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CSIRO Electric Driveway Project

Social Study on Attitudes, Drivers and Barriers to the Uptake of Electric Vehicles

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ABOUT THE CSIRO ELECTRIC DRIVEWAY PROJECT

The CSIRO Electric Driveway Project is undertaking a comprehensive assessment of potential electric vehicle (EV) uptake and use under Australian conditions, exploring potential future synergies between the different components of Australia's electricity and transport sectors. The research project is hosted by CSIRO's Energy Transformed Flagship and draws on the strengths of CSIRO, a Victorian Government consortium, university collaborators and industry in a creative and effective partnership.

For further information visit www.electricdriveway.com.au

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1. EXECUTIVE SUMMARY

This work forms part of the larger Electric Driveway project in CSIRO's Energy Transformed Flagship. The Electric Driveway project aims to demonstrate the intelligent integration of electric vehicles with home energy management, to develop integration technology prototypes, and to develop a toolkit for analysing scenarios of electric vehicle uptake in Australia, including policy/regulatory assessments and environmental impacts.

Within the broader Electric Driveway project, this social research was conducted in order to identify potential drivers and barriers associated with the uptake of electric vehicles and the uptake of the *electric driveway* concept (in which electric vehicles are integrated with household energy management technology, allowing the optimal exchange of electricity between the grid, the house and the batteries of the electric vehicle), and to characterise the potential uptake of electric vehicles and the electric driveway.

The social research described in this report consisted of two focus groups, a pilot survey, and a large-scale survey of Victorian car owners. The focus groups provided background on public perceptions of electric vehicles and of the electric driveway technology, and allowed us to develop more detailed questions for the surveys. These questions were further refined using a pilot survey of 200 people, before the final survey was administered to 2101 Victorian car owners. The survey measured a range of demographic and psychographic features, as well as self-reported measures of the likelihood that the respondents would purchase an electric car in the future, and the likelihood that they would adopt the electric driveway technology if they had an electric vehicle.

Qualitative Responses

The survey included several open-ended questions, which were designed to allow us to gather impressions of beliefs and concerns that were not coloured by the later content in the survey. Brief summaries of responses to the questions are shown below:

What would encourage you to buy an electric car? Acceptably low purchase price was the predominant consideration here (along with other cost-related issues like affordability and government subsides), followed by environmental benefits, running costs, range (including comments on battery capacity), recharging issues (ease and speed of recharging, availability of recharging points). Occasional mentions were made regarding the availability of features compared to normal cars, reliability, quiet operation, size of the vehicle, and power. A number of people also commented that they would never consider buying an electric car.

What would discourage you from buying an electric car? High purchase price and limited range (and low battery capacity) were frequently mentioned, as well as running costs (and battery replacement cost, increasing costs of electricity), general concerns about new and "untested" technology, safety concerns regarding stored electricity, lack of knowledge/information about electric vehicles, and concerns about ease and availability of charging. The emissions generated from electricity production were only occasionally mentioned, along with issues of lack of power, low speed, ugly shape, and lack of room.

Where would you want to recharge if you had an electric car? The most common response here was "at home". Recharging at work was also frequently mentioned, and there were a number of less frequent responses including petrol stations, "recharge points", shopping centres, parking garages, and also "anywhere I wanted to when it needed charging".

Questions about electric driveway technology. Questions raised by respondents about the ED concept primarily centred on issues of cost, further details of exactly how the system would

work, and concerns about complexity. Less frequent were questions about the impact on battery life, safety and reliability, and concerns about limiting the range of the electric vehicle.

Potential Uptake of Electric Vehicles

Demographic factors. Analyses identified some demographic influences that were slightly related to potential uptake. People who reported past performance of more emissions-relevant behaviours (like using solar hot water and attending to energy efficiency when buying appliances), people with higher levels of education, and younger people were more likely to report higher levels of potential uptake of electric vehicles.

Psychographic factors. A number of attitudes and beliefs showed strong relationships with potential uptake of EVs. In particular, concern about climate change and the importance of environmental issues were strongly related to potential uptake of electric vehicles, and a tendency to adopt new technology was also a positive predictor. Negative attitudes to electric vehicles were (as might be expected) negatively related to potential uptake, and having heard about electric vehicles in the media was positively related. The strongest single predictor of potential uptake was reporting positive attitudes to electric vehicles.

Comparison between conventional and electric vehicles. Impressions that EVs were better for the environment, able to do everything a conventional car can do, and more reliable were positively associated with levels of potential EV uptake. Less strongly related were a number of impressions that were not necessarily accurate (EVs have more standard features, are faster, and are less expensive to buy). Several negative perceptions were related to lower levels of potential uptake (EVs are more expensive to run, less powerful, and more complicated). These results demonstrate the presence of misperceptions amongst some respondents (especially relating to relative purchase price and running costs), which may indicate that respondents are relatively uninformed about the details of current-generation electric vehicles. This finding mirrors earlier evidence from the focus groups, suggesting that electric vehicles are often viewed as a “distant future” technology, and that people are often unaware that EVs are already being produced by a number of car manufacturers.

Predicting uptake. Analyses that incorporated all drivers to model potential uptake demonstrated that overall, the most important predictors were concern about climate change, tendency to take up new technology, positive attitudes to EVs, beliefs that EVs are better for the environment, and that they compare favourably with conventional vehicles in a number of ways.

Potential Uptake of Electric Driveway Technology

Potential uptake measures for electric vehicles and electric driveway technology were highly positively correlated: people who reported higher potential uptake of one were very likely to report higher potential uptake of the other. In addition, individual predictors tended to show similar relationships with ED uptake as with EV uptake. Therefore, we focussed on determining whether any of the potential predictors of ED uptake had any additional impact on prediction after accounting for differences in EV uptake. Regression modelling indicated that potential EV uptake was by far the strongest predictor of potential ED uptake, with some minor contributions made by a history of emissions-relevant behaviour, knowledge of ways to reduce greenhouse emissions, and a perception of EVs as being “better for the environment”.

Describing Purchase Decisions for Electric Vehicles

The relationship between potential for EV uptake and the relative importance of various vehicle features was examined. Some vehicle features appeared to be important for all people when considering a choice between a conventional and an electric vehicle: the cost of replacing the

battery in an electric car, maintenance cost, running costs, up-front cost of the car, ease of recharging the electric car, the total cost of ownership, safety and reliability.

Some features were less important for those people with a higher potential for EV uptake: top speed, size of the car, amount of power/torque, level of standard features, comfort level inside the car, time it takes to refuel / recharge, range of the vehicle. Two issues were more important for those people with higher potential for EV uptake: amount of noise made and level of CO_2 emissions. A final feature, the appearance of the car, was judged to be relatively unimportant for all respondents.

Overall, it appears that people with a high potential for EV purchase are much more concerned about CO_2 emissions than other people, and are less concerned by a number of features that are considered to be lacking in electric vehicles (e.g. time to recharge, range, speed, power, and size).

2. INTRODUCTION

This work forms part of the larger Electric Driveway project in CSIRO's Energy Transformed Flagship. The Electric Driveway project aims to demonstrate the intelligent integration of electric vehicles with home energy management, to develop integration technology prototypes, and to develop a toolkit for analysing scenarios of electric vehicle uptake in Australia, including policy/regulatory assessments and environmental impacts.

2.1 Aims

Within the broader project, this social research was conducted in order to:

- Identify potential drivers and barriers associated with the uptake of electric vehicles
- Identify potential drivers and barriers associated with the uptake of the *electric driveway* concept (integrating electric vehicles with household energy management technology)
- Characterise the potential for uptake of electric vehicles and the electric driveway from a large sample of the Victorian population.

2.2 Potential Drivers of EV uptake

The introduction and diffusion of electric vehicles (EVs) represents a major transition in land-based transportation, perhaps in the same order as the transition from horse-drawn carriages to automobiles. Combined with renewable energy, EVs hold the potential of significantly reducing emissions from the transport sector, which is estimated to increase from 14% of global emissions to 50% by 2050 (IEA, 2007). Building a market for EVs also addresses concerns over global oil depletion, energy security and air quality, particularly in densely populated urban environments.

Transportation is a societal function that operates as a complex socio-technical system, with well-established relationships among social groups in that system, as depicted in Figure 1 (Geels, 2005). Despite the prominence of EVs in the late 19th century, internal combustion engines (ICEs) emerged as the dominant transport technology by about 1905 (Cowan & Hulten, 1996). Initially, this was driven by aggressive mass production and marketing strategies, rather than by inherent technological advantages. Oil price shocks, and more recently, climate change concerns have tended to reinvigorate EV technology development, and have been met with growing government support (Hazeldine et al., 2009).

These drivers are shifting the socio-technical system for land based transportation. For example, the automobile market is witnessing significant growth in the market for small fuel-efficient cars. On the production side, auto-makers have been reconfiguring their operations for large-scale production of EVs. These changes have been met by an influx of EV infrastructure providers, and increased attention from regulators and policy makers (e.g. IEA, 2011).

However, the large-scale deployment of EVs presents risks and uncertainties for policy makers and electric utilities as they grapple with implications for regulation, policy and impacts on existing electricity infrastructure. In recent years, Australian electricity network providers have invested heavily in network infrastructure to replace aging assets and to cope with the growth in peak demand driven by the proliferation of electric appliances (Garnaut, 2011). Energy network capacity is geographically variable, and large-scale uptake of EVs will add further loads during charging, which raises the importance of predicting EV uptake, and mapping uptake spatially.

