Appendix 2.5: Distributed energy resources integration step change

Regulatory proposal for the ACT electricity distribution network 2024/29

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Glossary

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australia Energy Regulator
BAU	Business-as-usual
BESS	Battery energy storage system
BTM	Behind the meter
CBA	Cost benefit analysis
CECV	Customer export curtailment value
DER	Distributed energy resources
DNSP	Distribution network service provider
DOE	Dynamic operating envelope
DSO	Distribution system operator
EV	Electric vehicle
FTE	Full time equivalent
HV	High voltage
ICE	Internal combustion engine
LV	Low voltage
Opex	Operating expenditure
PV	Solar photovoltaics
RCP	Regulatory control period
SOCI	Security of Critical Infrastructure Act 2018
STATCOM	Static synchronous compensator
VPP	Virtual power plants
ZEV	Zero emissions vehicles

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1 Executive summary

1.1 The need for successful DER integration

In the past decade, there has been a considerable shift in consumer, industry, and government interest in decarbonising industries, specifically focussing on decentralising the electricity network through the adoption of distributed energy resources (DER) technologies. As demand for these technologies grows, electricity operators will need to ensure the networks are equipped for additional consumer assets and demand on the network and potential power system security risks.

As such, Evoenergy has a responsibility to ensure the successful integration of DER on the network, meeting the priorities and expectations from the broader community and developing the capabilities required to enable and support safe and high-quality DER in a prudent and efficient manner.

In line with Appendix 1.5 of the Regulatory Proposal, Evoenergy's DER Integration Strategy, Evoenergy is proposing to develop the capability that will support a better understanding of DER impacts on the network and enable management of the network such that increasing levels of DER can connect and actively participate in the network.

For the 2024–29 regulatory period, these enabling capabilities can be placed into three categories: network visibility, network operation, and enabling projects. A description of these categories is summarised below:

- **Network visibility** – Increasing the level of visibility in the network, particularly in the low voltage (LV) parts of the network, to enable data-driven planning, forecasting, decision-making, and compliance monitoring on customer and network performance. Network visibility will improve existing business functions and efficiency in network investment and enable dynamic network connections for DER.
- **Network operation** – Capability to implement and communicate flexible access to DER customers and aggregators and shift away from only offering static export limits. Dynamically communicating and allocating network capacity to DER customers through dynamic operating envelopes (DOEs) will improve the efficiency and utilisation of the network, unlocking value for customers.
- **Enabling projects** – Proactively resolving forecasted network constraints and alleviating customer curtailment through trialling innovative technologies and targeting investment in the network where it makes sense to do so from an economic perspective based on avoided curtailment. This will avoid the need to reactively address issues as they arise and enable and encourage additional DER to actively participate in the network.

This business case reviews three options for DER integration for the 2024–29 regulatory period, including:

- **Option 1 – Base Case** – Maintain the current practice of enabling DER through reactively addressing network constraints as they are identified and restricting the export capacity of new DER customers.
- **Option 2 – DER Readiness** – Gain readiness for increasing levels of DER connecting to the network through developing a base level of Distribution System Operator (DSO) capability to handle bi-directional power flows, improve customer access to dynamic exports and improve network utilisation.
- **Option 3 – Rapid Transition** – Prepare for rapidly transitioning to a high DER-penetration system by developing a greater level of DSO capabilities, efficiently and proactively resolving network constraints where it is economically justified to do so, and optimising network utilisation.

To ensure Evoenergy obtains these enabling capabilities in a prudent and efficient manner, Evoenergy has performed a cost-benefit analysis (CBA) across these options. The CBA outlines the operating and capital costs, and benefits of DER integration. Capital costs are related to quality of supply, reliability, and augmentation expenditure.

1.2 Recommended option

Option 2 is the recommended option based on a CBA of the costs and benefits associated with all three options. Option 2 reflects a 'no regrets' approach to integrating and enabling DER, which supports Evoenergy in acquiring core capability and functionality in line with the technological and regulatory progression of the industry and customer expectations while also aligning with Evoenergy's corporate objectives.

Option 2 has a net benefit differential of $3.1 million over 20 years compared to Option 1, which is higher than the other options and indicates that the additional investment proposed in Option 3 will not derive the highest levels of benefits at this time. Option 2 also received the greatest support through Evoenergy's community consultation, with 77 per cent support and an additional 15 per cent of the community panel suggesting that Evoenergy should do more.

Option 2 is expected to require $17.08 million in expenditure over the 2024–29 regulatory period, including both operating and capital expenditures. The total expenditure associated with each option over the 2024–29 regulatory period is summarised in Table 1 and the split between total opex and capex for all options is illustrated in Figure 1.

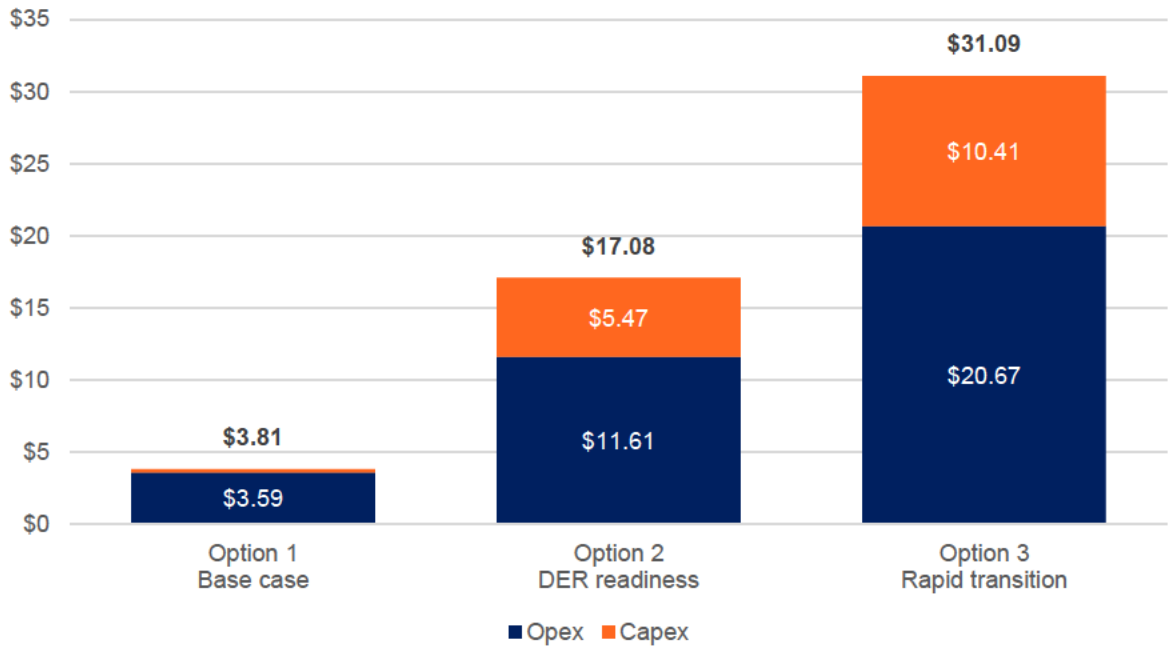
While Option 1 represents the base case and Evoenergy's existing approach, Option 1 does not adequately support the enabling capabilities required to meet increasing DER integration. As the network is not designed to efficiently optimise two-way energy flow, Evoenergy needs to invest in the right capability to ensure successful integration of DER into the network based on feedback from our customers and the Australian Energy Market Commission's (AEMC) review into access, pricing and incentive arrangements for DER. With an increasing demand for DER in the system, Evoenergy is expected to experience an increase in opex in response to the change in its operating requirements related to DER. Evoenergy can continue to keep the current level of expenditure outlined in Option 1, but this will not support the ongoing DER integration, nor will it support compliance with the Security of Critical Infrastructure Act 2018 (SOCI). SOCI requirements are being further developed as part of Evoenergy's overall compliance response to SOCI.

Table 1 Total opex and capex cost summary for all options ($ million, 2023/24)

	2024/25	2025/26	2026/27	2027/28	2028/29	Total
Option 1	0.62	0.56	0.71	0.85	1.07	**3.81**
Option 2	7.96	2.28	2.20	2.23	2.41	**17.08**
Option 3	14.86	4.00	4.03	4.01	4.19	**31.09**

Notes: Opex and capex have been included as the CBA was undertaken on a total expenditure basis. These costs are incremental to the expenditure level to achieve compliance related to the quality of the electricity supply.

Figure 1 The split between total opex and capex for all options ($ million, 2023/24)



Note: Option 1 (base case) is $3.81 million, which consists of $3.59 million for opex and $0.22 million for capex.

1.3 Proposed opex step change

Table 2 outlines the DER integration opex step change forecast for the 2024–29 regulatory period.

Table 2 DER integration opex step change ($ million, 2023/2024)

	2024/25	2025/26	2026/27	2027/28	2028/29	Total
Option 2 - DER integration step change	2.63	2.21	2.20	2.23	2.34	**11.61**

Evoenergy will revise the DER integration step change in our revised regulatory proposal based on updates to a range of factors, including:

- Inflation
- Labour cost escalators
- Population projections
- Customer export curtailment value (CECV)
- Value of Customer Reliability (VCR)
- Long run marginal cost (LRMC) estimates.

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2 DER overview

This chapter provides an overview of Evoenergy's DER integration program and the drivers for the opex step change. **This section only addresses the preferred Option 2, with the detailed options analysis included in Appendix 2.5.A**. Additionally, this business case does not consider DER integration as part of compliance with SOCI, which is being further developed as part of Evoenergy's program for overall compliance with SOCI.

2.1 DER overview

The national energy system and the National Electricity Market (NEM) have been transforming at an increasingly rapid pace through enhanced customer adoption of DER, including rooftop solar photovoltaics (PV), behind the meter (BTM) battery energy storage systems (BESS), and electric vehicles (EV).

DER technologies are significantly changing how electricity is used, generated by consumers, and managed by network service providers. The energy traditionally generated in large-scale centralised power systems is continually shifting towards a decentralised system where residential, commercial, and industrial customers generate their own electricity at certain times.

An increase in DER adoption introduces additional volumes of electricity being exported by consumers. If not appropriately managed, two-way energy flows can cause technical issues and challenges on the network, including:

- Exports from decentralised systems can cause network voltages to rise, which can trigger inverters to trip off (to maintain power quality), resulting in lost generation.
- Batteries and EVs can charge and discharge energy which changes a customer's energy usage profile and usage of the network. At scale and in aggregate, these technologies will contribute additional load and may increase peak demand, and introduce new reverse power flow peaks, if not coordinated effectively.
- Non-coincident peak exports and peak demand (exports in the middle of the day and demand in the evening) can cause voltage swings that are challenging to manage through network solutions.

Given solar PV capacity, BTM battery capacity, and the number of EVs expected in the Australian Capital Territory (ACT) over the next 20 years, DER adoption will increase significantly. The uptake of DER is based on ACT Government and AEMO modelling (see Table 21), where under a medium forecast scenario:

- Solar PV capacity is forecast to increase by 75 per cent by 2030
- Battery capacity is forecast to increase by 175 per cent by 2030
- The number of EVs is forecast to increase from the current approximately 2,000 vehicles to 51,300 vehicles in 2030, representing a 25-fold increase in EVs.

An overview of the anticipated trajectory of DER adoption in the next 20 years can be found in Appendix 2.5.D.

2.2 The current DER market is accelerating

The ACT's power system is becoming increasingly decentralised. Growth in DER is projected to rise significantly over the next regulatory period, and the Evoenergy network will increasingly face two-way energy flows from exports from solar PV, batteries, and additional load from batteries and EVs. This is influenced by changing expectations within industry, regulation, government, and customers:

- The ACT Government legislated a net zero greenhouse gas emissions target by 2045,[1] which will impact Evoenergy's system by electrifying transportation and gas appliances while maintaining 100% renewable electricity in the ACT.
- The ACT Government released its Climate Change Strategy for 2019–2025, including the provision of key priorities for the strategy, which align with the transportation of electricity[2]
- The AEMC released the Access, Pricing and Incentive Arrangements for DER rule change (Rule Change) which places clear obligations and opportunities for Evoenergy to efficiently support DER integration.[3] As a result of the Rule Change, the AER has released a series of guidance papers[4], which outlines the approach and requirements for distribution network service providers (DNSPs) in supporting increased DER integration.
- Customers are increasingly interested in adopting DER technology and accessing the benefits available. More information about how customers were engaged with DER technology can be found in Appendix 2.5.E.

