OWNING OUR FUTURE

THE CASE FOR AVIATION BIOFUELS

Tourism & Transport Forum submission to the Department of Industry's Energy White Paper

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TTF AUSTRALIA
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Executive summary

Time to secure Australia's aviation fuel supply

Fuel accounts for up one-third of an airline's operating expenses [(1)]. If oil prices are too high, then tourism suffers indirectly, as fuel surcharges push up ticket prices, dampening demand for travel to Australia. The good news is that oil prices are currently at record ten-year lows after a period of relative stability [(2)]. But conflict in Syria and Iraq has the potential to drag oil production back into the fray, creating longer-term problems for all oil-dependent industries such as air transport.

Currently, some 90 per cent of Australian liquid fuels are imported as just four Australian refineries remain in operation [(4)]. Domestically-produced aviation fuel is even scarcer, since most Australian crude is not of sufficiently high grade for jet aircraft fuel.

Tankers, largely from Singapore refineries, fill the gap. Last year Australia imported 3.5 gigalitres of aviation turbine fuel (jet fuel), roughly the equivalent of its petrol imports (5). Unlike standard petroleum for road transport, there is very little buffer: Australia only has 12-17 days' supply of aviation fuel, compared with some 60 days of road fuel (4). One off-specification, delayed or hijacked tanker would, therefore, be catastrophic for the air transport industry and could trigger serious flight cancellations across the country.

Australia is not alone in being concerned over fuel security. Yet unlike other countries, very little is being done to secure synthetic alternatives to conventionally-produced petroleum products.

The US is the leader in synthetic fuel research, chiefly thanks to a desire to power its military from domestically-produced fuel. Some 28 of the 50 states have synthetic fuel refineries either planned or in progress. The US Navy has a target to halve its petroleum use by 2015 and source 50 per cent of its energy from non-fossil fuel sources by 2020 [(6)].

The European Union, too, is working to ensure biologically-derived synthetic fuels (biofuels) are brought to the mainstream. The EU's motivation is environmental: biofuels do not result in fossil carbon being released into the atmosphere. Instead, the carbon in a biofuel was previously absorbed from the atmosphere by photosynthesis. Today half of all biofuel production takes place in Europe.

The huge commercial potential of the sector for agricultural producers has caught the eye of other countries, with Brazil, Japan, India, Malaysia and Indonesia investing heavily in biofuel production. Existing science allows almost any organic matter to be used as feed stock to synthetically produce a fuel identical to the conventional version. This includes many low value by-products of existing crops, such as sugar cane mulch or agricultural waste.

This alone should be motivation for the Australian government to act seriously on synthetic fuels. We have ample suitable land and farmers wanting to diversify into new crops that bring good returns. Australia should be in the vanguard of this burgeoning cash crop opportunity.

This new reality can only be achieved if biofuels are embraced as an alternative, long-term source of aviation fuel. For this to happen, the federal government must take the lead. Like in the US, biofuels' military application can provide the impetus for significant investment.

1. Tourism is a super growth industry

Manufacturing is declining. The mining investment boom is waning. Against the backdrop of an economy in transition, tourism continues to emerge as one of the foundations of Australia's future prosperity. Australian tourism offers high employment opportunities, a rapidly expanding base of potential customers and a strong competitive advantage. Tourism is already Australia's largest service export, directly employing almost three times as many people as the mining industry, and generating expenditure of over $100 billion every year - more than all our primary industries combined.

The significant potential of Australia's tourism industry was highlighted in the recent Deloitte Access Economics report *Positioning for Prosperity.* The report identified tourism as one of Australia's five super growth industries capable of collectively delivering an additional $250 billion to the national economy over the next 20 years [(7)]. This potential is contingent on good government policy.

The Australian government, together with all the states and territories, has endorsed an aggressive tourism target as part of the Tourism 2020 strategy. Very strong growth in Asian visitor spending, the fastest growing segment of Australia's visitor economy, underpins the target of doubling nominal overnight visitor spending from $70 billion in 2009 to $115-140 billion by 2020. But at the moment even the lower end of the range seems out of reach.

