Electricity Distribution Price Review FY2027 to FY2031 (EDPR 2026-31)

Business case: CER Enablement

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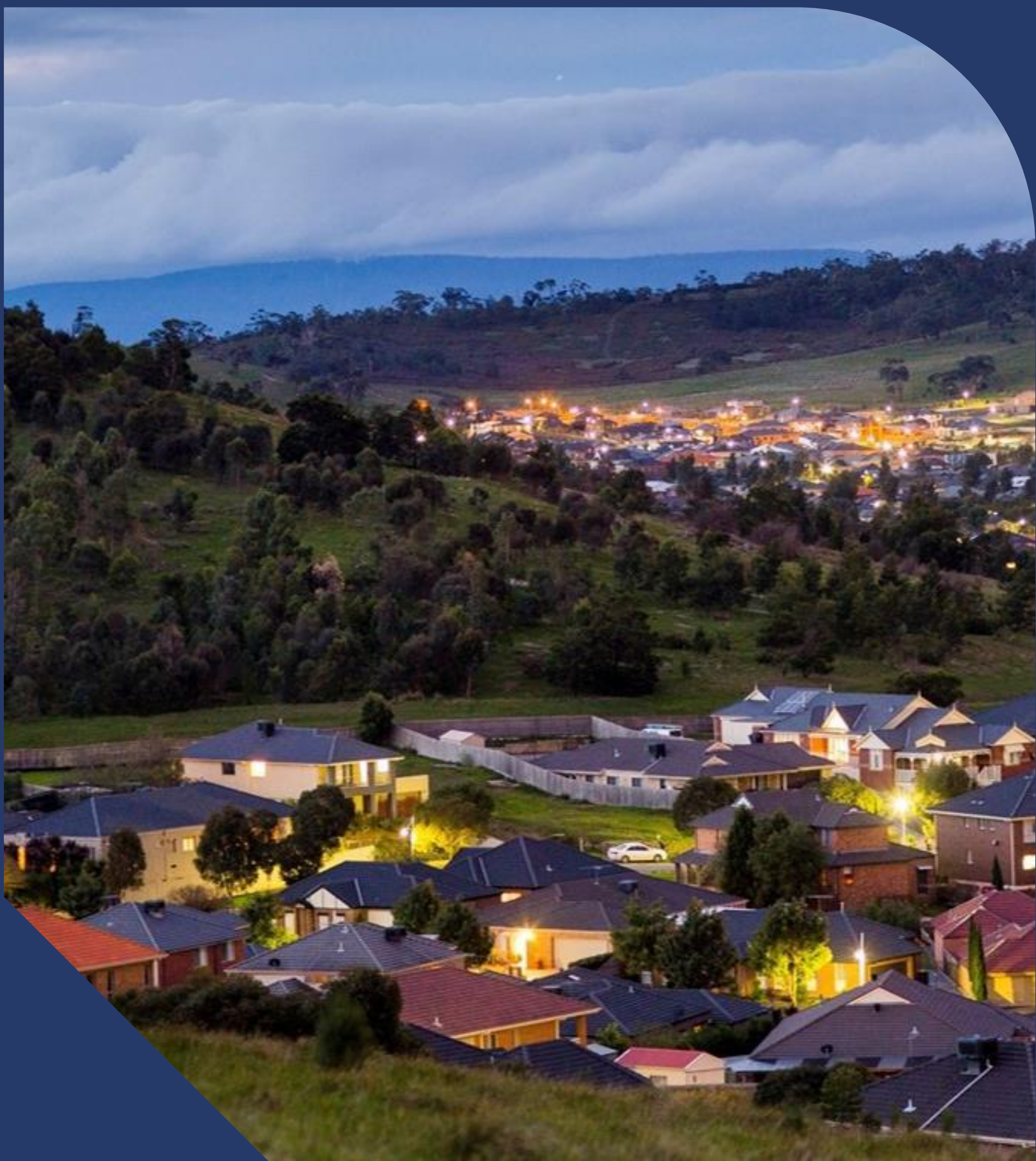

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1. Executive summary

This business case presents our investment plans to enable an efficient integration of consumer energy resources (CER) into our network, including by enabling efficient levels of export services to allow customers with the CER to import and export from the network in a way that unlocks value from their CER for themselves and all other energy consumers. In the context of the CER enablement program discussed in this section, CER includes customers' rooftop solar and rooftop solar + battery systems—technologies that can generate electricity on the site and export into the grid. CER such as electric vehicle smart chargers and other smart devices, which do not generate or export electricity, are not considered as part of this program.

We have engaged extensively on CER enablement with our customers and EDPR stakeholders, including through our Future Network and Tariffs and Pricing panels. The consistent feedback we receive from our customers is that they value solar exports highly and that they do not want us to waste any generated solar energy—they are willing to pay more than the economic value for networks to enable more exports. Conversely, through engagement with our Future Network and Tariffs and Pricing panels, we have been encouraged to consider efficiency as the primary driver of investment, to limit any inefficient costs being passed onto all customers, particularly those that do not have CER.

We anticipate AusNet will have 60,000 new rooftop PV systems installed during 2026-31, reaching 39% of AusNet customers. Solar batteries are anticipated to increase by 30,000 during 2026-31, reaching 7% of AusNet customers. With the increasing penetration of rooftop solar, and a much smaller penetration of solar batteries, we anticipate continuing to experience network challenges from solar exports, including thermal constraints and voltage variations.

This business case outlines a program of work needed to economically reduce wasted or curtailed solar generation and exports from network constraints and voltage variations, using the Australian Energy Regulator's (AER) Customer Export Curtailment Value (CECV) and the AER's Value of Emission Reduction (VER). The program assumes all new solar customers are offered 'flexible exports' from 1 July 2026, with 70% taking it up. Flexible exports are an efficient way to allocate network capacity which can defer network augmentation.

The program is anticipated to enable 264GWh of renewable exports, putting downward pressure on wholesale electricity prices and reducing 16.7kt CO_2 per year, which benefits all AusNet customers and energy consumers. Without the planned program of work, exports would need to be constrained using zero export limits, or solar generation would be automatically curtailed or tripped in areas of over-voltages (requirement of the AS 4777:2020 inverter standard). This would result in a lost opportunity to reduce emissions and potentially higher wholesale prices.

