

# Technical Appendices

**High-impact decisions that reduce household emissions**

**August 2025**

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## Appendix 1: Survey design and analysis

### Survey design

BETA designed the *Towards Net Zero* survey, in consultation with the Department of Climate Change, Energy, the Environment and Water and the Australian Energy Regulator, to understand the barriers and enables to making high-impact household decisions that limit greenhouse gas emissions.

We used the COM-B framework (Michie, Van Stralen and West 2011) to examine the home upgrade decision, and to design and analyse the survey. COM-B considers whether a decision-maker has the capability, opportunity, and motivation to perform a certain behaviour.

Figure 1 describes our key research questions (adapted from The Decision Lab, n.d.).

Figure 1. The decision to make home upgrades requires sufficient capability, opportunity, and motivation

We ran an online survey of 4,891 Australians. Our sample was broadly representative of the Australian population, with soft quotas on gender, age, and location (capital city or outside capital city). We oversampled the smaller States and Territories (Australian Capital Territory, Northern Territory and Tasmania) to allow analysis of cohorts within these regions. We set a hard quota of a minimum of 250 respondents from each State, and a minimum of 100 respondents in each Territory. To be eligible to complete our survey, respondents had to indicate they were aged 18 or over, and provide informed consent.

Respondents were recruited through a panel provider (The Online Research Unit) and completed the survey on Qualtrics from 18 July to 28 August 2023. The survey took an average of 15 minutes to complete.

#### Overview of survey questions

The survey questions fell into categories of capability, opportunity, motivations and home upgrade behaviours. We also included a spotlight on rooftop solar, cost of living, and typical demographics questions. The survey contained five main modules:

* **Climate motivations** – we asked about attitudes, values, and behaviours relevant to climate change to understand motivations for emissions reduction behaviours.
* **Home upgrades** – we asked about existing energy infrastructure in respondents’ homes, home upgrades they already have, and how much they know about the impact of upgrades on household emissions.
	+ We were interested in respondents’ **home energy efficiency ‘literacy’**. We presented various hypothetical scenarios that involve realistic choices a householder might need to make when considering home upgrades. There was an objectively correct answer to each question in the context of greenhouse gas emission reduction goals.
* **Residential rooftop solar** – as uptake and awareness of solar is high compared to other home upgrades, we asked households with solar panels about their motivations for installing solar and how easy or difficult they found the process. For households without solar, we sought to understand their motivations and barriers.
* **Cost-of-living** – we asked about perceptions and experiences of the cost of living, particularly energy prices, to understand how rising costs impact respondents’ values, priorities, and behaviour.
* **Demographics** – we asked about personal characteristics including age, location, employment status and housing status, to facilitate a more nuanced understanding of enablers and barriers across different cohorts.

Our full survey instrument is available on request.

### Data cleaning

We excluded responses if:

* They were speeders – defined as completing the survey in less than 4.5 minutes (approximately 33% of median completion time after excluding screenouts).
* Responses were incomplete – that is, respondents did not reach the final (10th) page of survey questions.
* The State or Territory (provided on the first page of survey questions) did not match the postcode (provided on the final page). We did not consider missing postcodes to constitute a mismatch.
* They were flagged by Qualtrics as low-quality. Flags are:
	+ A likely duplicate (Q\_RelevantIDDuplicate = true)
	+ A likely bot (Q\_RelevantIDFraudScore ≥ 30)
	+ Recaptcha failure (Q\_RecaptchaScore < 0.5)
* We discovered instances where the panel-provided ID was duplicated. These duplicates were manually checked. Where it seemed that duplicates represented the same person (e.g. matching postcode, age, gender), the first instance of each duplicate was retained. All other duplicates were removed.
* They were incomplete because they did not meet our screening criteria (did not give consent, under 18 years old)
* They were incomplete because a quota was full (for example State or Territory quotas).

We received a total of 6,477 survey responses. After excluding incomplete responses and cleaning the data, we were left with a total of 4,891 responses.

### Analysis

We had two main data analysis approaches. The first was an explaratory approach, using a series of frequency tables and cross-tabulations to describe the data. We generated these in Q, using data cleaned in Stata. The second was to use multiple regressions to quantify the relative impact of barriers and enablers of certain home upgrades. Regressions were performed in R. Appendix 3 details the regression results.

## Appendix 2: Knowledge scenarios

We were interested in understanding respondents’ **home energy efficiency ‘literacy’**. We presented various hypothetical scenarios that involve realistic choices a householder might need to make when considering home upgrades, across four topics: replacing old appliances, hot water systems, vehicles, and choosing between new appliances . There was an objectively correct answer to each question in the context of greenhouse gas emission reduction goals.

Responses to each question were averaged to generate a score (see Aggregate Measure).

### Scenario questions

Participants were asked to tell us what they think the best action is to limit greenhouse gas emissions. Each participant was shown four of the eight possible scenarios, randomly selected so that they saw one scenario about each of the four topics.

Scenario 1: Appliance

Ava lives in Cairns and works from home. Her house has a large air-conditioning unit which is 25 years old.

She wants to limit her household greenhouse gas emissions. What should she do?

*Response options:*

* Keep her current air-conditioning unit until it breaks down **(incorrect)**
* Replace her air-conditioning unit straight away with a new one that is more energy efficient **(Correct)**
* Don't know **(incorrect)**
1. Scenario 1 results

| Response | n | % |
| --- | --- | --- |
| Correct choice | 1,913 | 79% |
| Incorrect choice | 324 | 13% |
| Didn’t know (treated as incorrect) | 185 | 8% |
| Total | 2,422 | - |

Scenario 2: Appliance

Adam lives in a Brisbane apartment and usually eats out. His kitchen has a medium-sized fridge that is 15 years old.

