

Continuous Conversion of Corn Stover to Ethanol Using Engineered Thermophilic Bacteria**FOA Topic Area:** 1. Pre-Pilot Scale-Up of Integrated Biorefinery Technologies**Principal Investigator:** Dr. Lee Lynd, Terragia CTO**Co-Principal Investigator:** Dr. Chris Herring, Terragia VP of Technology Development**Co-Principal Investigator:** Zach Losordo, Terragia VP of Engineering**Co-Principal Investigator:** Dan Schell, Manager, Bioprocess Integration Section, NREL

Project Objectives: Terragia's project aims to advance from TRL 4 to TRL 5 corn stover conversion to ethanol using consolidated bioprocessing (CBP) with engineered thermophilic bacteria. Key objectives include: implement CBP at industrially-relevant solids loading for the first time using continuous processing and developed bacterial strains, demonstrate a ≥ 2 -fold reduction in reaction time with cascade continuous operation, operate at a 0.5 dry tons per day pilot scale, project favorable economics with techno-economic analysis (TEA), and lead activities aimed at promoting understanding of the bioeconomy, biofuels, and related workforce development.

Project Description: CBP offers significant advantages over the conventional processing paradigm for cellulosic biomass, including consolidation of processed steps, and leveraging the superior deconstruction capability of anaerobic thermophilic bacteria compared to commercial enzymes. Terragia will bring these features to bear to demonstrate the commercial viability of producing ethanol and fuel pellets from corn stover in a process co-located at a corn ethanol plant. At a scale of 2 million gallons of stover ethanol per year, project performance targets enable an IRR of 15% with a capital cost of \$27 million.

Impact: Lignocellulose is a crucial resource for the emergent bioeconomy, but high processing costs hinder cellulosic biofuel deployment. Recognizing this challenge, initiatives like the Bioenergy Technologies Office and the White House Biotechnology and Biomanufacturing Initiative highlight the urgent need for cost-effective technology for biological conversion of lignocellulose. Traditional approaches have fallen short despite substantial investment, leading to a reevaluation of strategies. Whether as a complement or replacement to existing processes, CBP holds potential to significantly reduce production costs, aligning with the goals of DOE R&D efforts and offering valuable options for future sustainable energy production.

Project Participants: With 21 employees and significant investment, new startup Terragia is the global leader in CBP development. Led by experts Dr. Lee Lynd, Dr. Christopher Herring, and Zachary Losordo, and in partnership with NREL for pilot work, the project team has deep expertise to deliver successful results.

Community Benefits Goals: Terragia's proposed Community Benefits Plan aims to foster open engagement with local communities, incorporating feedback into subsequent technology commercialization efforts. By prioritizing diversity, equity, and inclusion (DEI), investing in local initiatives, and establishing education and workforce development programs, Terragia seeks to not only drive technological success but also support social equity and sustainability goals outlined by the DOE.