THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

Developing community trust in hydrogen

School of Chemical Engineering
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Executive Summary

The Council of Australian Governments (COAG) Energy Council is committed to a vision of making Australia a major player in a global hydrogen industry by 2030. This report was commissioned by the National Hydrogen Strategy Taskforce to inform the key issue of community and stakeholder engagement. It builds on the work funded by ARENA in 2018 by Lambert and Ashworth (2018), "The Australian public's perception of hydrogen for energy", and Issues Paper 5 "Understanding Community concerns for safety and the environment" from the National Hydrogen Strategy consultation held in July 2019.

The research included a desktop review to develop a library of relevant and useful resources for informing best practice community engagement by summarising key literature, theories, case studies and relevant communication and engagement material. This was followed by mixed-methods research conducted across Australia in October 2019. Nine focus groups were conducted across three cities (Townsville, Warrnambool, and Darwin) which included general public participants and an influential stakeholder group in each city (n=72). Participants completed two short pre- and post- pen-and-paper surveys as part of the focus groups. In addition, 19 telephone interviews were undertaken with 21 influential stakeholders across Australia.

Early research into public attitudes towards hydrogen revealed that both in Australia and internationally, most individuals have a relatively neutral response to hydrogen. The desktop review revealed insights that are relevant to this early stage development of a hydrogen industry. These include paying attention to the pace and scale of development – if things happen too quickly it can have negative consequences. Possibly leading to a boom and bust outcome similar to those experienced by many in Queensland from the unconventional gas industry.

The need to co-exist with different sectors such as agriculture, the resources industry, and large-scale renewable energy projects was also raised as an important consideration. Other considerations included the need for context specific, early engagement that is culturally relevant and appropriate. As well, recognition of the need for identifying local benefits such as jobs, opportunities for co-ownership and co-contribution as part of the decision-making processes. Such a focus on local outcomes was seen to contribute to perceptions of procedural and distributive fairness which help to build trust in project developers and government regulators.

Overall, there were positive responses to the development of a hydrogen industry in Australia and the potential opportunities associated with developing a cleaner long-term alternative energy source. Common questions and concerns centred on overlapping themes that encompassed associated costs, benefits, opportunities, risks, and safety, as well as identifying the associated impacts for individuals, households, regions and the environment. Of particular interest was the Australia-wide and region-specific benefits that could emerge through the development of a hydrogen export industry. For example, opportunities for employment and skills development; the distribution of royalties; domestic versus foreign ownership; and control of technologies and related infrastructure, including ports.

Given the growing momentum occurring with hydrogen, concerns were raised around the unnecessary competition that was emerging between States, Territories and regions about who is best positioned to host an export facility. Although hydrogen can be produced by renewable energy through electrolysis and with fossil fuels combined with CCS, it appears that most individuals support the production of hydrogen from renewable energy sources. Some influential stakeholders felt that this type of production would give their local area a "green" edge, which in turn would make them attractive to other industries. Indigenous interviewees were also keen to be part of an industry that presented a clean and green image. Some participants were more tolerant of a transitional role for fossil fuels in hydrogen production. To some extent, this was influenced by geographic location and an individual's previous experience with fossil fuel industries. However, the scale of renewables required was still seen to be a challenge that would take time to be overcome.

Water for the production of hydrogen from the renewable energy electrolysis process was a key concern. This was particularly important where communities had faced drought in recent times and the sensitivities surrounding water use for agriculture. Therefore, the concept of exporting hydrogen and "our water" was not viewed positively. Related issues included trade-offs related to the siting of projects, e.g. whether it was best to locate hydrogen sites close to communities and water or whether it would make sense to desalinate water and transport it to the place of production. Other questions included what the environmental impacts are likely to be. For example, what might be the potential effects of large ports and processing plants on coastal ecosystems, as well as the impacts on biodiversity based on large scale solar and wind project developments?

When it came to communication, there was a strong undertone that the technology and message should be consistent with a long-term strategy, and that the frequency of communication and engagement should also be prioritised. Participants expressed a preference for balanced, objective and evidence-based information that clearly articulated safety considerations as well as the costs, risks and benefits. All participants emphasised the importance of managing expectations around how long it will take for projects to be up and running and when jobs and other opportunities would emerge. Trust was seen to be implicit if these considerations were adhered to.

It was recognised that there is not a one size fits all and stakeholder analysis and segmentation would be a key component of any communication strategy. Focus group participants indicated preferences for a variety of formats for receiving information and other educational materials about hydrogen, including social media, research and media articles, official websites and documentaries, and print, television, and cinema advertisements. Facebook was an important medium that is being increasingly used by local councils and residents to communicate and access local news. Research organisations, including universities and CSIRO, and governments were seen to have leading roles in disseminating information, followed by companies operating in the hydrogen industry.

There are a number of recommendations that emerged from the research which included:

1. **Manage expectations and communicate realistic timeframes** about how long it will take to scale up the production of hydrogen. Most recognised that a hydrogen industry will not happen immediately with many challenges to be overcome. However, with the growing interest from governments across Australia expectations were rising around prospects for renewed economic growth in regions and this needs to be managed.
2. **Ensure hydrogen is available for domestic use** without a premium price attached. Indigenous leaders stressed the importance of having access to the clean fuel themselves and that it should not only be produced for export or use elsewhere.
3. **Develop a standard framework for benefit sharing** that will ensure benefits are fairly distributed and includes Indigenous groups. While it was recognised that perceptions of benefits are likely to be different, open and transparent approaches were seen to build trust in the industry and project proponents.
4. **Clearly communicate the costs, risks and benefits** associated with hydrogen through consistent messaging including how safety issues and water concerns were being addressed given the recent droughts and the rising costs of water.
5. **Use case studies and pilot projects** (including demonstrations) to build confidence in the use of hydrogen and its production.
6. **Ensure the Commonwealth Government** takes an early lead in coordinating a national approach to hydrogen including the development of necessary standards and regulations.
7. **Engage further with emergency services** to ensure they have the necessary information available to them for establishing Australian standards for responding to any events. This was important given the volunteer nature of so many fire and rescue services in regional communities.

8. **Continue to engage with Traditional Owners** as this research was only successful in engaging a small number of Indigenous leaders but there was an expressed appetite to learn more about the opportunities hydrogen might present.
9. **Ensure nationally consistent messaging** about hydrogen are agreed across all levels of government. It may be opportune to develop a resource package of information materials for a variety of stakeholders that can be used by all levels of government and in schools.
10. **Establish a presence on Facebook** that can be used to disseminate the latest information about hydrogen and how the industry is evolving. While not always a medium embraced by federal and state governments, Facebook was seen as a valuable format for information sharing across local regions.

1. Introduction

With international demand for clean hydrogen growing, there is increasing global interest in how hydrogen will be produced. Australia as a resource rich country has the potential to be a major player in this industry. To realise this opportunity, the Council of Australian Governments (COAG) Energy Council has set a goal to develop a National Hydrogen Strategy by December 2019.

One cross-cutting issue that has been identified as imperative for realising this potential is around identifying how Australians may benefit from the emergent industry and ensuring adequate community and stakeholder engagement in the process. Particularly, understanding how different stakeholder groups impacted by an emergent hydrogen industry - be they remote, regional or suburban - may respond. Therefore, a critical component of the National Hydrogen Strategy sets out to establish agreement across States and Territories on ways to engage communities and affected stakeholders.

Community confidence in the safety of hydrogen production processes has also been deemed a critical success factor for the development of a clean hydrogen industry. Early research by the Lambert and Ashworth (2018) showed that the Australian community's understanding of hydrogen is low. If Australia is supporting the development of this industry, an important component will be to ensure that all Australians are brought along the journey, so they gain and maintain confidence in what is happening. Ensuring Australians have access to information about hydrogen and the emergent industry is also important for raising awareness about the potential industry and benefits it may bring.

Experience has shown that individual responses to new and emerging technologies will be influenced by a range of factors and these are also relevant to hydrogen. These include, but are not limited to: an individual's experience with, and knowledge of hydrogen and the associated production processes; their personal beliefs and values - do they believe in the need for climate mitigation?; do they have a strong preference for renewable energy?; social norms, that is, what their friends, family and other referent others believe; whether they are directly impacted by a hydrogen project – both positive and negative; and if they perceive there to be costs, risks and/or benefits from hydrogen that may affect their livelihood or lifestyle.

The source of production for hydrogen has also been identified as being important to many. Whether hydrogen is produced from a renewable electrolysis process or from fossil fuels combined with carbon capture and storage (CCS) affects stakeholders' views of the technology. Lambert and Ashworth's (2018) early research clearly showed that individuals held a range of views around this issue. While the research set out to understand the public's attitudes to the different opportunities for hydrogen including export, transport and domestic use, it did not examine likely responses to the export infrastructure required nor whether being situated close to such infrastructure might influence attitudes.

This is one of the gaps in knowledge explored as part of this follow up research which is seeking to:

- Identify and understand community concerns and perceptions of hydrogen
- Identify how best to engage and work with communities
- Understand community views on the roles of government (across all levels) and industry when it comes to hydrogen
- Identify how to improve awareness and educate the general population on hydrogen.

This report documents the current state of knowledge in relation to the social issues surrounding hydrogen projects, reviews leading practice stakeholder engagement and communication strategies and has developed a library of relevant and useful resources.

2. Early research into societal acceptance of hydrogen

2.1 Initial publications on attitudes to hydrogen

While the idea of using hydrogen for energy is not new, there remains some barriers and opportunities that have been identified as critical for a hydrogen economy to prosper. Despite the growing focus on hydrogen technologies and required supporting infrastructure, until recently, the willingness of the public to accept or tolerate such projects (either from large scale renewable energy or fossil fuels with CCS) has been relatively under explored.

As part of the early Australian research funded by ARENA, Lambert and Ashworth (2018) undertook a desktop search of the Web of Science database using the following terms: *hydrogen and public acceptance; hydrogen and public attitudes; hydrogen and public perception*. This search returned a total of 113 journal articles since 1998, after duplicates were removed. Of these, 81 were relevant (once nuclear, medical and water treatment papers were excluded), with 49 directly investigating public perception.

Analysis of these papers showed that public perception studies have been reported most commonly in Europe (33 studies across the UK, the Netherlands, Norway, Germany, Spain, France, Greece, Sweden and Slovenia), with thirteen across Asia (Korea, Japan, Malaysia, Taiwan and China), and three in North America, while only one included Australia. The studies used a mix of methodologies including telephone interviews, face-to-face questionnaires, online surveys, and focus groups. Participants were asked about their knowledge of hydrogen and hydrogen technologies, perception of the risks, and acceptance of technologies. Willingness to Pay (WTP) was also a focus of some studies (Iribarren et al., 2016; O'Garra et al., 2007; Garrity, 2004; Yang et al., 2017; Bigerna & Polinori, 2015).

Questions assessing environmental attitudes and behaviours were common (Xenias & Whitmarsh, 2013, Tarigan et al., 2012, O'Garra et al., 2007, Itaoka et al., 2017; Zimmer & Welke, 2012; Heinz & Erdmann, 2008) and trust was also addressed in several studies. This included trust in the media (Itaoka et al., 2017), trust in science and technology (Achterberg, 2014; Achterberg et al., 2010), trust in the government and trust in industry (Montijn-Dorgelo & Midden, 2008). Itaoka et al. (2017) also addressed participants' risk appetite while Ono and Tsunemi (2017) examined risk acceptance, risk avoidance and risk perception. Huijts (2018) and Huijts et al. (2013) drew connections between emotions (anger, fear, joy and pride) and attitudes based on perceived outcomes, fairness, novelty and trust.

2.1.1 Initial perceptions

Many of the research studies began by asking participants for their associations with hydrogen. The most common response being neutral associations. This also informed the Australian work by Lambert and Ashworth (2018, p.10) where "neutral responses (e.g. gas, energy, water) were the most common (81%), while 13% were negative (e.g. bomb, explosion, Hindenburg), 3% were positive (e.g. clean, future), and 4% did not know". In addition to the large neutral response, Zimmer and Welke (2012) found that associations with "hydrogen cars" were mainly positive and that negative associations were unrelated to risk, but were instead related to car performance (speed, power) and cost.

Safety and risk were less of a concern for public acceptance than "green" production. Hydrogen refuelling stations were not considered any more dangerous than conventional ones. Similarly, Schmidt and Donsbach (2016) reported that "specific dangers such as explosions or the hydrogen bomb were seldom mentioned" and only 3% cited safety concerns in a Canadian study (Hickson, Phillips & Morales, 2007). An online survey in the Netherlands (n=406) found 28% associated the word hydrogen with bomb, dangerous, explosion, while only 1% related it to the Zeppelin (Montijn-Dorgelo & Midden, 2008).

2.1.2 Effects of information provision

There were also a number of studies that experimented with the effects of information provision on individual knowledge and attitudes towards hydrogen. In all instances this led to the majority of those being exposed to the information becoming more supportive of the hydrogen technology being examined. For example, Huijts et al. (2013) compared the results for two Dutch samples in relation to hydrogen refuelling stations and an individual's intention to act in favour of, or against them. One group was provided with information on the topic of hydrogen refuelling in written form as part of a questionnaire, while the other was not.

In the information provision group, there was a shift from those who had previously reported a neutral attitude to more expressing support (neutral reduced from 45% to 27% in the information group). There were also more supportive attitudes (62%) reported in the information provision group compared with those in the no information group (44%). It is worth noting however, the percentage of negative responses was similar and remained the same regardless of whether they had been provided information or not (12% versus 11% respectively). The researchers found that moral considerations (Norm Activation Model) were stronger than self-interest (Theory of Planned Behaviour) and concluded that moral opposition may be reduced if policies promoting technologies that benefit society or the environment were introduced through information provision.

2.1.3 Emergency services engagement

Across the United States of America, the emergency services community has been identified as a critical group to engage on the topic of hydrogen. This is not only for safety considerations but also as a way of building trust and broader community confidence in the development of a hydrogen industry (Barilo, Hamilton & Weiner, 2017a). The paper by Barilo and colleagues (2017a) provides an update of a 15-year partnership between the California Fuel Cell Partnership and the Pacific North-West Laboratory in developing hydrogen safety first responder (emergency services) training materials. There are several excellent training resources that are available both to government and industry on the US Department of Energy website (see for example: http://www.hydrogen.energy.gov).

In addition, the European Commission's project, Hy-Response, also provides a number of useful resources that can be used for educational safety including virtual reality training ideas and mock-up life size facilities (http://www.hyresponse.eu/?LMCL=TFjaY5). It is a hydrogen emergency response training program for emergency services and includes international curriculum, hydrogen safety basics and other useful reference material.

Recognising the importance of this area Australia recently became a member of the *Center for Hydrogen Safety.* The Centre is a global not for profit dedicated to promoting hydrogen safety practices worldwide. It identifies and addresses concerns in relation to the safe use of hydrogen as a sustainable energy carrier and in commercial and industrial uses. Led by the United States it has over 60,000 members from across 110 different countries. This provides a direct opportunity for Australia's emergency services workers to learn best practices in hydrogen safety

3. Prior Australian research into hydrogen

3.1 Low knowledge with a need for more information

As part of the nationally representative online survey (n=2785) undertaken in 2018, investigating the public's response to the potential role of hydrogen in export, transport and domestic use in Australia (Lambert & Ashworth, 2018), it was found that there was low knowledge of hydrogen properties (average score 2.24 out of 5). That is, a large proportion of respondents did not know any hydrogen production or end uses. Despite the lack of overall knowledge of hydrogen, the vast majority of respondents were either supportive (52%), or neither supportive nor unsupportive (45%) of hydrogen. Only 3% of respondents were unsupportive about hydrogen as a possible solution for energy and environmental challenges. On further analysis, support was correlated with knowledge of hydrogen, and conversely a neutral stance on hydrogen was very much correlated with a lack of knowledge on hydrogen (Figure 1).

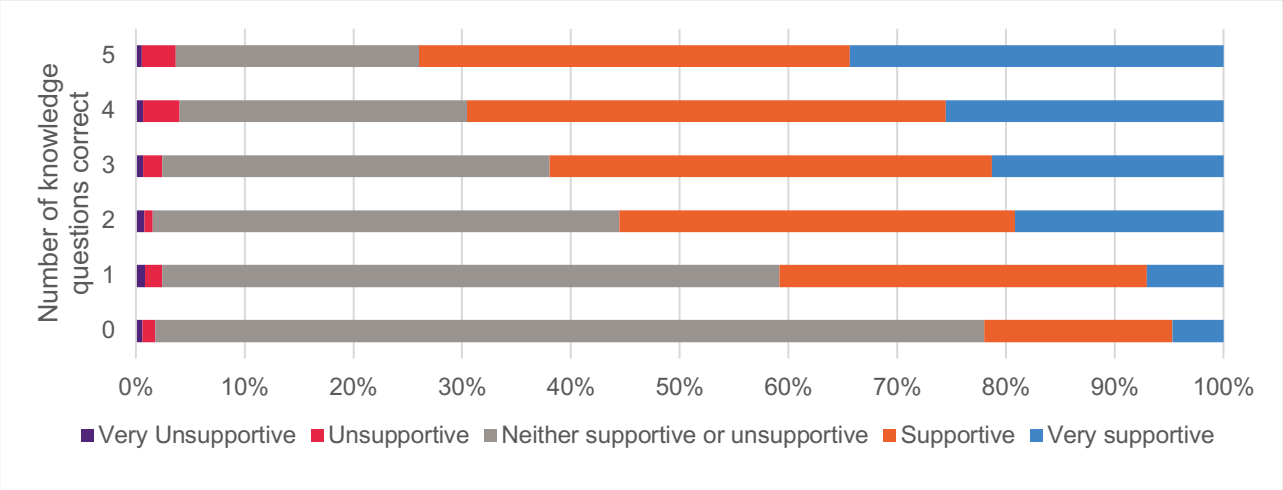

Figure 1: Support for hydrogen as a solution to energy and environmental challenges depends on knowledge (Lambert & Ashworth, 2018, p.13)

Regarding the types of hydrogen production, hydrogen produced from renewable energies was most favoured (57%). However, there was also acceptance of hydrogen from fossil fuels as an intermediate step while transitioning to renewables (38%), with only 25% prepared to tolerate the production of hydrogen exclusively from fossil fuels and CCS indefinitely (Figure 2). These views on point of production were consistent throughout Australia, with very little variability between States and Territories.

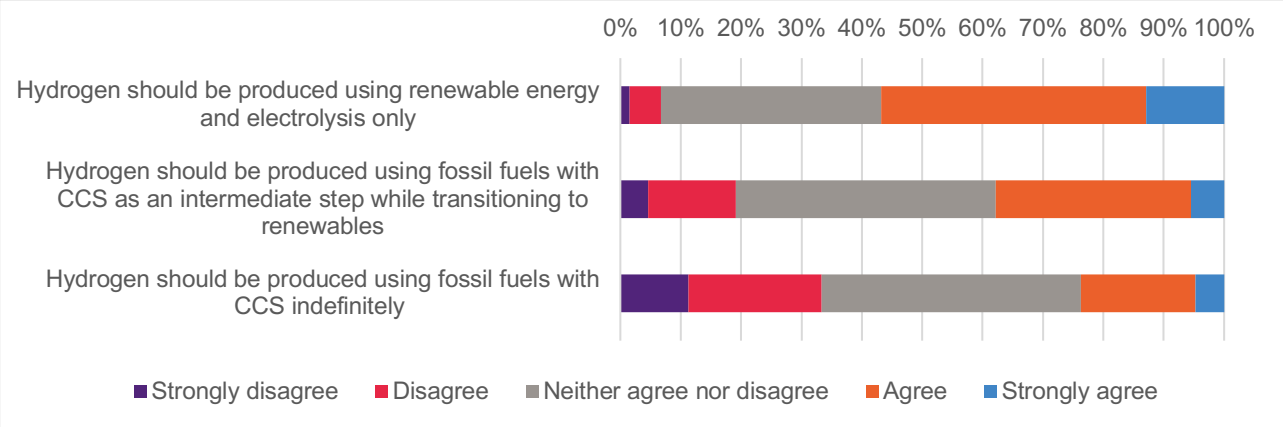

Figure 2: Levels of agreement for different production processes (Lambert & Ashworth, 2018, p. 18)

Cost was a key issue from respondents. Compared to conventional technologies, even if there were clear environmental benefits with hydrogen technologies, only 6% of respondents were willing to pay a lot more for hydrogen, while close to one third (31%) of respondents were willing to pay a little bit more. Although 39% of respondents were willing to pay a comparable cost, almost one quarter (24%) of respondents would be willing to pay, only if hydrogen was cheaper than conventional technologies. The research showed that willingness to pay was correlated with global warming beliefs. However, there was still a large group of respondents that, despite believing that global warming is happening now or will start happening in the next 30 years, were unwilling to pay more for hydrogen technologies (Figure 3).

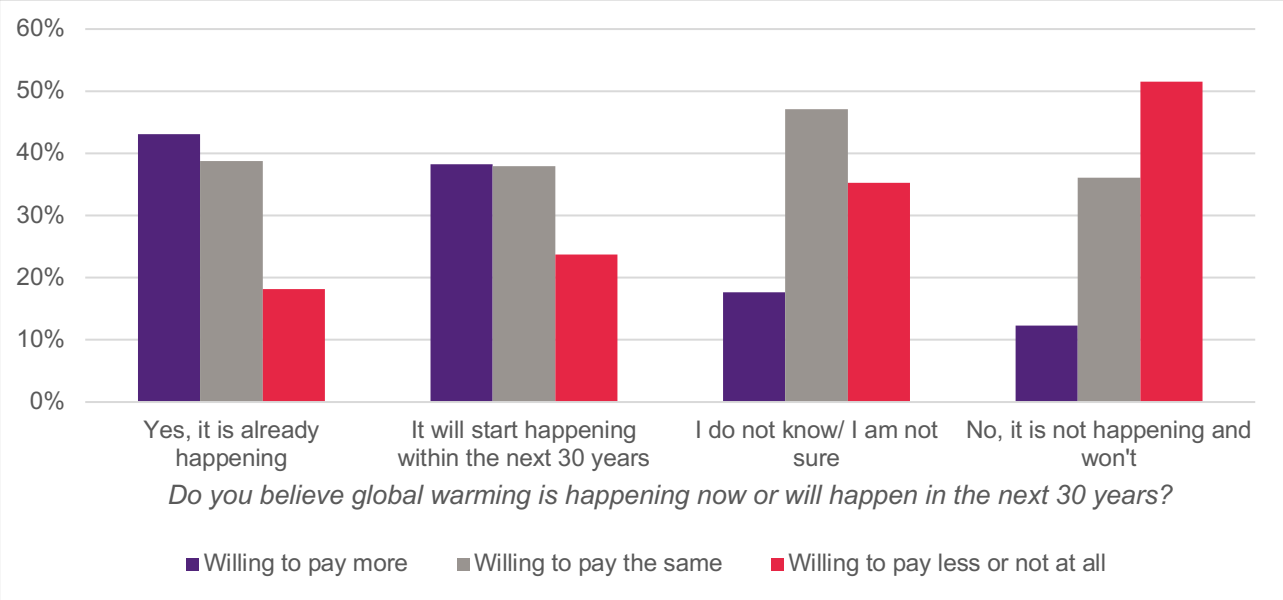

Figure 3: Global warming belief affects willingness to pay (Lambert & Ashworth, 2018, p.17)

Another important factor was safety, both in terms of the export of hydrogen as well as in the various transport end uses. Safety was the number one factor to be considered in any hydrogen development. As part of this, the government's role was to ensure that regulation was in place (74%) and standards were developed (63%) to maintain safety expectations of the broader community (Figure 4). Developing a long term strategy for hydrogen was also viewed as being an important role for government.

