Renewable Hydrogen Target – stakeholder feedback template

Submission from ITM Power

This template has been developed to enable stakeholders to provide feedback on the questions posed in the Renewable Hydrogen Target consultation paper.

Energy Policy WA encourage stakeholders to use this template. If you wish to provide additional feedback outside the template, wherever possible please reference the relevant question/section to which your feedback relates.

No.	Question	Feedback
Renewable Hydrogen Target for electricity generation		

No.	Question	Feedback
1	What are some examples of an objective or objectives that could be used to assess the benefits, costs and impacts of a Renewable Hydrogen Target for electricity generation?	A Renewable Hydrogen Target should be seen as an important first step towards achieving the long term vision of a 'net zero' electricity system based mainly on renewables. The only role for hydrogen power generation in such a system is to help solve the large temporal mismatch problem that will develop between renewable supply and electricity demand profiles. Achieving sufficient power generation capacity based on renewable hydrogen to complement direct renewable generation is a good long term objective. To achieve this requires WA to store (as a minimum) sufficient renewable hydrogen to enable the mismatch to be overcome (ie. satisfy demand when there is temporarily a drought in wind or solar generation). The vast natural resource potential of WA (in terms of both renewables and underground cavern storage) provides more than enough scope for achieving this by 2050. However, it requires making several interrelated technological interventions which are at present probably unfamiliar to electricity sector stakeholders (i.e. stepwise increases in the respective deployment of renewables, hydrogen production, hydrogen storage, hydrogen-to-power generation and associated hydrogen pipelines). So a set of intermediate objectives needs to be defined in order to progress renewable hydrogen directly towards its ultimate role in the electricity system. One such objective might be the implementation of one underground hydrogen store, served by a small number of large electrolysers in conjunction with hydrogen gas turbines which operate on a regime that gives them a distinct decarbonisation role in the electricity system (e.g. the GTs only operate during periods of wind or solar drought, or only during peak demand periods). A later objective may then be to achieve a much greater amount of hydrogen storage and much increased capacities of electrolysers and GTs in order to achieve a greater decarbonisation effect upon the electricity supply. These intermediate steps could relate to say 2030 and 2040 and would be best expressed quantitatively as installed capacity targets (e.g. in terms of how much of the 4GWe peak should be met respectively by renewables and by renewable hydrogen). The developed expertise to interconnect and manage a combination of renewables, electrolysis, hydrogen storage and hydrogen power generation at scale provides a basis for expanding into meeting new energy demands that currently lie outside the electricity system (eg. fuel production for maritime, aviation etc., feedstock for ammonia and steel production etc., and fuel/ammonia for export). If sufficient underground hydrogen storage can be developed, then the long term objective might also be framed as including this very substantial adjunct (ie. be more ambitious than just feeding renewable to hydrogen power generation for helping meet the 18TWhe demand).

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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?	Alongside the Renewable Hydrogen Target for the electricity sector it would seem appropriate to have similar targets for any major chemical or thermal processes that already use, or could use, hydrogen (steel, ammonia, methanol production etc) and for heavy vehicles in the transport sector. Taking parallel action would result in a greater overall rate of decarbonisation and get around the criticism that the electricity industry is being singled out. One good option is for refuelling facilities for heavy duty vehicles (road and off road) with companies being encouraged to switch from diesel to hydrogen vehicles. For example HRS can be located at truck and bus depots and the operating patterns of the associated electrolysers can be limited to ensure the hydrogen meets a defined target capacity and stays within a carbon intensity threshold. Government can support initially with Capex grants for deploying HRS and FCEVs, government agencies can procure hydrogen vehicles to show leadership in the early years, certificates could be used like the Renewable Transport Fuel Certificates scheme in the U.K.. Large consumers of natural gas could be obliged to switch to a H2NG blend or to 100% hydrogen where feasible by using electrolysers that are either located on their premises, or in an industrial zone serving a small number of offtakers (to minimise the risk of depending on one offtaker). The challenge is affording the Opex subsidy that will be required to bridge the financial gap between the price of natural gas and renewable hydrogen in the early years.
Considering hydrogen		

