evoenergy

Appendix 4.3: The Centre for International Economics – Demand for flexible load tariffs in the ACT

Revised regulatory proposal for the Evoenergy electricity distribution determination 2024 to 2029

November 2023

FINAL REPORT

Demand for flexible load tariffs in the Australian Capital Territory

Stated preference research

Prepared for
Evoenergy

27 November 2023

THE CENTRE FOR INTERNATIONAL ECONOMICS
www.TheCIE.com.au

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Background

Consumers in the Australian Capital Territory (ACT) have been substituting away from vehicles with internal combustion engines towards electric vehicles (EVs) and away from natural gas heating towards reverse-cycle air conditioning. This trend is expected to continue and accelerate in coming years. Decisions about the provision and pricing of Evoenergy's electricity network services must therefore consider how and when consumers prefer to use EV chargers and air conditioners and how responsive appliance use might be to different tariff offerings.

One way of limiting the use of these appliances during periods of peak electricity demand would be to promote the *controlled load tariffs* historically applied to water storage heaters for other appliances like EV chargers. On a controlled load tariff, specific appliances are wired on a separate circuit to the rest of a home's electricity. Electricity is supplied to these appliances for only a limited number of hours each day. Consumers on this tariff are rewarded with a lower price.

Smart appliances are emerging as another way of limiting demand during peak periods. These are appliances that can respond to remote communications from an electricity provider to automatically increase, decrease, stop or start using power. In Queensland, for example, consumers can choose to install a device in their air conditioner that enables electricity providers to communicate with and control the air conditioner. Consumers doing so are rewarded with a lower price for electricity. It is expected that in coming years similar and improved functionality will be built into selected air conditioners, as well as EV chargers, hot water storage heaters, pool pumps, pool heaters, and underfloor heating. Although Evoenergy has not yet proposed to do so, in future it could invest in network control systems that would enable it to offer *flexible load tariffs* that reward customers for handing over control of one or more of these appliances.

In 2023, Evoenergy commissioned The Centre for International Economics (CIE) to conduct stated preference research into potential future demand for controlled and flexible load tariffs in the ACT. This report sets out the methodology and results from that research.

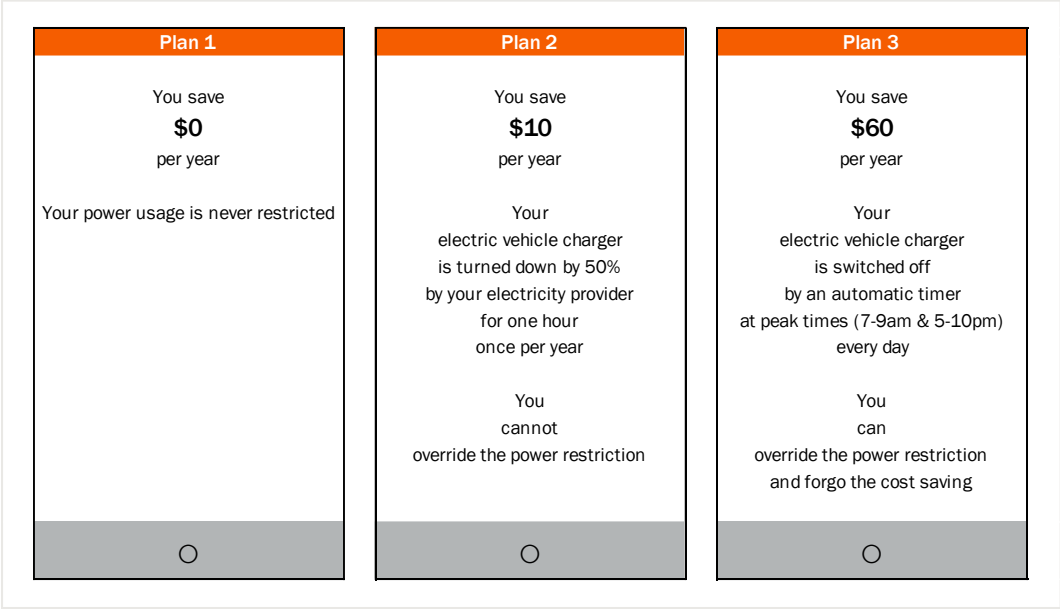
Methodology

The research involved an online survey of 721 households in the ACT, recruited through a combination of online panels and email invitations to a random sample of Evoenergy customers. The sample was reasonably representative of the ACT population, except that EV owners were oversampled in the email component of the sample. We corrected for

under- and over-sampling in the analysis using sampling weights, which place a lower weight on survey responses from EV owners, for example.

The survey employed a sophisticated quantitative survey technique called a discrete choice experiment (DCE) or choice modelling. This involved asking respondents to imagine a time in the future when they have an EV and smart appliances and then asking them a sequence of eight choice questions like the example provided in figure 1. The question presents the respondent with two controlled and/or flexible load tariff options and a no-change option and asks them which option they would choose if these three options were the only options available. In total, survey respondents made 5768 of these choices over the course of the study.

1 Example of a choice question



Data source: CIE

Some 192 different versions of this choice question were used in the research, with the cost savings, the nature of the restrictions on electricity usage, and the availability of consumer override varied by design from one question to the next. This enabled estimation of statistical models that can be used to predict the proportion of consumers choosing a given tariff.

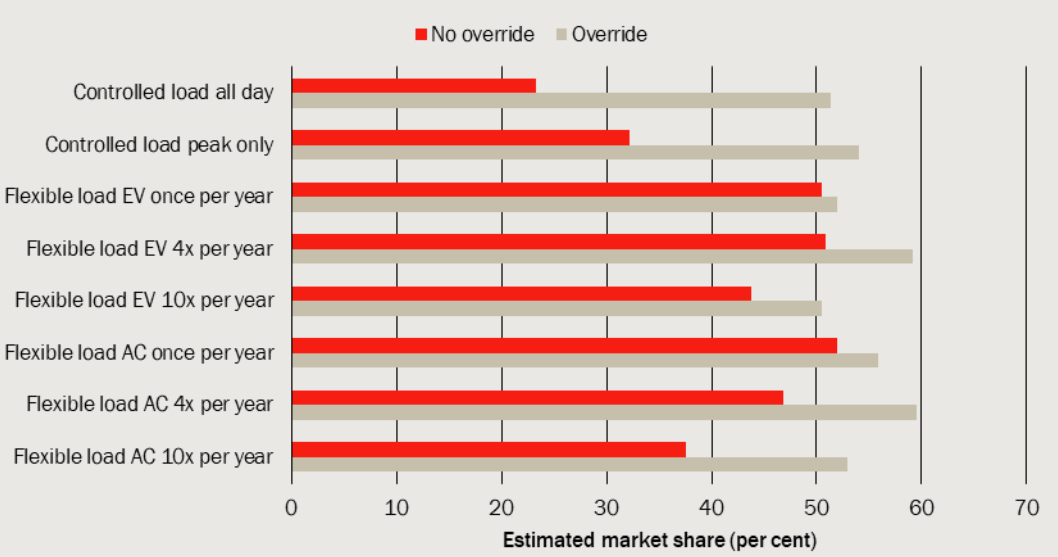
Findings

The key findings from this study are:

- Most EV owners charge their vehicles at home and this charging most often takes place outside periods of peak electricity demand.
- Around two thirds of EV owners who charge at home schedule their charging either by programming their vehicles or manually starting and stopping charging at specific times. Prospective EV owners indicated they would be more likely to use these means of scheduling than a controlled load tariff.

- Consumer demand for controlled and flexible load tariffs depends on the cost saving offered, the nature of restrictions on electricity usage, and whether it would be possible for consumers to override the restrictions.
- Consumers prefer flexible load tariffs to controlled load tariffs, particularly when override it not possible (chart 2).
- The appliance to which restrictions apply — EV charger or air conditioner — did not have a significant impact on demand for flexible load tariffs.
- If override is possible, many consumers would choose flexible load tariffs, even if very little cost saving is offered. For example, we estimate around half of consumers would choose a flexible load tariff restricting EV charging 10 times per year for a cost saving of just $25 per year.
- However, only 20 per cent of consumers expect to have an electric vehicle and a smart charger, and therefore be in a position to consider such a tariff, by 2028/29.
- As a result, the overall market share across all residential consumers of a hypothetical flexible load tariff applied to EV charging in 2028/29 is predicted to be between 10 and 14 per cent, depending on the cost saving offered and whether override is enabled (table 3).

2 Impacts of restrictions and override availability on conditional market share



Note: 'Controlled load all day' means electricity is switched off between 7 am-10 pm. 'Controlled load peak only' means electricity is switched off between 7-9am & 5-10pm. Assumes a $25 cost saving is offered with this tariff. Assumes a three-alternative choice set. The other two options are (1) an unrestricted tariff with zero cost saving, and (2) a controlled load tariff applied to EV charging during the day, with no override available, for a cost saving of $25 per year. Results are adjusted using sampling weights.

Data source: CIE

3 Unconditional estimates of market share

Plan features			Estimated market share
Cost saving	Restriction	Override	
$ per year			per cent
25	Flexible load EV 10x per year	×	9.4
25	Flexible load EV 10x per year	✓	10.7
100	Flexible load EV 10x per year	×	13.1
100	Flexible load EV 10x per year	✓	14.3

Note: Assumes a three-alternative choice set. The other two options are (1) an unrestricted tariff with zero cost saving, and (2) a controlled load tariff applied to EV charging during the day, with no override available, for a cost saving of $25 per year.

Source: CIE

Limitations

It is important to bear in mind there is uncertainty over the precision of the stated preferences described in this report as a predictor of real choices in a future market. This uncertainty arises from multiple sources, including:

- respondents' lack of real-world experience with EV charging, with less than a tenth of the sample owning an EV
- the survey results being conditional on customers being at the point of choosing between tariffs, in contrast to the real market where initiative to consider alternatives to default tariffs rests with customers, and
- limits on the extent to which survey respondents could be informed about the exact costs of implementing smart appliances and/or tariff options, including costs associated with potential meter upgrades, electrician fees, and smart appliances.

Evoenergy may wish to consider conducting field experiments or real-world tariff trials to resolve some of this uncertainty.

1 Introduction

Consumers in the Australian Capital Territory (ACT) have been substituting away from vehicles with internal combustion engines towards electric vehicles (EVs) and away from natural gas heating towards reverse-cycle air conditioning. This trend is expected to continue and accelerate in coming years. Decisions about the provision and pricing of Evoenergy's electricity network services must therefore consider how and when consumers prefer to use EV chargers and air conditioners and how responsive appliance use might be to different tariff offerings.

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Smart appliances are emerging as another way of limiting demand during peak periods. These are appliances that can respond to remote communications from an electricity provider to automatically increase, decrease, stop or start using power. In Queensland, for example, consumers can choose to install a device in their air conditioner that enables electricity providers to communicate with and control the air conditioner. Consumers doing so are rewarded with a lower price for electricity. It is expected that in coming years similar and improved functionality will be built into selected air conditioners, as well as EV chargers, hot water storage heaters, pool pumps, pool heaters, and underfloor heating. Although Evoenergy has not yet proposed to do so, in future it could invest in network control systems that would enable it to offer *flexible load tariffs* that reward customers for handing over control of one or more of these appliances.

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2 Methodology

This chapter sets out the methodology for the survey instrument, including the steps taken to review and test the questionnaire.

Structure of the questionnaire

The main objective of the survey instrument was to develop an understanding of potential demand and preferences for controlled and flexible load tariffs applied to EV charging and other smart appliances by 2028/29. The two key questions that need answering are:

- What share of consumers are likely to purchase, by 2028/29, an electric vehicle and/or the smart appliances required to enable flexible load tariffs?
- What is consumers' willingness to accept automated or remote control of specific appliances in exchange for lower electricity prices or for other altruistic reasons?