Critical to delivering the upper bracket of the growth target is maintaining airline capacity from Asia. Australia is almost uniquely dependent on air access for its tourism arrivals, with almost all visitors to Australia arriving by air.

Together with intergovernmental treaties on air services, the federal government has a responsibility to ensure the air transport industry has adequate fuel supplies. Uncertainty of supply would significantly impact on airlines' perception of Australia as a destination and would hamper airline attraction efforts made by our state tourism organisations. Two off-specification deliveries could impact the longevity of the air transport network in Australia, ultimately creating chaos.

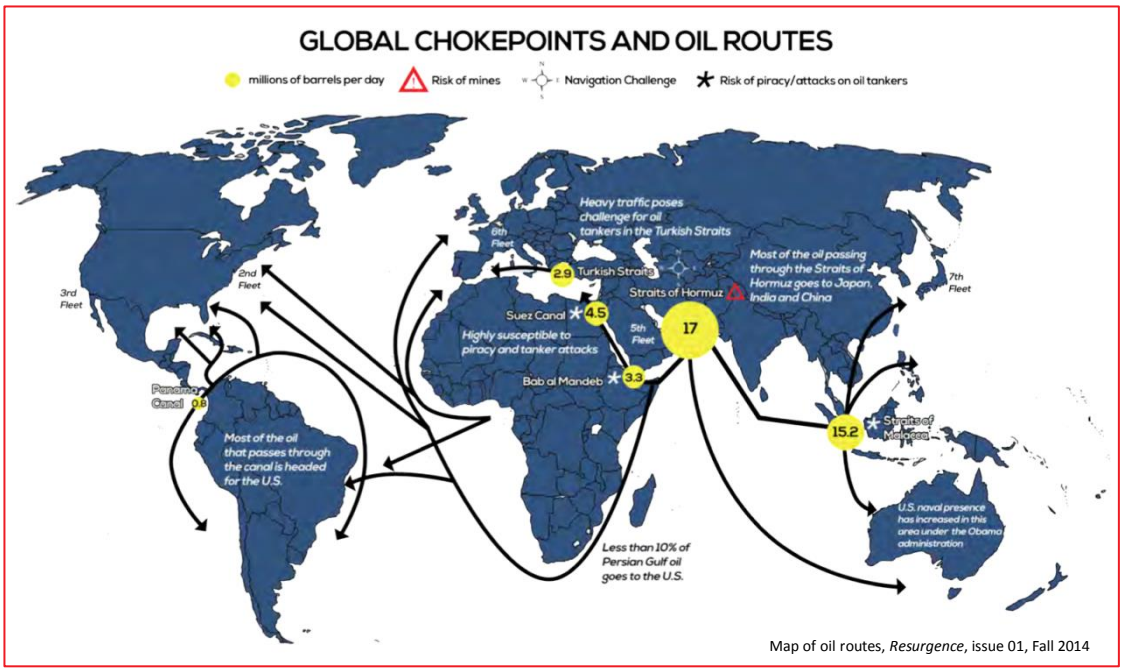
Supplies of aviation kerosene have remained largely stable over the past decade despite a rapid decline in domestic refining capability. This is more by luck than design and there is a potential for reputational risk if the supply lines of fuel from Singapore and the Middle East were interrupted.

2. Fuel security

Australia is heavily dependent on imported oil. Recent reports by the New South Wales roadside assistance provider National Roads & Motorists Association have painted the picture starkly: our dependency on crude oil has risen from 60 per cent in 2000 to over 90 per cent today [(4)]. Indeed, Australia is the sole signatory to the International Energy Agency treaty on fuel stocks that fails to meet the 90 days' supply target.