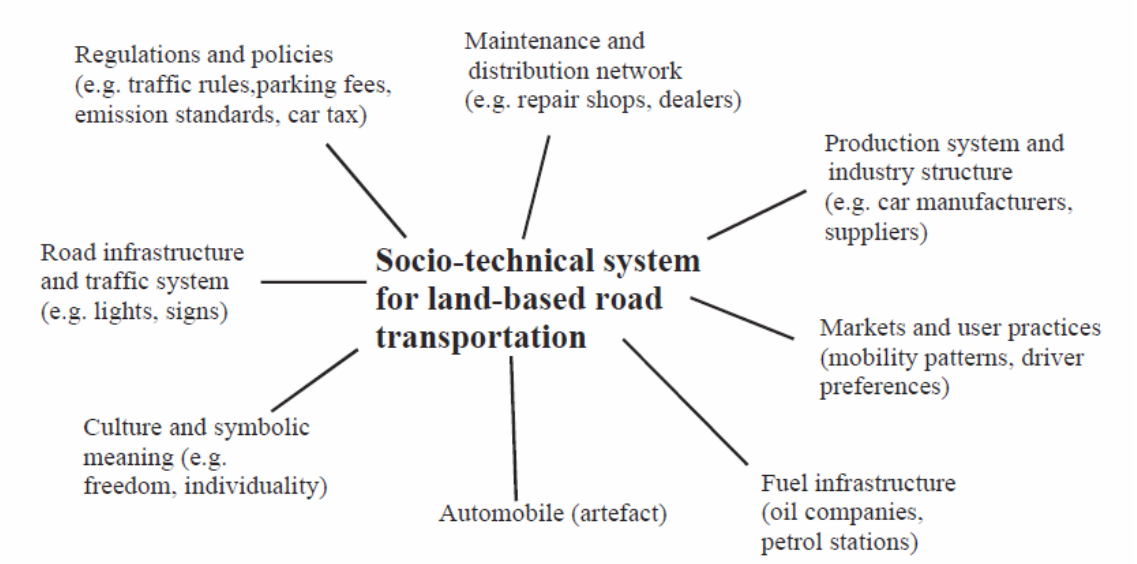

Figure 1: Socio-technical system for car-based transportation (Geels, 2005, p. 446).

Demographic characteristics often cluster spatially as localities and suburbs take on a certain character, aggregating people with similar incomes, age profiles, and education level. For example, a Swiss study comparing Toyota Prius Hybrid buyers to conventional ICE Corolla and Avensis buyers revealed that Prius buyers had higher household income and education level (de Hann et al., 2006). Recently, survey research with a large Turkish sample also demonstrated higher income and higher education level as important predictors of willingness to pay a premium for hybrid vehicles, but also highlighted the importance of global warming concerns (Erdem et al., 2010). Notwithstanding the importance of high incomes, other studies note the value of rebates in stimulating uptake of hybrid vehicles (e.g. Chandra et al., 2010).

Much research has identified consumer perceptions of EVs and attitudinal factors as key contributors to uptake. Early EV awareness and uptake studies revealed specific areas of consumer concern, namely purchase price, range, convenience of recharge facilities, and duration of recharging (Segal, 1995). One early study also highlighted the concern over cost and inconvenience of a dead battery (Cheron & Zins, 1997). More recently, Ernst and Young (2010) conducted a study of 4000 consumers to investigate interest in plug-in hybrid electric vehicles (PHEVs) and EVs in major global markets, and found that the main barriers were cost, range and access to charging stations, while fuel savings emerged as a key driver. These studies used decision modelling and other market forecasting methodologies, which typically vary vehicle attributes to determine consumer preferences. Other studies have drawn on social-psychological theories concerning pro-environmental behaviour and environmental concern to determine key drivers for uptake of low emission vehicles, including EVs (e.g. Lane & Potter, 2007; Ozaki & Sevastyanova, 2011).

The pro-environmental/environmental concern literature features cognitive behavioural theories, such as Ajzen's Theory of Planned Behaviour (TPB: Ajzen, 1991) which evolved from the earlier Theory of Reasoned Action (TRA: Ajzen & Fishbein, 1980). These theories suggest a linear process by which the values and beliefs of consumers lead to the adoption of certain behaviours, specifically through behavioural attitudes and intentions. The TRA asserts that consumers will develop intentions to adopt behaviour if they believe that behaviour will lead to a positive outcome and will be supported by those around them. TPB extends this theory by adding a further belief about how easy or difficult it is to perform the behaviour.

Research on environmental concern reveals an attitude-action gap, citing evidence to suggest that consumer behaviour has changed little despite growing public concern over environmental issues (Kalafatis et al., 1999; Kennedy et al., 2009). Perhaps only a segment of the market may be motivated substantially by environmental concern. For example, Ewing and Sarigollu (2000) conducted a study of 881 Montreal commuters, assessing their attitudes and preferences for clean fuel vehicles, including EVs. They surveyed 'general environmental attitude', 'environmental activism', 'locus of control', and 'attitude toward technology'. Forty percent of the sample was identified as 'actively concerned', and were likely to act on that concern by choosing EVs over conventional vehicles. Consistent with TPB, this group reported high pro-environmental attitudes, believe they have 'control' and indicated positive attitudes toward technology. However, the authors suggest that this group may have been over-represented in their sample.

The study by Ewing and Sarigollu (2000) also explored consumer preferences through discrete choice methodology. Results supported previous research, indicating that while environmental impact appears important, price and performance considerations (range, acceleration and refuelling time) were the critical determinants of consumer reactions.

Roger's (2003) Diffusion of Innovation Theory goes beyond notions of rational choice of product attributes or the rational link between values and beliefs and behaviour. According to the theory, adopting new technologies has an important emotional and social dimension. Consumers are influenced by their wider social network, which offers advice and approval. Therefore, Rogers puts forward five steps to adoption: gathering information about the innovation through social networks; forming an attitude; deciding whether to adopt; adopting it and confirming the decision. Axsen and Kurani (2009) found that social networks do in fact, impact on assessment of PHEVs. They undertook a qualitative study of 31 individuals in California, and found Diffusion of Innovation along with other social influence concepts useful in explaining their findings.

In the attitude formation step, Rogers (2003) suggests that consumers form attitudes based on perceptions of five characteristics of the new technology: relative advantage (economic and prestige), compatibility with existing values and practices, simplicity and ease of use, trialability (extent to which an innovation can be experimented with), and the degree to which consumers can observe results of adoption. In the case of EVs, purchasing decisions are likely to begin with consumers making comparisons with existing vehicle technologies (internal combustion vehicles) on basic attributes, such as cost and performance, and with previous experiences (refuelling, servicing, etc.), perhaps drawing heavily from the experiences and perspectives of key people in their social network.

A review of cleaner vehicle adoption studies in the UK revealed that motorist decisions are driven by financial and performance considerations, including price, fuel consumption, comfort, size, practicality and reliability (Lane & Potter, 2007). Environmental issues appear to play only a minor part. Based on the review, they propose a two stage process in the car-buying decision: consumers first evaluate overall capability and purchase price, and then they undertake a more detailed assessment of running costs, fuel economy, performance, safety, styling, image, brand and reliability.

In their review, Lane and Potter (2007) integrated literature compiled as part of the UK's Low Carbon Vehicle Partnership study (LowCVP, 2005). This review was graphically depicted in model (see Figure 2), which proposes a combined influence of psychological and situational factors, bringing together various notions of consumer rationality with habits and context-specific drivers.

Together the abovementioned studies provide an indication of what might predict EV adoption. The present survey of Victorian consumers incorporates past marketing and social research, and incorporates measures of the demographic and psychographic factors outlined above.

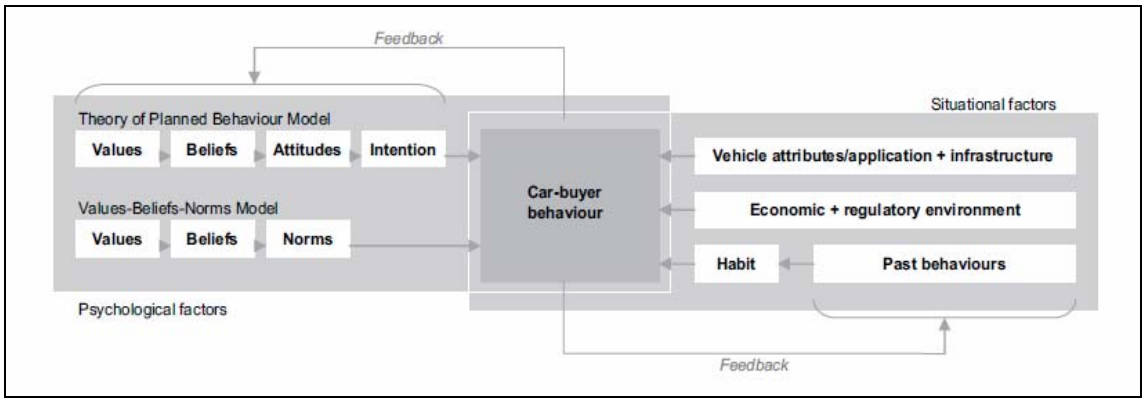

Figure 2: Integrated model of car-buying behaviour (Lane & Potter, 2007, p.1087).

2.3 Research Questions

The following research questions were addressed in the present study:

1. What issues and concerns do people raise about electric vehicles, charging locations, and electric driveway technology?
2. What best predicts the potential uptake of EVs, from amongst demographics, general psychographic measures, and EV-specific attitudes/perceptions?
3. What best predicts the potential uptake of electric driveway technology, from amongst demographics, general psychographic measures, and EV-specific attitudes/ perceptions?
4. How does potential uptake of electric vehicles and the electric driveway technology relate to each other?
5. How do people judge different aspects of vehicles when deciding between an electric and conventional vehicle?

3. STUDY 1: FOCUS GROUPS

Two focus groups were conducted with 17 adults from Melbourne to discuss participants' knowledge and impressions of electric vehicles, and their potential integration with household electricity consumption. The focus groups were intended to inform the subsequent survey work and the uptake modelling component of the Electric Driveway project. The focus groups identified a range of issues, concerns and questions that people raised with respect to electric vehicles and the notion of an 'electric driveway'.