The survey instrument was designed to address both questions. It comprised:

- screening questions to ensure respondents were ACT residents aged 18 years or over
- questions about key respondent and household characteristics, including whether the respondent makes or helps make decisions about the electricity provider or electricity plan for their home
- questions about the respondent's existing electricity plan, and either current or future electric vehicle ownership and home charging
- information about smart appliances and questions about the likelihood of future ownership of smart appliances
- information about controlled load and flexible load tariffs
- tariff choice questions (discussed further below)
- debriefing questions about how the respondent answered the tariff choice questions, and
- additional respondent and household characteristics.

The survey instrument was developed through a thorough process of review and testing, including in-depth cognitive testing interviews. A text version of the questionnaire, which was conducted online, is provided at appendix B. The remainder of this chapter outlines the rationale for the questionnaire, focusing primarily on the tariff choice questions.

Discrete choice analysis

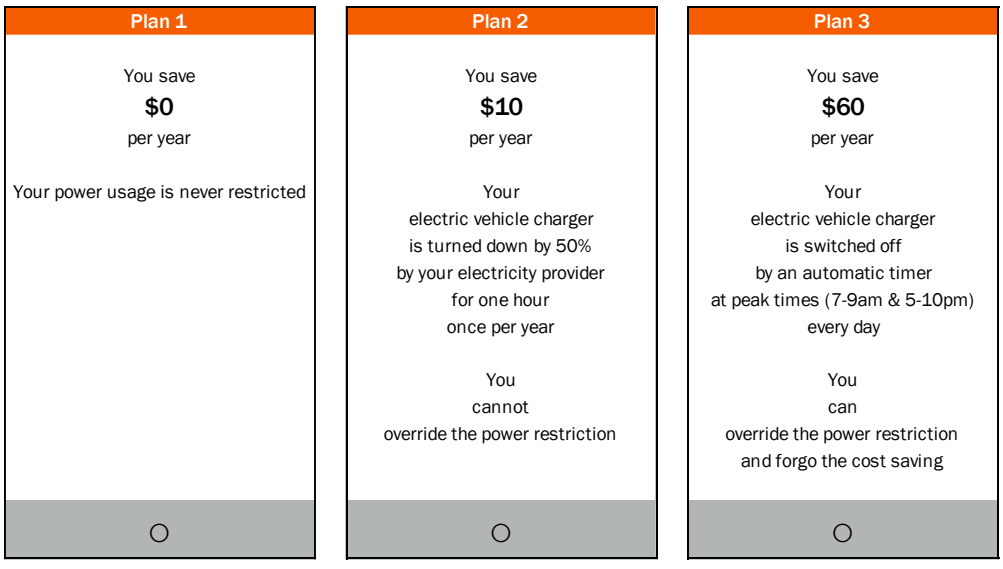
The tariff choice questions employed a sophisticated quantitative survey technique called a discrete choice experiment (DCE) or choice modelling. DCE involves presenting respondents with a set of alternatives described by a set of attributes and asking them to indicate the option they would choose if those were the only options available in a real market setting. Respondents answer a sequence of these questions. The attributes of the alternatives are varied across questions and across respondents to provide the variation needed for statistical estimation of the role of each attribute in consumer choice.

In the present study, the DCE technique was used to understand the future decisions respondents are likely to make about electricity tariffs, once they have installed smart appliances.

Choice design

An example of one DCE question is provided in figure 2.1. The DCE questions included three tariff alternatives — a 'no change' option and two controlled or flexible load tariffs. Offering more alternatives in each question was judged to be too complex for a self-administered survey. Offering only one alternative to the 'no change' option, while limiting cognitive burden for respondents, has in past surveys provided insufficient variation for statistical estimation.[1]

2.1 Example of a choice question



Data source: CIE

1 Rolfe, J. and Bennett, J., 2009. The impact of offering two versus three alternatives in choice modelling experiments. Ecological Economics, 68(4), pp.1140-1148.

Each respondent was presented with a sequence of eight choice questions. This was judged to strike an appropriate balance between the objectives of maximising choice observations and limiting bias from respondent fatigue.

Attributes

The tariff alternatives were described by the annual financial saving on electricity prices, the nature of restrictions on electricity usage, and whether it would be possible to override those restrictions and forgo the saving. The nature of restrictions on electricity usage was described in terms of the expected frequency and duration of restrictions and the technology by which they are implemented — either an automatic switch (on a controlled load tariff) or remote control (on a flexible load tariff).

The levels used in the survey for each of these attributes are set out in table 2.2. Cost savings of up to $200 per year were tested in the survey. This level was set higher than the expected saving from cost reflective tariffs to ensure the study would be able to identify the savings required to induce substitution to the most inconvenient tariff types. Controlled load tariff windows aligned with those applied in Evoenergy's existing 'Night' and 'Day and Night' tariffs. Flexible load tariffs were applied to EV chargers or air conditioners. They were described in every case as applying a 50 per cent power reduction for a period of one hour. The frequency of demand response events ranged from once to ten times per year.

2.2 Attribute levels

Cost saving ($ per year)	Restrictions on electricity usage	Override capability
10	Your electric vehicle charger is switched off by an automatic timer during the day (7am-10pm) every day	You can override the power restriction and forgo the cost saving
20	Your electric vehicle charger is switched off by an automatic timer at peak times (7-9am & 5-10pm) every day	You cannot override the power restriction
50	Your electric vehicle charger is turned down by 50% by your electricity provider for one hour once per year	
60	Your electric vehicle charger is turned down by 50% by your electricity provider for one hour 4 times per year	

Cost saving ($ per year)	Restrictions on electricity usage	Override capability
70	Your electric vehicle charger is turned down by 50% by your electricity provider for one hour 10 times per year	
100	Your air conditioner is turned down by 50% by your electricity provider for one hour once per year	
150	Your air conditioner is turned down by 50% by your electricity provider for one hour 4 times per year	
200	Your air conditioner is turned down by 50% by your electricity provider for one hour 10 times per year	

Source: CIE

Experimental design

The experimental design specifies which combinations of the attribute levels appear in each choice question. Experimental design is an important consideration when conducting choice modelling surveys, as it determines the amount of information that will be elicited from a given sample. If the researcher has information about the preferences of the population, there are techniques for generating designs that will elicit preferences more efficiently. A more efficient experimental design will narrow the statistical confidence interval on the estimates that are ultimately derived from the survey.

We used a design with 64 questions allocated to eight blocks of eight questions. Each respondent answered one block of questions. We adapted the experimental design during the survey fieldwork to improve its efficiency. The first wave of fieldwork used an optimal orthogonal-in-difference design that did not utilise any preference information. The second and third waves of fieldwork used efficient designs, optimised based on the preference information gathered in preceding waves (minimising D-error using design search in the Ngene software package).[2] As a result, 192 different versions of the question in figure 2.1 were asked over the course of the survey fieldwork.

2 Scarpa, R. and Rose, J.M., 2008. Design efficiency for non-market valuation with choice modelling: how to measure it, what to report and why. Australian journal of agricultural and resource economics, 52(3), pp.253-282.

In-depth interviews

Once the draft survey instrument had been developed, it was tested using four in-depth interviews. The purpose of the interviews was to verify the clarity and neutrality of the questionnaire and identify any unintended misperceptions created by the survey instrument. Each interview involved the participant completing the questionnaire and then engaging in a discussion for around 30 minutes. The discussion guide used for the interviews is provided in appendix A. The interviews identified several important changes that needed to be made to the survey instrument, including improving clarity so that respondents did not misinterpret the nature of restrictions on electricity use and the consequences of overriding the restrictions (table 2.3).

2.3 Changes made in response to in-depth interviews

Q	Issue	Change
Choice	Misperception that restrictions apply to all power usage	Restructure choice task to clarify
Choice	Uncertainty about whether price would be going up in the BAU option.	Note in the instructions that prices may increase over the next 5 years.
Choice	Override assumed to be costless	Add text to choice attribute emphasising override would involve forgoing cost savings
Q24-Q29	Likert scale questions don't have a 'don't know' response	Include instruction to select 3 if respondent has no impression
Q11	Jumped too quickly into questions about EVs without explanation of what they are	Include short explanation about EVs ahead of Q11

Source: CIE

3 Sampling

This chapter details our approach to sampling respondents to the survey, the characteristics of that sample, and the sampling weights we used to correct for differences between the sample and population characteristics.

Approach

The survey fieldwork was conducted online in October and November 2023 with two separate samples of ACT households:

- Households recruited through online panels, managed by Pureprofile (n=355), and
- Households responding to email invitations sent out by Evoenergy to a random sample of 20 000 Evoenergy customers (n=366).

The email sample was used to supplement the relatively small available panel sample, increasing the chances of finding statistically significant relationships. In general the email sample was less representative of the Canberra population than was the panel sample (as discussed further below). This bias was mitigated with the use of sampling weights, which weight more heavily responses from households in undersampled categories so that the results more closely match the true characteristics, attitudes and preferences of the underlying population.[3]

The survey was conducted in three waves, comprising two pilot surveys of 109 and 107 survey completions in early October 2023 and a third and final wave of 505 completions in late October 2023. The experimental design was improved with each successive wave, as discussed in chapter 2.

Representativeness of the sample

Four household characteristics were used to determine the representativeness of the sample:

- EV ownership
- Dwelling type
- Dwelling ownership status (tenure type)

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3 See for instance OECD (2009), "Sample Weights", in PISA Data Analysis Manual: SPSS, Second Edition, OECD Publishing, Paris, available at https://www.oecd-ilibrary.org/docserver/9789264056275-4-en.pdf?expires=1700529610&id=id&accname=guest&checksum=FA4CE3BC391E8FEF17CCAE5C029F96D4

- Location

To improve accuracy when generalising the survey results to the population, we generated sampling weights. These weights are generated in such a way that the characteristics of the weighted sample match those of the population for the four attributes listed above.

The characteristics of the sample with regard to these four attributes are shown in tables 3.1 through 3.4, including results for the panel and email samples separately, as well as the unweighted and weighted totals. Each table also shows the characteristics of the underlying population of ACT households.

The share of ACT households with an EV was estimated as the number of light vehicles registered in the ACT as electric or plug-in hybrid (6836 vehicles as at 1 October 2023)[4] as a proportion of the number of occupied private dwellings in the ACT. Although there are some uncertainties over the number of households with multiple EVs and the number of fleet vehicles registered, it is clear the email sample had a much higher share of EV owners than the underlying population. This may reflect sampling bias arising because the email invitations were sent by Evoenergy (whereas the panel respondents were told nothing of the survey topic until they had commenced the questionnaire).

3.1 Shares of EV ownership

Owns an EV	Email	Panel	Unweighted total	Weighted total	Population
	Per cent	Per cent	Per cent	Per cent	Per cent
No	87.2	94.9	91.0	96.1	96.1
Yes	12.8	5.1	9.0	3.9	3.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: The CIE

Both the email and panel respondents undersampled detached houses compared to the Canberra population, with a higher discrepancy in the email sample (table 3.2).

3.2 Shares of respondent dwelling types

Dwelling type	Email	Panel	Unweighted total	Weighted total	Population
	Per cent	Per cent	Per cent	Per cent	Per cent
Detached house	45.9	56.3	51.0	63.3	63.3
Townhouse	27.3	22.3	24.8	17.2	17.2
Apartment	26.8	21.4	24.1	19.4	19.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: The CIE

Renters were undersampled (and outright owners oversampled) in the email sampling (table 3.3).

4 From the dashboard available at https://www.climatechoices.act.gov.au/transport-and-travel/cars-and-vehicles

3.3 Shares of respondent ownership status

Ownership status	Email	Panel	Unweighted total	Weighted total	Population
	Per cent	Per cent	Per cent	Per cent	Per cent
Occupied rent-free	0.3	0.6	0.4	1.6	1.6
Owned outright	42.6	21.1	32.0	26.9	26.9
Owned with a mortgage	36.3	45.4	40.8	40.6	40.6
Rented	20.8	33.0	26.8	31.0	31.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: The CIE

The districts of Gungahlin and North Canberra were slightly oversampled among our respondents, with South Canberra, Tuggeranong, Weston Creek Molonglo and Woden Valley undersampled (table 3.4).

