Customer energy futures

SERVICE LEVEL OPTIONS PAPER:
2026–2031 REGULATORY PERIOD

NOVEMBER 2023

Table of contents

1. Purpose

CitiPower, Powercor and United Energy are distribution networks in Victoria. We service 64 per cent of the state and deliver electricity to nearly 2 million customers.

The purpose of this paper is to hear from customers and stakeholders about what futures they expect for consumer energy resources (CER), particularly solar exports and EV charging over the 2026–2031 regulatory period.

This includes views on supporting regional and rural customers, and vulnerable customers, in the energy transformation, as well as who should pay for required investments.

Our plan is for customer preferences for future options to inform the development of our investment cases, and ultimately price and service trade-offs that we will consult holistically on with the release of our draft proposals. Specifically, our draft proposals will consider:

- proposed export levels and service level commitments
- connection policies, including who pays for the energy transformation
- tariff design
- solar enablement investments
- bill impacts.

1.1 Key questions

Question 1	Which key customer impact(s) of solar export futures is most important to you and why?
Question 2	Which solar export future should we prioritise for our customers?
Question 3	Is the current electric vehicle connections framework fit for purpose?
Question 4	Who should pay for the network investments to facilitate at-home electric vehicle charging?
Question 5	Which key customer impact(s) of electric vehicle futures is most important to you and why?
Question 6	Which electric vehicle future should we prioritise for our customers?
Question 7	Who is the most appropriate party to engage with customers experiencing vulnerability during the energy transformation?
Question 8	What other practical messages should we be considering in solution design?
Question 9	Can simple cost-effective solutions be developed to address these challenges?
Question 10	Do you support improving service levels for regional and rural customers, even if it costs more?
Question 11	How should broader market benefits be considered in supporting regional and rural customer agency through the energy transformation?

1.2 Planned consultation

We invite all our customers and stakeholders to share their feedback on the options paper to drive the development of our investment plans and product offerings. Customers and stakeholders are encouraged to share their feedback via engage.unitedenergy.com.au or community@ue.com.au by 5 January 2024.[1]

We are also holding a customer and stakeholder forum to discuss our options paper and to facilitate discussion on what our customers expect from us.

Your feedback will be an important contribution to the development of our investment plans for 2026–2031.

A draft of our future investment plans will be available in August 2024, which will provide a further opportunity for customer and stakeholder input.

1 For clarity, the content of United Energy's options paper is identical to CitiPower and Powercor's options paper, but has been published separately to reflect their different ownership structures.

2. Customers are driving change

Customers are increasingly driving the energy transformation through investments in CER, such as solar photovoltaic (PV), battery technologies, residential electric vehicles (EV) and commercial vehicles such as those for farming or transport.

Adoption of new technologies is also changing the way that customers use electricity.

2.1 Customer preferences for CER and electrification

The decarbonisation journey towards zero emissions is being led by customers, as they seek to reduce electricity bills and achieve greater energy independence. We expect customers will continue installing CER as these technologies become increasingly more affordable.

2.1.1 Customer solar PV uptake is expected to more than double

To date, our customers have installed over 3GW of renewable generation across our networks. This includes 1.4GW of rooftop solar, 500MW of non-residential solar and 700MW of large-scale solar.

For rooftop solar, this comprises over 335,000 residential customers and 30,000 non-residential customers, and equates to 26 per cent of Powercor's, 18 per cent of United Energy's and 7 per cent of CitiPower's residential customers.

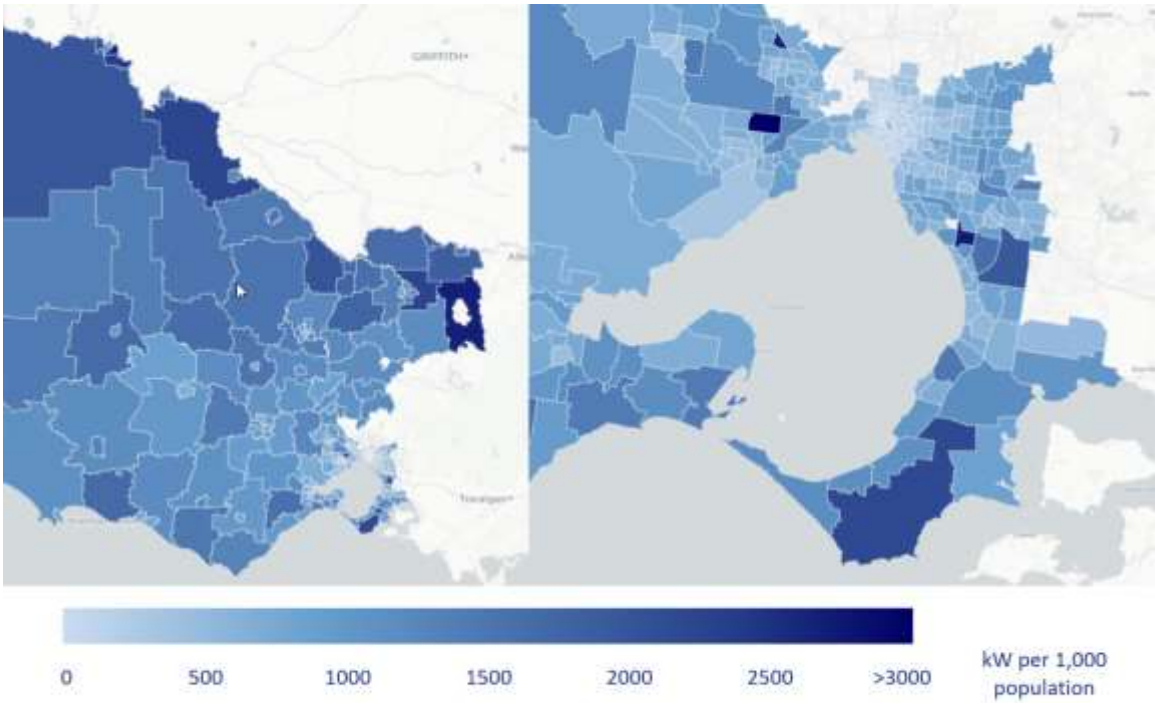
The capacity of residential and non-residential solar has doubled over the last five years as more customers continue to invest in renewable technologies. The average size of residential rooftop solar systems on our networks today is 4.4kW, but average new residential systems installed over the last 12 months are over 6kW, indicating customer willingness to invest in larger systems.

Government policies like the Solar Homes program are also driving uptake.

The Australian Energy Market Operator (AEMO) is forecasting that Victorian customers will more than double again the amount of solar PV capacity on their roofs by 2031, surging from around 4,200MW today to 9,300MW by 2031, plus an additional 1,500MW of large-scale solar.

As shown in figure 2.1, the uptake of rooftop PV in our networks out to 2031 will primarily be in northern Victoria, and growth corridors around western Melbourne, the Surf Coast and the Mornington Peninsula.

FIGURE 2.1 ROOFTOP PV FORECAST UPTAKE IN 2031



Source: CitiPower, Powercor and United Energy

2.1.2 Customer electrification of transport will increase exponentially

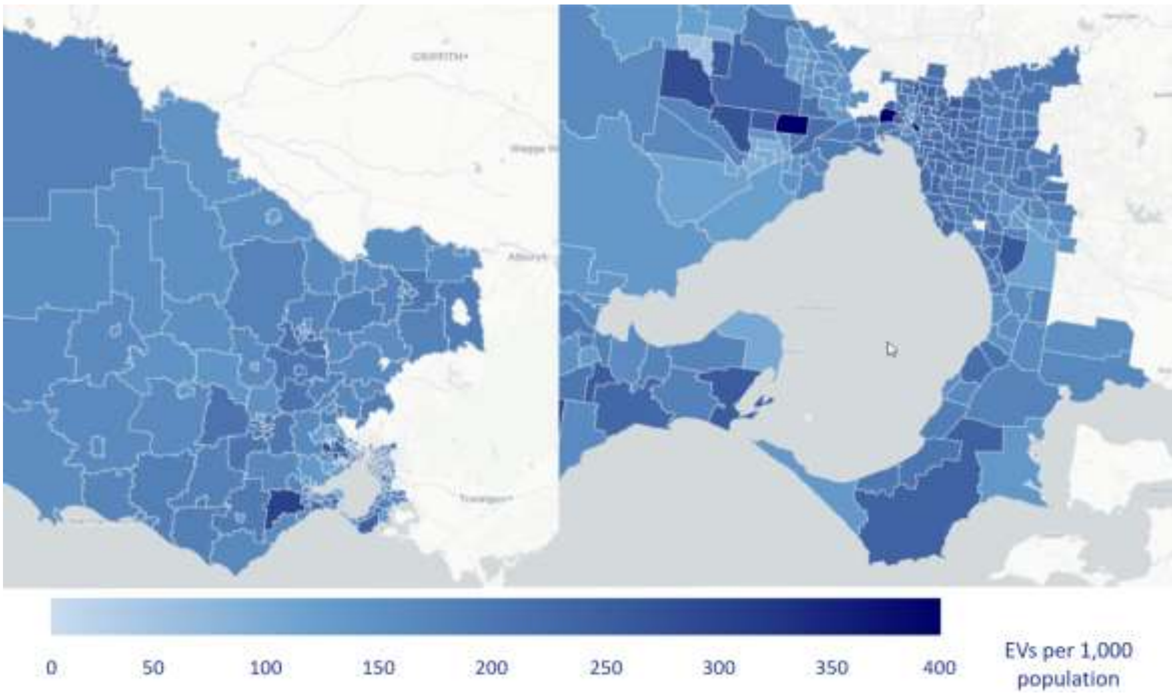
EV sales in Australia tripled in 2021 and doubled again in 2022, continuing the exponential trend of EV adoption. At June 2023, there were over 130,000 EVs in Australia, including 34,000 EVs in Victoria and nearly 25,000 in our networks.

While the increase in EV uptake has been substantial, Australia is far behind the rest of the world. For example, new EV sales comprise just 4 per cent compared to the global average of 14 per cent. As supply chains evolve, emissions standards are reformed and costs decline through technology advancements or government policy assistance, EV adoption will rise.

AEMO are forecasting that there could be up to 1.5 million EVs in Victoria by 2031. Significant EV uptake through the energy transformation is expected to place pressure on peak demand, creating additional capacity constraints and increasing the frequency of low voltage events.

Figure 2.2 shows that our modelling indicates that uptake of EVs will be relatively dispersed out to 2031. However, in our Powercor area we expect higher proportions to be located in western growth corridors and large regional townships like Geelong, Bendigo, Ballarat and Shepparton. In our CitiPower and United Energy networks we expect EV uptake will primarily be in higher income urban areas and the Mornington Peninsula.

