Australian Government

COAG Energy Council

NATIONAL HYDROGEN STRATEGY

Issues paper series

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This issues paper explores the current community perceptions of hydrogen technologies, environmental impacts, and particularly around growth in carbon emissions, water consumption and land use. It also outlines lessons from other sectors and explores models for community engagement, including with Indigenous Australians.

Community support is essential for all aspects of the supply chain including production, movement around Australia, export, and use in applications such as in fuel cell vehicles, or for heating homes.

A list of questions is presented at the end seeking further input from interested stakeholders.

Understanding community concerns for safety and the environment

This paper has been informed by submissions to the *Request for Information* released in March this year, as well as:

- targeted visits to countries that have already started to develop hydrogen technologies and markets
- the stakeholder roundtables that were held throughout May and June

The COAG Energy Council Hydrogen Working Group would like to thank industry and community members for their engagement in the strategy development process.

In this paper, unless otherwise indicated, 'hydrogen' refers to 'clean hydrogen,' defined as being produced using renewable energy or using fossil fuels with carbon capture and storage (CCS). This definition reflects the principle of technology neutrality set by COAG Energy and Resources Ministers when they commissioned a comprehensive and ambitious strategy for the development of an Australian hydrogen industry.

Current perceptions of hydrogen technologies

Hydrogen production presents many opportunities for Australian communities, especially in regional areas where sites are likely to be based. Obtaining and maintaining community trust and acceptance of large scale production projects will be crucial for the industry's long-term success. The submissions and early research of Australian community attitudes to hydrogen technologies suggest community acceptance is strongly linked to perceptions of safety. Community acceptance for hydrogen also depends on costs and environmental impacts, including emissions generated, land use and water consumption.

While there is growing interest globally for hydrogen technologies, knowledge of hydrogen in Australia is generally low. A study conducted by the University of Queensland found that, while Australians tend to be supportive of the opportunities emerging from a hydrogen industry, support was strongly dependent on knowledge: those who knew more about the properties and uses of hydrogen were more likely to be supportive.[1] At the same time, people were hopeful that hydrogen would bring additional benefits to regional Australia through new projects and jobs.

The risks and opportunities for acceptance of hydrogen will change as awareness grows, and as people start seeing the technology emerge in their lives.[2] A recent international study identified public acceptance for a hydrogen fuel station in Netherlands improved after the implementation of the project, especially among those living nearby.[3] It is important to build on areas of positive community perception as they are likely to be a key determinant of support for the industry at a local level.

While internationally hydrogen technology developments have generally been well received and positive, these responses are not universally shared or consistent over time. For example, an individual or community group may be supportive of efforts to reduce emissions through adoption of hydrogen technologies, but opposed to the construction of a hydrogen export terminal or hydrogen production using fossil fuel pathways with CCS.

Understanding these nuances will be vital to address the communities' expectations from hydrogen, while also highlighting the need for appropriate education to address misconceptions.

Environmental concerns, water consumption and land use

While many potential benefits arise from developing a new hydrogen industry, it is important to ensure this happens in a safe and responsible manner and does not adversely impact local communities, as well as Australia's natural resources and environment. In early consultations the Working Group heard that Australians acceptance for large-scale hydrogen production depends on impact on carbon emissions, carbon capture and sequestration, safety, water consumption and land use.

Carbon emissions

Global demand for hydrogen is being driven by countries looking to decarbonise, improve air quality and meet their international agreements on climate change. The Australian Government is committed to taking action on climate change and has a 2030 target to reduce economy-wide emissions by 26 to 28 per cent below 2005 levels. Developing a clean hydrogen export industry could help to strengthen Australia's reputation as a constructive international player and source of solutions for climate change.

Despite expectations that a hydrogen export industry will contribute to long-term global decarbonisation, a hydrogen export industry in Australia may impact on our national carbon emissions in the short term, and it is important to understand these potential impacts. The Working Group has commissioned Deloitte Access Economics to undertake modelling and analysis work to consider the effects from the development of an Australian hydrogen on expected carbon emissions reductions, possible environmental affects and impact on water use and availability out to 2050.

In its submission, the ANU Energy Change Institute noted that '*generating hydrogen with electrolysis may lead to short term increases in greenhouse gas emissions, if the electricity used is not fully renewable.*' The study conducted by ANU Energy Change Institute noted this depends on whether the rate of growth of renewable electricity capacity matches the pace of growth in demand. Additional fossil-fuel based electricity will be required to meet the hydrogen demand between 2025 and 2040, if the rate of renewable capacity installation remains constant at 2018 levels.[4] A new hydrogen facility using electrolysis will not result in increased emissions if the operators choose to build new renewable electricity production capacity to power it.