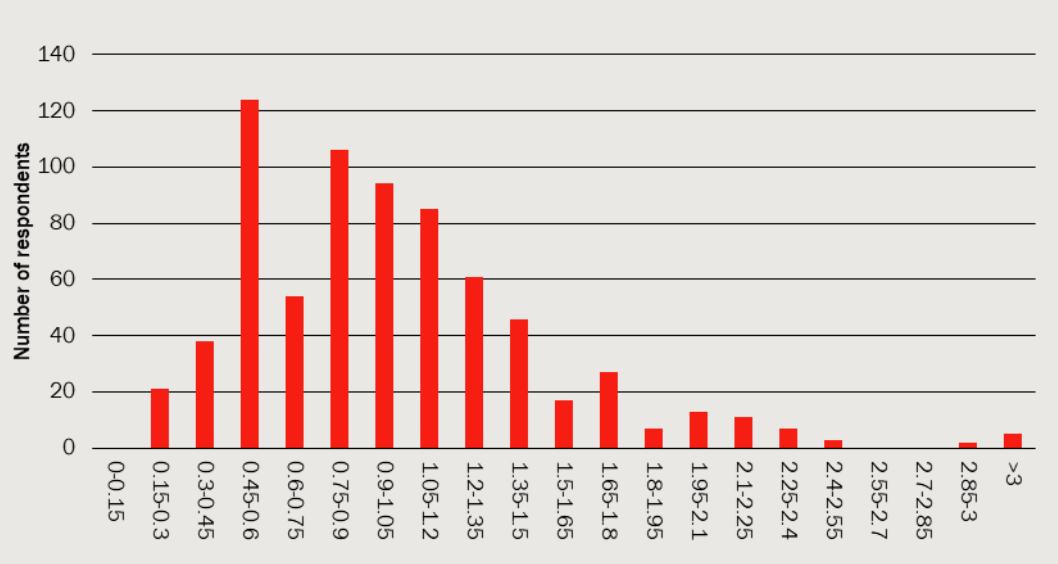
3.4 Shares of respondents by Statistical Area Level 3

SA3	Email	Panel	Unweighted total	Weighted total	Population
	Per cent	Per cent	Per cent	Per cent	Per cent
Belconnen	23.5	25.1	24.3	23.1	23.1
Canberra East	0.0	0.3	0.1	0.4	0.4
Gungahlin	26.8	19.7	23.3	17.1	17.1
North Canberra	21.6	16.1	18.9	15.0	15.0
South Canberra	8.5	4.5	6.5	8.5	8.5
Tuggeranong	10.7	21.7	16.1	18.9	18.9
Weston Creek Molonglo	2.2	7.3	4.7	7.8	7.8
Woden Valley	6.8	5.4	6.1	9.1	9.1
Total	**100**	**100**	**100**	**100**	**100**

Source: The CIE

The differences in sample and population characteristics were corrected simultaneously using a single set of sampling weights derived using iterative proportionate fitting. These weights ranged from a minimum of 0.16 to a maximum of 5.09, with the distribution shown in chart 3.5.

3.5 Distribution of sampling weights



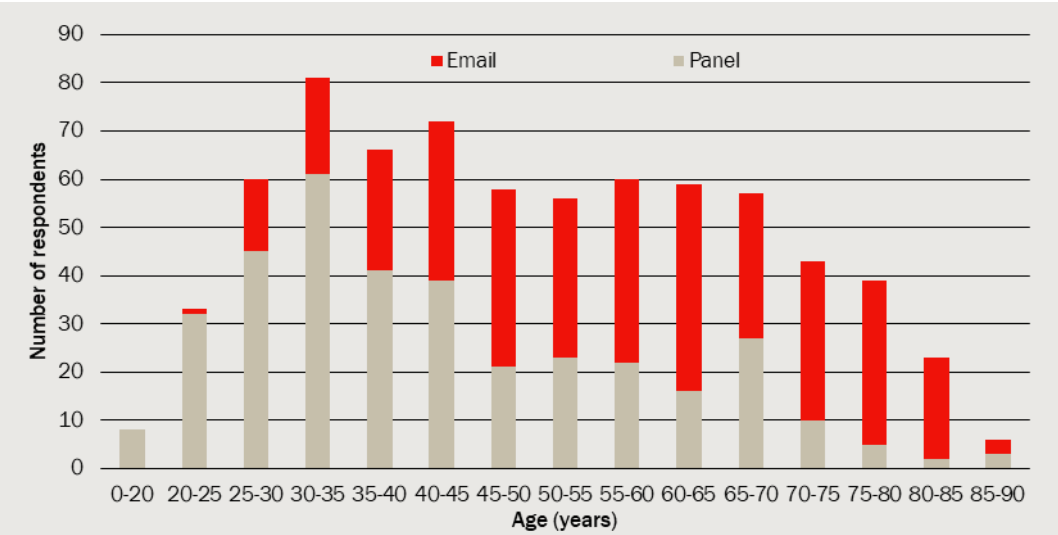
Data source: The CIE

Other characteristics of the sample

The sample included representation from a wide range of ages, incomes, genders and educational levels. Relative to the panel sample, the email sample tended to be weighted towards older, wealthier (table 3.8) and better-educated (table 3.9) respondents.

Chart 3.6 shows the distribution of ages amongst the respondents. Ages varied between 18 and 88, with good coverage over the entire range. The mean age was 49 years and the median was 48 years. The respondents recruited via email were on average older than the panel respondents.

3.6 Distribution of respondent ages



Data source: The CIE

Slightly over half of the unweighted sample respondents were women, and in the weighted sample this difference was increased (table 3.7).

3.7 Respondents by gender

Gender	Email	Panel	Total	Weighted total
	No.	No.	No.	No.
Man	217	121	338	318.4
Woman	139	232	371	392.9
Self-described	1		1	1.6
Prefer not to say	9	2	11	8.1
Total	**366**	**355**	**721**	**721.0**

Source: The CIE

3.8 Income distribution of respondents

Income	Email	Panel	Total	Weighted total
	Number	Number	Number	Number
Less than $41,600 per year	26	31	57	58.5
$41,600 - $78,000 per year	43	52	95	93.7
$78,000 - $104,000 per year	57	60	117	119.8
$104,000 - $156,000 per year	64	74	138	138.2
$156,000 - $208,000 per year	43	53	96	92.3
More than $208,000 per year	63	48	111	117.4
Do not wish to answer	70	37	107	101.1
Total	**366**	**355**	**721**	**721**

Source: The CIE

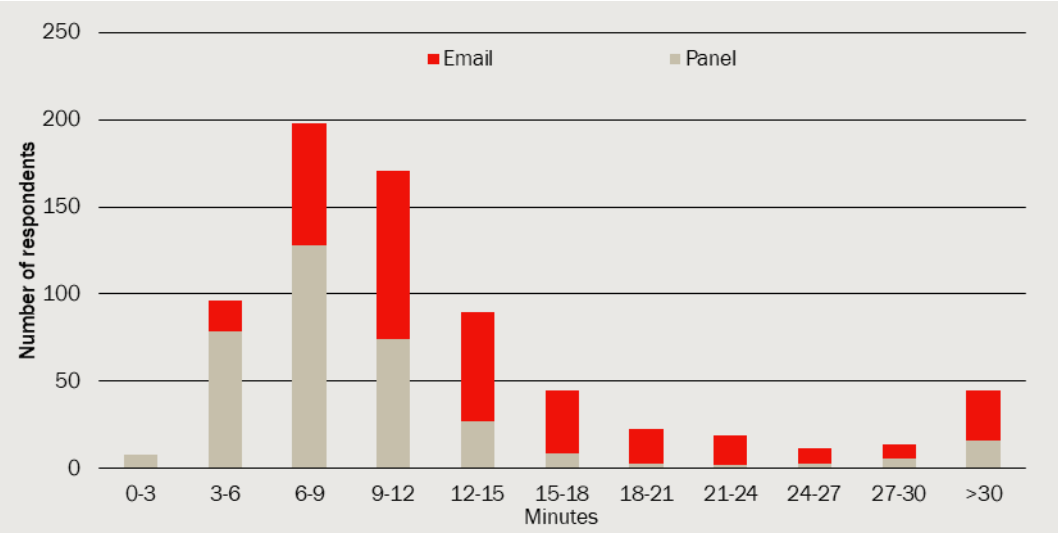
3.9 Education level of respondents

Education level	Email	Panel	Total	Weighted total
	Number	Number	Number	Number
Secondary education to Year 9 or below	3	2	5	5.7
Secondary education to Year 10	14	19	33	31.6
Secondary education to Year 12	32	55	87	93.6
Certificate I or II	1	5	6	4.5
Certificate III or IV	32	41	73	81.0
Advanced diploma or diploma	28	35	63	63.4
Graduate diploma or graduate certificate	36	27	63	62.7
Bachelor degree	100	108	208	213.6
Postgraduate degree	120	63	183	164.8
Total	**366**	**355**	**721**	**721.0**

Source: The CIE

The median length of interview (LOI) in the online sample was 10 minutes, with the panel respondents tending to complete the survey more quickly (a median of eight minutes) than respondents recruited via email. Some 51 respondents taking less than 5 minutes to complete the survey were excluded from the estimation of choice models. Results from the statistical analysis (discussed in chapter 5) indicate that the remaining 670 respondents gave due consideration to the detailed questions being asked.

3.10 Distribution of length of interview



Data source: The CIE

4 Consumer attitudes

This chapter sets out the results from the survey questions relating to home charging of electric vehicles, intentions to purchase smart appliances, and awareness of controlled and flexible load tariffs.

Electric vehicle ownership

As noted in chapter 3, only around 4 per cent of households in Canberra own an EV. Around nine per cent of our unweighted sample indicated they own an EV. Of the remaining 91 per cent of the sample (or 96 per cent of the weighted sample), over a third of respondents expect to own an EV within the next five years (table 4.1). This is consistent across both the panel and email samples.

4.1 When non-EV owners expect to purchase an EV

Timeframe	Panel	Email	Total	Total weighted
	Per cent	Per cent	Per cent	Per cent
I couldn't say	19.7	15.1	17.4	17.3
In less than a year	3.8	4.2	4.0	4.1
In 1-5 years	32.0	32.9	32.5	31.7
In 6-10 years	25.7	27.9	26.8	25.2
In more than 10 years	7.5	10.4	9.0	9.9
Never	11.3	9.5	10.4	11.8

Note: Non-EV owner unweighted sample size = 656

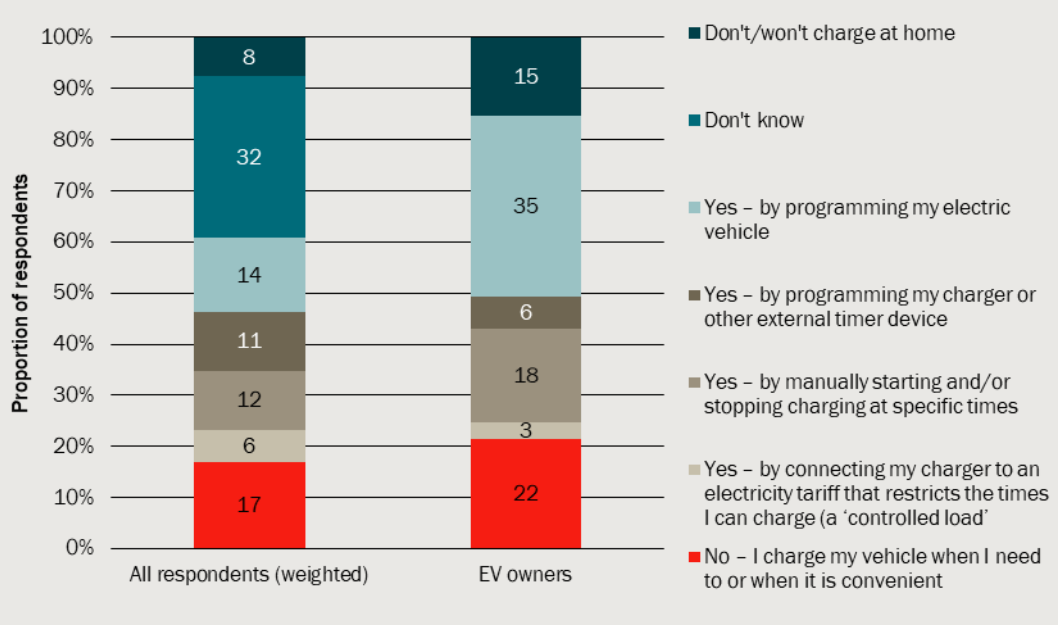
Source: The CIE

Home charging of electric vehicles

Only 22 per cent of EV owners indicated they never schedule their charging and charge only when convenient to do so (chart 4.2). The most common means of scheduling is programming the EV itself, followed by manually starting and stopping charging. Some 15 per cent of EV owners do not charge at home.