As of June 2014, Australia had 30 days' worth of liquefied petroleum gasoline in storage, 19 days of petrol, and 17 days of aviation fuel and just 12 days of diesel [(8)]. Closure of Australian refineries has made this situation worse, with some specific-grade fuels such as military aviation kerosene (F-44) under serious threat. It is likely that the Royal Australian Navy helicopters will have to be fuelled using imported F-44 in any future conflict [(9)].

Furthermore, many believe our low level of supply could be deliberately targeted either through diplomatic efforts as a protest against Australian foreign policy or by terrorist organisations. This latter theory appears to have been backed up by the first edition of al-Qaeda's English-language magazine, which a map showing the major shipping routes used by fuel suppliers between Asia and Australia (see below). The article's author urged followers to sabotage ports and ships to disrupt our fuel supply [(10)].



Map of oil routes, *Resurgence*, issue 01, Fall 2014

The current supply arrangements couple a reliance on international fuel imports with a lack of airport fuel infrastructure and competition at airports. This regularly leads to potential and actual shortages of jet fuel availability at Australian airports. In recent years it has, on several occasions, led to fuel rationing, cancellations of flights and expensive transhipment of fuel by airlines [(11)].

Another fuel supply challenge for aviation is the lack of capacity, investment and competition for aviation fuel supply at major airports. It leads to increases in costs and fuel supply issues for airlines. Any additional costs on fuel have an impact on an airline's cost base and competitiveness.

3. Biofuels as a sustainable alternative

To deliver greater fuel security, Australia needs to develop alternative sources of fuel. Today, some 97 per cent of all the energy consumed by our vehicles and aeroplanes remains petroleum-based, which is a non-renewable resource that is fast diminishing [(12)].

Airlines, air traffic management providers and aircraft manufacturers are all working together to reduce fuel consumption in the air transport sector. However, unlike other modes of transport where hybrid-electric technology, electrification and alternative fuels such as liquefied natural gas, liquefied petroleum gas, compressed natural gas and hydrogen can be substituted for internal combustion engines, airlines have no alternative in the medium term but to use kerosene.

There are, however, alternative sources of kerosene available. Liquid fuels derived from organic materials such as waste plant and animal matter, aviation biofuels, have been proved globally to be capable of being chemically-identical to oil-derived kerosene products. For this reason airlines are investing significant time and effort to understand and help facilitate the commercialisation of aviation biofuel production in Australia. The development and use of aviation biofuel is the only initiative through which the aviation industry can materially reduce emissions, address fuel costs and price volatility, while continuing to grow.

Aviation biofuels represent a high-growth future industry where Australia could hold a strong competitive advantage. Australia's well-established agriculture sector and large areas of non-arable or semi-arable land present an ideal opportunity for a biofuel. A 2011 study by the CSIRO, supported by the aviation sector, found that such an industry is feasible and, over the next 20 years, could generate more than 12,000 jobs and decrease greenhouse gas emissions by 17 per cent in the aviation sector [(13)].

Airline initiatives in sustainable aviation biofuel

Air New Zealand

In 2008, Air New Zealand operated the world's first commercial aviation test flight powered by a sustainable second-generation biofuel. The flight was a joint initiative of Air New Zealand, airframer Boeing, engine manufacturer Rolls-Royce and the UOP (formerly Universal Oil Products) fuel division of aviation supplier Honeywell. A study published after the flight found the biofuel blend used actually out-performed conventional Jet-A1 by around 1.2 per cent, due chiefly to its higher net heat of combustion.

Qantas Group

In 2012, Qantas operated Australia's first commercial biofuel flights from Sydney to Adelaide, followed a few weeks later by a Jetstar flight from Melbourne to Hobart (a world-first for a low cost carrier). Both flights were operated with a 50 per cent blend of aviation biofuel with traditional jet fuel in one engine. The purpose of both flights was to raise awareness and highlight the need for a sustainable aviation fuel industry in Australia.