No.	Question	Feedback
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?	See our answer to Q1. In the short term, hydrogen could be blended with natural gas and used by gas turbines to achieve a small decarbonisation effect. However when we only have a finite period left to achieve net zero, it is likely that this approach could be seen as doing too little too late. Alternatively WA could introduce power generators that are fuelled 100% with renewable hydrogen and then step up the number of them in a progression to 2050. As the installed capacities of renewables and hydrogen power generation increase, the annual load factors of coal and gas power will decrease until junctures are reached when coal and then gas plant can be shut down. This approach establishes a continuum all the way to 2050 which is advantageous. In general before renewable hydrogen can make a substantial decarbonisation impact, there is a need for the electricity sector to start preparing substantial capacities of (interconnected) electrolysis, hydrogen storage and hydrogen power generation in a known combination. This can then start to plug the gap that renewable generation cannot and thereby establish a pathway for the electricity system to no longer require fossil power generation.

No.	Question	Feedback
4	What role can the infrastructure associated with the production of renewable hydrogen (i.e. renewable electricity generation facilities, electrolysers, transport and storage infrastructure) play in the broader SWIS?	A very important role. Government needs to take action to facilitate the electricity sector building a system that interconnects each of the technologies in the renewable hydrogen chain. It is not enough to focus say only on electrolysis, or only on power generation. The focus needs to be on deploying some combination of renewables+electrolysis+pipelines+H2 storage+power generation because this is the opportunity. Government is best placed to play an integrative role and help overcome the significant inertia that often exists among the incumbent industries. There are substantial extra opportunities for the electricity sector to consider, which concern making and storing hydrogen in a greater volume than required by the WA electricity system. In the long run the potential scale of the overall commercial opportunity ought to be a good motivator.
Technical feasibility		

5	To the extent you are able please reflect on some of the technical issues, challenges and considerations in the utilisation of hydrogen in the generation of electricity. To what extent can these technical issues and challenges be overcome? How should this impact on the consideration of a Renewable Hydrogen Target for	- Lack of substantial amounts of electrolysis, underground hydrogen storage and hydrogen gas turbines in place today, and difficulties in simply ordering such quantities from suppliers due to inadequate rates of manufacture. - Insufficient rate of renewables deployment in WA to support both a renewable electricity and renewable hydrogen future. - The cost of renewable hydrogen in the early years will tend to be high compared with natural gas and coal, which suggests it should be used wisely rather than viewed as a mainstream fuel. - The modest efficiency of gas turbine technology (40% for OCGT) means hydrogen consumption will be high per MWe, requiring large amounts of hydrogen storage and large capacities of electrolysers and renewables. - A 5% H2NG blend by volume achieves a decarbonisation effect of only about 1.5%, assuming the carbon footprint of the renewable hydrogen is calculated via a specified method and known to be zero (if it isn't zero the decarbonisation effect of combusting the blend is even smaller). A blend of 30% that is somehow maintained steady across the year provides a decarbonisation effect of only 10%, which is significant if it can be implemented rapidly in the short term. - Gas turbine technology needs well defined H2NG concentrations if it is to combust blends safely without the flame front moving around, not time-varying concentrations (caused by the variability of renewables-driven electrolysis). It is wiser to step to using 100% hydrogen GTs and not attempt a progression in H2NG concentrations. - Unlike hydrogen GTs, fuel cells are more efficient and don't produce NOx, but they are not available at multi-MW scale and they are substantially more expensive per MW. The future options involving FCs amount to having to wait for large FCs to be developed; or deploy FCs as highly distributed generation which then forces the introduction of an extensive hydrogen pipeline network across urban areas (demand centres). Neither option is particularly attractive in terms of achieving a near term target. It is probably wiser to concentrate on deploying hydrogen gas turbines at key locations based on hydrogen supply factors and the electricity grid design.

	electricity generation in Western Australia?	