Across the whole sample, including those who do not yet own an EV, a third of respondents are unsure of whether they will schedule charging. Only 17 per cent indicated they will never schedule charging. A controlled load tariff was the least popular means of scheduling, behind programming the EV, programming the charger, and manual scheduling.

4.2 Scheduling home charging of electric vehicles

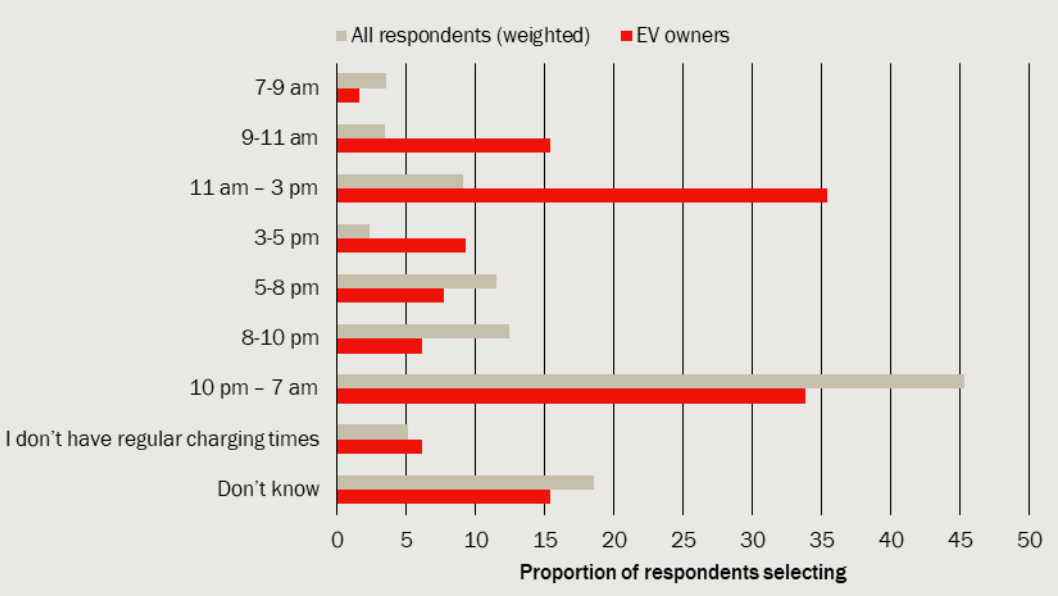


Note: Q: When charging your electric vehicle at home, do you (expect you will) schedule the times you charge? All respondents n=721, EV owners n=65

Data source: CIE

Most respondents who don't yet own an EV expect to undertake home charging at night (chart 4.3). Respondents who already own an EV, in contrast, are equally likely to charge during the day between 11 am and 3 pm. This difference could be a reflection of different needs and preferences of early adopters of EVs, but more likely it reflects a difference between intentions based on incomplete information and actual real-world behaviour.

4.3 Times of day respondents (would) most often charge their vehicle at home

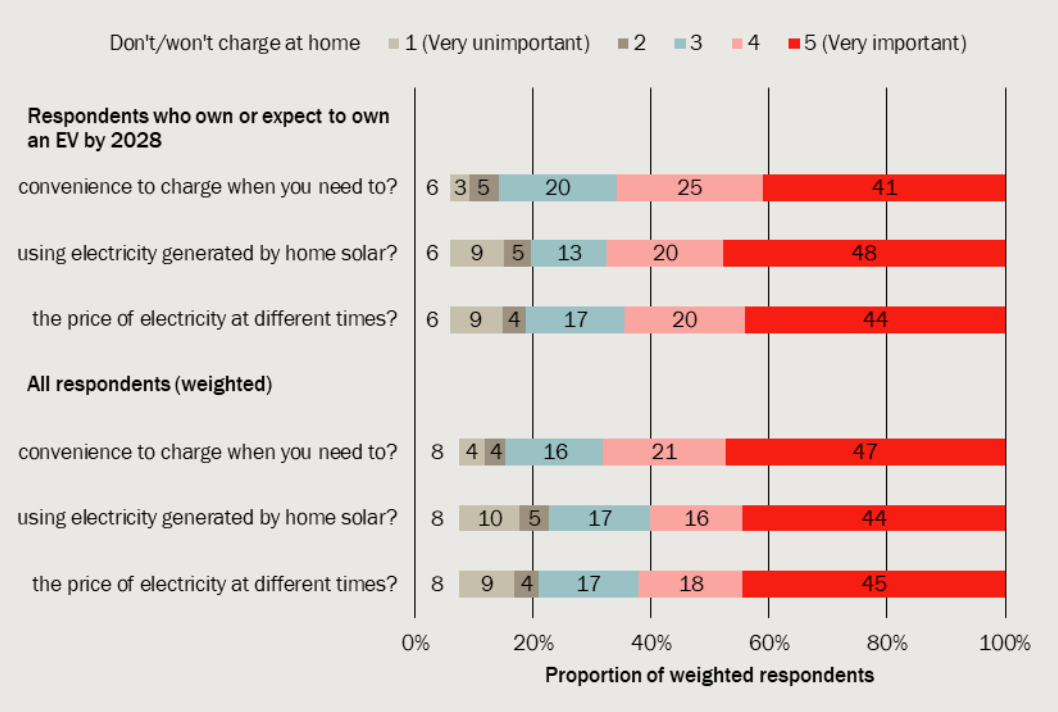


Note: Sample size of EV owners = 65; Multiple response (proportions sum to greater than 100 per cent)

Data source: CIE

Pricing, convenience, and the use of home solar were all considered important factors in deciding what time of day to charge an EV at home (chart 4.4).

4.4 When deciding what time of day to charge an electric vehicle at home, how important to you on a scale from 1 (very unimportant) to 5 (very important) is...

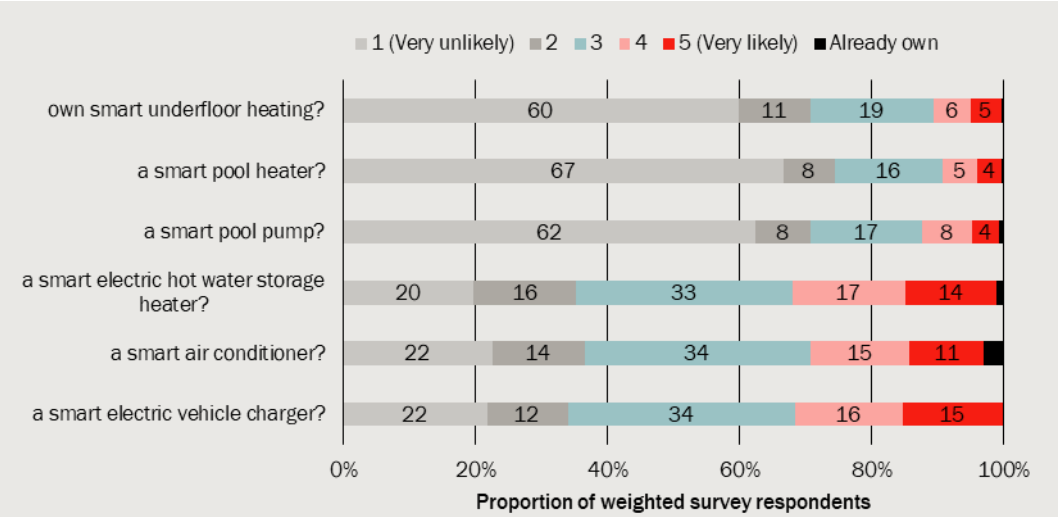


Data source: CIE

Smart appliances

The smart appliances that are most likely to be owned by Canberrans in five years' time are hot water storage heaters, air conditioners, and EV chargers. Roughly three in ten households think it at least likely they will own smart versions of these appliances in 2028. Fewer than 12 per cent think it at least likely they will own a smart pool pump, pool heater, or underfloor heating.

4.5 How likely is it on a scale from 1 (very unlikely) to 5 (very likely) that in 5 years' time you will own...



Data source: CIE

Awareness of controlled and flexible load tariffs

The level of consumer awareness about the concepts of controlled and flexible load tariffs is low. We estimate 68 per cent of consumers haven't heard of controlled load tariffs, despite the fact they have been operating in the ACT for many years. Some 83 per cent of consumers haven't heard of flexible load tariffs. This is less surprising, given flexible load tariffs have yet to be offered in the ACT. It is possible some of the 17 per cent of consumers who indicated they have heard of flexible load tariffs may be equating these tariffs with the popular virtual power plant offering from Reposit Power, which involves consumers handing over control of their home battery.

4.6 Awareness of controlled and flexible load tariffs

	Unweighted	Unweighted	Weighted
	Count	per cent	per cent
Had you heard of controlled load plans before taking this survey?			
No	478	66.3	68.1
Yes	170	23.6	20.7
(Question not asked, because respondent already on a controlled load tariff)	73	10.1	11.2
Had you heard of flexible load plans before taking this survey?			
No	586	81.3	82.9
Yes	135	18.7	17.1

Source: CIE

5 Results from the choice experiment

This chapter explains the statistical models estimated on responses to the DCE questions and sets out the results from debriefing questions about how respondents understood and perceived the choice questions and about the motivations for the choices they made.

Preferred model of tariff demand

Data from DCE are typically analysed using the multinomial logit (MNL) model or one of the many variants on the model developed over the past few decades. These models operate in the random utility framework developed by Daniel McFadden.[5] In the MNL model, the probability that alternative k is chosen by individual i can be expressed as:

$$p_{ik} = \frac{e^{U(X_k, S_i)}}{\sum_j e^{U(X_j, S_i)}}$$

where U is the utility of individual i with characteristics S_i.

We estimated a range of different model specifications to ensure the results from our chosen model are not outliers biased by our modelling choices. Some of the models not chosen as our preferred model are used in sensitivity testing. For the purpose of modelling responses to the DCE questions, we omitted 51 respondents who took less than five minutes to complete the entire survey. It was judged these respondents could not have given due consideration to the DCE questions.

The preferred model is set out in table 5.1. It is a mixed MNL, which estimates the variation in preferences across consumers for specified tariff attributes, assuming normal distributions and allowing for correlation between those distributions. The dependent variable is utility. The large Z values for many parameter estimates indicates that respondents did not choose tariffs randomly but rather gave consideration to the attributes (a Z value of around 2 indicates statistical difference from zero at the 95 per cent confidence level).

It was necessary to limit the number of random parameters for computation time. Model testing had shown that frequency of restrictions and type of appliance were not having a large impact on utility. The effects of these two attributes were therefore removed from random parameters by specifying just four random parameters covering the two main tariff types and whether override was available. Frequency of restrictions and appliance type are instead modelled as fixed parameters, which shift the mean of the distribution of utility over respondents, but not the variance.

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5 McFadden, D. (1973) Conditional Logit Analysis of Qualitative Choice Behavior. In: Zarembka, P., Ed., Frontiers in Econometrics, Academic Press, 105-142.

It is difficult to interpret the results directly from the utility function — they will become clearer in the next chapter — but already we can see from the means for random parameters that consumers value cost savings, prefer flexible load tariffs to controlled load tariffs, and value the override function.

