ENERGY CONSUMERS AUSTRALIA

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.