Citizens' panels on the role of future fuels in a low-carbon future energy mix in Australia

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Description	This report provides the findings of three deliberative processes conducted across Melbourne, Illawarra and South Australia in March, 2021. It shows the panels were effective in informing the public on the topic of future fuels and participants found the process valuable
Research Provider	University of Queensland
Project Leader and Team	Professor Peta Ashworth Dr Belinda Wade Dr Kathy Witt Dr Svetla Petrova Dr Vicki Martin Dr Katie Meissner Dr Amrita Kambo Bishal Bharadwaj Elliot Clarke
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Project start/completion date	August 2020/January 2022
IP Status	Public Domain
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Summary of Report

This report provides an overview of three citizens' panels held in February and March 2021 sponsored by the Future Fuels Cooperative Research Centre. The main aims of the panels were to i) document what Australians see as the challenges, opportunities and priority actions that will help Australia transition to a low-carbon energy future; ii) identify challenges, opportunities, and trade-offs in relation to the implementation of future fuels in the future energy mix; and (iii) evaluate the citizens' panel process based on participants' experience. Pre- and post-surveys along with recordings from each of the deliberative sessions helped to inform the research outcomes.

Each citizens' panel brought together a sample of members of the public from 1) Greater Melbourne, 2) Illawarra/ Wollongong Region, and 3) South Australia. Participants from each location met twice a week over a period of four weeks to learn about climate change, the current Australian energy system, future energy possibilities including future fuels and then discuss the role they see for future fuels in the future energy mix of Australia. While the panels were initially planned as in-person engagement, due to COVID-19 restrictions the design of the panels pivoted to be conducted all online via Zoom.

The citizens' panels provided insights into the factors the public prioritise when considering the transition to low-carbon futures, with or without future fuels. Both benefits and challenges were identified by the participants when they considered the transition. For example, regardless of which pathway to a low-carbon future ensues, it will be important to limit inconvenience to consumers as well as limiting the passing on of any additional costs that might arise as a result of the transition. Participants were adamant that additional costs brought about by the transition should be subsidised, with particular attention being paid to those from lower socio-economic areas, renters and individuals from culturally diverse backgrounds.

Other challenges were to ensure reliability and security of supply which was identified as being highly valued across all regions. In some areas, where participants had regularly experienced blackouts due to storms and other events, diversity in energy supply was also identified as holding significant value and having diversity was seen to contribute to overall affordability, another factor of high value. When considering the transition using future fuels, the emergent employment and economic opportunities of hydrogen projects were valued by most participants. However, participants were cognisant of the need to transition existing workers in fossil fuels industries to ensure the transition was equitable and did not present long lasting detrimental effects on some communities and workers. Timely reskilling of the current labour force was identified as being both important and necessary to facilitate this transition process.

Safety was of paramount importance in relation to future fuels, but it seemed that on the whole participants were comfortable that appropriate regulations would be in place to ensure public safety as the industry evolved. The use of communication and engagement activities to share more information about the required energy transition and the opportunities and challenges associated with it, was a view widely shared by participants. This included ensuring more education on ways to improve energy efficiency as well as information about the new technological opportunities that were emerging.

Almost all participants expressed a desire to see a transition that promoted progress on addressing climate change including overall greenhouse gas emissions reduction. This view aligns with widespread support for the use of renewable energy sources to produce hydrogen, with some caveats around costs and reliability. Most participants were aware of the need for energy transition over time and expected support from governments to do this. Participants also discussed the need for investment in R & D for a range of new energy technologies to ensure the lowest-cost pathways were identified, rather than anyone "picking winners".

The quantitative results showed that the deliberative process was effective for informing participants' attitudes, where participants felt their views about energy transition and future fuels had changed as a result of their participation in the panels. Surveys revealed that participants felt the panels were effective, they enjoyed the experience, felt their contributions were valued and that they were encouraged and able to participate. Most participants also indicated over the course of the deliberations they had developed relationships with others in their regional groups.

Some observations about the effectiveness of the panels and future considerations are summarised below.

- While originally planned to be conducted in face-to-face mode using the online process appeared to be effective. While some opportunities for informal networking disappeared, hosting the panels online reduced the costs significantly as there was neither travel nor catering costs for the research team or participants. It may also have allowed individuals to participate who otherwise may not have been able to do so if they had to attend in person.
- From tracking the demographics, younger participants were more likely to withdraw from the process and were also less likely to ask questions in the larger group deliberations. It would be of interest and a consideration for further work to hold one panel that focuses on this younger age group to see if that presents different viewpoints to those documented here. If conducted using online processes, this could potentially include representatives from across Australia.
- Based on the geographic differences that emerged, we recommend undertaking additional panels across other states, i.e. Western Australia and Queensland to identify if these regions have different views to those already conducted. These could be urban or regional areas.
- The research team, in consultation with both the Industry Steering Committee (ISC) of the Future Fuels CRC as well as our external Independent Advisory Panel (IAP) were challenged to clearly define future energy scenarios to adequately describe to participants the alternate pathways forward. Having more information about what the likely impacts of full electrification versus future fuels scenarios (particularly in relation to consumer costs) should help minimise the issues of uncertainty that arose.

In summary, we found that engaging everyday Australians in discussions about future fuels and exploring their views in relation to the low-carbon transition highlighted the complex nature of societal acceptance of energy technologies. Our research showed that even when people are presented with the same information, the way they perceive the technologies and approach the discussions are influenced by multiple factors. As a result of our analyses, we make the following recommendations for industry and government to consider.

Recommendations

A. We recommend undertaking additional citizens' panels for the states and territories not already covered in these results, for example Queensland and Western Australia to further explore the role of context.

B. Using citizens' panels in local contexts where projects are proposed would be an effective way of increasing the likelihood of support. Participants felt the deliberative process was educational and meaningful to them. Such processes could also elucidate local opportunities for projects.

C. Ensuring there is more accurate and widely accepted cost information on the all-electric and future fuels pathways would help with the deliberations and provide greater clarity and reassurance on how the transition might occur.

D. The principles that arose from the deliberations provide some useful insights for government and industry that require greater discussion with key stakeholders. This process could be facilitated through this work package and FFCRC key leaders.

E. The questions that arose from the weekly deliberations provide useful materials to inform the production of fact sheets providing a helpful basis for industry and government more broadly.

F. There is an opportunity to focus on more nuanced attitudes towards hydrogen based on whether a citizen is either renting, a homeowner or a landlord. Unpacking the different acceptance levels across these three actor groups could provide valuable insights into concerns which may impact hydrogen uptake.

G. There were several issues raised in relation to those living in rental housing and marginalised groups, particularly indigenous perspectives that need to be further explored in future research.

1. Introduction

The emergence of new technologies to address the challenge of climate change is transforming the way that energy is produced, supplied and used. While previous energy transitions have usually focussed on incremental change applying a single top-down approach (Lennon, Dunphy, Sanvicente, 2019), this transition is different. It involves many different energy resources and requires significant political, social and behavioural transformations. It is also very much a 'people-led' transition as consumer preferences have evolved to favour cleaner and renewable sources of energy over traditional sources like coal. With such a combination of social and political aspirations driving the transition, the actual configuration of a future low-carbon energy mix will, to a large extent, be determined at the local level, influenced, rather than prescribed by the national or even global agenda.

Already, some State and Territory governments have indicated their vision for their future energy supply, and they differ greatly. For example, Victoria and the Australian Capital Territory see their energy future as being mainly reliant on renewable electricity, while New South Wales, South Australia and Western Australia have embraced the use of carbon-neutral fuels such as hydrogen in their energy plans. This is attracting significant media and public attention towards hydrogen and the associated technologies. However, research has consistently revealed that Australian public awareness and knowledge of future fuels, and hydrogen in particular, is very low (Lambert & Ashworth, 2018).

Given the widespread unfamiliarity with hydrogen technologies and the range of social, economic and ethical implications it may have for different sectors of society, it is necessary to understand the context from which public responses are likely to emerge with their introduction. Deliberative engagement processes are well suited to this task as they allow for information provision and learning, rather than simply eliciting public opinion on a topic the individuals may know little about. History has shown there are different, and competing, values surrounding what is considered 'good' for individuals, a community, the country, and society more broadly, not to mention the planet in terms of energy production and use. To understand these different perspectives around the world, deliberative engagement processes are being used to help understand and integrate these different perspectives on energy related issues, as well as sharing and disseminating new kinds of knowledge and expertise on the topic.

This deliberative engagement on the role of future fuels was conducted as an academic research project led by a team of social scientists, business sustainability and energy experts at The University of Queensland. The main aims were to i) document what Australians see as the challenges, opportunities and priority actions that will help Australia transition to a low-carbon energy future; and ii) identify challenges, opportunities, and trade-offs in relation to the implementation of future fuels in the future energy mix; (iii) and evaluate the citizens' panel process based on participants' experience.

A series of citizens' panels were held in February and March 2021. Each panel brought together members of the public from 1) Greater Melbourne, 2) Illawarra/ Wollongong Region, and 3) South Australia. Participants from each location met twice a week over a period of four weeks to learn about climate change, the current Australian energy system, future energy possibilities including future fuels and then discuss the role they see for future fuels in the future energy mix of Australia. While it is recognised that all sectors of the economy are expected to contribute to reducing greenhouse gas emissions, this study concentrates on the role of future fuels in the energy generation and distribution sector. However, linkages to other sectors including transport are also recognised as being important.

This report details background to the citizens' panels in Chapter 2. The methods for the project are outlined in Chapter 3 and include the participant characteristics and results. Chapter 4 summarises the main findings that arose from the deliberations and quantitative findings from pre- and post- surveys provided to participants. The first two aims are addressed in this Chapter. Chapter 5 addresses the third aim and provides more details into the participants' evaluation of the citizens' panels based on participants' survey responses. An assessment of the effectiveness of the panels is made based on quantitative analysis and elucidates participants' experience with the process. Chapter 6 provides a discussion on some of the key results. Chapter 7 provides the main conclusions that can be drawn and makes recommendations arising from the panels.


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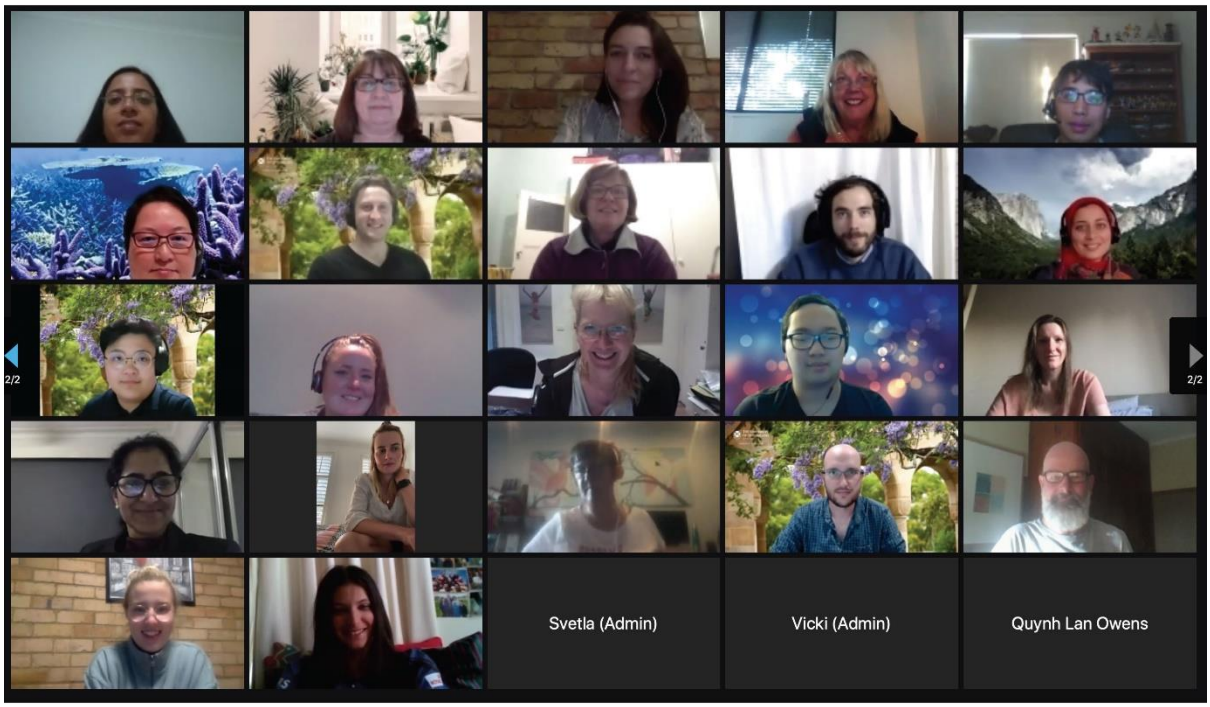
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2. Background

It is increasingly recognised that multilateral and participatory approaches are most effective when it comes to implementing energy technologies, innovations and policies (e.g. Batel & Devine-Wright, 2015; MacArthur, 2016). Meaningful public engagement is important for increasing understanding of the often-complex issues associated with energy transitions and the implementation of new technologies. For this study, we needed a methodology that could explore and accommodate different perspectives, foster understanding, and acceptance of alternative views, and had a futuristic, or visioning capability. That is, a method that enables informed discussion and the collection of a range of responses to possible future scenarios rather than a method to assess current (static) public attitudes to a known phenomenon.

2.1. DELIBERATIVE PROCESSES

Deliberative engagement processes are becoming a preferred tool in understanding responses to complex policy issues as they can provide a much richer understanding than survey-based research and other conventional modes of obtaining public opinion. For example, survey research and focus groups provide snapshots of opinion by members of the public who may know little or nothing about an issue. Results are often presented in terms of averages or majority views. Deliberative processes do not try to aggregate to a majority, nor find the average of public opinion but recognise, and are inclusive of, diverse knowledge, experiences and perspectives (O'Doherty, 2017). Deliberative processes also involve shared learning in that participants share their knowledge and views with others. A key premise of deliberative processes is that as different perspectives are discussed they become better understood and considered among the group.

Deliberative research (using deliberative processes) is based around the notion of deliberation, which involves members of the public coming together to discuss and address a problem of common concern. Deliberation has been defined as *mutual communication that involves weighing and reflecting on preferences, values and interests regarding matters of common concern* (Dryzek, 2002; Mansbridge, 2015). The term deliberation has its roots in the notion of weighing alternatives before eliciting an opinion or providing a considered view. To be able to do this, participants need to have access to a wide range of accurate, relevant, and accessible evidence and expertise. A key aspect of deliberative research therefore, that makes it different from other conventional research approaches, is the provision of information or evidence to participants that is relevant to the topic of discussion.

Subsequently, the use of deliberative processes has the potential to allow for insights into public attitudes, views and opinions before and after participants have been exposed to new information. Such an approach is particularly suitable for topics where there is little public knowledge or information, where there are likely to be strong and diverse opinions, and where there may be low trust in public policy and government. The provision of information in deliberative processes becomes critical in illuminating the complexities and boundaries of knowledge of the issues at hand (Fung, 2003). Indeed, research indicates that the information provided to the participants during the process has the greatest influence on their opinions (Goodin & Niemeyer, 2003; Thompson, Escobar, Roberts, Elstub, & Pamphilis, 2015). Therefore, the validity and veracity of deliberative process are highly dependent on how presenters are selected and how evidence is provided to the participants (Roberts, Lightbody, Low, & Elstub, 2020).

2.2. CITIZENS' PANELS

Deliberative processes are used in a range of contexts, from policy making through consultation and public engagement, to social research. Deliberative engagement processes take many forms, including deliberation in research, public dialogue and for decision-making. In recent years, deliberative forms of engagement and research have been gaining popularity in the context of energy as a complex policy issue. Deliberative processes have been used to evaluate new or emerging technologies, define policy directions, and guide industry plans and consumer policies. Recent examples of how deliberative processes have been used in relation to the energy transition have included: 1) a research project exploring public perceptions of hydrogen in the United Kingdom; 2) a deliberative process in New South Wales where randomly selected members of the general public were asked to recommend course of action with regard to alternative forms of energy generation; and 3) deliberative customer engagement to elicit perspectives and expectations on the future of the gas network in the Australian Capital Territory.

For this research, a form of citizens' panels was used. Citizens' panels involve groups of people who are selected to be representative of the wider public. Because the process is conducted over an extended period, this allows for multiple short surveys to be issued at points before, during and after the panel discussions, which can show how information is being processed and how perceptions change over time. This ability to track how participants respond to new types of information, with manageable group sizes, made citizens panels a good fit for this research.

A ***Citizens' Panel*** is an opportunity for a representative group of people to come together to discuss a specific issue. Participants are selected to statistically represent (demographically and attitudinally) the members of a wider population. These people meet together over an extended period of time to learn about an important issue, discuss it with other fellow citizens and come up with recommendations or present a collective view on a topic.

A **large group process** usually involves workshop-style collaboration, consisting of a mix of large group plenary sessions featuring expert presentations followed by questions, and small group breakout sessions where participants discuss the topics amongst themselves with the help of a facilitator. The workshop also features a series of questionnaires to capture participants' experience.

Deliberative workshops developed out of focus group method as a more in-depth alternative that provides participants with an opportunity to learn about and discuss an issue so that they reach an informed position. Deliberative workshops are dialogue events where the focus is on having informed discussion on a specific topic. A defining feature of those type of workshops is that all group discussions are supported by facilitators. Facilitators' main role is to support participants to communicate and interact in productive and respectful way.
Deliberative workshops allow the organisation conducting the event to have a greater understanding of reasons and explanations behind an opinion or how people's views change as they are given new information.

3. Methods

The citizens' panels were designed to explore perspectives about the role of future fuels in the future energy mix of Australia by outlining:

- opportunities and challenges for the implementation of future fuels in the future energy mix; and
- considerations and trade-offs that policy makers, industry and citizens, need to make to enable the decarbonisation of Australia's energy supply.

The panels were held over four weeks from February to March 2021. Each panel brought together approximately 40 members of the public from Greater Melbourne, Illawarra/Wollongong Region, and South Australia. These locations were chosen to represent a range of geographies (i.e. urban, regional and state level); states of energy transition (i.e. more reliant on fossil fuels through to greater penetration of renewable energy supply); and, representation of likely future fuel scenarios (i.e. domestic consumption, production and export). COVID-19 risks were also considered in the location selection as the citizens' panels were originally intended to be held in person.

To capture the discussion elements of the deliberations all interactions were recorded and transcribed for subsequent analysis. Pre- and post- surveys (Refer Appendix 2: Survey to Citizens' Panels) were used to measure attitudes towards various energy sources and technologies, climate change, and policy approaches and to assess the perceived effectiveness of the panels' processes and presentations (Refer Appendix 3: Presentation to Citizens' Panels). Participants were asked to complete the pre-survey at the very beginning of the process during the first learning session before any information was presented and the post-survey was completed in week three after each individual deliberation session. Participants were also asked to complete a shorter survey at the end of their deliberation sessions during week one and week two and these questions were repeated in the final survey for week three.

3.1. PROJECT GOVERNANCE

The project was overseen by an Industry Steering Committee, who provided advice on scope and direction to meet the FFCRC industry groups' needs. The Steering committee included representatives from the gas industry, federal and state government organisations and consultancy groups with an interest in future fuels from across Australia.

To ensure independence in the workplan, an Independent Advisory Panel (IAP) was established to provide strategic advice and support in relation to the activities planned for the citizens' panels. The IAP consisted of a Chair and seven members. The members were chosen by the project lead in consultation with the FFCRC Industry Steering Committee. The IAP included the following members:

- Hugh Possingham, Chair – Queensland Chief Scientist
- Alicia White – Energy Networks Australia
- Greg Bourne – Climate Council
- Matt Walden – ARENA
- Robyn Robinson – COTA Queensland
- Steve Davies – APGA
- Lesley Dowling – DISER
- Sabiene Heindl – Energy Charter

The IAP played an important role in providing strategic advice, particularly in the project planning phase. The IAP members were also invited to attend the learning sessions as observers. The terms of reference for the IAP were to provide feedback and input in relation to:

1. Key aspects of the Citizens' Panel design such as:

- The scenarios selected for evaluation
- The questions participants were asked to address
- Which experts were invited to speak and what they would cover in their presentations
- The briefing guide on climate change and energy provided to participants to help their discussions and understanding of the topic.

2. Confirmation that the information provided to participants is accurate and unbiased
3. Assistance with promoting the process and the outcomes to relevant institutions and organisations across Australia.

3.2. PANEL DESIGN AND PROCESS OUTLINE

As the risk of COVID-19 disruption did not abate, in consultation with the FFCRC and the IAP, a decision was made to move the panels to a wholly online format. This move presented some challenges for the design and delivery of the deliberative processes, particularly as the duration of the engagements was cut from 3 sessions over 2.5 days to 3 sessions of 2.5 hours each. However, the online format also presented opportunities, particularly linked to the ability to reach regional and remote participants, those with carer responsibilities, and for participants who work during the day, factors that can act as barriers to participation over multiple days within a face-to-face engagement process. The online format also resulted in financial saving through reduced time and travel requirements for the research team.

The panels met twice a week. At the start of each week participants from all locations attended one combined 2.5-hour learning session, where a series of expert presentations (Refer Appendix 3: Presentation to Citizens' Panels) and Q & A interactions took place (Refer Appendix 1: Questions via deliberations). Participants were also required to attend a second 2.5-hour panel deliberation session each week, with locations attending separate sessions (see Figure 1). There was one week break in the third week due to a public holiday falling on the Monday with the final learning and deliberation sessions held in the fourth week. Keeping the sessions within a four-week timeframe was important for two reasons. First, to try and minimise participant fatigue and subsequent drop-out and second, to reduce the possibility of panels' responses to information being overly influenced by major announcements, media events or political debate that could have arisen if the workshops were spread over a longer period.