5.1 Mixed logit model of tariff choice

Parameter	Coef.	Z value
Fixed parameters		
Cost saving ($ per year)	0.0212	15.0
Cost saving * own or likely to own electric vehicle by 2028 (effects coded, =-1 for respondents unlikely to own an EV by 2028)	0.0011	1.8
Cost saving * household decision maker (effects coded, =-1 for non-decision makers)	-0.0024	-1.9
Controlled load tariff at peak times only (dummy)	0.6370	4.6
Flexible load EV once per year (dummy)	0.5468	4.2
Flexible load EV four times per year (dummy)	0.5826	4.7
Flexible load AC once per year (dummy)	0.6668	5.5
Flexible load AC four times per year (dummy)	0.2395	2.0
Flexible load AC ten times per year (dummy)	-0.5107	-4.3
Controlled load tariff at peak times only, override (dummy)	-0.4226	-1.7
Flexible load EV once per year, override (dummy)	-0.4283	-1.8
Flexible load EV four times per year, override (dummy)	0.1645	0.7
Flexible load AC once per year, override (dummy)	-0.2086	-0.9
Flexible load AC four times per year, override (dummy)	0.5413	2.3
Flexible load AC ten times per year, override (dummy)	0.7140	3.0
Random parameters: means		
Controlled load tariff (dummy)	-1.9662	-6.6
Flexible load tariff (dummy)	0.0707	0.3
Controlled load tariff override (dummy)	2.5580	10.6
Flexible load tariff override (dummy)	0.7203	4.0
Covariance matrix for random parameters		
Controlled load tariff	5.3869	16.0
Controlled load tariff / Flexible load tariff	4.1455	14.3
Controlled load tariff / Controlled load tariff override	-1.2205	-4.2
Controlled load tariff / Flexible load tariff override	-0.5606	-4.5
Flexible load tariff	1.9016	10.8
Flexible load tariff / Controlled load tariff override	0.8253	3.1
Flexible load tariff / Flexible load tariff override	0.0007	0.0
Controlled load tariff override	1.3637	5.7
Controlled load tariff override / Flexible load tariff override	1.1745	7.2

Parameter	Coef.	Z value
Flexible load tariff override	0.7427	3.1

Note: Sample size n=670 respondents and 5360 choice observations. Log-likelihood = -4174.

Source: CIE

Estimation outputs for an MNL model and a latent class model — which uses a discrete rather than continuous distribution of preferences over consumers — are set out in appendix C.

Understanding and perceptions of the choice questions

Given the relative complexity of DCE questions, it is important to check that respondents felt they understood what was being asked of them. Fewer than 5 per cent of respondents indicated they didn't understand the questions and just 6 per cent felt they didn't have enough information to give an impression of their preferences (table 5.2). It is also important to check that respondents were assuming the options would be delivered as described, rather than on the basis of a different perception of what would be delivered. Around 13 per cent indicated the options were not realistic. Of those 13 per cent, two fifths indicated they imagined the option would be available (as instructed), but the remaining three fifths (around 8 per cent of the sample) either avoided choosing the option or assumed the option would have different cost or features to those shown. Overall, the questions appear to have been sufficiently simple and plausible to avoid any significant bias.

5.2 Responses to debriefing questions

	Unweighted sample	Unweighted sample	Weighted sample
	Count	per cent	per cent
I understood the questions			
1 (Strongly disagree)	10	1.4	1.7
2	21	2.9	2.4
3	113	15.7	17.0
4	222	30.8	30.8
5 (Strongly agree)	355	49.2	48.1
Total	**721**	**100.0**	**100.0**
I had enough information to give my impression			
1 (Strongly disagree)	9	1.2	1.6
2	37	5.1	5.0
3	129	17.9	19.1
4	254	35.2	34.9
5 (Strongly agree)	292	40.5	39.4
Total	**721**	**100.0**	**100.0**

	Unweighted sample	Unweighted sample	Weighted sample
	Count	per cent	per cent
The options were realistic			
1 (Strongly disagree)	40	5.5	6.2
2	58	8.0	8.6
3	209	29.0	27.9
4	244	33.8	33.7
5 (Strongly agree)	170	23.6	23.6
Total	**721**	**100.0**	**100.0**

Q40-42: Now a few questions about the plan choices you just made. To what extent do you agree with the following statements on a scale from 1 (strongly disagree) to 5 (strongly agree)?

Source: CIE

Reasons respondents chose controlled or flexible load tariffs

Some 88 per cent of respondents chose a controlled or flexible load tariff option at least once in the sequence of eight choice questions. These respondents were asked about their main reasons for choosing these tariffs. The most common motivation by far was the cost saving from the tariffs (85 per cent). However, the altruistic motivations of helping the community reduce load on the grid and gaining environmental benefits were each identified by around one third of respondents as a main reason for their choice. This is consistent with the fact that many respondents chose controlled or flexible load tariffs even when the cost saving offered was small. We discuss this result from the choice modelling questions further in subsequent chapters.

5.3 Reasons respondents chose controlled or flexible load tariffs

	Unweighted	Unweighted	Weighted
	Count	per cent	per cent
Cost savings/Financial benefit	537	84.2	84.9
Helping the community reduce load on our electricity grid	216	33.9	33.9
Environmental benefits	200	31.3	30.7
Using the newest technology	62	9.7	9.5
Other	29	4.5	4.4
Total	**1044**	**163.6**	**163.4**

Note: Q: "When you chose plans with a cost saving, what were the main reasons?" Question was asked only of 638 respondents who chose a controlled or flexible load option at least once. Totals add to more than 100 per cent because this question allowed multiple response.

Source: CIE

Around 4 per cent of the respondents chose to input another reasons into a text field. Most of these responses indicated the main reasons they preferred one flexible/controlled load tariff over another. They included less inconvenience, ability to override, and a need for cost savings. Others felt the tariff wouldn't affect them because they could use their solar panels instead or because they were unlikely to be at home.

Reasons respondents decided against controlled or flexible load tariffs

Only 379 respondents (or 53 per cent of the sample) chose the 'no change' option at least once across the eight choice questions they were shown (which, as an aside, indicates a strong preference to choose flexible load tariffs even when the cost savings are small). Concerns about comfort, EV charge, and having appliances controlled by someone else were each identified as reasons for choosing the 'no change' option by around one third of those respondents (table 5.4). A similar share of those respondents also indicated they chose the 'no change' option because they want to stick with what's working for them now. Almost a quarter of these respondents utilised the text field to provide another reason. By far, the most common response related to the cost savings being too small to induce a change. Other responses related to:

- a desire for convenience
- a desire for autonomy, and
- concerns about how the tariff would interact with solar PV systems and batteries.

5.4 Reasons respondents decided against controlled or flexible load tariffs

	Unweighted	Unweighted	Weighted
	Count	per cent	per cent
Concerns about room temperature/comfort	134	35.4	34.6
Concerns about my electric vehicle not getting enough charge	132	34.8	34.5
Concerns about having my appliances controlled by someone else	124	32.7	33.8
Sticking with what works for me now	104	27.4	29.8
Concerns about health/medical reasons	60	15.8	16.9
Concerns about security	48	12.7	13.2
Concerns about privacy	39	10.3	11.3
Other	92	24.3	23.9
Total	**733**	**193.4**	**197.9**

Note: Q: "When you chose the plan with no cost saving (Plan 1 on the left-hand side), what were the main reasons?" Question was asked only of 379 respondents who chose the 'no change' option at least once. Totals add to more than 100 per cent because this question allowed multiple response.

Source: CIE

6 Analysis

The output from the modelling discussed in the previous chapter is a rich preference model that can be used to estimate demand for a range of hypothetical user-defined tariffs in a range of user-specified consumer groups. In this chapter we present some examples of results from the model to enable conclusions to be drawn about consumer preferences.

Estimated market share

Conditional market share

Estimates of conditional market share for a range of different combinations of tariff attributes are provided in table 6.1, assuming a three-alternative choice set also including a 'no change' option and a controlled load tariff permitting EV charging only at night with no override and a $25 cost saving. This three-alternative choice set approach is used to keep the hypothetical scenarios within the bounds of those put to respondents in the survey. By conditional market share, we mean the estimates are based on an assumption that all respondents have electric vehicles and smart appliances.

The results are provided for the unweighted sample (excluding respondents taking less than five minutes to complete the entire survey), the weighted sample (using the sampling weights discussed in chapter 3), and the subsample of 275 respondents (or 38 per cent) who are household decision makers when it comes to electricity tariffs and who either own an EV or expect to own an EV by 2028. The table shows estimated market share is slightly lower once corrections have been made for sampling biases. Market share is slightly higher among the group who own or expect to own an EV by 2028 and make or help make decisions about electricity tariffs for their household.

6.1 Estimated market share conditional on respondents owning smart appliances

Plan features			Estimated market share		
Cost saving	Restriction	Override	Unweighted sample	Weighted sample	Subsample who are both decision makers and likely EV owners
$ per year			per cent	per cent	per cent
25	Controlled load all day	×	23.7	23.3	24.4
25	Controlled load peak only	×	32.7	32.2	33.7
25	Flexible load EV once per year	×	52.1	50.5	55.6
25	Flexible load EV 4x per year	×	52.5	50.9	56.0

Plan features				Estimated market share	
Cost saving	Restriction	Override	Unweighted sample	Weighted sample	Subsample who are both decision makers and likely EV owners
$ per year			per cent	per cent	per cent
25	Flexible load EV 10x per year	×	45.2	43.8	48.7
25	Flexible load AC once per year	×	53.6	51.9	57.1
25	Flexible load AC 4x per year	×	48.3	46.8	51.7
25	Flexible load AC 10x per year	×	38.7	37.5	42.0
25	Controlled load all day	✓	52.1	51.3	54.5
25	Controlled load peak only	✓	54.9	54.0	57.3
25	Flexible load EV once per year	✓	53.0	51.9	55.8
25	Flexible load EV 4x per year	✓	60.3	59.1	63.3
25	Flexible load EV 10x per year	✓	51.6	50.5	54.3
25	Flexible load AC once per year	✓	57.0	55.8	59.9
25	Flexible load AC 4x per year	✓	60.7	59.5	63.7
25	Flexible load AC 10x per year	✓	54.0	52.9	56.8
100	Controlled load all day	×	45.5	44.8	47.2
100	Controlled load peak only	×	52.7	51.9	54.8
100	Flexible load EV once per year	×	69.3	67.5	72.5
100	Flexible load EV 4x per year	×	69.6	67.8	72.8
100	Flexible load EV 10x per year	×	64.0	62.3	67.4
100	Flexible load AC once per year	×	70.3	68.6	73.5
100	Flexible load AC 4x per year	×	66.4	64.7	69.7
100	Flexible load AC 10x per year	×	58.5	56.8	62.0
100	Controlled load all day	✓	69.9	68.7	72.8
100	Controlled load peak only	✓	71.7	70.5	74.7
100	Flexible load EV once per year	✓	70.5	69.2	73.4
100	Flexible load EV 4x per year	✓	75.9	74.7	78.7
100	Flexible load EV 10x per year	✓	69.3	68.1	72.3
100	Flexible load AC once per year	✓	73.5	72.3	76.4
100	Flexible load AC 4x per year	✓	76.2	74.9	79.0
100	Flexible load AC 10x per year	✓	71.3	70.0	74.2

Note: Assumes a three-alternative choice set. The other two options are (1) an unrestricted tariff with zero cost saving, and (2) a controlled load tariff applied to EV charging during the day, with no override available, for a cost saving of $25 per year.

