**Summary/Abstract for Public Release**

## Production of Low-Cost and Highly Fermentable Sugar from Corn Stover via Chemical-Recovery-Free Deacetylation and Mechanical Refining (DMR) Process

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The pioneer 2nd generation cellulosic ethanol plants have struggled with low fermentability of the sugar hydrolysates produced by dilute acid pretreatment. To address this issue, the National Renewable Energy Laboratory (NREL) has developed a scalable atmospheric pressure and low severity biomass deconstruction and fractionation processes, also known as the Deacetylation and Mechanical Refining (DMR) process that demonstrates superior performance in converting corn stover to high-concentration, low-toxicity sugars at high yields. However, the recovery of NaOH is a complex and high initial capital investment process. To further reduce minimum sugar selling price (MSSP) of the DMR process, the goal of the proposed project is to develop a chemical-recovery-free DMR pretreatment technology to produce highly fermentable cellulosic sugars at a MSSP ≤ $0.20/lb. By its completion, we will demonstrate:

1. A novel patentable chemical-recovery-free pretreatment technology that produces high quality sugar at high yields (>85%) and high titer (> 130 g/L of total fermentable sugar).
2. The process will reduce the MSSP to ≤ $0.20 through chemical cost reduction and by-product value.
3. NREL will demonstrate pilot scale production of sugar hydrolysate from the modified DMR process and provide over 30 kg of sugars (oven dry weight) to each collaborated downstream partners.
4. WSU will demonstrate the spent liquor value as fertilizer through nitrogen and sulfur nutrient analysis and perform real nursery experiment using corn seed.
5. The produced sugar will demonstrate ≥ 90% fermentation yield compared to pure sugar mock solutions using Danimer Scientific's proprietary strain for PHAs (polyhydroxyalkanoates) production.
6. The produced sugar will demonstrate ≥ 90% fermentation yield compared to pure sugar mock solutions using POET's proprietary strain for ethanol production.
7. The produced sugar will demonstrate ≥ 90% fermentation yield compared to pure sugar mock solutions using Altek's proprietary strain for lipid production.
8. The produced sugar will demonstrate ≥ 90% fermentation yield compared to pure sugar mock solutions using Auburn University's proprietary strain for lactic acid production.

Through collaboration with biorefinery industry partners, this project will demonstrate a cost-effective yet environmentally friendly chemical-recovery-free deacetylation and mechanical refining (CRF-DMR) process in producing affordable, clean, and highly convertible cellulosic sugars from corn stover.