OLIVER WYMAN

Aviation, Aerospace & Defense

POINT OF VIEW

NEW ENERGY

WHICH BUDDING AVIATION FUELS COULD BLOOM?

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BREAKTHROUGH TECHNOLOGY

Alternative aviation fuel depends on timing. The aviation industry has been seeking alternatives to jet fuel for years. Even as ground transportation transitions to a variety of cleaner fuels, nearly all airplanes still run on petroleum-based jet fuel, with no clear path to new fuels. Aircraft cannot switch to electric, hybrid, or solar energy, or fill the tanks with an alternative fossil fuel such as liquefied natural gas or propane.

We doubt the industry will switch to one, break-through alternative. Instead, after careful review of the fuels in development, and in-depth work with airlines, original equipment manufacturers, and suppliers, Oliver Wyman expects several alternative fuels could emerge during the next few decades. Moving these key fuels to commercial viability will require more investment and development, and a consistent policy environment that prioritizes the production of alternative aviation fuels.

Two approved technologies already produce fuels that can be blended with petroleum for flight, hydroprocessing and Fischer-Tropsh technology. Longer-term technologies such as alcohol-to-jet and pyrolysis could provide impactful quantities of economically priced fuel, but have significant hurdles to large-scale commercialization. Eventually, algae and electricity could be viable alternatives.

SHORT-TERM

Converting natural oils and animal fats into hydroprocessed ester and fatty acids, or HEFA, is already occurring at commercial scale in several biorefineries across the globe. However, these biorefineries target renewable diesel production for surface transportation use in subsidized markets, only producing aviation fuels on an opportunistic basis, if at all. This technology is characterized by high and volatile feedstock costs, and low feedstock availability, with finished fuel costing approximately $2 per gallon more than petroleum-derived jet fuel.

The Fischer-Tropsch process can make synthetic fuel from biomass or fossil fuels. The technology is already producing fuels at commercial scale using coal and natural gas as feedstocks. However, Fischer-Tropsch has not yet been proven at commercial scale using biomass as a feedstock.

MEDIUM-TERM

Alcohol-to-jet technology produces jet fuel from alcohols such as ethanol. The ethanol used as a feedstock can be created from a variety of different sources, including corn, sugar cane, and cellulose, such as wood chips and farm waste. The technology benefits from a mature feedstock supply chain, but it requires additional research for economic viability.

Cryogenic fuels, such as liquefied natural gas, are used in cars and heavy trucks already. The fuel could cut carbon dioxide emissions from airplanes by about 15 percent and reduce nitrogen oxide pollution by 40 percent. However, these fuels would require new engines and substantial infrastructure upgrades at airports.

LONG-TERM

Electric airplanes emit far less carbon dioxide and pollution when operated compared with Jet A-fueled planes, and electricity is much cheaper than petroleum. Of course, the actual pollution created by electric planes depends on the fuel used to initially generate the electricity. Batteries would have to be powerful, and airports would have to beef up infrastructure to handle recharging them. Plus, there is no electric propulsion system for commercial airplanes to use.

There are other possibilities, fuel technologies being tested, and some still in the early research phases. From our perspective, these are the most viable paths to alternative aviation fuels. Yet, these technologies aren't yet ready for prime time. Even the technologies with the best potential require more development to become economically viable.

Each fuel alternative requires its own set of infrastructure and engine changes. For sustainability to become achievable, the industry will have to identify feed stocks that can be grown and harvested or collected without generating so much carbon dioxide and pollution to render the exercise pointless. The industry will need new planes and engines to accommodate some of the alternative fuels, as well as fueling station upgrades and means to transport the fuels.

Developing these fuels is critical to the long-term health of the aviation industry. Airlines are at the mercy of rising and volatile petroleum prices, spending as much as 40 percent of their annual budget on fuel. At the same time, the industry grapples with regulations of carbon dioxide emissions in various regions around the world, as well as restrictions on pollution. New fuels can also satisfy the industry's own goals of reducing pollution and greenhouse gas emissions, breaking its dependence on oil, and moving to a broader fuel portfolio.

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