Existing energy production, energy consumption, and carbon emissions frameworks would regulate hydrogen production facilities in Australia. The Safeguard Mechanism requires facilities emitting over 100,000 tonnes of carbon dioxide equivalent (CO_2-e) per year to maintain these emissions at a baseline level or offset any emissions above the baseline. Following amendments to the Safeguard Mechanism in March 2019, baselines for existing facilities are generally set using an audited forecast of emissions intensity; baselines for new facilities (post-2020) are set using a best practice benchmark emissions intensity.[5] For example, the Hydrogen Energy Supply Chain (HESC) project in the Latrobe Valley project, at commercial scale is likely to be required to keep its emissions below a to-be-determined Safeguard baseline.

Public perceptions of CCS and fossil fuel extraction for hydrogen production

Producing hydrogen from fossil fuels, currently the most cost competitive method, requires CCS if the hydrogen is to be considered clean. While CCS is an established technology, it has encountered financial, technical and political barriers to widespread adoption. Parts of the community acceptance depends on how storage of carbon dioxide is dealt with. Acceptance can differ depending on the identified storage site: sequestration offshore, such as proposed for the HESC project in Victoria, can have different impacts on communities to onshore sequestration sites.

CCS for hydrogen production has cost advantages over other forms of CCS, for example, from industrial processes production or energy generation. This is because the steam methane reforming process used to produce hydrogen generates relatively pure carbon dioxide as a by-product, avoiding some of need to build and maintain specific carbon capture equipment.

A study conducted by University of Queensland indicates that the public has mixed reactions about producing hydrogen from fossil fuels with CCS, when compared to producing hydrogen from renewables.[6] The survey indicated strongest support was for hydrogen produced by renewables (57%), 38% supported hydrogen produced from fossil fuels with CCS as an intermediate step while transitioning to hydrogen from renewables, and only 25% were prepared to tolerate production using CCS indefinitely.

Some submissions also identified possible impact on air quality, environment and health of neighbouring communities as an issue with large-scale production of hydrogen from fossil fuels and CCS technologies. For example, Voices of the Valley and Friends of the Earth Australia claimed that the communities in the Latrobe Valley and surrounding areas will be directly impacted by the proposed HESC project. Their views ranged from increased health risks (from exposure to particle emissions, toxic dust and smoke), to the large volumes of water required for coal mining and the costs associated with mine rehabilitation and managing waste pollution.

Some of the submissions also reflect Australian communities' changing attitudes about the impact of fossil fuel extraction in and around their community. For example, Beyond Zero Emissions, noted:

> *'People living in, or near, present and potential fossil-fuel extraction communities are no longer willing to tolerate the health and environment-impacting mining practices of the 20th century, nor the more complex methods of the 21st century such as hydraulic fracturing aka 'fracking'.*

CSIRO noted in its submissions that there is little information about what people's concerns are regarding the safety and the environment, and the origin of these concerns.

> *'To address such concerns a general social awareness and knowledge base relevant to hydrogen-based technologies could be encouraged to support appropriate development and deployment of new technologies that will enable the creation of these new industries and value chains*'.

The Working Group acknowledges the need to take a long-term, collaborative approach to working with local communities. It will be important for governments to understand and respond to community interests and for industry to demonstrate the production of safe and clean hydrogen. A guarantee of origin for hydrogen could be useful to address some of the community expectations regarding environmental impacts. This is discussed in the *Guarantees of origin* paper while engagement with communities is further discussed in the sections below.

Water consumption and land use

Production of hydrogen using renewable electricity and electrolysis requires both significant areas of land for renewable electricity generation and large amounts of water. Water usage for electrolysis is comparable to water usage for steam methane reforming.[7]

Community concerns about water and land use can range from environmental protection to uncertainty about livelihoods. This is especially the case where hydrogen production is seen to be competing for water and land resources with existing industries and employers, such as farming and agriculture. For example, proposals to use productive agricultural land for a large scale solar farm in the Southern Riverina of New South Wales are raising community concerns and opposition to the project.[8]

The Working Group also acknowledges climate change will impact rainfall patterns and water availability in future decades and it will be necessary to include consideration of climate impacts as part of assessing water consumption and siting of hydrogen production facilities.

