

Householder interest in active participation in the solar distributed energy market

Results from focus group meetings

EP129983

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Contents

| | | |
|---|---|-----|
| | Acknowledgments..... | iii |
| | Executive summary..... | iv |
| | Background | iv |
| | Participants | iv |
| | Factors influencing uptake | v |
| 1 | Introduction | 1 |
| 2 | Method..... | 2 |
| | 2.1 Sample | 2 |
| 3 | Results | 3 |
| | 3.1 Knowledge of solar and related business models | 3 |
| | 3.2 Support for the six energy options | 5 |
| | 3.3 Factors influencing preferences of energy options | 6 |
| | 3.4 Preferences for technology options | 11 |
| | 3.5 Preferences for finance options to invest in solar technology | 12 |
| | 3.6 Factors influencing preferences for finance options | 13 |
| | 3.7 Trust and sources of information | 16 |
| | 3.8 Considerations for investing in a distributed energy option | 17 |
| 4 | Discussion..... | 18 |
| | 4.1 A time of change | 18 |
| | 4.2 Important factors to consider in the survey | 19 |
| 5 | References..... | 21 |
| | Appendix A Workshop process | 22 |
| | Appendix B Demographics and characteristics..... | 24 |
| | Appendix C Post workshop questionnaire..... | 30 |
| | Appendix D Information provided | 38 |

Figures

| | |
|---|----|
| Figure 1 Participants' ability to explain to a friend distributed energy options before and after information provision | 4 |
| Figure 2 Participants' likelihood to consider installing any of the solar distributed energy options presented | 6 |
| Figure 3 Participants' preferences for payment options for investing in solar technology | 13 |
| Figure 4 Participants' mean level of trust in information sources providing information on EE | 16 |

Tables

| | |
|---|----|
| Table 1 Range of options presented in the focus groups..... | iv |
| Table 2 Solar PV technology and payment options..... | 2 |
| Table 3 Changes in mean self-rated knowledge..... | 5 |
| Table 4 Thematic analysis of pros and cons reported in workbooks, showing the number of comments recorded for each of the solar technology options..... | 9 |
| Table 5 Solar technology options participants would be willing to consider for their household..... | 11 |
| Table 6 Options participants would NOT be willing to consider for their household..... | 12 |
| Table 7 Thematic analysis of the pros and cons for each of the finance options for investing in solar technology, showing the number of comments reported for each option | 14 |
| Table 8 Participants' ranking of information sources when considering investing in solar technology | 17 |
| | |
| Apx Table B.1 Focus groups participants' gender..... | 24 |
| Apx Table B.2 Focus groups participants' age | 24 |
| Apx Table B.3 Focus groups participants' level of education | 24 |
| Apx Table B.4 Focus groups participants' employment status..... | 25 |
| Apx Table B.5 Focus groups participants' employment occupation | 25 |
| Apx Table B.6 Focus groups participants' home ownership | 25 |
| Apx Table B.7 Focus groups participants' dwelling characteristics..... | 26 |
| Apx Table B.8 Focus groups participants' household composition..... | 26 |
| Apx Table B.9 Focus groups participants' income level | 26 |
| Apx Table B.10 Participants' mean responses to VBN statements | 27 |
| Apx Table B.11 Participants' efforts to reduce electricity costs in their homes in the last 12 months | 28 |
| Apx Table B.12 Participants' assessment of their efforts to reduce their electricity costs..... | 28 |
| Apx Table B.13 No. of Participant that do/don't purchase Green Power | 28 |
| Apx Table B.14 Please write down the main reasons why you try to save electricity around the home. | 28 |
| Apx Table B.15 Please write down the main reasons why you don't save electricity around the home. | 29 |
| Apx Table B.16 What are some of the specific things you do to save electricity around the home?..... | 29 |

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Executive summary

Background

With the sharp rise in energy prices and motivations to transition to a low carbon energy supply, many Australians are making efforts to improve energy efficiency measures in their homes. A number of Australian householders have purchased various configurations of solar photovoltaic cells. These have mostly been incentivised through government rebates and feed-in tariff programs that have been offered over the past few years at the local, state and national levels. As such, there has been an unprecedented reduction in householders' demand for energy. Since July 1, 2012 however, a number of the major existing incentives for solar PV have now ceased. This has left many householders dubious about whether they should be considering alternative business models for distributed energy or if they should simply wait until a new form of incentive is offered.

With this in mind, the Australian Solar Institute (ASI) through the Australian Photovoltaic Association (APVA) sponsored this research to investigate the range of stakeholder opinions and likely preferences in relation to opportunities for participating in distributed energy and demand side response activities. This report presents the findings of six focus groups that were conducted with members of the Australian public in Brisbane, Melbourne and Sydney in October, 2012. An expert from the APVA was enlisted to present peer reviewed business models to the participants in the focus groups (see Table 1). The analysis of these focus groups will be used to inform a national survey which will be delivered across Australia in February, 2013.

Table 1 Range of options presented in the focus groups

| Solar PV technology options | | | |
|-----------------------------|--|--------------|--------------------------|
| Option | Solar technology | Abbreviation | Payment options |
| 1 | Energy efficiency and solar hot water systems | SHW | |
| 2 | Grid connected solar PV | SPV | Pay up front |
| 3 | Grid connected solar PV with battery | SPVB | Hire purchase |
| 4 | Battery alone | BA | Solar leasing |
| 5 | Community PV | CPV | Energy service companies |
| 6 | Off grid PV systems with battery and generator | OG | |

Participants

To assist in obtaining a cross section of the community, a market research company was used to recruit the participants. Specification for recruitment included ensuring equal representation of males and females, a cross section of ages and at least two participants in each group to have solar PV or solar hot water in their home.

In total, 61 participants attended the focus groups meetings. Of those 52% were male. Participants' age varied from 23 to 74 years old with a mean age of 45 years. Participants' level of education varied from some secondary schooling to postgraduate degree, with 47% of participants having completed a university degree. Most participants (59%) were employed either full-time or part-time, while 20% of participants were self-employed and 10% of participants retired. Only one person reported living in shared accommodation, while 13 people (~21%) were tenants and 47 (~77%) were homeowners.

Factors influencing uptake

Through all of the focus groups, cost of electricity and the opportunity to reduce energy bills was a prime motivator for participants. Many had undertaken a number of energy conservation actions to try and reduce their bills and the most frequently cited were turning off lights, standby switches and appliances when not in use, undertaken by 75% of participants; followed by purchasing and installing additional energy efficient measures such as ceiling fans, heat pump hot water, solar lights and solar hot water which was undertaken by 46% of participants.

The most popular distributed energy model was grid connected solar PV which 11 participants already owned. When investigating key factors that might affect greater uptake of the various options common responses, in no order of priority, included:

- **Tenancy and housing type** for renters and people living in apartment blocks.
- **Structural issues** such as unsuitable roofs or too much shade were given as reasons to rule out solar PV.
- **Aesthetics** was cited as a potential barrier particularly around visual amenity.
- **Mobility** of families and individuals who moved often between houses found it difficult to see the business case for investing in the options.
- **Size of household energy use** was a factor such that participants with low electricity bills felt less motivation than others to invest as they had little to gain.
- **Being home during the day** was mentioned because participants felt they would be able to draw more benefit from investing in solar PV as it was geared to daytime household electricity use.
- **Age/time of life** was considered important for those who were older because of less opportunity to achieve a return on your investment in their lifetime.
- **Return on investment** related to quality of the system, the unknown costs of repair and maintenance and whether changes to the regulations and feed-in tariffs would reduce the overall returns.
- **Competing priorities** - younger participants with children cited competing priorities for providing immediate needs for families versus the longer upfront costs.
- **Anticipated quality improvements** were a consideration for delaying investment into various business options.
- **Ability to access information** was also identified as important to enabling uptake.
- **Trust** was important and mistrust was commonplace amongst participants particularly of electricity retailers and the proliferation of “cowboy” installers.
- **Environmental impact** of batteries in relation to their disposal was raised as a concern and this extended to questions in relation to their overall safety in extreme weather events such as floods.
- **Energy independence and self sufficiency** was suggested several times in relation to participants being able to store their own energy and use as required particularly if there were power blackouts.

When it came to purchase options the majority of participants preferred to buy upfront if at all possible. The main reason given was that buying up front would provide participants with the required energy independence that most sought, particularly in relation to being self sufficient and supplying your own electricity needs. Incentives were also mentioned as being important as well as the likely return on investment based on the original cost of solar and how much it might contribute to reducing electricity bills.

From the results presented in this report it appears there are a number of considerations that would make distributed energy models more attractive to householders. The aim of the next stage of this project is to develop a survey to investigate how households prioritise these considerations. The survey will be delivered nationally in early 2013.

1 Introduction

For many years, cheap electricity, existing infrastructure and reluctance for change both at a political and individual level have delayed opportunities for distributed energy to be considered in Australia, with the exception of some remote communities and small scale trials (Gardner, Carr-Cornish, Ashworth, 2008). However, with the current rise in electricity prices and a concern for reducing greenhouse gas emissions the demand for cleaner energy is increasing. Coupled with a variety of government incentives for both energy efficiency measures and solar photovoltaic (PV) systems we have recently seen a transformation in Australia's electricity supply. This has resulted in a decrease in electricity use in absolute terms each year since 2008/09. Such transformation presents an opportunity to investigate new business models for distributed energy. More recently, the Australian Energy Market Commission's "Power of choice" review has further enhanced this opportunity by recommending a package of reforms to increase the responsiveness of the demand side for the next 15 – 20 years (AEMC, 2012).

In order to facilitate the creation of appropriate business models and inform the necessary regulatory arrangements, it is important to understand the range of ways in which customers, distributed network service providers and electricity retailers might consider participating in such a market. This project aims to investigate the range of stakeholder opinions and likely preferences in relation to opportunities for participating in distributed energy and demand side response activities. Overall the project has four objectives which are to:

1. Conduct focus groups with a cross section of the community to understand the issues and opportunities in relation to the distributed energy market;
2. Survey a national sample of the Australian population to ascertain their understanding and potential interest in participating in a distributed energy market;
3. Conduct interviews with distributed network service providers and electricity retailers to understand their interest in participating in such a distributed energy market and how it may operate; and
4. Conduct interviews and workshops with government agencies and regulators around the potential changes required to existing regulatory arrangements based on the findings of this research.