Considering these changing expectations and behaviours, the surge in DER adoption and potential technical issues on the network, Evoenergy has a crucial role in streamlining DER integration into the energy ecosystem. This includes managing and operating the distribution network to allow for the connection of customer-driven DER adoption and unlocking value for all customers as the ACT transitions towards a net zero emissions future while also maintaining prudent and efficient investment to ensure all customers benefit from the transition towards more DER.

While Evoenergy has undertaken investment in its current network to support DER, further investment is required to meet customer and ACT Government expectations. Further investment will ensure the following:

- LV network visibility, including network power quality, to accurately understand the behaviour of customers with DER, their impact on the network, and the existing level of capacity remaining to accommodate DER connections.
- Understanding of the level of compliance of installed DER to standards and agreements such as Evoenergy's embedded generation technical requirements[5], DER connection agreements and inverter standards (including AS4777).
- Further modelling, forecasting and analytical capability to accurately measure export service performance and understand the current and future state of the network
- Increased capability to provide DOEs.

[1] Section 6 of the Climate Change and Greenhouse Gas Reduction Act 2010: https://www.legislation.act.gov.au/a/2010-41.
[2] ACT Government, ACT Climate Change Strategy 2019-25, 2019.
[3] Australian Energy Market Commission, National Electricity Amendment (Access, pricing and incentive arrangements for distributed energy resources) Rule 2021, August 2021.
[4] Such as the Export Tariff Guidelines, Customer Export Value Curtailment Methodology, and the Assessing DER Integration Expenditure Guidance Note.
[5] Evoenergy, Power Quality, accessed from https://www.evoenergy.com.au/emerging-technology/power-quality.

Evoenergy has also historically adopted the approach of reactively addressing DER-related overvoltage complaints due to its lack of visibility of the network. The growing level of opex historically required to address these complaints is shown in Figure 2. Further, an analysis of the intrinsic hosting capacity of Evoenergy's existing network shows that residential customers that install a solar PV system have the capacity to export a median of 3.6 kW[6] per customer at any given time before voltage, thermal or capacity constraints occur in the LV and high voltage (HV) parts of the network,[7] which can cause additional power quality issues.

Figure 3 demonstrates that the average residential solar customer's solar PV size being installed in Evoenergy's network has increased over several decades. Further investment is therefore required to ensure better utilisation of Evoenergy's network for static and flexible export limits and to efficiently identify and resolve constraints as energy usage and exports change over time.

Without investment to address these challenges and by continuing with the current approach to reactively address DER-related overvoltage complaints, there is potential for over-allocating export capacity as hosting capacity decreases, leading to a deterioration of quality of supply for customers (such as inverters reducing output due to high voltage). This reduced supply quality can incur costly and reactive remediation activities to address the problems and would require Evoenergy to adopt a conservative approach to connecting DER systems at reduced static export limits.

Based on engagement with stakeholders in the preparation of the regulatory proposal (see Appendix 2.5.E), Evoenergy considers that maintaining the current approach to managing DER connections on the network and limiting DER would be inconsistent with changing expectations within customer, industry, regulatory, and government on the services that DNSPs should provide. Without further investment, customers with and without DER may be impacted by network issues and, therefore, unable to access the benefits and value associated with DER.

[6] Intrinsic Hosting capacity Analysis 2022: Details in section D.3.

[7] This does not include consideration for issues caused by phase imbalance or DER non-compliance with Evoenergy requirements and connection agreements. It also does not provide any contingency for commercial customers to connect solar PV systems.

Figure 2 Historical yearly opex for DER-related overvoltage complaint management ($ nominal)

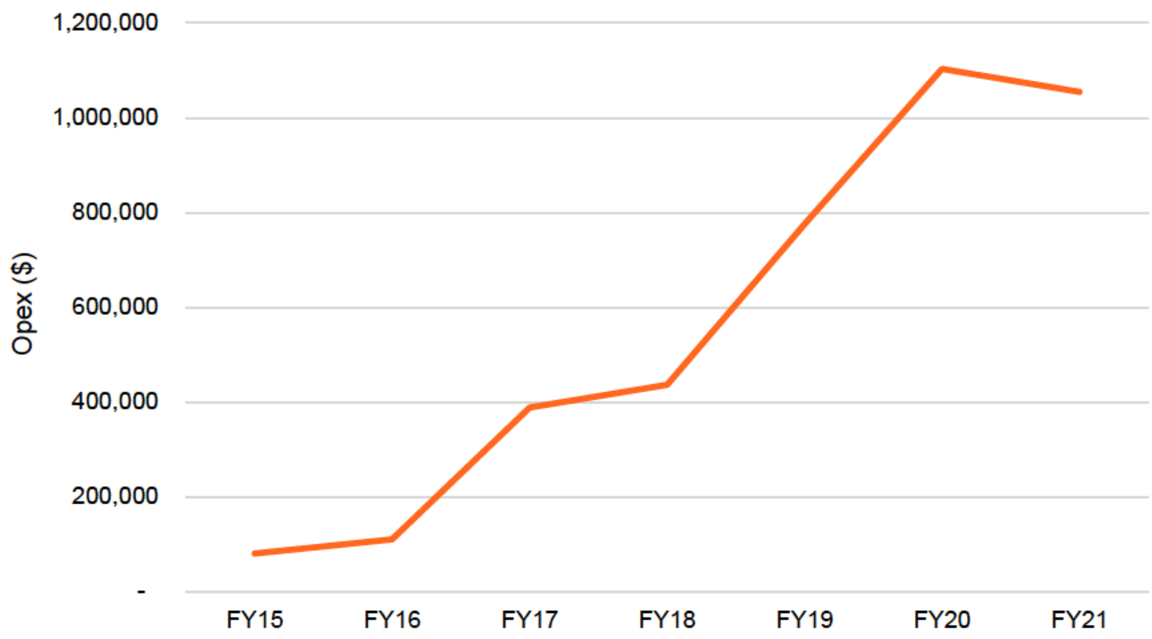
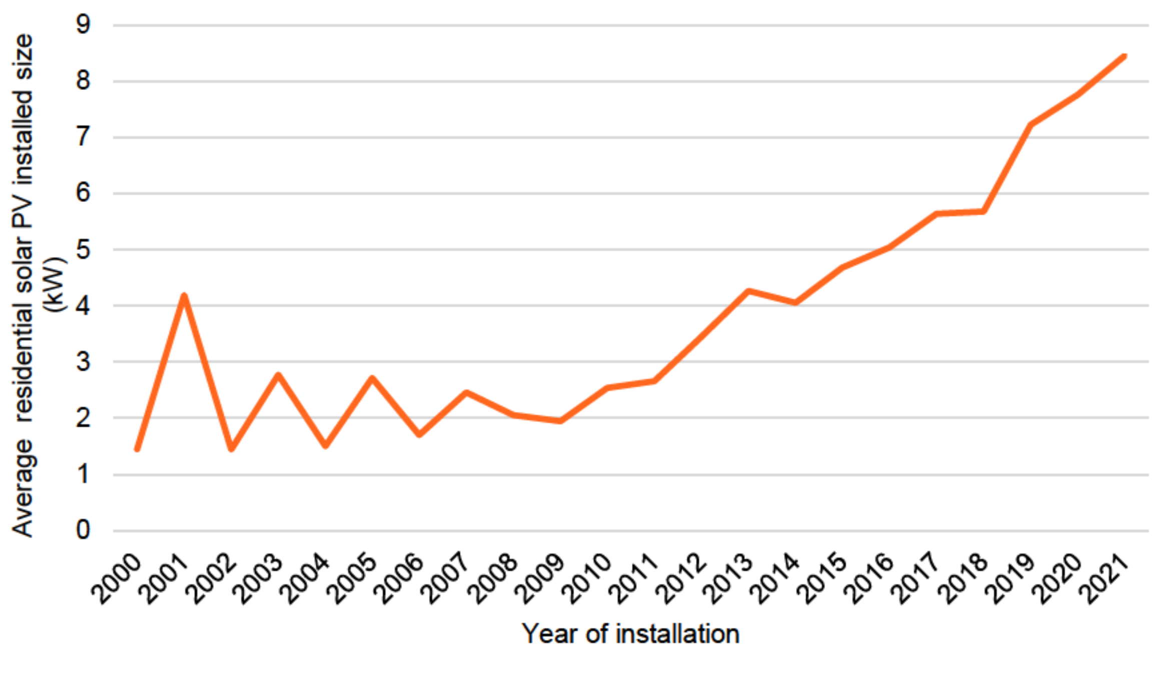


Figure 3 Historical average size of residential solar PV installed by year of installation



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3 Step change forecast

3.1 Reviewing options for DER

Evoenergy has performed a CBA across the following investment options:

- **Option 1 – Base Case** – Maintain the current practice of enabling DER through reactively addressing network constraints as they are identified and restricting the export capacity of new DER customers.
- **Option 2 – DER Readiness** – Gain readiness for increasing levels of DER connecting to the network through developing a base level of DSO capability to handle bi-directional power flows, improve customer access to dynamic exports and improve network utilisation.
- **Option 3 – Rapid Transition** – Prepare for rapidly transitioning to a high DER-penetration system by developing a greater level of DSO capabilities, efficiently and proactively resolving network constraints where it is economically justified, and optimising network utilisation.

Option 2 is the recommended option based on a CBA of the costs and benefits associated with all three options. Option 2 reflects a 'no regrets' approach to integrating and enabling DER, which supports Evoenergy in obtaining core capability and functionality in line with the technological and regulatory progression of the industry and customer expectations while aligning with Evoenergy's corporate objectives. The cost and benefits for each option are summarised in Table 3. Note that there are extensive non-quantified benefits of Options 2 and 3, illustrated in Appendix 2.5.A.

Table 3 Cost and benefit summary for all options ($ million, 2023/24)

Option	Cost over 5-years	NPV 20-year cost	NPV 20-year benefit	20-year net benefit relative to Base Case
1 – Base Case	$3.81	$13.29	$0.07	N/A
2 – DER Readiness	$17.08	$25.23	$15.10	$3.10
3 – Rapid Transition	$31.09	$44.77	$27.95	-$5.00

3.2 Proposed 2024–29 DER integration expenditure for Option 2

To meet Evoenergy's strategic objectives and support DER integration on the network, Evoenergy will need to enhance its capabilities and investments over the 2024–29 regulatory period. Table 4 represents actual, estimated, and forecast DER-related expenditure for 2021/22 to 2028/29.

Table 4 Evoenergy's DER integration expenditure actual, estimated, and forecast ($ million, nominal)

	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	Total EN24
DER integration expenditure	2.32	2.32	2.39	4.98	4.60	4.62	4.68	4.82	**23.70**

Note: 2021/22 is actual, and the remaining years are estimates and forecasts.

Evoenergy spent $2.32 million[8] in 2021/22 to service the needs and capabilities of the network, calculated based on quotes from suppliers, historical costs, and current DER connections. Table 4 demonstrates that Evoenergy is expecting an uplift in opex in each year of the 2024–29 regulatory period as DER penetration increases and, as such, requires a step change in costs.

3.3 Calculation of step change for Option 2

The DER-related investments in our step change reflect Evoenergy's prudent and efficient operating costs. The step change is derived on a basis consistent with the AER's preferred base-step-trend approach, Expenditure Forecast Assessment Guideline and Better Reset Handbook, and in accordance with our approved CAM. Our proposed DER integration step change costs are shown in Table 5.