Source: CIE

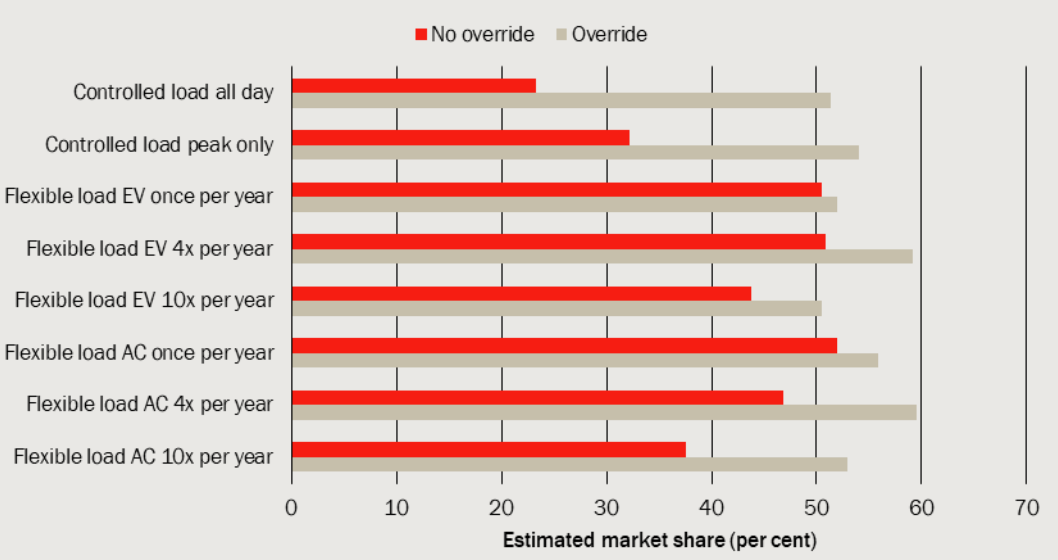
Illustrating these results in charts highlights some key findings.

- If override is unavailable, consumers would prefer flexible load tariffs to controlled load tariffs (notice the shorter red bars at the top of chart 6.2).
- Override matters and it matters most when restrictions are most inconvenient. Market share varies more widely across restrictions when override is not available (notice the

red bars in chart 6.2 vary from 23 to 52 per cent, while the tan bars vary only from 50 to 59 per cent).

- Demand for a tariff increases with its cost saving (chart 6.3). Large market shares of more than 70 per cent are predicted when cost savings of $100 per year are offered for flexible load tariffs with override available.

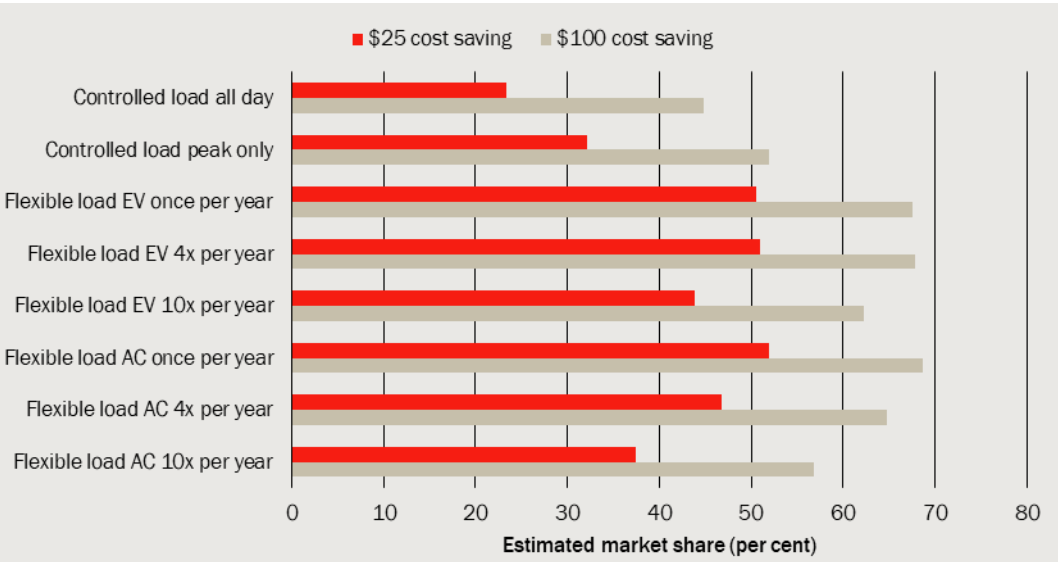
6.2 Impacts of restrictions and override availability on estimated market share



Note: Assumes a $25 cost saving is offered with this tariff. Assumes a three-alternative choice set. The other two options are (1) an unrestricted tariff with zero cost saving, and (2) a controlled load tariff applied to EV charging during the day, with no override available, for a cost saving of $25 per year. Results are adjusted using sampling weights.

Data source: CIE

6.3 Impacts of restrictions and cost saving on estimated market share



Note: Assumes no override is offered with this tariff. Assumes a three-alternative choice set. The other two options are (1) an unrestricted tariff with zero cost saving, and (2) a controlled load tariff applied to EV charging during the day, with no override available, for a cost saving of $25 per year. Results are adjusted using sampling weights.

Data source: CIE

Unconditional market share

The conditional market share estimates above need to be applied to the subgroup of consumers for whom the tariff alternatives will be feasible. For example, flexible load tariffs applied to EV smart charging in 2028/29 can be considered only by consumers who:

- already own an EV or indicated they are very likely or likely to own an EV by 2028, and
- already own or indicated they are very likely or likely to own a smart charger by 2028, and
- indicated they make or help make decisions about the electricity tariff for their home.

Some 19.9 per cent of the weighted sample meet these criteria. The predicted overall market share of a flexible EV load tariff in 2028/29 will therefore be the conditional market shares for consumers with these characteristics (set out in the right-hand-most column of table 6.1) multiplied by 19.9 per cent. Some examples of predicted overall market share are set out in table 6.4.

6.4 Unconditional estimates of market share

Plan features			Estimated market share
Cost saving	Restriction	Override	
$ per year			per cent
25	Flexible load EV once per year	×	10.8
25	Flexible load EV 10x per year	×	9.4
25	Flexible load EV once per year	✓	11.0
25	Flexible load EV 10x per year	✓	10.7
100	Flexible load EV once per year	×	14.2
100	Flexible load EV 10x per year	×	13.1
100	Flexible load EV once per year	✓	14.5
100	Flexible load EV 10x per year	✓	14.3

Note: Assumes a three-alternative choice set. The other two options are (1) an unrestricted tariff with zero cost saving, and (2) a controlled load tariff applied to EV charging during the day, with no override available, for a cost saving of $25 per year.

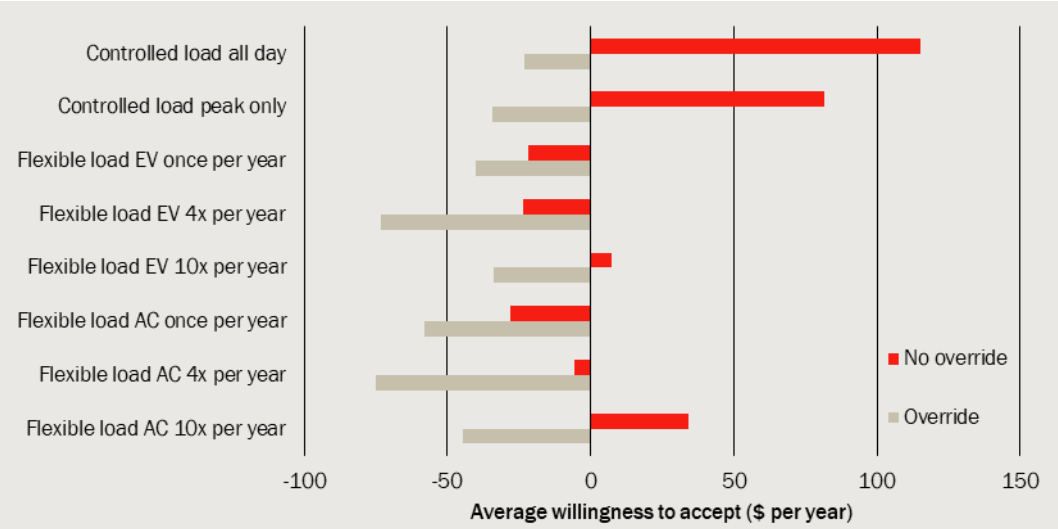
Source: CIE

Willingness to accept

Another potentially helpful way of analysing results from the model is to calculate the cost saving that would need to be offered with a given tariff such that the tariff generates a market share equal to the 'no change' tariff option. This cost saving is referred to as average willingness to accept (WTA). When controlled or flexible load tariffs were offered with an override capability, a majority of survey respondents chose those tariffs over the 'no change' option, even when very small cost savings, such as $10 per year, were offered. As a result, the statistical model estimates that negative cost savings (which weren't offered in the survey) would be needed for those tariffs to receive an equal market share to the 'no change' option (chart 6.5). These tariffs would not be priced this way in

practice, but this result is a true reflection of the preferences expressed by many survey respondents. It indicates a willingness to adopt flexible load tariffs for non-financial reasons, which is consistent with significant proportions of consumers indicating in debriefing questions that the main reasons they chose controlled and/or flexible load tariffs included environmental benefits and helping the community reduce load on the electricity grid.

6.5 Average willingness to accept cost savings



Note: Adjusted for sampling weights

Data source: CIE

The chart also confirms consumers' strong preference for flexible load tariffs over controlled load tariffs when override is unavailable.

The fact that many respondents were consistently choosing flexible load tariffs at minimal cost savings and others were consistently not choosing them even when large savings were offered, results in a wide posterior distribution of WTA across respondents — significantly wider than the range of cost savings presented in the survey (chart 6.6).

6.6 Estimated distribution of willingness to accept a flexible load tariff

Note: Assumes tariff applied to EV charging with 10 demand response events per year and no override.

Data source: CIE

Sensitivity analysis

Compared to the main, mixed logit, model, the MNL and latent class models tend to estimate lower and higher market shares, respectively, for controlled and flexible load tariffs (table 6.7). However, our key findings with respect to the importance of cost savings and override capability and the preference for flexible load tariffs over controlled load tariffs (at least when override is unavailable) are robust to the choice of statistical model.

6.7 Sensitivity of conditional market share to choice of statistical model

Plan features				Estimated market share	
Cost saving	Restriction	Override	Main model (mixed logit)	MNL	Latent class model
$ per year			per cent	per cent	per cent
25	Controlled load all day	×	23.3	17.8	23.6
25	Flexible load EV once per year	×	50.5	39.5	62.0
25	Flexible load EV 10x per year	×	43.8	34.5	46.3
25	Flexible load AC once per year	×	51.9	42.9	65.8
25	Flexible load AC 10x per year	×	37.5	28.3	42.5
25	Controlled load all day	✓	51.3	45.6	62.5
25	Flexible load EV 4x per year	✓	59.1	43.9	66.2
25	Flexible load EV 10x per year	✓	50.5	44.3	69.9
25	Flexible load AC 4x per year	✓	59.5	48.4	72.5
25	Flexible load AC 10x per year	✓	52.9	44.1	71.1
100	Controlled load all day	×	44.8	35.1	47.5
100	Flexible load EV once per year	×	67.5	62.0	82.8

Plan features				Estimated market share	
Cost saving	Restriction	Override	Main model (mixed logit)	MNL	Latent class model
$ per year			per cent	per cent	per cent
100	Flexible load EV 10x per year	×	62.3	56.8	71.2
100	Flexible load AC once per year	×	68.6	65.3	85.0
100	Flexible load AC 10x per year	×	56.8	49.7	68.2

Note: Assumes a three-alternative choice set. The other two options are (1) an unrestricted tariff with zero cost saving, and (2) a controlled load tariff applied to EV charging during the day, with no override available, for a cost saving of $25 per year.