The findings of the first stage of the research are presented in this report – six focus groups conducted across Brisbane, Sydney and Melbourne to examine householder interest in participating in the distributed energy market. The method used is briefly outlined and followed by results relevant to participant responses to the various technologies. Finally, the potential components of the draft survey are discussed.

2 Method

In October 2012, a total of six focus groups were conducted Brisbane, Melbourne and Sydney, with two in each capital city and a maximum of 12 participants per group. Spreading the focus groups across cities aimed to provide some representation to identify any apparent differences across each region. To assist in obtaining a cross section of the community a market research company, McGregor Tan Research, was used to recruit the participants. Specification for recruitment included ensuring equal representation of males and females, a cross section of ages and at least two participants in each group to have solar PV or solar hot water in their home.

Each focus group lasted for two hours ten minutes and was structured into three main sections (refer to Appendix A for the focus group run sheet). The main aim of the focus groups was to identify participants' preferences for a number of models of distributed energy and associated payment options (Table 2) to inform the development of a national survey. To assist in providing the information, an expert from the Australian Photovoltaic Association (APVA) shared their knowledge of the various business models through a presentation. The materials for the presentation had been developed from a desktop review of literature and latest legal and regulatory environment and were reviewed by two experts from CSIRO.

Table 2 Solar PV technology and payment options

| Solar PV technology options | | | |
|-----------------------------|--|--------------|--------------------------|
| Option | Solar technology | Abbreviation | Payment options |
| 1 | Energy efficiency and solar hot water systems | SHW | |
| 2 | Grid connected solar PV | SPV | Pay up front |
| 3 | Grid connected solar PV with battery | SPVB | Hire purchase |
| 4 | Battery alone | BA | Solar leasing |
| 5 | Community PV | CPV | Energy service companies |
| 6 | Off grid PV systems with battery and generator | OG | |

Pre- and post-questionnaires were used to quantify any changes in participant attitudes. During the focus groups, participants were asked to record their personal responses to the expert presentation in a workbook. Focus group discussions were recorded and transcribed for later analysis along with notes taken during the course of the focus groups. Audio transcripts were analysed using NVivo (QSR International, MA), a qualitative data analysis tool designed to assist in the coding process. The quantitative data was analysed using STATA statistical software (StataCorp, TX) and open ended responses were coded using a thematic approach. The combined results from the focus group transcripts, workbooks and the pre- and post-questionnaires are presented in Section 3 of this report.

2.1 Sample

In total, 61 participants attended the focus groups meetings. Of those 31 (52%) were male and 29 (48%) were female. Participants' age varied from 23 to 74 years old with a mean age of 45 years. Participants' level of education varied from some secondary schooling to postgraduate degree, with 47% of participants having completed a university degree. Most participants (59%) were employed either full-time or part-time, while 20% of participants being self-employed and 10% of participants being retired. Only one person lived in shared accommodation, while 13 people (21%) were tenants and 47 people (77%) were homeowners. Information pertaining to participant demographics can be found in Appendix A .

3 Results

In order to inform the creation of appropriate business models and regulatory frameworks for distributed energy networks, it is important to understand the range of stakeholder opinions and likely preferences in participating in distributed energy markets. To understand the householder perspectives in this space, a total of six focus groups were conducted across Brisbane, Sydney and Melbourne. The focus groups examined householder knowledge of solar technologies, likelihood of investment, factors influencing uptake and preferred finance options.

3.1 Knowledge of solar and related business models

To assess participants' understanding of solar energy and related technologies prior to being given any information, participants were asked to rate on a 5-point scale (1=strongly disagree to 5=strongly agree), whether they could easily explain to a friend what solar energy is about and what six different solar technologies are. Following a presentation by an expert from APVA describing solar energy and these six technologies, participants were again asked to use the same scale to rate whether they could explain these concepts to a friend. Prior to the presentation, participants were least familiar with community PV, battery alone and systems not connected to the grid (Figure 1, light blue).

Table 3 shows the mean ratings for subjective knowledge before and after the focus group. Results from the paired sample t-tests show that participants' knowledge significantly increased as a result of the information provided in the focus group meeting ($p < 0.001$). Following the presentation, participants agreed or strongly agreed that they could easily explain solar energy and all six associated technologies.

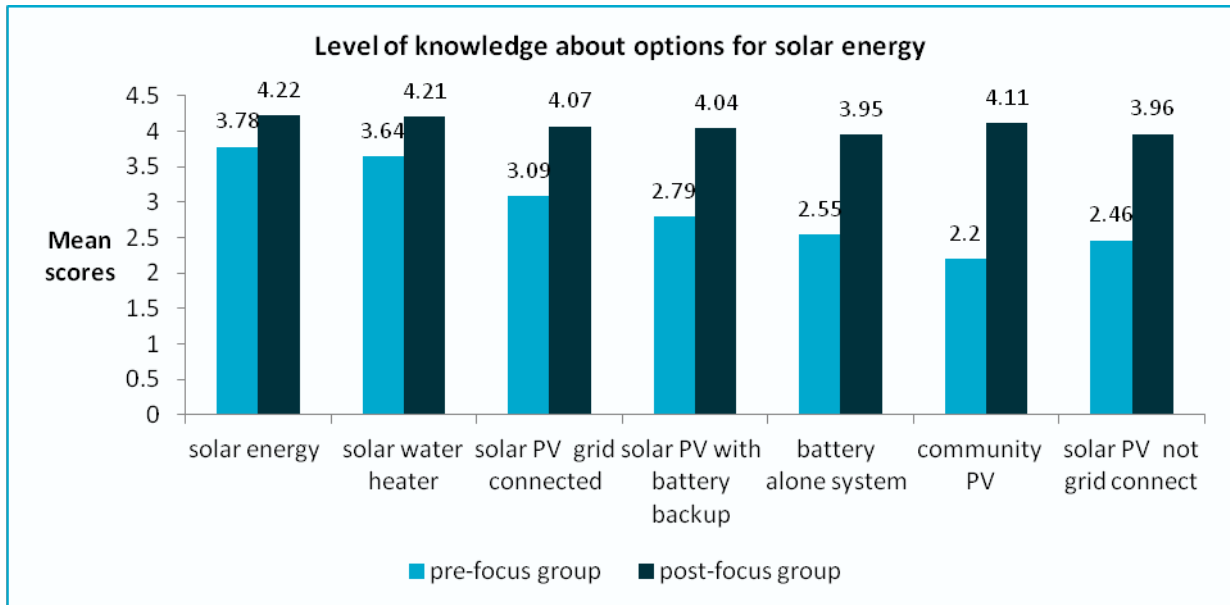


Figure 1 Participants' ability to explain to a friend distributed energy options before and after information provision

Table 3 Changes in mean self-rated knowledge

| I COULD EASILY EXPLAIN TO A FRIEND... | PAIRED T-TESTS | | PRE-FOCUS GROUP | | POST-FOCUS GROUP | |
|---|----------------|----|-----------------|-------|------------------|-------|
| | T VALUE | DF | M | SD | M | SD |
| ...what solar energy is about*** | 3.99 | 54 | 3.78 | 0.937 | 4.22 | 0.809 |
| ...what a solar water heater is*** | 4.59 | 55 | 3.64 | 1.086 | 4.21 | 0.811 |
| ...what a solar PV system connected to the grid is*** | 4.96 | 55 | 3.09 | 1.541 | 4.07 | 0.970 |
| ...what a solar PV system with battery backup system is*** | 6.48 | 55 | 2.79 | 1.345 | 4.04 | 0.934 |
| ...what a battery alone system is*** | 7.92 | 55 | 2.55 | 1.306 | 3.95 | 0.980 |
| ...what a community owned PV system is*** | 11.27 | 55 | 2.20 | 1.151 | 4.11 | 0.846 |
| ...what a solar PV system not connect to the grid is*** | 8.41 | 55 | 2.46 | 1.293 | 3.96 | 0.972 |

Likert scale 1=strongly disagree; 3= neither disagree nor agree; 5=strongly agree

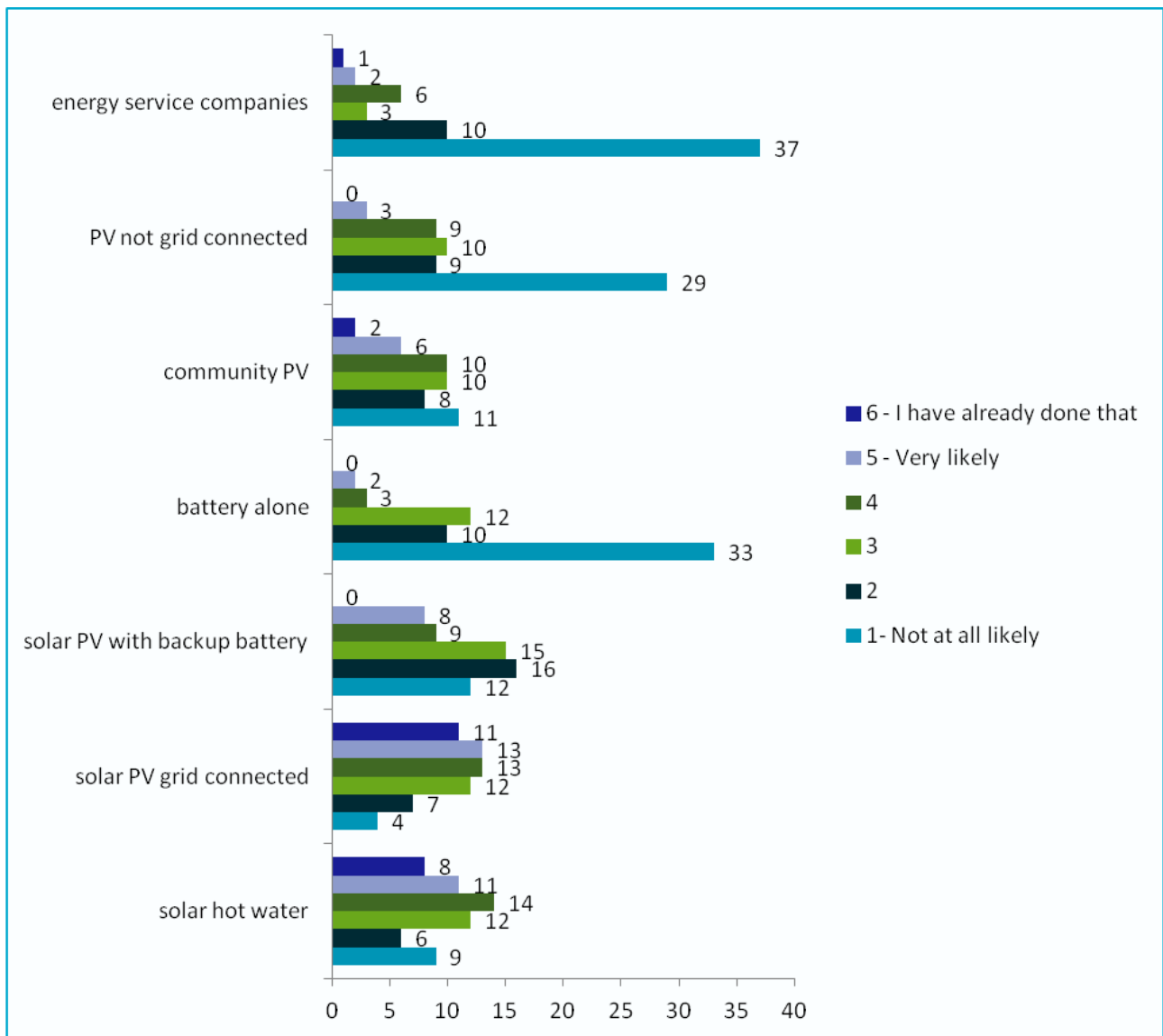
Paired t-tests are used to compare means obtained from two sets of related scores. The test-statistic produces a score called t-value. In this report it represents the difference between the mean of responses in the pre and post-questionnaire, while taking into account any variation in scores.