The preferred planned program of work is a proactive program which is specifically targeted at addressing network limitation in areas of export value. Three options are considered:

- Do nothing—no expenditure on addressing network limitations that impact export capacity.
- Option 1—economic approach to unlocking export capacity.
- Option 2—deterministic approach to unlocking export capacity.

AusNet proposes Option 1 at $38.6 million (real, $June 2024) over 2026-31, which represents a prudent and efficient network augmentation investment. Applying a discount rate of 5.56% per annum, this proposed program option has a net economic benefit of $427 million (real, $June 2024) over the 20-year assessment period as shown in Table 1.

Table 1: Economic Evaluation of CER Enablement Program Options ($m, 30th June 2024 dollars)

	FY27 to FY31 (undiscounted)			Full assessment period (discounted)			Comments
	Capex	Opex	Total cost	Total cost	Total benefits	NPV	
Do Nothing	0.0	0.0	0.0	0.0	0.0[1]	0.0	This option does not address the identified need
Option 1 – Economic approach	35.0	0.7	35.7	(40.0)	466.7	426.7	This is the preferred option as it maximises the NPV
Option 2 – Deterministic approach	167.0	4.1	171.1	(191.0)	491.8	300.8	This is the most expensive option

Source: AusNet analysis (relative to the base case of do nothing).

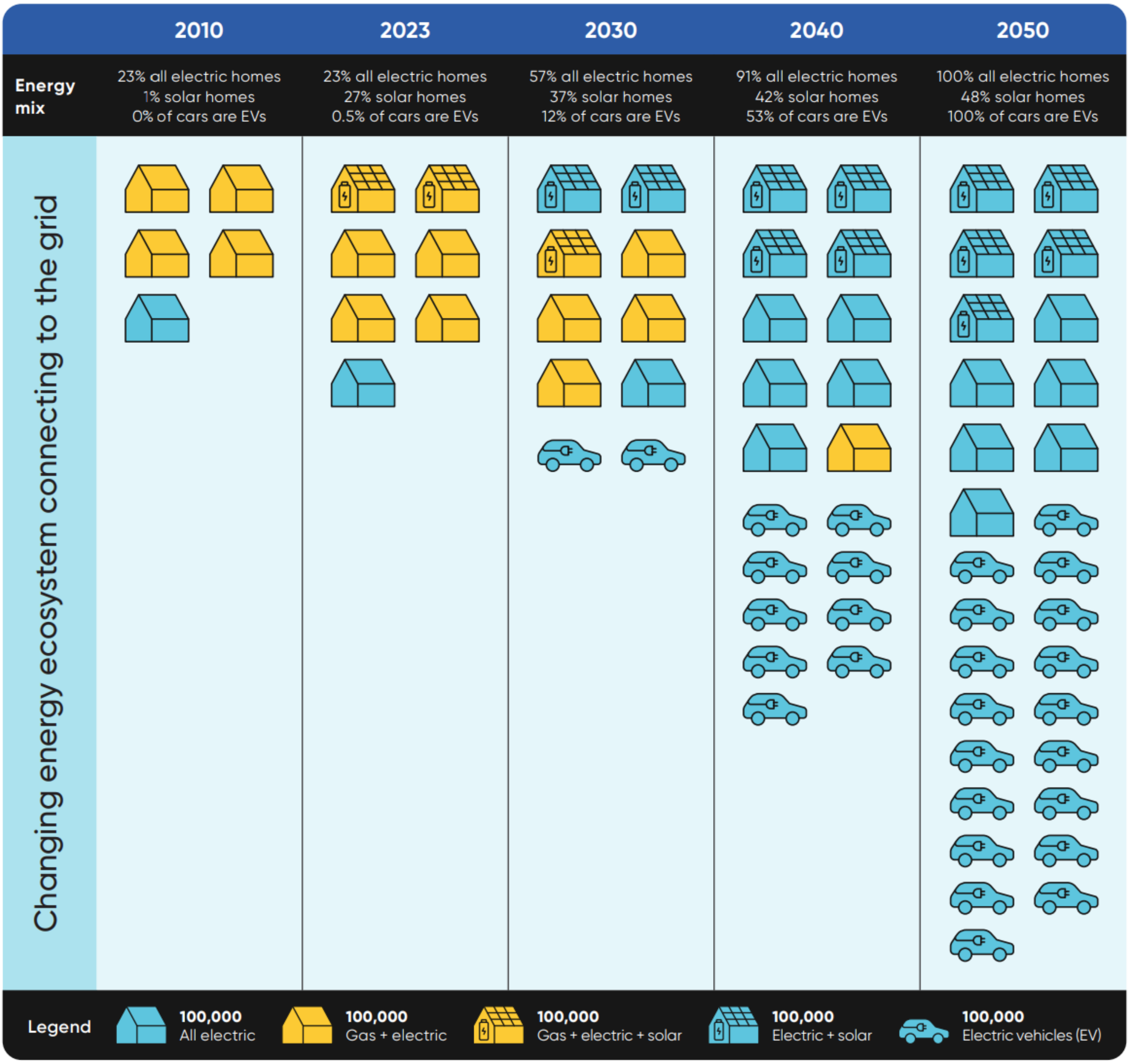
[1] The present value of total risk of greenhouse gas emissions, CER generation needing to be curtailed through either static export limits to manage network export limitations, or voltage-curtailed generation being experienced by customers due to higher network voltages from exporting CER, is valued at $1,373 million over the analysis period (real 30th June 2024 dollars). Refer Table 8.

2. Background

The growing penetration of CER is increasing the complexity of customer needs and the types of customers interacting with AusNet. The number of CER owned and used by AusNet customers is expected to grow from ~220,000 in 2023 (mostly rooftop solar) to ~630,000 by 2031, with a mix of rooftop solar, batteries and EVs. This is a material change in the number of factors and type of technologies distributors will need to plan for and integrated into the grid, which necessitates a foundational shift in how distributors operate and manage their customers' needs.

