# Submission to Update of National Hydrogen Strategy

August 10, 2023

## Introduction

The German-Australian Chamber of Industry and Commerce (AHK Australien) supports German businesses and their local subsidiaries through information, events, networking, and political support. In Australia, the Chamber has about 300 members, a strong local board, and hosts a number of relevant events and committees.

The Chamber actively participates in the bilateral Energy Partnership between Germany and Australia through chairing the sub-working groups for Hydrogen, through its Energy Cluster, and through its German-Australian Hydrogen Alliance.

As a Chamber of Commerce Abroad (AHK), AHK Australien is part of a global network and partially supported by the German Federal Ministry for Economic Affairs and Climate Action on the basis of a decision of the German Bundestag.

## Summary


> Demand for low-carbon fuels in aviation and maritime is growing exponentially – "a $40 to $50 billion global market .. by 2030" [1]. Australia is in a prime position to supply the Asia-Pacific region due to its geographical location and natural resources. However, biofuels represent only a limited and perhaps even counter-productive option (see below). "Power-to-Liquid (PtL)" or "e-fuels", made from hydrogen and carbon dioxide using renewable electricity, are carbon-neutral. Australia has the potential to produce them in sufficient amounts to cover a great share of the demand.
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> A related opportunity lies in the production of e-methane (gaseous hydrogen plus carbon dioxide) to transport hydrogen utilizing the same infrastructure that natural gas is using today.
>
> Both e-fuels and e-methane can use existing engines and infrastructure as they are chemically the same as fossil fuels and natural gas.
>
> The bottleneck lies in the availability and certification of carbon dioxide. Hence, to leverage this potential, Australia needs to adopt a Carbon Management Strategy.


## I e-fuels

### Demand:

With the rising global demand for alternative jet fuel to decarbonize the aviation sector, as well as the IMO having announced Net Zero by 2050 just in July 2023, low-carbon fuels will be experiencing

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[1] The Road Ahead for Low-Carbon Fuels | BCG, January 2022

a massive uptake. Australia is the only hub in the Asia Pacific region that has massive opportunities for global-scale renewable energy, given its land-to-population ratio, sun radiation, wind intensity as well as established infrastructure and work force. It is therefore in a prime position to serve the Asia-Pacific market (15% of the world population) by supplying those crucial fuels to both aviation and maritime.

### *Maritime:*

With increased demand for shipping, the maritime industry is estimated to account for 13% of global emissions by 2050[2]. It is likely to transition to ammonia and methanol (from biomass or hydrogen) as a fuel of the future. However, the jury is still out whether ammonia will receive environmental clearance due to NOx emissions and, more importantly, safety risks. In any case, vessels will thus far have to be made specifically for ammonia propulsion, whilst most existing vessels can be retrofitted to methanol. Given there is between 90,000 and 100,000 vessels out at sea, with a 30-year life span, not all of them will immediately be scrapped and replaced by new ones.

Methanol and e-Diesel are hydrogen-based options that can be used immediately, either with minor modifications to the vessels (methanol) or none at all (e-Diesel).

### Opportunity for Australia:

Singapore is the bunkering hub of the Asia Pacific region. It will need to replace current fossil shipping fuels with low-carbon fuels. Australia can supply fuels to Singapore and become a second bunkering hub[3]. NB: Australia will be able to supply both bio-methanol and e-methanol; however, bio-methanol will be contingent on biomass and entails the problems of biofuels outlined below. Both go by the name of green methanol. In addition to methanol, e-diesel can be provided to use on vessels without the need for any modification.

### *Aviation:*

Aviation accounts for approximately 2 to 3% of global CO2 emissions, and as air travel is expected to double in the next 15 years, these numbers will grow rapidly. The International Air Transport Association (IATA) – which includes Virgin and Qantas - is committed to net-zero carbon emissions from the global air transport industry operations by 2050, and Japan will have a mandate of 10% sustainable jet fuel for airlines by 2030. In the foreseeable future, larger aircraft will neither be propelled by batteries nor by hydrogen, due to the weight of batteries and the space hydrogen takes up. Therefore, e-kerosene will be the only option to decarbonize this sector at scale. Bio-jet-fuels can make up for a portion of it, but by far not enough to reach double-digit numbers across the board, only perhaps in select locations.

In addition, "synthetic jet and bio-jet fuels burn much cleaner than their traditional counterparts, leading to lower greenhouse-gas emission. (…) Factors such as technological maturity and cheaper renewables have started to accelerate the transition of large portions of the market towards renewable fuels such as hydrogen. A 2020 study conducted by CSIRO and Boeing suggests that, due

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[2] Emissions-free sailing is full steam ahead for ocean-going shipping | Research and Innovation (europa.eu)

[3] Port of Melbourne working to fuel ships with Tasmanian, Victorian green methanol (afr.com)

to their energy per volume, sustainable aviation fuels produced from hydrogen will be the fuel of choice for medium- to long-haul flights out to 2050."4

### Opportunity for Australia:

Australian jet fuel demand is likely to be increasing by 75% from 2023 to 2050[5]. Sustainable aviation fuel (SAF) demand is estimated to be 500m tons[6] by 2050 and to represent a $100-250 billion market by 2030. Australia could provide the regional market with e-kerosene.

### Solution: e-fuels

Whilst biofuels can account for a small percentage of carbon-neutral fuel, biomass as a feedstock is very limited and its supply even more unpredictable with rising climate change ramifications. In addition, biomass can compete with food crops and has a high carbon footprint due to the fuel used to produce, fertilize, harvest and transport it. In fact, "CO2 emission factors for biofuels might even exceed those for fossil diesel combustion due to large-scale land clearing related to growing biomass"[7][8].