He wants to limit his household greenhouse gas emissions. What should he do?

*Response options:*

* Keep his current fridge until it breaks down **(incorrect)**
* Replace his fridge straight away with a new one that is more energy efficient **(Correct)**
* Don't know **(incorrect)**
1. Scenario 2 results

| Response | n | % |
| --- | --- | --- |
| Correct choice | 1,539 | 63% |
| Incorrect choice | 697 | 28% |
| Didn’t know (treated as incorrect) | 213 | 9% |
| Total | 2,449 | - |

Scenario 3: Hot water system

Halina lives in country Victoria in a house with no rooftop solar system. The house has an old electric hot water tank.

She wants to limit her household greenhouse gas emissions. What should she do?

*Response options:*

* Keep her current hot water system until it breaks down **(incorrect)**
* Replace her hot water system straight away with a heat pump hot water system **(Correct)**
* Don't know **(incorrect)**
1. Scenario 3 results

| Response | n | % |
| --- | --- | --- |
| Correct choice | 1,681 | 69% |
| Incorrect choice | 480 | 20% |
| Didn’t know (treated as incorrect) | 267 | 11% |
| Total | 2,428 | - |

 Scenario 4: Hot water system

Hamish lives in country NSW in a house with a large rooftop solar system. The house has an old electric hot water tank.

He wants to limit his household greenhouse gas emissions. What should he do?

*Response options:*

* Set a timer to heat the water during the day instead of at night **(Correct)**
* Replace the hot water tank straight away with a heat pump hot water system **(Incorrect)**
* Don't know **(incorrect)**
1. Scenario 4 results

| Response | n | % |
| --- | --- | --- |
| Correct choice | 1,143 | 47% |
| Incorrect choice | 965 | 39% |
| Didn’t know (treated as incorrect) | 338 | 14% |
| Total | 2,446 | - |

Scenario 5: Vehicle

Chesna lives in the Canberra suburbs in a house with no rooftop solar system. She drives her 15-year-old petrol car to the office every day, twenty minutes each way.

She wants to limit her household greenhouse gas emissions. What should she do?

*Response options:*

* Keep her current car **(incorrect)**
* Replace her car straight away with a new electric vehicle **(Correct)**
* Don't know **(incorrect)**
1. Scenario 5 results

| Response | n | % |
| --- | --- | --- |
| Correct choice | 1,273 | 52% |
| Incorrect choice | 747 | 31% |
| Didn’t know (treated as incorrect) | 421 | 17% |
| Total | 2,441 | - |

Scenario 6

Cole lives in the outer suburbs of Adelaide in a house with no rooftop solar system. He is retired and usually only drives his 5-year-old petrol car to the local shops on Wednesdays.

He wants to limit his household greenhouse gas emissions. What should he do?

*Response options:*

* Keep his current car **(Correct)**
* Replace his car straight away with a new electric vehicle **(incorrect)**
* Don't know **(incorrect)**
1. Scenario 6 results

| Response | n | % |
| --- | --- | --- |
| Correct choice | 1,484 | 61% |
| Incorrect choice | 646 | 27% |
| Didn’t know (treated as incorrect) | 305 | 13% |
| Total | 2,435 | - |

Scenario 7

Elinor is building a house in Darwin and has already opted for a large rooftop solar system with a battery. Now she has to design her kitchen.

She wants to make her household greenhouse gas emissions as low as possible. What should she choose?

*Response options:*

* Gas cooktop **(incorrect)**
* Induction cooktop **(Correct)**
* Don't know **(incorrect)**
1. Scenario 7 results

| Response | n | % |
| --- | --- | --- |
| Correct choice | 1,772 | 73% |
| Incorrect choice | 313 | 13% |
| Didn’t know (treated as incorrect) | 359 | 15% |
| Total | 2,444 | - |

Scenario 8

Edwin is building a house in Perth and has already opted for a large rooftop solar system with a battery. Now he has to choose a heating system.

He wants to make his household greenhouse gas emissions as low as possible. What should he choose?

*Response options:*

* Ducted gas central heating **(incorrect)**
* Reverse cycle heater (split system) **(Correct)**
* Don't know **(incorrect)**
1. Scenario 8 results

| Response | n | % |
| --- | --- | --- |
| Correct choice | 1,588 | 65% |
| Incorrect choice | 343 | 14% |
| Didn’t know (treated as incorrect) | 513 | 21% |
| Total | 2,444 | - |

### Aggregate measure

Each person answered four questions – an incorrect answer, a ‘don’t know’ response and a missing answer were all recoded to 0, only a correct answer was coded as 1. People with more than 1 missing data point were excluded from analysis. These were summed and divided by 4 to derive the mean, giving each person a score from 0 – 1, in which 1 = 100% correct.

## Appendix 3: Frequency Tables

### Demographics

Tables 9-11 show that our sample was broadly representative on gender, age, and location.