A number of submissions recognised water use, especially in areas with competing demand for water as an issue. For example, Meridian Energy noted:

> *'One environmental impact that the Hydrogen Working Group should examine is the likely source of water required for the electrolysis process. Will it take water from alternate uses potentially driving demand and price up for what is already a scarce commodity'.*

H Energy Electrical recommended:

> '*the Hydrogen Working Group should consider the added burden on existing water consumption'.*

Aurecon commented that areas with large renewable energy resources either lack surface water or compete with agriculture for water use, and suggested desalination plants might be needed.

Some alternative solutions for water consumption for electrolysis include using desalination plants or recycled water. Current R&D efforts to develop electrolysers that can use salt water could make hydrogen production directly from sea water a reality. For example, recent research at the Leiden Institute of Chemistry has reportedly addressed the issue of chlorine gas formation at the anode and brought the prospects of using salt water for electrolysis much closer.[9]

Using existing desalination plants for hydrogen production might improve efficiency of utilisation of these assets. In any event, when implemented at large scale, using desalinated seawater adds just a few percent to the cost of producing hydrogen.[10]

Submissions from ITM Power and ATCO noted that it is important to consider the lifecycle environmental impact of hydrogen production, including disposal of materials as well as the impact on water supply and land use. This would be useful to inform the community of the relative advantages and disadvantages of the different hydrogen production pathways, such as electrolysis compared to steam methane reforming or coal gasification with CCS.

Safety expectations

Research undertaken by the University of Queensland shows that communities are mostly concerned with the volatility and flammable nature of hydrogen gas.[1] Addressing safety expectations will be vital for earning the trust of communities and individuals. While hydrogen is currently produced and used in large quantities globally, largely for industrial uses (such as petroleum refining), few people know about the current hydrogen industry, its regulations, standards and safety practices or what to expect from a future hydrogen industry. Safety aspects of the different uses of hydrogen (such as in the gas network, transport and industrial sectors) are discussed in more detail in the *Hydrogen in the gas network, Hydrogen for transport and Hydrogen for industrial users* papers.

Hydrogen Mobility Australia noted in its submission that while many of the environmental and safety aspects associated with the production, distribution and use of hydrogen can be effectively managed through existing regulations, codes and standards, it is of upmost importance that communities are aware of this fact.

Given their combustible nature, all conventional fuels have some degree of risk associated with their use. Perceived safety risks regarding accidents, collisions, fires and explosions are elevated due to low levels of public awareness. The different properties of hydrogen compared to petroleum, natural gas, electricity and batteries mean that those who design, operate and maintain the hydrogen systems will need to take these differences into account. This may require education and community outreach to inform people about the different properties of hydrogen and the relative risks compared to more familiar fuels.

Ongoing engagement between governments and industry, engineering, education, regulatory and emergency response authorities will also be required to ensure that appropriate standards and regulations are in place to ensure a hydrogen industry is a safe one.

Case study: USA first responders

In the USA, concerted effort has gone into training firefighters, police and ambulance officers to respond to incidents that involve hydrogen. This approach has had a two-fold effect: first responders know how to appropriately deal with hydrogen, and communities feel safer knowing that first responders have adequate training.

In California, the state that has more hydrogen fuel cell vehicles than any country in the world, local Fire Marshalls were seen as key stakeholders, and were engaged early in the roll-out of hydrogen fuel cell cars and refuelling stations. After coming to their own decision that hydrogen could be safely managed, Fire Marshalls have since helped the community feel comfortable with hydrogen technology and have been a key element in public acceptance.

This approach may also be effective in Australia, where state and territory emergency service organisations, particularly fire services and fire protection peak bodies, will need to become familiar with hydrogen technology.

Case study: South Australia HySafe

The South Australian Government has been a financial member of the International Association for Hydrogen Safety ("HySafe") since 2018 and has developed close links with hydrogen safety experts operating across the world. The 8th International Conference on Hydrogen Safety will be held in Adelaide, Australia in September 2019. The conference is the premier hydrogen risk management event globally and attracts relevant experts from all over the world by providing an open platform for presenting and discussing new findings, information and data on hydrogen safety – from basic research to applied development and from good practice to standardization and regulatory issues.

Lessons from other sectors

Community expectations about safety, land and water use are not unique to hydrogen: any proposed large industry, renewable electricity or resource project will need to address similar expectations in order to build the trust and support of the public.