FIGURE 2.2 ELECTRIC VEHICLE FORECAST UPTAKE IN 2031



Source: CitiPower, Powercor and United Energy

2.1.3 Governments are supporting customers to adopt CER

Governments are also supporting customers to electrify and invest in CER by implementing emissions reduction targets and policies to support the achievement of these targets.

Victorian Government targets

The Victorian Government has committed to achieving net-zero by 2045 and has a legislated net-zero emissions target of 2050.

It has set interim emissions reduction targets of 45–50 per cent by 2030 and 75–80 per cent by 2035, which are required under the *Climate Change Act (2017)*. The achievement of these targets relies on significant decarbonisation efforts by electricity consumers.

Additionally, the Victorian Government has committed to relying on 65 per cent renewable electricity by 2030 and 95 per cent renewable electricity by 2035.

The Victorian Government has also enacted a target for 50 per cent of all light vehicle sales being zero emission vehicles by 2030.

These emissions reduction, renewable energy and vehicle sales targets are supported by policies to encourage uptake of CER, like the Solar Homes Program and zero emissions vehicles subsidies. We expect that policy support for CER will continue over time to meet emissions targets.

Electrification of gas

The Victorian Government's Gas Substitution Roadmap outlines the Government's plan to transition away from fossil fuel gas use towards zero emissions alternatives. While gas electrification is not CER, it is important that we consider the impacts of gas electrification holistically with other drivers such as CER.

The roadmap flags incentives to encourage electrification and supporting policy and regulatory changes, including the recently announced policy to only approve all-electric planning permits for new residential dwellings, apartment buildings and residential subdivisions from 2024 onwards.

Victoria's electrification of gas is likely to add significant new loads to our network both for new fully-electric greenfield developments and for brownfield retrofits to electrify existing gas use. For example, the roadmap includes forecast scenarios that predict customer electricity consumption increases of around 20 per cent by 2031 that would otherwise have been gas use.[2]

Commonwealth Government

The Commonwealth Government has legislated emissions reduction targets of 43 per cent below 2005 levels by 2030 and achieving net-zero by 2050. These targets will guide Commonwealth policies in the future.

There are also Commonwealth policies for large-scale and small-scale renewable energy generation. The large-scale target to produce 33,000GWh of renewable electricity per year was met in 2019, while the small-scale scheme subsidises small-scale renewable installations with no quota.

2.1.4 We are a key partner in the decarbonisation journey

In collaboration with customers and Governments, we have a key role in enabling customers to maximise the value of their investments in CER.

We recognise it is important to place customers at the centre of our network investment decisions because customers ultimately benefit from and pay for this infrastructure. This is consistent with the view of Energy Consumers Australia at its 2023 Foresighting Forum, where it identified that system challenges need to be reframed to the consumers perspective:[3]

> *We need to change our approach in two ways. First, by flipping how we view system problems and framing them from a consumer's perspective, considering the barriers and constraints that they face. And second, by understanding the ways the system is, and isn't, working for consumers. To do this, we need to hear from a wide variety of voices.*

We agree with the ECA on the need to view the energy transformation from our customers perspectives, while understanding that our customer base is broad and diverse, with a wide-range of varied needs. ECA expands on the consumer perspective in its recent Stepping Up report, outlining that supporting consumer agency requires access to information and understanding customer needs and preferences.[4]

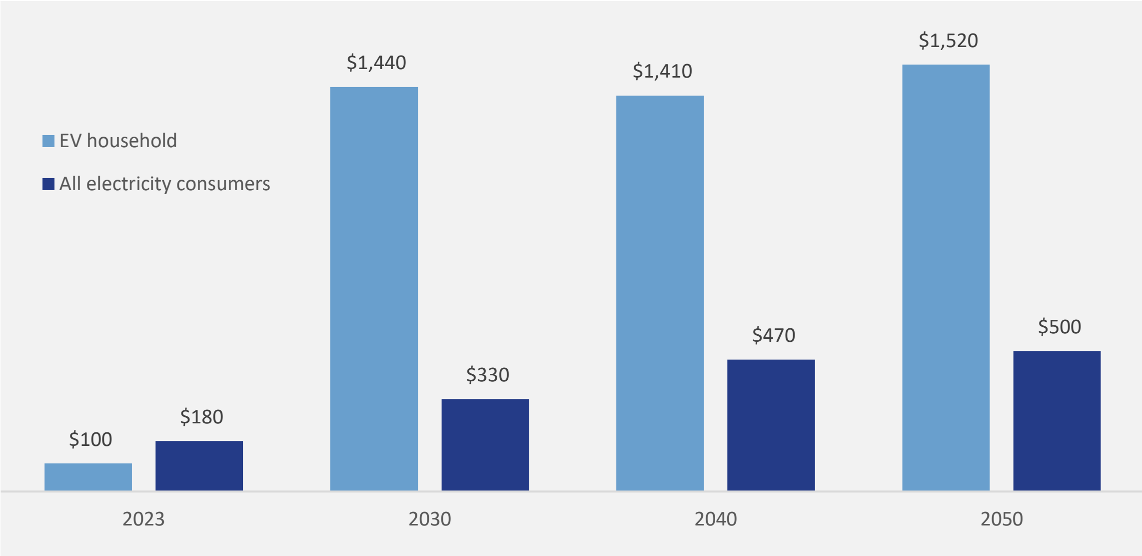
The Stepping Up report also highlights how the energy transformation can benefit all customers. For example, as shown in figure 2.3 below, the ECA found that households switching to an EV will provide significant benefits to both households that switch to EVs from an existing petrol or diesel car and all other electricity consumers. This assumes electric vehicle charging is predominately managed and does not materially increase peak demand.

2 Vic Gas Substitution Roadmap central scenario predicts 48PJ in 2031 will be electrified, and 8PJ in 2023. 40PJ is 11,111GWh. AEMO 2023 ESOO forecasts total 2031 energy consumption including solar self-consumption as 55,644GWh

3 Energy Consumers Australia Foresighting Forum 2023

4 Energy Consumers Australia, Stepping Up: A smoother pathway to decarbonising homes, p. 20.

FIGURE 2.3 ANNUAL SAVINGS FROM ELECTRIC VEHICLES



Source: ECA, Stepping Up report (2023)

Our regulatory challenge, therefore, is to understand customer perspectives and behaviours, and to provide them agency to maximise the value of their CER investments (individually and collectively). In the context of our regulatory proposal, this means engaging with our customers and key stakeholders to determine service level expectations and price trade-offs, and translating these into customer-preferred investments (including non-network solutions).

As an initial step, we have used customer insights—such as those from research undertaken by Monash University (see our case study box below, and appendix A)—to frame the development of potential service level options. We will also incorporate these insights into other areas of our regulatory proposals, like our demand forecasts.

Future Home Demand report[5]

In 2022, we engaged Monash University to identify customer-first behavioural trends in each of our three networks.

Monash worked with 36 households and surveyed a further 1,325 customers. The in-depth research with households was conducted in customers homes and tailored to capture the most critical and relevant issues to our customers and their energy futures.

The research identified several key trends that are relevant for understanding how customers expect to use CER in the future, and in particular solar and EVs. These trends have been valuable for understanding potential network implications and for defining service levels for CER. For example:

- customers are increasingly interested in sharing and resourcefully using renewable energy, with the desire to export to the grid going beyond financial benefit to include not wasting renewable electricity
- households continue to prefer the convenience of at home charging, with over 77 per cent of survey respondents with or intending to purchase an EV in the next 5 years indicating they do or would charge their EV at home
- many households envision being unwilling to hand over the management of their charging to a third party or automated system, noting concerns about such systems' inability to account for their daily life contingencies and irregular but important priorities.

Monash also found that people often have particular and fixed ideas around how and when to charge electronic devices like phones, smart watches, power tools and tablets. These charging routines are likely to translate into their practices around charging EVs or home batteries, including their automated settings and when they choose to override them. Rather than charging based on energy prices or energy availability, these habits and preferences exist to ensure that devices remain usable when needed, to protect the longevity of the battery, and to fit into broader sets of routines or priorities.

2.2 Network challenges in managing CER

Facilitating increasing levels of CER on our networks is a challenge that networks are embracing as part of the energy transformation. These networks impacts are outlined below to provide context for this options paper.

2.2.1 Demand and network capacity are key network considerations

Demand (or 'load') is the amount of electricity that customers are drawing from the network. Demand varies over the year, across the day and by location.

Demand is a key factor that drives electricity network investment. As demand for electricity increases, more network capacity is required to deliver electricity safely and reliably. Our network has traditionally been designed to ensure sufficient capacity is available to meet most maximum demand peaks.

Maximum demand

Maximum demand refers to the period when the highest amount of electricity is being used by consumers, and is typically in the early evening as solar production eases and customers return home from work to turn on appliances.

Significant uptake of new CER load through the energy transformation, in particular the electrification of transport and gas usage, will increase the amount of electricity that customers use. Increased electricity usage is likely to increase peak demand, although customer charging preferences will have an impact on maximum demand.

---

5 Monash University, Future Home Demand Report (2023)

Minimum demand

Minimum demand refers to the period when the lowest amount of electricity is being used by consumers, and is typically in the middle of the day when solar usage is highest.

Increasing adoption of solar PV generates additional localised electricity, and therefore reduces demand for electricity from the network. Each solar PV installation produces and potentially exports electricity at the same time, creating a coincident reduction in demand during the middle of the day.

Low electricity demand creates operating challenges for the network to maintain system stability and avoid potential consequences such as blackouts. AEMO will direct us to shut-off exports in times where minimum demand becomes too low and system stability is at risk.

Maximum and minimum demand effectively set the limits that our networks should be able to safely and reliably operate within. The amount of investment required to facilitate customer CER preferences will depend on how, when and where customers use electricity, and the range of cost-effective solutions available to manage constraints.

A summary of maximum and minimum demand impacts is shown in figure 2.4.

FIGURE 2.4 MAXIMUM AND MINIMUM DEMAND

Source: CitiPower, Powercor and United Energy

2.2.2 Delivering value for customers

One of the focus areas for our 2026–2031 regulatory proposals will be delivering value for customers. This typically involves delivering high quality services while maintaining low costs.

A key opportunity to deliver customer value is improving network utilisation. Higher network utilisation means more electricity is being provided by existing network assets, which lowers the average cost of electricity for all customers.

Utilisation could be improved by:

- shifting customer consumption away from peak periods
- improving network use during off-peak periods
- curtailing load or exports when network capacity is reached, though curtailment does not benefit customers because electricity is not supplied to customers’ premises.

While network utilisation is a reasonable measure of value and is generally efficient, it is not a comprehensive measure of value for customers because it does not consider customer preferences. Network utilisation and customer preferences may differ, for instance where customers may generally prefer to have access to additional network capacity to support more solar exports or EV charging, even when additional capacity comes at a higher cost.