1. How do you describe your gender? [Survey sample compared to 2021 Census]

| Gender  | BETA Survey % (n) | 2021 Census |
| --- | --- | --- |
| Woman or Female | 51% (2,491) | 51% |
| Man or male | 49% (2,383) | 49% |
| Non-binary |  <1% (9) |  |
| Not stated | <1% (8) |  |
| Total | 4,891 |  |

1. Please select your age bracket [Survey sample compared to 2021 Census]

| Age  | BETA Survey % (n) | 2021 Census |
| --- | --- | --- |
| 18-34 | 23% (1,148) | 21% (20-34) |
| 35-64 | 51% (2,514) | 38% |
| 65+ | 25% (1,229) | 17% |
| Total | 4,891 |  |

1. Do you live in a capital city or another part of the state? [Survey sample compared to 2021 Census]

| Location | BETA Survey % (n) | 2021 Census |
| --- | --- | --- |
| Capital city | 68% (3,342) | 67% (major Australian cities) |
| Another part of the state | 32% (1,549) | 33% |
| Total | 4,891 |  |

1. Where do you live?

| State  | n | % |
| --- | --- | --- |
| Western Australia | 687 | 14% |
| New South Wales | 1,087 | 22% |
| Australian Capital Territory | 190 | 4% |
| Queensland | 754 | 15% |
| South Australia | 598 | 12% |
| Tasmania | 364 | 7% |
| Northern Territory | 150 | 3% |
| Victoria | 1,061 | 22% |
| Other Territories | 0 | 0% |
| Total | 4,891 |  |

1. What is the highest level of education that you have completed?

| Education | n | % |
| --- | --- | --- |
| Year 10 or below | 354 | 7% |
| Year 11 or equivalent | 189 | 4% |
| Year 12 or equivalent | 695 | 14% |
| A trade, technical certificate or diploma | 1,357 | 28% |
| A university degree | 1,377 | 28% |
| Postgraduate qualifications | 916 | 19% |
| Total  | 4,888 |  |

1. Which of the following best describes your current employment status?

| Employment status  | n | % |
| --- | --- | --- |
| Full-time | 2,018 | 41% |
| Part-time | 537 | 11% |
| Casual | 247 | 5% |
| Self employed | 280 | 6% |
| Not employed | 156 | 3% |
| Student | 73 | 1% |
| Retired | 1,193 | 24% |
| Home duties | 232 | 5% |
| Unable to work | 114 | 2% |
| Other | 34 | 1% |
| Total | 4,884 |  |

1. Do you own or rent the home you live in?

| Home ownership | n | % |
| --- | --- | --- |
| I pay rent/board to a private landlord or real estate agent | 1,059 | 22% |
| I pay rent/board through public or community housing | 189 | 4% |
| I'm paying a mortgage on the home | 1,623 | 33% |
| I own the home outright and do not have a mortgage | 1,707 | 35% |
| I live with family or friends and do not pay rent | 242 | 5% |
| Other (please specify) | 69 | 1% |
| Total | 4,889 |  |

1. Is English the main language spoken at home?

| English spoken at home | n | % |
| --- | --- | --- |
| No | 360 | 7% |
| Yes | 4,517 | 93% |
| Total | 4,877 |  |

1. Climate zone (derived from ‘What is the postcode where you usually live?’)

| Climate zone | n | % |
| --- | --- | --- |
| Hot humid summer, warm winter | 185 | 4% |
| Warm humid summer, mild winter | 680 | 14% |
| Hot dry summer, warm winter | 45 | 1% |
| Hot dry summer, cool winter | 97 | 2% |
| Warm temperate | 1,758 | 37% |
| Mild temperate | 1,347 | 28% |
| Cool temperate | 657 | 14% |
| Total | 4,769 |  |

1. Solar zone (derived from ‘What is the postcode where you usually live?’)

| Solar zones | n | % |
| --- | --- | --- |
| Zone 1 (highest) | 37 | 1% |
| Zone 2 | 151 | 3% |
| Zone 3 | 3,375 | 71% |
| Zone 4 | 1,214 | 25% |
| Total | 4,777 |  |

### Climate motivations

1. Have you heard the term *net zero* before when talking about climate change?

| Awareness  | n | % |
| --- | --- | --- |
| No, never heard it | 604         | 12% |
| I think I have | 1,653         | 34% |
| Yes, I'm familiar with it | 2,437         | 50% |
| Not sure | 194         | 4% |
| Total | 4,888         |  |

1. Please rate your agreement or disagreement with the following statements about climate change.

| Climate change beliefs | Strongly disagree | Somewhat disagree | Neither | Somewhat agree | Strongly agree | n |
| --- | --- | --- | --- | --- | --- | --- |
| I believe that climate change is real | 5% | 5% | 11% | 29% | 51% | 4,866 |
| Climate change will bring about serious negative consequences | 5% | 7% | 15% | 31% | 42% | 4,874 |
| The main cause of climate change is human activity | 6% | 8% | 14% | 35% | 37% | 4,876 |
| My local area will be influenced by climate change | 5% | 6% | 21% | 39% | 28% | 4,873 |
| It will be a long time before the consequences of climate change are felt | 19% | 27% | 19% | 24% | 11% | 4,875 |
| If we act collectively, we can limit further climate change | 6% | 7% | 13% | 39% | 35% | 4,879 |
| I believe my actions can have a positive effect on climate change | 7% | 8% | 19% | 45% | 22% | 4,877 |

1. How important is it to you that you limit your greenhouse gas emissions?[[1]](#footnote-2)

| Importance | n | % |
| --- | --- | --- |
| Not at all important | 390         | 8% |
| Slightly important | 511         | 10% |
| Moderately important | 1,195         | 24% |
| Very important | 1,591         | 33% |
| Extremely important | 1,193         | 24% |
| Total | 4,880         |  |

1. How confident are you that you know which individual or household actions most limit greenhouse gas emissions?

| Confidence | n | % |
| --- | --- | --- |
| Not at all confident | 340         | 7% |
| Not very confident | 975         | 20% |
| Neutral | 1,499         | 31% |
| Fairly confident | 1,659         | 34% |
| Very confident | 412         | 8% |
| Total | 4,885         |  |

