole-of-system plan**.
- **Co-optimise** demand and supply-side resources.
- Improve the **robustness** and **transparency** of the modelling and of the ODP.

We outline what is an *achievable* path to an improved ISP by considering what immediate changes would have most effect on the costs borne by consumers.

A whole-of-system plan

We define a **whole-of-system plan** as a plan that considers all material resources and capabilities that can contribute to meeting consumers' electricity needs, regardless of whether they are traditionally classified as supply-side or demand-side.

The National Electricity Rules (NER)[1] already states that the purpose of the ISP is to establish such a plan. Note that the definition we give does not specifically include consideration of gas, public transport or other sectors that clearly have many meaningful interactions with the National Electricity Market (NEM).

One could reasonably argue that the current ISP is indeed a whole-of-system plan according to our definition, since it includes forecasts of many demand-side resources as a precursor to the production of demand traces that the supply-side is then built out to satisfy. We believe the current approach is insufficient and treats demand-side resources asymmetrically in the modelling.

[1] AEMC, *National Electricity Rules*, clause 5.22.2

A need for co-optimisation

We make the central definition of an **electricity system resource**, or **resource**.[2] This is any physical asset, operational decision, behavioural change, or policy decision that changes the quantity or timing of electricity that the wider system needs to provide.

Importantly, this definition removes the distinction between supply-side and demand-side resources. Both sides contain resources that can transform the system, and both should be treated symmetrically in an unbiased modelling framework.

The current framework does not do this. Demand-side resources are forecast and incorporated into the demand traces used by the subsequent optimisation. This optimisation then determines the least-cost combination of grid generation, storage and transmission required to meet the resulting operational demand.

This distinction is difficult to justify. A battery, an EV, energy efficiency or rooftop solar can all change the quantity and timing of electricity that the rest of the system needs to provide. What matters for planning is not whether a resource is conventionally classified as supply-side or demand-side, but what transformation it makes to the system and what that transformation costs.

We therefore recommend a transition towards a common framework in which **all** relevant resources can eventually compete within the optimisation. This reform is crucial now because the cost of not co-optimising is likely to increase as demand-side resources become a larger part of our energy system.

Our preferred strawperson – SP3

SP3 makes the most important change to the ISP by extending co-optimisation to distribution, CER and demand-side resources. It does this **without** simultaneously introducing the broader changes to actionability contemplated by SP4 or introducing gas modelling as required by SP5. ECA considers that broader actionability may have merit over time, but the priority should be to ensure that the underlying optimisation identifies the right combination of all resources.

Robustness and transparency

The ISP is, at its heart, a complex set of mathematical models. Stakeholders need to be able to understand the inputs, assumptions, methods and constraints used in the ISP. They also need to assess how changes to those inputs would affect the resultant ODP. This is especially important if the ISP begins to include a wider range of resources in its optimisation phase.

ECA therefore supports greater replicability of the modelling, retrospective comparison between ISP iterations, and stronger independent technical scrutiny through the creation of a Technical Panel.

Yours sincerely

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[2] ECA, *A Generalised Framework for Valuing Electricity System Resources*, 2026

The Purpose of the ISP

The NER states that the purpose of the ISP is to establish a “whole-of-system plan for the efficient development of the power system” over a planning horizon of at least 20 years.[3]

To interpret this rule, we require a precise definition of the term whole-of-system. In this document, we use **whole-of-system** to mean a plan that considers all material resources and capabilities that can contribute to meeting consumers' electricity needs, regardless of whether they are traditionally classified as supply-side or demand-side.

This definition does not mean that the ISP should attempt to include *every* sector affecting energy use in Australia. Clearly demand for electricity is influenced by decisions in other sectors such as gas and public transport. For example, improvements in public transport could significantly change transport behaviour and alter the electricity demand associated with EV uptake.

Instead, we should strive for the smallest meaningful scope in which the impact of external sectors to the model is minimised. These external interactions should be recognised where they materially affect the electricity system, but it would not be practical or appropriate for the ISP to become a model of the entire Australian economy.

We therefore believe that the NEM should remain the appropriate boundary for the modelling undertaken for the ISP. We do not recommend extending the optimisation to gas, public transport or other sectors. We consider these to be matters for longer-term evolution of the planning framework rather than priority reforms for this Review.

