Australian Government
Chief Scientist

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WEBINAR

Sometimes people refer to me as Captain Hydrogen. I like that. I like cool titles, such as Australia's Chief Scientist.

But actually, cool as it is, Captain Hydrogen is too narrow. It should actually be Captain Hydrogen and Hydrogen Derivatives.

But that is too much of a mouthful! The point is, clean hydrogen is not just important in its basic form but also in its derivatives, in particular ammonia.

I must admit, up until a couple of years ago, I only thought of ammonia as the main ingredient in toilet cleansers. But my viewpoint has expanded from a small bowl of spiralling water to the expansive oceans of planet Earth.

Today, the merchant ships navigating the oceans are responsible for nearly 3% of global emissions of carbon dioxide.

And if the industry does not reform, the share of carbon dioxide emissions would grow as other sectors of the global economy improve.

As you know, in recognition of this, the International Maritime Organisation has set a goal to halve fleet emissions by 2050 based on 2008 levels.

That's more difficult than it sounds because during the next thirty years the number of ships crisscrossing the oceans will increase.

To achieve the target, most new vessels commissioned in coming years will need to have a zero emissions propulsion system.

Simply shifting from bunker fuel to compressed natural gas would not be sufficient to halve the emissions.

And for reasons I will not go into now, biofuels or synthetic carbon-based fuels are unlikely to ever be available in the quantity required.

That leaves clean hydrogen, or clean ammonia made from clean hydrogen.

Comparing the two, both would work as a fuel, but there are some reasons why ammonia is likely to be preferable in shipping.

First, although it has a lower energy density by mass than hydrogen, it has a better energy density by volume. Volume is likely to be more of a consideration than mass.

Second, on-board handling is much easier, because ammonia can be kept in its pure liquid form at all ambient temperatures in tanks at just a few tens of atmospheres of pressure. Liquid hydrogen only exists at an incredibly low temperature, just 20 degrees above absolute zero where all the hydrogen molecules would stop vibrating. Thus, liquid hydrogen requires very sophisticated tanks and handling.

Third, international trade and stockpiling at hubs such as Singapore will be easier for ammonia than for hydrogen.

When considering the prospect of using ammonia as a maritime fuel, at first I thought that the ammonia would be used in fuel cells to generate electricity to drive electric motors.

And it could be.

But as it happens, it can be also used directly in modified marine diesel motors.

That would be an incredibly easy and convenient transition.

The main challenge is nitrogen oxide production – the so called NOx emissions – but I am confident that engine designers will solve that problem. I don't know how, but they will.

It is great to see that the shipping industry is actively exploring the use of ammonia as a marine fuel. For example, the world's largest manufacturer of marine diesel engines – MAN Energy Solutions – has an active program to develop diesel engines to safely run on ammonia.

Beyond 2030 it is likely that we will see giant ships powered by clean ammonia made from clean hydrogen.

There are other applications in which clean ammonia holds great potential to contribute to a low-carbon future. It can be used to make clean fertilizer, as an industrial chemical feedstock, as an energy carrier, and as a fuel for electricity generation.

Let's, though, consider its use as an energy carrier.

To export solar and wind energy from one continent to another, the sunshine and the wind energy will have to be packaged as a liquid.

The two leading contenders are liquid hydrogen and liquid ammonia.

The jury is out.

In my opinion, both will be used.

And the volumes in both cases will be huge.

Between them, we are talking a trillion dollar industry by 2050

The National Hydrogen Strategy recognises the potential for clean hydrogen and clean ammonia, and agrees that hydrogen production for clean ammonia exports should be a priority for research, pilots, trials and demonstrations.

Increasing demand for hydrogen, including for use in ammonia production, could generate thousands of jobs and contribute to the growth of the economy.

Development of a certification scheme will be important for building a clean hydrogen industry and facilitating international trade. Certification will allow the emissions profile of every kilogram of hydrogen produced to be tracked.

Work is underway to establish a common international methodology for certification of hydrogen production, and we are also consulting with our domestic industry on their requirements.

The hydrogen certification scheme will, ideally, be applicable to the certification of clean ammonia, thereby ensuring the confidence of our trading partners.

I commend the Ammonia Energy Association for identifying the huge opportunity to use clean ammonia as the marine fuel of the future.

Our planet needs visionary thinking like this.

Enjoy further, far-sighted discussions at today's conference.

May the Force be with you.

Thank you.