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10 November 2022

Hon. Bill Johnston MLA
Minister for Energy

Hon. Alannah MacTiernan MLC
Minister for Hydrogen Industry

Via email: EPWA-info@dmirs.wa.gov.au

Re: Renewable Hydrogen Target for Electricity Generation in the South West Interconnected System

Frontier Energy Limited (Frontier) welcomes the opportunity to respond to the State Government's consultation paper on the potential Renewable Hydrogen Target for electricity generation in the South West Interconnected System (SWIS).

Frontier is an Australian renewable energy development company and has the potential to be the first commercial producer of green hydrogen in Western Australia.

In 2022, Frontier completed the acquisition of Bristol Springs Solar Pty Ltd which is now a wholly owned subsidiary of Frontier. The Bristol Springs Solar Hydrogen Project (BSSH Project) is to be constructed in the South West of Western Australia and is designed to initially produce 114 MWdc of renewable electricity connected to the SWIS and deploy an initial 72 MWdc nominal capacity alkaline electrolysis hydrogen production plant.

The BSSH Project is strategically located in close proximity to WA's electricity grid, gas pipeline, scheme water, transport networks, major industrial players and a highly skilled and competent workforce. Under Stage One, the BSSH Project will produce 237,000 MWh of renewable energy per year generated from the solar PV plant, which will be used to supply energy to the green hydrogen production plant. The BSSH Project has secured a grid connection at the 330 kV Landwehr Terminal on the SWIS and is finalising the Access Offer with Western Power. Frontier plans to commence construction in quarter three of 2023. Frontier can be a key contributor to National and State hydrogen aspirations within the next two to three years.

In our view, green hydrogen will in due course compete commercially with both fossil fuels and with other forms of hydrogen. In the short term, however, Frontier believes that a Renewable Hydrogen Target will help ensure offtake demand, which is key to establishing and driving the industry and that WA's renewable hydrogen is competitive.

Frontier would support the broadening of a Renewable Hydrogen Target to include areas beyond the electricity sector. This could include the transport sector, particularly public transport, and the gas pipeline network.

The introduction of a market stimulus mechanism will provide investment certainty for continued industry investment. In the absence of a market stimulus mechanism, there is a need for short-term explicit product development opportunities.

Our BSSH Project also supports the State Government's target of a low carbon future**.** Hydrogen Australia, a division of the Smart Energy Council, has commenced precertification process assessing the BSSH Project's capacity

to produce Zero Carbon Renewable Hydrogen. We believe we are a key part in helping to deliver a low carbon future for our State and the wider community.

As always, Frontier appreciates the State Government's efforts to support the Hydrogen Industry development in WA. We look forward to continuing to contribute to this very important policy development proposal with you and your respective agencies. We are available at your convenience to discuss any aspect of our project and this letter, please contact me.