There is an important distinction between **whole-of-system** planning and **co-optimisation**. Whole-of-system describes the *scope* of the planning problem: which resources and capabilities are relevant to meeting consumers' electricity needs. Co-optimisation describes *how* those resources are treated within the planning process: whether they can compete with one another in determining the optimal pathway.

A plan can thus be broader in scope without being fully co-optimised. The current ISP is an example of this. It forecasts demand-side factors to estimate the demand that the supply-side would need to meet and then uses those demand traces in the optimisation of generation, storage and transmission.

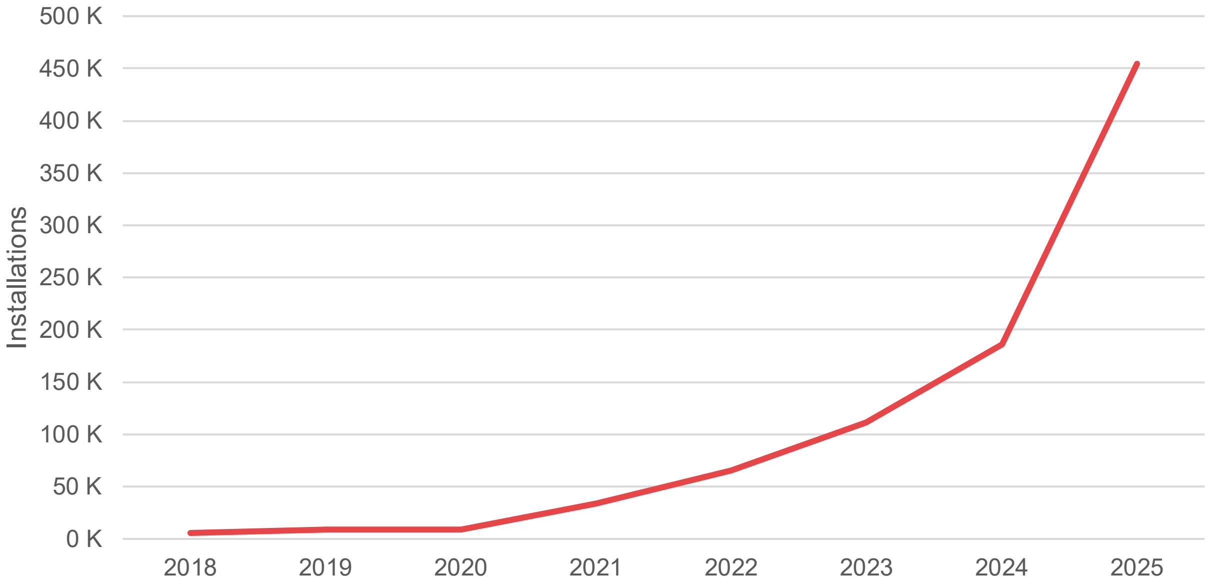
This treatment is insufficient to deliver the least-cost plan required by the Rules. The issue is not whether demand-side resources are considered, since they clearly are. The issue is whether they are treated as choices within the optimisation, in the same way as the supply-side resources with which they might otherwise compete.

[3] AEMC, *National Electricity Rules*, clause 5.22.2

Evolution of the ISP

The electricity system has changed significantly since the ISP was established in 2018.[4] Consumers are increasingly generating, storing and shifting electricity by using rooftop solar, batteries, EVs and flexible appliances. At the same time, the NEM is becoming increasingly dependent on variable renewable generation. These changes make whole-of-system planning more important and expose limitations in the current modelling approach.

Figure 1: Home battery installations since the ISP began



We distinguish **underlying demand** from the demand that the wider electricity system needs to supply, which is termed **operational demand**. Consumers have a set of activities they wish to do, and underlying demand is the electricity required to carry out those activities. Consumer resources can then change the quantity and timing of the electricity that needs to be supplied to the consumer by the wider system.

High-quality forecasting of underlying demand remains essential to the ISP. But the current approach to the ISP forecasts demand-side involvement and uses those forecasts to calculate the level of operational demand. The optimisation phase then determines the least-cost combination of generation, storage and transmission required to meet the resulting operational demand.

This means that an increasingly important part of the future electricity system is determined before the optimisation takes place.