Figure summarises historical and forecast customer trends in AusNet's network, from 2010 to 2050

Figure 1: Historical and forecast customer trends in AusNet's network, 2010 to 2050



Source: AusNet.

The trends shown in Figure are derived from independent sources including:

- Household number forecasts are based on the 2023 Victorian Government's Victoria in Future (VIF) five-yearly forecasts of population, using the 'Victoria in Future Small Areas' data set.
- All other forecasts are based on AEMO's 2024 ISP inputs for Victoria, extrapolated for AusNet's network.

2.1. Customer feedback and evolution of needs

We have done extensive research with our customers on their needs and preferences related to rooftop solar, batteries and EVs, whether they have the technologies or not. We have also engaged extensively with our 2026-31 Electricity Distribution Price Review (**EDPR**) stakeholders on their views and preferences related to CER integration.

We have summarised the key themes from our customers and stakeholder related to CER integration below. At times, our customers' and stakeholders' views have differed. We indicate throughout this document where our approach was informed by customer or stakeholder feedback, and where we have relied on direction from our EDPR stakeholders even if their feedback may have differed to those of our customers. We have only done this in instances where we believe our stakeholders were able to weight up the trade-offs between service levels, affordability and efficiently at a more holistic level compared to feedback received from customers.

On the following pages we summarise three key themes coming out of our research and feedback, while **Error! Reference source not found.** provides a holistic view of how our customers' needs are changing, and the emergence of new customer types through the energy transition.

Customers value solar exports and do not want them to go waste

Through our customer research, surveying and workshops, we have received consistent feedback that solar energy should not be wasted and that solar exports should be celebrated, both as renewable energy resources but also to allow neighbours to share in that energy. Our customers see beneficiaries of solar to be both those sharing excess solar, and those using clean energy generated by their neighbours. Customers also don't like the idea of 'wasting solar' and see better-utilising solar as a good way to bring down overall energy costs.

In our Quantified Customer Values research, customers put a high value on solar exports to be enabled through a customer willingness to pay (WTP).

Figure 2: Customer preferences around investment in solar exports

Both households ($52.26pa) and businesses ($197.74pa) customers attach a positive value to investing to enable more solar exports.

WTP to avoid 'spilling solar' is higher than avoiding managed charging, with customers keen to minimise electricity wasted.

	Households	Businesses
Willingness to pay	$52.26 $4.38 per month	$197.74 $16.48 per month
Rebased willingness to pay	$28.32 20.95% of total	$120.48 19.46% of total
Willingness to accept	$286.12	$651.91

Notes: WTP = Maximum amount a customer is willing to pay for a service. This can vary based on factors such as income, preferences, perceived benefits, and market conditions; rebased WTP = the maximum amount a customer is willing to pay for a service determined by their willingness to pay for the entire bundle of services; willingness to accept (WTA) = Minimum compensation a customer would accept to lose a service. It depends on various factors such as the individual's valuation of the item, opportunity costs, and personal circumstances.

Source: AusNet.

Overall, surveyed customers expressed the following perceptions:

- Customers view curtailed solar is wasteful and believe using electricity generated by rooftop solar offers overall benefits.
- Many customers see the ability to export solar energy as a right and a key part of the "solar value proposition" promoted by the government and solar installers.
- Some customers perceive AusNet curtailing solar as a failure of both AusNet and the government to work effectively behind the scenes.

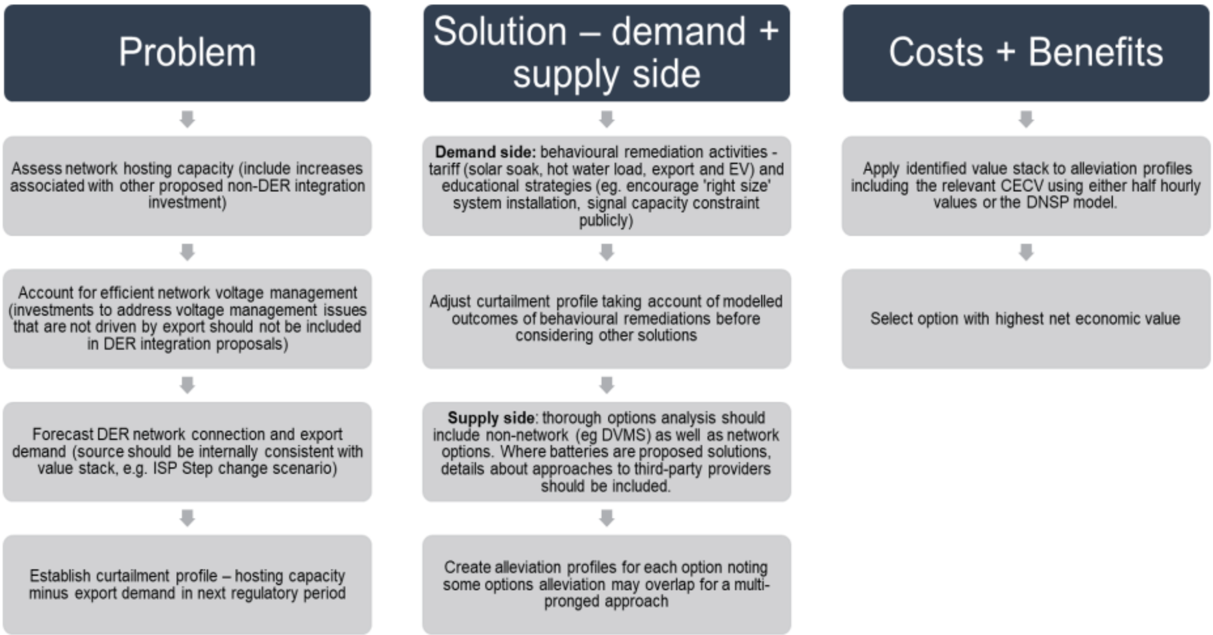
This was broadly consistent with customer workshop findings, where customers expressed willingness to pay extra for the network to enable solar exports, where approximately $40 per year was seen as a reasonable extra cost.