*** Paired t-tests are statistically significant at $p < 0.001$

3.2 Support for the six energy options

In the post-questionnaire participants were asked whether they had already invested, or if they would consider investing in any of the six options presented by the expert (1=not at all likely, 5=very likely, 6=already have). Eleven participants already owned grid connected PV and eight indicated they had a solar hot water system. Only one participant reported using an energy supplier to control their appliances and two stated they had already invested in community PV. In the Brisbane focus groups however, through a formatting error, the community PV question was omitted.

Figure 2 shows the frequency distribution of responses. It highlights that the most preferred options are grid connected solar PV (n=37) and solar hot water systems (n=33). As well, a large number of participants are not willing to consider having an energy supplier remotely control their appliances (n=37) one of the financing options presented, installing a battery alone system (n=33), or a PV system that is not grid connected (n=29).



Note: Community PV question was only asked in the Melbourne and Sydney focus groups

Figure 2 Participants' likelihood to consider installing any of the solar distributed energy options presented

Analysis of the qualitative data also showed the majority of participants were in favour of solar panels and were comfortable with the technology. The principle motivation for uptake of solar PV was cost related, in particular to reduce the amount of electricity required to be purchased from electricity retailers. A few participants suggested environmental considerations were also a key motivator. For example:

And I guess our interest probably in reducing electricity consumption is more environmental than cost, I would say, with our family.

3.3 Factors influencing preferences of energy options

During the discussion a number of factors were identified that would impact the uptake of the various solar distributed energy options and these are summarised below in no order of priority.

- **Tenancy and housing type** was the most obvious barrier to solar PV. That is, people who are renting their home and people living in apartment blocks cited it was far more difficult to find a way to install solar PV.

- **Structural issues** such as unsuitable roofs or too much shade were reasons to rule out solar PV. Some participants cited personal knowledge of water leakage from a solar hot water system, affecting the roof structure and in one case leading to collapse of a system into the house. Some participants also felt their houses were too old and not energy efficient and talked instead of insulation or other energy efficiency measures as a first priority.
- **Aesthetics** was cited as a potential barrier to the uptake of PV as a number of people felt that solar panels were unsightly. There were also concerns expressed around the size of batteries required for storage and issues of where they might be placed.
- **Mobility** of families and individuals or those who anticipated changes in circumstances showed a reluctance to commit to solar because it is viewed as a long term investment. Those that moved often between houses did not feel any compunction to invest in solar PV.
- **Size of household energy use** was also a factor. Given that cost saving is the main motivation for investing in solar PV, participants with low electricity bills felt less motivation than others to invest as they had little to gain. In Sydney and Melbourne, many cited low electricity bills as a result of having gas supplied to the house for heating their homes.
- **Being home during the day** was mentioned as a consideration because participants felt they would be able to draw more benefit from investing in solar PV as it was geared to daytime household electricity use. With a lowered feed-in tariff introduced, there no longer appeared to be a financial incentive to export electricity back to the grid.
- **Age/time of life** was considered important for the Brisbane groups who had an older profile than those in the other capital cities. A number of them mentioned the older you are the less likely you are to get a return on your investment in your lifetime.
- **Return on investment** also related to quality of the system. Concerns were also raised about unknown costs of repair and maintenance and whether changes to the regulations and feed in tariffs would reduce the overall returns. Participants were also concerned about the uncertainty of the impact of solar systems on property values. While they viewed systems which were paid up front as potentially increasing the value of the property, some of the other options in which the system wasn't owned by the householder, were viewed as potential detractors to property values and house sales.
- **Competing priorities** - younger participants with children cited competing priorities for providing immediate needs for families versus the longer upfront costs.
- **Quality improvements** was also a consideration with some participants suggesting that if they delayed investing a few more years they may be able to purchase a more improved and even cheaper system. This also related to batteries and discussion ranged about what the likely storage size for a battery might be.

I'd say 10 years down the track solar panels might be the size of a mobile phone sitting in.....that's the only thing that worries me.

I think it's clumsy and I would hope that in the not-too-distant future that'll become a lot more refined. So I think that I would be out of the market at the moment. It seems to me to be something that's in its infancy and is developing rapidly. I think there's going to be far better options in the not-too-distant future.
- **Information processing** was identified as a major barrier to the uptake of solar PV. Because of the size of the investment and the long term implications of a solar PV installation, participants felt overwhelmed by the amount of the research they felt they had to do and many cited lack of time to undertake research. Information was variously described as too complicated, too hard to

understand and others cited many unanswered questions. Lack of information was also extended to time of use tariffs which many reported being unfamiliar with.

We just haven't got anything installed yet because it's a lot of research and a lot of different companies offering a lot of different things, and it's hard to make sense of what actually some of them mean sometimes.

Yeah, it's definitely of interest....I'm annoyed at myself for not making the time to research it when all the rebates and everything were in.... So yeah, it's something I definitely want to make time for.

- **Trust** was highlighted as important and mistrust was commonplace amongst participants. The principle sources of mistrust related to the rebate schemes and the taint by association with the government insulation disaster and the proliferation of “cowboy” installers. In addition, there was a general mistrust of electricity retailers, including some solar installation options, and participants were also sceptical about the information provided to them.

...Happy to go out and do it. But I mean I'm just cautious of, there is a lot of new players on the market, and there's some cowboys. And there is some offering some really cheap deals. But sometimes the systems don't work properly, and then you get stuck with something that's sort of - you've got a customer service line that goes to China or something and no-one answers. And you've got a system that doesn't work. And so I'm just - I'm not sort of - I want to get something with a bit of quality about it.

And some of the quotes too don't include the inverter and it's in fine print once you read their contract. That's dishonest to begin with. You haven't even started and they're not being upfront with their information. How can they earn your trust? You couldn't do business like that. And I hear that their after-sales service too, their maintenance service, falls really short from where it should be

- **Environmental impact** of batteries in relation to their disposal was raised as a concern and this extended to questions in relation to their overall safety in extreme weather events such as floods.
- **Energy independence and self sufficiency** was suggested several times in relation to participants being able to store their own energy and use as required particularly if there were power blackouts.

There were multiple considerations that participants identified as either for or against each of the solar technology options. Table 4 summarises the most frequently occurring pros and cons and the options they were relevant to.

Table 4 Thematic analysis of pros and cons reported in workbooks, showing the number of comments recorded for each of the solar technology options

| PROS | SH | SP | SPVB | B | CP | O | CONS | SH | SP | SPV | B | CP | O |
|---|----|----|------|----|----|----|--|----|----|-----|----|----|----|
| Reduces cost/low or no power bill | 17 | 12 | | 6 | | 6 | Infrastructure issues | 16 | 8 | | | | |
| Energy efficient supply | 16 | | | | | | Not good when weather is cloudy | 15 | 8 | | | | |
| Environmentally friendly/sustainable | 13 | 13 | 11 | | 11 | 7 | Aesthetics - lack of visual amenity, size of batteries | 14 | 10 | 19 | 15 | | |
| Use of the sun's energy | 7 | | | | | | Performance issues | 12 | | | | | |
| Free cheap hot water | 6 | | | | | | Ongoing maintenance and service costs | 9 | 13 | 9 | | 5 | 15 |
| Easy to install | 5 | | | | | | Safety and damage uses | 7 | | 9 | 6 | 4 | |
| Viable for rural/semi-rural/remote areas | | | | | | 12 | Upfront cost | 7 | 6 | 10 | | | |
| Increased independence | 4 | 8 | 8 | | | 19 | Trust In supplier/installer (reliability) | 5 | 5 | | | 6 | |
| Self sufficient | | | 7 | | | 12 | Equipment intensive/requires generator | | | | | | 11 |
| Uses TOU to best advantage | | | | 17 | | | Policy uncertainty around tariffs | | 9 | | | | |
| Income potential | | 8 | | | | | Need for information | | 7 | | | 5 | |
| Generate power to grid/for others | | 5 | | | | | Lifespan, durability | | 6 | | | | |
| Renewable power/ green power | | 5 | | | | | Environmental issues | | | 11 | 17 | | 13 |
| Save/store power for backup | | | 22 | | | | Cost battery life replacement/longevity | | | 17 | 16 | | |
| Backup in grid power outage | | | 16 | 8 | | 15 | Technology - 18% energy loss with battery use | | | 10 | 7 | | |
| Back up in low solar radiation periods | | | 6 | | | | Highly technical and complex to understand for | | | 8 | 6 | 12 | 7 |
| Good for apartments/renters/no roof space | | | | 8 | | | Time Of Use - little known | | | | 5 | | |
| Sensible/economies of scale/use of roof | | | | | 13 | | Return on investment | | | | | | 11 |
| | | | | | | | Costs for management fees | | | | | 9 | 9 |
| | | | | | | | Generator noise | | | | | | 10 |
| | | | | | | | Isolated not connected to the grid | | | | | | 6 |
| | | | | | | | Weather dependent | | | | | | 7 |
| | | | | | | | Context appropriate for rural not suburbia | | | | | | 5 |

Abbreviations

| | |
|---|--------------------|
| SHW – Solar hot water | BA – Battery alone |
| SPV – Grid connected solar PV | CPV – Community PV |
| SPVB – Grid connected solar PV with battery | OG – Off grid |

Option 1: Solar hot water systems

Participants viewed SHW as proven technology and others described it as complementary to other solar technologies. Most participants, while feeling reasonably positive about solar hot water, were also more or less indifferent to it as an option.

