2026 Integrated System Plan Consumer Panel Report on the Draft 2026 Integrated System Plan

12 February 2026

Document 2 of 2: Response to the Demand Side Factors Statement (Appendix 9)

The 2026 Integrated System Plan (ISP) Consumer Panel members are:

- Mark Henley (Chair)
- Jarra Hicks
- Bev Hughson
- Craig Memery.

The Panel may be contacted by email: ISP@AEMO.com.au

Acknowledgement of country

The 2026 Integrated System Plan Consumer Panel acknowledges the Traditional Custodians of the land, seas and waters across Australia. We honour the wisdom of Aboriginal and Torres Strait Islander Elders past and present and embrace future generations.

We acknowledge that, wherever we work, we do so on Aboriginal and Torres Strait Islander lands. We pay respect to the world's oldest continuing culture and First Nations peoples' deep and continuing connection to Country; and hope that our work can benefit both people and Country.

Contents

Tables

Figures

Recommendations for DSF Summary

Topic	DSF recommendations	Who's responsible?
DSF - Nomenclature	That the DSF be renamed so that its meaning is more obvious to the general public. Something like the plan for 'Supporting Consumer Participation' (The 'DSF' should be a guide to the demand side, more than distribution networks)	AEMO
DSF - Nomenclature	DSF V1 is also a statement of Distribution Network factors, future DSF's need to more overtly consider other demand side factors too.	AEMO
DSF - ODP	The final 2026 DSF to identify and explain opportunities to 'leverage' distribution investment savings for all consumers – CER and non-CER households. (For example, in new augex reductions for network businesses, with savings reducing DUOS charges.)	AEMO
DSF - ODP	Updated modelling, including sensitivity analysis be undertaken to reflect rapid take up of CER, particularly home batteries and rooftop PV and factored into CDP analysis	AEMO
DSF - Data	Updated data from the draft 2026 Forecasting Assumptions Update supporting materials be applied to key Demand Side Factors, including EV projections, distributed PV and batteries/VPP forecasts and GEM – projections for DER, including non-scheduled generation.	AEMO
DSF - Sensitivities	Undertake a sensitivity analysis of the impacts on the 2026 ODP from applying more recent data from the Draft 2026 Forecasting Assumptions supporting materials. Specifically test the impacts of a more rapid take up of CER, specifically rooftop PV and home batteries, than considered in the 2025 IASR	AEMO
DSF - Sensitivities	Undertake sensitivity on more Energy Efficiency.	AEMO
DSF - Curtailment	AEMO explain assumptions about battery investment and price volatility, over time, noting battery investment is impacted by reducing volatility (from having more batteries).	AEMO
DSF - Curtailment	Clarify what AEMO considers to be efficient curtailment levels with differing levels of CER / DER (figure 8 in DFS), and how upstream curtailment has been accounted for to ensure.	AEMO
Recommendations for 2028 DSF (and beyond)		
DSF - Energy Efficiency	That enhanced modelling of energy efficiency opportunities be undertaken for 2028 ISP, including which energy efficiency options give best (cost-effective) outcomes for the energy system and consumers for the 2028 DSF.	AEMO
DSF - Energy Efficiency	The 2028 DSF include discussion about what needs to be done to enable much better take up of Energy Efficiency than is currently forecast.	DEECCW, Commonwealth and jurisdictional governments,

		AEMO, relevant industry associations
DSF – Scenarios	A distributed energy scenario being added to the 2026 ISP scenarios, utilising updated DSF data and related inputs	AEMO
DSF VPPs	That AEMO progressively improves its data base regarding VVP take up by consumers and VPP impacts on energy markets for the 2028 DSF and beyond.	AEMO

Introduction

This report deals specifically with Draft 2026 ISP Attachment 9, the Demand Side Factors statement. It is a support document to the main Draft 2026 ISP report with recommendations from this document being included in the recommendations listed in this report.

The Consumer Panel considers the development of the Demand Side Factors statement (DSF) to be an important aspect in the development of the ISP from initially being a transmission-focused plan to being more of a 'whole-of-system' plan.

The DSF's formal genesis is with an AEMC rule change[1] that was made on 19 December 2024, having been initiated in June 2024 by The Honourable Chris Bowen, Minister for Climate Change and Energy. Part of that rule change decision states:

> *"The final rule requires the Australian Energy Market Operator (AEMO) to publish a demand-side factors statement as part of its ISP. The final rule introduces obligations on distribution network service providers (DNSPs) to provide information to AEMO for the purposes of informing the ISP and demand-side factors statement." (Page 1 AEMC Final Determination.)*

A reality of this timing is that time was short for AEMO staff in putting together this first DSF statement in time for the draft 2026 ISP. We also think that it is important to note that this is not a process that has extensive international precedents.

At the outset of this report, we wish to commend the relevant AEMO staff teams for their exceptional work in putting together a 'world-leading', considered and data-rich first DSF statement.

As a first report, the 2026 DFS statement includes important definitions and context. The Demand Side Factors Information Guidelines[2], with Distribution Network Service Providers (DNSPs) as the main audience, restates the NER definition of a demand side factor as:

> *"a factor that affects demand for, or patterns of use of, the distribution services of a Distribution Network Service Provider, which may include:*
>
> *(a) a technological development or service available to end users;*
>
> *(b) the effect of distribution connected units;*
>
> *(c) a policy promoting electrification; or*
>
> *(d) demand management or energy efficiency schemes,*
>
> *but the effect of distribution connected units that are not small generating units or small bidirectional units is not a demand side factor." (Page 4 DSF Information guidelines)*

The demand side is, in economics terms, the actions and behaviours of consumers, generally in aggregate, purchasing goods and services while the supply side focusses on production and sellers. For energy markets, the supply side is often summarised as everything that happens to get electricity (or gas) to a customer's meter. Demand side is 'behind the meter'. The importance of the demand side, for the ISP, is that it considers the actions of consumers (households through to

[1] https://www.aemc.gov.au/sites/default/files/2024-12/erc0396_final_determination_-_improving_consideration_of_demand-side_factors_in_the_isp.pdf

[2] https://www.aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2025/demand-side-factors-guidelines-consultation/final-documents/demand-side-factors-information-guidelines.pdf?rev=ee03f520c0c447299e4fa739ea45e55d&sc_lang=en

industrial users) as energy buyers and now, demand side also refers to consumers as both producers of their own energy (PV) and suppliers back into the grid through Consumer Energy Resources (CER). So, demand side factors is a shorthand for the processes of consumers as energy buyers as well as consumers as investors in energy production, mainly through renewable technologies (PV, batteries and electric vehicles). The electricity distribution networks act as the interface between consumer electricity use and export back to the grid. Demand side also refers to actions taken by consumers to manage their electricity use through the timing of their use and through efforts to reduce use, particularly through energy efficiency measures.

Demand side factors are all about consumers and how they interact with the energy system which is why the DSF is very important for consumers.

We observe that the term 'Demand Side Factors' has limited general consumer understanding about what it means, so we suggest renaming it, maybe to something like the plan for 'Supporting Consumer Participation'. If the DSF is to remain a distribution networks-focused plan, then it can be called the 'Distribution Network Investment Plan' or 'Distribution Network Constraint Removal Plan' or similar. Note that the Panel thinks that the DSF focus should be broader than distribution networks, the main focus for 2026. Whatever the focus, it is important to explain what 'demand side' means in consumer-friendly language.

Recommendation:

That the DSF be renamed so that its meaning is more obvious to the general public, maybe something like the plan for 'Supporting Consumer Participation'.

For this first DSF, AEMO has focused on the following aspects of CER, these being assets connected to distribution networks across the NEM that can generate or store electricity, including:

- rooftop photovoltaic (PV) generation systems
- PV non-scheduled generation (PVNSG – PV Non-Scheduled Generators: 100kw < PVNSG < 30MW)
- batteries [under 50kW], and
- electric vehicles (EVs), including use of vehicle-to-grid (V2G).

Other distributed resources. These are assets connected to distribution networks across the NEM that can generate or store electricity but have a larger capacity than those considered to be CER2, and include:

- PVNSG (non-scheduled generation) with a larger capacity than that considered to be CER2, and
- batteries with a capacity larger than that considered to be CER2.

We note the inclusion of PVNSG, an aspect of CER that we will return to later, as this is the domain that includes 'Community energy' and mid-scale generation and storage, an aspect of the DSF that the Panel opines is important for the future energy market.

Recommendation:

This first DSF is also a statement about Distribution Network factors; future DSFs need to more overtly consider other demand side factors too.

