Final Survey Report

CaPPRe

Synergies
ECONOMIC CONSULTING

VALUE OF CUSTOMER RELIABILITY: WILLINGNESS TO PAY STUDY

Prepared for the **Australian Energy Regulator**

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OVERVIEW

BACKGROUND

The Australian Energy Regulator (the AER) is required to periodically review its methodology and estimates for Values of Customer Reliability (VCR), which are the economic values that electricity customers place on reliable supply.

Synergies Economic Consulting (‘Synergies’), together with Community and Patient Preference Research (CaPPRe), were commissioned by AER to update the 2019 VCR values by using customer survey data collected by Lonergan Research in October 2024.

The method of data collection, cleansing and econometric analysis used for the 2024 study remains substantially consistent with the methodology established for the previous, 2019 VCR study, as AER assessed that the methodology remains valid. Maintaining consistency of method with 2019 was also intentional as it enables comparability between the 2019 VCR and the 2024 VCR allows an assessment of how customer values for reliability have changed over time, absent any confounding factors created through major changes in questionnaire design.

The methodology includes two surveys: one for residential customers and another for business customers. The analysis uses contingent valuation and discrete choice experiments (DCEs) to assess preferences and willingness to pay (WTP) to avoid electricity outages. These surveys target a range of customer segments across the National Electricity Market (NEM).

A pilot study was conducted in June 2024 to test the survey instruments. The pilot identified no critical issues in the design or data collection process, and its results were consistent with economic theory regarding the expected relationships among variables in the survey response data. These findings provided sufficient confidence to proceed with the main survey, which was conducted in September - October 2024 by Lonergan Research.

Using results from the contingent valuation survey, this report outlines the average WTP to avoid a specified baseline outage for residential customers (segmented by climate zone and remoteness) and business customers (segmented by business type). The report uses the DCE results to assess how outage characteristics—such as severity, duration, and timing (e.g., season, day of the week, and time of day)—influence WTP.

The report does not include the Value of Customer Reliability (VCR) calculations. These will be conducted separately by the Australian Energy Regulator (AER).

DATA AND METHODOLOGY

METHODOLOGY

The contingent valuation and DCE techniques used in this study are summarised below.

Contingent Valuation

The contingent valuation survey asked participants (both in the business and residential surveys) for their WTP to avoid experiencing a baseline outage scenario, as defined below:

Imagine you experience two unexpected power outages a year. It turns out that each unexpected outage occurs on a different random weekday in winter (Jun, Jul, Aug) and lasts for one hour in off peak times (outside of 7-10am, 5-8pm). Each one only affects your local area.

To determine average WTP across the sample, the survey included three questions, with the second question contingent on the response provided to the first. The questions were sequenced as follows:

*Would you be willing to pay an increase of $**<$BILL>** in your **<frequency>** electricity bills (over six months this is a total of $**<$6M>**) to avoid both the power outages described in the above scenario?*

If the answer is 'yes',

*Would you be willing to pay an increase of $**(<$BILL>*2)** in your **<frequency>** electricity bills (over six months this is a total of $**(<$6M>*2)**) to avoid both the power outages described in the above scenario?*

If the answer is 'no',

*Would you be willing to pay an increase of $**(<$BILL>*0.5)** in your <<insert billing period>> electricity bills (over six months this is a total of $**(<$6M>*0.5)**) to avoid both the power outages described in the above scenario?*

The third question is;

*What is the maximum increase in $ you would be willing to pay in your **<frequency>** electricity bill to avoid both the power outages described in the above scenario?*

Residential survey

The first question in the residential survey proposed a specific WTP amount ('bid'), asking if participants are willing to pay the stated bid to avoid an outage (indicated as "$BILL" above). The bid is a randomised number from 2 to 11 (inclusive). Only whole numbers were possible including 2,3,4,5,6,7,8,9,10,11. These values were displayed as $/bill and adjusted based on the participant's billing frequency. For example, for bi-monthly billing, the amounts ranged from $4 to $22 (i.e., the monthly bid multiplied by 2), and for quarterly billing, the range was $6 to $33 (i.e., the monthly bid multiplied by 3).

A second question was used to introduce a different bid based on the individual's response to the first question. Respondents were asked once again if they are willing to pay this bid. Depending on their initial response, subsequent bids were adjusted accordingly: a 'yes' response resulted in a higher bid (initial bid x 2), while a 'no' response led to a lower bid (initial bid x 0.5). The answer to the third of these three contingent valuation questions was used to determine WTP.

In the residential survey, the answer to the third question was used as a measure of respondents' maximum WTP, except for respondents that entered a value greater than $32 for the third question above. These respondents were shown an additional question that appeared later in the survey (see below).

Imagine a company could install a backup power system at your premises. The system will readily provide electricity at your premises for one hour if an outage occurs. The total cost of the system, including installation, would be $32 per month.

Would you get the company to install the backup system at your premises at a cost of $32 per month?

The benchmark value of $32 represents the estimated average cost to Australian households of acquiring a backup system that would provide electricity to their premises for one hour (duration of baseline outage)[1]. If respondents indicated that they would have a backup system installed at their premises for $32 per month, their maximum WTP value was assumed to be $32 per month.

For those respondents that indicated they are not willing to pay $32 per month, a follow-up question was asked, as given below:

What is the maximum $ you would be willing to pay per month for this system?

The response to this question was then used as a measure of maximum willingness to pay. Responses were capped at $32.

Business survey

The business survey used a similar sequence of contingent valuation questions to that developed for the residential survey. The baseline outage scenario was identical to that used in the residential survey.

There were however some minor differences in the way that the bid amounts were presented, which are discussed below.

The bid amounts presented for the first two contingent valuation questions were based on a randomised percentage point increases in bills (ranging from 1 through to 10 percentage point increases[2]). This percentage of bill was applied to a bill estimate to give the dollar value presented for the first two contingent valuation questions.

