



## Session 1: Science matters - debunking some myths.

**Thursday 5 October, 3-4:30 pm AEST**

Paul Williams: Thanks so much for the presentation. the if I understood correctly the \$150-\$500M was from a 1997 article. If so, what are the modern numbers?

Prof Paul Williams 03:35 PM Hello Paul. Yes, the cost estimates need updating, although (partly because of commercial sensitivities) it is hard to find reliable recent estimates.

Thomas D. Pellegrin 03:17 PM Dr. Williams: thank you for this insightful presentation. Which climate SSP was assumed in predicting the increase in clear-air turbulence? Do you have a view on the likelihood of an SSP over another?

Prof Paul Williams 03:40 PM Hello Thomas. That was RCP8.5, which is a high-emissions future. As a physical scientist I'm not qualified to judge socioeconomic scenarios.

Prof Paul Williams 04:15 PM I am sure Brendan would have some good thoughts about this question.

Robert McLachlan 03:25 PM La Guardia was in fact flooded again last week.

Bruce 03:28 PM I live in a hot and humid Darwin. Hotter air holds more water. Have you modelled the impact of increased humidity on aircraft performance?

Thomas D. Pellegrin 03:37 PM Hi Bruce, I'm sure Dr. Williams will have his view, but in the meantime - my doctoral research did account for humidity as a variable (<https://commons.erau.edu/edt/720/>). You might find it useful.

Prof Paul Williams 03:42 PM I would echo Thomas's response. Changing surface winds on the runway are also a factor for generating lift (which we have included in our studies).

Mark Holmes (he/him) on Gadigal Land 03:30 PM Thanks Dr Williams for your insights. A lot of research has been conducted in the North Atlantic and very recently North Pacific (South Korea). Do you know if there has been research conducted on the five-weather metrics/phenomenon you mentioned in the graphic in the Australian/New Zealand context. I.e. - trans Tasman or transpacific flying?

Prof Paul Williams 03:47 PM Hi Mark. Thanks for raising this very important point. Indeed, a lot of the early focus has been on the northern hemisphere. My group have now published turbulence projections for the whole globe, but for the other impacts I think we urgently need new research on the Australian/NZ context.

AJ IQ 03:34 PM (Ok, I simply have to admit that I've written "following Lee et al" so many times in various reports that I'm having a fanboy moment. If I have to ask a question, I guess the only one I have is "will you autograph my copy the '91 special report?")

Chantal James 03:35 PM :D glad we could help you connect.

Paul Newsham 03:36 PM Dr. David Lee - thank you so much for participating from holiday.

Chantal James 03:37 PM We will certainly pass along your kind words :)

Prof David S. Lee 03:55 PM Thanks Paul, you will be probably pleased to know it is a domestic holiday - no flights!

Alex M 03:59 PM We both live in marvellous countries. Why leave?

Michael Bryan 03:50 PM Is it possible to get a link to Prof. Lee's paper on this subject?

Prof David S. Lee 03:52 PM <https://www.sciencedirect.com/science/article/pii/S1352231020305689>

Ella Maria Llanos Rodriguez 04:10 PM What share of global CO2 emissions come from aviation?  
Thanks

Prof Brendan Mackey 04:16 PM as a percentage of annual global emissions: CO2 2.5% CO<sub>2e</sub> 3.5%

Polly Lomas 04:14 PM Amazing presentations, will the slides be shared after the webinar?

Prof Brendan Mackey 04:17 PM yes

AJ IQ 04:14 PM Yes please (to SAF slides etc)

Prof Brendan Mackey 04:17 PM yes, they will be provided.

Paul Newsham 04:14 PM Will the presentations be available?

Prof Brendan Mackey 04:16 PM yes

Michael Bryan 04:15 PM I am very interested in the Saf discussion on top of what Brendon had to say.

Chantal James 04:23 PM Thanks for your question. Brendon has responded.

Paul Perera 04:15 PM When you see the emergence of Hydrogen what are your thoughts and challenges?

Chantal James 04:32 PM Thank you for your question - The panel has now provided a response.

Giffin M 04:16 PM Can Brendon give a quick summary on the issues around biologicals for SAF?

Prof Brendan Mackey 04:19 PM <http://dx.doi.org/10.1016/j.scitotenv.2023.163883>

Rhys Kenyon 04:16 PM I don't have a question currently, but Brendan I realised yesterday you were from Griffith Uni when I was at the ending native logging webinar yesterday and found the topic quite insightful.