For electric vehicles, these issues relate to the perception of electric vehicles in comparison with conventional cars, vehicle performance, issues of battery performance and the nature of charging, recharge infrastructure, cost upfront and over time, issues of maintenance and safety. Major potential drivers of the adoption of EVs appear to be their strong "green credentials", and the image of EVs as a "futuristic" technology. Major potential barriers to adoption include out-dated (and inaccurate) impressions of EV performance, distrust of battery technology to perform as advertised, and concerns about upfront cost.

For the electric driveway technology, the issues raised related to cost, some household-level practicalities, complexity of the technology, suspicions regarding energy companies, implications for the electricity grid, and implications for the battery of the EV in such a system. The rationale for the ED system as a way to address peak demand and rising energy costs appeared to be acceptable to the participants. A major barrier to acceptance and uptake appears to be concerns over the complexity of the technology, but this may not be an issue for more pro-technology consumers.

More detail on the focus group research is available in a separate report (Gardner & Quezada, 2010). Common responses from the focus groups were used to generate response categories for questions used in the survey.

4. STUDY 2: SURVEY

4.1 Method

4.1.1 Pilot survey

A pilot version of the survey was created, and two hundred participants drawn from the general population of Melbourne completed the survey in an online format. The collected data were examined to identify any potential misinterpretation of the survey wording, and to examine common open-ended responses. The most common open-ended responses were used to generate new response options for the final survey. In addition, some minor adjustments were made to question wording, and to response categories of some demographic questions, to improve clarity and to allow for easier integration with other sources of data.

4.1.2 Participants

For the main survey, data were gathered from 2101 adults drawn from the general population of Victoria. Fifty-three point three percent of respondents were female, and the median age range was 45 to 49 years. More detailed demographic information is provided in Appendix A.

To help assess the degree to which the sample was representative of the Victorian population, the demographic profile of the sample was compared to the profile for adults in Victoria drawn from ABS census data. The comparison indicated that the sample tended to over-represent older people, and under-represent younger people. This result is to be expected, since

participants in the research were selected on the basis of car ownership, which suggests an older demographic profile (see Appendix B for more details).

4.1.3 Survey

The survey was designed to assess a range of constructs, which were chosen on the basis of focus group research, the requirements of the diffusion modelling planned for the larger ED project, and on published research on adoption of innovation and adoption of electric vehicles. The survey was designed to allow administration as a telephone survey and as a self-completed online survey. Details of important measures in the survey are provided below, and a copy of the survey is presented in full in Appendix C.

Demographics. A range of items assessed standard demographic measures relating to the respondent (e.g. age, gender, education level), their household (e.g. household size & income), their current vehicles (e.g. number and details of existing cars), and their future plans for vehicles (when they will next purchase a car, how much they expect to spend). A set of five items also assessed current emission-relevant behaviours (e.g. purchase of green electricity, use of solar hot water, etc.). Responses on these items were combined into a single score ranging from 0 to 5, representing the total number of emission-relevant behaviours reported.

General psychographic measures

Some general psychographic measures were taken in the survey, to assess attitudes that did not relate specifically to electric vehicles, but which were expected on the basis of prior research to have some relationship with potential uptake. These measures assessed:

1. General knowledge of climate change
2. Specific knowledge of ways to reduce greenhouse emissions
3. Level of concern about climate change
4. Importance of environmental issues in general
5. Tendency to uptake new technology.

Potential uptake of electric vehicles. Five survey items assessed this construct:

- *Electric cars are a good idea*
- *Australians in general are likely to buy electric cars*
- *People I know are likely to buy electric cars*
- *I personally am likely to buy an electric car sometime in the future*
- *The next time I purchase a car, it is likely to be electric.*

These five questions about uptake of EVs were combined to form a single scale measure of potential EV uptake. This measure ranged from 1 to 6, with a mean score of 3.3 and a scale reliability of .86.

Potential uptake of *Electric Driveway* technology. Four items assessed this construct:

- *Using electric vehicles to partially power homes with off-peak or renewable electricity is a good idea*
- *Australians in general are likely to want to have such a system*
- *People I know are likely to want this system*
- *I personally would want this system if I had an electric car.*

These four questions about uptake of the electric driveway were combined to form a single scale measure of potential ED uptake. This measure ranged from 1 to 6, with a mean score of 4.0 and a scale reliability of .92.

General attitudes to EVs

Six items assessed general attitudes to electric vehicles. Three items addressed positive elements:

- *Electric cars are worth government investment*
- *Electric cars are likely to be the standard means of passenger transport in the future*
- *Electric cars can be recharged quickly*.

Three items assessed negative elements:

- *Electric cars need expensive recharging infrastructure*
- *Electric cars use expensive battery technology*
- *Electric cars are many years away from general public use.*

Both sets of items formed fairly reliable scales (Cronbach's alphas .66 and .63, respectively). A single item (*I have heard of electric vehicles in the media*) was analysed separately, since it represented exposure to information, which could be positive or negative.

EVs compared to conventional vehicles

Twelve items asked respondents to make a direct comparison between electric and conventional vehicles. These questions were worded as follows: *Compared to conventional cars, electric cars…*

- *Are better for the environment*
- *Are faster*
- *Are less powerful*
- *Tend to be smaller*
- *Are less expensive to buy*
- *Are more expensive to run*
- *Have more standard features*
- *Are quieter when driving*
- *Can drive longer distances*
- *Are more reliable (less likely to break down)*
- *Can do everything a conventional car can do*
- *Are more complicated to use*

To avoid a systematic bias in responses, some of the items were positively worded (e.g. EVs are faster), and some were negatively worded (EVs are less powerful). Note that, as written, some of these items are inaccurate (e.g. *EVs are less expensive to buy*), some are accurate (*are quieter when driving*), and some are contentious or uncertain (*are more complicated to use*).

Drivers of purchase decisions

Eighteen questions assessed specific drivers of purchase decisions. These questions asked respondents to rate how important each issue would be in helping them to decide whether to purchase a conventional or electric car the next time they bought a vehicle. The items were:

- *Up front cost of the car*
- *Cost of replacing the battery in an electric car*
- *Ease of recharging the electric car*
- *Amount of power/torque*
- *Top speed*
- *Comfort level inside the car*

- *Level of standard features (air conditioning, cruise control, etc.)*
- *Range (distance the car can travel before refuelling or recharging)*
- *Running costs (cost of fuel / cost of electricity)*
- *Maintenance cost*
- *Time it takes to refuel / recharge*
- *Level of CO_2 emissions*
- *Amount of noise made*
- *Reliability*
- *Safety*
- *How the car looks from the outside*
- *The total cost of ownership (purchase price plus running costs)*
- *Size of the car*

4.1.4 Procedure

The survey was administered in November and December 2010 in two formats: online and via telephone. The population of Melbourne and its surrounds, and other populous areas of Victoria, were sampled via an online survey (see Appendix D for area details). Members of the public from an online survey panel were screened based on their residential postcode, and participated voluntarily. A total of 1599 participants completed the online survey in their own time. Previous examination of online survey respondents suggests that they are broadly representative of the general population, although the typical online respondent may have slightly more education than the Australian average.

A specific area of regional Victoria was also targeted for surveying (see Appendix D for details). Because this region was underrepresented in online survey panels, telephone surveying was used to access this area. Random residential telephone numbers in this area were called by a market research firm, and potential participants were screened for suitability and then surveyed if they were willing to participate. A total of 502 telephone surveys were completed.

Since the wording and question order of the two survey formats was equivalent, it was assumed that the different formats would have a negligible impact on the quality and accuracy of the gathered data. However, given that the telephone sample was drawn from a specific area with a small population in a regional part of the state, it was expected that the two samples would show differences that reflected the different demographic profiles of urban versus rural populations.

As well as the analyses described in this report, the survey results were also used to inform the development of a mathematical model of the diffusion of electric vehicle uptake (see Higgins and Paevere, 2011). This model was designed to project the levels of EV uptake over time in specific geographic areas. The model drew on the results of the present survey data to calibrate the relative impact of age, household size, employment status, education, occupation and transport mode on rates of uptake. These variables were selected on the basis that data for them are available from the Australian Bureau of Statistics at sufficient levels of geographic specificity to usefully inform the model.

4.2 Results and Discussion

4.2.1 Qualitative responses

The survey included a number of open-ended comments, which in general preceded the closed response items on the same issue. For example, people were asked to write down what would encourage and discourage their purchase of an electric car, and then completed rating scales about attitudes to electric vehicles. A brief summary of comments is provided below for each open-ended question.

What would encourage you to buy an electric car? Acceptably low purchase price was the predominant consideration (along with other cost-related issues like affordability and government subsides), followed by environmental benefits, running costs, range (including comments on battery capacity), recharging issues (ease and speed of recharging, availability of recharging points). Occasional mentions were made regarding the availability of features compared to normal cars, reliability, quiet operation, size of the vehicle, and power. A number of people also commented that they would never consider buying an electric car.

What would discourage you from buying an electric car? High purchase price and limited range (and low battery capacity) were frequently mentioned here, as well as running costs (and battery replacement cost, increasing costs of electricity), general concerns about new and "untested" technology, safety concerns regarding stored electricity, lack of knowledge/information about electric vehicles, and concerns about ease and availability of charging. The emissions generated from electricity production were only occasionally mentioned, along with issues of lack of power, low speed, ugly shape, and lack of room.

Where would you want to recharge if you had an electric car? The most common response here was "at home". Recharging at work was also frequently mentioned, and there were a number of less frequent responses including petrol stations, "recharge points", shopping centres, parking garages, and also "anywhere I wanted to when it needed charging".

Questions about electric driveway technology. These questions primarily centred on issues of cost, further details of exactly how the system would work, and concerns about complexity. Less frequent were questions about the impact on battery life, safety and reliability, and concerns about limiting the range of the electric vehicle.