Option 2: Solar PV

Solar PV was the default option that most participants were familiar with and viewed as uncomplicated. A few participants derived satisfaction from the idea that they were helping by feeding back energy to the grid but also receiving a benefit for it.

I'd put it back into the grid because you get more – you're still paying (for) electricity, hopefully, and you'd be giving back as well to the grid.

...you could afford all of these things and you could afford to actually put that power too back into the grid to help other users.

Option 3: Solar PV with battery

The use of batteries with PV was a new concept for most participants. What participants liked most about this option was the idea that excess energy generated by the solar system could be stored for later use and could possibly offset peak demand.

Because it's comprehensive. It gets battery as well, so you're not limited to some, like, peak periods or some sun, or no sun or you have a longer lifespan.

Well, if I'm storing my day's excess, I'm then utilising and having – yeah, because it feels more truly efficient because I'm using in the evening what I've made in the day, and then I've got less risk on the grid...

Options 4: Battery alone

The battery alone solution was less popular. Participant comments indicated that not many understood the option which might be explained by an associated lack of knowledge about time of use (TOU) tariffs. Participants living in apartments did consider it as an option, but again size and portability of the battery would factor into their decision making.

...the battery alone one doesn't sound like a good idea to me at all. It just seems like an odd thing to do.

Option 5: Community PV

There was some misunderstanding of the concept of community PV as presented by the expert. Community PV was presented as a business investing in solar energy generation through solar PV installations on warehouses or other community buildings and selling the electricity to the renter or owner of the building at a lower rate than available from the electricity grid, and making a profit on the difference. The participants however, viewed community PV as something where members of the community came together to pool investment in a solar facility which would directly meet their electricity needs. The particular appeal of community solar was largely value related either to a "sense of community" or ethical and environmental considerations including better use of existing infrastructure. It was also thought equitable as an individual could invest as much or as little money as they desired.

There's a sense of community with that one too... Like community gardens and things like that.

And then the dividends, and it's a smaller investment, as someone said earlier. Like you might want to invest a couple of grand for maybe a few panels or you can chuck in 20 so you've got the power of the investment...

At the same time there were a number of concerns around management and legal requirements for such a proposal consistent with the misconception of what the community PV option was.

I can see the community one turning into a lot of bickering about who bought what and who gets paid what and who has to do what and that could turn into a really nasty body corporate.

Options 6: Solar PV off grid

As a very expensive option, solar PV off grid was only felt to be attractive to individuals who would have to pay large connection fees to the grid. Most participants related this to rural or remote properties however one Brisbane group spoke of battle axe blocks in Brisbane suburbs which were completely off grid. The option appealed most to those for whom self sufficiency and independence from energy retailers was seen as ideal.

Just the independence and I'd know it's mine. It's my home, my own electricity. There's a real sense of family and looking after ourselves, basically.

3.4 Preferences for technology options

At the end of the focus group participants were asked to list the options they would prefer for their household (participants were able to list one or more options). Responses were consistent with section 3.2. The option of grid connected solar PV panel (Option 2) was the most popular choice (n = 20, 25%) as shown in Table 5. Other popular choices included energy efficiency and solar hot water (n = 17, 21%), community PV (n = 15, 19%), and grid connected solar PV with battery (n = 15, 19%).

Table 5 Solar technology options participants would be willing to consider for their household

| SUMMARY OF RESPONSES | FREQUENCY | PERCENTAGE |
|--|-----------|------------|
| Option 2: Solar PV on the Grid | 20 | 25% |
| Option 1: EE and Solar Hot Water | 17 | 21% |
| Option 5: Community PV | 15 | 19% |
| Option 3: Solar PV with battery on grid | 15 | 19% |
| Option 6: Solar PV with battery off grid | 6 | 7% |
| Option 4: Battery only | 4 | 5% |
| None | 4 | 5% |

Source: Post-questionnaire (n=61) - multiple responses possible.

The question was reversed and participants were also asked which of the solar options discussed in the workshops they did not feel they would use in their homes (Table 6). Solar PV with battery off the grid was the option they would be least likely to consider (n = 28, 33%). Battery alone (n = 21, 24%) and solar PV with battery on grid (n = 16, 19%) were the next least popular options.

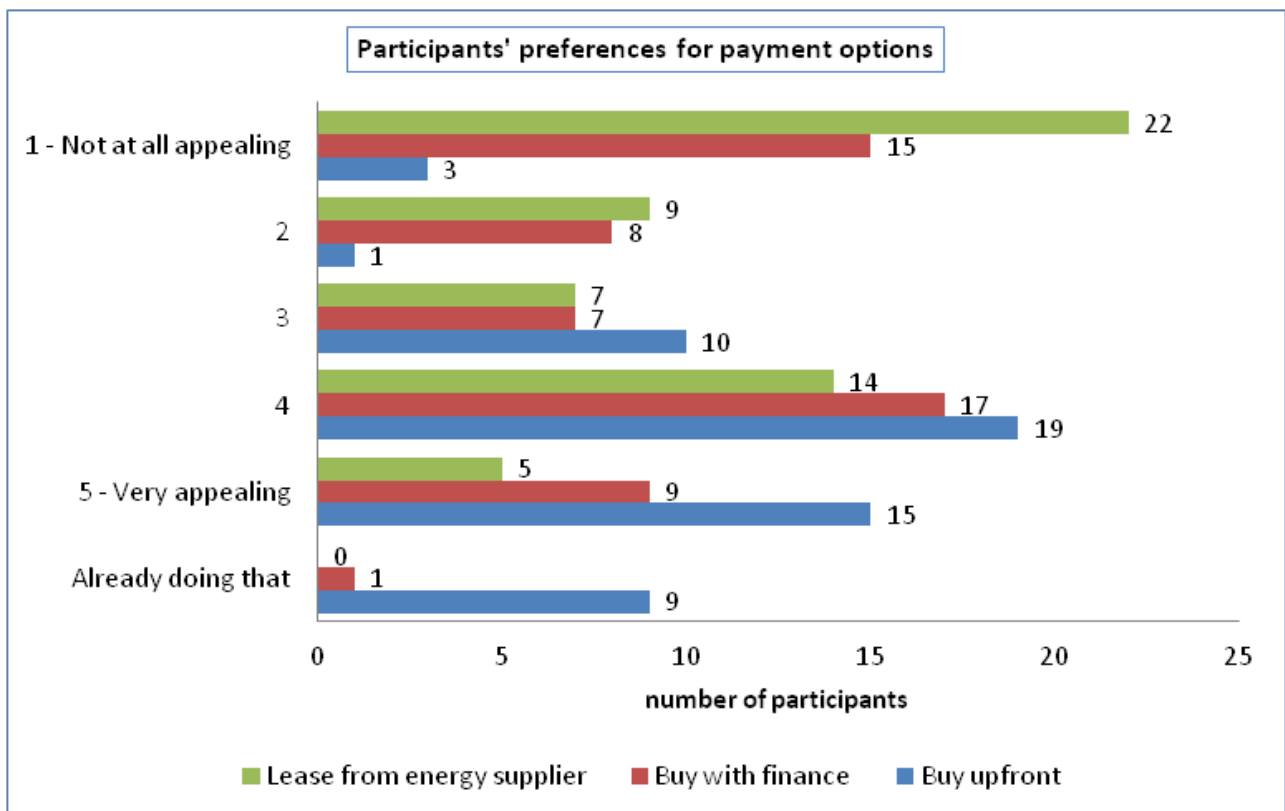
Table 6 Options participants would NOT be willing to consider for their household

| SUMMARY OF RESPONSES | FREQUENCY | PERCENTAGE |
|--|-----------|------------|
| Option 6: Solar PV, battery, off grid | 28 | 33% |
| Option 4: Battery alone | 21 | 24% |
| Option 3: Solar PV, battery on grid | 16 | 19% |
| Option 5: Community PV | 8 | 9% |
| Option 1: EE and Solar Hot Water | 4 | 5% |
| Option 2: Solar PV on the Grid | 3 | 3% |
| Would consider them all | 2 | 2% |
| People with solar already installed wouldn't consider any of other options | 4 | 5% |

Source: Post questionnaire (n=61) – multiple responses possible. Two no responses and two unintelligible responses.

3.5 Preferences for finance options to invest in solar technology

During the focus groups participants were presented with different payment options for investing in solar technology and asked to rate them on a 5-point scale (1=not at all appealing to 5=very appealing; or tick a separate box if they are already using one of the options). Figure 3 shows the frequency distributions of participants’ responses. Most participants (n=34) indicated that buying a solar device upfront would be appealing to them, with a further nine participants indicating they had already done so. Twenty six (n=26) participants indicated that buying a solar device with finance would be appealing to them, with one additional participant having already done so. Leasing a solar device was a less popular choice with 19 participants rating this option as either appealing or very appealing.



3.6 Factors influencing preferences for finance options

Participants in the focus groups were not aware of the different payment options available to them, as some of these, in particular solar leasing and Electricity Service Companies and Organisations (ESCOs), are very recent developments in Australia. Qualitative data indicate that the decision to purchase PV is one embedded in context and time. In particular, two contexts were relevant to decision making around PV, one is the availability of rebates and incentives and the other rising electricity prices.

