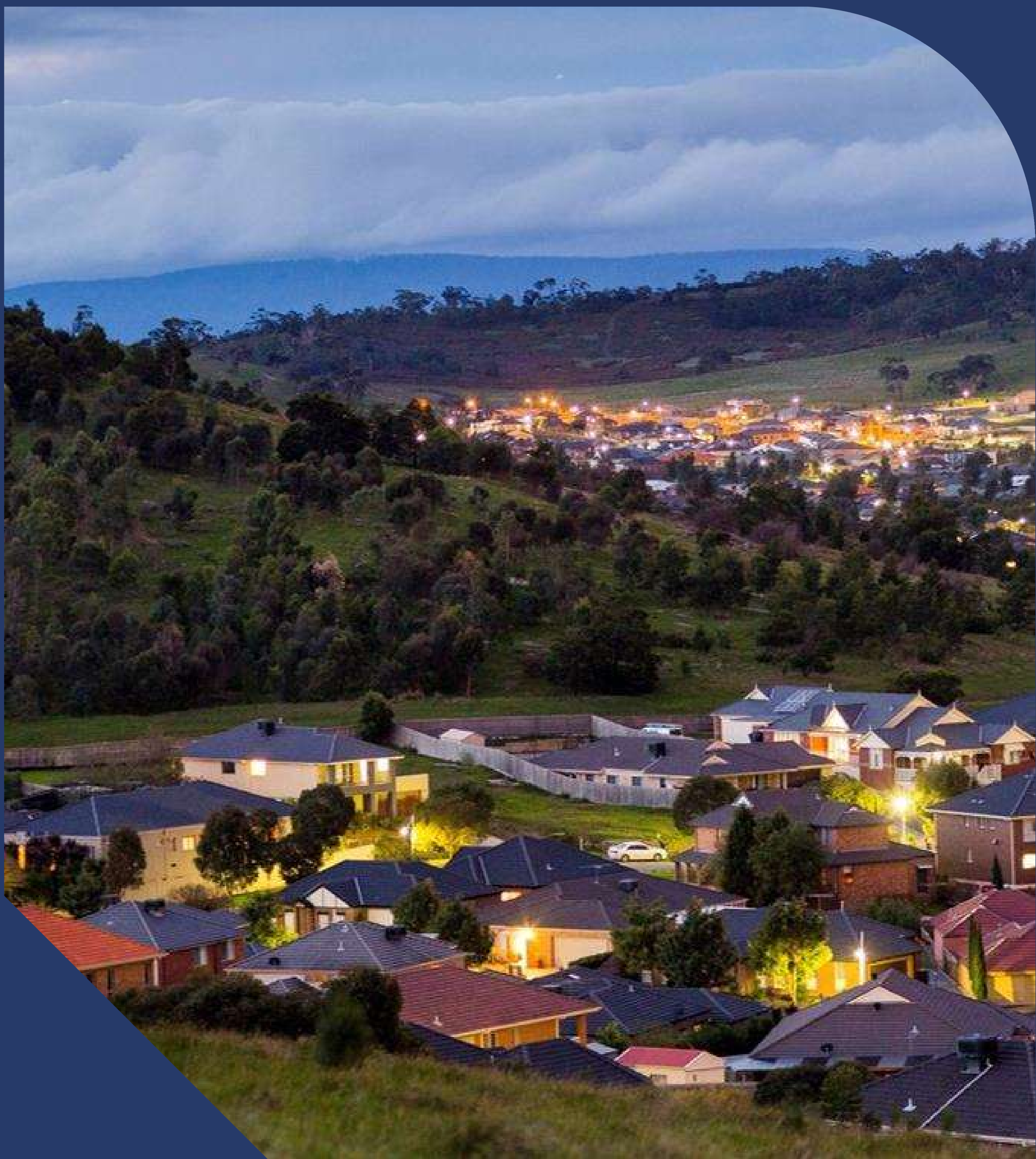
AusNet

Electricity Distribution Price Review (EDPR 2026-31)

Business case: Demand driven augmentation in the LV network & Flexible Services

Date: 31 January 2025



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1. Executive summary

This business case presents our investment plans to facilitate maximum demand growth across AusNet's existing low voltage (LV) and single wire earth return (SWER) distribution network, driven by electrification of transport and gas (largely in homes and small businesses). Electrification of gas and transport is expected to grow rapidly over the 2026-31 regulatory period, driven by government policies to reduce emission reductions and increase the penetration of renewable energy. The table below summarises some key trends in customer growth and the electrification of homes and transport estimated for AusNet during 2026-31.

Table 1: Forecast electrification rates for AusNet, 2026-31

CUSTOMER TYPE	2026	2031	% GROWTH
All electric homes only	**265,621**	**533,713**	**101%**
Electric vehicles	**40,051**	**244,883**	**515%**

Source: AusNet

This business case outlines a program of work needed to economically reduce expected unserved energy (EUE) for customers in the existing LV and SWER networks, resulting from an increase in maximum demand from electrification. The program includes a combination of network augmentation and efficient third-party 'flexible services' (type of non-network solution). Investment plans at the high-voltage (HV) distribution feeder, zone substation, and sub-transmission networks in response to electrification and maximum demand growth in general, are detailed in separate business cases.

Without the planned program of work, growth in demand in existing networks would result in network asset import limitations for some parts of the network, which may cause adverse impacts for customers. This includes the need to load shed customers such that AusNet's assets are not exposed to thermal overload beyond their technical rating, and customers are not exposed to steady-state over and under-voltages beyond the Electricity Distribution Code of Practice (EDCOP)[1] limits. Load shedding is a form of an outages for customers negatively impacting the reliability of their electricity supply, which is both disruptive to the economy and the wellbeing of our customers, particularly as these reliability risks are the highest during times of extreme ambient temperatures.

AusNet's LV and SWER network was largely designed decades years ago, with many areas of the network not designed or built to absorb additional new demand from the electrification of gas and transport. Hence, a proportion of our distribution substations and SWER lines are expected to be at risk of overload over 2026-31, particularly during 5pm to 9pm on days of extreme high or low ambient temperature. The network assets most at risk are those that are already highly utilised (or overloaded) at times of maximum demand, which were originally designed for lower demand patterns. This represents 5.5% of our distribution substation population and 43% of our SWER population. The limitations on these already highly utilised assets are expected to worsen over the next regulatory control period and new sites will emerge without further investment, with the expected levels of electrification, adversely impacting the reliability and quality of supply for our customers affected.

We engaged with our Future Network Panel and the Coordination Group on our augmentation program for the LV network and SWER. Both the Future Network Panel and the Coordination Group supported AusNet investing to enable customers to electrify their homes and vehicles, based on AusNet's value of customer reliability (VCR), as well as AusNet considering a demand management program to incentivise non-network solutions as part of the investment program.