Draft 2026 Forecasting Assumptions Update

In the rapidly updating world of energy markets, data keeps on changing, trendlines change rapidly and keeping up is almost impossible. For AEMO, the Draft 2026 ISP and DSF were released on 10 December 2025; 13 days later, AEMO released the *Draft 2026 Forecasting Assumptions Update*[3] that is focused on the ESOO and includes three related consultation documents and seven 'supporting materials' reports. This material "relates to proposed updates to assumptions to apply in the Reliability Forecast for the NEM and WEM Electricity Statements of Opportunities" (website overview statement). The release of the 2026 ESOO will likely occur in August 2026. While the Quarterly Energy Dynamics report for Q4 2025[4] was released in January 2026.

Both reports give very useful insights and data that is more up to date than the IASR data produced for the draft 2026 ISP. The Panel fully recognises that 'lines need to be drawn' about the timing of data and other inputs for key reports and processes and that the IASR data is robust and tested for the ISP. In the situation of the most-recent data for some topics covered in the DSF statement, the significant change over a very short time means that the more recent data should be used to the fullest extent possible in finalising the 2026 ISP. We refer specifically to the substantial investment in home batteries during 2025, in response to the Commonwealth Government's home battery subsidy scheme. This larger 'fleet' of home batteries enables some review of key aspects of the DSF statement particularly regarding batteries and their use in VPPs (or not?) and hence projections about 'coordinated CER' as a part of the future energy mix.

The Panel suggests that data from the *Draft 2026 Forecasting Assumptions Update* supporting materials can be applied to the final 2026 ISP and DSF statements.

DSF statement workshop

In the lead up to finalising this submission the Panel and AEMO co-hosted a workshop with a small number of invitees to explore the DSF, starting with Question 4 from the draft 2026 ISP document:

> *"For the first time, AEMO has assessed opportunities for investment in distribution networks across the NEM, that are consistent with the efficient development of the power system, to support operation of consumer energy resources. This recognises the key role of distribution networks in supporting the integration of consumer energy resources. See Appendix A9 for more information.*
>
> *Does the ODP appropriately identify and leverage distribution investment opportunities?"*

Discussion summaries from this workshop are included as Appendix 1 to this document and the discussion from the workshop has helped inform the Panel in preparing both this report and our report responding to the full Draft 2026 ISP.

We also list below the Panel's recommendations associated with both the 2026 DSF statement and future DSF statements. These recommendations are consolidated in Document 1 of this submission 'package'.

[3] AEMO | Draft 2026 Forecasting Assumptions Update

[4] https://www.aemo.com.au/-/media/files/major-publications/qed/2025/qed-q4-2025.pdf?rev=b29ae0bd014c48f59a259009d246280f&sc_lang=en&hash=49B19FB5A8783BBD5BF435153C523905

Why DSF is important (for consumers)

The Panel is clearly focused on consumers and consumer impact of many of the ISP factors, so while the DSF statement brings focus on the demand side of energy markets along with supply side considerations for the ISP, there must be benefits for consumers from the DSF considerations as well as system benefits. Both the current and previous Panels have emphasised the importance of demand side factors, often summarised as Consumer Energy Resources (CER) as being both a crucial part of the energy transition and a means for consumer value.

In discussions with the Panel, AEMO staff identified five main reasons for the DSF being important for consumers, these being:

1. More overtly recognises the role that consumer investment is playing in present and future energy systems.
2. Better aligns supply and demand considerations in the ISP.
3. Improves transparency of assumptions: Consumer Energy Resources, electrification, energy efficiency, demand flexibility.
4. Continues to strengthen the robustness of ISP decisions and enhances capability to explore uncertainties of future energy markets
5. Better coordinates Distribution Network System Providers (DNSP) inputs via DSF Information Guidelines

The Panel adds:

- Helps to identify opportunities to reduce expenditure on excessive network expansions and upgrades.
- Encourages future investment in CER, by consumers, that is most likely to be cost effective. This could include both household CER, as well as medium scale generation and storage by small business, farms, and community enterprises.
- Makes tangible progress towards the ISP being a genuinely 'all of system' plan.
- Actively recognises and takes action to support the contribution of consumers in achieving the ODP.

Consumers are integral contributors in the transition to renewable energy powered grid. Already, consumers have invested roughly $50 billion[5] of rooftop solar PV. There are also, we estimate about 20 community-owned solar farms and one community-owned wind farm in the NEM. The DSFS helps to give visibility and credence to the role of consumers and considers actions at the level of the distribution network that will help to unlock additional export capacity from existing CER, as well as enabling additional CER to be connected, where it is in the best interests for all consumers and the whole energy system.

The Panel has been interested in quantifying the level of household and small business investment in CER in Australia to ascertain some perspective, including in comparison with 'market spending'. The following table is a rough estimate of the total value of rooftop PV investment over recent years, showing an average of about $5 billion invested in rooftop PV each year.

[5] Assumptions: total cost of PV estimates given in Table 1, that is, about $5 billion per year for each of the last five years and then assume that half of current PV systems were installed before 2019 or during 2025.

Estimates of the value of PV investment by 'small' consumers

Table 1 Estimates of the value of PV investment by 'small' consumers

Year	Total PV installations in Australia	Average installation size (September)	Average installed cost per kW	Total (A$m) nominal
2020	370.320	8.1	$2085.9	$6,256.85
2021	377458	8.6	$1889.0	$6,131.96
2022	315,717	8.8	$1753.8	$4,872.56
2023	333,856	9.6	$1723.1	$5,522.56
2024	319,044	9.2	$1583.2	$4,647.02
2025	317,213 (Est)	10	$1,537.2	$4,877.15

Sources: Column 2 Data from Solar calculator[6] using Clean Energy Council data; Column 3 data from Australian Photovoltaic Institute; Column 4: ABS Household solar electricity generation[7].

For 2025, indications are that roughly 160,000 home batteries were installed, noting the support of the Commonwealth Home Battery Scheme with average cost of $12,342.00 for a 17kwh battery average size of installed battery, being about a $2 billion investment by consumers for the year.

So, indicative value of CER investment in Australia for 2025, a single year, was $7 billion, for rooftop PV and batteries, for one year. This equates to a couple of major transmission projects or four to five gas-fired (OCGT) power stations. To further extrapolate, if $7 billion per annum (real) is invested in CER (and excludes EV and any other emergent CER technology) over 25 years to 2050, the total consumer investment is $175 billion. This compares to the Draft 2026 ODP estimate of:

> "*The annualised total capital cost of* grid-scale generation, storage, transmission and distribution in the ODP would be $128 billio*n in today's dollars." (This is 2025 $A.)*

We can deduce from these very rough, indicative estimates that consumers are likely to invest more in electricity that the whole of the electricity market to 2050. This is substantial and serves to highlight the importance of customers being supported to both make efficient investments and to ensuring that consumer and market investments are complementary. To tell the story another way, between 2025 and 2050, consumers might pay of the order of $300 billion ($175 billion + $128 billion, rounded) as investment in electricity both as customers paying for market investments and as consumer investors. (We also stress that the estimates are crude and intended to be indicative only, more thorough and expert analysis would prove useful.)

[6] https://solarcalculator.com.au/blog/solar-energy-facts-and-statistics/

[7] https://www.abs.gov.au/articles/household-solar-electricity-generation-australian-national-accounts

Demand Side factors considered

The DSF Statement includes this summary of factors considered:

Table 2 Summary of Demand Side Factors considered

Table 1 DSF elements included in this DSF statement

DSF category	Forecast component	Definition	Development for and application in the ISP
CER technology	PV	Solar panels in a residential home or business with a capacity of less than 100 kW, or PVNSG (non-scheduled generation) with a capacity between 100 kW and 5 MW.	Exogenous unconstrained forecast[A] developed and consulted on within the 2025 IASR. Modelled with regard to distribution network capabilities that support the operation of CER, potentially constraining CER exports. Export to distribution network constrained by existing network limitations unless economic to augment the distribution network to harness latent CER capacity.
	Batteries	NEM connected battery in a residential home or business with a capacity not exceeding 50 kW.	
	EV	A battery EV or PHEV registered in the NEM.	
CER coordination	VPP	Coordination of batteries in the NEM through a 3rd party aggregator or retailer.	Exogenous unconstrained forecast developed and consulted on within the 2025 IASR, reflecting the dynamic management of the CER assets to maximise their benefit. Modelled explicitly as a component of the ISP capacity outlook modelling that can be operated to minimise system costs and maintain power system reliability, with regard to distribution network capabilities that support the operation of CER, potentially constraining CER exports. Export to distribution network constrained by existing network limitations unless economic to augment the distribution network to harness latent CER capacity.
	V2G	Coordination of electric vehicle batteries.	
Energy efficiency	EE	The cumulative reduction in energy use (energy savings) due to factors such as technical improvements in consumer appliances and the thermal efficiency improvements of buildings due to building energy efficiency standards.	Energy efficiency is developed as an exogenous forecast in the IASR, reflecting technology developments, policies and underlying consumer appetite for bill savings and environmental benefits.