We understand the customer sentiment on solar exports; however, we also need to consider whether there are unintended cross subsidies through enablement of exports at any cost. For that reason, we have engaged extensively on our export enablement proposal with our Future Expert Panel and our Tariffs and Pricing Panel. Our panel members are highly supportive of a move to Flexible Exports as a more efficient and more equitable way of managing exports in the future. They are also supportive of investment that unlocks efficient levels of expenditure based on the AER's customer export curtailment value (CECV) and value of emissions reduction (VER). We agree this approach, and while customers typically would like to see all solar exports utilised, we consider it is important to maintain efficiency of our investment in the long-term interest of all consumers.

2.2. AER's DER integration guidance note, CECV and VER

Following the recognition of export services as a distribution service in 2021 through the AEMC's Access, pricing and incentive arrangements for distributed energy resources (DER) rule change, the AER published its DER integration expenditure guidance note and the first iteration of the customer export curtailment value (CECV) in 2022. The AER's proposed process for the development of CER/DER integration expenditure shown in Figure 4**Error! Reference source not found.**. The AER updated its CECV values in July 2024.

Figure 4: AER's process for developing CER/DER integration investment proposals



Source: AER, DER integration expenditure guidance note, June 2022, p. 5.

In May 2024, the AER published its guidance on applying values of emissions reduction (VER) including the VER to be used by distribution networks, shown in figure 5.

Figure 5: AER's VER, May 2024

Year	Average IPCC & ACCU (using official IPCC) AUD2023	Year	Average IPCC & ACCU (using official IPCC) AUD2023
2023	66	2037	181
2024	70	2038	194
2025	75	2039	207
2026	80	2040	221
2027	84	2041	236
2028	89	2042	252
2029	95	2043	268
2030	105	2044	286
2031	114	2045	305
2032	124	2046	325
2033	135	2047	346
2034	146	2048	369
2035	157	2049	393
2036	169	2050	420

Source: AER, Valuing emissions reduction AER guidance and explanatory statement, May 2024.

2.3. Purpose and scope

The purpose of this business case is to describe the identified need in relation to enabling CER across the AusNet electricity distribution network, and to present credible options for programs of work that are able to address the identified need. This business case quantifies the:

- current and estimated future levels of identified CER hosting and export limitations across the network for each network asset;
- impact of network export limitations on CER customers in relation to
  - **imposing static export limits on CER customers -** AusNet's assets could be exposed to thermal overload beyond their technical rating, and AusNet's customers could be exposed to steady-state over-voltage beyond the EDCOP limits, if there are CER exports exceeding the network's technical capability; and
  - **voltage-curtailment of solar PV systems** (for a subset of options) - over-voltages cause tripping or reduction of solar PV inverter power output, preventing CER customers from generating and exporting electricity;
- increase in greenhouse gas emissions as a result of curtailed customer CER renewable generation
- costs and benefits of potential credible options to mitigate identified network export limitations,
- forward looking programs of work for implementation in the 2026-31 regulatory control period that ensure that CER enablement is undertaken at least lifecycle cost.

The scope of this business case is for CER Enablement only. There are other related programs (with separate business cases) with different identified needs and objectives that may have identified identical augmentation projects. Therefore, AusNet has removed duplicated projects from this CER Enablement business case where an overlap has been identified, so as not to double-count expenditures (i.e., this business case takes a lower precedence). The hierarchy we have applied for removal of duplicate projects from the programs of work is as follows:

- 1st priority—Voltage Compliance
- 2nd priority—Electrification
- 3rd priority—CER Enablement (this business case).

3. Identified need

Table 3 through to Table 6 illustrates AusNet's forecast hosting capacity, estimated CER generation and export levels, estimated voltage curtailment levels, and CER generated energy at risk, aggregated at each level of the network. This forecast is based on a do nothing investment scenario over the 2026-31 regulatory control period.

Table 2: AusNet aggregated forecast hosting capacity and network limitations – sub-transmission level

AusNet Sub-transmission hosting capacity and limitations				
Year	Gross hosting capacity (MW)	Net export hosting capacity (MW)	Inverter voltage curtailment (GWh pa)	Risk of export limiting (GWh pa)
2027	1972	1373	16	52
2028	1956	1348	16	64
2029	1931	1316	16	75
2030	1911	1290	16	84
2031	1892	1264	16	94

Table 3: AusNet aggregated forecast hosting capacity and network limitations – zone substation level

AusNet Zone Substation hosting capacity and limitations				
Year	Gross hosting capacity (MW)	Net export hosting capacity (MW)	Inverter voltage curtailment (GWh pa)	Risk of export limiting (GWh pa)
2027	623	44	38	114
2028	632	45	39	125
2029	634	46	50	134
2030	634	48	61	140
2031	639	49	67	143

Table 4: AusNet aggregated forecast hosting capacity and network limitations – HV distribution feeder level

AusNet High-Voltage Distribution Feeder hosting capacity and limitations				
Year	Gross hosting capacity (MW)	Net export hosting capacity (MW)	Inverter voltage curtailment (GWh pa)	Risk of export limiting (GWh pa)
2027	1144	459	20	637
2028	1131	452	20	694
2029	1151	440	21	725
2030	1152	427	21	781
2031	1150	414	22	827

Table 5: AusNet aggregated forecast hosting capacity and network limitations – SWER level

AusNet Single Wire Earth Return (SWER) hosting capacity and limitations				
Year	Gross hosting capacity (MW)	Net export hosting capacity (MW)	Inverter voltage curtailment (GWh pa)	Risk of export limiting (GWh pa)
2027	23	22	2	4
2028	23	22	2	4
2029	23	22	2	4
2030	23	22	2	4
2031	23	22	2	4

Table 6: AusNet aggregated forecast hosting capacity and network limitations – distribution substation and LV level

AusNet Distribution Substations and Low-Voltage hosting capacity and limitations				
Year	Gross hosting capacity (MW)	Net export hosting capacity (MW)	Inverter voltage curtailment (GWh pa)	Risk of export limiting (GWh pa)
2027	2752	2133	17	657
2028	2764	2130	17	707
2029	2774	2127	17	732
2030	2785	2123	17	778
2031	2796	2121	17	817

Over the 2026-31 regulatory control period, for a do nothing investment scenario, the amount of CER generation needing to be curtailed through either static export limits to manage network export limitations, or voltage-curtailed generation being experienced by customers due to higher network voltages from exporting CER, is expected to rise by 160 GWh pa, a 24% increase.