The preferred planned program of work is a proactive program which is specifically targeted at addressing network limitation that impact customer's reliability, needed in response to the growing maximum demand expected from the electrification of gas and transport. Three options are considered in addition to the do nothing case which are targeted at mitigating EUE in the LV distribution substation and SWER networks, these being:

- **Do nothing**—no expenditure on addressing network limitations that impact customer reliability.
- **Option 1**—economic probabilistic planning approach to minimise the reliability impact of network import limitations on customers, by selecting network augmentation projects that have a positive net present value (NPV).
- **Option 2**—economic probabilistic planning approach to minimise the reliability impact of network import limitations on customers, by selecting an efficient mix of network augmentation and non-network flexible services that have a positive NPV.
- **Option 3**—deterministic planning approach to remove all EUE risk from the network using network augmentation projects.

[1] Electricity Distribution Code of Practice – Essential Services Commission of Victoria, Version 2, 1st May 2023.

AusNet proposes Option 2 at a total cost of $130.1 million (real, $June 2024) over the 2026-31 regulatory period, which represents a prudent and efficient investment to address the impacts of electrification. Applying a discount rate of 5.56% per annum, this proposed program option has a net economic benefit of $3,529 million (real, $June 2024) over the 20-year assessment period as shown in Table 1. The capex requirement for option 2 is $119.5m.

Table 1: Economic evaluation of the 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[2]	0.0	This option does not address the identified need
Option 1 – Economic network augmentation	148.7	4.7	153.4	(187.5)	3,716	3,529	This is not the preferred option as it is not least cost
Option 2 – Economic network augmentation and flexible services	119.5	10.6	130.1	(185.8)	3,715	3,529	This is the preferred option as it maximises the NPV
Option 3 – Deterministic augmentation	497.1	15.1	512.2	(618.9)	3,839	3,220	This is the most expensive option

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

Over the 2026-31 regulatory control period, for an Option 2 investment, the amount of customer load needing to be curtailed through load shedding to manage network import limitations, is expected be:

- 7.9 GWh pa lower for distribution substations (compared to 0.5 GWh pa higher for do nothing)
- 1.8 GWh pa lower for SWER lines (compared to 0.2 GWh pa higher for do nothing).

The cumulative benefits delivered by this option are forecast to avoid 63% of the do nothing risk over that period, and by the end of the 20-year economic analysis period, avoid 65% of the total do nothing risk.

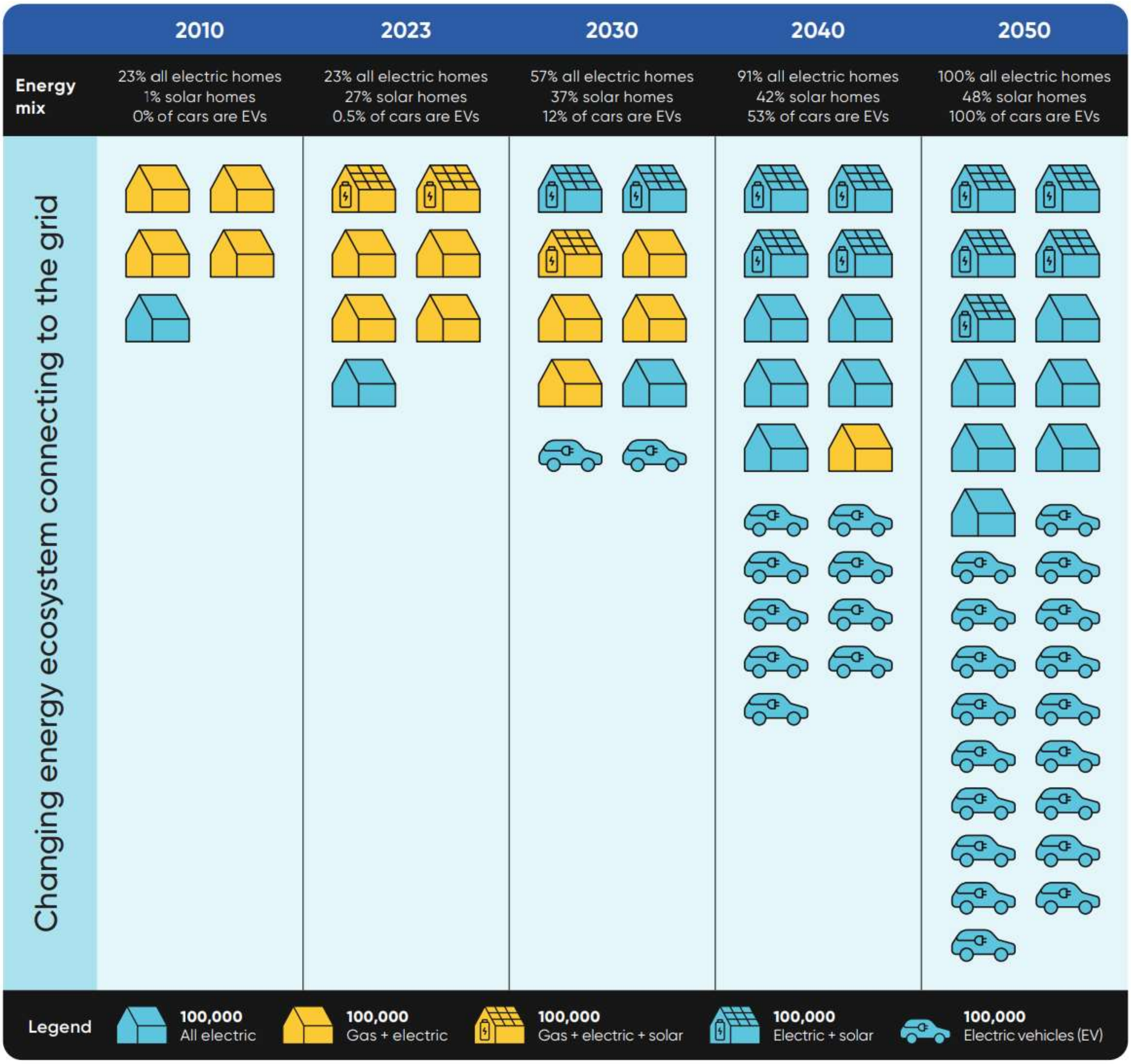
[2] The present value of total risk of EUE, is valued at $6,117 million over the analysis period (30th June 2024 dollars). Refer Table 5.

2. Background

2.1. Electrification trends

Electrification of gas and transport is expected to grow rapidly during the 2026-31 regulatory period, driven by market changes and government policy. Figure 1 summarises the trends expected in both electrification and installations of solar, comparing historical levels with the forecast out to 2050.

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



Source: AusNet.

The trends shown in Figure 1 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.

The electrification trends will happen both in new homes as well as existing homes – particularly with regard to electric vehicles which are likely to be bought by existing AusNet electricity customers. As more existing homes electrify their transport and gas appliances, this will put increasing pressure on existing assets that were not designed for the levels of electricity usage and demand that will result from electrification.