The third question was identical to the one used in the residential survey.

Respondents were asked to indicate the maximum amount they would be WTP, beyond their current electricity bill, to avoid the described power outages. The response was presented as a percentage

[1] This value was $22 in the 2019 study (KPMG & Insync, 2019).

[2] Only whole numbers were used, for example 1%, 2% through to 10%.

increase relative to their last bill on the screen. A respondent's WTP was then calculated using this percentage increase, capped at 100%.

Discrete Choice Experiments

An overview of the DCE approach is presented in Figure 1.

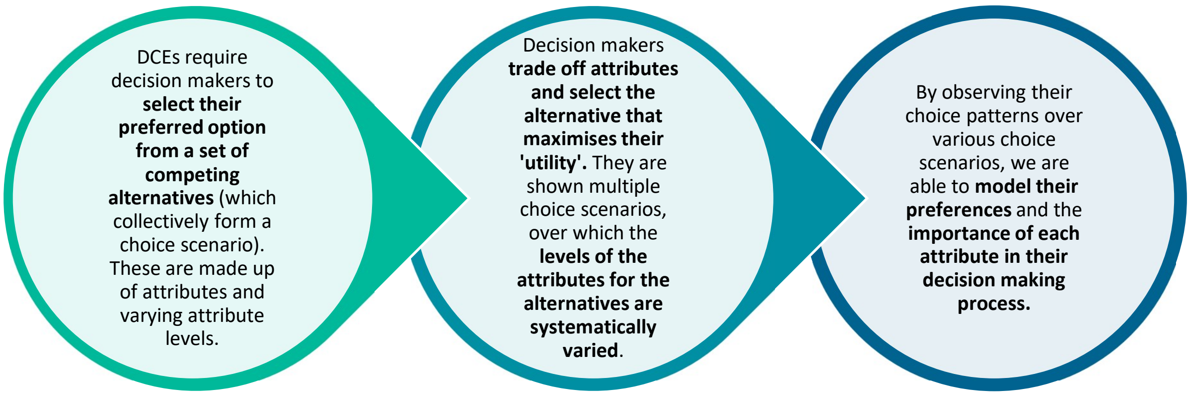

Figure 1: DCE approach

The attributes and levels used in the DCE are provided in Table 1.

Table 1: Attributes and levels used in the DCE

Attribute	Level	
	Residential	Business
Discount	No change	No change
	$4/month[3]	1% of bill
	$8/month[3]	2% of bill
	$18/month[3]	3% of bill
Localised/widespread	Localised	
	Widespread	
Duration	1 hour	
	3 hours	
	6 hours	
	12 hours	

[3] Levels were scaled based on billing frequency.

Frequency (fixed)	Twice a year
Summer/winter	Summer
	Winter
Weekdays/weekends	Weekdays
	Weekends
Time of day	Peak
	Off-peak

The DCE design (also referred to as the experimental design) involves the process of generating specific combinations of attributes and levels that participants evaluate in choice scenarios. The design used was generated by AER.

An example DCE scenario from the 2024 main survey is given in Figure 2.

