Market Research Report:

The Demand for Renewable Energy Technologies in Adelaide

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November 2008

Contents

1. Introduction and background

Staff in the University of South Australia's School of Management (Mr Peter Balan and Dr Dennis List) carried out an evaluation of the Adelaide market for an electric hybrid conversion service for motor vehicles in 2007[1], and sought a similar project for 2008. Mr Sandy Walker and Mr Martin Freney from the Louis Laybourne-Smith School of Architecture and Design nominated a project to explore the market for a range of renewable energy technologies to support their teaching and research programs. This project was developed and implemented by Mr Peter Balan and Mr Matthew McKinlay.

A review of the literature in the field showed that most of the literature addresses large-scale renewable energy technology applications such as wind farms. There were very few studies of renewable energy technologies at the domestic household level, and almost none at the local all community level in western developed economies (the only exception being studies of community biogas energy systems in developing countries).

This project therefore focused on renewable energy technologies that appeared to be feasible at both the individual household level, as well as at the local community level, and these included wind power, photovoltaic cells, geothermal and biogas. The specific objectives of this market evaluation exercise are to:

1. identify the characteristics of potential market segments for these technologies
2. identify possible motivations leading to purchase of these technologies at the household level, and the support for these technologies being implemented at the community level
3. identify possible barriers to purchase/support of these technologies at the household level, and at the community level
4. estimate the likely adoption of these technologies at the household level, and the likely level of support for the implementation of these technologies at the community level.

Market information was obtained using a multistage process and was carried out by 70 University of South Australia students who were enrolled in the undergraduate course "Entrepreneurial Marketing for New Ventures". Peter Balan (Course Coordinator and lecturer) designed the research process and delivered this course as a general elective in the winter study period for students from across the University. All students were required to contribute to this project, and sections of the course were tailored to address the needs of the project.

Ethics approval was obtained from the University of South Australia for this project (Ethics protocol P170/08 "Consumer adoption of renewable energy technologies"). Students were allocated into teams of three or four, and each team was allocated to carry out one of the following market information gathering activities:

- secondary data collection
- qualitative research (a total of 50 interviews)
- quantitative survey (a total of 219 interviews)

Each team was required to write a short summary of the outcomes of their market information gathering activity, and the summaries were made accessible to all students through the course website.

Students also took part in a Scenario Network Mapping exercise that was used to generate a range of possible futures for each of the technologies. They were given access to the results of each market information gathering activity, and used these as inputs to their team marketing plans. Teams could choose which of the specific technologies they could use as the subject of their marketing plan. In total, 19 separate marketing plans were written, and these team reports represented 40% of the assessment for the course for each student.

[1] Balan, P, and List, D., 2007, 'Market Research Report: The Demand for Retrofitted Electric Hybrid Vehicles in Adelaide'. A copy of this report is available from the authors.

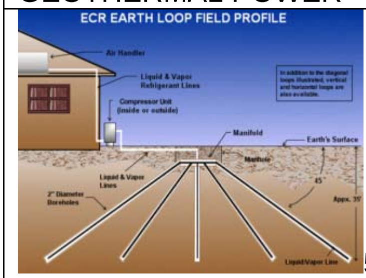
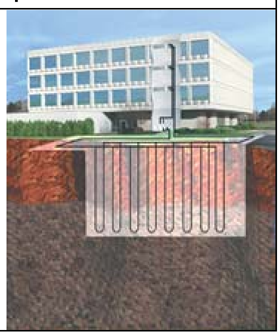
Acknowledgements

The authors acknowledge the contributions of Mr Sandy Walker and Mr Martin Freney from Louis Laybourne-Smith School of Architecture and Design in providing the topic of this research, and the University of South Australia students in gathering market information and in taking part in the Scenario Network Mapping exercise as part of the course "Entrepreneurial Marketing for New Ventures", that was delivered in July - August 2008, and whose names are included in Appendix 1. However, the opinions, comments and conclusions in this report are those of the authors.

2. The renewable energy technologies

Mr Walker and Mr Freney gave the students two technical briefings, and provided background materials on the technical aspects of the project. Mr Freney also organised a visit by students to his home to show them the implementation of a photovoltaic cell electricity generating system at the household level.

The following images illustrate the four technologies that were investigated. These images were used during the market research to make the subject of the research clear to participants.

SOLAR POWER INSTALLATION – INDIVIDUAL HOUSEHOLD AND COMMUNITY	
 1	2 
WIND POWER GENERATOR – INDIVIDUAL HOUSEHOLD AND COMMUNITY	
 3	4 
GEOTHERMAL POWER – INDIVIDUAL HOUSEHOLD AND COMMUNITY	
 5	6 

BIOGAS – INDIVIDUAL HOUSEHOLD AND COMMUNITY	
7	8 

Sources of images:
1: (http://www.braemacenergy.com.au/product_view.php?prod_selected=1&cat_selected=1, 8Jul08)
2. (http://www.braemacenergy.com.au/product_view.php?prod_selected=1&cat_selected=1, 8Jul08)
3. (http://www.energyenv.co.uk/D400WindTurbine.asp, 8Jul08)
4. (www.kitsplans.com, 8Jul08)
5. (http://www.energycore.com.au/index.php, 8Jul08)
6. (http://www.geoexchange.com.au/gxtechnology.aspx, 8Jul08)
7. (http://www.telegraph.co.uk/earth/graphics/2007/06/15/eabiogas15c.jpg, 8Jul08)
8. (http://home.btconnect.com/engindia/projects.htm , 8Jul08)

3. Methodology

The course content was tailored to meet the needs of the project, and lectures and workshop sessions addressed each of the activities discussed below. Students were given classroom simulation exercises to prepare them to carry out the interviews, and very detailed guidelines were prepared for the students and made available through the course website. In this way, students were given a great deal of guidance to help them understand and apply the approaches to be used.

3.1 Secondary research methodology

Three teams were allocated to gather secondary data. As a starting point, they were given access to a range of secondary materials that had been identified by the lecturer. These teams were given two weeks to collect background information on the market for these technologies, as well as other related information, using as wide a range of sources as possible. Each team produced a summary of their work, using a template provided by the lecturer. These summaries, including a list of references, were placed on the course website, and were available to all of the students in the class. The summaries formed part of the assessment for this course.

3.2 Qualitative research methodology

Qualitative survey questions were developed during one of the lecture/seminar sessions for this course, and each student in the class was asked to pilot the questionnaire with a neighbour/relative or friend. The questions were revised, based on feedback obtained from the class. The interview protocol is available from the authors.

