THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

The University of Queensland Surat Deep Aquifer Appraisal Project (UQ-SDAAP)

Scoping study for material carbon abatement via carbon capture and storage

Supplementary Detailed Report

Australian energy preferences and the place of carbon capture and storage (CCS) within the energy mix

June 2018

Authors

Dr Claudia Nisa, The University of Queensland
Dr Katherine Witt, The University of Queensland
Ms Michele Ferguson, The University of Queensland
Ms Amy Hodson, The University of Queensland
Prof Peta Ashworth, The University of Queensland

Acknowledgements

This working document was prepared for The University of Queensland Surat Deep Aquifer Appraisal Project (UQ-SDAAP), a 3-year, $5.5 million project funded by the Australian Government through the Carbon Capture and Storage Research Development and Demonstration (CCS RD&D) programme, by Coal 21, and The University of Queensland. Special thanks is given to Alexandra Wolhuter for providing the detailed maps showing the geographical spread of respondents.

Citation

Nisa C, Witt K, Ferguson M, Hodson A & Ashworth P (2018), *Australian energy preferences and the place of carbon capture and storage (CCS) within the energy mix*, The University of Queensland Surat Deep Aquifer Appraisal Project – Supplementary Detailed Report, The University of Queensland.

Referenced throughout the UQ-SDAAP reports as **Nisa et al. 2018.**

Publication details

This publication was originally released in 2018 on The University of Queensland Surat Deep Aquifer Appraisal Project website page, with the citation: Ashworth P, Nisa C, Witt K, Ferguson M, Hodgson A, (2018). 'Australian energy preferences and the place of Carbon Capture and Storage within the energy mix' report. The University of Queensland, Brisbane Australia.

It is republished as part of the full set of The University of Queensland Surat Deep Aquifer Appraisal Project final reports.

ISBN: 978-1-74272-245-0

Disclaimer

The information, opinions and views expressed in this document do not necessarily represent those of The University of Queensland, the Australian Government or Coal 21. Researchers within or working with the UQ-SDAAP are bound by the same policies and procedures as other researchers within The University of Queensland, which are designed to ensure the integrity of research. The Australian Code for the Responsible Conduct of Research outlines expectations and responsibilities of researchers to further ensure independent and rigorous investigations.

Contents

Tables

Figures

1 Executive Summary

This report presents findings from the *Energy Technology Preferences Survey*, which explored the Australian population's attitudes towards energy sources and technologies in Australia, with a particular emphasis on carbon capture and storage (CCS). CCS is one technology that has been proposed to play a major role in mitigating climate change (e.g. International Energy Agency (IEA), 2013). However, discussions about CCS have not been without controversy. Several CCS projects have been put on hold or cancelled due to public opposition, either failing to gain or sustain support from political actors (Wallquist et al. 2012; Hammond and Shackley 2010); or proved difficult to implement at the community level (Ashworth et al. 2012). Therefore, understanding public perceptions and evaluation of CCS technology is acknowledged as a critical determinant in the commercial development of CCS (Seigo et al. 2014). An important aim of this survey has been to identify which factors are more strongly associated with support for CCS, and to differentiate socio-economic and demographic groups regarding their views on this topic.

Data was collected between June and August 2017 from a nationally representative Australian sample of individuals aged 18 years of age and older (95% confidence level and +/-1.76% confidence interval). The sample included individuals from the general public (n=2383) and individuals randomly selected from specific regions (n=550). These are regions that have been exposed to energy technology projects such as coal seam gas (CSG) and CCS (in Queensland, n=186), wind farms (South Australia, n=176) and brown coal mines and coal-fired power station closures (Victoria, n=188). The regions are designated throughout this report as 'communities of interest' (COI). Additional attention was dedicated to the COIs in order to examine the impact that exposure to different energy projects may have had on the opinions of these subpopulation groups. This methodological approach enables us to better understand differences in attitudes between various demographics and across different regions.

Of individuals who responded to the survey, 52% were female, the average age was 48 years, and 59% resided in urban areas. Around one third of respondents had attained a level of education up to and including Year 12, while another third had completed a Bachelor degree or above. Median income was between AU$60-$90K per annum. Around one third of participants voted for the Australian Labor Party, and another third voted for the Coalition (Liberal Party and National Party combined), while 10% voted for the Australian Greens.

The survey questionnaire included a broad variety of questions to provide a solid contextualisation of the factors that are associated with public understanding and support for different energy sources and technologies. The results presented in this report focus on (i) knowledge about and support for different energy technologies, (ii) perceived risks and benefits of CCS compared to other renewable energy technologies and (iii) perceptions about global climate change. Where possible, current results were compared to previous surveys using nationally representative Australian samples.

Analysis of the results suggest that despite the increased media attention on issues surrounding affordability, energy security and supply, the Australian public's self-rated knowledge of the range of energy technologies has decreased since 2011, as has support for most energy technologies. Overall, our results convey low levels of knowledge and support for CCS, combined with some (limited) concerns for risks of accidents in storing and transporting CO_2. Lack of understanding in the Australian general public may increase public opposition towards some new energy projects if there is no recognition of the benefits such projects might bring. As concerns increase about the world's slow progress towards the Paris COP21 target of keeping global warming to less than 2 degrees Celsius, it may be that CCS becomes more widely accepted. However, it will require far greater communication efforts and investment if this is to become a reality, particularly in terms of educating the public about the fundamental value of CCS in enabling grid stability and reliability through supporting synchronous generation from traditional fossil fuels.

Key results

- Objective knowledge about electricity generation and energy use in average households was low across the Australian survey sample. Less than 5% of individuals responded correctly to all four knowledge questions about energy issues. However, participants from the COIs and those closer to energy projects tended to know slightly more than the general public.
- Knowledge appeared to be associated with support for different energy technologies. Higher levels of objective knowledge correlated with higher levels of support for renewable energy technologies including solar, wind, wave and hydroelectricity, than for technologies related to fossil fuels, but had a negative association with support for CCS.
- Participants reported lower levels of perceived knowledge about most energy technologies compared to survey data from previous years 2011 and 2013. Perceived knowledge levels about gas and coal in both 2013 and 2017 were comparatively high (and on par with solar thermal and wind), although they received generally lower levels of support than renewable energies. Thus for some industries, an increase in perceived knowledge may not translate to an increase in support for the industry.
- The energy technologies with highest support ratings were solar and wind. The least supported energy technologies were CSG, biomass and nuclear. However, compared to survey data from 2011 and 2013 support for energy technologies, including renewables, fell in 2017 with the notable exception of coal and nuclear. Nuclear power was significantly more supported as a public funding priority in NSW compared to QLD, VIC and WA.
- Furthermore, the findings confirmed that support of an energy technology is influenced by exposure and familiarity, as demonstrated in attitudes that appeared to be regionally specific.
- While renewable energy technologies had the highest levels of support, two thirds of participants were unwilling to pay more than a 10% increase in their electricity bill to use electricity generated only from renewable energy. Similarly, only a small proportion of individuals (13%) reported subscribing to GreenPower.
- Support for CCS was most strongly correlated with having a job that is associated with the coal or gas industries, and to economic (e.g. job opportunities) and cost issues (e.g. installation or maintenance costs of energy technology).
- Individual perceptions of renewable energy technologies were largely positive, and two thirds of respondents thought that the advantages outweigh the risks. However, less than half of respondents thought that the advantages of CCS outweigh the risks.
- The key benefit of CCS was perceived to be reducing CO_2 emissions. Risk perceptions about CCS were higher in the COIs in Queensland and South Australia, mainly related to risks in the transport and storage of carbon dioxide. The perceived benefits of CCS was weakly correlated to support for CCS.
- Perceptions of transparency, fairness and trust in both the government and industry were low in relation to developing new renewable energy technologies and CCS projects. Trust was slightly higher for the renewable energy industry.
- The majority of participants (approximately two thirds) believed that global warming is happening now. Although just over one third of individuals (37%) thought global warming is caused mostly by human activities, this proportion has increased from 2013 (27%) and 2011 (26%).

2 Introduction

The United Nations Framework Convention on Climate Change (UNFCC) Paris Agreement set the ambitious goal to limit average global temperature increase to 2°C relative to pre-industrial levels by the end of the century (Rogelj, 2016). However, many suggest this goal is unachievable in the face of rapidly increasing global energy demand, growing population and goals to move billions of people out of poverty. This is particularly so if high carbon intensive fossil fuels continue to dominate the world's energy generation.

Carbon capture and storage (CCS) is one technology that has been proposed to play a major role in potential ways to mitigate global warming (International Energy Agency (IEA), 2013). CCS is the process of capturing carbon dioxide (CO_2) from large point sources, such as fossil fuel power plants or industrial processes, transporting it to a storage site, and storing it in underground geological formations. The aim is to prevent the release of large quantities of CO_2 into the atmosphere. CCS is considered by many experts to be an integral component of attempts to lower global CO_2 levels and mitigate global warming – particularly given its potential to significantly reduce emissions from the current fossil fuelled power generation fleet and emission intensive industries. For more than two decades, CCS has been considered a medium-term option for reducing carbon dioxide (CO_2) emissions and transitioning to a more sustainable energy future particularly for those countries reliant on fossil fuels (Boot-Handford et al. 2014). CCS is also relevant to a number of fast developing countries including India, China and South Africa whose future CO_2 emissions are expected to continue to rise (Dütschke et al. 2016).

However, discussions about CCS have not been without controversy. Opponents argue that it promotes 'dirty energy' (Marshall 2016) and as a technological option, if deployed, its impact may be a 'double-edged sword' - leading to a technological lock-in that hinders the development of more renewable energy options (idem). In addition, several CCS projects have been put on hold or cancelled due to public opposition - either failing to gain, or sustain, support from political actors (Wallquist et al. 2012; Hammond and Shackley 2010). Moreover, some consider CCS technology as still in a developmental stage, and the full commercial scale projects that were originally mooted to test CCS have proven difficult to implement (Ashworth et al. 2012). At the same time, whilst CCS project developers primarily focus on the technical and geological specifications associated with a project during its planning and implementation phases, the social science literature indicates there is benefit in also taking into account the social characteristics of a potential host site and developing effective and appropriate stakeholder communication (Ashworth et al. 2015; Bruine de Bruin 2015).

Therefore, understanding public perceptions and evaluation of CCS technology is increasingly acknowledged as a critical determinant in the commercial development of CCS (Seigo et al. 2014). Further exploring the interconnections between technology and society. This report provides evidence of the Australian population's attitudes towards a variety of energy sources and technologies and the role that CCS may play as part of the portfolio of options within the array of possibilities. We aim to identify which factors are more strongly associated with support for CCS and to differentiate socio-economic and demographic groups regarding their views on this topic.

This report aims to provide answers to the following questions:

1. What are the factors associated with support for different energy sources and technologies?
2. What are the factors specifically associated with support for CCS?
3. What socio-economic and demographic groups are more or less likely to support CCS?
4. Does exposure to energy technologies influence the level of support?

3 Method

3.1 Questionnaire

The questionnaire used was designed to include a broad variety of questions to provide a solid contextualisation of the factors that are associated with public understanding and support for different energy sources and technologies (refer Appendix 1 – Survey questionnaire). We aimed to maintain a level of replicability with other surveys previously conducted to monitor changes in the evolution of preferences for different energy technologies in Australia (for example: Ashworth et al. 2009a; 2009b; 2011; 2013). In this context, the initial section of the questionnaire focused on factual and perceived knowledge about energy sources and technologies. The next section about the level of technology support, factors for support and funding priorities were also based on the Ashworth et al. (2014) survey. Before expressing their level of support and funding priorities, participants were presented with definitions for each of the energy sources and technologies under evaluation consistent with previous surveys (refer Appendix 1 – Survey questionnaire).

Additional questions were included to enable international longitudinal comparability including comparisons with previous environmental and energy-related surveys such as the World Values Survey (WVS) and the OECD Household Consumption (EPIC) surveys. This section included key questions about trade-offs between economic growth, environmental protection and climate change. Most questions were adapted from the WVS, which since 1995 includes similar questions. This enables both temporal pattern analysis and the comparison of Australians' attitudes with the rest of the world.

The following section of the questionnaire aimed to analyse attitudes and perceptions of CCS compared to renewable energy. Questions in this section were preceded by a video presenting CCS as one of several technologies that when combined with energy efficiency and renewable energy technologies can reduce global emissions and thus prevent climate change. Questions following this video were adapted from Huijts et al.'s (2012, 2014) framework for understanding technology acceptance. This framework incorporates questions about perceived risks and benefits for each energy technology and perceived fairness, transparency and trust of government and industry to regulate, support and deliver CCS or renewable energy projects. The last section (7) collected data on standard sociodemographic information to enable us to characterise our sample and understand different trends between groups.

The details of the questions are described in Table 1 below:

Table 1 Survey structure

Section	Topic	Example Questions	Source
1	**Screening questions**	Age Gender Postcode	NA
2	**Knowledge**	Objective knowledge e.g., "*How is most electricity in Australia generated?"* and perceived knowledge e.g., "*Please indicate your current level of knowledge about the following energy sources and technologies*" (scale from 1=no knowledge to 7=expert knowledge)	Adapted from Jeanneret et al. (2014)
3	**Support for energy technologies and public funding preferences**	Stated support e.g., "*Please indicate how strongly you agree or disagree with the following options as potential ways of generating Australia's future energy needs*" (scale from 1=strongly disagree to 7=strongly agree);	Adapted from Jeanneret et al. (2014)
4	**Economic trade-offs and Reliability concerns**	Willingness to pay e.g., "*I would give part of my income if I were certain that the money would be used to prevent environmental pollution*" (scale from 1=strongly disagree to 7=strongly agree); *Please indicate below how concerned you are that in the next 10-20 years electricity will become unaffordable for you?* (scale from 1=not at all concerned to 7=extremely concerned)	Adapted from OECD EPIC survey; WVS
5	**Climate Change**	Perceptions about global warming e.g., "*Do you believe global warming is happening now or will happen in the next 30 years?; How serious do you think are the environmental problems facing the world?* (1=not at all serious to 7=extremely serious)	Adapted from OECD EPIC survey; WVS
6	**CCS versus renewable energy perceptions**	E.g., How likely do you think the following consequences are as a result of using CCS technology? e.g., *An increase in the risk of a major accident involving the public occurring* (1=very unlikely to 7=very likely); *With regard to renewable energy projects to what extent do you trust renewable energy industries to e.g., act in the best interest of society?* (1=not at all to 5=trust a lot)	Adapted from Huijts et al. (2012, 2014)
7	Socio-demographic Information	E.g., Educational level, income level, household composition, political preferences	Adapted from Jeanneret et al. (2014)

3.2 Sample

A market research company (Q & A Research) was engaged to collect data via an online survey. Data was collected June - August 2017 from a nationally representative Australian randomised sample of 3135 individuals aged 18 years of age and older. The sample includes individuals from the general public and individuals randomly selected from specific regions. These regions are designated throughout this report as communities of interest or COI. This methodological approach enables us to better understand differences in attitudes between various demographics and across different regions. Additional attention was dedicated to the COIs in order to examine the impact that exposure to different energy projects may have had on the opinions of these subpopulation groups:

1. The Surat Basin, Queensland Coal Seam Gas/ CCS areas

   The development of an export CSG to LNG (Liquefied Natural Gas) industry in Queensland has created positive economic impacts for many people who are directly engaged with the industry (e.g. local businesses, employees, community organisations) as well as negative impacts for those engaged (e.g.

landholders) or not engaged (e.g. local tenants) with the industry. This has been evidenced through a range of social impacts, including an increase in youth populations (particularly educated and female youth), but also a loss of social cohesion and pressure on local infrastructure, housing affordability and services (Rifkin et al. 2015; Measham and Fleming 2014).

This COI has had significant CCS activity and is the target area of the UQ-SDAAP project and the Carbon Transport and Storage Company (CTSCo) project. Previously the region also hosted the proposed ZeroGen Integrated Gasification Combined Cycle (IGCC) project and the Callide Oxyfuel project. These projects were demonstration scale projects (Global CCS Institute, 2017) and while they may have not caused significant community impact, they may have influenced knowledge and attitudes towards CCS. Perceptions towards CCS may also have been negatively impacted by the environmental leaks from the Linc Energy underground coal gasification project (Sibson, 2018). The COI includes Emerald (in the adjacent Bowen Basin), which hosted the ZeroGen project and is a black coal mining area; and the coastal town of Gladstone, which was the community most affected by the building of three LNG plants on Curtis Island to process and export CSG. Despite the general public being supportive of renewable energy, based on this COIs context where individuals have been impacted by several CSG and other new projects they may also have little tolerance for new renewable projects, particularly if it requires trade-offs with prime agricultural farming land.

It is expected that this COI will display:

- Higher levels of knowledge about CCS and CSG
- Lower support for CSG
- Lower support for any new projects in the area including renewable technologies

2. Wind farms areas, South Australia

South Australia has witnessed a substantial development of renewable energy projects. In 2016-17, 39% of the electricity generated in South Australia came from wind farms and 9% from rooftop PV solar (AEMO 2017). This has contributed to the closure of several power stations including Northern and Playford coal-fired power stations and the Pelican Point gas-fired plant. Australia's first large-scale solar thermal plant has recently won a government tender and will be built in Port Augusta. In recent years, South Australia has also experienced a resurgence of interest in nuclear energy. The 2016 report by the Nuclear Fuel Cycle Royal Commission found that while electricity generation from nuclear energy was unlikely to be commercially viable, there were opportunities to expand South Australia's role in the nuclear cycle, particularly in the storage of nuclear waste. Subsequently, the South Australian government has run a widespread campaign to explain and examine the potential for hosting a nuclear waste reprocessing industry (Government of South Australia 2017).

The COI region hosts eleven operating wind farms (as of December 2017), the largest of which are the Snowtown, Hallett, Hornsdale and Lake Bonney Wind Farms. The first of these, the Starfish Hill Wind Farm, commenced generating power in July 2003. Local populations have experienced positive economic impacts from project development, and have also been exposed to the visual and audible amenity impacts of the infrastructure and to the economic impacts on power prices. This COI has been at the centre of public debate and controversy created by the development of a wind industry. Examples are the purported health impacts of the Waterloo wind farm (rejected by the Environmental Protection Agency (EPA 2009), the Australian Medical Association, South Australian courts (Renew Economy 2014) and a Senate committee (Senate Community Affairs References Committee 2011); cancellation of wind farms due to project economics and acknowledged opposition (including the Myponga Wind Farm); and the recent publicity with the current federal Coalition government accusing the wind industry of creating high energy prices and low grid stability in South Australia (Renew Economy 2016). Despite this, development of wind energy infrastructure continues and appears to be escalating.

It is expected that the integration of wind farms into this COI will mean the COI has, compared to the remainder of South Australia and Australia:

- Higher levels of knowledge about renewable technologies
- Higher support for renewable technologies
- Lower support for fossil fuels

3. Brown coal mines and coal-fired power station closures in La Trobe Valley, Victoria

Unlike the recent experience of CSG and CCS industries in Queensland, Victoria has had a long-term and multi-generational experience with brown coal mines and coal-fired power stations. This COI selected has been directly affected by the decommissioning of Morwell and Hazelwood brown coal-fired power stations over the last 3 years. The closures have caused uncertainty for many regarding job security and economic stability in the region. The area also experienced the Hazelwood coal mine fire which burned uncontrollably for 45 days in 2014. Since then, this COI has been involved in a number of public discussions regarding the predicted closure of the remaining coal-fired power stations and associated mines and proposed rehabilitation plans. The ability of the industry to fund and satisfactorily deliver the rehabilitation of the power stations and mines is also uncertain (Institute for Energy Economics and Financial Analysis (IEEFA 2016).

The COI also includes the township of Sale and surrounds. While not a coal mining region, this area is the centre for the Victorian offshore gas industry. This is also a multi-generational industry and provides economic stimulus and jobs to the area. An industrial incident at the Longford Gas Plant near Sale in 1998 was well publicised and the temporary shutdown of gas distribution in Victoria highlighted the dependence of the State on the gas industry (Gooch 2002). This COI also covers the CarbonNet project, however at the time of the survey this project has had minimal publicity and is not expected to have impacted technology perceptions.

It is expected that this COI will display:

- Higher levels of knowledge about coal and gas energy sources
- Higher support for fossil fuels
- Support for CCS consistent with the general population

3.3 Sample characteristics and analysis

A total of 3135 surveys were completed, and of these, 2933 surveys were included in the final data set reported here. The geographical distribution of participants per state follows a representative random sampling, corresponding to state population size. The three COIs that were selected are highlighted in Figure 1 and presented in more detail in Figures 2, 3 and 4 and Tables 2, 3, and 4 below. More details on sample sizes and sociodemographic characteristics of sample regions are presented in Table 5.

Data were cleaned and analysed using Stata/MP v.15.1 (StataCorp LLC). Completed surveys were discarded from the dataset if: completion time was more than 6 hours (average completion time was 30 minutes); or participants had responded in a biased way. Descriptive analyses examined respondents' knowledge of key energy issues and different energy technologies. Bivariate analyses (cross tabulations, one-way ANOVA and t-tests) explored relationships between demographic characteristics and jurisdictional differences (i.e. states and territories, the general public and COIs) and knowledge, support for, and perceptions of the risks and benefits of different energy technologies. Perceptions of climate change and environmental attitudes, and preferences for energy cost, reliability and stability were also examined using bivariate analyses. Correlations (Pearson Correlation, *r*) examined the strength of associations between energy preferences and key socio-demographic variables. Selected results were compared to the results from earlier surveys conducted in 2011 and 2013 (Jeanneret et al 2014).

National results, and those for state breakdowns are reported for the general public sample only n=2383 (excluding the COIs). Individual results for the ACT (n=54), the Northern Territory (n=16) and Tasmania (n=36) are not presented separately in this report, due to their small sample size and lack of statistical power.

Figure 1 Geographical spread of respondents

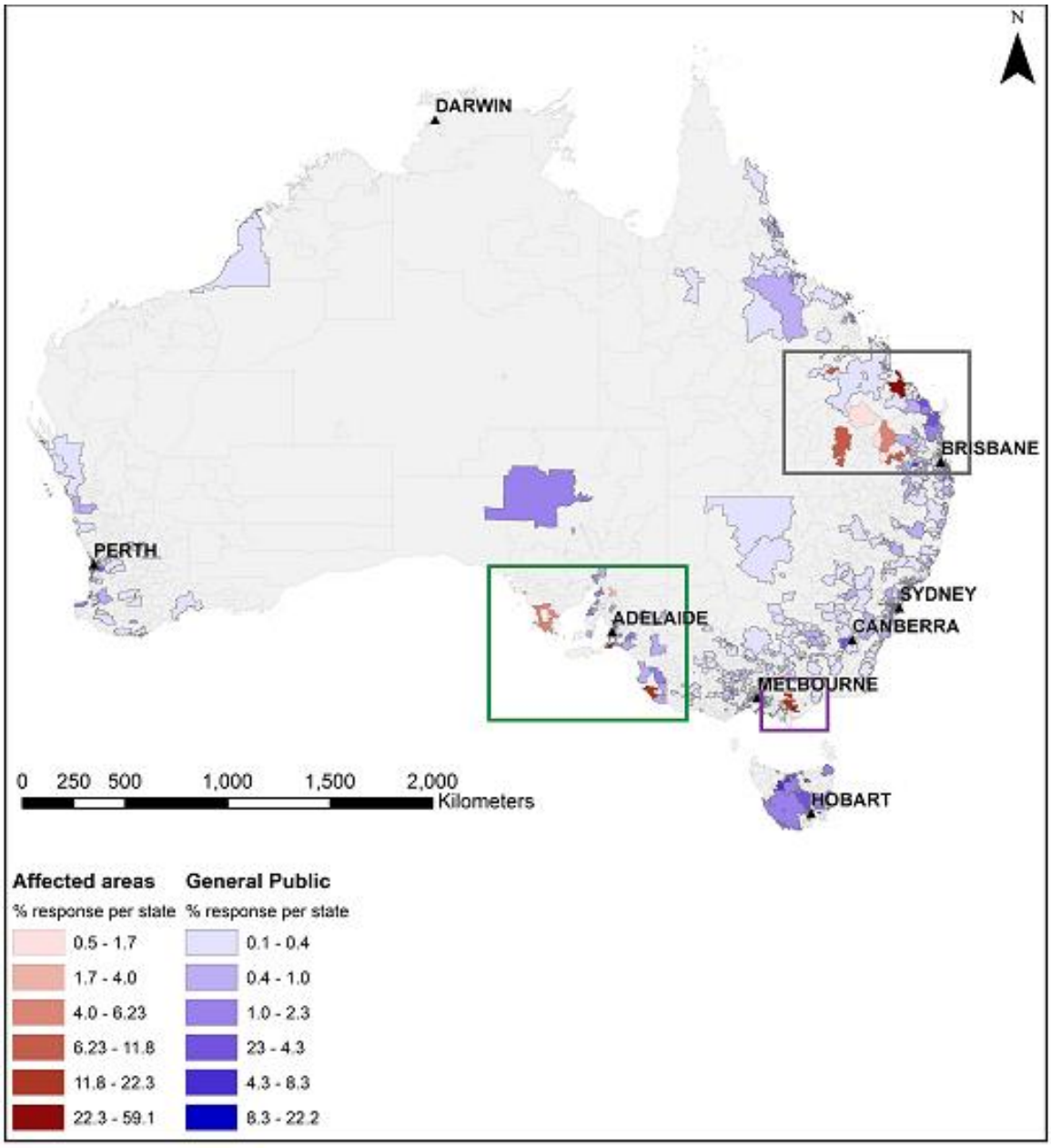


Table 2 COI Queensland responses

Postcode	Sample Size	Region	Technology exposure
4405	19	Dalby	CSG
4413	11	Cameby (Chinchilla)	CSG
4415	1	Columboola (Chinchilla)	CSG
4420	3	Taroom	CCS/ CSG
4421	2	Tara	CSG
4455	22	Roma	Gas/CSG
4680	110	Gladstone	Coal plant/ CCS/ CSG LNG
4720	18	Emerald	Coal mines / CCS

Figure 2 COI Queensland geographic spread (shown in red)

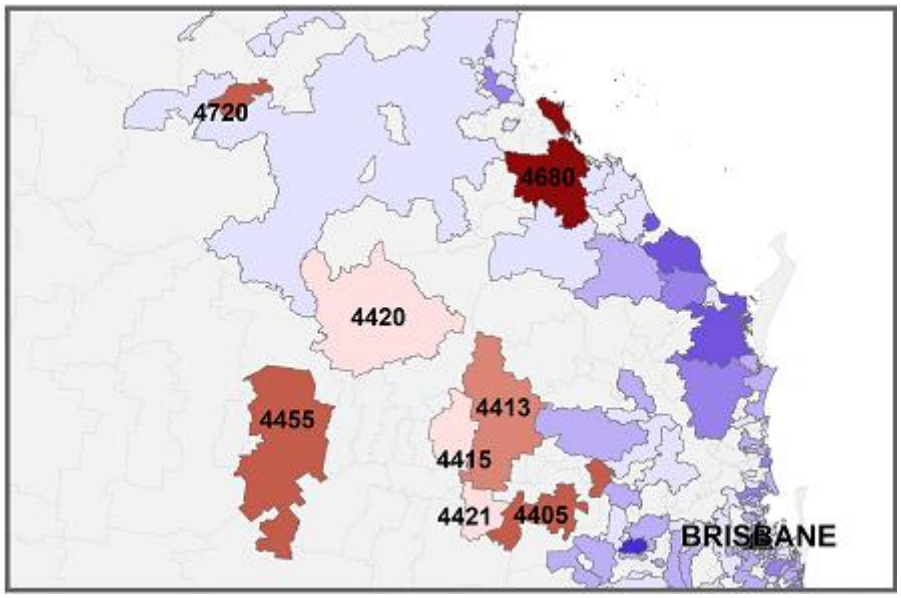


Table 3 COI Victorian responses

Postcode	Sample Size	Region	Technology exposure
3825	34	Hill End	Brown Coal
3840	30	Morwell/ Hazelwood	Brown Coal
3844	75	Carrajung/ Traralgon	Brown Coal
3850/ 3853	44	Sale/ Wurruk	Oil/ Gas
3854	5	Glengarry	Brown Coal

Figure 3 COI Victoria geographic spread (shown in red)