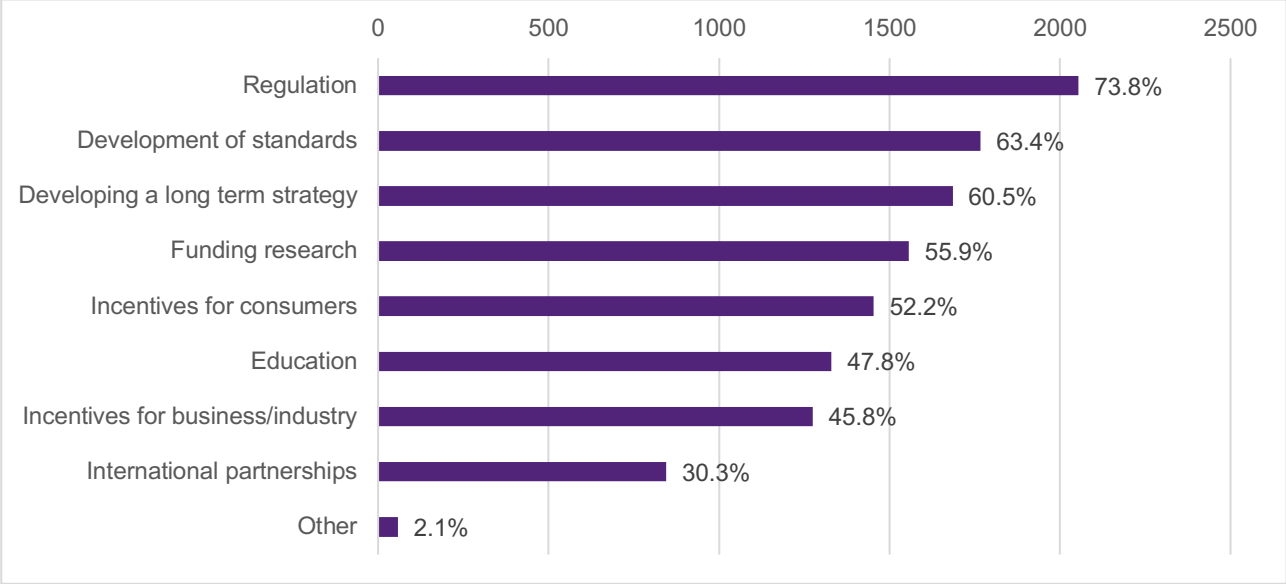

Figure 4: The role of government in developing a hydrogen economy (Lambert & Ashworth, 2019, p. 21)

Disseminating information about hydrogen (67%) was also seen as a primary role for government, followed by research organisations (49%) and industry (43%) (Figure 5).

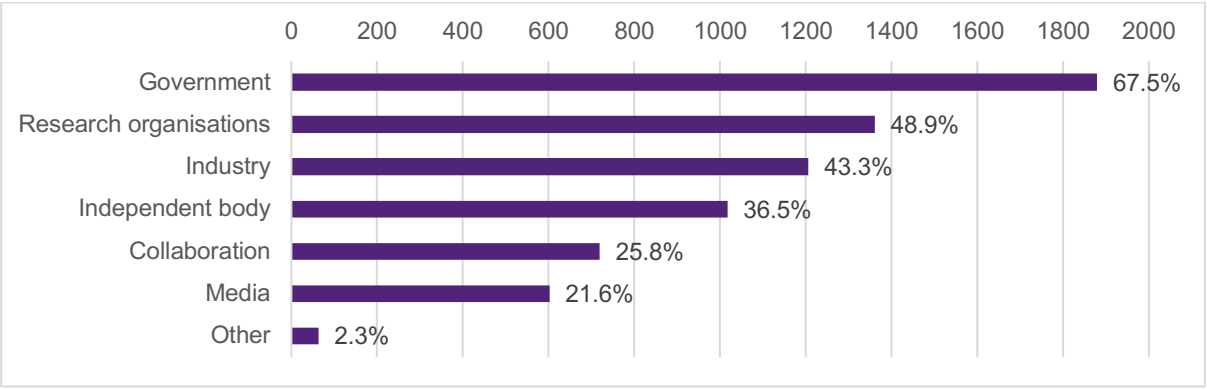

Figure 5: Who should be responsible for disseminating information? (Lambert & Ashworth, 2018, p. 22)

3.2 Concerns surrounding safety and costs but still optimistic

In addition to the survey, ten focus groups exploring public attitudes towards hydrogen for energy were conducted in 2018 in South Australia (Adelaide and Whyalla) and Victoria (Melbourne and Traralgon). There was broad agreement that the development of a hydrogen industry in Australia presented an opportunity to be a world leader. Many participants suggesting they would be supportive of such an industry if their overall concerns were addressed.

Common to all groups were questions about safety issues (e.g. storage, volatility, potential for traffic accidents, lack of visible flame on domestic cookers) and the long-term effects of using hydrogen. Other questions included time frames for transitioning and highlighted the need for a stable long-term strategy that has bipartisan support. Several participants raised concerns about policy backflips and a lack of follow through on previous strategies and projects led by governments, and to a lesser extent, industry. The potential for jobs and industry transitions were of interest to many participants.

Cost was consistently raised as a key concern. This was primarily the costs associated with the need to purchase new hydrogen technologies, such as fuel cell electric vehicles and domestic appliances. Most focus groups included comments about affordability for households and individuals, with the impact on lower socio-economic areas and fairness of the distribution of costs mentioned as a concern in several regional groups. Broader concerns related to the cost of establishing new production and export infrastructure and the cost of production itself in terms of the energy penalty. Concerns about the use of water, particularly if it was for export production, was also raised.

Participants were more supportive of hydrogen being produced from renewable energy technologies rather than gas or coal with CCS, in alignment with the findings detailed above in Section 3.1. There were comments relating to choosing the energy sources that are the best in the long-term, rather than going with what will be the easiest or makes the most money in the short term. Ideally there would be both economic and environmental benefits arising from a thriving hydrogen industry. While some participants considered they would pay a bit more for hydrogen energy if it benefitted the environment, others suggested for many Australians, the incentive to adopt hydrogen technologies would be driven by economics. That is, individual benefit rather than environmental benefits. Subsidies and incentives were seen to be important to offset the cost if the government wished to drive technology uptake.

Support for the development of an export industry was given, with the following caveats. Across all groups, participants expressed the need to ensure a domestic supply of hydrogen which included ensuring the affordability, reliability and continuity of supply. Many participants saw the potential economic benefits but suggested the need for fairness in the distribution of export profits, and clear information and transparency on how that money would then be used. There were several questions about ownership and the running of hydrogen facilities. Some participants expressed the view that too often, Australia has not done enough to protect its research and IP, and that by investing in hydrogen research and development (R&D) there may be the opportunity to create technologies and products that Australia could sell to the world. This was seen to bring additional economic benefits beyond the value of exporting hydrogen.

Government was seen to have several roles in the development of a national hydrogen industry. Participants suggesting it should take the lead in driving the strategy and setting the agenda, as well as taking responsibility for issues including ownership and governance models, particularly if the hydrogen industry was to be privatised. Associated government roles were in regulation and monitoring of the industry, ensuring safety and overseeing costs to avoid high energy prices.

Other participants suggested there should be a mix of government, industry and other bodies involved in driving the strategy. Although large companies were not seen to be credible, trustworthy leaders for solely driving a new industry. Others suggested government should take a role in establishing economic incentives and subsidies, both for industry and consumers. Economic incentives included funding R&D in public institutions such as CSIRO and universities as well as within industry. There were questions about the potential for small-scale R&D production (i.e. local industries and businesses), and the role of government in supporting such ventures.

Communication was seen as a major role for government. This included communicating with, and establishing joint ventures and trade agreements with other countries. Many suggesting that government should be responsible for communicating the hydrogen roadmap but also recognised that industry and companies needed to be involved. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) was frequently named as an important, trustworthy and credible source of information, and an organisation that participants would trust to establish pilot production plants or demonstrations in communities. Academic researchers and universities were also mentioned as trusted and non-biased sources of information.

Participants across all groups raised the need for accessible, easy to understand information about all facets of the transition to a hydrogen economy. Transparency was seen to be critical as was the need for balanced information that presented associated costs, benefits and risks. A range of communication strategies were

suggested, including providing information packs to households, media advertising, public seminars and discussions, school education, as well as pilots and demonstration sites. Participants felt messages should include information about incentives, benefits and timeframes. Narratives and case studies were also suggested to demonstrate how hydrogen has worked elsewhere.

3.3 Uncertainty for enhanced water recovery using CCS

In a separate 2018 study, a series of focus groups investigated public responses to the potential use of CCS for enhanced water recovery in the Great Artesian Basin (GAB). The study was part of a larger project exploring the feasibility of storing carbon dioxide (CO_2) emissions from coal- and gas-fired power plants in the Surat Basin in deep aquifers in the GAB (Garnett, Underschultz & Ashworth, 2019). The public focus groups were conducted in rural, regional and metro locations across the Surat Basin and Brisbane, with one additional focus group specifically for policy makers run in Brisbane.

The results of the focus groups demonstrated a mixed response to using CCS as part of an enhanced water recovery process in the Surat Basin. Participants mostly reported low levels of knowledge about CCS, and their perceptions of CCS largely aligned with results from previous studies. While some participants were encouraged by the prospects of the process and indicated they believed the advantages of CCS outweighed the risks, it was clear across all groups that there were several concerns that needed to be addressed.

Such concerns centred around costs, short- and long-term risks, impacts on water quality, safety and storage. An associated concern was the potential for CCS triggering seismic activity. Regarding the stability and sustainability of storage, the risk of leakage was a major concern for water quality and contamination, and environmental and human health. It was also seen as a costly exercise if the process failed to permanently store the CO_2. With the money better spent on investing in alternatives such as solar and wind. Some participants suggested they would prefer the CO_2 be stored offshore, although this raised the need for other trade-offs such as pipeline infrastructure, while others felt different options for storing CO_2 should be explored.

It was apparent from views expressed across the general public groups, and reiterated by policymakers, that there were concerns related to governance issues (i.e. regulation, monitoring). This included a lack of trust in government and industry, compounded by legacy issues resulting from the underground coal gasification industry in the Surat Basin. This has compounded into a lack of trust in the regulator. Trust in science was mixed in the groups, with particular concerns expressed about the ability of scientists to accurately assess the potential risks and the long-term consequences of new technologies. Examples were around legacy issues of technologies that had been thought to be safe but proved not to be so (e.g. thalidomide and DDT). Several participants in the public groups described the frustration and difficulty they experienced in trying to assess competing claims from experts about scientific matters such as climate change and not knowing who to believe. Some policymakers related experiences with landholders not believing data and emphasised that presenting information is not always enough, as sometimes the community will not accept the science and do not respect where it's coming from. Instead they tend to use other information seeking activities to reinforce their existing beliefs (Witt, Ferguson & Ashworth, forthcoming).

While preferences for communication and information were not specifically sought in the discussions, many participants pointed to the need for broad public education at all levels, including in schools if CCS was to be implemented. Policymakers additionally suggested the need to education journalists in the science, given the way the media sometimes describes and reports on the GAB. However, they noted that this was not due to a lack of available educational materials. There was consensus that there is a real need to increase the conversations in the public about these issues and the provision of independent, unbiased information was seen to be important. Participants felt communication was crucial, and even if it is based on good science, that it will take a lot of education and time for people to understand the concepts. Several participants suggested the need for more discussion groups and forums where there was the opportunity to hear other people's perspectives that were based on their own personal knowledge and experiences.

4. Results from 2019 regional engagement

4.1 Focus group summary

In October 2019, nine focus groups were conducted across three cities (Townsville, Warrnambool and Darwin) to investigate the potential of hydrogen for their region and Australia more broadly. Within each city, two focus groups included the general public split into two age demographics (18-35 years and 36-65+ years) while a third comprised influential stakeholders. Influential stakeholders were people of standing within the community, either formally or informally, which included representatives from the local council, state government, private businesses, secondary and higher education, and some non-government organisations (NGOs). The general public focus groups were recruited using Q & A Market Research, a recruitment agency. This enabled the selection of a representative sample of the community by age and gender. Influential stakeholders were recruited through targeted email invitations using existing channels and snowball sampling when appropriate.

Table 1: Focus groups

Location	Public 18-35 years	n	Public 36-65+ years	n	Influential stakeholders	n	Total
Townsville	TPY	8	TPO	9	TI	7	24
Warrnambool	WPY	10	WPO	9	WI	8	27
Darwin	DPY	7	DPO	9	DI	5	21
TOTAL		**25**		**27**		**20**	**72**

4.1.1 Response to hydrogen

When participants were asked for their initial responses to what they knew about hydrogen, the responses were very similar across all the groups. These included energy, gas, balloon, element, future technology, renewable and water, with a minority mentioning the hydrogen bomb. Influential stakeholders were more inclined to associate hydrogen with energy.

Across all general public focus groups (n=52), only two participants had heard about the National Hydrogen Strategy (NHS), with neither being able to provide any details about it. However, just over half of the influential stakeholders (12/20) had heard of the NHS and were aware of many of the details such as the opportunity for export to the Japanese market. In the case of Townsville influential stakeholders, participants suggested there was some confusion arising between the NHS and the announcement of the Queensland Government Hydrogen Strategy. One stakeholder commenting that they knew about the NHS but had not really interacted with it and were unaware of any federal government consultation processes in place for involving regions in the process. They suggested it was more regions being proactive, seeing the opportunity for hydrogen and taking the initiative.

After watching a video[1] introducing hydrogen in the Australian context, there were mixed responses. Many participants expressed positive sentiments and agreed that developing a hydrogen industry in Australia seemed like a good idea. Common questions included concerns around safety, what the potential costs are, likely employment opportunities, water availability and environmental benefits of hydrogen. General public participants could see the value in developing long-term alternative energy sources, as well as the opportunities for addressing emissions, transitioning from coal, and creating employment opportunities.

> *We need to look towards more longer-term energy sources – yes okay, coal and gas and everything have been serving us well for a long time but the idea of using wind and solar as a*

[1] Australia's hydrogen opportunity (DIIS 2019): https://www.youtube.com/watch?v=nO63TyoTNxE

direct replacement I don't think is a long-term thing. I think we need to look beyond that to things like better nuclear technologies or hydrogen that will give us the reliable and safe energy sources. TPO

However, some local differences emerged. For example, some of the older participants in Warrnambool suggested the federal government has been fixated on urban areas rather than the livelihoods of regional communities. A central concern was employment opportunities for regional communities and the lack of long-term strategies.

Government's always banging on about Melbourne, Sydney, Brisbane, and how they're becoming too big. If we do it right, and have…a major hydrogen industry in one region of every state, for example… DPO

In Townsville and Darwin, there were mixed responses around water availability in the regions. In Townsville, some felt there was plentiful water with the Burdekin nearby, while others were more sceptical. Concerns were raised around competing uses for fresh water and the issues that arose with the Murray Darling Basin. There were questions raised about the likely by-products from desalination and implications that may arise for the Great Barrier Reef. There was anticipation that a hydrogen pipeline might mean that water would also be piped into Townsville which was felt to be important for securing supply of water. Therefore, the potential for the development of associated infrastructure associated with the hydrogen industry was valued by participants. It was also recognised by influential stakeholders that some hydrogen activities are already underway and happening across the different regions.

Townsville needs water, if we get hydrogen, we'll get water? Does it need to be fresh water? Can it be sea water? There is not enough fresh water around for everyone. TPO

In Darwin, the extreme seasonality of water availability during the wet and dry seasons was an additional local concern. As a result, previous proposals involving use of water such as fracking or dams had elicited emotional responses in the electorate. One influential stakeholder noted how sensitivity over water use had not been a prominent theme in the previous discussions on hydrogen they had attended, where the focus was more on the scale of solar required.

It's interesting because this is probably the first time in discussions and groups I've gone to that people have talked about water – it's being talked about in small circles - but in big conversations people talk about solar but not water. DI

4.1.2 Response to large scale solar and other renewable energies

Across the groups, responses to second video[2] about large scale solar were mixed. Participants noted how there might be a need to find alternative options for solar across high value agricultural lands. However, it was suggested that where there was low-grade land, anything that produced income for the farmers would be welcomed. There were also discussions about whether grid connections would be required, or behind-the-meter options to solely produce hydrogen would be more likely. In Darwin, there was consensus that there was ample land available. However, there were concerns surrounding Native Title or other Traditional Owner legislation which might impact development. In the same light, they also saw this as an opportunity for Traditional Owners to benefit, remote communities gaining access to employment and training, and potentially distributed hydrogen generation. In Warrnambool, influential stakeholders mentioned Camperdown solar farm failing to gain approval due to concerns over co-existence issues with agricultural

[2] Renewable energy projects helping to revitalise rural towns (ABC 7.30 Report, 5 Sept 2019): https://www.youtube.com/watch?v=ElzG1an0Svg

land and some negative opinions toward large scale projects, either wind or solar, as blights on the natural landscape.

> *In the NT about 90% of the land is either under native title or some other TO legislation, but at the same time there is opportunity for TOs and could create a new industry for them too. It would create good opportunities for remote communities having access to jobs, training, and employment.* DPY

> *There have been concerns of noise and radiation-type problems from being too close to wind turbines... Everyone loves wind farms as long as they're not in their back yard... There are always going to be trade-offs, that's why these discussions are important at any level because you're never going to have a solution where everyone says, 'we are all happy'.* WPO (composite comments)

In Warrnambool and Townsville, large scale wind developments were seen to be more accepted by the community as there were several local wind farms already in use. However, concerns included the potential over industrialisation of scenic locations (amenity) and a lack of understanding of the long-term benefits of renewable energy. Influential stakeholders in Warrnambool noted there was still some contention over locations such as the Great Ocean Road and transmission lines. The need for coordination was felt to be critical to ensure the successful deployment of hydrogen projects.

4.1.3 The concept of carbon, capture and storage

A third video introduced the concept of carbon capture and storage (CCS)[3]. Some participants were extremely supportive of the idea and the option to transition. Others expressed reservations about whether CCS was really solving the problem, and concerns about safety, leakage and the costs involved. Much of the uncertainty appeared to be based on a lack of knowledge around the storability of carbon, with others being uninformed around the capture component of CCS. The influential stakeholder group in Townsville had the impression that the Queensland government was only interested in renewable hydrogen and would not consider CCS.

> *What are the risks? …Does it release slowly? …Does it contaminate groundwater? …When they store the CO_2, can they foresee what will happen over time? …Will it move?* TPO (composite questions)

> *What happens when the storage becomes full? ...So there's no downsides to it? Because if there aren't, why not use it? …What's the actual process [to capture the CO_2 and prepare it for storage]? …How hard is it to extract and store underground? …It depends on how accessible it is – is that a method that can be used everywhere in the world?* WPY (composite questions)

On the other hand, all three focus groups in Warrnambool acknowledged there was an international element with the CCS discussion, both in terms of the small fraction of global emissions that Australia contributes, but also as a potential facilitator of emission reductions elsewhere through CCS. In both Warrnambool and Darwin, several influential stakeholders expressed scepticism about the information presented, and the long-term safety and efficacy of CCS. Other influential stakeholders acknowledged their concerns with the technical aspects of CCS but recognised that it might be necessary as part of the transition, with a need to move away from an all or nothing thinking.

4.1.4 Local hydrogen potential

Discussions around the potential of hydrogen within the different cities resulted in a mixed response. The potential for export hubs in Townsville and Darwin received a positive response in terms of employment

[3] CCS: Bridge to a cleaner energy future (excerpt 00:00-02:54)(International Brotherhood of Boilermakers, Mar 2018: https://www.cleanerfutureccs.org/

opportunities and economic benefits. For example, participants in Townsville felt the region was well positioned having the necessary existing skills within the community either from existing industries in decline or others that had been closed. However, different concerns were raised. Participants in Darwin acknowledged that the potential of an export hub would require attracting skills and investment from outside the region, which was seen to bring its own challenges. In this light, participants acknowledged that the region would hope to avoid a boom and bust situation if a hydrogen industry was developed. They noted how attracting and retaining talent would be a much better situation than utilising "fly-in fly-out" workers. Furthermore, younger participants in Darwin saw hydrogen as a step in the right direction compared to the recent approval for fracking in the Territory.

> *Darwin is well placed in terms of proximity we have lots of examples of big infrastructure projects here in the past. However, there is a very poor economic situation here, and there's space, so a good opportunity – the whole idea of having a few more jobs in the Territory is pretty appealing, so building on existing infrastructure and knowledge, we're well placed. DI*

> *There are hierarchy of needs that people have. And right now, good, secure, well paid jobs are very high in the hierarchy of needs. We have a significant amount of capacity as it stands, we have a number of manufacturing facilities here, in Townsville that are now reaching the end of their economic life…They're closing down…They're people already working in those industries already. We're looking for opportunities to replace those. TI*

Across all Townsville and Darwin focus groups, participants strongly supported the concept. While participants were keen to see the environmental benefits of an emergent hydrogen industry, the economic benefits of jobs, including for future generations, was of highest priority. In Warrnambool, the transition to hydrogen was seen to centre on reducing gas dependence and transitioning to a cleaner fuel. There was a general awareness and appetite for change, but also an unwillingness to pay much more, with household budgets already seen to be stretched very thin in many cases. Some thought local and state governments were best positioned to lead the transition through demonstration and pilot programs as well as direct investment. However, the younger demographics exhibited a lack of trust in the local government, preferring community movements instead.

While the development of an export industry was generally seen as a positive opportunity for Australia, one consideration across all three cities was the need to ensure that the benefit for the domestic market for hydrogen is prioritised, and that a national strategy will "look after the locals". Several participants mentioned issues related to the development of Australia's LNG export industry, such as the resulting increased prices for domestic users, and the perception of unequal distribution of the benefits of export royalties.

> *If they're thinking about sending it to other countries – why? Why, instead of using it in our own country, if we have an abundance of it?* WPY

> *If we focus too much on export, we're at risk of going down the road of LNG, and if you're going to (develop this industry), the locals should get the benefits rather than giving them away overseas.* DI

4.1.5 Hydrogen and transport

Turning to the potential for a transition to hydrogen transport, there was strong support for fuel cell vehicles (FCVs), but price was an obvious barrier. Alongside this, the lack of existing infrastructure was also identified as an important consideration. If the cost and features of hydrogen cars compared to other types of vehicles were equivalent and the infrastructure was in place, many participants indicated they would consider purchasing a hydrogen car. They suggested they would even be happy to pay a little more for hydrogen if there were environmental benefits. As a result, incentives such as reduced registration or a reduced

purchase price were seen to be beneficial. A minority of participants indicated they were unlikely to consider purchasing a hydrogen car, for reasons such as the utility of their current conventional petrol or diesel vehicle (e.g. for towing) or for amenity-related reasons such as size and style.

> *Wish I had enough money to buy one. A bit pricey at the end of the day.* WPY

In Warrnambool, influential stakeholders noted that the electric vehicle (EV) infrastructure was already established in the city, and residents were starting to purchase EVs. As a result, and given the limitations of EVs for heavy transport, they suggested that hydrogen might play a greater role in the region in heavy duty transport options such as trains, trucks, freight and public transport. It was suggested that a focus on hydrogen public transport be prioritised as it would benefit more people than private vehicles and serve as a case study to build confidence around hydrogen transport options.

4.1.6 Communicating and engaging about hydrogen

Information dissemination was seen to be essential in gaining momentum about hydrogen across the community, but preferences for accessing and receiving information varied considerably. Younger demographics preferred information via social media, particularly Facebook, YouTube or Snapchat. In Warrnambool and Darwin, participants raised concerns over information reliability and "fake news" from sources like Facebook.