Table 5 DER integration opex step change ($ million, 2023/2024)

	2024/25	2025/26	2026/27	2027/28	2028/29	Total
DER integration step change	2.63	2.21	2.20	2.23	2.34	**11.61**

As the network is currently not designed to efficiently optimise two-way energy flows, Evoenergy needs to invest in the right capability to ensure the successful integration of DER into the network. With an increasing demand for DER in the system, Evoenergy is expected to experience a material increase in opex in response to the change in its operating requirements related to DER. With the current level of expenditure, Evoenergy is unlikely to maintain compliance with power quality standards required under the ACT Utilities (Electricity Distribution Supply Standards Code) Determination 2013.[9] Therefore, increased costs are unavoidable because the current trend of DER integration will accelerate in the short term.

[8] $2.32 million is in 2023/24 dollars and represents the total cost of export services incurred in 2021/22.
[9] For example, increased tap change operations to maintain compliance with AS 60038 Standard Voltages.

Appendix 2.5.A - Assessment of options for DER integration

Evoenergy has considered three feasible options to enable DER integration, including:

- Option 1 – Base Case
- Option 2 – DER Readiness
- Option 3 – Rapid Transition

Table 6 provides a summary of investment activities to build technical capability and enable DER integration across each of the options. Not all activities that support the enablement of DER are included in this business case, including the use of appropriate tariffs. Information on this can be found in the DER Integration Strategy (Appendix 1.5).

All results assume the medium DER adoption forecast scenario outlined in Table 21. However, sensitivities have been performed on other forecasts and are discussed in Appendix 2.5.B.

Table 6 Options framework

Enabling capability	Activity	Investments	Option 1	Option 2	Option 3
Network Visibility	Data collection and storage	Data from network monitors	✓	✓	✓
		Procure LV smart meter data		✓	✓
		Procure data from third parties		✓	✓
	Analytics	Modelling and forecasting uplift		✓	✓
Network Operation	DOEs	IT systems for DOE / Virtual Power Plant (VPP) integration		✓	✓

Enabling capability	Activity	Investments	Option 1	Option 2	Option 3
Enabling Projects		Community battery		✓	✓
		Voltage management static synchronous compensators (STATCOMs)		✓	✓
		Increase in business-as-usual (BAU) DER-related opex (complaints management)	✓	✓	✓
		Augmentation to increase hosting capacity			✓

Note: ✓ represents an investment in the relevant category; however, the amount of investment may differ across the three options.

A.1 Evaluation approach

In determining the DER Integration Program for the 2024–29 regulatory period, Evoenergy engaged CutlerMerz to undertake a CBA to quantify and compare the total costs and benefits associated with each investment item across a range of potential investment options.

The CBA provides an economic view of the costs, benefits, and net benefits across 20 years associated with each investment option.

For each investment item, costs were developed, tested, and reviewed to ensure estimates were as accurate as possible. Quotes from suppliers were used where possible or otherwise developed based on historical prices used in previous analyses to provide a view with the best information available when producing the results. Benefit types and value streams used in the CBA modelling are summarised in Table 7.

Table 7 Summary of CBA benefit types

Benefit type	Description
Alleviated curtailment	Types of curtailment considered include either offering a static limit to new customers that reduces over time, or exceeding hosting capacity, which results in intervention from inverters to comply with network voltage constraints. This benefit is estimated by quantifying the amount of generation that would have been curtailed using the AER's provided CECV.[10]
Avoided opex related to managing and enabling DER	Sources of opex considered include managing complaints and applying tap-changes to manage voltage. This benefit is estimated by comparing opex between two forecast scenarios, with and without investment items, and taking the difference as opex avoided through investment. The baseline scenario (without investment) forecasts the opex associated with DER based on historical data.
Avoided augmentation	Triggers for augmentation considered include upgrading the network to enable DER exports and EV charging, where they require increased hosting capacity and network capacity, respectively. To address the hosting capacity component, baseline augmentation costs are estimated by assessing upgrades to the LV and HV cables and distribution transformers (where hosting capacity for each distribution substation is forecast to be exceeded) against their associated CECV to develop a portfolio of CECV-justified augmentation. The component of the benefit is calculated to be the augmentation that would be avoided or deferred by alleviating network constraints. To address the network capacity component, benefits are calculated by: • Assessing the incremental increase in peak demand, driven by a combination of managed and unmanaged EV charging behaviours • Multiplying by the network's annualised long-run marginal cost (LRMC) • Calculating avoided augmentation through preventing increased peak demand through the investment items

Evoenergy has adopted a conservative approach in estimating the benefits from the proposed investment items. There are further value streams available which are not quantified and therefore excluded in the CBA modelling, including:

[10] CECV includes the value of avoided marginal generator short run marginal cost (SRMC), essential system services benefits, and reduced line losses in the distribution and transmission network, as outlined in the AER's DER Integration Expenditure Guidance Note.

- Additional wholesale market benefits from avoided generator capacity investment.
- Additional network benefits with improved public and worker safety with neutral integrity, ensuring compliance with relevant standards and performance obligations[11], and reducing the likelihood and duration of outages.
- Additional network benefits from any export service performance incentive schemes.
- Environmental benefits from avoided greenhouse gas emissions.
- Customer benefits from changes in DER investment, avoiding inefficient and unreliable operation of appliances, and improving customer connection experiences.
- Non-monetary customer benefits from reducing curtailment compared to those who would experience inverter ramping or tripping, as well as providing greater choice and offerings to customers to make the most of their investment.
- Non-monetary network benefits from improving reputation through better network performance and customer offerings.

Option 1 – Base Case

Under Option 1, Evoenergy will continue with our current practice of enabling DER through reactively addressing network constraints as they are identified and restraining the export capacity of new DER customers. Activities under this option are outlined in Table 8, while the costs and benefits are represented in Table 9 and Table 10, respectively.

Option 1 is low- cost and relies on third parties and other utilities to lead the energy transition until technologies are proven for adoption.

There are several key risks associated with adopting the base case option, including:

- Limited capability to identify network constraints as the limited data collected cannot unlock the full benefits based on Evoenergy's existing analytical capability.
- No improvement to hosting capacity constraints and customers will ultimately be curtailed as more DER connects to the network.
- Simple fixes to DER-driven network constraints, such as phase balancing and tap changes, may not be possible in every instance, leaving some customers with quality of supply and reliability issues.
- With no development of DOE capability, Evoenergy is likely to be left behind the industry in terms of innovation and advancements.
- Increased expenditure allowance for reactively responding to quality of supply issues.
- Inconsistency with the intent of the AEMC's rule change and ACT Government's net zero carbon emissions pathway and EV strategy.

[11] Including quality of supply and export service provision requirements.

Table 8 Summary of Option 1 activities in each enabling capability

Enabling capability	Investments	Description
Network Visibility	• Data from network monitors	• Evoenergy will gain visibility over the LV network through existing and new network monitoring devices installed as per Evoenergy's Visibility Plan. The new capability will be obtained to collect, store, and manage the data to be used with Evoenergy's existing limited analytical capabilities to analyse customer complaints and identify network constraints. • Costs associated with network visibility in this option include: o Storing and managing data o Increase in labour (approximately between 2 and 4 full time equivalents (FTEs)) to collect, store, and manage the data, including engineers, data analysts and compliance officers.
Network Operation	• Rather than additional investment, Evoenergy is proposing to use a strategy to alleviate this issue.	• Network power quality is to be managed through a curtailment strategy involving applying static export limits that will be adjusted downward over time as DER adoption increases. Some customers may need to be provided static zero export limits as early as 2024/25. Customers are allocated export based on a 'first come, first served' basis.
Enabling Projects	• Increase in BAU DER-related opex (complaints management)	• Evoenergy will reactively address network constraints as they are identified, including simple fixes to power quality and capacity constraints, such as phase balancing and transformer tap changes, if it is possible to do so. • Costs associated with enabling projects in this option include an increase in BAU opex related to DER as DER adoption increases.

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Table 9 Total cost breakdown for Option 1 ($ million, 2023/24)

Investments	Costs over 2024–29					
	2024/25	2025/26	2026/27	2027/28	2028/29	EN24 Total
Data from network monitors	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure LV smart meter data	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure data from 3rd parties	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Modelling and forecasting uplift	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
IT systems for DOE / VPP integration	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Community battery	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Voltage management (STATCOMs)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Increase in BAU DER-related opex (complaints and tap changes)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Augmentation to increase hosting capacity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$0.62**	**$0.56**	**$0.71**	**$0.85**	**$1.07**	**$3.81**

Note: Numbers may not add due to rounding.

Table 10 Total benefits breakdown for Option 1 ($ million, 2023/24)

Investments	Benefits over 2024–29					
	2024/25	2025/26	2026/27	2027/28	2028/29	EN24 Total
Data from network monitors	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure LV smart meter data	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure data from 3rd parties	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Modelling and forecasting uplift	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
IT systems for DOE / VPP integration	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Community battery	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Voltage management (STATCOMs)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Increase in BAU DER-related opex (complaints and tap changes)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Augmentation to increase hosting capacity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$0.04**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.06**

Note: Numbers may not add due to rounding.

Option 2 – DER Readiness

Under Option 2, Evoenergy will build a foundational set of DSO capabilities and gain readiness for increasing levels of DER connecting to the network. Option 2 is achieved through developing a base level of new capability to handle bi-directional power flows, improve customer access to flexible exports, and improve network utilisation. Option 2 involves:

- Installing network devices in targeted locations and procuring data from smart meter service providers and other third parties to achieve 20 per cent visibility across the LV network.
- Developing analytical capabilities to support and improve existing business capabilities, such as improving data quality to increase the accuracy of datasets, checking compliance, analysing customer complaints, and identifying network constraints and hosting capacity.
- Obtaining a base level of capability for DOEs through partnering with an industry service provider and leveraging their software solution. DOEs will be offered to a subset of residential DER customers as an alternative to a static export limit.
- Trialling LV STATCOMs and community batteries in targeted areas to alleviate network constraints, enable a higher hosting capacity and further understand their role in Evoenergy's network to support DER integration.
- Addressing network constraints as they are identified (and not resolved through Enabling Projects or DOEs), including traditional fixes to power quality and capacity constraints, such as phase balancing and transformer tap changes.
- Readiness for increasing adoption of DER and other emerging future market and industry models as the industry transitions towards decentralisation and unlocking additional value for customers.

A summary of the additional activities proposed for Option 2 compared to Option 1 against the three enabling capabilities is outlined in Table 11. The costs and benefits for Option 2 are represented in Table 12 and Table 13, respectively.

Option 2 provides greater levels of export services compared to Option 1 and aligns with the direction that the industry, Evoenergy customers, and the ACT Government are expecting while allowing for the opportunity to develop additional capability incrementally as needed to meet increasing levels of DER adoption. However, there may be some opportunities missed to derive maximum value for customers from the existing network.

Table 11 Summary of Option 2 activities in each enabling capability

Enabling capability	Investments	Description
Network Visibility	• Data from network monitors • Procure LV smart meter data	• Evoenergy will gain visibility over the LV network by collecting and using data from network devices (like Option 1) and procuring data from smart meters and DER aggregators. Procurement and storage of data will target

Enabling capability	Investments	Description

	• Procure data from third parties
	• Modelling and forecasting uplift
		visibility of 20 per cent of the LV network as soon as possible within the regulatory period.[12]
		• In parallel, Evoenergy will also develop its analytical capabilities to support and improve existing business capabilities, such as improving data quality to improve the accuracy of datasets and checking compliance.
		• These datasets, along with further developed analytical capabilities will support analysing customer complaints and identifying network constraints and hosting capacity proactively.
		• Costs associated with network visibility in this option include:
		  ○ Storing and managing data
		  ○ Increase in labour (approximately between 5 to 7 FTEs) to collect, store, and manage the data, including engineers, data analysts and compliance officers
		  ○ Ongoing expenditure to procure data from external parties

Network Operation	• IT systems for DOE / VPP integration	• Evoenergy will obtain a base level of capability for DOEs by partnering with an industry service provider and leveraging available software solutions. DOEs will be offered to standalone batteries and all customers installing new DER. • Software solutions and associated resources will be scaled as required, depending on the rate of DER adoption and the scale of dynamic connection offer uptake by customers. Customers that install new DER, and do not subscribe to the dynamic connection offering, may be provided with a reduced static export limit (as per Option 1). • Costs associated with network operation in this option include:

[12] This will be re-assessed in the revised regulatory proposal to incorporate AEMC's proposed recommendations in their review of the regulatory framework for metering services.