Understanding customer expectations for varying futures, and what value means to them are inputs that will shape the future state of our networks. This approach places customers at the centre of our regulatory proposals, identifying and delivering customer value through services that are in line with customer expectations.

2.2.3 We will use several solutions to manage constraints

A fulsome assessment of proposed solutions for providing customer value will be set out in our draft proposal, noting that the focus of this options paper is on service level considerations. However, a brief overview of potential solutions is provided below to support stakeholder understanding.

There are many options we can implement to deliver service level improvements for customers including tariffs, non-network solutions (like storage or demand management), network augmentation, flexible export products and more. Solutions that encourage load to shift into the middle of the day will also assist customers to export more solar. We can also curtail customer export or load as a last resort.

Our underlying principle in assessing solutions for a given constraint is that we will utilise lower cost solutions (and combinations thereof) to achieve desired service levels before considering higher cost alternatives.

Some solutions are also better suited to certain situations. For example, demand management solutions are suited to occasional, peaky loads that are not forecast to grow materially over the short to medium term. Augmentation solutions are typically better suited to areas with growing demand for load or exports, but can be applied to remediate all constraints.

TABLE 2.1 ABILITY FOR POTENTIAL SOLUTIONS TO MANAGE CONSTRAINTS

SOLUTION	LOCALISED CONSTRAINT	WIDESPREAD CONSTRAINT	GROWTH CORRIDOR	TEMPORAL CONSTRAINT	BILL IMPACT
Tariffs	Partially	Partially	Partially	Partially	Low
Education	Partially	Partially	Partially	Partially	Low
Demand management	Potentially	No	No	Potentially	Medium
Voltage management	Yes	Potentially	No	Potentially	Medium
Flexible connection agreements	Yes	Potentially	Potentially	Potentially	Medium
Non-network solutions (batteries)	Yes	Potentially	No	Yes	Medium
Augmentation	Yes	Yes	Yes	Yes	High
Curtailment	Yes	Yes	Yes	Yes	None

Source: CitiPower, Powercor and United Energy

Further discussion on the types of solutions available and where they are likely to be most impactful is set out in appendix B.

3. Options to facilitate customer agency

There are several options available in our 2026–2031 regulatory period to deliver agency to customers and meet expectations for CER usage.

This section focuses on several possible export and import scenarios, particularly for solar PV and EV charging futures. Customer preferences for different types of futures will guide our development of more detailed investment cases to maximise consumer value.

3.1 Maximising the value of customer exports

In the development of our 2021–2026 regulatory proposal, CitiPower and Powercor committed to enabling at least 85 per cent of customers to export their excess solar PV generation 85 per cent of the time. United Energy made this commitment 95 per cent of the time.

Through initiatives employed during this regulatory period (e.g. installing systems to remotely adjust voltage set points), we have been able to exceed these commitments, facilitating over 99 per cent of CitiPower, Powercor and United Energy customers to export 85 per cent of the time.

We will continue to use low-cost, high value interventions going forward, however, there are likely to be fewer low-cost opportunities available as CER penetration increases and utilises existing hosting capacity.

Other technologies such as batteries and EVs can also export to the network. However, we have focused on solar exports for simplicity because these make up the vast majority of all exports.

3.1.1 Current customer export framework

Hosting capacity is the ability for a network to 'host' solar exports. Intrinsic hosting capacity refers to the current capacity of our network to host solar exports with no additional investment.

Static exports until 2026

Static export limits refer to a fixed export capacity that does not change.

We currently offer new solar connection customers up to 5kW of static export capacity where adequate network hosting capacity is available. Network hosting capacity assessments are based on expected solar exports during the middle of the day on sunny, cool spring or autumn days where export levels are highest and demand is lowest.

When network capacity to host solar exports has been exhausted, zero export limits are given to new solar connection customers. Our solar enablement interventions have cost-effectively improved export hosting capacity for customers.

We will continue to improve hosting capacity using low-cost interventions and are working to implement flexible export products to make better use of existing hosting capacity.

Flexible exports

Emerging technologies are allowing distributors to implement flexible export offerings. A flexible export offering is an export limit that changes customer export limits based on the available network capacity at any point in time, rather than having a fixed limit that is 'reserved' for a specific customer.

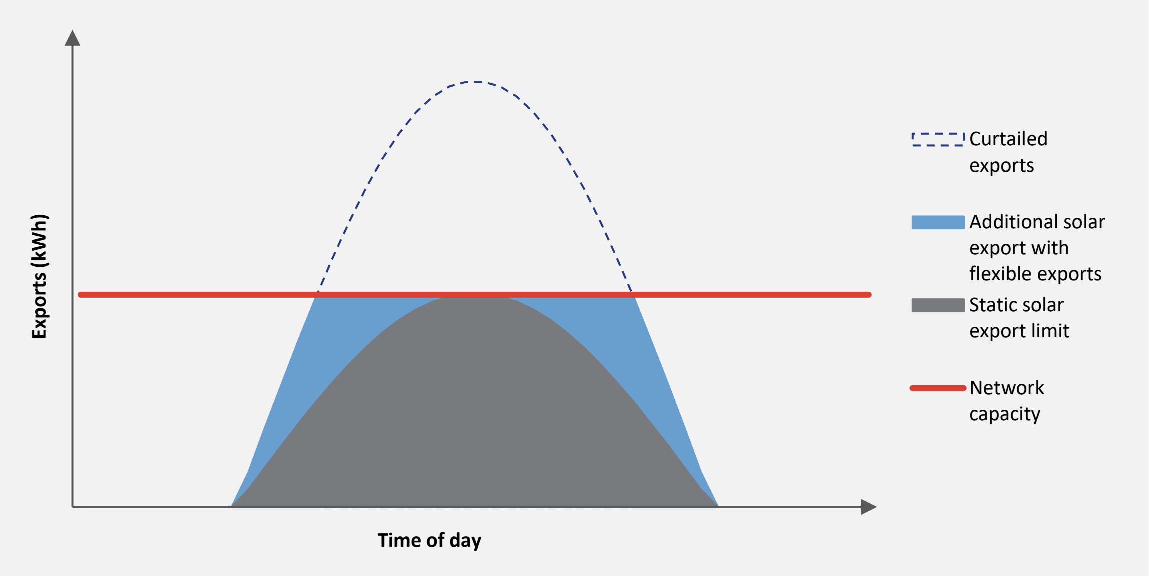
Flexible export offerings are more efficient that static offerings because they allow all flexible export customers to share network capacity that would otherwise be 'reserved' for static limit customers. Giving more customers flexibility to use this capacity will lead to more exports overall.

Two practical examples to demonstrate why flexible exports are more efficient are:

- a customer with a 5kW static limit is home during the day and self-consuming all of their solar, while their neighbour could be exporting the full 5kW limit but is constrained because of a zero export limit. The 5kW limit is 'reserved' for the customer who is fully self-consuming, but is wasted
- a customer with a 5kW static limit is only generating 2.5kW of electricity late in the day with low sunlight, while their neighbour could be exporting an additional 2.5kW, but has a zero static limit. Flexible exports could make use of the export capabilities of both customer systems.

The benefits of flexible exports are further illustrated in figure 3.1. For example, under a flexible export product, customers would share the available export hosting capacity between all flexible export customers, meaning that customers as a collective could make better use of available network capacity by allowing more customers to export more of the time outside peak export periods. Practically, flexible export products typically allow more solar to be exported during the morning and early evening, where additional solar export is more valuable than the middle of the day (due to the lower amount of overall solar generation).

FIGURE 3.1 ADDITIONAL SOLAR EXPORTS ENABLED BY FLEXIBLE EXPORTS



Source: CitiPower, Powercor and United Energy

AER flexible exports consultation

In November 2023, the AER released its draft export limit interim guidance note for consultation that provides clarity on its expectations for distributors when implementing export limits.

The AER considers that greater transparency and consistency in how distributors allocate available hosting capacity is preferable, while affording distributors flexibility to develop approaches suited to their circumstances and customer preferences. Capacity allocation should maximise the use of export hosting capacity while balancing customer expectations of transparency, cost and fairness.

The guidance note outlines that flexible export offerings should be opt-in for customers, with distributors providing customers information on the choice between static and flexible export limits, clearly outlining the differences between them.

We will consider the implications of the draft guidance note further through our customer engagement program and development of our regulatory proposal.

Export tariffs or rebates

Recent electricity rule changes have allowed distributors to propose export tariffs that would be used to recover expenditure primarily for improving export hosting capacity. Export tariffs would be designed so that the costs of improving export hosting capacity are paid for by customers who drive those costs, while also rewarding customers for exporting during times like peak usage periods. This is consistent with the AER's expectation for how distributors should recover costs.

We understand the Victorian Government will direct Victorian distributors to only implement export tariffs on an opt-in basis with customer's informed consent. Solar customers who choose to opt-in to an export tariff would likely incur additional charges during the middle of the day if they export solar.

We therefore expect that export tariff take-up by customers who have solar PV will be low as customers would not opt-in to a tariff that will cost them more. The costs to improve solar exports will be recovered from all customers if export tariff take-up by solar customers is low.

We expect that export tariff take up by customers who have coupled solar PV with a battery will be higher because batteries can take advantage of the rebates offered during the evening and can store excess solar electricity in the middle of the day.

3.1.2 We intend to offer an opt-in flexible export product

For the 2026–2031 regulatory period, we intend to propose that customers can opt-in to a flexible export service offering instead of the current default static capacity. This is consistent with our customer research on flexible exports.

We will also design our flexible exports offerings in line with the AER's principles in its export limits consultation guidance note, and our experience from our own flexible export research.

Flexible export research

Our research into how customers valued trade-offs between flexible export product attributes showed that customers have a strong preference for a variable product across most cohorts, including solar, non-solar and customers from all socio-economic indexes for areas rankings. These preferences reflected broad pre-existing positive associations with the attributes of flexibility and choice.

CUSTOMER PREFERENCE	POWERCOR	UNITED ENERGY	CITIPOWER
Fixed	32.5%	22.1%	34.7%
Variable	67.5%	77.9%	65.3%

Over 1,000 customers were given numerous choices of static and flexible export products, with different limits, providers, time constraints, flexible incentives and costs to stay on fixed products. Customer preferences then identified key factors that would influence flexible product take-up.

The research found the most likely combination to drive uptake of a flexible product was the Victorian Government and distributors taking responsibility for managing flexible export products.

PRODUCT MANAGEMENT	POWERCOR	UNITED ENERGY	CITIPOWER
Victorian Government	28.0%	30.6%	30.1%
Network distributor	25.3%	26.2%	25.5%
Energy retailer	25.1%	24.5%	23.7%
Solar installers	21.6%	18.7%	20.7%

The research including all findings can be found here.