E-fuels – "e" because (renewable) electricity is used to split water into hydrogen and oxygen – consist of hydrogen and carbon dioxide or monoxide. With sufficient renewable power and water in place, its supply can be endless and not dependent on climatic conditions, fertilizers, droughts, floods, or pathogens.

Also called Power-to-Liquid, e-kerosene and -diesel are produced using the well-established Fischer-Tropsch process that has been applied to turn gaseous hydrogen and carbon into liquid hydrocarbons for almost 100 years, while e-Methanol and DME are made from syngas (hydrogen and CO/CO2).

Companies such as Sasol (SA) in a JV with Topsoe (Denmark), HIF Global (USA), Iberdrola (Spain), ABEL Energy and HAMR (Australia), and Ineratec (Germany) have demonstrated their capacities in this field.

## II e-methanation:

### Demand:

Australia is aiming to produce and export huge amounts of green hydrogen. However, hydrogen does not lend itself to being transported as is. Rather, due to its huge volume, it requires further energy input to

a) Compress

[4] Defence and commercial aviation need to work together to transition from fossil fuels | The Strategist (aspistrategist.org.au)

[5] Sustainable aviation fuel opportunities for Australia - CSIRO

[6] Waypoint 2050 : Aviation: Benefits Beyond Borders (aviationbenefits.org)

[7] Worse than diesel and gasoline? Bioenergy as bad as fossils if there is no pricing of CO2 emissions from land-use change — Potsdam Institute for Climate Impact Research (pik-potsdam.de)

[8] World Economic Forum – Insight Report November 2020 - *Clean Skies for Tomorrow: Sustainable Aviation Fuels as a Pathway to Net-Zero Aviation*

b) Liquefy
c) Convert into ammonia
d) Convert into LOHC or metal hydride

with all the associated costs, such as ammonia crackers or LOHC dehydrogenation, involved.

### e-methanation

A solution to this problem is to bind the hydrogen atoms to a carbon atom, simply resulting in synthetic methane ($CH_4$). All existing natural gas infrastructure, standards and processes can be used to safely and efficiently export and transport hydrogen. To avoid emissions, the carbon can be captured as carbon dioxide at the site of arrival and sent back to the point of origin (or wherever else it might be needed). Carbon dioxide can be sent back using established routes and vessels. Using a closed loop for the carbon fraction, the emissions would be negligible and costs of transport reduced. Alternatively, the e-methane can be used as is, still avoiding the methane leakage that occurs in fossil natural gas production as well as fossil $CO_2$ emissions (e-methane can also be liquefied, hence e-LNG.)

Among the proponents of this technology are ATCO/Santos/Osaka Gas and TES-H2.

## III Challenge:

E-fuels and e-methane fulfill the need to de-fossilize whilst requiring a carbon source to "package" hydrogen into a transportable hydrocarbon.

There are three reasonable choices for the carbon source:

a) Biogenic (from biomass)
b) Carbon capture (from hard-to-abate sectors or refineries)
c) Direct Air Capture (DAC) – with carbon capture from sea water once commercial.

Biomass, as said before, is only available in sufficient quantities in select spots.

The only commercially viable sources would be carbon capture in a transition period, until all sectors can be de-fossilized and direct air capture has reached commercial scale and price.

## IV Solution:

We hereby recommend

a) the government enable CCU (carbon capture and use) from
   a. waste combustion (simultaneously avoiding methane emissions from landfill)
   b. hard-to-abate sectors

   e.g. via secure environment for long-term investment at point sources where a more sustainable solution like electrification is not possible,
   and/or massively support

   c. direct air capture, e.g. as developed by the CSIRO (awaiting investment to scale up, currently in pilot phase)[9], and
   d. carbon dioxide capture from the sea, where it is 100x more concentrated,

   to ramp up carbon dioxide availability as soon as possible.

b) certification includes credit to the carbon source, making e-fuels less carbon intensive than fossil fuels due to recycling carbon that was going to be emitted anyway, or carbon-neutral when using DAC.

## V Related measures in other countries:

- NZ: In February 2023, Airbus, Air New Zealand, Christchurch Airport, Fortescue Future Industries, Hiringa Energy, and Fabrum establish The Hydrogen Consortium, a joint technology partnership to advance hydrogen powered aviation
- US incentivises eJet producers with tiered credits of $1.25-1.75 per gallon depending on percent reduction of lifecycle GHG emissions, $130 per ton of CO2 utilized through DAC (45Q), $3 per kg of green hydrogen (45V)
- EU parliament created roadmap until 2050 peaking at 70% blending mandate with SAF that has 80% reduced lifecycle GHG emissions
- EU: Mandate for 1-2% RFNBO by 2034 (maritime); jet fuels: 6% in 2030, 70% in 2050 (of which 30% synthetic=e-kerosene)[10]; considering traditional jet fuel tax but leaving financial incentives to member states
- Japan will have a mandate of 10% sustainable jet fuel for airlines by 2030
- Panama: From 2030, 5% of bunker fuel available to vessels in the Canal's maritime infrastructure will be either hydrogen or its derivatives by 2030, rising to 30% by 2040 and 40% by 2050. Seeking to form intergovernmental consortium at COP28.

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[9] Climate control: U.S. will invest $1.2B in direct air capture initiatives (msn.com)
[10] HQM_Issue-3_website.pdf (hydrogeneurope.eu) p. 23ff