2023 consultation – Hydrogen Head start Consultation Paper

Consultation response from the Institution of Chemical Engineers (IChemE)

The Institution of Chemical Engineers (IChemE) is pleased to make this submission on Australia's Hydrogen Headstart Program: discussion paper consultation. As a Learned Society of chemical and process engineering professionals worldwide, IChemE shares and creates knowledge, providing evidence to inform policy.

The Institution of Chemical Engineers (IChemE) and the American Institute of Chemical Engineers (AIChE) — two leading professional societies dedicated to advancing the application of chemical engineering expertise internationally — have signed a letter of intent to collaborate on building a global alliance centered on the use of hydrogen. The partnership will bolster the professional societies' shared interest in supporting industry in the adoption of hydrogen as an energy carrier for industrial and commercial applications that will form a vital part of the road to net zero greenhouse gas emissions.

IChemE has responded to the nineteen conversation starter questions across a range of subject areas. The responses below will also help with addressing the current and future environmental challenges as outlined in the Government's 2021 Intergenerational Report - Australia over the next 40 years [1].

Question 2 set

Question 2.1: Please provide any feedback on the proposed eligibility requirements. Are there any other eligibility requirements the Program should consider?

We outline the following key comments to the eligibility requirements based on the requirements outline in the document. We agree with the requirements except for of the following:

- **Requirement**: *"There will be consideration of the balance between hydrogen production for export and domestic use"*.
    - **Feedback:** We suggest this is removed as the goal of this is unclear e.g. What "balance" is required and to what end? A plant in a regional area may have export advantages, hence the reason for locating in a regional area.

- **Requirement**: "*Projects must be for a single site deployment*"
    - **Feedback**: Clarification is required for "single site", because many hydrogen projects are feeding hydrogen into existing ammonia plants which are owned by different companies, are those projects considered as a "single site development" This could be addressed via consortia.

- **Requirement** "*Applications must have a valid commercial case for the end use of hydrogen*."
    - **Feedback:** The end use of hydrogen is heavily influenced by factors such as the price of hydrogen, the availability of technology, and government subsidies. It's important to note that small-scale plants might not be as competitive as large-scale ones, which could result in the 50MW electrolyser plants being considered less competitive for certain applications. Nevertheless, these smaller plants are more likely to be constructed first despite their potential lack of competitiveness due to reasons such as investor risk appetite, time to market etc. The program should prioritise the most commercial projects, that meet the program requirements regardless of size, and also cover a range of hydrogen end uses rather than several similar projects. Headstart should promote a mix of supply chains such as Hydrogen, Ammonia, Methanol, SAF etc and gather lessons learned from the range of supply chains.

Question 2.2: Is a minimum deployment size of 50MW appropriate for the Program?

This project appears to be set up for larger scale installations. The funding should be available to a range of supply chains as discussed above, at the greatest stage of commercial maturity.

Question 2.3: Are there benefits to considering a suite of project sizes, with both large and smaller scale projects (for example less than 50MW) being eligible?

IChemE believes the funding should be available to a range of supply chains as discussed above, at the greatest stage of commercial maturity.

We do note this support is about large-scale installation and that there are alternative sources of funds for small scale projects and technology development / proving.

Question 2.4: Are there benefits to considering projects that may only have scale if aggregated across multiple, but related sites?

Where these sites are new, we believe this should be considered (projects located across related complimentary industries). However, this does significantly change the safety case for approval by Planning departments, especially when dealing with existing sites constructed in the 1960s-1970s that require refurbishment. It introduces excessive complexity to an already challenging industry. A risk-based approach such as those familiar to that used by IChemE members (the IChemE Safety Centre is an example of this) could be integrated into the project development requirements.

Question 2.5: Other international schemes have sought to implement additional requirements of the renewable energy used in hydrogen projects such as new-build or time matched renewable energy. Please provide your views on any additional requirements the Government should consider for the Program in relation to renewable energy.

In the short term these requirements add complexity to the hydrogen headstart program (noting this should be addressed in the long term). The renewable energy projects in Australia are already facing delays and budget overruns because of issues with land access, planning approvals, community disengagement, and a shortage of skilled labour.