A. Unconstrained CER forecasts represent the expected uptake and operation of CER driven by underlying consumer demand, economics, technology trends before considering any operational and network constraints.

The key sections of the DSF statement are listed as:

- A9.2 Opportunities for the development of the distribution network
- A9.3 Demand side factors
- A9.3.1 Consumer energy resources
  - CER Technology: PV, Batteries and EV
  - CER Coordination: VPP and V2G
- A9.3.2 Energy efficiency

This report follows those headings in our exploration of the DSF statement.

Opportunities for the development of the distribution network

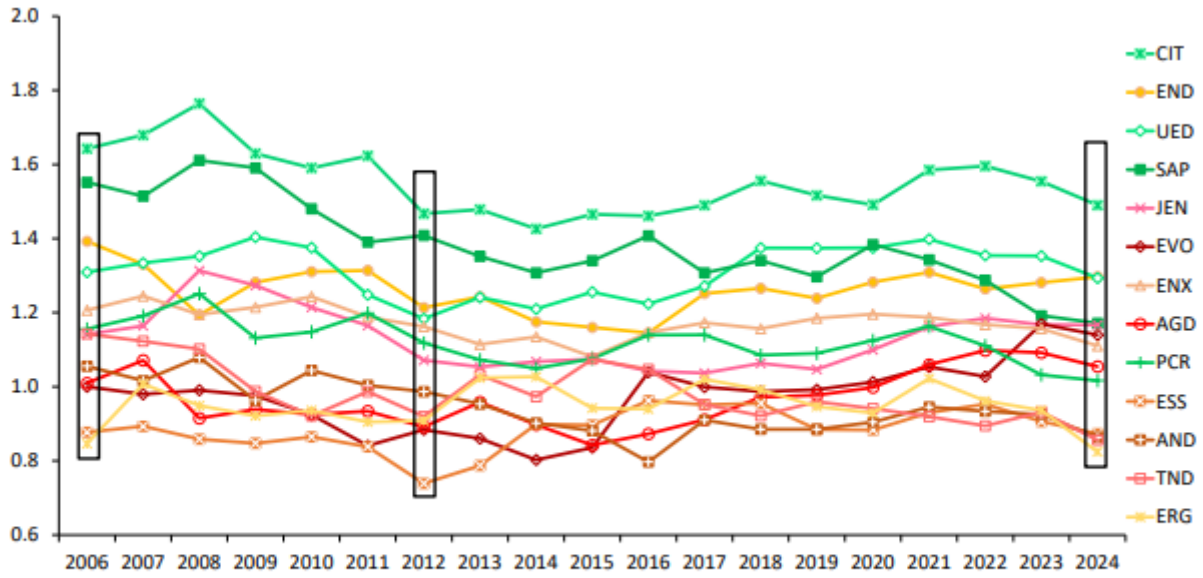
One of the major reasons for a focus on distribution networks (distribution network service providers – DNSPs) in their role in being "effective in supporting the integration of more CER and other demand side factors in a manner consistent with the

efficient development of the power system" (page 8). They are also an integral part of the electricity power system and can support consumers by being as efficient as possible.

There is also a strong interest in strategies to reduce new augmentation expenditure by DNSPs by using demand side factors to reduce peak loads. It makes little sense to build aspects of the network to operate for 10-20 hours of the year, at highest load periods, when these peak loads can by trimmed and so there is no need to build more network that will be rarely used.

Distribution network Multilateral Total Factor Productivity (MTFP) has been declining or at best static for nearly two decades as shown by the following chart from the AER's network Benchmarking report for 2025[8].

Figure 1 Distribution Network Multilateral Total Factor Productivity



Source: Quantonomics; AER analysis.
Note: Evoenergy's MTFP in 2006 is set to 1.000.

This chart suggests to us that there is considerable potential for improved productivity of distribution networks, by smart involvement of CER into these networks, providing a benefit to all consumers. So, a focus on opportunities for DNSPs, both to better utilise existing network and to judiciously augment the network to better integrate CER makes sense. We agree with AEMO's observation that a pragmatic approach to DNSPs is warranted and affirm the modelling that has been undertaken to identify distribution network opportunities to enable higher CER exports. We also recognise the willingness of DNSPs to work with AEMO to provide data and experience to the DSF process.

The distribution network development opportunities modelling summarised by Table 6 is practical and efficiency focussed, identifying modest augmentation costs and reasonable consumer benefit.

[8] file:///C:/Users/jmhen/Downloads/AER%20-%202025%20Annual%20Benchmarking%20Report%20-%20Electricity%20distribution%20network%20service%20providers%20-%20November%202025%20(4).pdf (page 14)

Recommendation

The final 2026 DSF to identify and explain opportunities to 'leverage' distribution investment savings for all consumers – CER and non-CER households. (For example, in new augex reductions for network businesses, with savings reducing DUOS charges).

Curtailment

The DSF contains some discussion about curtailment, a topic that the Panel has identified as a 'key theme' across the draft 2026 ISP. We also consider aspects of curtailment in our main report.

Some curtailment already occurs during negative price events, incentivised by feed in tariffs. During these periods of negative pricing, any curtailment 'avoided' in distribution networks serves only to displace curtailed utility-scale generation.

Some distribution curtailment reductions are – or soon will be, as the penetration of renewables increases – rendered ineffective due to upstream bottlenecks.

In both cases, measures in the distribution network to reduce curtailment work counter to the collective cost of networks and energy markets without making any emissions improvements.

The Panel recommends that distribution voltage management improvements to reduce curtailment should be limited to those that avoid these inefficient outcomes by being restricted to:

- Times that are not concurrent with high levels of negative pricing and
- Locations where 'unconstrained' energy in distribution systems does not just hit upstream bottlenecks.

We suggest that curtailment is an aspect of the transition and that where net costs to consumers of curtailment are low, it is better to have extra generation capacity and market signals about the sometime availability of very cheap electricity. Consequently, we do not consider minimisation of curtailment to necessarily be a priority.

Recommendation

AEMO explain assumptions about battery investment and price volatility, over time, noting battery investment is impacted by reducing volatility (from having more batteries).

Clarify what AEMO considers to be efficient curtailment levels with differing levels of CER / DER (fig 8 in DSF).

Demand side factors

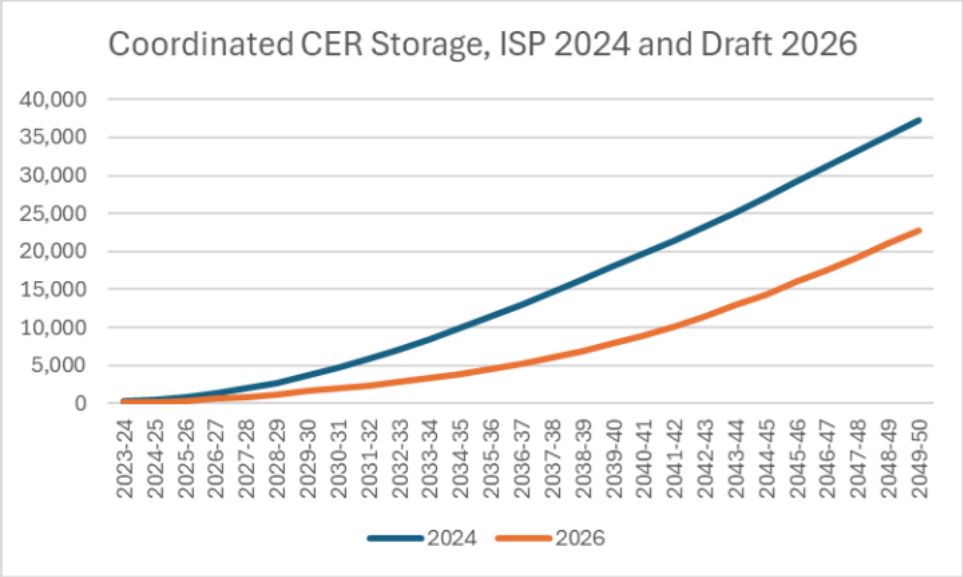
The DSF recognises that consumers play an active role in energy markets as investors and generators as well as being consumers. The Panel has tried to quantify this investment and has generated rough estimates that about $7 billion was invested in PV and home batteries during 2025 while a very rough estimate is that consumer have invested something of the order of $50 billion in PV over the past couple of decades. We are keen to see more accurate estimates, but these rough estimates give some sense of the magnitude of consumer investment in CER.