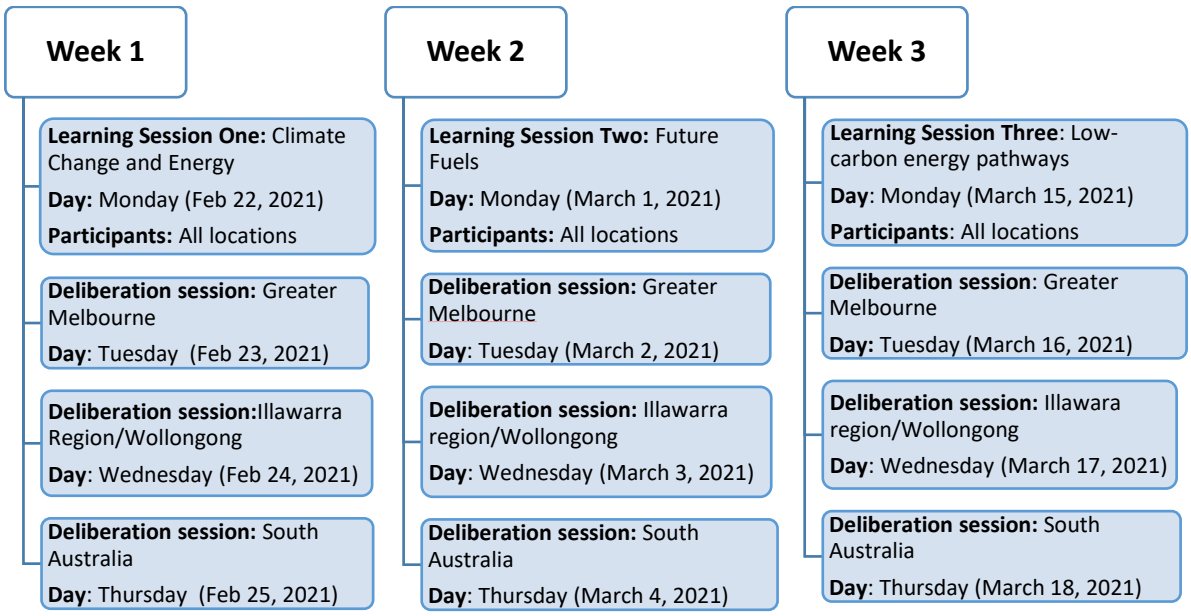

Figure 1 Deliberative workshops schedule
(Refer Appendix 3: Presentation to Citizens' Panels)

At the commencement of the sessions the participants were reminded of the overarching purpose of the panels - to discuss and identify preferred pathways for the transition to a low-carbon energy future. Specific tasks were set for each of the deliberative sessions. The first task was to identify what is important and valuable about the current energy system, then to develop a set of 'principles' to guide the energy transition. Tasks also included providing an outline of challenges and opportunities, perceived risks and benefits, and trade-offs involved in the transition, with a particular focus on the role of future fuels. As highlighted above the process involved both learning sessions and deliberation sessions (Figure 2)Figure 2 Citizens' Panels on Future Fuels . During the learning sessions participants were provided with information related to the challenges of climate change, the Australian energy system, future fuels and future energy pathways including their social implications. During the deliberative sessions, participants were invited to offer insights about:

- the aspects of the current energy system that are of a particular value to the members of the community and the aspects that need to change;
- the opportunities for future fuels and considerations that may be important for policymakers and industry stakeholders when making decisions around the deployment of future fuels;
- two potential future energy pathways; and,
- a set of 'principles' to guide the path to a low-carbon energy future for Australia.

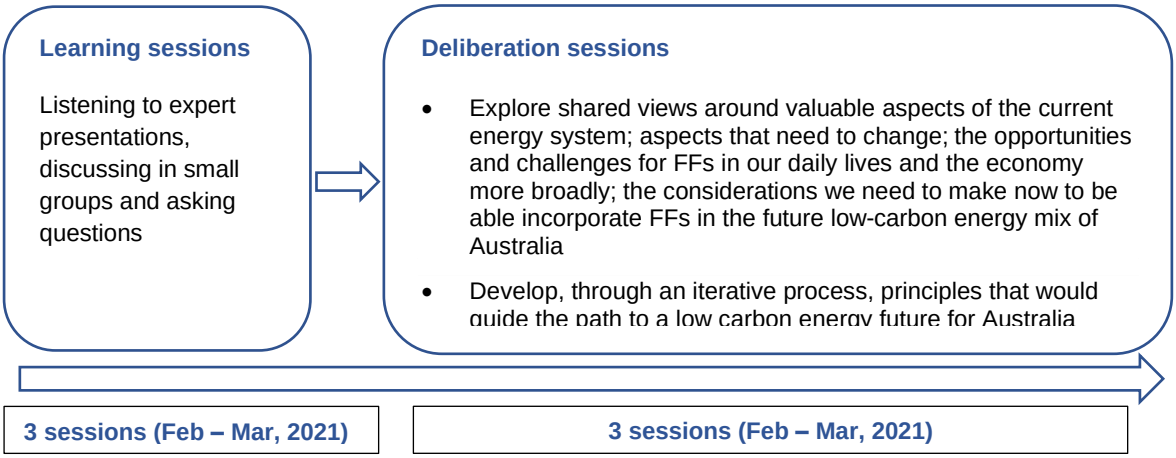

Figure 2 Citizens' Panels on Future Fuels Outline

3.2.1. Facilitation

The overall process was facilitated by Professor Peta Ashworth, the project lead, and an experienced group facilitator. The lead facilitator chaired the plenary sessions, explained the tasks, and provided direction to the work of the panels. She also clarified questions around the content and subject matter, the process and the tasks given to the participants.

At the beginning of each session the lead facilitator explained the rules for interaction and asked everyone to respect the rules. These rules included that participants should be: (i) honest and respectful in their communication; (ii) listen to, try to understand and/or disagree with each other in a fashion of curiosity not hostility; and, (iii) be brief so that everyone has an opportunity to participate.

After the Monday combined learning sessions, each panel met on a designated weeknight for the deliberative sessions where participants worked in smaller groups to address specific questions. Small group or 'breakout' discussions involved between 5 and 7 participants supported by UQ researchers and postgraduate students who acted as facilitators. The facilitators attended a training session prior to the start of the panels where they were fully briefed on the project, their role as facilitators and principles of facilitation. The training also included a practice session of how to navigate Zoom, use software and settings, and take notes. The main role of the facilitators was to ensure that all participants had the opportunity to speak and that the discussions remained

focused and on task. Although the deliberative sessions were all recorded, the facilitators were also responsible for taking notes and capturing participants' ideas that emerged during the discussions and reporting back to plenary sessions.

3.2.2. Information provision and questioning

Based on previous research findings, it was assumed that participants would have little prior knowledge of the topics. Therefore, subject matter experts were included in the sessions to provide adequate information to inspire an informed discussion, and to build awareness and knowledge among participants.

Participants were provided with information in various formats, both prior to and during the workshops. A special briefing guide was developed to provide a concise overview of the research aims and objectives, explain the participants' roles in the research and give some basic information about energy, climate change and actions to reduce CO_2 emissions within the Australian context (see Appendix 3: Presentations to Citizen Panels). The guide was emailed to the enrolled participants, along with the agenda for the first week, prior to the first information session. There were no specific requirements that participants should read the guide. Rather, it was optional reading to help them understand the context of the project and introduce them to the wider content surrounding the panels.

The briefing guide was developed in close consultation with the IAP and UQ academics who have specific expertise in energy and low-carbon technologies. A draft was first circulated to colleagues within UQ. Once their feedback was incorporated, the briefing guide was sent to the IAP members. Some IAP members provided feedback in written form, others presented their comments and suggestions in a group discussion setting that was held a week prior to the start of the project. Overall, valuable, and constructive feedback was received and incorporated, to the extent possible, in the final version of the guide.

Over the three learning sessions, participants heard presentations from nine experts who covered different topics related to the subject matter (see Table 1). At the start of the expert selection process, an initial list of experts and topics was proposed with four presenters identified to cover four key topics, namely climate change, energy, future fuels and low-carbon energy scenarios. After discussions with the IAP, the scope and the number of experts was broadened to include more aspects of the energy transition debate and process.

The experts who were included in the final list of presenters had different backgrounds. For example, the information on climate change and hydrogen was presented by scientists from the Bureau of Meteorology and the Commonwealth Scientific and Industrial Research Organisation (CSIRO); the topics on energy, biogas and energy vulnerability were presented by academics from UQ, the University of Adelaide and RMIT; the consumer perspective and the trade-offs of energy transitions were covered by advocates who represented NGOs and consumer advocacy; and, two private consultants explained the two potential decarbonisation pathways (all-electric and future fuels).

Table 1 Presentation Topics

Topic	Presenter background	Presentation outline
Climate change	Scientific	Australia's changing climate; Oceans; Greenhouse gases; Future climate projections (temperature, rainfall, fire weather; sea level)
Energy today	Academic	Primary energy and energy usage; Fossil energy; CO_2 emissions; Quality of life; Energy consumption & exports; Electricity; Gas; What is a way forward
Hydrogen	Scientific	Hydrogen as an energy carrier; Hydrogen in Australia; NHS and other government initiatives; Hydrogen demonstration projects; Uses of hydrogen (transport; gas networks; industrial processes; electricity generation; export)
Biomass/biogas	Academic	Organic waste generation; Drivers for biomethane industry; Food/garden waste generation; Biogas production; Biogas and zero net CO_2 emission
Low-carbon energy transition and consumers	Advocate	Why is transition to low-carbon energy necessary; Disadvantaged groups; Gas transition for residential consumers; Targeted and equitable policy

Potential decarbonisation pathways	Consultant	Current energy supply; Emissions intensity; Reducing emissions from gas and electricity; Existing energy supply chain; Hydrogen supply chain; Electricity supply chain; What are the costs to society?
Trade-offs and challenges of energy transitions	Advocate	Economic/Social/Environmental trade-offs; Energy transitions over the years; Trade-offs of energy transitions
Energy utility case study	Consultant	Net zero emissions strategy for gas assets by 2050; Change management journey; Zero net emission options
Energy vulnerability	Academic	Energy poverty and vulnerability; Why does it matter; Energy vulnerability measures

Note - Refer Appendix 3: Presentation to Citizens' Panels for complete set of information provided to participants

The experts' presentations were designed to provide the information relevant to the tasks and the work participants would be asked to perform in the deliberative sessions. Each expert presentation and time for Q&A varied in length depending on the content allocated to the presentation. Overall, participants spent about one third of their time learning and asking questions (See Appendix 1: Questions via Deliberations) about future fuels (hydrogen and biomass), about one third on climate change and energy (Appendix 1: Table 1) with the other third shared between the remaining topics covering the low-carbon energy transition and consumers; trade-offs and challenges in energy transitions; energy vulnerability; and future fuels pathways (Appendix 1: Table 2 & Table 3).

Participants had the opportunity to ask their questions in the Q&A session immediately following the presentation or to submit their questions via the chat function in Zoom. The questions submitted online were collected by the research team and a written response to each question was included in the Weekly reports distributed to all participants. Participants mainly asked questions that required further information around the presented topics, clarifying content of the presentations and requesting more detailed information related to either the presented data or the content. Most questions submitted and answered in the Weekly reports were technical questions relating to future fuels, energy and climate change. In an adaptive response to time limitations and participant requests, the time allocated for Q&A was different across the learning sessions. For week one and three learning sessions, the Q&A time took place after all presentations were finished, while for the week two learning session, Q&A time followed each presentation.

3.2.3. Questions and tasks for deliberation

The learning sessions were a valuable component of the deliberative process but were time consuming and so ensuring the effective use of the remaining time available for deliberation was essential. The tasks and questions for deliberation were designed in accordance with the project objectives and were agreed by the IAP and the FFCRC Industry Steering Committee. Figure 3 and Figure 4 below provides a summary of the specific steps and tasks of the panels for each week and the specific expected outcomes for each task. The process involved three distinct parts: exploratory – where participants explored questions about energy and future fuels; iterative – where participants developed a set of 'principles' to guide the path to a low-carbon energy future in Australia; and evaluative – where participants discussed two potential decarbonisation pathways (all-electric or incorporating future fuels) and evaluated how well each of those pathways met their agreed set of 'principles' for a low-carbon energy future.

Exploratory Phase. Participants addressed four exploratory questions in a small group setting. Because the dynamics of each deliberative session were slightly different, the time participants spent in the small group discussions varied by panel and by task. On average, participants spent approximately 20 minutes exploring each question. Their views and ideas were captured by the facilitators and recorded onto live, sharable worksheets (Google docs). At the end of each week, the project research team compiled the ideas from the Google docs, organised these into broader themes and then communicated those back to the participants for verification and comment through the Weekly reports. The outcomes of the small group discussions are presented in Section 4.

Iterative Phase. To develop the set of 'principles' that each panel believed should guide the path to a low-carbon energy future for Australia an iterative process was used that carried on throughout the entire deliberative process. In week one, participants were asked to brainstorm ideas for principles. The ideas from each of the

panels were collected and after the deliberative session, organised by the project team into broader themes. The themes were then fed back to the panels in week two. In the week two deliberation sessions, each small breakout group received a set of themed ideas and participants were asked to summarise those ideas into one or two full sentences to represent a 'principle'. The draft principles were then discussed and edited in a full panel plenary session. Because the process of editing the principles to an agreed version took longer than initially planned in the agenda, in some cases participants ran out of time to finalise the wording of all principles. The final principles were therefore finessed by the project team using as far as possible the same words supplied in the draft principles for authenticity of voice, and these were presented to the panels at the beginning of week three for voting and agreement. At completion of this process three sets of principles were developed, one by each panel.

Evaluative Phase. Finally, in week 3, participants were presented with a hypothetical future scenario and were asked to explore each of the two decarbonisation pathways (all electric or one that transitioned to future fuels) that had been presented to them in the final learning session. First, participants were asked to outline the changes and adjustments that would need to be made to their lives based on the information they were given for each pathway. The second part of the exercise was to then evaluate how well each decarbonisation pathway met the principles they developed as a panel.

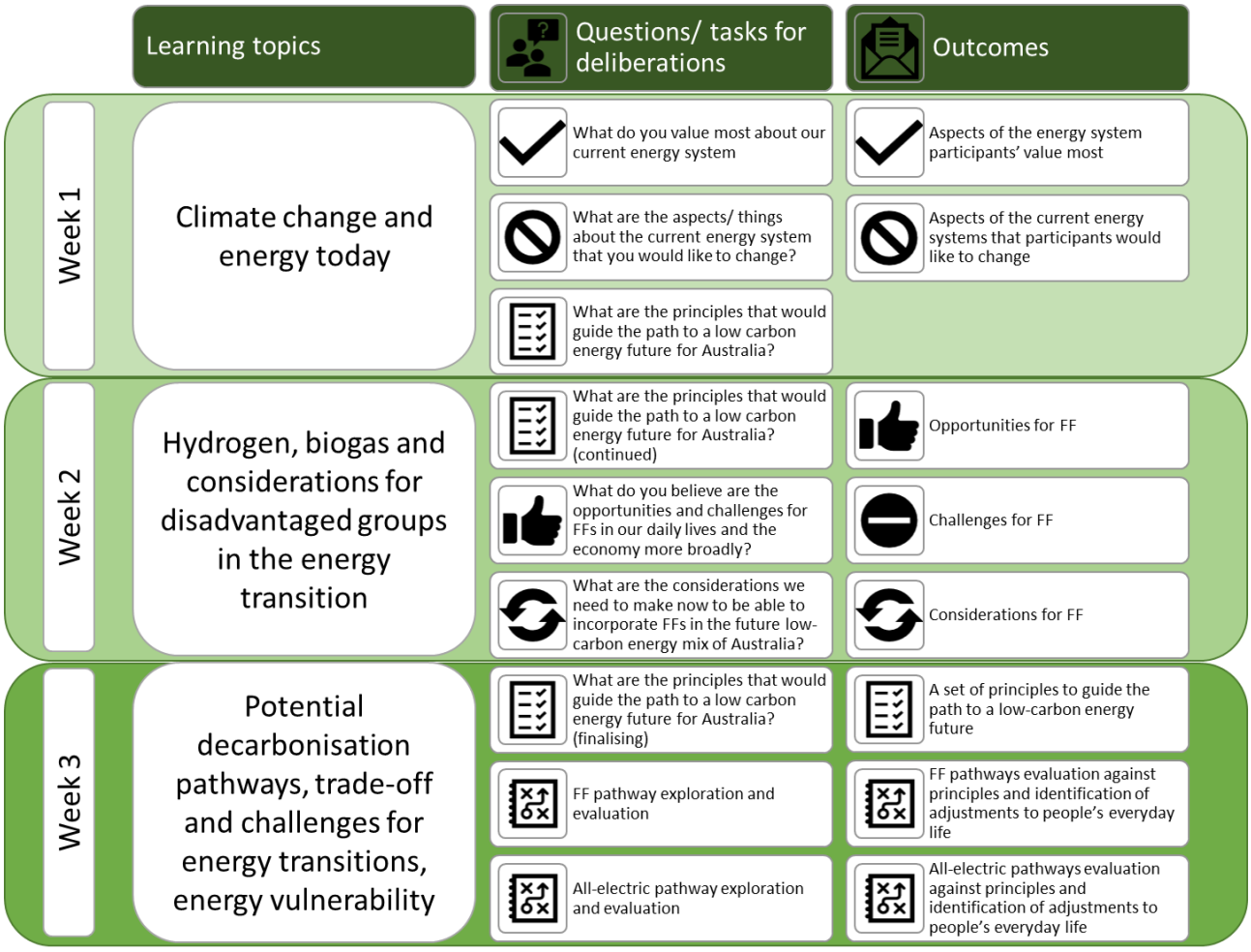

Figure 3 Citizens' Panels process – deliberations and qualitative outcomes
Note - Refer Appendix 3: Presentation to Citizens' Panels for complete set of information provided to participants

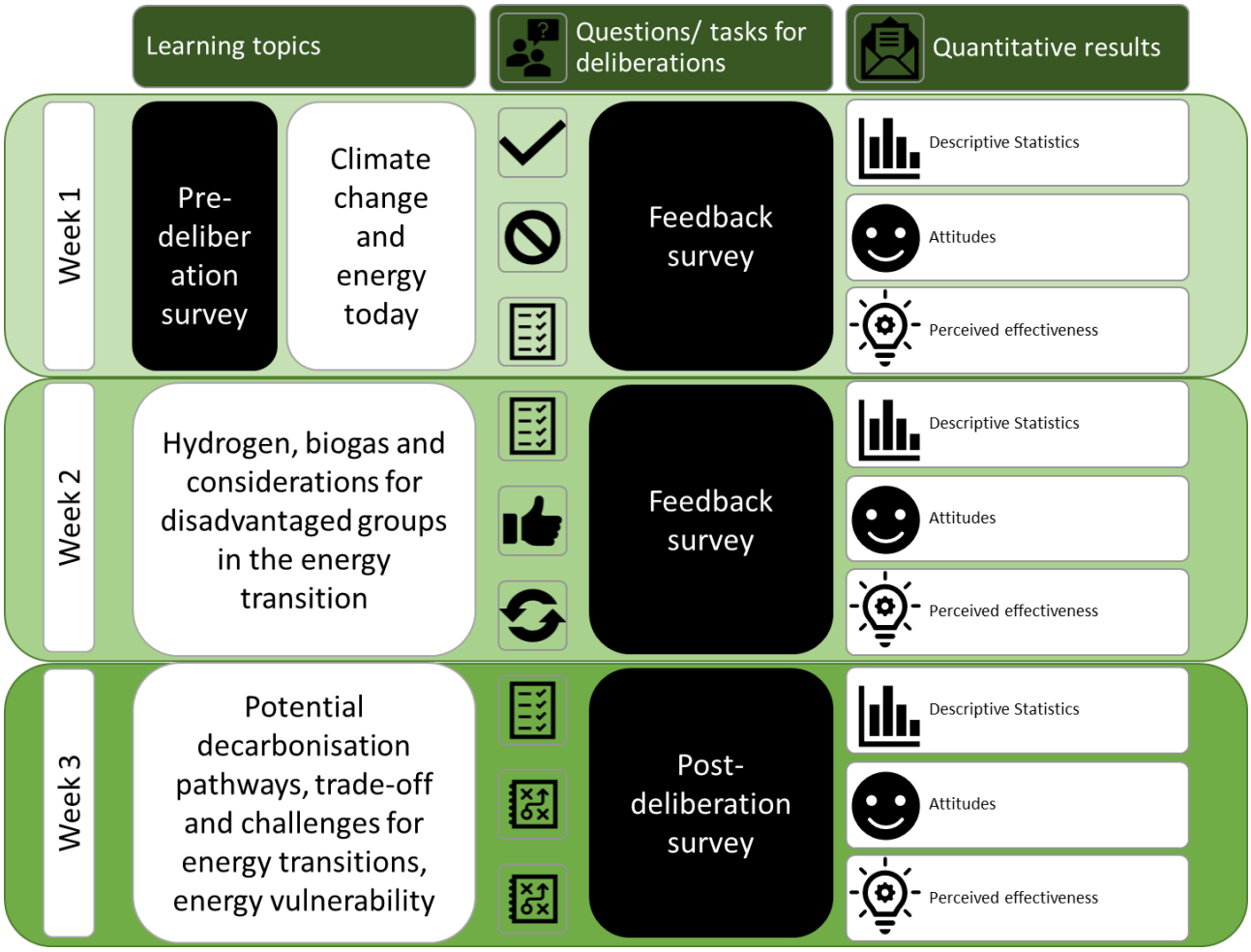

Figure 4 Evaluation of Citizens' Panels process - surveys and quantitative outcomes

3.2.4. Weekly agendas and reports

A weekly agenda was emailed to each participant prior to the commencement of the week's learning session. The agenda outlined the learning topics and specific activities for the week. At the end of each week, a Weekly report was emailed to the participants. The report combined the PowerPoint presentations for the week, answers to the questions that were not answered during the Q&A session, outcomes of the small group deliberations and results from the evaluative surveys of participants' experience with the process for that week.