The long term goal is to reduce the Life Cycle carbon footprint. Hence, rather than the source of the energy it is suggested the key metric should be the Life Cycle carbon footprint.

The UK Hydrogen Allocation Round does not stipulate new renewables but gives 'bonus' points for schemes that utilise new renewables – this may provide a fair compromise, recognising the challenges of setting up new renewables versus the risk of taking green power away from the grid.

Regarding time-matched renewable energy, the EU and UK approaches are quite restrictive and therefore a more flexible arrangement is welcome.

Question 2.6: Some international schemes have limitations on proposed end uses of hydrogen such as the UK scheme which specifically excludes gas blending. Should any limitations be placed on the end uses eligible for the Program?

IChemE agree with limiting the ability to undertake gas blending. This is defending sunk costs for the gas industry and provides an excuse not to reduce Life Cycle carbon as rapidly as we need to. The UK has rightly understood that there is no ability to place Hydrogen into existing gas pipelines and existing appliances are not able to use the hydrogen.

The existing market where possible and most appropriate should rapidly be electrified as this is the best means of reducing cost and cutting carbon for the community, hydrogen is not the solution for all problems.

Question 2.7: Other international schemes consider both export and domestic use of hydrogen as eligible while others specifically exclude export projects. How should the Program consider projects with proposed export offtake and the extent to which this offtake may support the development of an Australian hydrogen industry or other additional benefits to Australia?

Feedback: Both domestic and export industries should be included. Larger scale projects can tend to favour export due to a lack of local market. The key to build local markets is to displace existing uses for manufacture or fossil fuels or alternative develop new industries based on technological innovations, such as ammonia cracker or green steel making, and using this approval to attract more capital for the industry's development.

For export, one point to consider will be the definition of 'low carbon hydrogen' of the country importing from Australia, and how Australian production can meet the criteria of the importers.

Question 2.8: The proposed GO Scheme will be used to support the verification of hydrogen production. Are there projects where this would not be suitable? Should the Program apply a maximum emissions intensity for hydrogen production on a project lifecycle basis?

The GO Scheme is one of several that may be acceptable to an international market (with others existing such as CertifHy out of the EU). Hence, more important in the early days of low emissions hydrogen is the life cycle emissions intensity using the same calculation methodology. The desired method(s) for lifecycle emissions should be made clear. Again, to enable global reach we would suggest this is Lifecycle Carbon (noting the UK Treasury Infrastructure Carbon Review 2013 shows cutting carbon cuts cost).

Question 4.1: Please provide any feedback on the proposed funding mechanism.

It is noted there exists the scenario of large capital flows out of Australia to procure equipment for a hydrogen production facility, especially due to tight time frames. Proponents utilising local content should be weighted more heavily and receive additional time for local supply chains to develop to meet demand.

Question 9 Set

Question 9.1: Please provide any feedback on the proposed merit criteria.

We outline our response to each of the merit criteria as follows:

Requirement: Merit Criterion A, "*Mwh/ton of hydrogen delivered over contract terms*", "*program funding $/MW of electrolysis capacity installed*" and "program funding $ / tonne of CO2e abated"

- **Feedback**: Projects at the Front-End Engineering Design (FEED) stage have already extensively investigated these figures to ensure their bankability. Using these figures as criteria for funding allocation may lead to unhealthy competition, as projects might resort to creative calculations to win funding, rather than presenting realistic and feasible plans.
- Again, a lifecycle carbon analysis with a method template provided by government would reduce risks associated with supply etc. This aligned to a risk assessment as familiar to members of IChemE would also create a requirement for proving safety, quality and reliability.

Requirement: Merit Criterion A, "*program funding $/kg of hydrogen delivered or $ / tonne of hydrogen derivative product such as ammonia or methanol (i.e. value of HPC) over contract term (10 years).*

- **Feedback**: This is consistent with global Power / Water Purchase Agreements (over often 25-year terms) for the likes of power plants or desalination plants. Members of IChemE are familiar with the technical advisory portions of this work.
- A better comparison metric between hydrogen and it's various derivatives is $/GJ or $/MWhe, which addresses the efficiency of each process. It allows a fair assessment of Hydrogen, Ammonia, Methanol, SAF etc, especially when used in fuel applications.