Enabling capability	Investments	Description
		◦ Developing and integrating software from an industry service provider. ◦ Increase in labour (approximately 2 FTEs) to manage software services
Enabling Projects	• Community battery • Voltage management (STATCOMs) • Increase in BAU DER-related opex (complaints management)	• Like Option 1, Evoenergy will address network constraints as they are identified, including simple fixes to power quality and capacity constraints, such as phase balancing and transformer tap changes, if it is technically feasible. • Option 2 will be supplemented with trials of STATCOMs and community batteries in targeted areas to alleviate network constraints, enable a higher hosting capacity and further understand their role in Evoenergy's network to support DER integration. • Costs associated with enabling projects in this option include: ◦ Increases in BAU opex related to DER as DER adoption increases ◦ Trial of STATCOMs ◦ Trial of community batteries[13] ◦ Increase in labour (approximately 2 FTEs) to lead and manage the trials.

[13] The size and number of the community batteries will be re-assessed in the revised regulatory proposal to incorporate details about federal government's Powering Australia plan, expected to be released in early 2023.

Table 12 Total cost breakdown for Option 2 ($ million, 2023/24)

Investments	Costs over 2024–29					
	2024/25	2025/26	2026/27	2027/28	2028/29	EN24 Total
Data from network monitors	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure LV smart meter data	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure data from 3rd parties	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Modelling and forecasting uplift	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
IT systems for DOE / VPP integration	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Community battery	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Voltage management (STATCOMs)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Increase in BAU DER-related opex (complaints and tap changes)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Augmentation to increase hosting capacity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$7.96**	**$2.28**	**$2.20**	**$2.23**	**$2.41**	**$17.08**

Note: Numbers may not add due to rounding.

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Table 13 Total benefits breakdown for Option 2 ($ million, 2023/24)

Investments	Benefits over 2024–29					
	2024/25	2025/26	2026/27	2027/28	2028 /29	EN24 Total
Data from network monitors	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure LV smart meter data	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure data from 3rd parties	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Modelling and forecasting uplift	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
IT systems for DOE / VPP integration	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Community battery	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Voltage management (STATCOMs)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Increase in BAU DER-related opex (complaints and tap changes)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Augmentation to increase hosting capacity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$0.62**	**$0.59**	**$0.62**	**$0.69**	**$0.67**	**$3.20**

Note: Numbers may not add due to rounding.

Option 3 – Rapid Transition

Under Option 3, Evoenergy will be equipped for a rapidly transitioning high DER-penetration system through developing DSO capabilities, such as DOEs to manage bi-directional power flows, efficiently and proactively resolving network constraints, where it is economically justified, and optimising network utilisation.

A summary of the additional activities proposed for Option 3 compared to Option 1 and 2 against the three enabling capabilities is outlined in Table 14. The costs and benefits for the options are represented in

Table 15 and Table 16 respectively.

Option 3 is the most comprehensive in maximising export services on the network relative to the other options and matches other distribution networks in leading the energy sector transition while also aligning with the ACT Government's Climate Change and Zero Emission Vehicles Strategies.

As a result, Option 3 corresponds to higher operating and capital investment levels. There is a risk that some investment may not be optimal for the 2024–29 regulatory period if DER uptake and DOE adoption rates are not realised.

Table 14 Summary of Option 3 activities in each enabling capability

Enabling capability	Investments	Description
Network Visibility	• Data from network monitors • Procure LV smart meter data • Procure data from third parties • Modelling and forecasting uplift	• As per Option 2, Evoenergy will develop LV visibility by collecting and using data from network devices and procuring customer data from smart meters and DER aggregators. Procurement and storage of data will target a visibility level of at least 50% of the LV network as soon as possible within the regulatory period. • In parallel, Evoenergy will also develop its analytical capabilities to support and improve existing business capabilities, such as improving data quality to improve the accuracy of datasets and checking compliance. • These datasets and further developed analytical capabilities will be used to support analysing customer complaints, identifying quality of supply issues, network constraints, and understanding hosting capacity limits. • Costs associated with network visibility in this option include: o Storing and managing data o Increase in labour (approximately between 5 to 7 FTEs) to collect, store, and manage the data, including engineers, data analysts and compliance officers o Ongoing expenditure to procure data from external parties.
Network Operation	• IT systems for DOE / VPP integration	• As per Option 2, Evoenergy will develop capabilities for DOEs. However, the capability will be upscaled to ensure Evoenergy can offer DOEs for all DER customers. • Costs associated with network operation in this option include: o Developing and integrating software from an industry service provider o Increase in labour (approximately 3 FTEs) to manage software services.
Enabling Projects	• Community battery • Voltage management (STATCOMs)	• Evoenergy will proactively target and resolve power quality and quality of supply issues driven by DER exports through upgrades to the network to manage voltage imbalances and network upgrades to resolve voltage, load, and thermal constraints where it is economically justified.

Enabling capability	Investments	Description

	• Increase in BAU DER-related opex (complaints management)
	• Augmentation to increase hosting capacity
		• These projects will also be coupled with reactive approaches to addressing network constraints, including simple fixes to power quality and capacity constraints, such as phase balancing and transformer tap changes if it is technically feasible, as well as a larger rollout of STATCOMs and community batteries compared to Option 2 to alleviate network constraints and enable a higher hosting capacity.
		• Costs associated with enabling projects in this option include:
		  o Increases in BAU opex related to DER as DER adoption increases
		  o Trial of STATCOMs
		  o Trial of community batteries[14]
		  o Increase in labour (approximately 4 FTEs) to lead and manage the trials
		  o Network augmentation where it is economically justified.

[14] The size and number of the community batteries will be re-assessed in the revised regulatory proposal to incorporate details about the Federal Government's Powering Australia plan, expected to be released in early 2023.

Table 15 Total cost breakdown for Option 3 ($ million, 2023/24)

Investments	Costs over 2024–29					
	2024/25	2025/26	2026/27	2027/28	2028/29	EN24 Total
Data from network monitors	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure LV smart meter data	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure data from 3rd parties	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Modelling and forecasting uplift	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
IT systems for DOE / VPP integration	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Community battery	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Voltage management (STATCOMs)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Increase in BAU DER-related opex (complaints and tap changes)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Augmentation to increase hosting capacity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$14.86**	**$4.00**	**$4.03**	**$4.01**	**$4.19**	**$31.09**

Note: Numbers may not add due to rounding.

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Table 16 Total benefits breakdown for Option 3 ($ million, 2023/24)

Investments	Benefits over 2024–29					
	2024/25	2025/26	2026/27	2027/28	2028/29	EN24 Total
Data from network monitors	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure LV smart meter data	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure data from 3rd parties	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Modelling and forecasting uplift	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
IT systems for DOE / VPP integration	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Community battery	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Voltage management (STATCOMs)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Increase in BAU DER-related opex (complaints and tap changes)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Augmentation to increase hosting capacity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$2.56**	**$1.21**	**$1.38**	**$1.52**	**$1.50**	**$8.16**

Note: Numbers may not add due to rounding.

A.2 Options evaluation

Evoenergy has carefully considered each option, with the net present value (NPV) of the costs and benefits across the 20-year period outlined in Table 17.

Table 17 Summary of options evaluation ($ million, 2023/24)

Option	Total costs over 2024–29	NPV 20-year cost	NPV 20-year benefit	20-year net benefit relative to Base Case (NPV)
1 – Base Case	$3.81	$13.29	$0.07	N/A
2 – DER Readiness	$17.08	$25.23	$15.10	$3.10
3 – Rapid Transition	$31.09	$44.77	$27.95	-$5.00

Note: A further breakdown of costs over the 5-year regulatory period for each option is detailed in Appendix 2.5.A.

Note: Numbers may not add due to rounding.

Compared to Option 1 (the Base Case), Option 2 produces a higher net benefit. The net benefits of Option 2 compared to Option 1 are predominantly driven by the alleviation of export curtailment and network constraints from DOEs and trialling STATCOMs and community batteries. There is also the additional benefit of reducing the operational cost of resolving DER-related issues and compliance management.

Option 3 has a lower NPV relative to Option 1 and Option 2, indicating that additional investment to rapidly transition towards integrating DER at this time will not be beneficial to customers under current forecasts.[15]

A.3 Recommended Option

Upon reviewing the economic analysis and risks and opportunities associated with each option, Option 2 – DER Readiness is recommended, and Evoenergy's preferred option. Under this option, Evoenergy will:

- Obtain greater visibility in the network through obtaining data from network monitors, smart meters and third parties, and uplift modelling and forecasting capabilities to forecast, plan, and make data-driven network decisions.
- Develop IT systems to transition towards offering DOEs as an alternative to reduced static limits in a way that can be incrementally developed and scaled for an increasing DER customer base during and after the 2024–29 regulatory period.

[15] DER uptake forecasts may be updated in our revised regulatory proposal as additional information becomes available.

- Trial innovative technologies as an alternative to traditional network augmentation before a scaled deployment is deemed appropriate for the network, including STATCOMs and community batteries.
- Ultimately be ready for increasing adoption of DER and other emerging future market and industry models as the industry transitions towards decentralisation and unlocking additional value for customers.

Compared to Option 1, Option 2 provides greater levels of export services, visibility of the network and use of emerging innovative technologies at a level of investment which provides a greater value for customers. This is reflected in the net benefit derived from alleviating curtailment and network constraints relative to the base case in Option 1.

Option 3 has a lower NPV relative to Option 1 and Option 2, indicating that additional investment to rapidly transition towards integrating DER at this time will not be beneficial to customers under current forecasts. If actual DER uptake exceeds forecasts (as residential PV often has in models such as the AEMO's Integrated System Plan (ISP) or DER forecasts), then the NPV of Option 3 will increase, potentially outperforming Options 1 and 2.

Therefore, based on available information, we recommend Option 2 as the 'no regrets' approach to DER integration. However, Evoenergy may reassess the costs and benefits as part of our revised regulatory submission, updating the model for more recently available data.

Table 18 and Table 19 provide a breakdown of the investment items included in Option 2 across capex and opex, respectively. The benefits of Option 2 are primarily unlocked by dynamically managing exports to alleviate export curtailment and reduce network constraints. DOE implementation and adoption is a significant factor in realising the benefits of Option 2.

Table 18 Capex breakdown for Option 2 ($ million, 2023/24)

Investments	Capex over 2024–29					
	2024/25	2025/26	2026/27	2027/28	2028/29	EN24 Total
Data from network monitors	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure LV smart meter data	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure data from 3rd parties	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Modelling and forecasting uplift	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
IT systems for DOE / VPP integration	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Community battery	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Voltage management (STATCOMs)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Increase in BAU DER-related opex (complaints and tap changes)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Augmentation to increase hosting capacity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$5.34**	**$0.07**	**$0.00**	**$0.00**	**$0.00**	**$5.47**

Note: Numbers may not add due to rounding.

Table 19 Opex breakdown for Option 2 ($ million, 2023/24)

Investments	Opex Costs over 2024–29					
	2024/25	2025/26	2026/27	2027/28	2028/29	EN24 Total
Data from network monitors	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure LV smart meter data	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Procure data from 3rd parties	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Modelling and forecasting uplift	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
IT systems for DOE / VPP integration	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Community battery	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Voltage management (STATCOMs)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Increase in BAU DER-related opex (complaints and tap changes)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Augmentation to increase hosting capacity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$2.63**	**$2.21**	**$2.20**	**$2.23**	**$2.34**	**$11.61**

Note: Numbers may not add due to rounding.