Prof Brendan Mackey 04:18 PM thanks!

Anonymous Attendee 04:16 PM Interested in the panel's thoughts on industry-based initiatives such as CORSIA and how truly effective they can be in emissions reduction?

Prof David S. Lee 04:21 PM Most CORSIA offsets are 'avoidance' offsets, i.e., "we will not emit that which we intended to do": that is not a real reduction nor a permanent removal as per Brendan's highlighting of the scientific definition of NZE.

Thomas D. Pellegrin 04:17 PM Dr. Brendan, do you have a view on the respective likelihood of each climate SSP/RCP?

Prof Brendan Mackey 04:24 PM NDC put us in the middle path (4.5) but that assumes the mitigation commitments are implemented!

Thomas D. Pellegrin 04:27 PM Thank you. So that would be a 2.5-2.7C increase by 2100 over the pre-industrial baseline - and worse if the mitigation assumptions don't pan out.

Anonymous Attendee 04:19 PM To all experts: when could we see medium to long distance passenger and cargo planes flying on alternatives fuels - battery-electric, renewable fuels, etc.

Prof David S. Lee 04:22 PM I think we are talking decadal timescales. Now, we even have difficulty purchasing SAF for emissions tests.

Anonymous Attendee 04:21 PM Could we get a link to the roadmap analysis paper?

Tim Ryley 04:27 PM <http://dx.doi.org/10.1016/j.scitotenv.2023.163883>

Thomas D. Pellegrin 04:24 PM (not a question) H2 is great but works only for short haul.

Prof Brendan Mackey 04:29 PM Yes, I agree - and maybe medium haul??

Anonymous Attendee 04:25 PM Professor Mackey - you've spoken about the scale problems with alternative fuels. But what about the urgency: surely the mitigation gap means we can't wait for so-called SAF to come through, or speak about these being "sustainable" if they don't come for decades?

Prof Brendan Mackey 04:28 PM yes, I agree - we need solutions that will work at scale in the coming decades.

Michael Bryan 04:26 PM This is an excellent discussion about the industry's problems; how about we put our heads together and find solutions? The aviation industry under Willy Walsh has adopted a position on non-CO2s that they'll do nothing until "the science is in."

Dr Emma Whittlesea 04:33 PM Totally agree, please join us for the remaining sessions for some of the actions that are underway.

Chanika Mannawaduge Dona 04:17 PM Thank you for that insightful presentation, Prof. Brandon. I have a question on SAFs. Is there any analysis to quantify the SAFs contribution to reduce the CO2 emission.

Arno Schaaf 04:17 PM If we focus on decarbonising "travel", which includes air travel, what is the most effective approach to achieve this, including technical and non-technical means? In this context I mention recent suggestions in the UK (I believe) to shift the holiday season so people could fly to their destination outside the fire / storm flood season.

AJ IQ 04:22 PM If I can ask perhaps a meta question (for anyone): In terms of bridging the science/policy gap/chasm, what do the panel recommends as the best mechanisms for helping policy makers (and their constituents/influencers) to grapple with the complexities of atmospheric chemistry?

## **Session 2: Transformative policy - raising the bar for aviation decarbonisation.**

**Thursday 12 October, 3-4:30 pm AEST**

Rosalinde van der Vlies 03:23 PM Thanks Chris! According to our data, global aviation contributes to around 1 gigaton of CO<sub>2</sub>e out of around 50 GTs CO<sub>2</sub>e of anthropogenic emissions.

Arno Schaaf 03:15 PM To what degree is Europe planning to either legislate or encourage the use of alternative transport methods for short to medium distances? Contrary to Australia Europe has significant high speed rail infrastructure in place, which is much easier and quicker to decarbonise than aviation.

Rosalinde van der Vlies 03:30 PM Thanks Arno - good question! We are working on decarbonisation of different transport modes in Europe, following the same logic as I presented for aviation: developing a common strategic vision; ensuring that the regulatory framework supports the transition; and making available massive investments, both for research and innovation and deployment of solutions. Like for aviation, we are established partnerships with industry also in the rail, road, and waterborne sectors to co-invest in innovative solutions for these sectors.

Robert McLachlan 03:21 PM Is the level of investment & regulation determined by a requirement to achieving steady progress towards net zero aviation by 2050?