> *There is a generational gap. They (younger people) are not reading newspapers, watching television, news, documentaries or things like that. But they're super informed. The challenge in all that with young people, and with schools and education, is around discernment of that information…How do we develop those skills within our communities that enable them to discern the difference between what's reliable or not?"* WI

Older participants also mentioned social media but were more likely than younger participants to access mainstream media such as newspapers and television. Advertisements were also seen as a useful method by many participants. However others noted that many individuals, particularly younger, did not watch or read any advertisements across mainstream or social media.

> *If you see it everywhere, TV, billboards, things like that, quick advertisement of it. They'd have to make it interesting. I don't know how'd they make it interesting, but it has to be something that catches your attention. How can we benefit from it? What sort of time-frame? TPY*

Cinema advertising, where there was a captive audience, was suggested as one way of presenting information on hydrogen to a broad audience. A key consideration for this however, was the source of funding for such advertising. Some participants expressed scepticism about advertisements solely funded by industry and suggested that those developed collaboratively between industry, State and Federal governments might carry more weight and be considered more trustworthy and balanced.

More broadly, word of mouth was valued, especially from individuals within social networks as well as trusted organisations and community figures. For example, some participants mentioned local sporting teams or heroes (such as Jonathan Thurston in Townsville) as well as key figureheads like David Attenborough. Universities were also seen as useful and respected knowledge brokers for disseminating information, even in those communities where it was suggested that their local university had not played such a role previously.

It was explained that within the cities there were several different communities based around organisations with large numbers of employees including their families and extended networks, e.g. the local university, military base or local large industries. Similarly, there were other communities bonded by shared interests, for example sporting teams such as the Cowboys in Townsville, or sprint car racing in Warrnambool. These shared interest groups and networks were seen as credible avenues for communicating new information.

Other suggestions included displays in shopping centres, and public discussions similar to the information sharing in the focus groups. Case studies of current hydrogen projects and success stories of other locations using hydrogen for transport or domestically were frequently suggested as valuable methods of building confidence in the technology across a community. Demonstrations of the technology were also seen as an effective way to engage a broad range of community members and build familiarity with the technology. This included using hydrogen fuel cell cars and buses, a hydrogen BBQ, or even a demonstration or "pop-up" house which show cased the practical uses of hydrogen.

There was a strong undertone that the technology and message should be consistent with a long-term strategy, and that the frequency of communication and engagement should also be prioritised. Many participants expressed a preference for balanced, objective and evidence-based information that clearly articulated safety considerations and risks and benefits. All participants emphasised the importance of managing expectations around how long it would take for any projects to be up and running and when the jobs and other opportunities would emerge. Trust was seen to be implicit if these considerations were adhered to and information was effectively disseminated by trusted organisations. However, it was recognised that there is not a one size fits all and stakeholder analysis and segmentation would be a key component of any communication strategy.

4.1.7 Summary of final comments

Participants were enthusiastic about the potential of hydrogen both within their respective cities, as well as Australia more broadly. Many noted how their level of understanding and support had improved as a result of the focus group and they were eager for more information. Participants were impressed by the environmental benefits of hydrogen through low emissions and the potential for more jobs. However, still acknowledging the need to maintain safety and manage community expectations about realistic timeframes of when an industry would be delivered and projects might hit the ground. Of importance was not creating false hope.

> *If it's implemented correctly, I can't see any downside and bringing lots of benefits, now that I know more about it, I'm interested and would like to learn more about it.* TPO

> *I think the benefit for the region is twofold. One is the employment and everything that goes with it, the money into the area, which would be great, because we need it. The other part's probably to help us change the perception of what people down south think of us. I think they think we've got the Reef but we're vandalising it by digging it up – we're a quarry basically…we can change the perceptions to being a green area.* TI

> *I like the fact that they're going to try and export it across different countries and make lots of money, because then hopefully, that way it will bring the cost down for our country and have it for ourselves, but cheaper.* WPY

> *I mainly see positives, and win/win situation. I just believe, if Australia wants to export it overseas, when people hear that, if you really want to engage people, you've got to do it on our level, and say what we're going to benefit from it? Jobs in the region? How it's going to cut emissions and prices maybe on things that we use on a day to day basis. That's what people want to hear, how it's going to benefit people.* WPO – composite comment

> *Show me something, give me an example, a case study and how we could replicate that. Keep the community informed and bring them along.* WI

> *Always optimistic, I hadn't realised Australia had woken up to hydrogen. I think we're on the cusp of an energy miracle and I'd like to see the NT deal with it.* DPO

Need to consider and address the cost of not doing it. The major challenge of production is going to be a cost, and water – it would be a big challenge here to find enough water to do it. DI

4.2 Summary of focus group survey responses

Focus group participants also completed two short, pre- and post- pen-and-paper surveys. Both surveys included a question about how supportive participants felt about hydrogen as a possible solution for energy and environmental challenges (on a scale of 1=very unsupportive to 5=very supportive). As shown in Figure 6 below, there was significant increase in the level of support for hydrogen (Before: M=3.55, SD=1.68; After: M=4.58, SD=0.58; paired t-test $p<0.001$).

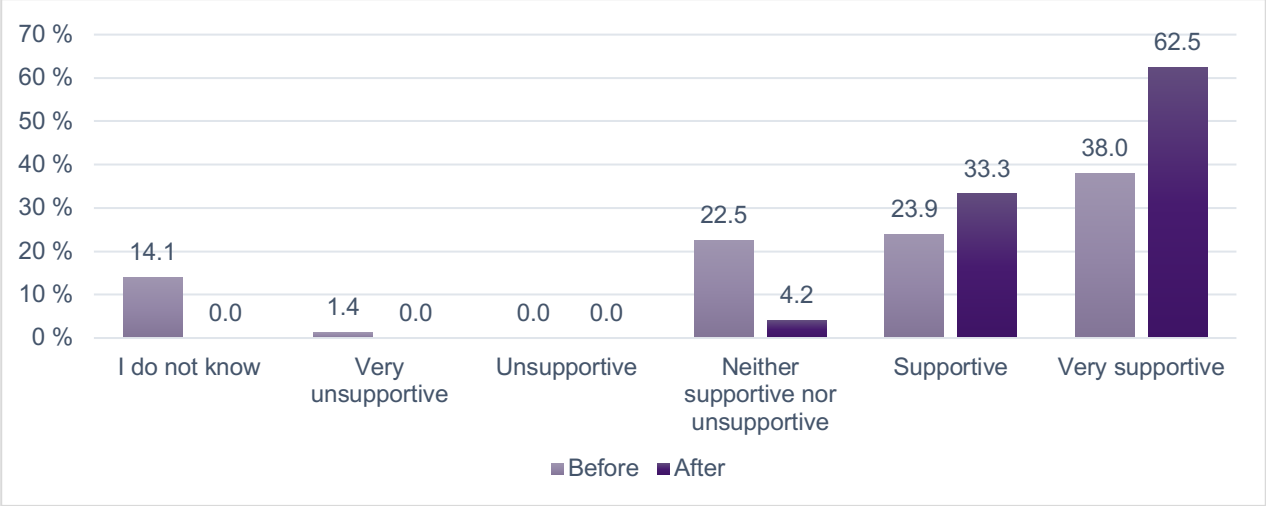

Figure 6: Before and after responses: Overall, how do you feel about hydrogen as a possible solution for energy and environmental challenges? (n=72)

Examining the differences between focus group types, influential stakeholders reported higher initial levels of support compared to the general public. However, the reported level of support after the focus group increased substantially for both younger and older public groups. The largest mean increases were reported for the older public in Townsville (+1.8), followed by both public groups in Warrnambool (+1.7).

Table 2: Mean scores: Overall, how do you feel about hydrogen as a possible solution for energy and environmental challenges? (n=72, 1=very unsupportive to 5=very supportive)

Location	Younger Public		Older Public		Influential	
	Before	*After*	*Before*	*After*	*Before*	*After*
Townsville	3.14	4.50	3.11	4.89	4.29	4.86
Warrnambool	2.90	4.60	3.00	4.50	4.63	4.50
Darwin	3.71	4.29	3.22	4.22	4.80	4.80

Participants were asked to indicate their level of agreement (on a scale of 1=strongly disagree to 7=strongly agree) with four statements about hydrogen production for energy (Figure 7). Around three quarters of participants agreed that hydrogen should be produced using renewable energy and electrolysis only (74%, M=3.99, SD 1.23) and that the use of hydrogen protects the environment (76%, M=3.94, SD=1.11). Just over half of the sample (54%, M=3.42, SD=1.28) agreed that hydrogen should be produced using fossil fuels with CCS as an intermediate step, compared to around one quarter of participants (24%, M=2.44, SD=1.38) who supported the production of hydrogen from fossil fuels with CCS indefinitely.

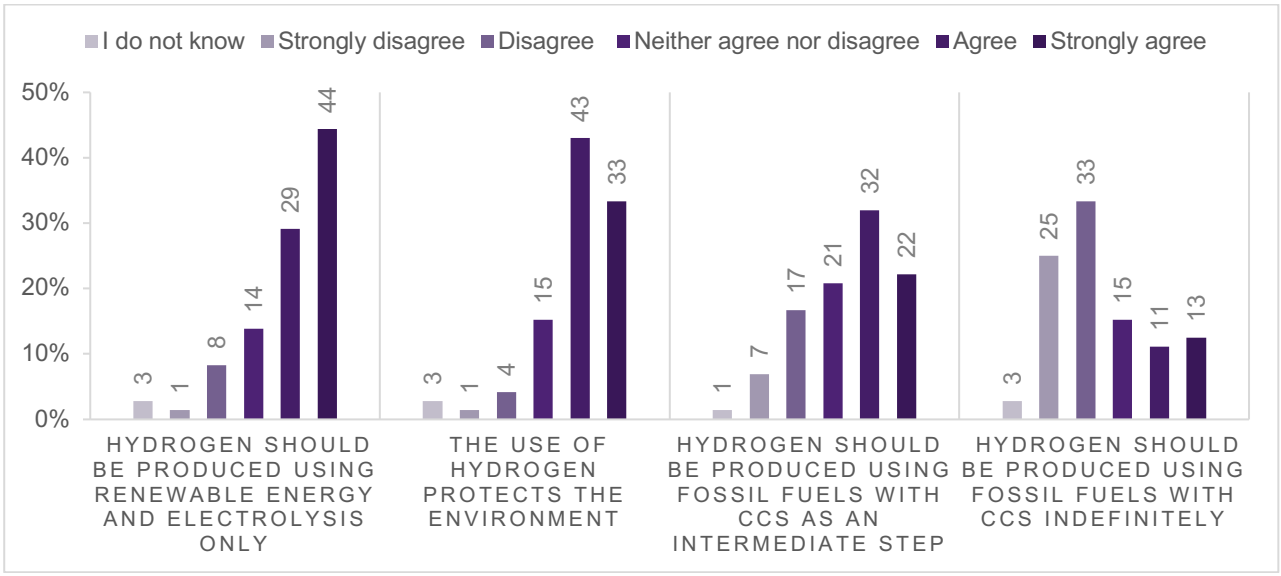

Figure 7: To what extent do you agree or disagree with the following statements about hydrogen production for energy? (n=72)

Participants were presented with five types of vehicles and asked to indicate how likely they would be to purchase each type if the price, features, design, and brand were the same (on a scale of 1=very unlikely to 5=very likely). As shown in Figure 8, well over three quarters of participants (85%, M=4.14, SD=1.13) indicated that they were likely or very likely to purchase a hydrogen vehicle, followed by hybrid (60%, M=3.46, SD=1.25) and battery electric (58%, M=3.37, SD=1.33) vehicles. Fully autonomous vehicles (39%, M=2.90, SD=1.55) and conventional petrol or diesel vehicles (42%, M=2.88, SD=1.41) were least likely to be purchased.

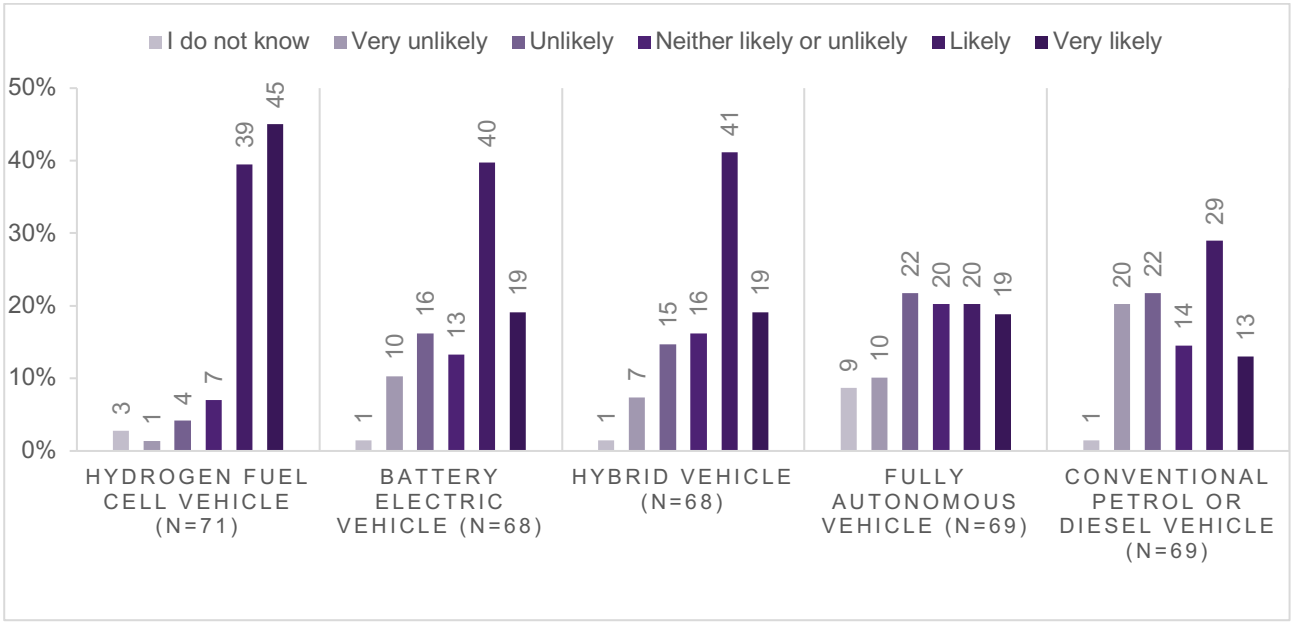

Figure 8: If the price, features, design, brand, etc. were the same, how likely would you be to purchase the following type of car?

If participants had to choose between the use of hydrogen or gas in the home, two-thirds (67%) of participants indicated they would choose hydrogen (Table 3). Around one quarter of participants were undecided (26%) and only 7% of participants indicated that they would choose gas.

Table 3: If you had to choose between the use of hydrogen or gas in the home, which would you choose?

	n	%
Hydrogen	48	66.67
Gas	5	6.94
I don't know/I am not sure	19	26.39
Total	72	100.0

Participants were asked to indicate their preferred information formats and education materials from a list of 11 types (Figure 9). Almost half of participants (49%) indicated that social media was a preferred format, followed by research and media articles (both 44%) and official websites and documentaries (43%). The least preferred formats were academic/ scientific seminars (28%) and blogs (11%).

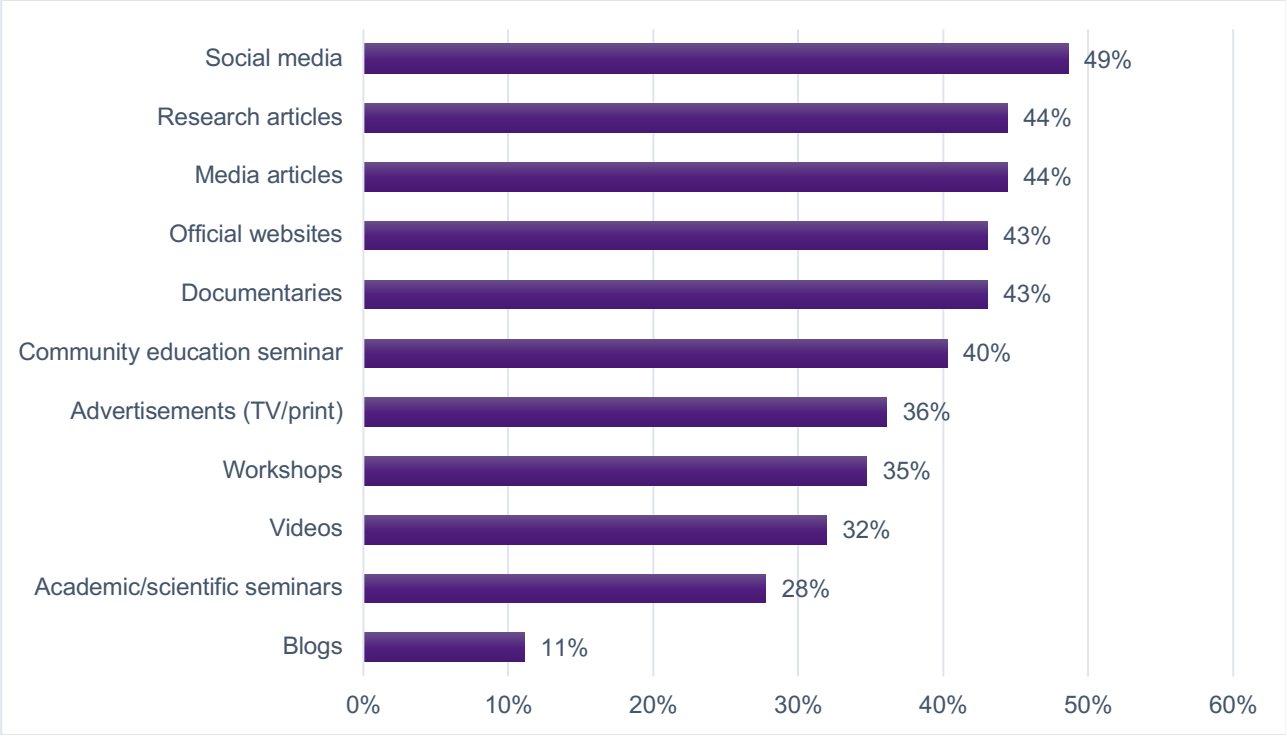

Figure 9: What would be your preferred format/s for information and other educational materials about hydrogen? (n=72)

Regarding responsibility for disseminating information, research organisations, researchers and government were most frequently selected, followed by companies operating in the hydrogen industry (Figure 10).

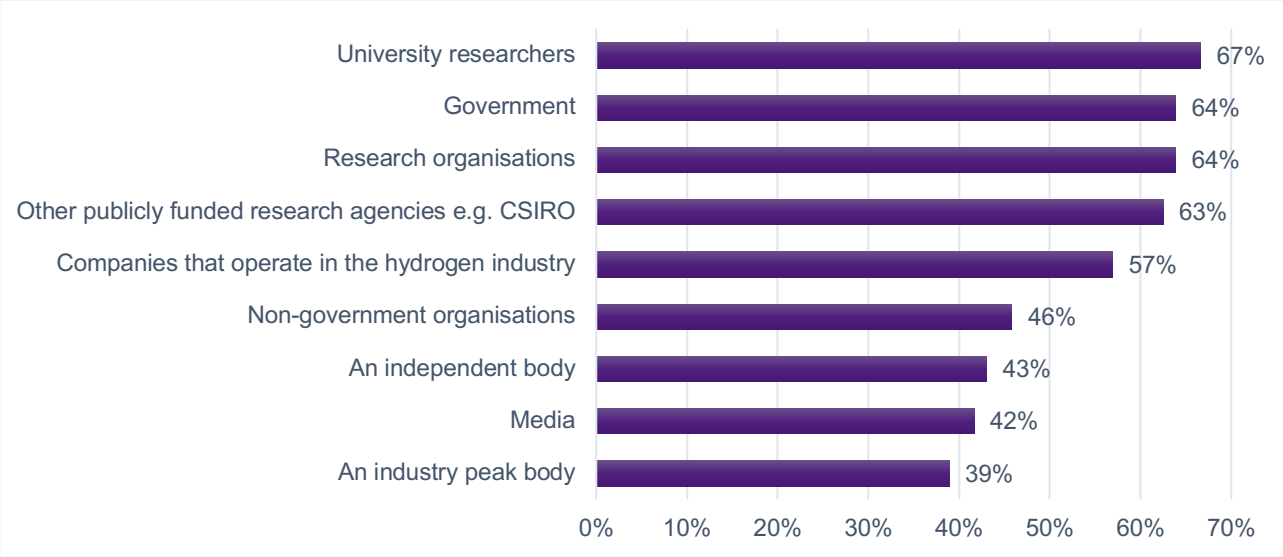

Figure 10: Who should be responsible for disseminating this information? (n=72)

However, when it came to trusting information sources communicating the benefits and risks of hydrogen, there were different responses. As shown in Table 4, while there was high trust in research organisations, trust in government and industry was much less. This is potentially because several participants in the focus groups stated mixed responses in relation to trust in local, state or federal governments, despite many suggesting that the federal government had a definite role to play in communicating about hydrogen.

Table 4: To what extent would you trust information about the benefits and risks of hydrogen if it were to come from the following sources?

		Not at all	Very little trust	Neutral	Somewhat trust	Trust a lot		
Source	n	%	%	%	%	%	Mean	SD
University researchers	71	0	0	6	34	61	4.55	0.60
Other publicly funded research agencies e.g. CSIRO	71	0	0	8	32	59	4.51	0.65
Research organisations	71	0	1	7	34	58	4.48	0.69
An independent body	71	0	1	23	43	32	4.06	0.78
Non-government organisations	68	1	4	29	50	15	3.72	0.83
An industry peak body	69	1	14	24	45	15	3.59	0.97
Companies that operate in the hydrogen industry	71	3	20	28	32	17	3.41	1.08
Government	71	3	31	25	34	7	3.11	1.02
Media	69	9	29	46	13	3	2.73	0.91

4.2.1 Questions arising from participants

At the end of the survey participants were asked to record the top three remaining questions they had about hydrogen after the focus group discussion. In total there were 181 questions recorded with the main themes focusing on costs, environmental considerations, the time frame for the industry to develop, safety and benefits (Table 5).

Table 5: Participant questions about hydrogen

n	TOPIC	QUESTIONS
30	**Costs**	• What is the cost of implementing on the general public and who owns it? • What cost saving solutions can be in place to help industry transition? • What would be the cost of use in daily life?
19	**Environmental Considerations**	• Effect on ecosystems in the set up? • Is it really good for the environment? • How will it affect the environment?
18	**Timeframe**	• How long will it take to get this happening? • How quickly can we get it going? • What is the timeframe for real life application for production?
17	**Safety**	• What are the biggest safety concerns? • How safe will households be? • Is it safe and sustainable in years to come?
13	**Benefits**	• Who will benefit from this? • Will the benefits be shared across all sectors of the community? • How will it benefit us/me? On a daily basis?

4.3 Results from interviews with influential stakeholders

In total 19 telephone interviews were undertaken with 21 influential stakeholders from across Australia representing a range of organisations. These included representatives from state and local government, renewable energy projects, port authorities, environmental NGOs, fire brigades and emergency response departments and Indigenous groups.

4.3.1 Challenges, opportunities and benefits

Some participants reported an extensive knowledge of the hydrogen opportunity that was emerging for Australia, while others had only heard about the emergent industry and some had heard nothing at all. Overall, the majority of participants were positive about the prospects the industry would bring. Particularly, the opportunity for employment and the potential economic benefits for a local community. Others were positive about the reduced emissions if hydrogen was to become more mainstreamed for use in local transport and other domestic uses. There were few concerns about safety *as long as it is handled properly* and participants were keen to know how hydrogen would be stored and transported.