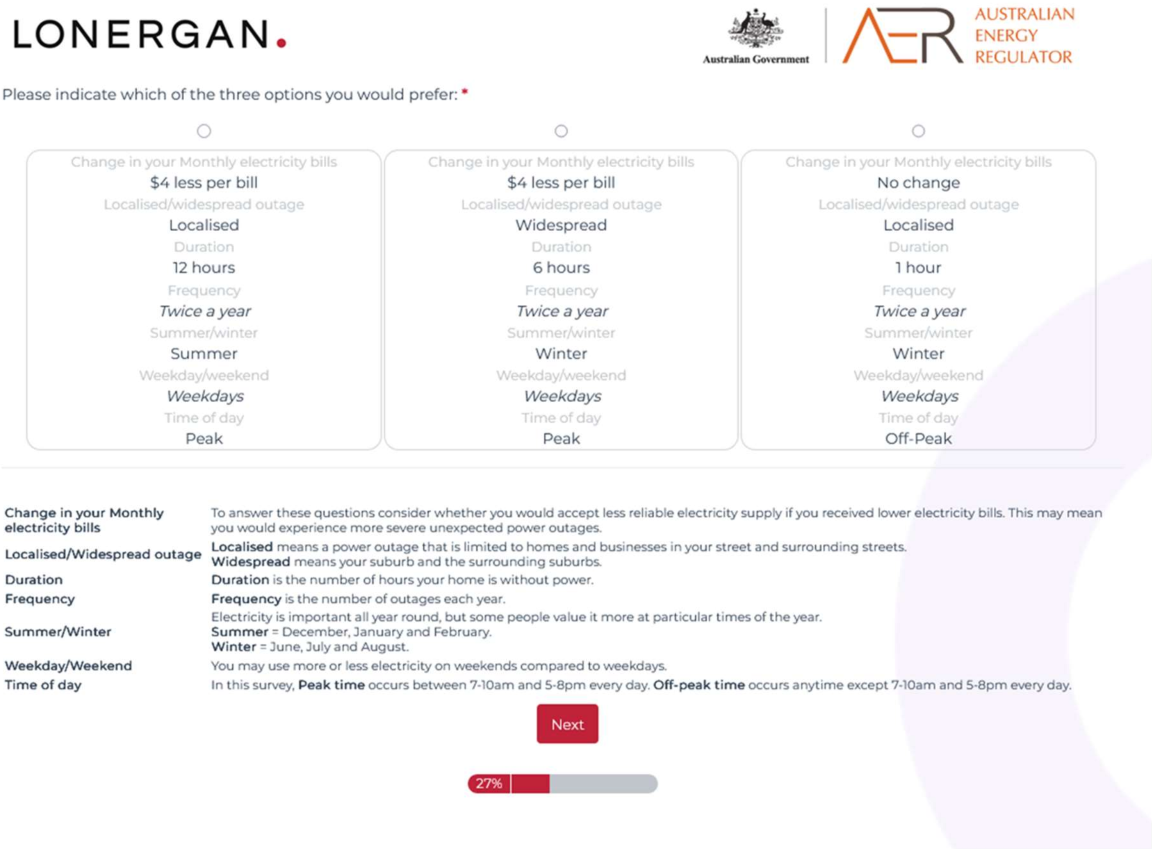

Figure 2. An example scenario from the 2024 survey

SURVEY STRUCTURE

Two surveys were conducted: one for residential respondents and another for business cohorts. Each survey included an online questionnaire consisting of contextual and demographics questions, contingent valuation questions and a DCE. The survey content closely resembled the VCR 2019 study developed by AER (KPMG & Insync, 2019). The 2024 fieldwork was conducted by Lonergan Research.

DCE ANALYSIS

For the DCE analysis, a Multinomial Logit (MNL) model was used to estimate the parameters of the choice model, consistent with the approach used in 2019. Further information on DCE analysis is contained in Appendix 1.

The DCE data was structured such that the categorical attributes were re-coded using simple dummy coding, using one of the levels as a reference category (for an attribute with l levels, l–1 dummy variables were created) and the numerical attribute 'discount' was treated as continuous variable. The reference category for each attribute level is provided in the parameter estimates tables in the following section.

RESULTS

RESIDENTIAL

The residential survey included 3,600 respondents after data cleaning. The analysis was conducted on the full residential dataset as well as across 12 distinct segments.

Contingent valuation baseline values: residential

The baseline WTP is given in Table 2 and is expressed as a dollar value per month. The average WTP to avoid the baseline outage for all residential customers was $4.92/month per two 1-hour outages. The average WTP ranged between $3.47 and $6.49/month per two 1-hour outages, differing by segment.

Table 2: Residential WTP to avoid the baseline outage

Segment	Sample size	$/month per two 1-hour outages occurring within a 12-month period
CZ1 Regional	289	$6.49
CZ2 CBD & Suburban	294	$4.71
CZ2 Regional	293	$4.05
CZ3+4 Regional	247	$4.23
CZ5 CBD & Suburban NSW	276	$4.72
CZ5 CBD & Suburban SA	297	$4.53
CZ5 Regional	277	$5.78
CZ6 CBD & Suburban	318	$5.03
CZ6 Regional	339	$3.47
CZ7 CBD & Suburban	303	$5.28
CZ7 Regional	376	$5.24
NT	291	$5.60
All Residential	3600	$4.92

DCE model coefficients for scenario attributes: residential

The MNL model results for all residential customers and 12 segments are given in Table 3 to Table 15. The structure of the utility functions specified within the MNLs are given in Appendix 2. The model parameter estimates, and their associated standard errors (SE), z-value and p-value are displayed in each table.

MNL model results: All residential

MNL model results for the total residential sample are presented in Table 3.

When considering the severity of the outage, residential respondents overall showed a preference for localised outages over widespread ones. They favoured shorter durations, with a preference for a 1-hour outage over 3-hour, 6-hour or 12-hour outages. Winter outages were preferred over summer ones, and off-peak times were preferred over peak times. Weekday outages were also preferred over weekend outages. Additionally, higher discount amounts were preferred over lower discounts, all else being equal.

Table 3: MNL model results: All residential

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.470	0.031	14.96	0.000
Severity					
Widespread	wide	-0.100	0.021	-4.79	0.000
RC: Localised					
Duration					
3 hours	3h	-0.702	0.028	-25.28	0.000
6 hours	6h	-1.159	0.029	-39.96	0.000
12 hours	12h	-1.469	0.032	-45.54	0.000
RC: 1 hour					
Season					
Summer	summer	-0.068	0.020	-3.38	0.001
RC: Winter					
Time of day					
Peak	peak	-0.075	0.021	-3.56	0.000
RC: Off-peak					
Weekend/weekdays					
Weekend	weekend	-0.091	0.021	-4.39	0.000
RC: weekdays					
Discount					
Discount (continuous)	*discount*	0.061	0.002	34.37	0.000
Number of respondents: 3600; Number of choice observations: 28800; RC: Reference category; SE: Standard error					

MNL model results: CZ1 Regional

MNL model results for the CZ1 Regional cohort are presented in Table 4.

When considering the severity of the outage, CZ1 Regional cohort respondents preferred localised outages over widespread ones. They showed a preference for shorter durations, favouring a 1-hour outage over those lasting 3, 6 or 12 hours. Outages during winter were preferred over those in summer. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 4: MNL model results: CZ1 Regional

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.415	0.109	3.80	0.000
Severity					
Widespread	wide	-0.222	0.073	-3.01	0.003
RC: Localised					
Duration					
3 hours	3h	-0.669	0.098	-6.80	0.000

Parameters	Symbol	Coefficient	SE	z-value	p-value
6 hours	6h	-1.033	0.103	-10.06	0.000
12 hours	12h	-1.153	0.111	-10.42	0.000
RC: 1 hour					
Season					
Summer	summer	-0.149	0.070	-2.12	0.034
RC: Winter					
Time of day					
Peak	peak	-0.049	0.075	-0.65	0.514
RC: Off-peak					
Weekend/weekdays					
Weekend	weekend	-0.079	0.073	-1.08	0.281
RC: weekdays					
Discount					
Discount (continuous)	*discount*	0.050	0.006	7.98	0.000
Number of respondents: 289; Number of choice observations: 2312; RC: Reference category; SE: Standard error					

MNL model results: CZ2 CBD & Suburban

MNL model results for the CZ2 CBD & Suburban cohort are presented in Table 5.