Yours sincerely

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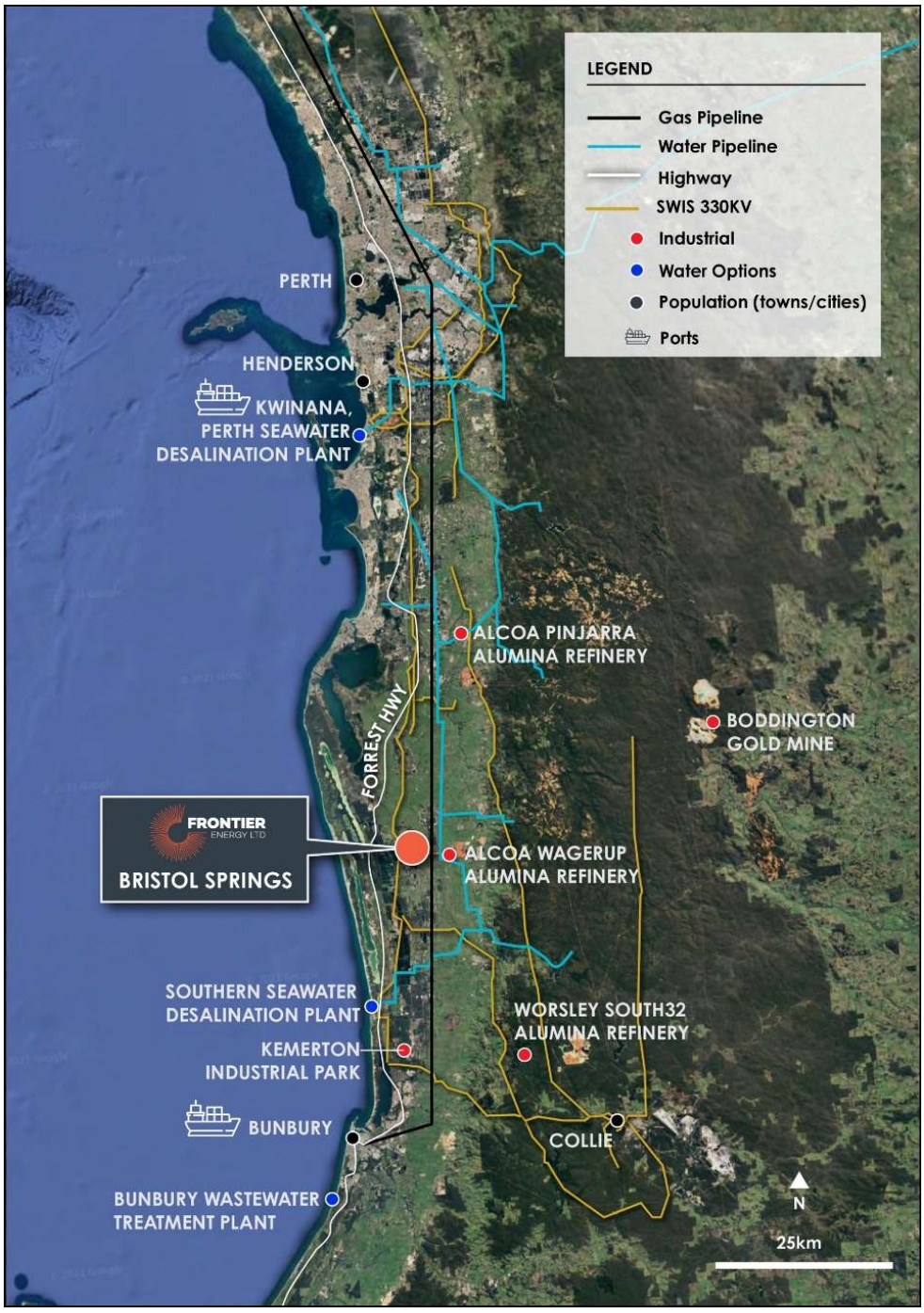
Appendix A: Consultation Responses

Frontier Energy Location

The BSSH Project benefits from its unique location surrounded by major infrastructure. This reduces operating and capital costs compared to more remote hydrogen projects, while also being surrounded by likely early adopters into the hydrogen industry in the transition from fossil fuels.



Appendix A: Consultation Responses

Question 1

We believe that hydrogen production in WA used in the SWIS can present an opportunity to maximise continued LNG exports and associated value for WA whilst safeguarding domestic gas and energy. WA's position in the LNG industry for export e.g., North Asia, Europe is well established and there are ongoing investments in that important sector. Using domestically produced hydrogen to fulfil domestic gas and energy needs and thus enabling LNG producers to realise greater exports supports the LNG industry and associated government revenues, providing a clean energy source for domestic use and helping to stimulate uptake of hydrogen in WA.

As an independent company developing a hydrogen project at a time when the market is embryonic, the importance of confidence in an offtake market cannot be overstated. It is a key challenge for projects seeking to make investment decisions in the coming years. A domestic market is the most viable option in the short term, and we believe government can play a key role. Mechanisms that can be introduced to ensure confidence in offtake will be vital to contemplated project's breaking ground. We would therefore suggest that an objective should be seen as ensuring independent projects can reach final investment decision with offtake secured.

The long-term benefits of helping to establishing the production of green hydrogen in Western Australia are significant given its natural advantages.

The use of hydrogen in the system can help create an LGC equivalent that is potentially tradeable internationally.

We agree the key objectives to assess the benefits, costs and impacts include:

- industry development and demand for hydrogen
- decarbonisation of the electricity grid
- electricity grid reliability and stability
- reducing the cost of electricity in the long run
- decarbonisation of the Western Australian economy

But might also include

- Increase domestic gas production via hydrogen

Economic Security: A Renewable Hydrogen Target for electricity generation could help ensure WA's natural advantages are fully realised ensuring its renewable hydrogen is among the most cost competitive in the world.

Frontier believes that if the industry is left to develop organically, the pace of development will be gradual, and the opportunities and benefits will be more limited.