There was a sentiment expressed that the scale of development required for a successful hydrogen industry could be equated to the challenge of building the first Snowy Hydro scheme. Some felt it could be viewed as nation building activity and something that all Australians could benefit from. As such, it was suggested that hydrogen was something that all governments and broader Australians could get behind if it was kept from becoming political.

> *I think it almost goes back to …when the Snowy scheme was being built. You do get the impression that people saw the Snowy as a real nation building activity. Lots of migrants got employed lots of communities got opportunities…it was a real nation building narrative and I think that is the narrative we could use to build a 100% renewable energy economy in Australia and a 200 - 300% superpower and hydrogen would be part of that.* IS003

However, many of those interviewed still had questions they needed answered before they could accept that a hydrogen industry would be a viable one for their region over the longer term. Of interest was the net energy balance required to produce hydrogen?; how much it cost to produce and transport hydrogen?; and how much water was needed to produce hydrogen? This was particularly important where communities had recently faced drought or experienced sensitivities surrounding water use for agriculture. Other questions tended to be more specific around the types of infrastructure required? What pipes, storage tanks and loading docks would be needed for a port to become hydrogen export ready? What size is needed for a port exporting hydrogen? What types of skills would be needed? How hydrogen could be used in transport? Would it be cheaper or more expensive than current fuel stocks?

There were also concerns raised about whether other environmental impacts might arise. In particular, the potential effects of large ports and processing plants on coastal ecosystems, and the impacts on biodiversity based on large scale solar and wind project developments. Other concerns were in relation to the observed competition between different States, Territories and regions that was already emerging around who is best positioned to host an export facility.

> *The worst thing would be that you get two projects alongside each other because they just didn't know. Or it was not communicated.* IS009

4.3.2 Production process considerations

Unless there was a direct link to the coal or gas industry (where representatives saw a role for CCS to produce clean hydrogen), the majority of interviewees were keen to see hydrogen produced from renewable energy sources. They felt this type of production would give their local area a “green” edge, which in turn would make them attractive to other industries.

> *There is the perception that – we have had the McArthur River mine with its problems with toxins, where companies take the money and run and have not invested in the future. The Ranger uranium mine where they covered it up and ran. I think that CCS would be a difficult thing to sell here.* IS016

However, one of the key considerations when it came to renewable energy was the scale that would be required. Interviewees recognised that such a scale could not happen all at once. However, this was also seen as a benefit in that projects could be rolled out over time ensuring there were local jobs beyond just a boom and bust cycle as had happened with Queensland’s unconventional gas industry.

> *There’s no end to sunshine so the amount we produce only depends on how much solar and wind infrastructure we want to build. It can’t be done all at once so there would have to be a lot of planning and progression.* IS006

Similarly, several grappled with where projects would be sited. The trade-off being, whether it was best to locate hydrogen project sites close to communities and water, or whether it would make sense to desalinate water and transport it to the place of production via pipelines. Some also discussed the nature of solar PV cells which were likely to have a lifespan of only about twenty years. While there was not much discussion about the need to recycle the old panels, the need for continuous replacement was seen as an opportunity for ongoing employment.

> *If we are going to build hydrogen plants they would need to be close to the port but that’s nowhere near where we can generate the power from. So if we make hydrogen at the port we need transmission lines, and if we made hydrogen where the energy is, then we would need massive pipeline infrastructure.* IS007

Solar farms last 20 -30 years at best. So you could be building them and then start replacing them if you get to the biggest scale. If you say you are going to build a 100GW solar farm that is going to cover a very large space - 100 square kilometres. You could spend the next 20 years building that and then you would have to start replacing it. IS008

4.3.3 Considerations for Indigenous communities

Initial interviews with Indigenous leaders in the Northern Territory (NT) provide a good starting point for further exploration with representatives Indigenous communities. One of the key issues they raised was concerns around the use of fresh water, suggesting that production requiring fresh water in the NT was unlikely to be tolerated. However, sea water was seen to have potential.

Anything that uses freshwater would be opposed. There is huge concern about freshwater reserves. There is huge connection and culture around freshwater. Songlines around water are part of a living culture - it is part of everyday life and language. Not just in the background. It is critically important. IS015

Ensuring all Indigenous groups received adequate benefits that were fairly distributed was also highlighted as important. Given the size of land a renewable energy project was likely to cover, it was acknowledged that it would likely encounter multiple ownership claims, which presented its own level of complexity. However, it was recognised that perceptions of benefits are likely to be different for different groups and providing adequate opportunities for them to negotiate terms was seen as important. One suggestion, from previous experience with iron ore in Western Australia (WA), was that a standard benefits package was seen to be a much fairer way to ensure everyone benefitted equally. Such an open and transparent approach was also seen to build trust in the industry and project proponents.

Negotiations can be very complex, especially if over a large area of land and there are multiple groups involved. This would be an issue perhaps for large scale solar farms. IS015

For iron ore there's been an agreement made. They (Indigenous groups) seem pleased with it. With iron ore it's easy because it's standard amount. IS010

Indigenous interviewees were also keen to be part of an industry that presented a clean and green image. They stressed the importance of having access to the clean fuel themselves and that it should not only be produced for export or use elsewhere. Giving local communities access to hydrogen was also seen as a potential benefit sharing opportunity. Recognising the remote nature of where many Indigenous groups lived and the long distances many had to drive, the use of hydrogen for transport was also attractive to the Indigenous leaders.

Any development must benefit local communities. If producing energy, then it would be silly to export the energy and leave remote communities running on diesel engines or without power. IS015

We have fleet of around 40 vehicles and drive 750 thousand kilometres every year so we are interested in hydrogen from both a demand and supply side. IS016

When it came to communicating about an emergent hydrogen industry to Indigenous groups, the recommendations were very similar to other interviewees. Critical was ensuring engagement was respectful of their culture, started early to build individuals' familiarity with the industry, but was also enduring over time. Those who had worked, or were working, with Indigenous groups also stressed the importance of engaging early and regularly to make sure any questions Indigenous group had could be answered appropriately.

> *Start early and get the repetition required to build understanding and familiarity over time. Communication should be the beginning of a relationship, not just consult then nothing more and no action.* IS015

> *We are meeting ever two months with the Elders. We took them to an existing plant, so they could see it. They met with the traditional people on that project so they could compare notes.* IS018

> *We want to see recognition of the traditional custodianship. It is our land you are using. We want to see genuine attempts to minimise environmental harms and transfer of value where there will be impacts.* IS016

Managing expectations of the time frames over which such an industry would emerge was also deemed important. It was highlighted that there were already many discussions occurring around the benefits of using renewable energy for climate change and so there were potential synergies for the hydrogen industry to start early to coincide with these conversations. Finally, it was stressed that choosing the "key influencers" who are respected within the Aboriginal community would ensure they would be listened to and projects taken more seriously.

4.3.4 Fire and emergency services

Interviews with representatives from these organisations was revealing. It appears that to date there has been little engagement and the representatives were keen to find out more about the industry. The two areas they stressed as important were the development of standards around how to respond and also ensuring emergency service workers' general knowledge about hydrogen was developed. For example, the different forms of hydrogen production, how it is stored and transported, and understanding what the implications were for domestic fuel cell use and transport refuelling. Gaining knowledge and understanding about the operations of these was seen to be a high priority across the emergency services' agenda.

> *Scientists are not talking a lot at the emergency services side. We are going to have one refuelling station here in Canberra for a fleet of vehicles. I think about ten vehicles. So that is our interest. Having a look at the infrastructure and the risks. What are the exposures around that?* IS005

> *Something we will have to look at is if you have a tank on the side of the house does it have a huge explosive potential? Is it any different from having a gas bottle around the house? Barbecues? I would assume it would be the same with a hydrogen tank. As I said before just another hazard that we have to look at it in its own right. No fear of having it.* IS005

When it came to standards, while it was seen to be ideal to create an Australian standard for all things relating to hydrogen, it was recognised in the absence of this, that international ISO standards or US standards could be used in the interim.

> *We would be looking for a consistent approach for fire and emergency services across Australia. And we would generally feed that into Australian Standards Committees. So, if the standard is put together then our concerns are addressed in there. IS005*

One of the big issues for fire and emergency services was the volunteers that comprised a large component of these organisations, particularly in regional Australia. One of those interviewed felt it would be unfair to expect a volunteer to be well versed and trained in how to respond to a hydrogen emergency, and it would be inappropriate to ask them to respond in such emergencies. Instead they suggested the default in these instances would be the industry internal emergency services. It was stressed that this would be an important

role for government departments to continue to ensure these processes are in place as projects are approved.

> *XXXX emergency response people. They are trained for that. They do everything. If they have an ammonia leak, within 15 minutes someone has arrived and they had it repaired. Technically our volunteers are not trained for gas leaks we would not want that.* IS017

4.3.5 Regulatory considerations

One issue that was raised for project developers and for consideration by governments was around the royalty regime that would be imposed on projects that were exporting green hydrogen and the associated products. One suggestion being that export of hydrogen did not fit with the usual commodities of finite resources such as coal and gas.

The other suggestion was around managing the complexity of projects that might cross different jurisdictions. For example, pipelines that would head off-shore that could require approvals from both state and federal governments. It was also noted that most of the existing pipeline regulations are for hydrocarbons rather than hydrogen. A plea was made to ensure a consistent approach was strived for, to minimise the burden of approvals processes.

> *One of the issues we are having is complexity. We will have several pipelines that will head offshore for loading, so there are different jurisdictions that we need approval from - State and Federal.* IS018

When it came to benefit sharing there was a suggestion from those experienced in the area that standardised benefit packages were much easier for successful project deployment. This was also reflected by those in WA who had experienced the issues of benefits and compensation for land under iron ore exploration and production. It was felt that there were many successful examples of transparent benefits packages which led to more satisfactory outcomes. It was suggested that as soon as confidentiality clauses were placed on agreements it created high levels of distrust and individual concern that people were not being treated fairly or equally.

> *My general view it that for host landowners and neighbours a standard agreement is good. It needs to be fair and in plain English and of course checked by lawyers from both sides and clear about provisions and title issues.* IS019

Similarly, mandating industries' emergency response plans and trained personnel was an important consideration. Although it was recognised, requirements are already in place for mining and other large industrial processes, ensuring the same for hydrogen to take the burden from volunteer firefighters and emergency services was deemed critical. However, training for emergency services was still seen to be a priority. Although this had to be kept in perspective, as given that many are only volunteers, even attending training places an extra burden on their time.

4.3.6 Communication

There were a number of considerations for communication raised during the interviews and these confirmed what had emerged from the literature review and focus groups. For example, to ensure people were confident in the safety of hydrogen it was recommended to use pilot projects, demonstration cars and barbecues as well as documenting other international case studies to build confidence in the technology.

> *Demonstrations – real things. Shopping centre displays and videos so people can touch, feel, and see what it is really like.* IS008

The story is there, there is nothing to hide. You tell people absolutely everything. IS007

Similarly, it was emphasised how important it was to provide balanced, open and honest information about hydrogen. Commencing with how the hydrogen production process worked, the exact amount of water that was required, the net energy balance and of course the costs involved. These were seen as important, to ensure 'naysayers' did not negatively influence perceptions of the industry from the outset. Sensitivity to drought and land access around co-existence with agriculture was also emphasised repeatedly.

First thing to have traction with this – we are in a drought. I don't know how much water this will use but convincing farmers to use water with renewables, which is producing electricity anyway, through this process to get gas. I assume you are taking an intermittent source of energy to then produce a firm power arrangement through gas. First thing, explain all of that. What are the economics to make it work? What sort of water you need per unit of output? There is a fair bit of work needed around that. IS019

Suggestions for key messages to be communicated about hydrogen were around safety and the benefits it would bring in terms of usefulness. It was cautioned that while it would be important to communicate the environmental benefits of hydrogen, the costs involved would also need to be clearly articulated. Particularly around the different production options and quantifying what the relative emissions reduction would be. Similarly, providing clear timeframes for how the industry might evolve was also critical. Whichever the message, ensuring people had access to the information they needed to answer their questions was stressed as an imperative for building trust in the industry.

People just need to understand what it is to be used for. The common idea is that it's an explosive gas and it's really dangerous – why would we be using it then? IS007

The reality is that many of parts of the community open to all, some are closed to come. The general community do support opportunities for making a better future, economically and environmentally. One of the challenges for these components and all governments, is to ensure we are literate on these issues, and unfortunately, too many people take a position on something and they are not informed. IS012

Need honest and frank public conversations about hydrogen, with evidence for the climate benefits (emissions reductions) for the different production methods. A balanced discussion with acknowledgment of the risks as well as benefits. Only talking about benefits will induce more mistrust…. Unfortunately you read the newspapers and it seems that this wonderful new green hydrogen technology is there and ready to plonk on the ground and solve all our problems but it's not that simple. IS014

Similar to the focus groups, social media outlets were considered an important tool for communicating to mass audiences. Facebook appears to have become an important tool for local governments and is a major place that councils use to communicate information to the wider community. However, many recognised the value of meaningful engagement with a variety of individuals from different groups. One stakeholder suggesting the use of an *eminent panel of trusted individuals* for communication, would be one of the best ways to build trust in the development of a hydrogen industry. Again, it was emphasised that it was not a one size fits all. That you needed a comprehensive communication strategy that included industry groups, service clubs, schools and other education outlets.

No one right way to get community engagement done. That is a hard gig. Try and hit everything. Social media and internet are the go to as far as community engagement. I do not think that is the right way. Community meetings and regular community meetings is probably the right way. While it needs people and is resource intensive it is probably the best but hardest. IS005

We have Facebook site, and we maintain that, we have a girl full time that follows that. Whenever something gets asked, it's always responded to. Really well read. It seems to be all ages. IS010

Be prepared to go to town hall meeting, and some of those techniques, to employ an independent person or panel, of eminent individuals who are informed but also respected to facilitate the discussion…who will be regarded as an honest broker. IS012

You need to get them into the schools they're (students) a sponge to this stuff. It will leave a lasting impression on them. IS013

5. Lessons from other projects, toolkits and handbooks

There are a number of lessons that can be drawn from previous project case studies and a range of communication and engagement materials that have been developed for various projects. While a comprehensive review of the literature and theories of communication and engagement is provided in Appendix A, this section provides a summary of the key findings from relevant case studies and various toolkits and handbooks.

5.1 Unconventional gas

There have been numerous lessons learned from the early development of Queensland's unconventional gas industry. Examining several case studies and peer reviewed literature on this topic it is clear the large scale and rapid pace of development created significant impacts for local communities and for individual psychological wellbeing (Lai et al. 2017; Leonard, McCrea & Walton, 2016). These were compounded by the pre-existing political, social, economic and cultural considerations of each of those communities and their ability to respond to the opportunities and challenges that were presented by the emergent industry. Witt et al. (2018a) highlight the importance of considering the cumulative effects of multiple associated projects, or from one project, in addition to other projects in the region. Another observation is the uneven distribution of costs and benefits, both within and between local communities, and between the local region and the State. In places, this led to social conflict and polarised views of the industry with those who managed to capture benefits in favour and those who perceived themselves to have either "missed out" or be negatively affected, against the industry. It is worth noting, that despite similar issues arising in the USA from its rapid development of the shale gas industry (Jacquet, 2014; McElfish & Stares, 2014), none of these lessons transferred to Australia. Such uneven allocation of risks and benefits points to issues of procedural and distributive justice highlighted in the theory section (Witt et al. 2018a).

This raises important flags for those working in the development of Australia's hydrogen industry - that caution must be exercised to ensure that its development occurs in a measured and coordinated fashion and that there are mechanisms in place to maximise local opportunities to capture a range of benefits to avoid the perception of' "winners and losers". From their research, Leonard, McCrea and Walton (2016) identified the importance of community agency which their analysis suggests was underpinned by the presence of community resilience actions such as planning and leadership, collective efficacy, inclusive decision making and trust.

In response to concerns expressed by local communities about the unconventional gas industry, in 2012 the Queensland government established the Gasfields Commission Queensland. The Commission was an independent statutory body formed to facilitate sustainable co-existence between landholders, regional communities and the onshore gas industry in Queensland (Gasfields Commission, 2017, p.12). Originally there were six Commissioners with a range of focus areas. The commissioners held various respected positions of standing within the community with some being large landholders themselves.

Some of the major learnings that were reported in the document "On New Ground" which arose from the 2010 – 2015 review of the Gasfields Commission are also relevant to the development of a hydrogen industry. The top learnings included:

1. "Land access is a 'business to business' relationship;
2. There must be a robust and trustworthy regulatory framework;
3. The gas industry must understand all impacts on the community;
4. Trust facts not emotion (especially good science on geology and water);
5. Pursue effective communications and engagement;
6. Leverage legacy opportunities" (Gasfields Commission, 2017 p.13).

This document provides a number of lessons that will be helpful in informing engagement and communication activities for large scale hydrogen projects.

5.2 Wind

Wind is another technology that has a long history of contention and opposition (Wolsink, 2005; Devine-Wright, 2009; Hall, Ashworth & Devine-Wright, 2013; Colvin, Witt & Lacey, 2016). In a review of seven wind projects Hall, Ashworth and Devine-Wright (2013) found that on the whole, there was a silent majority of support for wind farms. However, they highlighted the presence of a vocal minority that tended to dominate news. In on instance, despite a referendum clearly identifying majority support. Regardless, it was clear that energy projects like wind can be divisive and in small communities this can have severe negative impacts on community cohesion.

The Hall, Ashworth and Devine-Wright study (2013) identified four key process issues which included “trust, distributional justice, procedural justice and place attachment” (2013 p.203). Trust recommendations related to the wind company being honest and transparent in all of their engagement activities, with many examples provided of how trust in the project developer was built through regular and ongoing engagement activities. Wüstenhagen, Wolsink and Burer (2007) in their paper on wind farms also identified the importance of building trust both in the information being provided as well as the intentions of all actors involved in the project (regulatory and project developer). Local champions were one way that project developers built trust in their community and community liaison groups were also seen as a helpful way of building trust (Ashworth et al. 2012).

Expectations for justice in how costs and benefits were shared for projects was repeatedly highlighted as being important for those in communities (Hall, Ashworth & Devine-Wright, 2013). Many early wind farm developments only compensated direct turbine hosts, rather than near neighbours, which participants reported as being unjust. Other projects provided compensation for broader infrastructure developments as well as funds for other community requirements. This notion of creating broader economic benefits to the community was highly valued by most stakeholders.

Similar to the literature, procedural justice was also seen as critical for successful wind project deployment. The three key components to help build perceptions of procedural justice included “honesty and transparency, full and unbiased information, and ensuring that donations of funds to community infrastructure or programs were not perceived as tacit support” (Hall, Ashworth & Devine-Wright, 2013, p.205). Participants recommended four key stages for engagement they felt were procedurally fair. These included pre-proposal, project announcement through direct communication, opportunities for community input and ongoing dialogue and information updates.

In contrast to much of the literature on best practice engagement, Colvin, Witt and Lacey (2016) in their study of the King Island wind farm pointed to five key drivers which were seen to be problematic in the development of the project. The five included:

- Problematic pre-feasibility engagement - where there was a lack of detailed information about the project and what was being involved;
- Not engaging a third-party facilitator for the local community consultative committee which led to mixed response to the information that was provided and its impartiality;
- Holding a vote to identify support despite the intention to endorse a democratic process it resulted in polarising the community due to ineligibility of some voters as well as a lack of agreement on what comprised a majority vote.
- Lack of a clear place in the engagement process for local opposition to be expressed and debated; and
- Underestimation of the significance of the local context. (2016, p. 483)

To counter complaints and issues arising from opposition to wind, the Australian Government established a National Wind Farm Commissioner (NWFC) (https://www.nwfc.gov.au) who reports to the Minister for Energy. The role of the Commissioner is also relevant to the hydrogen industry because of its overlap with both wind and utility scale solar farms:

> *The Commissioner's role is to receive and refer complaints from concerned community residents about wind farms, large-scale solar farms and energy storage facilities as well as promote best practices for industry and government to adopt in regard to the planning and operation of these projects. The Commissioner will also provide greater transparency on information related to proposed and operating wind farms, large-scale solar farms and energy storage facilities.*
>
> *(https://www.nwfc.gov.au Accessed 11 September 2019)*

There are a range of resources relevant to best practice engagement available on the NWFC site in particular the 2018 Annual Report (pp. 23 – 55). Many of these have been detailed in the resource file accompanying this report.

5.3 Hydrogen project responses

Although conversations of a hydrogen economy have been around for decades, it is only recently that there have been several demonstration projects under development around the world. Today, only half of the 316 global hydrogen projects[4] started before the year 2015. Due to the relatively low number and age of demonstration projects, and their nature of most of them being research, there are few insights into community responses to these hydrogen demonstration plants.

However, there are pockets of documented community responses to hydrogen production and fuel cells. Trencher and van der Heijden (2019) found that the vision of Fukushima as a future hydrogen and renewable centre, at both national and local levels, had been directly shaped by the environmental, economic and social damage incurred during the tsunami and subsequent nuclear power plant disaster in 2011. They noted while there was widespread concurrence about the role of hydrogen in Fukushima as a transition to renewable energy, this was not without contestation. Some small local grassroot energy utilities argued that diffusion of hydrogen projects in Fukushima would clash with the principle of energy democracy, on the grounds that the technical complexity of hydrogen technology favours large corporations, while decreasing opportunities for small community-led projects for hydrogen production from renewables. Secondly, while locals favour a renewable future for the region, the imaginary of a hydrogen future does not align with their vision of a decentralised future for Fukushima. This is closely related to the devastation from the nuclear disaster which destroyed trust in centralised energy systems that exploit resources in weaker rural areas for the benefit of cities. These findings align well with the importance of history and local context which can influence local attitudes towards different energy projects and associated corporations.

In another paper, Sherry-Brennan (2008) found that the local experience with a wind-hydrogen demonstration plant on an island off Scotland was positive, not only in terms of boosting the island's economy, but also in terms of regenerating the island's population. The community felt the project created employment opportunities for young people who previously would have left the island.

Rouvroy et al. (2008) developed early guidelines (Table 6) for local community engagement based on some early hydrogen transport projects in Hornchurch, London and Perth, Australia. This compliments another study by Miles and Gillie (2009) investigating hydrogen projects in Spain, the United Kingdom, Canada, Norway, Iceland and New Zealand. It was found that a great deal of awareness-raising and general information provision was needed through initiatives such as:

[4] As according to the IEA hydrogen project database (n=316).

- School children visiting the research centres;
- Residential courses on hydrogen systems;
- Focus on job creation as integral value propositions to the public, as well as the promotion of creating an economy around R&D, demonstration and the export of technical expertise (Miles and Gillie, 2009, p.10).