We also note the Step Change scenario estimates that:

- By 2035, 47% of the households20 in the NEM would have rooftop solar, rising to 56% in 2050, driven by declining costs. At that time, forecast rooftop solar capacity would be 87 GW.
- By 2050, about half of all solar households will have supporting batteries.
- Residential and commercial battery capacity in the NEM is expected to grow to 5.2 GW in 2030, then 27 GW by 2050.
- Forecasts are that 53% of batteries will be coordinated as part of a VPP by 2050.
- EV ownership is expected to surge from the late 2020s driven by falling costs, greater model choice and availability. By 2050, up to 80% of all vehicles are expected to be battery EVs. (page 34)

Yet we return to our comments from our main report about the estimates of declining Coordinated CER.

Figure 2 Coordinated CER Storage - 2024 ISP and Draft 2026 ISP



Source: AEMO 2024 ISP and 2026 Draft ISP data.

We remain unconvinced by these estimates, considering them to be too low for the 2026 ISP.

CER Technology

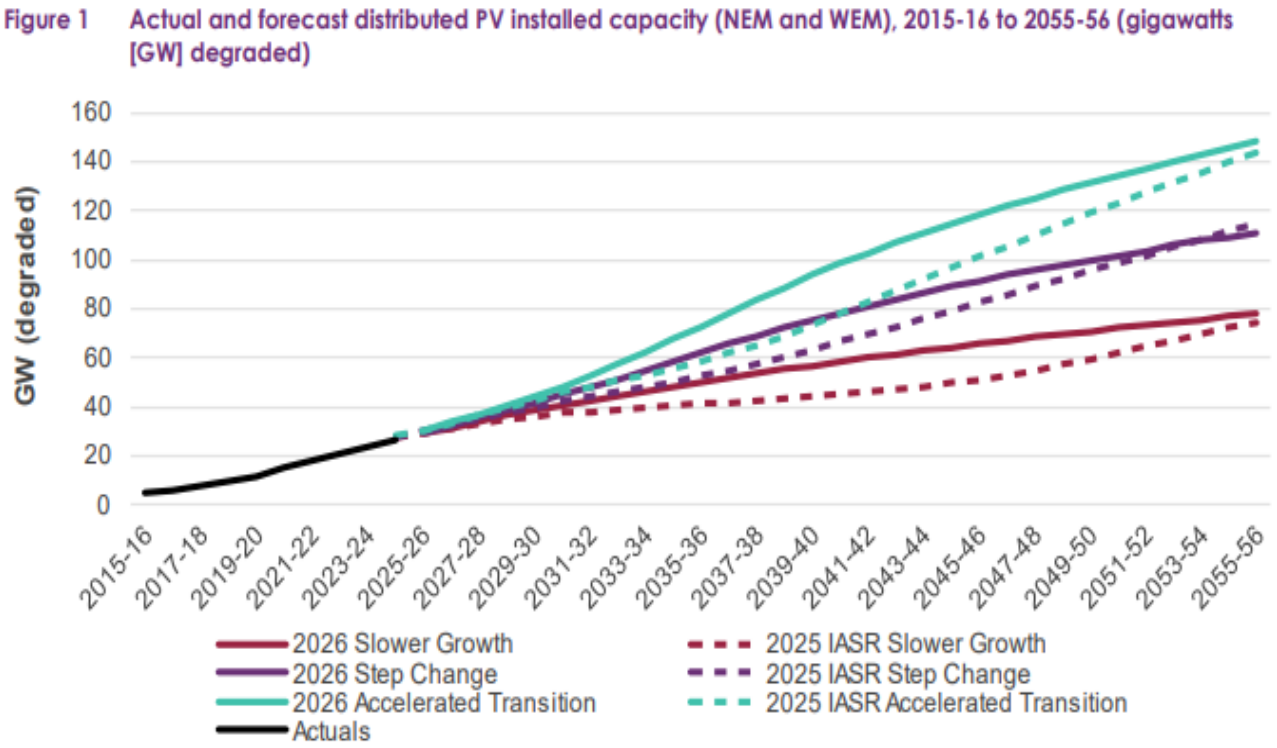
The DSF discusses three main CER technologies: rooftop PV, home batteries and electric vehicles. We focus on PV and batteries as the 'technologies' with the broadest current uptakes.

The DSF statement says that "exogenous unconstrained forecasts were developed and consulted on within the 2025 IASR." This is a factual statement. The question though for the Panel is the extent to which more recent demand side data in this instance, is considered in finalising the 2026 ISP, data more recent than the twin IASR reports of early 2025.

In the rapidly changing world of energy markets, there is constant change through rules, regulation, technology and trends with data back-up. On 23 December 2025, AEMO released the *Draft 2026 Forecasting Assumptions Update* with workbook, CSIRO GenCost consultation report and seven supporting documents that include more up-to-date data on CER and related distributed energy factors.[9] This testing of forecasting assumptions and associated data is formally a part of the ESOO process and we would assume leading to the release of the 2026 ESOO in about August 2026, two to three months after the release of the final 2026 ISP.

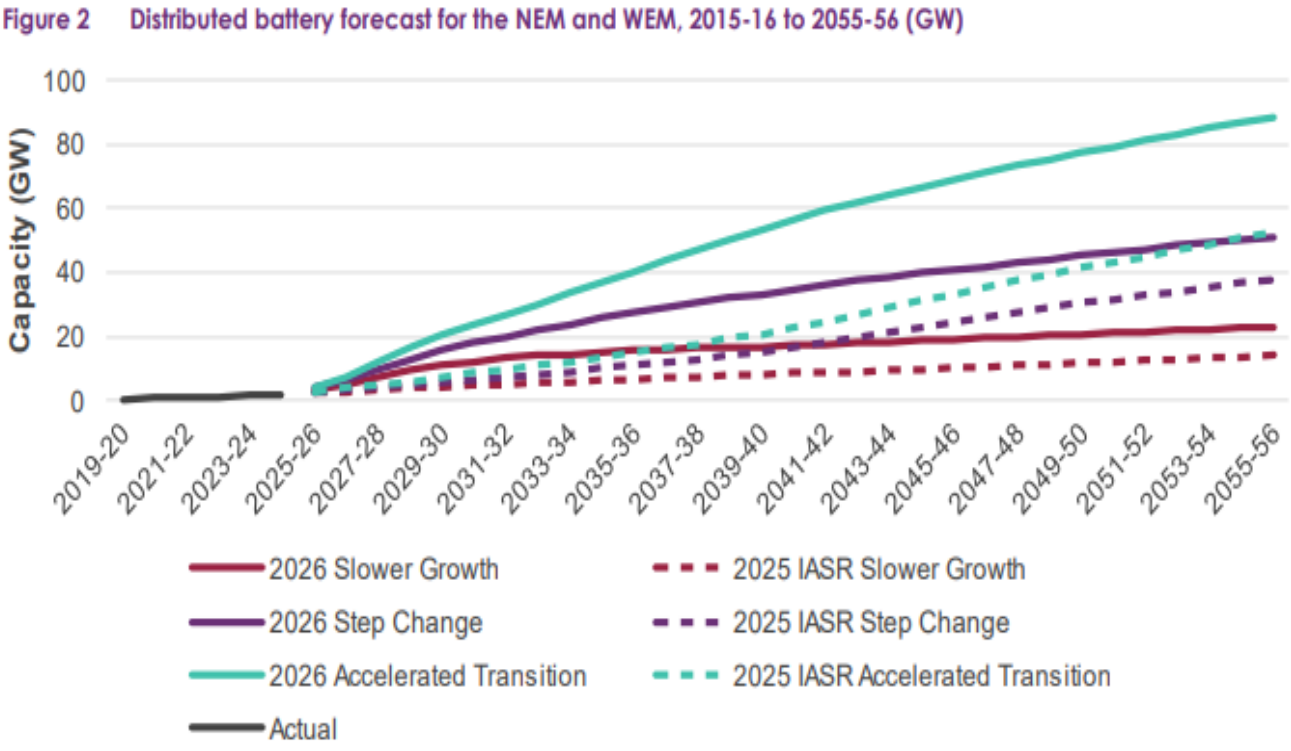
We note the following graphs from the supporting documents for the *Forecasting Assumptions Update*.

Figure 3 Actual and forecast distributed PV installed capacity (NEM) and (WEM)



[9] AEMO | Draft 2026 Forecasting Assumptions Update

Figure 4 Distributed battery forecast for the NEM and WEM



Both figures are from supporting Document 3 while CSIRO gives this chart as its summary of assumed costs for battery storage installation, by ISP scenario.