Question 2

Enabling consumption across sectors will allow and/or expedite more significant projects to be developed.

a) The Renewable Hydrogen Target certificate scheme could also accommodate consumption of renewable hydrogen in transport, particularly in public transport and short-haul transport. Use of hydrogen as an alternative to imported liquid fuels would be an important benefit moving forward.

b) The scheme could also extend to displacing natural gas in transmission pipelines with renewable hydrogen which Frontier believes is a not a dollar-for-dollar issue. Other factors such as the environmental externalities involved in burning natural gas instead of renewable hydrogen, and the economic and societal benefits can be realised. Frontier believes that such a scheme would extend to gas-fired power generation connected to WA's transmission pipelines such that hard-to-abate sectors could transition more gradually to net-zero.

c) Fiscal levers could be considered for other use cases where alternatives are subject to duty or excise regimes, which is particularly relevant to liquid fuels in transport. The effect of the diesel fuel rebate scheme is as a rebate or credit of indirect taxes on liquid fuels where used in certain circumstances. An equivalent scheme

could be designed for diesel use although the detail would need to reflect how hydrogen production and consumption is taxed. A scheme could encourage the uptake of renewable hydrogen.

Question 3

Frontier believes that hydrogen will play a critical role in deep decarbonisation of the electricity system specifically in the areas of energy storage and balancing.

Our view is that the electricity system will be dominated with intermittent generation technologies such as wind and solar. As the share of renewables in the energy mix on the grid continues to rise, renewable hydrogen is one of the few technologies that can help balance the electricity system year-round. During times with high wind and solar supplies, excess renewable energy can produce green hydrogen for long-term energy storage. When renewable supplies are low, the stored hydrogen can provide a clean energy source through fuel cells, hydrogen turbines or engines to meet demand.

The dispatchable nature of grid-connected hydrogen production plants could also provide Essential System Services, particularly in Load Following Ancillary Services as a variable load and Frequency Control Ancillary Services.

Fundamentally, connection onto the SWIS and existing market mechanisms are key factors that could expedite low-cost green hydrogen in WA.

The production cost of green hydrogen depends on the capital cost of the electrolysers, their utilisation factor and the cost of electricity produced from Renewable Electricity. In 2020, the capital cost for an alkaline electrolyser was about $1,000-1,200 per kilowatt (kW). If the utilisation factor of a green hydrogen facility is low, such as below 10% (fewer than 876 full load hours per year), then those capital costs are distributed among fewer units of hydrogen, translating into hydrogen costs of $15-21/kg or higher, even when the electrolyser is operating with zero-priced electricity. In comparison, the cost of grey hydrogen is about $1.4-2.8/kg, considering a price range of natural gas of around $5.5 – 6.5 per gigajoule (GJ). If utilisation factors are higher, however, capital investment costs make a smaller contribution to the per-kg green hydrogen cost. Therefore, as the facility load factor increases, the electrolyser capital cost contribution to the final hydrogen production cost per kg drops and the electricity price becomes a more relevant cost component.

At a given price of electricity, the electricity component in hydrogen's final cost depends on the efficiency of the process. For example, with an electrolyser efficiency of 65 percent and electricity price of $30 per megawatt hour (MWh), the electricity component of the total cost would increase to $42/MWh of hydrogen, equivalent to $1.4/kg. Given today's relatively high electrolyser costs, low-cost electricity is needed to produce green hydrogen at prices comparable with grey hydrogen. The objective of green hydrogen producers is now to reduce these costs, using different strategies. Once electrolyser costs have fallen, it will be possible to use "market-competitive-cost" renewable electricity to produce green hydrogen. However, while electrolyser costs are dependent on scale economies, WA would benefit from its existing electricity market mechanisms for grid connected hydrogen production plants, specifically from Reserve Capacity Markets and Essential System Services. It is therefore of economic and strategic significance that WA pursue setting a Renewable Hydrogen Target for electricity generation.

Question 4

While decarbonisation is a primary objective, other broader benefits such as economic prosperity must be considered in modelling scenarios.