Cathay Pacific

Cathay Pacific is leading efforts to establish an Asian chapter of the Sustainable Aviation Fuel Users Group (SAFUG), an organisation designed to accelerate the commercialisation of sustainable jet fuel. The carrier is also a member of the Roundtable on Sustainable Biofuels, an international initiative hosted within the Swiss Federal Institute of Technology in Lausanne, Switzerland whose aim is to develop a global certification standard for sustainable biofuels.

4. Australian agriculture and biofuel production

As noted by the CSIRO's *Sustainable Aviation Fuel Road Map*, Australia has strong potential for producing bio-derived jet fuel. The report outlines key advantages Australia possesses in the production of biofuels.

The geographical landscape of Australia, its suitable climate zones and considerable land base to produce biomass feedstock are key natural advantages [(13)]. In particular, Australia's most productive zones are along southern and eastern coasts, varying by feedstock source. This means that waste from Australia's higher value crops such as sugar cane in Queensland can be used to produce biofuels. Additionally, algae feedstock production in Australia could use Australia's vast areas of land with low agricultural potential using grey or sea water.

Additionally, developing a lignocellulose biofuels industry in Australia is advantageous. Biomass crops can be used to add value to existing rural industry processes and provide unique opportunities for new agricultural industries to be developed. In less productive agricultural lands, woody shrubs and perennial grasses can be grown with few inputs, competing less with land and water resources needed for food crops.

This has led foreign investors to purchase large tracts of otherwise non-arable land in developing nations on which to grow crops destined for biofuel production. Since 2000, over 37 million hectares of land acquired in Africa, Asia, and Latin America is earmarked for future biofuel projects, making it the single largest motivator [(14)].

Unlike many of these countries, Australia has a stable geopolitical climate, as well as comparative advantages in construction, research, development and efficient agricultural production. By developing suitable infrastructure and technology to produce biofuels in Australia, this will create skilled jobs in remote areas of Australia, including Victoria, Queensland, South Australia and the Northern Territory.

Despite these natural advantages, Australia already lags behind countries such as the United States where targeted agriculture, energy and defence policy have all contributed to a large and growing advanced biofuels industry. As a result of these policies, such as the Renewable Fuel Standard, more than US$5.8 billion in private capital has been invested in the United States in building an advanced and cellulosic biofuels industry. Furthermore, 28 out of 50 states now have at least one existing or planned bio refinery [(15)].

Yet in Australia, according to the Biofuels Association of Australia, in-depth production of aviation biofuels is yet to occur. Qantas, in partnership with Shell Australia, conducted a feasibility study to understand the economic conditions under which an aviation biofuel industry in Australia could be viable, using existing supply chain and refining infrastructure.

The study, supported by a $575,000 grant from the Australian Renewable Energy Agency (ARENA), represents the most detailed investigation to date regarding the commercial viability of the end-to-end aviation biofuel supply chain in Australia for currently certified production pathways. The study found that, while technically feasible, a number of challenges need to be addressed to make an aviation biofuel industry in Australia viable. Of particular importance is the need to address feedstock volume and economics as well as supportive policies to help incentivise production of aviation biofuel [(16)].