The summary of the costs associated with each of these activities over the 2024–29 regulatory period is summarised in Table 20.

Table 20 Cost summary for Option 2 – DER Readiness ($ million, 2023/24)

Enabling capability	Activity	Investments	Costs over 2024–29		
			Capex	Opex	Total expenditure
Network Visibility	Data collection and storage	Data from network monitors	[redacted]	[redacted]	[redacted]
		Procure LV smart meter data	[redacted]	[redacted]	[redacted]
		Procure data from 3rd parties	[redacted]	[redacted]	[redacted]
	Analytics	Modelling and forecasting uplift	[redacted]	[redacted]	[redacted]
Network Operation	DOEs	IT systems for DOE / VPP integration	[redacted]	[redacted]	[redacted]
Enabling Projects		Community battery	[redacted]	[redacted]	[redacted]
		Voltage management (STATCOMs)	[redacted]	[redacted]	[redacted]
		Increase in BAU DER-related opex (complaints and tap changes)	[redacted]	[redacted]	[redacted]
		Augmentation to increase hosting capacity	[redacted]	[redacted]	[redacted]
Total			**$5.47**	**$11.61**	**$17.08**

Note: Numbers may not add due to rounding.

Appendix 2.5.B - Sensitivity analysis

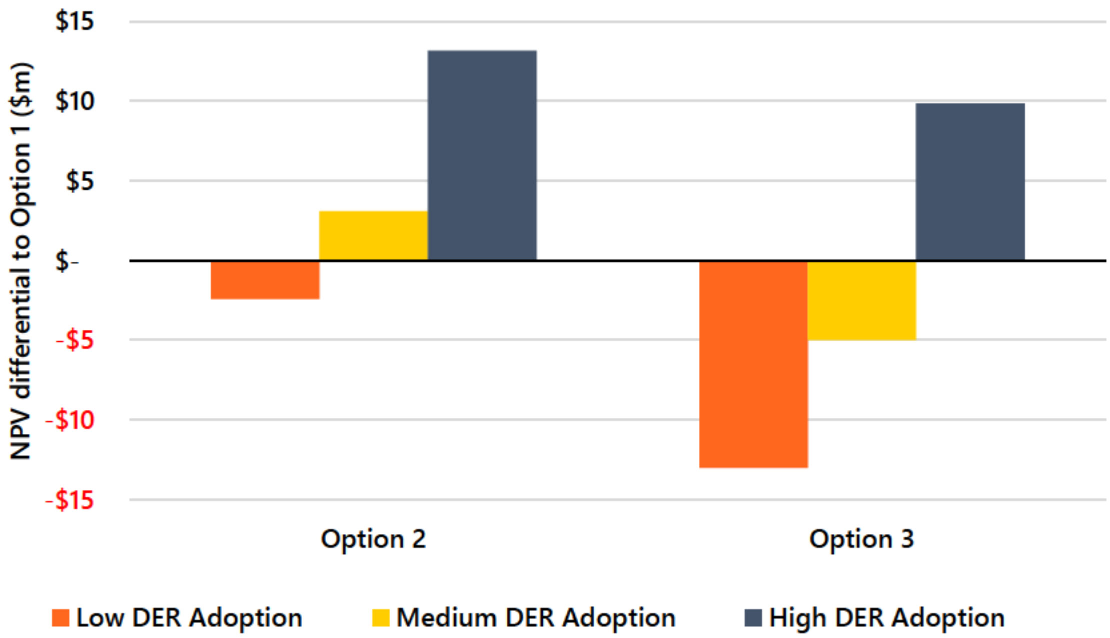
As the benefits are largely dependent on specific inputs and assumptions, Evoenergy has undertaken a sensitivity analysis to pressure test and further evaluate the risks associated with the recommended option. These include looking at varying DER adoption forecasts and the timing of investment to the next regulatory period.

B.1 DER Adoption Forecasts

The costs and benefits across the 20-year modelling period were evaluated against the Low, Medium and High DER adoption scenarios. The net benefits for Option 2 and Option 3, relative to Option 1, for each DER adoption scenario, are shown in Figure 4, where an increase in DER adoption results in an increase in net benefits. An increase in DER customers subsequently results in an increase in customers that adopt DOEs and, therefore, a decrease in curtailment and DER-driven network issues. As such, more benefits are unlocked through alleviated export curtailment and avoided DER-related opex with only a slight increase in overall costs to offer DOEs to the additional customers.

As the net benefits of the options relative to Option 1 vary significantly across different DER adoption forecasts, the net benefits for the options are sensitive to the actual adoption of DER and DOEs. This poses a risk that the level of investment in the options may not be as beneficial to customers and the energy market as assessed if the level of DER and DOE adoption is lower than the medium forecast. Conversely, higher levels of DER adoption and subsequently higher number of customers that take up DOEs, will result in greater levels of benefits than assessed.

Figure 4: Comparison of options across DER adoption forecasts

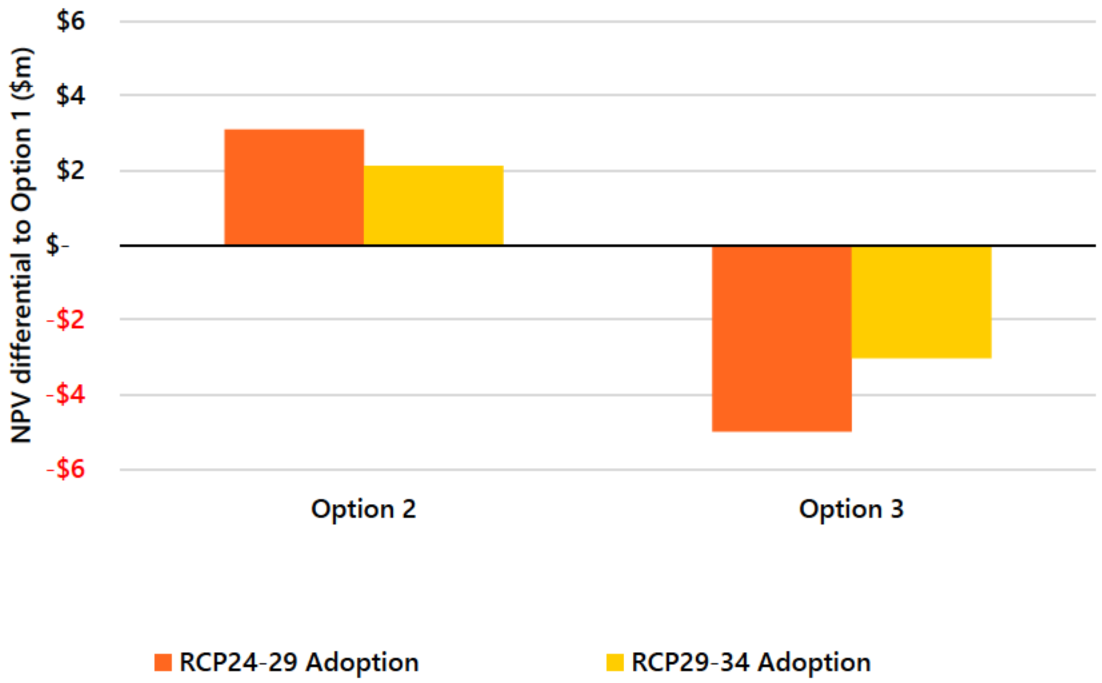


B.2 Timing of investment

The costs and benefits of deferring all investment proposed in the recommended option to the following period (i.e., shifting all costs in Option 2 from the 2024–29 regulatory control period (RCP) to the 2029–34 period) were evaluated where the net benefits compared to Option 1 in their respective investment timeframe are shown in Figure 5. A swifter investment in the 2024–29 RCP to increase capability within visibility, operations and enablement, in general, provides a higher economic net benefit to customers. In net present value terms, investment deferred until the 2029–34 RCP, together with the additional cost of DER-related opex in the 2024–29 RCP, is relatively cheaper than if all investment is incurred in 2024–29. However, the cost savings from deferring investment are not enough to offset the lost opportunity of unlocking benefits from alleviating curtailment and improving network utilisation in the earlier years.

In addition to the higher economic net benefit compared to Option 1, an earlier investment of capability further aligns with the expectations of customers in building a network where both existing customers and those interested in connecting DER can get the most value from their systems. As such, this assessment further supports the need to build readiness in integrating DER into the network in the next regulatory control period.

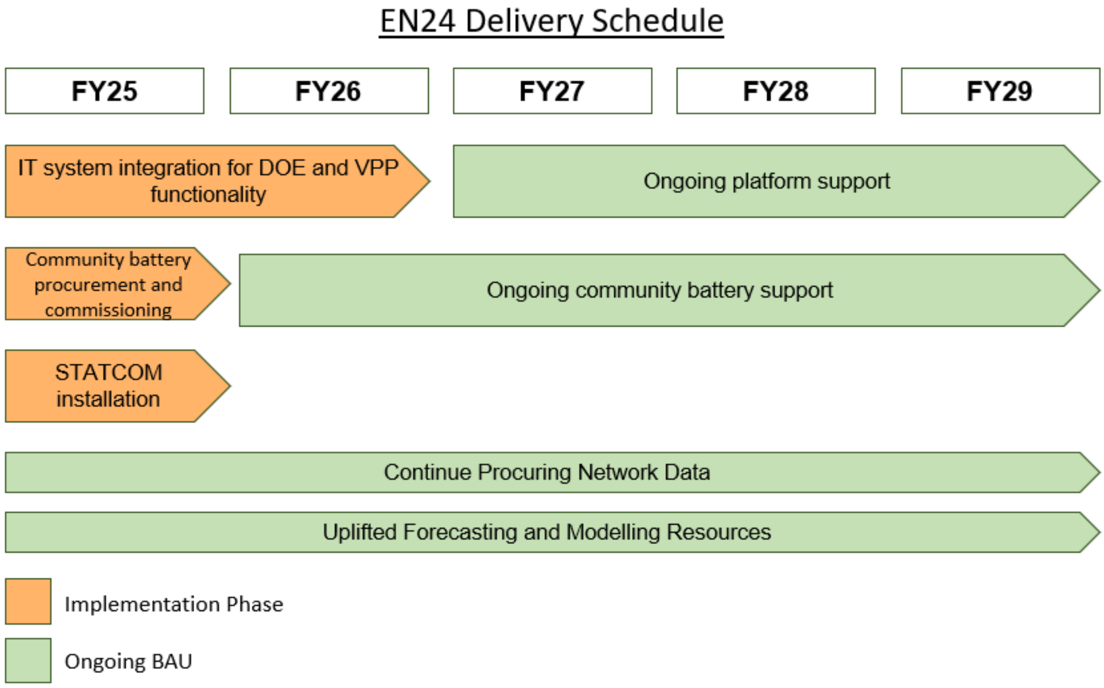
Figure 5: Comparison of Options across different timing of investment



Appendix 2.5.C – Delivery Roadmap

Evoenergy expects the delivery of the DER integration step change program to follow the schedule shown in Figure 6 below. The program commences immediately from the start of the 2024–2029 regulatory control period.

Figure 6 Delivery Schedule for the DER step change program



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Appendix 2.5.D - CBA inputs and assumptions

D.1 Historical and future DER market

The historical and forecast adoption of residential solar PV, battery storage systems, and EVs are shown in Figure 7, Figure 8, and Figure 9, respectively.

Historically, the number and the average size of residential solar PV and batteries have increased over time. While considering the past decade of DER installations in Evoenergy's network, the average size of residential solar PV systems and batteries is 7.15 kW and 12.98 kWh, respectively. These values are assumed to be constant over the modelling period for new adoptions.