Lessons from the forestry sector in Tasmania also show that gaining public support requires engaging a broad range of stakeholders, and being responsive to changes in societal expectations, such as shifts in expectations about natural resource management or environmental protection.[11]

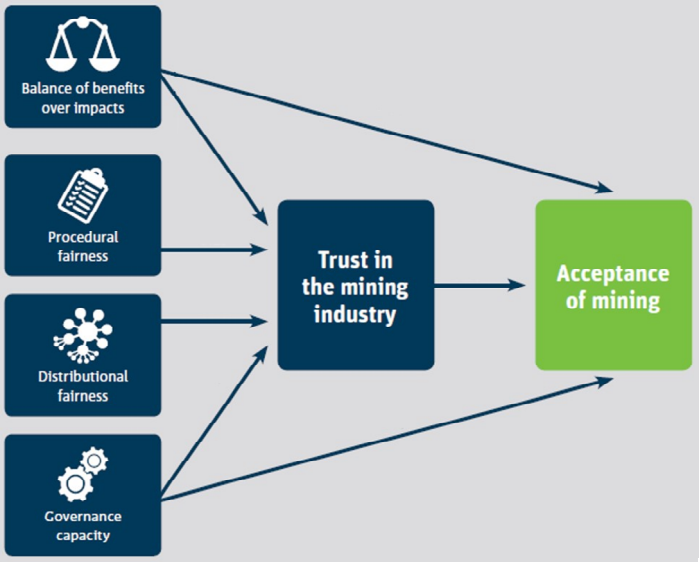
In the mining industry, citizen perceptions are key to acceptance of mining or what is known as the social licence to operate. Four key factors have been found to help to build trust, and ultimately acceptance. These elements are described in Figure 1 and include:

- Benefits over impacts: balance of benefits, such as local employment, infrastructure and economic, over impacts, such as impacts on the environment, other sectors and cost of living
- Procedural fairness: transparent decision making and responding to community expectations

- Distributional fairness: perception that benefits are shared equitably
- Governance capacity: appropriate governance structures, including regulation and legislative frameworks.

All factors contribute to trust in the industry, which can lead to acceptance of mining. However, having perceptions of overall benefits and the level of confidence in governance ('governance capacity') both have an additional direct effect on acceptance. The perceived overall benefits of mining are the strongest predictor of acceptance of the industry, and to a lesser extent, trust in the industry.[12]

Figure 1: Building community acceptance of mining[12]



Lessons from the LNG sector demonstrate the importance of distributional fairness for public acceptance. Perceptions of imbalance between export interests and domestic customers were reflected, for example, in a submission from Mr Rory Quinn, who asserted that '*we must not repeat the chaotic gas market'* and that *'domestic business and retail customers must benefit from the hydrogen boom'.*

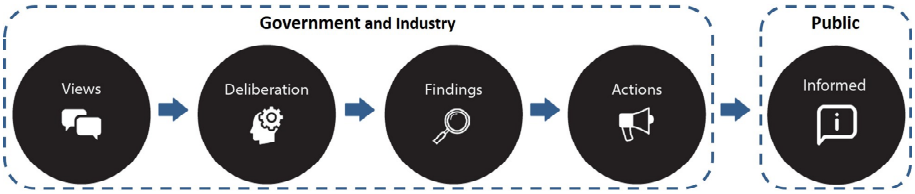
Another example of a proactive approach is the Gas Industry Social and Environmental Research Alliance (GISERA). Through GISERA, industry, CSIRO, Australian and State Governments collaborated to address concerns held by some communities regarding onshore gas development. Its activities focus on social and environmental topics including: groundwater and surface water, biodiversity, land management, the marine environment, human health and socio-economic impacts.

Models for community engagement

There are a number of engagement models for assessing the expertise and experiences of communities and being responsive to their expectations.[13] Community engagement must be fit for purpose: for instance, some models are better suited to raising public awareness, whereas others can be used to find compromises between groups with competing values or interests. Four such models – share, consult, deliberate, and collaborate – could be useful for industry and governments to choose the best way to engage with communities. Below, the paper explores how each model might be employed to engage with communities on hydrogen.

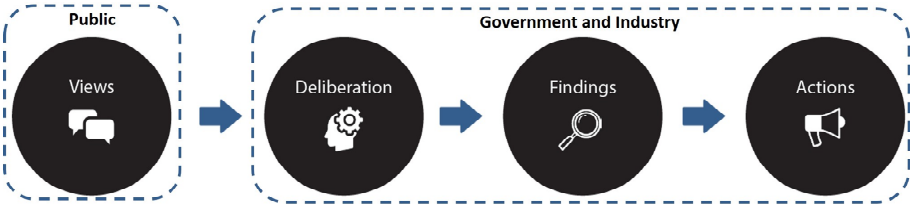
Share

Information sharing is generally a one-way communication of factual information. As the Australian public's awareness of hydrogen is generally low, information sharing could be an effective way of industry and government informing people about a hydrogen industry's potential opportunities, risks and impacts on Australian communities.