Table 6: Dos and Don'ts of stakeholder engagement for hydrogen transport (Rouvroy et al., 2008, p.15)

DO	DON'T
Recognise that stakeholder perceptions are important and must be addressed	Engage if you are not going to listen
Spend at least as much time listening as talking	Try and develop all the answers before starting engagement
Engage in a way that allows all stakeholders to be heard	Base engagement on pre-existing personal contacts instead of a systematic process to identify issues and stakeholder
Develop mutually-agreed processes for engagement	Assume silence means consent
Give time for social, informal contact before and after consultation to engage trust and develop	Assume that one engagement approach works with all
Recognise the time stakeholders give up to participate in consultation	Assume stakeholders have your timelines
Follow-up with stakeholders after meetings rather than waiting for them to follow up with you	Rely on technology to substitute for face to face communication
Maintain records	Use external consultant to manage the process
Provide clear boundaries of what is and is not possible	Engage only with friendly stakeholders

In a more customer facing role, through their Keele gas project, HyDeploy found they achieved positive customer engagement through the specific appointment of a dedicated customer liaison member. Lessons learnt included:

- "Never underestimate the time and effort to communicate with customers. It was the critical few that required the majority of the attention.
- Issues that arose were often nothing to do with the project itself.
- Timing of engagement was important for customers." (HyDeploy, 2018, p. 21)

More recently Barilo et al.'s (2017a, 2017b) reporting on their first responder training, provided insights into how hydrogen safety training could be improved. This included:

- Improving images and videos, new props, and considerations of virtual reality tools could help improve the instruction quality of potential reach of first responder's hydrogen safety resources.
- Limited access to safety data, limited availability and affordability of insurance, insufficient technical data to revise standards, and a lack of consistency in training of officials.
- One of the better approaches would be develop tools for sharing information and knowledge through electronic media such as web-based portals and mobile apps.

5.4 Ports

Ports are integral to global energy supply chains. Historically viewed as sources of public livelihood and commerce, ports have transitioned to being potential facilitators of environmental degradation and industrial blight (Knatz, 2013). This has created tensions in port communities as issues around labour relations (previously large employers now highly automated), foreign ownership (Huang, 2018; Walsh, 2019) and animal welfare (RSPCA, 2019) have arisen. As well as concerns over the environment, both around port expansions and being potential facilitators of environmental pollution internationally. These factors create friction on a port's ability to maintain community confidence, as, much like the technologies and resources being imported and exported, social acceptance is paramount for long term sustainability and viability of ports.

Australia has over a relatively short period transformed into the world's largest exporter of liquified natural gas (LNG). Australia can learn much from its own LNG experience, as well as from experiences around the world in relation to LNG port facilities. For instance, Gladstone residents were found to have a general resilience to the social impacts of the LNG 'boom' as they had previous experience with industrial 'booms' in the region (albeit not of the same scale). However, Benham (2016) observed there was a visible increase in certain types of crime, a general increase in fear among the general community, as well as the overburdening of local hospitals and clinics. All of these were associated with the influx of construction workers for the three LNG developments which occurred simultaneously, alongside other developments in the region. Although impacts were not exclusively attributable to LNG developments, LNG construction was seen to severely exacerbate the impacts associated with heightened levels of "fly in fly out" and shift workers amongst the community. Some of the longer-term effects of the LNG port development have been that the region holds the highest financial delinquency rate in the nation post-boom. A secondary effect was the rapid increase in house prices during the boom, coupled with high wages in the LNG sector. This created a false sense of security around borrowing potential and future house price growth (Thorpe, 2018).

Similar activities occurred at other LNG port developments around the world, but particularly in the United States, which has a long history with LNG port developments. For instance, where proposals for LNG (import) facilities did fail, such as Ventura County, California, local factors such as a lack of similar industry or history not only shaped the reaction to the new facilities but had a powerful effect on the community's ability to learn about and quickly mobilize against it. Furthermore, Ventura County is located one hour south of Santa Barbara, a well-known hotbed for coastal and environmental activism stemming from an oil spill in 1969. In other communities, such as Cameron Parish, Louisiana with a long history of oil resource development, new LNG port facilities were openly accepted and supported. These communities saw LNG as a natural extension of the well accepted oil and gas industry but also as a mechanism to improve dwindling economic prospects in the region (Wright & Boudet, 2012). The proposed project was also downstream from Lake Charles, Louisiana, which hosts one of the oldest LNG facilities in the United States. As a result, residents in Cameron Parish were both familiar with LNG facilities and their operations.

Apart from LNG, insights can be drawn from other existing port facility expansions. For instance, in Whatcom County, Washington, BP proposed expanding its Cherry Point oil refinery. Although community opposition developed, concerns were more about maximising impact mitigation rather than disagreements about the expansion itself. In this instance, the community was presented with an "objectively threatening proposal, located in a community that had the capacity, opportunity and experience to mobilize in opposition, but chose not to because of existing contextual conditions that limited motivation. Specifically, the proposal came from a company that had safely operated an existing facility and had been a major employer in the community for over 30 years" (Wright & Boudet, 2012, p. 756). Furthermore, the expansion was seen to be in an area already industrialised and represented a reasonable extension of existing operations.

These experiences indicate the complexity of large-scale developments in port communities, which can be influenced by a variety of factors often unique to each community. These local experiences are important in shaping the response of a community to 'threatening proposals'. This is particularly important in Australia, which has had strong emotional community responses to proposed developments with links to fossil fuel

energy exports, whether that is oil (Greenpeace, 2018), gas (Environment Victoria, 2019; Market Forces, 2018), coal (Robertson, 2019; Mitchell, 2015), or hydrogen derived from coal (Victorian National Ports Association, 2018). Therefore, it is paramount to understanding the community confidence with regards to type of technology as well ports technical and historical capability in processing the type of export.

5.5 Barendrecht and Tomakomai CCS projects

CCS is another technology that is not without opposition (Ashworth, Wade, Reiner et al., 2015). While there are some successful CCS projects operating, a notable case where public opposition forced a project not to go ahead was the Barendrecht case in the Netherlands (Brunsting, de Best-Waldhober, Feenstra et al., 2011). Key findings from a review of the project highlighted a top down approach to engagement, with little community engagement at the project design stage. As a result, communication efforts were reactive to public opposition rather than proactively involving stakeholders. Negative opinions that were formed early about the project, proved impossible to overcome for project proponents. There were also different views about the project that were proffered from senior Dutch Professors. Their different and opposing views were represented in the media which also led to confusion in the general public about CCS and a decline in trust of the project.

Conversely, the Tomakomai project in Japan has been extremely successful in engaging its communities to gain support for the project. Through a series of interviews Mabon, Kita and Xue (2017) reported stakeholders, particularly those representing the fisheries industries, hold a relatively neutral stance towards the CCS project. The researchers highlighted the importance of relating the project to the marine environment and how an individual's attachment to the sea and their familiarity with oil and gas industries operating in the area helped build acceptance of the CCS project. Similar to the early findings of Lambert and Ashworth (2018) in relation to public attitudes to hydrogen, the researchers reported community and stakeholder responses towards the Tomakomai CCS project may best be characterised as neutral or cautiously supportive (Mabon, Kita & Xue, 2017, p. 247). Other reasons offered for the supportive attitudes included a sense of pride in the local industries, trust in local government and an awareness of climate change and the development of other low carbon energy projects in the area. It appears the flexibility of the project leaders, to take the time to engage with the wide range of stakeholders, particularly the fisher groups, was a critical component that led to the success of the project.

The Tomakomai project website provides links to a range of resources that have been used to engage the community and keep key stakeholders informed of the project. These resources also include education resources for children, videos and a range of fact sheets that may be useful to inform engagement activities in Australia (https://www.japanccs.com/en/business/demonstration/index.php). Many of the ideas for Tomakomai's engagement activities were informed by the publication *Communication/Engagement Toolkit for CCS Projects* developed under funding of the Global CCS Institute and led by the CI on this project (Ashworth et al., 2011). As can be seen in the resources folder accompanying this report there are a number of suggestions on how a project can step through best practice community engagement starting from collecting baseline social data through to stakeholder identification activities and developing a dedicated communication and engagement plan.

5.6 A summary of criteria for best practice community engagement

Our review of literature (Appendix A), theories in community engagement and a number of project case studies revealed a set of criteria that should be considered for leading practice. The criteria included the need for communication and engagement to be:

1. **Purposeful –** Engagement must have a clear purpose which should be made explicit from the start.
2. **Inclusive** – Engagement needs to provide for the full diversity of people impacted by decisions and activities. All need to be given the opportunity to have a say in those decisions and activities, even if

they choose not to engage, and their views must be respected. There must be a number of ways for different groups to participate that are appropriate to their needs and cultural requirements.

3. **Timely** - Community engagement needs be included in the decision-making process from the start, seeking to engage stakeholders from the earliest possible stage. Enough time needs to be allowed for participation by all interested or affected stakeholders in accordance with the appropriate level of community involvement required.
4. **Transparent** – The organisation must be honest and open during the engagement process. The rationale for engagement is clearly stated, including full disclosure of information about the project and decision that needs to be made. This might include: who will be responsible for making the decision? How the decision will be made? How community feedback can be provided? What is negotiable and what is not negotiable? There can be no engagement with hidden-agendas or that promotes a predetermined outcome. At the end of the process, participants should be informed on the outcome of the engagement process and the decision that was taken.
5. **Relationship building –** Engagement should seek to build relationships and promote mutual understanding through the processes of engagement and associate activities. Activities and communications that risk dividing the community, creating conflict or opposing extremes should be avoided.
6. **Positive** – Organisations can create a momentum for change by providing positive images of the future. Best generated by using questions to inspire positive action.
7. **Well-resourced –** Organisations need to commit adequate funding and resources, both time and money, over appropriate time frames
8. **Iterative and adaptive** – Organisational engagement needs to be reflexive, incorporating systems for monitoring and evaluating the acceptability of outcomes (including ongoing monitoring as required), and for actively responding to changing circumstances, increased knowledge and updated predictions to drive continuous improvement.
9. **Place-based** - locally tailored engagement activities appear to be more effective, although the importance of engaging with stakeholders in non-place-based "communities of interest" is also important.

These criteria[5] are important considerations for governments and industry when developing communication and engagement activities around the development of a hydrogen industry to benefit all Australians.

5.7 The APS Framework for engagement and participation

The recent release of the *Australian Public Service Framework for engagement and participation* is a valuable resource that sets out the principles and standards that underpin effective engagement (Australian Government, 2019). The standards provide ten expected behaviours for dealing with non-government stakeholders, many of which overlap with the criteria for best practice engagement outlined above. The behaviours include:

1. Define the objective
2. Choose the right approach
3. Manage expectations
4. Choose the right people for the job
5. Be transparent
6. Provide sufficient information
7. Provide opportunities to be heard
8. Understand all views
9. Close the loop

[5] With acknowledgement to researchers at the Centre for Social Responsibility in Mining, Sustainable Minerals Institute, The University of Queensland.

10. Commit to continuous improvement based on feedback.

Complementary to this framework are two volumes that have been developed to outline best practices and assist in the design of public participation processes which are an immediate resource for all government and industry stakeholders seeking to develop best practice deliberative processes (Australian Government, 2019).

5.8 Review of communication toolkits, handbooks

As part of this research, 18 national and international resources that present guidelines and tools for best practice community engagement and participation were reviewed. Some of these resources encompass broad principles for public participation applicable to many types of engagement (such as the IAP2's Public Participation Spectrum) or Social Impact Assessment (International Association for Impact Assessment). Other resources were specific to engagement for particular types of energy technologies (e.g. solar, wind, CCS) and/or context (Indigenous and/or Tribal). A synthesis of these are detailed below. Key steps include understanding the local context; identifying stakeholders through analysis; developing a communication and engagement plan; and finally developing a media strategy targeting various journalists. Regardless of which activities, it is clear that communities need to be involved from the earliest stages of any project. Local councils and other influential stakeholders can play an important role as well as providing opportunities for the broader community to be involved in as many activities as they wish (Figure 11).

Understand the context: by developing a community profile through social data collection (7 resources)

- What is the sociodemographic makeup of the location?
- What is the business and industry composition?
- What have the community's previous experiences with project developers, investors, and regulatory authorities?
- What is the community's previous experience with public participation?
- What are the main community values, norms and other issues?
- Undertake a social impact and social risk assessment (SIA).

Stakeholder identification and analysis (8 resources)

- Identifying the range of stakeholders, both individual and group, and levels of influence and interest in a project, with an emphasis on the local community. Stakeholder types include individuals, businesses, organisations, local interest groups and government.
- Develop a stakeholder contact database
- Conduct a SWOT analysis to assist in developing strategies to engage stakeholders.
- Assessment of appropriate levels of engagement for each stakeholder group and when to engage which stakeholders.
- Establish an independent steering group; community consultative committee; and/or citizen task force/advisory board to act as liaison between the project and community.

Develop a communication plan, activities & roles (11 resources)

- Ensure early engagement which includes processes that allow the community to provide into the process of developing an overall engagement plan.
- Ensure all activities acknowledge local stakeholder context, e.g. social values and norms, type of community (e.g. farming) and activities are designed to suit local needs.
- Ensure key decision-makers are present as appropriate
- Undertake regular and continuous engagement during all project phases and monitor effectiveness of activities
- Draw on the range of tools and modes for information dissemination, including face to face
- Ensure the provision of sufficient resources for engagement (both time and money).
- Establish the role of a community liaison officer to answer questions and share information

Develop a media strategy with journalist engagement activities (4 resources)

- Primary focus is to generate or earn news coverage that is accurate.
- Create key media contact lists including appropriate print and electronic outlets, including those that target a specific audience.
- Update information regularly.

Figure 11: Communication & engagement - key elements

In addition, some resources highlighted specific activities for Indigenous engagement which are also detailed below (Figure 12). What differentiates Indigenous groups from mainstream populations is that they hold a unique set of rights and have special connections to land and sea environments that require additional consideration and respect in all stages of a project's life cycle. Indigenous rights are important policy and legal considerations for any new development. Proponents are expected to ensure that Traditional Owners have been properly identified and engaged. As well, that affected Indigenous communities are equipped to derive long term benefits from projects. This usually means finding a balance between enabling economic

participation in the project (and its supply chain) and respecting rights to protect land and sea country, to maintain culture and traditions as well as rights to control the nature of development pathways (self-determination).

Indigenous engagement (6 resources)

- Recognise and value the importance of Indigenous cultural skills and knowledge
- Build trusting relationships that create genuine partnerships with Aboriginal families, organisations and communities.
- Meet as early as feasible and understand the level of engagement, partnership and co-design that is possible, desired and appropriate throughout project stages.
- Set the role and purpose of the engagement by clearly defining the objectives of the engagement and agree assigned roles.
- Identify any constraints for Indigenous participation.
- Recognise that mutually acceptable outcomes are contingent on clear, open and transparent communications at every stage of the process.

Figure 12: Indigenous engagement guidelines

6. Discussion

> *While it is often acknowledged that the industrial impact of new developments is felt by local communities, the larger benefits on which these projects are sold to governments, investors, shareholders, and society as a whole are disproportionately not local. Therefore, the list of stakeholders who have a legitimate claim to influence and shape the nature of conditions of an SLO is much broader than those living along the "fence line" (the immediate local area).*
>
> Gallois, Ashworth, Leach et al., 2017, p.10.

The quote clearly highlights the need for community engagement that is inclusive. The literature confirms that community engagement is crucial to good public decision-making, and to ensuring the appropriate levels of participation by those impacted by decisions, either positively or negatively. While there are many definitions of engagement, community engagement has been defined as "mutual communication and deliberation that occurs between government and citizens that allows citizens and government to participate mutually in the formulation of policy and the provision of government services" (Cavaye, 2004, p. 3). Because communities are diverse, community engagement must also be prepared to respond to the diversity and dynamics of communities.

Our review of the literature identified a number of key criteria for leading practice which included the need to have a clear purpose; be inclusive; timely; transparent; build relationships; create positive images around the momentum for change; well-resourced in both time and money; reflexive; and tailored to local needs. It was clear that engagement can takes many forms. From providing people with information about a proposed project through to empowering stakeholders to lead ideas and actions themselves (IAP2, 2017a). This is clearly illustrated in the IAP2 spectrum which was heavily cited by many communication toolkits and guidelines.

Our research also highlighted that rather than being a single one-off event, effective engagement helps to build ongoing relationships between community, stakeholder groups and the project developer or engaging agency. The literature revealed that building such a relationship happens over time and will include a range of activities. These may include one on one individual meetings, small group meetings and discussions, as well as specific activities including focus groups, participatory planning exercises and public meetings. However, engagement is the relationship, not the activity (Cavaye, 2004). Some engagement relationships are long term and last for years, while others will be much shorter depending on the goals and nature of the engagement issue.

That said, effective engagement is not only about discussions and relationship building, it also needs to lead to real outcomes for communities. The relationships that form between stakeholders in effective engagement not only lead to improved trust, they can often lead to new ideas, collaborations, information and shared decision-making. This in turn leads to improved services, facilities, policy, infrastructure and other opportunities for communities. As many of Australia's regional communities are currently in decline this becomes even more important today.

Australians participating in our research were generally optimistic about the prospects emerging from a hydrogen industry and would like to see all Australians, and more specifically, regional communities, benefit from its development. Providing local communities with the opportunity to provide input at the earliest stages of a hydrogen project will be critical for building trust in the sector. Section 5 describes in more detail the lessons from other sectors that will ensure best practice in community engagement is utilised for the development of a hydrogen industry in Australia.

There is an important role for governments at this very early stage in the development of a new and unfamiliar industry. To not only build confidence in the technical parameters of the industry, but also in their ability as government to coordinate and regulate such a large-scale and rapidly expanding industry. Case studies such as the Barendrecht CCS project in the Netherlands show that opposition and suspicion are

generated when stakeholders and the broader public are not engaged early in the project. The CSG-LNG experience and, as relayed by Northern Territory participants, the experience from engagement around a potential shale gas industry in the Northern Territory highlight the necessity for a strong government presence in the earliest stages of engagement. When there is a lack (or perceived lack) of government presence and leadership, the discourse can easily become a polarised, two-player debate aimed at legitimising or de-legitimising stakeholder groups who hold different opinions about a project.

Participants in our research expressed the expectation that if a hydrogen industry is in the "national interest", then the nature of that interest, along with the costs, risks and benefits should be clearly explained by the government. As projects become more imminent, industry investors and operators then have the responsibility to build relationships with communities and engage around their specific projects. However, the expectation was that pre-project engagement should be led by government in conjunction with trusted institutions such as universities and other research organisations like the CSIRO.

A key aim being to ensure the development of objective information to answer questions that might arise in these early stages. Key questions that arose in relation to hydrogen were around the costs, environmental considerations, the time frames for the industry to develop, safety issues and the likely benefits. The primary purpose of early led government engagement is to enable informed participation and constructive deliberations about how a hydrogen industry might proceed across different regions of Australia, rather than to convince people to support the industry.

Communication also needs to be relevant, sensitive to culture, geography, local and historical context and have the appropriate level of detail. As the industry matures, the level of detail required is likely to change as project locations and specifics become better defined. In line with our review (Section 5.8) key steps for engagement include first understand the local context, next identify key stakeholders within that community and understand their position and levels of interest towards the project. From this a plan for communication and engagement and be developed and implemented.

Ensuring and maximising social and economic benefits for both host communities and the nation as a whole were important factors emerging from the interviews, focus groups and case studies. Novel types of benefit sharing arrangements already exist in relation to renewable energy projects including "community owned" wind and solar farms, where the local community owns a stake in the business. In the resources sector, where royalties are paid to governments, royalty return arrangements are also common where royalties collected from extractive industries are returned to local communities and in some instances to individual landowners. One suggestion, from previous experience with iron ore in Western Australia (WA) was that a standard benefits package was seen to be a much fairer way to ensure everyone benefitted equally. Such an open and transparent approach was also seen to build trust in the industry and project proponents.

Participants stressed the importance of communicating realistic time frames for the overall scale up of such an emergent industry. This was something they felt would be appropriate for the Commonwealth government, supported by a bi-partisan approach at the State and Territory level. Coupled to this was managing expectations in regions about how quickly the industry might develop and what the implications for them would be. Particularly in relation to job opportunities and other potential collaborations.

Because the development of a large-scale hydrogen industry is likely to be a massive undertaking occurring over a number of years, it was felt that the Commonwealth government had an important enabling and coordinating role. In addition to creating the appropriate policy environment that was consistent across States and Territories, and ensures national standards and regulations were in place, participants were very keen to see the Commonwealth government ensure a level playing field between regions and states looking to capture the market.

There was some concern that competition between different States, Territories and regions was already occurring around who is best positioned to host an export facility. Therefore, it was seen as critical that the Commonwealth foster a collective rather than competitive approach to developing the industry in Australia.

As well, to avoid some of the issues that emerged from the LNG industry, the Commonwealth Government need to assist in the coordination of infrastructure, particularly common user (and interstate) infrastructure.

> *The worst thing would be that you get two projects alongside each other because they just didn't know. Or it was not communicated.* IS009

Another role was for the Commonwealth to *broker and assist to manage international partnerships* so that 1) buyers and foreign governments have confidence and consistency in Australian hydrogen products; and 2) to protect the national interest where multinational companies and foreign investment is involved. One interviewee even suggested that if the scale that is required materialises, the move to hydrogen could become a nation building activity that all governments and broader Australians could get behind and benefit from.

> *I think it almost goes back to …when the Snowy scheme was being built. You do get the impression that people saw the Snowy as a real nation building activity. Lots of migrants got employed lots of communities got opportunities…it was a real nation building narrative and I think that is the narrative we could use to build a 100% renewable energy economy in Australia and a 200 - 300% superpower and hydrogen would be part of that. IS003*

7. Conclusions and recommendations

Our review of the literature clearly identified best practices for communicating and engaging that are relevant to a hydrogen industry. It will be imperative that governments agree to a way to do this that is consistent, both in approach and also messaging. From our engagement with both influential stakeholders and the lay public there is a genuine appetite for a new hydrogen industry centred on relatively green credentials. While there was less appetite to produce hydrogen from CCS, some viewed CCS as an important element of the transition away from fossil fuels, rather than just a "switch it off" mentality. However, either way this will need to be carefully managed.

For almost all that were engaged, there was a level of excitement about the potential economic benefits and jobs a hydrogen industry would bring to regional communities, including Indigenous areas. However, it is unlikely that the scale required will happen overnight and as such there is a need for governments to proactively manage community expectations and communicate clearly the expected timeframes about when benefits might emerge.

Another caution that emerged was in relation to water which is treasured by all across Australia as a finite valuable resource. For farmers and Traditional Owners there are particular sensitivities around the use of fresh water. With areas across Australia experiencing severe drought this sensitivity is heightened, particularly with the rising costs that local communities are needing to pay for water. Therefore any announcements surrounding this industry will need to be carefully managed. Clearly communicating the expected sources of water, volumes required, and how this will be managed with existing demands was a high priority.

There are a number of recommendations that emerged from the research which included:

1. **Manage expectations and communicate realistic timeframes** about how long it will take to scale up the production of hydrogen. Most recognised that a hydrogen industry will not happen immediately with many challenges to be overcome. However, with the growing interest from governments across Australia expectations were rising around prospects for renewed economic growth in regions and this needs to be managed.
2. **Ensure some hydrogen is available for domestic use** without a premium price attached. Indigenous leaders stressed the importance of having access to the clean fuel themselves and that it should not only be produced for export or use elsewhere.
3. **Develop a standard framework for benefit sharing** that will ensure benefits are fairly distributed and includes Indigenous groups. While it was recognised that perceptions of benefits are likely to be different open and transparent approaches were seen to build trust in the industry and project proponents.
4. **Clearly communicate the costs, risks and benefits** associated with hydrogen through consistent messaging including how safety issues and water concerns were being addressed given the recent droughts and the rising costs of water.
5. **Use case studies and pilot projects** (including demonstrations) to build confidence in the use of hydrogen and its production.
6. **Ensure the Commonwealth Government** takes an early lead in coordinating a national approach to hydrogen including the development of necessary standards and regulations.
7. **Engage further with emergency services** to ensure they have the necessary information available to them for establishing Australian standards for responding to any events. This was important given the volunteer nature of so many fire and rescue services in regional communities.