Figure 5 Assumed capital costs for battery storage installations by scenario

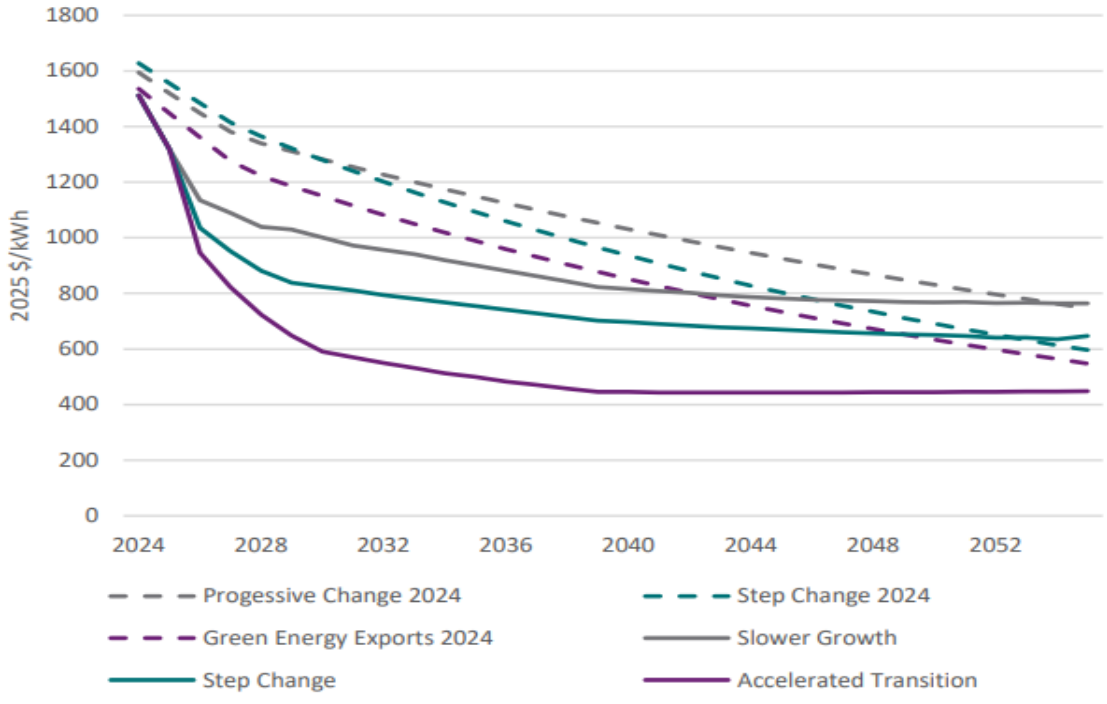


Figure 4-3 Assumed capital costs for battery storage installations by scenario

This data shows that in the roughly one year since the two-part 2025 IASR was released:

- Forecast PV installed capacity has increased significantly for all scenarios
- Forecast distributed battery capacity has increased significantly for all scenarios with step change scenario for 2026 significantly exceeding 2025 IASR projections for (what was) Green energy Exports – the fastest change scenario
- Assumed cost of battery installations falling significantly in the most recent data.

These are remarkable and rapid changes.

This updated data has potential implications for some key aspects of the 2026 ISP, including:

- The Panel infers that the rapid take up batteries during 2025 may well flow into higher levels of Coordinated CER than indicated in the Draft 2026 ISP, both in the shorter and longer terms
- Draft 2026 step change forecasts for both PV and batteries equal or exceed the 2024 Green Energy Export scenario from now until at least the early 2040s
- Distributed battery forecasts for 2026 step change scenario reach 2024 forecasts for Green Energy Exports, the 'ambitious' 2024 scenario in a couple of decades
- The fall in cost of batteries from near $1400 (2025$/kwh) for step change in 2024 to a bit above $800 for step change in Draft 2026 suggests to us that the relative costs of distributed energy solutions (battery focussed) are likely to be nearing or exceeding network solutions in some instances noting that network construction costs continue to grow.

We cannot know whether the rapid change in battery take up during 2025 is a one off or a trend, this recant data however shows, if nothing else, a considerable appetite from consumers, to invest in CER and this, we suggest is likely to continue, at very least for the mid-term (5-10 years).

The Panel is acutely aware of the tension between sticking to the ISP process, which is pressure packed, the merits of being up to date and maintaining separate processes (for example, ISP and ESOO). In this situation we consider the most recent CER data to be significant and appropriate to use for the final 2026 ISP so that the ODP can be as 'optimal' as possible.

Recommendations

- Updated modelling, including sensitivity analysis be undertaken to reflect rapid take up of CER, particularly home batteries and rooftop PV and factored into CDP analysis.
- Updated data from the draft 2026 Forecasting Assumptions Update supporting materials be applied to key Demand Side Factors, including EV projections, distributed PV and batteries/VPP forecasts and GEM – projections for DER
- Undertake a sensitivity analysis of the impacts on the 2026 ODP from applying more recent data from the Draft 2026 Forecasting Assumptions supporting materials. Specifically test the impacts of a more rapid take up of CER, specifically rooftop PV and home batteries, than considered in the 2025 IASR.
- Undertake sensitivity on more Energy Efficiency.

(Noting the commentary about a $12 billion cost to consumers or under investment in energy efficiency.)

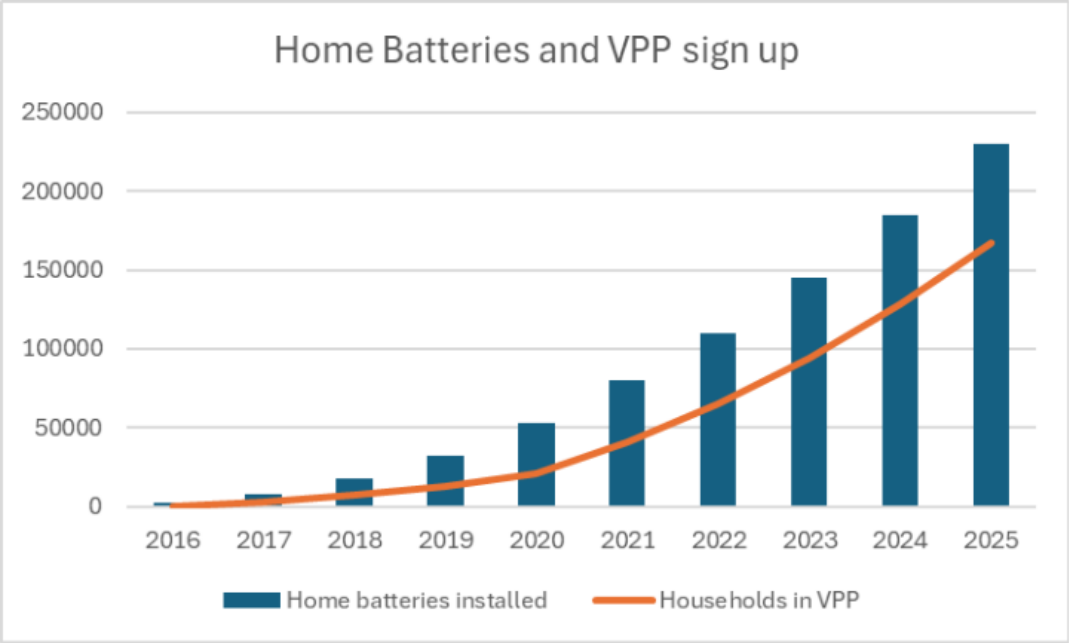
CER coordination

The Panel considers CER coordination to be one of the more important questions posed by the 2026 draft ISP. The relationship between home battery purchase and signing up for VPP's is not as clear cut as we'd anticipated.

Virtual power plants

We started our exploration of the question about virtual power plants (VPPs) take up rates and this relationship with increasing home battery investment, by asking AI (Co-Pilot) and the following was the result.

Figure 6 Home batteries and VPP sign up



Source: Graph is AI generated via a search using Co-Pilot.

We are not convinced that the growing rate of VPP take up from this AI response is accurate, the data sources were vague! However, it gave us enough to suggest that contrary to recent commentary (including from out DSF workshop - see appendix 1) that people were not signing up for VPPs, maybe the sign-up rate was higher than the apparently more pessimistic commentary.

VPPs are currently the predominant way that small consumers can be coordinated to respond to grid needs, given that the demand response mechanism only applies to large energy users. VPPs aggregate and coordinate multiple household battery systems to act like a single controllable load able to be dispatched when the grid needs additional supply. In return for this service, participants receive financial benefits.