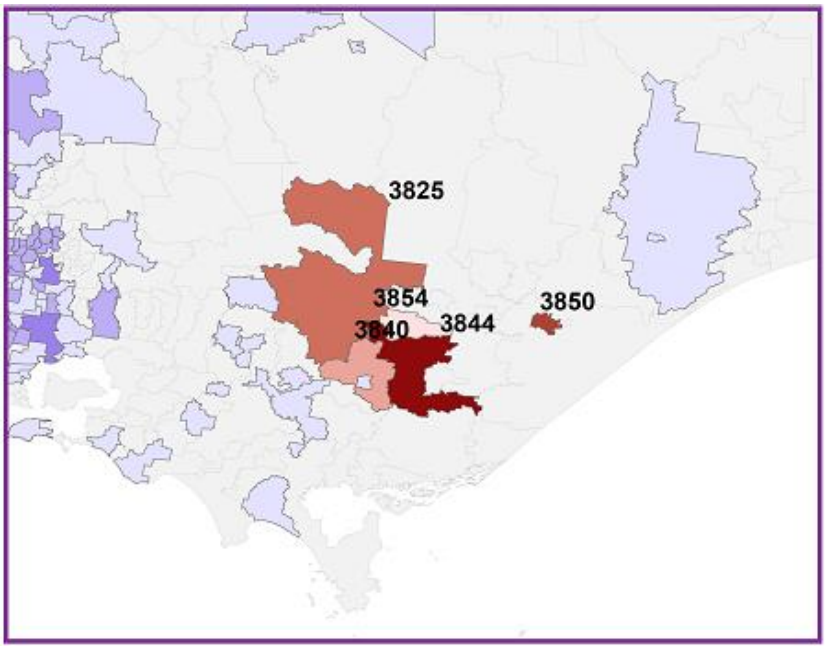
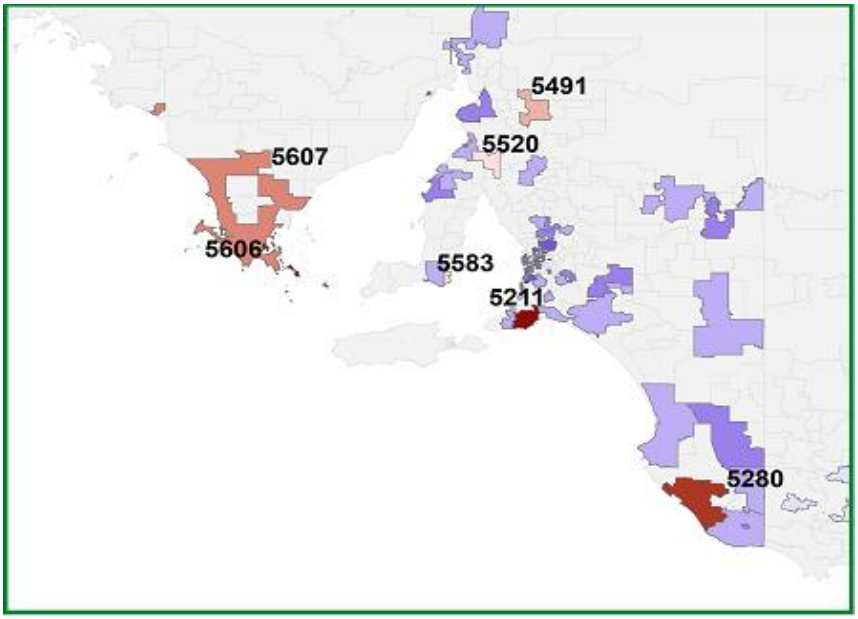


Table 4 COI South Australian responses

Postcode	Sample Size	Region	Technology exposure
5211	67	Waitpinga/ Victor Harbor	Wind Farms
5280	26	Thornlea/ Millicent	Wind Farms
5491	7	West Bundaleer	Wind Farms
5520	1	Bumbunga	Wind Farms
5583	3	Sultana Point	Wind Farms
5606/ 5607	72	Port Lincoln	Wind Farms

Figure 4 COI South Australia geographic spread (shown in red)



Participants' sociodemographic characteristics are presented below in Table 5. The samples were fairly balanced in terms of gender for the general public and for the South Australian COI (SA COI), although in the remaining two COIs females made up between 59-65% of the sample. The average age was higher in the SA COI than in the other COIs and general public (56 years versus 47-49); and in SA COI almost two thirds of the sample aged were aged 55 and above.

In terms of education, around one third across the four samples attained a highest level of education at Year 12. The general public sample had the largest proportion of respondents with a Bachelor degree or above (35%), which was twice the proportion of the VIC COI. Educational differences, however, were not reflected in household income. The QLD and VIC COI had the most participants in the highest income bracket (19% and 17% respectively), while the general public sample and SA COI had the most participants in the lowest income bracket (20%). Some differences may be attributable to urban or rural location. Sixty-nine per cent (69%) of the general public were sampled from urban areas, whereas the COIs were either all (VIC and QLD COI) or had the majority (60% SA COI) of participants from rural areas. Around one third of participants across the samples voted for the Australian Labor Party with the exception of the SA COI (22%) where there was a high concentration of voters for the Nick Xenophon Team (30%). Around one third of all sampled voted for the Coalition (Liberal Party and National Party combined).

Table 5 Socio demographic characteristics of sample groups

		General Public	COI QLD	COI VIC	COI SA	Total
Gender	Male	48.7%	40.9%	35.1%	53.4%	1397
	Female	51.3%	59.1%	64.9%	46.6%	1536
Age	Mean	47.5	48	49	56.2	2933
	(SD)	16.8	13.4	14.8	14.3	
Age Group	18-34	28.9%	17.2%	20.2%	9.1%	775
	35-54	35.4%	48.9%	42.6%	29.0%	1066
	55+	35.7%	33.9%	37.2%	61.9%	1092
Education	Up to year 11	15.61%	16.22%	19%	28.16%	484
	Year 12	16.11%	12.97%	14.59%	8.62%	448
	Certificate	18.56%	24%	29.19%	21.84%	576
	Diploma/Adv. Diploma	15%	19.46%	20.00%	18.39%	449
	Bachelor Degree	22.35%	17.30%	10%	15%	607
	Postgraduate Degree	12.86%	10.27%	7.03%	8.05%	351
Household Income	Less than $30,000	20.59%	14%	16.39%	20.00%	562
	$30,000-$59,999	24.18%	14%	30%	32.00%	696
	$60,000-$89,999	19.85%	13.81%	16.94%	14.29%	540
	$90,000-$119,999	13.32%	23.20%	15%	15%	403
	$120,000-$149,999	11.46%	17.68%	4.37%	10.29%	323
	$150,000+	10.60%	19.34%	17.49%	8.57%	327
State	NSW	32.73%	0%	0%	0%	780
	VIC	25.18%	0%	100%	0%	788
	QLD	19.43%	100%	0%	0%	649
	SA	7.43%	0%	0%	100%	353
	WA	10.78%	0%	0%	0%	257
	TAS	2.27%	0%	0%	0%	54
	NT	0.67%	0%	0%	0%	16
	ACT	1.51%	0%	0%	0%	36
Region	Urban	69.26%	0%	0%	40%	1718
	Rural	30.84%	100%	100%	60%	1215
Political Vote	The Coalition:LPA	26.06%	19.89%	18.62%	30.68%	747
	The Coalition: NPA	4.66%	14.52%	15.43%	0.00%	167
	Labor Party	33.91%	32.80%	37.23%	22.16%	978
	Greens	11.20%	4.84%	7.45%	3.98%	297
	Nick Xenophon Team	3.06%	0.54%	0.00%	29.55%	126
	Pauline Hanson's One Nation	7.68%	11.29%	9.57%	7.39%	235
	Other/not disclosing	13.43%	16.13%	11.70%	6.25%	383
TOTAL		**2383**	**186**	**188**	**176**	**2933**

4 Results

4.1 Knowledge and Support for different energy technologies

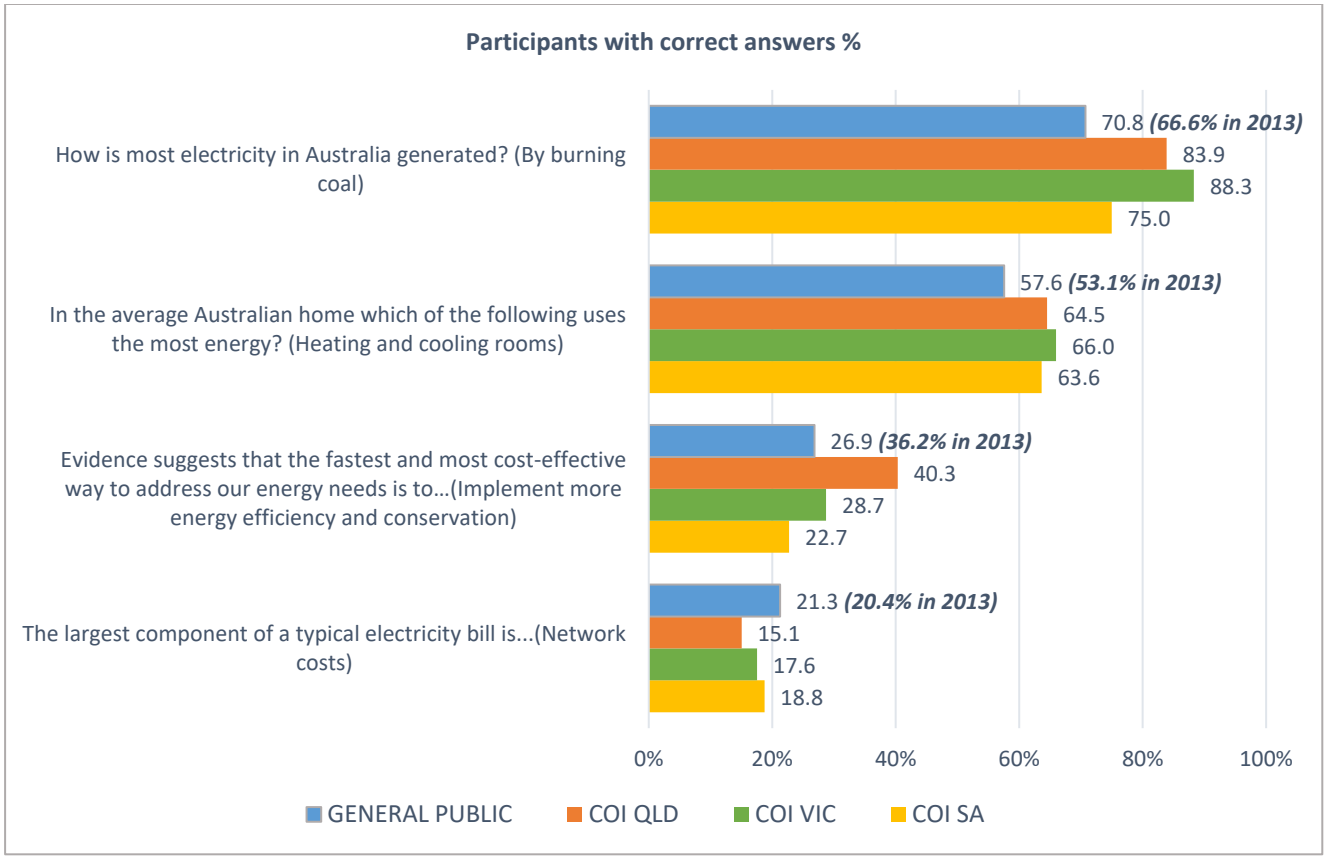
4.1.1 Objective and Perceived Knowledge

This section reports on individuals' objective and perceived knowledge about energy key issues and different energy technologies.

To assess levels of objective (factual) knowledge, respondents were asked four questions about electricity generation and energy use in Australia. Figure 5 displays the proportion of participants that correctly answered each question. While over two thirds of respondents correctly answered that most electricity in Australia is generated by burning coal, only 15-21% correctly answered that network costs are the largest component of a typical electricity bill. On average, the general public was less knowledgeable than individuals from the COIs. There were statistically significant differences between these groups for the first three questions presented below ($p<0.05$). For the final question ("What is the largest component in a typical electricity bill?") differences between the groups did not reach statistical significance.

Not surprisingly, the coal mining COIs in Queensland and Victoria were particularly knowledgeable of how most electricity is produced in Australia (coal). All groups of participants had noticeably less knowledge of the fastest and most cost-effective way to address Australia's energy needs (energy efficiency), although the QLD COI had a significantly higher proportion of individuals who correctly answered this question.

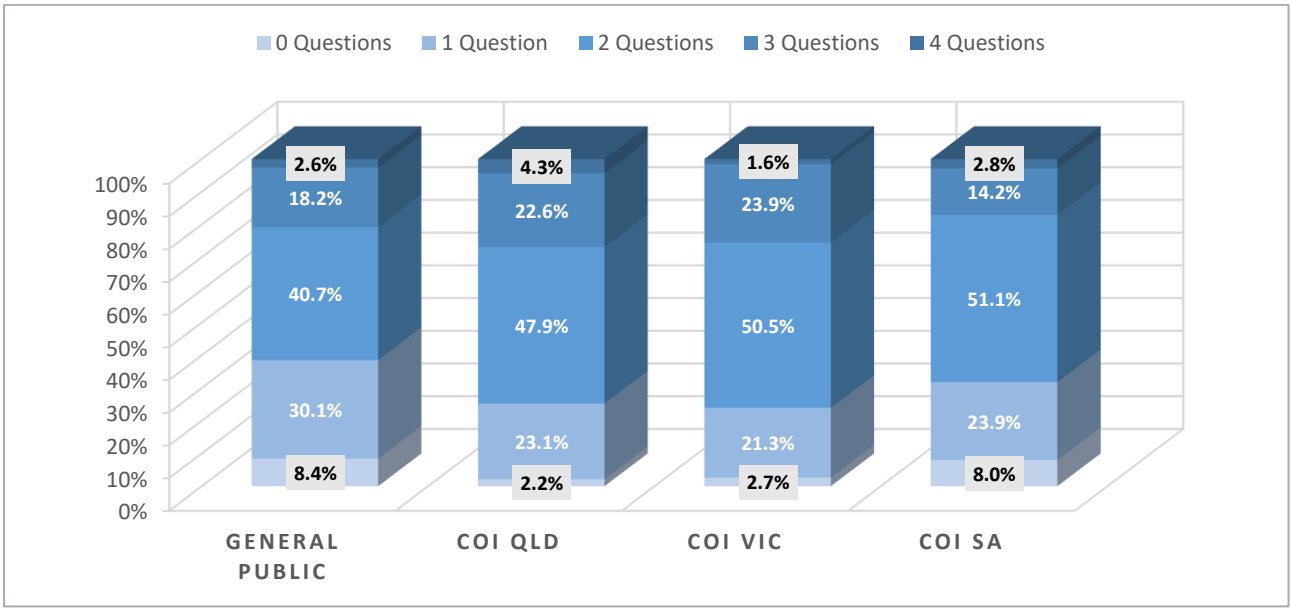
Figure 5 Respondents' objective knowledge of energy



There were generally low levels of objective knowledge about energy, with the largest proportion of participants across all groups answering two out of four questions correctly. A higher proportion of participants

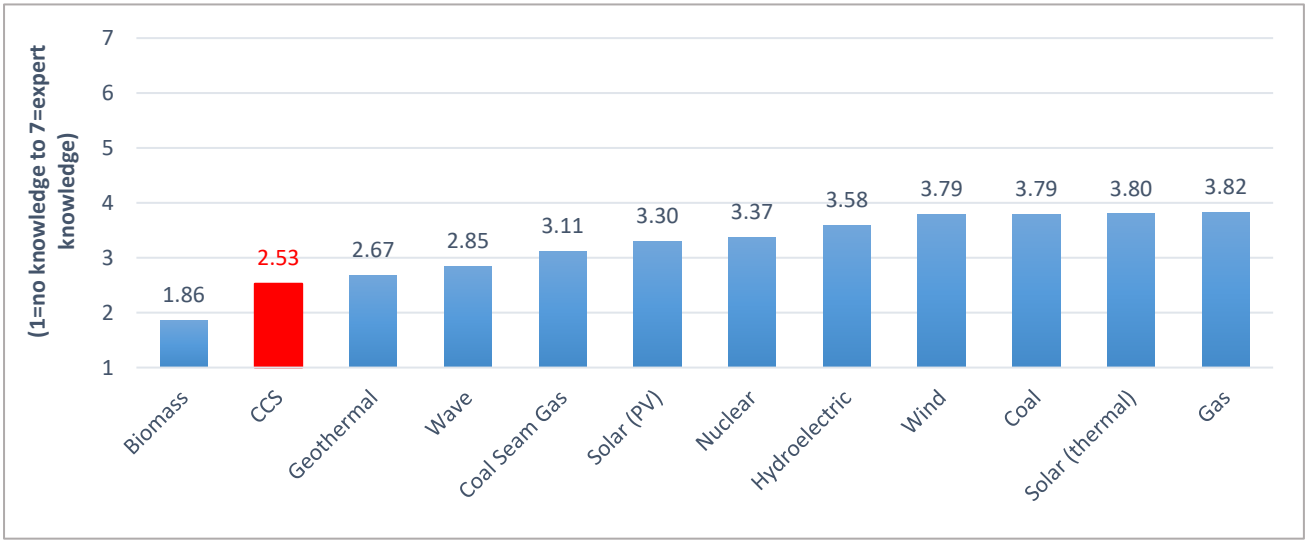
in the general public (38.5%) answered one or fewer knowledge question correctly compared to 24-32% in the COIs (Figure 6). Less than a quarter of respondents across all groups responded to three out of four questions correctly. Less than 5% of individuals in each group answered all questions correctly. These results align with the low levels of objective knowledge among the public, previously reported by Jeanneret et al. (2014).

Figure 6 Objective knowledge about energy – correct answers per region



For perceptions of knowledge about different energy technologies, Figure 7 below shows that on average, people self-reported having limited knowledge (that is, a mean below 4 on a 7-point Likert scale) about energy sources and technologies. Biomass was the form of energy most unknown to individuals, followed by CCS, geothermal and wave. The top four energy technologies that individuals reported knowing most about (although in every case still a very limited amount) were gas, solar (thermal), coal and wind.

Figure 7 Perceived knowledge of each energy technology – general public sample (n=2383)



However, when viewed on a state-by state basis, there were some variations between state average levels of perceived knowledge (Table 6). These variations included:

- Respondents from New South Wales (NSW) reported higher levels of knowledge about coal and coal seam gas (CSG) than other states. They also reported higher levels of knowledge about CCS, although these levels were still generally low.
- Respondents from Western Australia (WA) reported knowing less about coal seam gas (CSG) and CCS than the remaining states.
- Queenslanders (QLD) reported higher levels of knowledge about solar (thermal and photovoltaic) than other states, although these differences were not significant.

There were no significant differences for other energy technologies. Across all states, biomass was the form of energy that respondents reported knowing least about.

Table 6 Perceived knowledge by State and Territory

	NSW (n=780)	**VIC** (n=600)	**QLD** (n=463)	**SA** (n=177)	**WA** (n=257)
Biomass	1.98	1.84	1.80	1.84	1.71
Coal**	3.88	3.84	3.85	3.47	3.55
Coal Seam Gas**	3.33	3.05	3.23	2.84	2.71
Gas	3.83	3.94	3.74	3.69	3.77
CCS	2.64	2.54	2.42	2.51	2.42
Geothermal	2.76	2.66	2.60	2.60	2.67
Hydroelectric	3.67	3.62	3.55	3.39	3.37
Nuclear*	3.47	3.42	3.28	3.28	3.22
Solar (thermal)	3.84	3.84	3.85	3.66	3.61
Solar (PV)	3.27	3.33	3.38	3.23	3.32
Wave	2.91	2.87	2.69	2.78	3.03
Wind	3.77	3.87	3.78	3.73	3.78
Total	3.3	3.24	3.18	3.09	3.1

Mean scores where 1= no knowledge, 4= moderate knowledge and 7= expert knowledge. (p<0.1; **p<0.05)*

Comparing the views of the general public to the COIs (

Table 7), the results demonstrate that individuals from the COIs perceived themselves to be more knowledgeable about coal (general public average score of 3.79 versus above 4 for COIs with $p<0.05$). The QLD COI reported higher levels of perceived knowledge for CSG compared to all other groups (3.84 vs ratings around 3 with $p<0.05$) and the VIC COI reported knowing significantly less about geothermal (2.39) than the other groups. In contrast, the SA COI reported significantly higher levels of perceived knowledge for renewable energies including solar (thermal and photovoltaic), wave and wind. There were no differences between the four groups for biomass, gas, CCS, hydroelectricity and nuclear. Contrary to our initial hypothesis, the QLD COI reported knowing marginally less about CCS than the general public and the other COIs, but the difference was not large enough to be statistically significant.

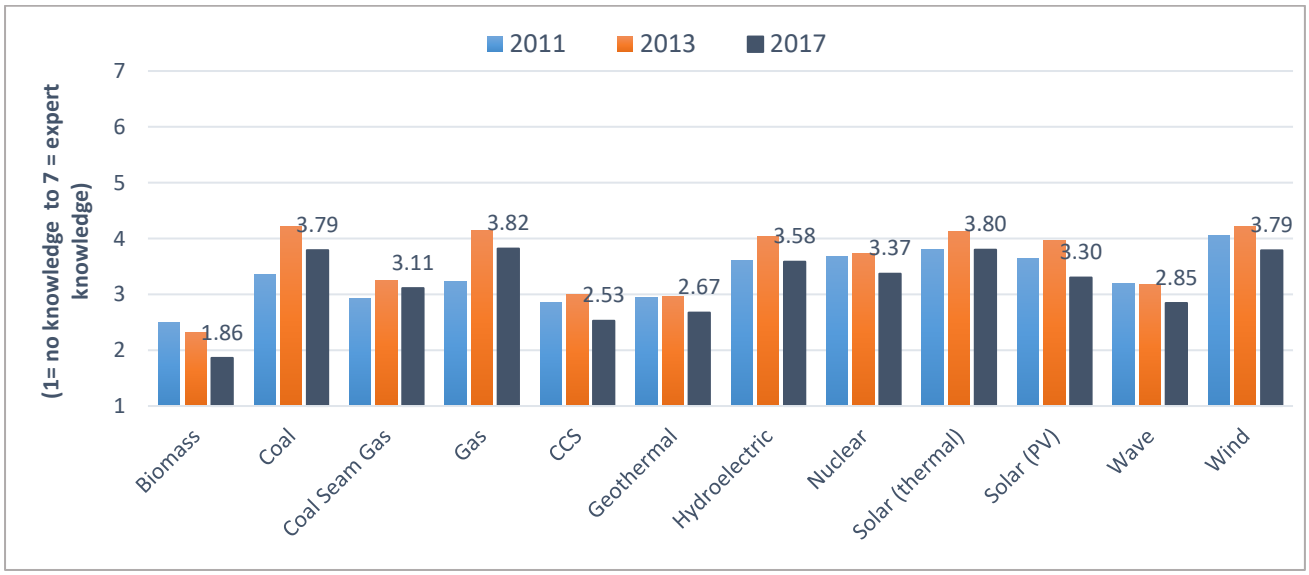
Table 7 Perceived knowledge of the general public sample compared to COIs

	General Public (n=2383)	Communities of Interest		
		QLD (n=186)	**VIC** (n=188)	**SA** (n=176)
Biomass	1.86	1.91	1.75	2.03
Coal**	3.79	4.24	4.38	4.01
Coal Seam Gas**	3.11	3.84	2.91	3.24
Gas	3.82	3.87	3.98	4.01
CCS	2.53	2.48	2.60	2.65
Geothermal**	2.67	2.57	2.39	2.90
Hydroelectric	3.58	3.55	3.40	3.80
Nuclear	3.37	3.14	3.10	3.40
Solar (thermal)**	3.80	3.74	3.64	4.18
Solar (PV)**	3.30	3.62	3.12	3.89
Wave**	2.85	2.66	2.45	3.12
Wind**	3.79	3.75	3.72	4.29
Total	3.21	3.28	3.12	3.46

Mean scores where 1= no knowledge, 4= moderate knowledge and 7= expert knowledge. (p<0.1; **p<0.05)*

Comparing the general public's self-rated knowledge with data from Australian nationally representative samples in 2011 and 2013 (Jeanneret et al. 2014), the data suggests that, on average, there was a decrease in self-rated knowledge about all energy sources and technologies, in many instances below the levels reported in 2011. Although we cannot evaluate the statistical difference between the current and previous results, this suggests a decline in self-rated knowledge about most energy technologies. Self-rated knowledge about renewable energy technologies decreased to levels below those reported in 2011, with the exception of solar (thermal). A similar pattern occurred for nuclear, CCS and biomass. A less pronounced decline occurred for knowledge about coal, CSG and gas (Figure 8).

Figure 8 Perceived knowledge of energy technologies across 2011, 2013 and 2017 samples



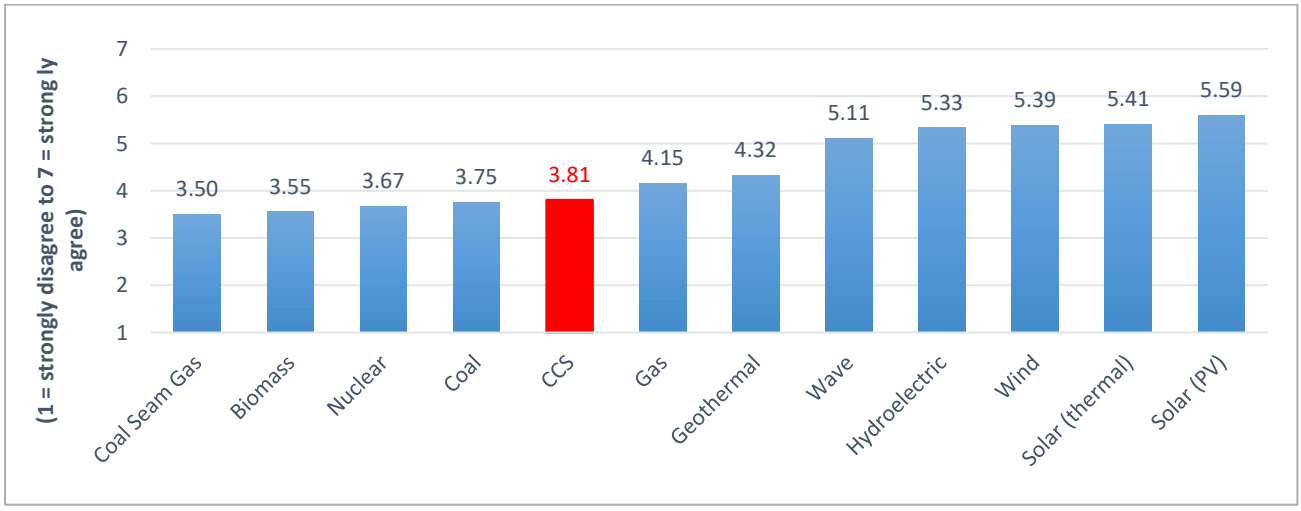
Note: 2017 sample n = 2383; 2013 sample n=2986; 2011 sample n=1907.

4.1.2 Support and Funding Priorities

Participants were asked to rate how strongly they agreed or disagreed with support for the different energy technology options. In terms of the support expressed (Figure 9), CSG was the least supported technology followed by biomass, nuclear, coal and CCS. These energy technologies all have mean values below four on the Likert scale (1=strongly disagree to 7=strongly agree), which means individuals tended to be less supportive of using such technologies to meet Australia's energy needs. Gas and geothermal are two forms of energy with more neutral evaluation by the public. Consistent with previous surveys, the energy technologies that had higher support ratings were wave, hydroelectricity and wind. Solar power (both thermal and photovoltaic) was the most supported with the highest scores, although this was still only showed moderately high support (Jeanneret et al. 2014).

Frequency distributions revealed further variations between levels of support for the energy technologies (see Appendix 2 – Levels of support for energy technologies). Nuclear (21%) and CSG (18%) were the technologies with the highest proportions of 'strongly disagree' responses. The histogram reflects a group displaying staunch opposition to these technologies which is consistent with the controversial nature of them. Although biomass has a similar mean score to both nuclear and CSG (Figure 9), this is due to the large proportion of respondents (33%) who 'neither agreed nor disagreed', rather than were strongly opposed to the technology. This was also the case for CCS (33%) and geothermal (29%) where a large percentage sat on the fence in relation to these technologies. Similarly, gas (29%), CSG (26%) and coal (23%), had a relatively high proportion of those in the population who 'neither agreed nor disagreed' which suggests there remains some tolerance for these technologies across Australia.