3.1. Key inputs and assumptions

Key inputs, calculations and assumptions used in this business case are described in detail in AusNet's Hosting capacity and voltage compliance, electrification and CER enablement methodology document (Document no. XXXXX). Other key assumptions used in this business case are summarised in Table 7

Table 7: Key assumptions

Parameter	Value	Comments
Discount rate	5.56%	Average of our forecast of pre-tax WACC (3.91%) and AEMO's 2023 IASR central case (7.00%)
Evaluation period	20 year	Benefits calculated for the first 10-years, then maintained from years 11 to 20. No benefits assumed beyond year 20.
CECV & VER	AER 2024 Values	Used for voltage-induced curtailment of CER.
Flexible export uptake rate	70% of new CER customers per annum	Our modelling assumes that Flexible Export services are taken up by the majority of new CER installations.

Source: AusNet analysis

4. Options assessed

4.1. Credible solutions

In developing the options for this business case, we have considered a range of credible solutions, that are able to address the network export limitations identified, and the voltage-induced CER curtailment that is likely to be occurring. To identify which solutions are least-cost technically feasible to resolve the nature of the identified limitations, a set of decision rules are applied to each asset (at each network level) using the measured actual and forecast operating conditions and limitations.

The range of credible solutions considered are as follows:

- Dynamic Voltage Management (DVM)
- Network augmentation:
    - Switched reactors
    - Transformer upgrades (larger rating and/or lower impedance) and replacements (with wider tapping ranges)
    - New transformers
    - New feeders and circuits
    - Splitting or reconfiguring circuits
    - Tap changes
    - Float voltage setting changes and line drop compensation
    - Phase balancing
- Non-network alternatives (including storage, and inverter support).

These solutions are discussed in further detail below.

4.1.1. Dynamic Voltage Management (DVM)

Like other Victorian distributors, AusNet is ideally placed with its ubiquitous availability of Advanced Metering Infrastructure (AMI) smart meters to adopt DVM as a credible solution to addressing voltage-related network export limitations and voltage-induced CER curtailment. AMI to date has given us greater visibility of steady-state voltage performance through a suite of analytical tools which has enabled the business to understand, monitor, report on, and act upon voltage compliance issues within the network, yet AusNet has not used to date AMI for near real time voltage control.

As such, AusNet is now embarking on, in the current regulatory control period, using the AMI smart meter voltage data for near real-time operational voltage control for a trial adopting DVM capability at several of our zone substations with high penetrations of CER. We intend (at the conclusion of this trial) to transition to a more widespread use of DVM which provides a more advanced, data-driven way to manage both HV and LV voltages over network augmentations, eliminating the need for voltage drop assumptions, and having the capability to dynamically respond to changes in CER operation in near-real-time to accommodate more exports and less curtailment.

Whilst this solution can be used to address voltage-related network export limitations and voltage-related generation curtailment of CERs, it cannot address any thermal overload related limitations resulting from reverse power flows exceeding the assets' export ratings. For thermal export limitations, a network augmentation solution or non-network solution is required to address the need.

We have assessed the deployment of this new DVM capability against other network augmentations and other non-network alternatives in this business case, to develop a CER Enablement Program that achieves the maximum enablement of CER at least cost.

4.1.2. Network augmentations

It should be noted that DVM acts on a population basis (per HV voltage control zone) rather than act to achieve satisfactory voltage for any individual CER customer. Hence, whilst DVM capability can act to alleviate much of the voltage-related export limitations and voltage-induced curtailment, addressing limitations for individual customers would need to continue to be undertaken at the localised level using more network solutions.

The extent that an automated DVM system would cease to be effective from a population basis for addressing voltage-related limitations would arise under two conditions:

- an excessive (greater than 37 V) LV voltage distribution spread (per HV voltage control zone) at times of maximum demand (usually on days of extreme ambient temperature) where LV voltage distributions may be so broad, preventing DVM from addressing the voltage-related network export limitations and curtailments, in which case some network augmentations would be required to enable a DVM solution; and
- running out of available taps (on a zone substation transformer) at times of minimum daytime demand where voltage distributions are pushed so far towards the higher end of the regulatory limits by exports that there is no ability to lower voltages to resolve the network export limitations and curtailments, in which case a transformer replacement (with wider tapping range) or switched reactor would be required with a DVM solution.

The typical work undertaken under network augmentation solutions include:

- **Switched reactors** – these are used to draw more reactive power through the network to create a voltage drop which will result in transformers operating on more nominal taps during times of minimum demand, rather than at their extreme buck tap. This solution however, does not address thermal overload limitations.
- **Transformer upgrades (lower impedance, higher rating) and replacements (with wider tapping ranges)** – to cater for voltage limitations that are caused by low short-circuit levels, or a lack of available buck taps during times of minimum demand. This solution also addresses thermal overload limitations by the use of a higher rating transformer.
- **New transformers and new circuits** – to cater for voltage limitations that are caused by long or high impedance circuits, by splitting up and reconfiguring the network with shorter circuits and fewer customer per circuit. This solution also addresses thermal overload limitations by increasing the capacity of the network with the new assets.
- **Tap changes** – to allow the voltage to be dropped when the voltage is elevated across all operating conditions. Many of AusNet's legacy transformers are operating at their extreme buck tap and cannot be tapped down any further without a transformer replacement. This solution does not address thermal overload limitations.
- **Float voltage setting changes** – this has been completed across many of AusNet's sites already.
- **Phase balancing** – targeted at sites where there is significant unbalance at maximum demand causing a wide voltage spread across phases. This solution can also address thermal overload limitations if balancing is undertaken for minimum demand, provided such action does not adversely create a balancing limitation at maximum demand.

4.1.3. Non-network alternatives

Battery energy storage and CER inverter settings could be used to support network voltage, and therefore alleviate voltage-related network export limitations and curtailments. This solution also addresses thermal overload limitations triggered by reverse power flows exceeding the assets' export rating.