### Home upgrades

1. How many people live in your household?

| Number of people | n | % |
| --- | --- | --- |
| 1 (only me) | 895         | 18% |
| 2 | 2,046         | 42% |
| 3 | 818         | 17% |
| 4 | 751         | 15% |
| 5 | 254         | 5% |
| 6 | 85         | 2% |
| 7 or more | 37         | 1% |
| Total | 4,886         |  |

1. Is there someone at home during the day?

| Someone at home | n | % |
| --- | --- | --- |
| Hardly ever or never | 403         | 8% |
| Some of the time | 935         | 19% |
| Half of the time | 946         | 19% |
| All or most of the time | 2,594         | 53% |
| Total | 4,878         |  |

1. What type of building do you live in?

| Type of home | n | % |
| --- | --- | --- |
| Separate house | 3,474         | 71% |
| Semi-detached, row or terrace house or townhouse | 591         | 12% |
| Flat or apartment | 751         | 15% |
| Other type of home (please specify) | 67         | 1% |
| Total | 4,883         |  |

1. Is your home located within shared or common property?

| Shared or common property | n | % |
| --- | --- | --- |
| No | 3,702         | 76% |
| Residence with a body corporate, home owners association or strata title | 901         | 18% |
| Retirement village | 107         | 2% |
| Caravan Park | 19         | 0% |
| Don't know | 96         | 2% |
| Other (please specify) | 55         | 1% |
| Total | 4,880         |  |

1. What year was your home built? (If unsure, please take your best guess)

| Year of build | n | % |
| --- | --- | --- |
| Pre-1900 | 98         | 2% |
| 1900-1949 | 265         | 5% |
| 1950-1979 | 1,006         | 21% |
| 1980-1999 | 1,361         | 28% |
| 2000-2009 | 856         | 18% |
| 2010-2014 | 523         | 11% |
| 2015-2019 | 530         | 11% |
| 2020-2023 | 245         | 5% |
| Total | 4,884         |  |

1. How energy efficient do you think your home is?

| Self-rated energy efficiency | n | % |
| --- | --- | --- |
| Terrible | 148         | 3% |
| Poor | 580         | 12% |
| Average | 2,128         | 45% |
| Good | 1,541         | 32% |
| Excellent | 363         | 8% |
| Total | 125         |  |

1. Has your home ever had an energy assessment?

| Home ever had an energy assessment | n | % |
| --- | --- | --- |
| Yes | 552         | 11% |
| No | 3,249         | 66% |
| Don't know | 1,085         | 22% |
| Total | 4,886         |  |

1. Do you know what rating scheme was used to assess your home?[[2]](#footnote-3)

| Efficiency rating scheme used | n | % |
| --- | --- | --- |
| NatHERS - Nationwide House Energy Rating Scheme | 37         | 7% |
| NSW BASIX scheme | 30         | 5% |
| NABERS | 33         | 6% |
| Green Star | 81         | 15% |
| ACT EER | 47         | 9% |
| Victorian Residential Efficiency Scorecard | 30         | 5% |
| Don't know | 283         | 52% |
| Other (please tell us) | 8         | 1% |
| Total | 549         |  |

1. Do you know your home’s energy efficiency star rating?[[3]](#footnote-4)

| Efficiency star rating | n | % |
| --- | --- | --- |
| Less than 1 star | 5         | 1% |
| 1 or 2 stars | 11         | 2% |
| 3 or 4 stars | 50         | 9% |
| 5 or 6 stars | 134         | 24% |
| 7 or 8 stars | 104         | 19% |
| 9 or 10 stars | 29         | 5% |
| Don't know | 209         | 38% |
| Other (please tell us) | 9         | 2% |
| Total | 551         |  |

1. Thinking about your home, do you think that renovating your home or replacing a major appliance would reduce your energy bill?

| Think home upgrade would reduce energy bills | n | % |
| --- | --- | --- |
| Definitely not | 267         | 5% |
| Unlikely | 1,508         | 31% |
| Likely | 2,311         | 47% |
| Definitely | 800         | 16% |
| Total | 4886         |  |

1. How confident are you that you could choose the right renovation or major appliance upgrade to reduce your energy bills?[[4]](#footnote-5)

| Confidence in choosing the right upgrade | n | % |
| --- | --- | --- |
| Not confident at all | 91         | 3% |
| Not very confident | 557         | 18% |
| Somewhat confident | 1,827         | 59% |
| Very confident | 628         | 20% |
| Total | 3,103         |  |

1. Does your current home have insulation?

| Insulation | n | % |
| --- | --- | --- |
| Roof insulation | 3,153         | 65% |
| Wall insulation | 1692         | 35% |
| Underfloor insulation | 367         | 8% |
| No | 547         | 11% |
| Don't know  | 875         | 18% |
| Total | 4,880         |  |

1. Does your current home have double glazing?

| Glazing | n | % |
| --- | --- | --- |
| Double or triple glazing on all windows | 3,182         | 9% |
| Double or triple glazing on most windows | 463         | 6% |
| Double or triple glazing on some windows | 317         | 5% |
| No | 260         | 65% |
| Don't know | 659         | 14% |
| Total | 4,881         |  |

1. Does your current home have a natural gas connection?

| Gas connection | n | % |
| --- | --- | --- |
| Mains gas | 2,519         | 52% |
| Bottle gas | 550         | 11% |
| No gas connection to the house | 1,577         | 32% |
| Don't know | 242         | 5% |
| Total | 4,888         |  |