That distinction becomes increasingly important as consumer resources become more material. A home battery, for example, can absorb electricity when it is abundant and discharge it when electricity is scarce. Managed EV charging can shift consumption between periods. Energy efficiency can reduce the amount of electricity required to do an activity. These capabilities could be genuine alternatives to investment in generation, storage or networks.

[4] AEMO, *2026 Integrated System Plan, Appendix A4: System Operability*, June 2026

As the NEM moves towards higher levels of variable renewable generation, the timing of operational demand becomes ever more important. There is thus an increasing opportunity cost from maintaining a planning process in which consumer resources are forecast separately from the optimisation of the rest of the system.

The ISP must evolve before this opportunity cost becomes larger still. The objective should not be to predict ever more accurately what consumers will do while continuing to treat those outcomes as fixed inputs. This is why ECA has supported the development of FlexCost: to help develop the information needed to enable consumer resources to be incorporated into the ISP's optimisation.[5]

The aim should be to understand consumers' underlying energy needs and then determine the most efficient combination of **all** resources to meet them.

[5] CSIRO, *FlexCost Report: A method for estimating comparative costs of demand side resources*, June 2026

Co-optimisation of resources

Our central recommendation to this Review is that the ISP should move towards **genuine co-optimisation of all electricity-system resources**.

An **electricity system resource**, or **resource** is any physical asset, operational decision, behavioural change, or policy decision that changes the quantity or timing of electricity that the wider system needs to provide.

This definition deliberately removes the distinction between supply-side and demand-side resources. Both can transform the system. What matters for planning is the transformation they provide and the cost of achieving it. This is consistent with the framework proposed in ECA's work on the inaugural FlexCost report, our recommendation to which is attached to this submission.

Under this approach, a large generator, a battery, a household solar panel, an EV, an energy efficiency technology and a demand-response program can all be represented within a common conceptual framework. They will have different costs, operational characteristics and impacts on the system, but there is no need for the distinction between supply and demand to determine how they are represented in the optimisation.

A simple representation of the current modelling sequence is:

1. Establish supply-side resource costs.
2. Forecast underlying demand.
3. Forecast consumer energy resource (CER) uptake.
4. Construct operational demand traces using underlying demand and CER.
5. For each scenario, optimise generation, storage and transmission based on the operational demand traces.
6. Use the resulting least-cost development paths to construct candidate development paths.
7. Select an ODP based on the performance of those candidate development paths across the scenarios.

The proposed direction is:

1. Establish **all** relevant resource costs (with the help of FlexCost).
2. Forecast underlying demand.
3. For each scenario, optimise across **all** relevant resources.
4. Use the resulting least-cost development paths to construct candidate development paths.
5. Select an ODP based on the performance of those candidate development paths across the scenarios.

The important change is not to the ISP's scenario framework or to the subsequent comparison of development paths. It is to the optimisation problem within each scenario.

The approaches answer different questions. The current approach asks:

> *What is the least-cost* ***supply*** *given a forecasted level of demand-side participation?*

The proposed approach asks:

> *What is the least-cost combination of resources to meet underlying energy needs?*

Illustrative Example

We provide an illustrative example, in which all costs are hypothetical.

Suppose that the NEM requires an additional 1GW during a defined period. Assume that we are at the optimisation phase in the modelling.

In the current approach, the level of demand-side participation has already been established, so the optimisation must find a supply-side solution to meet the additional energy requirement. Let’s suppose the least-cost supply-side solution in this case is a generation and network investment costing $1.5 billion.

Suppose also that a demand-side program exists that is expected to produce the same 1GW during the critical period. For illustration, we will assume this program would cost $0.5 billion.

Under the current approach, the optimisation cannot choose such a demand-side program since demand-side participation has already been determined. It therefore selects the $1.5 billion supply-side option.

Under a co-optimised approach, the optimisation would be able to compare all options available during the critical period. In this illustration, the demand-side program would be chosen.

The distinction between the two approaches becomes increasingly important as consumer resources become a larger component of the energy system. In the limiting case where almost all electricity-system capability was provided by consumer resources, it would be ludicrous to justify forecasting the deployment of almost the entire system and then optimising only the small residual supply system.

Computational complexity

Broader co-optimisation will increase the size and computational burden of the optimisation. However, it does not follow that the ISP would become a more complex modelling framework in every respect.