Figure 9 Support for each energy technology – general public sample (n=2383)



Support for the various technologies differed between the States and Territories (

Table 8). Only gas and geothermal had no significant differences. The significant differences identified included:

- NSW and QLD reported significantly higher support for coal and CSG than the average support expressed in WA.
- NSW reported significantly higher support for CCS than WA.
- Nuclear energy received higher support in NSW compared to QLD and WA.
- SA and WA reported higher support for solar (thermal) than all other states;
- WA had the highest support for wind, wave and solar (photovoltaic) compared to all other states.

Table 8 Support for energy technologies across States

	NSW (n=780)	**VIC** (n=600)	**QLD** (n=463)	**SA** (n=177)	**WA** (n=257)
Biomass**	3.61	3.48	3.62	3.71	3.27
Coal**	3.97	3.66	3.87	3.67	3.22
Coal Seam Gas**	3.59	3.46	3.60	3.58	3.14
Gas	4.23	4.08	4.13	4.27	4.04
CCS*	3.92	3.77	3.79	3.88	3.59
Geothermal	4.37	4.32	4.29	4.35	4.27
Hydroelectric	5.34	5.28	5.44	5.20	5.23
Nuclear**	3.88	3.61	3.50	3.78	3.38
Solar (thermal)	5.34	5.42	5.43	5.47	5.51
Solar (PV)**	5.46	5.66	5.66	5.50	5.80
Wave**	5.01	5.11	5.16	5.06	5.43
Wind**	5.22	5.49	5.41	5.28	5.63

Mean scores where 1= strongly disagree, 4= neither agree nor disagree and 7= strongly agree (p<0.1; **p<0.05)*

There were substantial differences between the general public and the COIs around support for different technologies, particularly those in SA and VIC (Table 9). The VIC COI was more supportive of coal, gas and CCS with mean ratings of above 4, while the SA COI supported coal and CCS significantly less than the other groups. However, the SA COI reported the highest support, significantly higher than all other groups, for geothermal energy and for the renewable energies solar (both thermal and photovoltaic) and wind; and also had a significantly higher proportion of individuals who strongly disagreed with support for coal (27%) and CSG (30%). These results highlight the regional differences between the COIs and the sources of energy technologies they most rely on. Contrary to our initial hypothesis, support for CSG was higher in the QLD COI than the general public and the other COIs, which suggests a growing acceptance of this technology.

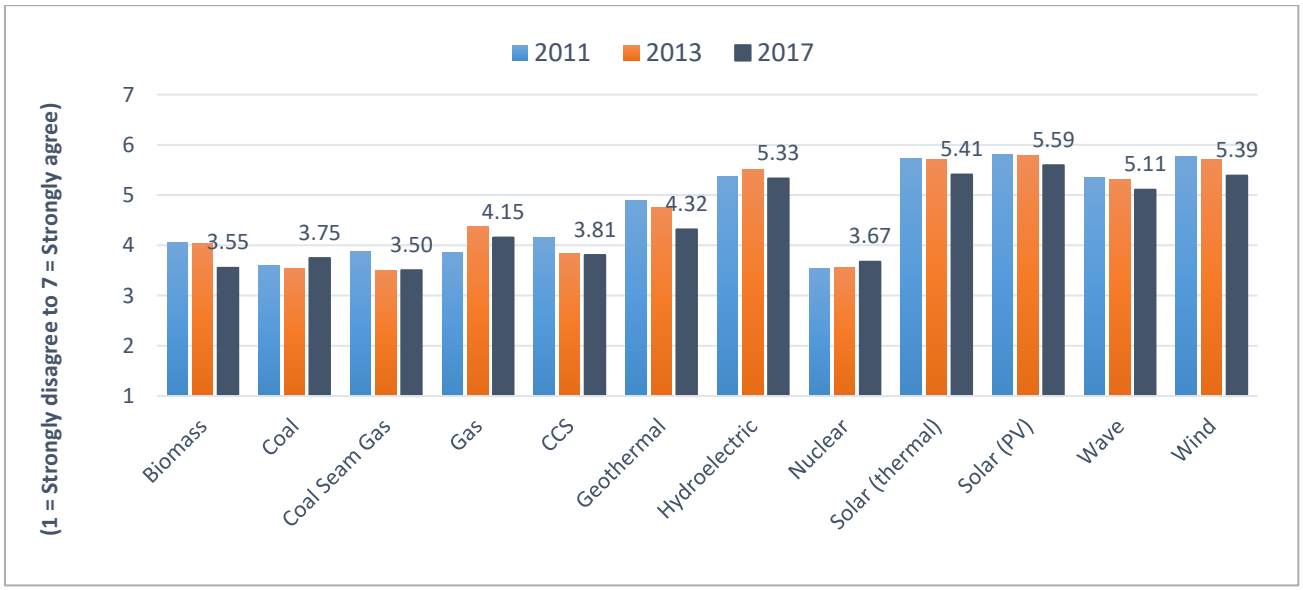
Table 9 Support for energy technologies comparing general public and COIs

	General Public (n=2383)	**Communities of Interest**		
		QLD (n=186)	**VIC** (n=188)	**SA** (n=176)
Biomass**	3.55	3.63	3.71	3.20
Coal**	3.75	4.01	4.49	3.27
Coal Seam Gas**	3.50	3.77	3.58	2.96
Gas**	4.15	4.05	4.51	4.14
CCS*	3.81	3.81	4.02	3.61
Geothermal**	4.32	4.14	4.13	4.60
Hydroelectric	5.33	5.42	5.15	5.42
Nuclear*	3.67	3.45	3.35	3.86
Solar (thermal)**	5.41	5.45	5.30	5.78
Solar (PV)**	5.59	5.75	5.47	5.93
Wave	5.11	5.11	4.86	5.22
Wind*	5.39	5.39	5.26	5.66

Mean scores where 1= strongly disagree, 4= neither agree nor disagree and 7= strongly agree (p<0.1; **p<0.05)*

A comparison of the 2017 data with 2011 and 2013 data (Jeanneret et al. 2014) suggests a trend of lower support for most energy technologies, in particular renewable energy sources (Figure 10). Notably, support for coal and nuclear energy were the only technologies that saw a slight increase in support from previous years; although in both cases the mean was below neutral (4 on a 7 point scale).

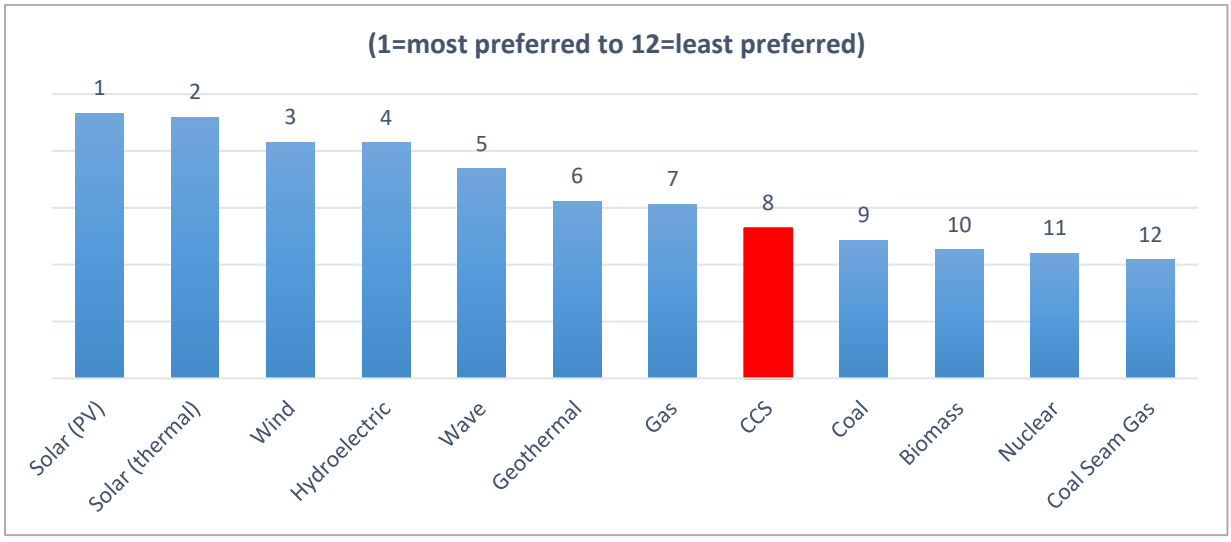
Figure 10 Support for energy technologies across 2011, 2013 and 2017 samples



Note: 2017 sample n = 2383; 2013 sample n=2503; 2011 sample n=1907

Providing support ratings on a 7-point Likert scale for different energy technologies allows individuals to give the same or similar ratings to several options, i.e. support different options equally. To better identify individuals' preferences, participants were also asked to rank the 12 energy technologies in terms of priority for allocating public funds, where (1) is most preferred to (12) least preferred, i.e. a smaller score is more positive. This ranking exercise requires a forced choice between these alternatives. Figure 11 below shows consistency between the average rankings and the ratings in terms of support (Figure 9 above), which suggest a stable set of preferences from participants.

Figure 11 Ranking for public funding priorities – general public sample (n=2383)



Rankings for different energy technologies per state (focusing only on data from the general public sample) is presented below in Figure 12. As for the overall sample, rankings appear to mirror the ratings from the 7-point scale preferences shown above in Figure 11. Solar (thermal and/or photovoltaic) were predominantly the top choice for public funding priority, followed by wind, hydroelectricity and wave. Across all States, these technologies were the five top funding priorities. CCS was ranked in 8th position. The bottom priorities for public funding were also consistent: biomass, coal, coal seam gas and nuclear. Nuclear power was ranked slightly higher in NSW and WA (10th place) and lowest in QLD and SA. It is of note that nuclear was ranked as least preferred in the SA general public sample despite higher levels of support for nuclear reported in the SA COI, as shown in Table 9.

Figure 12 General public priority ranking of energy technologies

Further comparisons explored differences between the general public and the COIs in ranked preferences for funding energy technology priorities (Table 10). Across the general population and the COIs, CSG was one of the least preferred priorities, although it ranked significantly higher in the QLD COI (10 out of 12). The VIC COI significantly ranked gas (5 out of 12) and coal (7 out of 12) higher than the remaining groups. The SA COI reported a significantly higher ranking for nuclear energy (8 out of 12) compared to all remaining groups, which tend to place nuclear at the bottom of funding priorities.

Table 10 Ranking for public priorities comparing general public and COIs

	General Public	Communities of Interest		
		QLD	VIC	SA
Solar (PV)	1	1	2**	2
Solar (thermal)	2	2	1**	1
Wind	3	3	3	3
Hydroelectric	4	4	4	4
Wave	5	5*	6**	5
Geothermal	6	7	8	6**
Gas	7	6	5**	7*
CCS	8	9*	9**	9**
Coal	9	8**	7**	11**
Biomass	10	11*	10	10*
Nuclear	11	12	12	8**
Coal Seam Gas	12	10**	11	12**

*Mean scores ranked where 1 = most preferred to 12= least preferred (*0.1; **p<0.05)*

In an attempt to uncover the motives that influenced individual preferences, participants were asked to rate a list of factors in terms of how much they considered these factors when making their choices. Four factors demonstrated significant differences between the States (Table 11). Environmental protection and climate change were significant factors in WA compared to other States. Electricity price and location were highly significant factors in QLD compared to the other states, and QLD had the highest mean score for reliability. Electricity price and reliability the highest of the factors within SA, which has recently experienced both rising electricity costs and supply reliability issues.

Table 11 Factors underlying energy preferences per State

	NSW (n=780)	**VIC** (n=600)	**QLD** (n=463)	**SA** (n=177)	**WA** (n=257)
Environmental Protection**	5.51	5.57	5.60	5.22	5.75
Climate Change*	5.19	5.33	5.27	5.08	5.55
Economy	4.98	5.01	5.19	5.01	5.11
Cost	5.10	5.05	5.29	5.06	5.14
Electricity Price**	5.44	5.38	5.71	5.51	5.40
Reliability	5.58	5.53	5.72	5.59	5.65
Location**	4.84	4.84	5.13	4.84	5.05

*Mean scores, where 1=not at all, 4=to some extent, 7=very much (* p<0.1; **p<0.05)*

The reasons behind energy preferences followed a different pattern in the COIs (Table 12). The SA COI reported considering electricity price, reliability, and environmental protection as factors when making choices. The VIC COI considered climate change the least, with more emphasis on economic factors when making energy preferences, which is consistent with concerns around job losses and economic downturn in the face of the closing of the Hazelwood coal-fired power station. The most influential factors in the QLD COI were the economy and environmental protection, which is consistent with concerns about both ensuring employment in the area, and the environmental costs of mining and CSG.

Table 12 Factors underlying energy preferences between the general public and COIs

	General Public (n=2383)	**Communities of Interest**		
		QLD (n=186)	**VIC** (n=188)	**SA** (n=176)
Environmental Protection**	5.55	5.91	5.58	5.84
Climate Change	5.28	5.34	5.07	5.43
Economy **	5.05	5.33	5.59	5.14
Cost	5.12	5.11	5.00	5.13
Electricity Price**	5.48	5.66	5.59	5.87
Reliability*	5.61	5.75	5.75	6.08
Location	4.92	4.99	4.83	5.09

*Mean scores, where 1=not at all, 4=to some extent, 7=very much (* p<0.1; **p<0.05)*

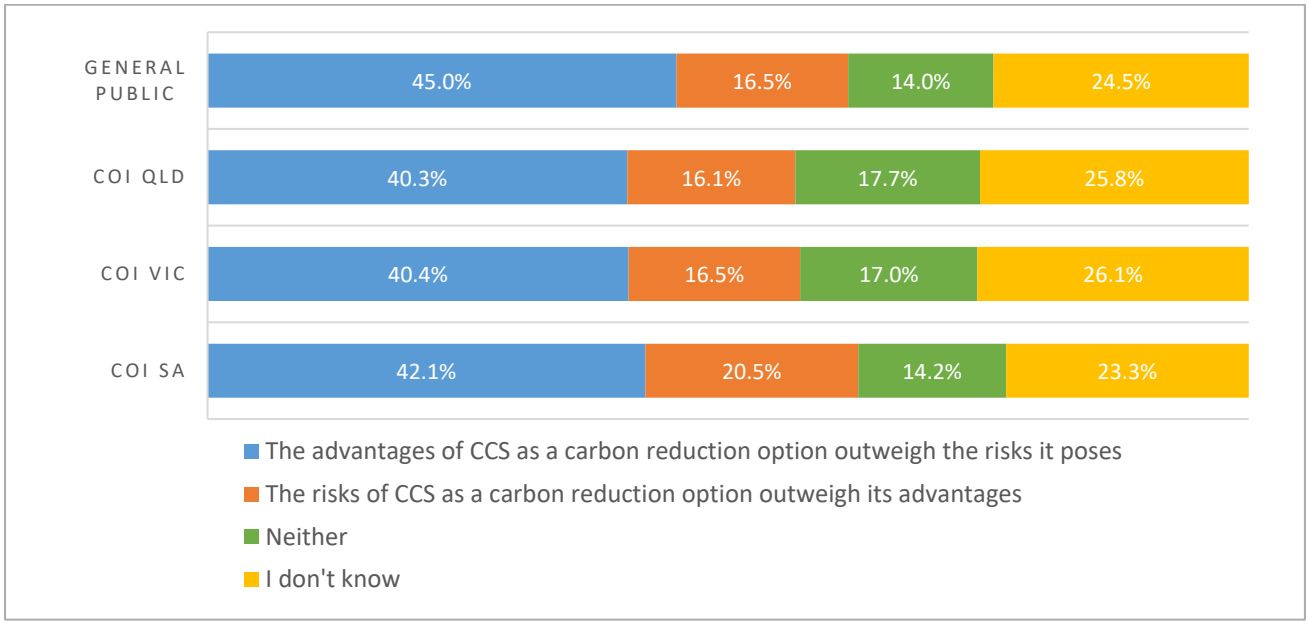
4.2 Perceptions of CCS versus renewable energy

4.2.1 Perceived Risks and Benefits

To provide more information about CCS, a short video was shown which discussed the roles of CCS, renewable energy and energy efficiency as options for mitigating carbon emissions. A set of questions about the potential risks and benefits of CCS and renewable technologies were then asked in order to understand how individuals perceived the two technologies following the video. These sets of questions were presented in a randomised order to prevent any order bias.

Figure 13 below demonstrates that results were consistent across the four groups. Less than half of individuals in all sample groups considered that the advantages of CCS as a carbon reduction option outweigh the risks it may pose. The SA COI had a slightly higher proportion of individuals (20.5%) considering the risks of CCS outweigh its advantages, but this difference wasn't statistically significant. The proportion of participants who saw neither net risks nor net benefits was around 15% of participants across all groups, which suggests a neutral rather than negative attitude towards CCS technology.

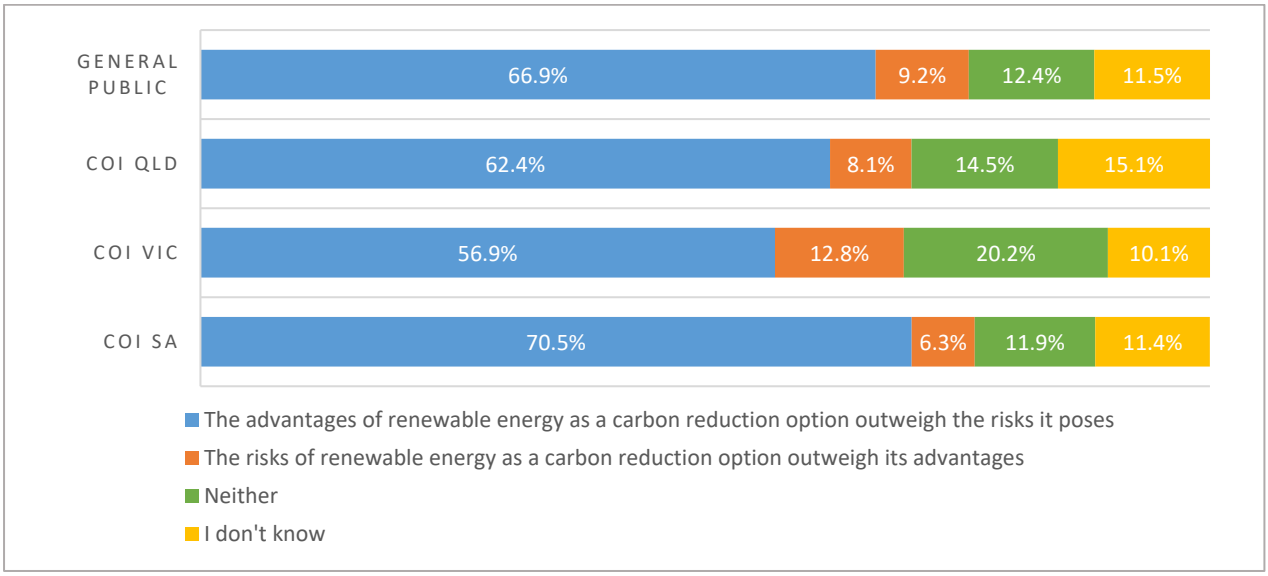
Figure 13 When you think about CCS, what first comes to mind?



Pearson chi2 (9) = 6.42, Pr = 0.697

Perceptions about renewable energy followed a different pattern (Figure 14). Consistent with the energy preferences and funding priorities for each of the technologies, all groups were largely favourable towards renewable energy. The majority of particpants in all groups considered that the advantages of renewable energy outweighed its possible risks, ranging from 70.5% in the SA COI, to 57% in the VIC COI. A smaller proportion of individuals in each group (6-13%) considered that the risks of renewables outweigh their advantanges, compared to the same response for CCS. The average proportion of participants who saw neither net risks nor net benefits was about the same for renewables as it was for CCS. However, the proportion of participants who did not know about the risks and benefits of renewable energy options was considerably lower than the proportion of those who did not know about CCS.

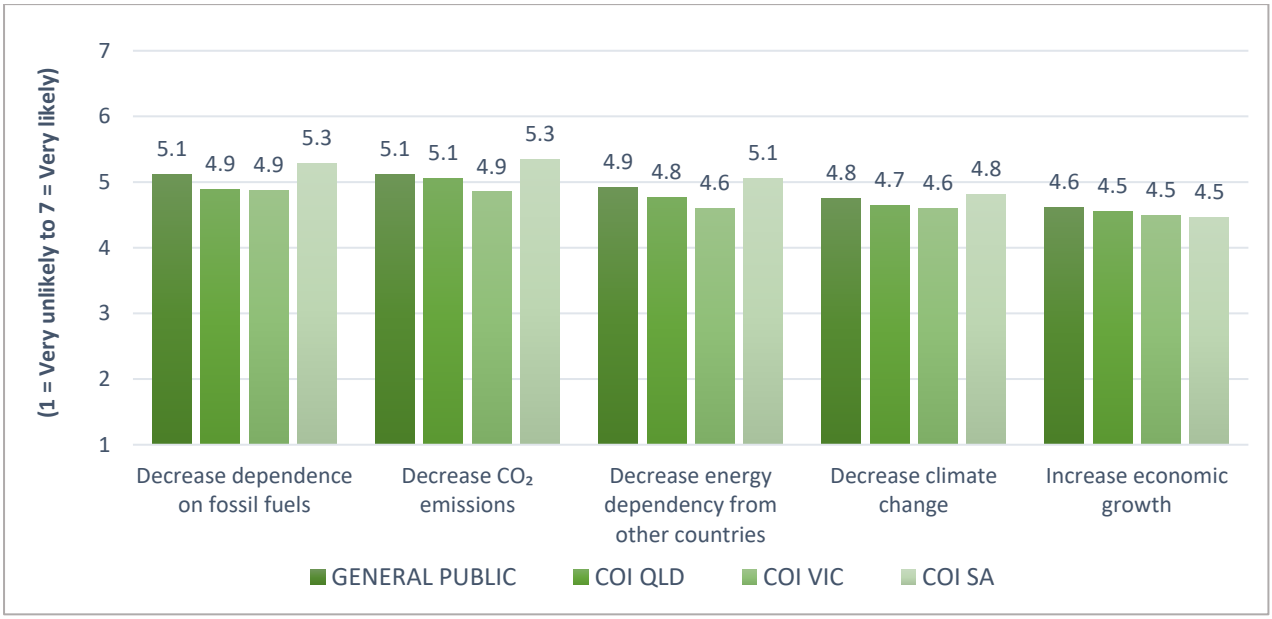
Figure 14 When you think about renewable energy, what first comes to mind?



Pearson chi2 (9) = 18.97, Pr = 0.025

Analysing the specific risks and benefits of both renewable energy and CCS in more detail, participants were asked about the likelihood of a variety of outcomes for each energy technology (the detailed list of outcomes are fully described in Appendix 1 – Survey questionnaire). Results show that individuals from all groups, including the COIs, perceive the more likely outcomes of renewable energy to be positive (Figure 15). These outcomes ranged from decreasing CO_2 emissions through to increased economic growth.

Figure 15 Top 5 perceptions about renewable energy



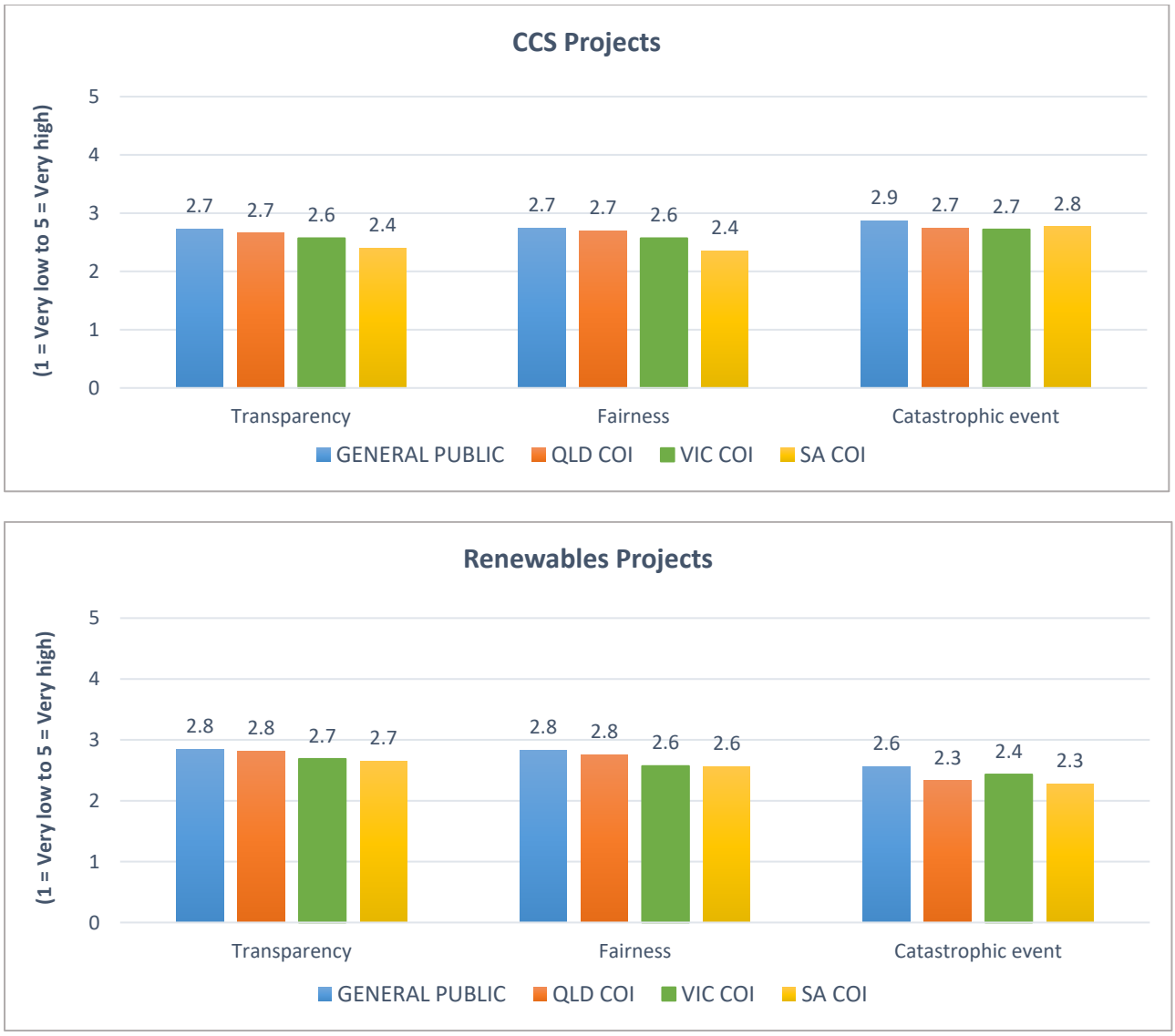
When examining responses to CCS, groups varied in their perceptions. These results are presented separately for each group below in Figure 16. The general public and the VIC COI appeared to rate the benefits more highly than risks, despite their preferences being different. Conversely, the QLD and SA COIs were more likely to focus on the risks of accidents in storing and transporting CO_2. The SA COI was also concerned about risks presented to future generations. All groups acknowledged that the benefit of CCS was reducing CO_2 emissions.

Figure 16 Top 5 perceived risks and/or benefits about CCS

4.2.2 Transparency, Fairness and Trust

Examining perceptions about transparency, fairness and trust surrounding CCS and renewable energy projects helps to identify the likely social licence to operate (SLO) (Moffat and Zhang 2014), and potential for community acceptance of such projects. Low trust or unclear procedural fairness in project implementation have been shown to be associated with lower community support for energy technology developments (Terwel et al. 2009; Bradbury et al. 2011). Figure 17 below shows an overall perception of low transparency and fairness across all sample groups (below the neutral point 3 in a 5-point Likert scale). However, it was generally considered that renewable energy projects are perceived to be slightly more transparent and fair than CCS projects. This perception was strongest in the South Australian COI. All groups similarly perceived the probability of a catastrophic event occurring from the development of both CCS and renewable energy projects to be low, although all groups also thought that this probability is somewhat higher for CCS projects.