Source: CIE

7 Conclusions

The key findings from this study are:

- Most EV owners charge their vehicles at home and this charging most often takes place outside periods of peak electricity demand.
- Around two thirds of EV owners who charge at home schedule their charging either by programming their vehicles or manually starting and stopping charging at specific times. Prospective EV owners indicated they would be more likely to use these means of scheduling than a controlled load tariff.
- Consumer demand for controlled and flexible load tariffs depends on the cost saving offered, the nature of restrictions on electricity usage, and whether it would be possible for consumers to override the restrictions.
- Consumers prefer flexible load tariffs to controlled load tariffs, particularly when override it not possible.
- The appliance to which restrictions apply — EV charger or air conditioner — did not have a significant impact on demand for flexible load tariffs.
- If override is possible, many consumers would choose flexible load tariffs, even if very little cost saving is offered. For example, we estimate around half of consumers would choose a flexible load tariff restricting EV charging 10 times per year for a cost saving of just $25 per year.
- However, only 20 per cent of consumers expect to have an electric vehicle and a smart charger, and therefore be in a position to consider such a tariff, by 2028/29.
- As a result, the overall market share across all residential consumers of a hypothetical flexible load tariff applied to EV charging in 2028/29 is predicted to be between 10 and 14 per cent, depending on the cost saving offered and whether override is enabled.

It is important to bear in mind there is uncertainty over the precision of the stated preferences described in this report as a predictor of real choices in a future market. This uncertainty arises from multiple sources, including:

- respondents' lack of real-world experience with EV charging, with less than a tenth of the sample owning an EV
- the survey results being conditional on customers being at the point of choosing between tariffs, in contrast to the real market where initiative to consider alternatives to default tariffs rests with customers, and
- limits on the extent to which survey respondents could be informed about the exact costs of implementing smart appliances and/or tariff options, including costs associated with potential meter upgrades, electrician fees, and smart appliances.

Evoenergy may wish to consider conducting field experiments or real-world tariff trials to resolve some of this uncertainty.

A In-depth interview questions

- How long did the questionnaire take to complete?
- Were there any parts of the survey that were confusing or unclear?
- Which questions other than the energy plan choice questions did you need to stop and think most about?
- Were the energy plan choice questions difficult to answer?
- Was it hard to imagine owning an electric vehicle?
- Was it hard to imagine whether restrictions on your appliances would be inconvenient?
- How did you feel towards the end of the choice questions? e.g. were you bored of the repetition? Without an interviewer present, would you have dropped out of the survey?
- How did you go about answering the energy plan choice questions? e.g. which features did you look at first? What were the most important features for you?
- Did any of the options look strange to you? Which ones, and why?
- Did you find you were always picking the same type of plan (e.g. always your current plan or always a flexible plan with remote control?)
- In how many of the questions did you choose to stay on your current plan? Why?
- Did any of the prices look very unrealistic? If so, how did you treat that option when answering the question?
- Did the questionnaire seem neutral and factual (i.e. not biased or leading)?

B Questionnaire

Welcome
Thank you for participating in this survey, which is being run by Pureprofile and The Centre for International Economics on behalf of Evoenergy.
This survey is about energy plans. Your input is very important and will help inform the way energy is provided in the future.
This questionnaire will take around 15 minutes to complete.
CLIENT LINK VERSION ONLY By participating, you could go into the draw to win one of four $250 Coles Group and Myer gift cards. (Please note, to enter the draw, you would need to provide contact details for the purpose of contacting prize winners.)
We assure you this is genuine market research. Your individual survey responses will remain anonymous. Results will be reported to Evoenergy in a grouped format.
In the unlikely event of any technical difficulties please click on the technical support e-mail link.
Please keep in mind…
Do not use your Back or Forward browser buttons while you are taking this survey. Once you answer a question, you will not be able to go back and change your answer.
Before we go through to the main study, we would like to ask you some questions to make sure we are interviewing a good cross section of people.

1. Do you or a member of your household work for Evoenergy?
    a. Yes TERMINATE
    b. No
2. What is the postcode of your home address? TERMINATE IF OUTSIDE A.C.T.
3. What is your gender?
    a. Woman
    b. Man
    c. Self-described _____
    d. Prefer not to say
4. What is your age?
    a. Less than 18 years TERMINATE
    b. 18-29 years

c. 30-39 years
d. 40-49 years
e. 50-59 years
f. 60-69 years
g. 70-79 years
h. 80 years or over

5. Is your home…
    a. A detached house
    b. A townhouse, terrace, villa, unit or other semi-detached
    c. An apartment

6. Do you make or help make decisions about the electricity provider or electricity plan for your home?
    a. Yes
    b. No

7. Is your home…
    a. Owned outright
    b. Owned with a mortgage
    c. Rented
    d. Occupied rent-free

This survey is about your electricity needs. We are planning for the future and want to understand:

- your current energy needs
- what your energy needs might look like in 5 years' time, and
- what sort of electricity plan you might prefer to choose in 5 years' time.

8. What type of electricity plan are you currently on?
    a. Single rate tariff (price doesn't change throughout the day)

b. Time-of-use tariff (prices differ by time of day: peak, off-peak and shoulder)

c. Demand tariff (part of your bill is based on your maximum demand during peak periods)

d. Don't know

9. Electricity plans with controlled load apply lower prices to specified appliances – usually hot water storage heaters – that operate only at off-peak times. Do you have controlled load on your electricity plan?

a. Yes

b. No

c. Don't know

10. How often is there someone at home during times of peak electricity demand (6-9am and 5-8pm)?

a. All of the time

b. Most of the time

c. Some of the time

d. Very little

e. Never

11. Electric vehicles are vehicles powered by an electric motor that draws electricity from a rechargeable battery. Do you own an electric vehicle? *In this survey, 'electric vehicle' does not include hybrid vehicles that run on both an electric motor and petrol or diesel fuel.*

a. Yes

b. No

12. **IF Q11=a** Do you charge your electric vehicle at home?

a. Yes

b. No

13. **IF Q12 =a** What kind of charger do you use at home?

a. Standard home power point (Level 1 charger up to 2.4 kW – 3.7 kW)

b. A specialised single-phase charger installed by an electrician (Level 2 charger up to 7.2 kW)

c. A specialised three-phase charger installed by an electrician (Level 2 charger up to 22 kW)

d. Don't know

14. IF Q11=b When do you see yourself buying an electric vehicle? (If you haven't planned future vehicle purchases, please just give your impression)

    a. In less than a year

    b. In 1-5 years

    c. In 6-10 years

    d. In more than 10 years

    e. Never

    f. I couldn't say

15. IF Q11=b If you buy an electric vehicle, do you expect you will charge it at home?

    a. Yes

    b. No

    c. Don't know

16. IF Q12=a OR Q15=a,c When charging your electric vehicle at home, do you IF Q15=a,c expect you will schedule the times you charge?

    a. Yes – by programming my electric vehicle

    b. Yes – by programming my charger or other external timer device

    c. Yes – by connecting my charger to an electricity tariff that restricts the times I can charge (a 'controlled load' tariff)

    d. Yes – by manually starting and/or stopping charging at specific times

    e. No – I charge my vehicle when I need to or when it is convenient

    f. Don't know

17. IF Q12=a OR Q15=a,c Which times of day do you IF Q15=a,c expect you will most often charge your electric vehicle at home? MULTIPLE SELECTION

a. 7-9 am
b. 9-11 am
c. 11 am – 3 pm
d. 3-5 pm
e. 5-8 pm
f. 8-10 pm
g. 10 pm – 7 am
h. I don't have regular charging times **EXCLUSIVE**
i. Don't know **EXCLUSIVE**

IF Q12=a OR Q15=a,c When deciding what time of day to charge an electric vehicle at home, how important to you on a scale from 1 (very unimportant) to 5 (very important) is… **CAROUSEL**

18. the price of electricity at different times?
19. using electricity generated by home solar?
20. convenience to charge when you need to?

Now, we want to ask you some questions about smart appliances.

The type of smart appliances we want to talk about in this survey are appliances that can respond to remote communications from your electricity provider to automatically increase, decrease, stop or start using power. This can help you save money by using less when power prices are high and instead using power when prices are low.

This is new technology. In some parts of Australia, households can choose to install a device (see image below) in their air conditioner, which enables electricity providers to communicate with and control the air conditioner. In future, this capability will be built into new appliances, including:

- electric vehicle chargers
- air conditioners
- pool pumps, and
- hot water storage heaters.

21. Before this survey, had you heard of smart appliances capable of remote control by your electricity provider?

    a. Yes

    b. No

22. IF Q21 = Yes Does your home IF Q5 = c or body corporate property have any smart appliances (capable of remote control by your electricity provider)?

    a. Yes

    b. No

    c. Don't know

23. IF Q22 = Yes Which smart appliances do you IF Q5 = c or your body corporate have? (Select all that you are aware of) MULTIPLE SELECTION

    a. electric vehicle charger

    b. air conditioner

    c. electric hot water storage heater

    d. pool pump

    e. pool heater

    f. underfloor heating

    g. other _____

How likely is it on a scale from 1 (very unlikely) to 5 (very likely) that in 5 years' time you IF Q5 = c or your body corporate will own… (*if you have no impression, please select 3*) CAROUSEL

24. IF Q23 NOT a a smart electric vehicle charger?
25. IF Q23 NOT b a smart air conditioner?
26. IF Q23 NOT c a smart electric hot water storage heater?
27. IF Q23 NOT d a smart pool pump?
28. IF Q23 NOT e a smart pool heater?
29. IF Q23 NOT f own smart underfloor heating?

Now, we want to ask you some questions about electricity plans.

Controlled load plans

On a controlled load plan, specific appliances are wired on a separate circuit to the rest of your home's electricity. Electricity is supplied to these appliances for only a limited number of hours each day.

The electricity provider does not remotely control your appliances on this plan. There is a physical switch on a timer in your meter box.

Controlled load plans are used most often for hot water systems, but they can also be used for electric vehicle chargers. For example, your electric vehicle charger may be supplied electricity only at night between 10 pm and 7 am.

This takes pressure off the electricity grid, which may mean less investment is needed in the poles and wires used to deliver electricity to your home. You are rewarded with a lower price.

You may be able to override the time control using a switch on your meter, which would allow you to use power at different hours, but at a higher price.

30. IF Q9=b or c Had you heard of controlled load plans before taking this survey?
    a. Yes
    b. No

Flexible load plans

In the future, when more homes have smart appliances, your electricity provider may offer a flexible load plan.

On a flexible load plan, you could allow your electricity provider to remotely turn down your smart appliances at times when everyone in Canberra is using a lot of power at the same time (peak events). This means less investment is needed in the poles and wires used to deliver electricity to your home. You are rewarded with a lower price.

31. Had you heard of flexible load plans before taking this survey?

    a. Yes

    b. No

In a peak event:

- your electric vehicle charger might slow to 75% or 50% of its usual charging speed
- your air conditioner might turn down to 75% or 50% of full power

These events would:

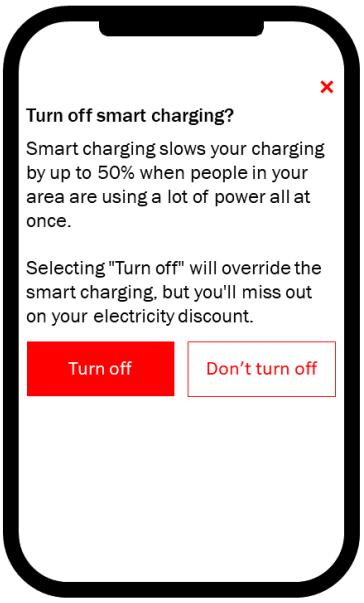
- last up to one hour
- tend to happen on the coldest winter mornings (6-9 am), the coldest winter evenings (5-10 pm) and the hottest summer evenings (5-10 pm).

Please think about how your electricity provider turning down your smart appliances might affect you.

Turning down your electric vehicle charger may not affect you at all. Or, it might mean you have less charge when taking an unexpected trip or when needing to charge quickly. As a guide, a Tesla Model 3 takes 8-12 hours to fully charge on a Level 2 charger.

Turning down your air conditioner might vary the temperature in your home by a few degrees from where you usually set your thermostat.

Some flexible load plans may allow you to override remote control. For example, you might receive notification of a peak event in an app and use the app to override the event because you know you're going to need to take a long trip in your electric vehicle the next day. When you override, you would not receive the discounted electricity price.



Some customers like controlled and flexible load plans because they are an automatic, set-and-forget way of saving money by shifting energy usage from times with high prices to times with low prices.

