Renewable Hydrogen Target Consultation Submission

Introduction

Clean State forms part of the Conservation Council of WA (CCWA), the state's foremost non-profit, non-government conservation organisation representing more than 100 environmental organisations across Western Australia.

Clean State is a non-partisan, not-for-profit climate action initiative advocating for green jobs and a green economy for Western Australia. We envision sustainability will be integral to our way of life – so current and future generations can continue to live, work and enjoy WA for many years. Our mission is to achieve a strong WA climate policy that helps us realise our renewable energy potential, diversifies our economy, creates thousands of jobs and builds resilient, climate-clever communities.

Clean state is committed to supporting renewables projects that offer effective strategies to decarbonise energy networks, which do not produce significant and residual environmental impacts.

Overview

An increased global focus on decarbonising the global economy has seen renewable hydrogen take root as an opportunity to displace the use of fossil fuels to tackle climate change in those areas where other renewable energy sources cannot do it. However, the WA Government's Renewable Hydrogen Target for electricity generation in the South West

Interconnected system has shifted the focus, and the main aim is now to develop a renewable hydrogen industry and not to tackle climate change.

WA's energy transformation requires a major shift in electricity generation from fossil fuels to renewable sources - like solar, wind, and tidal energy - greater energy efficiency, and the general electrification of energy uses, from transport to heating and cooling and manufacture. But not all sectors or industries can easily make the switch from fossil fuels to electricity. Hard-to-abate sectors include steel, cement, chemicals, land transport, maritime and aviation. Fortunately, green hydrogen can be used in these sectors by linking to renewable electricity generation. Hydrogen, in general, is a suitable energy carrier for remote electricity grids or that require a high energy density, and it can serve as a feedstock for chemical reactions to produce a range of synthetic fuels and feedstocks.

To use hydrogen to decarbonise the WA industry, WA must develop a market - especially on the supply side. This has been the focus of the WA renewable hydrogen strategy: developing the renewable hydrogen industry and stimulating the supply and demand of this fuel.

This would be a positive outcome for the WA economy. When looking into climate change action, it is important to look at the impacts that any climate policy would have on the economy, but **it is crucial to maintain the focus on the primary objective: to reduce carbon emissions**. The development of a new industry would have a positive impact on the state economy, growth, GDP, and the labour market, **but this does not mean that a hydrogen target in the grid is the most practical and efficient way to mitigate climate change.**

The consultation paper is more focused on the development of the domestic industry than an effective transition to mitigate climate change. Even though focusing on electrical grid decarbonisation may be far more feasible than attempting to decarbonise each sector separately, based on our research, the suggested target **does not meet the objectives for genuine decarbonisation of the WA economy** and decarbonisation of the grid, principally because **hydrogen is not the most effective way to reduce carbon emission in the energy sector**. The electrification of the grid must be prioritised over the use of hydrogen for electricity generation. Green hydrogen should then be principally used in hard-to-abate sectors.

As such, Clean State's submission to the Renewable Hydrogen Target consultation will focus on the following:

> **Question 2:** How might other uses of renewable hydrogen be accommodated under a Renewable Hydrogen Target certificate scheme? How might Government otherwise support and/or encourage other use cases for hydrogen?
>
> **Question 3:** What role do you believe renewable hydrogen can play in the decarbonisation of electricity generation? To what extent will a Renewable Hydrogen

Target for electricity generation in the SWIS assist in achieving the decarbonisation objectives of the State Government?

<u>Recommendation 1:</u> *<u>Direct generation of electricity when used in fuel cells is the only way renewable hydrogen should be used.</u>*

Renewable hydrogen in the SIWS will not decarbonise the grid

The proposed scheme determines that hydrogen could be used by blending with natural gas fuel sources to supply existing or new gas turbines or by generating gas turbines as the sole fuel source. However, these two ways to use hydrogen have technical limitations, and high capital costs.

Blending renewable hydrogen with natural gas fuel is **counterproductive to the objective of decarbonisation of the grid.** Therefore, the renewable hydrogen target for electricity generation in the SWIS won't have a significant impact on the decarbonisation of the grid.

With little to no modifications within this existing infrastructure, a blend of hydrogen with natural gas can be transported, which makes the entire system reusable. However, blending hydrogen into gas grids does not have a significant reduction in GHG emission - for instance, "a 10% hydrogen blend will reduce emission by approx. only 2-3%" (DMIRS, 2022). Under his case, natural gas will still be needed to use in combination with green hydrogen for electricity generators to meet the target, which means that the proposed target will truly inhibit the decarbonisation of the grid.

To achieve true decarbonisation of the grid, we should be aiming for 100% renewable hydrogen use - but if that were the case, a **new or retrofitted piping infrastructure would be necessary, which will imply significant capital costs** and these are likely to be transferred to the end consumer.