3.3. DATA ANALYSES

In each of the deliberative sessions, the facilitators created sharable Google documents that captured the responses of the participants. These documents, together with the full transcripts from the recordings allowed for further qualitative analysis both during the citizens' panel processes and afterwards. For example, all the information that was reported by each of the small group facilitators through Google documents was coded to different themes and reported during the weekly updates. Transcriptions of the small group discussions were coded to identify common themes and these were checked against the original codes from the Google documents. Quotes to highlight themes have been selected to provide examples and meaning to the summary information.

Information from the pre- and post- surveys responses were first checked for incomplete or unmatched responses. Using participants' unique identifiers there were 105 participants that could be matched with their survey responses over time. These are reported as descriptive statistics showing changes in means for responses before and after the deliberations. This analysis provides insights into how participants' attitudes towards the various technologies, including hydrogen changed as a result of the panel process. There are also

several measures which point to how the participants viewed the effectiveness of the panels and their involvement in them which are also included in this report.

3.4. RECRUITMENT OF PARTICIPANTS

For each panel there was a goal to recruit 42 participants from each of the three locations - Greater Melbourne, Illawarra/Wollongong region and South Australia - in quotas that would represent the Australian population, to the extent possible, for each location. Basic demographic criteria of gender, age, employment and CALD[1] status was selected to guide the recruitment. A market research company used an existing market research panel, applying a non-probability quota sampling approach based on the characteristics of the Australian population from the 2016 Census data.

The first step of the recruitment process was to identify those members of the broad market research panel who would be willing and interested to take part in this research, given the time and commitment requirements. Prospective participants (who had already registered their interest to participate in paid research) were invited to complete a brief online screening survey, which included the initial selection criteria. In total 666 members of the market research panel responded to the call with 508 respondents meeting the selection criteria. The next phase of recruitment involved phone calls from the recruitment agency to respondents to provide them with an overview of the project, including times and dates as per the Participant Information Sheet approved by the University of Queensland Ethics Committee. It was stressed that respondents were expected to commit to take part in all 6 sessions and would be offered $450 for their time. If respondents were happy to commit to the research, a booking was initiated, and their participation confirmed. The recruitment process took two weeks, between Feb 8 and Feb 22, 2021.

Most quotas were filled easily, however the recruiters experienced some difficulties identifying people who were interested to participate and could commit to the time requirements of the project in regional areas and among younger age groups (35 years and under). In addition, there were some last minute drop-outs that occurred in the 24-hour period between finalising recruitment and the start of the project, reducing the actual sample size to 40 for Greater Melbourne and South Australia and 37 for the Illawarra/Wollongong region (respondents who did not attend were not paid).

3.5. CITIZENS' PANEL COMPOSITION AND CHARACTERISTICS

3.5.1. Demographics

The composition of each citizens' panel according to gender, age, CALD, employment status and level of education is presented in Table 2 below. The participants were generally well-educated with an over representation of people with a bachelor's degree or higher. In South Australia and the Illawarra region, there were twice as many participants with a degree in the panel than would be expected in the Australian public, and in the Greater Melbourne panel there were three times as many.

Table 2 Composition of panel and their socio-demographic characteristics

	Greater Melbourne			Illawarra/Wollongong			South Australia		
Variables	**Quota (n)**	**Start**	**End**	**Quota (n)**	**Start**	**End**	**Quota (n)**	**Start**	**End**
GENDER									
Male	20	19	15	21	17	15	21	19	18
Female	22	21	20	21	20	18	21	21	19
AGE									
20-24	4	3	3	4	7	7	4	3	3
25-34	9	8	6	7	5	2	7	7	6

[1] CALD - Culturally and linguistically diverse

	Greater Melbourne			Illawarra/Wollongong			South Australia		
Variables	**Quota (n)**	**Start**	**End**	**Quota (n)**	**Start**	**End**	**Quota (n)**	**Start**	**End**
35-44	8	8	6	7	7	6	7	10	9
45-54	7	7	7	7	6	6	7	5	4
55-64	6	6	6	7	3	3	7	6	6
65+	8	8	7	10	9	9	10	9	9
TOTAL	**42**	**40**	**35**	**42**	**37**	**33**	**42**	**40**	**37**
CALD	**15**	**16**	**15**	**10**	**9**	**8**	**12**	**11**	**11**
EMPLOYMENT STATUS									
Employed full time		21	18		10	7		13	12
Employed part time		6	5		10	10		12	11
Shift work		2	1		1	1		1	1
House work/student /unemployed		6	6		6	5		9	8
Retired		5	5		10	10		5	5
LEVEL OF EDUCATION (%)									
Year 10 or below		3%			0%			3%	
Year 12 or equivalent (11)		3%			6%			24%	
Certificate III or IV		14%			21%			20%	
Advanced Diploma / Diploma		9%			28%			11%	
Bachelor's degree level and above		71%			41%			42%	

3.5.2. Participants' Household Energy Profile

Participants' energy use profiles were captured in the initial pre-deliberation survey. All participants in all panels indicated that they have access to electricity in their homes, however the use of other energy sources varied across panels. Almost all participants (97%) from the Greater Melbourne indicated that they use reticulated gas. The share of reticulated gas users in the other locations was 75% for Illawarra/Wollongong and 68% for South Australia. Higher proportions of reticulated gas users correspond with lower proportions of bottled gas users – 42% of participants from South Australia use bottled gas in their households, while only 20% in Greater Melbourne. As anticipated, South Australia had the highest proportion of Solar PV users (41%) but the solar for hot water systems is lowest (7%) while 21% of the participants from Greater Melbourne and the Illawarra region reported that they use solar for hot water systems (see Table 3). Given the high percentage of households who reported having access to gas, either reticulated or bottled, across each of the panels, it is difficult to ascertain quantitative differences in the preferences.

Table 3 Participants' household energy profile

	Total	Greater Melbourne	Illawarra/ Wollongong	South Australia
Electricity grid	100%	100%	100%	100%
Gas mains	80%	97%	75%	68%
Gas bottled	30%	21%	27%	42%
Solar hot water	15%	19%	19%	7%
Solar PV	35%	29%	35%	41%
Battery storage unit	9%	6%	13%	7%
Battery electric vehicle	5%	9%	7%	0%
Hybrid vehicle	8%	13%	7%	3%

4. Results

The results section is divided into two main sub-sections. The first presents key qualitative outcomes of the deliberation process. It includes how participants value the current energy system, the opportunities and challenges of future fuels perceived by participants, considerations for incorporating future fuels in the decarbonization process and principles to guide choices around Australia's low-carbon pathways. The second presents a range of the quantitative findings which support the qualitative analysis. It compares pre- and post-citizen panels on support for hydrogen and their willingness to accept it in their daily household use and highlights the change in participants' views on energy priority and export due to participation in the citizen panels.

4.1. OUTCOMES OF THE DELIBERATION

This section presents the outcomes of the citizens' panels on the role of future fuels. These are presented separately for each question/task addressed by the participants throughout the course of the process. Below, the key themes that emerged from each of the panels is presented by location. The first two questions posed to participants asked them what they value most about Australia's current energy system and what aspects they would like to see change. The questions were general in nature and were not specifically focused on the regional locations.

4.1.1. What participants' value most about our current energy system

After a period of deliberation, participants produced a list of characteristics of the current energy system that they value. These lists were thematically coded to identify the recurring and different themes that arose and are detailed in Table 4 below. Across the three panels participants identified similar aspects of the energy system they valued most. These included energy reliability, readily available energy to support people's lifestyles and a diversity in choice of energy sources and providers as reflected in the quotes below.

> *What do we value most of the current energy system? … We really like the idea that you know citizens are allowed to have different forms of electricity generation for example, you can choose to have electricity supply … also quite a relatively high degree of transparency. P2*

> *One of the things I value at the moment is that there are incentives for people to be able to put solar panels on [their roofs] in Victoria, and therefore sort of make a difference in their energy bills … So, if you make 20% on your money, hey, that's a really good financial incentive as well as environmental incentive. P3*

> *I'm a freelancer, so I go months without work, [I value] that it's affordable as well. Like, I don't stress so much about the gas bill, because it's always quite low. So I'm not going to be like, I better not use too much water or whatever because it's going to blow my budget on bills or that kind of thing. I appreciate that. It's as much as it's consistent. P4*

When identifying these valuable aspects, participants reflected on their personal experiences stemming from the specifics of the local context. For example, the Greater Melbourne panel valued the reliability of their energy source. Panel members emphasised how important energy reliability is in relation to severe weather events that negatively affect the outer areas of greater Melbourne. This included the Dandenongs, where winter temperatures can be below freezing, and residents regularly lose power during storms. As a result of regular power outages in greater Melbourne, some panel members claimed that having a combination of power sources, namely gas and electricity, was their preferred option to ensure reliable energy in precarious weather.

> *We live in the Dandenongs, you know, if a tree comes down, everything goes down*.

> *I live in the Dandenongs, and we completely understand the issues that you can have with transmission lines and your power going out and losing your electricity, which is why we actually like having gas as well. Everything just being one source of energy doesn't make me comfortable.*

Table 4 What do you value most about our current energy system?

Greater Melbourne	Illawarra/Wollongong	South Australia
Reliability of the energy system (17)[2]	Readily available energy to everyone to support their needs and lifestyle (17)	Reliability of energy supply (18)
Readily available energy to everyone to support their needs and lifestyle (16)	Diversity of choice - providers and sources (17)	Available energy to support our lifestyles, energy security (13)
Utilisation of smart technologies to monitor energy usage (9)	Reliability of the energy system (15)	Diverse options of energy sources, providers (11)
Diversity of energy sources and providers (7)	Affordability (5)	Affordability and price (9)
Affordability (6)	Safety (4)	The availability of solar energy and battery storage (8)
Flexible arrangements with providers/green power (5)	Economic benefits (1)	Quality of service, service providers (7)
The benefits of exporting of energy (1)		Safety (2)

The South Australian panel were the only group to identify the availability of solar energy and battery storage as a valuable aspect of their energy system. The value placed on solar energy and battery storage by South Australians appeared to stem from their history of energy blackouts, including the infamous blackout of 2016 that triggered the installation of the world's largest lithium-ion battery to store energy from a nearby wind farm.

> *After going through the catastrophic power failure that we had in 2016, it really brought it home, how much we depend on energy and electricity*.

Panel members expressed approval of South Australia's energy mix of coal, solar and wind. They also felt that South Australia offered the right conditions for renewable energies, particularly solar, with significant amounts of sunshine each year and plenty of land on which to place solar and wind farms which would not compromise the use of viable, arable farming land. While the state has embraced renewables, panel members from South Australia place an importance on their state government retaining ownership of energy assets going forward, including solar farms and battery storage. This was felt to ensure that the assets are used to promote energy reliability for all rather than simply profits for a private company.

> *It's good that there's versatility of electricity options in South Australia*.
>
> *In South Australia, we've already got foreign ownership of what used to be the Electricity Trust of South Australia, but you can't go back can you?*

Energy affordability was actively discussed as an aspect of value among participants in the Greater Melbourne and South Australia panels, however it was only briefly mentioned in the Illawarra/Wollongong panel. Panel members explained that they are open to new sources of energy so long as the cost does not increase significantly.

> *I would hope that cost would sort of stay the same*.
>
> *If the cost did go up, I don't think I could deal with that. But if they didn't go up, then that would be fine*.

Panel members also explained that affordability of new energy sources extends beyond just paying energy bills to also include replacing or updating appliances to adapt to new energy sources. For example, changing gas appliances to electric or hydrogen appliances. Panel members stated they could adapt to changing sources of energy depending on costs and called for government subsidies or incentives to assist households in making the change to a new energy source

[2] The number in brackets indicates the number of comments/aspects that fall within the broader category, in this case there were 17 comments/aspects discussed by the participants in the small group discussions that referred to the reliability of the energy system.

You could have a lot of expense depending on the appliances and how retrofittable they are.

People are more concerned about costs in terms of, you know, the change in appliances or retrofitting the appliances.

I think it [tolerance for new energy sources] depends on how expensive that's going to be and if there's going to be subsidies.

Despite being open to new energy sources, some panel members viewed cooking and heating with gas as superior to electricity and described it as important to their needs and lifestyle. Panel members expressed a particular attachment to cooking with gas, stating that the speed with which they could control the temperature influenced their reluctance to switch to cooking with electricity.

I use a lot of gas for cooking...I've used electric and I can't stand it.

I don't want to give up my gas cooker.

However, other panel members were quick to defend cooking with electricity, stating that electricity-based induction was just as fast and easy to control as gas.

I can vouch for induction.

I've got so much power under my hot plate that you can't even imagine what it's like. That's a new induction.

In the colder climate of greater Melbourne, heating a home efficiently and inexpensively was important to panel members and some panel members felt strongly that achieving this was best done with gas.

It's more expensive to use electricity for heating than gas.

4.1.2. What participants would like to change about our current energy system

Table 5 highlights the aspects where change was desired. The most frequently mentioned change related to the 'greening' of the energy system through investment in new technologies for both domestic and export. Political will and policy implementation to enable a transition were also recognised as important, as was price, i.e, changes to ensure energy affordability.

I think it's about being environmentally friendly, but also having a cost saving there. And I think it puts less load on the grid as well. Obviously, more solar panels on the less load we've got on the grid in summertime.

Table 5 What are the aspects/things about our current energy system that you would like to change?

Greater Melbourne	Illawarra/Wollongong	South Australia
Changes to allow for more renewable, cleaner and sustainable sources of energy and technologies for domestic use and export (17)	Changes to allow for more renewable, greener and sustainable sources of energy (17)	Changes related to tariffs, cost and rebates (18)
Changes around solar panels tariff, billing and alternative providers (14)	Changes that require government action and interventions (15)	Changes related to policy (12)
Change at government and political level (10)	Mechanisms to increase affordability (10)	Research and investment in new technologies (12)
Changes around government regulation on energy prices (gas prices and affordability) (10)	Education and information provision around energy savings and the various energy sources out there (6)	Changes and improvements related to energy providers (12)
Technological advances and exploration of new/alternative technologies (7)	Research and funding mechanisms for new/alternative technologies (4)	The role of government and politics (8)
Change in energy use behaviour at individual and community level (4)	How companies operate (4)	Decentralisation and location of infrastructure (4)
Other changes briefly discussed in small groups:		Need for education, simplification of information (3)

Greater Melbourne	Illawarra/Wollongong	South Australia
The use of different types of resources to generate energy The disadvantages of solar panels – particularly life-cycle issues The need for education around energy savings and consumer impact Transparency of energy companies Energy export		
		Competition between energy suppliers (3)
		Changes of transport fuels sources (2)

Across the geographic locations Greater Melbourne and Illawarra/Wollongong panels most commonly discussed changes that would allow for more renewable, cleaner and sustainable sources of energy and technologies, while changes in tariffs, costing and rebate schemes were desired among the South Australian panel. Energy affordability was discussed across the three panels with emphasis on changes to solar panel feed-in tariffs and incentives, billing and implementing new government led mechanisms that would increase affordability for consumers.

4.1.3. Opportunities for future fuels in their daily lives and the economy

Across all three panels the opportunities for future fuels were seen as environmental benefits, benefits associated with public health (i.e. less pollution), and social advantages of utilising greener energy sources. The use of future fuels was also discussed as enabling the process of transitioning to a low-carbon energy future. The economic prospects of the implementation of a new fuel, along with opportunities for creating new jobs were also considered as favourable possibilities (see Table 6).

> *I think a good opportunity would be in terms of increasing reliability for regional areas, especially with maybe hydrogen as a seasonal storage. Especially in places where there's lots of, let's say, issues with storms and trees falling and let's say in the same way that you'd have a generator, you might have a sort of hydrogen battery. But that also poses that challenge in terms of the consensus as well, in terms of electrification, versus retaining the split grid system with electricity and gas. And then we transition away from, you know, a split system, depending on which side you want to take.*

> *I think what we should perhaps capture as well is to have research resulting in renewable energy, but it should be done in such a way that people who lose a job can be re-employed in a new industry because there is a lot of resistance. For example, in Queensland because all those coal miners want another coal mine because if they don't have a coal mine, they don't have a job. So, they are resistant to progress. And it's understandable because they are scared to lose a job.*

> *But they [are] opportunities in the fact that we could actually set up mini plants and hopefully bring the cost down by having production plants, instead of central production plants, we're having lots of smaller production plants, effectively in the service station, you can set up a hydrogen plant, you can get a hydrogen piece of equipment I saw yesterday, which is like two meters by three meters and will produce hydrogen for you.*

Table 6 What do you see are the opportunities for future fuels?

Greater Melbourne	Illawarra/Wollongong	South Australia
Cleaner sources of energy and benefits to the environment and public health (7)	Environmental and social benefits (10)	Clean sources of energy and benefits to the environment and public health (7)
The transition to a low-carbon energy future and the role of government (7)	Production and usage of fuels/energy (9)	Employment and workforce upskilling (6)
Employment, workforce upskilling and skill transfer (7)	Workforce training and transition to new employment (9)	Economic and financial opportunities (5)
	Export and economic benefits (9)	The process of transitioning to a low-carbon future (5)
	Workforce training and transition to new employment (9)	
	Greening the transport sector (5)	Opportunities around transport (4)
	Community involvement and education (5)	Export (4)
		Education (2)

4.1.4. Challenges for future fuels in their daily lives and the economy

Conversely, participants saw the main challenges of future fuels to be associated with the cost and the financial implications of developing the necessary technologies and establishing the required infrastructure. Public perceptions, political will and the establishment of an adequate policy framework were also discussed among the three panels as important challenges for the implementation of future fuels. Another set of potential difficulties included the need to guarantee safety, affordability and reliability of new technologies and infrastructure as well as careful planning of employment and workforce training and the upskilling of workers whose jobs may become redundant (see Table 7).

> *I'm not sure whether it's a challenge or an opportunity - the traditional industries like coal, oil, and that sort of thing. I think there maybe needs to be a way [for them] to transition in a way and have an opportunity within the carbon neutral future ... There's a lot of experts in those areas, how do we transition them to a carbon neutral future.*

> *I think that another challenge will be to add on to the resistance, I think, just in general, for people to understand and get their heads around something different. Rather than seen as a traditional energy source, and whether there's going to be extra cost in actually having to change appliances, like what they were mentioning, yesterday, that would be a huge concern.*

> *I think the challenge is infrastructure for the new technologies, so getting out the infrastructure for the other alternative fuels that we're looking to do.*

> *This is where another challenge is - getting the information out to people who may already have a particular mindset. That may not see, you know, future fuels in a positive light. Because even like a lady in our group the other day from the Illawarra region. She said, like 45 of her family work in the coal mines. And that's her immediate family. So, she said, they just shut down coal mines.*

Table 7 What do you see are the challenges for future fuels?

Greater Melbourne	Illawarra/Wollongong	SA
Technology and infrastructure (14)	Challenges around cost (12)	Cost and financial implications (9)
Cost of establishing a future fuels industry (11)	Safety concerns (8)	Education, engagement and public opinion (8)
Challenges around public perceptions, political will and policy (9)	Employment and workforce training (7)	Infrastructure (7)
Affordability and security of supply (7)	Public perception of future fuels (6)	Reliability and safety (6)
The process of transitioning to low-carbon energy (3)	Affordability, reliability and access to available technology (5)	Affordability (4)
Safety (3)	The nature of future fuels and their generation process (4)	Workforce training (3)
Employment (2)	Uptake future fuels technologies (4)	Implementation of Technology, Transport, Export and Waste of future fuels
	Loss of fossil fuel revenue (3)	

4.1.5. Considerations to incorporate future fuels in Australia's low-carbon energy mix

To successfully incorporate future fuels into the future low-carbon energy mix of Australia, the considerations that participants thought were important to start thinking about now were broadly related to the process of how we, as a society, transition to a low-carbon energy future, so that it is equitable, safe and affordable. These included considerations around: 1) the cost and associated economic implications along with energy affordability; 2) what the governance model and the political leadership would need to be, e.g. how do we manage public perceptions and how do we educate the broader public about the transition; 3) how employment, training and upskilling an adequate workforce would work; 4) where we locate future fuels infrastructure; 5) how we manage safety and 6) how we consider and manage the export of future fuels. The ideas that arose throughout the discussions were similar across the three panels (see Table 8) and the quotes below further highlight the considerations raised.

> *I just like how it's a good opportunity for Australia to develop hydrogen and export [it]….it's important that we can expand our economy, in renewable sectors, we've been shown that Australia has so many energy resources. And if the world is looking towards that net zero carbon future, then why don't we lead the way, and we can also build our economy and like, convert our economy instead of being a coal-based economy to renewable based economy.*

> *There should be an obligation to provide energy to the citizens of Australia before exporting to other countries. The energy transition throughout the years needs to have system redundancies to ensure secure energy so the future fuels pathways is a reality.*

> *Energy is an essential service that big companies and government should act in the public interest so that energy services are equitable. Energy providers should put human and environmental impacts alongside profit.*

> *We focus on safety because traditionally, Australia's been really forward - we've been a real leader as far as safety. If you look at examples, one is Qantas where we're well known for it. If that's something we develop and take ownership of that, that would be something that we could export to other countries. Increasing the quality of what we provide in our energy sector.*

Table 8 What are the considerations for incorporating future fuels?