Rosalinde van der Vlies 03:26 PM Thank you for the question, Robert. the European Commission has decided to co-invest EUR 1.7 billion in a clean aviation partnership with industry on the condition that this partnership focusses on breakthrough innovative solutions for clean aviation. The investments in individual projects depend on the budget needs to deliver it. Regarding regulations, all our EU regulatory framework contributes to the overall objectives of the European Green Deal.

Manori 03:26 PM Dear Rosalinde, it was an interesting presentation. You said about non-CO<sub>2</sub> emissions. Is that other GHGs only? Does that include gases that influence air quality including (CO, NO<sub>x</sub>, HC)

Rosalinde van der Vlies 03:27 PM Hi Manori - regarding non-CO<sub>2</sub> emissions, we are doing lots of research and our European legislator has recently decided to start with an obligatory monitoring, verification, and control system, paving the way to binding legislation in the future.

Arno Schaaf 03:29 PM Will NZ, in its sustainable tourism review, include the emissions of inbound tourist passengers as well?

Robert McLachlan 03:31 PM International aviation emissions associated with tourism is part of the review, it will be interesting to see what they come up with

Dr Maile Giffin 03:45 PM No doubt. At the moment we only account for domestic emissions but there is discussion now about including international emissions into our targets.

What is MBIE doing to shift air traffic out of airspace in which contrails are produced?

Dr Maile Giffin 03:47 PM I don't know of any work at MBIE in this space at the moment. It was interesting to hear at last week's talks around the contrails and fuel consumption as you move into different airstreams, so I imagine a more holistic view of the challenges will need to happen.

Maile - when is SAA expected to report?

Cindy Park 03:49 PM Hi Robert, thank you for your question! The SAA Leadership Group meets four times a year and each of the working groups will meet every six weeks. This partnership just kicked off, so we don't expect any reporting until next year. However, we are working closely with the SAA to coordinate advice to the Government, including using the SAF working group as a coordinating body to inform industry's views on the SAF mandate once consultation opens.

Yvonne Weeber 03:37 PM Are you considering all carbon emissions of airports including building new airports e.g., Christchurch Airports proposal of a new airport at Tarras?

Dr Maile Giffin 03:48 PM I imagine any new airports that are built and come online would have their carbon emissions also accounted for.

Arno Schaaf 03:40 PM What is the safety consideration for producing large volumes of hydrogen next to airports - just thinking of the location of the airports in Auckland and Wellington? Are there good links between the hydrogen and electrification streams to ensure the most economic and fastest routes to decarbonisation are pursued?

Robert McLachlan 03:45 PM Good point. Possibly there is a workstream on hydrogen, a separate workstream on renewable energy – but none on phasing out fossil fuels.

Dr Maile Giffin 03:52 PM There is work going into the safety considerations of onsite production of H2 for airports, including blast zones. Supply chains and existing infrastructure is also being looked at. There is interest from those producing electricity to what they can do in the H2 space, so yes definitely linkages there as the amount of electricity needed for H2 is substantial and if we are to produce green H2 we need to increase our amount of renewable electricity.

Robert McLachlan 03:55 PM Graham - have these programs reduced California aviation emissions yet?

Graham Noyes 04:02 PM Yes, but only small scale thus far. About 15 million gallons in 2022 averaging about a 70% reduction relative to conventional jet fuel.

Ralph grimes 03:59 PM thank you, Graham - Robin Vercrease spoke with us earlier this year - we'd like to contact you.

Robert McLachlan 04:00 PM It seems that incentives for domestic SAF production is a major driver in several different places.

Graham Noyes 04:07 PM That is certainly the case in the US.

Yvonne Weeber 04:13 PM EU countries are promoting land based fast rail to make a transition away from aviation. What are New Zealand and Australia doing to transition to fast rail and moving away from aviation?

Chantal James 04:18 PM Thank you for your question. The panel has provided a response.

Yvonne Weeber 04:17 PM Short routes should be fast rail not aviation.

Arno Schaaf 04:20 PM Challenging in NZ from a geography and population density point of view. Plus, if you want to include Christchurch, Cook Strait is in the way. Less excuses in Australia not to pursue it, except the commercial interest of the airlines.

Robert McLachlan 04:23 PM Yes. At one point Sydney-Melbourne was the second busiest air route in the world.