When considering the severity of the outage, CZ2 CBD & Suburban cohort respondents showed a preference for localised outages over widespread ones. They favoured shorter durations, with a preference for a 1-hour outage over 3-hour, 6-hour or 12-hour outages. Outages during off-peak times were preferred over peak times. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 5: MNL model results: CZ2 CBD & Suburban

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.411	0.111	3.72	0.000
Severity					
Widespread	wide	-0.167	0.075	-2.22	0.026
RC: Localised					
Duration					
3 hours	3h	-0.832	0.098	-8.46	0.000
6 hours	6h	-1.406	0.106	-13.21	0.000
12 hours	12h	-1.670	0.117	-14.31	0.000
RC: 1 hour					
Season					
Summer	summer	-0.055	0.073	-0.75	0.451
RC: Winter					
Time of day					
Peak	peak	-0.159	0.076	-2.09	0.037
RC: Off-peak					
Weekend/weekdays					

Parameters	Symbol	Coefficient	SE	z-value	p-value
Weekend *RC: weekdays*	weekend	-0.097	0.074	-1.31	0.192
Discount					
Discount (continuous)	*discount*	0.061	0.006	9.54	0.000
Number of respondents: 294; Number of choice observations: 2352; RC: Reference category; SE: Standard error					

MNL model results: CZ2 Regional

MNL model results for the CZ2 Regional cohort are presented in Table 6.

When considering the severity of the outage, CZ2 Regional cohort respondents preferred localised outages over widespread ones. They showed a preference for shorter durations, favouring a 1-hour outage over those lasting 3, 6 or 12 hours. Outages during winter were preferred over those in summer, and off-peak times were favoured over peak times. Furthermore, higher discounts were preferred over lower discounts, all else being equal.

Table 6: MNL model results: CZ2 Regional

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.520	0.114	4.56	0.000
Severity					
Widespread *RC: Localised*	wide	-0.144	0.075	-1.92	0.055
Duration					
3 hours	3h	-0.766	0.102	-7.54	0.000
6 hours	6h	-1.191	0.106	-11.23	0.000
12 hours	12h	-1.454	0.117	-12.45	0.000
RC: 1 hour					
Season					
Summer *RC: Winter*	summer	-0.177	0.073	-2.43	0.015
Time of day					
Peak *RC: Off-peak*	peak	-0.176	0.077	-2.30	0.021
Weekend/weekdays					
Weekend *RC: weekdays*	weekend	-0.011	0.075	-0.14	0.886
Discount					
Discount (continuous)	*discount*	0.060	0.006	9.39	0.000
Number of respondents: 293; Number of choice observations: 2344; RC: Reference category; SE: Standard error					

MNL model results: CZ3+4 Regional

MNL model results for the CZ3+4 Regional cohort are presented in Table 7.

When considering the duration of the outage, CZ3+4 Regional cohort respondents favoured shorter durations, with a preference for a 1-hour outage over 3-hour, 6-hour or 12-hour outages. Outages during off-peak times were more preferred than those during peak times, and outages on weekdays were preferred over those on weekends. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 7: MNL model results: CZ3+4 Regional

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.509	0.122	4.17	0.000
Severity					
Widespread	wide	-0.120	0.081	-1.49	0.135
RC: Localised					
Duration					
3 hours	3h	-0.706	0.107	-6.61	0.000
6 hours	6h	-1.189	0.112	-10.62	0.000
12 hours	12h	-1.535	0.126	-12.23	0.000
RC: 1 hour					
Season					
Summer	summer	-0.113	0.077	-1.46	0.144
RC: Winter					
Time of day					
Peak	peak	-0.169	0.081	-2.08	0.037
RC: Off-peak					
Weekend/weekdays					
Weekend	weekend	-0.279	0.079	-3.52	0.000
RC: weekdays					
Discount					
Discount (continuous)	*discount*	0.080	0.007	11.78	0.000
Number of respondents: 247; Number of choice observations: 1976; RC: Reference category; SE: Standard error					

MNL model results: CZ5 CBD & Suburban NSW

The MNL model results for the CZ5 CBD & Suburban NSW cohort, as shown in Table 8, indicate that respondents preferred shorter outage durations, with a preference for a 1-hour outage over longer durations (3, 6, or 12 hours). Outages occurring on weekdays were also more favoured than those on weekends. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 8: MNL model results: CZ5 CBD & Suburban NSW

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.403	0.110	3.67	0.000
Severity					
Widespread	wide	-0.044	0.074	-0.59	0.554
RC: Localised					
Duration					
3 hours	3h	-0.689	0.098	-7.04	0.000

Parameters	Symbol	Coefficient	SE	z-value	p-value
6 hours	6h	-1.097	0.102	-10.71	0.000
12 hours	12h	-1.398	0.114	-12.24	0.000
RC: 1 hour					
Season					
Summer	summer	-0.030	0.070	-0.43	0.669
RC: Winter					
Time of day					
Peak	peak	-0.099	0.075	-1.32	0.188
RC: Off-peak					
Weekend/weekdays					
Weekend	weekend	-0.184	0.073	-2.51	0.012
RC: weekdays					
Discount					
Discount (continuous)	*discount*	0.065	0.006	10.36	0.000
Number of respondents: 276; Number of choice observations: 2208; RC: Reference category; SE: Standard error					

MNL model results: CZ5 CBD & Suburban SA

The MNL model results for the CZ5 CBD & Suburban SA cohort, as shown in Table 9, indicate that respondents preferred shorter outage durations, favouring a 1-hour outage over longer durations (3, 6, or 12 hours). Outages during winter were preferred over those in summer, and outages on weekdays were preferred to those on weekends. Furthermore, higher discounts were preferred over lower discounts, all else being equal.