Source: Forethought Research, Customer preferences for flexible export products, summary of results (2022)

Post-2026 static solar export limit design and flexible export uptake incentives

There are numerous ways we could design static export offerings for customers over the 2026–2031 regulatory period, which can be different from existing arrangements. With the inclusion of export tariffs and flexible export options in the regulatory framework, designing static limits will need to be considered in tandem with flexible export product outcomes and flexible export uptake incentives.

Setting static export limits higher would 'reserve' more capacity for static export limit customers and remove hosting capacity from the shared pool that flexible export customers could utilise, leading to lower levels of exports overall. This recognises that flexible export customers will be curtailed before static export customers because of existing connection agreement terms.

In contrast, setting lower static export limits would 'share' more capacity for flexible limit customers, incentivising more customers to take up flexible export limit products.

We have used these key design considerations to develop six potential solar export futures. A summary of the alternative futures is provided in figure 3.2, with the options described in more detail thereafter. Table 3.1 also sets out an assessment matrix for the different customer impacts from each option.

FIGURE 3.2 SOLAR EXPORT FUTURES SUMMARY

	Maintaining existing capacity	Adding capacity
Reserving capacity for future customers	**Shared capacity** New customers get static limit set at the intrinsic hosting capacity Medium flexible export limit take up Medium exports for flexible customers	**Solar abundance** New customers get static limit set at the intrinsic hosting capacity High flexible export limit take up High exports for flexible customers
Moderate capacity allocation	**Solar future** New customers get 2.5-3kW static limit if capacity is available Medium-low flexible export limit take up Medium-low exports for flexible customers	**Fast transition** New customers get 2.5-3kW static limit if capacity is available Medium-high flexible exports take up Medium-high exports for flexible customers
Capacity given to first connections	**Status quo** New customers get 5kW static limit if capacity is available Medium-low flexible export limit take up Low exports for flexible customers	**Capacity driven** Most new customers get 5kW static limit if capacity is available Medium-low flexible export limit take up Medium exports for flexible customers

Network investment →

Legend: **High variation** in solar customer equity — **low variation** in solar customer equity

Notes: (1) Customers serviced by single-wire-earth-return (SWER) lines, who are typically regional and rural customers are excluded from the descriptions and are discussed separately in section four.

(2) The nature of existing static export connection agreements would not change under each option unless a customer requests to change their connection. That is, legacy customers with 5kW static export limits will continue to be entitled to export 5kW even if we change our approach for new connections going forward.

TABLE 3.1 CUSTOMER IMPACT ASSESSMENT MATRIX

CUSTOMER IMPACT	ASSESSMENT
Solar PV exports enabled	The amount of solar PV exports enabled and the amount of renewable electricity exported by customers
Network investment required	The amount of additional network investment (and cost) required to support option
Incentive to transition to flexible export product	The incentive for customers to opt-in to a flexible export product based on how much customers could likely export relative to the static option
Fairness with existing solar customers	The relative fairness of export capacity allocation between new customers and existing solar customers
Fairness for non-solar customers	The relative fairness of costs recovered from non-solar customers to support solar customers

Source: CitiPower, Powercor and United Energy

1 Status quo

This option maintains the status quo, with static solar export connection applications up to 5kW approved where adequate network capacity is available. It would also include low levels of augmentation to enable solar exports where economic to do so, based on the AER's established CER valuation frameworks.

Once customers have accepted a static export limit connection offer, this reduces the available capacity for subsequent connections. Therefore, over time, this approach would result in more customers receiving a zero static export limit, or opting-in to a flexible connection agreement. However, flexible export customers would likely be steadily curtailed during peak export periods.

2 Capacity driven

This option would seek to maintain the approval of 5kW static export limits for most new customers, rather than a zero static limit, with additional capacity unlocked by network investment.

Performance metrics (e.g. similar to our existing solar enablement commitments of 85 or 95 per cent of customers being able to export 85 per cent of the time) would be developed in collaboration with customers to guide network investment. This option would likely require additional network investment beyond that supported by the AER's established CER valuation frameworks.

3 Solar future

Under this option, new solar export connection offers would receive a static export limit of between 2.5–3kW where capacity is available. This strikes a balance between low export limits based on intrinsic hosting capacity assessments and current export limits.

Network investments to unlock additional solar exports would be based on the AER's established CER valuation frameworks.

4 Fast transition

Under this option, all new solar export connection offers would be offered static export limits of between 2.5–3kW. This strikes a balance between low export limits based on intrinsic hosting capacity assessments and current 5kW export limits.

Network investment would be pursued to improve access to network hosting capacity in constrained areas. The amount of network investment would be based on ensuring that all new customers have access to 2.5–3kW static limits.

❺ Shared capacity

Under this option, new solar export connection offers would be offered a static export limit equal to the intrinsic hosting capacity, which is expected to be low. Opt-in flexible offerings would enable export levels higher than this when and where capacity is available within safe network operating limits.

Network investments to unlock additional solar would be based on the AER's established CER valuation frameworks.

❻ Solar abundance

This option would approve all new solar export connection offers with a static export limit equal to the intrinsic hosting capacity (similar to the shared capacity future).

While the static export limit would remain low, additional network investment would facilitate improved export levels for flexible export customers. This is likely to improve both flexible export uptake and utilisation of existing and future network capacity.

Network investments to unlock additional solar hosting capacity would be based on flexible export performance metrics. These measures are not yet designed but would likely be network-wide and related to the amount of time customers could export up to a certain level.

With sufficient uptake of flexible export limits, this option would result in the highest amount of exports for customers overall. We expect that incentives for customers to transition to a flexible export limit will be compelling.

3.1.3 Summary of customer export options

A summary of the broad characteristics of each option is provided below.

TABLE 3.2 SUMMARY OF SOLAR EXPORT FUTURES CUSTOMER IMPACTS

	SOLAR PV EXPORTS ENABLED	NETWORK INVESTMENT REQUIRED	INCENTIVE FOR FLEXIBLE EXPORT UPTAKE	FAIRNESS FOR SOLAR CUSTOMERS	FAIRNESS FOR NON-SOLAR CUSTOMERS
Status quo	Medium-low Existing capacity is utilised quickly	Low Based on established CER valuation frameworks	Low Low incentive for 5kW static customers, high incentive for zero static customers	Highly variable Early solar adopters receive 5kW until capacity is exhausted, then many other customers miss out with zero limits	High Investment and cost are low
Capacity driven	Medium-high Capacity built to enable current and future exports	Medium-high Once existing solar hosting capacity is exhausted	Medium-low Medium-low incentive for 5kW static customers, high incentive for zero static customers	High Same static allowance is available to most customers	Medium-low Higher network investment will be paid for by all customers
Solar future	Medium-low Medium static limit balances exporting customers with remaining hosting capacity	Low Based on established CER valuation frameworks	Medium-low Some flexible take-up incentives, but customers may still prefer static export certainty	Low Legacy customers have 5kW, new customers have significantly less	High Investment and cost are low
Fast transition	High Additional highly utilised capacity enables more exports	Medium Export capacity beyond the AER's CER valuation frameworks is required	Medium-high Good flexible take-up incentives, but customers may still prefer static export certainty	Medium-high Capacity improvements let new customers export more on flexible products	Medium-low Higher network investment will be paid for by all customers
Shared capacity	Medium-low Lower static limit leaves most potential customer exports curtailed, unless flexible export uptake is high	Low Based on established CER valuation frameworks	Medium Reasonable flexible take-up incentives, but customers may still prefer static export certainty	Low Legacy customers have 5kW, new customers have significantly less	High Investment and cost are low
Solar abundance	High Flexible take-up and investment means highly-utilised capacity and maximum exports	Medium Export capacity beyond the AER's CER valuation frameworks is required	High Strong flexible take-up incentives, certain static limit would be low	Medium-high Capacity improvements to grow shared export capacity pool let new customers export more on flexible products	Medium-low Higher network investment will be paid for by all customers

Source: CitiPower, Powercor and United Energy

Our initial preference

Our initial preference is to pursue the solar abundance export future, reflecting customers' views expressed during our Broad and Wide stakeholder engagement sessions.

The solar abundance future is likely to lead to the highest amount of overall customer exports and leads to more equitable customer export outcomes through highly-incentivised uptake of flexible export products. It also gives future solar customers agency to export a reasonable amount of solar and prepares for large-scale battery adoption when batteries reduce in cost.

Broad and Wide customer feedback

CitiPower – solar was seen as a major part of customers' energy future, and for this reason customers prioritised investment in making solar more widespread and available.

Powercor – customers placed high importance on helping everyone gain access to future electricity technology such as electric vehicles (EVs), solar, and electricity storage.

United Energy – EVs and solar panels were the most commonly discussed technologies within the subject of the energy transformation, both of which customers preferred greater proliferation of.

Question 1	Which key customer impact(s) for solar export futures is most important to you and why?
Question 2	Which solar export future should we prioritise for our customers?

3.2 Maximising the value of customer imports

Most new loads that customers are adopting tend to be predictable, reasonably standardised and incremental in their usage. Electrified gas load for example typically consists of heating during cold days, cooking in the evening and hot water on controlled load profiles.

Customers, however, have several different options for charging electric vehicles. This includes charging at home, work, local shopping centres, high-capacity public stations and more.

Monash University's Home Energy Futures research that found most customers would charge EVs at home. The focus of this section, therefore, is on various options for customers to charge at home.

Monash University's Home Energy Futures research found that 77 per cent of surveyed customers in our network areas would charge EVs at home (n=399, 68 per cent CitiPower, 81 per cent Powercor and 82 per cent United Energy).

3.2.1 Current arrangements for EVs

Before discussing possible futures, it's important to identify where the EV framework stands today. Important aspects of the regulatory framework design include EV visibility, tariffs, new connections, allocating costs and managed charging.

EV visibility

Under current arrangements, customers work with electricians to install EV charging infrastructure, and electricians do not have to engage with distributors during installation. We do not have visibility of where EVs are connected and charged on our network, creating uncertainty for network planning and operation.

We are developing internal algorithms to detect EV charging on our network, however, we do not have full visibility. We are also supporting external initiatives to improve visibility such as including new EV registrations in the DER register.

Improving EV visibility will enable us to better target network investments to deliver more value for each dollar invested.

EV fast charging connections at home

The minimum required infrastructure to charge electric vehicles at home is a simple wall plug that can charge electric vehicles from a standard power point socket, known as trickle charging. Each new EV comes with a wall plug as standard. This option can take around 30 to 50 hours to fully charge an EV, depending on the vehicle.

Customers can also choose to install a fast charger if they would prefer to charge their EV quicker.