- **Incentives** were mentioned as being the reason some had purchased solar panels, however, there were other participants who were less knowledgeable about incentives for solar. Most were aware that incentives for solar PV had been reduced and a number of participants were hoping that incentives or higher feed-in tariffs become available again. A few people argued against incentives as being the best way to manage solar uptake.

I think, sometimes, we want too much from the government, and it's our responsibility. It's no use putting these solar hot water service back in if we're still going to have a 30 minute shower, or whatever. I think sometimes we tend to want to take what is not ours. If we take it from the government, we're still paying for it in our taxes. And, therefore, if it accommodates one another like that, I think sometimes, naively, I think we expect too much rebate.

- **Rising electricity bills** was cited as a motivation for investing in solar particularly as prices continued to rise despite their efforts to reduce their energy consumption. Energy prices were also viewed as likely to increase in the future.
- **The cost of solar PV** is such that most participants felt they had to take time to weigh up the pros and cons to consider the affordability and financial implications of investing in solar PV. This is especially true as the principle motivation for the purchase of solar PV would appear to be to save money. In order to proceed with a purchase participants felt they needed to be able to meet the upfront costs, calculate the payback period or return on investment and be assured that they were getting a good deal or at least the right deal for them.

The other thing would be one – of the guys at work was telling me they're getting solar installed, and the cost that it is, as a family, we could not afford that. We just don't have the funds available to pay that upfront. I'd rather pay an extra few hundred dollars on my bills than to pay thousands of dollars upfront at this point in time.

Table 7 lists the major themes that arose from qualitative responses in relation to the pros and cons of each of the finance options. There were a number of one-off comments but for the purpose of this report only those that appeared more frequently are listed. It is worth noting that when comparing across options there are few overlaps in the specific considerations for each option.

Table 7 Thematic analysis of the pros and cons for each of the finance options for investing in solar technology, showing the number of comments reported for each option

| PROS | UPF | HP | SL | ESCO | CONS | UPF | HP | SL | ESCO |
|---|-----|----|----|------|-------------------------------------|-----|----|----|------|
| Cheaper in the long run/no additional costs | 13 | | | | Need access to funds | 10 | | | |
| You own it | 8 | | | | Expensive/affordability | 9 | | | |
| Pay and forget/over and done with | 6 | | | 4 | High upfront costs | 7 | | | |
| Affordability/no large upfront payment/ payment spread over additional cost or interest is reasonable | | 23 | | | Long payback period/ROI | 7 | 2 | | |
| No maintenance responsibility | | | 6 | | Responsible for maintenance | 5 | | | |
| Good if fixed prices | | | 5 | | Higher costs | | 23 | | |
| Reduced electricity bills | | | 4 | | Long term contract (15 to 20 years) | 23 | | 23 | |
| Minimal upfront costs/good for budgeting, affordability | | | 4 | 6 | Problematic/condition of sale | | | 10 | |
| Do decision making and research for you to get best solution | | | | 4 | Locked in/circumstances can change | | | 4 | |
| Quick | | | | 8 | Control issues | | | | 24 |
| | | | | 4 | Trust | | | | 7 |
| | | | | | Too confusing/complicated | | | | 5 |

Source: Workbook

| | |
|--------------------------------|-------------------------------|
| Abbreviations: | |
| UPF – Upfront purchase in full | SL – Solar leasing |
| HP – Hire purchase | ESCO – Energy service company |

Option 1: Payment upfront

Payment up front was the preferred option of the focus group, especially if it was within participants' means. Payment up front was variously described as "getting it out of the way", "a personality thing" and "the Australian way". Paying up front was also associated with ownership, independence, and being in control.

Option 2: Hire purchase

Hire purchase was the second most popular finance option. Participants were familiar with the concept, but not in relation to solar PV. A few participants liked the hire purchase option especially as it was presented as not particularly more expensive in the longer term than the pay up front option. Benefits of the hire purchase option appeared to be not having to find the money up front. The other positive feature of hire purchase was having regular payments which could be budgeted for. One participant considered it a natural extension of existing arrangements and quoted the example of mobile phones, which are rarely purchased up front but paid off over time. Some participants were aware that the reduced energy bills would help finance the hire purchase. Disadvantages were that the costs were perceived as higher in the longer term, however, a few participants pointed out that this was not necessarily true.

Option 3: Solar leasing

Solar leasing was an entirely new concept for participants and for a number of them it was difficult to get to grips with. It was the least popular of the four finance options. The principle concern was being locked in for a long period of time and consideration for what happened if you moved house. The concern was whether the lease arrangement would transfer over to the new owner and if it would be seen as an advantage or disadvantage.

I'm only leasing. That works for your renters and your buyers. The bill gets brought down. You sign up for a 10 year contract, I'd want them to make a monthly arrangement at the same price for the 10 years. You're effectively just hiring out your roof space for cheaper electricity. They say, fine, 50 bucks a month for your electricity, done... maintenance on the equipment not my problem, it's their equipment. I'm just renting them the space to put it in and I get cheaper bills out of it.

Option 4: Electricity Service Companies

Electricity Service Companies (ESCOs) were also a new concept to participants and the second least popular of the four finance options. The role of ESCOs in the supply of household electricity was presented as a range of potential options, from just an audit and advice to a fully remotely controlled system. The biggest concern about ESCOs was perceived loss of control and the fear of being locked in. However, participants appeared to like the idea of having a professional come in to complete an energy audit and advise them on the best possible options for them

...I don't like other companies controlling my devices and money...

I guess my ears pricked up when I saw the fixed monthly payment. What period that would be reviewed? Like I am a lady with two cats, I might get pregnant. Things change, in a year and half's time. What frequency of review do they have?

3.7 Trust and sources of information

Trust in the information source has been shown to be important when communicating with the general public. Participants were asked to indicate to what extent they trust (1=not at all to 5=very much) a list of groups and organisations to provide honest information about energy efficiency and the use of solar energy in the household. Figure 4 provides the mean ratings which show that participants are more likely to trust CSIRO, university scientists and engineers, scientists working with the solar industry and friends and family. Participants indicated that the least trusted organisations to communicate about energy efficiency and solar energy are political parties, the media, government and industry.

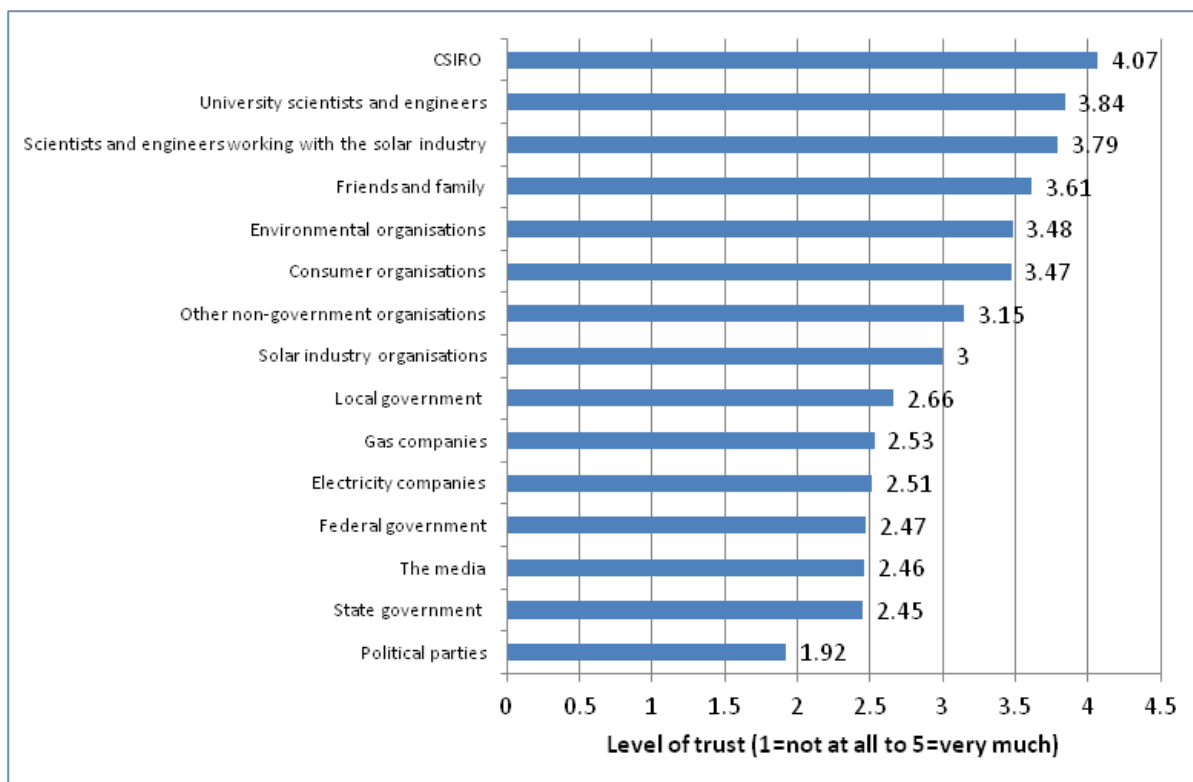


Figure 4 Participants’ mean level of trust in information sources providing information on EE

Participants were also asked to rate (1= most important to 7= least important) the sources of information they would seek out if considering investing in solar energy. Table 8 shows the mean ratings of the responses. Participants indicated that they were most likely to turn to the solar industry or association website, followed by the energy supplier website. Newsletters, energy supplier phone calls and associated advertising were least likely to be sought after.

Table 8 Participants' ranking of information sources when considering investing in solar technology

| SOURCES | RANK | MEAN | SD |
|------------------------------------|------|------|-------|
| Solar industry/association website | 1 | 2.33 | 1.632 |
| Energy supplier website | 2 | 2.74 | 1.596 |
| Energy supplier newsletter | 3 | 3.93 | 1.996 |
| Council newsletter | 4 | 4.09 | 1.605 |
| Energy supplier phone call | 5 | 4.66 | 1.562 |
| Newspaper advertising | 6 | 4.86 | 1.527 |
| TV advertising | 7 | 5.66 | 1.760 |

Rank order of Importance (1- greatest importance to 7-least importance)

3.8 Considerations for investing in a distributed energy option

In the closing activity, participants were asked to identify considerations and any actions they would undertake before committing to one of the distributed energy options or combinations. Main concerns were around the information being provided to them and by whom, how much time they had to make the decision, any incentives available to them and quality of the products they were purchasing.