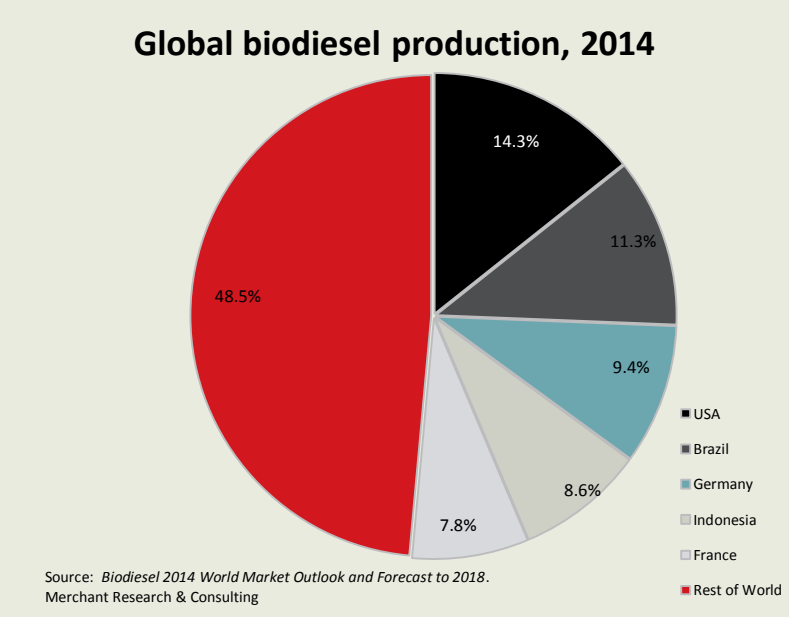
One such policy, introduced by a previous federal government was the Second Generation Biofuels Research and Development Program. This project has now been abandoned, along with commitments made to retain the effective excise free status of renewable biofuels until 2021 [(17)].

In 2009, the US Secretary of the Navy developed the initiative of a 'Great Green Fleet', to include ships and aircraft to be powered using alternative energy sources. The purpose of this goal was to decrease the US Navy's reliance on foreign sources of oil. With the fleet planned to be deployed by 2016, and partaking in a Pacific tour, the Royal Australian Navy has aimed to make all of its ships and aircraft biofuel-capable within six years. Without investment in the biofuel sector, this poses a massive challenge for the federal government.

5. Global comparisons

Without investing into the biofuels sector, Australia will fall further behind the world leaders. The United States leads the world today in production of biofuels. Petrochemical research specialist Merchant Research & Consulting found that in 2014, it will account for some 15 per cent of global production [18]. Much of this is ethanol, which is credited with having created over 150,000 jobs and generating over $3.5 billion in taxes (19).

Although European countries France and Germany are also large producers of biodiesel, developing nations are also gaining footholds in the emerging market, notably Brazil and Indonesia (see chart). These countries are attracted by the agricultural potential of supplying a lucrative new energy sector. Many of these countries have supportive government policies for biofuel production.



- **Brazil:** Government policy in Brazil has played a significant role in the development of the biofuel industry, reducing registration fees for biofuel-run cars as well as ensuring biofuel sources are available at all fuel stations. Over 57 per cent of the cars in Brazil today are able to run on either petrol or ethanol [20].
- **The European Union:** European biodiesel production was almost 10 million tonnes in 2010, or over half the world's output [21]. The European Union's attention has shifted to setting up sustainability systems to verify that the biofuel used in the various countries complies with the Renewable Energy Directive's criteria.
- **China:** As the world's third biggest nation biofuels producer, China has highlighted biotechnology and new energy as strategic industries in its 12th Five-Year Plan, which sets a target of renewable energy consumption of 11.4 per cent by 2015 [22]. China aims to source 30 per cent of its aviation fuel from biofuel by 2020 [23].
- **India:** The National Biofuel Policy was introduced in 2008 with a target of meeting 20 per cent of its diesel demand with biodiesel and 10-20 per cent of its petrol production with bioethanol [21]. Legislation ensures bio refineries do not source feedstuff from food-producing agricultural land [24].
- **Indonesia:** The Indonesian government has firmly committed to developing biofuels as an alternative energy source, creating the National Biofuel Development Team and providing fiscal incentives, investment guarantees and protections to encourage international and domestic investment into biofuel production [25].

6. Aviation's quest for fuel price stability

Airlines are seeking long-term price stability as longer term price reduction. Unlike fossil fuels, which are prone to erratic price spikes, biofuels are renewable and thus less vulnerable to geopolitical instability. Even if commercial quantities of aviation biofuel were the same price as conventional jet fuel, it would still be invaluable as a hedge against price fluctuations.

There is a side benefit as well for the airline industry in reducing carbon emissions while maintaining growth. Currently aviation represents two per cent of global emissions, but is expected to grow to three per cent by 2050.