Five teams were allocated to carry out in-depth interviews with 10 individual participants. Interviews were carried out by students working in pairs, and they were given two weeks to complete this task. During this time, workshops were scheduled to discuss key aspects including recruitment of the participants and the management of interviews. Students were given very detailed guidelines regarding recruitment, and including specifications for the profile of participants. A theoretical sampling frame was used, and participants were required to have adopted of at least one of five energy-saving measures (the use of "green electricity", installation of low energy light bulbs, installation of a solar hot water system, installation of a photovoltaic cell system, ownership of an electric hybrid car). The purpose was to ensure that these interviews would be a rich source of information as they would be made with people who have demonstrated an awareness of, and interest in, energy conservation. Each team produced a summary of their work, using a format provided by the lecturer. These summaries were placed on the course website, and were available to all of the students in the class. The summaries formed part of the assessment for this course.

3.3 Survey methodology

Peter Balan and Matthew McKinlay developed a survey questionnaire, based on the results of the secondary research and the qualitative interviews. This was a personal interview survey, to be carried out face to face. The survey questionnaire is available from the authors.

The remaining 11 teams were then given 10 days (including two weekends) to each survey 20 individual target customers. An analysis of the suburb of residence of students in the class showed that they were relatively evenly distributed across the Adelaide Metropolitan area. Teams were then instructed to carry out surveys within walking distance of their home, with the exception of the Adelaide central business district. Students were instructed to interview adult home owners who had implemented one or more forms of energy conservation (the use of "green electricity", installation of low energy light bulbs, installation of a solar hot water system, installation of a photovoltaic cell system). The reason for including this requirement was to ensure that the surveys would generate reasonable response levels for each type of technology. In addition, secondary data was available relating to the adoption of these particular technologies and this would allow survey results to be extrapolated to the general population. People renting dwellings were excluded because the technologies being investigated required a significant investment in the property, which would not be undertaken by renters.

Students were given detailed guidelines for carrying out the survey, and were given quotas, based on gender, age group and employment status, using these three variables in a quota sampling matrix. Within those quotas, location of interviews was left to the students. Student teams were asked to practise carrying out these interviews among themselves before interviewing members of the public. Interviews were carried out by students working in pairs, and took place in private homes.

Teams were provided with an Excel spreadsheet into which they entered their data. Peter Balan cleaned up, consolidated and analysed the data and provided students with SPSS output in the form of frequencies for the whole sample (219 useable questionnaires). This was done within 24 hours of the deadline for teams to submit their survey data file and completed questionnaires. Each team produced a summary of the surveys that their team had carried out, using a format provided by the lecturer. These summaries were placed on the course website, and were available to all students in the class (together with the SPSS outputs described above). The team summaries formed part of the assessment for this course.

3.4 Scenario Network Mapping methodology

Scenario Network Mapping was developed by Dr Dennis List[2] as a systematic and practical method for developing possible future outcomes. This approach is based on identifying the influences of stakeholders and external business environment trends on the possible futures of a business activity. This approach was introduced during the lecture/seminar sessions. Students were given guidelines on this approach as well as starting points for the workshop exercise; this information was provided through the course website and was therefore available to all students.

The lecturer conducted a scenario network mapping workshop session when all of the market information gathering activities had been carried out, and all of the results described above had been made available to students through the course website. The maps developed during the workshop were finalised by the lecturer, were posted on the course website, and made available to all students.

3.5 How this information was used

It was explained to students, during the lecture and workshop sessions, how they could use the information collected using these different approaches to write their individual team marketing plans.

[2] List, DH 2004, 'Multiple pasts, converging presents and alternative futures', *Futures,* vol. 36, no. 1, pp. 23-43.

All the results collected were made available through the course teaching website, and students were advised when new sets of information were posted.

The value of this approach for the students is that they were introduced to a range of important market information gathering activities, and were able to take part in a professionally designed and managed market research exercise. They were also given access to a very comprehensive range of market research summaries and outputs, and were given advice on the ways in which the research findings could be used in writing a marketing plan.

4. Findings

Findings are presented in this sequence: the most relevant data from secondary research, the qualitative study, the survey, and the finally the scenario network mapping exercise.

4.1 Secondary Research

The students found a great deal of public information on these technologies, but most of this related industrial-scale implementation and to international markets, and there was very little that was applicable to the Adelaide/South Australian market. To keep this report concise and relevant, the only secondary research summarised here is that which is strictly relevant to the technologies being considered and the South Australian market.

The Market

- This is the market for renewable energy technologies at the individual household, and at the community level, located in Adelaide, South Australia.
- This market is considered to be at the embryonic stage of growth, with only about 3% of Australia's electrical power being generated by renewable energy methods, and this is primarily through industrial scale wind farms. The market for domestic level renewable energy technologies is currently extremely small.
- Consumers are generally considered to not have a good understanding of alternative energy sources, except perhaps for solar power cells and commercial wind farms, and only about 10% currently purchase "green power".

Industry Conditions

- There are many small suppliers entering the market, particularly from other countries, offering products over the Internet.
- The major barrier to entry at this stage appears to be lack of customer awareness and understanding of the technologies

Competition

- Australian suppliers were identified for each of the technologies being investigated, although there was limited distribution of these products in Adelaide, except for solar power cells

General business environment trends

- There is a general increase in community awareness of climate change and of the desirability for individuals to reduce their "carbon footprint"
- The Federal government had reduced access to a rebate for installation of solar power cells
- Proposed carbon trading schemes may encourage the development of renewable energy technologies at the domestic level
- Renewable energy technologies are gradually becoming cheaper with improvements in design (such as vertical axis wind generators) and in the efficiency of energy conversion.

4.2 Qualitative research findings

Student teams carried out in-depth one-on-one interviews (with a total of 50 participants) who had demonstrated an interest in energy conservation by adopting one or more energy-saving measures (green electricity, low-energy lightbulbs, solar hot water system, solar power cells, an electric hybrid car).

Awareness of renewable energy technologies
Most participants were familiar with solar power cells and with wind farms, but had low levels of awareness of geothermal and biogas technologies, and limited knowledge of these. Most people were informed by word of mouth and “traditional myths”. Many people needed to be shown images of these technologies, to see what they were, but they were then relatively easily able to determine how the systems might operate.

Solar power
This was the technology that was the best known and best understood. A small number of participants had already installed solar power cells to reduce their energy costs, and to reduce their carbon footprints.

People who had not installed solar power cells would be motivated to do so in order to sell electricity into the grid, to benefit the environment, and to be self-sufficient. In addition, solar power cells increased the value of the property, were not prominent on the roof, and were silent. Reasons for not installing power cells were the cost involved, the exclusion of some households from the government rebate, concern about the unattractive appearance of solar panels, and about the small amount of power generated, and the lack of power generation at night.