Customers do not have to let their distributor know that they have connected fast EV charging infrastructure. The option only requires an electrician to connect their fast charger to a single phase of supply and there is no customer network connection cost. However, this can result in unintended consequences such as load tripping and potential safety risks for the connecting customer, and power quality issues for other nearby customers where our existing network is not designed to accommodate the additional load.

Customers can instead choose to work with their distributor to connect EV charging. This ensures that households have adequate supply capacity and minimises impacts on other customers:

- if there is adequate network capacity available to support EV charging, connection costs are minimal
- if adequate network capacity is not available, we would require customers to contribute to the network cost of upgrading network capacity in the local area. If three-phase supply is available locally but the customer has a compliant single-phase connection, the customer's connection cost will likely be low.

Requiring customers to contribute to the cost of capacity upgrades is a disincentive for customers to work with their distributor to connect EV charging. It is also a disincentive for customers to purchase an EV in the first place.

Four EVs on a street in Brighton

Local customer impacts associated with EV charging are already occurring.

Media reports in 2022, for example, highlighted the challenges of even small numbers of EV customers charging coincidentally.

Four EV customers in Brighton have resorted to printing flyers that called for local EV owners to develop a roster to stagger charging days and times to ensure their vehicles were charged. The flyers also asked local customers to 'ration' their power use and avoid air conditioners, washers and dryers during scheduled charging days and times.

Customers noted that EV owners had been told by their power company that they could not charge multiple vehicles in the same street, and that EVs could be charged using an ordinary power point.

Who should pay for EV capacity upgrades?

The regulatory framework was established in the 1990s to minimise costs during a steady-state period, with additional capacity investments able to be made on a user-pays basis. Customers can connect with minimal cost where adequate capacity is available, but customers are forced to pay when capacity is not available.

An alternative option would be for distributors to contribute more of the up-front cost of general upgrades to facilitate EVs and lowering customer contributions, rather than requiring the 'last' customer to pay for capacity upgrades. This option would improve EV uptake by making fast charging connections more affordable and improve power quality because more customers would choose to engage with their distributor.

However, the costs of capacity upgrades would be recovered from customers, including those without an EV.

Question 3	Is the current electric vehicle connections framework fit for purpose?
Question 4	Who should pay for the network investments to facilitate at-home electric vehicle charging?

EV tariffs

Tariffs are a mechanism to incentivise behavioural change and recover the costs of providing services from the customers who are benefiting.

The Victorian government currently has a policy requiring distributors to place residential and small business customers with an EV charger above 3.6kW on a network time-of-use (ToU) tariff to incentivise charging outside peak periods. These customers cannot opt-out to a flat network tariff. However, we are currently limited in our ability to implement this policy because we do not have visibility of EV chargers.

United Energy used analytics to identify about 1,600 customers who are likely to have a fast EV charger of at least 7kW. Table 3.3 shows that these identified customers are on a mix of flat and ToU network tariffs.

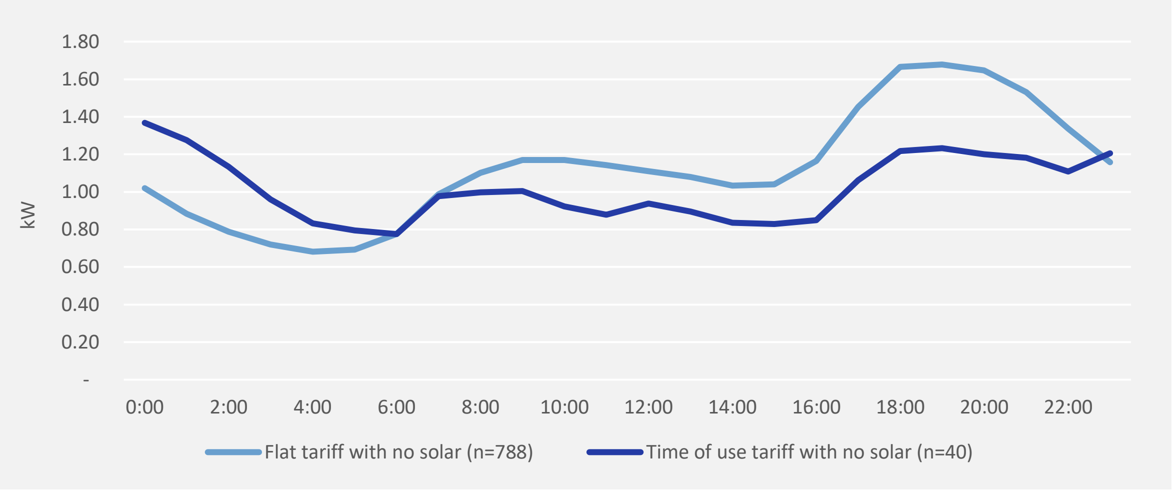
TABLE 3.3 CUSTOMER TARIFFS WITH EV FAST CHARGERS

NETWORK TARIFF	WITH SOLAR	WITHOUT SOLAR
Flat	371	788
ToU	423	40

Source: United Energy

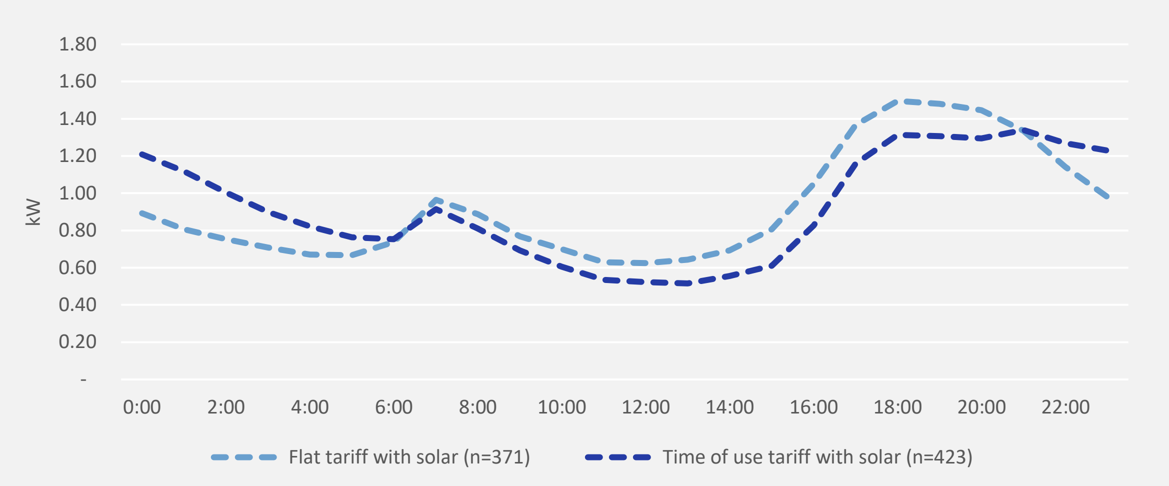
Figure 3.3 and 3.4 also compare the average total household load profile of these customers, with and without solar, over a three-month period. Those customers with a 7kW+ EV charger consume less electricity during the day and early evening, and more electricity overnight. However, EV charging behaviour observed with early adopters may not be representative of mass market behaviour, and this analysis does not include customers who charge from a standard wall plug (trickle charging).

FIGURE 3.3 AVERAGE HOURLY CONSUMPTION PROFILE, WITHOUT SOLAR



Source: United Energy, June to August 2023

FIGURE 3.4 AVERAGE HOURLY CONSUMPTION PROFILE, WITH SOLAR



Source: United Energy, June to August 2023

We will explore options for how more customers owning EVs can be assigned to time-of-use tariffs as part of our tariff structure statement consultation.

Management of EV charging

A key consideration for developing future EV scenarios is the level of management that customers will accept for EV charging, either from distributors or third parties. More management of charging would allow more customers to connect EV charging infrastructure and limit the network investment required to support EVs.

Managed EV charging is a means to shift charging outside peak periods. Other options such as tariffs and demand management will incentivise some customers to charge outside peak periods, but not all customers. We expect that managed charging may be required in some instances.

Management of EV charging could make better use of the existing network and allow more customers to charge EVs as charging load could be shifted to the daytime to make use of solar resources or overnight where demand is not as high.

However, our customer research has broadly identified that customers prefer maintaining control rather than allowing third parties to manage charging. This preference extends to solar PV and energy storage as well.

EV grid trial

70 United Energy customers participated in an EV grid trial to understand customer charging behaviour and their willingness for third parties to manage their EV charging. Customers opted-in to give control of their charger during events between 2021 to early 2023.

The trial included five demand response events where customers were rewarded for switching off their chargers during maximum demand periods, and five solar soak events where customers were rewarded from turning their chargers on during minimum demand periods. SMS notifications were sent prior to demand management events to give customers the opportunity to opt-out.

87 per cent of customers rated the experience as easy or extremely easy, indicating that some customers are supportive of third parties managing charging on their behalf.

Monash Home Energy Futures - maintaining control over charging continues to be a priority over relying on automation

Automated charging of EVs is still an unfamiliar concept for both current and prospective EV owners. Many households envision being unwilling to hand over the management of their charging to a third party or automated system. Many are concerned about such systems' inability to account for their daily life contingencies and irregular but important priorities, such as having an EV with sufficient charge in case of an unexpected emergency.

This is especially true of rural areas where distances to essential services are longer, and therefore having a near-fully charged EV is envisioned as necessary to be able to reach vital services.

Additionally, only one in three customers plan to charge their vehicles using a smart charger.

Monash also found that 34 per cent of respondents who own or plan to purchase an EV in the next five years (n=399), do, or plan to, use a smart charger at home

Of those who said they charged or would use a smart wall box charger at home, 56.6 per cent said they would want to be able to override smart appliances; 35.3 per cent said they would want to set or control the settings themselves, and only 3.7 per cent said they would be happy for smart appliances to be fully automated.

Our research findings indicate that managed charging will not be a silver bullet for managing network peaks as we transition towards mass EV uptake. Similar to tariffs, managed charging is likely to complement other solutions to collectively facilitate broad EV charging.

Further, the AEMC is currently consulting to unlock CER benefits through implementing flexible trading, which would allow third parties to manage customer appliances (including EVs) and offer separate deals to customers as compensation. The proposed rules would not require third parties to comply with distributor signals to manage charging, raising questions around whether we will be able to manage charging to smooth peak demand or not.

Energy Queensland recently proposed that all vehicle chargers above 20 Amps (most fast chargers) that use single-phase power should be required to connect through a demand management system, allowing Energy Queensland to manage charging during peak periods. Responses to this proposal were generally negative, particularly from EV groups, who believe the change is a strong disincentive for customers to adopt EVs.

Some EV charging supply equipment providers have supply equipment that reduces charging throughput when network voltage levels become too low, functioning as a backstop measure. Technology like this is a form of managed charging, and large-scale technology adoption (potentially through industry standards) could allow more customers to connect fast chargers.