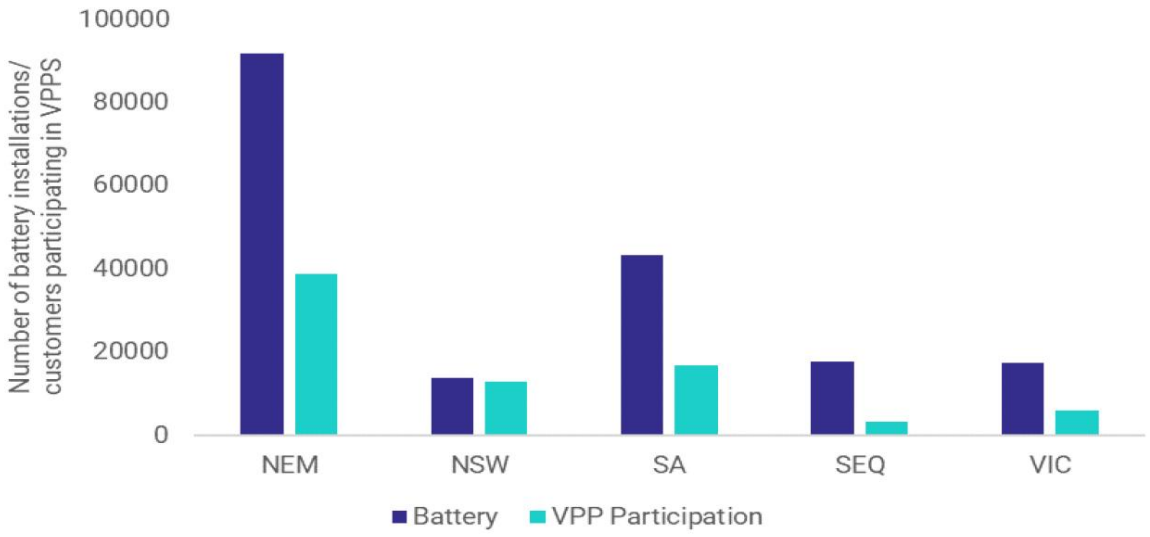
CER coordination is recognised by AEMO as being an integral part of the ODP because it ensures that CER is able to contribute to and respond to grid needs in such a way that benefits all consumers and the system (as well as the owners of the CER). However, rates of CER coordination presented in the DSFS are lower than those in the 2024 ISP. We query this, as there seems to be much flux in CER coordination at present, with trends indicating increasing uptake.

There were 90,000 battery and solar installations installed across the NEM as of January 2025 according to the ACCC[10], with 38,200 of those estimated to be involved in VPPs. This represents 41.5% of consumers with batteries as participants in VPPs, with the rates of VPP participation are growing at roughly 22% every six months from 2022-2025.

Figure 7 Comparison of battery installations and VPP participation rates by region

Figure 3.13: Rates of virtual power plant uptake vary by state, but nationally, participation lags total batteries installed

Comparison of battery installations and virtual power plant participation rates by region, as at 2 January 2025



Source: ACCC analysis of retailers' and AEMO distributed energy resources data.

Competition and a diversity of offers is aiding the uptake of VPPs, where small retailers and non-retailers are providing a majority of VPPs. However, there remain barriers both to providers and to customers pursuing VPPs. For providers, a VPP offering requires significant software investment and regulatory requirements, and for consumers there are concerns about loss of control, battery health, value and lack of trust in some providers.

The ACCC report (July 2025) found that VPP participants pay cheaper energy bills than others with solar and batteries.

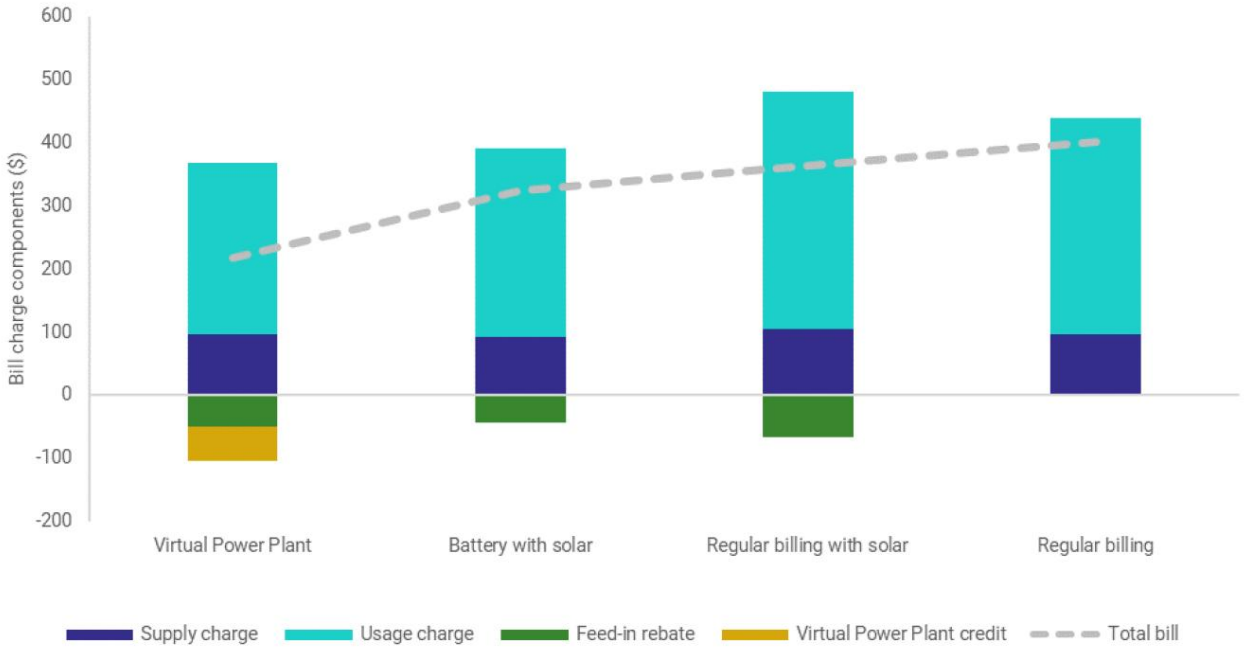
In NSW, IPART found that VPP customers had lower median bills than other households, including those with solar and a battery. The median quarterly bill can be 34% to 72% lower than that for customers with solar and a battery. (IPART 2024-25 review.)

[10] ACCC source: https://www.accc.gov.au/system/files/inquiry-national-electricity-market-report-july-2025.pdf

Figure 8 VPP customers have cheaper bills

Figure 3.15: Virtual power plant customers have cheaper bills

Comparison of bill components between virtual power plant customers and other customer types (excluding EnergyAustralia virtual power plant customers), quarter 3 of 2024



A number of participants at our DSF workshop identified Amber Electric as company a that was proving to be attractive to home battery owners, Amber claims that "Amber operates the largest virtual power plant (VPP) in Australia, with almost double the capacity of the next biggest player". They have "over 40,000 customers". The AEMC lists 14 VPP[11] providers. This suggests to us that there is increasing interest from energy businesses in VPPs and interest by some to trial alternative models. Perhaps a growing number of VPP providers will increase the level of interest from consumers and take-up rates. We wonder whether rates of sign up to Amber, at least over the next few years, may be a useful data proxy for VPP investment.

We observe that VPP take up rates are not as pessimistic as some observers suggest and may well be increasing as a rate of take up for new home battery investors. It is a clear question for which better data is needed, including to better discern impacts on the energy system and hence future ISPs.

The Panel thinks that AEMO should be progressively improving its database regarding levels of VPP take up and exploring the factors that influence take up, along with impacts of VPPs on energy markets and supporting communications that encourage consumers to be a part of well managed VPP schemes.

[11] https://www.aemc.gov.au/news-centre/data-portal/retail-energy-competition-review-2020/vpp-offers-available

Recommendation:

That AEMO progressively improves its data base regarding VVP take up by consumers and VPP impacts on energy markets for the 2028 DSF and beyond.

This first DSF statement has demonstrated the importance of demand side factors, particularly for distribution network roles in enabling CER utilisation.

The work on CER, particularly PV and batteries, also provides solid evidence of the increasing role in energy markets of distributed energy. We recognise that this includes grid scale DER (distributed energy resources) which, coupled with CER, identify the emerging role of distributed energy. The Panel suggests that the shift in the ISP from a transmission plan focus to more of a whole of system plan means that a distributed energy focussed scenario should be included as one of the 2028 ISP scenarios. We suggest that this would likely be a fourth scenario, to maintain consistency with the three existing scenarios.