Requirement: Merit Criterion C: Under the 3rd bullet point regarding the "*completeness of the project timeline"*

- **Feedback**: We suggest adding procurement in as it is a critical component of the project life cycle. This also aligns to a Carbon Lifecycle.

Requirement: Merit Criterion C "*the identification and consideration of securing the proposed site and all required permits (including environmental and planning), license, approvals and consents for the projects"*

- **Feedback**: We suggest that the federal government work with state governments to grant exemptions or provide resources to enable fast – track planning processes to hydrogen projects to support the industry. By doing so, the government can provide necessary support and remove unnecessary hurdles that could hinder the progress of hydrogen projects, enabling a more consistent and favorable environment for the industry's growth. Delivery risk and timeframes would be called into question for projects that do not have permits for the proposed site (or a robust permit pathway).

Requirement: Merit Criterion C "*the extent to which the proposal supports development of utility (for example water) and social infrastructure (for example, community facilities)"*

- **Feedback:** The hydrogen industry requires support, as a substantial amount of private funding has been invested in it, and these private companies have taken considerable risks. Government responsibility lies in supporting utilities and social infrastructure, and this support should not divert the focus from private investments. An example of this is desalination plants that benefit both the hydrogen industry and the community. Water companies do not have the money to fund these projects (or the projects make up a very large portion of approved capital works spend that other projects are deferred), whereas the provision of water for Hydrogen Production is a small portion of the overall cost. There are a number of challenges with integrating these assets, such as standards and requirements from water companies are likely to be very different to those from a Hydrogen project with a shorter lifespan. This requires greater integration from government, or these utilities will be developed in isolation.
- Furthermore, the hydrogen industry is progressing at a much faster pace compared to utilities and infrastructure. Assessing them together could potentially slow down the advancement of the hydrogen industry.
- While the development of hydrogen plants offers benefits like creating local jobs, boosting the local economy, and providing training opportunities, these aspects should not be the primary priority in the assessment process. The main focus should remain on supporting the growth and sustainability of the hydrogen industry.

Question 9.2: How should merit criteria be structured or weighted to ensure the success of delivery of hydrogen from projects? (For example, by adding weighting to criteria that deal with: the capability and capacity of a project proponent to deliver its proposal; the credibility and level of conditionality of the offtake agreement, the extent to which the project has already undergone project planning processes including feasibility/FEED studies, the identification of sustainable water sources, other environmental aspects and community engagement; and/or the unique attributes of the project.)

At the Front-End Engineering Design (FEED) level, hydrogen projects already take into account considerations like water, utilities, environmental impact, and community factors. As a result, there might not be significant differences between projects in these aspects.

The definition of "success of delivery of hydrogen from projects" should be clear and specific. The scale of hydrogen production that this funding aims to support is unprecedented in terms of electrolysis. Although hydrogen production itself is not a new concept, with companies producing hydrogen for years and ammonia technology suppliers utilizing methane reforming (SMR) to produce hydrogen as a side stream, these technologies are not directly applicable to the scope of this paper, which focuses on electrolysis.

Question 9.3: Should an applicant be required to have at least a conditional offtake arrangement in place before applying to the Program? What standard should be applied to determine the reliability of such an arrangement?

Different businesses have very different cultures for how to formalise procurement. This should be a more generic "evidence of future hydrogen demand" with examples of evidence being conditional offtake arrangements, non-binding MoUs, Letters of Intent, etc. This may have the effect of forming a barrier to funding.

Projects at FEED level should have already considered offtakers and should be able to provide robust preconditional agreements.

Question 9.4: What additional outcomes should be incorporated into the formal merit criteria for the Program in order to deliver broader benefits? (For example: level of private investment leveraged; number of jobs created; number of apprentices supported; level/value of common user infrastructure supported; level/value of social infrastructure supported; level/value of local suppliers; use of hydrogen towards existing or new manufacturing industries; level of knowledge shared with the broader industry.)