By and large, these comments show strong correspondence with the closed response options in the survey, supporting the contention that we successfully mapped the most likely responses using the focus groups and pilot survey.

4.2.2 Individual predictors of potential EV uptake

In these initial analyses, the potential predictors of EV uptake were assessed individually. Correlations between potential predictors and the measure of potential EV uptake are presented in the figures below. To promote comparison amongst predictors, all the graphs use the same scale.

Demographics

The relationships between demographic measures and potential EV uptake are presented in Figure 3. None of the demographic measures showed strong relationships with potential EV uptake, except for the global measure of emission-relevant behaviour: people who reported a larger number of emission-relevant behaviours were more likely to report high levels of potential uptake of electric vehicles. Education and age were also slightly related to potential uptake: people with higher levels of education, and younger people, were more likely to report higher levels of potential uptake. Other demographics that were expected to show an impact (like

income in particular) showed only a weak effect in the expected direction. Since correlations only assess linear relationships, it is possible that some of these predictors have non-linear relationships with potential uptake.

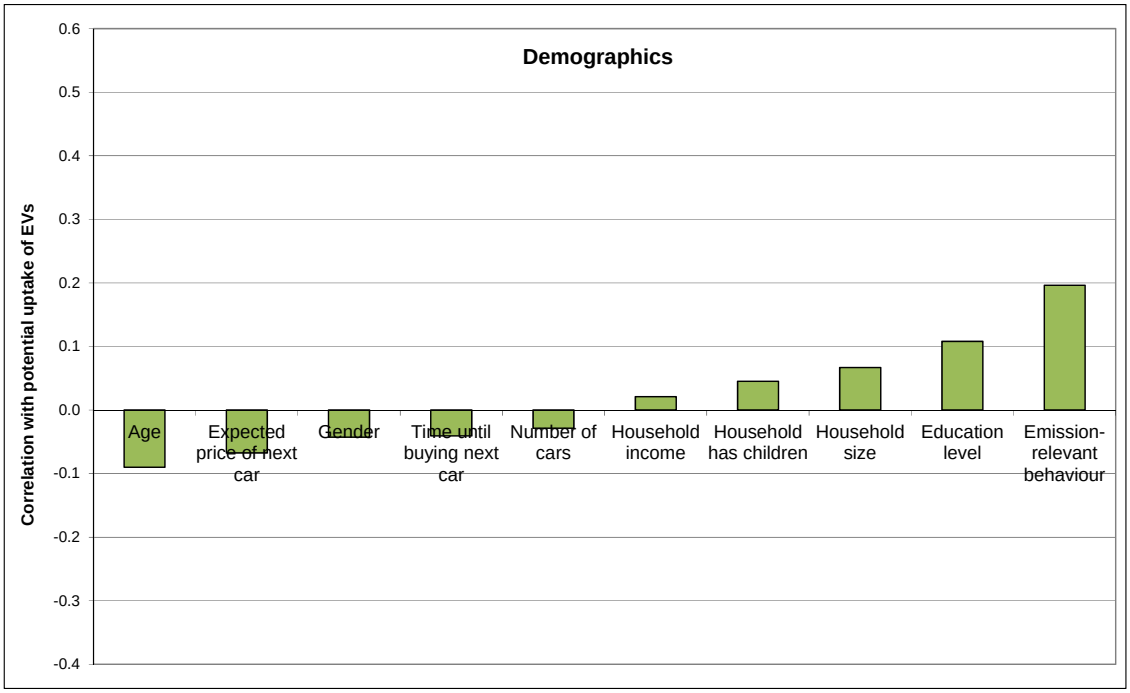

Figure 3. Relationships between demographic measures and potential EV uptake.

Psychographics:

The relationships between psychographic measures and potential EV uptake are presented in Figure 4. In general, these measures show much stronger relationships to potential uptake than the demographic measures. Amongst general measures (not related to electric cars specifically), concern about climate change and the importance of environmental issues were strongly related to potential uptake of electric vehicles, as was a tendency to adopt new technology. Negative attitudes to electric vehicles were (as expected) negatively related to potential uptake, and having heard about electric vehicles in the media was positively related. The strongest single predictor was (unsurprisingly) positive attitudes to electric vehicles.

Comparison of EVs to Conventional Vehicles

The items comparing electric vehicles with conventional vehicles were also assessed for relationships to potential EV uptake (see Figure 5). The strongest positive predictors were impressions that EVs were better for the environment, able to do everything a conventional car can do, and more reliable. Less strongly related were a number of impressions of arguable accuracy (EVs have more standard features, are faster, and are less expensive to buy). Several negative impressions, also of arguable accuracy, were related to lower levels of potential uptake (EVs are more expensive to run, less powerful, and more complicated). These results demonstrate the presence of some misperceptions amongst some respondents (especially relating to relative purchase price and running costs), which may indicate that many respondents are relatively uninformed about the details of current-generation electric vehicles, and are drawing on out-dated beliefs to form judgements.

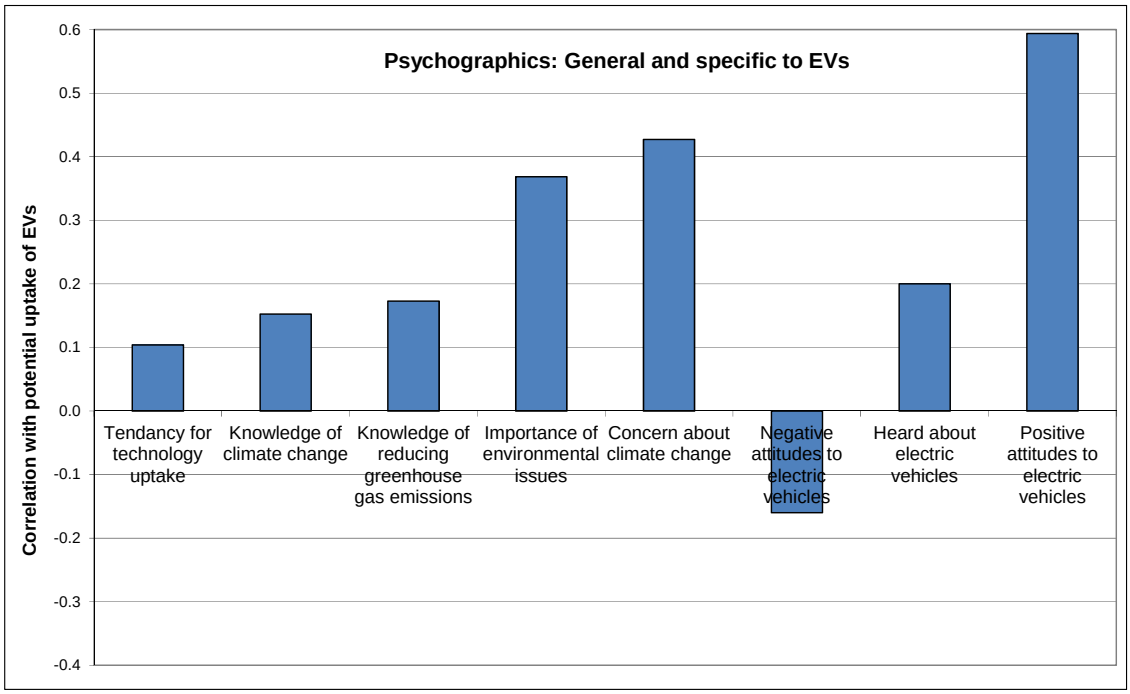

Figure 4. Relationships between psychographic measures and potential EV uptake.

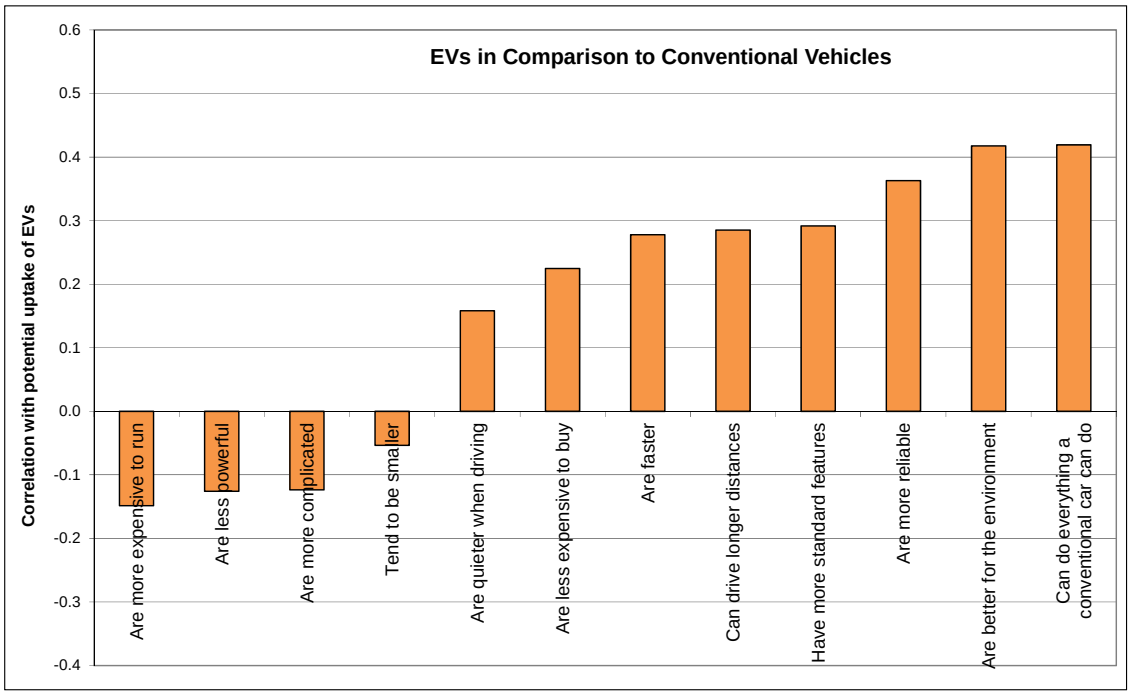

Figure 5. Relationships between EV-conventional car comparisons and potential EV uptake.