Yvonne Weeber 04:24 PM We had a better rail passenger system 50 years even 30 years ago throughout New Zealand. Transport policy, regulation and money needs to look at all ways of reducing carbon emissions. This means looking back to the future of rail public transport throughout New Zealand.

Arno Schaaf 04:24 PM Compared to Madrid - Barcelona, also once the busiest air corridor, which lost 70% of air passengers once HSR opened.

Chantal James 04:27 PM Thank you for your point.

Anonymous Attendee 04:16 PM What technological developments would you wish for to increase SAF production? Is the efficiency of converting biomass into SAF sufficient?

Chantal James 04:29 PM Thank you for your question.

### Session 3: Climate-ready aviation – industry perspectives and practice

Thursday 19 October, 3-4:30 pm AEST

Robert Boyd 03:31 PM Absolutely. Can be freely downloaded.

<https://www.weforum.org/whitepapers/sustainable-aviation-fuels-offtake-manual/>

Heather Morecroft 03:24 PM Does the Virgin-UK Government SAF transatlantic flight scheduled for November link in with the Aviation First Movers Group?

Robert Boyd 03:34 PM Not directly connect with the First Movers Coalition. currently the Airlines in FMC are Lufthansa, DHL, Fedex, United and Delta. It is directly part of our Boeing work.

Michael K 03:25 PM With a significant amount of respect, isn't it a convenient excuse to slow progress by citing new technologies need "demand" to be developed? I mean, isn't saving our planet (enough that we can continue to inhabit it) enough of a reason to not expedite development of new technologies? After all, unit Tesla worked they industry resistance, major auto companies all protected the status quo by only introducing incremental advances (and mostly to still to ICE vehicles)

Michael K 03:25 PM sorry meant "enough of a reason to expedite" not (not expedite)

Robert Boyd 03:37 PM The motivation of FMC is to accelerate new technology development. Business case failure slows progress. One of the key factors of a yet to be proven business case is a robust demand signal. FMC just in aviation is a 3.5 bil demand signal. The objective is that these become bankable offtakes.

Michael Bryan 03:26 PM I don't have a question, but this is one of the most pragmatic discussions I've been party to on this subject. Thank you.

Chantal James 03:28 PM Thanks for your feedback, Michael.

Arno Schaaf 03:34 PM Whilst it is important to clean up the current aerodyne technology platform, what activity is taking place to develop other platforms that can achieve significant fuel and emissions savings, but at the expense of speed. Variolift in the UK is developing a rigid lighter than air platform that can lift significant loads, has a range of around 14,000km and a maximum speed of around 350km/h. What research exists on the acceptability of slowing down long and restructuring distance travel and slowing down the delivery of intercontinental. non-perishable freight? It appears to me that if consumer acceptance of this mode of travel can be achieved, it may be a good option - acknowledging that significant further development would still be needed.

Arno Schaaf 03:36 PM "Slowing down and restructuring".

Robert Boyd 03:43 PM being worked on. All the major OEMs are plugged in to these options. The challenge - as I mentioned, is the strategic reality of what can make an impact within the 27-year time frame. The answer is it 'is' and should be both. But these non-traditional options (while fantastic) won't shift the needle enough in the med term - why for net zero 2050, SAF must step up. Refer: ICAO LTAG report for governments. Very technical analysis of this. Towards / beyond 2050, you'll see many of these solutions you refer to.

Arno Schaaf 03:46 PM I agree - I asked the question because I can see limitations in cleaning up the current platform and lighter than air, on its own or in a hybrid mode, could achieve very significant reductions, as well as reduce demand on SAF (see the question about rain forest protection).

Avishek Khanal 03:34 PM Very informative session particularly sustainability and Net-Zero information.

Chantal James 03:37 PM Thank you for your feedback Avishek. We are pleased that you are enjoying our sessions. All the replays are available on our website: <https://www.griffith.edu.au/institute-tourism/news-events/aviation-reimagined-2023>.

Anonymous Attendee 03:36 PM What safeguards are in place to absolutely ensure that bio-SAF will not be responsible for rainforest loss, i.e., Robert mentioned a workshop in Brazil... how can aviation be sure that use of feedstock does not indirectly lead to more deforestation, and does achieve the objectives of net zero?

