Please direct all responses/queries to:
Peter Metcalfe
T: +61 8 9348 6237
E: peter.metcalf@woodside.com.au

Our reference: DRIMS#1400806827

Woodside Energy Ltd.
ACN 005 482 986
Woodside Plaza
240 St Georges Terrace
Perth WA 6000
Australia
T +61 8 9348 4000
F +61 8 9214 2777
www.woodside.com.au

27/07/2018

Attn: Committee Secretary
Department of the Senate
PO Box 6100
Parliament House
Canberra ACT 2600

By email: electricvehicles.sen@aph.gov.au

Dear Sir or Madam

INQUIRY ON ELECTRIC VEHICLES

Thank you for the opportunity for Woodside to provide a submission to the Senate Select Committee Inquiry into the use and manufacture of electric vehicles. Woodside believes this Inquiry is timely in the broader context of Australia progressing towards a lower emission future and moving forward the policy debate on zero emission vehicles.

Woodside recognises the scientific consensus on climate change and the challenge of providing safe, clean, affordable, and reliable energy whilst reducing emissions. We are committed to being part of the solution. One of the ways in which we strive to meet this objective is to evaluate the resilience of our portfolio and our investment decisions to potential changes in global climate policy.

As a result, Woodside is actively investigating hydrogen opportunities, both domestically and within an international market. We recently announced our intention to develop export markets and local refuelling infrastructure based on hydrogen derived from both natural gas and renewable sources.

We believe a thriving domestic market for hydrogen will assist grid stability, enable increased renewable energy penetration, lower carbon emissions, improve domestic energy security, provide Australian jobs and export income.

By building hydrogen infrastructure, along with the adoption of Hydrogen Fuel Cell Electric Vehicles (HFCEVs) and Hydrogen Fuel Cell power generation, Australia can begin to achieve a significant step towards a hydrogen future.

Benefits of Hydrogen and Hydrogen Fuel Cell Electric Vehicles

Hydrogen Fuel Cell Electric Vehicles are a class of hybrid battery electric vehicle (BEV) which consume hydrogen in a fuel cell to produce electricity to either charge a battery or provide power for an electric motor. Hydrogen fuel cells emit purified air and steam and are free of harmful emissions.

Hydrogen can be produced from electricity or natural gas. Refer to Attachment A: Hydrogen Value Chain.

- The cheapest way to produce hydrogen is from Natural Gas. The process of steam methane reforming (SMR) reacts natural gas with high-temperature steam to separate hydrogen from the water and the gas. Industry terms this 'blue' hydrogen once carbon emissions are offset through bio-sequestration. Technologies are under development to separate the carbon as a saleable product.
- The alternative method for hydrogen production, though not yet economic, is to use electrolysis and renewable energy sources, such as solar or wind. In acknowledgement of its renewable energy source, this class of hydrogen is termed 'green' hydrogen.

Hydrogen vehicles have greater range than electric vehicles (between 600-800km for light vehicles, up to 1500km for heavy vehicles) and are well suited to Australia's sparse environment. Hydrogen can be used for multimodal transport across buses, trains, ferries and planes.

Refilling a HFCEV takes approximately three minutes, enabling high vehicle utilisation. HFCEV are especially suited in materials handling, return to base fleet, public transport and shared autonomous vehicle applications. This has resulted in adoption from companies like Amazon, Walmart, and Anheuser-Busch.

Fuel cells are more durable than batteries; performance does not decline with cycles, nor during the cycle. Because of this durability, vehicle manufacturers are signalling longer warranty periods. HFCEV have fewer batteries than a BEV and therefore less harmful hazardous waste for disposal.

Hydrogen can be manufactured domestically, which improves fuel security and options for disaster recovery. Australia relies heavily on imported liquid fuel. It was recently reported that our fuel stocks dipped to only ~20 days, well below the International Energy Agency's recommendation of 90 days' supply. Should an event cause a liquid fuel supply disruption, 98% of transport would be impacted. This risk can be mitigated by adding hydrogen fuel cell vehicles to the transport options.

Today's advanced battery electric vehicle chargers are now consuming upwards of 120kW of power per vehicle being charged. Battery chargers proposed for buses consume upwards of 800kW of power. Supporting multiple chargers will require additional power generation that could also be provided by hydrogen fuel cell power generation at the charging site, thereby minimising the amount of grid investment required as electric vehicle penetration increases.

Ensuring support for all types of electric vehicles allows consumers to make the choice that is appropriate for them. We advocate there would be considerable benefit from clear government mandates on zero emission vehicles and support for vehicle infrastructure.