4.2.3 Modelling potential uptake of electric vehicles

These analyses were conducted to identify what measures were best able to predict potential EV uptake in combination with other measures. Sequential multiple regression analysis was used, in which demographics were entered in one group of predictors, psychographics were entered in a second group, and EV-conventional vehicle comparative measures were entered in a third group. The model used is displayed in Figure 6.

When demographics are entered into the model, they explain a fairly minor proportion of variance in potential EV uptake (6.5 %). Emission-relevant behaviours, household size, being female rather than male, and level of education are positive predictors; expected price of next car is a negative predictor of potential uptake. People with a history of emission-relevant behaviours, women, people from larger households, people with higher levels of education, and people who expect to pay less for their next car are more likely to report higher levels of potential EV uptake.

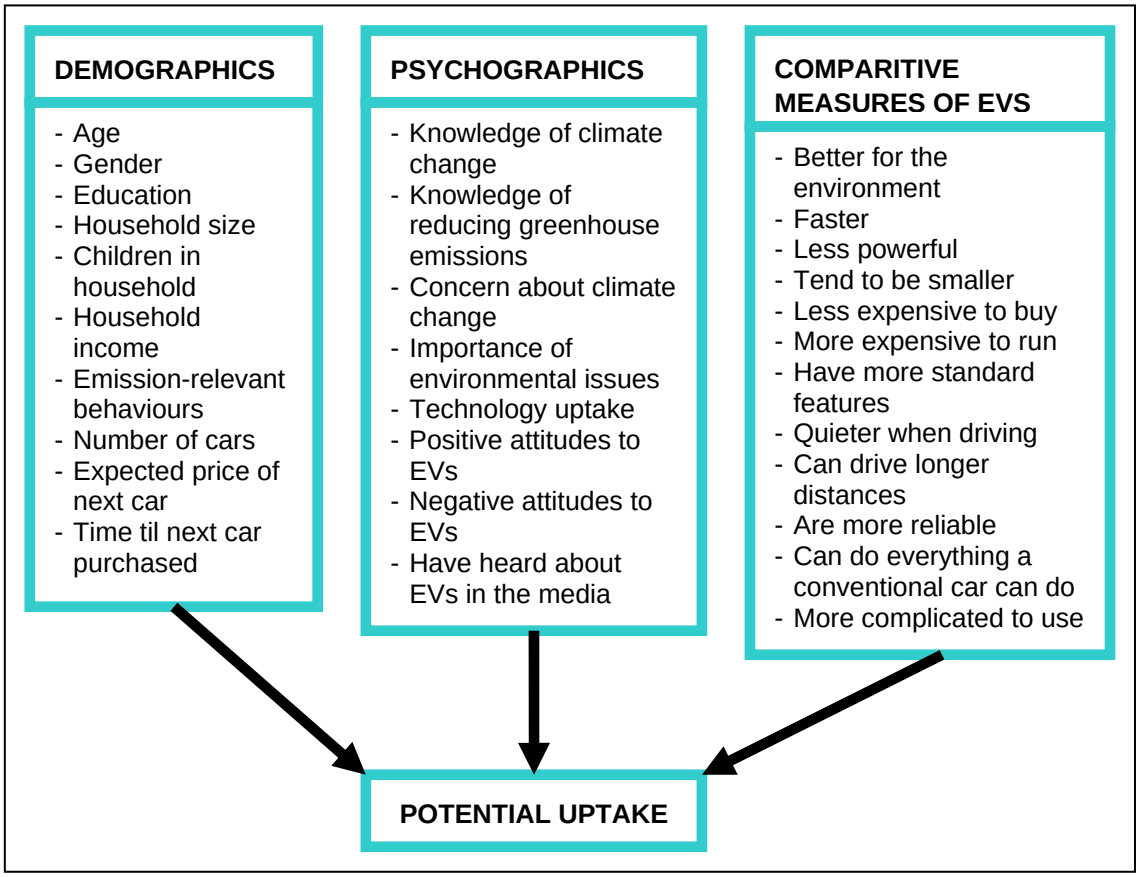

Figure 6. The regression model used to predict potential uptake of EVs.

When psychographic measures are entered into the model, they explain an additional 38.0 % of variance in potential uptake (after correcting for demographic variables). Concern about climate change, importance of environmental issues, tendency to uptake new technology, and positive attitudes to electric vehicles are positive predictors; negative attitudes to EVs was a negative predictor of potential uptake.

When direct comparisons between EVs and conventional vehicles are entered into the model, they explain a small additional component of variance in potential uptake (5.8%). Perceptions of

EVs as better for the environment, faster, more reliable, and being able to do everything a conventional car can do are positive predictors of potential uptake.

Overall, the model explained 50.3% of the variance in the potential uptake measure, with the majority of explanatory power coming from concern about climate change, tendency to take up new technology, positive attitudes to EVs, and beliefs that EVs are better for the environment, and that they compare favourably with conventional vehicles in a number of ways. Detailed modelling results are presented in Appendix E.

4.2.4 Modelling potential uptake of electric driveway technology

Potential uptake measures for electric vehicles and electric driveway technology were highly positively correlated: people who reported higher potential uptake of one were very likely to report higher potential uptake of the other. In addition, individual predictors tended to show similar relationships with ED uptake as with EV uptake. Therefore, we focussed on determining whether any of the potential predictors of ED uptake had any additional impact on prediction after accounting for differences in EV uptake. Sequential multiple regression analysis was used, in which potential EV uptake was entered first, demographics were entered in a second group of predictors, psychographics were entered in a third group, and EV-conventional vehicle comparative measures were entered in a fourth group.

When potential EV uptake is entered into the model, it explains 30.7% of the variance in potential uptake of the electric driveway technology. The effectiveness of EV uptake as a predictor of ED uptake is to be expected, since the value of the ED technology is contingent on owning an electric vehicle.

When demographics are entered into the model, they explain only a minor 1.5% of additional variance in potential ED uptake. People with a history of emission-relevant behaviours are more likely to report higher levels of potential ED uptake.

When psychographic measures are entered into the model, they explain an additional 3.1 % of variance in potential uptake. Knowledge of reducing greenhouse gas emissions are a positive predictor of potential uptake, perhaps indicating that people with more knowledge in this area find it easier to understand the value of managing electricity flows between house, car and grid.

When direct comparisons between EVs and conventional vehicles are entered into the model, they explain a small additional component of variance in potential uptake (2.1%). A perception of EVs as better for the environment was the only positive predictor of potential uptake amongst these measures.

Overall, the model explained 37.3% of the variance in the potential uptake of ED, with the large majority of explanatory power coming from potential uptake of an electric vehicle. The model is not very effective at accurately predicting potential uptake of ED technology; this result is to be expected given that the electric driveway is an unfamiliar technology that respondents encountered for the first time within the survey. Detailed modelling results are presented in Appendix E.

4.2.5 Describing important features for ED

A series of features of the electric driveway technology were listed in the survey, and respondents were asked how important these features might be in influencing their decision to purchase an electric car. The features were:

- Automatically charge the electric car with off-peak and renewable electricity
- Reduce my consumption of electricity when it is most expensive
- Sell some electricity back into the grid when I don't need it

- Recharge my car and store energy from solar panels on my own roof
- Partially power my house for a few hours during a blackout

These features were all rated as important by people with high levels of potential ED uptake, and were all rated as relatively unimportant by people with low levels of potential ED uptake. Thus, we cannot usefully differentiate a specific feature (or features) of the ED system that is particularly attractive to potential purchasers. The hypothetical and abstract nature of the ED technology that may explain the low levels of differentiation amongst features here: if people like the idea, they tend to like all the features.

4.2.6 Describing purchase decisions for EVs

To examine the relationship between potential EV uptake and issues involved in car purchase, we compared the ratings of relevant vehicle features for people with particularly high and particularly low levels of potential EV uptake. This analysis reflects an informal analysis of where the relative advantage of electric vehicles lies within the decision process of choosing a new vehicle.

A group with “high potential uptake” were defined as the third of the survey sample with the highest scores on the potential EV uptake measure. People with “low uptake” were likewise defined as the third of the sample with the lowest scores on this measure. These two groups thus represented segments of the sample that were most and least likely to be predisposed to buying an electric vehicle. The relative importance of 18 vehicle features is presented in Figure 7, shown separately for these two groups.