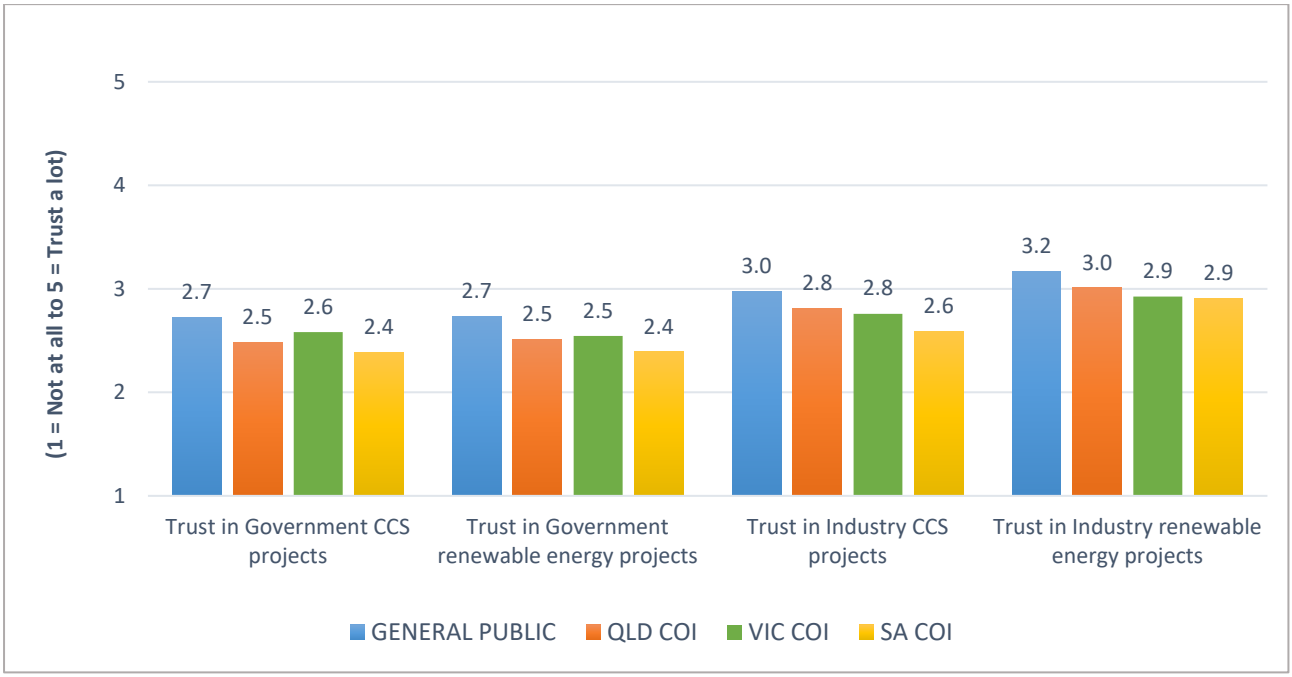
Figure 17 Considerations about CCS and renewable energy projects



Trust in government and industry to act in society's best interest in relation to new technology development was also observed as low (Figure 18 below). Individuals report low levels of trust in government intervention for both CCS and renewable energy projects. Trust levels for industry were slightly higher, especially industries related to renewable energy. The SA COI had the lowest levels of trust in both sectors and project

types which may relate to their recent experiences of blackouts and the ensuing discussion that emerged across the media.

Figure 18 Trust in government and industry in relation to CCS and renewable energy projects

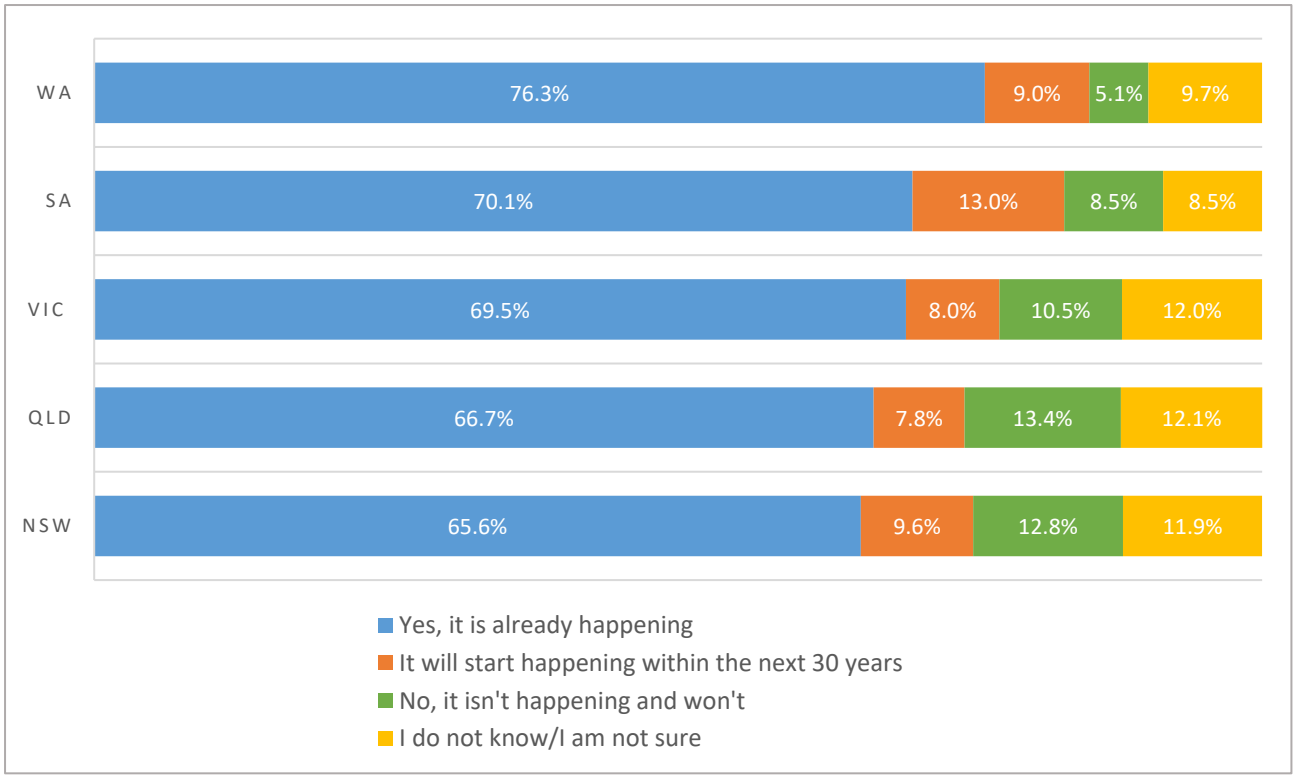


4.3 Climate Change and Environmental attitudes

4.3.1 Is global warming happening?

Perceptions about climate change have been associated with support for, or lack of support for, different energy technologies and can also be related to different levels of energy efficient behaviours (e.g., Pisarski and Ashworth, 2013). Here we report current perceptions about climate change and whether these perceptions have changed over time by comparison to 2011 and 2013 (Jeanneret et al. 2014). Across the general public, about two thirds (69%) of respondents agreed that global warming is happening now. Figure 19 below shows that this belief varied between a minimum of 66% in NSW and a maximum of 76% in WA. The remaining individuals who did not believe global warming is already happening were similarly distributed among other points of view: global warming will start happening within the next 30 years (from 8% in QLD to 13% in ACT); global warming is not happening and it won't (from 5% in WA to 13% in QLD and NSW); and individuals who were unsure about this topic (from 8% in SA to 12% in NSW, QLD and VIC).

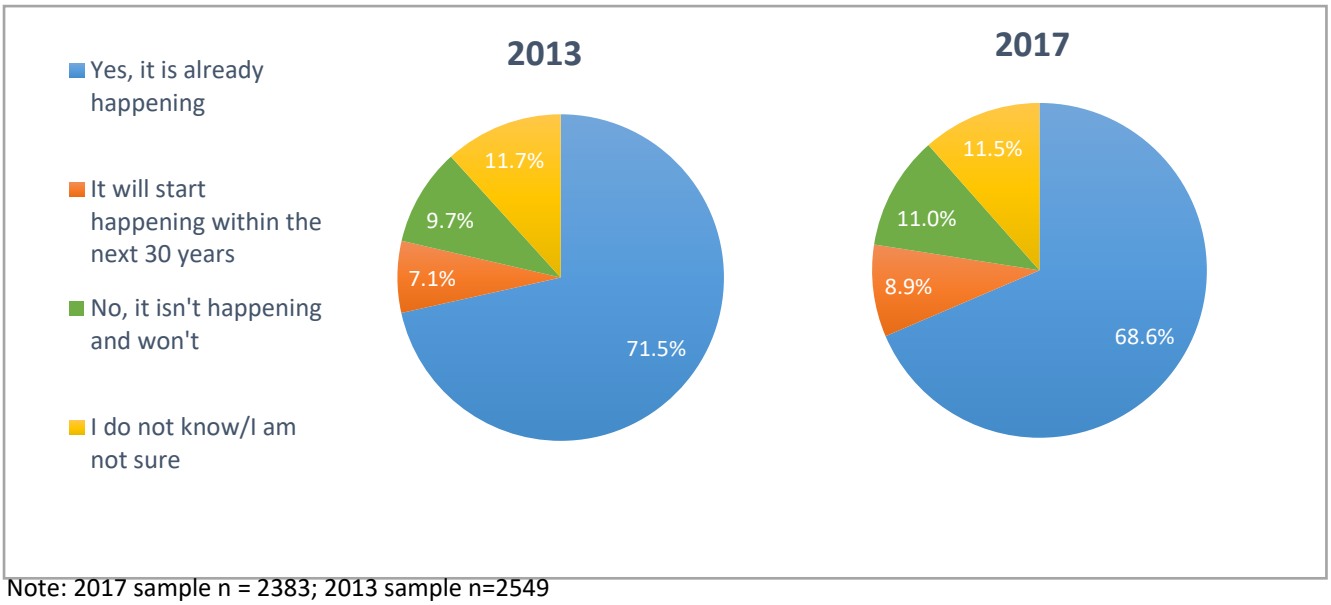
Figure 19 Belief global warming is happening now or will happen in the next 30 years, by State (% participants)



Pearson chi2 (21) = 30.55, Pr = 0.081

A comparison of the combined sample of the general public's perceptions about this issue between 2013 (Jeanneret et al. 2014) and 2017 presents a very similar distribution (Figure 20). There was a slight decrease in the proportion of people who consider that global warming is already happening (from 71.5% in 2013 to 68.6% in 2017), and a slight increase in the number of people who say global warming isn't happening and won't (from 9.7% in 2013 to 11% in 2017), but overall perceptions tend to be analogous between these two periods.

Figure 20 Comparing attitudes to global warming: 2013 vs 2017



Note: 2017 sample n = 2383; 2013 sample n=2549

When comparing the general public responses with the COIs, some differences emerged (Table 13). The SA COI had the largest proportion of individuals acknowledging global warming as a real issue (72%), while in the VIC COI just over half the individuals (58.5%) thought global warming is already happening. The VIC COI had the largest proportions of individuals who were unsure about climate change (18.5%) or who did not think global warming is or will ever happen (15%).

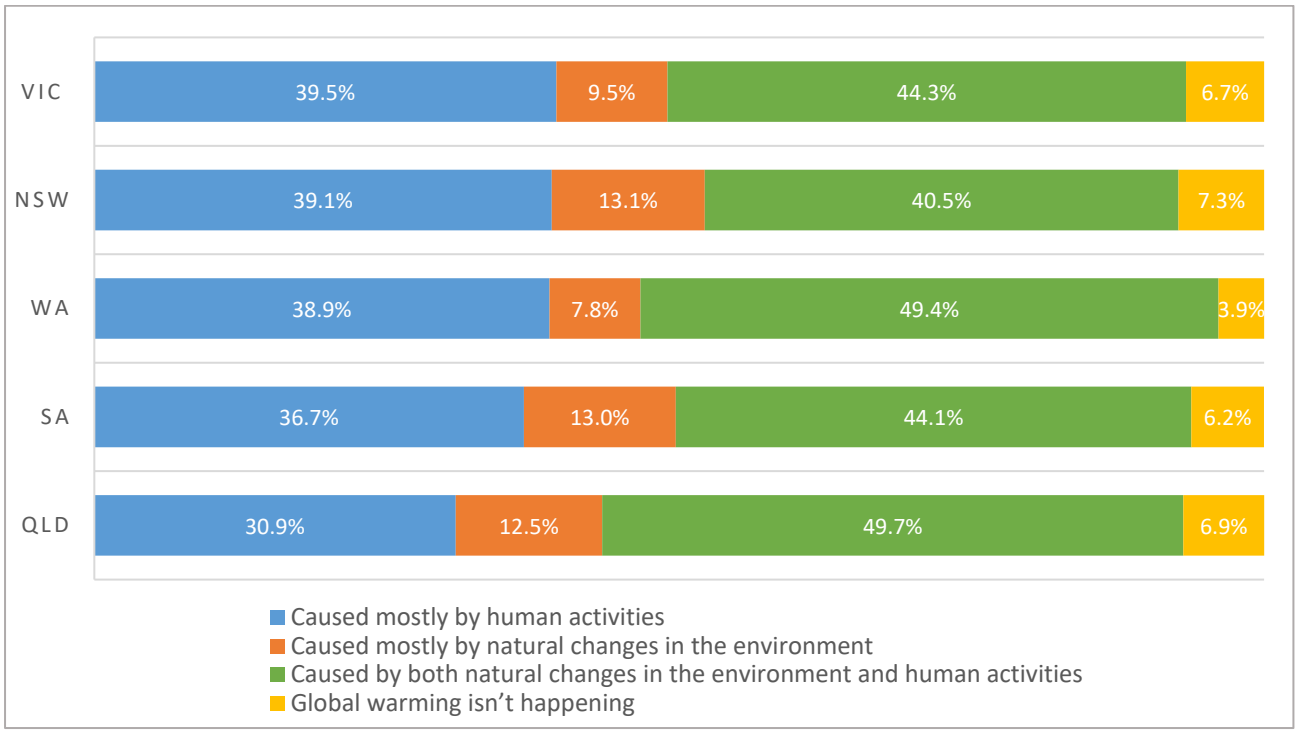
Table 13 Belief global warming is happening now or will happen in the next 30 years, general public and COIs

	General Public	COI		
		QLD	VIC	SA
Yes, it is already happening	68.6%	68.3%	58.5%	71.6%
It will start happening within the next 30 years	8.9%	6.5%	8.5%	5.1%
No, it isn't happening and won't	11.0%	12.9%	14.9%	9.1%
I do not know/I am not sure	11.5%	12.4%	18.1%	14.2%

Pearson chi2 (9) = 16.99, Pr = 0.049

While two-thirds of the overall sample believed that global warming is already happening, there was less consensus on the perceived underlying causes of global warming (Figure 21). Across the general public, around one third (37%) of participants thought global warming is caused mostly by human activities, ranging from 31% in QLD to 40% in VIC. Across the States, the majority of individuals considered that global warming is caused by both natural environmental changes and human activities (between 41% and 50%).

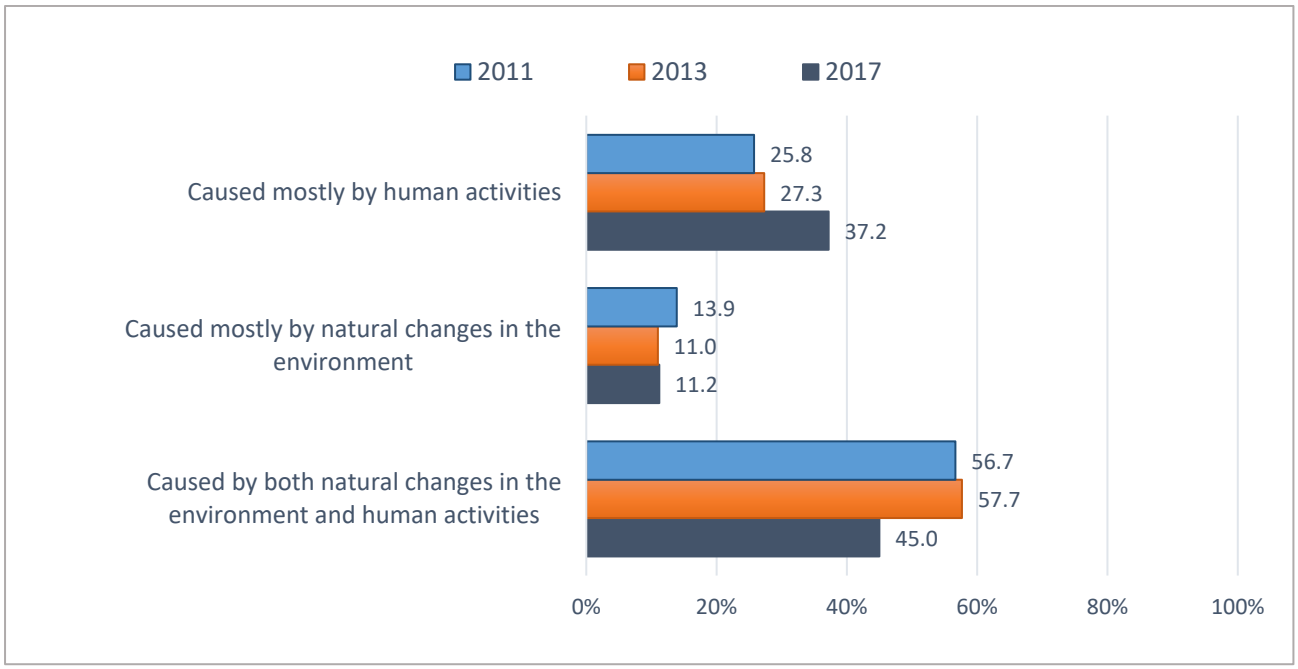
Figure 21 Causes of global warming by State (% participants, n=2383)



Pearson chi2 (21) = 33.10, Pr = 0.045

Figure 22 shows that although in 2017 just over one third (37%) of individuals thought global warming is mostly caused by human activities, this proportion has increased since 2013 (27%) and 2011 (26%). Correspondingly, the proportion of respondents who consider global warming is mostly caused by both natural changes in the environment and human activities decreased from 57% in 2013 to 45% in 2017.

Figure 22 Main causes of global warming across 2011, 2013 and 2017 samples



Note: 2017 sample n = 2383; 2013 sample n=2303; 2011 sample n=1712

Once again, differences between the general public and the COIs are more noteworthy (Table 14). Consistent with previous questions, the VIC COI had the highest proportion of individuals (11%) who responded that global warming is not happening compared to the other COIs and the general public. The QLD and VIC COIs had the lowest proportion, around a quarter of individuals, who responded that global warming is mostly caused by human activities. The main difference between these two COIs is that a larger proportion of individuals in the QLD COI (62%) responded that global warming is caused by both natural changes in the environment and human activities.

Table 14 Causes of global warming – general public and COIs

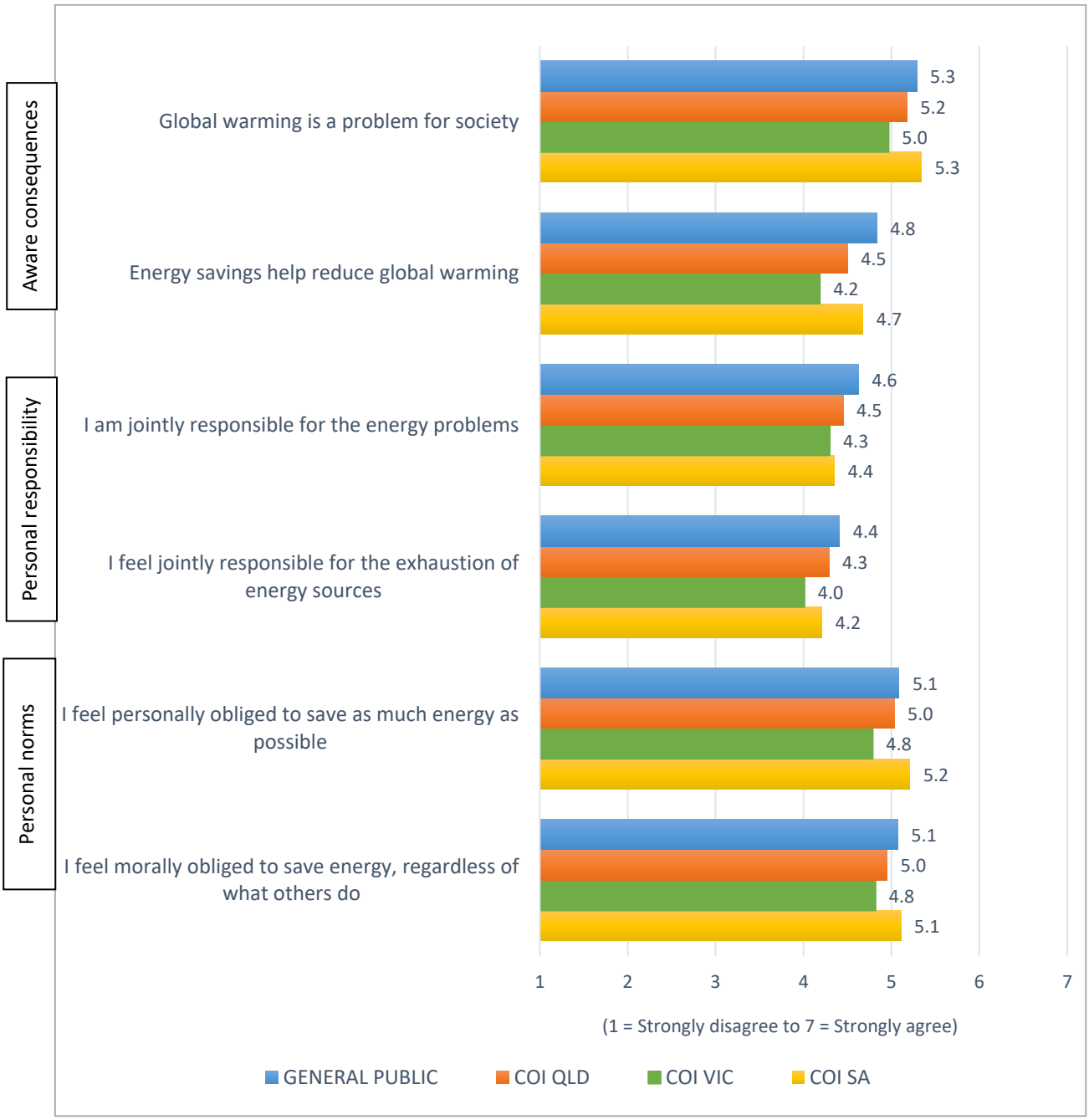
	General Public (n=2383)	**COI**		
		QLD (n=186)	**VIC** (n=188)	**SA** (n=176)
Caused mostly by human activities	37.2%	24.2%	28.2%	33.0%
Caused mostly by natural changes in the environment	11.2%	8.6%	8.0%	5.7%
Caused by both natural changes in the environment and human activities	45.0%	61.8%	52.7%	56.8%
Global warming isn't happening	6.6%	5.4%	11.2%	4.6%

Pearson chi2 (9) = 41.36, Pr = 0.000

We turn to the analysis of values, beliefs and norms (VBN) relating to global warming and energy savings based on the work of Steg et al. (2005). These authors propose that environmental concern, including support for different energy policies, has multiple dimensions including: a) personal norms – a feeling of moral obligation to act pro-environmentally; b) beliefs that environmental conditions threaten things the individual values (awareness of consequences); and c) beliefs that the individual can act to reduce this threat (ascription of responsibility). Respondents were asked to respond to each question on a scale of 1=strongly disagree to 7=strongly agree.

Over half of the general public (53%) and between 44-46% of participants across the COIs strongly agreed or agreed that global warming was a problem for society, with a mean response of 5.2 across the groups (Figure 23). The mean responses to feeling personally or morally obliged to undertake energy saving measures to address the problem were slightly lower (4.8 – 5.2). Responses were neutral to slight agreement that energy saving measures would help reduce global warming, with the VIC COI responses remaining neutral. The VIC COI was also neutral about feelings of shared responsibility for the exhaustion of energy supplies. The VIC COI comparatively recorded the lowest ratings for acknowledging consequences and accepting responsibility for action, which corresponds with the lower proportion of respondents who indicated that global warming is a problem for society. There was little difference between the COIs regarding feeling personal and moral obligation to save energy, or about shared responsibility for contributing to energy problems. Frequency distributions revealed further variations between the groups (see Appendix 3 – Values, beliefs and norms (VBN) frequency distributions).

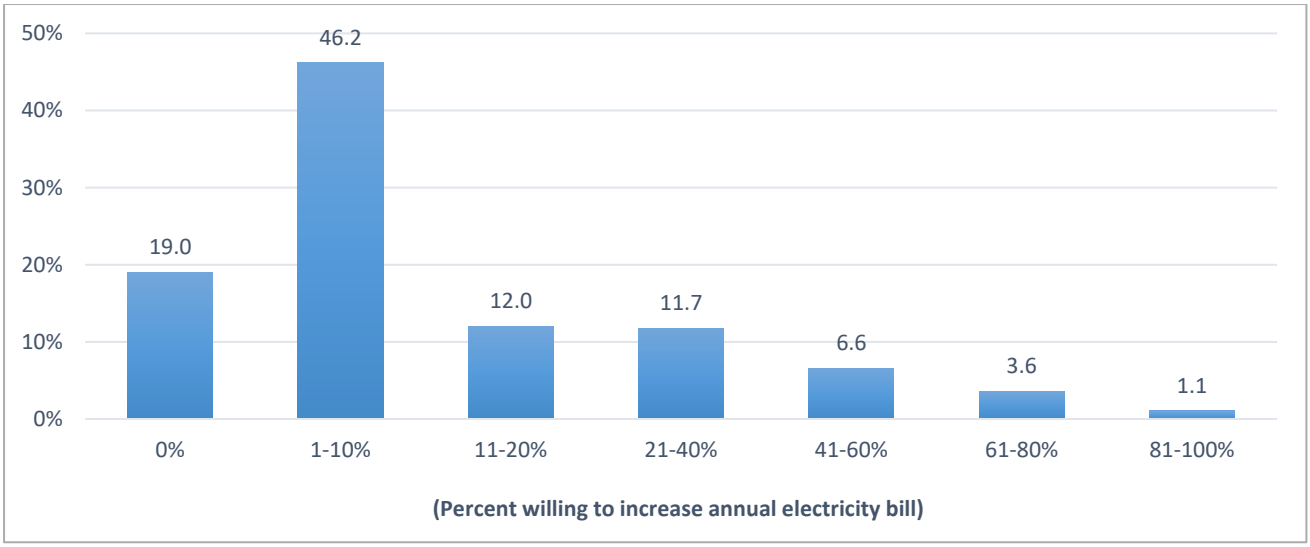
Figure 23 Values, beliefs, norms in relation to global warming



4.3.2 Willingness to pay for renewable energy

There is a recognition that if Australia is to transition to a low carbon energy supply, this will most likely require significant capital investment, which will in turn lead to increased electricity bills. We therefore investigated individuals' willingness to pay more for electricity bills to use only renewable energy sources (Figure 24). The results show that close to half of respondents (46%) in the general public would only be willing to pay an increase of between 1-10%, and around a quarter of the general public would be willing to pay an increase of between 11-40%. One fifth (19%) of respondents reported not being willing to pay any increase at all.

Figure 24 By how much would you be willing to increase your annual electricity bill to use only renewable energy sources? (%, n=2383)



Regarding the higher levels of willingness to pay in the general public, defined here as participants willing to pay above a 20% increase in their electricity bill, there were no differences according to gender but there were differences related to:

- *Age:* Young people aged 18-34 (37% of individuals were willing to pay above 20% more in their electricity bill, in comparison to 19% of individuals in ages 35-54 and 15% in ages above 55);
- *Location:* Living in urban areas (24% of individuals in metropolitan areas reported higher willingness to pay compared to 20% in rural areas);
- *Education:* More educated (about 28% of participants with Bachelor or higher degrees compared to 17-21% of participants with education up to and including Year 12);
- *Income:* Medium-high income levels (about 20% of participants in the lower income levels [up to $120,000] were willing to pay above 20% more, compared to an average of 24-34% of participants in the medium-high range [$120,000-$270,000]);
- *Perceptions of personal responsibility:* Regarding joint responsibility for energy problems and the exhaustion of energy sources (willing to pay above 20% more = 5.1 vs 4.3 in 7-point Likert scale);
- *Knowledge:* Participants willing to pay above 20% or more tended to have lower objective knowledge about energy topics but more perceived knowledge;
- *Political vote:* Participants willing to pay increases above 20% were more likely to have voted for the Australian Greens (35%) or The Coalition: National Party (31%) than for other major parties (between 13-25%).