- **Researching options** was a key consideration for participants to confirm what the financial payback period would be for each option. It was felt the simpler the information was the more likely participants would find it useful to inform their decisions.
- **The source of information** was very important to participants and they expressed a desire to receive information from trusted intermediaries including friends, family, people who worked in the trade, voluntary groups, or consumer websites. Case studies were deemed particularly useful as well as home shows and solar home visits.
- **Reputation of the company** was also seen as a critical consideration. In particular a desire for the company to still be in operation in 20 years time. As such, many participants expressed a preference for blue chip companies. This was especially import for finance options such as solar leasing and ESCOs because of the long term nature of the contracts. Other important factors taken into account are the quality of the customer service and the credibility of the sales staff.
- **Quality of the product** intended for purchase was also considered an important consideration. This included warranties and guarantees as important indicators of a quality product. Country of origin of the panels and performance information was also mentioned as being important.
- **Time** was also considered an important factor. Many participants did not respond positively to the notion that a decision had to be made on the spot. Some participants went so far as to say that they would not even consider such an offer.

4 Discussion

Findings from the focus groups include that participants are generally uninformed on some solar technology options but once provided with information feel that they could more easily explain the options to a friend. Householders represented in the focus groups are most likely to invest in grid connected solar PV and energy efficiency and solar hot water and the key factors influencing these decisions were reducing the cost of their electricity bills and some environmental benefits. The preferred payment option for most participants was the upfront payment method because most wanted to have control and did not see the value in paying additional interest charges if you could afford to buy the system up front. The amount of research required for all various technology and payment options was considered daunting for most participants – particularly in relation to what is being offered, the quality of the system and who is promoting it. These results indicate that householders' willingness to actively participate in a solar distributed energy market can be enhanced by the provision of clear and concise information on technology and payment options from a trusted source.

4.1 A time of change

It is clear from the results that cost is the key influencing factor for Australians to make decisions around whether to invest in the various distributed energy models offered as part of this research. This includes the variety of incentives that may also encourage uptake. However, with the recent changes in government rebates combined with the dramatic drop in the feed-in tariff that is paid to consumers for generating electricity, it is unlikely that rapid uptake will be realised. Unless alternative propositions that tap into the range of factors identified in this research can also be included, installation of new distributed energy models is likely to be difficult to achieve.

Recently however, the AEMC's (2012) "Power of choice" review has identified opportunities for consumers to make more informed choices about the way they use electricity. The review states it "has also addressed the market conditions and incentives needed for network operators, retailers and other parties to maximise the potential of efficient DSP (demand side participation) and respond to consumers' choices." So in essence there is hope that despite the recent changes a variety of options may emerge in response to the recommendations of the Power of choice review. The national survey that will follow these focus groups in February 2013 will assist in identifying how wider Australia may respond to such initiatives and perhaps suggest some essential components for achieving a successful distributed energy market.

Society will have a fundamental affect on the market for any of the options depending on its perceived risk. Oskamp (2000) identified that perceived risk can delay the implementation of new innovation, which raises a key question about ways to encourage individual uptake of distributed energy systems. In this sphere, the literature on risk perception comes to the fore (Cvetkovich & Löfstedt, 1999). Risk perception has historically been attributed to problems of public information, but more recently has been understood as part of the relationships within the technological system (Grove-White, Macnaughten & Wynne 2000). Risk was certainly a consideration for householders, particularly when presented with new technology ideas with which they were not familiar. As such issues around trust and reliability became more apparent when discussing these options.

Trust in the messenger is an important part of the communication process, thus influencing technology acceptance and/or uptake (Marks 2001; Pueppke 2001). Trust is not something that can be decreed, but emerges as part of genuine engagement with the public, to address its concerns and

aspirations (Gardner & Ashworth, 2008). Relationships are key, and this was emphasised in the focus groups around the need for a reputable company to be offering the models with accessible easy to understand information from a credible source. Having time to consider the options and undertake their own personal research was also seen as important.

Finally, while reward systems may be structured differently according to whether they follow a 'carrot' (i.e., incentive) or 'stick' (i.e., punishment) approach, they all have the underlying goal of extrinsically motivating customers to engage in a desired behaviour. Rewards tend to be favoured over punishments as rewards are associated with positive affect and attitudes that support behavioural changes (Geller, 2002). Research shows that they have quite a strong positive impact on energy savings so long as the reward is present and this has certainly been the case for the early adopters of solar PV. It is important that the reward system activates goals to make change and facilitates the implementation of goals (Steg & Vlek, 2009). However, when rewards are strong, people can attribute their behaviour change to the reward and not to their personal motivation. Therefore, rewards tend to have effects that last as long as the reward is in place and this appears to have impacted on the distributed energy market now that the majority of key incentives have been withdrawn. Understanding the exact balance between the required reward and a householder's intrinsic motivation will be a key consideration for developing the survey (Gardner & Ashworth, 2008). Therefore, we have outlined what we believe to be the key factors that need to be considered in the survey and will trial the combinations of options and considerations raised by participants in the pilot of the survey.

4.2 Important factors to consider in the survey

In addition to reducing electricity costs, it appears there are a number of factors which rate highly on individual preferences for new distributed energy options. The challenge for the survey will be to identify which factors have a higher priority and what trade-offs individuals or sets of individuals are prepared to make. Key factors identified from the focus groups that should be considered include:

1. Independence from energy retailers
2. Self sufficiency
3. Levels of control
4. Ownership
5. Environmental impact
6. Helps to save money over time
7. Reliability of the option
8. Level of risk involved
9. Safety
10. Long lasting (ie. durable)

There are also key structural factors to be considered such as:

1. Tenancy and household types
2. Number of people at home during the day
3. Existing household energy use
4. Influence on the value of the property
5. Mobility of purchaser and ability to take them with them
6. Aesthetics (ie. visual appeal)
7. Easy to install and use
8. Low or no maintenance

9. Product country of origin (ie perceived quality)

Finally considerations for payment options include:

1. Available finance required
2. Size and type of incentives available
3. Return on investment
4. Level of flexibility (ie. no locked contracts)
5. Simple and easy to understand
6. Minimal upfront costs
7. Affordability

5 References

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Appendix A Workshop process

| TIME | MINUTES | ACTIVITY | SPEAKER |
|------------|---------|--|--|
| B.00 pm | 15 min | Pre-workshop questionnaire Turn on tape recorders! | <ul style="list-style-type: none"> All |
| B. 15pm | 10 min | Welcome and introductions <ul style="list-style-type: none"> Aims of the social research, this workshops and presenter Participants' names, backgrounds and expectations Guidelines for participation Remind about tape recorders | <ul style="list-style-type: none"> Peta (lead facilitator) |
| B.25 pm | 20 min | Facilitated discussion to understand pre-existing knowledge Electricity Prices <ul style="list-style-type: none"> Have people noticed electricity prices rising? Do you think they will continue to rise? What kind of things have you considered or are doing to reduce your electricity costs? How much room do you have to reduce your electricity costs and what happens when you have done everything you can? | <ul style="list-style-type: none"> Peta to facilitate |
| B:45 pm | 20 min | Experience with Solar PV <ul style="list-style-type: none"> Someone mentioned they have solar panels – what motivated you to buy them? What are the reasons why you or people in general buy solar panels? (probe responses why is that reason important?) What are the reasons why you or people in general don't buy solar panels? What would make take up of solar panels more attractive to people who don't already have them? What do you see as the risks associated with solar PV as a technology? What might be the risks associated with investing in solar? | <ul style="list-style-type: none"> Peta to facilitate |
| 1.05 pm | 50 min | Expert presentation and discussion <ul style="list-style-type: none"> Expert presents the six options (3 x 2) options <ul style="list-style-type: none"> Solar water heaters and other EE Solar PV on grid Discussion of potential advantages and risks for each. <ul style="list-style-type: none"> Solar PV battery back up Battery alone Discussion of potential advantages and risks for each. <ul style="list-style-type: none"> Community PV Solar PV off grid Discussion of potential advantages and risks for each. Also explore tradeoffs for exporting to the grid or using for self | <ul style="list-style-type: none"> Peta facilitates Rob to present and answer questions as appropriate Participants can make notes, encourage them to record reactions – advantages and disadvantages as many reasons as you like |

| | | | |
|------------|--------|--|---|
| | | <ul style="list-style-type: none"> • Ask participants to chose their most favoured option and outline why | |
| 1.55 | 15 min | <p>Final</p> <p>Now I want you to imagine that I am the salesman, and I am going to ask you to sign the contract right NOW, this offer is only valid today, tomorrow it will be a less attractive option.</p> <p>Write down:</p> <ul style="list-style-type: none"> • What is going through your head, • Who would you have to talk to, • Where would you hesitate • What else would you have to take into consideration • Why would be your fears | <ul style="list-style-type: none"> • Peta to lead |
| 2.10 pm | 15 min | Evaluation questionnaire and thank you voucher | <ul style="list-style-type: none"> • Peta concludes and distributes vouchers |

Appendix B Demographics and characteristics

B.1 Participant demographics

A total of 61 participants attended the focus groups and completed pre- and post-questionnaires. Tables with frequencies less than 61 indicate missing responses.