2.2. Flexible services

We are currently investing in the development of a Distribution System Operator (DSO) operational technology platform, and we intend to introduce applications with capabilities to support the introduction of Flexible Services for our customers for the 2026-31 regulatory control period.

The Flexible Services capabilities aim to provide additional levers for us to continue to support the efficient management of our electricity distribution network, and to address identified network limitations. The capabilities will allow us to address identified network needs using a broader range of solutions (including non-network solutions) than just traditional network augmentations, in an effort to deliver lower cost distribution services for our customers into the future.

2.2.1. Types of flexible services

Table 22 summarises various types of flexible services that can be utilised to efficiency defer network augmentation. It is important to note that most of the flexible services can be provided by AusNet or third parties. The table below does not specify either way.

Table 2: Flexible services options

Solution	Description	Advantages	Disadvantages	Applicability as a substitute for network augmentation
Load shedding	Demand-side only solution involving rotational tripping of supply of customers to curtail network load, so as to maintain the operation of the distribution network within its capabilities.	Proven method for addressing network import limitations. i.e. high use case maturity.	Can result in comparatively high adverse impact on customer supply reliability levels. (i.e., poor customer service outcomes)	Can be used to substitute network augmentation, however not a credible option to resolve reliability risk (this is the 'do nothing' option).
Export limiting	Involves limiting customer exports on the network by curtailing generation, so as to maintain the operation of the distribution network within its capabilities.	Proven method for addressing network export limitations. i.e. high use case maturity.	Can result in comparatively high adverse impact on customer generation output. (i.e., poor customer service outcomes)	Not suitable as a substitute for addressing maximum demand import limitations.
Dynamic Operating Envelopes (DOE)	Dynamically calculates and publishes the capability of the network to maximise the opportunity for increased customer demand on the network for imports or exports.	Sophisticated allocation of import and export capacity among customers.	Low technical maturity for import management, and low customer appetite at present as impacts on customer daily lives unclear.	Primary use case is for flexible export services. Could be applied for flexible import services, but most customer impacts untested yet.
Supply Capacity Limiting (SCL)	Utilises supply capacity limit function of a smart meter to rotationally trip supply of customers when their load exceeds a defined value. Alternatively, the load contactor of a smart meter can be used to trip downstream loads or generators (separate meter) within the customers' premises.	Relatively low cost system to implement to manage demand. Reliably delivers the demand reductions required to address the need.	Individual customers may lose supply on a rotational basis, which may have a large impact on their reliability. Understanding supply capacity limits and managing electricity usage accordingly is challenging for customers.	Can be used to substitute network augmentation relating to maximum demand import limitations, however not a credible option to resolve reliability risk.

Behavioural Demand Response (BDR)	Providing near real-time information to a customer via a mobile app or other interface trigger a demand response to an imminent network limitation. The customer has full control over what actions that are taken (if at all) to vary their load or generation.	Provides a high level of flexibility and choice for customers. The solution encourages customer engagement, empowering customers to make informed choices about their energy usage and can lead to permanent behaviour changes.	A critical level of customer participation is needed in aggregate to avoid loss of supply on the network. Customer rewards payments are currently typically lower than customer expectations.	Can be used to substitute network augmentation relating to maximum demand import limitations.
Direct Load Control (DLC)	Involves establishing a communication link direct to customer loads to enable switching of, duty-cycle change, thermostat control or other form of load control of large customer appliances that are enrolled into a direct load control scheme. (e.g., electric vehicle, air-conditioning, pool pump and/or storage).	Direct control of high energy consumption appliances can produce larger demand responses than behavioural programs. The solution is easily scalable and likely to have a lower operating costs than behavioural programs.	Customers may override direct load control or the communication may be inadvertently interrupted. Upfront costs in setup or appliance rebates are required. Less flexibility for customers compared to behavioural programs.	Can be used to substitute network augmentation relating to maximum demand import limitations.
Third-party contracted Virtual Power Plant (VPP)	Virtual power plants are an orchestration of storage, generation, and/or demand response resources (including an aggregation of customer and community storage facilities, solar PV installations, EV charging stations, load control and demand response). They enable a scheduled response, to maintain the operation of the distribution network within its capabilities.	More reliable than other forms of demand response at meeting the need. VPPs participate in energy markets and provide grid services (value stacking) making them potentially more attractive investments than other forms of demand response solutions.	Energy limited or variable resources in the portfolio need to be managed carefully in order to be able to service an imminent network limitation. Implementing and managing VPPs involves integrating a diverse array of technologies. This complexity can pose challenges for system integration, data security, interoperability, and performance.	Can be used to substitute network augmentation relating to maximum demand import limitations, as well as export limitations.

Source: AusNet analysis

2.3. Customer insights

Our customers know that electrification is the way the world is heading and have clearly told us that they expect AusNet to be working behind-the-scenes with government to ensure we can accommodate their policy directions on electrification and solar. We engaged with our Future Network Panel and the Coordination Group on the impact of electrification on our network and our proposal to invest in the existing network to enable more homes and businesses to electrify their gas and transport.

Our Future Network Panel and the Coordination Group have supported efficient necessary investment to enable customers to electrify. The way we measure efficiency is basing investment on the value of customer reliability (VCR). The Future Network Panel and the Coordination Group have supported AusNet to use its own VCR values derived through detailed research, for residential customers on the condition that the AER will satisfy itself that these values are suitably robust and have been applied in a consistent manner.

The Future Network Panel and the Coordination Group have also welcomed the inclusion of a demand management program to incentivise non-network solutions as part of it.

2.4. Purpose and scope

The purpose of this business case is to describe the identified need in relation to addressing the reliability of supply impacts of electrification across the AusNet electricity distribution network at the low-voltage distribution substation and SWER network levels, and present credible options for programs of work that are able to address the need. This business case quantifies the:

- current and estimated future levels of expected unserved energy (EUE) across the low-voltage distribution substation and SWER network for each network asset;
- costs and benefits of potential credible options to mitigate identified network import limitations,
- forward looking programs of work for implementation in the 2026-31 regulatory control period that ensure that mitigating EUE is undertaken at least lifecycle cost.

The scope of this business case is for mitigating EUE associated with network import limitation driven by electrification for the low-voltage distribution substation and SWER network levels only. Plans for augmentation at the high-voltage distribution feeder, zone substation, and sub-transmission networks in response to electrification and maximum demand growth in general, are detailed in separate business cases. 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 Electrification business case where an overlap has been identified, so as not to double-count expenditures. The hierarchy we have applied for removal of duplicate projects from the programs of work is as follows:

- 1st priority—Voltage Compliance
- 2nd priority—Demand driven augmentation in the LV network (this business case)
- 3rd priority—CER Enablement.