This is why Clean State believes a Renewable Hydrogen Target in the SIWS is an inefficient method of meeting emissions reduction targets.

Additionally, some of the technical barriers in blending hydrogen:

The below information has been taken from the IEA Global hydrogen review 2021 (2021)

- *Parameters related to natural gas quality (composition, calorific value and Wobbe index) – as regulated in different countries – can limit (or completely prevent) injection of hydrogen into gas grids. The hydrogen purity requirements of certain end users, including industrial clients, can further constrain blending.*

- *In addition, resulting changes in the physical characteristics of the gas can affect certain operations, such as metering. To avoid interoperability issues arising from the changing quality of gas, hydrogen blending will require that adjacent gas markets co-operate more closely.*
- *Hydrogen can be injected into gas networks either directly in its pure form or as "premix" with natural gas. Due to its chemical properties, however, it can cause embrittlement of steel pipelines, i.e. reactions between hydrogen and steel can create fissures in pipelines.*
- *Depending on the characteristics of the gas transmission system, hydrogen can be blended at rates of 2-10 vol%H232 without substantial retrofitting of the pipeline system*
- *The hydrogen tolerance of polymer-based distribution networks is typically greater, potentially allowing blending of up to 20 vol%H2 with minimal or possibly no modifications to the grid infrastructure.*
- *The injection of low-carbon hydrogen into gas grids has grown sevenfold since 2013, but volumes remain low. In 2020, ~3.5 kt H2 were blended, almost all in Europe and mainly in Germany, which accounted for close to 60% of injected volumes.*

Recommendation 2: *WA government should incentivise the use of renewable hydrogen in hard-to-electrify sectors.*

Hydrogen will have a critical role to play in deep decarbonisation strategies. However, it is only one of several options available to phase out fossil fuels, including:

1. Use of widely available renewable energy sources
2. Direct electrification
3. Improved energy efficiency
4. Lastly, the Renewable Hydrogen use

Instead, renewable hydrogen could be **better applied to hard-to-abate sectors.**

Hydrogen for hard-to-abate sectors

In a hydrogen economy, hydrogen would be used in place of the fossil fuels that currently make up a significant share of the state's energy supply and emit the bulk of global greenhouse gas emissions.

However, we argue that hydrogen should not be prioritised over other renewable energy sources for electricity generation.

Renewable hydrogen could play an important role in the decarbonisation of industry, but there are more efficient and effective ways to achieve this than the proposed renewable hydrogen target for electricity generation in the SWIS. **Clean State believes the proposed target will not have a significant impact on the decarbonisation of the grid or any other industry sectors of the state's economy.**

It will be more effective in terms of decarbonisation to stipulate a **renewable hydrogen target in hard-to-abate sectors** instead of sectors where **electrification is feasible.**

If the objective of using hydrogen is to mitigate climate change, it is more effective to have a renewable hydrogen target in hard-to-electrify sectors where electricity can't be the solution - for example, heavy buses, trucks, ships, trains, planes, steelmaking, and chemicals. A regulatory measure such as a target or a quota will force carbon-intensive users to meet a minimum (share) consumption of renewable hydrogen instead of fossil fuels.

"If you were removing a tonne of CO2, it would make more sense to put the hydrogen in the steel or ammonia sectors than worrying about the last 10% of the electricity demand decarbonisation." (Evans & Gabbatiss, 2020)

For those sectors in which electrification is not an option still, renewable hydrogen can bring them renewable electricity generation. For instance, **hydrogen works as a suitable energy carrier for remote electricity grids, that require a high energy density,** and it can serve as a feedstock for chemical reactions to produce a range of synthetic fuels and feedstocks instead of using fossil fuel.

If the objective is to develop the renewable hydrogen market, the target needs to be focused on the right market to then assist with the further decarbonisation of other industries. The renewable hydrogen target should be focused on opportunities outside of the SWIS, to develop the market to achieve the full decarbonisation of the whole industry from an economic perspective.

There is also an opportunity cost of using renewable hydrogen in a sector that could be easily electrified. Quotas to replace fossil fuels with renewable **hydrogen will have a higher impact in hard-to-ablate sectors**. Given that the supply of renewable hydrogen is scarce, there is a high opportunity cost of putting renewable hydrogen quotas in electricity generation in the SWIS instead of using it in hard-to-abate sectors.

The proposed scheme it is not designed to and will not assist in achieving the decarbonisation objectives of the State Government from an economic perceptive. The scheme should cover hard-to-abate sectors in which the use of green hydrogens is required to decarbonise.

These uses can increase the future demand for hydrogen and take advantage of possible market expansion, which will help to create larger economies of scale, decreasing the costs in the green hydrogen value chain, and making it more attractive (more competitive) for companies to use it to fully decarbonise. The development of the hydrogen industry should be supported to create larger economies of scale and faster deployment, leading to a virtuous circle of increasing demand and supply.