Apx Table B.1 Focus groups participants' gender

| | FREQUENCIES | PERCENTAGE |
|--------|-------------|------------|
| Female | 29 | 48 |
| Male | 31 | 52 |
| Total | 60 | 100 |

Apx Table B.2 Focus groups participants' age

| AGE | FREQUENCIES | PERCENTAGE |
|--------------------|-------------|------------|
| Under 30 years old | 6 | 10 |
| 30-39 | 14 | 23 |
| 40-49 | 23 | 38 |
| 50-59 | 8 | 13 |
| Over 59 years old | 9 | 15 |
| Total | 60 | 100 |

Apx Table B.3 Focus groups participants' level of education

| LEVEL OF EDUCATION | FREQUENCIES | PERCENTAGE |
|----------------------------------|-------------|------------|
| Some secondary schooling | 4 | 7 |
| Year 12 or equivalent | 8 | 13 |
| Trade certificate/apprenticeship | 8 | 13 |
| Diploma/advanced diploma | 12 | 20 |
| Bachelor/honours degree | 16 | 27 |
| Postgraduate degree | 12 | 20 |
| Total | 60 | 100 |

Apx Table B.4 Focus groups participants' employment status

| EMPLOYMENT STATUS | FREQUENCIES | PERCENTAGE |
|--------------------|-------------|------------|
| Employed full-time | 26 | 44 |
| Employed part-time | 9 | 15 |
| Self employed | 12 | 20 |
| Casual employment | 2 | 3 |
| Retired | 6 | 10 |
| Student | 1 | 2 |
| Not employed | 3 | 5 |
| Total | 59 | 100 |

Apx Table B.5 Focus groups participants' employment occupation

| OCCUPATION | FREQUENCIES | PERCENTAGE |
|-----------------------------------|-------------|------------|
| Managerial professional | 18 | 38 |
| Technician/trade worker | 3 | 6 |
| Sales worker | 2 | 4 |
| Clerical/administrative worker | 8 | 17 |
| Community/personal service worker | 3 | 6 |
| Other | 13 | 28 |
| Total | 47 | 100 |

Apx Table B.6 Focus groups participants' home ownership

| | FREQUENCIES | PERCENTAGE |
|-----------------------------------|-------------|------------|
| A rented apartment/house | 13 | 21 |
| An apartment/house with mortgage | 30 | 49 |
| An apartment/house owned outright | 17 | 28 |
| Share households | 1 | 2 |
| Total | 61 | 100 |

Apx Table B.7 Focus groups participants' dwelling characteristics

| | FREQUENCIES | PERCENTAGE |
|--------------------------------|-------------|------------|
| Separate house | 44 | 72 |
| Flat, unit, or apartment | 11 | 18 |
| Row or terrace house/townhouse | 3 | 5 |
| Semi-detached house | 2 | 3 |
| Other | 1 | 2 |
| Total | 61 | 100 |

Apx Table B.8 Focus groups participants' household composition

| | FREQUENCIES | PERCENTAGE |
|---|-------------|------------|
| Single person household | 12 | 20 |
| Shared person household | 5 | 8 |
| Couple with no child/children | 16 | 26 |
| Couple with child/children | 19 | 31 |
| One parent with child/children | 5 | 8 |
| Other family (e.g. extended family household) | 4 | 7 |
| Total | 61 | 100 |

Apx Table B.9 Focus groups participants' income level

| | FREQUENCIES | PERCENTAGE |
|-----------------------|-------------|------------|
| Less than \$20 000 | 2 | 4 |
| \$20 000 - \$39 999 | 7 | 12 |
| \$40 000 - \$59 999 | 12 | 21 |
| \$60 000 - \$79 999 | 3 | 5 |
| \$80 000 - \$99 999 | 4 | 7 |
| \$100 000 - \$124 999 | 11 | 19 |
| \$125 000 - \$149 999 | 7 | 12 |
| \$150 000 or more | 11 | 19 |
| Total | 57 | 100 |

B.2 Participant environmental beliefs and attitudes

Research conducted by Steg et al. (2005) has shown that an individual's values, beliefs and norms (VBN) affect pro-environmental behaviour. The VBN theory investigates whether individuals believe that:

- environmental conditions threaten things that are of value to them (awareness of consequences)
- as individuals they can act to reduce this threat (ascription of responsibility)
- as individuals they have a moral obligation to act pro-environmentally (personal norms).

Apx Table B.100 Participants' mean responses to VBN statements

| | MEAN | SD |
|--|------|------|
| The depletion of energy sources is a problem for society | 4.44 | 0.87 |
| I feel partly responsible for the depletion of energy sources | 3.48 | 0.99 |
| In principle, individuals on their own cannot contribute to the reduction of energy problems | 2.38 | 1.19 |
| I feel personally obliged to save as much energy as possible | 4.02 | 0.90 |
| I feel morally obliged to save energy, regardless of what others do* | 3.93 | 1.01 |
| Not only the government and industry are responsible for high energy consumption levels, but I am too* | 4.03 | 0.99 |
| I feel morally obliged to use green instead of regular electricity | 3.36 | 0.97 |
| I feel obliged to bear the environment and nature in mind in my daily behaviour | 4.00 | 0.93 |
| Environmental quality will improve if we use less energy | 4.00 | 0.89 |
| Energy savings help reduce climate change | 3.84 | 1.02 |
| Climate change is a problem for society | 4.11 | 1.08 |
| I feel partly responsible for climate change | 3.26 | 1.11 |
| Security of electricity supply (uninterrupted power) is important to me | 4.23 | 0.84 |

Where 1=strongly disagree; 3= neither disagree nor agree; 5=strongly agree. * n=60

Apx Table B.11 Participants' efforts to reduce electricity costs in their homes in the last 12 months

| | FREQUENCIES | PERCENTAGE |
|-------|-------------|------------|
| No | 9 | 15 |
| Yes | 51 | 85 |
| Total | 60 | 100 |

Apx Table B.12 Participants' assessment of their efforts to reduce their electricity costs

| | FREQUENCIES | PERCENTAGE |
|---------------------------------|-------------|------------|
| Bill reduction of less than 1% | 7 | 15 |
| Bill reduction of about 1-5% | 11 | 23 |
| Bill reduction of about 5-10% | 9 | 19 |
| Bill reduction of about 10-25% | 13 | 28 |
| Bill reduction of about 25-50% | 6 | 13 |
| Bill reduction of more than 50% | 1 | 2 |
| Total | 57 | 100 |

Apx Table B.13 No. of Participant that do/don't purchase Green Power

| | FREQUENCIES | PERCENTAGE |
|-------|-------------|------------|
| No | 47 | 82 |
| Yes | 10 | 18 |
| Total | 57 | 100 |

Apx Table B.14 Please write down the main reasons why you try to save electricity around the home.

| SUMMARY OF RESPONSES | FREQUENCY | PERCENTAGE |
|---|-----------|------------|
| Reduce costs, save money, reduce power bill | 54 | 89 |
| Environmental concerns | 20 | 33 |
| Doing the right thing | 4 | 7 |
| Reducing waste | 3 | 5 |
| Other | 14 | 23 |

Source: Pre-questionnaire. Two participants did not respond to this question.

ApX Table B.15 Please write down the main reasons why you don't save electricity around the home.

| SUMMARY OF RESPONSES | FREQUENCY | PERCENTAGE |
|---|-----------|------------|
| Convenience or comfort | 24 | 39 |
| Energy intensive lifestyle | 6 | 10 |
| Meet basic needs | 6 | 10 |
| Complacency or laziness | 5 | 8 |
| Forgetfulness (leaving lights or switches on) | 5 | 8 |
| Other | 23 | 38 |

Source: Pre-questionnaire. Please note: 12 people did not respond to this question

ApX Table B.16 What are some of the specific things you do to save electricity around the home?

| SUMMARY OF RESPONSES | FREQUENCY | PERCENTAGE |
|--|-----------|------------|
| Turning off lights, switches, stand-by, and appliances when not in use | 45 | 74 |
| Buy, install and use energy efficient options (ceiling fans, lights, power boards, kill switches, solar lights, solar hot water, heat pump hot water) | 28 | 46 |
| Minimise use of appliances (heaters, air conditions, lights, dish washer, washing machines, clothes dryer, fridge, freezers, laptops, hot water/shorter showers, gas appliances) | 23 | 38 |
| Take advantage of nature for cooling, heating, drying clothes, solar rays (north facing aspect); man power for washing dishes and cooking food, wood heater, candles) | 8 | 13 |
| Apply measures to reduce cool/heat/energy requirements (insulation, draught excluders, short showers, shade trees, heat pump hot water, BBQ cooking) | 14 | 23 |
| Reduce peak demand (running appliances in off peak period) | 5 | 8 |

Source: pre-questionnaire

Appendix C Post workshop questionnaire

Q5. Which of the solar options we have discussed today would you NOT be willing to consider for your household? And why not?

SECTION 3: PARTICIPATION IN THE ENERGY MARKET

Q6. Please indicate below how likely it is that you would consider each of the following options in your household, in order to improve your household energy efficiency, and/or reduce your household electricity costs?

| How likely is it that you would... | Not at all likely | | | | | Very likely | I have done that already |
|---|-------------------|---|---|---|---|-------------|--------------------------|
| ...install a solar hot water heater | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| ...install a solar PV system connected to the grid | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| ...install a solar PV system with battery backup system | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| ...install a battery alone system | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| ...invest in a community owned PV system | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| ...install solar PV system <u>not</u> connected to the grid | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| ...allow the energy supplier to remotely switch off certain domestic appliances during peak demand | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| Please specify any other options you would consider, or have already taken up, and rate as appropriate. | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |

Q7. In deciding whether you would install/invest in each of the solar options presented today, what factors would be likely to influence your decision? Please explain below your reasoning for each of the following options:

A. Solar water heaters

B. Solar PV connected to the grid

C. Solar PV system with battery backup system

D. Battery alone system

E. Community owned PV system

F. Solar PV system not connected to the grid

G. Allowing energy supplier to switch off certain appliances during peak demand

Q8. All things considered, please indicate to what extent each of the following options would be appealing to you.

| How appealing would it be to you to... | Not at all appealing | | | | | Very appealing | I am already doing that |
|---|----------------------|---|---|---|---|----------------|--------------------------|
| | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| ...buy a solar device upfront | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| ...buy a solar device with finance | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |
| ...lease a solar device from an energy supplier | 1 | 2 | 3 | 4 | 5 | | <input type="checkbox"/> |

Q9. Can you please tell us, as best you can, why each of those solar options would be appealing/not appealing to you? Please explain below your reasoning for each of the following options:

A. Buying a solar device upfront

B. Buying a solar device with finance

C. Leasing a solar device from an energy supplier

SECTION 4: INFORMATION SOURCES

Q10. If you were considering investing in solar PV, which of the following information sources would you be likely to turn to? Please rank them all in order of their importance to you, from 1 (for the most important source) down to 7 (for the least important source).