Greater Melbourne	Illawarra/Wollongong	SA
Considerations around governance and political leadership (14)	Planning and transitioning to a low-carbon energy future (16)	The transition towards low-carbon energy (11)
Cost, economic and financial implications (11)	Education and information provision (11)	Cost and economic considerations (9)
Providing information and education around future fuels and the move from fossil fuels (10)	Cost (10)	Affordability and safety (6)
The implications of different technologies (7)	Affordable and equitable transition (7)	Public perceptions, education and consultations (5)
Considerations around affordability, availability and reliability (6)	Governance and political leadership (7)	Employment and workforce training (4)
Transition to new employment and upskilling workforce (5)	Public opinion (4)	Government regulations (4)
Location of infrastructure (4)	Employment and workforce training (4)	Policy and political will (3)
Safety and equity (3)	Safety (3)	Export (3)
		Infrastructure (3)
		Environment

4.1.6. Principles to guide a pathway to a low-carbon energy future for Australia

As explained, over the course of the deliberation each panel was tasked to develop principles they felt should guide the path to a low-carbon energy future for Australia. During the last session of week three, participants in each group were asked to indicate whether each of the principles they had developed collectively represents their views fully, partially or not at all (see Table 9, Table 10 and Table 11).

The principles the Greater Melbourne panel developed were closely linked to notions of safety, reliability and affordability, equity and fairness in resource distribution, and energy security. The need for both government and industry to take an active role in the transition and to encourage and support scientific research and education was also highlighted as an important marker to guide the transition to a low-carbon future. Participants in this panel also pushed the idea that Australia should participate in global efforts to reduce CO_2 emissions, and this was seen as one of the fundaments to guide the process to a low-carbon energy future for Australia.

Table 9 Principles developed by the Greater Melbourne panel

Principle	Represents my views well	Partially represents my views	Does not represent my views
Every person has the right to safe, reliable, and affordable energy supplies that are supported by fair tariffs and rebates. Therefore, all Australians should have reliable, guaranteed energy when they need it and at a price they can afford.	100%	0%	0%
The implementation of new low-carbon energy technologies should be based on scientific research, education, and supported by government and industry funding.	85%	9%	6%
The new energy technologies should be safe to produce, consume, and dispose of in comparison to the current technology.	85%	15%	0%
Australia should participate in global efforts to reduce CO_2 emissions. It should prioritise the development of renewable energy, introduce targets to approach zero net carbon emissions and a code of conduct informing Australians about all energy choices.	76%	21%	3%
Energy is an essential service. Big companies and government should act in the public interest, so that energy services are equitable. Energy providers should put human and environmental impacts alongside profit.	74%	26%	0%
Government and private support for education and research with a purpose to encourage innovative and progressive technology with an	71%	26%	3%

Principle	Represents my views well	Partially represents my views	Does not represent my views
objective to produce financially viable renewable sources of safe, environmentally friendly and reliable energy.			
Governments' decisions should be apolitical and instil fair incentives for moving towards renewables and penalties for non-compliance. They should allow free enterprise to develop alternative energies at a cost-effective rate for the consumer, through tax incentives.	68%	24%	9%
There should be an obligation to provide energy to the citizens of Australia first before exporting to other countries. The energy transition throughout the years needs to have system redundancies to ensure energy security.	65%	29%	6%

While the Greater Melbourne panel developed broader principles to guide an energy transition, the Illawarra/Wollongong panel offered mixed insights. These insights related to the energy transition broadly, and more specifically to future fuels and net-zero targets. For this panel, a principle for the energy transition was to have a transparent and sustainable supply chain that is economically viable for both consumers and producers. The role of the community in the transition process and the need for information provision and education was also strongly highlighted. In terms of future fuels, participants suggested that those should be developed in a context where safety is important and environmental concerns are taken into consideration. Illawarra/Wollongong participants highlighted that it is important for such a transition to be supported by ground-breaking scientific research and innovation and guided by clear rules and guidelines to create sustainable future living.

Table 10 Principles developed by the Illawarra/Wollongong panel

Principles	Represents my views well	Partially represents my views	Does not represent my views
(Energy) companies need to be transparent with their supply chains and dealings.	91%	9%	0%
The Government should seek to transition our society by providing multicultural, reliable and transparent information/education to improve understanding that will lead to positive change.	88%	12%	0%
Build sustainable energy supply chains by recycling and considering product life-cycle with lowest possible environmental contamination.	88%	12%	0%
Future fuel sources should have safety as the highest priority.	84%	16%	0%
Future fuels and energy usage should be prioritised along with environmental concerns. The creation of sustainable renewable resources should be underpinned by legislation.	84%	16%	0%
Green energy should be economically viable for producers and consumers of any economic status and residential location.	84%	11%	3%
Equitable and sustainable community-based decisions surrounding energy consumption, production and employment for current and future generations.	84%	12%	3%
Governments, in consultation with the corporate sector should create policies that support private infrastructures to ensure ongoing reliability while not compromising on quality.	66%	28%	6%
Transition to net-zero carbon emission and future energy usage in general requires early investment in ground-breaking scientific research and innovation - including more directional research into non-renewable and low-carbon energy. That research should be future focused, drive sustainable power, ensure new technology is safe for all Australians and the environment and inform industries and Government decision processes.	65%	35%	0%
Successfully achieve net-zero by 2050 without needing to radically change infrastructure, with clear rules and guidelines to build sustainable future living.	63%	33%	0%
The Government should seek out community views on how Australia should transition to reduce its carbon footprint.	59%	38%	3%

For the South Australian panel principles included reliability and affordability, transparency of the transition process and the way companies operate, reliance on scientific evidence and sustainable planning and development of infrastructure. A special emphasis was put on access to and provision of information as well as public education around energy production and usage and technologies.

Table 11 Principles developed by the South Australian panel

Principles	Represents my views well	Partially represents my views	Does not represent my views
Develop community and public education for Australians to understand energy production, usage and disposal to increase overall efficiency/efficacy in the transition to cleaner energy while reducing waste/misuse	88%	12%	0%
Resources and new technologies relating to renewable energy that originate from Australia should be owned by Australians instead of capitalising on them through overseas ownership. Therefore, Australia should be operating and building infrastructures that are within Australia's operation capabilities.	85%	15%	0%
The transition to a low-carbon future should not negatively affect the reliability and affordability of Australia's energy supply of Australia.	85%	15%	0%
Public policy should be adjusted to keep electricity providers honest and transparent seeking to meet clean energy usage targets as well as assisting and incentivising consumers and businesses to move towards renewable energy to achieve a carbon neutral home and businesses by 2050. This should be done by exploring alternative options including emerging technologies.	82%	15%	3%
Establish an independent Government authority to use scientific evidence and provide evidence-based solutions to consult transparently with the community to make final decisions to reduce our carbon footprint and preserve our environment for the future.	79%	18%	3%
Planning and development play a central role to ensure sustainability and minimal impact on communities, people, livelihoods and the environment. This could be achieved by selecting infrastructure which reduces the impact of urbanisation.	76%	18%	6%
Access to updated information and simple reports produced by energy providers, which show the method of generation, will support people to make informed choices and to become aware of the long-term impact of various different technologies.	62%	38%	0%

4.1.7. Responses to the two alternative pathways

During week three learning sessions, participants were presented with two potential decarbonisation pathways that included a future fuels scenario (where gas is replaced by hydrogen) and an all-electric scenario (where gas is replaced by only electricity) (for more details on the presented pathways see the presentations in Appendix 3). In the deliberation sessions during that final week, participants were put in a hypothetical future situation and asked to discuss each of the two potential decarbonisation pathways separately. First, they were asked to outline changes and adjustments that they would potentially have had to make to their lives based on the information they were provided for each pathway. The second part of the exercise was to indicate how each pathway met the principles they had already developed to guide the pathway towards a low-carbon energy future.

This last session posed some challenges to participants, which influenced the outcomes of the discussions. People struggled with the hypothetical situations and had difficulty thinking into the 'future' to imagine how the pathways would impact their everyday lives. Participants shared either in the plenary sessions or in the small discussions with the group facilitators that they would require more information and context to be able to fully address the tasks. Participants also grappled with assessing the extent to which each pathway met their principles. The limited time for discussion made this exercise even more challenging and these considerations should be noted in the interpretation of the results below. The quotes below highlight some of the deliberations that emerged in relation to future fuels and all electric.

If we're saying imagine the future fuel pathways reality, so if I were using hydrogen as a generator, for example, what changes or adjustments do we have to make to our lives under this scenario? … I guess, are we asking how many of us out of the six or whatever people there are? How many will tolerate the initial cost?

So, we have future fuels … is everyone going to have safe, reliable and affordable energy supplies? Well, it's very hard to judge. Well … we did see the people that were struggling to heat their homes … I don't know whether everyone will have that still, unless something else happens. Unless we have a change of government policy, you know, it's costly. It'll partially get there. It'll get there for most people, but I don't think it will get there for everyone. But that's more our welfare commitments rather than whether we have future fuels.

Well, it's hard to tell when we don't know what the price is going to be, is going to be more expensive than electricity and gas? If it is, then it doesn't meet it necessarily. But if it's below, then it does. We don't know what the price is going to be.

I don't think that much that would change [with an all-electric pathway]. Because there's a lot of states that are already mostly electricity in the first place. Like Tassie and ACT. I don't know about any other states, but I'm not sure. Like, I can't think of much that would change.

The key highlights from the deliberative processes and the voting outcomes are presented below separately for each group and each pathway.

4.1.7.1. Low-carbon pathways evaluation: Greater Melbourne

a. Future fuels pathway

Aspects of participants' daily lives related to energy use and experience that were considered to stay the same included:

- Panel members anticipated little to no change in supply for people who already use electricity for all their energy needs. Providing electricity from a future fuels' pathway is reliable (particularly during storms and extreme hot and cold weather that is characteristic of Greater Melbourne), citizens thought they could expect a similar service to what is available currently.
- Where citizens already have appliances that use electricity (as opposed to gas), citizens expected little to no expense in receiving electricity from a future fuels pathway as they felt they will not need to adapt or replace current appliances as electricity will still be an option.
- Under a future fuels' pathway, panel members expressed their desire that supply costs should remain comparable and affordable relative to current costs given Greater Melbourne's reliance on continued heating during winter.

Aspects of participants' daily lives related to energy use and experience that would require changes and adjustments:

- Panel members questioned the expense involved in either retrofitting current appliances and/or buying new appliances to accommodate future fuels, particularly changing from gas to electricity. Panel members raised important questions over who bears responsibility for this cost in the event that citizens are renting their accommodation, and whether landlords would pass this cost on to renters. The link between energy and housing costs was pertinent to panel members who currently don't own their home, and for some panel members who felt that home ownership was out of reach.
- For a future fuels' pathway, panel members also discussed the need for additional infrastructure and changes to current infrastructure, for example, to allow for charging electric cars. Panel members stated that these infrastructure requirements would be needed at all workplaces, schools, shopping centres etc. Potentially, charging costs would then be borne by the property owner rather than the current situation where individuals pay for their own petrol.
- With the shutdown of coal fired power stations in Victoria over recent years, panel members expressed interest in creating further opportunities for training and development in technology that is needed for a future fuels' pathway.

- Panel members wanted the introduction of government support through subsidies and rebates to offset the costs to individuals and businesses in moving toward a future fuels' pathway, particularly if the transition required adjusting or purchasing new appliances and equipment.
- Some changes raised by panel members were not physical or financial but rather emotional. Panel members from Greater Melbourne expressed attachment to cooking and heating with gas. With high rates of mains gas to residences, some panel members felt strongly that heating and cooking with gas was superior to electricity. Heating with gas was through to be more efficient in the colder climate and improved control over temperature was the main reason given for the preference for cooking with gas. While panel members were, on the whole, open to a future fuels' pathway, they expressed regret at changing from gas in relation to heating and cooking.

Table 12 How the future fuels pathway meets the Greater Melbourne principles

Principles	Yes	No	Partial	N/A
Every person has the right to safe, reliable, and affordable energy supplies that are supported by fair tariffs and rebates. Therefore, all Australians should have reliable, guaranteed energy when they need it and at a price they can afford.	26	1	5	2
There should be an obligation to provide energy to the citizens of Australia first before exporting to other countries. The energy transition throughout the years needs to have system redundancies to ensure energy security.	16	2	15	2
Energy is an essential service. Big companies and government should act in the public interest, so that energy services are equitable. Energy providers should put human and environmental impacts alongside profit.	25	0	8	1
Governments' decisions should be apolitical and instil fair incentives for moving towards renewables and penalties for non-compliance. They should allow free enterprise to develop alternative energies at a cost-effective rate for the consumer, through tax incentives.	12	3	17	2
Government and private support for education and research with a purpose to encourage innovative and progressive technology with an objective to produce financially viable renewable sources of safe, environmentally friendly, and reliable energy.	33	1	0	0
Australia should participate in global efforts to reduce CO_2 emissions. It should prioritise the development of renewable energy, introduce targets to approach zero net carbon emissions and a code of conduct informing Australians about all energy choices and their environmental impacts.	33	1	0	0
The implementation of new low-carbon energy technologies should be based on scientific research, education, and supported by government and industry funding.	26	1	7	0
The new energy technologies should be safe to produce, consume, and dispose of in comparison to the current technology.	29	0	5	0

b. All-electric pathway

Aspects of participants' daily lives related to energy use and experience that were considered to stay the same:

- Panel members claimed that citizens who currently solely rely on electricity would experience little to no change with the move to an all-electric pathway, so long as the electricity was reliable during extreme weather.
- Citizens who currently have electric appliances would not incur costs or changes in adapting to an all-electric pathway.

Aspects of participants' daily lives related to energy use and experience that would require changes and adjustments:

- Citizens currently using a mix of electricity and gas expected to incur expenses relating to adapting appliances or buying new appliances. There was concern that significant expense may be incurred to retrofit or install new heating systems.
- With the change to an all-electric pathway, panel members thought that citizens should expect to move to self-generation of electricity (e.g. solar panels on a residence) and subsequent storage of self-generated electricity.

- Moving to an all-electric pathway may also mean all citizens are more likely to be driving electric vehicles, which would require changes to current vehicles or purchasing new vehicles.
- Panel members suggested that an all-electric pathway may mean significant changes to the cost of energy supply to fund upgrades to infrastructure. They felt that citizens could expect to be charged more for electricity to support the increased costs in the supply chain.

Table 13 How an all-electric pathway meets the Greater Melbourne principles

Principles	Yes	No	Partial	N/A
Every person has the right to safe, reliable, and affordable energy supplies that are supported by fair tariffs and rebates. Therefore, all Australians should have reliable, guaranteed energy when they need it and at a price they can afford.	28	0	7	0
There should be an obligation to provide energy to the citizens of Australia first before exporting to other countries. The energy transition throughout the years needs to have system redundancies to ensure energy security.	21	3	8	3
Energy is an essential service. Big companies and government should act in the public interest, so that energy services are equitable. Energy providers should put human and environmental impacts alongside profit.	21	0	13	1
Governments' decisions should be apolitical and instil fair incentives for moving towards renewables and penalties for non-compliance. They should allow free enterprise to develop alternative energies at a cost-effective rate for the consumer, through tax incentives.	11	5	19	0
Government and private support for education and research with a purpose to encourage innovative and progressive technology with an objective to produce financially viable renewable sources of safe, environmentally friendly, and reliable energy.	31	0	4	0
Australia should participate in global efforts to reduce CO_2 emissions. It should prioritise the development of renewable energy, introduce targets to approach zero net carbon emissions and a code of conduct informing Australians about all energy choices and their environmental impacts.	25	1	8	1
The implementation of new low-carbon energy technologies should be based on scientific research, education, and supported by government and industry funding.	27	1	0	0
The new energy technologies should be safe to produce, consume, and dispose of in comparison to the current technology.	28	0	0	0

4.1.7.2. Low-carbon pathways evaluation: Illawarra/Wollongong

a. Future fuels pathway

Aspects of participants' daily lives related to energy use and experience that were considered to stay the same:

- Panel members anticipated no change for citizens who already use electricity only, for these citizens, everything will stay the same.
- It was anticipated that citizens would continue to receive a reliable source of energy and that standards of living would not change.
- Panel members from Illawarra/Wollongong were less concerned with cooking using energy from a future fuels' pathway. Panel members felt there would be little change to cooking habits.
- Where citizens already have appliances that use electricity (as opposed to gas), citizens could expect little to no expense in receiving electricity from a future fuels' pathway as there won't be a need to adapt current appliances or buy new appliances.

Aspects of participants daily lives related to energy use and experience that would require changes and adjustments:

- Citizens who currently use non-electric appliances (gas) would incur expenses relating to retrofitting appliances or buying new appliances in order to adapt to a future fuels' pathway.

- Panel members expected that households would need to change or adjustments would need to be made to heating systems, and also a change made to cooking with hydrogen blends or electricity (for gas users).
- Panel members suggested that a negative aspect of following a future fuels' pathway was potentially paying more for energy bills (e.g. electricity plus future fuels).
- Panel members discussed that a future fuels' pathway could bring about further transport options (both private and public) and bring about wider adoption of more environmentally friendly vehicles.
- They felt a move to a future fuels' pathway may mean new safety standards, meaning that new technologies could be safer, or more dangerous and that citizens would need to adapt.

Table 14 How the future fuels pathway meets the Illawarra/Wollongong principles

Principles	Yes	No	Partial	N/A
The Government should seek to transition our society by providing multicultural, reliable and transparent information/education to improve understanding that will lead to positive change.	24	0	4	5
Future fuel sources should have safety as the highest priority	28		4	
Future fuels and energy usage should be prioritised along with environmental concerns. The creation of sustainable renewable resources should be underpinned by legislation.	24	1	5	2
Green energy should be economically viable for producers and consumers of any economic status and residential location.	29	0	3	0
Transition to net-zero carbon emission and future energy usage in general requires early investment in ground-breaking scientific research and innovation - including more directional research into non-renewable and low-carbon energy. That research should be future focused, drive sustainable power, ensure new technology is safe for all Australians and the environment and inform industries and Government decision processes.	25	1	6	1
Successfully achieve net zero by 2050 without needing to radically change infrastructure, with clear rules and guidelines to build sustainable future living.	25	1	7	0
Build sustainable energy supply chains by recycling and considering product life-cycle with lowest possible environmental contamination.	32	0	0	1
Equitable and sustainable community-based decisions surrounding energy consumption, production and employment for current and future generations.	27	1	3	0
The Government should seek out community views on how Australia should transition to reduce its carbon footprint.	18	2	11	0
Governments, in consultation with the corporate sector should create policies that support private infrastructures to ensure ongoing reliability while not compromising on quality.	18	3	5	0
(Energy) companies need to be transparent with their supply chains and dealings.	27	0	0	0

b. All-electric pathway

Aspects of participants' daily lives related to energy use and experience that were considered to stay the same:

- The panels discussed that electric household appliances could remain in continued use in an all-electric pathway, resulting in no changes or expenses for citizens.
- Similarly, energy use would not change for households currently relying solely on electricity. However, households with gas appliances would incur expenses and require a change in their energy use. Some participants shared their positive, emotive experiences around cooking with gas:

  "I like, I like my gas. Everything works really well."

  Others shared their negative experiences around cooking with electricity:

"I don't like cooking with electricity it's so slow. And it's, it's so uneven...But to me, that would be annoying to me, to take the gas away 'cause electric is slower"

This deep personal, emotive attachment to the experience of cooking with gas is a point to be noted.

- Panel members thought that supply and reliability would remain largely unchanged, recognising limited diversity in fuels. Limited diversity in the fuel mix, along with a greater dependency on the grid maybe perceived as a risk as stated by one participant:

  "Like, in the unlikely event of like a blackout, we don't have many anymore. But when we do like, it's great having the gas because you can still warm up the water… you can still cook, you can still do all those things. So, if we're just electricity based [how will we manage?]

Aspects of participants' daily lives related to energy use and experience that would require changes and adjustments:

- An all-electric pathway would require expense for individuals to transition from gas appliances to electric. Several participants expressed concerns around costs and how they might be impacted.
- If there is increasing move from Internal Combustion Engine (ICE) to Battery Electric Vehicle (BEV) vehicles, changes to infrastructure (charging stations) will be required in homes, workplaces, schools, shopping centres etc.

Table 15 How an all-electric pathway meets the Illawarra/Wollongong principles

Principles	Yes	No	Partial	N/A
The Government should seek to transition our society by providing multicultural, reliable and transparent information/education to improve understanding that will lead to positive change.	24	0	3	6
Future fuel sources should have safety as the highest priority	30	0	3	0
Future fuels and energy usage should be prioritised along with environmental concerns. The creation of sustainable renewable resources should be underpinned by legislation.	27	0	5	2
Green energy should be economically viable for producers and consumers of any economic status and residential location.	31	1	1	0
Transition to net-zero carbon emission and future energy usage in general requires early investment in ground-breaking scientific research and innovation - including more directional research into non-renewable and low-carbon energy. That research should be future focused, drive sustainable power, ensure new technology is safe for all Australians and the environment and inform industries and Government decision processes.	25	1	2	5
Successfully achieve net zero by 2050 without needing to radically change infrastructure, with clear rules and guidelines to build sustainable future living.	26	3	1	3
Build sustainable energy supply chains by recycling and considering product life-cycle with lowest possible environmental contamination.	30	2	1	1
Equitable and sustainable community-based decisions surrounding energy consumption, production and employment for current and future generations.	31	1	1	0
The Government should seek out community views on how Australia should transition to reduce its carbon footprint.	19	1	6	7
Governments, in consultation with the corporate sector should create policies that support private infrastructures to ensure ongoing reliability while not compromising on quality.	19	1	8	5
(Energy) companies need to be transparent with their supply chains and dealings.	33	0	0	0

4.1.7.3. Low-carbon pathways evaluation: South Australia

a. Future fuels pathway

Aspects of participants' daily lives related to energy use and experience that were considered to stay the same:

- Panel members felt that little would change regarding energy use and supply. Currently, South Australian homes have lower rates of gas mains compared to other states and cities, and therefore citizens mostly use electricity for appliances.
- Given South Australia's current use of solar and wind energy and their citizens' familiarity with alternative energy sources, panel members felt confident that reliability of their supply would remain unchanged with a future fuels' pathway.
- Panel members thought that energy costs in a future fuels' pathway would be comparable, claiming that otherwise there would be little incentive to change.

