

Report finds no single alternative to fossil-based jet fuel to support present demand

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Professor Mercedes Maroto-Valer. Credit: Heriot-Watt University

Decarbonizing the aviation industry by removing fossil fuels is an enormous challenge and requires a "whole systems approach," according to a leading scientist at Heriot-Watt University.

Professor Mercedes Maroto-Valer, deputy principal for [global sustainability](#), made the comments in response to an influential new

report from the Royal Society.

Published on Feb. 28, "Net zero aviation fuels: resource requirements and environmental impacts" says there is no single, clear, sustainable alternative to jet [fuel](#) able to support flying on a scale equivalent to present day use.

Some of the country's foremost scientists including Professor Maroto-Valer contributed to the study. They explored the resource availability challenges of alternative fuels, as well as likely costs, life-cycle impacts, infrastructure requirements and outstanding research questions across four fuel types, green hydrogen, biofuels (energy crops and waste), ammonia and synthetic fuels (efuels). Batteries were not considered, as aircraft powered solely by batteries are not expected to reach the energy density requirements of long-distance commercial flight by 2050.

While each fuel type has advantages and drawbacks, the findings underscore the challenges of decarbonizing aviation, especially when resources are likely to be in global demand for a range of "net-zero" objectives. For example, producing a sustainable, more eco-friendly aviation fuel capable of meeting current demand from energy crops would require around half of the U.K.'s agricultural land.

Over the last year, the Working Group analyzed and compared different pathways to net zero aviation and the environmental impacts of alternative aviation fuels in the U.K. context.

She said, "Aviation is one of the most difficult sectors to decarbonize and solutions to replace fossil aviation fuel require a multidisciplinary approach. Flying is something we have all become accustomed to but this activity accounts for about 2% of global greenhouse gas emissions. It's clear that if we wish to meet global net zero targets there is an urgent need to explore other options that reduce the impact on the environment

while attempt to meet current demand.

"The startling conclusion to come from this study is that there is no clear alternative to existing jet fuel. That is a problem and we have to be realistic in how we overcome this challenge. Research and science will be crucial in addressing this issue and it was an honor to be part of this distinguished group of experts and co-author this Royal Society policy briefing that systematically examines net zero alternatives to [jet fuel](#)."

Heriot-Watt is committed to finding solutions to global challenges including climate change. A team of researchers at the University have been developing a cleaner, greener aviation fuel over a number of years.

Sustainable Aviation Fuels (SAFs) also form part of the industrial decarbonization research portfolio of the U.K. Industrial Decarbonisation Research and Innovation Center (IDRIC), hosted by Heriot-Watt. As Director of IDRIC, Professor Maroto-Valer heads up research embedded in areas of energy intensive industry across the U.K.—with more than 60 funded projects that are led by 30 U.K. research institutions and covering a wide range of decarbonization solutions.

Professor Maroto-Valer, adds, "IDRIC works with the industrial clusters that are at the forefront of wide-scale deployment of low carbon technologies, such as hydrogen, direct air capture or biofuels, that are critical for the development of the sustainable [aviation](#) fuels identified in this report. Our whole systems approach also addresses key technical, social, economic and policy aspects, and we are investigating some of the challenges discussed in the Royal Society report."

The Royal Society estimates that producing sufficient green hydrogen fuel would require 2.4–3.4 times the U.K.'s 2020 renewable electricity generation.

They also identify the need for significant research in scaling up net zero fuels, from storage and handling, to environmental impacts including CO₂ and non-CO₂ emissions.

Addressing these challenges requires global coordination, particularly for navigating the transition period between current and future generation aircraft.

"Research and innovation are vital tools for the delivery of net zero," said Professor Graham Hutchings FRS, Regius Professor of Chemistry, Cardiff University, and chair of the report working group. "But we need to be very clear about the strengths, limitations, and challenges that must be addressed and overcome if we are to scale up the required new technologies in a few short decades.

"This briefing tries to pull together those realities, to allow [policy makers](#) to understand the future resource implications of today's policy and R&D decisions and to support international dialogue on this global technology transition."

More information: Net zero aviation fuels: resource requirements and environmental impacts: [royalsociety.org/topics-policy ... zero-aviation-fuels/](https://royalsociety.org/topics-policy/zero-aviation-fuels/)

Provided by Heriot-Watt University

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