3. Identified need

3.1. EUE risk profile in June 2026

Based on AusNet's probabilistic planning methodology, we manage EUE risk to strike an economic balance between risk, cost and reliability performance to achieve optimal outcomes for our customers.

Table 3 estimates how that EUE risk is expected to be distributed across each level in our network at the start of the 2026-2031 regulatory control period. The table illustrates that EUE risk at the low-voltage distribution substations and the SWER network is significant. In both instances, there are assets within these populations with both high utilisation and low redundancy (or load transfer options).

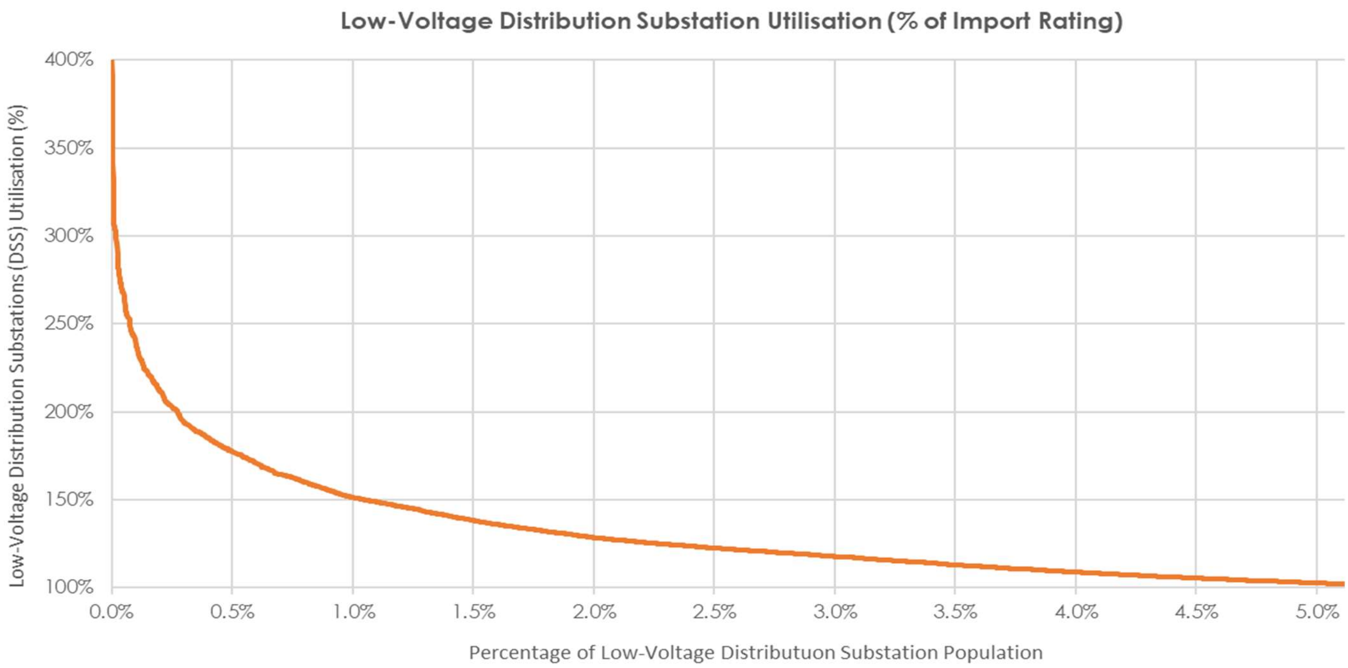
Table 3: EUE risk profile across our LV and SWER network at the start of the 2027-2031 regulatory control period

Network level	Expected Unserved Energy (EUE) (GWh pa)	Assets contributing to this risk
LV distribution substations	8.1	3,067 sites
SWER	1.9	221 sites

Source: AusNet analysis

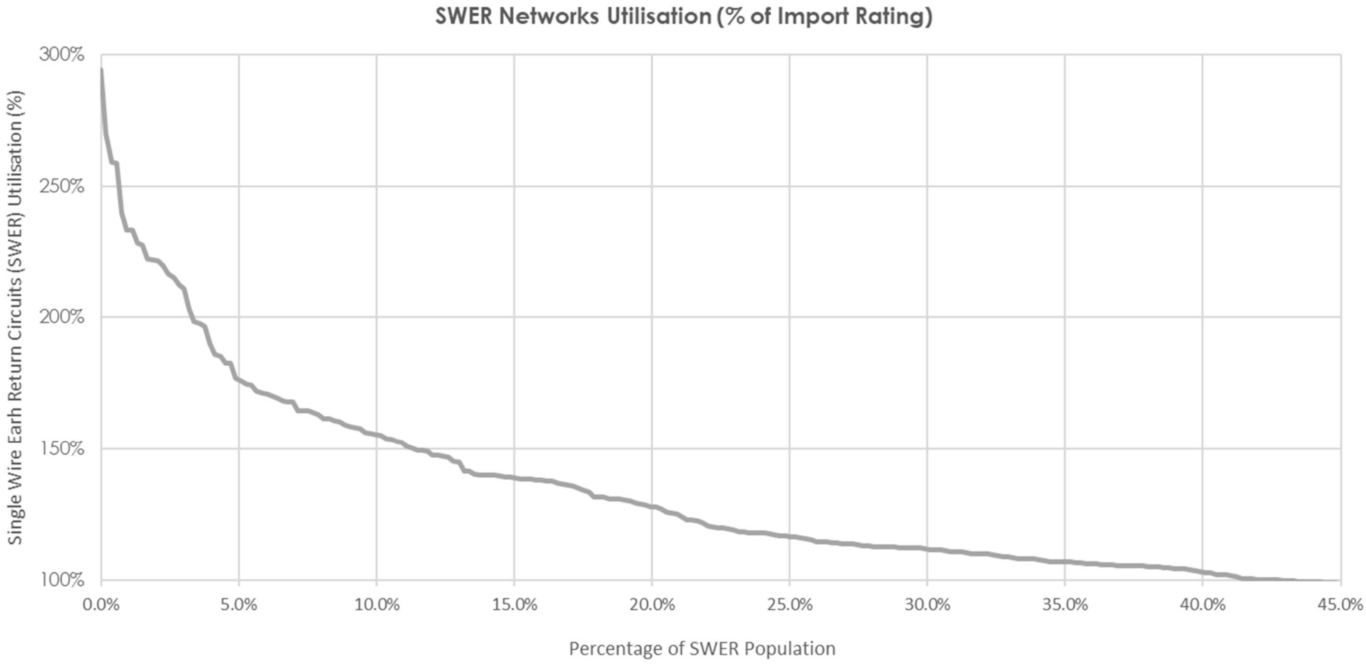
Figure 2 and Figure 3 illustrate that the EUE risk in LV and SWER networks is being carried by 5%[3] of AusNet's population of distribution substations, and 42%[4] of AusNet's SWER lines. They present the utilisation profile of our population of distribution substations and SWER networks (respectively) that are expected to experience an EUE limitation at the start of the regulatory control period.