We have already mandated the use of Volt-Watt and Volt-VAr settings on CER inverters to allow the voltage to be lowered by either drawing reactive power through the network impedance, or curtailing the generation output of the inverter, to the extent that the inverter is able to achieve this. It is expected that as more customers apply the settings, the active and reactive power support would enable more solar customers to be connected to the network with reduced levels of non-compliance.

The opportunity lies with storage in being able to defer or displace a network augmentation by charging during minimum demand and utilising its inverter for voltage support. The opportunity to adopt storage as a non-network alternative will be assessed on a case-by-case basis, since the business case for using storage for network support, requires value stacking with market benefits, given its current higher cost premium.

4.2. Assessment approach

4.2.1. Assessment methodology

The regulatory framework facilitates quantifying a prudent level of CER enablement investment through the AER's CECV and VER. AusNet has adopted these as an economic approach to valuing the impact of network limitations on CER exports, with the aim of enabling exports[2] and reducing emissions and voltage-induced curtailment[3] for CER customers.

To identify the limitations and economic viability of the projects which make up the CER Enablement Program, AusNet has developed a detailed model that maximises the use of its AMI data and other measurement data, to determine the network performance and its characteristics, in-lieu of power system simulation and modelling assumptions. Figure 1 identifies the modelling components of AusNet's CER Enablement Program that identify and economically justify expenditure on this program for the 2026-31 regulatory control period, based on forecast network export limitations and CER voltage-related curtailments.

Figure 1: CER Enablement Program Modelling

Modelling Inputs

Customer segmentation and demand scenarios, network characteristics, outputs from AusNet's Tactical Hosting Capacity (THC) model, actual voltages, operating states and demand measurements from AMI and SCADA.

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HV, SWER and LV Models

These models determine the network export ratings, CER hosting capacity, CER curtailment levels and network thermal overload and voltage limitations arising in each part of the network (HV and LV) over the forecasting period, for different demand and customer segmentation scenarios. The outputs of the models are:

Forecast expected generated energy at risk for each network asset in each half-hour over the planning horizon, where CER is at risk of being export limited by AusNet due to identified network export limitations (thermal and voltage limitations triggered by reverse power flows).	Forecast voltage-curtailed generation for each network asset in each half-hour over the planning horizon, for CER being curtailed by its own inverters (defined by AS4777.2:2020 Volt-Watt, Volt-VAr and tripping characteristics), in response to steady-state LV network over-voltages.

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CER Enablement Economic Model

The CER Enablement program economic model uses the CECV and VER methodologies to justify investment in the program for enabling CER exports and reducing emissions and voltage-induced CER curtailment across AusNet's customer base, and how this may change over time, particularly with falling minimum daytime demand.

The model uses the costs and characteristics of credible options to identify the preferred option for each location, ranking the projects to develop a program of works of the most economically viable projects.

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CER Enablement Program Business Case (this business case)

The methodology applied is described in detail in AusNet's Hosting capacity and voltage compliance, electrification and CER enablement methodology document (Document no. XXXXX), with the quantification of the identified needs and economic evaluation approach summarised from this document below.

[2] Avoiding CER export limiting that may otherwise be needed to address thermal overload and voltage limitations in the network as a result of reverse power flows.

[3] Avoiding CER generation curtailment associated with inverters responding to network over-voltages through the action of their mandated AS4777 inverter Volt-Watt and tripping settings.

4.2.2. Valuing exported energy and over-voltage curtailed energy

This CER Enablement business case utilises the CECV methodology and the CER assessment guideline. The AER published the most recent CECV on 1 July 2024.[4] These values have been used verbatim (copied directly from the AER workbook, as values) into the CER Enablement models, filtered for the Victorian region. They cover every half hour period from 1/7/2024 to 30/6/2045 and are expressed in Australian dollars per MWh ($2023, real).

The assessment approach in this business case applies CECV to the exporting of CER generation that causes minimum net demand to fall to levels that exceed the export rating of each network asset under assessment. This is referred to as the *expected generated energy at risk*, because the CER contributing to these network export limitations is at risk of having export limits imposed by AusNet.

The steps taken to do this included

- comparing the annual load profile (based on customer segmentation, maximum and minimum demand forecasts) with the calculated export rating, for each asset under assessment
- identifying the *generated energy at risk* at times when the annual load profile breaches the asset's export ratings
- weighting the results by the 10POE and 50POE demand scenarios to get an *expected* value
- multiplying the *expected generated energy at risk* calculated from this process with the escalated CECV for each half hour of the analysis period.

The assessment approach in this business case also applies CECV to the voltage-induced curtailment of generation from the action of Volt-Watt control in AS4777.2 solar PV inverters at that location. To estimate the level of voltage-induced curtailment on inverters, it is necessary to understand the gross level of solar PV generation being produced during the year and its profile during the day, and the voltage levels that are being experienced by the inverter which may trigger the operation of the Volt-Watt or inverter tripping functions in solar PV inverters.

The steps taken to do this included

- identifying a seasonal gross generation equation for a typical solar PV system located in outer eastern Melbourne, being representative of the heartland of AusNet's residential solar PV customer population.
- identifying an equation that describes the curtailment of the gross generated energy from the action of the Volt-Watt and tripping settings that occurs from the inverter responding to steady-state over-voltages.
- netting out the impacts of shading and cloud cover that can change across different seasons.
- multiplying the net curtailed energy calculated from this process with the escalated CECV for each half hour of the analysis period.

4.2.3. Valuing emissions reduction

The CER enablement program is also supported by the quantification of greenhouse gas emissions reductions. The curtailment of CER generation could result in higher emissions of greenhouse gasses if additional fossil-fuel generation is dispatched to meet the increased demand. The AER has released draft guidance on applying value of emissions reduction for network capital investments utilising a Value of Emissions Reduction (VER) Methodology[5], as well as forecasts VER for use by DNSPs in economic evaluations.