Most people interviewed supported the installation of solar panels at the community level for environmental reasons, and with the hope that savings would eventually filter to them. Reservations included the unattractive appearance of large areas of solar panels (reflections), the installation expense, and concerns that the cost might not be distributed equally across the community.

Wind power
There was some confusion about this option, and some people imagined large windmills on top of houses. Some participants thought that this would be a cheaper option to install than solar power cells, that it looks more innovative than solar, and offered long-term energy expense savings. Reservations included the unattractive appearance and the effect on neighbours, installation cost, possible noise, and possible problems in selling electricity into the grid, as well as being a danger to birds.

There was more understanding of wind power at the community level, as a number had seen wind farms. The large majority of participants supported wind generators at the community level with the hope that electricity prices would be reduced, to benefit the environment, and thought that this would be a good use for stobie poles. Concerns related to the appearance of large wind generators (“ruin the community”), ongoing maintenance costs, noise, and danger to birds.

Geothermal power
There was a limited awareness of this technology, and geothermal power was confused by many people with “hot rocks” technologies. Household geothermal power was appealing because it appeared to be hidden underground, and would be a good/cheap source of heating and cooling, and operated 24 hours a day. By and large people had very little knowledge about this technology, and thought it would take a lot of space and be expensive to install, and would be expensive to operate.

Participants felt that geothermal power would be more feasible at the community level as they had the impression that it worked better on a larger scale. However participants were concerned about the space required for this type of technology, as well as the expense of installation and maintenance, and the overall efficiency of this approach.

Biogas power
People had little knowledge about this. They thought that it would reduce waste and would be cheaper than other energy options. Reservations included the smell, lack of space, that it would be labour intensive and high maintenance, and that it would be hard to get enough waste to generate power.

Participants would support community biogas systems to help divert waste from landfill and reduce pollution. However they had concerns about whether individuals would actually have to deliver waste to a central point, hygiene and safety, smells, and high operating costs.

Conclusions
Most people interviewed were motivated by saving money on their power bill, and by doing something for the environment. Most of the reasons for not supporting these technologies were related to the perceived cost of installation, and the length of time to pay off the investment. Most people were unsure about how these technologies work, and details of how it would benefit them.

The results from this part of the study were used to develop the survey questionnaire.

4.3 Survey findings

This section summarizes the findings of the survey undertaken with 219 adult householders in the Adelaide metropolitan area in August 2008. The survey excluded householders who were renting their property, and was restricted to those who had implemented at least one energy conservation measure (the use of "green electricity", use of low energy light bulbs, installation of a solar hot water system, installation of a photovoltaic cell system).

4.3.1 Demographic data about respondents

Age group (Q.45)

	%	ABS Category	ABS %
18 to 25	16	15 to 24	17
26 to 35	22	25 to 54	51
36 to 45	21		
46 to 55	21		
56 to 65	13	55 to 64	14
66 to 75	0.5	65 and over	19
Over 75	6		
Total	100%		
Valid participants	216		

The ABS Census (2006) presents data in different age categories, but a comparison shows that this study under-represented people over 65 years old, and were more likely to be in the middle age group (26 to 55 years).

Household income (Q.46)

	%
Less than $40,000 per year	17
$40,000 to $79,999	39
$80,000 to $99,999	19
Over $100,000	26
Total	100%
Valid participants	198
No response	10%

Employment status (Q.42)

	%	ABS Statistics (%)	
Student only	5	*	
Full time worker	59	58.7	
Part time worker	18	30	
Unemployed	2	5.2	
Retired	10	*	
Home duties	5	*	
Total	100%		
Valid participants	210		

*The ABS Census (2006) statistics do not segregate data into these categories. The categories of students, retired or home duties are classified by the ABS as not in the current labour force. As such, comparing the equivalent categories of full time, part time and unemployed, our data broadly reflects the wider population.

Gender (Q.48)

	%	ABS data (%)
Male	56	48.8
Female	44	51.2
Total	100%	100%
Valid participants	217	1,105,839

The ABS Census data (2006) indicates that the participants in this study included more males than the general population, possibly because of the under-representation of people over 65 years.

Highest education qualification (Q.44)

	%	ABS data (%)
Primary or secondary school completion	30	
TAFE certificate	19	16
University degree	38	14
Postgraduate university qualification	14	2.5
Total	100%	
Valid participants	208	374,108

The ABS Census (2001) shows that there were 374,108 people in the region of Adelaide aged over 15 years with a post-secondary qualification, or 32.5% of the total population of Adelaide. In comparison, the people surveyed in this study had about twice the proportion (70%) with post-secondary qualifications.

Type of dwelling (Q.8)

	%
House on block of land	75
Courtyard home	12
Unit	9
Apartment	4
Total	100%
Valid participants	219

Number of people in the household (Q. 9)

	%
1	5
2	32
3	24
4	27
5	10
6	2
Total	100%
Valid participants	219

According to the 2006 ABS Census data, the average household size for Adelaide was 2.4 people per household. The weighted average for our dataset is 3.11 people per household, which suggests that the sample for the survey was biased towards slightly larger households.

Community involvement (Q.44)

Participants were asked if they took part in any local community activities. Participants were not prompted and were able to give multiple responses (with an average of 1.1 responses per person).

	%
None	52
Local sports group	24
Voluntary community group (library, residents association, church group)	19
Local service club (Rotary, Lions, Apex)	8
Local government involvement (local Council member or local committee member)	6
Valid participants	213
No response	3%

Energy conservation measures that were implemented by participants (Q.7)

Participants were asked to nominate energy conservation measures that were implemented in their dwelling, and they needed to have at least one of these to be selected to complete the survey. Participants were able to give multiple responses (with an average of 1.5 responses per person). These results are compared with available secondary data, as shown below.

	Survey %	% of households
Low-energy lightbulbs	92	38% in 2005 (1)
Green electricity	26	11% in 2008 (2)
Solar hot water	21	4% in 2004 (3)
Solar power cells	13	0.9% in 2008 (4)
Valid participants	219	

(1) The ABS report "4602.0 Environmental Issues: People's Views and Practices, March 2005", page 28 states that 38.2% of dwellings in South Australia used energy-saving lights, compared with 24.1% in March 2002. This suggests that about 52% of households would have used these devices at the time of the survey.
(2) The "National GreenPower Accreditation Program Status Report, Quarter 2 - 1 April to 30 June 2008" states that 72,769 residential customers in South Australia purchased green electricity, and this represents approximately 11% of the estimated 655,000 households in 2008 (using the ABS report "3236.0 Household and Family Projections 2001 to 2026", page 46.)
(3) ABS report "4618.4 Domestic Use of Water and Energy, South Australia, October 2004", page 31.
(4) The Australian Government Department of the Environment, Water, Heritage and the Arts indicates that there were 5909 grid and off grid systems installed in South Australia to September 2008 (www.environment.gov.au/settlements/renewable/pv)

In conclusion, the comparison of the survey data with the secondary information suggests that the survey sample had adopted energy conservation measures at about twice the rate of the general population.