Examining the data more closely, Table 15 displays the average amount participants from each State were willing to pay more for electricity bills to use only renewable energy. South Australia had the highest

proportion of participants (24%) unwilling to pay any increase; the state also has the highest before-tax residential electricity prices (ACCC 2017). Almost half of participants in VIC (49%) were willing to pay an increase of between 1-10%, while WA had the highest proportion of participants (40%) willing to pay more than 10% more to use only renewable energy.

Table 15 Willingness to increase electricity bill to use only renewable energy, by State

	NSW (n=780)	**VIC** (n=600)	**QLD** (n=463)	**SA** (n=177)	**WA** (n=257)
0%	19.9	18.0	20.5	24.3	14.0
1-10%	44.2	49.2	47.7	39.0	45.5
11-20%	12.8	10.5	9.9	13.6	16.7
21-40%	12.3	10.0	11.7	9.0	14.0
41-60%	6.0	7.0	5.2	9.6	6.6
61-80%	3.5	4.3	3.7	4.0	3.1
81-100%	1.3	1.0	1.3	0.6	0.0

Pearson chi2 (42) = 54.89, Pr = 0.088

Table 16 below examines differences between the general public and the COIs. This data suggests that the willingness to pay more for electricity to support a fully renewable energy supply was more limited in the COIs, with a higher proportion of participants who were unwilling to pay any increase (between 26-29%) compared to the general public. Only around 18% of participants across the COIs were willing to pay more than a 20% increase in electricity, compared to the general public (23%). As the COIs have already been somewhat affected by energy transitions, perhaps people in these regions consider that they are already bearing some of the costs, and are less willing to shoulder further increases in support a fully renewably energy supply.

Table 16 Willingness to increase electricity bill to use only renewable energy, general public and COIs

	General Public (n=2383)	**Communities of Interest**		
		QLD (n=186)	**VIC** (n=188)	**SA** (n=176)
0%	19.0	26.9	25.5	29.0
1-10%	46.2	36.6	45.7	36.4
11-20%	12.0	18.8	10.1	17.1
21-40%	11.7	10.8	12.8	13.6
41-60%	6.6	5.9	3.7	3.4
61-80%	3.6	0.5	1.1	0.0
81-100%	1.1	0.5	1.1	0.6

Pearson chi2 (18) = 52.09, Pr = 0.000

Australia has a government-accredited scheme, GreenPower, which allows individuals and businesses in Australia to pay for electricity produced by renewable energy sources through their electricity retailer (Clean Energy Regulator 2018). It is a joint initiative of QLD, NSW, ACT, SA, VIC and WA governments. For those individuals who are concerned about the environment they can actively choose to subscribe to 100% GreenPower. This will substantially increase their electricity bill but would mean it is coming from renewable energy sources.

Table 17 below displays the percentage of individuals in each of the States, as well as the COIs, who subscribe to GreenPower to meet their energy demands. Of the States, WA had the lowest subscription rate (10%) and SA the highest (14%). The rate of GreenPower subscription is lower in the QLD COI (10%)

compared with the wider state (13%), but it is higher in COIs in South Australia (20% vs 14%) and Victoria (15% vs 12%). Across the States, an average of 18% of participants did not know if they subscribed to GreenPower, compared to around one quarter of participants across the COIs. Note that some individuals if they have solar panels believe they do not need to purchase GreenPower as they feel they are already offsetting carbon from electricity generation.

Table 17 Do you subscribe to GreenPower? (State and COI)

	General public					Communities of Interest		
(%)	**NSW**	**VIC**	**QLD**	**SA**	**WA**	**COI QLD**	**COI VIC**	**COI SA**
Yes	12.1	12.3	13.0	14.1	10.1	9.7	15.4	19.9
No	71.4	71.7	67.4	71.8	66.2	61.8	63.3	51.1
Don't know	16.5	16.0	19.7	14.1	23.7	28.5	21.3	29.0
Total n	780	600	463	177	257	186	188	176

State: Pearson chi2 (14) = 21.56, Pr = 0.088; COIs: Pearson chi2 (6) = 40.16, Pr = 0.000

Examining the group of participants who reported subscribing to GreenPower, Table 18 shows that across the States and COIs, subscription levels varied substantially. A large proportion of participants across all groups did not know the percentage of GreenPower they subscribed to, ranging from just over a quarter of individuals in NSW and VIC to 50% in WA, and 55% in the VIC COI. Although 1-10% of GreenPower subscription is often provided to households for free as a way of attracting them to different retailers (Jeanneret et al. 2014), this level of subscription was the most common in QLD only, both at State and COI level. The majority of individuals subscribed to more than 20% GreenPower, ranging from 38% in WA to 58% in VIC across the States. In comparison to the State levels, the VIC COI had a far smaller proportion of individuals (31%) who subscribed to more than 20% GreenPower, and the proportion was also lower in the QLD COI (28%) compared to QLD state (40%). However, the SA COI (54%) had a higher proportion of individuals subscribing to more than 20% GreenPower than both the other COIs and SA state (48%).

Table 18 How much GreenPower do you subscribe to (%)?

	General public					Communities of Interest		
(%)	**NSW**	**VIC**	**QLD**	**SA**	**WA**	**COI QLD**	**COI VIC**	**COI SA**
1-10%	13.8	5.4	16.7	8.0	7.7	27.8	10.3	2.9
11-20%	7.5	8.1	5.0	4.0	3.9	5.6	3.5	5.7
21-40%	19.2	17.6	10.0	12.0	11.5	11.1	13.8	25.7
41-60%	7.5	12.2	8.3	20.0	11.5	0.0	10.3	17.1
61-80%	11.7	16.2	15.0	12.0	11.5	5.6	6.9	2.9
81-100%	11.7	12.2	6.7	4.0	3.9	11.1	0.0	8.6
% not known	28.7	28.4	38.3	40.0	50.0	38.9	55.2	37.1
Total n	94	74	60	25	26	18	29	35

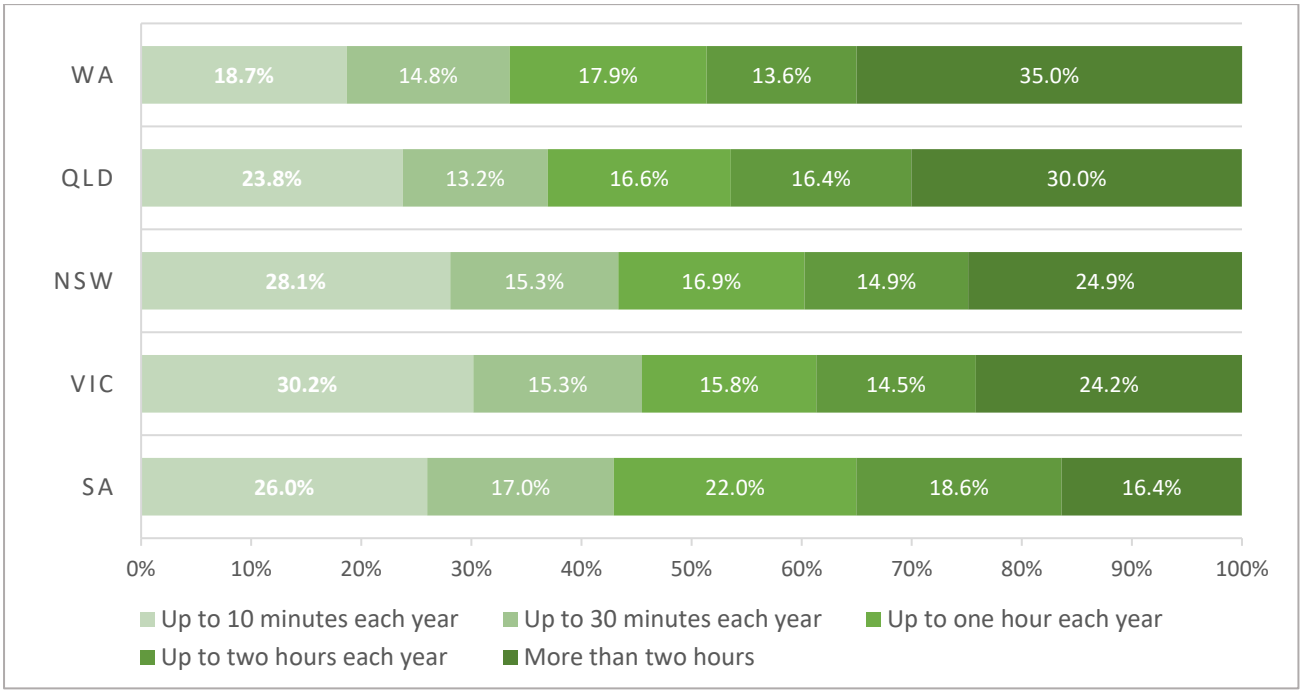
State: Pearson chi2 (42) = 30.95, Pr = 0.895; COIs: Pearson chi2 (18) = 23.56, Pr = 0.170

4.3.3 Energy reliability concerns

Australian reliability standards require that, on average, each person in Australia should not be without electricity for more than 10 minutes per year. When it comes to reliability concerns i.e., perceptions and preferences about energy security, we examined individuals' willingness to accept a change from the current Australian reliability standards, if this change would result in lower electricity bills.

Figure 25 below shows that preferences for reliability tended to be predominantly divided between individuals with no acceptance of reliability failures (maintaining the 10 minutes/year) and a substantial acceptance of lower standard (more than two hours/year). About one quarter of individuals preferred to keep the status quo regarding reliability standards (ranging from 19% in WA to 30% in VIC). More intermediate preferences for energy reliability (between 30 minutes to a maximum of two hours) came from an average of around 15% of respondents. On average, about one quarter of individuals (ranging from 35% in WA down to 16% in SA) would accept more than two hours per year without electricity to have a lower electricity bill. The significantly smaller proportion of participants in SA willing to accept a lower standard of reliability may again be related to recent experiences during the 2016-17 blackouts.

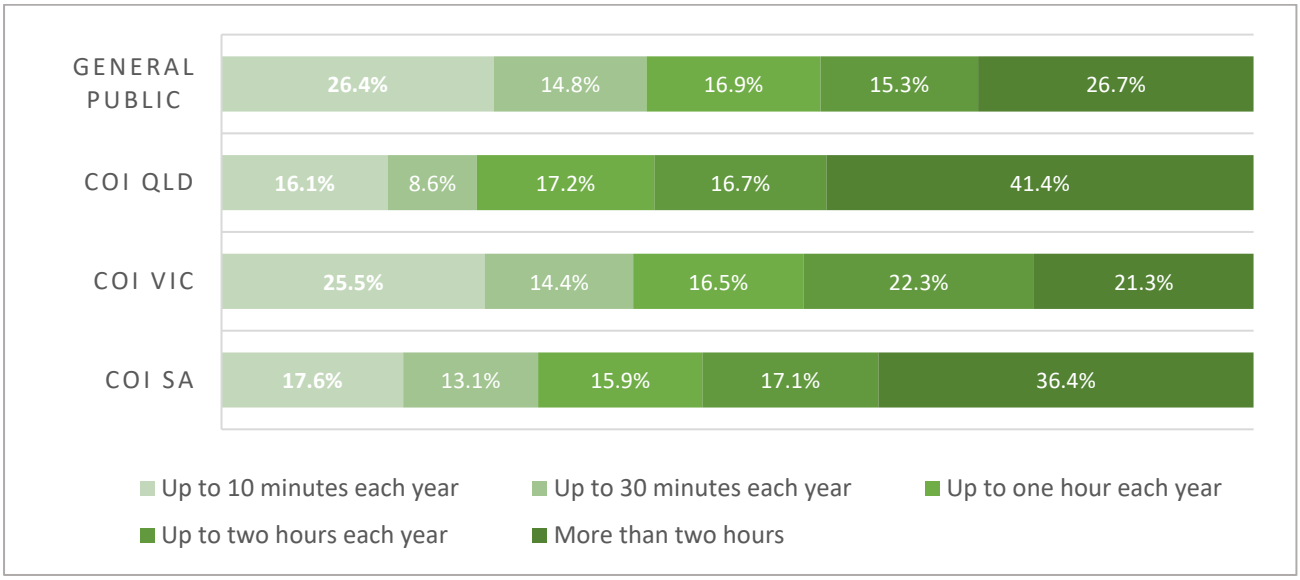
Figure 25 Preferences for energy reliability (per State)



Pearson chi2 (28) = 55.43, Pr = 0.002

A comparison between the average responses of the general public preferences for energy reliability with the COIs (Figure 26) shows that the VIC COI had similar preferences to the general public and to the broader results for Victoria. The QLD and SA COIs demonstrated a higher preference for more flexible reliability standards; more than half of the participants would accept up to two hours or more without electricity (58% and 53% respectively), notably higher than the broader results for those states (46% and 35% respectively).

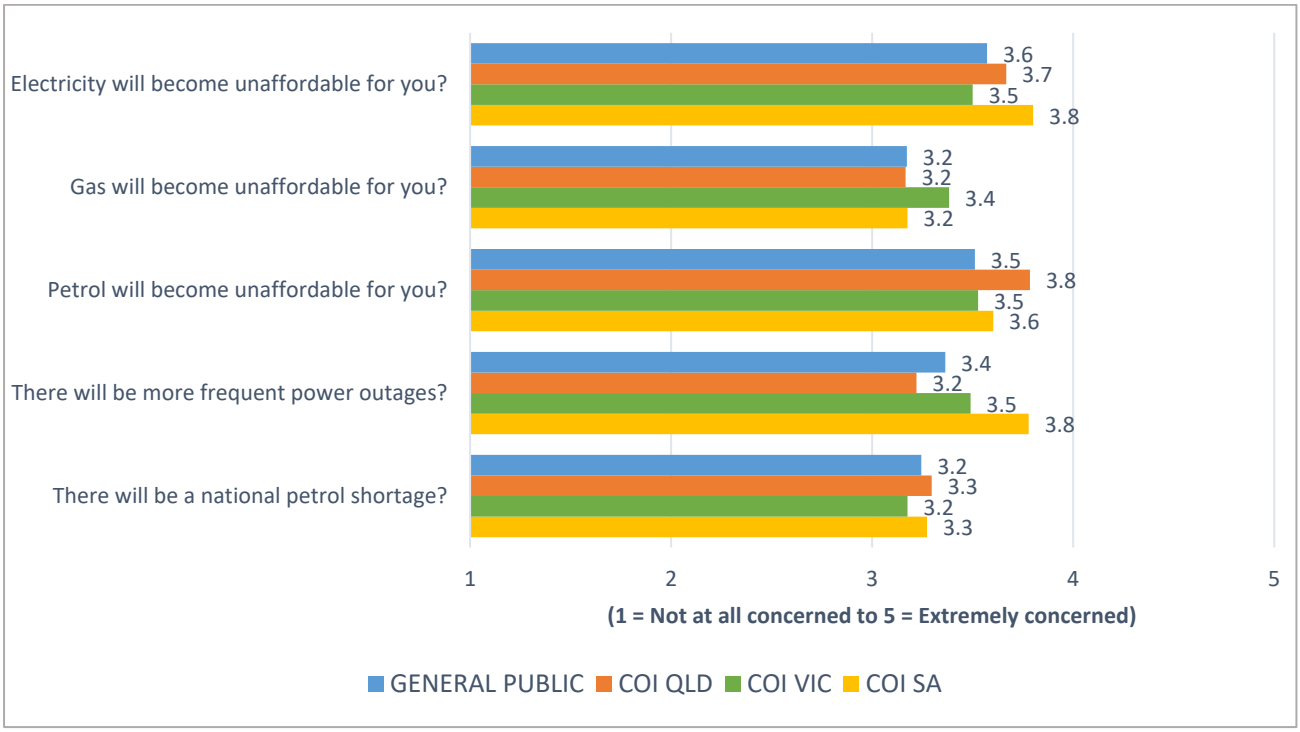
Figure 26 Preferences for reliability – general public vs COI



Pearson chi2 (12) = 42.98, Pr = 0.000

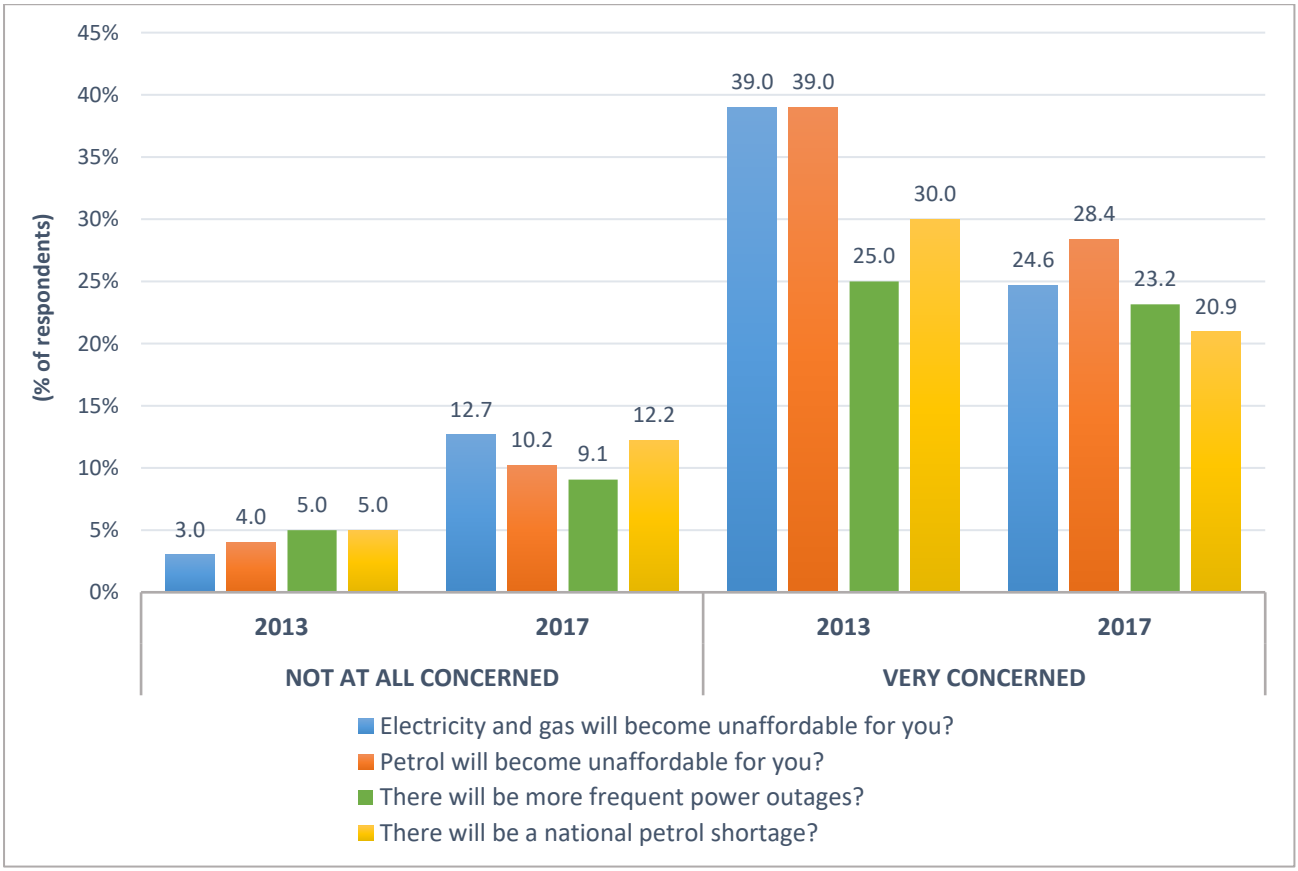
In terms of concerns regarding possible future unaffordability and shortages of energy and power, Figure 27 shows that, on average, individuals were somewhat concerned about these issues (i.e. mean scores greater than 3 on a 5-point Likert scale). The general public had similar levels of concern about these different issues, with no significant differences between distinct issues. The highest ratings of concern in both the QLD and VIC COIs were about electricity and petrol becoming unaffordable. In the SA COI, the most concerning issues were about electricity becoming unaffordable and the frequency of power outages. The VIC COI expressed a slightly higher level of concern that gas will become unaffordable.

Figure 27 How concerned are you that in the next 10-20 years…



These concerns were also examined in 2013 (Jeanneret et al. 2014). As shown in Figure 28, the results suggest that people are less concerned on average about all issues related to energy affordability and supply. The largest reduction is in the concern for electricity and petrol becoming unaffordable. This rating reduced from 39% of people reporting being very concerned in 2013 to 25-28% in 2017. Concerns about a national petrol shortage were also substantially reduced from 30% in 2013 to 21% in 2017. The proportion of individuals who reported being very concerned about power outages remained close between these periods – from 25% in 2013 to 23% in 2017.

Figure 28 Please indicate how concerned you are that in the next 10-20 years… (2013 vs 2017)



Note: 2017 sample n = 2383; 2013 sample n=2986

4.4 Correlates of Energy Preferences

This section explores the correlations between support for different energy technologies and multiple variables that have been examined from a descriptive standpoint.

Table 19 below shows that objective knowledge (OK), i.e. the number of questions participants answered correctly about energy issues, was not correlated to income and had its strongest (albeit relatively weak) correlations with age (positive association) and individuals working for the coal or gas industry (negative association). This employment relationship with the coal or gas industry had positive correlations with perceived knowledge about all forms of energy, in particular biomass, CCS and wave. Gender was the socio-demographic characteristic with the strongest association with perceived knowledge (PK). Men tended to have higher perceived knowledge than women, but the correlation between gender and objective knowledge was much smaller. Perceived knowledge about CCS was most highly correlated with gender and working for the coal or gas industry. Higher education was associated with higher perceived knowledge about the less widely understood energy technologies such as biomass, geothermal, nuclear and wave.

Table 19 Correlates of knowledge and socio-demographic variables (n=2383)

	Age	Gender	Education	Income	Urban	Job coal	OK
Objective knowledge (OK)	0.160	-0.044	0.066	-0.005	0.041	-0.181	
PK Biomass	-0.161	-0.242	0.243	0.063	-0.063	0.397	-0.026
PK Coal	0.168	-0.292	0.140	0.030	0.013	0.210	0.188
PK Coal seam gas	0.130	-0.273	0.162	0.034	0.009	0.282	0.114
PK Gas	0.133	-0.243	0.130	0.026	-0.017	0.226	0.136
PK Gas Coal CSS	-0.045	-0.284	0.199	0.053	-0.071	0.368	0.044
PK Geothermal	-0.020	-0.309	0.223	0.042	-0.058	0.302	0.076
PK Hydroelectric	0.211	-0.328	0.146	0.004	0.028	0.188	0.159
PK Nuclear	0.039	-0.311	0.203	0.031	-0.041	0.218	0.110
PK Solar (thermal)	0.037	-0.156	0.124	-0.005	0.016	0.192	0.097
PK Solar (PV)	0.040	-0.283	0.182	0.014	0.012	0.229	0.139
PK Wave	-0.041	-0.284	0.216	0.026	-0.032	0.285	0.077
PK Wind	0.062	-0.230	0.146	-0.003	0.002	0.203	0.116

**Note: p<0.05. Non-significant results are identified by the lighter font.*

Examining the correlation of socio-demographic characteristics with support for different energy technologies,

Table 20 below shows that objective knowledge was positively associated with support for renewable energy technologies, including solar, wind, wave and hydroelectric, and was negatively associated with support for CSG. As might be expected, having employment related to the coal or gas industry had a positive association with support for fossil fuels, as well as for biomass and nuclear energies. Support for gas was also correlated with gender and age, with older men (possibly with employment in coal or gas related industries) more likely to support gas. Formal education levels appeared to have little association with support for energy technologies, although as previously stated, levels of objective knowledge about the technology did.

Table 20 Correlates of energy support and socio-demographic variables (n=2383)

	Age	Gender	Education	Income	Urban	Job coal	OK
Support Biomass	-0.112	-0.041	0.038	0.000	-0.023	0.157	-0.039
Support Coal	0.086	-0.089	-0.021	0.009	0.001	0.171	-0.090
Support Coal seam gas	-0.023	-0.075	0.022	0.015	-0.071	0.218	-0.119
Support Gas	0.137	-0.155	0.038	0.011	-0.038	0.156	0.008
Support Gas Coal CSS	0.054	-0.098	0.031	0.033	-0.034	0.176	-0.038
Support Geothermal	0.022	-0.156	0.089	0.001	-0.034	0.077	0.079
Support Hydroelectric	0.137	-0.100	0.043	-0.038	0.057	-0.058	0.139
Support Nuclear	0.062	-0.221	0.083	0.038	-0.059	0.167	-0.038
Support Solar (thermal)	-0.007	0.007	0.061	-0.065	0.028	-0.105	0.107
Support Solar (PV)	0.039	-0.003	0.066	-0.034	0.048	-0.144	0.140
Support Wave	-0.026	-0.047	0.072	-0.043	-0.009	-0.093	0.137
Support Wind	-0.042	0.014	0.062	-0.036	0.011	-0.079	0.104

**Note: p<0.05. Non-significant results are identified by the lighter font.*

Exploring the correlations between the range of factors behind energy preferences and support for different energy technologies, Table 21 below indicates that concern for environmental protection and climate change were the factors more strongly associated with support for energy technologies. Both of these factors were negatively correlated with support for biomass, nuclear, and technologies related to fossil fuels including CCS, i.e. the higher the concern for environment and climate, the less support for these technologies. In contrast, there was a stronger positive correlation with support for renewable energies, in particular solar and wind. The factors of cost, price and reliability were associated to a moderate extent with support for gas and hydroelectric energy. Reliability was also positively associated with solar (thermal and photovoltaic). There were no strong correlations with support for CCS.

Table 21 Correlates of energy support and factors behind energy preferences (n=2383)

	Environ protection	Climate change	Economy	Cost	Electricity price	Reliability	Location
Support Biomass	-0.071	-0.068	0.096	0.090	0.041	-0.002	0.057
Support Coal	-0.300	-0.389	0.157	0.184	0.175	0.126	0.089
Support Coal seam gas	-0.247	-0.230	0.138	0.161	0.110	0.059	0.081
Support Gas	-0.158	-0.205	0.193	0.204	0.214	0.195	0.113
Support Gas Coal CSS	-0.190	-0.203	0.151	0.166	0.144	0.111	0.100
Support Geothermal	0.072	0.060	0.131	0.101	0.104	0.124	0.075
Support Hydroelectric	0.214	0.132	0.205	0.123	0.242	0.270	0.133
Support Nuclear	-0.203	-0.206	0.170	0.143	0.096	0.102	0.063
Support Solar (thermal)	0.375	0.386	0.133	0.069	0.121	0.155	0.111
Support Solar (PV)	0.416	0.408	0.124	0.079	0.134	0.184	0.106
Support Wave	0.338	0.349	0.097	0.055	0.093	0.120	0.108
Support Wind	0.380	0.456	0.070	0.022	0.059	0.090	0.080

**Note: p<0.05. Non-significant results are identified by the lighter font.*

Table 22 (below) explores the relationship between beliefs around global warming and concerns about issues related to future energy affordability and supply, and support for different energy technologies. There was a positive association between participants who believe that global warming is happening now and all renewable energy sources, with the strongest association identified in support for wind; and negative associations with nuclear, biomass, and fossil fuel-related energy sources, particularly coal and CSG. Believing that humans are the leading cause of global warming presented a similar pattern of results, although the associations were lower in magnitude. Concern about electricity and/or gas affordability was positively associated with support for fossil fuel-related energy sources and technologies, but not with renewable energy sources, with the exception of hydroelectricity, which suggests that participants may consider renewable energy to be more expensive. Concerns about power outages and energy reliability exhibited a similar pattern of associations, and demonstrated higher positive associations with coal and gas. Support for wind energy was negatively (but not significantly) correlated with concern about electricity affordability.