Table 9: MNL model results: CZ5 CBD & Suburban SA

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.288	0.109	2.64	0.008
Severity					
Widespread	wide	-0.106	0.074	-1.44	0.150
RC: Localised					
Duration					
3 hours	3h	-0.655	0.096	-6.84	0.000
6 hours	6h	-1.391	0.104	-13.40	0.000
12 hours	12h	-1.733	0.116	-14.89	0.000
RC: 1 hour					
Season					
Summer	summer	-0.330	0.071	-4.68	0.000
RC: Winter					
Time of day					
Peak	peak	-0.020	0.075	-0.27	0.789
RC: Off-peak					
Weekend/weekdays					
Weekend	weekend	-0.157	0.073	-2.16	0.031
RC: weekdays					
Discount					

Parameters	Symbol	Coefficient	SE	z-value	p-value
Discount (continuous)	*discount*	0.067	0.006	10.66	0.000
Number of respondents: 297; Number of choice observations: 2376; RC: Reference category; SE: Standard error					

MNL model results: CZ5 Regional

The MNL model results for the CZ5 Regional cohort, as shown in Table 10, indicate that respondents preferred shorter outage durations, favouring a 1-hour outage over longer durations (3, 6, or 12 hours). Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 10: MNL model results: CZ5 Regional

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.495	0.113	4.38	0.000
Severity					
Widespread	wide	-0.095	0.075	-1.27	0.205
RC: Localised					
Duration					
3 hours	3h	-0.636	0.100	-6.38	0.000
6 hours	6h	-1.049	0.104	-10.06	0.000
12 hours	12h	-1.231	0.114	-10.84	0.000
RC: 1 hour					
Season					
Summer	summer	-0.075	0.072	-1.05	0.296
RC: Winter					
Time of day					
Peak	peak	-0.093	0.076	-1.22	0.224
RC: Off-peak					
Weekend/weekdays					
Weekend	weekend	-0.077	0.074	-1.04	0.301
RC: weekdays					
Discount					
Discount (continuous)	*discount*	0.051	0.006	8.13	0.000
Number of respondents: 277; Number of choice observations: 2216; RC: Reference category; SE: Standard error					

MNL model results: CZ6 CBD & Suburban

MNL model results for the CZ6 CBD & Suburban cohort are presented in Table 11. Respondents showed a preference for shorter durations, favouring a 1-hour outage over those lasting 3, 6 or 12 hours. Outages during summer were preferred over those in winter, and outages during off-peak times were preferred to those during peak times. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 11: MNL model results: CZ6 CBD & Suburban

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					

Parameters	Symbol	Coefficient	SE	z-value	p-value
Status Quo	constant	0.441	0.107	4.13	0.000
Severity					
Widespread *RC: Localised*	wide	-0.098	0.070	-1.40	0.161
Duration					
3 hours	3h	-0.797	0.095	-8.41	0.000
6 hours	6h	-1.261	0.097	-12.96	0.000
12 hours *RC: 1 hour*	12h	-1.583	0.108	-14.64	0.000
Season					
Summer *RC: Winter*	summer	0.109	0.066	1.65	0.099
Time of day					
Peak *RC: Off-peak*	peak	-0.171	0.071	-2.40	0.016
Weekend/weekdays					
Weekend *RC: weekdays*	weekend	0.083	0.069	1.21	0.228
Discount					
Discount (continuous)	*discount*	0.066	0.006	11.31	0.000
Number of respondents: 318; Number of choice observations: 2544; RC: Reference category; SE: Standard error					

MNL model results: CZ6 Regional

MNL model results for the CZ6 Regional cohort are presented in Table 12. Respondents showed a preference for shorter durations, favouring a 1-hour outage over those lasting 3, 6 or 12 hours. Outages during weekdays were preferred over those on weekends. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 12: MNL model results: CZ6 Regional

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.421	0.102	4.14	0.000
Severity					
Widespread *RC: Localised*	wide	-0.032	0.068	-0.47	0.636
Duration					
3 hours	3h	-0.748	0.090	-8.33	0.000
6 hours	6h	-1.235	0.093	-13.23	0.000
12 hours *RC: 1 hour*	12h	-1.674	0.106	-15.81	0.000
Season					
Summer *RC: Winter*	summer	-0.091	0.064	-1.42	0.157
Time of day					
Peak	peak	-0.024	0.069	-0.35	0.724

Parameters	Symbol	Coefficient	SE	z-value	p-value
RC: Off-peak					
Weekend/weekdays					
Weekend *RC: weekdays*	weekend	-0.124	0.067	-1.85	0.064
Discount					
Discount (continuous)	*discount*	0.070	0.006	12.12	0.000
Number of respondents: 339; Number of choice observations: 2712; RC: Reference category; SE: Standard error					

MNL model results: CZ7 CBD & Suburban

MNL model results for the CZ7 CBD & Suburban cohort, as shown in Table 13, reveal that respondents favoured shorter durations, with a preference for a 1-hour outage over 3-hour, 6-hour or 12-hour outages. Outages during off-peak times were also more preferred than those during peak times. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 13: MNL model results: CZ7 CBD & Suburban

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.330	0.106	3.11	0.002
Severity					
Widespread *RC: Localised*	wide	-0.099	0.071	-1.40	0.160
Duration					
3 hours	3h	-0.745	0.094	-7.91	0.000
6 hours	6h	-1.155	0.098	-11.84	0.000
12 hours *RC: 1 hour*	12h	-1.420	0.108	-13.19	0.000
Season					
Summer *RC: Winter*	summer	0.003	0.067	0.05	0.964
Time of day					
Peak *RC: Off-peak*	peak	-0.178	0.072	-2.48	0.013
Weekend/weekdays					
Weekend *RC: weekdays*	weekend	-0.051	0.070	-0.73	0.465
Discount					
Discount (continuous)	*discount*	0.060	0.006	10.07	0.000
Number of respondents: 303; Number of choice observations: 2424; RC: Reference category; SE: Standard error					