Robert Boyd 03:51 PM Really important point. Without confidence that SAF is sustainable, it is just jet fuel. The best framework and the one that the industry tends to refer to is the ICAO CORSIA sustainability criteria. 12 criteria including - including ILUC. It is more than just life cycle... things like soil, air, water etc. Two sustainability verification schemes (so far) can certify SAF for the purpose of CORSIA, being RSB and ISCC (regarded as the two strongest in the world). Again - mountains of info under ICAO, annex 16-4 or look directly at the RSB website. Specifically, Brazil (and could include other regions such as Indonesia / Malaysia etc...) the aviation standard is clear (esp. for ILUC) and this is one of the benefits of an international sector. Challenges can exist in domestic markets, often for ground fuels.

Anonymous Attendee 03:37 PM What strategies does BNE Airport have in place to achieve zero waste to landfill by 2030? Thanks.

Jessica Rudd 03:53 PM At the moment we are focused on securing the correct waste contractor to help us meet our zero-waste target. We have been working with our retailers within the terminal to reduce waste and will start to work with their suppliers to avoid waste coming into the terminal. We are focused on the basics which is waste education the correct partners. We have installed Oscar sort systems in the terminals which is an AI system to help educate passengers and reduce contamination. Long term we are investigating a waste to energy plan but unsure if this will be onsite or through a third party.

Anonymous Attendee 03:38 PM Good day, Thanks a lot guys for putting this together. How can I get the recording of this session and other past sessions?

Chantal James 03:40 PM We are pleased that you are enjoying our sessions. All the replays are available on our website: <https://www.griffith.edu.au/institute-tourism/news-events/aviation-reimagined-2023>

Yi Bian 03:39 PM Why does BNE airport use blue carbon rather than other green carbon projects? Could you please provide the link of official documents about using blue carbon? Thank you very much.

Jessica Rudd 03:54 PM We are using blue carbon as we have mangroves and marine ecosystems within our biodiversity zone. We are unable to share any of the documents on this work as it is still underway. Once finalised we will have a detailed section on our website with all the information about our process, verification, and pathway forward.

Jo 03:55 PM Sorry Ms. Rudd, what's blue carbon and what's the difference between this and green carbon? thank you.



Jessica Rudd 04:01 PM Oh apologies! Blue carbon is associated with carbon stored within marine ecosystems such as mangroves. Green carbon is carbon stored within terrestrial trees/environments. Think of blue carbon = ocean/marine and green = land. I hope that helps.

Jo 04:02 PM great explanation, thanks Ms. Rudd

Anonymous Attendee 03:42 PM What's SRUP on the future BNE plan - in-between ITB Aerobridges & Check-in upgrades? cheers.

Jessica Rudd 03:51 PM Security and retail upgrade project

Michael Bryan 03:57 PM Has there been any analysis of the benefits of Trajectory-Based Operations (which includes route optimisation) to the industry in terms of direct benefit as well as emissions?

Nik Mungilwar 04:13 PM Michael, yes benefits are calculated. the details are <https://www.airservicesaustralia.com/about-us/innovation-and-technology/onesky/>

AJ IQ 04:02 PM I very much appreciate hearing from the optimists: When the pessimists say something can't be done, that's just "as expected". It's when the optimists explain that something can't be done that, I take notice. We seem to have again optimistically heard that of course aviation can be decarbonised, so long as we 'merely' overcome a Sisyphean parade of monumental "challenges". Is there anyone on the panel who thinks that's an unfair synopsis? Or is it perhaps that by simply accepting "the spice must flow" as unexamined axiom, we're frittering away our timeline asking the wrong questions, expending our limited resources on dead-end pathways? Should perhaps the real question be "how do we preserve (and extend) the benefits of travel, without requiring mass consumer flight"?

Chantal James 04:16 PM Thank you for this question. The panel has provided a response.

The slide containing the noise complaints and co2 emissions seemed to have almost an inverse relationship. Can you elaborate?

Nik Mungilwar 04:18 PM that was the intent to show they are not co-related as such as their other factors most of the time.

Anonymous Attendee 04:12 PM A question for Jessica - Jessica, thanks for your presentation, very informative. How challenging do you think it is for BNE Airport to get your sub-tenants onboard and aligned with your aspirational targets - particularly airlines and like of Airservices.

Chantal James 04:18 PM Thank you for this thought-provoking question. Jessica has provided a response.