1. Have you ever replaced any gas appliances with electric appliances?[[5]](#footnote-6)

| Ever replaced gas with electric appliance | n | % |
| --- | --- | --- |
| No | 1,926         | 63% |
| No, but I'm considering doing so in future | 461         | 20% |
| Yes | 607         | 15% |
| Don't know | 66         | 2% |
| Total | 3,060         |  |

1. Have you had your gas connection disconnected and switched your appliances to electric?[[6]](#footnote-7)

| Ever disconnected gas connection | n | % |
| --- | --- | --- |
| Yes, in the last two years | 46         | 3% |
| Yes, more than two years ago | 69         | 4% |
| No, have never had a gas connection in this house | 1,397         | 89% |
| Don't know | 60         | 4% |
| Total | 1,572         |  |

1. What were your reasons for replacing gas appliances with electric appliances?[[7]](#footnote-8)

| Reasons switched from gas to electric appliance | n | % |
| --- | --- | --- |
| To save on energy costs | 292         | 51% |
| To be environmentally sustainable | 227         | 40% |
| To improve the value of the house | 97         | 17% |
| To make the home more comfortable | 134         | 23% |
| Better performing appliances | 243         | 42% |
| To improve the air quality in the home | 130         | 23% |
| Don't know | 24         | 4% |
| Other | 64         | 11% |
| Total | 574         |  |

1. Do you own any of the following vehicles (car, truck, or motorbike)?

| Vehicle owned | n | % |
| --- | --- | --- |
| Electric Vehicle | 147         | 3% |
| Hybrid Vehicle | 259         | 5% |
| Petrol Vehicle | 3,793         | 78% |
| Diesel Vehicle | 1,000         | 20% |
| None | 377         | 8% |
| Don't know | 14         | 0% |
| Other vehicle (specify) | 34         | 1% |
| Total | 4,881         |  |

1. Does your home have any of the following features?

| Home features | n | % |
| --- | --- | --- |
| Fixed rooftop solar panels, no battery | 1,569         | 32% |
| A battery storage system connected to solar panels | 332         | 7% |
| Solar hot water | 717         | 15% |
| Smart meter | 1,437         | 30% |
| Home energy power monitor (e.g. smart plug or in-home display) | 330         | 7% |
| Wind turbines | 56         | 1% |
| Passive design | 160         | 3% |
| Electric Vehicle charging point | 113         | 2% |
| Off-grid | 37         | 1% |
| None | 1,879         | 39% |
| Don't know | 183         | 4% |
| Total | 4,863         |  |

### Residential rooftop solar

1. Were your solar panels installed when the house was built?

| Solar panels installed after house built | n | % |
| --- | --- | --- |
| Yes | 314         | 17% |
| No, solar panels were installed later | 1,530         | 80% |
| Don't know | 57         | 3% |
| Total | 1,901         |  |

1. When were your solar panels installed? (If unsure, please take your best guess)

| Year solar panels installed | n | % |
| --- | --- | --- |
| Before 2000 | 11         | 1% |
| 2000-2009 | 113         | 7% |
| 2010-2014 | 354         | 23% |
| 2015-2019 | 497         | 32% |
| 2020-2023 | 504         | 33% |
| Don't know | 51         | 3% |
| Total | 1,530         |  |

1. What were all the reasons for installing solar panels?

| Reasons for installing solar | n | % |
| --- | --- | --- |
| To save on energy costs | 1,545         | 81% |
| To be environmentally sustainable | 899         | 47% |
| To improve the value of the house | 430         | 23% |
| To have off-grid access to electricity | 224         | 12% |
| To keep the power on during blackouts | 196         | 10% |
| To charge an electric vehicle | 94         | 5% |
| The choice was made by someone else | 184         | 10% |
| I don't remember | 16         | 1% |
| Other | 40         | 2% |
| Total | 1,901         |  |

1. Out of the reasons you’ve chosen, what was the main reason for installing solar?

| Main reason for installing solar | n | % |
| --- | --- | --- |
| To save on energy costs | 1,258         | 67% |
| To be environmentally sustainable | 256         | 14% |
| To improve the value of the house | 47         | 2% |
| To have off-grid access to electricity | 39         | 2% |
| To keep the power on during blackouts | 35         | 2% |
| To charge an electric vehicle | 24         | 1% |
| I don't remember | 16         | 1% |
| Don't know - the choice was made by someone else | 184         | 10% |
| Other (please specify) | 25         | 1% |
| Total | 1,884         |  |

1. These are some of the tasks that people might do when making the choice to get solar panels. Did you find these tasks easy or hard? (Participants with solar)

| Task | I didn't do this | Very difficult | Somewhat difficult | Somewhat easy | Very easy | n |
| --- | --- | --- | --- | --- | --- | --- |
| Choosing the system that was right for you | 8% | 5% | 23% | 43% | 20% | 1,693 |
| Working out how big a system was needed | 10% | 5% | 21% | 43% | 20% | 1,697        |
| Working out how big the savings would be | 13% | 8% | 25% | 39% | 14% | 1,690        |
| Checking my eligibility for government subsidies o | 17% | 6% | 17% | 38% | 23% | 1,693        |
| Choosing an installer | 8% | 6% | 20% | 44% | 22% | 1,693        |
| Getting finance or a loan | 60% | 3% | 8% | 18% | 11% | 1,690 |
| Learning the technical jargon | 15% | 10% | 26% | 35% | 14% | 1,691 |
| Deciding whether or not to get a battery | 29% | 6% | 19% | 26% | 20% | 1,695 |
| Deciding whether or not to get solar panels | 6% | 2% | 12% | 39% | 42% | 1,694 |
| Working out the environmental benefits | 25% | 6% | 17% | 33% | 19% | 1,692 |
| Working out how much money to spend | 9% | 5% | 24% | 41% | 21% | 1,695 |
| Getting a quote | 7% | 3% | 12% | 43% | 35% | 1,690 |

