

Introduction to Hydrogen Production, Distribution, and Use

Due to its high gravimetric energy density and carbon-free nature, hydrogen has the potential to act as an energy carrier in a low greenhouse gas emissions future. Despite these fundamental advantages over carbon-based carriers, hydrogen still must overcome several technological barriers before it can be widely adopted. Large-scale production of hydrogen is neither efficient nor carbon-free at the present time.

Transportation and storage of hydrogen is difficult because of its low volumetric energy density. And hydrogen may offer pathways to higher conversion efficiencies than are available to traditional fuels, although those pathways are not currently cost effective. GCEP is continuing to investigate the basic science and technology solutions to all three of hydrogen's main challenges.

Currently, Professor Jim Swartz and his group are working on a project aimed at efficient production of high levels of hydrogen from glucose. This three-year project is building on an exploratory effort funded by GCEP where Professor Swartz and his lab group achieved levels of hydrogen production larger than any reported in the literature at that time, using a cell free enzyme pathway. Professor Swartz has filed a provisional patent application based on this work. These researchers have identified the rate-limiting enzyme and are making good progress toward improvements in hydrogen production rates and in conversion yields.