The current approach already requires substantial modelling of demand-side resources to forecast their uptake. Under a co-optimised approach, some of these outcomes would instead become decisions within the optimisation.

The optimisation would therefore contain more decision variables. However, if resources can be encoded using a common framework, there is no need for a fundamentally different mathematical treatment simply because a resource is conventionally classified as demand-side rather than supply-side.

A Common Framework for Valuing Resources

A common approach to resource valuation is an important prerequisite for co-optimisation.

Our feedback to the FlexCost methodology proposes a generalised framework in which resources are valued according to their transformation of the system's net demand profile and not treated differently because they are on the supply or demand side.

We therefore see value in developing FlexCost and GenCost in a more symmetric and generalised way and encourage the development of a common language for describing and valuing resources.

Our Preferred Strawperson

ECA does not recommend attempting to implement every desirable change to the ISP at once.

We distinguish between **priority reforms** that should be pursued through this Review and **longer-term evolution** that may require further technical development.

We consider co-optimisation of resources to be the highest-priority reform. Broader actionability and the inclusion of gas may ultimately be desirable, but it should not be implemented at the expense of getting the underlying optimisation right.

For this reason, ECA supports **SP3** as the preferred strawperson. SP3 extends co-optimisation to distribution, CER and demand-side resources without simultaneously introducing the broader changes to actionability contemplated by SP4 or including gas within the optimisation as in SP5.

Robustness and Transparency

Robustness

The ISP is not a forecast. It instead explores several possible scenarios under different assumptions about technology, policy, consumer behaviour and other factors.

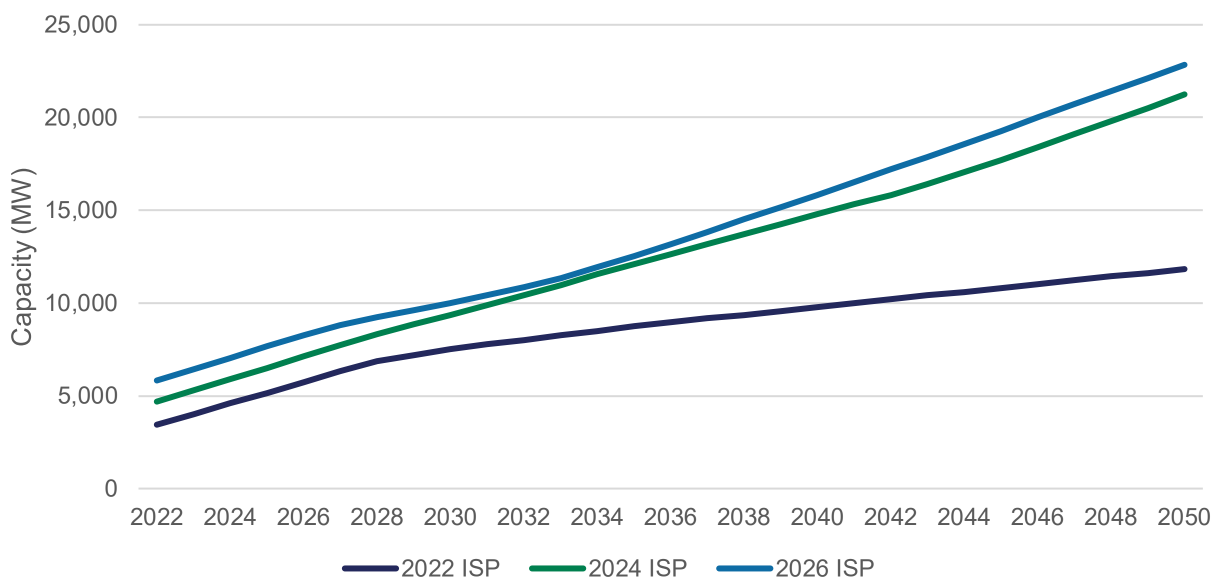
However, the ODP is presented as a concrete pathway. It is therefore important that stakeholders are aware of which aspects of that pathway are robust to perturbations in the assumptions, and which aspects depend more heavily on them.

We therefore define the term **robustness** to mean the extent to which the ODP remains close to a least-cost pathway when the future differs from the assumptions used to develop it. For example, we would say an ODP that remains (almost) least-cost when there is a slight drop or increase in expected immigration levels is **robust with respect to immigration level**. A robust plan is to be preferred to one that is not robust, all other things equal.