Table 22 Correlates of energy support and global warming & reliability concerns (n=2383)

	Global warming is happening	Humans cause global warming	Concern: electricity affordable	Concern: gas affordable	Concern: power outages	Concern: energy reliability
Support Biomass	-0.057	-0.028	0.035	0.043	0.071	0.037
Support Coal	-0.328	-0.239	0.107	0.117	0.197	0.164
Support Coal seam gas	-0.207	-0.133	0.094	0.120	0.166	0.073
Support Gas	-0.185	-0.169	0.093	0.109	0.183	0.110
Support Gas Coal CSS	-0.202	-0.157	0.067	0.098	0.167	0.087
Support Geothermal	0.013	0.008	0.040	0.030	0.076	0.002
Support Hydroelectric	0.066	0.031	0.059	0.045	0.070	0.024
Support Nuclear	-0.171	-0.087	0.018	0.050	0.101	0.071
Support Solar (thermal)	0.227	0.148	0.022	-0.012	0.000	-0.069
Support Solar (PV)	0.256	0.137	0.003	-0.024	-0.040	-0.059
Support Wave	0.214	0.157	0.025	0.027	-0.003	-0.088
Support Wind	0.310	0.212	-0.026	-0.038	-0.062	-0.102

**Note: p<0.05. Non-significant results are identified by the lighter font*

Finally,

Table 23 reports the associations between perceptions about possible risks and benefits for both CCS and renewable energy technology and support for the energy technologies; here we present solar thermal (CST), solar photovoltaic, and wind as the more illustrative examples for support for renewables. The factors more highly associated with CCS support were trust in government about CCS and trust in the CCS industry, whereas for the renewables the stronger association was for trust in renewables industry; there was a very weak positive association between trust in government about renewables and support for wind only. There was a moderately strong positive association between the perceived benefits of renewables and support for wind and solar (both CST and PV), and a negative association with support for CCS. The perceived benefits for CCS were more weakly related to support for CCS; however it was also related to support for all three renewable energy technologies.

Table 23 Correlates for energy support and risk/ benefits & trust perceptions (n=2383)

	Support CCS	Support Solar (CST)	Support Solar (PV)	Support Wind
Risk perception CCS	-0.047	-0.032	-0.026	-0.016
Benefit perception CCS	0.118	0.098	0.084	0.103
Trust in government about CCS^	0.227	-0.007	-0.038	0.020
Trust in CCS industry	0.192	0.078	0.048	0.103
CCS projects transparency	0.162	0.061	0.024	0.101
CCS projects fairness	0.175	0.055	0.012	0.074
CCS projects chance catastrophe	-0.021	0.078	0.037	0.076
Risk perception renewables	0.103	-0.167	-0.196	-0.177
Benefit perception renewables	-0.114	0.275	0.288	0.341
Trust in government about renewables	0.205	0.021	-0.003	0.060
Trust in renewables industry	-0.001	0.247	0.245	0.319
Renewables projects transparency	0.051	0.111	0.100	0.189
Renewables projects fairness	0.060	0.097	0.084	0.170
Renewables projects chance catastrophe	0.100	-0.078	-0.126	-0.101

**Note: p<0.05. Non-significant results are identified by the lighter font*

^ The four trust factors in Table 23 are composite variables, created by combining the three questions exploring levels of trust in each of government and industry, for each of CCS and renewables.

5 Discussion of results

5.1 Knowledge and support for energy technologies

On average, objective knowledge about electricity generation and energy use in average households was low across the Australian survey sample. Across all groups, around 40-50% of participants were able to answer two of the four knowledge questions correctly. However, participants from the COIs and those closer to energy projects tended to know slightly more than the general public. The QLD and VIC COIs had the highest proportion of participants able to answer 3-4 questions correctly (27% and 26% respectively). In any group of individuals under analysis, less than 5% of individuals responded correctly to all questions about energy issues. The general public and the SA COI had the highest proportions of participants (8%) who were unable to answer any questions correctly, and a further 30% of the general public were only able to answer one question correctly. Objective knowledge about energy issues was not correlated with income; it had only a weak positive correlation with age and education; and a negative correlation with having employment related to the coal or gas industry.

Corresponding with low objective knowledge, participants self-rated having a limited amount of knowledge about the variety of different energy sources and technologies. Participants reported knowing least about biomass and CCS, and knowing most (but still only moderate levels of knowledge) about gas and solar (thermal). Participants reported lower levels of perceived knowledge about most energy technologies compared to survey data from 2011 and 2013. Perceived knowledge levels about gas and coal in both 2013 and 2017 were comparatively high (and on par with solar thermal and wind), although they received generally lower levels of support than renewable energies. Thus for some industries, an increase in perceived knowledge may not translate to an increase in support for the industry. In the 2017 sample, even for those technologies people thought they knew more about, the scores remained below 4 (a moderate level of knowledge) out of 7. For perceived knowledge, gender was the socio-demographic characteristic with the strongest association, with men reporting higher levels of perceived knowledge. However, the gender correlation for objective knowledge was much weaker. This has been evidenced in earlier surveys where men reported higher perceived knowledge than women on energy technologies.

In recent years, the range of energy technologies has been a major topic of discussion, both politically and in the media. It is possible that the ensuing debate and the different positions held between political parties may have led individuals to question their own knowledge about the various options for energy generation and mitigating carbon emissions as a result.

Knowledge appeared to be associated with support for different energy technologies. Higher levels of objective knowledge correlated with higher levels of support for renewable energy technologies including solar, wind, wave and hydroelectricity, than for technologies related to fossil fuels. This is somewhat consistent with other studies which have found that tertiary education generally leads to a) higher income and b) attitudes and values that tend to support more ‘progressive’ climate and energy policies (Sovacool and Blyth 2015). Consistent with previous surveys, the energy technologies with the highest support were solar and wind, and participants’ self-rated knowledge about these energies was also higher. The least supported energy technologies were CSG, biomass and nuclear, and overall, participants self-rated biomass as the energy technology they knew least about (mean 1.86 on a 7-point scale); however, participants thought they knew slightly more about CSG and nuclear energy (means 3.11 and 3.37 respectively).

Compared to survey data from 2011 and 2013 support for energy technologies, including renewables, fell in 2017 with the notable exception of coal and nuclear. Nuclear power had relatively low levels of support across the general public although it was significantly more supported as a public funding priority in NSW compared to QLD, VIC and WA. Higher levels of support in NSW may potentially be related to public engagement and communication in that state in 2015 in relation to additional radioactive waste storage at the Australian Nuclear Science and Technology Organisation (ANSTO) facility in Sydney. There has also been widespread public consultation on nuclear power in SA based on the engagement following the 2016 Nuclear Fuel Cycle Royal Commission. Additionally, discussion generated at a national level by the 2016 and 2017 SA blackouts may have increased individuals’ awareness of the differences between energy technologies, and in turn,

influenced their levels of support. Concerns about energy reliability and power outages were positively (though weakly) correlated with support for coal and nuclear for the general public.

The low levels of energy literacy found in this survey are not surprising. In a similar survey of the Danish public, where Denmark is seen as a global leader in the energy transition to renewable energy sources, Sovacool and Blyth (2015) found that despite extensive public engagement on energy issues people generally thought they knew much more about energy issues than they actually did - i.e. a gap between objective and perceived knowledge. Similarly, only a small proportion of Danes understood their electricity bills, energy consumption or fuel pricing.

Low objective and perceived knowledge ratings raise concerns because they suggest that individuals may have a lower capacity to make informed decisions, which in turn is likely to affect which energy technologies are preferred and supported. There are significant implications of widespread low energy literacy for democratic processes needed to determine location, public acceptance and the procedural and distributive justice elements associated with new energy projects. This study has shown that both objective and perceived knowledge are related to energy preferences, but to varied extents – from no association to a medium association. This suggests a complex relationship exists between knowledge, information and energy preferences, which needs to be examined further. This examination would involve understanding the role of knowledge in formulating preferences (and by logic, opposition) to energy technologies and also the role of knowledge in changing energy consumption behaviours (not described in this report).

5.2 Risk and benefits of CCS vs renewable energy

A series of questions evaluated participants' perceptions of CCS and associated potential risks and benefits. As a point of comparison, participants were also asked to evaluate similar risks and benefits of renewable energy generally, without specifying any particular renewable energy technology.

The results demonstrated that less than half of individuals in all groups considered that the advantages of CCS as a carbon reduction option outweigh the risks it may pose. This suggests that more effort around increasing awareness and understanding will be needed if CCS is to be accepted as a beneficial technology for mitigating climate change as recommended by the IEA. Interestingly, the SA COI, which reported lower support for the coal industry and CCS, was the COI with the higher proportion of individuals considering CCS as mostly advantageous (42%), but also the highest proportion of respondents who considered the risks outweigh the advantages (20%). There may be some connection with this group wanting to ensure reliability in supply after losing power in 2016, where they feel that CCS to support the continued use of fossil fuel powered generation may provide this. A marginally lower proportion of respondents in the QLD and VIC COIs considered CCS as mostly advantageous (40%), even though the QLD COI has already experienced some engagement around CCS technology. These evaluations were similarly reflected in ratings of specific risks and benefits of CCS, where the general public and the VIC COI rated the benefits more highly than risks. Conversely, the QLD and SA COIs highly rated the risks of accidents in storing and transporting CO_2. The SA COI was also concerned about risks presented to future generations.

Nonetheless, about one quarter of the overall sample did not know whether the risks of CCS outweighed the advantages and approximately 16% responded neither, which suggests a more neutral attitude towards the technology. Furthermore, despite these differences, groups equally acknowledged that the key benefit of CCS was reducing CO_2 emissions.

Perceptions about renewable energy followed a different pattern. All groups were largely favourable towards renewable energy and the top perceptions individuals had about specific benefits and risks of renewable energy were consistently positive. The majority considered the advantages of renewable energy outweigh its possible risks (between 57-70%), with a small proportion (6-13%) of respondents considering the risks of renewable energies to outweigh its advantanges. Again, the SA COI had the largest proportion of respondents who considered renewable energy mostly advantageous (70%). The VIC COI that had the largest proportion of respondents who considered that the risks outweigh the advantages (13%), double that of the SA COI (6%). Results show that individuals from all groups, including the COIs, perceived the more likely outcomes of

renewable energy to be positive. These outcomes ranged from decreasing CO_2 emissions through to increased economic growth.

The proportion of participants who saw neither net risks nor net benefits was about the same for renewables as it was for CCS (12-20%). However, the proportion of participants who did not know about the risks and benefits of renewable energy options was on average less than half the proportion of those who did not know about CCS. This demonstrates that within the majority of participants who have an opinion formed about energy technologies, renewables seem to be preferred to CCS. This suggests an increased awareness and acceptance of renewables, despite reporting only low-moderate levels of perceived knowledge about the various renewable energy technologies. It also confirms that support of an energy technology is influenced by exposure and familiarity.

Perceptions about the transparency, fairness and levels of trust in both the government and industry processes were similarly low for both CCS and renewable energy, although slightly higher for the renewable energy industry. To a limited extent, individuals seem to consider industry more trustworthy compared to government for both CCS and renewable energy projects. Yet, despite being low in absolute magnitude, the factors more associated with support for CCS were trust in government and trust in industry, whereas for renewables it the stronger factor was trust in industry, with a very weak positive association between trust in government and support for wind only. These results bring to attention the possible detrimental effects of any government-led campaigns favouring specific energy technologies when trust is low.

Participants considered that renewable energy projects tend to be marginally more transparent and fair than CCS projects. The difference was largest in the SA COI, which largely favoured renewable energy projects. All groups similarly perceived that the probability of a catastrophic event occurring is low from the development of both CCS and renewable energy projects although all agreed that this probability is somewhat higher for CCS projects. This suggests that opposition to CCS (or renewable energy projects) is not driven by perceptions of imminent risk but by other barriers unrelated to considering that disasters are likely to happen.

Overall, our results convey low levels of knowledge and support for CCS, combined with some (limited) concerns for risks of accidents in storing and transporting CO_2. However, participants also tended to have a limited understanding of renewable energy sources and technologies, yet these were perceived as environmentally more beneficial. The factor most strongly correlated with support for renewables was their perceived benefits, while perceived benefits for CCS were more weakly correlated to support for CCS. While renewable energy was perceived as bringing a mix of environmental and economic development benefits, CCS was perceived as being useful mostly to promote employment and economic growth. Although all groups of participants agreed that the key benefit of CCS was reducing CO_2 emissions, CCS was not as highly perceived by the public as a climate change mitigation tool.

One limitation of this survey was the inability to assess, as a benefit, the fundamental value of CCS in enabling grid stability and reliability by supporting synchronous generation of intermittent renewable energy sources, e.g. solar and wind, and coal (with and without CCS), gas, nuclear and hydroelectric. Grid stability is a topic that the public has begun to learn more about as a result of the SA blackouts, and relates to how long people are willing to go without electricity. This suggests it may be a valuable consideration of the value of CCS to include in future research of this kind and will be explored in follow up qualitative research through focus groups.

5.3 Climate change and global warming

At least two thirds of individuals in all States and Territories thought global warming is already happening. This belief varied between a minimum of two thirds in NSW, VIC and QLD, to three quarter of individuals in WA. The remaining individuals who do not believe global warming is already happening were fairly equally distributed among other points of view: global warming will start happening within the next 30 years (from 8% in QLD and VIC to 13% in SA); global warming is not happening and it won't (from 5% in WA to 13% in QLD); and individuals who are unsure about this topic (from 8% in SA to 12% in NSW, VIC and QLD).

Differences in beliefs around global warming were also found between the general public and the COIs particularly exposed to energy technologies. Our results suggest that perceptions about climate change –

either believing that global warming is happening or not – are somehow related to the extent to which an individual's livelihood and the economic stability of the region could be threatened or improved by the acknowledgement of climate change. These perceptions could also be associated with the broader community narrative and social norms in these areas, and in-group identity (e.g. see Jans et al. 2018). Compared with the other COIs, the VIC COI had the smallest proportion of participants (59%) who believed that global warming is already happening, and subsequently the largest proportion who were unsure about this topic (18%) or who do not think global warming is or will ever happen (15%). The SA COI had the largest proportion of participants (72%) who believed global warming is already happening.

A comparison of public perceptions about this issue between 2013 and 2017 presents analogous results for the two periods. There was a slight decrease in the proportion of people who consider that global warming is already happening, from 72% in 2013 to 69% in 2017. However, views about what causes climate change have evolved over time. In 2017, just over one third of individuals (37%) thought global warming is caused mostly by human activities; an increase from 2013 (27%) and 2011 (26%). Correspondingly, the proportion of respondents who considered that global warming is caused by both natural environmental changes and human activities decreased in 2017 (45%) from 58% in 2013 and 57% in 2011. However, the proportion of individuals who consider that global warming is mostly a natural environmental occurrence has been fairly steady (14% in 2011, 11% in 2013 and 2017). While the majority of individuals accept global warming is happening and are increasingly convinced that human activities play the largest role, this suggests that there is a small but consistent proportion of the population that rejects the effects of human activities on climate change.

Differences between the general public and the COIs in relation to the causes of climate change are also notable. Around one quarter of individuals in the QLD and VIC COIs considered global warming is caused mostly by human activities (compared to one third or more in the SA COI and general public), possibly because these regions rely on energy technologies related to fossil fuels, specifically coal and coal seam gas. However, all three COIs had smaller proportions of respondents who considered that global warming is caused mostly by natural changes in the environment, compared with the general public.

Although there is a general awareness that global warming is a problem, individuals have, on average, only a moderate acceptance of their shared responsibility for contributing to the problem (average mean score of 4.3, just above 'neither agree nor disagree'), and only moderately feel personally or morally obliged to save energy (average mean score of 5, 'slightly agree'). Following a similar pattern, individuals' average willingness to pay more for their electricity bills to use only renewable energy was low. Nineteen percent of the general public were unwilling to pay for any increase at all, and interestingly, this proportion was highest in the SA COI (29%). Two thirds of participants across all groups were unwilling to pay more than 10% more, with the highest proportion in the VIC COI (71%). The lower levels of willingness to pay more than a 20% increase in the COIs, as regions that have already been somewhat affected, may be due to individuals believing they are already bearing some of the costs for the energy transition. The individuals willing to pay an increase of more than 20% to use only renewables were more likely to be younger, more highly educated, with a higher household income, and from urban areas. There was also an association with having a higher acceptance for individual personal responsibility towards energy saving and a higher perceived knowledge about energy technologies. Objective factual knowledge about energy, nonetheless, had a negative association with being more willing to pay for renewable energy.

Similarly, only a small proportion of individuals reported subscribing to GreenPower. An average of 13% of the general public subscribed to GreenPower, with little variation between the States. However, there was a larger variation in the COIs, ranging from 10% of participants in the QLD COI to 20% in the SA COI. A large proportion of participants across all groups did not know the percentage of GreenPower they subscribed to, ranging from just over a quarter of individuals in NSW and VIC to 50% in WA, and 55% in the VIC COI. Across all groups, the majority of individuals subscribed to more than 20% GreenPower, with the exception of the QLD and VIC COIs.

In terms of concerns regarding possible future unaffordability and shortages of energy and power, participants in the QLD COI were most concerned about electricity and petrol becoming unaffordable. These issues were also of most concern in the VIC COI, along with concern about the frequency of power outages. In the SA

COI, concerns were highest about electricity unaffordability and the frequency of power outages, perhaps as the result of recent experiences. In comparison to previous years, the proportion of respondents who were 'very concerned' about future unaffordability and shortages of energy and power dropped substantially for all concerns with the exception of frequent power outages, which remained steady at around 25% between 2013 and 2017.

6 Policy implications

When compared with previous surveys, these findings indicate that the Australian public's self-rated knowledge of the range of energy technologies has decreased since 2011. This is despite the increased media attention on issues surrounding affordability, energy security and supply. While it is not clear why self-rated knowledge has reduced, it may be that the increased media coverage and polarisation of the debate about energy technologies has reinforced to the public how little they know and understand about the topic. Lack of understanding in the Australian general public may increase public opposition towards some new energy projects if there is no recognition of the benefits such projects might bring. As energy is so critical to our daily life, such a lack of knowledge has increased discussion about the need to build a more energy literate constituency to enable informed debate and decision-making. The provision of factual information about generation cost and emissions can significantly change support ratings for various energy technologies (Hobman and Ashworth 2013).

Regardless of their knowledge, Australian individuals consistently favoured renewable energy technologies (predominantly solar thermal and photovoltaic energy) over all others. At the same time, the majority of respondents expressed an unwillingness to pay more for renewable energy. While the price of renewables has fallen considerably, this expressed reluctance to pay more does have implications for government if Australia is to transition away from having the majority of our energy generated from fossil fuels. Any such transition will not be without economic penalty, such as paying extra for energy storage to complement renewable energy generation or finding alternative income sources for workers likely to be displaced by the closure of larger baseload power plants. Both alternatives have implications for policy makers and project developers who will need to identify the value proposition for the public to justify increasing investment in new forms of energy generation as price of electricity has become a political concern across Australia.

The findings confirmed that support for an energy technology is influenced by exposure and familiarity, as demonstrated in attitudes that appeared to be regionally specific. For example, South Australia is the state with the largest percentage of renewable energy projects and participants in the state generally, but particularly in the COI, expressed greater support for renewable energy. Similar results were seen at both state and COI level in Victoria (support for coal), and in Queensland (support for coal seam gas). Given the diversity in support, there is merit in documenting different individuals' reasons for their support through focus group discussions. From this a range of messages could be developed that may help to build greater support for various technologies, as individuals may be more likely to identify with other Australians that have no vested interest in any of the options, rather than government or industry project developers.

Regarding CCS technology, the findings indicated that self-reported knowledge and support for CCS were low. Less than half of the sample thought that the benefits of CCS technology outweigh the risks, and perceived the specific benefits to be reducing emissions and mitigating climate change. As concerns increase about the world's slow progress towards the Paris COP21 target of keeping global warming to less than 2 degrees Celsius, it may be that CCS becomes more widely accepted. However, it will require far greater communication efforts and investment if this is to become a reality, particularly in terms of educating the public about the fundamental value of CCS in enabling grid stability and reliability by supporting synchronous generation.

What is clear is the Australian public are genuinely concerned about climate change and would like to see action to reduce emissions. However, given their reluctance to pay it will need a finely nuanced approach to move away from our predominantly fossil fuel driven power supply.

7 References

Ashworth, P., Wade, S., Reiner, D. & Liang, X. (2015). Developments in public communications on CCS. *International Journal of Greenhouse Gas Control*, *40*, 449-458.

Ashworth, P., Muriuki, G. & Jeanneret, T. (2014). Understanding Australian attitudes to low carbon energy technologies. *Energy Procedia, 63*, 6991-6998.

Ashworth, P., Dowd, A-M., Rodriguez, M., Jeanneret, T., Mabon, L. & Howell, R. (2013). Synthesis of CCS social research: Reflections and current state of play in 2013. CSIRO EP134303, Australia.

Ashworth, P., Bradbury, J., Wade, S., Feenstra, C. F. J. (Ynke), Greenberg, S., Hund, G. & Mikunda, T. (2012). What's in store: Lessons for implementing CCS. *International Journal of Greenhouse Gas Control, 9*, 402-409.

Ashworth, P**.**, Jeanneret, T., Gardner, J. & Shaw, H. (2011). Communication and climate change: What the Australian public thinks. CSIRO: EP112769

Ashworth, P., Pisarski, A. & Thambimuthu, K. (2009a). Public acceptance of carbon dioxide capture and storage in a proposed demonstration area. *Proceedings of the Institution of Mechanical Engineers, Part A: Journal of Power and Energy, 223*(3), 299-304.

Ashworth, P., Carr-Cornish, S., Boughen, N. & Thambimuthu, K. (2009b). Engaging the public on Carbon Dioxide Capture and Storage: Does a large group process work? *Energy Procedia, 1*(1), 4765-4773.

Australian Competition & Consumer Commission (ACCC). (2017). Electricity report details affordability, completion issues. Media release 16 October 2017. Retrieved June 2018: https://www.accc.gov.au/media-release/electricity-report-details-affordability-competition-issues

Australian Energy Market Operator (AEMO) (2017). South Australian Electricity Report. Published November 2017. Retrieved May 2018: http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2017/South-Australian-Electricity-Report-2017.pdf

Boot-Handford, M. E., Abanades, J. C., Anthony, E. J., Blunt, M. J., Brandani, S., Mac Dowell, N., …Fennell, P.S. (2014). Carbon capture and storage update. *Energy & Environmental Science*, *7*(1), 130-189.

Bradbury, J., Greenberg, S. & Wade, S. (2011). Communicating the risks of CCS. *Global CCS Institute*: *Melbourne.*

Bruine de Bruin, W., Mayer, L.A. & Morgan, M.G. (2015). Developing communications about CCS: three lessons learned. *Journal of Risk Research, 18*(6), 699-705.

Clean Energy Regulator (2018) Green Power. Retrieved May 2018: http://www.cleanenergyregulator.gov.au/RET/Pages/Scheme%20participants%20and%20industry/Individuals%20and%20small%20business/GreenPower0224-9157.aspx

Dütschke, E., Wohlfarth, K., Höller, S., Viebahn, P., Schumann, D., & Pietzner, K. (2016). Differences in the public perception of CCS in Germany depending on CO_2 source, transport option and storage location. *International Journal of Greenhouse Gas Control*, *53*, 149-159.

Environmental Protection Agency (EPA) (2009). EPA Wind Farms Environmental Noise Guidelines 2009. Retrieved October 2017: http://www.epa.sa.gov.au/environmental_info/noise/types_of_noise/wind_farms/waterloo_wind_farm_environmental_noise_study/report_summary

Global CCS Institute (2017) Projects database: Pilot and demonstration. Retrieved October 2017. (http://www.globalccsinstitute.com/projects/pilot-and-demonstration-projects)

Gooch, L. (2002). Coroner blames Esso for Longford disaster. *The Age*, November 15. Retrieved October 2017: http://www.theage.com.au/articles/2002/11/15/1037080898920.html

Government of South Australia. (2017). Know Nuclear. Retrieved October 2017: https://nuclear.yoursay.sa.gov.au/the-program

Hammond, J. & Shackley, S. (2010). Towards a public communication and engagement strategy for carbon dioxide capture and storage projects in Scotland: Scottish Centre for Carbon Capture Working Paper 2010-08. *Edinburgh: SCCS*.

Hobman, E.V. & Ashworth, P. (2013) Public support for energy sources and related technologies: The impact of simple information provision. *Energy Policy, 63*, 862-869.

Huijts, N.M.A., Molin, E.J.E. & van Wee, B. (2014). Hydrogen fuel station acceptance: A structural equation model based on the technology acceptance framework. *Journal of Environmental Psychology, 38*, 153-166.

Huijts, N.M. A., Molin, E.J.E. & Steg, L. (2012). Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. *Renewable and Sustainable Energy Reviews*, *16*(1). 525-31.

International Energy Agency (IEA). (2013). Technology Roadmap – Carbon capture and storage. Paris.

Institute for Energy Economics and Financial Analysis (IEEFA) (2016). Subcritical Australia: Risks from market imbalance in the Australian National Electricity Market. Retrieved October 2017: http://ieefa.org/wp-content/uploads/2016/05/Sub-Critical-Australia-Risks-From-Market-Imbalance-in-the-Australian-National-Electricity_May-2016.pdf

Jans, L., Bouman, T. & Fielding, K. (2018). A part of the energy "in crowd": Changing people's energy behaviour via group-based approaches. *IEEE Power and Energy Magazine, 16*(1), 35-41.

Jeanneret, T. Muriuki, G. & Ashworth, P. (2014) Energy technology preferences of the Australian public: Results of a 2013 national survey. CSIRO: Pullenvale. EP145414

L'Orange Seigo, S., Arvai, J., Dohle, S. & Siegrist, M. (2014). Predictors of risk and benefit perception of carbon capture and storage (CCS) in regions with different stages of deployment. *International Journal of Greenhouse Gas Control*, *25*, 23-32.

Marshall, J. P. (2016). Disordering fantasies of coal and technology: Carbon capture and storage in Australia. *Energy Policy*, *99*(C), 288-298.

Measham. T.G. & Fleming, D.A. (2014). Impacts of unconventional gas development on rural community decline. *Journal of Rural Studies, 36*, 376-385.

Moffat, K., & Zhang, A. (2014). The paths to social licence to operate: An integrative model explaining community acceptance of mining. *Resources Policy*, *39*, 61-70.

Pisarski, A., & Ashworth, P. (2013). The Citizen's Round Table process: canvassing public opinion on energy technologies to mitigate climate change. *Climatic Change, 119*(2), 533-546.

Renew Economy (2014). South Australia court dismisses anti-wind farm claims. Retrieved November 2017: http://reneweconomy.com.au/south-australia-court-dismisses-anti-wind-farm-claims-80228/

Renew Economy (2016). Turnbull leads attack on wind as Coalition readies carbon price backflip. Retrieved November 2017 at http://reneweconomy.com.au/turnbull-leads-attack-on-wind-as-coalition-readies-carbon-price-backflip-46010/

Rifkin, W., Witt, K., Everingham, J. & Uhlmann, V. (2015). Benefits and burdens for rural towns from Queensland's onshore gas development. SPE-176941-MS. Society of Petroleum Engineers.

Rogelj, J., den Elzen, M., Höhne, N., Fransen, T., Fekete, H., Winkler, H., ...Meinshausen, M. (2016) Paris Agreement climate proposals need a boost to keep warming well below 2 C. *Nature*, *534*(7609), 631-639.

Senate Community Affairs References Committee (2011). The social and economic impact of rural wind farms. Canberra: Commonwealth of Australia.

Sibson, E. (2018). Linc Energy found guilty of serious environmental harm at controversial UCG plant. ABC. Retrieved June 2018 from: http://www.abc.net.au/news/2018-04-09/court-linc-energy-guilty-serious-environmental-harm-ucg-plant/9632964

Sovacool, B. & Blyth, P. (2015). Energy and environmental attitudes in the green state of Denmark: Implications for energy democracy, low carbon transitions, and energy literacy. *Environmental Science & Policy*, 54, 304-315.

Steg, L., Dreijerink, L. & Abrahamse, W. (2005). Factors influencing the acceptability of energy policies: A test of VBN theory. *Journal of environmental psychology*, *25*(4), 415-425.

Terwel, B. W., Harinck, F., Ellemers, N., Daamen, D. D. & De Best-Waldhober, M. (2009). Trust as predictor of public acceptance of CCS. *Energy Procedia*, *1*(1), 4613-4616.

