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Project Title.

Biohydrogen systems for electricity and transportation

Abstract.

Microbes produce green energy gases including molecular hydrogen (H₂) and methane (CH₄). Because microbes use renewable feedstocks as substrates, these energy gases are renewable. This proposal seeks to further the development of microbial biohydrogen production by de novo synthesis and by interconversion of methane to hydrogen for electricity production and transportation. It addresses NCESR topic Energy Storage along with Carbon-free fuels, and potentially a Nebraska Hydrogen hub. To achieve the project goals, two strategies will be used; development of advanced biohydrogen fermentation, and bioconversion of methane to hydrogen. In prior studies the DOE supported a project in the PI's lab for biohydrogen production that led to an issued UNL patent (US 11332763) that has been optioned and is currently being licensed for commercialization. Objective 1 will establish the feasibility of a natural microbial metabolic pathway that converts methane to hydrogen. Objective 2 will establish the benefit of using cellulosic substrates derived from waste agricultural feedstocks for hydrogen synthesis along with physiologic and genetic interventions to increase hydrogen yield. Further optimization and subsequent scaleup of the proposal outcomes would support energy storage, large scale electricity generation but at reduced carbon intensity and support transportation using electricity or hydrogen fuel cells.