Other customers don't like these plans because of the potential inconvenience.

We are interested in whether you might choose one of these plans within the next 5 years.

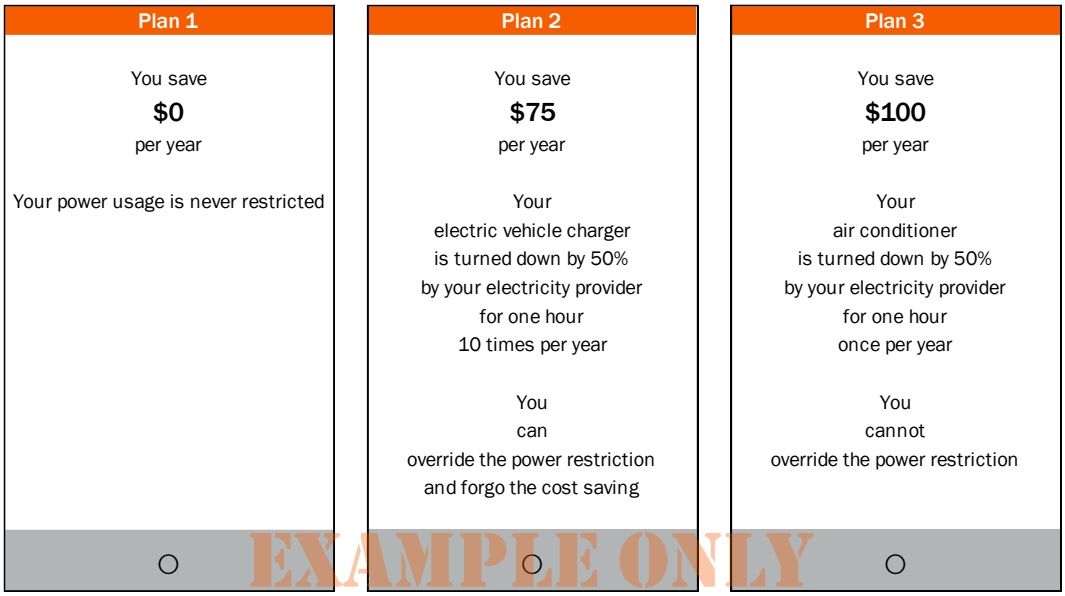
For the next 8 questions, we want you to imagine it is 2028 and you have an electric vehicle and a smart air conditioner (even if you have told us that is unlikely).

In each question we will show you three plans: your current plan and two other plans. The other plans will be described by:

- the cost saving you would get each year by moving onto a controlled or flexible load plan, and
- the impact on how you can use your electric vehicle charger or air conditioner.

See the image below for an example.

Please choose the plan you think you would be most likely to choose in 2028. We understand this is a big ask because the future is uncertain, but please give us your impression.



A few things to remember:

- Q5 = c If appliances are owned by your body corporate, please assume you and the body corporate would both be signing onto the same type of plan and the bill saving is the total saving you would receive through energy bills and body corporate fees.
- The 8 questions will look very similar. Once you select an option and click 'next' it may not look like a new page, but the features of the plans will have changed. Please pay attention to these.
- Some of the plans may look strange to you. That is because there are many different ways of operating these plans.

32. If these were the only three electricity plans available, which one would you choose?

33. If these were the only three electricity plans available, which one would you choose?

34. If these were the only three electricity plans available, which one would you choose?

35. If these were the only three electricity plans available, which one would you choose?

36. If these were the only three electricity plans available, which one would you choose?

37. If these were the only three electricity plans available, which one would you choose?

38. If these were the only three electricity plans available, which one would you choose?

39. If these were the only three electricity plans available, which one would you choose?

Now a few questions about the plan choices you just made. To what extent do you agree with the following statements on a scale from 1 (strongly disagree) to 5 (strongly agree)? **CAROUSEL**

40. I understood the questions
41. I had enough information to give my impression
42. The options were realistic

43. **IF Q42<3** How did you answer when you saw an unrealistic option?
    a. I imagined the option would be available
    b. I avoided choosing the option

c. I assumed the option had different cost and/or features than those shown

44. When you chose the plan with no cost saving (Plan 1 on the left-hand side), what were the main reasons? **MULTIPLE SELECTION. SHOW IF PLAN 1 CHOSEN IN AT LEAST ONE QUESTION.**

    a. Concerns about my electric vehicle not getting enough charge
    b. Concerns about room temperature/comfort
    c. Concerns about health/medical reasons
    d. Concerns about privacy
    e. Concerns about security
    f. Concerns about having my appliances controlled by someone else
    g. Sticking with what works for me now
    h. Other _____

45. When you chose plans with a cost saving, what were the main reasons? **MULTIPLE SELECTION. SHOW IF PLAN 2/3 CHOSEN IN AT LEAST ONE QUESTION.**

    a. Cost savings/Financial benefit
    b. Environmental benefits
    c. Helping the community reduce load on our electricity grid
    d. Using the newest technology
    e. Other _____

46. **IF b SELECTED ABOVE** Which environmental benefits were you thinking of? **MULTIPLE SELECTION.**

    a. Reducing carbon emissions
    b. Saving resources on the electricity network (e.g. reducing investment in new poles and wires)
    c. Other _____

Finally, a few questions about your household.

47. How many vehicles are owned and used by people in your household?
    a. None
    b. One
    c. Two
    d. Three
    e. Four
    f. Other _____ **REQUIRE NUMERICAL 5-20**

48. What is the highest level of education you have attained?
    a. Postgraduate degree
    b. Graduate diploma or graduate certificate
    c. Bachelor degree
    d. Advanced diploma or diploma
    e. Certificate III or IV
    f. Secondary education to Year 12
    g. Secondary education to Year 10
    h. Certificate I or II
    i. Secondary education to Year 9 or below

49. Do you speak a language other than English at home?
    a. Yes
    b. No, English only

50. Which of the following best describes your household?
    a. Couple without children at home
    b. Couple with one child at home
    c. Couple with two or more children at home
    d. Single parent with one child at home
    e. Single parent with two or more children at home
    f. Multiple family household
    g. Group or shared household

h. Single person household

i. Other

51. What is your annual personal **IF g ABOVE** household **OTHERWISE** income before tax and superannuation are taken out?

    a. Less than $41,600 per year (less than $800 per week)

    b. $41,600 - $78,000 per year ($800 - $1,500 per week)

    c. $78,000 - $104,000 per year ($1,500 - $2,000 per week)

    d. $104,000 - $156,000 per year ($2,000 - $3,000 per week)

    e. $156,000 - $208,000 per year ($3,000 - $4,000 per week)

    f. More than $208,000 per year (more than $4,000 per week)

    g. Do not wish to answer.

52. Have you used a payment plan or other financial hardship arrangements offered by your electricity retailer at any time in the past five years?

    a. Yes

    b. No

    c. Prefer not to say

53. **CLIENT LINK VERSION ONLY** Would you be happy to provide an email address or phone number we could use to contact you if you are drawn as a winner of one of four $250 Coles Group and Myer gift cards?

    a. Yes

    b. No

54. **IF YES ABOVE** Please provide your contact details below. These will be used only for the purpose of administering the prize draw for this survey.

    a. Name _____

    b. Phone _____

    c. Email _____

    REQUIRE RESPONSE TO a&b OR a&c

55. Thank you for your responses to this survey. Finally, is there any feedback you would like to provide on this survey? **NOT MANDATORY**

_____
_____
_____
_____

Thank you for participating in this survey. Your opinions are very important.
To keep up to date with survey findings and how they are being used by Evoenergy visit https://engagewithenergy.com.au/

C Models used for sensitivity testing

C.1 Multinomial logit model

Parameter	Coef.	Z value
Cost saving ($ per year)	0.0122	16.7
Cost saving * own or likely to own electric vehicle by 2028 (effects coded)	0.0015	5.2
Cost saving * low income (effects coded =-1 if income not stated)	0.0008	1.5
Cost saving * medium income (effects coded =-1 if income not stated)	0.0009	2.0
Cost saving * high income (effects coded =-1 if income not stated)	-0.0002	-0.5
Cost saving * household decision maker (effects coded)	-0.0032	-5.0
Cost saving * age 18-39 years (effects coded =-1 if age 60+)	0.0010	2.4
Cost saving * age 40-59 years (effects coded =-1 if age 60+)	-0.0015	-3.8
Cost saving * household owns exactly one car (effects coded)	0.0005	1.6
Controlled load EV all day (dummy)	-1.5195	-15.2
Controlled load EV peak only (dummy)	-1.1300	-12.2
Flexible load EV once per year (dummy)	-0.4143	-5.2
Flexible load EV four times per year (dummy)	-0.3650	-4.6
Flexible load EV ten times per year (dummy)	-0.6285	-7.4
Flexible load AC once per year (dummy)	-0.2721	-3.4
Flexible load AC four times per year (dummy)	-0.3787	-4.5
Flexible load AC ten times per year (dummy)	-0.9153	-10.3
Controlled load EV all day override (dummy)	1.3571	10.5
Controlled load EV peak only override (dummy)	0.9653	7.5
Flexible load EV once per year override (dummy)	0.1815	1.5
Flexible load EV four times per year override (dummy)	0.6086	5.0
Flexible load EV ten times per year override (dummy)	0.4126	3.3
Flexible load AC once per year override (dummy)	0.2225	1.8
Flexible load AC four times per year override (dummy)	0.6272	5.1
Flexible load AC ten times per year override (dummy)	0.6905	5.3

Note: Sample size 670 respondents, 5360 choice observations. Log likelihood = -5492.

Source: CIE

C.2 Latent class multinomial logit model

Parameter	Class 1		Class 2		Class 3	
	Coef.	Z value	Coef.	Z value	Coef.	Z value
Fixed parameters						
Cost saving ($ per year)	0.015	22.3	0.015	22.3	0.015	22.3
Random parameters						
Controlled load EV all day (dummy)	2.332	2.9	-3.058	-13.8	-5.378	-13.1
Controlled load EV peak only (dummy)	2.610	3.4	-1.935	-10.1	-5.709	-10.3
Flexible load EV once per year (dummy)	3.470	4.8	-0.325	-1.8	-4.335	-9.8
Flexible load EV four times per year (dummy)	3.508	4.8	-0.312	-1.9	-5.002	-9.1
Flexible load EV ten times per year (dummy)	3.698	5.0	-1.310	-6.0	-6.326	-7.6
Flexible load AC once per year (dummy)	3.662	5.1	-0.229	-1.3	-4.105	-11.0
Flexible load AC four times per year (dummy)	3.576	4.9	-0.708	-3.7	-5.348	-9.0
Flexible load AC ten times per year (dummy)	3.368	4.6	-2.024	-7.5	-5.089	-12.0
Controlled load EV all day override (dummy)	1.143	5.1	2.762	10.6	1.072	1.4
Controlled load EV peak only override (dummy)	1.107	5.1	1.508	6.2	1.889	2.6
Flexible load EV once per year override (dummy)	-0.297	-1.3	0.664	2.7	0.340	0.4
Flexible load EV four times per year override (dummy)	0.485	2.3	0.800	3.5	1.713	2.4
Flexible load EV ten times per year override (dummy)	-0.095	-0.5	0.974	4.1	3.465	4.0
Flexible load AC once per year override (dummy)	0.578	2.8	-0.015	-0.1	0.377	0.5
Flexible load AC four times per year override (dummy)	0.833	3.9	0.832	3.6	1.941	2.5
Flexible load AC ten times per year override (dummy)	0.063	0.3	1.751	6.2	2.762	5.3
Class probability model						
Own or likely to own electric vehicle by 2028 (dummy)	0.603	2.6	0.533	2.2		
Low income (dummy, 'not stated' omitted)	0.829	2.4	0.408	1.0		
Medium income (dummy, 'not stated' omitted)	0.598	1.9	0.909	2.6		
High income (dummy, 'not stated' omitted)	0.123	0.4	0.311	0.9		

Note: Sample size 670 respondents, 5360 choice observations

Source: CIE

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