8. **Continue to engage with Traditional Owners** as this research was only successful in engaging a small number of Indigenous leaders but there was an expressed appetite to learn more about the opportunities hydrogen might present.
9. **Ensure nationally consistent messaging** about hydrogen are agreed across all levels of government. It may be opportune to develop a resource package of information materials for a variety of stakeholders that can be used as a resource by all levels of government and in schools.
10. **Establish a presence on Facebook** that can be used to disseminate the latest information about hydrogen and how the industry is evolving. While not always a medium embraced by federal and state governments, Facebook was seen as a valuable format for information sharing across local regions.

8. References

Achterberg, P. (2014) The changing face of public support for hydrogen technology explaining declining support among the Dutch (2008-2013). *International Journal of Hydrogen Energy, 39*: 18711-18717.

Achterberg, P., Houtman, D., Van Bohemen, S. & Manevska, K. (2010) Unknowing but supportive? Predispositions, knowledge, and support for hydrogen technology in the Netherlands. *International Journal of Hydrogen Energy, 35*: 6075-6083.

Ashworth, P., Wade, S., Reiner, D. & Liang X. (2015) Developments in public communication about CCS. *International Journal of Greenhouse Gas Control, 40*: 449-458. http://dx.doi.org/10.1016/j.ijggc.2015.06.002

Ashworth, P., Bradbury, J., Feenstra, C.F.J., Greenberg, S., Hund, G., Mikunda, T., Wade, S & Shaw, H. (2011) Communication/Engagement Toolkit for CCS Projects. Brisbane: CSIRO.

Australian Government. (2019) The Australian Public Service Framework for engagement and participation. Accessed 13 September 2019: https://www.industry.gov.au/data-and-publications/an-open-approach-to-policy-making

Barilo, N. F., Hamilton, J. J., & Weiner, S. C. (2017a) First responder training: Supporting commercialization of hydrogen and fuel cell technologies. *International Journal of Hydrogen Energy, 42*(11): 7536-7541.https://doi.org/10.1016/j.ijhydene.2016.06.226

Barilo, N. F., Weiner, S. C., & James, C. W. (2017b) Overview of the DoE hydrogen safety, codes and standards program part 2: Hydrogen and fuel cells: Emphasizing safety to enable commercialization. *International Journal of Hydrogen Energy, 42*(11): 7625-7632. https://doi.org/10.1016/j.ijhydene.2016.04.070

Benham, C. (2016). Change, opportunity and grief: Understanding the complex social-ecological impacts of Liquefied Natural Gas development in the Australian coastal zone. *Energy Research & Social Science*, *14*: 61-70.

Bigerna, S. & Polinori, P. (2015) Willingness to Pay and Public Acceptance for Hydrogen Buses: A Case Study of Perugia. *Sustainability, 7*:13270-13289.

Brunsting, S., de Best-Waldhober, M., Feenstra, C.F.J. & Mikunda, T. (2011) Stakeholder participation practices and onshore CCS: lessons from the Dutch CCS Case Barendrecht. *Energy Procedia 4*: 6376-6383.

Cavaye, J. M. (2004). Governance and community engagement - The Australian experience. In W.R. Lovan, M. Murray, & R. Shaffer (Eds.), *Participatory governance: Planning, conflict mediation and public decision making in civil society,* pp. 85-102. Hants, England: Ashgate Publishing UK.

Clean Energy Regulator (2019) *Large-scale Renewable Energy Target market data*. Accessed 30 October 2019: http://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target/Large-scale-Renewable-Energy-Target-market-data

Colvin, R.M., Witt, G.B., Lacey, J. & Witt, K. (2019) The community cost of consultation: Characterising the qualitative social impacts of a wind energy development that failed to proceed in Tasmania, Australia. *Environmental Impact Assessment Review, 77*: 40-48. https://doi.org/10.1016/j.eiar.2019.03.007

Colvin, R. M., Witt, G. B. & Lacey, J. (2016) How wind became a four-letter word: Lessons for community engagement from a wind energy conflict in King Island, *Australia. Energy Policy, 98*: 483-494.

Colvin, R. M., Witt, G. B. & Lacey, J. (2015) The social identity approach to understanding socio-political conflict in environmental and natural resources management. *Global Environmental Change 34*: 237-246.

Dare, M., Schirmer, J. & Vanclay, F. (2014). Community engagement and social licence to operate. *Impact Assessment and Project Appraisal 32*(3):188-197.

Devine-Wright, P. (2009) Rethinking NIMBYism: The role of place attachment and place identity in explaining place-protective action. *Journal of Community & Applied Social Psychology, 19*(6): 42-441.

Emery, M. & Flora, C. (2006) Spiraling-Up: Mapping Community Transformation with Community Capitals Framework, *Community Development, 37*(1): 19-35.

Environment Victoria. (2019). Stop AGL's dirty as plan for our Bay. Accessed 25 September 2019: https://environmentvictoria.org.au/campaign/stop-agls-dirty-gas-plan-for-our-bay/

Ferguson, M., Witt, K., Nisa, C. & Ashworth, P. (2019) Effects of message framing on the support for carbon capture and storage (CCS) and alternative energy technologies. Final report. Brisbane, Australia: The University of Queensland.

Franks, D.M., Brereton, D., Moran C.J., Sarker, T., & Cohen, T. (2010) Cumulative impacts – a good practice guide for the Australian coal mining industry. Centre for Social Responsibility in Mining & Centre for Water in the Minerals Industry, Sustainable Minerals Institute, The University of Queensland. Australian Coal Association Research Program. Brisbane.

Gallois, C., Ogay, T., & Giles, H. (2005) Communication accommodation theory: A look back and a look ahead. In W. Gudykunst (Ed.), *Theorizing about intercultural communication,* pp.121-148. Thousand Oaks, CA: Sage.

Gallois, C., Ashworth, P., Leach, J. & Moffat, K. (2017) The language of science and social licence to operate*. Journal of Language and Social Psychology, 36*(1): 4-60. http://dx.doi.org/10.1177/0261927X16663254

Garnett, A., Underschultz, J. & Ashworth, P. (2019). Scoping study for material carbon abatement via carbon capture and storage: Project report. The University of Queensland Surat Deep Aquifer Appraisal Project (UQ-SDAAP). Brisbane, Australia: The University of Queensland.

Garrity, L. (2004) Public Perception and Economic Preferences towards the use of H2FC buses in Perth. Hydrogen and Fuel Cell Futures Conference, 12th - 15th September 2004.

Gasfields Commission. (2017) On New Ground: Lessons from development of the world's first export coal seam gas industry. June. Accessed 12 September 2019: www.gasfieldscommsionqld.org.au

Giles, H. (Ed.) (2016) *Communication Accommodation Theory: Negotiating personal and social identities across contexts*. Cambridge, England: Cambridge University Press.

Greenpeace. (2018). Huge swell of public opposition to new oil plot release in protected marine park. Press release, 6 February 2018. Accessed 25 September 2019: https://www.greenpeace.org.au/news/huge-swell-of-public-opposition-to-new-oil-plot-release-in-protected-marine-park/

Hall, N., Ashworth, P. & Devine-Wright, P. (2013) Societal acceptance of wind farms: Analysis of four common themes across Australian case studies. *Energy Policy, 5*: 200-208.

Heinz, B. & Erdmann, G. (2008) Dynamic effects on the acceptance of hydrogen technologies - an international comparison. *International Journal of Hydrogen Energy, 33*: 3004-3008.

Hickson, A., Phillips, A. & Morales, G. (2007) Public perception related to a hydrogen hybrid internal combustion engine transit bus demonstration and hydrogen fuel. *Energy Policy, 35*: 2249-2255.

Huang, K. (2018). Why China buying up ports is worrying Europe. South China Morning Post, 23 September 2018. Accessed 25 September, 2019: https://www.scmp.com/news/china/diplomacy/article/2165341/why-china-buying-ports-worrying-europe

Huijts, N. M. A. (2018) The emotional dimensions of energy projects: Anger, fear, joy and pride about the first hydrogen fuel station in the Netherlands. *Energy Research and Social Science, 44*:138-145.

Huijts, N. M. A., De Groot, J.I.M., Molin, E.J.E. & Van Wee, B. (2013) Intention to act towards a local hydrogen refueling facility: Moral considerations versus self-interest. *Transportation Research Part a-Policy and Practice, 48*: 63-74.

Huijts, N.M.A., Molin, E.J.E. & Steg, L. (2012) Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. *Renewable and Sustainable Energy Reviews, 16*: 525-531. https://doi.org/10.1016/j.rser.2011.08.018

HyDeploy. (2018) HyDeploy Project: Gas Network Innovation Competition. Second Project Progress Report (PDR). Accessed 20 September 2019: https://hydeploy.co.uk/app/uploads/2018/12/15055_HD_PH2_PROJECT_REPORT_v2.pdf

IAP2. (2017a) The IAP2 Public Participation Spectrum. Accessed 13 September 2019: https://www.iap2.org.au

IAP2. (2017b) Core Values for Public Participation. Accessed 13 September 2019: www.iap2.org/resource/resmgr/pillars/2017_core_values-24x36_iap2_.pdf

Iribarren, D., Martín-Gamboa, M., Manzano, J. & Dufour, J. (2016) Assessing the social acceptance of hydrogen for transportation in Spain: An unintentional focus on target population for a potential hydrogen economy. *International Journal of Hydrogen Energy, 41*: 5203-5208. https://doi.org/10.1016/j.ijhydene.2016.01.139

Itaoka, K., Saito, A. & Sasaki, K. (2017) Public perception on hydrogen infrastructure in Japan: Influence of rollout of commercial fuel cell vehicles. *International Journal of Hydrogen Energy, 42*: 7290-7296.

Jacquet, J. B. (2014) Review of risks to communities from shale energy development, *Environment Science and Technology, 48*: 8321 – 8333.

Knatz, G. (2013) Looking beyond cargo and cruise ships: Promoting academic marine research and clean technologies as an economic development strategy for ports. *Coastal Management*, *41*(4), 314–326.

Lacey, J., & Lamont, J. (2014) Using social contract to inform social licence to operate: an application in the Australian coal seam gas industry. *Journal of Cleaner Production, 84*: 831-839.

Lai, P.H., Lyons, K.D., Gudergan, S.P. & Grimstad, S. (2017) Understanding the psychological impact of unconventional gas developments in affected communities. *Energy Policy, 101*: 492-50.

Lambert, V. & Ashworth, P. (2018) *The Australian public's perception of hydrogen for energy*. Accessed 11 September 2019: https://arena.gov.au/assets/2018/12/the-australian-publics-perception-of-hydrogen-for-energy.pdf

Leonard, R., McCrea, R. & Walton, A. (2016) Perceptions of community responses to the unconventional gas industry: The importance of community agency. *Journal of Rural Studies, 48*: 11-21.

Mabon, L., Kita, J. & Xue, Z. (2017) Challenges for social impact assessment in coastal regions: A case study of the Tomakomai CCS Demonstration Project. *Marine Policy, 83*: 243-251. http://dx.doi.org/10.1016/j.marpol.2017.06.015

Market Forces. (2018). Fierce opposition to Narrabri gas project. Accessed 25 September 2019. 3 May 2018. Accessed 25 September 2019: https://www.marketforces.org.au/fierce-opposition-to-narrabri-gas-project/

Mercer-Mapstone, L., Rifkin, W., Louis, W. & Moffat, K. (2017) Meaningful dialogue outcomes contribute to laying a foundation for social licence to operate. *Resources Policy, 53*: 347-355.

Miles, S. & Gillie, M. (2009) Benefits and barriers of the development of renewable/hydrogen systems in remote and island communities. IEA Hydrogen Task 18 working group. Accessed 20 September 2019: http://ieahydrogen.org/pdfs/Annex-Reports/RemoteIslandBenefits.aspx

Mitchell, T. (2015). Adani lodges Abbott Point Port plans as Carmichael Mine takes centre stage in a political stoush. New Matilda, 20 August 2015. Accessed 25 September 2019:

https://newmatilda.com/2015/08/20/adani-lodges-abbot-point-port-plans-carmichael-mine-takes-centre-stage-political-stoush/

Montijn-Dorgelo, F. N. H. & Midden, C. J. H. (2008) The role of negative associations and trust in risk perception of new hydrogen systems. *Journal of Risk Research, 11*: 659-671.

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

McElfish, J. & Stares, D. (2014) Getting the Boom without the Bust: Guiding Southwestern Pennsylvania through shale gas development. Washington DC: Environment Law Institute.

O'Garra, T., Mourato, S., Garrity, L., Schmidt, P., Beerenwinkel, A., Altmann, M., Hart, D., Graesel, C. & Whiteshouse, S. (2007) Is the public willing to pay for hydrogen buses? A comparative study of preferences in four cities. *Energy Policy, 35*: 3630-3642.

Ono, K. & Tsunemi, K. (2017) Identification of public acceptance factors with risk perception scales on hydrogen fueling stations in Japan. *International Journal of Hydrogen Energy, 42*: 10697-10707.

Popper, F.J. (1985) The environmentalist and the LULU environment. *Science and Policy for Sustainable Development*, 27(2): 7-40. https://doi.org/10.1080/00139157.1985.9933448

Prno, J., & Slocombe, D.S. (2012) Exploring the origins of 'social license to operate' in the mining sector: Perspectives from governance and sustainability theories. *Resources Policy, 37*(3): 346-357.

Prno, J. (2013) An analysis of factors leading to the establishment of a social licence to operate in the mining industry. *Resources Policy, 38*(4): 577-590.

RSPCA. (2019). Why is the RSPCA opposed to the live export trade? Accessed 25 September 19: https://kb.rspca.org.au/knowledge-base/why-is-the-rspca-opposed-to-the-live-export-trade/

Robertson, J. (2019). What we know about Adani's Carmichael coal mine project. ABC, 26 April, 2019. Accessed 25 September 2019: https://www.abc.net.au/news/2019-04-26/what-we-know-about-adanis-carmichael-coal-mine-project/11049938

Rouvroy, S., Rickard, A., Whitehouse, S., Tsatsami, V. & Kentzler, M. (2008) People, transport and hydrogen fuel: Guidelines for local community engagement when implementing hydrogen powered transport. Report:TREN/05/FP6EN/ S07.52298/019991. HyFLEET: CUTE. Accessed 20 September 2019: https://www.eltis.org/sites/default/files/case-studies/documents/people_transport_and_hydrogen_fuel_4.pdf

Sherry-Brennan, F. (2008) Social Representations of Hydrogen in the Context of a Community-Owned, Wind Energy Generation Project. PhD thesis. ISBN 978-1-392-03034-9. https://search.proquest.com/docview/2203395576?accountid=14723

Schmidt, A. & Donsbach, W. (2016) Acceptance factors of hydrogen and their use by relevant stakeholders and the media. *International Journal of Hydrogen Energy, 41*: 4509-4520.

Tarigan, A. K. M., Bayer, S. B., Langhelle, O. & Thesen, G. (2012) Estimating determinants of public acceptance of hydrogen vehicles and refuelling stations in greater Stavanger. *International Journal of Hydrogen Energy, 37*: 6063-6073.

Terwel, B.W., Harinck, F., Ellemers, N. & Daamen, D.D.L. (2009) Competence-Based and Integrity-Based Trust as Predictors of Acceptance of Carbon Dioxide Capture and Storage (CCS). *Risk Analysis, 29*(8): 1129-1140.

Terwel, B. W. & Ter Mors, E. (2015) Host community compensation in a carbon dioxide capture and storage (CCS) context: Comparing the preferences of Dutch citizens and local government authorities. *Environmental Science & Policy, 50*: 15-23. http://dx.doi.org/10.1016/j.envsci.2015.01.015

Thorpe, A. (2018). Gladstone's mortgage woes topped the country last year. The Gladstone Observer, 15 April 2018. Accessed 25 September 2019: https://www.gladstoneobserver.com.au/news/gladstones-mortgage-woes-topped-the-country-last-y/3387765/

Trencher, G. & van der Heijden, J. (2019) Contradictory but also complementary: National and local imaginaries in Japan and Fukushima around transitions to hydrogen and renewables, *Energy Research & Social Science*, *49*: 209-218. doi: 10.1016/j.erss.2018.10.019

Vanclay, F., Esteves, A.M., Aucamp, I. & Franks, D.M. 2015. Social Impact Assessment: Guidance for assessing and managing the social impacts of projects. International Association for Impact Assessment.

Vanclay, F. (2003) International principles for Social Impact Assessment. International Association for Impact Assessment, Washington DC. Accessed 13 September 2019: https://www.iaia.org/pdf/Sections/SIA/IAIA%20SIA%20International%20Principles.pdf

Victorian National Parts Association. (2018). Rally to oppose AGL gas import and Kawasaki projects in Western Port Bay. Media release, 29 June 2018. Accessed 25 September 2019: https://vnpa.org.au/rally-oppose-agl-gas-import-kawasaki-projects-western-port-bay/

Walsh, C. (2019). Can the Darwin Port's 99-year lease to China be reversed? And what role, if any, did Andrew Robb play? ABC, 19 March 2019. Accessed 25 September 2019: https://www.abc.net.au/news/2019-03-19/can-darwin-port-99-year-lease-china-be-reversed-andrew-robb-role/10912478

Walsh, B., van der Plank, S. & Behrens, P. (2017) The effect of community consultation on perceptions of a proposed mine: A case study from southeast Australia. *Resources Policy, 51*:163-171.

Witt, K., Ferguson, M. & Ashworth, P. (2019) Understanding the public's response towards 'enhanced water recovery' in the Great Artesian Basin (Australia) using the carbon capture and storage process. *Hydrogeology Journal* (forthcoming).

Witt, K., Kelemen, S., Schultz, H. & Vivoda, V. (2018a). Industry and government responses to unconventional gas development in Australia. *The Extractive Industries and Society, 5*(4): 422-426.

Witt, K., Whitton, J. & Rifkin, W. (2018b) Is the gas industry a good neighbour? A comparison of UK and Australia experiences in terms of procedural fairness and distributive justice. *The Extractive Industries and Society, 5*(4): 547-556.

Witt, K., Vivoda, V., Everingham, J., Bainton, N. (2017) *A framework for social impact assessment of shale gas development in the Northern Territory*. Centre for Social Responsibility in Mining, Sustainable Minerals Institute, The University of Queensland.

Wolsink M. (2005) Wind power implementation: the nature of public attitudes: equity and fairness instead of backyard motives. *Renewable and Sustainable Energy Reviews, 11*: 1188-207.

Wolsink. M. (1994) Entanglements of interests and motives: Assumptions behind the NIMBY-theory on facility siting. *Urban Studies, 31*(6): 851-866. https://doi.org/10.1080/00420989420080711

Wood, D., Daley, J. & Chivers, C. (2018) A crisis of trust: The rise of protest politics in Australia. Grattan Institute.

Wright, R. A., & Boudet, H. S. (2012). To act or not to act: Context, capability, and community response to environmental risk. *American Journal of Sociology*, *118*(3): 728-777.

Wüstenhagen,R., Wolsink, M. & Burer, M. (2007) Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy. 35*: 2683-2691.

Xenias, D. & Whitmarsh, L. (2013) Dimensions and determinants of expert and public attitudes to sustainable transport policies and technologies. *Transportation Research Part a-Policy and Practice, 48*: 75-85.

Yang, H. J., Cho, Y. & Yoo, S. H. (2017) Public willingness to pay for hydrogen stations expansion policy in Korea: Results of a contingent valuation survey. *International Journal of Hydrogen Energy*, 42: 10739-10746.

Zimmer, R. & Welke, J. (2012) Let's go green with hydrogen! The general public's perspective. *International Journal of Hydrogen Energy, 37*: 17502-17508

Appendix A

A-1 Review of Literature

A-1-1 Achieving broad community support

Community engagement is well recognised as being a key vehicle for achieving a social licence for projects (Prno & Slocombe 2012; Prno 2013). Social license can be conceived as a form of social contract in which the project operator acts in accordance with community expectations and norms (Lacey & Lamont, 2014). Community engagement is important for negotiating those expectations and understanding the social norms and values within local host communities. Stakeholder theory tells us that a social license is unlikely to be a single 'contract' between the project operator and the local community but instead will be made up of multiple 'contracts' with different stakeholder groups who each have a different set of expectations, norms and values. Therefore, broad community support is likely to be created from the aggregate effect of best practice engagement with different stakeholder groups. Stakeholder groups may be based on 'communities of place' (e.g. residents, business owners and Indigenous peoples) or communities of interest (e.g. NGOs, state government agencies, energy markets and consumers) (Dare et al., 2014).

Understanding the different stakeholder groups and how they interact with each other - particularly in relation to the nature of their interest and influence is a key initial component of a community engagement plan. Understanding the underlying interest and motivations of stakeholder groups improves the quality of relationships that can be built. Early research into social license revealed that it is the quality of contact rather than the amount of contact that is key to building trust and a social license to operate (Mercer-Mapstone et al., 2017).

There is increasing interest in using community benefits schemes to increase community support for energy projects and high levels of support have been associated with significant flows of benefits to local areas. These have been in the way of a fund, held by a local organisation/s with an annual payment based on production/outputs that can be used for local projects at the discretion of the community. Community-owned energy projects are also becoming more common-place, with Australia's first community-owned wind farm near Daylesford, Victoria.

Another driver of community acceptance is procedural fairness, which incorporates tenets of respect and inclusiveness. How stakeholders perceive their involvement in decision-making can affect their acceptance of the whole project (Walsh et al., 2016).

A-1-2 Principles of effective community engagement and consultation

Communities are diverse and consist of a wide range of sectors, groups and individuals with differing perceptions, interests and interactions with each other and external agencies. Therefore, effective community engagement requires extensive understanding, planning, and commitment to an ongoing process. This involves identifying the situations and preferences of different groups within communities, building and maintaining relationships, using appropriate methods to engage diverse stakeholders and providing feedback and follow-up action. Therefore, engagement arrangements need to ensure community representation, attention to power and authority, as well as the potentially conflicting goals of sub-communities and different stakeholder groups.

The International Association for Public Participation (IAP2) described community engagement as a continuum. They describe a spectrum of participation from minimal, such as receiving information about a project, through to taking a leadership role in decision making. The spectrum can help organisations to choose the level of participation that best suits their requirements in terms of the goals, time frames and

resources of the engagement process as well as the degree of influence the community will have on the final decision. It also helps organisations to manage the expectations of the communities they are planning to engage with. The five levels of participation include: inform, consult, involve, collaborate and empower and are detailed in the table below.

Table 7: The IAP2 Public Participation Spectrum (adapted from IAP2, 2017a)

	Inform	Consult	Involve	Collaborate	Empower
Public Participation Goal	Provide the public with balanced information to assist their understanding of the problem, alternatives and solutions	Obtain public feedback on analysis, alternatives and/or decisions	Work with the public to ensure that concerns and aspirations are understood and considered	Partner with the public in decision making including the generation of alternatives and identified of the preferred solution	Places final decision-making power in the hands of the public
Promise to the Public	We will keep you informed	We will keep you informed, listen to and acknowledge your concerns and aspirations and provide feedback on how your input influenced the decision	We will work with you to ensure your concerns and aspirations are directly reflected in the outcomes and provide feedback on how your input influenced the decision	We will look to you for advice and innovation in formulating solutions and incorporate your advice in decision to maximum extent possible.	We will implement what you decide
Role of the Community	Listen	Contribute	Participate	Partner	Decide

To ensure participation at all levels is effective, the IAP2 developed core principles that underpin Best Practice (IAP2, 2017b). The IAP2 Core Values of public participation are:

- "Public participation is based on the belief that those who are affected by a decision have a right to be involved in the decision-making process;
- Public participation includes the promise that the public's contribution will influence the decision;
- Public participation promotes sustainable decisions by recognising and communicating the needs and interests of all participants, including decision makers;
- Public participation seeks out and facilitates the involvement of those potentially affected by or interested in a decision;
- Public participation seeks input from participants in designing how they participate;
- Public participation provides participants with the information they need to participate in a meaningful way; and
- Public participation communicates to participants how their input affected the decision (IAP2 2017b)".