No.	Question	Feedback
Certificate schemes for Renewable Hydrogen Target for electricity generation in the SWIS		
6	Do you believe a renewable hydrogen electricity generation certificate-based scheme represents an efficient and effective means to deliver a Renewable Hydrogen Target for electricity generation in the SWIS? Please explain your answer.	Yes providing you specify exactly on what basis the hydrogen fuelled power generation is to operate. For example, only when wind+solar generation temporarily falls below X% of total demand (GW); or only during peak hours when peak demand exceeds Y GW; or only during hours of darkness if the future electricity system is to be solar dominated. Policymakers need to define some rules to address this issue, because it is wasteful of renewable energy if the specified target simply allows hydrogen power generators to operate as baseload in order to clock up plenty of renewable hydrogen consumption. We believe operation has to be constrained to times when the role of hydrogen power generation is at its most valuable for decarbonisation, even if that amounts to only a few hundred hours per year. A high price (c/MWhe) has to exist for stakeholders who operate hydrogen power generation, because of the amount of investment in renewables+electrolysis+storage that is required in order for them to operate. However, renewables are cheap, surplus electricity for operating the electrolysers is cheap and underground hydrogen storage is cheap, so there ought to be a good business model for stakeholders provided they can get a good price for the electricity they generate. Can a certificate-based scheme deliver that? Government should focus on doing what's necessary to establish that business model.

No.	Question	Feedback
7	What are some other approaches which could be considered alongside a renewable hydrogen electricity generation certificate scheme that would provide a framework to deliver on the objectives or outcomes sought?	It may be more effective to implement say a 7 year rolling plan to get to first base by aiming to build the first renewables+electrolysis+H2 pipeline+H2 storage+H2 power generation combination of technologies. This might be achieved via grant funding and loans to provide Capex support plus some form of Opex support possibly afforded by a levy on fossil power generators and large electricity users.
Liable entities		

No.	Question	Feedback
8	Is the proposed approach of certification, deemed liability and certificate transfer an efficient and effective way to deliver on the intent of the Renewable Hydrogen Target for electricity generation? Are there alternative approaches which could better deliver on the objectives?	We like the logic of using electricity generated from hydrogen to pull through the necessary technologies to produce and provide the hydrogen to the generators, by making it a requirement on the liable entities. Stipulating that the end use is electricity overcomes much of the uncertainty that has tended to characterise hydrogen projects to date (ie. offtaker risk), because electricity demand is firm and predictable. However, as stated above we think it would be better for the scheme to emphasise the capacity of installed hydrogen power generation, rather than the amount of electricity it produces per annum and to shape how it should operate in an increasingly renewable electricity system. There is a need to prove the hydrogen being used is 'renewable' with appropriate definitions and a calculation method, which may slow the process of implementing a certification scheme. Our experience in Europe is that Hinicio and LBST have been working to develop CertifHy for about 8 years now and after much good work they've a working certification system, but it's still not widely accepted and the EC now wants a 70% reduction in carbon footprint relative to grey hydrogen, whereas the CertifHy datum is 60%. Meanwhile in the USA the lowest category of carbon footprint in the Inflation Reduction Act equates to a 95%+ reduction and in the U.K. the Low Carbon Hydrogen Standard equates to an 80%+ reduction. So it's important to define what carbon footprint is acceptable for the 'renewable' hydrogen to count towards achieving the WA target and to have a methodology that is as straightforward as possible (to avoid protracted analyses and negotiations to get the certificate scheme in place).
Exemptions		

No.	Question	Feedback
9	What are the benefits, costs and impacts of an exemptions regime for a Renewable Hydrogen Target for electricity generation?	We don't really understand why you would want to make exemptions so cannot comment.
Non-renewable hydrogen		
Renewable fuels		

No.	Question	Feedback
10	Should the Renewable Hydrogen Target for electricity generation consider alternative renewable fuels as eligible for the creation of Renewable Hydrogen Electricity Generation Certificate? Why or why not?	No, keep the focus on hydrogen. It avoids the energy loss of converting it to another fuel and the airborne emissions associated with combusting a more complex fuel for generating electricity. A policy focused on renewable hydrogen is also a simpler proposition for all parties to appreciate.
Setting a target		