MNL model results: CZ7 Regional

MNL model results for the CZ7 Regional cohort, as shown in Table 14, reveal that respondents favoured shorter durations, with a preference for a 1-hour outage over 3-hour, 6-hour or 12-hour outages. Outages during summer were also more preferred than those during winter. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 14: MNL model results: CZ7 Regional

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.747	0.100	7.49	0.000
Severity					
Widespread	wide	-0.072	0.065	-1.10	0.273
RC: Localised					
Duration					
3 hours	3h	-0.676	0.087	-7.80	0.000
6 hours	6h	-1.022	0.089	-11.47	0.000
12 hours	12h	-1.497	0.102	-14.74	0.000
RC: 1 hour					
Season					
Summer	summer	0.210	0.063	3.35	0.001
RC: Winter					
Time of day					
Peak	peak	0.069	0.067	1.04	0.298
RC: Off-peak					
Weekend/weekdays					
Weekend	weekend	-0.080	0.064	-1.23	0.217
RC: weekdays					
Discount					
Discount (continuous)	*discount*	0.054	0.006	9.84	0.000
Number of respondents: 376; Number of choice observations: 3008; RC: Reference category; SE: Standard error					

MNL model results: NT

MNL model results for the NT cohort, as shown in Table 15, indicate that respondents favoured shorter durations, with a preference for a 1-hour outage over 3-hour, 6-hour or 12-hour outages. Outages during winter were also more preferred than those during summer. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 15: MNL model results: NT

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.624	0.114	5.49	0.000
Severity					
Widespread	wide	-0.038	0.074	-0.51	0.609
RC: Localised					
Duration					
3 hours	3h	-0.534	0.099	-5.41	0.000

Parameters	Symbol	Coefficient	SE	z-value	p-value
6 hours	6h	-0.930	0.102	-9.15	0.000
12 hours	12h	-1.283	0.114	-11.25	0.000
RC: 1 hour					
Season					
Summer	summer	-0.228	0.071	-3.22	0.001
RC: Winter					
Time of day					
Peak	peak	0.100	0.075	1.33	0.183
RC: Off-peak					
Weekend/weekdays					
Weekend	weekend	-0.062	0.073	-0.85	0.394
RC: weekdays					
Discount					
Discount (continuous)	*discount*	0.049	0.006	8.00	0.000
Number of respondents: 291; Number of choice observations: 2328; RC: Reference category; SE: Standard error					

Subgroup analysis: residential

A subgroup 'face validity' analysis was conducted similarly to the 2019 study, using results from the contingent valuation method. As requested by AER, WTP to avoid baseline outages was calculated for a number of selected subgroups given in Table 16 to Table 19.

Current financial situation

The results presented in Table 16 show that respondents with higher incomes and fewer financial constraints had a higher baseline WTP, aligning with economic theory. Those who live comfortably reported a WTP of $5.69/month, while those struggling to meet basic expenses had a lower WTP of $3.92/month.

Table 16: Subgroup analysis: Baseline willingness to pay by current financial situation

Label	$/month per two 1-hour outages	Number of respondents (n)
Live comfortably	$5.69	890
Meet basic expenses with a little left over for extras	$4.85	1457
Just meet basic expenses	$4.38	953
Don't have enough to meet basic expenses	$3.92	247
Prefer not to say	$8.28	53

Electric Vehicle usage

Table 17 shows that electric vehicle (EV) drivers had higher baseline WTP compared to non-EV drivers, with EV drivers reporting $10.27/month per two 1-hour outages, while non-EV drivers report $4.81/month.

Table 17: Subgroup analysis: Baseline willingness to pay by Electric Vehicle usage

Label	$/month per two 1-hour outages	Number of respondents (n)
Non-EV drivers	$4.81	3528
EV drivers	$10.27	72

Rooftop solar usage

Table 18 indicates that respondents without rooftop solar are willing to pay slightly more, at $5.16 per month, for two 1-hour outages compared to rooftop solar owners, who are willing to pay $4.49.

Table 18: Subgroup analysis: Baseline willingness to pay by rooftop solar usage

Label	$/month per two 1-hour outages	Number of respondents (n)
No rooftop solar	$5.16	2318
Rooftop solar owners	$4.49	1282

Observation

The subgroup analysis for residential customers does not contradict what one would expect based on economic theory and intuition and provide us with a degree of confidence that the survey instruments are performing as intended and generating valid measures of WTP.

BUSINESS

The business survey included 2,323 respondents after data cleaning. The analysis was conducted on the total business sample as well as agriculture, industrial and commercial segments.

Contingent valuation baseline values: Business

In the business sample, the baseline WTP was expressed as a percentage increase in the total bill to avoid a baseline outage scenario. The results are presented in Table 19 for the total sample, as well as for the industrial and commercial subgroups.

Table 19: Business willingness to pay as a percentage increase in total bill

Segment	Sample size	Percentage increase in total bill
Agriculture subgroup	247	5.76%
Industrial subgroup	1575	11.03%
Commercial subgroup	501	11.96%
Total business sample	2323	10.67%

The distribution of WTP as a percentage increase in the total bill for business respondents is highly left-skewed, with the majority of respondents indicating a low percentage.

DCE model coefficients for scenario attributes: Business

The structure of the utility functions specified within the MNL are given in Appendix 2. The model parameter estimates, and their associated SE, Z value and p-value are displayed in Table 20 to Table 23.