Household Electricity Bill (Q.47)

Participants were asked to give the total amount for the last electricity bill. The average three-monthly electricity bill was $328, with a median of $277.

	%
Less than $100	3
$100 to $299	24
$200 to $299	26
$300 to $399	19
$400 to $499	14
$500 to $599	5
$600 to $699	3
$700 to $799	1
$800 to $899	2
$900 to $999	1
$1000 to $2000	2
Total	100%
Valid participants	196
No response	11%

4.3.2 Awareness of energy as an issue

Do you think there is an energy problem? (Q.37)

	%
Yes	88
No	12
Total	100%
Valid participants	219

If the answer is yes, why do you think we have not already solved that problem? (Q.38)

Participants were not prompted and were able to give multiple responses (with an average of 1.5 comments per person).

	%
Governments are not doing enough	61
Technologies are too expensive	39
People are too set in their ways	39
Technologies are not good enough	12
Governments profit from oil/coal	1
Valid participants	186
No response	15%

Whose responsibility do you think it is to implement alternative ways of generating power? (Q.39)

Participants were asked to give the order of importance of each of the following agencies by numbering them in order of importance from 1 through to 4)

	Mean	Std Deviation
Governments	1.39	0.793
Business	2.78	0.926
Individual households	2.86	1.119
Local communities	2.97	0.807
Valid participants	208	
No response	5%	

Participants definitely considered that governments should take the major responsibility for implementing renewable energy technologies, while the other three agencies were by and large grouped together with no significant difference between them.

4.3.3 Respondent awareness of different ways of generating renewable energy in their home

Participants were asked to name any renewable ways to generate energy in their home, excluding engine-driven generators (Q.10). Participants were not prompted, and were able to give multiple responses (with an average of 1.6 responses per person).

	%
Photovoltaic cell systems/solar power cells	91
Wind	48
Biogas/biomass	14
Geothermal	10
Don't know any	1
Valid participants	219

It is clear that biogas and geothermal technologies had low levels of awareness, and only 2 participants were not able to name at least one technology (with no prompting).

4.3.4 Participants who already had installed solar power cells

There were 29 people interviewed (13% of the sample) who already had solar power cells installed in their home, and they were asked to give reasons why they had done this (Q.11). Participants were not prompted and were able to give multiple responses (with an average of 2.5 responses per person).

	%
To reduce electricity bills	86
To benefit the environment	69
To get the government rebate	31
To increase the property value	31
Installed by previous owner	7
Required in our locality*	7
Valid participants	29

* Two respondents lived in new developments where installation of solar power cells was a requirement.

These people were also asked if they had any reservations about their installation (Q.12). Participants were not prompted and were able to give multiple responses (with an average of 2.4 responses per person who provided a response).

	%
Expensive installation	52
Maintenance cost	41
No reservations at all	28
Low amount of power generated	24
Low price obtained for selling power back to the grid	24
Technology is not proven, may not last	14
No power generation at night	10
Unattractive appearance	10
Valid participants	29

The high "no reservations" proportion of answers to Q.12 suggests that most people were happy with the installation of solar cells in their home.

4.3.5 Household adoption of renewable energy technologies

Participants were separately shown images of renewable energy technologies installed at the domestic level (this was done at different stages of the interview). For each technology in turn, participants were asked to give the probability that they would install that renewable energy technology in the next three years, on a scale where zero meant "definitely not", through to 100% meaning "definitely yes". Overall, there was a relatively high preparedness to install solar power, compared with the other forms of energy, as shown in the following summary table:

Probability of purchase in 3 years	Solar power (Q.13)%	Wind power (Q.19)%	Geothermal power (Q.25)%	Biogas power (Q.31)%
0%	19	31	55	51
1% to 9%	2	5	5	4
10% to 19%	7	14	8	10
20% to 29%	7	14	9	9
30% to 39%	8	7	5	4
40% to 49%	6	6	3	3
50% to 59%	22	14	7	7
60% to 69%	12	4	2	2
70% to 79%	7	2	2	3
80% to 89%	5	1	2	4
90% to 99%	2	0.5	0.5	0.5
100%	3	1	0.5	2
Total	100%	100%	100%	100%
Valid participants	177	215	217	217

This data can be represented in a simplified form that more clearly shows consumer attitudes:

Probability of purchase in 3 years	Solar power (Q.13)%	Wind power (Q.19)%	Geothermal power (Q.25)%	Biogas power (Q.31)%
0 to 49%	49	77	85	81
51 to 100%	51	23	15	19
Mean%	40	23	15	18

Overall, there was a high probability that the group surveyed would invest in solar power cells. The reduced probabilities of investment in the other forms reflects the lack of knowledge about these options.

4.3.6 Support for renewable energy technologies at the community level

Participants were separately shown images of renewable energy technologies installed at the local or community level (this was done at different stages of the interview). For each technology in turn, participants were asked to give the probability that they would support that type of renewable energy technology being installed somewhere close to their residence, on a scale where zero meant "definitely not", through to 100% meaning "definitely yes".

Probability of support	Solar power (Q.16)%	Wind power (Q.22)%	Geothermal power (Q.28)%	Biogas power (Q.34)%
0%	2	8	9	21
1% to 9%	0.5	1	3	3
10% to 19%	2	5	5	10
20% to 29%	2	3	8	9
30% to 39%	0.5	3	4	7
40% to 49%	3	6	5	2
50% to 59%	6	16	23	17
60% to 69%	11	11	6	4
70% to 79%	12	6	7	5
80% to 89%	15	10	6	6
90% to 99%	8	6	4	4
100%	39	25	21	13
Total	100%	100%	100%	100%
Valid participants	218	216	217	215

This data can be represented in a simplified form that more clearly shows consumer preferences:

Probability of support	Solar power (Q.16)%	Wind power (Q.22)%	Geothermal (Q.28)%	Biogas power (Q.34)%
0 to 49%	9	26	34	51
51 to 100%	91	74	66	49
Mean%	78	61	55	41

Overall, there was very high support for the installation of the best known technologies (solar power cells and wind), and good support for the other forms of renewable energy technology. These results also show that the people surveyed were more prepared to support community or local installation of these technologies than to install them in their own household, which reflects a risk-reduction attitude.