No.	Question	Feedback
11	Please consider the benefits, costs and implications of a 1%, 5% and 10% Renewable Hydrogen Target for electricity generation in the SWIS on your business or industry, and provide commentary on how you would expect to react from a commercial and investment perspective to each target level.	It would seem a 1% target would correspond with most of the existing natural gas turbine fleet switching to a 5% H2NG blend. Or to installing a small number of hydrogen gas turbines. But 1% doesn't seem very ambitious for a target of ~ 10 years. If the 1% target were to be achieved via blends it forces the subsequent target to be large to realistically achieve a trajectory towards net zero, suggesting confidence would be needed at the outset that such a step to high concentration blends is feasible and a good reason as to why natural gas should still be used in the 2030s (rather than 100% hydrogen). Given the aforementioned ultimate role for hydrogen power generation in a renewables-dominated electricity system, we think consideration should be given to (a) placing the focus on deploying hydrogen GTs by increasing the number of them in a progression to achieve a future target, because it would be straightforward to subsequently continue the progression towards a much greater target; and (b) setting a % capacity target, rather than a % energy consumption target. We seek to scale up our manufacturing of PEM electrolysers, but more widely we are concerned about the limited time between now and 2050 to make the necessary interventions to achieve a net zero electricity system. So we favour the most ambitious targets being applied (eg. 10%). We believe there is a need to get on with deployment and focus on achieving capacity in terms of electrolysers, hydrogen power generators and underground hydrogen storage, more so than on hydrogen consumption per se. Using renewable hydrogen for power generation must come second to using renewable electricity directly - it is a supplementary aid, not a competitor that must achieve a large percentage of the future market.

No.	Question	Feedback
12	At a whole-of-economy and / or sectoral level, what do you consider to be some of the benefits, costs and implications of a 1% target, a 5% target, and a 10% target?	The more ambitious you are now for the electricity sector the more likely it is to realise additional cross-sector benefits in due course by supplying renewable hydrogen to non-electricity end uses. For example, if the sector needs say 1TWh of hydrogen storage to buffer hydrogen power generators in 2050, but it can establish geological stores of say 6TWh then it can deploy more renewables+electrolysers and sell up to 5TWh of hydrogen into other markets. Power system modelling could reveal what capacities of electrolysers, hydrogen storage and hydrogen GTs would be required for a number of future scenarios including some that export hydrogen out of the electricity system.
Target terms		

No.	Question	Feedback
13	Is the suggested approach of a medium term aggregate target, with annual entity targets, an efficient and effective means to achieve the objectives of the Renewable Hydrogen Target for electricity generation in the SWIS? Why or why not?	

No.	Question	Feedback
14	To what extent should banking and borrowing of liabilities be permitted under the scheme? What are the benefits and costs of a borrowing mechanism as described in the paragraph above?	
Scheme commencement and ramp up		

No.	Question	Feedback
15	How soon do you believe a Renewable Hydrogen Target for electricity generation in the SWIS could be feasibly delivered from a technical perspective (i.e. if cost was not a consideration)? Please reflect on your own organisation and/or sector when providing your answer.	Towards the end of this decade (2028/29). Almost every project in the hydrogen area is taking longer to bring to fruition than originally expected, because of supply chain issues, the need to scale up manufacturing and the newness of the approach for stakeholders. The targets need to follow an S-shaped curve between now and 2050. We are aiming to increase our electrolyser manufacturing capacity from 1 GW p.a. to 5 GW p.a. by December 2024, because of the exponential growth in demand we have experienced, and expect to continue experiencing in the coming years. Delivering such a target within the electricity industry, given its very limited experience of hydrogen to date, amounts to a major challenge. Achieving things rapidly from square one is not the norm. However it's probably worth recalling that it took only 7 years to put a man on the moon after President Kennedy set the target and he did that only a few months after John Glenn first orbited the Earth. NASA achieved it by putting 400,000 people on the job! Internationally we are in an analogous position with renewable hydrogen if significant targets are to be realised by later this decade.

