Bio-Fuel Cells Project

Project Description and Goals
Under several federal government awards, HNEI is advancing the development of biofuel cell technology through an array of quantitative in situ characterization techniques, test cells, and modeling capabilities to determine limitations to bioelectrocatalysis. In addition, HNEI has created a technology base with know-how to improve performance (e.g., catalyst lifetime, current density) with respect to important process variables such as choice of catalyst, choice of mediators, immobilization matrix, and mode of immobilization (e.g., covalent attachment versus physical entrapment of enzyme).

Project Benefits
Bio-fuel cells (BFCs) are fuel cells that use enzymatic or microbial biocatalysts to convert chemical energy directly to electricity as power sources. BFCs promise niche applications for generation of electricity at small scale, niche feedstocks, and under extreme conditions. They also complement conventional fuel cell technologies that rely on transitional metal oxides or noble metals as catalysts for conversion of chemical energy, typically stored in hydrogen or other biofuels, to useful electrical energy.

Status and Accomplishments
We have moved from standardized stack cell prototypes for enzymatic and microbial fuel cells to a pilot scale microbial fuel cell feeding upon anaerobic digestion effluent. Preliminary results are promising, with the anode in three electrode mode producing a -300 mV potential vs. a Ag/AgCl reference electrode and 5 mA of current.

Reports and Publications
To date, as a result of this project, a total of over 30 peer reviewed manuscripts and over 40 professional presentations have been completed by Drs. Cooney and Liaw and can be found at this website: http://www.hnei.hawaii.edu.