Global Uptake of Hydrogen Fuel Cell Electric Vehicles

Hydrogen as a fuel is becoming more commonplace around the world. Hydrogen is being used successfully as a fuel in California where half of the world's private HFCEVs have been adopted. California has 30 refuelling stations that service 3,430 cars, and plans to build 200 stations by 2025.

In Japan, there are currently 100 hydrogen refuelling stations. By May 2021, Japan aims to have 160 hydrogen refuelling stations and 40,000 HFCEVs on the country's roads. By 2030, it aims to have 900 stations to service some 800,000 HFCEVs including buses and forklifts.

Korea has hydrogen power stations and plans to build a 50 MW hydrogen fuel cell power plant in Seosan City. Korea currently has 12 hydrogen refuelling stations with 310 planned for operation by 2022. The Korean government has ordered 5000 Hyundai Nexo HFCEVs.

Hydrogen vehicle uptake has increased in European countries such as Germany, Italy, France, and the UK. Hydrogen buses are a core part of their clean air strategy. Over 10 million kilometres have been driven by fuel cell buses in these countries up to March 2018.

Government financial support has assisted the rollout of hydrogen infrastructure and HFCEV across these countries.

How the Government can assist

Australian governments could support a zero-emission vehicle future via the following initiatives:

Infrastructure

- Funding support for initial infrastructure, such as production, storage and dispensing;
- Developing consistent national codes and standards; and,
- Consideration of dedicated private-public consortium to coordinate industry/government funds and optimise station roll out.

Vehicles

- Government fleet procurement guarantees (used vehicles flow to the consumer market);
- Government commitment to zero emission fleets (including targets for public transport);
- Incentives to overcome new technology premiums (including Luxury Car Tax concessions);
- Equal treatment between HFCEV and BEV with respect to Fuel Excise; and,
- Consumer education.

Conclusions

By 2030, Woodside expects to see hydrogen production at-scale around the world. Australia has an opportunity to participate in this export opportunity, to enable high levels of renewable generation and create export jobs and growth.

Woodside, as Australia's largest independent energy company, is uniquely positioned to facilitate this opportunity. Its LNG is already being used for overseas hydrogen production and its strong relationships in LNG markets position Australia for success.

We believe there is an opportunity for Australia to grow our export market. To do this, it is essential that domestic infrastructure and knowledge is developed which in turn will provide new job opportunities. However, just like the development of the LNG industry in the 1980s, government support is essential to secure a domestic market that enables the export opportunity.

Both Japan and Korea have already signalled their firm intentions to move to hydrogen for transportation, heat, and power to meet their Paris Agreement targets. Woodside has signed hydrogen-related non-binding Memorandum of Understanding (MOUs) with Korea Gas Corporation and Pusan National University in Korea, and is in discussions with overseas counterparts who have expressed their intention to work with Woodside in this transition.

HFCEV technology is mature, and consumer adoption is growing. Battery electric vehicles are complementary to hydrogen electric vehicles (both use the same platforms and power-trains). While battery and fuel cell vehicles have zero emissions, the HFCEV has longer range, and faster refuelling times.

Australia has the right base of available natural gas, renewable resources, innovative people, leadership and partnerships to make the adoption of hydrogen fuel cell electric vehicles a success.

It is recommended that the Committee ensures that hydrogen fuel cell electric vehicles (HFCEVs) are considered in any narrative that discusses electric vehicles and their uptake in Australia.

Yours sincerely

Shaun Gregory
Executive Vice President
Exploration and Technology
Woodside Energy Ltd.

Enc: Attachment A: Hydrogen Value Chain

HYDROGEN VALUE CHAIN

NATURAL GAS

STEAM REFORMING

Gas reacts with high temperature steam to separate Hydrogen from both the water and gas.

RENEWABLE ELECTRICITY

ELECTROLYSIS

Green Hydrogen is generated from water using renewable energy and electrolysis.

CO_2 MANAGEMENT

Carbon emissions are offset by tree planting, revegetation, and carbon projects.

TRANSPORT & STORAGE

Hydrogen can be distributed and stored like natural gas

LIQUEFACTION & EXPORT

Hydrogen is transported via ship to export markets overseas like Japan, Korea and China.

ZERO-EMISSIONS TRANSPORT

Fuel-cell vehicles have long range, are efficient, and only emit water.

CLEAN CHEMICALS

Hydrogen can help create carbon free chemicals that we use every day.

POWER GENERATION & STORAGE

Carbon free energy can be stored and power generated when renewables are unavailable.