Analysis of correlations suggest that there is a:

- positive correlation between education level and the probability of purchase of solar cells, geothermal systems and biogas systems at the household level; that is, people with a higher level of education would be more likely to invest in these technologies in their homes. There were no correlations between education and the domestic purchase of wind generators, or with regard to support for the community installation of any of these technologies.
- negative correlation between household income and probability of purchase of household solar cells; that is, people on a lower income would be more likely to invest in solar cells (possibly because of the awareness of means testing for the government incentive for domestic solar power cells).
- negative correlation between age group and support for community wind power; that is, younger people were more likely to support this option.

4.3.7 Solar power cells at the household and community level

Participants who had not already installed solar power cells in their home were shown an image of a domestic solar power cell installation and were asked to give reasons why they might consider doing this (Q.14). Participants were not prompted and were able to give multiple responses (with an average of 2.0 responses per person).

	%
To reduce electricity bills	80
To benefit the environment	70
To get the government rebate	30
To increase the property value	8
Familiar technology	4
To be self-sufficient	2
To sell power back to the grid	2
Valid participants	181
No response	10%

Participants were asked to give reasons why they would not want to install power cells in their home (Q.15). Participants were not prompted and were able to give multiple responses (with an average of 1.9 responses per person).

	%
Cost of installation	81
Cost of maintenance	38
Do not know enough about the technology	19
Low amount of power generated	16
Unattractive appearance	11
Technology is not proven and may not last	10
No electricity generation at night	9
Low price obtained for selling power back to the grid	4
Payback period is too long	3
Not eligible for the government rebate	2
Valid participants	184
No response	3%

The low no response rate to these questions shows that people interviewed were quite familiar with this technology applied at the domestic level, and were able to respond with a range of comments.

Participants were shown an image of a larger scale solar power cell system and were asked to give reasons why they might support this type of installation near their residence (Q.17). Participants were not prompted and were able to give multiple responses (with an average of 1.4 responses per person).

	%
To benefit the environment	78
Costs shared	49
Better at a community scale	4
Cheaper electricity	4
Visually less intrusive	2
Increased self-sufficiency	1
Valid participants	208
No response	5%

Participants were asked to give reasons why they might not support this type of installation near their residence (Q.18). Participants were not prompted and were able to give multiple responses (with an average of 1.6 responses per person).

	%
Cost of installation	56
Cost of maintenance	36
Unattractive appearance	27
Do not know enough about the technology	21
Not a priority for community spending	21
Not sure where to locate it	4
Valid participants	169
No response	23%

The high no response rate to Q.18 (especially compared with the low no response rate for Q.17) indicates that a significant proportion of people interviewed had no adverse comments to make about the installation of solar cells at the community level. However, the lower number of average responses regarding community installation (compared with those given in relation to household use) suggests that people interviewed felt a relative lack of knowledge about the installation of solar cells at the community/local level.

4.3.8 Wind power at the household and community level

Participants were shown an image of a domestic wind generator and were asked to give reasons why they might consider installing one of these in their home (Q.20). Participants were not prompted and were able to give multiple responses (with an average of 1.4 responses per person).

	%
To reduce electricity bills	87
To benefit the environment	19
Seems a reliable technology	13
Innovative appearance	10
Familiar technology	7
Valid participants	176
No response	20%

Participants were asked to give reasons why they would not want to install a wind generator in their home (Q.21). Participants were not prompted and were able to give multiple responses (with an average of 1.8 responses per person).

	%
Unattractive appearance	40
Do not know enough about the technology	39
Possibly noisy	36
Too much variability in power output	29
Cost of installation	15
Would reduce property values	10
Technology is still experimental	7
Do not have enough space	3
Do not have enough wind	2
Not allowed (by council or by strata)	2
Might harm birds	0.5
Valid participants	206
No response	6%

The differences in the no response rates and the average comments per person for these two questions suggest that people interviewed found it easier to give reasons not to adopt this technology, and were more motivated to identify barriers.

Participants were shown an image of a larger wind generator and were asked to give reasons why they might support this type of installation on a community/local basis near their residence (Q.23). Participants were not prompted and were able to give multiple responses (with an average of 1.4 responses per person).

	%
Better at a community scale	52
Costs shared	44
To benefit the environment	26
Visually less intrusive	13
Cheaper electricity	4
Valid participants	193
No response	12%

Participants were asked to give reasons why they might not support this type of installation near their residence (Q.24). Participants were not prompted and were able to give multiple responses (with an average of 1.8 responses per person).

	%
Possibly noisy	45
Visually unattractive/might be too big	43
Need to be in an open space	34
Do not know enough about the technology	25
Might reduce property values	11
Technology is still experimental	8
Cost of installation and maintenance	6
Might harm birds	2
Not enough wind	1
Safety problems	0.5
Valid participants	201
No response	8%

Again, the differences in the no response rates and the average comments per person for these two questions suggest that people interviewed found it easier to give reasons why they would not support this technology.

4.3.9 Geothermal power at the household and community level

Participants were shown an image of a domestic geothermal installation and were asked to give reasons why they might consider installing this in their home (Q.26). Participants were not prompted and were able to give multiple responses (with an average of 1.4 responses per person).

	%
To reduce heating and cooling bills	74
To provide a continuous power source	22
Low maintenance	19
Benefit the environment	16
Not intrusive	5
Cheapest renewable energy technology option	1
Valid participants	152
No response	31%

Participants were asked to give reasons why they would not want to install a geothermal system in their home (Q. 27). Participants were not prompted and were able to give multiple responses (with an average of 2.2 responses per person).

	%
Cost of installation	60
Do not know enough about the technology	53
Cost of maintenance	32
Concern about the amount of space needed	27
Costs of operations/running	16
Technology is still experimental	16
Hard to install in an existing house	9
No hot rocks available	2
Valid participants	211
No response	4%

The large differences in the no response rates and the average comments per person for these two questions suggest that the people interviewed found it much easier to give reasons not to adopt this technology (about which they had limited knowledge).

Participants were shown an image of a larger scale geothermal system and were asked to give reasons why they might support this on a local or community basis near their residence (Q.29). Participants were not prompted and were able to give multiple responses (with an average of 1.6 responses per person).

	%
More effective at a community scale	52
Costs shared/more efficient for drilling holes	33
Continuous power supply	24
Visually acceptable	18
Cheap to run	5
Reduce power bills	3
Valid responses	185
No response	16%

Participants were asked to give reasons why they might not support a geothermal system near their residence (Q.30). Participants were not prompted and were able to give multiple responses (with an average of 1.4 responses per person).