4.2.4. Economic evaluation approach

The proposed program expenditure is derived from an assessment approach that aims to maximise the net economic benefit to customers as follows:

- Using the costs and avoided risks (calculated from the do nothing risks above) of the identified credible solutions, the net present value (NPV) of the solution at each asset location is calculated.
- The site NPVs are ranked to develop a program of works of the most economically viable projects, comprising only NPV positive projects.
- The optimum timing for each project occurs when the annualised avoided risk exceeds the annualised cost of the project.

The present values are calculated using a discount rate over a 20-year planning horizon, keeping forecasts of risk and benefits beyond 10-years constant at the year 10 value. An expenditure profile is developed based on the list of economically viable sites and their optimum timing forming a programme of works.

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[4] https://www.aer.gov.au/system/files/Oakley%20Greenwood%20-%20CECV%20workbook%20-%202023.xlsx
[5] AER releases draft guidance on applying value of emissions reduction | Australian Energy Regulator (AER), 28th March 2024.

Two program options were considered, with Option 1 following the economic approach. Option 2 applies a similar approach to Option 1 considering multiple solutions to remove constraints in the low voltage and the 22 kV network to allow for zero constraints, however the preferred solution does not necessarily deliver the most positive net benefit to all customers. Instead, it is focussed on delivering the largest improvement in CER enablement possible at least cost.

4.3. Do nothing

The do nothing (counterfactual) option assumes that AusNet would not undertake any proactive investment in CER enablement—that is, none of the CER Enablement Programs are adopted. Since this option assumes no investment outside of the normal operational and maintenance processes, this is a zero incremental investment cost option.

Over the 2026-31 regulatory control period, for a do nothing investment scenario, the amount of CER generation needing to be curtailed through either static export limits to manage network export limitations, or voltage-curtailed generation being experienced by customers due to higher network voltages from exporting CER, is expected to rise by 160 GWh pa, a 24% increase.

The present value of total risk of CER generation needing to be curtailed through either static export limits to manage network export limitations, or voltage-curtailed generation being experienced by customers due to higher network voltages from exporting CER, is valued at $1,373 million over the analysis period (Real, 30th June 2024 dollars).Table 8 shows the undiscounted risk values.

Table 8: Do nothing risk ($m, undiscounted, 30th June 2024 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Avoided export limits	20.5	29.6	46.5	39.1	41.9	**177.6**	**1,557**
Avoided generation curtailment	0.4	0.4	0.7	0.5	0.5	**2.4**	**37.2**
Emissions reduction	9.8	10.2	10.1	11.7	13.1	**55.0**	**392.1**
Do Nothing Risk	**30.7**	**40.2**	**57.3**	**51.3**	**55.5**	**235.0**	**1,986**

Source: AusNet analysis

The incremental investment cost of do nothing is zero.

The do nothing risk represents an upper limit of the pool of potential benefits that are available to credible options that can address the identified need, as detailed below.

4.4. Option 1 – Economic approach

This option is a proactive CER Enablement Program which is specifically targeted at following the economic approach to minimise the impact of network limitations on CER exports from the imposition of static export limits, *including* addressing voltage-curtailed generation for customers with over-voltage, noting that this option has removed projects that have been identified in Option 1 of the Voltage Compliance and Electrification business cases.

The sites which have been identified under this option for targeting CER enablement solutions are shown in Table 9. All projects in this listing are NPV positive, all considering the benefits of the avoided risks of imposing static export limits and avoided voltage-curtailed generated energy. The NPV analysis is shown in Table 10.

Table 9: Option 1 projects

Optimum project type	Identified sites
Zone substation reactor & DVM	DRN
HV distribution feeder regulator & DVM	MOE13, EPG12, CRE21, PHM24, BGE23, RVE12, CPK11, CPK12, LDL13

Optimum project type	Identified sites
Dynamic Voltage Management (DVM)	MBY
HV distribution feeder augmentation	EPG21, EPG13, CLN13, CLN21, CLN12, CLN14, DRN11, CLN23, KLO14, CLN11, EPG32
Distribution substation and LV circuit augmentation	CORE MARKET, CHEVROLET FERRARI, WONTHAGGI NORTH 62F, STANTON 3, RAWLINGS 10
Distribution substation transformer replacement Distribution substation tap down	75 sites
Distribution substation phase peak load balance Distribution substation tap up	1,028 sites

Source: AusNet analysis

Table 10: Option 1 ($m, undiscounted, 30th June 2024 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Cost	(8.3)	(6.5)	(0.2)	(20.4)	(0.4)	**(35.7)**	**(46.6)**
Benefits	7.4	20.2	23.9	23.4	27.6	**102.5**	**680.0**
NPV	**426.7**						

Source: AusNet analysis (benefits are relative to do nothing, representing reduced do nothing risk)

4.4.1. Cost

4.4.1.1. Capital expenditure

Table 11 represents the forecast capital expenditure that is economically prudent for AusNet to be investing in the network to enable CER exports, and to facilitate reduced CER curtailment.

Table 11: Option 1 capital expenditure ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Capex	(8.3)	(6.4)	-	(20.3)	-	**(35.0)**	**(35.4)**

Source: AusNet analysis

4.4.1.2. Operating expenditure

Table 12 represents the forecast incremental operational expenditure that is economically prudent for AusNet to be investing in the network to enable CER exports, and to facilitate reduced CER curtailment.

Table 12: Option 1 operating expenditure ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Opex	(0.0	(0.1)	(0.2)	(0.2)	(0.4)	**(0.7)**	**(11.2)**

Source: AusNet analysis

4.4.2. Benefits

Over the 2026-31 regulatory control period, the amount of CER generation needing to be curtailed through either static export limits to manage network export limitations, or voltage-curtailed generation being experienced by customers due to higher network voltages from exporting CER, is expected to fall by 264 GWh pa, a 32% reduction (compared to a 24% increase for the do nothing investment scenario).