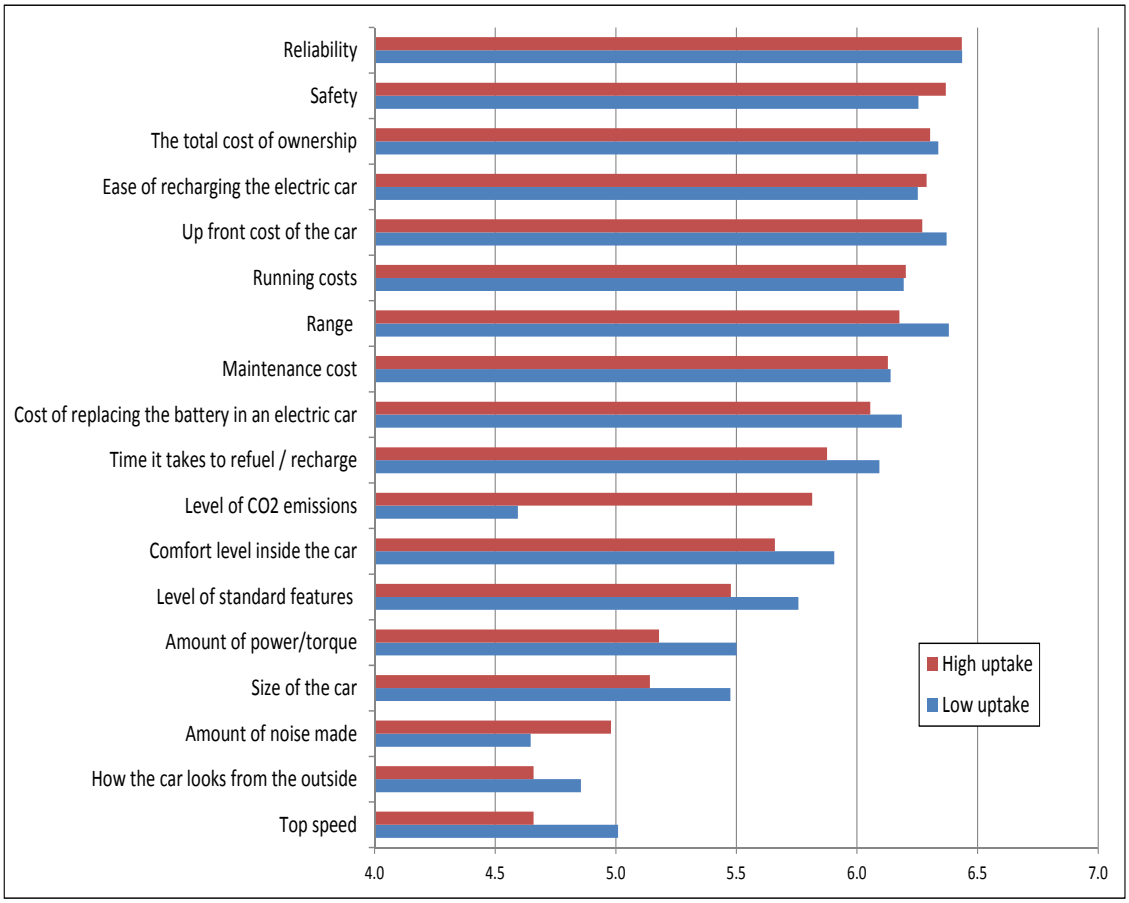

Figure 7. Relative importance of vehicle features for people with high and low levels of potential EV uptake.

Analysis of differences between the groups indicated that some features were important for all respondents, regardless of their potential for EV uptake:

- Cost of replacing the battery in an electric car
- Maintenance cost
- Running costs
- Up front cost of the car
- Ease of recharging the electric car
- The total cost of ownership
- Safety
- Reliability

Some features were less important for those with higher potential for EV uptake:

- Top speed
- Size of the car
- Amount of power/torque
- Level of standard features
- Comfort level inside the car
- Time it takes to refuel / recharge
- Range

Two features were more important for those with higher potential for EV uptake:

- Amount of noise made
- Level of CO_2 emissions

A final feature, “How the car looks from the outside”, was relatively unimportant for all respondents.

Overall, it appears that people with a high potential for EV purchase are much more concerned about CO_2 emissions than other people, and are less concerned by a number of features that are considered to be lacking in electric vehicles (e.g. time to recharge, range, speed, power, and size).

5. GENERAL DISCUSSION AND CONCLUSIONS

Overall, attitudinal and perceptual measures appear to be stronger predictors of potential EV uptake than are demographic features, although demographic features did show results in the expected direction (e.g. higher education and lower age are associated with higher potential uptake). The most important predictors of potential EV uptake were concern about climate change, tendency to take up new technology, positive attitudes to EVs, and beliefs that EVs are better for the environment.

The survey results also demonstrated the presence of misperceptions regarding EVs amongst respondents, especially relating to relative purchase price and running costs. This finding may indicate that many respondents are relatively uninformed about the details of current-generation electric vehicles, and are drawing on out-dated impressions to form judgements.

When we examine vehicle purchasing decisions, it appears that people with a high potential for EV purchase are much more concerned about CO_2 emissions than other people, and are less concerned by a number of features that are considered to be lacking in electric vehicles (e.g. time to recharge, range, speed, power, and size).

At the moment, the best predictor of ED uptake is potential EV uptake: people who like the idea of owning an electric car also like the idea of the ED technology. Once the ED technology is demonstrated and available, and once EVs have been taken up in larger numbers, different issues are likely to become more important predictors of actual ED uptake, like installation cost and perceived complexity.

An important limitation of these results is the self-reported and hypothetical nature of the data. Potential uptake of EV and ED technology is not equivalent to actual uptake: the former will likely have been influenced by a range of biases endemic to social survey research. Answers may be coloured by respondent's wishing to present themselves in a positive light, and wishing to provide "socially acceptable" and internally consistent answers. These biases may have led to stronger links between concern about climate change and willingness to buy, as people recognise that being concerned about climate means that they "ought" to be willing to spend money on low-emission technology like electric vehicles.

Because of these influences, it is likely that actual uptake of electric vehicles will show stronger relationships to various pragmatic issues such as availability of money and a need to replace an existing vehicle. When modelling actual uptake behaviour, we might reasonably expect that levels of income increase in importance as predictors, and that concern about climate change (for example) decreases in importance. Such findings would be consistent with the research findings regarding actual uptake studies reviewed earlier in this report. Similarly, for uptake of the electric driveway, actual uptake of this technology is likely to depend more strongly on cost relative to available income (and other pragmatic concerns) for those people who take up electric vehicles.

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APPENDIX A: SUMMARY OF SAMPLE DEMOGRAPHICS

Individual measures

Respondent Gender

	Frequency	Percent
Female	1119	53.3
Male	982	46.7
Total	2101	100.0

Respondent Age Group

	Frequency	Percent
18-19	18	.9
20-24	69	3.3
25-29	137	6.5
30-34	188	9.0
35-39	201	9.6
40-44	201	9.6
45-49	238	11.4
50-54	242	11.6
55-59	206	9.8
60-64	205	9.8
65-69	184	8.8
70-74	116	5.5
75-79	57	2.7
80-84	25	1.2
85-89	6	.3
90+	1	.0
Total	2094	100.0
Don't know/refused	7	
Total	2101	

Education category

	Frequency	Percent
Year 12 or below	718	34.3
Certificate	330	15.8
Diploma	284	13.6
Bachelor	472	22.6
Post grad	289	13.8
Total	2093	100.0

Note: 8 people did not answer.

Employment category

	Frequency	Percent
Full time	775	36.9
Part time/casual	382	18.2
Self employed	141	6.7
Unemployed	64	3.0
Retired/other	737	35.1
Total	2099	100.0

Note: 2 people did not answer.

Occupation category

	Frequency	Percent
Manager	224	10.7
Professional	474	22.6
Trade/technical	134	6.4
Clerical or admininistration	238	11.3
Other	265	12.6
None	764	36.4
Total	2099	100.0

Note: 2 people did not answer

Household Measures

Household size

	Frequency	Percent
1	307	14.6
2	808	38.5
3	375	17.9
4	377	18.0
5	161	7.7
6	49	2.3
7	12	.6
8	5	.2
9	2	.1
12	1	.0
Total	2097	100.0

Note: 4 people did not answer.

Household type

	Frequency	Percent
Single person household	304	14.5
Group household (people from more than one family)	113	5.4
One parent with children	139	6.6
Couple with no children	691	32.9
Couple with children	730	34.7
Extended family household (e.g. parents, children and grandparents)	124	5.9
Total	2101	100.0

Building type

	Frequency	Percent
House (or other detached dwelling)	1755	84.5
Townhouse (or other semi-detached dwelling)	118	5.7
Apartment or flat	204	9.8
Total	2077	100.0
Other/did not answer	24	
Total	2101	

Garage/Carport and/or private driveway

	Frequency	Percent
Garage/carport	1881	89.5
No garage but a private driveway	148	7.0
No garage or private driveway	72	3.4
Total	2101	100.0

Home ownership

	Frequency	Percent
I/we own it outright	935	45.8
Paying off a mortgage	669	32.8
Renting	437	21.4
Total	2041	100.0
Other/refused	60	
Total	2101	

Household income

	Frequency	Percent
Up to $25,000 per year	225	12.9
$25,001 to $50,000 per year	437	25.1
$50,001 to $75,000 per year	326	18.7
$75,001 to $100,000 per year	284	16.3
$100,001 to $125,000 per year	172	9.9
$125,001 to $150,000 per year	128	7.3
$150,001 to $175,000 per year	87	5.0
$175,001 to $200,000 per year	38	2.2
$200,001 or more per year	47	2.7
Total	1744	100.0
Prefer not to say/refused	357	
Total	2101	

Emission-relevant behaviours

	Frequency	Percent
I have considered energy consumption (star ratings) as an important factor when choosing a new electrical appliance	1898	90.3
I have a solar hot water system	227	10.8
I have solar panels to generate electricity	229	10.9
I purchase green power	601	28.6
I use energy efficient light bulbs in the house	1926	91.7
Total	2101	

Vehicle measures

Number of cars in the household

	Frequency	Percent
0	23	1.1
1	745	35.5
2	959	45.6
3	257	12.2
4	83	4.0
5	21	1.0
6	8	.4
7	4	.2
8	1	.0
Total	2101	100.0

Note: Households that did not own a car were included where the survey respondent drove someone else's car.

Will your next car be new or used?