	%
Do not know enough about the technology	49
Might disturb the infrastructure	30
Might take up too much space	28
Technology is still experimental	21
Cost of installation	12
Low efficiency	3
Not safe	2
Valid participants	197
No response	10%

The differences in the no response rates and small difference in the average comments per person for these two questions, suggest that people interviewed did not have enough knowledge to take a strong position on this technology at the local or community level.

4.3.10 Biogas/biomass power at the household and community level

Participants were shown an image of a domestic biogas system and were asked to give reasons why they might consider installing this in their home (Q.32). Participants were not prompted and were able to give multiple responses (with an average of 1.6 responses per person).

	%
Good way of using existing waste	61
Cheap to build/install	33
Reduce landfill problems	28
Low operating costs	21
Benefit the environment	11
Reduce power bills	8
Valid participants	166
No response	24%

Participants were asked to give reasons why they would not want to install a biogas system in their home (Q.33). Participants were not prompted and were able to give multiple responses (with an average of 2.1 responses per person).

	%
Smell	62
Do not know enough about the technology	39
Needs too much space	26
Visually unacceptable	23
Concerned about safety	22
Too labour intensive	20
Do not have enough waste to run this	5
Not efficient	5
Cost	4
Health problems/vermin/residues	3
Valid participants	209
No response	5%

The large differences in both the no response rates and the average comments per person for these two questions, suggest that people interviewed found it much easier to give reasons not to adopt this technology (about which they had limited knowledge).

Participants were shown an image of a larger scale biogas system and were asked to give reasons why they might support this near their residence (Q.35). Participants were not prompted and were able to give multiple responses (with an average of 1.8 responses per person).

	%
Good use of existing waste	62
Reduce landfill problems	34
Better at community scale	33
Cheap to build/install	19
Lower operating costs	18
Benefit the environment	14
Smells better contained (than at household level)	1
Valid responses	187
No response	15%

Participants were asked to nominate any reasons why they might not support a biogas installation near their residence (Q.36). Participants were not prompted and were able to give multiple responses (with an average of 2.0 responses per person).

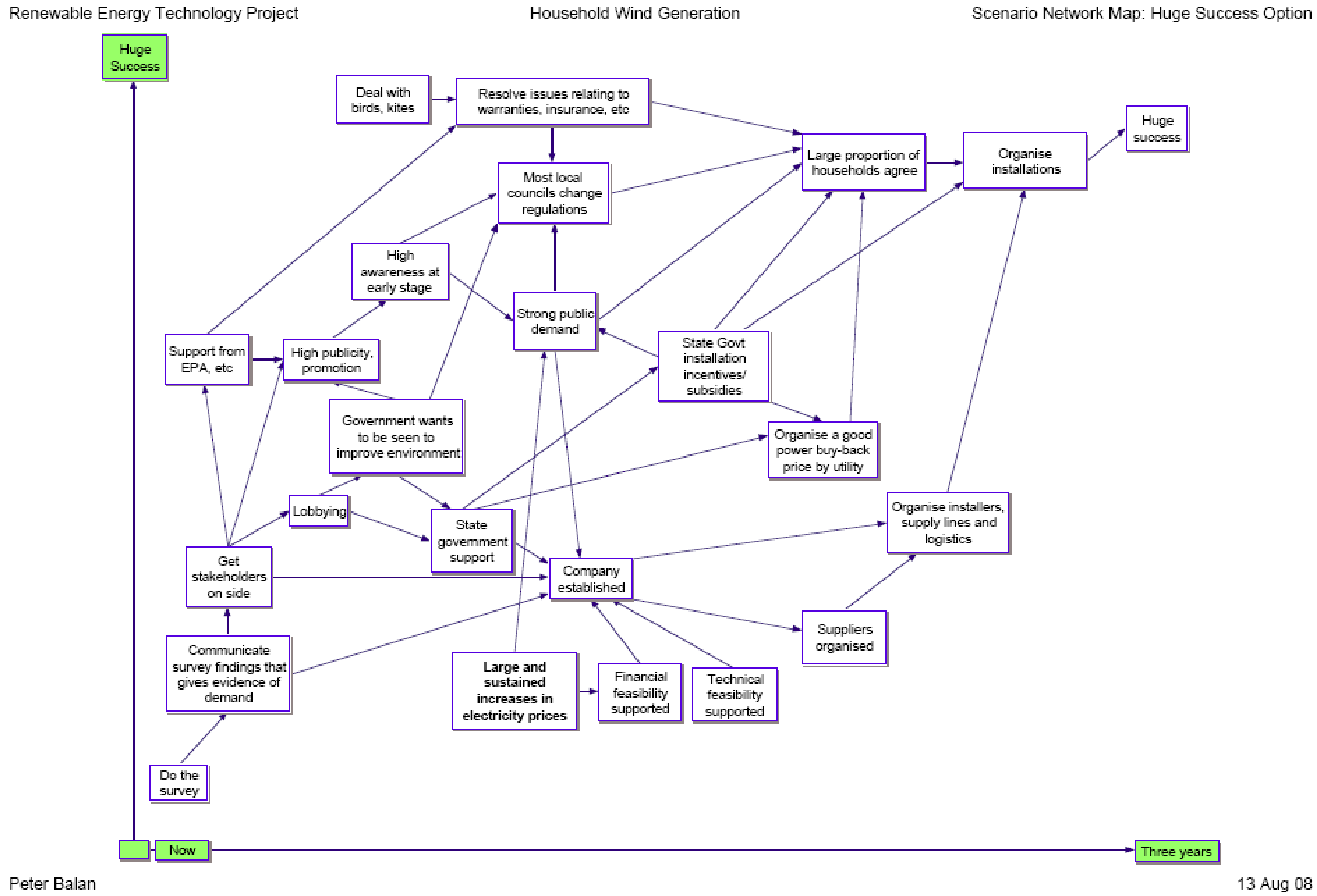
	%
Smell	58
Do not know enough about this	37
Visually unacceptable	30
Safety concern	27
Would take up too much space	23
Too labour intensive	14
Cost	5
Health concerns/vermin/residues	2
Valid participants	202
No response	8%

The significant difference in the no response rates, and the smaller difference in the average comments per person for these two questions, suggest that people interviewed found it easier to give reasons not to support this technology (about which they had limited knowledge).