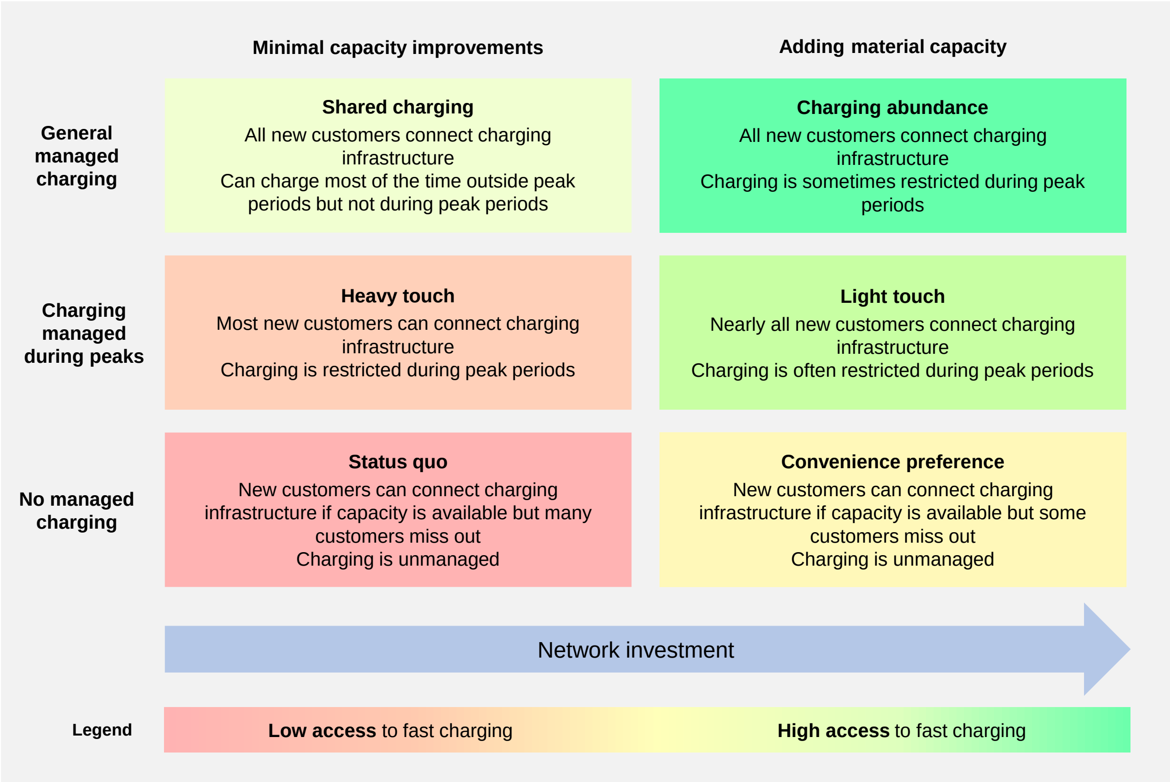
One of the key questions we are seeking to explore in this paper is whether customers are comfortable with third parties managing their EV charging.

3.2.2 Future EV scenario options

There are numerous potential EV futures that we could facilitate for customers over the 2026–2031 regulatory period. Broadly, the futures have different levels of managed charging, network investment and access to fast charging.

A summary of these alternative futures is provided in figure 3.5, with the options described in more detail thereafter.

FIGURE 3.5 ELECTRIC VEHICLE FUTURES SUMMARY



Source: CitiPower, Powercor and United Energy

All the EV scenarios above are assumed to have tariff pricing signals that incentivise charging outside peak usage periods. However, we expect that tariffs will have little impact on customer charging preferences based on historical tariff application and Monash University's Future Home Demand customer learnings.

We also assume that all customers will have a universal right to ‘trickle’ charging via a standard Australian wall plug. This will ensure that customers always have an option to charge their EV irrespective of their connection type or access to available network capacity to support faster charging options.

Trickle charging uses a comparable amount of electricity as a standard air conditioner, and we expect that EV load from trickle charging will be significant.

Using customer considerations from our consultation to date, we have identified the factors in table 3.4 for comparing alternative scenarios.

TABLE 3.4 CUSTOMER ASSESSMENT MATRIX FOR EV FUTURES

CUSTOMER IMPACT	ASSESSMENT
Customers who can access fast EV charging at home	The relative amount of customers who have connected fast-charging infrastructure at home
Amount of fast EV charging at home	The total amount of fast EV charging that customers have access to at home
Managed charging by distributors or third parties	The amount of charging that would need to be managed to limit impacts on network peak demand
Customer equity	Customer equity outcomes, particularly driven by the prevalence of unintended power quality issues created on the network by EV customers
Network investment required	The required network investment (and customer cost) to support this future

Source: CitiPower, Powercor, United Energy

1 Status quo

The existing arrangements and frameworks for EVs would largely remain unchanged.

Customers who work with their distributor to connect fast charging infrastructure could connect if capacity is available. However, available spare capacity would be relatively low. Once capacity is exhausted, customers would not be able to connect fast chargers. The overall amount of fast charging would be relatively low.

Alternatively, customers could continue to connect fast chargers without notifying or working with their distributor. This would exacerbate power quality issues on the local network and lead to poor quality electricity supply for other local customers.

Distributors or third parties would not manage charging for customers and network investment would be focused on enabling trickle charging.

2 Convenience preference

The existing arrangements and frameworks for EVs would largely remain unchanged.

Customers who work with their distributor to connect fast charging infrastructure could connect if capacity is available, with investment targeted towards enabling fast EV charging capacity. The amount of customers able to connect fast EV charging would be improved compared to status quo, but some customers would still be unable to connect fast chargers.

As customers could continue to connect fast chargers without notifying or working with their distributor, we would target reactive investments towards improving local power quality impacts caused by EV charging. This would improve the quality of supply for other local customers.

Distributors or third parties would not manage charging for customers.

3 Heavy touch

Heavy touch would require more visibility of EV locations and a way for distributors to manage charging during peak periods. Distributors or third parties would manage charging for customers during peak periods to limit the network impacts of EV charging.

More EV customers would be able to connect fast chargers than if charging were unmanaged because of the relatively lower peak demand contribution of EV charging that occurs with managed charging.

Customers who work with their distributor to connect fast charging infrastructure could connect if capacity is available. Available spare capacity would be relatively low. Once capacity is exhausted, customers would not be able to connect fast chargers. The overall amount of fast charging would be somewhat low.

Network investment would be focused on enabling trickle charging.

4 Light touch

Light touch would require more visibility of EV locations and a way for distributors to manage charging during peak periods. Distributors or third parties would often manage charging for customers during peak periods to limit the network impacts of EV charging, but management may not be required during lower-usage seasons or days.

Customers who work with their distributor to connect fast charging infrastructure could connect if capacity is available. Network investment would be focused on improving capacity to facilitate EV fast charging connections and the amount of available spare capacity would be reasonably high.

Nearly all EV customers would be able to connect fast chargers because of the relatively lower peak demand contribution of EV charging that occurs with managed charging.

5 Shared charging

Shared charging would require more visibility of EV locations and a way for distributors to generally manage charging. Distributors would generally restrict fast charging for customers during peak periods and potentially during other times to limit the network impacts of EV charging.

All new EV customers would be able to connect fast chargers because of the low peak demand contribution of fully managed fast EV charging. However, our research suggests that this level of control and restriction may not deliver customer value in practice.

Network investment would be focused on enabling trickle charging during peak periods.

6 Charging abundance

Charging abundance would require more visibility of EV locations and a way for distributors to manage charging during peak periods. Distributors would rarely restrict fast charging during peak periods, likely limited to 'critical peak' periods to limit the network impacts of EV charging.

Network investment would be focused on improving network capacity to enable fast charging during peak periods.

All new EV customers would be able to connect fast chargers because of higher available capacity and the fallback of managed EV charging.

3.2.3 Summary of potential EV futures

A summary of potential EV futures is provided in table 3.5, and we welcome stakeholder views on each option (or additional options not listed).

TABLE 3.5 SUMMARY OF ELECTRIC VEHICLE FUTURES CUSTOMER IMPACTS

	ACCESS TO AT-HOME FAST EV CHARGING	AMOUNT OF AT-HOME FAST EV CHARGING	MANAGED CHARGING	CUSTOMER CONNECTION EQUITY	NETWORK INVESTMENT REQUIRED
Status quo	Low	Low-medium	None	Low	Medium-low
	Some EV connections enabled by minimal capacity improvements	Connected customers fast-charge freely but many customers miss out	Customer charging would not be managed by networks	Existing frameworks, create power quality issues for non-EV customers	Investment to facilitate trickle charging
Convenience preference	Medium-low	Medium-high	None	Medium-low	Medium-high
	Some network capacity improvements for more EV connections	Connected customers fast-charge freely but some customers miss out	Customer charging would not be managed by networks	Power quality reactively addressed, some customers can't install fast-chargers	Investment to support trickle charging and some fast charging
Heavy touch	Medium	Medium	Medium-high	Low	Medium-low
	Most new customers can access fast EV charging at home	More customers connected and able to fast-charge; some still miss out	Charging managed during peak periods	Some power quality issues remain and some customers can't install fast-chargers	Investment to facilitate trickle charging
Light touch	High	High	Medium	Medium-high	Medium-high
	Nearly all customers can access fast EV charging at home	Capacity improvements and management enable some charging during peaks and all charging outside peaks	Charging often managed during peak periods	Nearly all new customers can connect fast chargers	Investment to support managed fast charging primarily outside peak periods
Shared charging	All customers	Medium-high	High	High	Medium-low
	All customers can access fast EV charging at home	Shared capacity enables customer charging most of the time outside peak periods, but not during peak periods	Charging restricted during peak periods and managed outside peak periods	All new customers can connect fast chargers; same charging management applies to all customers	Investment to facilitate trickle charging
Charging abundance	All customers	Very high	Medium-low	High	High
	All customers can access fast EV charging at home	Capacity improvements and some management enable charging at all times except in critical peaks	Charging sometimes managed during peak periods	All new customers can connect fast chargers; same charging management applies to all customers	Investment enables capacity that supports flexible, available charging

Source: CitiPower, Powercor and United Energy

Our initial preference

Our initial preference is to pursue the 'light touch' EV future, reflecting customers' views expressed during our Broad and Wide sessions and Monash University's Home Energy Futures research findings.

This future prioritises enabling the energy transformation by connecting all customers who wish to install EV charging infrastructure.

It then balances customer preferences for autonomy found through Monash University's Home Energy Futures research with the efficiency and utilisation benefits of some managed charging that will lower investment costs.

Broad and Wide customer feedback

CitiPower customers saw EVs as integral to the future of society and therefore felt that having adequate infrastructure in place was important. Greater charging stations would mean that EVs would be integrated more successfully into society.