Aspects of participants' daily lives related to energy use and experience that would require changes and adjustments:

- It was recognised that citizens who heat their homes or cook using gas will need to change their appliances to accommodate a future fuels pathway. The need to adjust or convert gas appliances or heating systems will result in additional expenses for some citizens. Panel members from South Australia expressed concern about these expenses and felt that alternative sources of energy should not become more expensive than current energy costs.
- Adjustments to vehicles might be needed to change to hydrogen vehicles. Again, this would be an expense to individuals.
- Panel members expected that infrastructure upgrades, including pipelines, would be needed in the move to a future fuels' pathway. Infrastructure upgrades were thought to be time consuming and expensive. Questions were raised as to how the government would approach this and manage having some portions of the population upgraded before others.

Table 16 How future fuels pathway meets the South Australian principles

Principles	Yes	No	Partial	N/A
Develop community and public education for Australians to understand energy production, usage and disposal to increase overall efficiency/efficacy in the transition to cleaner energy while reducing waste/misuse	27	3	3	4
Access to updated information and simple reports produced by energy providers, which show the method of generation, will support people to make informed choices and to become aware of the long-term impact of various different technologies.	27	2	8	0
Public policy should be adjusted to keep electricity providers honest and transparent seeking to meet clean energy usage targets as well as assisting and incentivising consumers and businesses to move towards renewable energy to achieve a carbon neutral homes and businesses by 2050. This should be done by exploring alternative options including emerging technologies.	30	1	5	1
Establish an independent Government authority to use scientific evidence and provide evidence-based solutions to consult transparently with the community to make final decisions to reduce our carbon footprint and preserve our environment for the future.	31	1	2	3
Planning and development play a central role to ensure sustainability and minimal impact on communities, people, livelihoods and the environment. This could be achieved by selecting infrastructure which reduces the impact of urbanisation.	21	2	10	4
Resources and new technologies relating to renewable energy that originate from Australia should be owned by Australians instead of capitalising on them through overseas ownership. Therefore, Australia should be operating and building infrastructures that are within Australia's operation capabilities.	25	1	8	2
The transition to a low-carbon future should not negatively affect the reliability and affordability of Australia's energy supply of Australia.	33	1	2	1

b. All-electric pathway

Aspects of participants' daily lives related to energy use and experience that were considered to stay the same:

- An all-electric pathway in South Australia was not expected to result in any changes for those who currently rely solely on electricity. Given the state's current use of solar and wind to provide electricity

and to improve energy reliability, panel members were comfortable with moving to an all-electric pathway and see little difference in this to their current energy supply mix.

- Again, for those with electric appliances and heating/cooling systems, an all-electric pathway would result in no change in participants' daily lives.
- South Australian panel members view keeping costs comparable with current energy costs as important, given the state's cold winters and very hot summers and the subsequent need to heat and cool their homes.
- Considering the state's history of energy blackouts, reliability of an all-electric pathway was important to panel members, and an all-electric pathway was welcomed if it improved reliability.

Aspects of participants' daily lives related to energy use and experience that would require changes and adjustments:

- Citizens with gas appliances would incur expenses in adjusting or replacing gas appliances with electric. Participants preferred that new sources of energy are comparable to current costs and viewed expenses negatively.
- Reliability of energy supply is important to South Australians and infrastructure upgrades to ensure reliability of supply was viewed as necessary but expensive and time consuming.
- In an all-electric pathway, participants thought that transport and vehicles (both private and business) will need to adjust to running on electricity.

Table 17 How an all-electric pathway meets the South Australian principles

Principles	Yes	No	Partial	N/A
Develop community and public education for Australians to understand energy production, usage and disposal to increase overall efficiency/efficacy in the transition to cleaner energy while reducing waste/misuse	27	2	8	0
Access to updated information and simple reports produced by energy providers, which show the method of generation, will support people to make informed choices and to become aware of the long-term impact of various different technologies.	19	6	10	2
Public policy should be adjusted to keep electricity providers honest and transparent seeking to meet clean energy usage targets as well as assisting and incentivising consumers and businesses to move towards renewable energy to achieve a carbon neutral homes and businesses by 2050. This should be done by exploring alternative options including emerging technologies.	34	1	2	0
Establish an independent Government authority to use scientific evidence and provide evidence-based solutions to consult transparently with the community to make final decisions to reduce our carbon footprint and preserve our environment for the future.	26	2	6	3
Planning and development play a central role to ensure sustainability and minimal impact on communities, people, livelihoods and the environment. This could be achieved by selecting infrastructure which reduces the impact of urbanisation.	29	1	7	0
Resources and new technologies relating to renewable energy that originate from Australia should be owned by Australians instead of capitalising on them through overseas ownership. Therefore, Australia should be operating and building infrastructures that are within Australia's operation capabilities.	26	3	9	0
The transition to a low-carbon future should not negatively affect the reliability and affordability of Australia's energy supply of Australia.	33	1	3	0

4.2. QUANTITATIVE RESULTS

This section outlines participants' responses to the pre- and post- survey questions and details any changes that occurred as a result of the citizens' panels.

4.2.1. Participants' self-rated knowledge of hydrogen applications

Participants were asked to rate their knowledge about the various hydrogen applications. Responses included never heard of it, heard of it, heard of it and can describe it to a friend. Each group of responses varied by hydrogen application with the use of *hydrogen fuel cells in homes, hydrogen as an energy storage medium for electricity and hydrogen refuelling stations* appearing to be the least familiar hydrogen applications. Figure 5 shows that after the citizens' panels, participants' subjective awareness of the various hydrogen applications increased across the locations. The least change in knowledge was around the use of hydrogen fuel cells in vehicles which is expected, given that transport was not a large focus of the citizens' panels.

Figure 5 Participants' pre- and post- self-rated knowledge of hydrogen

4.2.2. Participants' perceptions of energy sources and technologies

To measure how participants' general perceptions of energy sources and technologies, their support and willingness to use hydrogen changed as a result of the citizens' panels, we asked three questions which included:

- How do you feel about hydrogen as a possible solution for energy and environmental challenges?
- If hydrogen were available today, how willing would you be to use it in your home for the following uses?
- How strongly do you agree or disagree with the use of the following energy sources and related technologies as potential ways of generating Australia's future energy needs?

These questions had been previously developed for the first Australian national survey to understand perceptions of hydrogen in 2018. The key questions covered general support for hydrogen, willingness to use hydrogen in homes and level of agreement with various energy sources and technologies.

4.2.2.1. Support for hydrogen

By the end of the process, general support for hydrogen increased across all three panels. People from South Australia were the most supportive both before and after the panels (see Figure 6), while the level of support for hydrogen in the Greater Melbourne and Illawarra/Wollongong panels was similar.

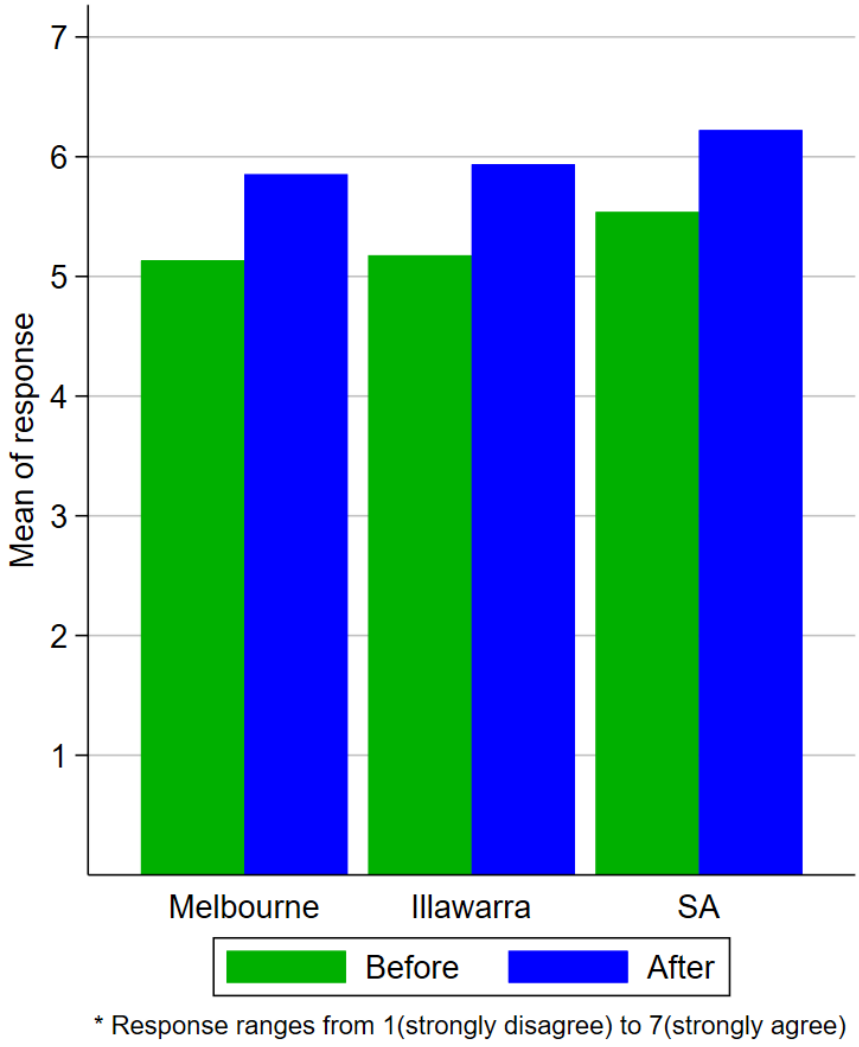

Figure 6 Pre- & post- mean change in support for hydrogen as a potential solution for energy and environmental challenges

4.2.2.2. Agreement with energy technologies

Participants were asked to indicate their level of agreement with a range of energy technologies using a Likert scale: 1 = strongly disagree to 7 = strongly agree. Table 18 shows the mean responses for each of the technologies. Agreement with hydrogen and biomass as potential ways of generating Australia's future energy needs registered the largest and most significant positive increases in agreement. Given these two topics were the focus of the information provided during the panels, the results are not surprising, but also reinforces the impact of information provision and engagement on a topic. Agreement with coal decreased the most of all technologies with only slight decreases for gas and oil (this change was not significant). Similarly, there was a slight positive (not significant) increase in agreement for wind, solar and nuclear at the end of the panels.

Table 18 Mean test for levels of agreement across the range of energy technologies and sources

	Before		After		
Variables	N	Mean	N	Mean	Difference
Hydrogen	109	5.119	102	6.039	-0.920***
Coal	105	2.952	100	2.62	0.332
Gas	107	4.299	100	4.23	0.069
Carbon Capture	107	4.093	99	4	0.093
Wind	110	6.291	99	6.374	-0.083
Solar	110	6.464	99	6.535	-0.072
Oil	107	3.636	100	3.44	0.196
Nuclear	110	4.064	100	4.08	-0.016
Biomass	107	4.757	100	5.3	-0.543***

Note: *** p<0.01, ** p<0.05, * p<0.1

4.2.2.3. Willingness to use hydrogen in the home

Willingness to use hydrogen in the home was overwhelmingly positive both before and after the panels. Figure 7 displays participants' willingness to use hydrogen for six different applications in the home. From the responses it appears that most participants were confident that any safety issues would be well managed from the outset whether it was for within the home – electricity, cooking, heating, or externally for cars. The question used a Likert scale response from 1=very unwilling to 7= very willing and asked *If hydrogen were available today, how willing would you be to use it in your home for the following uses:*

- On-site electricity generation
- Cooking
- Using natural gas that contains some hydrogen (i.e. a blend)
- For driving hydrogen fuel cell electric vehicles
- Hot water heating
- Space heating.

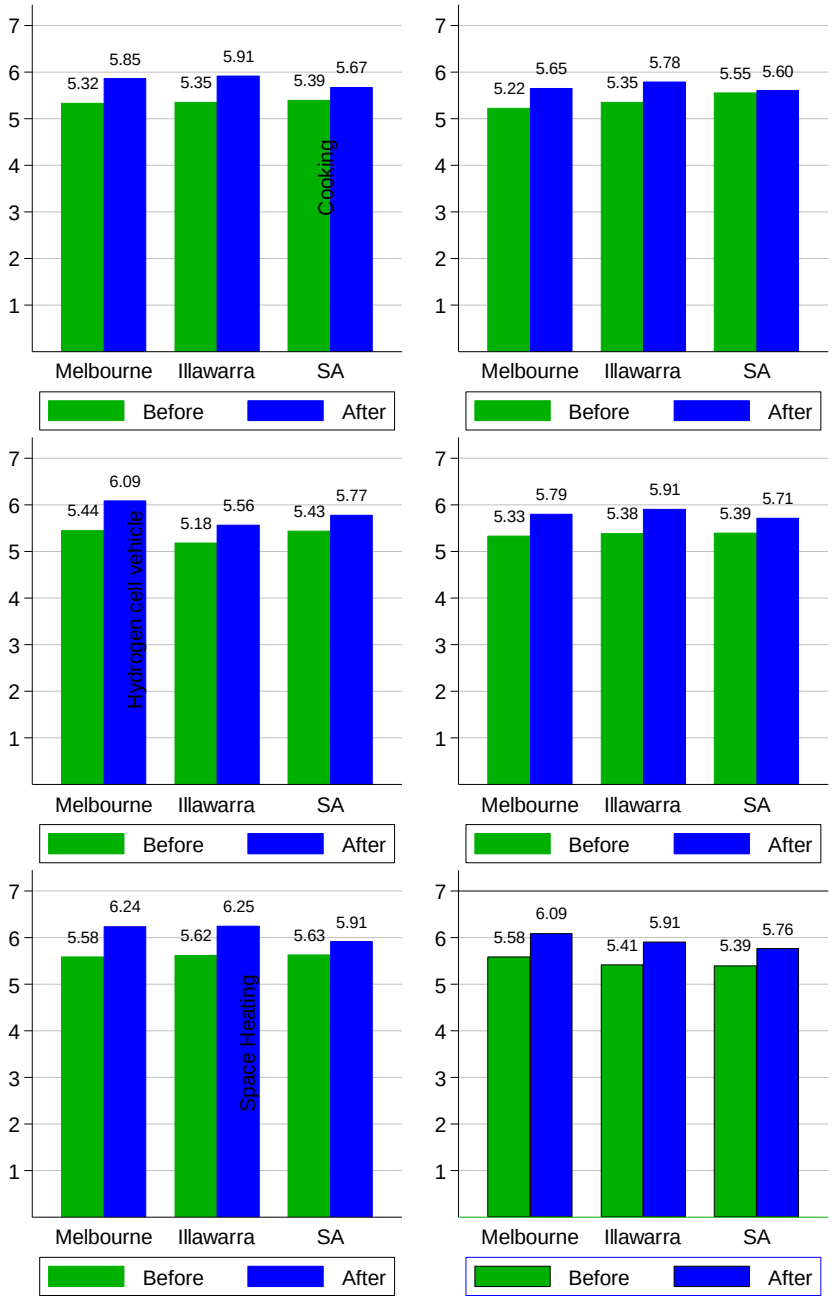

Figure 7 Bar graph showing mean value of participants' willingness to use hydrogen in the home

4.2.2.4. Participants' feelings towards hydrogen

We also measured participants' attitudes in relation to the experiential (affect; feelings) and instrumental (benefits; functions) dimensions of their attitudes towards hydrogen. The literature recommends disaggregating these two measures when assessing attitudes and so we included two separate questions with their own discreet measures.

The first explored participants' experiential responses to hydrogen asking: *When you think about the use of hydrogen in Australia, please indicate how it makes you feel.* Responses ranged from:

- Very angry (-3) to Very calm (+3)
- Very embarrassed (-3) to Very proud (+3)
- Very uninspired (-3) to Very inspired (+3)
- Very sad (-3) to Very happy (+3)
- Very unconcerned (-3) to Very concerned (+3)

To capture the positive and negative feelings the response scale was from -3 through to +3. As shown in the table below, participants appeared to attribute mainly positive feelings towards hydrogen, and this increased significantly for all responses across all panels by the end of the deliberative process. Participants who reported feeling concerned about hydrogen in the beginning of the process felt less concerned by the end (concerned being a negative feeling so a negative response means not concerned).

Table 19 Change in participants' experiential responses or feelings towards hydrogen

	Before		After		
Variable	N	Mean	N	Mean	Difference
Calm	99	1.04	98	1.612	-0.572***
Proud	96	0.938	95	1.474	-0.536***
Inspired	96	0.979	98	1.612	-0.633***
Happy	97	0.948	98	1.561	-0.613***
Concerned	97	-0.093	98	-0.592	0.499*

Note: *** p<0.01, ** p<0.05, * p<0.1

The second question explored participants' instrumental responses to hydrogen (utility, benefits) asking: *Overall, do you think using hydrogen for energy in Australia would be:*

- Very worthless (-3) to Very worthwhile (+3)
- Very useless (-3) to Very useful (+3)
- Very harmful (-3) to Very beneficial (+3)
- Very Bad (-3) to Very good (+3)

To capture the positive and negative perceived experiences again, the response scale was from -3 through to +3. Again, responses were overwhelmingly positive with a significant positive change for each response which demonstrates participants deemed hydrogen to be beneficial, worthwhile and useful to Australia.

Table 20: Change in participants' perceived instrumental responses to hydrogen.

	Before		After		
Variable	N	Mean	N	Mean	Difference
Worthwhile	100	1.36	99	2.152	-0.792***
Useful	99	1.414	99	2.182	-0.768***
Beneficial	99	1.394	97	2.062	-0.668***
Good	98	1.408	97	2.01	-0.602***

Note: *** p<0.01, ** p<0.05, * p<0.1

4.2.3. Alignment with energy generation sources for Australia and export

Participants were given four different statements about energy sources and priorities for Australia and asked to indicate *how close each statement is to your own point of view (1=strongly against and 7=strongly aligned).* The statements included:

- Australia should focus on renewables, even if we need to invest more in infrastructure to make the system more reliable
- Australia should focus on renewables but in the meanwhile continue to use gas as a transition fuel to make the transition smooth and affordable
- Australia should focus on traditional energy sources such as coal & gas, even if the environment suffers to some extent
- Australia should focus on traditional energy sources such as coal & gas in a post-COVID environment to allow for economic recovery

Most participants across the three panels were consistently aligned with the view that Australia should focus on renewable energy sources, even if we need to invest more in infrastructure to increase the reliability of the system. Continued use of fossil fuels was least favoured amongst the three panels and over the course of the panels, participants became more supportive of renewable sources and less supportive of coal and gas.

Table 21 Change in participants' preferences for energy generation priorities in Australia

Variable	Before		After		
Australia should focus on:	N	Mean	N	Mean	Difference
…renewables and even if we need to invest in infrastructure to make the system more reliable.	102	6.382	101	6.446	-0.063
…renewables but in the meanwhile continue to use gas as a transition fuel…	102	5.441	99	5.778	-0.337*
…traditional energy sources such as coal & gas, even if the environment suffers to some extent.	102	2.461	100	2.19	0.271
… traditional energy sources such as coal & gas in a post-COVID environment to allow for economic recovery	102	3.147	100	2.81	0.337

Note: *** p<0.01, ** p<0.05, * p<0.1

Given there has been much debate about Australia's LNG exports and availability of affordable domestic gas we felt it was important to understand perceptions towards hydrogen export opportunities. Another set of statements were about energy export and priorities for Australia, with a similar response requirement where participants were asked to indicate *how close each statement is to your own point of view (1=strongly against and 7=strongly aligned).* The statements included:

- Australia should continue to export coal to developing countries, to help them reduce poverty and develop their economies.
- Australia has an abundant supply of fossil fuels, and we should continue to export them to keep our economy strong.
- Australia should develop a renewable energy industry by investing in hydrogen technologies, to help other countries reduce their carbon emissions.
- Australia should continue to export fossil fuels to keep our economy strong in a post-COVID environment and use some of the profits to establish a renewable energy industry for export.

Table 22 Change in participants' preferences for energy exports for Australia.

Variable	Before		After		
Australia:	N	Mean	N	Mean	Difference
… should continue to export coal to developing countries, to help them reduce poverty and develop their economies.	102	4.294	101	4.168	0.126
…has an abundant supply of fossil fuels and we should continue to export them to keep our economy strong.	102	3.941	99	3.758	0.184
…should develop a renewable energy industry by investing in hydrogen technologies, to help other countries reduce their carbon emissions.	103	5.583	100	6.2	-0.617***

… should continue to export fossil fuels to keep our economy strong in a post-COVID environment and use some of the profits to establish renewable energy industry for export.	102	4.569	100	4.18	0.389

Note: *** p<0.01, ** p<0.05, * p<0.1

Figure 8 shows the change in alignment around the four statements by geographic region both pre- and post- panel engagement. The figure shows consistent and high alignment with the use renewable energy sources as a priority for export, particularly for producing hydrogen as also evidenced in the change in means above in Table 22.