Anonymous Attendee 04:06 PM A question for Robert please, and the facilitator Prof Becken who has written on this topic - SAF production and supply as I understand will never be sufficient to meet current aviation fuel demand and can have a variety of negative impacts. With that in mind, 1) is the current focus on SAF distracting and limiting other opportunities and innovations; and 2) with the limited amounts available, and considering Roberts's chart of no other solutions for long haul - is that its target and necessary application, and should regional and general aviation sectors be looking at and investing in the alternative technologies?

Chantal James 04:25 PM Thank you for this question. The panel has provided a response.

Anonymous Attendee 04:11 PM What is happening to actively explore partnership with land transport providers e.g., rail, helping move traffic from air to more carbon efficient modes.... is this part of the strategy?

Chantal James 04:26 PM Thank you for this question. The panel has provided a response.

Anonymous Attendee 04:22 PM Does noise pollution also factor into net zero? I know net zero largely focuses on reducing and eventually potentially eliminating carbon emissions, but noise has also been particularly poignant; particularly community furore over BNE's new runway and flights over Moreton Bay? this might be more in Ms Rudd and Mr. Mungilwar's wheelhouse but also keen to hear what Mr. Boyd might have to say. thank you.

Paul Perera 04:24 PM We need Synthetic Aviation Fuels from a Power to Liquid feedstock, and Robert dismisses Hydrogen - why not pump prime Green Hydrogen as a feedstock? This would support other options; battery electric is unlikely to make a huge dint on CO<sub>2</sub>e for aviation, but Green Liquid Hydrogen could - please accelerate these options.

Chantal James 04:29 PM Thank you for this interesting question. Something for the panel to consider.

Anonymous Attendee 03:44 PM Great presentations so far, and to understand the significant challenge of Scope 3 emissions for airports from flights and aviation fuel. Good to see Brisbane's recognition of this and the 3 staged approach to trying to resolve this, but it seems like a rapid shift away from fossil fuel is what is needed. What do the panel think would make the BIGGEST difference to enact this urgent transformation, 3 wishes each!

Michael Bryan 03:55 PM Can you provide the time delay in holding or vectoring in these figures? CO<sub>2</sub> is only one aspect of the cost of these delays.

Anonymous Attendee 04:08 PM Question for Jessica, how does Brisbane airport plan for sea level rise?

## Session 4: Technological innovation and advancements

Thursday 26 October, 3–4:30 pm AEST

Professor Simon Weeks 03:40 PM Future jet engines will be even quieter than today - turbofan engines will have much higher bypass ratios with larger lower speed fans at the front that emit less noise. Propellor aircraft will have quieter propellers. Electrically powered aircraft (battery or fuel cell) will produce no jet noise so will be quieter again. Research is also underway to reduce airframe noise - today, most of the aircraft noise you hear on approach is from the aircraft, not the propulsion system.

Michael K 03:18 PM For Prof Weeks: how difficult/expensive is it to convert fuel systems to use SAF which is over the 50% mix level?

Professor Simon Weeks 03:43 PM As already answered, straightforward and shouldn't have an impact on new aircraft cost.

Michael K 03:47 PM Thank you... my apologies, I was more focused on how costly it would be for retrofitting existing aircraft (as opposed to building such capability into new aircraft)

What's the contrail effect when burning SAF?

Professor Simon Weeks 03:47 PM The consensus is that contrails should be lower due to lower carbon particulate formation.

Chester 03:20 PM How challenging to change the existing fuel system from the existing aircraft in adapting the various mix levels of SAF, as mentioned.

Professor Simon Weeks 03:42 PM The changes are relatively small such as changing elastomeric seals in the fuel system. Fairly straightforward at new aircraft build

Paul Newsham 03:22 PM Professor Weeks: For SAF already certified as a drop-in fuel, how do you see the capacity limitations (i.e., feedstock, production, spatial constraints) being resolved in the short term?

Stephen Forshaw 03:30 PM This is a very complex policy question that governments will have to resolve. Feedstock will not be available to meet demand for all sustainable fuel uses. Prioritisation and securing feedstock will be very important national policy issues. For example, if Australia has an abundance of feedstock but not yet production capability, then what happens if all the feedstock is exported by the time, we have onshore production?

Chester 03:24 PM Will this mix of SAF as mentioned affects the performance of the aircraft?

Professor Simon Weeks 03:46 PM Yes - should have a minor positive impact on aircraft range, engine life and particulate emissions as well as the impact on net carbon emissions.