Since wind and solar continue to make up a larger proportion of the NEM, the future electricity system will be increasingly dependent on weather. Because of this, the ODP should be assessed across a broad range of plausible weather conditions.

Consumer energy resources have a key role to play in increasing the robustness of the ISP. Since they are made up of lots of smaller units, they can be deployed incrementally rather than through a single large investment, decreasing the risk of over-investment or poorly directed investment.

Figure 3: Forecasted rooftop solar capacity by differing ISPs (Step Change Scenario)



A useful addition to this process would be the introduction of a retrospective analysis of successive ISPs. As we can see in Figure 3, there can be significant differences between the key inputs used in successive ISPs.

A retrospective analysis would create a feedback mechanism through which the ISP can learn from previous forecasts and assumptions. This would improve robustness and help identify where future ODPs are sensitive to uncertain or systematically biased assumptions.

Transparency

The ISP is a complex modelling undertaking, making transparency increasingly important. Stakeholders need to be able to understand the inputs, assumptions, modelling methods and constraints that determine the ODP and assess how changes to those inputs and assumptions affect the plan.

If, as we recommend, a wider range of resources are included in the optimisation then this becomes crucial. Users of the ISP should be able to determine that demand-side and supply-side resources have genuinely been represented and valued on an equivalent basis.

We therefore support an academic standard of replicability of the modelling, including but not limited to:

1. Publication of the objective function and constraints for each optimisation.
2. Definitions of variables.
3. Use of open-source software.

As mentioned in our feedback to the consultation phase of this Review, the Consumer Panel should be supported by an **independent technical panel** with expertise in both consumer issues and modelling.[6]

Whilst the ISP is not a document that must be understood directly by consumers, it does need to be sufficiently accessible for consumer advocates to understand and interrogate it on the consumers' behalf. For example, we have previously proposed a representative **bill of the future** to help translate the implications of different scenarios into terms that are meaningful for consumer representatives.

[6] ECA, *Feedback on the ISP Framework Review Consultation Paper*, February 2026

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A Generalised Framework for Valuing Electricity System Resources

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I Introduction

In this note, we provide feedback to the first FlexCost Methodology Report [1]. Energy Consumers Australia (ECA) funded this report to ensure that the interests of consumers are properly integrated into the way we plan the future of the National Electricity Market (NEM). Such planning has traditionally separated supply-side resources (such as grid generators and storage) from demand-side resources (such as rooftop solar and demand flexibility). This distinction was historically practical but has become increasingly limiting as the NEM incorporates much greater quantities of distributed resources.

What ultimately matters for consumers and system planners is not whether a resource is located at the supply-side or demand-side of the meter, but whether it can provide a valuable transformation of the system at an acceptable cost. We therefore propose a generalised framework for measuring these costs in which elements from both GenCost and FlexCost are represented as **resources** that transform the system net demand profile. Within this framework, levelised resource costs are calculated using a time-weighted measure of system value rather than by measuring energy delivered during predefined periods of analysis.

II Definition of a Resource

We informally define an electricity system resource to be any physical asset, operational decision, behavioural change, or policy that transforms the net demand profile in a reference period T.

To make this definition precise, let $D : T \to \mathbb{R}$ represent a net demand profile for the system during the reference period, and let $\mathcal{D}$ denote the set of all such demand profiles. Then a **resource** is defined as a mapping:

$$\begin{aligned} R : \mathcal{D} &\to \mathcal{D} \\ D &\mapsto D_R \end{aligned}$$

The **impact** I_R of resource R is then defined as the reduction in the net demand it induces:

$$I_R(t) = D(t) - D_R(t)$$

These definitions remove the need for a distinction between supply and demand-side resources. All resources are instead characterised by the transformation they induce on the system's net demand profile.