DER forecasts were developed based on industry forecasts adjusted to the Evoenergy network and consistent with those used in Evoenergy's Net Zero modelling, including:

- Solar PV capacity forecasts are a combination of estimates from ACT Government forecasts[16] and the forecast of installed capacity from AEMO's latest ISP for the NEM region NSW (which includes NSW and ACT),[17] both scaled using historical ACT solar PV capacity.
- Battery capacity and install forecasts are a combination of ACT Government forecasts and AEMO's latest ISP forecasts for installed battery capacity for the NEM region NSW scaled using the ACT population relative to the NSW region.
- EV forecasts are calculated from a combination of actual ACT annual growth of vehicles, EV penetrations rates estimated from ACT Government's forecasts, and EV growth factors for NSW in AEMO's 2022 ISP.

The Low, Medium and High scenarios are derived from various scenarios as outlined in Table 21.

Table 21 Mapping of scenarios

	Low	Medium	High
Solar PV	AEMO's Slow Change (growth rate from AEMO's modelling applied to ACT actuals for 2021/2022)	Evoenergy NZM	AEMO's Step Change (growth rate from AEMO's modelling applied to ACT actuals for 2021/2022)
Batteries	AEMO's Slow Change (scaled by ACT to NSW population proportion)	Evoenergy NZM	AEMO's Step Change (scaled by ACT to NSW population proportion)
EVs	AEMO's Step Change (scaled by ACT to NSW population proportion)	Evoenergy NZM	AEMO's Strong Electrification (scaled by ACT to NSW population proportion)

[16] ACT Government Environment, Planning and Sustainable Development Directorate, Economic and Technical Modelling of the ACT Electricity Network Base Case Report, April 2022.
[17] AEMO, 2022 Integrated System Plan (ISP), 2022.

Figure 7 Historical and forecast adoption of rooftop solar PV

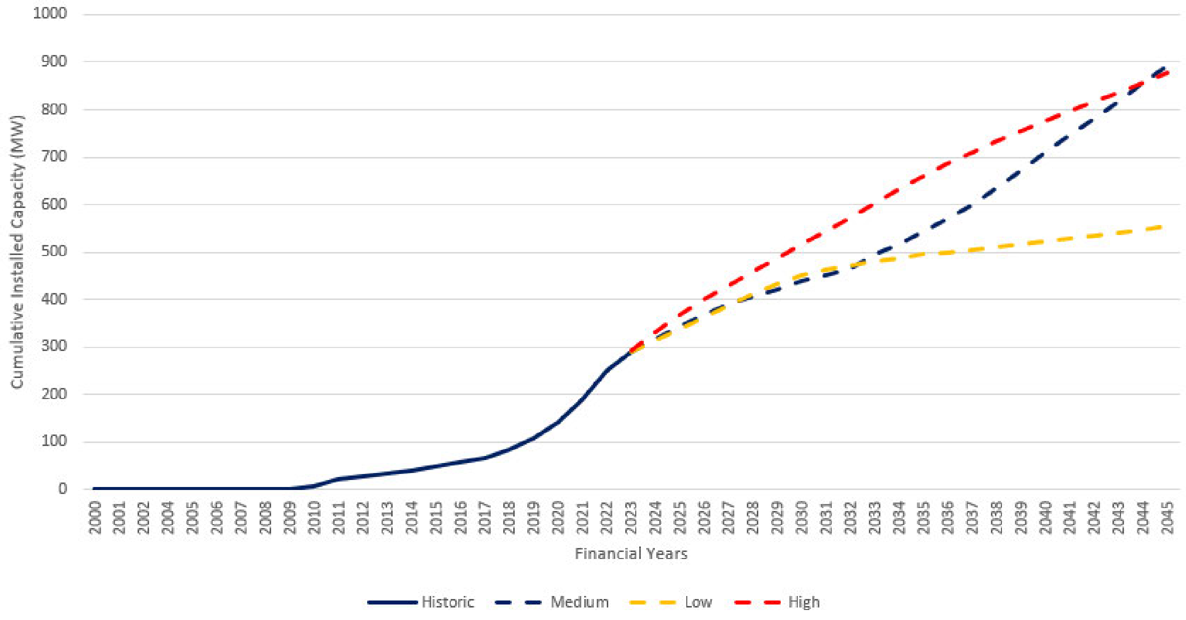


Figure 8 Historical and forecast adoption of batteries

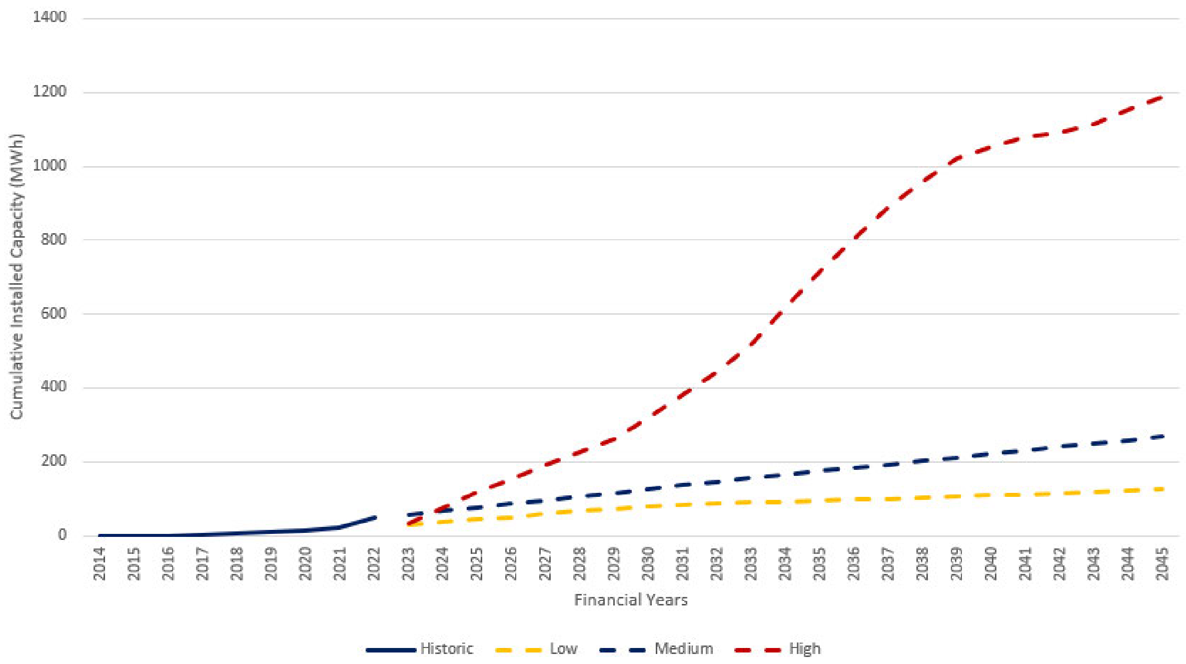
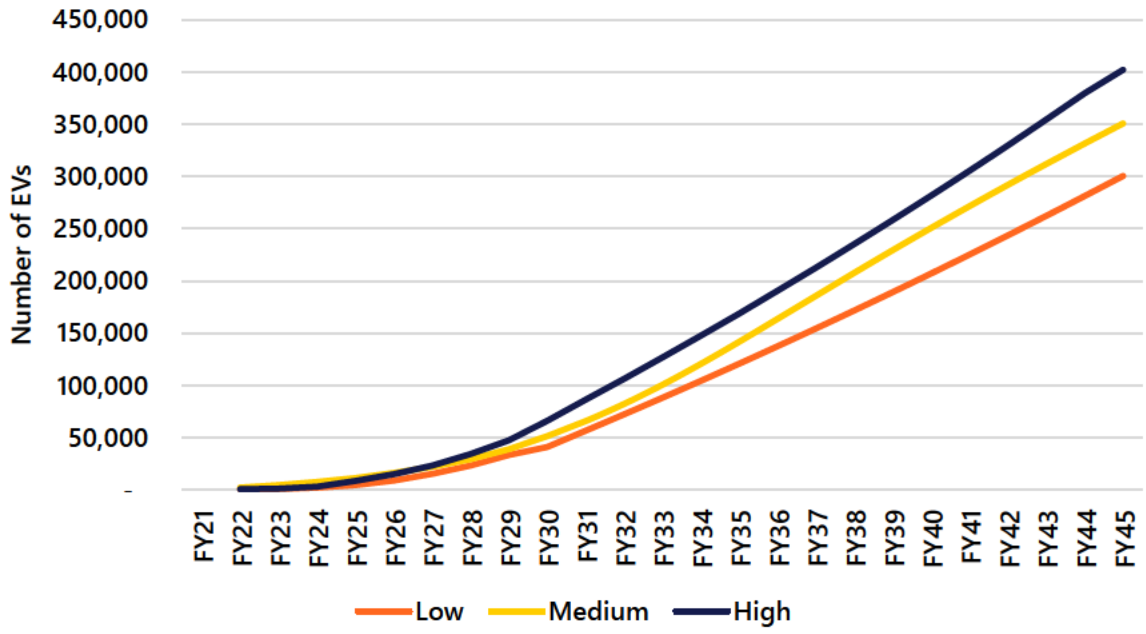


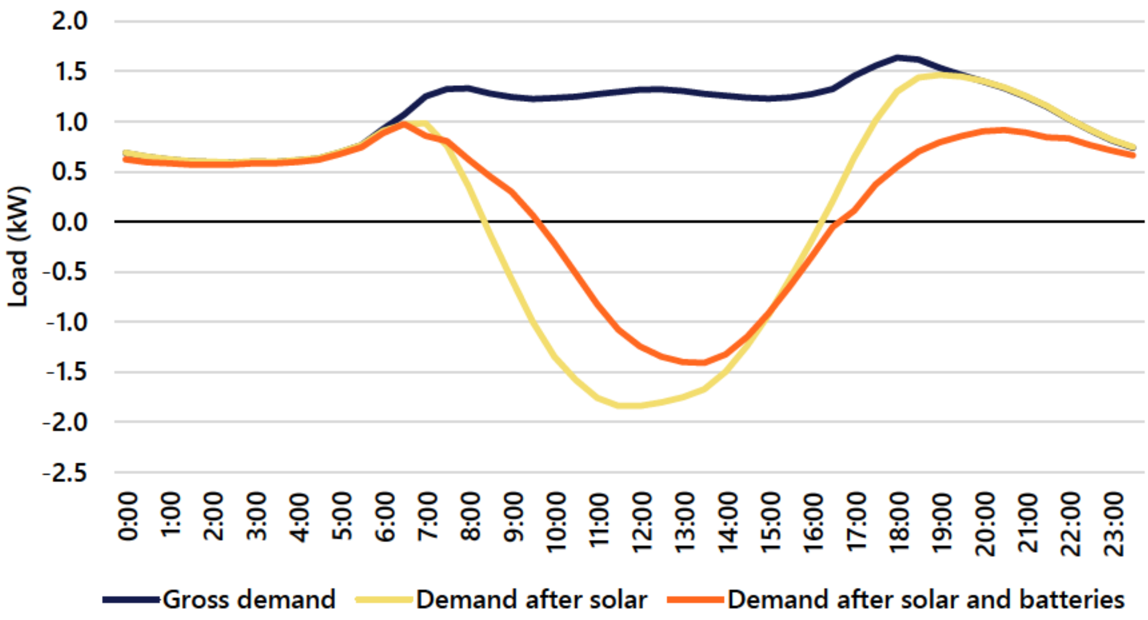
Figure 9 Forecast EVs in the ACT



D.2 Impact of DER on the network

An average customer profile was used to represent existing and future DER customers on the network to determine the impact of solar, batteries, and EVs. The customer demand, solar generation, and battery charge and discharge profiles are derived from existing customers in the Evoenergy network currently participating in an aggregator's VPP model. The average daily load profile for an average DER customer in the Evoenergy network is shown in Figure 10.

Figure 10 Average customer average day load profile



EV impact on the network is calculated by applying an average EV charging profile to the network load. The average day loads per EV are derived from AEMO's assumptions on EV charging profiles and forecast change in charge type within the fleet in the latest ISP.[18] The average day per unit kW charging profiles by charge type and the weighted average is shown in Figure 11.