| Sources | Rank order of Importance (1- greatest importance →7-least importance) |
|------------------------------------|---|
| Energy supplier newsletter | |
| Energy supplier website | |
| Energy supplier phone call | |
| Solar industry/association website | |
| TV advertising | |
| Newspaper advertising | |
| Council newsletter | |

Q11. If other information sources would be of greater importance to you when considering investing in solar PV, please list those other sources below:

SECTION 5: SOLAR ENERGY TECHNOLOGY

Q12. Please tell us to what extent you agree or disagree that:


| I could easily explain to a friend... | Strongly Disagree | | Neither Disagree nor Agree | | Strongly Agree |
|---|-------------------|---|----------------------------|---|----------------|
| ...what solar energy is about | 1 | 2 | 3 | 4 | 5 |
| ...what a solar water heater is | 1 | 2 | 3 | 4 | 5 |
| ...what a solar PV system connected to the grid is | 1 | 2 | 3 | 4 | 5 |
| ...what a solar PV system with battery backup system is | 1 | 2 | 3 | 4 | 5 |
| ...what a battery alone system is | 1 | 2 | 3 | 4 | 5 |
| ...what a community owned PV system is | 1 | 2 | 3 | 4 | 5 |
| ...what a solar PV system not connect to the grid is | 1 | 2 | 3 | 4 | 5 |

SECTION 6: COMMENTS

Q13. Is there anything else you would like to tell us?


THANK YOU FOR YOUR PARTICIPATION

Appendix D Information provided

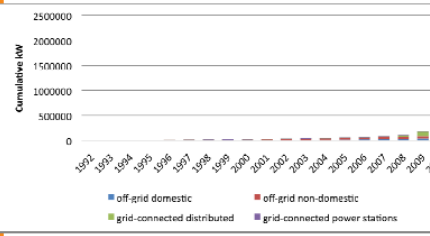


Electricity Costs and Options to Reduce Them


Dr Rob Passey, APVA, UNSW & IT Power
CSIRO/APVA Focus Groups, Oct 2012
 Funded by the Australian Solar Institute



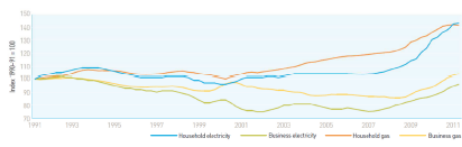
What's Happened to Solar PV




Source: PV in Australia reports. Prepared for the International Energy Agency Co-operative Programme on PV Power Systems, by the Australian PV Association on behalf of the Australian Government



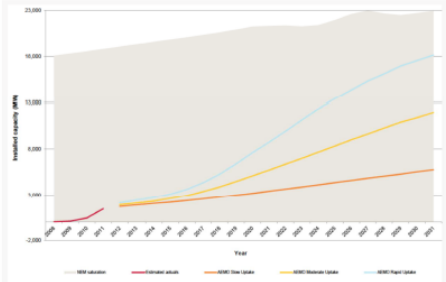
What's Happened to Electricity Prices




Source: Fact Sheet: Electricity Prices, Department of Resources, Energy and Tourism, Australian Government, 2012



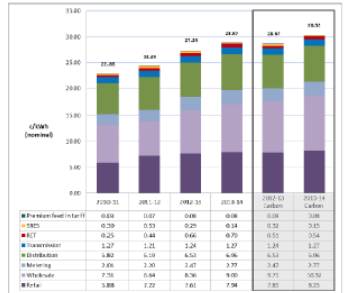
Solar PV in the Future



Source: Rooftop PV Information Paper National Electricity Forecasting 2012, Australian Energy Market Operator, 2012




Electricity Prices in the Future



| | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 |
|---------------|---------|---------|---------|---------|---------|---------|
| Wholesale | 0.08 | 0.87 | 0.98 | 0.98 | 0.98 | 0.98 |
| Distribution | 0.20 | 0.20 | 0.20 | 0.14 | 0.12 | 0.12 |
| Retailer | 0.25 | 0.44 | 0.66 | 0.70 | 0.55 | 0.54 |
| Transmission | 1.27 | 1.21 | 1.24 | 1.27 | 1.24 | 1.27 |
| Pool/retailer | 9.82 | 6.29 | 6.52 | 6.96 | 6.54 | 6.96 |
| Marketing | 3.06 | 3.30 | 3.47 | 3.77 | 3.47 | 3.77 |
| Wholesale | 7.56 | 6.68 | 6.76 | 6.90 | 6.75 | 6.90 |
| Total | 5.88 | 7.22 | 7.61 | 7.94 | 7.85 | 8.25 |

Source: Possible Future Retail Electricity Price Movements: 1 July 2011 to 30 June 2014, Final Report, Australian Energy Market Commission 2011



Options to Reduce Electricity Costs

- 1 Solar Water Heaters and other energy efficiency options
- 2 Solar PV on the grid
- 3 Solar PV on the grid + battery
- 4 Battery alone
- 5 Community PV
- 6 Solar PV OFF the grid

Options to Reduce Electricity Costs

Australian PV Association

- 1 Solar Water Heaters and other energy efficiency options
- 2 Solar PV on the grid
- 3 Solar PV on the grid + battery
- 4 Battery alone
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Options to Reduce Electricity Costs

Australian PV Association

- 1 Solar Water Heaters and other energy efficiency options
- 2 Solar PV on the grid
- 3 Solar PV on the grid + battery
- 4 Battery alone
- 5 Community PV
- 6 Solar PV OFF the grid

1. Solar Water Heaters and other Energy Efficiency

Australian PV Association

3. Solar PV on grid + battery

Australian PV Association

2. Solar PV on the grid

Australian PV Association

1. SOLAR PANELS CONVERT SUNLIGHT TO DIRECT CURRENT ELECTRICITY (DC)
2. INVERTER CHANGES DC ELECTRICITY TO HOUSEHOLD AC (ALTERNATING CURRENT)
3. INVERTER AC OUTPUT IS CONNECTED TO THE UTILITY THROUGH A BACK-FEED BREAKER IN THE EXISTING SERVICE PANEL

4. Battery - example TOU tariff

Australian PV Association

Time of Use tariff (c/kWh)

| Time of day | Cost (c/kWh) |
|-------------|--------------|
| 1 | 13 |
| 2 | 13 |
| 3 | 13 |
| 4 | 13 |
| 5 | 13 |
| 6 | 13 |
| 7 | 13 |
| 8 | 53 |
| 9 | 53 |
| 10 | 53 |
| 11 | 20 |
| 12 | 20 |
| 13 | 20 |
| 14 | 20 |
| 15 | 20 |
| 16 | 20 |
| 17 | 20 |
| 18 | 20 |
| 19 | 20 |
| 20 | 20 |
| 21 | 20 |
| 22 | 13 |
| 23 | 13 |
| 24 | 13 |

Options to Reduce Electricity Costs



- 1 Solar Water Heaters and other energy efficiency options
- 2 Solar PV on the grid
- 3 Solar PV on the grid + battery
- 4 Battery alone
- 5 **Community PV**
- 6 **Solar PV OFF the grid**

Pros and Cons (not cost-related)



| | SWH etc | PV | PV + battery | Battery | Community PV | PV off-grid |
|--------------------|---------|-----------|--------------|---------|--------------|-------------|
| Own your house | Yes | Yes | Yes | No | No | Yes |
| Solar access | Yes/No | Yes | Yes | No | No | Yes |
| Storage space | No | No | Yes | Yes | No | Yes |
| Responsibility | Yes | Yes/No | Yes/? | Yes/? | No | Yes/? |
| Energy payback yrs | Various | 0.75 to 4 | 2 to 13 | 1 to 10 | 0.75 to 4 | 2 to 13 |
| Waste disposal | Yes/? | Yes/? | Yes/? | Yes/? | Yes/? | Yes/? |

5. Community PV



- Allows people without roof space to have PV
- On local commercial building
- Individuals pay for shares in PV system
- Receive payments for electricity

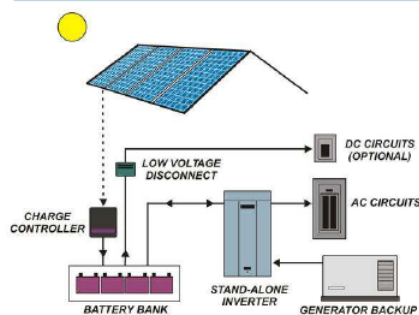


Options for Payment



- 1 Buy upfront
- 2 Hire purchase
- 3 Solar leasing
- 4 Energy Service Companies (ESCOs)

6. Solar PV Off-grid



Cost, Benefit of 1.5kW PV on Grid

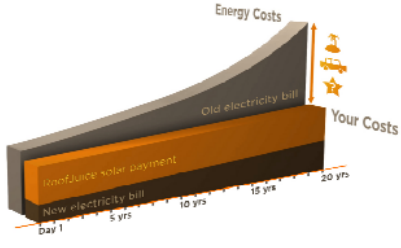


- 1 Buy upfront - \$3,500 to \$5,500, average \$4,500
- 2 Hire purchase - \$450 up front + \$6.20/day for 2 years = \$4,950

| | Tariff | Payback time (on grid) | | |
|-------------|-------------|------------------------|--------------|------------|
| | | PV | PV + Battery | Battery |
| Cost | | \$4,500 | \$15,500 | \$6,000 |
| Flat tariff | \$1.5 c/kWh | 9.9 years | 18.6 years | NA |
| TOU Tariff | Off-peak | 13 c/kWh | | |
| | Shoulder | 21 c/kWh | 12 years | 18.7 years |
| | Peak | 33 c/kWh | | 26 years |

Alternative Payment Options

3 Solar leasing – 26c/kWh



Alternative Payment Options-2

4 ESCO – Energy Service Company

- I. Energy audit, organise appropriate options (PV, battery, SWH, other EE etc), they leave, you pay bills
- II. As above but they lease the options to you, you still pay bills
- III. As for 2 but they also pay your bills. You pay a fixed monthly amount.
 - Could include remote control of selected appliances (AC, washing machine, clothes driers etc)

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