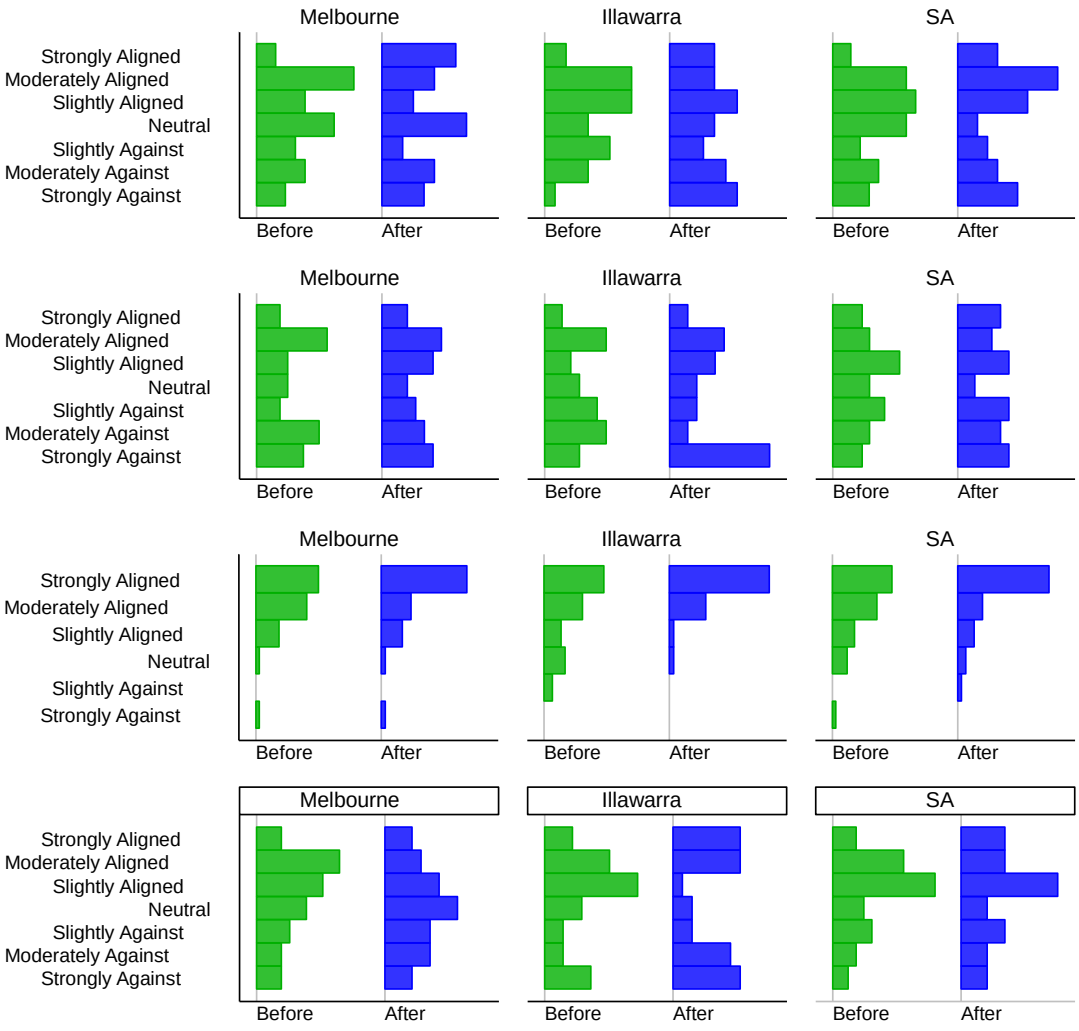

Figure 8 Level of alignment with preferred energy sources for export by area, before and after the citizens' panels

4.2.4. Energy policy and trade-offs between the economy and the environment

Using an established measure around trade-offs between prioritising either the economy or the environment participants were given the statement: *Energy policy can involve difficult trade-offs between the economy and the environment. Which of the following statements best describes your view?* Responses included:

- The highest priority should be given to protecting the environment, even if it hurts the economy.
- Both the environment and the economy are important, but the environment should come first.
- Both the environment and the economy are important and balancing the two should be the highest priority.

- Both the environment and the economy are important, but the economy should come first.
- The highest priority should be given to economic considerations even if it hurts the environment.

As illustrated in Figure 9, before the deliberations, the Illawarra/Wollongong panel was divided equally between giving priority to the environment or balancing both the economy and the environment. In the post-deliberation survey this shifted slightly in favour to the environment but overall, participants were still split between the two views. About two thirds of the South Australian panel were in favour of the view that balancing the economy and the environment should be given highest priority both before and after the deliberations. This was almost double than both other regions. Before the deliberations, participants from Greater Melbourne were split between prioritising the environment or prioritising both the environment and the economy, slight favouring towards prioritising both. However, at the end of the deliberations the largest proportion of participants (39%) thought that the environment should be prioritised, while only 36% thought that balancing both should be a priority.

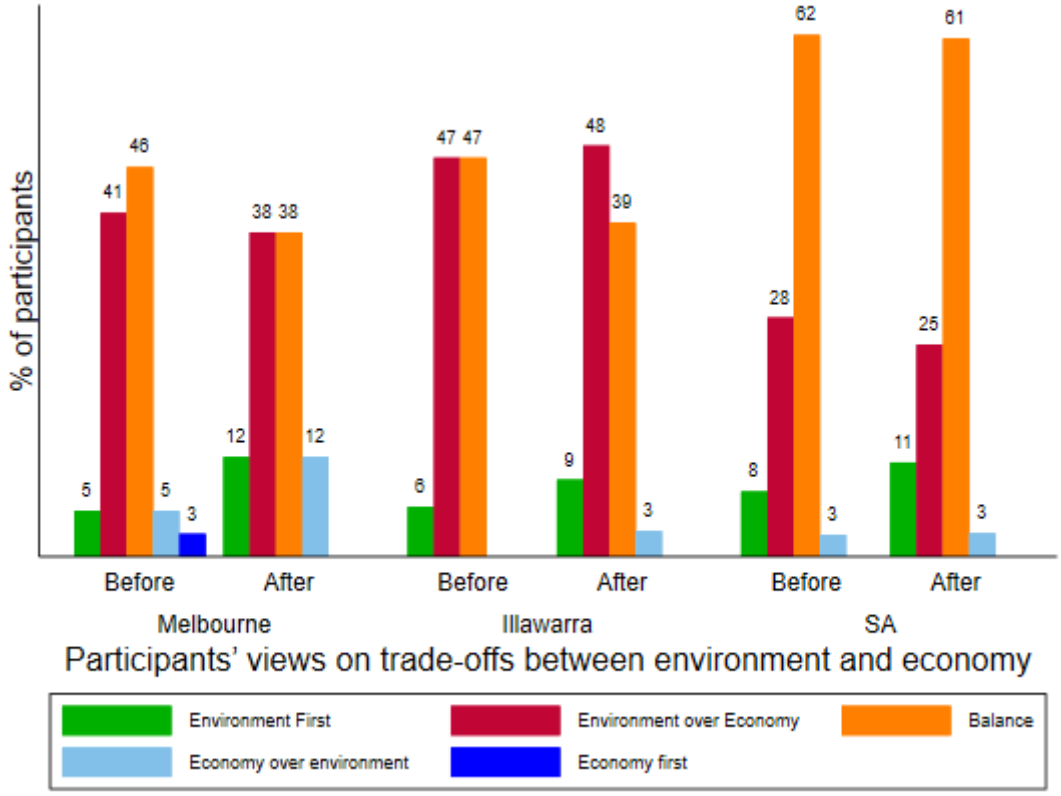

Figure 9 Bar graph showing participants' views on trade-offs between the environment and the economy.

Figure 10 shows that before the citizens' panel participants that favour the environment expressed highest support for using hydrogen as a future fuel of Australia, with support dropping slightly away for each category that leaned towards the economy. However, after the citizens' panels, participants with a preference for the environment over the economy showed the highest support for hydrogen fuel followed by participants seeking a balanced approach. Those participants who felt that the environment should come first showed a decrease in support for hydrogen when compared with before the panel. However, their support for hydrogen fuel remains relatively high. Participants seeking a balance between the economy and environment also showed consistent support for hydrogen fuel.

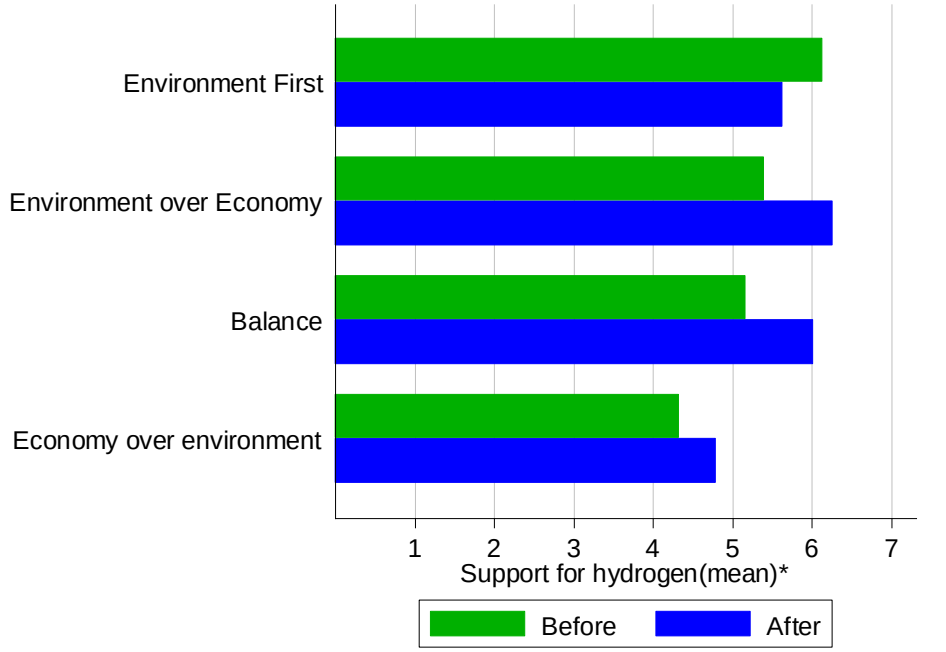

Figure 10 Bar graph showing support for hydrogen fuel by participants' view on trade-offs.
Note: Economy first was dropped as only one participant in pre-panel survey chose it.

4.2.5. Comparing range of descriptive responses by geographical regions

Earlier research has highlighted that the public responses towards energy technologies is influenced by geographical context. This section details the before and after responses of each of the citizens' panels groups by each geographic location compared with the other two groups. Only significant differences are reported in the tables for each region.

4.2.5.1. Greater Melbourne compared to other panels

Before the citizens' panels the Greater Melbourne region had no significant differences when compared to the other two regions. However, after the citizens' panels they were more supportive of coal and gas and less supportive of solar, which was also reflected in their lower agreement with the statement *Australia should focus on renewables even if we need to invest more in infrastructure to make the system reliable.* The results also show some viewed that hydrogen was less worthwhile as an energy source for Australia. These responses indicate that the Melbourne panel appeared somewhat more supportive of more traditional energy sources.

Table 23 Post engagement mean comparison of significant variables between Greater Melbourne and other regions

Variable	Other		Greater Melbourne		Difference
	N	Mean	N	Mean	
AFTER					
Coal	66	2.364	34	3.118	-0.754**
Gas	66	4.015	34	4.647	-0.632*
Solar	65	6.708	34	6.206	0.502***
Oil	66	3.091	34	4.118	-1.027***
Worthwhile	66	6.288	34	5.882	0.406*
Concerned	66	3.167	33	3.909	-0.742*
Australia should invest in renewables	68	6.618	34	6.088	0.529**

Note: *** p<0.01, ** p<0.05, * p<0.1

4.2.5.2. Illawarra/Wollongong compared to other panels

Before the citizens' panels the Illawarra/Wollongong participants were more likely to view hydrogen as being more useful when compared to the other panels. However, they felt less proud and were more concerned about hydrogen development in Australia. After the citizens' panels they showed lower levels of agreement for the use of oil as a future low-carbon energy source in Australia.

Table 24 Before and after mean comparison of significant variables between Illawarra and other regions

Variable	Other		Illawara		Difference
	N	Mean	N	Mean	
BEFORE					
Useful	73	5.548	33	5.121	0.427*
Proud	72	5.125	31	4.581	0.544**
Concerned	72	3.708	32	4.469	-0.760**
AFTER					
Oil	68	3.721	32	2.844	0.877**

Note: *** p<0.01, ** p<0.05, * p<0.1

4.2.5.3. South Australia compared to other panels

In the South Australian group before the citizens' panel the participants showed higher support for biomass and when thinking about using hydrogen for energy in Australia were more likely to take the view that it is useful, beneficial and very good. South Australians reported feeling more calm, proud, inspired, and happy about hydrogen as well as less concerned when compared to the other panels. After the citizens' panel South Australians expressed lower support for gas and higher support for solar as part of Australia's future energy. They continued to be more calm and less concerned about hydrogen.

Table 25 Before and after mean comparison of significant variables between South Australia and other regions

Variable	Other		SA		Diff
	N	Mean	N	Mean	
BEFORE					
Biomass	69	4.565	38	5.105	-0.540*
Useful	69	5.246	37	5.73	-0.483*
Beneficial	68	5.25	38	5.737	-0.487*
Good	68	5.25	37	5.784	-0.534**
Calm	68	4.912	38	5.342	-0.430*
Proud	66	4.758	37	5.324	-0.567**
Inspired	67	4.776	36	5.417	-0.641**
Happy	67	4.806	37	5.297	-0.491*
Concerned	67	4.239	37	3.405	0.833**
AFTER					
Gas	66	4.455	34	3.794	0.660*
Solar	65	6.431	34	6.735	-0.305*
Calm	65	5.446	34	5.882	-0.436*
Concerned	64	3.656	35	2.971	0.685*

Note: *** p<0.01, ** p<0.05, * p<0.1

4.2.6. The three most important considerations for Australia to transition

Participants were asked to select what they thought were the three most important considerations Australia needs to make now to transition towards a low-carbon energy future. These varied across the different regions and are presented below in Figure 11, Figure 12 and Figure 13.

For the Greater Melbourne group, political, social and economic considerations were viewed as almost equally important before the deliberations. The same three main considerations remained the most important at the end of the deliberations with a higher proportion selecting social considerations and less priority being given to environmental, and technological considerations. This may be a result of the focus of the presentations in weeks two and three which included social equity and justice issues.

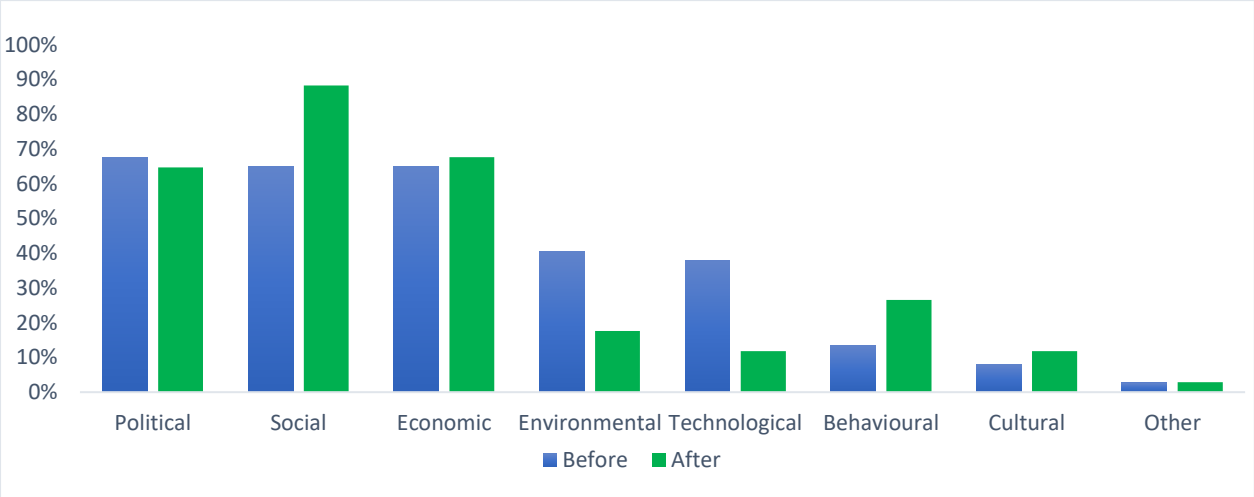

Figure 11 Greater Melbourne panel's three most important considerations for Australia to transition

For the Illawarra/Wollongong panel, the three most important considerations both before and after the deliberations were social, behavioural and technological in the same order of priority with social considerations growing between the beginning and the end and environmental and political considerations dropping away. This may be because individuals were comfortable with what was being presented in how the transition would most likely occur and that they were confident environmental benefits would ensue. There also appeared to be some recognition of the priority that would need to be given to the social considerations of both acceptance, equity and behaviours.

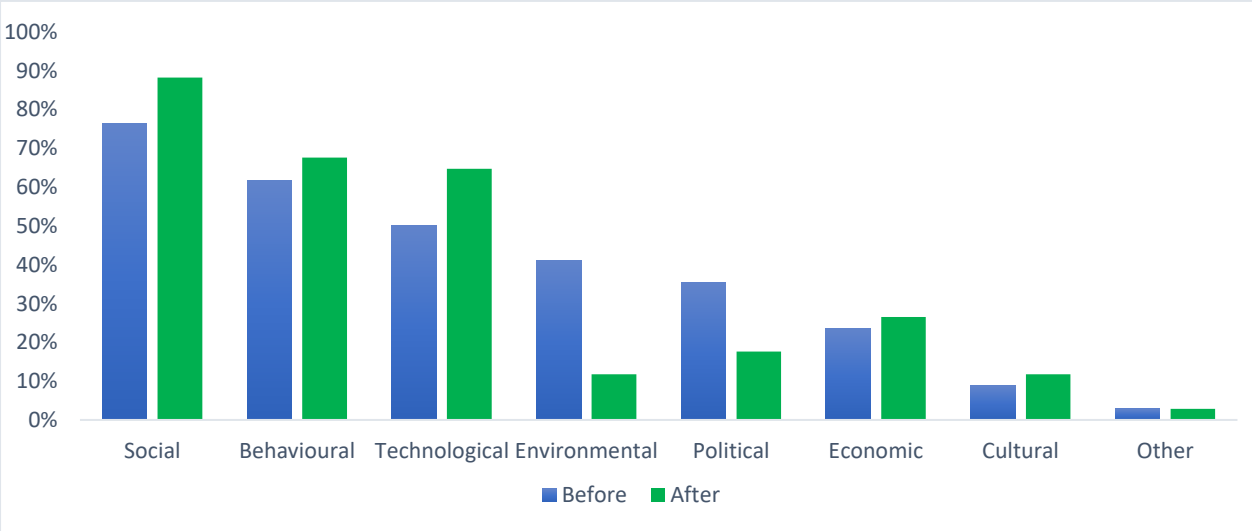

Figure 12 Illawarra/Wollongong panel's three most important considerations for Australia to transition

Like the Illawarra/Wollongong panel, South Australian participants gave the biggest priority to social, behavioural and technological considerations with political and environmental considerations dropping away. There were some who saw the economic considerations as more important after the panels.

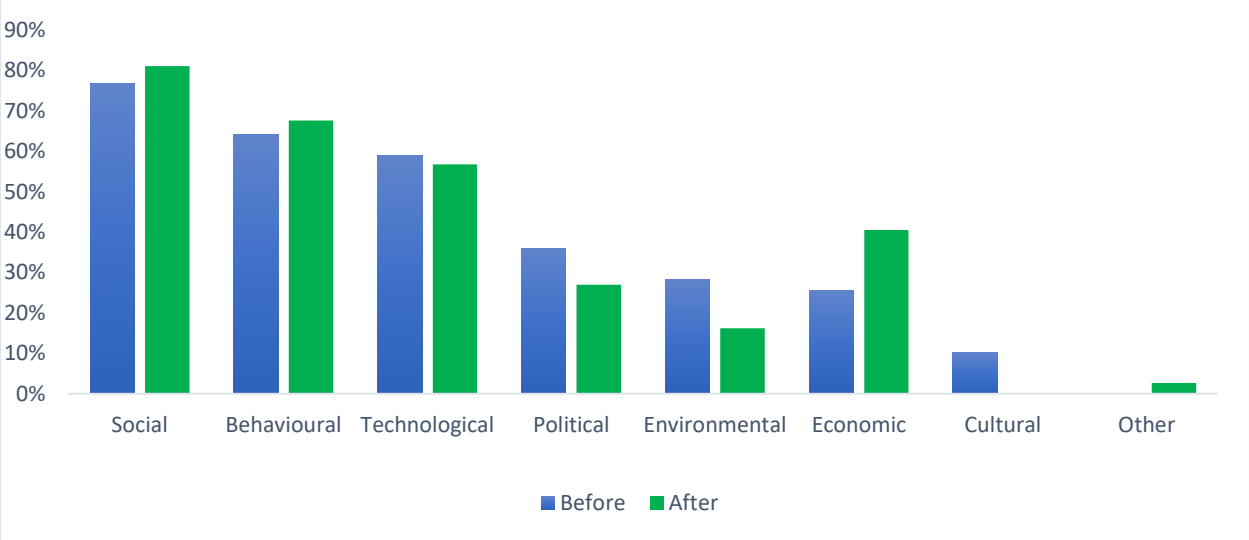

Figure 13 South Australian panel's three most important considerations for Australia to transition

4.2.7. Social licence considerations for Australia to transition

Work by Moffat and Zhang (2014) revealed that gaining a social licence to operate is influenced by an individual's trust in the ability of government and industry to manage the associated risks and to act in the best interests of the community. To test this with participants, we included the question: *If a hydrogen economy was to be developed in Australia, to what extent do you agree or disagree, that the following groups would act in the best interest of the consumer?* Responses were on a Likert scale of 1=*Strongly disagree* through to 7=*Strongly agree*. Table 26 shows the spread of responses. The CSIRO, which is often ranked highly in questions of trusted organisations, received the highest score, with trust increasing by the end of the deliberations. This may be related to having a CSIRO presenter for a large part of week 2 presentations. Environmental NGOs also scored highly as were state and local governments.

