

Engineers go microbial to store energy, sequester carbon dioxide

December 15 2020, by Blaine Friedlander



Bioengineered microbes may one day be used to store the sun’s energy, as well as absorb atmospheric carbon dioxide to later turn it into fuel. This illustration features microbe images taken by postdoctoral researchers Youngchan Park and Bing Fu in chemistry. Credit: Wendy Kenigsberg/Cornell University

By borrowing nature's blueprints for photosynthesis, Cornell University bioengineers have found a way to efficiently absorb and store large-scale, low-cost renewable energy from the sun—while sequestering

atmospheric carbon dioxide to use later as a biofuel.

The key: Let bioengineered [microbes](#) do all the work.

Buz Barstow, assistant professor of biological and [environmental engineering](#) at Cornell University, and doctoral candidate Farshid Salimijazi have assembled theoretical solutions and models that calculate efficiency in microbes, which could take in electricity and store [carbon dioxide](#) at least five times more efficiently than photosynthesis, the process by which plants turn sunlight into [chemical energy](#).

"Soon, we will be living in a world with plentiful renewable electricity," Barstow said. "But in order to bring the bountiful energy to the grid, we will need [energy storage](#) with a capacity thousands of times greater than we have today."

The research, "Constraints on the Efficiency of Engineered Electromicrobial Production," was published in October in the journal *Joule*. Salimijazi is lead author.

Electromicrobial production technologies fuse biology and electronics so that energy gathered from wind, sun and water can get converted into renewable electricity in the form of energy-storage polymers (engineered microbes). Solving a storage problem, these microbes can be used on demand or to create low-carbon transportation fuels.

"We need think about how we can store energy for rainy days or for when the wind doesn't gust," he said, noting that battery or [fuel-cell technology](#) can take up a lot of space. "We need solutions on how to store this large amount of energy in a cheap and clean way."

In the paper, the researchers suggest taking advantage of microbial electrosynthesis, in which incoming electrons are fed directly to an

engineered microbe, which would convert carbon dioxide into non-carbon molecules. More research is necessary to determine the best microbes for the job.

Postdoctoral researcher Alexa Schmitz, a member of Barstow's lab, said the engineered microbes both store [energy](#) and absorb carbon dioxide. The CO₂ can be converted into a hydrocarbon fuel—effectively neutralizing the carbon cycle, resulting in net-zero carbon emissions.

"While the hydrocarbon fuel would not be carbon negative, carbon neutrality is still very good in this case," Schmitz said. "For a lot of machinery or in aviation, society may still need low-density hydrocarbon fuels for that sector."

That scenario is much better than carbon expansion, she said. "We want to be able to make low-carbon fuel without digging for oil or getting gas out of the ground," she said, "and then releasing the carbon into the atmosphere."

"The microbes act as an efficient microscopic fuel cell," said Barstow, a Cornell Atkinson fellow. "That's why we're offering this road map for the best ways to exploit this potential. More research is necessary to determine the best microbes for the job, as everything comes down to efficiency at the end of the day."

More information: Farshid Salimijazi et al, Constraints on the Efficiency of Engineered Electromicrobial Production, *Joule* (2020). [DOI: 10.1016/j.joule.2020.08.010](https://doi.org/10.1016/j.joule.2020.08.010)

Provided by Cornell University

Citation: Engineers go microbial to store energy, sequester carbon dioxide (2020, December 15)
retrieved 18 April 2024 from
<https://techxplore.com/news/2020-12-microbial-energy-sequester-carbon-dioxide.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.