In light of this, the global air transport industry has announced aggressive targets to reduce fuel burn and thus emissions. The aviation sector already has an enviable record of improving its environmental performance over time [(26)]. In 2010, IATA consolidated previous efforts into three new targets for the global airline industry:

- Between 2010-2020: a 1.5 per cent average annual fuel efficiency improvement;
- By 2020: carbon neutral growth;
- By 2050: reduce net emissions by 50 per cent compared to 2005 levels.

These targets appear achievable. The aviation industry has already taken significant measures to reduce emissions largely through a strong focus on increasing efficiency. Over the past four decades, aircraft fuel efficiency has improved 70 per cent, with 23 per cent taking place in the last 10 years.

More efficient aircraft design

To date, aircraft and engine manufacturers have led the charge in reducing fuel burn through more aerodynamic fuselages and new turbofan technology.

For example, Boeing's 787 Dreamliner will consume some 17 per cent less fuel than the 757 it replaces. The US manufacturer has also reengineered existing aircraft types such as the 737 narrowbody to reduce fuel burn by an additional eight percent over today's most fuel-efficient single-aisle airplanes. Boeing's 737 Max range includes design updates like advanced technology winglets that reduce drag, optimising performance on longer flights. For airlines the attraction is commercial: Boeing predicts the 737 Max family of aircraft will save some US$112 million in cost to airlines over its lifetime [(27)].

European airframer Airbus has developed fuel efficient versions of its existing aircraft under the New Engine Option (neo) sub-brand. The A320neo has evolved from Airbus's current A320 with new engines and a refined design including curved wing tips. Airbus estimates that the A320neo family will reduce fuel consumption by 15 per cent against the current classic A320. Airbus currently counts over 3000 orders from airlines around the world, including 13 from Air New Zealand and 99 from Jetstar.

Key to the technological upgrades is the use of geared turbofan engines. These engines, such as the Pratt & Whitney PW1000G used on the A320neo, uses gears to separate the engine fan from the low pressure compressor turbine, allowing each of the modules to operate at optimum speeds [(28)].

Advances in air traffic management

Within the air traffic management sector, Australia is credited for being a reputable world leader in using air navigation technology to reduce fuel burn. Some of the most notable innovations include continuous descent approaches, flexible flight tracks and the Asia and South Pacific Initiative to Reduce Emissions (ASPIRE).

Continuous descent, for example, replaces traditional landing approaches where aircraft descend in successive steps from cruising altitudes to the runway. In a continuous descent approach, the aircraft flies from cruise altitude all the way down to the runway in one smooth and uninterrupted descent. Under ideal circumstances, a plane can practically glide into the airport with engines idling. This descent can last anything up to 20 minutes and can potentially save as much as 400kg of fuel per arrival [(29)].

The use of flexible flight tracks (flextracks) allows airlines to use jet-stream winds to their advantage and avoid strong winds. Airservices Australia calculates and publishes this flextrack information for airlines flying into and out of the Australian airspace, and allows aircraft to be speedier, cheaper to operate and more fuel efficient. Flextracks are now being used widely in Australia, Asia and the Middle East.

However, Australia has not taken advantage of the economies of scale it possesses in producing biofuels, which could be a potential growth area in the future.

Advanced biofuels

By the aviation industry investing in modern technologies that reduce the cost of fuel, as outlined above, the industry can be more competitive, benefitting both the domestic market and consumers.

However, the commercial reality is that with the increasing cost of conventional fuel, coupled with a limited supply of this resource, the aviation industry needs not only to reduce fuel consumption but also to invest in other forms of fuel if it is to continue to grow while reducing emissions.

The search for viable alternative aviation fuels has followed strict criteria when assessing their viability to ensure:

- Alternative fuels have the right energy density and performance characteristics to allow safe operation within the aviation industry (suitability);
- Alternative fuels are sustainable from an environmental and social perspective, and should not compete with food, land or water (sustainability); and
- Alternative fuels have the capability of being produced in a large-scale commercial environment (industrial capability).