Recommendation:

A distributed energy scenario being added to the 2026 ISP scenarios, utilising updated DSF data and related inputs

Electric Vehicles (EV)

The Panel recognises that electric vehicle to grid (V2G) has considerable potential to add battery storage capacity to energy networks, boosting the contribution of household batteries (through VPP's) and grid scale batteries. We also recognise that EV purchase rates are increasing but are still modest compared to many past predictions and likely very modest compared to purchase rates over the coming decade.

The DSF statement is right to give some attention to EVs, our only comment at this stage is to support data gathering about EV's and V2G developments in future DSF statements and to recognise that both policy and EV charging tariffs will be crucial to build trust and provide incentives for significant future participation in V2G by households.

Energy efficiency

"The additional generation and storage deployments observed in Lower Energy Efficiency contribute to an additional $12 billion in system costs by 2049-50 compared to the Step Change scenario" (page 41).

This projected loss for consumers emphasises the importance of concerted and prompt action to implement the policies and programs that will deliver energy efficiency and the flow on benefits for both consumers and the energy system

At present the DSF statement identifies two types of energy efficiency improvements: those that improve the technical efficiency of consumer and commercial appliances (including industrial processes), and those that improve the thermal efficiency of buildings such that the energy needs of heating and cooling devices are reduced. The DSFS found that extending current levels of policy support for energy efficiency out to 2050 would save $12 billion dollars in avoided costs, because less generation and less transmission would be needed. This is a significant benefit to consumers.

Australian housing stock is still well below European counterparts for energy efficiency standards, especially for rental housing. It is in consumers interests, to assume (hope!) that energy efficiency standards and programs will increase into the future, especially as heat stress becomes more pronounced with a changing climate. In addition to new building standards,

policies to support programs around household retrofitting (for example, draft proofing, curtains, double glazing, insulation) behaviour change have been effective to drive energy efficiency.

We posit that it is reasonable to expect that governments will enhance energy efficiency programs and targets into the future. We suggest that there would be value in modelling a sensitivity for increased levels of energy efficiency in the future.

The Panel continues to regard Energy Efficiency as providing significant opportunities to both reduce household energy costs while improving health and comfort levels as well as reducing carbon emissions.

Given the value of levels of energy efficiency already modelled in the DSF, it would be useful to know how much more could be saved if energy efficiency policies were enhanced over time.

Recommendations

That enhanced modelling of energy efficiency opportunities be undertaken for 2028 ISP, including which EE options give best (cost effective) outcomes for the energy system and consumers for the 2028 DSF.

The 2028 DSF include discussion about what needs to be done to enable much better take up of Energy Efficiency than is currently forecast (DEECCW and Commonwealth and jurisdictional governments).

Appendix 1: Notes from DSF Workshop, 5 February 2026

On 5 February 2026, AEMO and the Consumer Panel co-hosted a workshop of people with a keen interest in the Demand Side Factors. The following notes are from that workshop and are in response to two questions that were discussed by breakout groups and a number of the ideas and comments have been included in the Panel's reports.

Overarching Q4 from Draft 2026 ISP: *Does the Optimal Development Path appropriately identify and leverage distribution investment opportunities?*

Short Answer: it's a good start, with more work needed in next versions on:

- Battery storage levels, new data showing rapid take up and suggests a sensitivity for final 2026 ISP with higher battery levels
- VPP take up rates and grid impact and "coordinate CER estimates in draft 2026 ISP.
- Role of mid-scale / community energy
- Energy efficiency: underdone in DSF, plenty of opportunities for EE improvement, more EE should also be a "sensitivity' alongside the $12b lost by not enough EE by 2050 finding.

'Car park' (Comments made during workshop discussion that were outside the discussion at the time)

- A community battery scheme, similar to the home battery scheme would increase incentive for community based (mid-scale) projects that can significantly enhance "coordinated CER/DER" as well as social licence.
- "Electrification" is mentioned in the DSF statement but there is no section in the report outlining the assumptions. There is opportunity for the 2028 ISP to drill into gas to electricity fuel switching impacts, both for residential and industrial sectors.
- Data collection from DNSPs should be open access.

Other reports and research:

Various reports were mentioned that the Panel was encouraged to reference, including:

Rob Murray Leech and Energy Efficiency Council report on Energy Efficiency, demand management and electrification: https://eec.org.au/wp-content/uploads/2025/10/EEC-17-4-28-Senate-Inquiry-submission.pdf

ACCC: Inquiry into the National Electricity Market report – July 2025 https://www.accc.gov.au/about-us/publications/serial-publications/inquiry-into-the-national-electricity-market-2018-26-reports/inquiry-into-the-national-electricity-market-report-july-2025

National CER Roadmap: https://www.energy.gov.au/sites/default/files/2024-07/national-consumer-energy-resources-roadmap.pdf

Breakout 1

Question 1: *Do the trends in CER, CER coordination and EVs presented in the 2026 ISP's optimal development path align with your understanding of likely and desirable outcomes for consumers? If not, why not?*

Supplementary questions:

- *Did the Draft 2026 ISP explore appropriate levels of CER coordination to support its insights?*
- *How could the DSF statement better consider energy efficiency opportunities?*

Modelling, scenarios and inputs

- Uptake of technologies (for example, PV, EV, VPP) can be unpredictable and influences by unforeseen, sometimes random things as well as planning things e.g. media events, programs, price, international markets.
- Need for wide range of scenarios and choose 'least regrets' approach.
- Do we have the ability to map an outrageous scenario, in case that ends up being the most likely (as precedent by Greenpeace has shown)?
  - Mapping non-linear scenarios/solutions e.g. solar efficiencies with PV integration, PV integrated EVs.
  - Households getting highly self-sufficient – We underestimate these scenarios when they are arguably more likely to happen than the green-export forecasts. Great to see an accelerated technology scenario.
- Seems risky that the ODP is very reliant on consumer decisions within a market dominated by for-profit companies (retailers).
- Difference between what's likely and desirable, constant tension.
- What decisions do consumers really have? What motives are/ would drive VPP participation and CER adoption?
- Need more innovation in the space and support for other actors to get involved that can better represent consumer interests and system needs.
- Should consider including sensitivity analysis for:
  - High energy efficiency
  - High levels of CER coordination.
- Battery forecasts
  - Clarify if and how battery forecasts are updated in FAU (forecasting assumptions update) for recent events.
  - Further analysis on geographical distribution of batteries
  - Specify base year increases and forecast increases?
- Community batteries – mid scale, what data is available and needed?
- Vehicle to grid is given as zero through to 2030, is not there more potential for this?

  - Noted that scenarios differ, it is zero in 'step change'
  - Should be in CER workplan so it is more measurable before 2030.
- Be clearer about barriers to CER orchestration.
- Community batteries – mid scale, what data is available and needed?
- Community batteries – mid scale, what data is available and needed?

Community energy / batteries

- Community batteries can help address equity issues and increase participation while delivering system benefits (ease of visibility and control).
- There is a sizable cohort of highly engaged and interested community members/consumers who are keen to help drive the transition. They will invest time and money in it and help bring people in their communities along – building trust and social licence. Community projects have the following unique benefits:
  - Could be a quicker way to deploy MWs of generation and storage, in distribution network – therefore less need for transmission, which is prone to cost and time blowouts
  - Help address equity issues currently facing CER
  - Build trust (in transition) and participation (including in VPPs)
  - Leverage otherwise untapped source of capital funding
  - SOCIAL LICENCE
  - Build resilience and reliability in face of weather events for remote/ rural communities.
- Current focus on CER in DSF, but not DER. This is a big gap. Need to keep visibility into mid-scale (100kW-30MW) and look into the unique opportunities/ contribution this scale can make to ODP, for example, community energy, council energy, farms, community batteries.
- See Community Power Networks sandbox trial, Ausgrid.
- There is community interest in funding community batteries and getting benefits for themselves and networks.
- 2028 ISP should explore how to encourage and develop DER – collective/ community-based generation and storage (mid-scale).
- Community batteries – mid scale, what data is available and needed?
- Behind-the-meter optimisation should be priority (accounting for volatility).
- 'Material impact':
  - Passive battery = more investment infrastructure acquired
  - No need to duplicate utility storage investments if you install dynamic batteries.
  - If DOEs get rolled out successfully, there's no need for network investment. This should allow for the optimization of the existing network (unless there's an overwhelming amount of DER that needs to be addressed). VPPs can use as much capacity as they want without causing the need to invest more.

- The language of DER coordination is so fraught for those attempting to reach in and coordinate activities: Dynamic batteries can respond to network restraints (whether it's in wholesale or not), if it is connected to DOE.

Virtual Power Plants (VPPs)

(Note: the Amber model and Amber's approach was part of discussion by all break out groups with generally positive comment about its approach and comments about its rapid rate of sign up.)