When using dummy coding for the business analysis in the "Business All," "Commercial," and "Industrial" models, the coding for the duration variable was handled differently. Specifically, the levels for "6 hours" and "12 hours" were combined into a single category. This approach was chosen because there were no significant differences between these two levels, making it more intuitive and sensible for interpretation to treat them as a single variable.

MNL Model results: Business All

As given in Table 20, business respondents expressed a preference for shorter outage durations, favouring 1-hour outages over those lasting 3 hours or 6-12 hours. They also preferred outages in winter over summer and during off-peak times rather than peak hours. Weekend outages were also preferred over weekday outages. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 20: MNL model results: Business All

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.577	0.046	12.58	0.000
Severity					
Widespread	wide	-0.021	0.025	-0.81	0.417
RC: Localised					
Duration					
3 hours	3h	-0.332	0.035	-9.58	0.000
6 & 12 hours	612h	-0.552	0.031	-17.77	0.000
RC: 1 hour					
Season					
Summer	summer	-0.075	0.023	-3.22	0.001
RC: Winter					
Time of day					
Peak	peak	-0.075	0.024	-3.08	0.002
RC: Off-peak					
Weekend/weekdays					
Weekend	weekend	0.087	0.024	3.56	0.000
RC: weekdays					
Discount					
Discount (continuous)	*discount*	0.222	0.017	13.03	0.000
Number of respondents: 2323; Number of choice observations: 18114; RC: Reference category; SE: Standard error					

MNL Model results: Agriculture

Agriculture sample results as given in Table 21, indicate a preference for shorter outage durations, favouring 1-hour outages over those lasting 3 hours, 6 hours or 12 hours. These respondents also preferred outages in winter over summer. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 21: MNL model results: Agriculture

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.419	0.143	2.92	0.003
Severity					
Widespread	wide	-0.085	0.081	-1.06	0.291
RC: Localised					
Duration					
3 hours	3h	-0.521	0.106	-4.91	0.000
6 hours	6h	-0.904	0.109	-8.27	0.000
12 hours	12h	-1.035	0.117	-8.82	0.000
RC: 1 hour					
Season					
Summer	summer	-0.251	0.076	-3.31	0.001
RC: Winter					

Parameters	Symbol	Coefficient	SE	z-value	p-value
Time of day					
Peak *RC: Off-peak*	peak	-0.030	0.079	-0.38	0.701
Weekend/weekdays					
Weekend *RC: weekdays*	weekend	0.027	0.080	0.34	0.733
Discount					
Discount (continuous)	*discount*	0.212	0.053	4.02	0.000
Number of respondents: 247; Number of choice observations: 1938; RC: Reference category; SE: Standard error					

MNL Model results: Commercial

Commercial sample results as given in Table 22, reveal a preference for shorter outage durations, favouring 1-hour outages over those lasting 3 hours or 6-12 hours. They also preferred outages in winter over summer and during off-peak times rather than peak hours. Outages on weekends were preferred over those on weekdays. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 22: MNL model results: Commercial

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.646	0.056	11.59	0.000
Severity					
Widespread *RC: Localised*	wide	0.027	0.031	0.86	0.390
Duration					
3 hours	3h	-0.364	0.042	-8.62	0.000
6 & 12 hours *RC: 1 hour*	612h	-0.572	0.038	-15.14	0.000
Season					
Summer *RC: Winter*	summer	-0.062	0.029	-2.18	0.029
Time of day					
Peak *RC: Off-peak*	peak	-0.077	0.030	-2.59	0.010
Weekend/weekdays					
Weekend *RC: weekdays*	weekend	0.099	0.030	3.34	0.001
Discount					
Discount (continuous)	*discount*	0.239	0.021	11.46	0.000
Number of respondents: 1575; Number of choice observations: 12266; RC: Reference category; SE: Standard error					

MNL Model results: Industrial

Industrial sample results as given in Table 23. When considering the severity of the outage, *Industrial* respondents preferred smaller outages that affected only a local area (localised) instead of larger ones that affected many places (widespread). They favoured shorter durations, with a preference for a 1-hour outage compared to 3-hour, or 6-12 hour outages. Business respondents also preferred outages during off-peak times rather than peak hours, and during weekends compared to weekday ones. Additionally, higher discounts were preferred over lower discounts, all else being equal.

Table 23: MNL model results: Industrial

Parameters	Symbol	Coefficient	SE	z-value	p-value
Constant					
Status Quo	constant	0.427	0.098	4.34	0.000
Severity					
Widespread *RC: Localised*	wide	-0.136	0.053	-2.55	0.011
Duration					
3 hours	3h	-0.150	0.075	-2.01	0.045
6 & 12 hours *RC: 1 hour*	612h	-0.310	0.067	-4.66	0.000
Season					
Summer *RC: Winter*	summer	-0.047	0.049	-0.97	0.331
Time of day					
Peak *RC: Off-peak*	peak	-0.095	0.051	-1.85	0.064
Weekend/weekdays					
Weekend *RC: weekdays*	weekend	0.088	0.052	1.71	0.087
Discount					
Discount (continuous)	*discount*	0.172	0.036	4.79	0.000
Number of respondents: 501; Number of choice observations: 3910; RC: Reference category; SE: Standard error					

Subgroup analysis: business

Table 24 shows that most businesses experienced few outages last year, with 31.38% reporting none and 23.07% having one outage. Only 4% faced more than six outages, highlighting that frequent outages were less common.

Table 24: Number of businesses reporting experience with a specified number of outages in the last year

Outages	Number of businesses	% of businesses
None	729	31.38%
1 outage	536	23.07%
2 outages	456	19.63%
3 outages	237	10.20%
4 outages	155	6.67%
5 outages	80	3.44%

6 outages	37	1.59%
More than 6 times	93	4.00%

CONCLUSION

This study finds that residential customers are WTP $4.92 per month to avoid the baseline outage scenario. This represents a 40% increase on the $3.51 WTP reported in the 2019 study. After adjusting for inflation over this period[4], WTP is found to have increased in real terms by 16%. This real increase may be explained by heighted consumer awareness of the importance of reliable electricity services, especially in light of recent disruptions caused by climate-induced events. The increase in WTP is notable, given there are other countervailing factors that have emerged since 2019 that are likely to be working in the background to dampen consumer capacity and WTP for increased reliability – in particular the higher cost of living.