The aviation industry has demonstrated a strong commitment to research and development focussed on fuel efficiency measures, which has delivered proven, consistent and substantial fuel efficiency gains over time. Despite this, alternative fuels hold the key to placing the industry on a low emission path in the future, and the rate at which this occurs. The challenge for industry going forward is commercialisation at an industrial scale, and the investment and infrastructure to support it.

The science of biofuels has largely been proved. Yet today, despite almost 2000 flights having been conducted using biofuels, the fuel still represents a very minor proportion. The barriers are price and quantity: without ongoing investment in commercialising these technologies they will not experience the economies of scale that come from optimising the production processes and engineering.

The production of aviation biofuels, particularly those derived from waste products or crops grown on partially-arable land, present a huge opportunity for Australia. Not only are Australian conditions extremely favourable for the cultivation of feedstock, but Australia is also well placed to become a production base for Asia. An Australian-based biofuel industry could therefore see Australia become a major exporter of aviation fuel as opposed to it being largely an import.

Australian airlines at a competitive disadvantage

Without local production, Australian air transport is also doubly penalised through costlier imports combined with global emissions trading schemes that will discount environmental levies for those airlines with access to domestically-produced aviation biofuels.

In 2013, the International Civil Aviation Organization (ICAO) agreed to develop a global market scheme to limit carbon emissions in international aviation [(31)]. Within this scheme, biofuel emissions will be exempt. As such, Australian airlines will be at a competitive disadvantage if there is no access for the local aviation industry to locally-produced biofuels.

Ultimately, an alternative fuel source would increase price competitiveness of the current aviation fuel market, where airlines consider themselves to be price takers. Airlines are calling for greater competition innovation from fuel suppliers to help create a more efficient air transport network [(32)]. Biofuels can be part of this future mix.

There is also a reputational risk through inaction on this front. Australia's reputation as a prime tourism destination could potentially be affected if European consumers change their decisions to travel based on perceived lack of government responsiveness to the prevailing climate change theory [(33)]. This is relevant in the face of efforts made by other economies to reduce greenhouse emissions.

7. Creating the conditions for local biofuel production

Given the structural change to Australia's fuel industry, including the closure of domestic refineries, the Australian government should encourage the creation of conditions necessary to allow the emergence of more competitive jet fuel markets. The real advances will only come if biofuels are embraced as an alternative, long-term source of aviation fuel. Ultimately, all industry participants will benefit from a more resilient, innovative and cost-efficient supply of jet fuel, and Australia should lead the way in this industry.

Instead, Australia lags behind both developed nations and also less developed nations in its biofuel production.

Investment is needed for Australia to catch up with the leaders in the field and become one of the first countries producing aviation biofuel in commercial quantities. Closed refineries could be converted, but at some cost, while incentives could entice foreign investors to base their activities in Australia.

Other governments have seized this opportunity. For example, in January Etihad Airways signed a cooperative partnership with Boeing, Total Oil and the Masdar Institute of Science and Technology to develop a comprehensive framework for a United Arab Emirates (UAE) biofuel supply chain. Despite the UAE being the ninth-largest producer of crude oil in the world, the initiative is supported by Takreer, a wholly-owned subsidiary of the state-owned Abu Dhabi National Oil Company [(33)].

There is already significant Australian technological expertise going offshore. In 2011 Virgin Australia entered a memorandum of understanding with Somersby, NSW-based biofuel company Licella to support the commercialisation of a new process that converts biomass into sustainable aviation fuel. The Australian invention, Catalytic Hydrothermal Reactor (CAT-HTR), uses water technology to produce high-quality synthetic crude oil from a wide range of different biomass, including agricultural and farm waste. However, through lack of government investment, the largest CAT-HTR facilities are now in California. Rather than see such investment go to waste, the Australian government should produce grants to encourage overseas producers to refine in Australia or use Australian feed stocks.