Knowledge Sharing is a primary and critical aim of this program. Where public funds contribute to a commercial project, the knowledge generated by the project should be of use to local industry. It is appreciated that some information is commercially sensitive, however where reasonable, the project delivery knowledge and lessons learned should be shared.

It is critical that "lighthouse" projects such as those receiving public funding provide detailed information as well as easy to understand and step-by-step "play books" on how to deliver hydrogen facilities.

In an environment of limited technical resources, personnel with limited hydrogen specialisation and/or personnel with finite project execution experience need access to clear and relevant information on how to deliver a facility that is safe, adheres with regulations and meets performance requirements – Knowledge Sharing is a primary aspect of this.

Support for apprentices is mission critical for industry; just as mission critical is upskilling trades, engineers and technical staff from traditional (oil & gas; coal) to the hydrogen economy. Again, in an area where knowledge is limited, and other traditional industries will be phased out it is important that resources and training are available to enable movement of labour whilst retaining safety and robustness in processes. It is important that international accreditation bodies such ICHemE are involved given robust systems for engineering accreditation, training and materials availability and the ability to transfer international best practice.

Level/value of common user infrastructure supported: this is a highly complex issue and drives support for specific locations as opposed to locations that enjoy the lowest renewable energy cost and/or areas for new highly skilled jobs in regional / remote areas. It is recommended that this requirement be removed. Common user infrastructure tends to exist in areas that have received extensive historical public funding / support and hence have a disproportionately higher advantage.

Feedback: IChemE suggest adding safety and reliability as essential considerations for the merit criteria. Where skills are being transitioned from other industries, it is important that lessons are captured, and appropriate safety standards are required.

Question 9.5: What other aspects of an export-oriented proposal should be assessed to ensure the Program funds demonstrate tangible benefits to Australians?

When assessing lifecycle emissions, it is essential to determine the allocation between Australia and other countries involved in the hydrogen supply chain. As discussed previously Carbon Lifecycle costs and overall costs of producing energy will present benefits to the community in a tangible fashion when compared to previous rhetoric around maintaining traditional energy sources and the benefits to society in general as to cutting carbon.

Foreign countries often utilize their technology when participating in the hydrogen supply chain. Instead of merely treating Australia as a resource provider, they should be encouraged to share knowledge and collaborate.

Question 9.6: How should emissions abatement calculations consider the different end uses of hydrogen and greenfield vs brownfield facilities?

Ultimately a government provided Carbon Lifecycle assessment tool should reduce the potential of manipulating carbon calculations and the potential for greenwashing. It should be noted that Hydrogen primarily serves as a storage method rather than a power generation method. Its critical role lies in addressing hard-to-abate industries like Aluminium and steel. However, the technology for these industries is not yet ready. Thus, assessing emission abatement calculation for hydrogen production at this stage may be premature.

What we need are projects that can swiftly demonstrate the feasibility of emission reduction through hydrogen, making hydrogen products more financially viable. We are at a technology proving phase and practical demonstrations and collating lessons learned are essential for progress (and ultimately reducing the cost of associated carbon abatement).

Question set 15

Question 15.1: Does the timing proposed for the Program outlined below appear appropriate? If not, please note in your view an appropriate alternative.

We feel that whilst constrained, the timing is appropriate given the scale of projects and expectation of project development.

EOI Requirements

Question: Do the above EOI information requirements seem reasonable? Are there any additional items you would add to the EOI information list, or items that may be subject to different interpretations / challenging to provide?

It may be of value to undertake a two-stage screening for the EOI process. The first stage a simple response to enable filtering of ineligible project followed by a more robust screening process for finalising project details and selecting successful applicants.

The following are key enablers that government could request information on and provide assistance for removing associated roadblocks.