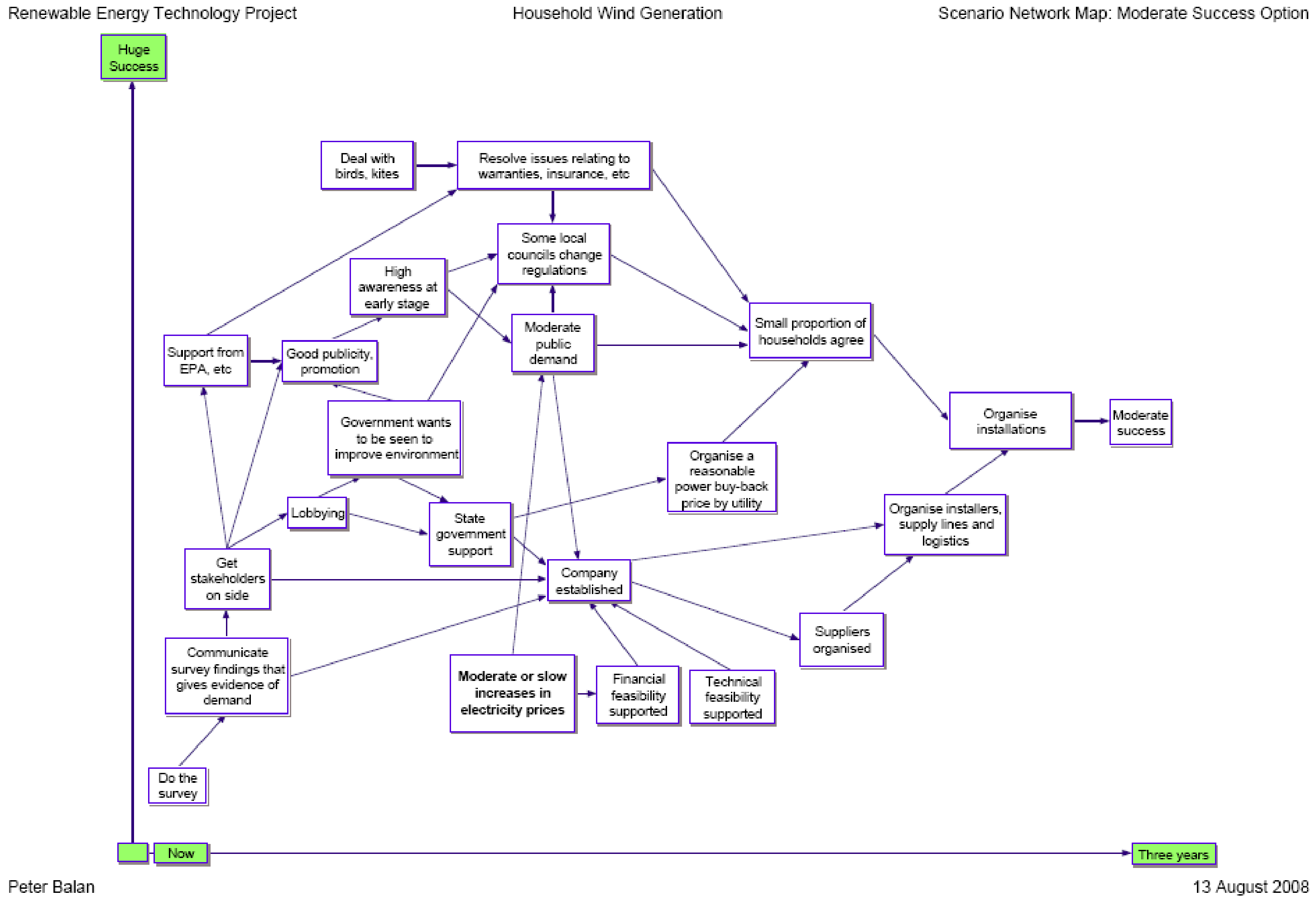
4.4 Scenario network mapping: likely trajectories

From the secondary research, the qualitative research, and the survey, we identified three possible scenario trajectories for each possible RET at the domestic level and at the community level. The trajectories were: “huge success”, “moderate success”, “death”. Examples are shown below:

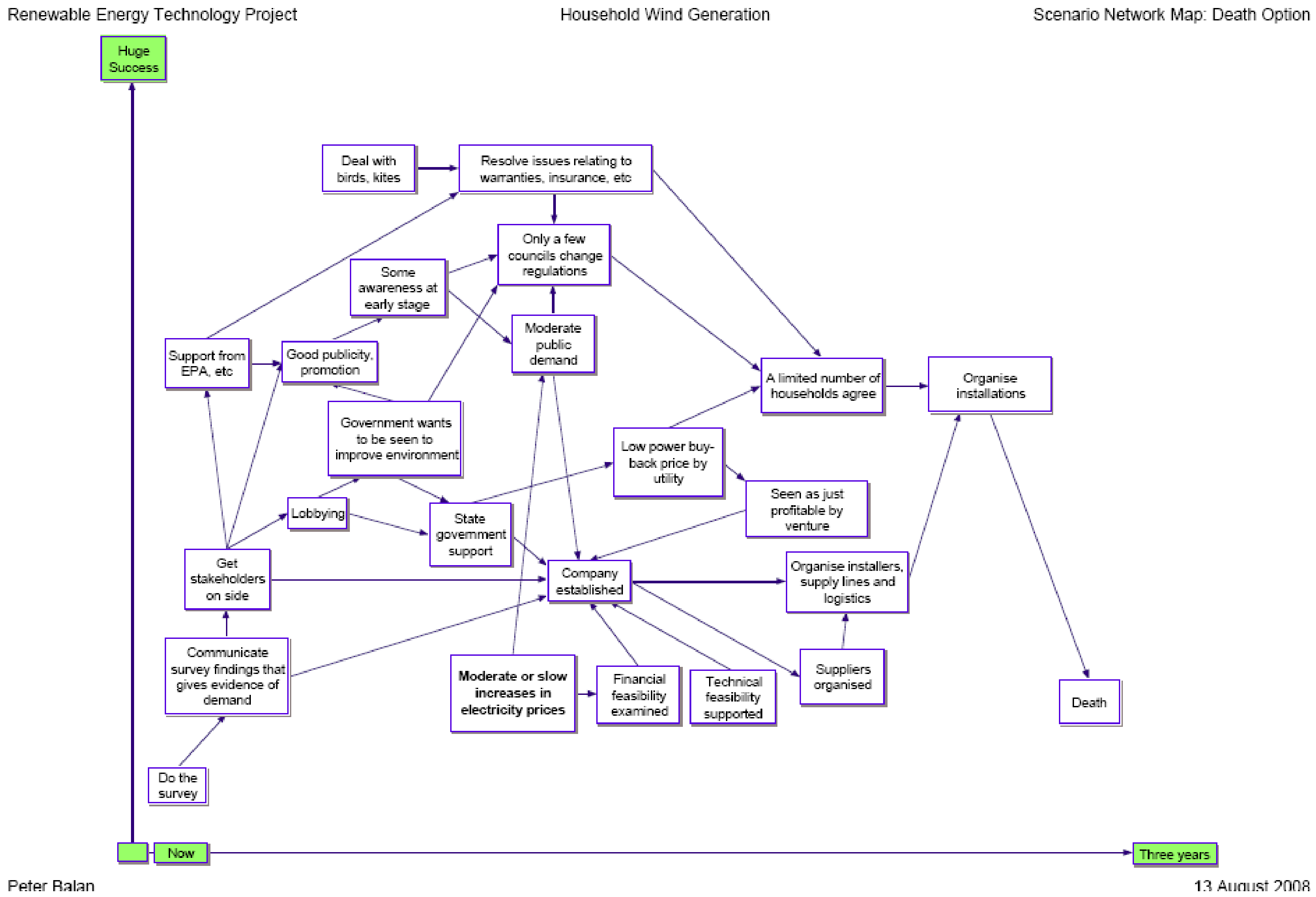
Example: “Huge success” scenario for domestic wind power



