Advanced Research Projects Agency • ENERGY

ELECTROFUELS PROJECT

GINKGO BIOWORKS

BIOFUELS FROM E. COLI

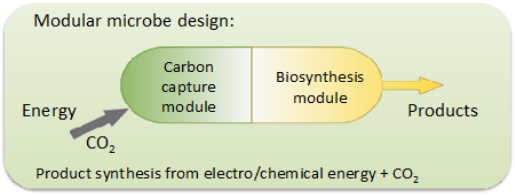
PROJECT TITLE:	Engineering E. coli as an Electrofuels Chassis for Isooctane Production		
ORGANIZATION:	Ginkgo Bioworks	LOCATION:	Boston, MA
PROGRAM:	Electrofuels	ARPA-E AWARD:	$6,668,000
TECH TOPIC:	Advanced Fuels	PROJECT TERM:	7/16/10 – 7/15/13
WEBSITE:	www.ginkgobioworks.com		

CRITICAL NEED

Domestic biofuels are an attractive alternative to petroleum-based transportation fuels. Biofuels are produced from plant matter, such as sugars, oils, and biomass. This plant matter is created by photosynthesis, a process that converts solar energy into stored chemical energy in plants. However, photosynthesis is an inefficient way to transfer energy from the sun to a plant and then to biofuel. Electrofuels—which bypass photosynthesis by using self-reliant microorganisms that can directly use the energy from electricity and chemical compounds to produce liquid fuels—are an innovative step forward.

PROJECT INNOVATION + ADVANTAGES

Ginkgo Bioworks is bypassing photosynthesis and engineering E. coli to directly use carbon dioxide (CO_2) to produce biofuels. E. coli doesn't naturally metabolize CO_2, but Ginkgo Bioworks is manipulating and incorporating the genes responsible for CO_2 metabolism into the microorganism. By genetically modifying E. coli, Ginkgo Bioworks will enhance its rate of CO_2 consumption and liquid fuel production. Ginkgo Bioworks is delivering CO_2 to E. coli as formic acid, a simple industrial chemical that provides energy and CO_2 to the bacterial system.



IMPACT

If successful, Ginkgo Bioworks would create a liquid transportation fuel that is cost competitive with traditional gasoline-based fuels and 10 times more efficient than existing biofuels.

- SECURITY: Cost-competitive Electrofuels would help reduce U.S. dependence on imported oil and increase the nation's energy security.
- ENVIRONMENT: Widespread use of Electrofuels would help limit greenhouse gas emissions and reduce demands for land, water, and fertilizer traditionally required to produce biofuels.
- ECONOMY: A domestic Electrofuels industry could contribute tens of billions of dollars to the nation's economy. Widespread use of Electrofuels could also help stabilize gasoline prices—saving drivers money at the pump.
- JOBS: Widespread use of Electrofuels could create jobs in fuel production, distribution, and sales.

CONTACTS

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