Powercor customers placed high importance on helping everyone gain access to future electricity technology such as electric vehicles, however lower income customers believed that 'anyone but us' should pay for the transition.

United Energy customers would become more reliant on electricity into the future and lacked confidence that the network was able to support increased demand. United Energy customers were looking for a leader to take charge of the transition.

Question 5	Which key customer impact(s) of electric vehicle futures is most important to you and why?
Question 6	Which electric vehicle future should we prioritise for our customers?

4. Promoting agency for key customer groups

4.1 Customers experiencing vulnerability

Through our stakeholder engagement program, we are striving to design and provide service solutions that can support customers experiencing vulnerability while also gauging the willingness of other customers to support any investments to provide these service solutions.

Decarbonising homes will raise significant up-front costs for most customers. Some customers will face greater barriers and costs than others. For example, rental properties and multi-unit dwellings face some of the largest challenges to electrify.

Renters rely on their landlord to invest in the necessary changes to enable electrification. Landlords have limited incentives to electrify as they incur the costs without necessarily receiving the benefits.

The quarter of Australian households living in multi-unit dwellings also face multiple challenges to decarbonise. Many of these buildings have shared energy services. They also have limited roof space for solar panels. Large changes, such as shutting off gas supply, can require agreement from all unit owners. Even detached houses can encounter barriers such as limited space and being heritage listed.

Other countries with higher transport electrification rates highlight ongoing struggles helping apartment buildings add and share electric vehicle chargers. Cost, electrical capacity limitations, assigning parking spaces and wiring a charger to an apartment's electricity meter are among the challenges identified.

Barriers can also derive from people's personal circumstances. This can include where they live, age, income, level of literacy, fluency in English, access to internet and digital capabilities. Some of these barriers were identified in Powercor's Rural and Regional Summit report.

All of these barriers must be identified and addressed to ensure all customers have an equal opportunity to access the right support to benefit from the energy transformation. Our consultation to date has focused on what vulnerability means for our customers and how we could assist.

4.1.1 What we have heard

Our Rural and Regional Summit report emphasised the need to consider the distribution of impacts and social license issues in the energy transformation. It is crucial to recognise that some communities will bear a disproportionate burden of hosting energy infrastructure. The distribution of impacts between inner city and rural communities was not addressed in detail in the Stepping Up report and will require careful consideration in transition planning by Victorian electricity distributors.

Through our broad and wide engagement and customer forum report, CitiPower and United Energy customers highlighted the need for accessibility to new services and communications for all customers. There was an expectation that CitiPower and United Energy invested to ensure they address the needs of customers experiencing vulnerability. This included prioritising requests from customers experiencing vulnerability. Greater subsidisation of solar costs were considered desirable as a means to ensure those most financially vulnerable were able to participate in the renewables revolution.

Powercor customers similarly prioritised that customers who experience vulnerability are able to access new services. Powercor customers specifically highlighted the plight of 'invisible' vulnerable customers (i.e. those living just above the threshold for receiving government support). This point was also identified through our Yorta Yorta community engagement.

The Customer Advisory Panel (CAP), who are a group of customer representatives informing us of customer views on their behalf, has encouraged us to engage with social services organisations to better understand the spectrum of issues that the energy transformation presents for vulnerability.

The importance of exploring customer needs and feedback from the margins and then validating with the broader customer base was seen as desirable. The CAP recommended engagement with customers who are going to be paying for customer vulnerability reform, and further analysis to understand how effective customer vulnerability packages to manage the energy transformation may be. The opportunity for tariff reforms to support the energy transformation was also raised.

Participants in Victorian distributor collaborative forums identified key opportunities ranging from community hubs and 'building back better', to social tariffs and increased electrification. Participants noted that distributors often implemented programs aimed at assisting vulnerable groups to solve a problem without considering how these initiatives could empower individuals to take charge of their circumstances. The opportunity to develop and leverage partnerships with local government and communities was seen as critical.

4.1.2 Game changer

The AER's 'Game Changer' report on the proposed package of reforms) has been considering the broader topic of customer vulnerability. It identified a set of principles it considers ensure will lead to enduring solutions including:

- impact – deliver systemic reform for consumers experiencing vulnerability and support consumers with complex needs
- scale – materially reduce the quantifiable and unquantifiable costs of consumer vulnerability
- efficiency – improve efficiency of the energy system and incentivise businesses to identify customers experiencing vulnerability as early as possible
- equity – deliver more equitable outcomes for energy market participants including better risk allocation
- context – optimise with complementary supports for consumers experiencing vulnerability and avoid unintended consequences
- agility – respond to the evolving energy system durably.

These principles will be considered when developing solutions to support customers experiencing vulnerability in the context of the energy transformation.

Some of the AER's findings are relevant to our consideration of solutions, including that:

- the energy market is complex, difficult to navigate and not inclusive
- unaffordable energy bills lead to underconsumption
- energy is becoming less affordable, particularly alongside increases in other essential costs such as housing
- consumers distrust energy companies.

Our findings have differed from those of the AER when it comes to trust. While we also found a lack of trust in various electricity industry agents, Powercor customers trusted Powercor more than any other agent in the industry. Customers have repeatedly identified a level of distrust with retailers to us, making it difficult for us to reconcile the primacy of the role the AER is providing retailers in customer communication.

Stakeholders have also echoed the prevalence of misinformation during the energy transformation. Misinformation can originate from friends and outdated sources but can also arise from retailers. We were provided examples of retailers promoting expensive carbon-neutral plans to customers as the 'best option'. These customers may not have the financial means to afford such options and are not offered a base level plan. This issue underscores the need for clearer, more transparent information dissemination and the consideration of affordability constraints for customers when presenting eco-friendly alternatives.

Question 7	Who is the most appropriate party to engage with customers experiencing vulnerability during the energy transformation?

4.1.3 Our objectives

Our engagement undertaken so far has told us that:

- we should embrace that no one is left behind by the energy transformation
- our solutions should be designed with end users in mind, not the network
- stability in price and service levels is highly valued
- providing agency for customers to make informed decisions wherever possible is beneficial
- we should be aware of the implications for legacy gas customers.

Question 8	What other practical messages should we be considering in solution design?

4.1.4 The challenges

Empowering customers to make decisions

We have heard that agency is important. Customers should be empowered to make the right decisions for themselves through clear information that is relevant for their situation. It is essential to identify target groups (e.g. culturally and linguistically diverse, elderly, First Nations) and develop support structures to empower these groups to take advantage of the energy transformation. For example, information about the transition away from gas and suitability of alternatives.

Balancing costs and the energy transformation

The tension between immediate financial concerns, and broader challenges associated with the energy transformation is noteworthy. Navigating an energy transformation is a lower priority when customers face more immediate issues including cost of living, affordability and access to necessities like food, healthcare and switching on a heater during the colder months. This requires a balance between costs of energy transformation, and who pays for it. This is not only an absolute expenditure consideration but a distributional one.

Fear of authority

It has been highlighted, especially amongst CALD communities, there may be a fear of authority, hindering their ability to engage effectively on matters such as paying bills let alone the energy transformation. This point was echoed by First Nation's communities who noted the historical trauma they have endured can lead to some customers prioritising paying energy bills over buying food, due to the fear of the retailer requesting payment. This further complicates engagement in the transition process. This trauma can make participation a daunting and emotionally charged experience.

Energy efficiency

Amplifying the importance of energy efficiency and offering rebates as part of the energy transformation to customers experiencing vulnerability has been proposed to us. These services or rebates can benefit customers experiencing vulnerability, including those transitioning to electric vehicles, but need to be paid for by other customers.

Tailoring information

More tailored information and support has been repeatedly identified. CALD communities noted it is critical to tailor information and support specific needs of various communities and individuals within them. An example cited was the reliance of gas stoves for high heat in Asian cooking and that there should be information about the benefits of using electric induction cooktops.

To better support different groups, we need to explore different channels to engage with various groups. Examples include going to culturally safe spaces in-person to engage with the community and using both digital and non-digital channels to disseminate information.

Recognising the benefits beyond economics

To make the transition successful, stakeholders have collectively agreed that there is a need to increase energy transformation understanding among the broader community including what electricity networks may look like in 2031. This involves identifying organisations and channels that are seen as trustworthy who can provide clear and easily accessible information. Some participants mentioned the Victorian Government could play through provision of clear, unbiased information.

It was noted information should be conveyed in simple terms and that key information should be translated. Often language is convoluted in economic or engineering jargon or terminology and not focused on what the energy transformation provides to the end customer.

Energy products are becoming increasingly complex

Stakeholders have highlighted to us that products are becoming increasingly complex and targeted to specific customer segments that benefit from the energy transformation. This complexity poses a challenge in ensuring that customers experiencing vulnerability are not left behind during the transition. To address this, robust consumer protection frameworks should be established to complement the evolving product landscape along with clear and unbiased information.

Question 9	Can simple cost-effective solutions be developed to address these challenges?

4.2 Regional and rural customers

Regional and rural customers are typically supplied by longer lines that have a lower network capacity than urban lines. Regional and rural customers make up 62 per cent of Powercor's 920,000 customers, with 24 per cent of these customers being supplied by long rural lines.

Further, 20,000 Powercor customers are supplied by single wire earth return (SWER) lines, which are the lowest capacity lines that are designed to supply only a handful of customers at the edge of our network. Regional and rural customers supplied by SWER lines have less agency to participate in the energy transformation because of the lower amount of capacity in the existing network to connect new technologies.

On average, 83 per cent of urban Powercor solar customers are able to export up to 5kW at all times, whereas 5 per cent can partially export and 12 per cent of solar customers are constrained to zero exports. Only 50 per cent of solar customers on SWER lines can export up to 5kW at all times, and 37 per cent of SWER solar customers are constrained to zero exports.

Regional and rural customers also bear the localised burden of hosting large scale generation infrastructure, but do not have access to the energy capacity or benefits that this infrastructure produces.

Regional and rural customers will also face increasing challenges to connect EV charging equipment at homes and businesses to charge EVs as EV adoption increases and available capacity to charge vehicles becomes increasingly utilised. This is a challenge for all customers, but the lower capacity of regional and rural lines is an additional limitation for regional and rural customers.

Regional and rural forum

Regional and rural customers attended a forum we held in June 2023 to hear about the key future issues they see. Customers told us that enabling capacity for load and exports was their top priority and they expected Powercor to have a long-term plan for enabling capacity, with recognition that this would take several regulatory periods to deliver across the state.

