OXCCU, converting CO_2 into fuels, chemicals and plastics

As part of our quick founder questions series - or QFQs - we spoke to Andrew Symes, Founder and CEO of OXCCU about carbon, hyrdocarbons and building a cost-effective alternative to fossil-based jet fuel.

OXCCU was launched to address the escalating impact of greenhouse gas emissions, especially from fossil fuels. Carbon is an incredibly useful element, especially when used in hydrocarbons and some sectors have no viable alternatives. Using renewable electricity directly is simply not an option. Our mission is to enable future generations the continued use of hydrocarbons for these sectors but without their climate impact.

Carbon capture and storage (CCS) has been proposed as a solution for climate change for more than 30 years. However CCS is not without risks to the environment and only some countries and sectors can easily implement CCS. Carbon Capture and Utilisation (CCU) offers an alternative solution whereby rather than burying the CO2, we can repurpose it for various applications, such as producing chemicals, fuels, or plastics as we move towards a circular economy.

The utilisation of CO2 is the foundation of our technology. We have developed an innovative, one-step process to convert CO2 and H2 directly into jet fuel range hydrocarbons, suitable for use as sustainable aviation fuel or as precursors for petrochemical products. We combine CO2, either from air,

biomass processes or industrial processes, with H2 from water and renewable electricity, to produce lower carbon or circular fuels, chemicals, and biodegradable plastics.

Tell me about the business – what it is, what it aims to achieve, who you work with, how you reach customers and so on?

OXCCU is at the forefront of scientific advancement, the company was spun out of the University of Oxford in 2021. We specialise in novel catalysts and reactor designs to convert CO2 and H2 into hydrocarbons, focusing on sustainable aviation fuels (SAF), chemicals, and biodegradable plastics. We have a diverse range of partners, including oil companies like ENI and Saudi Aramco, international airlines such as United, and commodity trading companies like Trafigura.

Our unique, one-step process offers a cost-effective and scalable solution to fuel production compared to traditional two-step processes. We plan to licence our technology, providing customers with a technology package that includes our novel catalyst, a reactor design and engineering support.

How has the business evolved since its launch?

Since our launch in 2021, OXCCU has undergone significant evolution. We secured £18M in Series A funding earlier this year and recently received a £2.8M government grant to fast track the decarbonisation of the aviation sector. Our team has doubled over the last year, including key hires to scale operations and deliver demonstration plants. Our catalyst stability has been validated in the lab under a wide range of conditions and we are now building demo plants to demonstrate performance at scale as well as the future potential of our technology. This will be the world’s first direct conversion of CO2 to fully deoxygenated jet fuel range hydrocarbons at these scales.

Tell us about the working culture at

OXCCU

At OXCCU, our team is a dynamic blend of entrepreneurial skills, chemical expertise, and a commitment to technological innovation. Led by myself, Dr. Tiancun Xiao, cofounder and CTO and Dr. Jane Jin, cofounder and COO, our collective goal is to contribute impactful solutions to combat climate change. We foster innovation, scientific rigour, and a shared commitment to accelerate progress to net zero.

How are you funded?

OXCCU is funded through a combination of sources. *In 2023 we secured £18M in Series A funding* and received a £2.8M government grant. Our major investors include IP Group (Kiko), Clean Energy Ventures, ENI, United Airlines, Aramco Ventures, Braavos, Trafigura, TechEnergy Ventures and Doral.

What has been your biggest challenge so far and how have you overcome this?

One of the significant challenges for sustainable aviation fuels (SAFs) and e-hydrocarbons generally is cost competitiveness. To overcome this, we focused on developing the one-step catalytic conversion process that significantly reduces both capital and operational costs. Independent research from Imperial College London has validated our approach, showing a a 50% lower capital cost, and reduced operational costs due to higher selectivity yield in the jet fuel range. This breakthrough positions our OXEFUEL as a cost-effective and decarbonized alternative to fossil-based jet fuel.

How does OXCCU answer an unmet need?

The direct Fischer Tropsch conversion of CO2 and H2 to long chain hydrocarbons is challenging; other attempts at direct conversion technologies have only been able to form undesirable short-chain hydrocarbons and methane, or produce significant low value alcohols as byproducts which are expensive to separate from the produced water. Hence, the majority have looked instead at first making CO, and then doing Fischer Tropsch with the CO and additional H2 (syngas), rather than using CO2 and H2 directly. However, making CO from CO2 (called Reverse Water Gas Shift or RWGS) is a difficult, energy intensive process, and is yet to be scaled commercially. Also with CO

and H2 (syngas) Fischer Tropsch, you generally make heavy wax which needs to be cracked in another energy intensive step.

Two steps generally means more separation steps, more heat management issues and higher costs. Our unique breakthrough catalyst and reactor system, developed in OXCCU with world-leading scientists from Oxford University, enables the direct formation of jet-fuel range hydrocarbons in a single step. Compared to the other indirect routes, such as the two-step process via CO, our direct route is much more energy-efficient, selective and scalable and can be easily programmed to produce other hydrocarbons or valuable chemicals.

What's in store for the future?

In the next three years, OXCCU will be building demo and pilot plants and will then licence our technology, selling our catalysts and reactor designs to project developers looking to make sustainable aviation fuel (SAF). We will continue to innovate and improve our catalyst performance and process, and develop other CO2 or CO catalysts, enabling the expansion of sustainable hydrocarbons beyond aviation fuel, for other fuels, plastics and chemicals, as well as demonstrating integration with waste biomass and biogas processes. We will form key partnerships with the major players in the engineering, aviation and chemical industries.

What one piece of advice would you give other founders or future founders?

For fellow founders and future entrepreneurs, my advice would be to ensure you do whatever you are most passionate about and have a deep interest in, don't be afraid to try, surround yourself with a diverse and skilled team that shares your passion, and be resilient in the face of setbacks. Success often comes from a combination of vision, perseverance, and adaptability.

And finally, a more personal question! What's your daily routine and the rules you're living by at the moment?

As a team we're united by our values, such as teamwork, kindness, respect for each other's capabilities and a belief in hard work, innovation and thinking big. We always remain humble and commit to our overarching mission of making a true impact in the fight against climate change.

Andrew Symes is the founder and CEO of *OXCCU.*

Article by ANDREW SYMES