Figure 2: Low-Voltage distribution substations operating above 100% utilisation, June 2026



[3] 3,067 of AusNet's 62,801 distribution substations.
[4] 221 of AusNet's 531 SWER networks.

Figure 3: SWER networks operating above 100% utilisation, June 2026

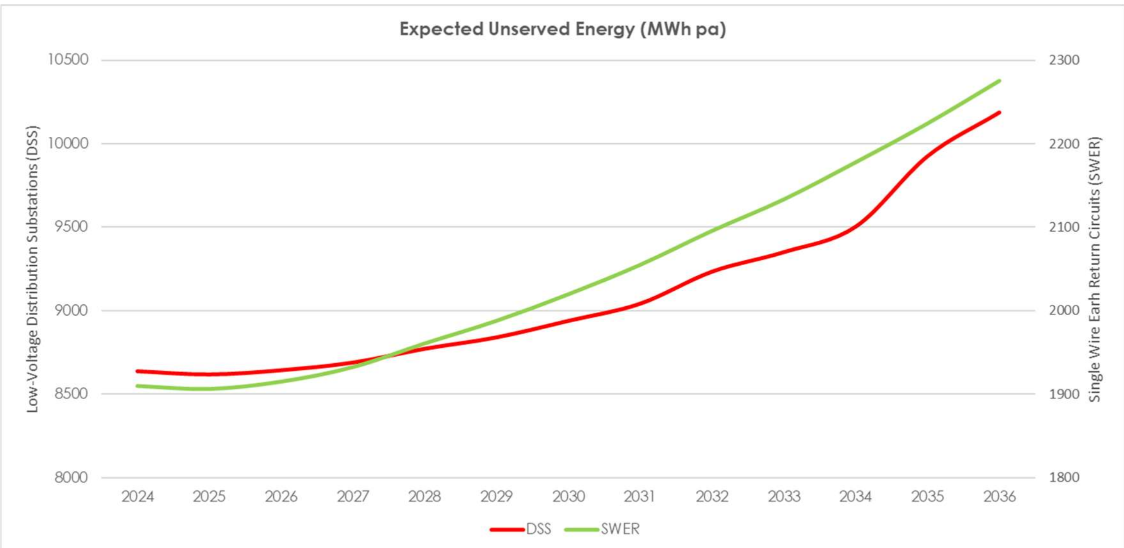


3.2. Forecast EUE risk profile by 2031

With residential EV charging and residential gas substitution starting to grow, a proportion of our distribution substations and SWER lines are expected to be at risk of overload over the next regulatory control period, particularly during 5pm to 9pm on days of extreme high or low ambient temperature. The network assets most at risk are those that are already highly utilised (or overloaded) at times of maximum demand as presented above. The limitations on these already highly utilised assets are expected to worsen over the next regulatory control period and additional overloaded sites will emerge without further investment, with the expected levels of electrification, adversely impacting the reliability and quality of supply for our customers affected. Therefore, for customers electrifying their gas appliances and cars on this subset of highly utilised low-voltage distribution substations and SWER networks, is likely to result in material detrimental impacts on reliability of supply for all customers in these localised areas of the network.

Figure 4 presents AusNet's 10-year forecast increases in EUE in the highly utilised parts of the low-voltage distribution substation networks and SWER networks, primarily due to electrification impacts in our latest 2024 maximum demand forecasts.

Figure 4: Forecast EUE due to demand growth from electrification



By the end of the 2026-31 regulatory control period (i.e., 2031-32), for a do nothing investment scenario, the amount of customer load needing to be curtailed through load shedding to manage network import limitations, is expected to rise by 0.5 GWh pa for distribution substations, and 0.2 GWh pa for SWER lines.

3.3. 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. Other key assumptions used in this business case are summarised in the table below.

Table 4: Key assumptions

Parameter	Value	Comments
Discount rate	5.56%	Average of 4.11% and AEMO's 2023 IASR central case (7.00%)
Evaluation period	20 years	Benefits calculated for the first 10-years, then maintained from years 11 to 20. No benefits assumed beyond year 20.
Value of customer reliability	Site specific	Using AER December 2023 values for commercial, industrial and agricultural sectors, and AusNet's QCV values for the residential sector. VCR methodology is applicable for quantifying the value of EUE.

Source: AusNet analysis

4. Options assessed

4.1. Credible solutions

In developing the options for this business case, AusNet has used the cost of the most credible network solution for upgrading *grossly* overloaded low-voltage distribution substations or SWER networks, such that they completely address the identified network import limitation at each site, that being either

- upgrading (or a new) distribution transformers, and splitting (or new) low-voltage circuits
- upgrading SWER lines from single steel to twin steel conductor, and increasing the size of the isolation transformer, or rebuilding the front part of the SWER line as a multi-phase circuit.

We have used unit costs from similar recent projects and applied these to the volume of assets identified through the economic analysis, by network level.

We also consider non-network solutions (including storage and third party 'flexible services') and their costs.

These solutions are discussed in further detail below.

4.1.1. Network augmentation

The typical work undertaken under network augmentation solutions include:

- **Upgraded distribution transformers and split low-voltage circuits**—we split up and reconfigure the low-voltage circuits of a distribution substation with shorter circuits (and fewer customer per circuit), and we upgrade the capacity of the existing distribution transformer.
- **New distribution substation with new low-voltage circuits**—alternatively, we can establish a new distribution substation using a new transformer and new low-voltage circuits to transfer load away from the adjacent import-limited distribution substation.
- **Upgrading SWER lines**—the backbone of the SWER line can be rebuilt from single steel to twin steel conductor and increasing the size of the existing isolation transformer.
- **Rebuild SWER as multi-phase**—alternatively, where a SWER line branches off into two or more spurs, the SWER backbone back to the distribution feeder can be upgraded to multi-phase, and the isolation transformers located down at the spurs. This solution is only viable in limited situations as easement renegotiation is often needed with the additional poles or wider easement required.

4.1.2. Non-network solutions and flexible services

Battery energy storage or flexible services could be used to support network loading and therefore alleviate overload-related network import limitations.

The opportunity lies with storage and flexible services in being able to defer or displace network augmentation by discharging (or reducing load or increasing generation) in the vicinity of the network limitation during maximum demand. The opportunity to adopt these non-network and flexible services solutions is impacted by:

- storage requiring value stacking with market benefits, given its current higher cost premium; and
- flexible services relying on ability to generate customer response and control customer generation / load, in sufficient numbers to be effective.

4.2. Assessment approach

4.2.1. Assessment methodology

The regulatory framework facilitates quantifying a prudent level of electrification augmentation investment through the AER's Value of Customer Reliability (VCR)[5] methodology. AusNet has adopted this VCR methodology in its probabilistic planning as an economic approach to valuing the impact of network limitations on customers, with the aim of mitigating EUE through an Electrification Program.