Would the liquid H2 tank need to be at the aircraft's centre of gravity?

Professor Simon Weeks 03:53 PM In today's aircraft, fuel is largely accommodated in wing and belly tanks that are near the CoG. For LH2, our design studies indicated that it was not possible to do that, leading to a more challenging problem to manage through a flight.

Yvonne Weeber 03:27 PM Wellington Airport is surrounded in residential houses very near the airport and refuelling areas of planes. What would the distance need to be for hydrogen refuelling to be safe?

Professor Simon Weeks 03:59 PM About 20 metres from the refuelling point - if hydrogen leaks it will rapidly vaporise and rise as it's much lighter than air. There will be no odour at the airport or around it as for kerosene.

Yvonne Weeber 03:29 PM Any research into solar powered planes through solar panels? The Bridgestone Solar World Challenge is finishing now and over this weekend in Adelaide. Are there any similar competitions for solar powered planes?

Professor Simon Weeks 04:03 PM I'm not aware of any. Solar cell power is limited by the area of the aircraft surface exposed to the sun - which means that the total power generated is low - to enable these aircraft to fly they must be ultra lightweight and can only carry one or two passengers for weight reasons.

Anonymous Attendee 03:30 PM Given the fact that some airports are located near water bodies as well as residential houses, any considerations to be for hydrogen refuelling to be safe.

Professor Simon Weeks 04:04 PM I already answered on surrounding houses - not sure what you mean by water bodies?

Kushla Gale - Tilma Group 03:33 PM Can the chat be left on during the recording please?

This question has been answered live.

Kushla Gale - Tilma Group 03:34 PM Is there enough "waste" on the planet to create "SAF" out of waste? Biofuels use a huge amount of land needed for the global goal of doubling food production by 2050.

Professor Simon Weeks 04:05 PM No - we would need to exploit a large range of feedstock for Bio SAF - both waste and crops. Land and water use are problems associated with biofuels - no silver bullet I'm afraid!!

Phil Potterton 03:34 PM Q for Simon please: Rex Airlines who operate mostly shorter regional routes in Australia with the Saab340 have flagged the possibility of 40 per cent operating cost reductions by retrofitting batteries into their aircraft. What might underpin that some of efficiency improvement?

Professor Simon Weeks 04:08 PM Battery powered aircraft should be much cheaper to fly than kerosene powered aircraft - battery electric systems much simpler than jet engines and don't have thermal degradation (although batteries deteriorate over time). Electricity costs should be lower than fossil fuel over time as renewables increase. The aircraft will only have short range though (10% of kerosene powered at best)

Anonymous Attendee 03:47 PM also, would alternative fuel sources like hydrogen be able to get to a point in development, where they could be used for long haul overseas travel? The current fuel less options seem to be designed more for regional or short hop travel. thanks

Stephen Forshaw 04:08 PM Yes, but it will take time. Every generation of new aircraft will bring step-changes in technology, efficiency, and ambition. This needs to be science-led, so as science helps us find ways to derive more energy from hydrogen, or make the engines powered by it more efficient, then range will increase.

Kushla Gale - Tilma Group 03:48 PM What are the tactics to reduce demand for aviation?

Stephen Forshaw 04:06 PM I'm not sure I can answer this, because my objective is to make aviation more sustainable so we can continue to provide the benefits to society that come with connectivity,

movement of people and goods, and the economic activity that aviation supports, but do so more sustainably.

Kushla Gale - Tilma Group 03:49 PM Has the industry identified where and how offsets would happen for the long term? For example, there isn't enough land on the planet to plant trees to replace our emissions.

Stephen Forshaw 04:05 PM absolutely correct, which is why we see offsets as only suitable for the last mile of getting to net zero. There should also be pathways for offsets to be able to fund the generation of new SAF, for example, through PTL and hydrogen, as well as reforestation etc.

Anonymous Attendee 03:50 PM But if let's say alternative fuel sources like hydrogen or SAF is being applied which time will tell, does aircraft need to stop over somewhere especially flying long-haul for example Brisbane to London

Stephen Forshaw 04:03 PM It may be the case ... less so with SAF, which essentially operates like current jet fuels. But with new forms of propellant, we may need to adjust range - especially in the shorter term as the technology develops. Just as range for jet fuel powered aircraft has increased as technology and efficiency improve, the same will be the case for new forms of powered flight.

