Q&A with Paddy Lowe at the World Aviation Festival

10th October, 2022: Zero Petroleum CEO Paddy Lowe joined a panel of experts at the World Aviation Festival last week to discuss how to utilise next generation technology, innovation and new types of fuel to get closer to achieving real scalable solutions for clean air travel. Lowe provided his expert insight on synthetic fuels alongside Daniel Riefer (McKinsey), Adrian Gane (Ethihad), Alexander Küper (IATA) and Max Held (Mission Possible).

All the panellists agreed that the need to develop scalable solutions will steer Sustainable Aviation Fuels (SAF) in the direction of synthetics, with a need to create carbon neutrality as rapidly as possible. These are some of the highlight comments made by Lowe during the conversation.

On the climate challenge and aviation

"It is urgent, very urgent, but let's be optimistic, there is a bright future out there. However, I would add to that: let's invest together in the right solutions, the things that really solve the core problems properly and aren't window dressing or interim solutions without a vision about the long-term game. We have a vision where flying is not something seen as bad, wasteful. 'Flying guilt' should not be the case. In a fully circular world, with a circular economy in energy, there will be nothing whatsoever wrong with flying. We see that future. More and more people want to fly, and they should enjoy the ability to fly in a way that is not damaging to the environment. That is completely possible. I am really optimistic about that. We live in a context at the moment that is quite depressed about where we are going. Actually, when you look at the vision of a circular world, it's really exciting."

On why the internal combustion engine is here to stay

"Combustion has a bad name at the moment around all forms of travel. If you read the newspapers, 'the internal combustion engine is the work of the devil.' Synthetic fuels can change that opinion. Fossil fuels have plateaued in the last several decades in terms of evolution and quality. In synthetics, where every molecule costs the same amount whether it is good or bad, we will be making new fuels that have better performance, better combustion and are better for the environment than anything we have around today. We have no sulphur in synthetic fuels whatsoever, we are reducing NOX, we reduce particulates, there are great benefits coming our way. Combustion engines are here to stay, by necessity, and combustion is here to stay, but with very exciting developments around efficiency.

On the need to move on from bio-derived SAF

"Mainstream aviation will rely on liquid fuel indefinitely. Hydrogen and direct electric really are just niche solutions in my view, and many agree. So we need liquid fuel and the low hanging fruit is the SAFs we have around now, which are made typically from cooking oil, some sort of bio product, or municipal waste. Ideally, this will move to bio solutions that are not competing for land – what I call second-

generation bio. Really, though, to go to scale, we need synthetic fuels developed in a circular manner, and this is both a challenge and a point of excitement for us."

On why synthetic fuel is different

"With synthetic fuels, we are not digging stuff out of the ground like we do with fossil fuels and we are not using large areas of land mass to create the feedstock. We are literally making it from the carbon in the air, just as happens in biology. There is a great parallel here. Plants take carbon from the atmosphere and energy from the sun and turn them into the hydrocarbons, which we, as animals, combust, putting it back out into the atmosphere again. In an industrial context, for 300 years we have been doing the combustion bit, we now need to transition to the point where we do the equivalent of photosynthesis and we make those hydrocarbons from the very material that we emit. The numbers around quantity, capital, are immense, but they are actually deliverable. Energy can come from many renewable sources including solar, wind, hydro, and I am also a great believer in nuclear fusion. That will come one day. With nuclear fusion, we will be making synthetic fuels in abundance to use wherever we want without any guilt. We see that as the end game."

On the development of synthetic fuels

"This history of Power to Liquids is Fischer-Tropsch (FT), which is the main process used to make many of the current SAF fuels as well. That goes back 100 years in Germany, where it was developed. Originally it was developed to process coal gas, 'syngas', with carbon monoxide and hydrogen coming from gas supply in coal. In the new context of renewable fuels, we have two challenges. One is to work with Carbon Dioxide rather than Carbon Monoxide – and that is a process of reduction, reverse water gas shift or other electrolysis pathways to do that – and then the second is in optimising the FT. Energy, which is the main cost in the fuel, is expensive, so you don't want to make molecules that aren't any use to you. The challenge in the FT process is to hone it to produce a narrow range. So, if you want a jet fuel, you want the most number of molecules you're making to be jet fuel. In addition to that, you want to make sure the quality of those molecules does not much refinement, or ideally no refinement, so the product can go straight into your application. At Zero Petroleum, we have a variant of the FT process that is very narrow, so we can produce a very high proportion of the target fuel without other by-products. We can produce a jet fuel, for example, that can go straight into use as whole blend.

On how synthetic fuels can improve energy security

"We've all grown up thinking that oil is a thing that you buy from another country, it gets transported with difficulty, it sometimes leaks into the sea causing catastrophe, and there is extreme volatility because different people control the taps and the price. Making fuel industrially, from your own capacity in nation, is a whole new paradigm in energy security, controlling volatility of price. When you have a fuel production plant of your own, with no feedstocks to buy because it's just the air, you set your own price because you own the machine."