Example: "moderate success" scenario for domestic wind power



Example: "death" scenario for domestic wind power



5. Discussion and conclusions

In general:

- Survey participants were selected on the basis of their behaviour in adopting one or more of four energy conservation measures
- The survey participants had a similar employment and gender profile to the general population, but the proportion of those with post-secondary education was approximately double that of the general population, and the sample was a skewed towards middle-aged people
- The large majority of participants considered that there was an energy problem, and that leadership and action was clearly the responsibility of government, rather than the business sector, or individuals
- The participants appeared to have implemented energy conservation measures at approximately twice the rate of the overall population
- Almost all participants could identify solar power cells as a method for generating power at the domestic level, about half identified wind energy as an option, and there was very low awareness of biogas or geothermal energy options.
- Approximately half of the households survey indicated that there was a more than 50% probability that they would install solar power within the next three years. Less than a quarter of the household surveys indicated by more than 50% probability of installing either wind, geothermal, all biogas systems in their household within the next three years. Overall, this suggests a very high level of possible adoption.
- Almost all participants would support the installation of community based solar power systems, about three quarters would support community-based wind generators and between two thirds and a half would support community-based geothermal and biogas energy systems near their residence. Overall, this suggests a very high level of support for community-based implementation of renewable energy technologies.
- The major reasons for installing renewable energy technologies at the household level were generally similar, and were mainly to “reduce electricity bills”, and “to benefit the environment”. Only 30% of participants said that they would be motivated by government rebate.
- The major reasons for not being prepared to install a renewable energy technology at the household level tended to be related to cost of installation (particularly for solar cells), but also the lack of knowledge of the other technologies investigated.
- The major reasons for supporting the installation of renewable energy technologies at the local or community level were to share costs across the community, and to improve effectiveness. The major reasons for not supporting this were cost (for solar cells), noise (for wind), and lack of knowledge for the other technologies (biogas and geothermal).
- The way that reasons for and against were given for the different technologies reflects a lack of public knowledge about options other than solar cells.
- The scenario network mapping exercises showed the importance of generating awareness to address the lack of knowledge about these renewable energy technologies, and the need to have clear regulations at the state and local government level to facilitate the installation of these technologies (both at the household, and at the community levels). These also identified a role for incentives for the installation of these technologies, as well as for the buyback of power generated, even though these did not have a great importance in the quantitative survey. These scenarios also identified the role of large and sustained increases in electricity prices.
- In particular, the factors that would make a difference between “huge success” and “death” were considered to be local council regulations, incentives for installation, and electricity price increases.

In conclusion, this study focused on people who had demonstrated the adoption of energy conservation devices in their home, and could be assumed to have a greater awareness of energy-related matters than the general population. These people reported a good level of awareness of solar power cells and wind energy as renewable energy technologies, but limited knowledge of the other options investigated. This suggests that the general population would have less knowledge of these technologies.

Comparison of the profile of the participants in this study with the profile of the population as a whole suggests that the results relating to preparedness to install and support should be halved to provide a more accurate representation of the attitudes of the population as a whole. However, the reasons for installing or supporting these technologies are still relevant, as it is this group of people that was studied that are likely to be the earlier adopters of these technologies.

The results therefore suggest that there is a very good level of readiness in the community to install and support these technologies.

Appendix 1 – Students who contributed to this study

Mr	Sultan	Al Maadeed
Miss	Valeria	Alonso
Mr	Vladimirs	Andrejevs
Mr	Zachary	Anesbury
Mr	Anshu	Babbar
Mr	Cameron	Ballard
Ms	Carla	Biskup
Mr	Trent	Cavanagh
Miss	Sarah	Chataway
Mr	Alwyn	Chin
Ms	Elise	Corena
Mr	Joshua	Della-Pietra
Miss	Thanh Thien Y	Doan
Mr	Marek	Dubovinsky
Mr	Adam	Ellershaw
Mr	Dylan	Fairweather
Miss	Cara	Fischetti
Mr	Kurt	Galpin
Ms	Ioana	Ghita
Miss	Irina	Gromchenko
Miss	Kylie	Hoang
Miss	Josephine	Hodge
Miss	Naomi	Hodges
Ms	Sasha	Hogenbirk
Ms	Habiba	Huka
Miss	Courtney	Ivett
Mr	Roni	Jalkanen
Ms	Veronica	James
Mr	Lee	Kelly
Miss	Melissa	Krollig
Mr	Branislav	Krstic
Mr	Kevin	Li
Ms	Sha	Lu
Mr	David	Malan
Mr	Henry	Mason
Mr	Michael	McIlwaine
Mrs	Judy	McKay
Miss	Nur Hazwani Binti	Mohd Hasnul Hisham
Miss	Katherine	Myers

Miss		Nazampreet Kaur
Mr	Kim	Nganga
Mr	Rhian	Oliver
Miss	Wala	Omer
Ms	Tahnee	O'Shaughnessy
Mr	Gerald	Pathinathan
Mr	Nicholas	Patterson
Mr	Ewan	Pettigrew
Mr	Constandinos	Pirgousis
Mr	Paul	Rees
Mr	Paul	Reilly
Mr	Yi	Ruan
Miss	Adriana	Russo
Miss	Lidija	Samardzija
Mr	Ali	Sharafi
Ms	Nicole	Sheridan
Mr	Surinder	Singh
Miss	Stephanie	Springbett
Mr	David	Stobbe
Ms	Kathryn	Sutherland
Mr	Nicholas	Symons
Mr	Liang Shiong	Tee
Ms	Silvi	Tiivas
Mr	Peter	Titley
Miss	Thu Trang	Tran
Miss	Quynh	Tran
Mr	Heath	Varcoe
Ms	Jessica	Whitaker
Miss	Kate	Williams
Miss	Ying	Yang
Mr	Muhama	Yotham