



## Is There A Better Way To Power Airplanes?

Jet planes require a huge amount of fuel for flight, which is both costly and extremely polluting. In this video, we investigate the problems with our current method of fueling jet planes and the challenges facing available alternatives. We also explore the benefits and major hurdles in what may be our best route forward.



**0:00***Animation of jet fuel usage and cost.*

Hi, this is Alex from MinuteEarth. Jet planes are basically flying fuel tanks with seats; at takeoff, as much as 45% of their total weight is jet fuel, which makes sense when you consider that to carry each passenger on a 7 hour flight requires burning 125 kilograms of jet fuel. This massive amount of fuel wouldn't be a problem except it's really expensive and it causes huge amounts of pollution. So, we might want to replace jet fuel with something else. But that's really hard. For starters, whatever alternative we came up with would require an airplane redesign, since jet planes are currently built specifically to run on jet fuel. But, even ignoring that serious challenge, most alternatives to jet fuel aren't energetic enough. Jet fuel has a high "specific energy", meaning it contains a lot of energy for how heavy it is, yet planes still need a lot of it, because they need to be able to fly literally around the world.

**0:55***Animation of weights of and space required for different fuels.*

Fuels like coal and wood and batteries could probably get a plane off the ground—after all, some of the first flight attempts used coal as a fuel—but a plane wouldn't be able to carry enough of them to power a long-haul flight. Other fuels like natural gas, propane, butane, and hydrogen hold enough energy for their weight, but since they're gases, they take up more space and require big, heavy storage containers that would wipe out any benefit from flying with a lighter fuel. Diesel and gasoline, on the other hand, are as energetic as jet fuel, but they congeal or catch fire too easily, and in the extreme conditions of an airplane, they could block pipes or explode. And while nuclear fuels hold millions of times more energy, their radioactivity makes them a little too risky, both in the air and in case of a crash. So, there's not really a great alternative to jet fuel.

**1:44***Animation of synthetic jet fuel uses and cost.*

That's why the best bet may be to create synthetic jet fuel that holds as much energy as conventional jet fuel, is just as safe, causes less pollution, and could work within the current system. Over the last couple decades, we've been able to make a few million liters of synthetic jet fuel in a few different ways, but so far, it's still more expensive than conventional jet fuel. That's because conventional jet fuel is made from petroleum, which formed—for free—all around the world over millions of years, and which we've spent the last couple hundred years figuring out how to extract and use at massive scales.

*Animation of production of synthetic jet fuel.*

To make synthetic jet fuel work, not only do we need to figure out how to more efficiently mimic the natural processes that occurred over millions of years, we also need to scale up the industry so it can produce fuel as cheaply as conventional jet fuel. Plane-ly speaking, that could take a while, but even so, synthetic jet fuel is the jet fuel alternative with the best chance of taking off.



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