A-1-3 Trust and project acceptance

All models stress the importance of trust in gaining acceptance (Terwel et al. 2009; Huijts, Molin & Steg, 2012) and achieving a social licence to operate for projects (Moffat & Zhang, 2014; Gallois, Ashworth, Leach et al. 2017). In Australia there has been a noticeable declining trust associated with energy projects. This is best evidenced by the need for companies associated with the energy supply chain to establish 'The Energy Charter' (https://www.theenergycharter.com.au/signatories/). The goal was to establish a framework that made an effort to meet community expectations in relation to energy. Given that hydrogen is associated with energy, building and maintaining trust in all parts of the hydrogen supply chain will be critical. This includes both project proponents and all levels of government and associated regulators.

The research by Terwel et al. (2009) clearly highlights that the development of trust in organisations is based on their apparent and perceived organisational integrity and competence. Related to this is the existing reputation of the company and what their previous track record has been also compounded by what the local context is and what has happened previously in that community. Terwel and colleagues found that when trust in project operators was high, individuals tended to perceive less risks and more benefits from a project (2009).

Community engagement builds trust for those directly involved in engagement activities but also more broadly as they pass on information and learnings from their experiences to others. The Enhanced Water Recovery focus groups (Section 2.7) were a good example of this occurring as participants expressed their gratitude for the opportunity to engage on the issue. They also expressed a desire to share their learnings with friends and family, including suggestions that more engagement activities could be conducted.

Trust is also influenced by the media. Media can portray either negative or positive images of an industry (or raise concerns about integrity and performance) which can have immediate and significant effects on levels of trust and broad community acceptance (e.g. a moratorium on live cattle exports following portrayal in the media of animal welfare issues). There is much to be gained from engaging with media and proactively using social media to communicate messages. If done well by both government and industry, such proactive communication can often counter negative stories that maybe portrayed by self interest groups opposed to a project or development.

A-1-4 Indigenous Engagement

As discussed above, responsible project/industry development engages with local communities, builds relationships of trust and respect, minimises risks and disturbance and provides opportunities for local participation and economic benefits. What differentiates Indigenous Peoples is that they hold a unique set of rights and have special connections with the land and sea environments that require additional consideration and respect in all stages of the project's life cycle.

Indigenous rights are important legal and policy considerations for any new development. Proponents are expected to ensure that Traditional Owners have been properly identified and engaged and affected Indigenous communities are equipped to derive long term benefits from projects. This usually means negotiating a balance between enabling economic participation in the project (and its supply chain) and respecting rights to protect land and sea country, to maintain culture and traditions as well as rights to control the nature of development pathways (self-determination). In the resources sector, these negotiations mostly result in formal compensation and benefit-sharing agreements between the resource company and the relevant Indigenous group/s and should reflect the FPIC standard outlined in Appendix A-2. Agreements include provisions across a suite of issues including environmental protection, cultural heritage, rights and interests in land and sea, financial payments, employment and training, business development and roles and responsibilities in agreement implementation (O'Faircheallaigh 2015). Government is largely removed from the negotiating process, except to establish the minimal requirements for engagement (e.g. through the *Native Title Act* and other state government Acts).

However, O'Neill et al (2019) argue for a stronger role for Government/s to develop policies that explicitly encourage benefit-sharing agreements between the renewables industry and Indigenous peoples. When entering a negotiation, the Indigenous community should first establish its goals for the negotiation which requires understanding the project and the likely impacts/opportunities.

Building this understanding requires effective communication about the project and it social, environmental, economic and environmental impacts (see the SIA section below) but the first step is to identify the appropriate people to be engaging with. Native Title legislation has formal processes for establishing ownership rights and for identifying and engaging with recognised Traditional owners. However, Aboriginal communities can be complex and are bound by relationships of connection and interest rather than geographic location. Key people in these communities may not reside in the local vicinity of the project but are nevertheless important to include.

There are several best practice guides developed to promote and facilitate engagement within Indigenous communities – mostly from the extractives and health sectors. Points to note are that English may be a second or third language, particularly for older people in remoter communities, and to be cognisant of legacy and social justice issues –namely that many Indigenous communities remain in disadvantaged states in relation to education, housing, employment and health.

From these key learnings have been distilled:

1. **Cultural competency** - recognising and valuing the importance of Indigenous cultural skills and knowledge (e.g. Hunt, 2013).
2. **Building Trust and Relationships** – the development of "genuine partnerships with Aboriginal families, organisations and communities built on a commitment to developing long-term sustainable relationships based on trust. Relationships are the heart and soul of effective partnerships" (DCPFS, 2016, p.6).
3. **Early Engagement and Time Management –** engaging as early in the project planning process as possible with appropriate timeframes for consultation
4. **Role and Purpose Setting -** the objectives of the engagement need to be clear and agreed with clearly assigned roles.
5. **Knowledge sharing and reciprocation –** recognising that mutually acceptable outcomes are contingent on clear, open and transparent communications at every stage of the process

A-1-5 Social Impact Assessment as an engagement tool

Social impacts are the changes experienced by people and communities, as a result of projects and activities that impact on the way they live work, relate to one another, relax and organise themselves. Because social impact is conceived as being anything linked to a project that benefits, affects or concerns any impacted stakeholder group, almost any change can potentially have a social impact so long as it affects something that is valued by or important to a specific group of people (Witt et al. 2017).

Social Impact Assessment (SIA) is a framework methodology to identify the potential social and economic impacts from a project. SIA is widely practised internationally as a predictive study that is part of the regulatory approval process for projects. In most cases SIA remains included as a component of an Environmental Impact Assessment (EIA) with the purpose of regulating the activities of proponents to minimise social impacts. This is, however, a narrow conception of SIA.

SIA can contribute to sustainable development outcomes by enabling a proactive approach to development to ensure more equitable and sustainable outcomes for local communities, not just to manage potential negative impacts. Leading practice SIA is intended to promote community development and empowerment, build capacity, and develop social capital (social networks and trust) by mitigating harms and maximising

benefits (International Association for Impact Assessment (IAIA) 2015). SIA also contributes to the process of developing adaptive management of policies, programs, plans and projects.

SIAs are usually specific to a single project but are increasingly used in a strategic and regional context to establish baseline understandings of social and economic conditions, community assets and strengths, to better align the opportunities and investments created by development of multiple projects with regional needs and aspirations. This is particularly useful where there is large-scale development, or shared supply chains. For example, the Northern Territory is taking such an approach in relation to the development of a shale gas industry.

Where there are likely to be multiple projects in a region, Government (rather than proponent) led strategic and regional assessments may establish the conditions for future development and reduce or remove the requirements for project-specific impact assessments prior to regulatory approval, if the proposals meet the conditions outlined in the assessment. Such an approach has obvious benefits for investors and industry as it can:

- lead to better coordination of social infrastructure and services, as well as better environmental outcomes;
- provide certainty for development proposals;
- reduce the potential for consultation fatigue;
- reduce the regulatory burden and shorten the approvals process;
- avoid the duplication of project level assessments; and
- inform prospective developers about the environmental and social context in which they operate (Franks et al. 2010).

Leading practice SIA begins with understanding the nature and extent of impact factors associated with the project (e.g. demand for water and land) including cumulative effects. In order to predict and measure impacts, a baseline understanding of current conditions is necessary. A social and economic baseline assessment can identify stakeholder groups and networks, a range of social values, relevant socio-economic indicators to monitor over time, current trends and trajectories as well as provide insights about community strengths, aspirations and needs. The baseline assessment then becomes the starting point for an ongoing monitoring program that evaluates the effectiveness of strategies put in place to minimise harms and maximise benefits and allows for adaptive responses if social and economic circumstances should change due to other influences. SIA can inform decisions - before they are made - to align the likely outcomes with expectations and aspirations for sustainable and equitable outcomes.

This baseline data would include identification of stakeholder values, and current assets in different types of capital ‘stocks’, as well as assessing trends, and aspirations for these stocks. We recommend using the Community Capitals Framework (CCF), which is well-established in community development literature and practice (Emery & Flora 2006). The CCF measures community development in relation to seven types of capitals including:

- natural - e.g., the condition of place-specific elements, biodiversity, amenity, beauty;
- cultural - e.g., traditional knowledge and languages, rituals and festivals, heritage;
- social - e.g., networks, trust, norms of behaviour, giving, neighbourliness, cooperation;
- human - e.g., skills, knowledge, health, abilities, leadership;
- political - e.g., influence, having a voice, self-determination;
- financial - e.g., credit, savings, income, assets; and
- built - e.g., infrastructure, housing, roads, sewerage, sports facilities, lighting.

The baseline assessment would identify initial stocks of capitals, but also trends, where possible and importantly identify local and regional goals and aspirations in relation to these capitals.

A social baseline assessment can be an effective starting point for conversations about future proposals. Another advantage is that these conversations are facilitated by an independent party, being neither the proponent nor the regulating/enabling government. Using collaborative methods to identify relevant and meaningful indicators for each of the capitals is also beneficial for consistency in reporting. The UQ Boomtown Toolkit outlines a tested approach to developing indicators that the industry needs for compliance, that the community agree represent their concerns, values and aspirations and that government want to track in order to monitor cumulative impacts and regional development outcomes.

A-2 Relevant theories and concepts from the literature

A review of the international literature around communication and engagement for new energy projects and other large infrastructure projects identified a range of socio-psychological theories and factors that may influence how individuals within a community may respond – either positively or negatively - to such projects. The list below summarises a range of the key theories that arose in no order of priority:

Acceptance – Huijts, Molin, and Steg (2012) categorised public responses to projects ranging from 'acceptance', where behaviours actively support or promote the technology, through to 'tolerance', where people are in favour of a technology and do not take action against it. Opposition to projects is communicated through protests, community blockades, or other activities like court actions and letters to government requesting intervention" (Gallois, Ashworth, Leach et al., 2017, p.53).

Communication Accommodation Theory (CAT) – is an intergroup theory of interpersonal communication that assumes two overarching communicative motivations: cognitive or comprehension (understand other speakers and communicate one's own ideas, attitudes, emotions clearly) and affective or identity-related (communicate one's attitude and emotional stance towards speakers in one's own group or a salient out-group) (Gallois, Ashworth, Leach et al. 2017; Gallois, Ogay & Giles, 2005; Giles, 2016).

Distributive Fairness – Is the extent to which costs, risks and benefits are distributed fairly (Wolsink, 2005), where fairness does not necessarily mean equally. This has emerged in a number of wind and CCS projects when the decision making has been external to the host community and there is a perception that some sectors in the community bear greater burdens than others. It was also a criticism in CCS deployment where the benefits of carbon mitigation were seen as having a global benefit while the risks were perceived to be born locally (Ashworth et al., 2015).

Free Prior Informed Consent (FPIC) – The UN Declaration on the Rights of Indigenous Peoples (2007) affirms that governments should obtain 'free, prior and informed consent' (FPIC) from Indigenous peoples about any project that may affect their livelihoods. FPIC recognises indigenous peoples' rights to their lands and resources and their legitimate authority to require that third parties enter into an equal and respectful relationship with them based on the principle of informed consent. FPIC requires processes that allow and support, meaningful choices by Indigenous peoples about their development path, in line with human rights to self-determination (Hanna & Vanclay, 2013). Although FPIC remains contested in how it is defined and implemented in practice, it is recognised in the International Finance Corporation (IFC 2012) Performance Standards, which apply to all IFC-funded projects, and, by extension, the Equator Principles, which apply to an increasing number of financing institutions.

Human Rights – The United Nations has endorsed standards to govern the adverse impacts of business activities on the human rights of individuals and groups (UN Guiding Principles on Business and Human Rights 2011). It is based on three principles: 1) Protect, 2) Respect and 3) Remedy. Protect is the State duty to protect against human rights abuses by third parties, including by businesses; 2) is the corporate responsibility to respect human rights; and 3) is the need for more effective access to remedies where human rights have been breached. Impact assessments for large projects are increasingly required to consider possible impacts on human rights, particularly the 'economic, social and cultural rights' which

include the right to a livelihood; the right to participate in the cultural life of a community; the right to a fair wage, health care and other social services; the right to family life; and freedom from gender and other types of discrimination (Kemp & Vanclay 2013). Some opponents of coal seam gas development in Queensland claimed human rights violations in terms of procedural fairness and environmental harm.

LULU – Locally unwanted land uses is another common term used to describe opposition to projects (Popper, 1985) that are seen as 'undesirable' (usually polluting or resource-intensive). This can also manifest itself through issues of co-existence between different industry sectors and disputes over the material use of resources. For example, large scale energy projects in competition with prime agricultural land and projects to store carbon dioxide in the ocean where fishing industries operate (Mabon, Kita & Xue, 2017).

NIMBY – Opposition to the siting of projects has been labelled as Not-In-My-Back-Yard (NIMBY) syndrome, where those opposing are thought to act in self-interest alone. Critics of the NIMBY label call it a politicised term intended to discredit local opposition (Wolsink, 2006). Increasingly, researchers have criticised the concept of NIMBY as being over-simplistic by not giving due consideration to risk perceptions nor to the social and political complexities underlying the opposition (Wolsink, 2006; Devine-Wright 2009). Recent studies have suggested that NIMBY alone does not explain all local opposition to projects, but other socio-psychological factors influence public opposition to projects (see for example Huijts, Molin & Steg, 2012) as well as more legitimate concerns around the impacts of projects on livelihoods and lifestyles (Ashworth et al., 2015).

Organisational competence – If people think the organisation involved has appropriate experience and expertise around the issue it will help to build trust in a project (Terwel et al., 2009).

Organisational integrity – When people consider the organisation to be transparent, open and honest in its communication and hold genuine concern for public interest regardless of the organisational interest will build trust in a project (Terwel et al., 2009).

Place attachment – "a form of place-protective action, which arises when new developments disrupt pre-existing emotional attachments and threaten place-related identity processes" (Devine-Wright, 2009). In early projects place attachment was often misinterpreted as NIMBY-ism.

Procedural Fairness – Relates to perceptions of fairness in the decision-making process of a project. The more potentially impacted stakeholders are involved from the outset and given a voice in the process of decision-making, the more likely the process will be deemed fair (Hall, Ashworth & Devine-Wright, 2013).

Social Impact Assessment – "the process of analysing, monitoring and managing the intended and un-intended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by these interventions." (Vanclay, 2003). It is important to note that social impacts begin as soon as a project is announced, and these are not always captured in a social impact assessment of the project. Even if the consultation process results in no project eventuating, the social impacts arising from the consultation process can have long term effects (Colvin et al., 2019).

Social license to operate – "the ongoing acceptance or approval of an operation by those local community stakeholders who are affected by it and who can affect its profitability" (Moffat & Zhang, 2014). The main drivers of social license are perceptions of procedural fairness, distributive justice, quality of relationships, and levels of trust. The concept has been criticised as being too focussed on risks to the company (project) and not enough on building meaningful relationships with the host communities to understanding the risks of the project to them (Owen and Kemp 2013) but the term is commonly used as a metaphor for a level of community acceptance.

Social identity theory – This theory has been used to explain social conflict in wind and other energy projects, where different stakeholder groups enter into a struggle for influence over the decisions being

made. Social identity theory explains both the relationship between a person and the groups with which they identify, and the nature of relationships between identity groups (Colvin, Witt & Lacey, 2015).

Technology Assessment Framework – Outlines an intention to act in favour or against a project is influenced by a range of attitudinal, social and personal norms combined with whether the individual perceives they have the potential influence the direction of the project (perceived behavioural control) (Huijts, Molin & Steg, 2012). The authors explain that individual attitudes are influenced by the perceived costs, risks and benefits, positive and negative feelings in response to the technology, trust, procedural fairness and distributive fairness. (p.525). In their research, Kraft and Clary (1991) found that strong opposition to a (nuclear) project was a function of: (1) distrust of the project proponents; (2) limited information about siting issues; (3) attitudes toward the project that are focussed on local issues with less regard to broader implications; (4) an emotional orientation towards the conflict; and (5) high levels of concern about project risks.

A-3 Communication and regulatory considerations

There are a number of key resources and findings from research that has taken place in Europe and also work in the USA. Similarly, in the United Kingdom (UK), the H21 project in Leeds run by the Northern Gas Networks have produced several videos which provide useful resources. Similarly, the HyDeploy trial at Keele University campus in the UK (https://hydeploy.co.uk) has developed some interesting videos and communication materials. The research team will continue to liaise with contacts from these international projects and others once ethics approval has been granted.

The H2TRUST project was funded from June 2013 – February 2015 by the EU. Their Executive Summary provides some interesting considerations for communicating about hydrogen. Some of the key messages emphasised in the summary which are also relevant to the COAG communication activities include:

- "Hydrogen is already widely produced and used in industry today, for example, for ammonia synthesis and oil refinery; it has been NASA's shuttle fuel since the sixties.
- The most important properties to be taken into account from a safety perspective are:
    - Hydrogen is odourless, tasteless, non-toxic, and non-corrosive.
    - It is highly diffusive.
    - It presents high buoyancy (proportional to the diffusion coefficient and changes with temperature).
    - Small size.
    - Small molecular weight.
    - Low viscosity.
- When compared to other gases and liquids, including methane for home heating or petrol for passenger vehicles, hydrogen is not an especially dangerous substance. However, it presents certain characteristics which, due to its rarity in pure form and the need to pressurise it for efficient transport and storage, give rise to the need for unique safety awareness and new precautionary measures.
- The most significant safety differences between hydrogen and other fuels such as natural gas (NG) or gasoline are the ease of ignition and the leakiness, both of which will require more stringent safety measures than today's fuels.
- Another point to reinforce is the manufacturing and maintenance standards and regulations, defining requirements for gas tightness like leak test, welding procedures, frequency of checking and maximum time life of different elements. It is accepted that areas requiring attention are:
    - Harmonization of safety distances for H2 storage systems,
    - H2 refuelling in non-vehicle context,

- Installation and use of H2 and Fuel Cells (FC) systems for stationary power generation in buildings, installation and use of alternative storage systems
- Handling/storage/use of liquid hydrogen."

Downloaded from 15th September 2019: https://cordis.europa.eu/project/rcn/109535/reporting/en

A-4 Solar regulation

Across Australia there are large volumes of utility scale renewable energy projects either about to complete or in the pipeline (Clean Energy Regulator 2019). However, the regulatory requirements for these projects vary between states with either the state or local government being the consent authority for project proposals. Project proposals must comply with several state and federal regulations, as well as numerous standards.

Importantly, although community engagement is encouraged early in the stages of development, it is not a legislative requirement nor are there set standards in place. Some States have developed guidelines for community engagement around wind and solar projects, often with external guides and toolkits for consideration. Queensland has developed such guidelines but there are differences in the level of community engagement considered reasonable between the Department of State Development's guideline and the Department of Natural Resources, Mines and Energy's guideline, the latter being developed in consultation with key stakeholders.

There are also differences in who are the consenting authorities between and within the states. Both Victoria and New South Wales direct proposals through their respective Ministers and/or Departments of Planning. Whereas in Queensland, utility-scale solar proposals are often approved through local governments. In New South Wales, if a project is deemed of state significance, then it is reviewed by an Independent Planning Commission. While, in Queensland, wind projects can be classified as either code assessable or impact assessable depending on the projects distance (1.5km) from non-host lots. That said, projects can agree to a deed with owners of non-host lots within 1.5km, thereby avoiding a more public and lengthy Impact Assessment which must prescribe to the State's Development Assessment Rules.

Lastly, there is variability in the level of planning documents required between states and technologies. New South Wales requires only an overall Environmental Impact Statement (which is assumed to incorporate some of the explicit plans required by other states), whereas Queensland and Victoria require separate plans for different parts of the project. In the case of solar in Queensland, these planning requirements are only considerations for local government approval. Although there are several similarities between the guidelines, there also appears to exist asymmetries in planning requirements between guidelines for solar and wind, particularly in the case of community engagement.

Appendix B

B-1 Guidelines and toolkits matrix – quick reference guide

Key:

Guidelines

Guidelines & tools

Source	Context: Social data collection/community profile	Identifying stakeholders	Independent steering group	Community consultative committee/Citizen task force/advisory board	Community liaison - establishing/ electing officer	Communication & engagement plan/activities/roles	Indigenous engagement	Media strategy & engagement/activities	SIA & social risk analysis	Evaluation/ Monitoring/Assessment of community engagement	Project timeline	IAP2	Complaint management process	Benefit sharing
Ashworth et al. 2011. Communication/Engagement Toolkit for CCS Projects. CSIRO.	■	■	■	■	■	■		■	■		■			
Brook et al. 2015. Establishing the social licence to operate large scale solar facilities in Australia. IPSOS, ARENA.	■	■				■	■							
CanWEA. 2017. Wind energy development: Best practices for Indigenous and public engagement.	■	■				■	■	■						

Source	Context: Social data collection/community profile	Identifying stakeholders	Independent steering group	Community consultative committee/Citizen task force/advisory board	Community liaison - establishing/ electing officer	Communication & engagement plan/activities/roles	Indigenous engagement	Media strategy & engagement/activities	SIA & social risk analysis	Evaluation/ Monitoring/Assessment of community engagement	Project timeline	IAP2	Complaint management process	Benefit sharing
Clean Energy Council. 2018. Community engagement guidelines for the Australian wind industry.	■	■		■		■				■		▫	■	
DOE Office of Indian Energy. 2015. The five-step process framework for project development.						■								
DILGP. 2017. Community engagement toolkit for planning.		■				■	■	■		■		▫		
Forbes et al. 2010. CCS and community engagement: Guidelines for community. WRI.	■	■		▫	▫	■		▫	■		▫			▫
Hicks et al. 2018. Enhancing positive social outcomes from wind farm development. CEC.	▫					▫			■	■	▫	▫		▫
IAP2 International Federation. 2014. IAP2's Public participation spectrum.												▫		
Lane et al.2017. Community engagement and benefit sharing in renewable energy development (VRET guide). DELWP.	■	■				■	▫	▫	■	■		▫	▫	■

Source	Context: Social data collection/community profile	Identifying stakeholders	Independent steering group	Community consultative committee/Citizen task force/advisory board	Community liaison - establishing/ electing officer	Communication & engagement plan/activities/roles	Indigenous engagement	Media strategy & engagement/activities	SIA & social risk analysis	Evaluation/ Monitoring/Assessment of community engagement	Project timeline	IAP2	Complaint management process	Benefit sharing
Moore, N. 2019. Co-design and deliberative engagement: What works? Democracy 2025.														
National Wind Farm Commissioner. 2018. Annual Report.														
NSW Government. 2016. Community Consultative Committee Guidelines.														
O'Neill et al. 2019. Ensuring Indigenous benefit from large-scale renewable energy projects. ANU.														
South Australia EPA. 2018. Site contamination: Guideline for communication and engagement.														
Thorburn et al. 2019. Renewable energy projects on the Indigenous estate. ANU.														
Vanclay, F. 2003. International Principles for Social Impact Assessment. IAIA.														

Source	Context: Social data collection/community profile	Identifying stakeholders	Independent steering group	Community consultative committee/Citizen task force/advisory board	Community liaison - establishing/ electing officer	Communication & engagement plan/activities/roles	Indigenous engagement	Media strategy & engagement/activities	SIA & social risk analysis	Evaluation/ Monitoring/Assessment of community engagement	Project timeline	IAP2	Complaint management process	Benefit sharing
Vanclay et al. 2015. Social Impact Assessment: Guidance for assessing and managing the social impacts of projects. IAIA.														