The residential survey revealed important insights into customer preferences regarding power outages. In the pooled residential model (All Residential), respondents preferred localised outages over widespread ones and shorter durations over longer outages. Seasonal preferences also played a significant role, with winter outages favoured over summer ones, and off-peak outages preferred over peak-time outages. Additionally, weekday outages were assessed by consumers as being less disruptive than weekend outages. Higher discount amounts were preferred over lower discounts, all else being equal. These preferences were generally consistent across all segments, with some variability observed. The DCE models provide a robust understanding of residential customers' WTP and the specific outage characteristics they value most.

The results showed that businesses, on average, were WTP an additional 10.67% on their total bill to avoid the baseline outage scenario, with industrial and commercial sectors showing higher WTP (11.03% and 11.96%, respectively). Compared to the 2019 study, the 10.67% WTP result is lower than 14.2% bill increase that business customers were WTP in 2019 for avoiding the same baseline outage scenario.

The analysis of business customers also revealed preferences for shorter outage durations, winter outages, and off-peak hours. Subgroup analysis highlighted that most businesses experienced few outages in the past year, with a significant portion reporting none or only one.

Overall, the results of the study are consistent with economic theory in key areas, while also aligning with intuition in others, showing clear preferences for reduced outage durations, localised outages, and seasonal timing. The findings provide a reliable and valuable understanding of customer preferences, with no significant issues or concerns identified, offering useful insights for future planning and decision-making.

[4] Australian cumulative inflation over the period September 2019 to September 2024 was 20.54%.

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APPENDIX 1: DCE ANALYSIS

Econometric software, Nlogit version 6, was used to model the DCE data. The model structure was consistent with Random Utility Theory (RUT), which states that decision makers compare alternative goods and services within a market and select the bundle of attributes or goods that yield the maximum utility (i.e., the respondent is a utility maximiser) (Hensher et al., 2005). In the following, U_{nsj} denotes the utility of alternative j by respondent n in choice situation s. RUT proposes that overall utility U_{nsj} can be written as the sum of the observable component[5], V_{nsj}, expressed as a function of the attributes presented and a random or unexplained component, ε_{nsj} as shown in equation (1).

$$U_{nsj} = V_{nsj} + \varepsilon_{nsj} \quad (1)$$

where:

U_{nsj} is the overall utility of alternative *j* by respondent *n* in choice situation *s*

V_{nsj} is the observed or explained component of utility (for alternative *j* by respondent *n* in choice situation *s*)

ε_{nsj} is the random or unexplained error component.

The multinomial logit model (MNL)

Consistent with the 2019 study, the data were modelled using a multinomial logit model (MNL). For this model the parameter weights (β) are assumed to be invariant across the sample.

[5] Otherwise referred to as the systematic or observed component.

APPENDIX 2: UTILITY EQUATIONS

The structure of the utility functions that were specified within the MNL model are shown below. There are utility functions for the Option 1, Option 2 unlabelled alternatives and Option 3 which is defined as the status quo/current below. The parameter coefficients were generic/consistent across alternatives.

Residential and Business Agriculture

$$U_{Option1} = \beta_{wide}x_{wide} + \beta_{3h}x_{3h} + \beta_{6h}x_{6h} + \beta_{12h}x_{12h} + \beta_{summer}x_{summer} + \beta_{weekend}x_{weekend} + \beta_{peak}x_{peak} + \beta_{discount}x_{discount} + \epsilon_A$$

$$U_{Optio} = \beta_{wide}x_{wide} + \beta_{3h}x_{3h} + \beta_{6h}x_{6h} + \beta_{12h}x_{12h} + \beta_{summer}x_{summer} + \beta_{weekend}x_{weekend} + \beta_{peak}x_{peak} + \beta_{discount}x_{discount} + \epsilon_B$$

$$U_{Option3} = \beta_{SQconstant} + \beta_{wide}x_{wide} + \beta_{3h}x_{3h} + \beta_{6h}x_{6h} + \beta_{12h}x_{12h} + \beta_{summer}x_{summer} + \beta_{weekend}x_{weekend} + \beta_{peak}x_{peak} + \beta_{discount}x_{discount} + \epsilon_{SQ}$$

Business All, Business Commercial and Industrial

$$U_{Option1} = \beta_{wide}x_{wide} + \beta_{3h}x_{3h} + \beta_{612h}x_{612h} + \beta_{summer}x_{summer} + \beta_{weekend}x_{weekend} + \beta_{peak}x_{peak} + \beta_{discount}x_{discount} + \epsilon_A$$

$$U_{Optio} = \beta_{wide}x_{wide} + \beta_{3h}x_{3h} + \beta_{612h}x_{612h} + \beta_{summer}x_{summer} + \beta_{weekend}x_{weekend} + \beta_{peak}x_{peak} + \beta_{discount}x_{discount} + \epsilon_B$$

$$U_{Option3} = \beta_{SQconstant} + \beta_{wide}x_{wide} + \beta_{3h}x_{3h} + \beta_{612h}x_{612h} + \beta_{summer}x_{summer} + \beta_{weekend}x_{weekend} + \beta_{peak}x_{peak} + \beta_{discount}x_{discount} + \epsilon_{SQ}$$

The position of the "status quo" option was varied in the experiment; In other words, it was not always presented as Option 3 in all scenarios, despite being represented that way in the utility equations above.