Kushla Gale - Tilma Group 03:53 PM How much land will be producing a billion litres of SAF take away from food and fibre production?

Stephen Forshaw 04:04 PM If the production of fuels uses biomass from the food supply chain, we don't regard that as sustainable. Biomass - to make SAF - needs to come from waste or sources that don't feed humans.

Kushla Gale - Tilma Group 03:53 PM What existing biomass are you referring to?

Stephen Forshaw 04:00 PM things like agricultural waste (sugar cane waste converts to ethanol), forestry waste, used cooking oil and other wastes that can be chemically converted to propellant fuels.

Jaap Hatendoer | UMCG Ambulance Zorg 03:53 PM An important factor that made the aviation sector so successful is its impressive safety track record. Is the sector capable of going through the necessary period of fast progress (with potentially a higher risk profile)?

Stephen Forshaw 04:01 PM I think we can, but it requires the right balance to ensure in the rush to make ourselves more sustainable, people understand and have patience to ensure we do the research, tests, pilot programmes, certification exercises and share knowledge and research across the industry. While our industry is competitive, I am heartened to see that on issues of safety, everyone - even the fiercest competitors - work together to share and improve.

Kushla Gale - Tilma Group 03:56 PM Who is responsible to get the Australian SAF industry started? What's the barrier to getting it started?

Stephen Forshaw 03:59 PM No singular responsibility, but Government can play a role as a catalyst to bring industry together, encourage production, fast-track approvals and secure our feedstock. However, capital providers can also support by investing in businesses that will produce SAF and other sustainable fuels.

Yvonne Weeber 03:59 PM Thank you for these presentations over the last 4 weeks. I need to go to another meeting now. But will listen to this and last week's presentations online. I will also provide information to others.

Anonymous Attendee 04:07 PM You say it is good to retire older aircraft and fleet replacement is a good part of the decarbonisation journey, does this consider the lifecycle perspective, and what about retrofitting planes with electric, hydrogen-electric and hybrid systems? This also helps prevent stranded assets and advance transition toward net zero.

Stephen Forshaw 04:09 PM very challenging, because every new generation of aircraft have such significant systems changes across the entire aircraft that retrofitting the aircraft is not economic in every respect. However, recycling and upcycling of components is an important part of the mix.

Anonymous Attendee 04:10 PM What is deemed short distances for the smaller ZEROe aircraft and how does this align to average domestic flight distances, considering countries national carbon accounts only account for domestic flights, which are short to medium haul in most cases.

Stephen Forshaw 04:12 PM initial generation of H2 aircraft likely to be operating ranges of <2000km with up to 100 passengers, give or take. But we would hope future generations would increase range, capacity.

Anonymous Attendee 04:15 PM What is the most efficient use of H2, using hydrogen in PTL SAF, or to use it in direct combustion or with fuel cells? (Considering energy losses when energy is converted)

Professor Simon Weeks 04:16 PM Fuel Cell > Direct Combustion > PTL - ease of use is the opposite!!

Anonymous Attendee 04:18 PM is the course available on Mr. Feray's company's website or can it only be accessed with the QR code? Thanks.

Alexandre Feray 04:22 PM Yes, you can find it on our website. Send me a LinkedIn if you have any difficulty finding it.

Jo 04:24 PM thank you, Mr. Feray. Unfortunately, I don't have LinkedIn at the moment, is there another way I can ask you how to find the course on the website if I can't find it? Thanks.

Anonymous Attendee 04:19 PM All great presentations, thank you, but noting they seem to use different decarbonisation forecasts, with different pathways and % contributions – good to recognise variations of data, opportunity, and opinion, but this creates challenges too.

Stephen Forshaw 04:25 PM Absolutely and it could be simply that we're basing data off different timelines, and we model forecasts a little differently. The thing that pleases me (especially as I was speaking second) is that my view of the assumptions is remarkably aligned with Simon's, indicating industry is starting to coalesce around some core principles and necessary actions.

Kushla Gale - Tilma Group 04:23 PM Is it time for a carbon tax on flights?

Alexandre Feray 04:27 PM There are already emissions trading schemes. For example, European airlines have to buy carbon allowances to compensate for all their carbon emissions. This is going international with CORSIA, and 76 states have volunteered to compensate (part of) their emissions starting 2024.