Table 26 Extent of agreement that each group would act in the best interests of the consumer

	Pre-			Post-			
Variable	N	Mean	SD	N	Mean	Sd	Mean Diff
Federal	108	4.676	1.651	102	4.765	1.742	-0.089
State	106	5.019	1.454	101	4.871	1.629	0.148
Local	109	5.055	1.38	100	4.84	1.637	0.215
Electricity Company	107	3.953	1.616	102	3.588	1.731	0.365
Fuel/gas supplier	106	3.802	1.732	101	3.446	1.735	0.356
Car Manufacturer	107	4.411	1.578	101	4.317	1.593	0.094
University	108	4.204	1.587	101	4.099	1.466	0.105
CSIRO	108	5.778	1.163	102	6.225	0.911	-0.448***
Media	108	4.537	1.513	101	4.168	1.625	0.369*
Environmental NGO	108	5.574	1.284	101	5.545	1.315	0.03

Note: *** p<0.01, ** p<0.05, * p<0.1

5. Process Evaluation

In this chapter, we evaluate the citizens' panel process based on participants' experience. It is important to note that in this study, citizens' panels are used a method to elicit participants' attitudes and perceptions around future fuel implementation. It is important to note that our use of citizens' panels as a method is different to the mainstream purpose of citizens panels. Usually, citizens' panels are triggered as a government initiative and so directly inform policy. In a deliberative democracy sense, outcomes are consensus/majority opinion). However, our use of citizens panels as a research method (without the decision-making power) is a little bit different. To show the underlying rigour of the citizens' panel design, participants' experience with the process is a meaningful measure (See 5.1).

Next, levels of self-identity indicate how participants' may have engaged with the process from start to finish (Section 5.1.1.). Therefore, self-identity measures were included to check for effectiveness within the citizens' panel design. In the mainstream/deliberative democracy sense, effectiveness would be gauged by the group successfully reaching consensus. We cannot have that criteria since this is a research initiative aimed at exploring perceptions towards the complexities of future fuel implementation. Effectiveness in our study indicates participants' ability to define a set of guiding principles that most participants agreed with. This also includes participants' ability to discuss and weigh up the 2 different pathways that were presented to them.

5.1. PARTICIPANTS' EXPERIENCES WITH THE PROCESS

At the end of the deliberative process, participants were asked to evaluate their experience with the panels using a Likert scale (1=not well at all through to 5=extremely well). Participants were asked to indicate *the extent of change in their views about the low-carbon energy transitions and the possible pathways as a result of this week's workshop.* Figure 14 below shows the range of responses across each of the weeks for each of the panels.

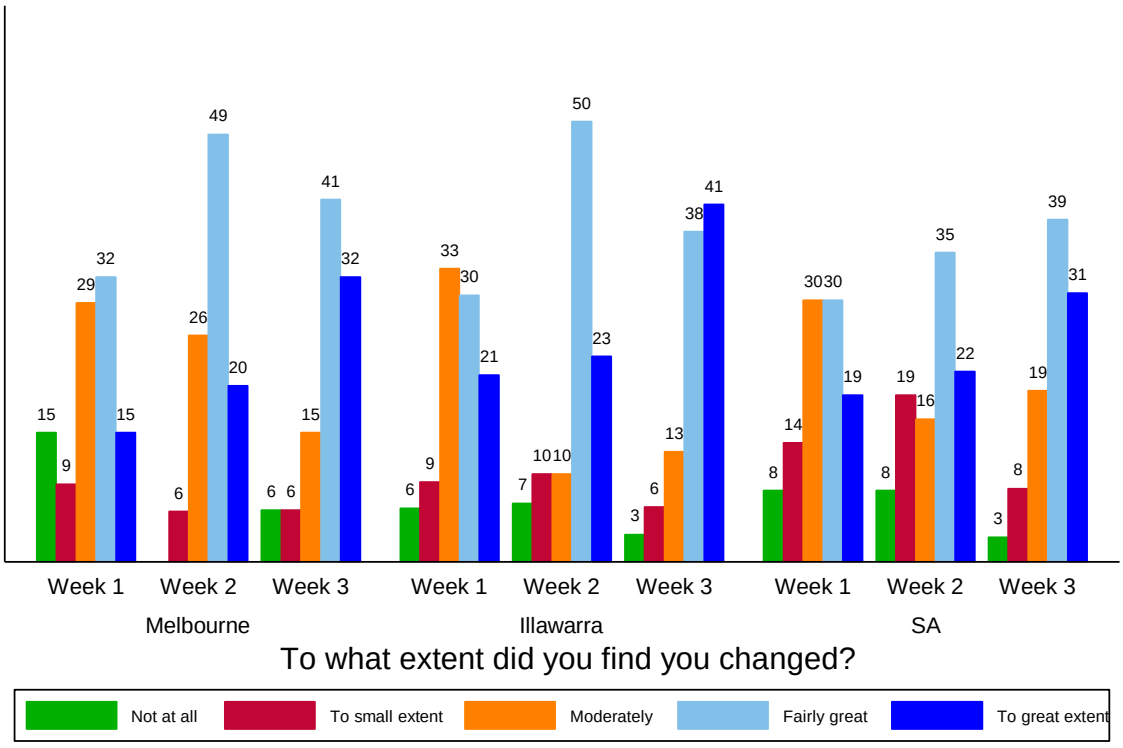

Figure 14 The extent to which participants' views changed over the course of the panels

Similarly, participants were asked to evaluate their experience using a Likert scale (1=not well at all through to 5=extremely well). The question was: *How well did you feel you were able to:*

A. Understand the key issues under discussion
B. Learn about the issues that were discussed in the breakout rooms
C. Listen to what others in your break room have to say about the topics under discussion
D. Express your own views on the topics under discussion in the breakout rooms
E. Understand the purpose of the research
F. Understand your role in the research

Table 27 presents the mean value of participants' ratings of their experiences over the three weeks. The differences between week 1 and week 3 were positive, with a few of them being significant. It shows that participants felt they were able to understand the issues and their role within the panel. There were two variables that were missing in the final data, during week 2 so these are marked accordingly.Table 27 Mean difference in participants' experiences with the process between week 1 to week 3

Variables	Week 1		Week 2		Week 3		Difference (W3-W1)
	N	Mean	N	Mean	N	Mean	
Your view changed	104	3.375	102	3.657	102	3.931	-0.556***
Understand issue	104	3.981	102	4.059	102	4.118	-0.137
Learn issue	104	4.029	102	4.098	102	4.186	-0.157
Listen Other	104	4.24	101	4.257	102	4.363	-0.122
Express view	103	4.058	101	4.059	101	4.248	-0.189*
Purpose of the research	104	3.865	0	Missing	102	4.157	-0.291**
Understand your role	104	3.846	0	Missing	102	4.196	-0.350***
Participation encouraged	104	4.394	102	4.324	102	4.539	-0.145
Contribution valued	104	4.346	101	4.307	102	4.559	-0.213**
Discussion fruitful	104	4.221	101	4.287	102	4.382	-0.161

Note: *** p<0.01, ** p<0.05, * p<0.1

Using a Likert scale of *1=not at all* through to *5 = definitely*, the next set of questions asked participants *How much do you believe that:*

A. Your participation was encouraged by the breakout room facilitator
B. Your contribution was valued and respected by the other participants in your breakout room
C. The discussions in your breakout room resulted in useful conclusions and outcomes

Figure 15 provides a tab plot of the total sample of participants' responses on each aspect of the breakout rooms. The top panel of the figure shows that participants felt their participation was encouraged by the facilitator, that their contribution was valued and respected by other participants; and the discussions in the breakout rooms resulted in useful conclusions and outcomes.

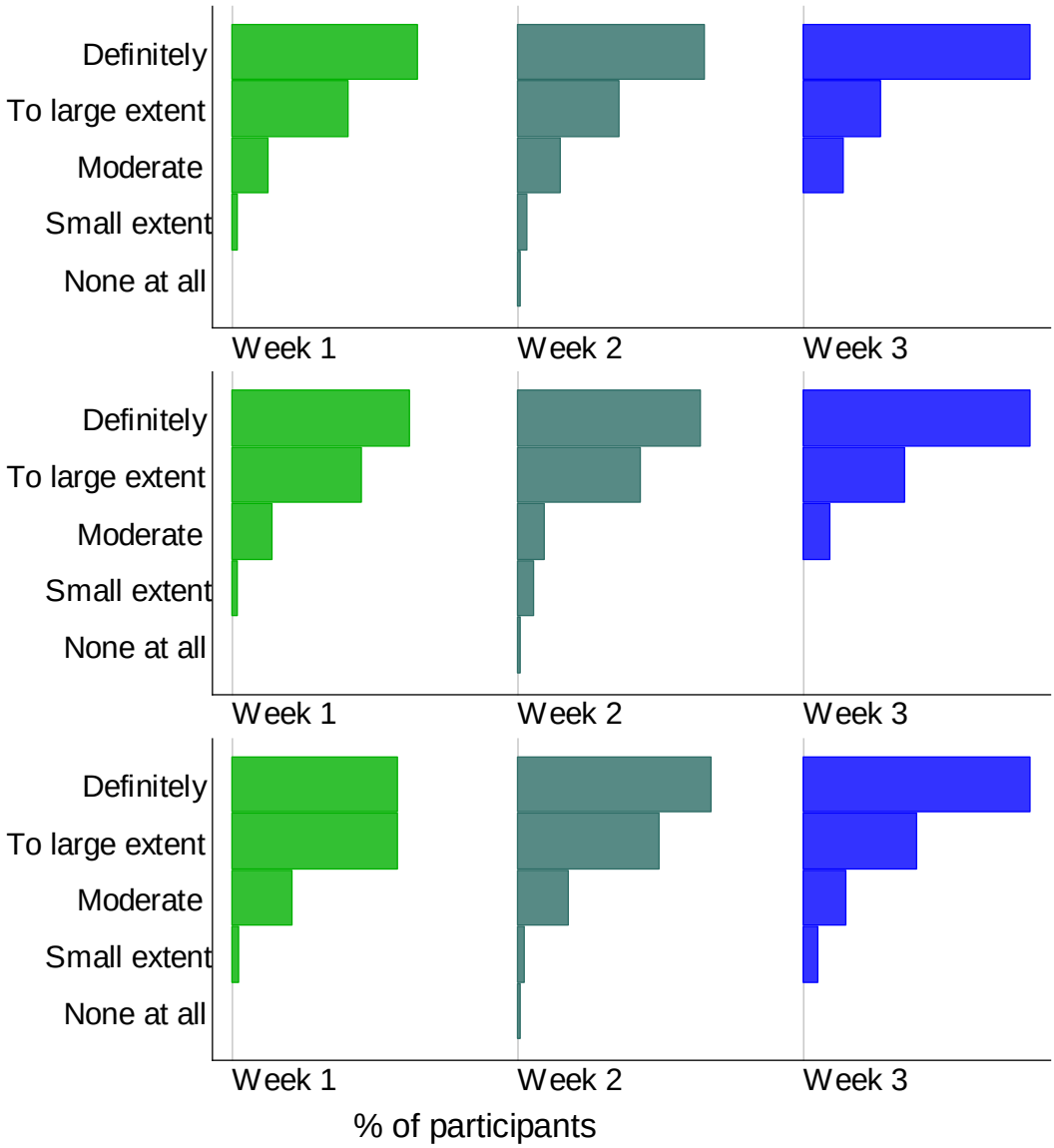

Figure 15 Participants' feelings on the effectiveness of the breakout rooms of the citizens' panels

Panel effectiveness was calculated by first generating the mean value of responses by all participants and then dividing it by 5, the range of the scale is then expressed as a percentage. Figure *16* (left) shows the overall panel effectiveness (in percentages) based on responses from across the three regions. The right panel shows the participants' experience with the deliberative process based on their responses to the question: *How did you enjoy your overall experience with this research project?* (1= not well at all to 5=very well). The mean response was above 4, indicating they felt they had a very positive experience with the deliberative process.

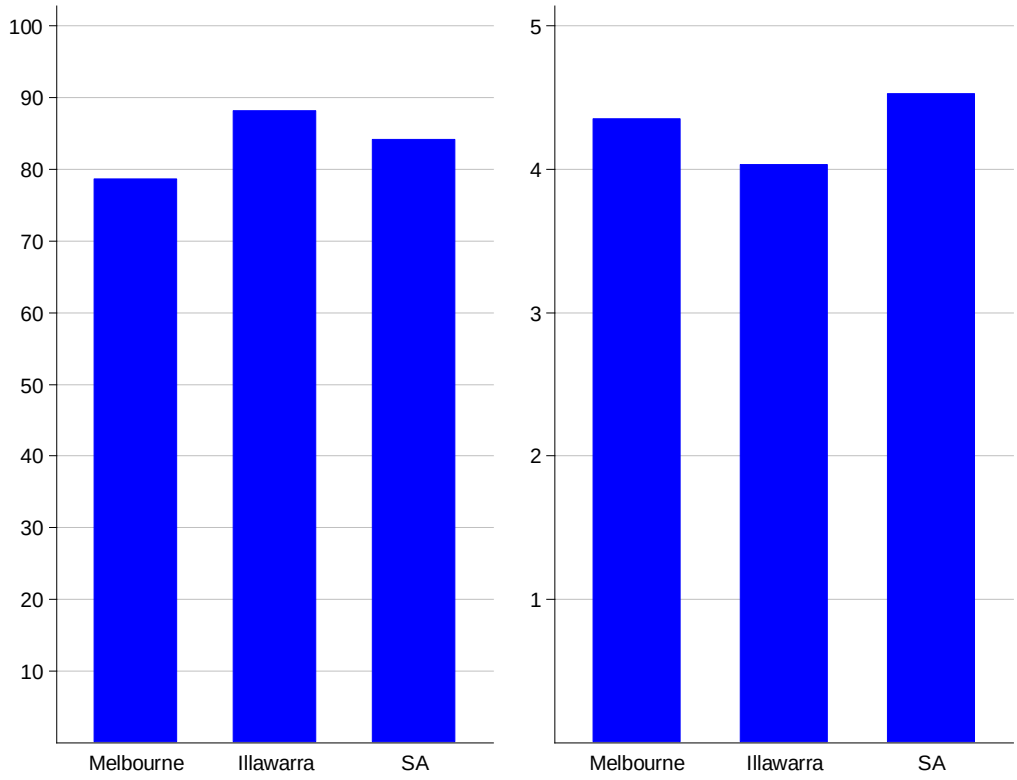

Figure 16 Participants' subjective evaluation of the effectiveness and experience with the citizens' panel

5.1.1. Participants' levels of identity within the panels

Social identity theory is a psychological theory that is focused on the study of intergroup relations and how individuals within groups relate to one another. An individual's level of self-identity within a group can strongly influence their overall attitudes and responses to different situations and information shared amongst group members. That is, if people consider themselves to identify strongly with a group, they are more likely to agree with what is being put forward and even change their viewpoint to align more strongly with the group.

To further understand how participants viewed their position within their groups as part of the panel process, we asked them to rate how they viewed their relationship with others in the Zoom meeting as well as with their Breakout Room (small groups) participants. We hypothesised that because the breakout room discussions were smaller and facilitated by a moderator, an individual's identity would most likely be higher with the smaller group. As well, that their overall identity with the larger Zoom group would grow over the three-week period the deliberations were held. How the question occurred in the questionnaire is detailed below in Figure 17.

If the circle on the left represents you and the circle on the right represents all the people in the Zoom meeting, select the diagram that best describes your relationship with other fellow citizens that attended the Zoom meeting today:

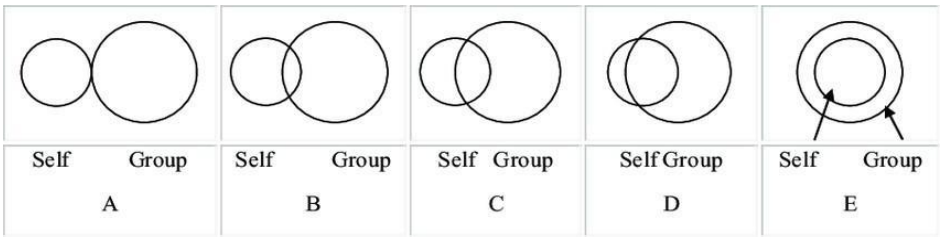

Figure 17 Identity and connectedness circles

The spread of responses by region are shown below in Figure 18 and Figure 19. On the whole participants seemed to relate well although week 2 there were a number of participants who obviously found it harder to relate than in the other weeks. Between week 1 and week 3 participants relationships and identity had grown.

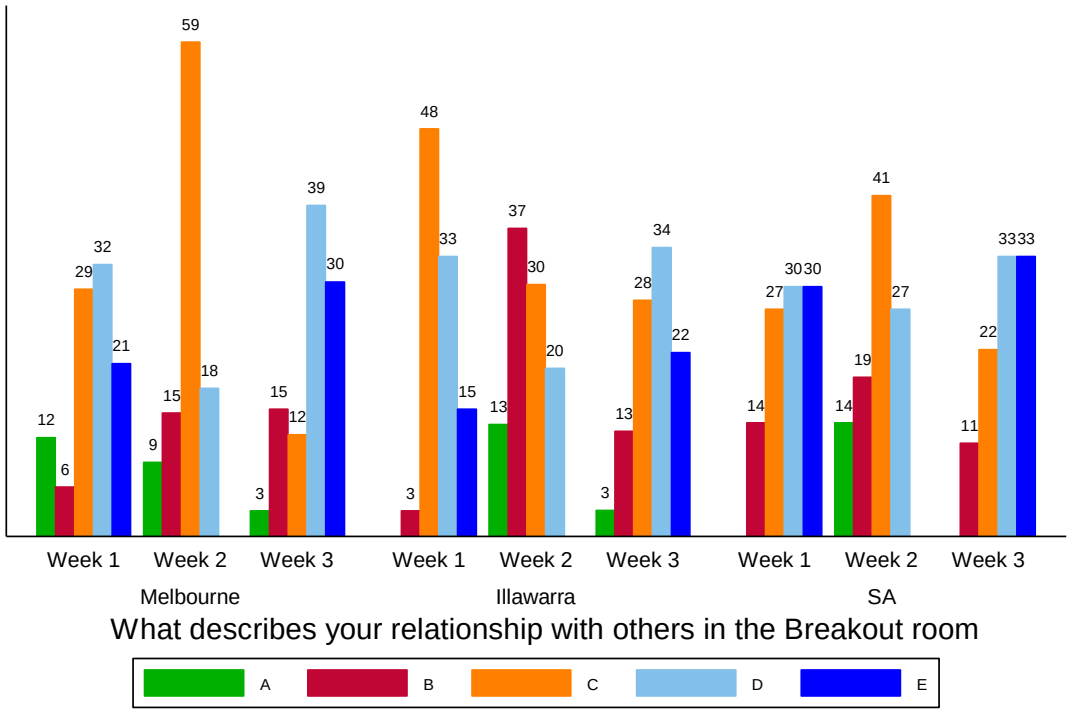

Figure 18 Categories of responses to how participants viewed their relationship with others in the breakout groups

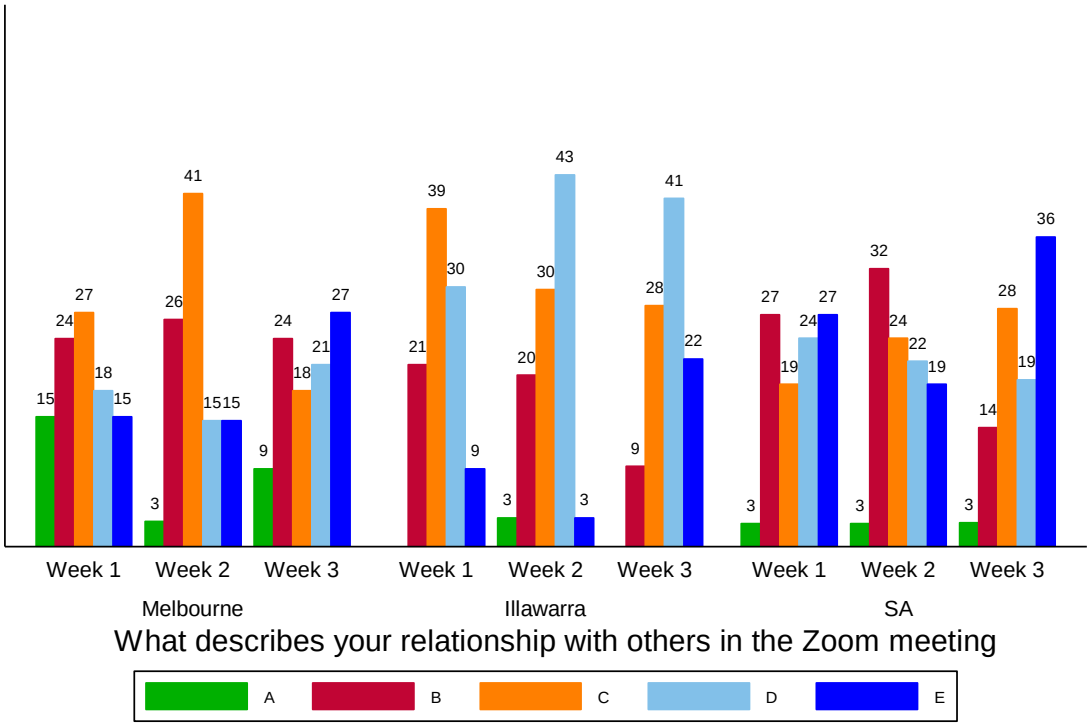

Figure 19 Categories of responses to how participants viewed their relationship with others in the Zoom meetings

As mentioned, the mean response from participants showed that on the whole participants' identity did increase from the beginning to the end of the panel process as they related more strongly to others in the group (Table 28). In week 2, participants did not rate that their relationship with the rest of the group was as strong and in fact it dropped for both the breakout rooms and the full zoom meeting (Figure 20).