16	Similar to the above, how soon do you believe a Renewable Hydrogen Target for electricity generation in the SWIS could be feasibly delivered from a commercial or economic perspective (i.e. if cost was a consideration)? Please reflect on your own organisation and/or	Early 2030s but clarity is needed about what form of Capex/Opex support will be necessary/available for renewable hydrogen so that stakeholders can appreciate the business model ASAP. From a manufacturing standpoint we are seeking to build gigafactories at key locations where the state or national government is determined to take a leading position on renewable, so that we can cost-effectively meet the domestic market and look to export to neighbouring regions in due course.

	sector when providing your answer.	

No.	Question	Feedback
17	Over what period of time do you believe is an appropriate ramp up period for the Renewable Hydrogen Target for electricity generation in the SWIS? In providing your answer reflect on the actions your organisation and / or sector would need to take to participate in the scheme.	It needs to follow an S shape curve, say with a target point every 7 years. If the first point is at 2030 it needs to be seen as ambitious now, while the point at 2037 needs to be super ambitious. In this respect we find the shape of the curves in Fig 4.1 to be a bit odd. Our role is to manufacture electrolysers. We'd be pleased to provide electrolysers to help stakeholders achieve the Renewable Hydrogen Target and to manufacture them in WA if appropriate. We were first to open an electrolyser gigafactory in January 2021 in Sheffield, U.K., and are aiming to build further similar factories in order to scale up manufacturing rates and bring costs down.
Hydrogen cost outlook		

No.	Question	Feedback
18	In the short (<5 years), medium (5-15 years) and long (15+ years) term, where do you expect the cost of production of renewable hydrogen to move from the estimated levels of today? What do you expect to be the drivers of this change?	We believe the cost of electrolysers can be halved within 5 years, which will help reduce hydrogen costs, but it requires a large scaling up of manufacturing in the intervening years. We expect further significant reductions in solar and wind power costs in the next 5-15 years, which will progressively improve the economics of hydrogen across the lives of operating electrolysers. We appreciate the high ambition of the Hydrogen Shot in the USA, which if successful would reduce hydrogen costs by 80% within 10 years. The drivers for change are: the reorientation and reform of electricity markets away from fossil fuels to renewables; the scaling up of manufacturing facilities for technologies in the renewable hydrogen chain; the setting of decarbonisation targets by governments, especially renewable hydrogen targets; the more active involvement of electricity sector players in renewable hydrogen; the introduction of policies which provide a business model for operators of electrolysers, hydrogen storage facilities and hydrogen power generators; and the increasing desire across society to have a zero emissions fuel to use, alongside zero emissions electricity, before the impact of climate change really bites.
Hydrogen demand and electrolyser capacity		

No.	Question	Feedback
19	To what extent to you believe the above scenarios are reasonable and achievable? Please explain your answer with reference to your previous answers regarding the objectives of the scheme.	We think the 10% scenario underestimates the capacity of hydrogen power generation that will be required in 2050. The method for calculating what's required should be based on the expected capacities of wind and solar in the 2050 electricity system and the impacts of temporary droughts in their generation due to weather conditions, because this dictates the amount of hydrogen power generation needed (to ensure the demand can be satisfied at those times without resorting to fossil power generation).

No.	Question	Feedback
20	How would you expect the levels of hydrogen demand for electricity generation in the SWIS to be met at various points in the supply chain? Would you expect a single generator would emerge and provide all certificates?	

21	Would you expect one very large renewable hydrogen producer, a number of very small renewable hydrogen producers, or some other combination, to emerge in the State as a result of the scheme? Alternatively, would a domestic-focused producer have sufficient scale to operate in a domestic market only?	It depends on the geographic colocation possibilities. In the extreme, the cheapest solution would be one very large electrolysis plant fed by one very large renewable power source located next to a very large salt cavern with an adjacent group of hydrogen gas turbines feeding the electricity grid. However realistic solutions would need to emerge from an analysis using a colocation logic to keep costs down within the constraints of the existing grid design and the location possibilities for geological hydrogen storage, electrolysers, hydrogen pipelines and hydrogen gas turbines. A domestic focused producer would acquire experience of supplying the electricity sector and be aware of the extra opportunities that could be realised by serving other markets besides the domestic one, which would presumably persuade them to remain domestic focussed or not. A domestic focus on the electricity sector would seem to be a very good place to start.