1. These are some of the tasks that people might do when making the choice to get solar. Are you finding these tasks easy or hard? (Participants without solar)

| Task | I have not done this | Very difficult | Somewhat difficult | Somewhat easy | Very easy | n |
| --- | --- | --- | --- | --- | --- | --- |
| Choosing the system that is right for you | 10% | 14% | 39% | 29% | 7% | 387 |
| Working out how big a system is needed | 10% | 13% | 37% | 32% | 8% | 387 |
| Working out how big the savings will be | 13% | 15% | 33% | 31% | 9% | 386 |
| Checking my eligibility for government subsidy | 14% | 13% | 32% | 31% | 10% | 387 |
| Choosing an installer | 16% | 19% | 33% | 26% | 6% | 388 |
| Getting finance or a loan | 36% | 9% | 22% | 24% | 8% | 387 |
| Learning the technical jargon | 10% | 15% | 36% | 31% | 9% | 387 |
| Deciding whether or not to get a battery | 10% | 11% | 36% | 31% | 11% | 387 |
| Deciding whether or not to get solar panels | 3% | 6% | 30% | 39% | 23% | 388 |
| Working out the environmental benefits | 13% | 6% | 23% | 43% | 15% | 386 |
| Working out how much money to spend | 9% | 15% | 36% | 32% | 7% | 388 |
| Getting a quote | 15% | 6% | 19% | 43% | 17% | 385 |

1. Was the cost of solar panels higher or lower than you expected?

| Cost of solar compared to expectations | n | % |
| --- | --- | --- |
| A lot higher | 165         | 10% |
| A bit higher | 466         | 27% |
| As expected | 858         | 51% |
| Lower | 110         | 6% |
| Don't know | 100         | 6% |
| Total | 1,699         |  |

1. How did you manage the upfront cost of the solar panels? (The amount you needed to pay after any rebates or discounts were applied). Select all that apply.

| Upfront cost of solar panels | n | % |
| --- | --- | --- |
| Used savings | 1,125         | 66% |
| Financed with a mortgage (e.g. line of credit, redraw or by increasing mortgage) | 163         | 10% |
| Financed with a personal loan | 108         | 6% |
| Financed with a credit card | 133         | 8% |
| Financed with a low interest green loan (or a government loan) | 144         | 8% |
| Don't know | 84         | 5% |
| Other | 133         | 8% |
| Total | 1,699         |  |

1. Did you notice any of the following before you got solar panels installed?

| Noticed | n | % |
| --- | --- | --- |
| A neighbour had solar panels or a battery installed | 272         | 16% |
| Friends or family had solar panels or a battery installed | 508         | 30% |
| You came across a website containing helpful information o | 353         | 21% |
| You heard about government subsidies or rebates for solar | 782         | 46% |
| A door to door salesperson offered to assess your home for | 167         | 10% |
| A salesperson or installer provided you with helpful information | 473         | 28% |
| You heard about loan or finance options for solar panels o | 181         | 11% |
| None of the above | 340         | 20% |
| Total | 1,696         |  |

1. Have you been satisfied or dissatisfied with your solar panels?

| Satisfaction | n | % |
| --- | --- | --- |
| Dissatisfied | 113         | 6% |
| A bit of both | 468         | 25% |
| Satisfied | 1,202         | 63% |
| Don't know | 111         | 6% |
| Total | 1,894         |  |

1. Would you like your home to have rooftop solar?

| Would like solar | n | % |
| --- | --- | --- |
| No | 329         | 11% |
| Not really | 472         | 16% |
| Yes, somewhat | 1,038         | 35% |
| Yes, very much | 1,151         | 38% |
| Total | 2,990         |  |

1. What are all the reasons you would like your home to have rooftop solar?

| Reasons for wanting solar | n | % |
| --- | --- | --- |
| To save on energy costs | 1,960         | 90% |
| To be environmentally sustainable | 1,490         | 68% |
| To improve the value of the house | 633         | 29% |
| To have off-grid access to electricit | 804         | 37% |
| To keep the power on during blackouts | 704         | 32% |
| To charge an electric vehicle | 165         | 8% |
| Don't know | 30         | 1% |
| Other | 13         | 1% |
| Total | 2,188         |  |

1. Out of the reasons you’ve chosen, what is the main reason you would like your home to have rooftop solar?

| Main reason for wanting solar | n | % |
| --- | --- | --- |
| To save on energy costs | 1,364         | 63% |
| To be environmentally sustainable | 541         | 25% |
| To improve the value of the house | 44         | 2% |
| To have off-grid access to electricity | 90         | 4% |
| To keep the power on during blackouts | 75         | 3% |
| To charge an electric vehicle | 22         | 1% |
| Don't know | 30         | 1% |
| Other (please specify) | 6         | 0% |
| Total | 2,172         |  |

1. Are you planning to have rooftop solar installed?

| Planning to install solar | n | % |
| --- | --- | --- |
| Not my choice to make | 572         | 26% |
| No | 257         | 12% |
| Unlikely | 230         | 11% |
| Yes some day | 507         | 23% |
| Yes in the next five years | 336         | 15% |
| Yes in the next year | 151         | 7% |
| No, don't want solar | 0         | 0% |
| Don't know | 132         | 6% |
| Total | 2,185         |  |