- VPPS have ability to respond to certain value streams but hard to reflect these in the modelling.
- Trust is an important issue, but evidence from UK that clear dollar benefit can overcome trust issue, for example, a guaranteed monthly $x dollars off your bill.
- Market is still immature - much to be worked through for sustainable business model for community-based projects.
- Technology software status and cost a barrier.
- Problems with existing retailer offers:
  - no mandated disclosure of profits to 'share' between customer and aggregator - need a minimum profit share of 50%
  - AER's comparison website does not publish VPP offers.
- Will VPP's survive if there is less volatility in the wholesale market?
- Community VPPs currently still require a retail partner - but noting Ambers' success in the market, should this continue?
- VPPs (including wholesale price exposure options such as Amber) didn't go as projects in 2024 ISP (uptake has been lower) but has started to increase recently.
- Will state (for example, WA, NSW) requirements to be VPP ready translate into VPP participation? In short term? Long term?
- Is Amber considered a VPP for AEMO's purposes? Does response to wholesale price signals (and therefore will help deal with peak demand) – but isn't visible to AEM in the same way.
- Could VPP and other energy services be delivered by actors other than retailers?
- Historically there's been unwillingness from consumers to participate in VPPs (for example, to hand over control of an expensive asset, not trust retailers to give them a fair deal, ceding personal benefit) but also evidence that consumers respond to signals and incentive.
- VPP offerings need to meet requirements be fit for purpose
- VPPs fundamental for future but are set up for retailers rather than consumers which have different motives.
- More innovation needed in the space
- Anecdotal evidence that Amber is not able to keep up with VPP signup demand at present in NSW (six-week delays for onboarding). Amber does meet the NSW Government requirements for VPP.

(Orange Power from the UK was mentioned as a popular UK VPP/batteries provider that has a similar model to Amber. Website given as www.orangepower.co.uk The Panel has not been able to access this link with LinkedIn and facebook seeming to be the main sources of communication for the company.)

Energy efficiency

- Energy efficiency: benefits come from needing less generation and storage.
  - Where does the $12 billion cost to consumers for underdone EE come from? (as quoted in DSF)
- Could do a lot more with energy efficiency.
- Absence of interim projections to check progress on trends?
- Transparency of data used by AEMO, for example, GEM, CSIRO is lacking.
- what about electrification in the DSF?
- Target heat pump in an energy efficiency program for example.
- EE should be quantified further in the DSF?

Electric vehicles

- EV predictions – very unpredictable, especially V2G
  - Will depend on incentives and support programs e.g. charger network
  - May need to distinguish between rural/regional and urban population purchase trends.
- Australians tend to keep cars longer, so replacement timeline is longer = long transition into EVs.
- EVs pushed into network will be limited by inverter sizes (cannot do a huge amount at once) unless something is reformed.
- Market cap may incentivise individual household EV owners to push out into the network.

What needs to happen?

- Stronger consumer protection for batteries – to reduce distrust
  - Also, a stronger focus on communications and engagement is needed.
- Distinction between CER and DER, ISP to explore the difference between the two to address equity issues + moving transition quicker + trust issue to get participation happening.
- Tariffs: reforms are needed coupled with apps and education / communications
  - There is distrust of VPPs. Is this accounted for in DSF modelling?
- VPPs need to have clear benefit for consumers
  - With comparisons to wholesale prices being readily available
  - Transparency essential in all VPP related communications.
- Passive DER, this can be managed by software

  - Supported by reflective price signals from retailers.
- Significant opportunities in flexible hot water management - cheaper than batteries.
- Re efficiency improvements – see, for example, "Greenhouse and Energy Minimum Standards (GEMS) regulatory program:
  - Appliances/housing/vehicles
- Independent review of distribution networks required, like the Nelson Review.

Other matters

- Expand use of dynamic operating envelopes to provide greater capacity in the distribution network and relieve network constraints and voltage issues.
- Address issues arising from higher existing voltage (greater than 230) observed in many DBs.
- Impact of inverter sizes on opportunities to expand export input into the market.

Discussions on developing demand-side mechanisms

- Reference to the potential for the Wholesale Demand Response Mechanism (WDRM) to reduce demand on the system at critical periods by improving demand-side participation in the wholesale market.
- Similarly, the potential benefits to CER of expanding flexible trading ('unlocking CER benefits through flexible trading) and integrating price-responsive resources into the market through implementing the proposed AEMC rule changes.
- Accelerating growth in DER market generally.
- Importance of connection standards - see ENA report on this to support coordination of CER.
- Price/export tariff benefits, see NT example.
  - Network needs should be better communicated to consumers
- Curtailment – what is the efficient level?

Question 2: What needs to happen for optimal distributed energy to benefit both consumers and the 'system'?

Supplementary questions

- *What key impacts do participants believe will be provided by VPPs / coordinated DER, and is the DSF / ISP capturing this reasonably, to support the DSF and/or the ODP?*
- *What learnings have participants had on the role of batteries (passive), and is there a key distinction between passive and dynamic batteries, such that there's a material impact expected on the power system of one vs the other?*
- *What concerns would the participants have on retailer / VPP churn, such that coordinated VPP activity might drive temporary benefits, that may go away if/when customers move off VPP arrangements?*

- Distrust of constant changes to FiT and so clear consumer protections needed to ensure community outcomes weighted against.
- Stickability with VPPs! Is it because people want to or have to under state schemes? Are people opting out as soon as they don't have to? Stickability is strong with Amber.
- Question re VPP retailers having to Hedge???
- DER must be valued and procured where it delivers greatest value to both local community and system benefits.
- 'Network batteries' a more accurate term than 'community batteries' in most cases. (Note: The Panel has used the term "Neighbourhood batteries" to describe those that are not directly community owned / operated).
- DNSPs have different classes of consumers (for example, with PV, with PV & battery) – is this being used/ analysed as part of DSFS?
  - Could AEMO / consultants do analysis to understand CER trends by:
    - o Regional/ urban
    - o Post code and socio-economic status
    - o Rental, apartment, home ownership rates
    - o Behavioural data, for example, electricity use for those with batteries and solar
    - o Age (are younger people investing in CER? Do they own their own houses?)
- Might help to give greater accuracy to modelling trends and help target interventions where needed. For example, if we know that younger people support the energy transition but are disproportionately not able to install CER, maybe incentivising collective opportunities to invest in generation and storage (such as community energy) might be beneficial for them and system OR if we know that over 60s have PV and batteries but are not inclined to participate in VPPs, then targeting them in education/support campaigns?
- Concerns around reliance on private ownership of the VPP provider and meeting objectives of the ISP outcome (trust issue)
  - Distrust from feed in tariff and a belief people have been duped
  - Consumer protections need to be clear, more heavily regulated to ensure community outcomes are weighted against profit initiative
  - Many people purchased solar for feed in tariff, they don't understand
  - Agencies need to establish a trustworthy framework
- Looking into consumer behaviour and what impacts it.
- A lot of disinformation that influences peoples' energy habits, for example, political influences.
- We need VPPs to work well for people to receive benefits.
- EV charging flexibility vs behind the meter batteries.
- Take up / signup of VPPs vs batteries.

  - Uptake of VPPs getting closer to batteries
  - No variable data to support this yet though.
- There are social licence / trust issues with anyone else controlling CER (rooftop solar)
- 'Stickability' of VPPs, is it because people want to or have to under state schemes? Are people opting out as soon as they don't have to?
  - Mirroring things in the UK
  - Innovative retailers go out of business in 2022 (risk) - private sector always has a risk
  - What's the risk for Amber? Will they still be around in 10 years' time.
- Personal lived experience around batteries.
- CER vs DER discussion, DER must be valued and procured where it delivers the greatest local benefit + system benefits
  - CER, consumers are making that judgement
  - How do we get these funded and in place?
  - DNSP modelling?
  - Batteries / VPPs mostly installed by DNSPs
  - Naming of mid-scale batteries.
- Batteries, tricky one, reputable brands forecasting of solar, load and prices, and schedule according to that. If the customers on a tariff, as soon as they enter the relevant time period, the battery will charge or discharge.
  - Yes, there is a difference between operational patterns (batteries).
- AEMO just starting to get more and more data
  - Does AEMO get better data quality around batteries?
  - AEMO said: Currently from DNSPs, postcode level forecast for some things.
- How granular does the data go? Can AEMO get data that can make distinctions region / urban, postcode, social econ status.

(Note that these comments are as recorded on the workshop and from three breakout groups. The notes have not been fully integrated and so there is some duplication. The views expressed are from individuals and to not necessarily reflect consensus views or align with Panel thinking. This said, the Panel considered there to be a high level of alignment of opinions between participants and Panel members.)