- *Detail any land access requirements and current status of approval.*

- *Detail of any regulatory licences required to carry out the project and current status of registration.*
- *Analysis of the availability of required power capacity and to what extent grid augmentation would be needed to support the project's electricity requirements.*
- *Detail regarding the status of grid connection agreement process and where possible, evidence provided to confirm the current status.*
- *Detail process of water provision and maturity of licensing and approvals for water take and brine provisions (if relevant)*

It is recommended to reduce the weighting of the following requirements because they are overly ambitious and not of top priority or immediate relevance to the design and construction of hydrogen plants. Instead, they may divert the efforts of hydrogen plant developers and lead to increased costs for producing hydrogen.

- *"Detail regarding the proposed use of local supply chains, including sourcing of domestically manufactured equipment or domestically supplied services to deliver the project or support the establishment of new manufacturing capability."*
- *"Detail on how the project may support the development of utility (for example water) and social infrastructure (for example community facilities)."*

It is recommended to provide a template with a standard method and training as to developing Carbon Lifecycle Assessments for the applicants on the following items.

- *A section summarising the estimated carbon abatement potential of the project. Applicants should calculate the estimated Scope 1, Scope 2 and Scope 3 CO_2e emissions that would be avoided relative to incumbent fossil-fuel production technologies. Carbon abatement should be calculated using a consistent framework to be specified (for example, the proposed GO Scheme).*
- *Detail on whether the hydrogen (or its derivative product) is expected to abate existing emissions or drive development of new clean energy industries.*

Application requirements

Question: Do the above Full Application information requirements seem reasonable? Are there any additional items you would add to the Full Application information list?

The two-stage process is a valid approach where the number of applications proceeding to Full Application should be the smallest number possible due to the large personnel resources and hence financial burden in the completion of a Full Application. In summary this application process will require significant resources and will limit applicants. If this is the intention, then the approach is valid.

The program should be as technology agnostic as possible to support innovation and a sample financial model and Carbon Lifecycle calculation should be provided. It is appreciated that each project is different; and a specified financial model is likely unsuitable for all projects, hence a sample calculation provides guidance whilst not inhibiting how data can be presented. This then needs to include certainty over the timeframes for investment.

Given the targets from Infrastructure Australia around digital maturity, this project should at least have a level of digital maturity aligned to these targets if it is being funded. This will provide greater certainty in project development, safety systems and cost control (and enable Carbon Lifecycle assessments).

The Institution of Chemical Engineers (IChemE)

The Institution of Chemical Engineers (IChemE) is a professional association with 30,000 members. IChemE is a not-for-profit, member-led qualifying body and learned society that advances chemical engineering's contribution worldwide for the benefit of society. We support the development of chemical, biochemical and process engineering professionals and provide connections to a powerful network of over 30,000 members in more than 100 countries. The Institution of Chemical Engineers in Australia has a board and staff in Australia.

This response has been produced by IChemE members in Australia and draws on the Institution's position on climate change published in November 2020 [2]. In 2020-22, IChemE also produced sectoral plans to support climate change action in multiple industries and jurisdictions, including energy transition, clean energy, water, food and pharmaceuticals. IChemE has submitted a detailed formal submission [3] on the Low Emissions Technology Statement 2022 consultation: Department of Industry, Science, Energy and Resources, Australian Government.

We support our members in applying their expertise and experience to make an influential contribution to solving major global challenges, including achieving the UN Sustainable Development goals.

IChemE would welcome the opportunity to provide more detailed information if required.

References

[1]. Australian Government (2021). 2021 Intergenerational Report, Australian Government, The Treasury, 28 June 2021, ISBN: 978-1-925832-37-2 https://treasury.gov.au/knowation/2021-intergenerational-report

[2]. IChemE (2022a). IChemE Climate Change Statement, Retrieved from Climate Change Statement: Retrieved from IChemE: https://www.icheme.org/media/14873/icheme-climate-change-statement.pdf

[3]. IChemE (2022b). IChemE Low Emissions Technology Statement 2022 consultation: Department of Industry, Science, Energy and Resources, Australian Government, Retrieved from IChemE: https://www.icheme.org/media/18004/icheme-response-australian-lets-consultation.pdf