1. Have you started investigating the options for rooftop solar yet?[[8]](#footnote-9)

| Started investigating rooftop solar | n | % |
| --- | --- | --- |
| No | 98         | 20% |
| A little | 290         | 60% |
| Yes | 99         | 20% |
| Total | 487         |  |

### Cost of living

1. How do you think the price you pay for electricity ($ per kilowatt-hour) has changed since this time last year?

| Perceived rise in electricity prices | n | % |
| --- | --- | --- |
| Price has gone up a lot | 2,644 | 54% |
| Price has gone up a bit | 1,560 | 32% |
| No change | 255 | 5% |
| Price has gone down | 94 | 2% |
| Don’t know | 280 | 6% |
| NA | 47 | 1% |
| Total | 4,880 |  |

1. How do you think the price you pay for gas ($ per megajoule) has changed since this time last year?

| Perceived rise in mains gas prices | n | % |
| --- | --- | --- |
| Price has gone up a lot | 23         | 50% |
| Price has gone up a bit | 181         | 35% |
| No change | 891         | 7% |
| Price has gone down | 1,261         | 1% |
| Don’t know | 162         | 6% |
| NA | 0        | 0% |
| Total | 2,518         |  |

1. How do you think the price you pay for gas ($ per bottle) has changed since this time last year?

| Perceived rise in bottle gas prices | n | % |
| --- | --- | --- |
| Price has gone up a lot | 19         | 31% |
| Price has gone up a bit | 71         | 40% |
| No change | 222         | 13% |
| Price has gone down | 172         | 3% |
| Don’t know | 65         | 12% |
| NA | 0    | 0% |
| Total | 549         |  |

1. Perceived rise in energy prices[[9]](#footnote-10)

| Perceived rise in energy prices | n | % |
| --- | --- | --- |
| No | 276 | 6% |
| Yes | 4,333 | 94% |
| Total | 4,609 |  |

1. Who is responsible for making financial decision in your household, including making major purchases?

| Responsibility for financial decisions | n | % |
| --- | --- | --- |
| Me | 2,250         | 46% |
| Someone else | 314         | 6% |
| Shared responsibility | 2,304         | 47% |
| Other | 11         | 0% |
| Total | 4,879         |  |

1. Given your current needs and financial responsibilities, would you say that you are:

| Current level of financial comfort | n | % |
| --- | --- | --- |
| Struggling | 559 | 11% |
| Just getting along | 1,590 | 33% |
| Reasonably comfortable | 2,193 | 45% |
| Very comfortable | 495 | 10% |
| Prefer not to say | 45 | 1% |
| Total | 4,882 |  |

1. In the last 12 months, did any of the following happen to you because of a shortage of money?

| Financial hardship indicators | n | % |
| --- | --- | --- |
| Could not pay electricity, gas or telephone bills on time | 412         | 8% |
| Could not pay the mortgage or rent on time | 250         | 5% |
| Pawn or sold something | 439         | 9% |
| Went without meals  | 412         | 8% |
| Was unable to heat home | 363         | 7% |
| Asked for financial help from family and friends | 481         | 10% |
| Asked for help from welfare / community organisation | 153         | 3% |
| None of these  | 3604         | 74% |
| Total | 4,877         |  |

1. How much could you afford to pay upfront? (without needed a loan or credit)

| Amount they could afford to pay upfront | n | % |
| --- | --- | --- |
| Little or nothing | 976         | 20% |
| Up to $500 | 412         | 8% |
| Up to $1000 | 524         | 11% |
| Up to $2000 | 711         | 15% |
| Up to $5000 | 766         | 16% |
| Up to $10,000 | 454         | 9% |
| More than $10,000 | 595         | 12% |
| Don’t know | 449         | 9% |
| Total | 4,887         |  |

## Appendix 4: Regression Results

### Solar panel uptake is significantly predicted by living in a house, owning your home, and living in a geographical area that receives more solar radiation

We hypothesised that home ownership status, type of housing, financial comfort, and solar zone would have a stronger effect on solar panel uptake than self-perceived efficacy and attitudes towards energy reduction. We expected:

* Renting (rather than owning your home) to be a barrier to having solar panels installed, as renters cannot make the decision themselves.
* ‘Strong enablers’ facilitate uptake of solar panels, and include: living in a separate or semi-detached house (rather than an apartment), living in a low solar zone (where lower numbers indicate the geographical area receives more solar radiation and is therefore eligible for a higher government rebate), and a greater level of self-rated financial comfort.
* ‘Soft enablers’ that may be related to uptake of solar panels. Soft enablers are: greater response efficacy (i.e. belief that climate change can be mitigated), greater self-rated importance of limiting greenhouse gas emissions, and a belief that renovating your home or upgrading appliances can reduce energy bills.

Table 65 shows that renting was significantly related to lower solar uptake. But solar uptake among renters was not zero; 17.5% of renters reported having solar panels. It is possible that most (or all) of these renters live in properties whose owners decided to install solar panels (that is, the decision to install solar panels had nothing to do with the tenants).

Living in a detached or semi-detached house was even more influential than rental status, and had the largest effect of all predictors tested.

People living in solar zone 4 (i.e. the areas of the country that receive the least solar radiation) were less likely to have solar panels than people living in solar zones 1, 2, or 3. Other research has also found a relationship between solar uptake and geographical location, based on solar radiation and therefore amount of government subsidy received (e.g. Best et al. 2019).