[5] Update Value of customer reliability | Australian Energy Regulator (AER), 18th December 2023.

The network assets considered for this program are those that have limitations whose EUE mitigation solutions are in themselves economically viable, based on the VCR methodology. To identify the limitations and economic viability of the projects which make up the program, AusNet has developed a detailed model that maximises the use of its advanced metering infrastructure (AMI) data and other measurement data, to determine the network performance and its characteristics, in-lieu of power system simulation and modelling assumptions. Figure 5 identifies the modelling components of AusNet's Electrification Program that identify and economically justify expenditure on this program for the 2026-31 regulatory control period, based on identified and forecast network import limitations.

Figure 5: Electrification (demand driven augex in the LV network) 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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SWER and LV Models

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

Forecast annual numbers of customers in each steady-state over-voltage and under-voltage (defined in the Victorian Electricity Distribution Code of Practice - EDCOP) voltage distribution bin.	Forecast expected unserved energy at risk for each network asset in each year over the planning horizon, where customers are at risk of being load-shed by AusNet due to identified network import limitations.

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Electrification Economic Model (demand driven augex in the LV network)

The Electrification program economic model applies the VCR methodology to identified import limitations, using the costs and characteristics of credible options to identify the preferred option for each location, ranking projects to develop a program of works of the most economically viable projects.

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Electrification (demand driven augex in the LV network) 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, with the quantification of the identified needs and economic evaluation approach summarised from this document below.

4.2.2. Valuing expected unserved energy

This business case utilises the Value of Customer Reliability (VCR)[6] values published by the AER in December 2023 for commercial, industrial and agricultural sectors, and AusNet's QCV values for the residential sector. The electrification program models are specifically tailored for assessing the value of expected unserved energy (EUE) in the form of customer load-shedding that may be needed to address thermal overload and voltage limitations as a result of forward power flow breaching import ratings.

The assessment approach in this business case applies VCR to the importing of load that causes maximum net demand to increase to levels that exceed the import rating of each network asset under assessment. This is referred to as the expected unserved energy (EUE) at risk, because the load contributing to these network import limitations is at risk of having to be load shed 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 import rating, for each asset under assessment.
- identifying the energy at risk at times when the annual load profile breaches the asset's import ratings.

[6] https://www.aer.gov.au/industry/registers/resources/reviews/values-customer-reliability

- weighting the results by the 10POE and 50POE demand scenarios to get an expected value.
- multiplying the expected unserved energy (EUE) at risk calculated from this process with the location specific VCR for each year of the analysis period.

4.2.3. 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 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, ignoring forecasts of risk and benefits beyond 10-years.

An expenditure profile is developed based on the list of economically viable sites and their optimum timing forming a programme of works.

Three program options were considered, with Options 1 and 2 following the economic probabilistic planning approach. Option 3 applies a deterministic planning approach to allow for zero constraints.

4.3. Do nothing

The do nothing (counterfactual) option assumes that AusNet Services would not undertake any proactive investment in mitigating EUE for the low-voltage distribution substations and SWER network levels – that is, none of the Electrification (demand driven augex in the LV network) 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.

By the end of the 2026-31 regulatory control period (i.e., 2031-32), for a do nothing investment scenario, the amount of customer load needing to be curtailed through load shedding to manage network import limitations, is expected to rise by 1.6 GWh pa for distribution substations, and 0.2 GWh pa for SWER lines.

The present value of total risk of EUE relating to network import limitations, is valued at $6,117 million over the analysis period (real 30th June 2024 dollars) as shown in Table 5.

Table 5: Do nothing risk ($m, discounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Do nothing risk	488	479	470	262	454	**2,353**	**6,117**

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. We do not consider do nothing is a viable option due to significant customer outcome risk.

4.4. Option 1 – Economic network augmentation

This option is a proactive program using an economic approach to mitigate EUE with network augmentation where there is a positive net present value. To avoid duplication of capital expenditure, projects that have been identified in Option 1 of the Voltage Compliance business case are not included in this option.

The sites which have been identified under this option for targeting EUE mitigation solutions are shown in Table 6. The positive NPV is shown in Table 7.

Table 6: Option 1 projects

Optimum project type	Number of identified sites
SWER augmentation	70
LV distribution substation augmentation	1,340

Source: AusNet analysis

Table 7: Option 1 NPV analysis ($m, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Cost (undiscounted)	(33.2)	(30.0)	(29.6)	(30.0)	(30.5)	**(153.4)**	**(216.0)**
Benefits (undiscounted)	92.2	101.1	457.3	521.8	544.6	**1,717**	**4,720**
NPV (discounted)	**3,529**						

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 8 represents the forecast capital expenditure in network augmentation that is economically prudent for AusNet to be investing in the network to enable electrification.

Table 8: Option 1 capital expenditure ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
SWER	(32.9)	(4.0)	-	(1.0)	-	**(37.8)**	**(69.7)**
DSS	-	(25.4)	(28.6)	(27.8)	(29.0)	**(110.9)**	**(131.8)**
Total	(32.9)	(29.4)	(28.6)	(28.8)	(29.0)	**(148.7)**	**(201.5)**

Source: AusNet analysis

4.4.1.2. Operating expenditure

Table 9 represents the forecast incremental operational expenditure that is economically prudent for AusNet to be investing in the network to enable electrification.

Table 9: Option 1 operating expenditure ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Total	(0.3)	(0.7)	(0.9)	(1.2)	(1.5)	**(4.7)**	**(14.5)**

Source: AusNet analysis

4.4.2. Benefits

Over the 2026-31 regulatory period, for an Option 1 investment, the amount of customer load needing to be curtailed through load shedding to manage network import limitations, is expected be:

- 7.9 GWh pa lower for distribution substations (compared to 0.5 GWh pa higher for do nothing), and
- 1.8 GWh pa lower for SWER lines (compared to 0.2 GWh pa higher for do nothing).

The cumulative present value of benefits delivered by this option are forecast to avoid 63%[7] of the do nothing risk over that period, and by the end of the 20-year economic analysis period, avoid 65%[8] of the total do nothing risk. The value of those benefits is shown in Table 10.

Table 10: Option 1 benefits ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Avoided EUE	92.2	101.1	457.3	521.8	544.6	**1,717**	**4,720**

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

4.5. Option 2 – Economic network augmentation and flexible services

This option is a proactive program using an economic approach to mitigate EUE with an efficient mix of network augmentation and non-network flexible services, where there is a positive net present value. To avoid duplication of capital expenditure, projects that have been identified in Option 1 of the Voltage Compliance business case are not included in this option.

The sites which have been identified under this option for targeting EUE mitigation solutions are shown in Table 11. The NPV value of option 2 is shown in Table 12.