Wallquist, L., Visschers, V. H., Dohle, S. & Siegrist, M. (2012). The role of convictions and trust for public protest potential in the case of carbon dioxide capture and storage (CCS). *Human and Ecological Risk Assessment: An International Journal*, *18*(4), 919-932.

8 Appendices

Appendix 1 – Survey questionnaire

PROJECT TITLE: Understanding attitudes towards low carbon technologies in Australia

PARTICIPANT INFORMATION

Project Overview

This research project intends to advance understanding about the social challenges associated with low carbon energy technologies regarding their public acceptance and use. The main aim is to identify public understanding of the different energy technologies, and the perceived risks and benefits of increasing the use of low carbon technologies in Australia.

This project is funded by the Australian government under the Carbon Capture and Storage Research Development & Demonstration, the Australian Coal Association Low Emissions Technology Pty Ltd (ACALET), the Carbon Transport and Storage Company (CTSCo) and the University of Queensland. These organisations partnered in order to better understand climate change mitigation, and to better inform public debate and policy makers on how low carbon technologies could be a real option in Australia.

What is involved?

You are invited to respond to this online survey which will take up to 25 minutes of your time. We are keen to access the views of a range of Australians and you do not need to be an expert in this field.

Do I have to be part of this program?

Completion of the online survey is completely voluntary and you are free to withdraw at any time without prejudice or penalty. If you wish to withdraw from the study your information will be removed from the study. We would like to encourage you to participate in the study as your participation will ensure that we understand your opinion about low carbon energy technologies and your preferred options for Australia.

How will my responses be recorded, used and kept?

The completed online survey will only be seen by members of the research team. All your personal information will be de-identified meaning that your responses will be assigned an identity code and your personal information will be detached from your survey responses. All data collected will be kept in locked storage for up to five years. Information will be used to prepare research reports and academic publications. Your personal information will not appear in any publications. Data collected in this survey may be used for comparative analysis to similar data collected in China and we would also like to be able to reuse some of your responses to compare with subsequent surveys and related research we complete on Australian attitudes to energy technologies.

How can I find out more about the study?

If you would like more information about this study please contact the project leader Peta Ashworth by phone (+61 7 3346 3883) or email (p.ashworth@uq.edu.au).

Has this project received ethical clearance?

This study adheres to the Guidelines of the ethical review process of The University of Queensland and the National Statement.

Please tick the appropriate box:

Yes, I have reviewed the information above and I agree to participate in this online survey

Sorry, I do not wish to participate in this online survey

Screening Questions:

What is your age (in years)?

What is your postcode?

What is your gender?

Male

Female

We would like to start by asking you some general questions about energy. Please choose what you think is the right answer.

How is most electricity in Australia generated?

a. By burning coal

b. By burning natural gas

c. Through wind and solar energy

d. At hydroelectric power plants

e. Don't know

In the average Australian home which of the following uses the most energy?

a. Lighting rooms

b. Heating water

c. Heating and cooling rooms

d. Power for appliances

e. Don't know

Evidence suggests that the fastest and most cost-effective way to address our energy needs is to…

a. Develop all possible domestic sources of oil and gas

b. Build nuclear power plants

c. Develop more renewable power plants

d. Implement more energy efficiency and conservation

e. Don't know

The largest component of a typical electricity bill is . . .

a. Wholesale energy costs

b. Network costs (poles and wires)

c. Retail costs and margins

d. Taxes and subsidies

e. Don't know

Please indicate your current level of knowledge about the following energy sources and technologies.

	No knowledge			Moderate knowledge			Expert knowledge
	1	2	3	4	5	6	7
Biomass	○	○	○	○	○	○	○
Coal	○	○	○	○	○	○	○
Coal seam gas	○	○	○	○	○	○	○
Gas	○	○	○	○	○	○	○
Gas or coal with Carbon Capture and Storage	○	○	○	○	○	○	○
Geothermal	○	○	○	○	○	○	○
Hydro-electric	○	○	○	○	○	○	○
Nuclear	○	○	○	○	○	○	○
Solar (concentrating solar/solar-thermal)	○	○	○	○	○	○	○
Solar (photovoltaic)	○	○	○	○	○	○	○
Wave/ tidal	○	○	○	○	○	○	○
Wind	○	○	○	○	○	○	○

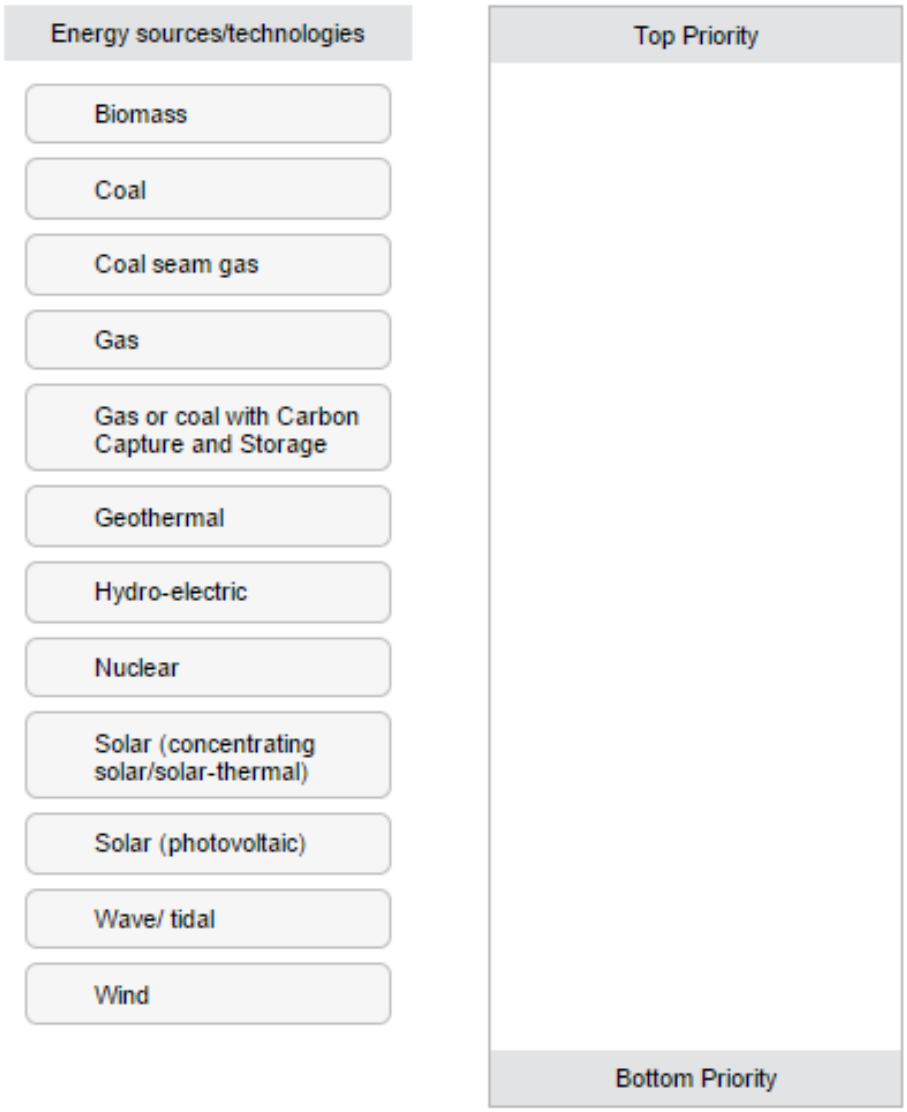
Please find below a definition of the different energy technologies.

Please indicate how strongly you agree or disagree with the following options as potential ways of generating Australia's future energy needs.

		Strongly disagree			Neither agree nor disagree			Strongly agree
		1	2	3	4	5	6	7
Biomass	The energy obtained directly from burning organic material (e.g., wood) or from refined organic matter (e.g., ethanol, biodiesel)	○	○	○	○	○	○	○
Coal	The energy of coal converted into electricity in coal-fired power plants.	○	○	○	○	○	○	○
Coal seam gas	The natural gas (mostly methane) that is attached to coal along its natural fractures, and is released when pressure on the coal seam is reduced. The energy of this gas is released by burning.	○	○	○	○	○	○	○
Gas	The energy of gas (mostly methane) released by burning.	○	○	○	○	○	○	○
Gas or coal with Carbon Capture and Storage (CCS)	The energy of gas or coal converted into electricity in power plants that use carbon capture and storage technologies. Carbon capture and storage (CCS) technologies capture carbon dioxide (CO2) from fossil fuel power plant exhaust and store it in underground reservoirs.	○	○	○	○	○	○	○
Geothermal	The energy available as heat extracted from within the earth's crust, usually in the form of hot water or steam. These resources are accessed by drilling wells into the earth and piping the steam or hot water to the surface.	○	○	○	○	○	○	○
Hydro	The energy of flowing water converted into electricity in hydroelectric plants.	○	○	○	○	○	○	○
Nuclear	The energy produced from controlled, non-explosive nuclear reactions within a nuclear power plant.	○	○	○	○	○	○	○
Solar (concentrating solar/solar-thermal)	The energy of sunlight (solar radiation) captured by concentrating mirrors focussed onto a heat transfer fluid which is used to generate steam and drive a turbine (concentrating solar/solar-thermal).	○	○	○	○	○	○	○
Solar (photovoltaic)	The energy of sunlight (solar radiation) captured by solar panels (photovoltaic cells).	○	○	○	○	○	○	○
Wave/tidal	The energy of the ocean's waves and tides captured by various types of wave energy converters/tidal turbines.	○	○	○	○	○	○	○
Wind	The motion-based energy of wind captured by wind turbines. Wind turbines are large windmill-type structures that may be located on land or in the ocean.	○	○	○	○	○	○	○

Please rank the following energy sources/technologies in the priority order that you would allocate public funds toward their development and implementation.

Select your priority ranking <u>from highest to lowest</u>, by dragging and ordering the options in the right column.



In deciding whether or not to support new energy sources and related technologies, please indicate how much you consider the following factors:

	Not at all			To some extent			Very much
	1	2	3	4	5	6	7
Environmental issues (e.g., impact on ecosystems, humans, plants and animals)	○	○	○	○	○	○	○
Climate issues (e.g., level of CO_2 emissions, global warming)	○	○	○	○	○	○	○
Economic issues (e.g., job opportunities, knowledge and skill development, power plant building	○	○	○	○	○	○	○
Cost (e.g., installation or maintenance cost)	○	○	○	○	○	○	○
Electricity price issues (i.e., the cost of electricity to you as the consumer of electricity)	○	○	○	○	○	○	○
Reliability of electricity supply (i.e., stability in the supply of electricity to your home, "power cuts")	○	○	○	○	○	○	○
Location of the energy infrastructure (such as power plants, transmission lines and pipelines	○	○	○	○	○	○	○

Below are two statements people sometimes make when discussing the environment and economic growth. Which of them comes closer to your own point of view?

a. Protecting the environment should be given priority, even if it causes slower economic growth and some loss of jobs

b. Economic growth and creating jobs should be the top priority, even if the environment suffers to some extent

Here is a list of statements about the environment. For each one, please indicate whether you agree or disagree with it:

	Strongly disagree			Neither agree nor disagree			Strongly agree
	1	2	3	4	5	6	7
I would give part of my income if I were certain that the money would be used to prevent environmental pollution	○	○	○	○	○	○	○
I would agree to an increase in taxes if the extra money was used to prevent environmental pollution	○	○	○	○	○	○	○
The Government should reduce environmental pollution, but it should not cost me any money	○	○	○	○	○	○	○

To what extent do you agree with the following reasons some people give to not pay more to use only renewable energy sources?

	Strongly disagree			Neither agree nor disagree			Strongly agree
	1	2	3	4	5	6	7
If I had more money I would be more willing to pay more to use only renewable energy	○	○	○	○	○	○	○
I consider there is already enough renewable energy in the general electricity supply mix	○	○	○	○	○	○	○
I do not trust that paying more for renewable energy would actually increase renewables in the mix	○	○	○	○	○	○	○
I do not believe there are environmental benefits associated with renewable energy	○	○	○	○	○	○	○
I am not interested in renewable energy	○	○	○	○	○	○	○
I don't think I should have to pay extra	○	○	○	○	○	○	○

Australian reliability standards require that, on average, each person in Australia should not be without electricity more than 10 minutes per year.

How many minutes each year would you accept being without access to electricity if it meant you had a lower electricity bill?

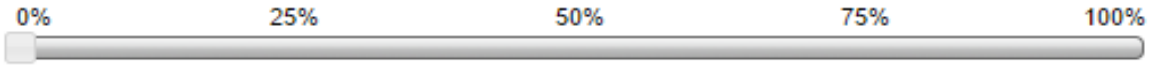
a. Up to 10 minutes each year, I think the current arrangement is necessary
b. Up to 30 minutes each year
c. Up to one hour each year
d. Up to two hours each year
e. More than two hours

Please indicate below how concerned you are that in the next 10-20 years…

	Not at all concerned	A little concerned	Somewhat concerned	Quite concerned	Extremely concerned
	1	2	3	4	5
Electricity will become unaffordable for you?	○	○	○	○	○
Gas will become unaffordable for you?	○	○	○	○	○
Petrol will become unaffordable for you?	○	○	○	○	○
There will be more frequent power outages?	○	○	○	○	○
There will be a national petrol shortage?	○	○	○	○	○

By how much would you be willing to increase your annual electricity bill to use only renewable energy sources? (Assuming your energy consumption remains the same)

Increase by: 0%



Do you believe global warming is happening now or will happen in the next 30 years?

a. Yes, it is already happening.
b. It will start happening within the next 30 years
c. No, it is not happening and won't
d. I do not know/ I am not sure

Assuming global warming is happening, do you think it is:

a. Caused mostly by human activities
b. Caused mostly by natural changes in the environment
c. Caused by both natural changes in the environment and human activities
d. None of the above because global warming isn't happening

How serious do you think are the following environmental problems facing the world?

	Not at all serious			Somewhat serious			Extremely serious
	1	2	3	4	5	6	7
Waste generation	○	○	○	○	○	○	○
Climate change (global warming)	○	○	○	○	○	○	○
Water pollution	○	○	○	○	○	○	○
Natural resource depletion (forest, water, energy)	○	○	○	○	○	○	○
Endangered species and biodiversity	○	○	○	○	○	○	○

Please indicate the extent to which you agree or disagree with each of the statements below.

	Strongly disagree			Neither agree nor disagree			Strongly agree
	1	2	3	4	5	6	7
Global warming is a problem for society	○	○	○	○	○	○	○
Energy savings help reduce global warming	○	○	○	○	○	○	○
I am jointly responsible for the energy problems	○	○	○	○	○	○	○
I feel jointly responsible for the exhaustion of energy sources	○	○	○	○	○	○	○
I feel personally obliged to save as much energy as possible	○	○	○	○	○	○	○
I feel morally obliged to save energy, regardless of what others do	○	○	○	○	○	○	○
Plants and animals have as much right as humans to exist	○	○	○	○	○	○	○
Humans are seriously abusing the environment	○	○	○	○	○	○	○

Please say which, if any, of these things have you done or not done in the last 12 months, out of concern for the environment?

(tick as many as applicable)

a. Have chosen household products that you think are better for the environment

b. Have decided for environmental reasons to reuse or recycle something rather than throw it away

c. Have tried to reduce water consumption for environmental reasons

d. None of the above

Has your household installed any of the following items over the past ten years in your current primary residence?

	Yes	No. My house was already equipped.	No. It is not possible or feasible to make these changes in my house.	No. I didn't want to spend the money.
Top-rated energy efficient appliances? (e.g., washing machines, refrigerators)				
Low-energy light bulbs (compact fluorescent, LED)				
Energy efficient windows (e.g., double or triple glazed windows)				
Thermal insulation of walls/ roofs				
Solar panels for electricity or hot water				
Air conditioning controlled by a utilities company				

How often do you perform the following in your daily life?

	Never	Rarely	Sometimes	Frequently	Always
	1	2	3	4	5
Turn off lights when leaving a room					
Cut down on using heating/ air conditioning to reduce energy consumption					
Only run full loads when using washing machines or dishwashers					
Washing clothes using cold water instead of warm/ hot water					
Switch off standby mode of appliances/ electronic devices (e.g., TV, computer)					
Air dry laundry instead of using a clothes dryer					
Take public transport, walk or cycle when possible to reduce the use of a car.					
Drive an electric car.					

Do you subscribe to green power?

a. Yes

b. No

c. Don't know

(If yes) And what percentage do you subscribe to green power?

Percentage green power 0 %

0% 25% 50% 75% 100%

I don't know

There is much discussion as to what might be the best options to transition to a more sustainable energy use.

The video below introduces you to some of these concepts.

https://www.youtube.com/watch?v=aHtbDmzjYgg

The following sets of questions are about your reactions to some of the technologies discussed in the video. Please select the answer that best represents your opinion.

Once you have watched the video, press 'Next' to continue

When you think about carbon capture and storage (CCS), what first comes to mind?

a. The advantages of CCS as a carbon reduction option outweigh the risks it poses
b. The risks of CCS as a carbon reduction option outweigh its advantages
c. Neither
d. Don't know

When you think about renewable energy (e.g., wind, solar, geothermal), what first comes to mind?

a. The advantages of renewable energy as a carbon reduction option outweigh the risks it poses
b. The risks of renewable energy as a carbon reduction option outweigh its advantages
c. Neither
d. Don't know

How likely do you think the following consequences are as a result of using CCS technology?

a. An increase in the risk of a major accident involving the public occurring
b. An increase in the risk of accidents occurring for future generations
c. An increase in environmental problems
d. An increase in health risks for the local host community
e. An increase in the risks of accidents related to the storage of CO_2using CCS technology
f. An increase in the risks of accidents related to the transport of carbon dioxide in pipelines.
g. An increase in the use of fossil fuels

1. Very unlikely
2. Unlikely
3. Somewhat unlikely
4. Neither likely nor unlikely
5. Somewhat likely

6. Likely
7. Very likely

How likely do you think the following consequences are as a result of using CCS technology?

a. An increase in economic growth
b. A decrease in climate change
c. An increase in employment
d. More affordable energy
e. A decrease in CO_2 emissions
f. A decrease in the dependency of energy supply from other countries

1. Very unlikely
2. Unlikely
3. Somewhat unlikely
4. Neither likely nor unlikely
5. Somewhat likely
6. Likely
7. Very likely

In relation to building and operating CCS projects in Australia:

a. How transparent do you think the decision making processes would be to determine whether or not to implement CCS technology?
b. How fair do you think the decision making processes would be to determine whether or not to implement CCS technology?
c. What do you believe would be the chance of a catastrophic/ irreversible event occurring?

1. Very low
2. Low
3. Moderate
4. High
5. Very high

With regard to CCS projects to what extent do you trust <u>your government</u> to:

a. Act in the best interest of society
b. Act responsibly
c. Do what is right

1. Not at all

2. Very little trust
3. Neutral
4. Somewhat trust
5. Trust a lot

With regard to CCS projects to what extent do you trust <u>the CCS industry</u> to:

d. Act in the best interest of society
e. Act responsibly
f. Do what is right

1. Not at all
2. Very little trust
3. Neutral
4. Somewhat trust
5. Trust a lot

How likely do you think the following consequences are as a result of using renewable energy technologies?

a. An increase in the risk of a major accident involving the public occurring
b. An increase in the risk of accidents occurring for future generations
c. An increase in environmental problems
d. An increase in health risks for the local host community
e. An increase in the risks to wildlife (i.e. bird kill, bats etc.) when using wind technology
f. An increase in the risk of disputes over competing land use

1. Very unlikely
2. Unlikely
3. Somewhat unlikely
4. Neither likely nor unlikely
5. Somewhat likely
6. Likely
7. Very likely

How likely do you think the following consequences are as a result of using renewable energy technologies?

a. An increase in economic growth
b. A decrease in climate change
c. An increase in employment

d. More affordable energy
e. A decrease in CO_2 emissions
f. A decrease in the dependency of energy supply from other countries
g. A decrease in the dependence on fossil fuels

1. Very unlikely
2. Unlikely
3. Somewhat unlikely
4. Neither likely nor unlikely
5. Somewhat likely
6. Likely
7. Very likely

In relation to building and operating renewable energy projects in Australia:

a. How transparent do you think the decision making processes would be to determine whether or not to implement renewable energy?
b. How fair do you think the decision making processes would be to determine whether or not to implement renewable energy?
c. What do you believe would be the chance of a catastrophic/ irreversible event occurring?

1. Very low
2. Low
3. Moderate
4. High
5. Very high

With regard to renewable energy projects in Australia to what extent do you trust <u>your government</u> to:

a. Act in the best interest of society
b. Act responsibly
c. Do what is right

1. Not at all
2. Very little trust
3. Neutral
4. Somewhat trust
5. Trust a lot

With regard to renewable energy projects to what extent do you trust <u>renewable energy industries</u> to:

a. Act in the best interest of society

b. Act responsibly

c. Do what is right

1. Not at all
2. Very little trust
3. Neutral
4. Somewhat trust
5. Trust a lot

Imagine a CCS project is under consideration to be implemented near your residential area. How much money (in AUD$) would you be willing to pay to stop this from happening?

AUD$ _____

Imagine a renewable energy project (e.g., wind farm) is under consideration to be implemented near your residential area. How much money (in AUD$) would you be willing to pay to stop this from happening?

AUD$

Imagine a CCS project is under consideration to be implemented near your residential area. How much money (in AUD$) would you want as compensation to consent having such a project close to you?

AUD$ _____

Imagine a renewable energy project (e.g., wind farm) is under consideration to be implemented near your residential area. How much money (in AUD$) would you want as compensation to consent having such a project close to you?

AUD$ _____

In your day to day life how important is …

	Not important at all			Somewhat important			Very important
	1	2	3	4	5	6	7
Careful management of money (Thrift)							
Going on resolutely in spite of opposition (Persistence)							
Long-term planning							
Giving up today's fun for success in the future							
Personal steadiness and stability							
Working had for success in the future							

To what extent do you agree or disagree with the following statements?

	Strongly disagree			Neither agree nor disagree			Strongly agree
	1	2	3	4	5	6	7
Individuals should sacrifice self-interest for the group.							
Group welfare is more important than individual rewards.							
Group success is more important than individual success.							
Individuals should only pursue their goals after considering the welfare of the group							
Group loyalty should be encouraged even if individual goals suffer							
Individuals should stick with the group even through difficulties							

What is your primary source(s) of information about energy sources and technologies? (Pick your top 3 options)

a. National newspapers
b. State newspapers
c. Local newspapers
d. Periodicals (e.g., magazines)
e. Academic articles based on scientific research
f. Professional reports from the industry
g. Professional reports from the government
h. Professional reports from other stakeholder groups (i.e. NGO's)
i. Blogs
j. Twitter
k. Facebook
l. Television
m. Family/ friends/ colleagues

n. Other (please specify)

How much do you trust the following sources of information?

	Not at all	Very little trust	Neutral	Somewhat trust	Trust a lot
National newspapers	○	○	○	○	○
State newspapers	○	○	○	○	○
Local newspapers	○	○	○	○	○
Periodicals (e.g. magazines)	○	○	○	○	○
Academic articles based on scientific research	○	○	○	○	○
Professional reports from industry	○	○	○	○	○
Professional reports from government	○	○	○	○	○
Professional reports from other stakeholder groups (i.e. NGO's)	○	○	○	○	○
Blogs	○	○	○	○	○
Twitter	○	○	○	○	○
Facebook	○	○	○	○	○
Television	○	○	○	○	○
Family/Friends/Colleagues	○	○	○	○	○

What is the highest level of education you have completed?

a. Below Year 10
b. Year 10 or equivalent
c. Year 11 or equivalent
d. Year 12 or equivalent
e. Certificate (including trade certificate)
f. Diploma/Advanced diploma
g. Bachelor degree (including honours)
h. Graduate diploma/Graduate certificate
i. Postgraduate degree
j. Other (please specify)

Which term below best describes you?

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

Which term below best describes your employment?

a. Manager or Administrator
b. Professional
c. Associate Professional
d. Tradesperson or Related Worker
e. Advanced Clerical or Service Worker
f. Intermediate Clerical, Sales and/or Service Worker
g. Intermediate Production or Transport Worker
h. Elementary Clerical, Sales or Service Worker
i. Labourer or Related Worker
j. Other (please specify)

To what extent is your job associated with the Coal and/ or Gas Industry?

What is your household's total income per year (before tax)?

a. Less than $30,000
b. $30,000 - $59,999

c. $60,000 - $89,999
d. $90,000 - $119,999
e. $120,000 - $149,999
f. $150,000 - $179,000
g. $180,000 - $199,999
h. $200,000 - $219,999
i. $220,000 - $239,999
j. $240,000 - $269,999
k. $270,000 - $299,999
l. More than $300,000
m. Other (please specify)

Which of the following best describes your household?

a. Group household
b. Single person household
c. One parent with children
d. Couple with children
e. Couple with no children
f. Other family (e.g. extended family household)

Do you rent or own the home in which you live?

a. Rent
b. Own
c. Other (please specify)

Which party did you vote for in the last election?

a. The Coalition: Liberal Party of Australia
b. The Coalition: National Party of Australia
c. Australian Labour Party
d. Australian Greens
e. Nick Xenophon Team
f. Pauline Hanson's One Nation
g. Other (please specify)

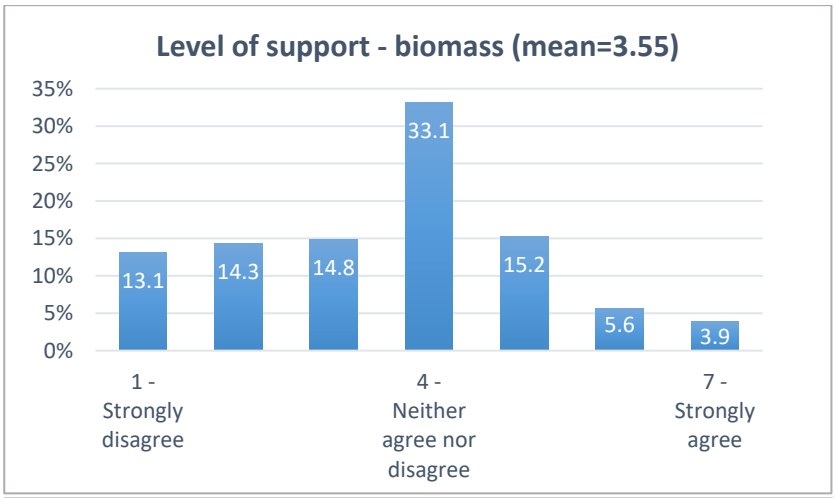
A summary of the findings will be made available to participants on the completion of the project. Would you like the summary to be emailed to you? Please tick the appropriate box.

