Tulane wins share of $35 million Department of Energy clean energy grant

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Barri Bronston bbronst@tulane.edu

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Nicholas Sandoval, an assistant professor in the Tulane Department of Chemical and Biomolecular Engineering, is teaming up with researchers at the University of Delaware on a clean energy project that cuts across the energy, transportation and agriculture sectors. (Photo by Paula Burch-Celentano)

Tulane University will share in a U.S. Department of Energy award designed to advance new technologies to decarbonize the biorefining processes used to convert organic material, such as plant matter, into fuel. The effort cuts across the energy, transportation and agriculture sectors.

The Tulane Department of Chemical and Biomolecular Engineering is teaming up with researchers at the University of Delaware on one of 15 projects supported by the DOE's Advanced Research Projects Agency-Energy (ARPA-E) and the Carbon Optimized Synthesis for the Bioeconomy program

The program focuses on developing advanced synthetic biology tools to engineer novel biomass conversion systems that are more efficient and produce less emissions than current fermentation processes widely used in biorefining. The $35 million investment in clean energy technology is part of the Biden-Harris administration's goal of achieving 100% clean energy economy and net-zero emissions by 2050.

Tulane is part of a $2.75 million project that aims to develop a platform technology based on synthetic consortia of *Clostridium* microbes to enable fast and efficient use of renewable carbohydrates to produce targeted metabolites (which are created as organic material breaks down) as biofuels or chemicals. *Clostridium* is a genus of bacteria that naturally consumes a wide variety of feedstocks and can produce a wide-range of biochemical products.

The Tulane portion of the grant will be led by Nicholas Sandoval, assistant professor in the Department of Chemical and Biomolecular Engineering. He and his team will focus on the genetic engineering of Clostridium acetobutylicum, a microorganism that produces acetone and butanol, to control and maximize the metabolites of interest.
Delaware will focus on the bioprocess portion of the work, including coculturing with a related bacterium called *Clostridum ljungdahlii*, which naturally consumes carbon monoxide, carbon dioxide and hydrogen gas.

"Here, we are going to culture these two bacteria together so that we can produce biochemicals without loss of any carbon from the starting sugars," Sandoval said. "A primary technical challenge that the team needs to overcome is to identify genetic and bioprocess conditions that enable stable co-culturing.

"Interestingly, when we do so, we can get products that are not produced by either species individually, meaning that they share chemicals and can do chemistries that neither can do on their own," he said. "This is super interesting because it means that specialty chemicals can be produced not only through genetic engineering of single strains but by mixing and matching engineered strains."

If researchers achieve their goals, they will be able to use this process to sequester carbon through additional consumption of gaseous carbon. This will make the production of biochemicals a carbon sink, absorbing atmospheric carbon.