Table 11: Option 2 projects

Optimum project type	Number of identified sites
SWER augmentation	71
LV distribution substation augmentation	995
Flexible service at LV distribution substations	344

Source: AusNet analysis

Table 12: Option 2 NPV analysis ($m, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Cost (undiscounted)	(33.6)	(30.8)	(30.5)	(23.4)	(11.8)	**(130.1)**	**(188.2)**
Benefits (undiscounted)	92.2	101.1	457.3	521.5	543.0	**1,715**	**4,719**
NPV (discounted)	**3,529**						

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 13represents the forecast capital expenditure in network augmentation that is economically prudent for AusNet to be investing in the network to enable electrification.

[7] 1,717 ÷ 2,712 = 63%
[8] 4,720 ÷ 7,265 = 65%

Table 13: Option 2 capital expenditure ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
SWER	(32.9)	(4.0)	-	(1.0)	-	**(37.8)**	**(69.7)**
DSS	-	(25.4)	(28.3)	(19.6)	(8.4)	**(81.7)**	**(131.8)**
Total	(32.9)	(29.4)	(28.3)	(20.6)	(8.4)	**(119.5)**	**(201.5)**

Source: AusNet analysis

4.5.1.2. Operating expenditure

Table 14 represents the forecast incremental operational expenditure that is economically prudent for AusNet to be investing in the network for electrification. This includes non-network service payments to third party providers for flexible services.

Table 14: Option 2 operating expenditure ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Network	(0.3)	(0.7)	(0.9)	(1.2)	(1.4)	**(4.6)**	**(12.9)**
Flexible services	(0.4)	(0.8)	(1.2)	(1.6)	(2.0)	**(6.0)**	**(6.0)**
Total	(0.7)	(1.5)	(2.1)	(2.8)	(3.4)	**(10.6)**	**(18.9)**

Source: AusNet analysis.

Refer to section 7 for the method of evaluating the non-network solutions.

4.5.2. Benefits

By the end of the 2026-31 regulatory control period (i.e., 2031-32), for an Option 2 investment, the amount of customer load needing to be curtailed through load shedding to manage network import limitations, is expected be:

- 7.9 GWh pa lower for distribution substations (compared to 0.5 GWh pa higher for do nothing), and
- 1.8 GWh pa lower for SWER lines (compared to 0.2 GWh pa higher for do nothing).

The cumulative present value of benefits delivered by this option are forecast to avoid 63%[9] of the do nothing risk over that period, and by the end of the 20-year economic analysis period, avoid 65%[10] of the total do nothing risk. The value of these benefits is captured Table 15.

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

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Avoided EUE	92.2	101.1	457.3	521.5	543.0	**1,715**	**4,719**

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

4.6. Option 3 – Deterministic augmentation

This option is a proactive program targeted at removing all EUE from the low-voltage distribution substation and SWER networks. To avoid duplication of capex, projects that have been identified in Option 2 of the Voltage Compliance business case are not included in this option. The sites which have been identified under this option for targeting EUE mitigation solutions are shown in Table 16. The NPV is shown in Table 17.

[9] 1,715 ÷ 2,712 = 63%
[10] 4,719 ÷ 7,265 = 65%

Table 16: Option 3 projects

Optimum project type	Number of identified sites
SWER augmentation	259
LV distribution substation augmentation	4,150

Source: AusNet analysis

Table 17: Option 3 ($m, undiscounted, 30th June 2024 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Cost (undiscounted)	(102.6)	(102.0)	(101.4)	(102.6)	(98.7)	**(512.2)**	**(713.9)**
Benefits (undiscounted)	101.4	103.4	511.4	552.4	559.4	**1,828**	**4,868**
NPV (discounted)	**3,220**						

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

4.6.1. Cost

4.6.1.1. Capital expenditure

Table 18 represents the forecast capital expenditure in network augmentation to deliver option 3.

Table 18: Option 3 capital expenditure ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
SWER	(101.6)	(53.8)	-	-	-	**(155.4)**	**(257.0)**
DSS	-	(46.1)	(98.3)	(98.5)	(98.7)	**(341.7)**	**(409.1)**
Total	(101.6)	(99.9)	(98.3)	(98.5)	(98.7)	**(497.1)**	**(666.0)**

Source: AusNet analysis

4.6.1.2. Operating expenditure

Table 19 represents the forecast operating expenditure in network augmentation to deliver option 3.

Table 19: Option 3 operating expenditure ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Opex	(1.0)	(2.0)	(3.0)	(4.0)	(5.0)	**(15.1)**	**(47.8)**

Source: AusNet analysis

4.6.2. Benefits

By the end of the 2026-31 regulatory control period (i.e., 2031-32), for an Option 3 investment, the amount of EUE should be minimal if this program is adopted with the Voltage Compliance Option 2 as well.

Table 20: Option 3 benefits ($m, undiscounted, $June 2024)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period
Avoided EUE	101.4	103.4	511.4	552.4	559.4	**1,828**	**4,868**

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

5. Preferred option and sensitivity testing

Option 2 is the preferred option over the 2026-31 regulatory control period, which represents a prudent and efficient mix of network augmentation and non-network flexible services, to manage the risk of growth in demand from electrification. Option 2 was chosen as the economic option with the highest NPV and least cost. Table 21 summarises the options.

Table 21: Economic evaluation of the 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[11]	0.0	This option does not address the identified need
Option 1 – Economic network augmentation	148.7	4.7	153.4	(187.5)	3,716	3,529	This is not the preferred option as it is not least cost
Option 2 – Economic network augmentation and flexible services	119.5	10.6	130.1	(185.8)	3,715	3,529	This is the preferred option as it maximises the NPV
Option 3 – Deterministic augmentation	497.1	15.1	512.2	(618.9)	3,839	3,220	This is the most expensive option

Source: AusNet analysis

Over the 2026-31 regulatory control period, under Option 2 the amount of customer load needing to be curtailed through load shedding to manage network import limitations, is expected be:

- 7.9 GWh pa lower for distribution substations (compared to 0.5 GWh pa higher for do nothing), and
- 1.8 GWh pa lower for SWER lines (compared to 0.2 GWh pa higher for do nothing).

The cumulative benefits delivered by this option are forecast to avoid 63% of the do nothing risk over that period, and by the end of the 20-year economic analysis period, avoid 65% of the total do nothing risk.

Table 22 compares the costs and benefits of the program options for credible variations in input variables.

[11] The present value of total risk of EUE, is valued at $6,117 million over the analysis period (30th June 2024 dollars). Refer Table 5.