Figure 12 shows the change in charge type within the fleet over time, which were used to derive the weighted average charging profiles.

[18] AEMO, 2022 Integrated System Plan (ISP), 2022.

Figure 11 Average day per unit EV charging profile

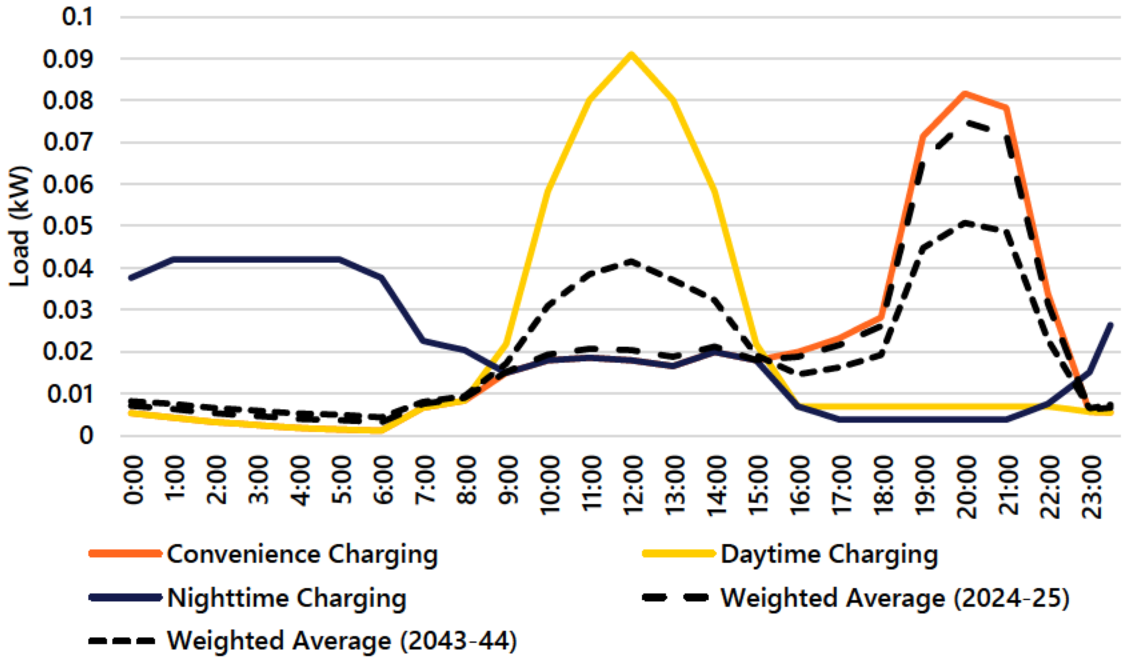
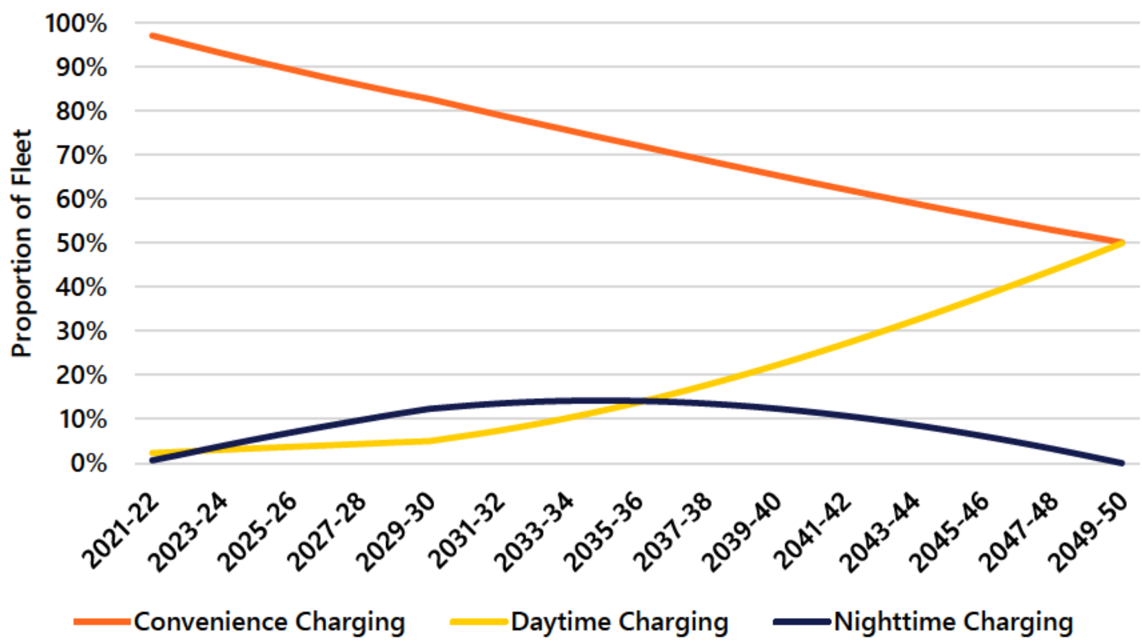


Figure 12 Fleet charge type forecast



D.3 Network hosting capacity

To determine the intrinsic hosting capacity of Evoenergy's current network, Evoenergy engaged Zeppelin Bend (ZepBen) to undertake load flow modelling of the LV network. Intrinsic hosting capacity was derived by:

- Understanding the existing state of the network regarding the potential thermal and voltage ranges that the network can accommodate.
- Incrementally applying PV penetration uniformly across each feeder.
- Running load flow analysis to understand whether there are network violations at the LV level, distribution transformer, or the HV level.

D.4 Curtailed generation and exports

Curtailed generation and exports can occur through two means, including:

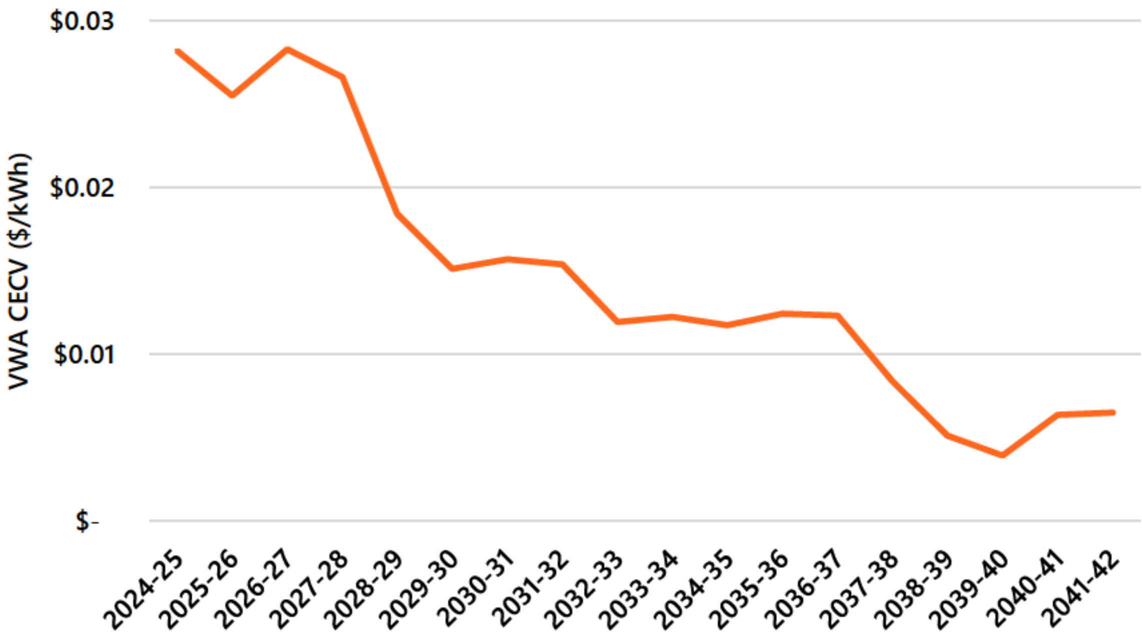
- Curtailed exports due to reduced static export limits
- Curtailed generation from inverter tripping-off because of voltage constraints in the network.

These occurrences of curtailment are both calculated by:

- Applying the solar PV adoption forecast to distribution substations
- Applying a static limit to new solar PV installs reducing over time to 2.4 kW per customer by 2044
- Calculating the level of curtailment using the solar generation and customer export profiles to understand the periods in the year where exports are greater than the static limit and when network constraints would cause inverters to trip, given the level of intrinsic hosting capacity on the distribution substation
- Applying the CECV profile to the curtailment profile to develop an understanding of the value of curtailment in Evoenergy's network.

The annual CECV assumptions calculated by weighting the CECV profile against the export profile are shown in Figure 13.

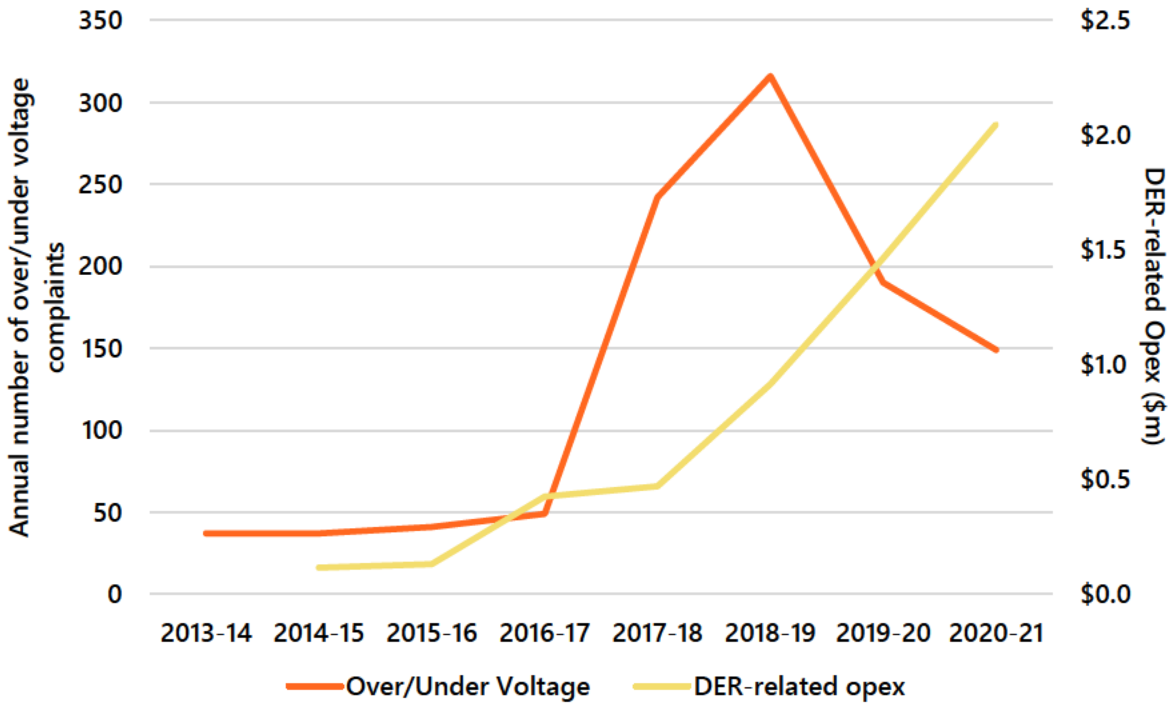
Figure 13 Volume weighted average CECV



D.5 DER-related opex

A forecast of expenditure needed to respond to DER issues, such as quality of supply complaints from over-voltage issues, is derived from the historical number of complaints from DER and the associated expenditure to resolve these complaints, as shown in Figure 14.

Figure 14 Historical DER-related quality of supply complaints and expenditure ($nominal)



D.6 Additional network assumptions

The network LRMC estimates the cost of additional capacity in the network to accommodate EV impacts. These are shown in Table 22.