Table 13: Option 1 benefits ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Avoided export limits	4.9	14.9	19.4	17.8	20.8	**77.9**	**533.1**
Avoided generation curtailment	0.1	0.2	0.3	0.2	0.3	**1.1**	**12.7**
Emissions reduction	2.4	5.1	4.2	5.4	6.5	**23.5**	**134.2**
Total	**7.4**	**20.2**	**23.9**	**23.4**	**27.6**	**102.5**	**680.0**

Source: AusNet analysis (benefits are relative to do nothing, representing reduced do nothing risk)

4.5. Option 2 – Deterministic approach

This option is a proactive CER Enablement Program which is specifically targeted at following the deterministic least cost approach to remove all static export limits and voltage-curtailed generation, noting that this option has removed projects that have been identified in Option 2 of the Voltage Compliance and Option 3 of the Electrification business cases.

The sites which have been identified under this option for targeting CER enablement solutions are shown in Table 14. All projects in this listing have benefits but are not necessarily NPV positive to achieve a full CER export and no curtailment outcome. Project solutions are based on least cost. The NPV value is shown in Table 15.

Table 14: Option 2 Projects

Optimum project type	Identified sites (NPV > 0)	Identified sites (NPV ≤ 0)
Zone substation augmentations	0 sites	CLN, WGI
Zone substation reactor & DVM	0 sites	CLN, OFR, PHI, WGI, WN
HV distribution feeder regulator & DVM	PHM24	MFA22
HV distribution feeder augmentation	11 sites	KLO24
DVM on regulators	0 sites	44 sites
SWER augmentation	0 sites	9 sites
Distribution substation and LV circuit augmentation	4 sites	7 sites
Distribution substation transformer replacement **Distribution substation tap down**	52 sites	150 sites
Distribution substation phase peak load balance **Distribution substation tap op**	1,017 sites	1,613 sites

Source: AusNet analysis

Table 15: Option 2 ($m, undiscounted, 30th June 2024 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Cost	(50.4)	(17.2)	(0.8)	(100.9)	(1.8)	**(171.1)**	**(223.2)**
Benefits	7.9	23.0	25.9	25.4	28.0	**110.2**	**716.0**
NPV	**300.8**						

Source: AusNet analysis (benefits are relative to do nothing, representing reduced do nothing risk)

4.5.1. Cost

4.5.1.1. Capital expenditure

Table 16 represents the forecast capital expenditure that is a deterministic removal of all export constraints.

Table 16: Option 2 ($m, undiscounted, 30th June 2024 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Capex	(50.3)	(16.6)	-	(100.1)	-	**(167.0)**	**(179.0)**

Source: AusNet analysis

4.5.1.2. Operating expenditure

Table 17 represents the forecast incremental operational expenditure related to a deterministic removal of all export constraints.

Table 17: Option 2 ($m, undiscounted, 30th June 2024 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Opex	(0.1)	(0.6)	(0.8)	(0.8)	(1.8)	**(4.1)**	**(44.1)**

Source: AusNet analysis

4.5.2. Benefits

By the end of the 2026-31 regulatory period, the amount of curtailment and export limiting needed to manage the network should be minimal, only if this program is adopted with the Voltage Compliance and Electrification Option 2.

Table 18: Option 2 ($m, undiscounted, 30th June 2024 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Avoided export limits	5.3	17.0	21.0	19.4	21.1	**83.8**	**561.2**
Avoided generation curtailment	0.1	0.2	0.3	0.2	0.3	**1.1**	**13.4**
Emissions reduction	2.5	5.8	4.6	5.8	6.6	**25.4**	**141.4**
Total	**7.9**	**23.0**	**25.9**	**25.4**	**28.0**	**110.2**	**716.0**

Source: AusNet analysis (benefits are relative to do nothing, representing reduced do nothing risk)

5. Preferred option and sensitivity testing

Option 1 is the preferred option at a total cost of $35.7 million (real, $June 2024) over the 2026-31 regulatory period, which represents a prudent and efficient network augmentation investment to enable CER. Applying a discount rate of 5.56% per annum, this proposed program option has a net economic benefit of $427 million (real, $June 2024) over the 20-year assessment period as illustrated in Table 19.

Table 19: Economic evaluation of CER enablement options ($m, $June 2024)

	FY27 to FY31 (undiscounted)			Full assessment period (discounted)			Comments
	Capex	Opex	Total cost	Total cost	Total benefits	NPV	
Do Nothing	0.0	0.0	0.0	0.0	0.0[6]	0.0	This option does not address the identified need
Option 1 – Economic approach	35.0	0.7	35.7	(40.0)	466.7	426.7	This is the preferred option as it maximises the NPV
Option 2 – Deterministic approach	167.0	4.1	171.1	(191.0)	491.8	300.8	This is the most expensive option

Source: AusNet analysis

Over the 2026-31 regulatory period, for an Option 1 investment, the amount of CER generation needing to be curtailed through either static export limits to manage network export limitations, or voltage-curtailed generation being experienced by customers due to higher network voltages from exporting CER, is expected to fall by 264 GWh pa, a 32% reduction (compared to a 24% increase for the do nothing investment scenario).

Despite the increases in CER connections expected over the period, this Option 1 investment program effectively delivers an improved CER export performance outcome for CER customers.

Table 20 compares the costs and benefits of the program options for credible variations in input variables.

Table 20: Sensitivity of CER Enablement Program NPV ($m, $June 2024)

	Central assumptions	Project delayed by one year	4.11% discount rate	15% reduction in capital costs	5% increase in demand	25% increase in failure probability	7.00% discount rate	15% increase in capital costs	5% reduction in demand	25% reduction in failure probability	Comments
Do nothing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	This option does not address the identified need
Option 1	**426.7**	**392.4**	**522.1**	**432.7**	**473.4**	**543.4**	**369.0**	**420.7**	**356.7**	**310.0**	This is the preferred option as it maximises the NPV
Option 2	300.8	269.8	389.5	329.5	350.0	423.7	224.3	272.1	227.1	177.9	This is not a preferred option

Source: AusNet analysis

This table illustrates that the decision to select Option 1 as the preferred option remains robust, being the option with the highest NPV and remaining positive under the majority of credible sensitivities.

[6] The present value of total risk of CER generation needing to be curtailed through either static export limits to manage network export limitations, or voltage-curtailed generation being experienced by customers due to higher network voltages from exporting CER, is valued at $1,373 million over the analysis period (real 30th June 2024 dollars). Refer Table 8.

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