	Frequency	Percent
New	1023	48.7
Used	997	47.5
I do not think I will buy a car in the future	81	3.9
Total	2101	100.0

Likely price of the next car you buy

	Frequency	Percent
Less than $10K	240	11.9
$10k to $19K	557	27.5
$20K to $29K	578	28.6
$30K to $39K	340	16.8
$40K to $49K	163	8.1
$50K to $59K	80	4.0
$60K to $69K	32	1.6
$70K to $79K	12	.6
$80K to $89K	5	.2
$90K to $100K	7	.3
More than $100K	9	.4
Total	2023	100.0

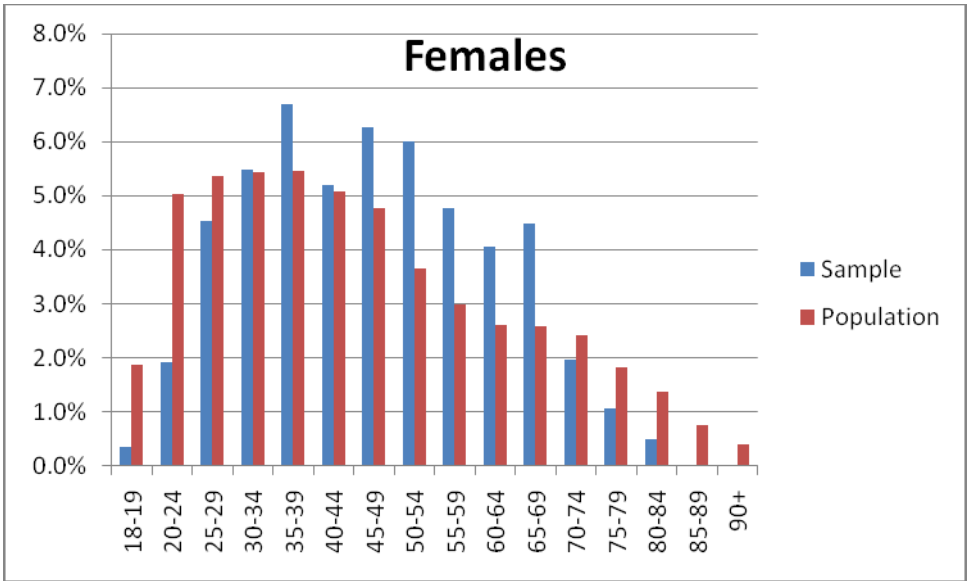
Note: excludes respondents who did not think they would buy a car in the future.

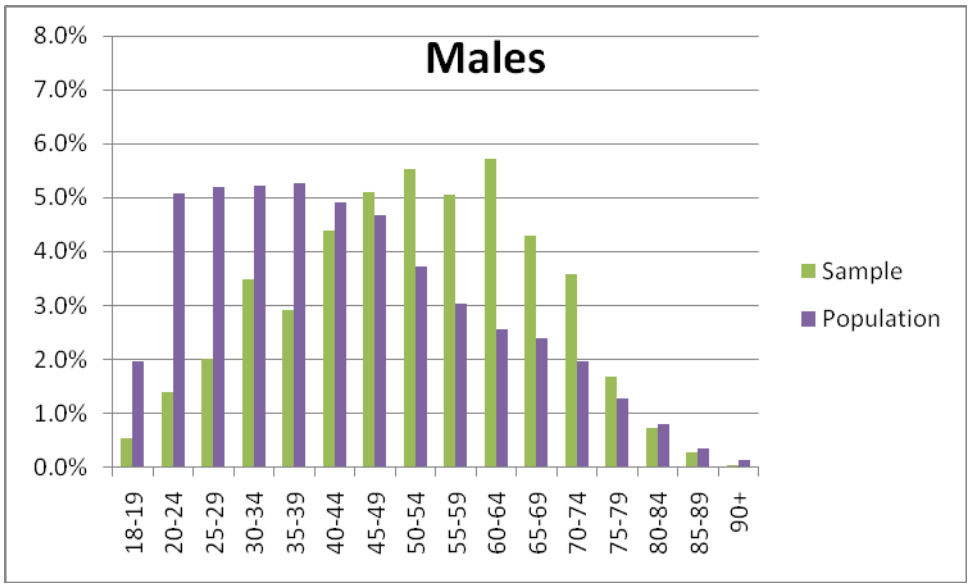
When will you next buy a car?

	Frequency	Percent
In the next year	358	19.2
In 2-3 years	679	36.4
In 4-5 years	412	22.1
More than 5 years from now	418	22.4
Total	1867	100.0
I am unlikely to buy another car	234	
Total	2101	

APPENDIX B: SAMPLE COMPARED TO ABS DATA

The charts below show the sample data compared to Victorian population data, drawn from 2006 Census data for Victoria (Australian Bureau of Statistics, Cat. No. 2068.0).





APPENDIX C: SURVEY

Note: this survey was presented via two formats: the version below represents the survey formatted for telephone interview. The online version had the same questions but had written instructions and slightly different formatting of some response options to improve clarity for participants.

INTRODUCTION

This survey is about your response to and understanding of electric cars. By "electric cars", we mean cars that are able to drive on electric power alone, and which can be recharged by plugging them into a normal power point in your home, or a public charge point. These cars can drive without using any petrol or diesel like "normal" passenger cars, so we are not talking about hybrids such as the Toyota Prius.

Section A: General attitudes

Question 1: Your knowledge of Electric Cars

Please indicate your agreement with the following statements about electric cars. For each statement I'd like you to tell me to what extent you agree or disagree. A score of 6 would mean that you completely agree with the statement. A score of 1 would mean that you completely disagree. The numbers in between show the degree to which you agree or disagree.

- I have heard about electric cars in the media
- Electric cars are many years away from general public use
- Electric cars use expensive battery technology
- Electric cars can be recharged quickly
- Electric cars need expensive recharging infrastructure
- Electric cars can help reduce greenhouse gas emissions
- Electric cars are worth government investment
- Electric cars are likely to be the standard means of passenger transport in the future

Question 2: Comparing Electric Cars to conventional cars

Respondent NOTE: "Normal cars" - petrol or diesel cars

Now I'm going to read out a few statements comparing electric cars to normal cars, what do you think is likely to be true? Again, 1 = completely disagree and 6 = completely agree.

In comparison, electric cars:

Are better for the environment	Have more standard features
Are faster	Are quieter when driving
Are less powerful	Can drive longer distances
Tend to be smaller	Are more reliable (less likely to break down)
Are less expensive to buy	Can do everything a conventional car can do
Are more expensive to run	Are more complicated to use

Section B: Potential Uptake

Question 3: If you were thinking about buying an electric car:

1. What would encourage you to go ahead and buy an electric car?

Tell us whatever comes to mind, this might be things you would like to know, or potential features of an electric car that would help convince you to buy one, etc. (open-ended response)

2. What would prevent you from buying an electric car?

Tell us whatever comes to mind, this might be concerns you have, or things you have heard about electric cars that make them unsuitable for you, etc. (open-ended response)

3. If you had an electric car, where do you think you would most likely want to recharge it?

Please list all locations you think you might use (open-ended response)

Question 4: Drivers/Barriers for purchase

Imagine you were getting ready to buy a new car, and you were deciding between buying a conventional car or an electric car.

How important would the following issues be in helping you to decide which to choose? A score of 1 would mean that it is not at all important. A score of 7 would mean that it is very important. The numbers in between show the degree of importance to you.

- Up front cost of the car
- Cost of replacing the battery in an electric car
- Ease of recharging the electric car
- Amount of power/torque
- Top speed
- Comfort level inside the car
- Level of standard features (air conditioning, cruise control, etc)
- Range (distance the car can travel before refuelling or recharging)
- Running costs (cost of fuel / cost of electricity)
- Maintenance cost
- Time it takes to refuel / recharge
- Level of CO_2 emissions
- Amount of noise made
- Reliability
- Safety
- How the car looks from the outside
- The total cost of ownership (purchase price plus running costs)
- Size of the car

Question 5: general uptake

Please answer the following questions about your attitude. Please provide me with a number between 1 and 6. A score of 1 would mean that you completely disagree. A score of 6 would mean that you completely agree with the statement. The numbers in between show the degree to which you agree or disagree.

- Electric cars are a good idea
- Australians in general are likely to buy electric cars

- People I know are likely to buy electric cars
- I personally am likely to buy an electric car sometime in the future
- The next time I purchase a car, it is likely to be electric.

Section C: Integrating Electric Vehicles and Household Energy Management

Imagine you owned an electric car, and could install a system in your home that would allow you to use your car's battery as source of power for your home while the car is not being driven.

Such a system would allow you to use your electric car to store electricity:

- From the grid when it is available at very low prices late at night, and/or
- From solar panels installed on your house roof (if you had them), and/or
- From unused renewable resources like night-time wind-power

The system could then use this stored electricity in the car battery to power your home:

- When it is expensive to buy it from the grid at peak price periods, and/or
- When solar panels are inactive in the evening, and/or
- When there is a blackout

Electricity stored in the car would only be used when there is at least enough energy remaining in the battery to drive 50 km (or a distance that you specify). The system would allow you to save up to 30% a year on your annual electricity bill.

Please answer the following questions about your attitudes to the electricity storage system described above.

Question 6: first reactions:

What questions do you have about this system? That is, what further information would you like to know? (open-ended)

Question 7: general uptake

Please answer the following questions about your attitudes to this type of system: Please use the same scale where a score of 1 would mean that you completely disagree and a score of 6 would mean you completely agree. The numbers in between show the degree to which you agree or disagree.

- Using electric vehicles to partially power homes with off-peak or renewable electricity is a good idea
- Australians in general are likely to want to have such a system
- People I know are likely to want this system
- I personally would want this system if I had an electric car

Question 8: Electric cars and your home

For each of the following, would this system make it more likely or less likely that you would want to buy an electric car?

Please provide me with a number between 1 and 7 where a score of 1 would mean you are much less likely to want to buy an electric car and a score of 7 would mean you are much more likely to want to buy an electric car.