B-2 Toolkit matrix – full references

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
Ashworth, P., Bradbury, J., Feenstra, C.F.J. (Ynke), Greenberg, S., Hund, G., Mikunda, T., Wade, S. & Shaw, H. 2011. Communication/Engagement Toolkit for CCS Projects. CSIRO.	It is intended to be a practical and informative tool to assist in the design and management of communication and engagement activities for individual CCS projects. The Toolkit provides best practice methods for addressing the various social components that surround CCS deployment.	*Australia*	CCS	Social data collection	• Worksheet 1: Demographics/Project impact/local attitudes to projects • Baseline survey: Who, What, Why, When, How • Interview guide example: questions and focus (Community issues; values; knowledge of & attitudes to energy technologies and related topics, i.e. climate change; CCS; trade-offs; trust in information sources; knowledge of project; demographics)
				Independent Steering Group (ISG)	• Establish meeting times/terms of reference/Community Liaison Working Group (CLWG)

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
					• Suggested representatives, i.e. Independent chair, project representative, technical experts, government representative, communications expert, environmental NGO representative, community liaison officer
				Citizen Task Force/ Advisory Board: Overview	• Suggestions for strategic recruitment and membership • Sample discussion topics
				Electing a Community Liaison Officer (CLO)	• Recruitment strategies and considerations • Example job description • Example job advertisement
				Identify the Stakeholders	• Stakeholder map example & worksheet (matrix - stakeholder interest/potential to influence CCS project) • Stakeholder list example & worksheet
				Media release	• Media release example and guidelines
				SWOT Analysis	• SWOT Analysis worksheet
				Communication and Engagement Plan	• Suggested activities and modes of information dissemination • Example plan (table; multiple years)
				Project timeline for CCS	• Outlines the different stages and processes that occur
				Education	• Examples include school curricula; online resources; books and training (not all links active)
				Information resources	• Blogs/websites/videos (as above)

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
Brook, J. & Clark, S. 2015. Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry. IPSOS, ARENA.	Preconditions and best practises for establishing social license to operate.	*Australia*	Large scale solar	Sections 1 & 3 give an overview of the background and research findings of a survey and interviews with the general public.	
				Section 2: Social licence to operate and community engagement in renewable energy.	• Figure 1: SLO: Adaptation of Thomson and Boutilier's pyramid model • Figure 2: Community engagement - The IAP2 Spectrum of Public Participation
				Section 4: Establishing the social licence to operate large scale solar projects in Australia. Identifies 5 key themes/building blocks: 1. Reliability and efficiency 2. Visual impacts 3. Environmental impacts 4. Economic and employment impacts 5. Health	• Each theme features a matrix summary of SLO stages and approaches to driving support related to the theme. The characteristics of the stage and approaches to drive support are outlined for each SLO stage.
				Section 5: Applying the building blocks to community engagement planning	Bulleted lists of suggested actions and options: • Preparation and stakeholder mapping • Community engagement during planning, construction & operation • Community engagement tools, e.g. fact sheets, newsletters, displays, site visits/open days, websites,

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					public meetings, quantitative and qualitative data collection.
CanWEA. 2017. Wind energy development: Best practices for Indigenous and public engagement.	Best practises guide for responsible and sustainable development of Wind Energy. Namely outlines specific practises for Indigenous and public engagement. Promotes early and on-going consultation.	*Canada*	Wind	Section 2. Understanding the community Similar topics covered as Ashworth et al. 2011.	• List of important contacts during early stages of development • List of people who can support engagement activities • Considerations for working with formal and informal leadership; arranging meetings with politicians; working with municipal leadership Strategy design • Elements of a well-rounded strategy • Engagement activities to consider • Ongoing engagement
				Section 3. Establishing and earning community support	• Terminology; cultural sensitivity • Context: Historical, legal (incl. consultation levels), regulatory, and Path to Reconciliation • Indigenous relations & developing Indigenous Engagement Principles • Positive corporate culture and develop an Indigenous relations policy • Project engagement - identify and learn about Indigenous Communities; develop an engagement plan
				Section 4. Indigenous Peoples	• Guided by three key elements: opportunity, information, and response • Includes detailed suggestions for website design
				Section 5. Engagement and consultation activities	• Media relations plan and strategy. Includes dos and don'ts for working with reporters

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
				Section 6. Communicating with the media	
				Section 7. Presentation skills Section 8. Addressing opposition effectively and respectfully	• List of regulatory requirements and key contacts, by province. This includes guidance documents that describe Indigenous and public consultation requirements.
				Section 9. Provincial regulations	• Checklist: News conference • Checklist: Facility openings/events • Checklist: Digital and social media • Template: Media advisory • Example: General notification • Sample: Open house comment sheet • Sample: Formal presentation comment sheet • Template: Media screening report • Resources: IAP2 Public Participation Spectrum/Five Steps for Public Participation Planning • Canadian Electricity Association (CEA) National Principles for Engagement of Aboriginal Peoples
				Section 10. Checklists, templates and resources	• List of important contacts during early stages of development • List of people who can support engagement activities • Considerations for working with formal and informal leadership; arranging meetings with politicians; working with municipal leadership Strategy design • Elements of a well-rounded strategy

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
					• Engagement activities to consider • Ongoing engagement
Clean Energy Council. 2018. Community engagement guidelines for the Australian wind industry.	Best practice approach to community engagement that addresses six key stages of the wind farm lifecycle and offers practical advice for action.	*Australia*	Wind	Section 1. What is community engagement? - Benefits of engagement - Mapping community engagement against the six stages of the wind farm lifecycle: • site selection • project feasibility • planning and approvals • construction • commissioning and operations • decommissioning	• Approach to community engagement - foundational principles matrix • Priorities and implications for community engagement at each project stage matrix • IAP2 Public Participation Spectrum matrix • Engagement practices matrix
				Community Engagement Toolkit Each tool includes a What? And How? section	• Matrix of tool x project stage • Social baseline study • Stakeholder identification and mapping • One-on-one briefings • Newsletters • Project websites • Telephone information lines • Open houses, incl. satisfaction survey • Site visits • Community workshops • Drop-in centre • Project advertisements • Community reference groups • Community partnerships, incl. example matrix to identify issues

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
					• Complaints management mechanism, incl. example flow chart of process & template for documenting engagement
DOE Office of Indian Energy. 2015. The five-step process framework for project development.	A five-step project development and financing process that focuses on key decision points and outlines a chronological path to smart renewable energy development. The framework is based on experience, and shows that project development is iterative.	*United States*	Solar PV and small scale wind	1. Potential: Data collection and opportunity assessment	NOTE: Each step lists the purpose and tasks, and resources. • Solar PV and wind energy resource mapping; local site considerations (diagrams); terrain images; placement & installation priorities • Advice on tools for basic PV modelling
				2. Project options: Strategy and details	• List of potential team members; role of the project champion; Tribal roles • Project ownership options and structures, including matrix for evaluating options, and a list of related resources • Interconnection and net metering, includes net metering design components • Permitting and regulatory key considerations (table), site due diligence (table including links to resources), information on timelines and recommendations under NEPA
				3. Project refinement: Planning and development	• Funding opportunities, project costs, financing options dependent on project ownership (i.e. direct ownership/3rd party Power Purchase agreement (PPA)/community solar) and sources of capital • Energy Savings Performance Contract (ESPC);

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
					Renewable Energy Certificates (REC); • Procurement process for facility- and community-scale projects, incl. request for proposals (RFP) process outline
				4. Project implementation: Financing and construction	• Implementation activities; commissioning process example
				5. Project operations and maintenance (O&M) Resources section: link to on-demand curriculum (dead link)	• Post-procurement: Project O&M; drivers for improved O&M • Solar PV O&M cost considerations; activities; example solar PV O&M maintenance plan • Wind energy O&M costs; major components at risk; small wind O&M activities; • Revisit energy plan
Department of Infrastructure, Local Government and Planning. 2017. Community engagement toolkit for planning. Queensland Government.	A non-statutory set of practical tools and information intended to support local governments meet their requirements to engage with the community, as outlined in the Minister's Guidelines and Rules (MGR) for plan-making.	*Queensland, Australia*	N/A	Part 1. Guiding principles - What is community engagement - What do we mean by 'community?' - Why is community engagement important?	• Six core principles • IAP2 Public Participation Spectrum matrix • IAP2 Australasia Contemporary Engagement Model - diagram
				Part 2. Developing a community engagement plan	• Checklist for developing an engagement plan • Matrix - aligning community engagement to stakeholder impact levels • Decision-making flowchart to help align community engagement to stakeholder impact levels • Listing negotiable and non-negotiable items table example • Stakeholder identification/analysis checklist

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
					• Stakeholder ability to influence outcomes matrix • Checklist for identifying stakeholder needs • Stakeholder prioritisation table • Example community engagement action plan - Local plan for a rural town
				Part 3. Selecting community engagement tools	• Checklist of tools and techniques by community engagement critical success factor • Engagement options matrix and checklist, listing level of participation, benefits and considerations by type of option (incl. media, social media and online engagement)
				Part 4. Engaging with specific groups	• Overview checklist for engaging with specific groups • Checklists and lists of resources for engaging with: Aboriginal and Torres Strait Islander communities; older people; young people; people with a disability; people with CALD backgrounds; disadvantaged and homeless people
				Part 5. Content development	• Ten tips for creating suitable content for engagement • Checklist to guide development of engagement material
				Part 6. Implementing your community engagement strategy	• Checklist for determining data analysis requirements • Example Excel community engagement database
				Part 7. Feedback and reporting	• Checklist for following up after engagement and preparing a report
				Part 8. Evaluation	• Checklist to guide evaluation of a community engagement process

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
				Part 9. Success stories	• Case study template • 3 case studies with exemplars
				Part 10. References	• Comprehensive list of community engagement resources with links.
Forbes, S., Almendra, F. & Ziegler, M. 2010. CCS and community engagement: Guidelines for community engagement in carbon dioxide capture, transport, and storage projects. WRI, Washington DC, USA.	Proposes how to effectively engage local communities during CCS project planning, development, operation, and long-term stewardship.	*International*	CCS	Guidelines grouped by audience: • Regulators • Local decision makers • Project developers	Avoids providing a step-by-step methodology for community engagement because each CCS project and community is unique and requires an engagement process tailored to suit site-specific needs. • Matrix: Key principles in CCS community engagement and roles for each party in the process (regulators/local decision makers/ project developers
				Introduction	• Role mapping exercise for potential stakeholders • Principles for effective CCS community engagement
				CCS-specific issues for community engagement	• Matrix: Innovation chain and CCS components • CCS regulatory environment/site selection/technical considerations
				Leveraging experience from other industries and CCS projects	• Ten ways community engagement can fail • FPIC • Synthesis of case studies from CCS research and demonstrations: Figure 4 includes project type, engagement tools used and project outcome, each case study then described in detail • Common themes and lessons
				<u>Guidelines for CCS community engagement:</u> 1. Understand local community context	• Figure 6. Factors to consider (as with Ashworth et al. 2011; CanWEA 2017)

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
				2. Exchange information about the project	
				3. Identify appropriate level of engagement	• Figure 7. Spectrum of community engagement approaches: - process (inform, consult, negotiate)/action (one way, two way)/outcome • ESTEEM Community Outreach model for project developers - diagram (Feenstra & Mourik)
				4. Discuss risks and benefits of project	• Figure 8. Breakout of potential CCS project impacts by category (socioeconomic/health & safety/storage security/environment/ stewardship) • How to design effective risk communication (mental models approach)
				5. Continue engagement through time	
				Supplementary information	• Appendix 1: Existing legal frameworks for public participation in select countries and regions (some of which will have been superseded) • Literature databases (now out of date)
Hicks, J., Lane, T., Wood, E. & Hall, N. 2018. Enhancing positive social outcomes from wind farm development: Evaluating community engagement and benefit-sharing in Australia. Clean Energy Council.	Snapshot of current community engagement and benefit-sharing practises in Australian wind farms. Provides evidence-based and recommendations for improving social outcomes from wind development for communities, regulators and developers.	*Victoria, Australia*	Wind	General recommendations and specific recommendations for: • Wind developers • Regulators • Industry associations and NGOs	Table 2: Factors contributing to positive social outcomes from wind development (from the literature review)
				Status of community engagement practices	• Community engagement plans (32 plans analysed) • Analysis of key practices applied during engagement - types and perceived usefulness/effectiveness.

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
					• Status of benefit-sharing practices, e.g. payments to communities; payments to landowners; community co-investment or co-ownership; non-cash benefits
				Contribution of guides to community engagement practices	• Survey results show CEC's community engagement guidelines, IAP2 Spectrum and ACT's Best Practice for community engagement were documents frequently referred to.
				Best practice community engagement	• Findings and suggestions
IAP2 International Federation. 2014. IAP2's Public participation spectrum.	Framework developed by IAP2 that defines the public's role in any public participation process. Quickly becoming an international standard.	*Australia*	N/A	1 page document featuring the IAP2 matrix	• Five stages of participation (Inform, Consult, Involve, Collaborate, Empower • Promise to the public and public participation goal for each stage
Lane, T. & Hicks, J. 2017. Community engagement and benefit sharing in renewable energy development: A guide for applicants to the Victorian Renewable Energy Target Auction. Department of Environment, Land, Water and Planning, Victorian Government, Melbourne.	VRET expectations for best practice community engagement and benefit sharing across all renewable technologies, and how these will be assessed under the VRET auction. Includes case studies as well as practical information.	*Victoria, Australia*	Renewables	Part A: Better practice community engagement Sections: 1. Tailored to the local context 2. Social feasibility 3. Fairness in the process - includes case studies in solar 4. Fairness in the outcomes - includes case study in bioenergy 5. Trust and relationships - Fig. 1: The process of building a social licence to operate 6. Face-to-face engagement and local staff 7. Complaint management process -	• Key factors that consistently contribute to positive social outcomes and strong community support • Guiding principles for the development of good practice • Table 1: A spectrum of approaches to community engagement (modification of authors 2014 adaptation of IAP2 Spectrum) - Matrix consisting of IAP2 five stages; at each stage: community engagement objective; promise to the community; community engagement outcomes • Considerations for appropriate engagement with Victorian Aboriginal groups • Case studies in solar and bioenergy

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				includes current community concerns about wind energy and opportunities to alleviate them. 8. Legacy projects in the planning system; improving engagement through the development cycle	• Fig. 1: The process of building a social licence to operate
				Part B: Benefit sharing Sections: 1. Local jobs and procurement 2. Neighbourhood benefit programs 3. Compliance related activities 4. Community benefit funds and sponsorship 5. Employee volunteerism 6. Innovative products 7. Innovative financing	• Tips for benefit sharing - notes overlap with Corporate Social Responsibility (CSR) initiatives • Types and benefit sharing approaches, and understanding approaches • Case studies - wind and bioenergy
				Part C: Tools for enhancing social outcomes	• Building a Context Narrative • Social site map
				1. Social risk analysis	• Context Narrative • Social impact site map • Table 2: Social Risk Matrix • Building a Context Narrative • Tips for social risk analysis for all technologies (generic, incl. wind; solar; bioenergy; geothermal; offshore: wave, tidal power and wind) • Building a Context Narrative • Stakeholder Mapping Spreadsheet

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
				2. Community engagement strategy	• Questions to consider • Wind specific considerations • Figure 2: Community engagement and/or benefit sharing techniques that are consistently beneficial • Community Engagement and Benefit Sharing Plan documentation for VRET applicants • Tips for developing a community engagement strategy and relevant considerations across technologies: generic and specific (battery storage; geothermal; bioenergy; hydropower pumped storage; solar thermal; wave and wind power, incl. offshore wind) • Table 3: Possible engagement activities by project phase: comprehensive matrix of activities, community engagement tools and their application, using wind farm development phases as an exemplar
				3. Benefit sharing program	• List of key questions to consider when designing the program • Recommended Benefit Sharing Program documentation for VRET applicants • How to calculate the value of the Benefit Sharing Program
				4. Reporting, monitoring and evaluation	• Monitoring and evaluation metrics, e.g. SMART goals • Evaluation process methods, and suggested questions or topics to cover through chosen method • Evaluation committee - selection and activities • Written feedback and surveys
MacCourt, D. 2010. Renewable Energy Development in Indian	Handbook for tribal leaders/enterprises with regards to	*United States*	Renewables	The information in this handbook provides a general overview of the renewable	

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
Country: A Handbook for Tribes. National Renewable Energy Laboratory report NREL/SR-7A4-48078.	the financing and contractual developments of renewables in Indian Country.			energy project development process, focusing on the financial and legal aspects. This includes different types of tribal enterprises and joint ventures/joint development of projects; partnering with non-Tribal business entities.	
Moore, N. 2019. Co-design and deliberative engagement: What works? Report No. 3, Democracy 2025, Canberra.	Conceptual model draws on 33 case studies and 36 theoretical studies to identify six key variables that interact to influence outcomes in co-design and deliberative engagement.	*Australia*	N/A	The aim of this conceptual model is to provide a tool for public sector organisations to evaluate the quality of engagement with citizens to improve both theory and practice.	• Box 3: Variable and outcomes measurement scale (table) • Figure 2: Conceptual model for assessing the quality of engagements with citizens - a representation of the variables and their recommended assessment methods
				Representation related variables	• Inclusive representation of affected people and professionals • Plurality of viewpoints and engagement methods • Autonomy and equality of participants
				Non-representation related variables	• Citizen engagement as an accepted democratic value • Quality process design and facilitation • Transmission of citizen generated recommendations to formal decision-making bodies
				Outcome variables	• Citizens agreeing on the solution or recommendations arising through the citizen engagement process • Citizens trusting the legitimacy of the citizen engagement process to influence decision-making • Consequentiality defined as decision-making bodies accepting citizen generated recommendations

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National Wind Farm Commissioner. 2018. Annual Report to the Parliament of Australia. Australian Government, Melbourne.	Includes a number of observations about the governance, development and operation of wind farm projects along with preliminary recommendations for consideration (pp. 23-55).	*Australia*	Wind farms	1. Host landowner negotiations 2. Neighbour consultations and agreements 3. Community engagement 4. Planning permits - time limits and scope changes 5. Governance and compliance of standards and permit conditions 6. Use and selection of experts 7. Wind farm complaint handling and emergency procedures 8. Site selection 9. Health matters	Each section contains observations and recommendations.
NSW Government. 2016. Community Consultative Committee Guidelines.	Guidelines clarifying the roles and responsibilities community consultative committees in state significant projects.	*Australia*	N/A	1. Purpose of the committee 2. Establishment of the committee 3. Members of the committee, including selection process for the independent chairperson, and community, council and alternative representatives 4. Committee meetings, including frequency, timing and location of meetings 5. Responsibilities of the proponent 6. Communication with the broader community	• Sample advertisement for community members • Nomination form - Local community members • Nomination form - Representatives of stakeholder groups • Code of Conduct Agreement - Independent Chairperson • Code of Conduct Agreement - Members • Declaration of pecuniary and non-pecuniary interests
O'Neill, L., Thorburn, K. & Hunt, J. 2019. Ensuring Indigenous benefit from large-scale renewable energy projects: Drawing on	Reflection on industry experiences in negotiating access and benefit sharing agreements with traditional	*Australia*	Renewables	2. Changing relationship: legal and policy drivers • Legal drivers: recognising Indigenous peoples' rights to land	• List of best practice guidelines from the literature on both the extractive and renewable energies • Table: Summary of findings from O'Faircheallaigh

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
experience from extractive industry agreement making and the importance of policy settings. Working Paper 1. CAEPR, ANU, Canberra.	owners to identify best practice to date.			• Corporate social responsibility (CSR) • Social Licence to Operate (SLO) 3. Legal instruments and their limits • Agreement making and the Australian Native Title Act • Native title agreement making and resource extraction • Native title land and renewable energy 4. The role of the State in Agreement Making 5. Agreement making in practice • How do Traditional Owners maximise agreement outcomes? • The personal aspects of agreement making • Best practice: from negotiation to implementation • Agreement making and renewable energy industry	(2015) - strong and weak provisions in agreement making
South Australia Environmental Protection Authority. 2018. Site contamination: Guideline for communication and engagement.	Establishes roles and responsibilities for the EPA, consultants, landowners and appropriate persons.	*South Australia, Australia*	Contaminated sites	3. Responsibility to engage with the community	• Table 2: Roles and responsibilities
				4. The role of the lead communicator	• List of activities and responsibilities of the lead communicator

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				7. When to engage	• Table 3: Project phases that may trigger communication and engagement, and associated objectives • Table 4: Engagement activities suitable for each phase
				8. Starting the communication and engagement process	• Summary of 9 stages involved in the on-the-ground delivery of stakeholder engagement
				9. Developing a site-specific community engagement plan	• Key elements of a community engagement plan (example included in Appendix 1): - Preparing introductory communications - Assessment program communications and engagement - Case management for key stakeholders - Communicating results - Next steps: • Table 5: Communicating results, conclusions and next steps - possible next steps and associated communication and response
				11. Principles of engaging effectively with the community	• Table 6: Incorporating the IAP2 Public Participation Spectrum - adaptation: inform, consult and involve stages, and the associated IAP2 goal, relevant community stakeholders, IAP2 commitment, and communication/engagement techniques • SA government's Better Together program guiding principles (includes external link)

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
Thorburn, K., O'Neill, L. & Hunt, J. 2019. Renewable energy projects on the Indigenous estate: Identifying risks and opportunities of utility-scale and dispersed models. ZCWP02-19. Energy Change Institute, ANU, Canberra.	Considers the opportunities and risks of renewable energy developments for Aboriginal communities in Australia's Pilbara and Kimberley regions, both at the utility-scale and via smaller, dispersed models.	*Western Australia*	Solar and wind	1. Background and context, incl. current status of renewable energy in Indigenous communities 2. Indigenous benefit and policy settings: A brief review of the renewable energy transition in Canada	
				3. Utility scale renewable energy projects: Risks, benefits and opportunities	• Figure 1: Indigenous Estates and determinations where native title exists September 2018 (map) • List of commercial opportunities associated with large scale developments • List of constraints to Indigenous participation • Other considerations, i.e. longer timeframes, dispersal of resource
				4. Dispersed model renewable energy developments: Risks, benefits and opportunities	
Vanclay, F. 2003. International Principles for Social Impact Assessment. International Association for Impact Assessment, Washington DC.	Overview of values and principles for Social Impact Assessments.	*International*	N/A	2 page document defining Social Impact Assessment (SIA) and its primary purpose	• Six core values of the SIA community of practice • Eight fundamental principles for development • Twelve principles specific to SIA practice • Recommendations for developing context and audience specific guidelines, and groups who may be potentially interested in guidelines for SIA
Vanclay, F., Esteves, A.M., Aucamp, I. & Franks, D.M. 2015.	Seeks to provide advice on good practice in the undertaking and	*International*	N/A	Phase 1: Understand the issues Phase 2: Predict, analyse and assess the	• Box 1: What are social impacts? • Box 2: The 26 tasks that comprise social impact

Source	Aims and objectives	Location	Technology	Topics/guidelines	Tools
Social Impact Assessment: Guidance for assessing and managing the social impacts of projects. International Association for Impact Assessment.	appraisal of SIAs and the adaptive management of projects to address the social issues			likely impact pathways Phase 3: Develop and implement strategies Phase 4: Design and implement monitoring programs	assessment across the four phases • Example contents listing of a SIA report and/or a Social Impact Management Plan (SIMP) • Review criteria for checking SIA reports and SIMPs.

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