Consult

Consultation is an opportunity for communities to present their views to decision-makers in industry and government through fora such as town hall meetings, written submissions, online surveys or roundtables. Decision-makers commit to keeping stakeholders informed, listening to and acknowledging concerns and aspirations, and providing feedback on how public input influenced the decision ultimately taken. A consultation approach could also be a useful model for government and industry to seek the views of community and the expertise of specific stakeholders on implementing aspects of the strategy.



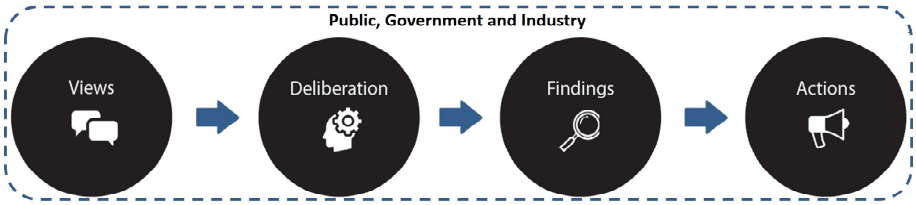
Deliberate

Where there are competing values and interests, ‘deliberate’ engagements can be used to arrive at trade-offs or compromises. In this model, participants have clear rules and boundaries (set by an engagement plan) for how far and in what way they can participate in decision making. Participants are asked to listen to each other’s views, weigh evidence, find win-win solutions or compromises, and develop recommendations for solutions. Subject to the boundaries and rules set by the engagement plan, decision-makers commit to incorporating the advice and recommendations into final decisions to the maximum extent possible.

In areas where water allocation is contentious, for example, this model of engagement could help industry and communities to find fair compromise. This would build and demonstrate both procedural and distributional fairness.

Collaborate

Collaborative engagements involve a commitment between governments, organisations and citizens to align efforts to achieve a shared goal. In this model, communities work with governments or companies to define an issue, develop solutions and divide responsibility for implementing them.



Like the ‘deliberate’ process, clear rules set boundaries about the ways in which stakeholders can participate in decision making. In addition to coming up with solutions and reaching compromises, the communities are directly involved in delivering and implementing the recommended solutions.

Collaborate engagements might be valuable to solve hydrogen issues that no single person or organisation has the power to achieve alone, and build agreement on governance capacity.

Community Consultative Committees in the wind industry

Wind farm project proponents have found that establishing a Community Consultative Committee (CCC) can be a useful way of consulting with communities. Committees are made up of representatives of the community, stakeholder groups and local council. This type of engagement has been so effective that the National Wind Farm Commissioner has recommended that all developers should consider establishing a CCC for proposed wind projects (noting that in some jurisdictions establishing and engaging regularly with a CCC is mandated).[14] While a CCC is not a decision-making body, and typically used in the *consult* model, it could also be a useful forum for *deliberate* and *collaborate* forms of community engagement and may provide a model for the hydrogen industry.

Engaging with Indigenous communities

Aboriginal and Torres Strait Islander people now own or have controlling interests in some 40 per cent of the Australian land mass under various forms of title and legislation.[15] In many areas, engaging with Indigenous communities and collaborating with them to realise the shared benefits of this transition in the energy system, will be a vital part of gaining local community acceptance for a hydrogen industry.

Indigenous communities are diverse and have different languages, beliefs, customs, traditions, social structures and cultural practices. Therefore engagement with Indigenous communities should be culturally sensitive, respectful, tailored and flexible. It is also vital that any engagement recognises Aboriginal and Torres Strait Islander peoples' unique relationship to the land, sea and waterways.

Governments could consider the policy settings that can best facilitate Traditional Owners to develop and own hydrogen projects on their land. For example, governments could facilitate better understanding in the financial sector about lending for developments on traditional lands. Industry could also consider arrangements with traditional owners that allow for equity or debt participation in the ownership of a project.