- Being able to automatically charge the electric car in my home with off-peak and renewable electricity
- Being able to reduce my consumption of electricity when it is most expensive
- Being able to sell some electricity back into the grid when I don't need it
- Being able to recharge my car and store energy from solar panels on my own roof
- Being able to partially power my house for a few hours during a blackout

Section D: Other attitudinal questions:

a) How would you rate your knowledge of climate change? Using a scale from 1 – 7 where 1 is no knowledge and 7 is a very high knowledge
b) How much do you know about reducing greenhouse gas emissions (that is, "mitigation")? using a scale from 1 – 7 where 1 is no knowledge and 7 is a very high knowledge
c) How concerned are you about climate change? using a scale from 1 – 7 where 1 is not at all concerned and 7 is very concerned
d) How important to you are environmental issues in general? using a scale from 1 – 7 where 1 is not at all important and 7 is extremely important

Question 9: technology acceptance/uptake:

Think about how you buy new advances in technology (things like smart phones, Bluray players, flat screen TVs, etc). When a new piece of technology becomes available, which of the following best describes you: (SINGLE response)

- I am among the first people to buy new technology
- I buy new technology before most other people
- I buy new technology about the same time most other people are buying it
- I buy new technology later than most people
- I buy new technology later than everyone else, or I don't buy it at all.

Question 10: other technologies

Please tell me the following that apply to you (Yes/No response):

1 I have considered energy consumption (star ratings) as an important factor when choosing a new electrical appliance.
2 I have a solar hot water system
3 I have solar panels to generate electricity
4 I purchase "green" power
5 I use energy efficient light bulbs in the house

Section E: DEMOGRAPHICS

These final questions are designed to help us summarise the types of people who responded to this survey.

1. Questions about your household

Question 11: Household size

How many people (including yourself) live in your household? ____

Question 12: Household type

Which of the following best describes your household? *(SINGLE response)*

a) Single person household
b) Group household (people from more than one family)
c) One parent with children
d) Couple with no children
e) Couple with children
f) Extended family household (e.g. parents, children and grandparents)

Question 12a: What type of building do you live in?

(a) House (or other detached dwelling)

(b) Townhouse (or other semi-detached dwelling)

(c) Apartment or Flat

(d) Other (please specify_____)

Question 12b: Do you have a garage or carport? Yes/No

Question 12c: Do you have a private driveway? Yes/No

Question 13: Ownership of the home

a) Who owns the dwelling in which you live? *(SINGLE response)*
b) I/we own it outright
c) Paying off a mortgage
d) Renting
e) Other (please specify)

Question 14: Household Income

What is your household's total income before tax? *(SINGLE response.)*

1. Up to $25,000 per year	*6. $125,001 to $150,000 per year*
2. $25,001 to $50,000 per year	*7. $150,001 to $175,000 per year*
3. $50,001 to $75,000 per year	*8. $175,001 to $200,000 per year*
4. $75,001 to $100,000 per year	*9. $200,001 or more per year*
5. $100,001 to $125,000 per year	

Question 15: Location

What is the postcode of your home address? _____

Question 16: Current energy usage

How much was your last quarterly electricity bill? $_____ (an approximate is fine)

2. Questions about cars

We want to ask you some questions about the cars you own:

Question 17.

How many cars are there in your household? ____

Question 18.

For each car, please give us the following information:

Detail	Car 1	Car 2… etc (up to max of 4 cars)
Make		
Model		
Age (estimate)		
Purchase price (estimate)		
Km per year (estimate)		
What is this car mostly used for (please select one only): - Driving to and from work - Short trips for personal use (shopping, school, etc) - Long trips - Other (please specify)		

Question 19.

When do you think you will next buy a car? (SINGLE response)

a) In the next year
b) In 2-3 years time
c) In 4-5 years time
d) More than 5 years from now
e) I am unlikely to buy another car

Question 20.

If or when you next by a car, will it be new or used?

Question 21.

If or when you next buy a car, how much do you expect to pay for it? (SINGLE response)

less than $10K	$60K to $70K
$10k to $20K	$70K to $80K
$20K to $30K	$80K to $90K
$30K to $40K	$90K to $100K
$40K to $50K	More than $100K
$50K to $60K	

3. Questions about you

These last few questions are about you...

Question 22: Age

1. 15-19	7. 45-49	13. 75-79
2. 20-24	8. 50-54	14. 80-84
3. 25-29	9. 55-59	15. 85-89
4. 30-34	10. 60-64	16. 90+
5. 35-39	11. 65-69	
6. 40-44	12. 70-74	

Question 23: Gender

What is your gender?

Question 24: Education

What is the highest level of education you have completed? *(SINGLE response.)*

Year 8 or below	Certificate (including trade certificate)
Year 9 or equivalent	Diploma/Advanced diploma
Year 10 or equivalent	Bachelor degree (including honours)
Year 11 or equivalent	Graduate diploma/Graduate certificate
Year 12 or equivalent	Postgraduate degree

Question 25: Employment

Which term below best describes you? *(SINGLE response.)*

a) Employed full time
b) Employed part time or casual
c) Self employed
d) Unemployed
e) Retired/pension recipient
f) Home duties
g) Full time student
h) Part time student

Question 26: Occupation

If you are currently in paid employment, which term below best describes you?

(SINGLE response.)

a) Manager
b) Professional
c) Technician or trade worker
d) Community or personal service worker
e) Clerical or administrative worker
f) Sales worker
g) Machinery operator or driver
h) Labourer
i) Not in paid employment

APPENDIX D: ONLINE AND TELEPHONE SURVEY POSTCODES

Online Survey Sample Postcodes

Postcodes	**Area**
All city and surrounding suburb postcodes	Melbourne
3214, 3215, 3218, 3220, 3219, 3221, 3224, 3216, 3217	Geelong
3223, 3222, 3225, 3226, 3221, 3227	Bellarine
3922, 3923, 3925	Phillip Island
3912, 3913, 3915, 3916, 3918, 3919, 3920, 3926, 3927, 3928, 3929, 3930, 3931, 3933, 3934, 3936, 3937, 3938, 3939, 3940, 3941, 3942, 3943, 3980	Mornington Peninsula
3550, 3555, 3453, 3556	Bendigo
3350, 3355, 3356, 3357	Ballarat
3844	Traralgon
3850	Sale
3677, 3678	Wangaratta

Telephone Survey Sample Postcodes

Postcode	**Suburb Name**
3073	Reservoir
3074	Thomastown
3082	Mill Park
3083	Bundoora
3087	Watsonia, Watsonia North
3088	Briar Hill, Greensborough, Saint Helena

3093	Lower Plenty
3094	Montmorency
3095	Eltham
3111	Donvale
3113	Warrandyte
3114	Park Orchards
3132	Mitcham, Mitcham North
3133	Vermont, Vermont South
3134	Ringwood
3135	Ringwood East, Heathmont
3136	Croydon
3152	Wantirna South
3153	Bayswater, Bayswater North
3155	Boronia
3179	Scoresby
3180	Knoxfield

APPENDIX E: REGRESSION MODELLING OF UPTAKE

1. Prediction of potential uptake of electric vehicles

Predictor type	Predictors	Step 1	Step 2	Step 3
Demographics	Age	-.054+	-.046+	-.029
	Gender (Male/Female)	-.031	-.012	-.004
	Education level	.093*	.048+	.049+
	Household size	.082+	.044	.038
	Children in household	-.030	-.007	-.001
	Household income	-.013	-.019	-.011
	Emission-relevant behaviours	.186**	.034	.024
	Number of cars	-.047	-.028	-.019
	Expected price of next car	-.086*	-.022	-.012
	Time til next car purchased	-.032	-.018	-.011
Psychographics	Knowledge of climate change		-.013	-.016
	Knowledge of reducing greenhouse emissions		.056	.070+
	Concern about climate change		.133**	.100**
	Importance of environmental issues		.086*	.067
	Technology uptake		-.068*	-.056*
	Positive attitudes to EVs		.496**	.332**
	Negative attitudes to EVs		-.112**	-.060*
	Have heard about EVs in the media		.040	.033
EVs compared to conventional cars	EVs are better for the environment			.118**
	EVs are faster			.068*
	EVs are less powerful			-.027
	EVs tend to be smaller			-.011
	EVs are less expensive to buy			.048+
	EVs are more expensive to run			-.042+
	EVs have more standard features			.029
	EVs are quieter when driving			.032
	EVs can drive longer distances			.046+
	EVs are more reliable (less likely to break down)			.081**
	EVs can do everything a conventional car can do			.096**
	EVs are more complicated to use			-.035
Explained variance	**Change in R-squared**	.065**	.380**	.058**
	R-Squared	.065**	.445**	.503**

2. Prediction of potential uptake of electric driveway technology

Predictor type	Predictors	Step 1	Step 2	Step 3	Step 4
Uptake	Potential EV uptake	.554**	.528**	.405**	.392**
Demographics	Age		-.024	-.033	-.053+
	Gender (Male/Female)		-.049+	-.041	-.048+
	Education level		-.020	-.033	-.029
	Household size		.039	.039	.035
	Children in household		.011	.009	.013
	Household income		.016	.016	.008
	Emission-relevant behaviours		.077**	.040	.038
	Number of cars		-.023	-.021	-.018
	Expected price of next car		-.053+	-.039	-.034
	Time til next car purchased		-.015	-.015	-.016
Psychographics	Knowledge of climate change			.001	.002
	Knowledge of reducing greenhouse emissions			.000	-.005
	Concern about climate change			.115**	.110**
	Importance of environmental issues			.052	.034
	Technology uptake			.001	-.001
	Positive attitudes to EVs			.086*	.056+
	Negative attitudes to EVs			-.013	-.025
	Have heard about EVs in the media			.053+	.028
EVs compared to conventional cars	EVs are better for the environment				.090**
	EVs are faster				-.019
	EVs are less powerful				.003
	EVs tend to be smaller				.019
	EVs are less expensive to buy				-.023
	EVs are more expensive to run				.048+
	EVs have more standard features				.008
	EVs are quieter when driving				.056+
	EVs can drive longer distances				-.044
	EVs are more reliable (less likely to break down)				-.006
	EVs can do everything a conventional car can do				.052+
	EVs are more complicated to use				-.042
Explained variance	**Change in R-squared**	.307**	.015**	.031**	.021**
	R-Squared	.307**	.322**	.353**	.373**

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