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SYNTHETIC FUELS ARE THE DECARBONIZATION TOOL WE DIDN'T KNOW WE NEEDED

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When we talk about “switching to clean energy,” we usually think about putting up solar panels, wind farms, or nuclear power plants to “replace” fossil fuels. But these strategies only address electricity generation. Electricity is only 30-40% of the total energy pie, while other energy sectors – shipping, aviation, and industry, to name a few – will also need to be decarbonized. These sectors are called “difficult-to-decarbonize” sectors because they require entirely different approaches to become emissions-free.

Aviation, maritime ships, long-haul trucking, and industry all use hydrocarbons (gas, petroleum, oil, coal and coke) for fuel. These fuels are all highly energy dense (and highly emitting), making them ideal for long journeys, or achieving extreme temperatures for manufacturing. As such, these sectors are immensely difficult to run without them. We don’t yet have proven technology to fuel commercial jets or ships with solar-powered batteries, or run a factory on 100% renewable energy instead of much more reliable coal and natural gas. As a result, alternative fuels that can be swapped in for hydrocarbons are beginning to become attractive.

Hydrogen-Enabled Synthetic Fuels Study

A new report by energy research and consultancy firm LucidCatalyst says that carbon-neutral, hydrogen-enabled synthetic fuels might be the answer to transitioning these “difficult-to-decarbonize” sectors. Synthetic fuels – meaning fuels made chemically instead of mined from the earth – can be economically competitive with fossil fuels, according to the report.

This is a crucial breakthrough. First, implementing synthetic fuels gets rid of the need to *electrify* everything. Assuming these fuels are carbon neutral, all we have to do is swap them in for hydrocarbons.

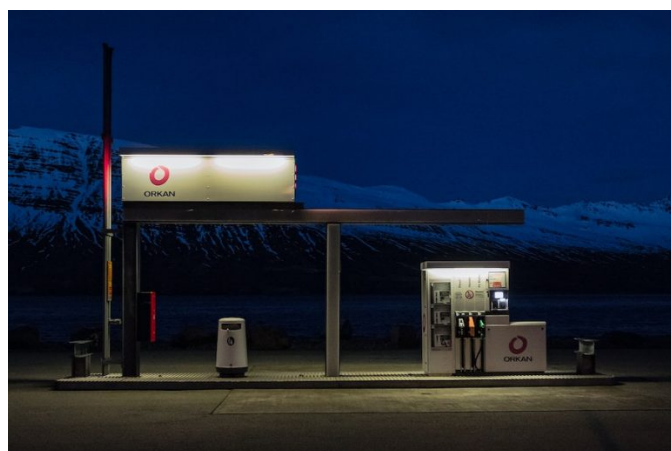
Second, they could replace the 50-60% of global emissions attributed to these sectors, at identical cost to cheap traditional fuels.

The report is titled “Missing Link to a Livable Climate: How Hydrogen-Enabled Synthetic Fuels Can Help Deliver the Paris Goals.” Its authors, Kirsty Gogan and Eric Ingersoll, believe that once they become competitive, these fuels can help speed the delivery of carbon-free solutions to meet the goal of limiting temperature increases outlined in the Paris Accord in 2015.

Hydrogen-based fuels are made by combining hydrogen – extracted from water through electrolysis – and carbon, sequestered from the environment using capture technology. There is no harmful mining involved in the process. To make the fuels, advanced modular nuclear reactors, referred to in the report as advanced heat sources, could provide emissions-free energy. These technologies have all been proven at Idaho National Laboratory, and will soon become commercially available.

Hydrogen must achieve a target price of \$0.90/kg by 2030. The report outlines a Gigafactory and world-class shipyard manufacturing approach that could build the heat sources rapidly and at scale. This model could bring down total operations cost to \$0.90/kg by quickly rolling out new units. It would require an investment of \$17 trillion spent over 30 years from 2020-2050. This is even less than the \$25 trillion the oil and gas industries will spend to produce conventional fuels over the next several decades. And renewables like solar and wind would require a massive \$70 trillion just to produce equivalent hydrogen.

Replacing the World's Transport Fuel



[Click the image to read the full Lucid Catalyst Report](#)

Renewables also suffer from scale constraints. It's not possible to rely only on renewables to produce the billions of tonnes per year of hydrogen required to replace all of the world's transport fuel, without country-sized buildouts of solar and wind. Gogan and Ingersoll conclude that advanced heat options are "the only technology that can realistically achieve this low price from electrolysis in the short to medium term."

Several companies (see examples [here](#), [here](#), and [here](#)) currently have synthetic fuels on the market, though none are the hydrogen-enabled fuels outlined in the report. All alternative fuels currently available are biofuel-based. Some companies pair their fuel technology with carbon capture and sequestration to lower their overall carbon output. But Gogan and Ingersoll believe companies developing hydrogen-enabled fuels are next.

Even if we successfully decarbonize electric grids with a huge expansion of clean sources, we will still find that a huge gap — about 75% — in our carbon output remains unaddressed. To meet the Paris goals, we only have another decade to cut our emissions in half. This means alternative fuel options that can easily plug into our ways of running civilization could really be the "missing link" to getting every economic sector on a strong path to decarbonization.



ABOUT THE AUTHOR



Amelia Tiemann

Amelia Tiemann is a science journalist who writes about all things energy and environment. She worked as a nuclear advocacy intern for Generation Atomic, and contributes to The 4th Generation Blog, curated by Terrestrial Energy Inc. She was a Generation Fellow at the Breakthrough Institute, where she researched public opinion on climate change. Ms. Tiemann has a B.A. in Environmental and Urban Studies from Bard College in New York State.

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