> *"It baffles me, I can't have the option of three-phase power, but I am providing food for the nation." (Powercor customer, 2023)*

> *"It's a basic service inequity when a man in the city can subdivide a block and get three-phase for 'tinkering in his shed', when genuine businesses which are the fabric of the community, and employing so many, can't get it." (Powercor customer, 2023)*

Customers felt that unless sufficient capacity was available for EV charging and solar PV exports, they would not have access to the energy transformation. Customers also expected that broader benefits such as economic growth should be considered in business cases to support regional network upgrades.

The electricity needs of regional and rural customers are different to urban customers. EVs will be travelling further on average with larger distances being covered for work, errands and recreation. Vehicles and machinery used for other purposes such as farming are often the source of rural livelihoods and will also need to be progressively electrified to achieve net-zero.

We are currently investigating what it would take to prepare Powercor's regional network for an electrified, net-zero future. This is likely to compose additional protections and recovery measures from major environmental events like storms, flooding and bushfires, as well as upgrades for capacity to support the energy transformation.

Question 10	Do you support improving service levels for regional and rural customers, even if it costs more?

4.2.1 The regulatory challenge for supporting regional investments

The regulatory framework broadly relies on customer density and total electricity usage to justify network investments. The framework typically supports more investment in urban areas than regional and rural areas because:

- regional and rural areas have a lower customer density than urban customers but a comparable value of customer reliability
- meeting the needs of regional and rural areas typically requires more extensive works with projects costing far more per customer
- the benefits to justify investments are restricted to electricity supply benefits rather than considering a broader scope of benefits such as regional growth and employment
- the value that rural communities contribute to urban communities through agriculture and other socially valuable goods and services is not considered.

These factors will make it increasingly challenging to support regional and rural customers (particularly to the same extent as urban customers) with agency as their transport, home energy needs and other equipment shift towards electric alternatives.

Achieving long-term emissions reduction requires long-term participation from regional and rural customers. The key challenge for long-term participation is ensuring that regional and rural customers have access to their own agency to decarbonise.

Question 11	How should broader market benefits be considered in supporting regional and rural customer agency through the energy transformation?

A Monash University: Home Energy Futures

We engaged Monash University to undertake customer-first research with 36 households across our three networks, supported by a survey of 1,325 customers. The research was tailored to capture the most critical and relevant issues to CitiPower, United Energy, and Powercor households and their energy futures, as well as draw on previously conducted background research.

The research identified several key customer trends that are relevant for understanding how customers expect to use CER in the future, and in particular solar and EVs. These trends have been useful for understanding potential network implications and for defining service levels for CER.

We have considered these customer insights in the development of our service level options, and will incorporate them into our forecasting, customer service level commitments and business cases.

Monash University - Home Energy Future

- Customers are increasingly interested in sharing and resourcefully using renewable energy. “Solar self-consumption is appealing, but not always possible for households. In the context of expected low feed-in tariffs, the desire to export to the grid is not only about financial benefit that can be derived from feeding solar into the grid, but increasingly about not wasting renewable electricity. Wasting renewable electricity is incompatible with the reason many continue to install solar, which is not only about the financial payoff, but also about doing their part in decarbonisation efforts and increasing their own energy independence.”
- Households continue to prefer the convenience of at home charging. Most also envision that in the future they will charge their EV at home. Even when greater charging public infrastructure is available, people are still likely to prefer to charge at home. 77 per cent of survey respondents with or intending to purchase an EV in the next 5 years (n=399), do or would charge their EV at home, with greater per centages in Powercor and United Energy distribution areas.
- Automated charging of EVs is still an unfamiliar concept for both current and prospective EV owners. Many households envision being unwilling to hand over the management of their charging to a third party or automated system. Many are concerned about such systems’ inability to account for their daily life contingencies and irregular but important priorities, such as having an EV with sufficient charge in case of an unexpected emergency. 34 per cent of respondents who own or plan to purchase an EV in the next 5 years (n=399), do, or plan to, use a smart charger at home. However, of the 136 people who said they charged or would use a smart wall box charger at home, 56.6 per cent said they would want to be able to override smart appliances; 35.5 per cent said they would want to set or control the settings themselves, and only 3.7 per cent said they would be happy for smart appliances to be fully automated.
- People often have particular and fixed ideas around how and when to charge electronic devices like phones, smart watches, power tools and tablets. These charging routines are likely to translate into their practices around charging EVs or home batteries including their automated settings and when they choose to override them. Rather than charging based on energy prices or energy availability, these habits and preferences exist to ensure that devices remain usable when needed, to protect the longevity of the battery, and to fit into broader sets of routines or priorities.

B Potential solutions for managing constraints

This appendix outlines the types of solutions available for managing constraints, and where they are likely to be most impactful.

B.1 Network tariffs

Tariffs are a traditional pricing mechanism that is used to shift customer behaviour by employing pricing signals that vary by time of day.

Time of use tariffs can set lower prices during low use periods to incentivise more usage during a particular time. For example during the middle of the day to offset increasing electricity exports.

They can also set higher prices during peak demand periods to disincentivise usage and reduce required network expenditure.

Tariffs can be applied to separate metered loads, for example to hot water units. If distributors can control certain loads, we can automatically schedule them during the middle of the day, or overnight.

Tariffs have been shown to be less effective in practice because they require retailers to agree to take up the tariff and 'pass on' the pricing signals to customers. Retailers often haven't passed through network tariffs directly to customers in the past, creating challenges for shifting customer behaviour using tariffs.

Many customers are unaware of their retail tariff pricing and whether it varies over different times of the day.

B.2 Education

Education campaigns to alert customers that there are community benefits from reducing load during peak times can be a cost-effective approach to managing demand on a network

Monash University's Future Home Demand research found that 47 per cent of customers surveyed (n=1325) on our network would respond to a campaign asking people to reduce their energy use with no financial incentive.

Improving energy literacy can improve outcomes for all customers by encouraging load shifting to free up network capacity.

We are developing an education campaign as part of our 2026–2031 regulatory proposals to assist with encouraging customers to shift their consumption and load to off peak periods and reduce demand during peaks.

Energy literacy campaign

In 2022, we designed an online welcome pack for new United Energy customers that aimed to help customers understand more about energy and their choices.

The pack introduced United Energy as their distributor and provided advice about electricity consumption, network tariffs, electricity bill structure and information available to support customer research into rooftop solar, batteries and electric vehicles.

The welcome pack supported over 600 customers to foster their own agency through voluntarily engaging with their energy use.

B.3 Demand management

Demand management programs provide financial rewards to customers who agree to reduce their demand when called upon by the network.

Monash University's Future Home Demand research found that a further 31 per cent of survey respondents (n=1325) would respond to financial incentives to reduce demand if called upon, alongside the 47 per cent who would respond to a campaign asking people to reduce their energy use without a financial incentive.

We are developing a demand management program as part of our 2026–2031 regulatory proposals to incentivise reductions in demand on our network, lowering overall costs for customers.

Summer Saver

Our existing 'Summer Saver' demand management program has been rewarding customers for reducing demand in key network areas since 2017.

Over 8,000 customers have signed up over the seven years of the program, collectively reducing demand by an average of 1.5MW for each of the 40 demand management events.

Customers have been rewarded nearly $1 million in incentives for their contributions.

B.4 Voltage management

Australian electrical appliances and equipment are designed to operate efficiently at 230 volts but can tolerate voltage levels within a band around 230V. Our voltage management programs enable us to manage voltage levels for the majority of customers on our networks within defined boundaries of 216V and 253V for 98 per cent of the time.

Solar that is exported to the network typically raises voltage levels, while load on the network like air conditioning typically lowers voltage levels. Voltage levels can vary across different areas of the network and across the day as customers use and export electricity.

As more customers install solar and begin to export during the middle of the day, voltage levels on our networks will be pushed higher. At the same time, increasing EV adoption and charging during peak evening periods will reduce voltage levels across the network.

Our voltage management programs enhance our ability to manage voltage levels and will allow us to facilitate additional solar exports and EV charging.

To find out more about voltage management in distribution networks, please head to the Victorian Government's recently released Directions Paper on the topic.

B.5 Tailored connection agreements (flexible exports and demand management)

Solar export limits on our networks have historically operated on a first come first serve basis where solar export connections are approved unless there is insufficient network capacity to facilitate any more solar exports. Customers are then offered lower export limits, or no limits at all.

Our tailored connection agreements provide an alternative to customers, particularly those customers who currently have reduced or no export capability. Tailored connection agreements would provide flexibility to design demand management and export arrangements that meet customer needs and are suitable for the network.

B.6 Non-network solutions

Non-network solutions are options other than direct network investment to reduce constraints and improve service levels for customers. These solutions typically involve batteries, whether they be network-owned, community batteries or third-party batteries.

We will be considering where non-network solutions can address constraints and minimise total costs for customers, including engaging publicly on our planned investments to invite alternative solutions from other service providers.

B.7 Network augmentation

Network augmentation will be used to deliver service levels when other alternative solutions have been exhausted. Traditional augmentation typically improves network capacity by upgrading transformers or electrical line capacities.

While augmentation is typically more expensive than other solutions, augmentation can always be used to improve the ability for customers to charge EVs and to export to the network. In many cases, augmentation is the most viable solution to improve service levels. For example when demand in an area is expected to continue increasing over time.

B.8 Curtailment

If no other solution is viable to improve service levels, curtailment will be required to ensure that the network remains safe and reliable. We understand that curtailment is not what customers expect from network providers but in certain circumstances it may be the only viable solution.

While curtailment does maintain network safety and reliability, it does not allow customers to use or export their electricity. Curtailment also does not contribute to the achievement of broader emissions reduction targets because curtailed exports are renewable.

C Glossary

ACRONYM	WHAT IT IS	WHAT IT MEANS
AEMC	Australian Energy Market Commission	Sets the rules and regulations for the energy industry
AEMO	Australian Energy Market Operator	Manages electricity markets to ensure that supply and demand are balanced
AER	Australian Energy Regulator	Administers the rules and regulations for the energy industry and produces more detailed industry guidelines
CER	Customer Energy Resources	Resources that can generate or store power for customers, including solar, batteries and electric vehicles
DER	Distributed Energy Resources	A historic term, now known as Customer Energy Resources
EV	Electric Vehicle	A vehicle powered by electricity rather than combustible fuel
Solar PV	Solar photovoltaic	Rooftop solar panels that generate electricity
ECA	Energy Consumers Australia	Energy Consumers Australia is the independent, national voice for residential and small business energy consumers
kW	Kilowatt	A measure of electricity load drawn from the network or export passed to the network
kWh	Kilowatt hour	A volumetric measure of the amount of electricity used or exported over time
MW	Megawatt	A volumetric measure of the amount of electricity used or exported over time
GW	Gigawatt	A volumetric measure of the amount of electricity used or exported over time
PJ	Petajoule	A volumetric measure of the amount of gas used over time
ToU	Time of use	A pricing structure where electricity is cheaper during low-demand periods and more expensive during peak periods