Table 22: Sensitivity of Electrification (demand driven augex in the LV network) Program NPV ($m, $June 2024)

	Central assumptions	Projects 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	
Option 1	3,529	2,999	3,963	3,558	3,901	4,459	3,152	3,499	3,048	2,599	
Option 2	**3,529**	**2,999**	**3,963**	**3,558**	**3,901**	**4,459**	**3,155**	**3,500**	**3,048**	**2,599**	Preferred option under all sensitivities
Option 3	3,220	2,699	3,636	3,309	3,601	4,174	2,861	3,129	2,646	2,263	

Source: AusNet analysis

This table illustrates that the decision to select Option 2 as the preferred option remains robust, being the option with the highest NPV, the least cost, and NPV remaining positive under all credible sensitivities.

6. Method for evaluating non-network solutions

This section describes our approach to evaluating 'flexible services' that can efficiency defer network augmentation.

The criteria for applying flexible services is based on a risk management approach:

- **Reliability:** minimising the risk of customer outages (i.e., avoiding fuse blows), recognising the fact that the flexible services may not fully meet their performance objectives in some cases, due to uncertainties, limited monitoring/control, and immaturity of utilising this new technology. A certain level of accelerated loss of life of transformers may be acceptable (in some instances) to manage residual overload risk, rather than completely removing the flexible service. The reliability of a flexible service is expressed relative to a distribution substation's reliability.
- **Uptake rate:** the opt-in uptake rate of third parties being able to secure different types of flexible services needed to provide an effective network support service. The uptake rate of a flexible services is expressed as a percentage of the total number of customers, noting that most flexible services are expected to be an aggregation of customer response.
- **Costs:** the high-level costs of flexible services based on the scope, including the fixed cost of an augmentation versus the cost of operating an effective flexible solution that is dependent on the level of kW overload, growth rate, energy kWh pa at risk, and frequency/duration of service, or a combination of all these.

The comparison of the level of impact of flexible services on peak demand reduction is shown in Table 23.

Table 23: Expected peak demand reduction from flexible services, at different levels of utilisation

Overload (% of substation rating)	Peak demand reduction[12] (% of substation rating)	Shortfall (% of substation rating)	Applicability of flexible services
0%	11.7%	Nil	Flexible services not required
10%	12.9%	Nil	Flexible services meets entire need (i.e., eliminates EUE) up to 13% overload
13%	13.2%	Nil	
20%	14.0%	6.0%	Flexible services leaves some residual EUE above 13% overload. The shortfall grows larger with higher utilisation making flexible services less attractive compared to traditional network augmentation.
30%	15.2%	14.8%	
40%	16.4%	23.6%	
50%	17.6%	32.4%	
60%	18.7%	41.3%	

Source: AusNet analysis

There are two key customer experience factors that need to be considered when targeting flexible services at higher utilisation overloaded sites. The first is that the higher the overload, the greater the residual EUE will be not being able to fully address by the flexible service. The second is that the higher than annual EUE for an overloaded site, the greater the adverse impact on customers' experience with the programs (e.g., customers needing to sacrifice comfort / convenience or to engage with the programs more frequently and for longer periods of time), which could discourage customer participation in the programs. To strike a balance between maximising the use of flexible services, versus the potential risk of customers departing from the programs due to onerous demand reduction requirements, we define three scenarios which are set by a minimum economic threshold for delivery of the flexible services.[13] By doing this we define a base case use of flexible services scenario, as summarised in Table 24.

Table 24: Scenarios

Scenario	Percentage of Eligible DSS Sites	Number of Eligible DSS Sites
High	35%	538
Base	25%	370
Low	10%	137

Source: AusNet analysis

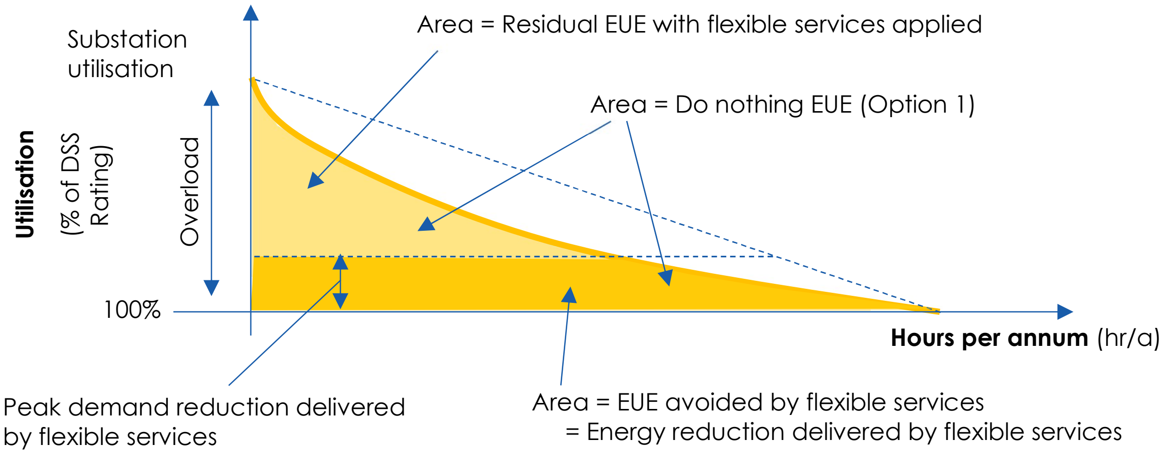
[12] Peak demand reduction (% of DSS Rating) = Peak demand reduction (% of DSS Utilisation) x DSS Utilisation (%)

[13] Based on a maximum demand response delivered per participating customer which corresponds to the substation annual EUE limit of 2.0MWh per annum identified above an overloading limit of 60%, limiting the total number of sites for the high scenario to approximately 538 sites.

We have adopted the **base** scenario for Option 2 in this business case.

The application of Flexible Services has the effect of reducing the "do nothing" EUE, which can be approximated based on the load-duration curve as illustrated in Figure 6.

Figure 6: Reduced EUE provided by Flexible Services



6.1.1. Calculating the net benefit of flexible services

The EUE offset with flexible services is used to calculate the augmentation deferral. This revised capital and operational cost information, is applied in the business case analysis as the capital and operational costs for Option 2.

The cost of delivering the flexible services is calculated based on the level of response assumed (the EUE offset by flexible services), and this cost is applied as an additional operating expenditure in the business case analysis for the Option 2. We have used an estimated value of $4,200 / MWh value of non-network service payments, based on anticipated rewards customers would expect to get for allowing their devices to be aggregated / for behavioural response. We have also assumed the flexible services engaged to provide this level of response must be efficient, meaning the NPV of the operating expenditure of the flexible service is lower than the NPV of the deferred augmentation.

This service level benefit of flexible services is summed with the benefit of the revised traditional network augmentation program and is applied in the business case analysis as the benefit for Option 2.

AusNet Services

Level 31
2 Southbank Boulevard
Southbank VIC 3006
T +613 9695 6000
F +613 9695 6666
Locked Bag 14051 Melbourne City Mail Centre Melbourne VIC 8001
www.AusNetservices.com.au

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