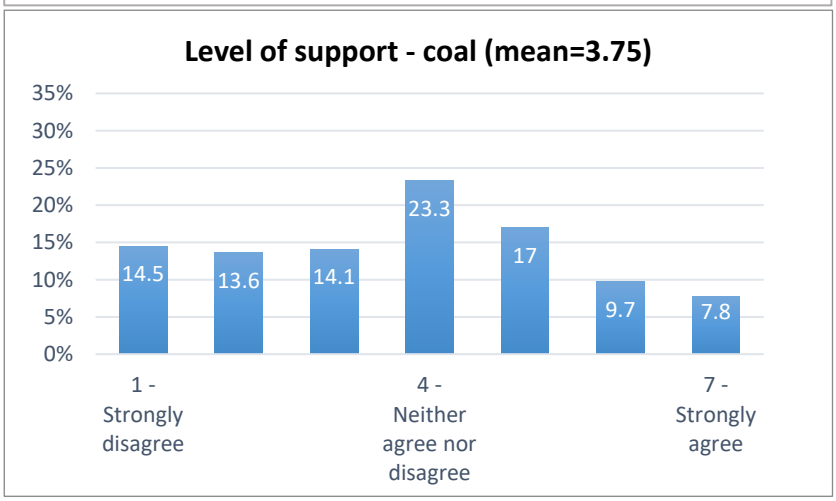
a) Yes

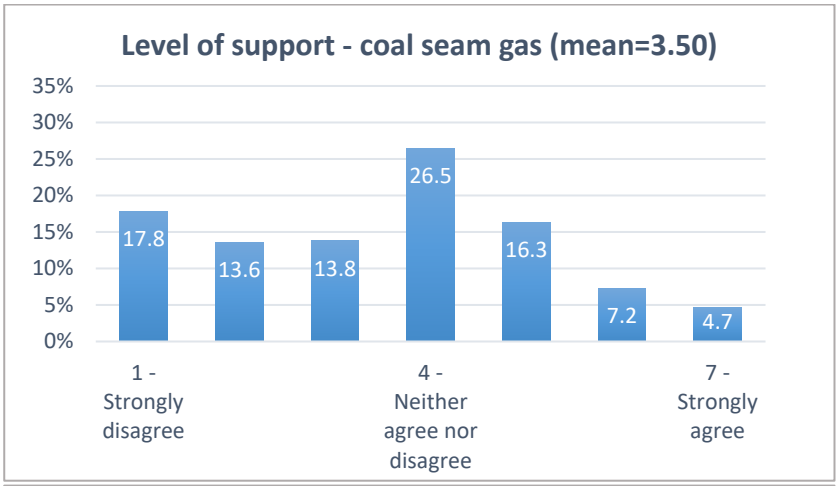
b) No

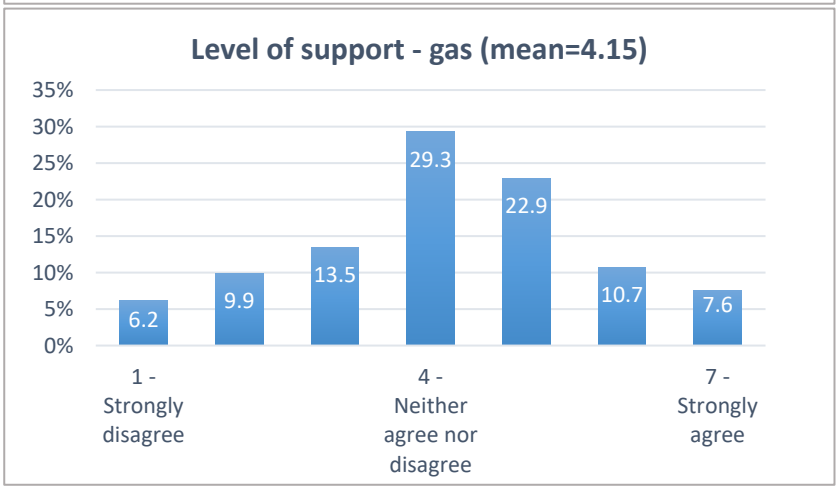
Appendix 2 – Levels of support for energy technologies

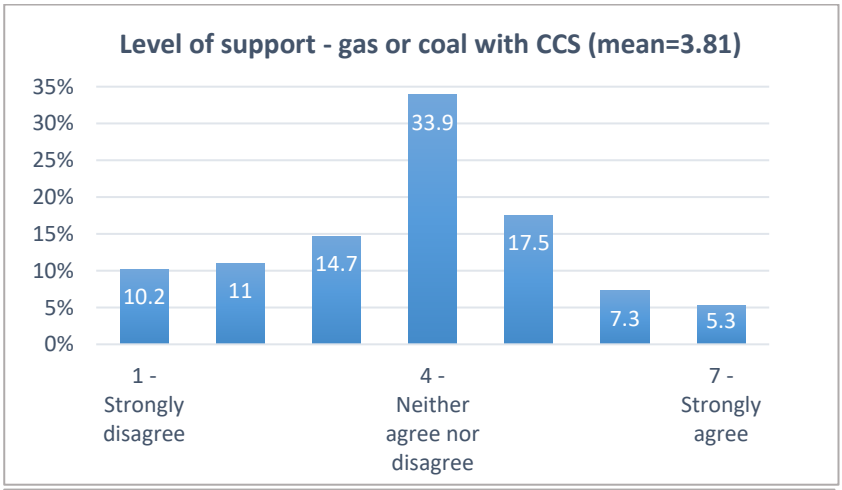
Energy technology frequency distributions (n=2383)

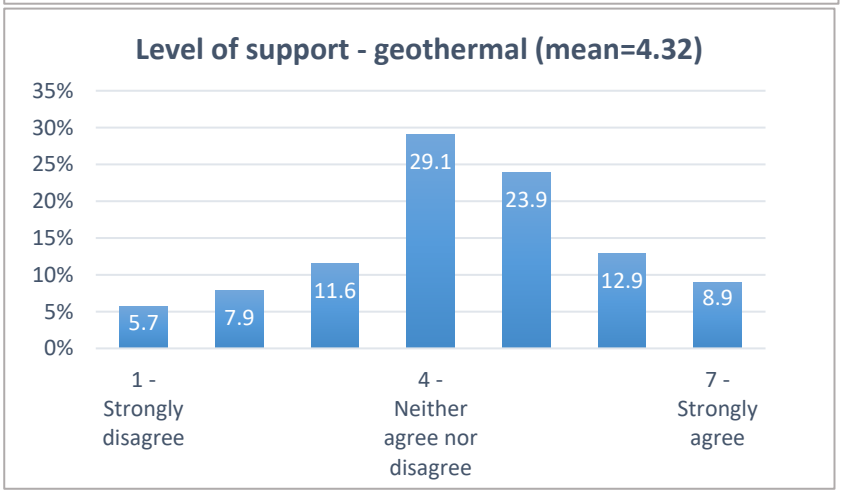


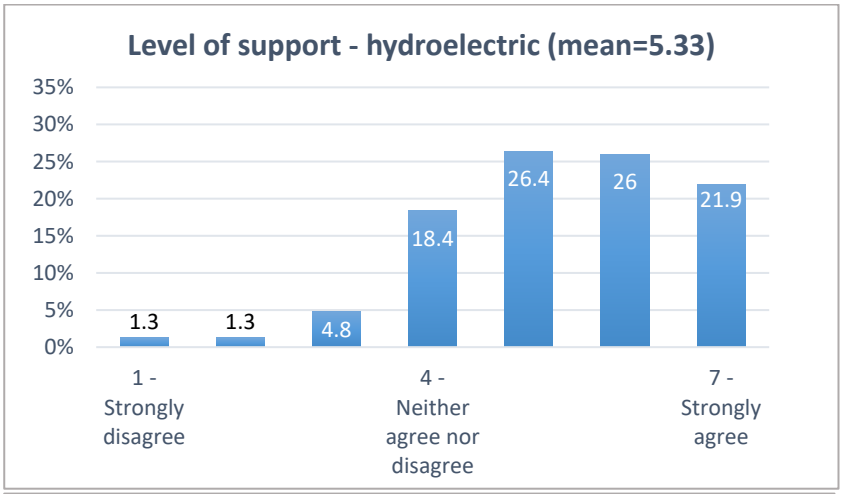


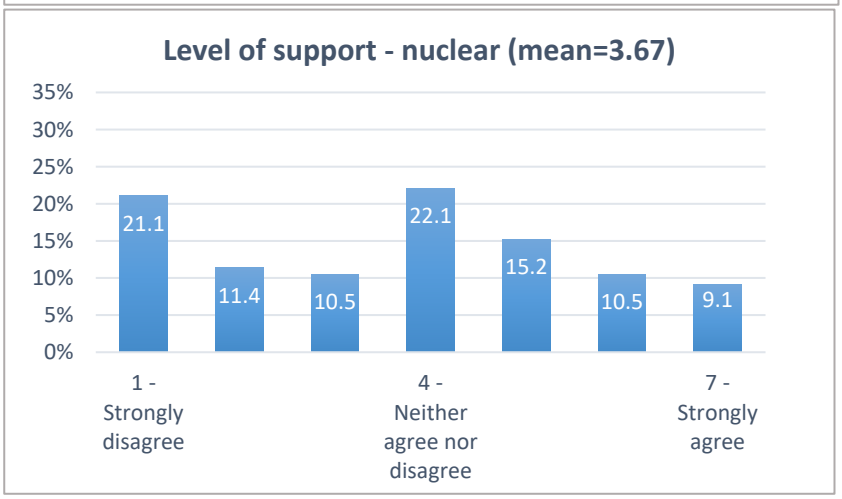

Level of support - coal seam gas (mean=3.50)
35%
30%
25%
20%
15%
10%
5%
0%
17.8
13.6
13.8
26.5
16.3
7.2
4.7
1 - Strongly disagree
4 - Neither agree nor disagree
7 - Strongly agree

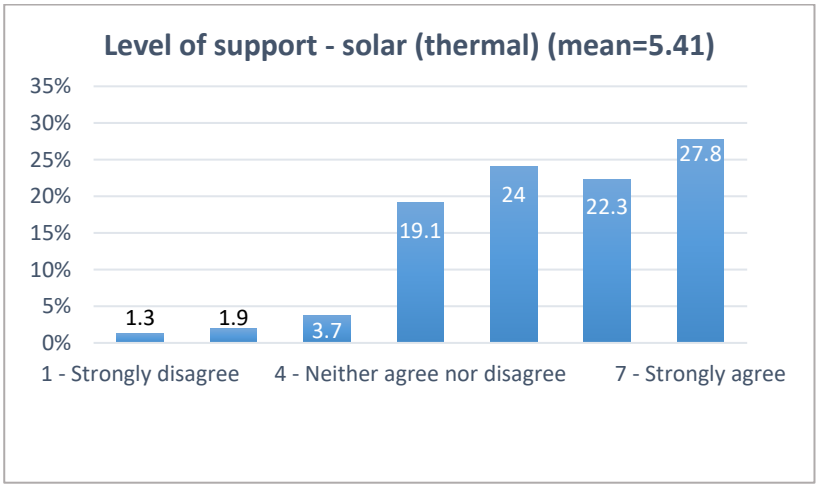

Level of support - gas (mean=4.15)
35%
30%
25%
20%
15%
10%
5%
0%
6.2
9.9
13.5
29.3
22.9
10.7
7.6
1 - Strongly disagree
4 - Neither agree nor disagree
7 - Strongly agree

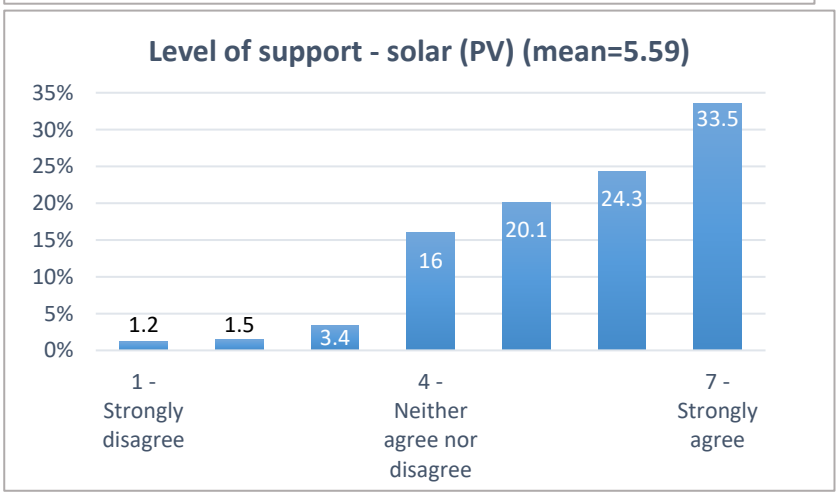

Level of support - gas or coal with CCS (mean=3.81)
35%
30%
25%
20%
15%
10%
5%
0%
10.2
11
14.7
33.9
17.5
7.3
5.3
1 - Strongly disagree
4 - Neither agree nor disagree
7 - Strongly agree

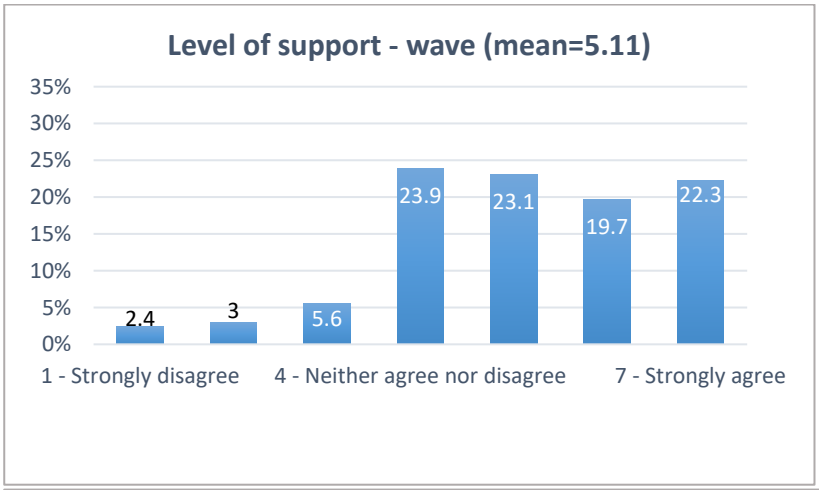

Level of support - geothermal (mean=4.32)
35%
30%
25%
20%
15%
10%
5%
0%
5.7
7.9
11.6
29.1
23.9
12.9
8.9
1 - Strongly disagree
4 - Neither agree nor disagree
7 - Strongly agree

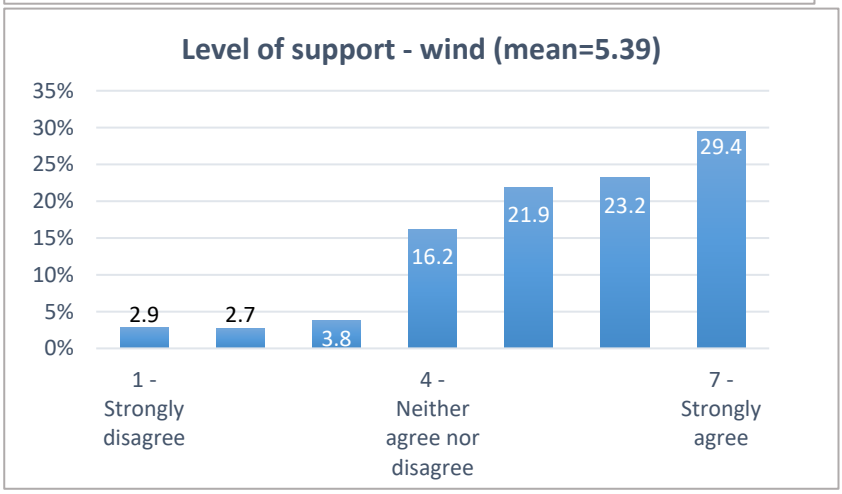

Level of support - hydroelectric (mean=5.33)
35%
30%
25%
20%
15%
10%
5%
0%
1.3
1.3
4.8
18.4
26.4
26
21.9
1 - Strongly disagree
4 - Neither agree nor disagree
7 - Strongly agree


Level of support - nuclear (mean=3.67)
35%
30%
25%
20%
15%
10%
5%
0%
21.1
11.4
10.5
22.1
15.2
10.5
9.1
1 - Strongly disagree
4 - Neither agree nor disagree
7 - Strongly agree


Level of support - solar (thermal) (mean=5.41)
35%
30%
25%
20%
15%
10%
5%
0%
1.3
1.9
3.7
19.1
24
22.3
27.8
1 - Strongly disagree
4 - Neither agree nor disagree
7 - Strongly agree

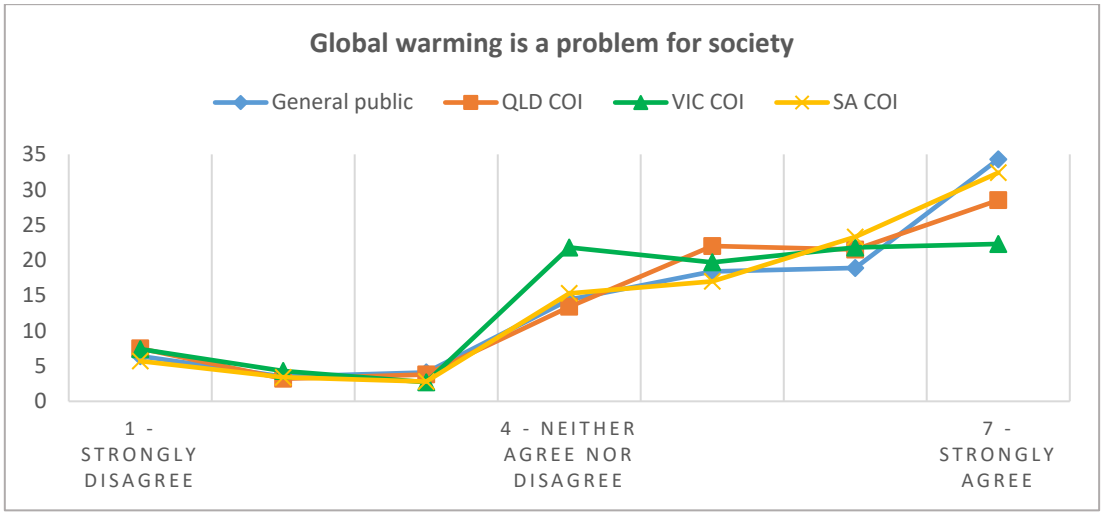

Level of support - solar (PV) (mean=5.59)
35%
30%
25%
20%
15%
10%
5%
0%
1.2
1.5
3.4
16
20.1
24.3
33.5
1 - Strongly disagree
4 - Neither agree nor disagree
7 - Strongly agree

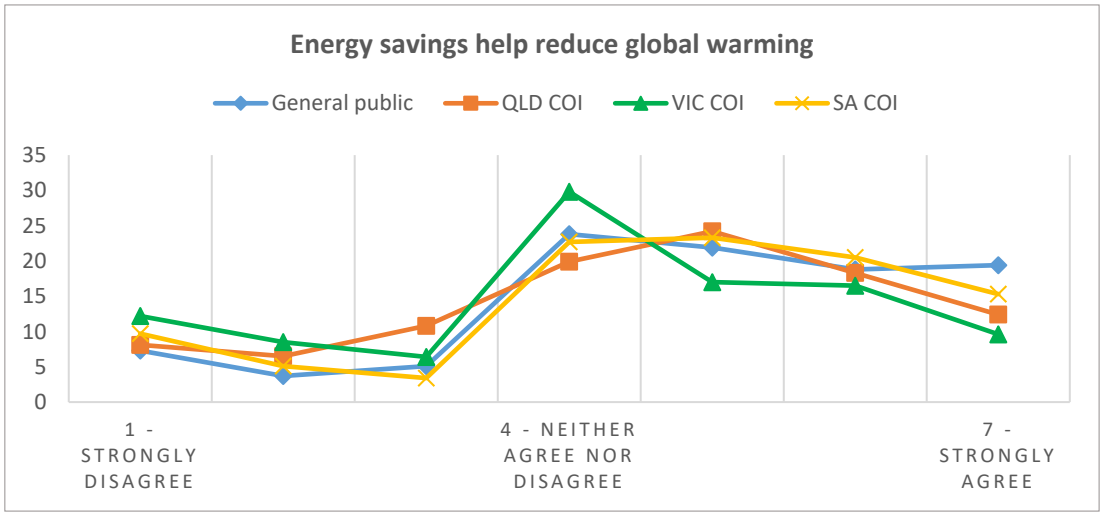

Level of support - wave (mean=5.11)
35%
30%
25%
20%
15%
10%
5%
0%
2.4
3
5.6
23.9
23.1
19.7
22.3
1 - Strongly disagree
4 - Neither agree nor disagree
7 - Strongly agree


Level of support - wind (mean=5.39)
35%
30%
25%
20%
15%
10%
5%
0%
2.9
2.7
3.8
16.2
21.9
23.2
29.4
1 - Strongly disagree
4 - Neither agree nor disagree
7 - Strongly agree

Appendix 3 – Values, beliefs and norms (VBN) frequency distributions

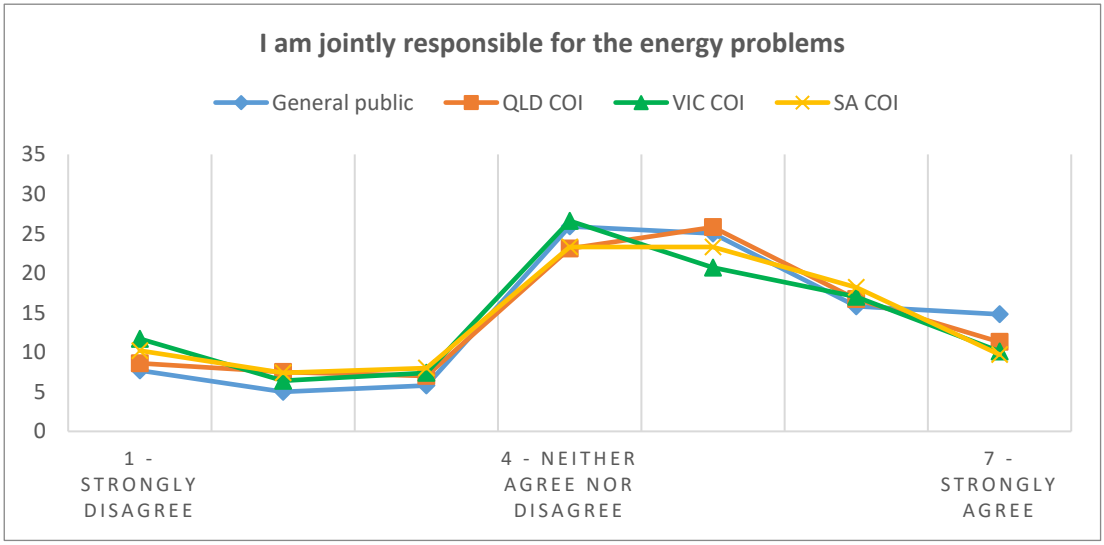
Awareness of consequences

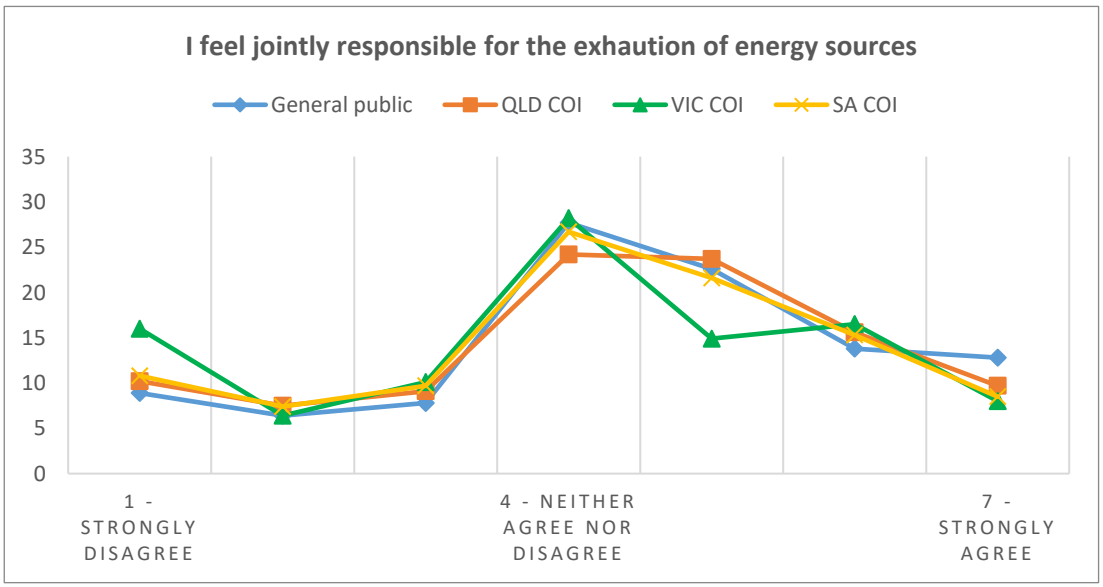




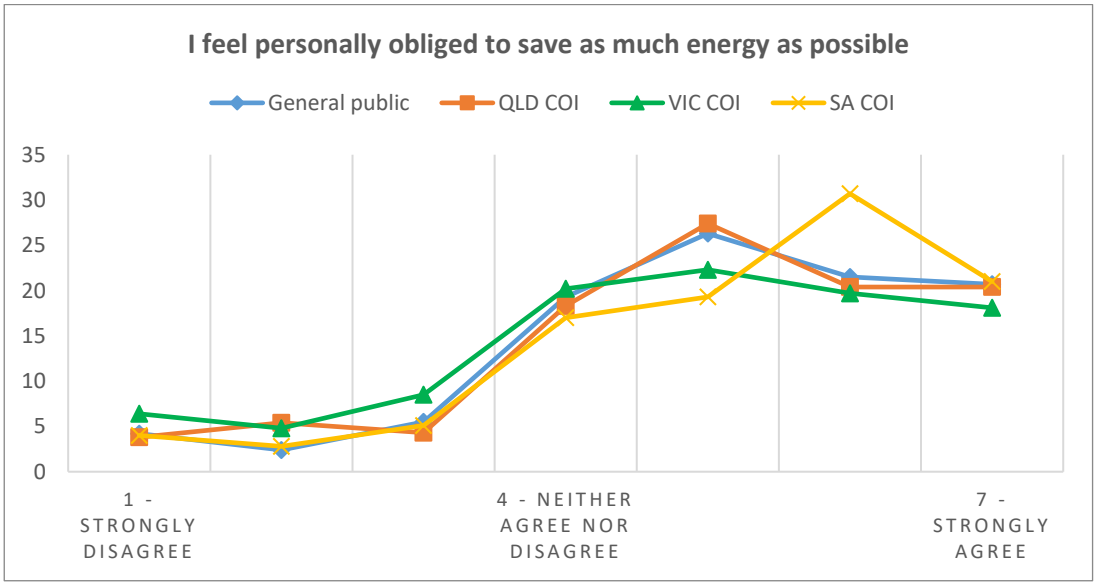
Note: General public n=2383; COI QLD n=186; COI VIC n=188; COI SA n=176

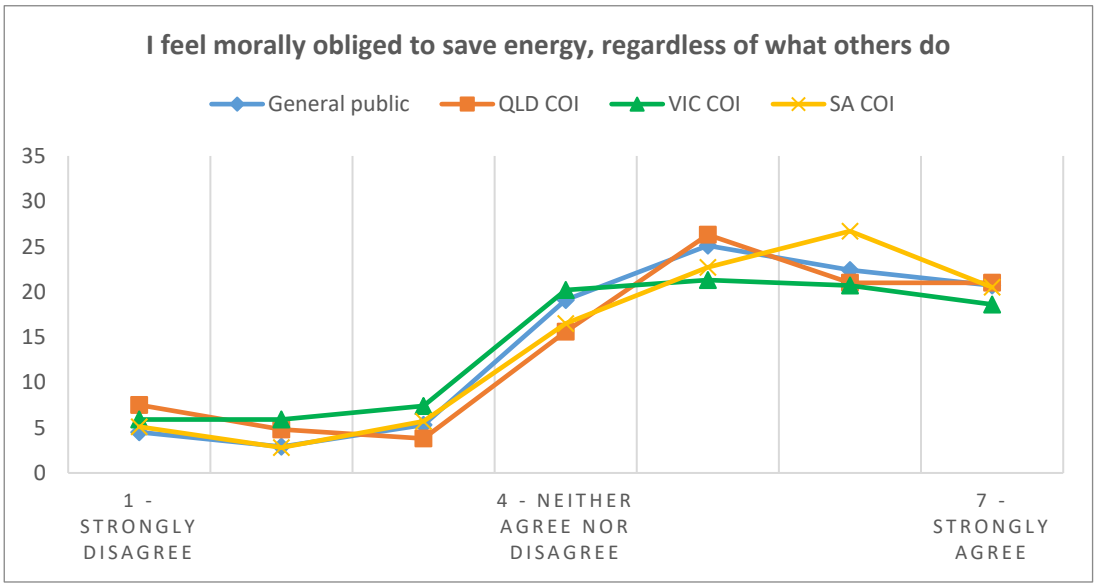
Personal responsibility





Personal norms


I feel personally obliged to save as much energy as possible
General public
QLD COI
VIC COI
SA COI
35
30
25
20
15
10
5
0
1 - STRONGLY DISAGREE
4 - NEITHER AGREE NOR DISAGREE
7 - STRONGLY AGREE


I feel morally obliged to save energy, regardless of what others do
General public
QLD COI
VIC COI
SA COI
35
30
25
20
15
10
5
0
1 - STRONGLY DISAGREE
4 - NEITHER AGREE NOR DISAGREE
7 - STRONGLY AGREE

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

CRICOS Provider Number 00025B