Table 22 LRMC assumptions (2023/24 dollars)

Tariff Class	LRMC ($/kW p.a.)
LV Residential	$122
LV Commercial	$61
HV	$45

The unit rates of upgrading network assets are used to increase hosting capacity, as shown in Table 23.

Table 23 Per unit network upgrade cost assumptions ($nominal)

	Unit rate
LV ABC overhead (per km)	[redacted]
LV underground (per km)	[redacted]
11kV overhead (per km)	[redacted]
11kV underground (per km)	[redacted]
Pad mount substation upgrade	[redacted]
OTLC incremental cost	[redacted]

Appendix 2.5.E - Engagement with customers on DER

Evoenergy has been engaging with consumers broadly and in-depth to better understand consumer preferences in relation to how to better integrate, use and maximise the value of DER and related services. This engagement includes surveys, panel workshops and discussions, and collaboration with other DNSPs and industry stakeholders. For instance, workshops were held with small groups of customers around Evoenergy's DER Integration Strategy to understand customers' understanding, preferences, and views on enhancing network capability to better integrate DER. This was followed up with a larger survey of 650 Canberrans to gain diverse quantitative information on the issues.

Through these processes, Evoenergy has heard that consumers need energy that is affordable, sustainable, reliable, and safe. Consumers also want an energy network that is innovative and enables the efficient and smart use of energy as the ACT transitions towards a net zero emissions future.

Consumers recognise that Evoenergy has a key role in enabling and supporting the growing uptake of DER. In delivering the transition, consumers have said[19] that they are:

- Mostly interested and open to installing a DER system (either solar, battery and EVs granted they do not have it already).
- Valuing the cost of electricity and reliability highly, but seeking to maximise value from their DER systems.
- Aware of the disparities between early adopters and those that install DER now and in the future.
- Supportive of Evoenergy undertaking the transition[20], view that it should be implemented, and are willing to pay more for the network transition, particularly around DSO capability[21] as well as a step-change in operating expenditure for DER integration.
- Open to tariff reform which is more cost-reflective and provides benefits to all customers, not just DER customers, such as through export pricing and solar sponge tariffs.
- Flexible around EV charging times and tariff structures to give consumers and the network the most value whilst being fair for all network users.

[19] Through forums such as the community panel meetings, DSO customer engagement workshops and surveys.
[20] Noting that advocates of grid upgrades towards DSO capability are likely to be higher educated consumers who have solar and a positive attitude about the future.
[21] One third of consumers share this view and not all have solar.

Appendix 2.5.F - DER Legislation and supporting documentation

F.1 Legislative requirements

ACT Government's Net Zero Target and Zero Emissions Vehicle Strategy

The ACT Government has legislated to achieve net zero greenhouse gas emissions in the ACT by 2045. The Climate Change Strategy 2019-25[22] outlines the challenge, goals and actions required to achieve the target across all sectors. In working towards net zero, there will be significant impacts to the electricity network through:

- Encouraging a shift from gas to electricity by removing the mandated requirement for gas connection in new suburbs, supporting gas to electric appliance upgrades and transitioning to all-electric new builds (recently updated with a ban on new gas connection and plans to transition all fossil fuel gas usage to electrified sources by 2045[23]).
- Maintaining 100% renewable electricity through efficiency and additional procurement of renewable electricity if required.
- Planning for efficient and sustainable urban land use to reduce emissions and maintain and enhance living infrastructure and biodiversity.
- Continuing to encourage the uptake of zero emissions vehicles and explore the need for further incentives.

The ACT Government has also released a zero emissions vehicle (ZEV) strategy for 2022-30[24] that includes a range of measures to make owning zero-emission vehicles more affordable and accessible to Canberrans, including:

- Setting a target that 80-90% of new vehicles sales are ZEVs by 2030.
- Prohibiting new light internal combustion engine (ICE) vehicles from onboarding into taxi and ride-share fleets by 2030.
- Exploring a phase out of new light ICE vehicles by 2035.
- Increasing the availability of EVs and EV chargers.

These strategies are supported by ACT Government schemes and incentives to accelerate DER uptake, such as:

- The Sustainable Household Scheme, offering eligible households interest-free loans up to $15,000 for the purchase of DER, electrified appliances, and electric vehicles.
- The Energy Efficiency Improvement Scheme, which provides financial assistance for the purchase of electric heating and cooling systems, and electric hot water systems.
- The Next Generation Energy Storage Program, offering rebates up to $3,500 for residential and $35,000 for commercial battery installations.
- EV incentives such as stamp duty exemption and two years free vehicle registration, in addition to eligibility for the Sustain House Scheme interest-free loan of up to $15,000.

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[22] https://www.environment.act.gov.au/__data/assets/pdf_file/0003/1414641/ACT-Climate-Change-Strategy-2019-2025.pdf
[23] https://www.climatechoices.act.gov.au/__data/assets/pdf_file/0009/2052477/Powering-Canberra-Our-Pathway-to-Electrification-ACT-Government-Position-Paper.pdf
[24] https://www.climatechoices.act.gov.au/transport-and-travel/cars-and-vehicles/the-future-of-zevs

- The Home Energy Support Program, offering Pensioner Concession and Veterans' Affairs Gold Card holders rebates of up to $5,000 for sustainable home upgrades such as PV and electrified heating and cooking upgrades.

Access, Pricing, and Incentive Arrangements for DER rule change

On 12 August 2021, the AEMC published the final determination for the Access, Pricing and Incentive Arrangements for DER rule change (Rule Change).[25]The Rule Change seeks to integrate DER more efficiently into the electricity grid and places clear obligations on Evoenergy to support DER connecting to the grid, including:

- Highlighting export services as a core service to be provided by DNSPs.
- Requiring that customers seeking an export connection must not be provided with a static zero export limit (unless exemptions apply).
- Requiring DNSPs to offer a basic export level in all tariffs without charge for ten years.
- Introducing new customer safeguards to help the transition to export pricing.[26]
- Plan for the provision of export services and explicitly explain the approach to DER integration.
- Requiring Evoenergy to consult widely and test and trial options using Export Tariff Guidelines developed by the AER.

In addition, the rule change required the AER to develop and consult on a CECV methodology and publish CECVs annually.

AER's DER Integration Expenditure Guidance Note

On 30 June 2022, the AER published the final guidance note for DER integration expenditure, which outlines the AER's expectations for how DNSPs should develop business cases and quantify values associated with network investments for DER integration. The guidance note complements the AER's CECV methodology and published values to be used. The analysis for this DER Integration Program business case is consistent with the AER's DER Integration Expenditure guidelines.

AER's Draft Report on Incentivising and measuring export service performance

Following the publication of the AEMC's Rule Change, the AER released a draft report[27] on *Incentivising and measuring export service performance* consultation outlining the AER's proposed approach to export service incentive arrangements, performance reporting, and benchmarking. Once finalised[28], the report will likely require DNSPs to report export service performance to the AER. Metrics to assess export service performance are designed to provide transparency, including for the:

- Relative performance of DNSPs in providing export services
- Performance of DNSPs against their own export tariff parameters

[25] https://www.aemc.gov.au/rule-changes/access-pricing-and-incentive-arrangements-distributed-energy-resources.

[26] Including requirements that existing solar customers cannot be put on export pricing arrangements until 1 July 2025 at the earliest (unless they elect to do so), Evoenergy to develop and have an approved export tariff transition strategy describing any plans to phase-in export pricing over time, and an increase to tariff trial thresholds to support Evoenergy to develop and trial new, innovative network tariffs.

[27] Available here: https://www.aer.gov.au/system/files/AER%20-%20Incentivising%20and%20measuring%20export%20service%20performance%20-%20Draft%20report%20-%20November%202022.pdf.

[28] Submissions on the draft report closes 20 January 2023.

- Use of static zero export limits
- Impact of system limitations on availability or use of export services.

Proposed metrics and the AER's current position can be found in the attachments of the draft report.

This reporting incentivises Evoenergy to monitor and improve its export service performance, which involves many of the initiatives in the DER integration business case, over time.

AER's review of the Connection Charge Guidelines

Since the recent AEMC Rule Change, the AER is updating the Connection Charge Guidelines for Electricity Customers[29] for the development of connection policies by DNSPs. The updated Connection Charge Guidelines are currently in a draft state, and consultation closed in November 2022. The new arrangements will officially commence in the ACT on 1 July 2024.The proposed updated guidelines stipulate that DNSPs can only impose static zero export limits to micro embedded generator connections if:

- The export from the generator will have a high probability of resulting in the DNSP not meeting regulatory obligations or maintaining the network within its technical limits.
- The cost of augmenting network assets to allow a reasonable export capacity level outweighs the benefits arising from providing the additional export capacity, taking into consideration the expected future new DER that will be able to export to the grid arising from the augmentation.

The guidelines also provide the following principles to be included in a standard assessment framework to decide on whether to impose a zero export constraint for each individual application that DNSP may choose to establish:

- The identification of network limitations caused by constraints such as but not limited to thermal issues, voltage issues and projection systems.
- Network expenditure yet to be undertaken to relieve these network constraints.
- The DNSP must undertake a CBA to identify that a static zero export limit is the least cost option for addressing the above network constraints.
- If connection applicant is not utilising a suitable dynamic response system, the DNSP can apply a static zero export limit if it is the least cost option.

Increasing Evoenergy's network visibility capabilities will allow more accurate and efficient decision-making when assessing connection applications. Aspects of network operations and enabling projects (such as DOEs, community batteries, and STATCOMs) present alternate solutions to efficiently support a larger amount of exported energy and larger export limits, compared to zero export limits or costly network upgrades and augmentation.

AEMC's Draft Report on the Review of the Regulatory Framework for Metering Services

The AEMC is reviewing metering services in the NEM to identify problems with the current framework, opportunities to improve customer outcomes, and identify reforms that would accelerate smart meter

[29] Available here: https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/connection-charge-guideline-review-2022.

deployment in the NEM. The AEMC's draft report, published in November 2022,[30] contains the following set of recommendations:

- A target of 2030 to have universal uptake of smart meters
- Changes to the NER that would reduce delays in meter replacements, facilitate coordination between market participants and empower customers to request meter upgrades
- Measures to create greater transparency for customers and information on how they can access benefits created from their smart meter, and appropriate consumer safeguards
- New requirements to allow DNSPs, market participants and customers to access power quality data.

These recommended changes highlight the increased need to collect and use data on the electricity network more intelligently and will support many DNSP and DSO initiatives that can utilise smart meters and smart meter data. As the review's recommendations are not finalised, they are not currently accounted for in this business case. Our revised regulatory proposal will consider and incorporate changes based on the metering service reforms.

[30] https://www.aemc.gov.au/sites/default/files/2022-11/Draft%20report.pdf.

F.2 Supporting documentation

Together with this business case, there is a suite of documents, which further support the proposed DER step change:

- **DER Integration Strategy** – Sets out the roadmap for establishing key capabilities to delivering DER integration and DSO capabilities and acts as the parent document to this business case.
- **Network Development Plan** – Details the plan to develop a network that supports the transition towards net zero carbon emissions by 2045. Key inputs and assumptions used in this business case align with those used in the net zero modelling.
- **Tariff Structure Statement** – Provides details on tariff structures proposed in the upcoming regulatory period, including tariff reform to support DER integration through customer and DER behaviour change, including tariff components such as a solar sponge, export charges and battery tariff. Tariff reform is not included in this business case.
- **ICT Strategy and Business Cases** – Sets out ICT capabilities that will upgrade and improve core business capabilities. All ICT-related investments that will support DER integration are captured in this business case and excluded from the ICT Strategy and proposed ICT expenditure.
- **ADMS Enhancements Business Case** – Provides options for upgrading the ADMS to support better forecasting, new constraint management tools, and integrating the new DOE platform with the ADMS. These ADMS enhancements will complement activities from the DER integration plan, such as utilising network data acquired through the DER integration plan's network visibility activities for operational and planning purposes.