Although self-rated level of financial comfort was a significant predictor, it had a relatively small effect. It is likely that a more precise measure of financial status *at the time rooftop solar was installed* may be more predictive.

Of the soft enablers, only the self-rated importance of limiting personal greenhouse gas emissions was a significant predictor. The size of this effect was comparable to the size of the effect of financial comfort. Response efficacy and the belief that a household renovation or upgrade could reduce energy bills had non-significant effects.

1. Results of the hierarchical regression testing strong and soft enablers of installing solar panels.

| Independent Variables | Strong enablers | Soft enablers |
| --- | --- | --- |
| **Renting** | -.197\*\*\* | -.200\*\*\* |
| **Living in a house** | .262\*\*\* | .262\*\*\* |
| Living in solar zone 1 or 2 (zone 3 reference group)  | -.059 | -.060 |
| **Living in solar zone 4 (zone 3 reference group)** | -.153\*\*\* | -.153\*\*\* |
| **Financial comfort** | .067\*\*\* | .063\*\*\* |
| Climate change response efficacy |  | -.001 |
| **Personal importance of limiting greenhouse gas emissions** |  | .071\*\*\* |
| Belief that upgrade or renovation can reduce energy bills |  | .004 |
| *N* | 4,697 | 4,679 |
| Adjusted *R2* | .121 | .125 |
| *R2change* |  | .004 |

*Note.* Entries are estimated coefficients; \*p < .05, \*\*p < .01, \*\*\*p < .001. Significant predictors in the final model are shown in bold.

### Climate change beliefs have a larger effect on intentions to install solar panels, than actual solar panel uptake

We again hypothesised that home ownership status, type of housing, financial comfort, and solar zone would have a stronger effect on intending to install solar panels than self-perceived efficacy and attitudes towards energy reduction.

We operationalised ‘intending to install solar panels’ as responding *Yes in the next year* or *Yes in the next five years* to the question ‘Are you planning to have rooftop solar installed?’.

Respondents only answered this question about intentions to install rooftop solar if they previously said they would like to have rooftop solar. We excluded renters from this analysis, because very few said they would like to have rooftop solar. Based on qualitative responses, we think that many renters who said they would not like solar said that because they *cannot* install solar.

Table 66 shows that the soft enablers played a much larger role in intending to install solar panels than they did in explaining actual solar uptake (as previously shown in Table 65). All three soft enablers were significant predictors, suggesting beliefs about emissions reduction are related to motivations to install solar.

Living in a house rather than an apartment had a large significant effect on intentions. Solar zone or level of financial comfort were not significant predictors.

The difference in results between actual solar panel uptake and intentions to install solar point to an intention-action gap. Intention-action gaps are widely documented in the literature on environmental behaviours (Grandin et al. 2021; Kormos and Gifford 2014). For many of the reasons we outlined earlier in the document, climate change beliefs might drive a desire for solar but not actually translate into solar uptake. The results of this regression show that the people who ultimately installed solar were also more financially comfortable.

1. Results of the regression testing strong and soft enablers of intending to install solar panels

| Independent Variables | Strong enablers | Soft enablers |
| --- | --- | --- |
| **Living in a house** | .129\*\*\* | .126\*\*\* |
| Living in solar zone 1 or 2 (zone 3 reference group)  | -.058 | -.061 |
| Living in solar zone 4 (zone 3 reference group) | -.014 | -.018 |
| Financial comfort | .019 | .014 |
| **Climate change response efficacy** |  | .042\*\*\* |
| **Personal importance of limiting greenhouse gas emissions** |  | .083\*\*\* |
| **Belief that upgrade or renovation can reduce energy bills** |  | .124\*\*\* |
| *N* | 1,696 | 1,686 |
| Adjusted *R2* | .013 | .087 |
| *R2change* |  | .074 |

*Note.* Entries are estimated coefficients; \*p < .05, \*\*p < .01, \*\*\*p < .001. Significant predictors in the final model are shown in bold.

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1. In the survey question we included the following text: “When we talk about 'limiting greenhouse gas emissions' in this survey, we are talking broadly about any actions that prevent carbon dioxide and methane being released into the atmosphere, tackling the most widely agreed cause of climate change.” [↑](#footnote-ref-2)
2. This question was only displayed to respondents who answered ‘Yes’ to ever had an energy assessment. [↑](#footnote-ref-3)
3. This question was only displayed to respondents who answered ‘Yes’ to ever had an energy assessment. [↑](#footnote-ref-4)
4. This question was only displayed to respondents who answered ‘Definitely’ or ‘Likely’ to home upgrades would reduce their energy bills. [↑](#footnote-ref-5)
5. This question was only displayed to respondents who answered ‘Mains gas’ or ‘Bottle gas’ to home has natural gas connection. [↑](#footnote-ref-6)
6. This question was only displayed to respondents who answered ‘No gas connection to the house’ to home has natural gas connection. [↑](#footnote-ref-7)
7. This question was only displayed to respondents who answered ‘Yes’ to ever replaced any gas appliances with electric appliances, or ‘Yes’ to ever disconnected gas connection from home. [↑](#footnote-ref-8)
8. This question was only asked to respondents who said ‘Yes’ to planning to have rooftop solar installed. [↑](#footnote-ref-9)
9. ‘Yes’ responses if respondents answered ‘How do you think the price you pay for electricity ($ per kilowatt-hour) / gas ($ per megajoule) / gas ($ per bottle) has changed since this time last year?’ was ‘Price has gone up a lot’ or ‘Price has gone up a bit’. [↑](#footnote-ref-10)