III Accounting for Costs

We believe a resource valuation framework should adopt a whole-of-system perspective on costs. Rather than focus on a particular type of stakeholder, we should assess the total economic cost C_R required to create a resource R. Resource costs can therefore be partitioned into private costs (incurred by consumers and asset owners) and government costs (encompassing subsidies, administration and program delivery):

$$C_R = C_{\text{private}} + C_{\text{government}}$$

This approach is consistent with FlexCost, GenCost and the Integrated System Plan (ISP) modelling. However, there is another way of breaking down the cost of a resource. There are costs associated with the purchase of a technology (**asset costs**) and costs associated with incentivising purchase of that technology (**program costs**):

$$C_R = C_{\text{asset}} + C_{\text{program}}$$

An asset cost is conditional on adoption of that asset. A program does not (usually) create a fixed number of assets directly, but instead changes the probability distribution of adoption of that asset.

IV A Generalised Value Function

The value of a resource depends on when it modifies demand. To reflect this, we define a **value function** to be any function $v : T \to \mathbb{R}$. The choice of v represents the valuation of reduction in net demand at different points in time. For example, in most electricity systems a reduction in net demand during evening peak periods will have greater value than an equivalent reduction during periods of abundant generation.

Once v is fixed, we calculate the total value V_R created by resource R to be:

$$V_R = \sum_{t \in T} v(t) I_R(t)$$

Informally, the value of a resource is the weighted sum of the changes it induces in the net demand profile, with higher weights assigned to periods where those changes are more valuable to the system.

Possible choices of v include:

1. $v(t) = w(t)$ where w is the wholesale price at time t.

2. Let $A \subset T$ and define:

$$v(t) = \begin{cases} 1, & t \in A \\ 0, & t \notin A \end{cases}$$

Note that the suggested approach for FlexCost is exactly the second example with A representing the period of analysis. In this way we see that the approach outlined here is a generalisation of what appears in the current FlexCost methodology.

V Levelised Resource Cost

Once we have a satisfactory choice of value function v we can define the **levelised cost** of resource R as:

$$LCR_R = \frac{\widetilde{C_R}}{V_R}$$

Here $\widetilde{C_R}$ is the annualised version of C_R, and we assume that T represents a full year.

This metric can be applied consistently to all resource types.

VI Limitations of the Periods of Analysis Approach

Suppose a period of analysis $A \subset T$ is selected by identifying the 600 five-minute settlement periods corresponding to the 50 hours with the highest wholesale prices. The corresponding value function is then defined as:

$$v(t) = \begin{cases} 1, & t \in A \\ 0, & t \notin A \end{cases}$$

Let $t^* \in A$ be a time achieving the highest wholesale price. Now consider the following resources (recall that positive values of the impact functions represent reductions in net demand):

1. Resource R_1 has impact function:

$$I_{R_1}(t) = \begin{cases} 10, & t \in A \\ 0, & t \notin A \end{cases}$$

2. Resource R_2 has impact function:

$$I_{R_2}(t) = 10 \quad \forall t \in A$$

3. Resource R_3 has impact function:

$$I_{R_3}(t) = \begin{cases} 6000, & t = t^* \\ 0, & t \neq t^* \end{cases}$$

Clearly R_1, R_2 and R_3 represent very different resources. R_1 operates only within the period of analysis but does not distinguish between different levels of system constraint within that period. R_2 operates identically to R_1 during the period of analysis but also provides additional reductions across the entire reference period T. R_3 provides a highly concentrated response precisely when the system is most constrained.

However, a straightforward calculation shows that under this approach $V_{R_1} = V_{R_2} = V_{R_3} = 6000$ and all three resources are valued equally.

This demonstrates that the Period of Analysis approach discards information about the magnitude and timing of system impacts both within and outside the selected period. A more general value function allows these differences to be faithfully represented.

VII Conclusion

Electricity system resources should be evaluated according to the system transformations they provide rather than as 'supply-side' or 'demand-side'. Such a common language is essential to enable genuine co-optimisation of all resources in future ISP modelling.

We recommend that the FlexCost methodology adopt a more general underlying valuation framework as outlined in this note. It should be opinionated about which value function is best, since providing multiple Period of Analysis metrics instead leaves decision-makers without a clear way of choosing between competing resources.

A unified approach allows all possible resources to be compared using a common mathematical structure. This approach supports decisions that best recognise the role consumers can play in shaping the future of the NEM.

References

[1] C. Dunstan, V. Aryai, L. Poruschi, P. Graham, and S. White. Towards flexcost: A method for estimating comparative costs of demand side resources. Technical report, CSIRO, Australia, 2026.