It is broadly understood that a 10% hydrogen blend (by volume) is expected to reduce emissions by approximately 2-3%, however broader implications including asset stranding should be considered factors. Factors such as value preservation in sunk assets could benefit the State in developing the hydrogen industry. In this regard, other assets such transformers, poles and wires in a town like Collie can be significantly utilised as the state-owned coal-fired power stations retire. Frontier's Bristol Springs Solar Hydrogen plant is proposed to be located some 50km from Collie. A hydrogen lateral from the plant to Collie and new hydrogen Gas Peaker could transition the town to renewable energy while meeting the State's decarbonisation and Collie transition objectives to support other

emerging industries in the region. Fundamentally, the use of existing infrastructure could play a critical role in developing a hydrogen industry in WA.

In this regard we think it is important to focus on projects that make sense of and utilise the current infrastructure and are relevant to ambitions for the broader community and broader economy. Frontier's Bristol Spring solar hydrogen project is an example of realising the benefits of major infrastructure (poles and wires, gas infrastructure, freshwater access, transport links) to support the development of credible hydrogen projects. It is also an example of a project that we believe is in tune with the needs of the broader WA community recognising the need for regeneration in the Collie area, availability of a workforce and the potential to link to industrial users grappling with the energy transition. We believe renewable hydrogen projects need to be developed in a manner that is integrated with these broader aspects.

Question 5

Regarding gas blending for power generation, it has several control options including gas meter pulse output proportional control. The ratio of high frequency gas meter pulses from the identical low pressure natural gas vs hydrogen meters are directly compared in the PID and the hydrogen flow rate control valve is instantaneously adjusted to match the natural gas pulse rate ratio. One potential technical issue is programming errors which would prevent the system from working as designed, which could be addressed by the PID manufacturer. The table below shows the preliminary hydrogen blending test results published by the Australia Renewable Energy Agency[1].

Test period (minutes)	Start-NG (m3)	End-NG (m3)	Total-NG (m3)	Start-H2 (m3)	End-H2 (m3)	Total-H2 (m3)	Total volume (m3)	Total flowrate (m3/h)	%H2	Control Valve position (% open)	%H2 on GC
1	5.151	5.411	0.260	3.667	3.680	0.013	0.273	16.380	**4.8%**	**5.0%**	
3	5.411	6.198	0.787	3.698	3.759	0.061	0.848	16.960	**7.2%**	**10.0%**	
3	6.198	6.988	0.790	3.772	3.835	0.063	0.853	17.060	**7.4%**	**10.0%**	
3	6.988	7.751	0.763	3.844	3.949	0.105	0.868	17.360	**12.1%**	**15.0%**	
3	7.751	8.496	0.745	3.958	4.104	0.146	0.891	17.820	**16.4%**	**20.0%**	
3	8.496	9.213	0.717	4.112	4.303	0.191	0.908	18.160	**21.0%**	**25.0%**	
3	9.213	9.909	0.696	4.311	4.538	0.227	0.923	18.460	**24.6%**	**30.0%**	
3	9.909	10.738	0.829	4.546	4.584	0.038	0.867	17.340	**4.4%**	**6.0%**	
3	10.738	11.550	0.812	4.593	4.636	0.043	0.855	17.100	**5.0%**	**7.5%**	**6.1%**
10	11.550	16.283	4.733	4.640	4.807	0.167	4.900	29.400	**3.4%**	**7.5%**	**5.4%**

Question 6

Frontier believes that the proposed scheme is a critical building block to developing a Hydrogen industry. Attracting early investment into WA is predicated on significant signals and policy.

We believe an International tradeable certificate scheme is required immediately.

Question 7

a) The Government could instruct retailers of natural gas to supply renewable hydrogen. Government departments could request their retailers to supply a certain percentage of renewable hydrogen with their natural gas.

b) Government departments could procure hydrogen directly from suppliers.

c) The State-owned retailer could block purchase renewable hydrogen for either power generation or as a product offering to large industrial consumers of natural gas in a bid to displace natural gas.

d) Development of a Feed-in-tariff like the renewable electricity sector. Customers could be credited for injecting hydrogen in the gas grid for power generation. This mechanism would compel power generators to purchase renewable hydrogen whenever it is injected into the gas grid.

Questions 18:

[1] *https://arena.gov.au/knowledge-bank/clean-energy-innovation-hub/*

Early mover projects to support the hydrogen industry must attract prices that allow for capital payback quickly in recognition of and shield against technology and market maturity risks. Early mover prices around $10 per kilogram may be required to ensure projects are paid back within 5 years. As seen in the solar industry, projects in a mature market attracting lower electricity prices make returns challenging for developers to attract investment.

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