The government should also set targets for biofuel use within areas it can control. As in the United States, biofuels' military application can provide the impetus for significant investment and provide flow-on benefits for private industry. The Department of Defence needs to match the US's aggressive targets for biofuel use.

Given competing priorities, the Australian government has concentrated on alternatives to petroleum and diesel for road vehicles. Aviation fuel poses challenges due to its high specification. Yet the market is very substantial and the number of supply points infinitely smaller than those for automotive fuel. Alternative jet fuel is also able to be co-mingled in joint storage facilities and blended at any percentage with conventional fuel. This is not possible with ethanol into petrol, making aviation biofuel distribution logistically simpler.

Yet aviation biofuel is not currently prioritised by the government. Through the fuel tax credit programme, road haulage and other businesses users can claim 12¢ per litre of the fuel excise back when travelling on public roads and 38¢ when using private roads [(35)]. There is no similar rebate scheme applying to air transport.

There are certification roadblocks, too. The Civil Aviation Safety Authority (CASA) may seek to certificate biofuel standards in Australia despite there being existing, industry-led specifications from both the US and Europe on which CASA could base its certification. The prevailing global standards for Jet A-1 grade are the D1655 standard from the American Society for Testing and Materials (ASTM) [(36)] and the UK Ministry of Defence Standard

(DefStan) 91-91. ASTM D1655 and DefStan 91-91 have nearly identical requirements for Jet A-1 and as such Australia accepts fuel complying with either of these two standards as Jet A-1 [36].

In the US, there is a revised standard, D7566, developed by the ASTM Committee on Petroleum Products, Liquid Fuels, and Lubricants, which allows a biomass-based renewable jet fuel. The European Committee for Standardisation and its Brazilian counterpart Associação Brasileira de Normas Técnicas work collaboratively with the ASTM to ensure that this certification standard applies within their jurisdictions equally [38]. It would be both symbolic and provide a level of reassurance to potential foreign investors if the Australian government followed suit and formally recognised D7566.

TTF therefore strongly supports measures to accelerate the development of a sustainable aviation biofuel industry in Australia. Currently, the Department of the Environment has commenced developing direct actions to reduce Australia's emissions through initiatives including the Emissions Reduction Fund. One element of this strategy, the carbon farming initiative, would provide solid foundations on which to base biofuels investment [39]. In particular, to reduce emission intensification within the Australian transport sector, carbon farming would support fuel switching, or investing in a mix of energy sources. Whilst developments in this space will assist in the ability for Australia to both grow and own its future, TTF urges the federal government to ensure the legislation includes the air transport industry.

Australia should work towards closing the gap between its investment into emissions reduction and that of other world leaders. Namely, the recent announcement by China and the United States to limit emissions from 2025 [40] is in line with Australia's ambitions to reduce overall emissions. Government investment in biofuel production would help Australia achieve its targets in this area.

As demonstrated in this paper, there are fuel security benefits that would flow from investing in Australian-produced alternative fuels, the federal government will also need to demonstrate its commitments to carbon emissions reductions also needs new strategies to take to the United Nations Climate Change Conference taking place in Paris next year.

TTF urges the federal government to act to address the hole in Australia's transport industry fuel future.

Recommendations

1. The government should ensure the Energy White Paper includes a clear strategy to mitigate the potential for aviation fuel shortages in Australia
2. Air transport should be considered as a priority industry in the framing of the carbon farming initiative of the Emissions Reduction Fund
3. The Department of Defence should take the lead in setting targets for the use of sustainable biofuel in the Royal Australian Air Force and Royal Australian Navy aircraft fleets
4. Australia should seek to join the tripartite agreement between Brazil, Europe and the US to recognise ASTM D7566 as the global certification standard for aviation biofuel
5. The Department of Agriculture should review the biofuel potential of Australia's partially-arable and non-arable land
6. The Department of Industry should provide a programme of grants to encourage overseas producers to refine in Australia or use Australian crops

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