Hydrogen is not competitive yet, therefore if it is used in sectors where is not required (like the grid), it will have an unjustified impact on the energy cost with almost no significant climate impact.

Energy cost

The Renewable Hydrogen Target could trigger an increase in energy prices. Implementing a target on the demand side of a market with scarce supply, with significantly high costs of entry, will typically drive the presence of market power and drive prices even higher. It is also important to note that green hydrogen still hasn't achieved a competitive price. If the price is not competitive and there is a scarce supply, and energy generators need to meet the target - this can lead to electricity generators transferring the increase in costs to households and small businesses.

Recommendation 3: *The use of renewable hydrogen should only be considered to balance the electricity grid after other low-emission energy sources, such as solar, wind, tidal energy and battery storage, have been used at maximum capacity.*

Renewable hydrogen use in the grid

Renewable hydrogen should only be considered to balance the electricity grid after other low-emission energy sources, such as solar, wind, tidal energy and battery storage, have been used at maximum capacity.

Renewable energy makes up just 2.3% of WA's energy mix, so it follows that wind, hydro and solar energy are not utilised at maximum capacity (Department of Climate Change, Energy, The Environment and Water, 2021). Renewable hydrogen should therefore function as a complementary option to other renewable energy measurements to eliminate completely the use of fossil fuels in the grid and bring stability to it.

At this point, it is unknown how much renewable hydrogen will be required to bring stability to the grid once other renewable sources are used at their maximum capacity. Therefore, setting up a target at this point, considering the lack of data, will be inefficient.

Additionally, it is important to note that it is more efficient to use renewable energy directly into the grid than use it to electrolyse hydrogen which will then be used in the grid, due to the energy loss involved in the process.

> "All energy carriers, including fossil fuels, encounter efficiency losses each time they are produced, converted or used. In the case of hydrogen, these losses can accumulate

across different steps in the value chain. After converting electricity to hydrogen, shipping it and storing it, then converting it back to electricity in a fuel cell, the delivered energy can be below 30% of what was in the initial electricity input." (Bulgarian Institute, 2022)

"Green hydrogen incurs significant energy losses at each stage of the value chain. About 30-35% of the energy used to produce hydrogen through electrolysis is lost (IRENA, 2020d). In addition, the conversion of hydrogen to other carriers (such as ammonia) can result in 13-25% energy loss, and transporting hydrogen requires additional energy inputs, which are typically equivalent to 10-12% of the energy of the hydrogen itself (BNEF, 2020; Staffell et al., 2018; Ikäheimo et al., 2017). Using hydrogen in fuel cells can lead to an additional 40-50% energy loss." (IRENA, 2020)

It is, therefore, more economically efficient to source electricity from other forms of renewable energy at maximum capacity before turning to electrolysis and green hydrogen.

Research on the topic suggests the following:

- "Electrolysers could be used to produce hydrogen using "curtailed" electricity generation that would otherwise go to waste during particularly sunny or windy periods when renewable supply exceeds demand, or when the energy price is negative. This reduces the unnecessary big stale projects and, therefore, will reduce the impact that renewable projects will have on the environment, like land clearing and impact on land and marine ecosystems. Making of curtailed power has been proposed as a strategy that makes sense not only to cut emissions, but to save money". (HYDROGEN: a renewable energy perspective, 2019)

- "Renewable electricity, sourced from domestic grids at times when it is abundant and cheap, can be converted into hydrogen. Hydrogen could be a useful form of energy storage, covering seasonal variations in renewable-heavy systems when batteries are insufficient". (Evans & Gabbatiss, 2020)

- The renewable hydrogen used to store the surplus of renewable energy produced in the stage could be used to import to other states or overseas, contributing to the decarbonisation of other industries. WA has an absolute advantage in producing renewable energy at a low cost which then could be used to produce renewable hydrogen for exports to other states or internationally. A low cost of electricity is, therefore, a necessary condition to produce competitive green hydrogen." The most significant single cost component for on-site production of green hydrogen is the cost of the renewable electricity needed to power the electrolyser unit". (Reglobal, 2021)This creates an opportunity to produce hydrogen at locations like WA that have optimal renewable resources to achieve competitiveness in external markets.

Conclusion

Implementing a renewable hydrogen target to decarbonise the grid should **only be the last resort or complement the transitions after implementing all other renewable energy resources**, such as wind, tidal and solar energy, and batteries. Once the above has been implemented, this fuel in the grid should only be used to provide stability to the grid. There is still the potential for hydrogen to play a hugely significant role in reducing emissions in hard-to-abate sectors. For instance, a target of renewable hydrogen in hard to electrify sectors will be more feasible to mitigate climate change.

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