Table 28 Mean value of participants' sense of identity between week 1 and week 3.

Variables	Week 1		Week 3		
	N	Mean	N	Mean	Mean Diff
Breakout Room	104	3.606	101	3.762	-0.157
Zoom Meeting	103	3.233	101	3.604	-0.371**

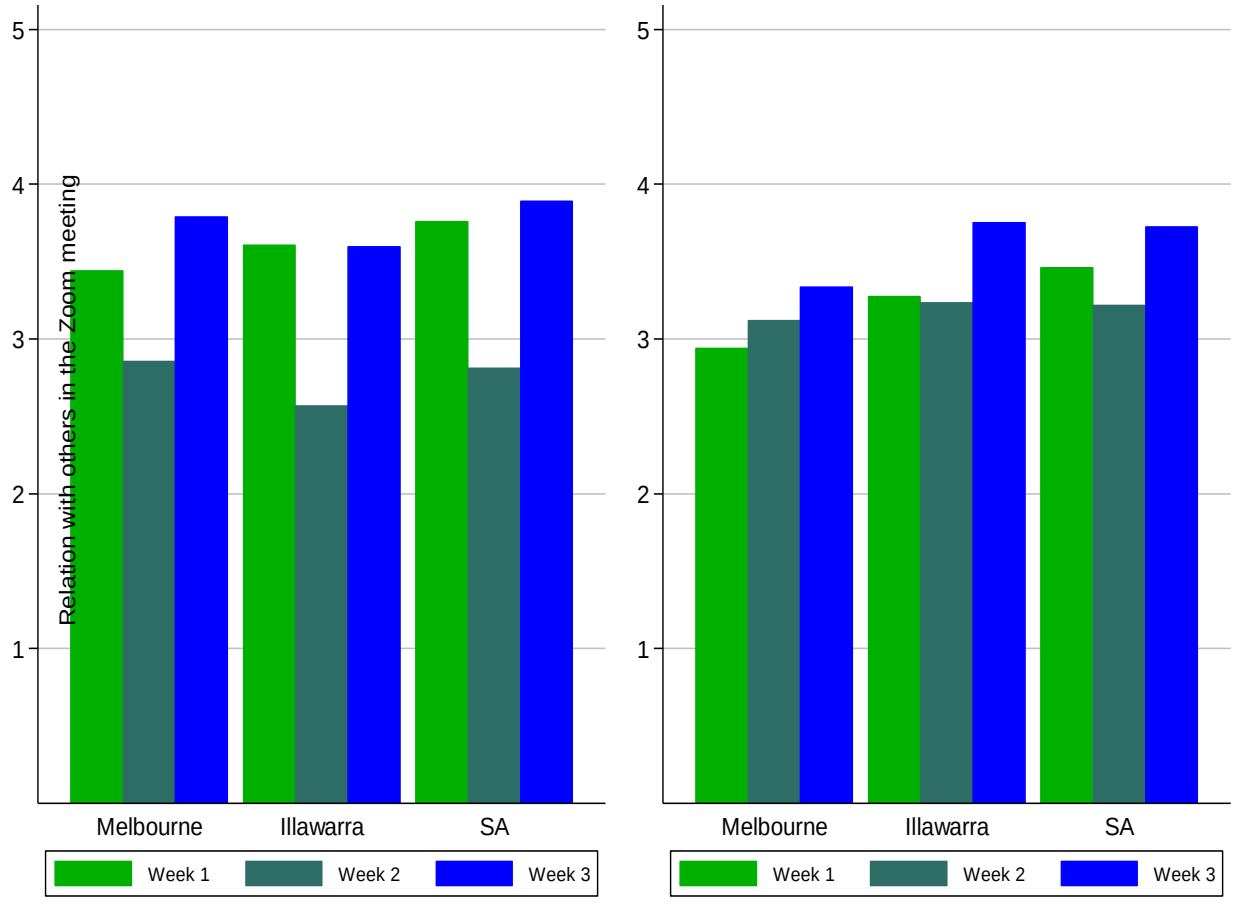

Figure 20 Mean value of identity by region and week - Breakout room (left) and Zoom meeting (right)

6. Discussion

6.1. CONSIDERATIONS FOR LOW-CARBON PATHWAYS

Over the course of the three weeks, panel participants discussed a series of questions that focused on the aspects of the current energy system - what they valued and what they would like to change about it. This also included what they felt would be the considerations, opportunities, and challenges for the deployment of future fuels and potential future energy pathways. As part of the process, participants were also tasked to develop a set of principles to guide the path to a low-carbon energy future for Australia. When discussing the potential low-carbon energy pathways, participants in all three panels raised similar issues. Regardless of which pathway Australia may progress along – either all-electric or one with future fuels – key factors influenced their views of the challenges and benefits that may arise. The following discussion serves as a synthesis of these points and other salient findings of this report that have implications for industry, policy makers and citizen participation in decarbonisation solutions into the future.

At the commencement of the deliberative process, across all panels, participants were supportive of hydrogen and their expressed support increased significantly over the three-week process. However, support for other energy sources varied across the different panels. As indicated in the pre- and post- surveys, support also grew for biomass and renewable energy sources, while mostly, support for fossil fuels and nuclear dropped (with the exception of the Melbourne panel where support for coal and oil increased slightly).

While we had hoped to be able to distinguish if there was a difference in attitudes and preferences between those already living in an all-electric household and those that use gas regularly, the large numbers of households in our panels which had both gas and electricity made it difficult to distinguish any real quantitative differences. However, this is where the discussions in the deliberations provide some useful insights, particularly from week 3, where participants were forced to evaluate the pathways they had been introduced to. Overall, most participants were comfortable that an all-electric pathway would not provide them with too many challenges (although having a choice in energy supply was valued), as long as the price of electricity did not increase significantly. However, there were a number of participants who were large users of gas that really valued the diversity that it provided in the energy supplied to their home. Others expressed a strong emotional attachment to cooking and heating with gas, which they saw as superior to electricity, which made them express greater support for future fuels.

Local context also played an important role in the discussions as the participants' knowledge and shared experiences of energy were always based on their personal interactions within their local context. While the discussions across the three panels covered similar aspects, when developing their principles for a low-carbon future, they each approached the task differently. The Greater Melbourne and South Australian panels developed broad principles to guide an energy transition, while the Illawarra/Wollongong group had a very practical approach focused on the need for transparent and sustainable supply chains that are economically viable for both consumers and producers.

Regardless of which low-carbon pathway eventuates, it was highlighted that any changes required to be made to appliances and houses, do not cause or amplify injustices, and do not place the cost burden of change directly onto consumers. Participants were adamant that any additional costs of transition will need to be minimised or subsidised by governments. This was recognised as being particularly important for those from lower socio-economic brackets, the elderly, and others unable to advocate for themselves. It was also seen as important to provide appropriate ad timely information to people from different cultural backgrounds.

6.1.1. Prospects and challenges – lessons and implications for industry and policy

While participants identified and discussed the benefits and challenges of pathways for decarbonising Australia's energy systems, many issues were common to all three panels but not all were given the same priority. There were several barriers or impediments to transition that arose in the deliberations and that were identified as areas of interest for industry and policy development for future hydrogen and other future fuel development. These are detailed below.

Personal cost and financial implications – Affordability and personal cost/benefit assessments were a central component of the participants' assessment of future fuels acceptance. This is consistent with technology and social acceptance models when measuring willingness to support other technologies such as solar PV, EVs or hydrogen fuel cell vehicles is weighed up through a risk and cost benefit analysis (Huijts et al. 2012). Affordability was also underscored by an emphasis on accessible energy prices in what citizens believed was important to Australia's current energy system.

Therefore, there is something to be learned from finding synergies between future fuels development and what citizens currently value. More information is required to be able to provide a broader picture of how a transition towards hydrogen may initially impact consumer experiences, in particular their personal choices and costs. Given there were mixed responses from citizens with some being more concerned about potential costs, clarification of the expected household costs of transition alongside the benefits of emissions reductions achieved would assist in moving towards future acceptance.

Here, strong signalling in the form of policy through subsidies, incentives and benefits may assuage some fears about gaps in citizens' abilities to make financial contributions to home installations and ongoing costs. These findings also suggest targeted campaigns about energy use, efficiency and savings may also be of use in localised contexts. This would serve to create better informed potential consumers of future fuels.

Reliability and security of supply – Issues of reliability were raised across several groups and manifested in several ways depending on what participants' prior experiences of reliability had been. For example, in the Dandenongs, where some had suffered interruptions to electricity supply due to severe storms and trees falling across lines, there was concern that limiting diversity in fuel choices could have a negative impact on overall reliability. Similarly, some South Australians in their panel, recalled the major blackout in 2016 that was experienced in their state. In this instance some of them were comfortable with greater self-generation through solar and home storage battery mixes. However, in all of these diverse options, affordability was also important.

Economics, employment and workforce training/reskilling – Wider economic benefits that could be distributed into the community is an important consideration within social acceptance of technology. There was some concern expressed around what the transition would mean for those currently employed in the energy industry, particularly in the Greater Melbourne region where participants were cognisant of what had happened once the Hazelwood coal fired power station had closed. However, wider economic benefits through employment, reskilling, training and anticipated revenue from exports were all viewed as positive outcomes by participants and were seen as being fairly significant to those who expressed support for hydrogen. These positive opportunities are likely to be important when communicating about what a hydrogen industry (for domestic or export use) might bring to various regions and communities.

Environment and energy trade-offs for climate change – At the beginning of the panels, positive views towards the environment were associated with positive views towards future fuels. At times, citizens commented on their willingness to pay more, within their scope and abilities, to opt into greener energy solutions for their household. This indicates that consumers may be willing to engage in further trade-offs for stronger ecological and climate results. However, within balancing the environment and economy question, it seemed the participants that valued the environment above all else, became less supportive, albeit only slightly, towards hydrogen. It is not clear why this occurred. However, it may be related to the discussions around the production of hydrogen from fossil fuels which is not the preferred solution for the final transition. In almost all instances hydrogen produced from renewable energy was preferred.

Renewable energy and emissions reduction - A reduction in emissions was also perceived as a positive step towards enhancing public health and wellbeing. Again, this suggests that while cost remains a central and uncertain obstruction to widespread uptake for some, a change in willingness to consider alternatives such as hydrogen was the result of benefits to the environment being made visible to panel participants and how it may impact their life over a longer period. This observation aligns with the way that social and personal norms and beliefs are integrated within individual acceptance models (Huijts et al. 2012). The implications of the range of trade-offs in the panels and how they changed over time, could further translate into positive trends towards acceptance within the broader community.

Infrastructure and development – These concerns fall within the scope of social licence whereby citizens engaged with ideas about where and how infrastructure development would impact their daily life. 'Not In My Backyard' (NIMBY) views, while evident, are also not the only factor influencing scepticism or resistance to proposed energy developments. The scope of social impact is now much wider and requires a broader field of assessment to include analysing national sentiments. Ongoing early intervention within the community across the local, regional and national scales in Australia should continue to be best practice to mitigate reservations surrounding siting matters. This includes being mindful of perceptions about who should benefit from proposed facilities and infrastructure. Evidence of concerns occurred as discussions appeared in the media about Andrew Forrest's push for the export of LNG from the Port Kembla development. One participant remarking that the terminal was less than 2km from her home. The participant claimed she would be asking many questions about the project and was thankful to have been able to become more informed about the topic through the panel process.

Social considerations and rental arrangements – Social considerations was one of the key priorities identified across the panels and this increased by the end of the panels. This manifested in many ways but one key issue for participants, which was expressed across several groups, were concerns about whether those who rent would be able to benefit from potential domestic hydrogen applications. This concern had been exacerbated by many who rent, not being able to easily access solar panels which therefore clouded their view on the likelihood of others benefiting from a future fuels' pathway. Several other social justice and equity issues arose through the discussions, many focusing on those less fortunate being able to access adequate supplies of cleaner energy without being negatively impacted through price or landlord choices.

Safety – This area remains a barrier for some participants. Although many in both their deliberations and their survey responses demonstrated being relatively comfortable with the development of a hydrogen industry. Regardless, safety will require ongoing collaborative attention by both industry, other non-state stakeholders and policy makers into the future. Mainly to ensure matters surrounding safety are communicated to the broader public where some uncertainties and deficiencies in trust remain. Of interest here are the additional social licence to operate questions replicated in the pre- and post- survey around participants' levels of trust in different organisations to act in the best interest of the consumer. The CSIRO and environmental NGOs were the most trusted and may be important partners for communicating the safety aspects of the transition and use of future fuels.

Communication of science and education – Somewhat related to safety, across the principles there was recognition for the need for greater communication and education on the topic of energy generally. Participants were a comparatively well-educated group and understood many of the basics around energy supply. However, they had many questions about hydrogen and broader future fuels and clearly recognised the importance that the broader population need to understand what the transition to a low-carbon society will require. The participants were supportive of more education and engagement activities being undertaken and felt that government had a responsibility to ensure this was being done adequately to bring the population along with the changes. They recognised this would require some investment in development of materials and included the need to also be made available to different cultures. That is, there may be a need to produce materials in different languages to help with understanding.

Investment in research and development – Similarly each of the panels were interested in future research being undertaken to develop technologies that are fit for purpose, will minimise the impact on the environment and not be too costly for anyone individual or group. They were supportive of increasing funds to guarantee adequate R & D was undertaken across the range of low-carbon technologies to ensure the most efficient and safe pathway was implemented that would not disadvantage any Australians.

6.2. PANEL PROCESS EFFECTIVENESS

As part of the evaluation the pre- and post- surveys not only helped us to track individual perceptions and understanding of the topic of future fuels and an all-electric pathway it also helped us to understand how participants viewed the effectiveness of the panels, their ability to contribute to the discussion, be listened to and feel respected. Overall, the quantitative results show that participants felt the citizens' panels were effective and they were able to participate actively and fairly in the process. They also appeared to enjoy the experience with

mean values of these questions well above the mid-point. This provides positive indications that the citizens' panels method is an appropriate way to engage on the topic. For research this could be across other states and territories, but it is also worth considering as a process for local communities in the early stages of project deployment.

Most participants indicated they developed relationships with others in their breakout rooms and larger Zoom groups which increased their overall self-identity with the panels. From a process point of view this is also important as the literature suggests if people identify with their groups, they are more likely to listen and value their group's responses, will share their ideas more willingly as well as take on board feedback from their peers. However, not all individuals were completely satisfied, which could be attributed to a range of reasons however most of the comments were positive. Further investigation of the qualitative comments that arose from the discussions and final feedback will also help to elucidate these reasons.

While most participants demonstrated great enthusiasm and remained engaged throughout the course of the research project, there are some observations about the process that have implications for future panel processes to enhance their effectiveness and capture a wider set of views and values. These are outlined below in no order of priority.

6.2.1. Lessons for ongoing future fuel deliberation and public engagement processes

Geography: It was difficult to secure participation from people in regional areas. Importantly, given this research illustrated divergent views at times across sites, conducting panels across other states and regions in Australia would provide a more complete vista of public attitudes towards future fuels. Potential locations would include Western Australia (Perth), Queensland (Brisbane, Gladstone, Townsville), Tasmania and the Northern Territory. Because these online panels demonstrate the flexibility of bringing together people from around Australia, future panels could also pursue mixes of different regions and states using Zoom where required.

Retention and age considerations: Participants 35 years of age and younger were more likely to withdraw as the project progressed. While one participant reached out to share his frustration with some of the older panel participants' fixed views against climate change there is not a lot of evidence provided as to why this was the case. As well, even though representatives from all age groups participated in the plenary discussions and the Q and A sessions, those 65+ and 35-44 were the most active participants. While the reasons for this are not clear, it may also be that those younger individuals did not feel as confident in the subject matter as their older counterparts. Their lower interaction, at times, gave the false view that there was a poor representation of younger members on the panels. Further panels should consider how to promote active engagement from participants within younger age groups. It may be worth considering conducting a 35 years or younger specific panel which could potentially include participants from across Australia of conducted on-line.

Gender: Overall, men were more active in the Q and A sessions than women in both the plenary sessions and submitting questions via the chat. Again, this is an area of focus for group facilitators to mitigate as the imbalance may impact on some participants feeling disengaged.

Information and presentations: Overall participants had a positive experience with the information that was presented to them. However, some participants across the three panels reported that they had some difficulties understanding the content of the two presentations that related to the potential decarbonisation pathways. This was a contributing factor towards participants seeking more information and content clarification around those presentations. It will be important to understand what it was in those presentations that created the concerns. Similarly, the research team struggled to find appropriate cost information to support the alternative pathways as it is still hotly contested. This was even in consultation with both the Industry Steering Committee (ISC) of the Future Fuels CRC as well as our external Independent Advisory Panel (IAP). Moving forward, having more information about what the likely impacts in relation to costs of the two pathways will be, should help minimise the issues that arose.

7. Conclusions and Recommendations

The locations selected for these deliberations were purposely selected for the differences they brought to the table. For example, Greater Melbourne was chosen because it was a large city with relatively high numbers of gas users; Illawarra/Wollongong because it was a regional area close to a port where export of hydrogen may eventually take place; and South Australia because it allowed a state representation as well as being an area that has a large penetration of renewable energy. All of these choices were decided in close consultation with both the ISC as well as our external IAP.

The IAP was helpful in providing advice as to what were the most suitable topics for presentations as well as who might be the best presenters. One area where the researchers, ISC and IAP struggled was in defining the most appropriate scenarios to use when presenting the alternative decarbonisation pathways. While there are multiple scenarios, most of them are not binary and have so many assumptions it is difficult to decide what to include and what to leave out. Because of this, it was decided to go with two high level alternate pathways but they lacked the detailed cost assumptions that could be shared with participants and still be considered impartial. This was possibly one of the major deficits of this round of panels and it would be ideal if more concrete information on this topic could be provided.

While we had originally anticipated that these panels would be conducted face to face, due to COVID-19 this was not the case, but our results clearly demonstrate that it is possible to produce meaningful results using online engagement tools such as Zoom. While it meant that participants and researchers missed out on informal discussions and networking opportunities that would normally occur during meal breaks, considerable savings were made in not having to travel and bring the participants and research team physically together in the same venue. It also allowed people to participate from the comfort of their own home which may have helped some participate who may otherwise would have declined.

Qualitative research is sometimes criticised for using small sample sizes which can make it difficult to generalise findings. However, through in-depth discussion and deliberation the panels provided much richer, and deeper insights into how people are thinking and responding to the topic, in this instance future fuels. For example, it was obvious that while there were some common principles identified that all participants would expect in the transition to a low-carbon society, each individual's background, and level of understanding about energy combined with their local context, impacted their responses to the various pathways presented. The pre- and post- surveys provide additional information which helps to unpack the changes in attitudes and effectiveness of the panels. Our results show that while there are many similarities across the three panels there are indeed differences which are influenced by location as well as socio-economic factors such as age, gender, education, and cultural backgrounds.

One thing that was clear from these results is the importance participants placed in having a diversity in their energy choices, ensuring affordability and reliability of supply, as well as taking action on climate change and reducing emissions. These were the non-negotiables. There is no doubt the long-term goal for participants was for clean energy supplying their needs with minimal environmental impact. The information that arose from the panel discussions suggests they have an expectation for government and industry to take responsibility for transitioning to a low-carbon supply. Their suggested pathways included using informed policy positions that helped enable the transition, educating the broader public on what needs to happen as well as limiting any increased costs being passed on to consumers. The importance of transparency and communicating and engaging on the transition was highlighted at multiple stages throughout the deliberations.

We found that engaging everyday people in discussions and exploring how they relate to new and emerging technologies and concepts in a context where they are given the space and time to consider relevant information is important. It helps to shed light into the complex nature of societal acceptance of technologies. Our research showed that even when participants are presented with the same information, the way they perceive the technologies and approached the discussion are influenced by multiple factors. While these are reflected in models of social acceptance and social license to operate, these deliberations allow for greater insights as to what are the key factors impacting the public's attitudes.

Recommendations

A. We recommend undertaking additional deliberative panels for the states and territories not already covered in these results, for example Queensland and Perth could be useful next steps.

B. Using citizens' panels in local contexts where projects are proposed would also provide an effective way of increasing the likelihood of support as participants felt the deliberative process was meaningful and could help to elucidate local opportunities for projects.

C. Ensuring there is more accurate and widely accepted cost information on the all-electric and future fuels pathways would help with the deliberations and provide greater reassurance on how the transition might occur.

D. The principles that arose from the deliberations provide some useful insights for government and industry that require greater discussion with key stakeholders. This process could be facilitated through this work package and FFCRC key leaders.

E. The questions that arose from the weekly deliberations provide useful materials to inform fact sheets that will provide a helpful basis for industry and government more broadly.

F. There is an opportunity to focus on more nuanced attitudes towards hydrogen based on whether a citizen is either renting, a homeowner or a landlord and unpacking the different acceptance levels across these three actors could provide valuable insights into concerns which may impact hydrogen uptake.

G. There were several issues raised in relation to those living in rental housing and marginalised groups, particularly indigenous perspectives that need to be further explored in future research.

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