Northam Solar Project

The Northam Solar Project in Western Australia, is a ground-breaking partnership between an Indigenous group, Indigenous Business Australia (a Commonwealth statutory authority) and a solar developer. Bookitja Pty Ltd (a company owned and operated by Ballardong and Whadjuk Noongar people) and Indigenous Business Australia together have majority ownership of the 10 megawatt solar farm northeast of Perth. The project resides on the traditional lands of the Ballardong Noongar people. Former Bookitja Pty Ltd chairman Cedric Jacobs said the project was a good fit with the Noongar way: '*Our forefathers, ancestors and elders have all had a cultural responsibility to protect and nurture Mother Earth for the current and future generations'*.[16] The three co-owners worked to drive Noongar and Aboriginal employment and procurement outcomes in the construction and operation of the Northam Solar Project.

Engaging Australian communities on hydrogen production projects

The development of a National Hydrogen Strategy presents an opportunity to establish best practices for how industry and governments will engage with communities. Best practice guidelines would acknowledge the vital role that communities play in developing new industries and could:

- be co-designed with the communities that are likely to be directly affected by a large-scale hydrogen industry
- set out ways in which government and industry identifies key stakeholders, engages and listens to communities, shares information and responds to issues raised by community members
- outline how engagement will contribute to procedural and distributional fairness, governance capacity, and balancing benefits over impacts.

Best practice guidelines could also include, for example, the development of an industry code of conduct. Through such a code of conduct, industry could commit to agreed principles for community engagement, which might include principles such as:

- respect – parties agree to respect the views, expectations and expertise of all participants
- transparency – industry commits to "procedural fairness" by setting clear goals for the engagement, responding to expectations, and clearly communicate their limitations or constraints on decision making
- inclusiveness – engagement incudes a broad range of stakeholders who represent diverse community interests

The Commonwealth and State Governments have a clear role in ensuring that the legislation, codes and standards under which a hydrogen project would operate meet communities' expectations of the benefits and management of the impacts, such as environmental protection, safety and effects on the local area and people. Governments could also set requirements for robust natural resource management plans, developed in consultation with affected communities, and which set out how a company will manage resources, such as water, over the life of the project, while minimising adverse effects to the area and community.

In developing a new hydrogen industry for Australia, it is recognised that it is essential to respond transparently to community interests and expectations about the potential social, economic and environmental impacts of the introduction of new hydrogen technologies. This paper has sought to summarise the key community expectations relevant to hydrogen technologies, draw on lessons from other sectors and move toward best practice community engagement for developing a hydrogen industry in Australia.

Getting this right will foster and develop constructive relationships among stakeholders, ensure the inclusion of diverse perspectives, build trust and understanding between stakeholders, support purposeful information sharing and knowledge building, enhance procedurally and distributional fair processes, and improved outcomes for all affected. Building a meaningful dialogue about hydrogen technologies seeks to realise these mutually beneficial outcomes for all Australians.

Questions

The National Hydrogen Taskforce is seeking responses to the questions below. You can submit your comments via the Department of Industry, Innovation and Science's consultation Hub: https://consult.industry.gov.au/national-hydrogen-strategy-taskforce/national-hydrogen-strategy-issues-papers

1. *Do existing regulations adequately manage the potential carbon emissions of a large-scale national hydrogen industry?*

2. *What are the main community concerns about the use of CCS? How can we better manage these concerns and potential CCS projects in regional areas?*

3. *What are the risks about using desalination plants or water recycling facilities to produce water for electrolysis?*

4. *How can we best balance the water and land use requirements for environmental, agricultural, community and hydrogen production uses?*

5. *Hydrogen production projects will require significant project and environmental approvals at the local, state and federal level. What approaches could help to manage these approvals to facilitate industry development while providing suitable environmental and natural resource protections and managing community expectations? When do these approaches need to be in place by?*

6. *What are the most important standards and regulations to have in place to ensure a safe hydrogen industry and address the community expectations?*

7. *As an individual, how would you like to be engaged on hydrogen projects? Which aspects would you like to be kept informed of? Which aspects would you like to be consulted on? Are there any types of issues or challenges that you, or affected communities, would want to be a part of formulating solutions and recommendations?*

8. *What are the best ways of engaging diverse communities in regional and remote areas?*

9. *What role could an industry code of conduct play in gaining community support for hydrogen projects? What community engagement principles would you like to see in an industry code of conduct?*

10. *What governance structures (such as legislation and regulation) would the federal, state and local governments need to put in place for a large scale hydrogen facility?*

11. *What further lessons can we learn from the mining, resources and renewable energy sectors about establishing and maintaining community support?*

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