Could the future of air travel be hydrogen?

If you are like me you are longing to get back to travelling for business, pleasure or holidays. Once we do get back to flying again, the need for sustainable aviation becomes pressing. With the EU and many European government net neutral targets coming ever closer, there are efforts to increase decarbonisation efforts across all sectors. Transport, in general, has been a huge focus of decarbonisation as it contributes around 12% of the worlds CO2 output, as well as it being the most public facing way of displaying that change is happening. There has been much action in decarbonising ground mobility such as passenger cars, busses and trucks, with many of these vehicles having commercial greener methods available already. However, when it comes to aviation, there has been much less movement. There are currently no scalable solutions that exist today, but things are starting to take off…

So what alternatives are being used and developed for jet fuel? A whole category of fuels labelled Sustainable Aviation Fuels (SAFs) are being developed with the aim of reducing net CO2 output. These include both synthetic and bio fuels. Synfuels, such as gasoline, diesel or kerosene, are created from adding green hydrogen to recycled CO2, usually from industrial processes. Biofuels are a produced from plant/bacterial sources such as crops, algae, tallows and waste oils. The CO2 the crops/bacteria harness when growing leads to a net neutral CO2 output when the biofuel is combusted. Biofuels can be used directly, or as a feedstock for synthetic fuels. However, both synthetic and bio fuels still pollute at the point of use. In order to get completely 100% renewable, other fuels are required. So is hydrogen an option?

Hydrogen's viability has been demonstrated in many use cases throughout the world in the past couple few decades and is acknowledged as one of the solutions that will be used to enable Europe to reach its 2050 target. It's uses in fuel cells has been demonstrated with passenger vehicles, trucks, busses and trains that are all up and running, with some even in mass production. It has also demonstrated its use as a combustion fuel in test boilers for heating applications, and engines are being developed for it to be applied to aviation.

Despite its effectiveness, there are many current barriers to using hydrogen as an aviation fuel. Commercial aircraft still require development as well as the significant large scale infrastructure changes that will be required at airports. Optimism is found in industry

leaders such as Airbus stating that hydrogen aviation will be developed and used to reach 2050 targets. This will, no doubt, be in combination with other SAF decarbonisation routes.

Much work is needed to ensure that hydrogen is ready for deployment, so where do we start? Components such as light weight liquid hydrogen tanks, hydrogen turbines and FC systems are being researched and different sized aircraft are being developed. Small regional planes are looking to transition first and commuter prototypes are on the horizon. However, long range aircraft are further off and will most likely follow a different sustainability pathway (SAFs). Additionally, action is needed in the funding and policy available for these developments in order to direct and support accelerated change.

One of the first applications of the aviation industry to utilise hydrogen effectively are fuel cell UAVs. Whilst they are a much smaller scale of aviation, the concepts and technology are useful for the commercial airlines of the future. Hydrogen has powered drones for the last decade in multiple applications i.e. military, agriculture and long rage delivery of essential supplies.

On a larger scale, ZeroAvia, based in Cranfield UK, have adapted a small 6 seat fixed wing passenger plane to run on hydrogen. They have received funding to test the range and suitability of hydrogen within a 10-20 seat aircraft and aim for a 300 mile zero emission flight. Pipstrel have announced their own 20 seat hydrogen aircraft called the Miniliner. It is said to be capable of operating quietly from runways shorter than 1 km, including grass airstrips. Not to be out done, Airbus have also put forward concept designs for their own hydrogen aircraft called the Airbus ZEROe.

As well as aircraft, there are many aspects of the industry that are building momentum in favour of hydrogen. For its success three aspects are required likely to be required: a sector roadmap to guide the transition, a step-up research/innovation activity and funding, and a long-term, global policy framework. One project delivering a vision of this future is EnableH2 which is looking at the technical aspects of how we position hydrogen in aircraft. The project sees a gradual migration towards hydrogen over the coming decades and plans a hydrogen aviation roadmap to help inform and influence those changes still to come.

ENABLE·H2

Initial changes to aircraft will be minimal. Cabin power is likely to be powered by fuel cells, smaller regional aircraft will be the first to transition most likely to gaseous hydrogen, with

larger commuter range aircraft requiring the large scale liquid hydrogen infrastructure. Given that smaller aircraft are going to be developed first, regional airports will be lead with supplies of liquid hydrogen being trucked in. This has the potential to ‘open up’ aviation with more flights from local airports. Later, larger airports will have the possibility of connecting to national hydrogen pipeline networks and using their own liquid hydrogen production infrastructure.

There is an enormous amount of innovation yet to come from the aviation sector. The R&D work behind the scenes is progressing technology at a rapid rate. The infrastructure required to enable wide deployment of this technology is already realised and in use in other industries - it just requires adapting and scaling.

With the correct policy and funding from governments, you have a real possibility of experiencing a hydrogen take off from your local airport in the next decade.