Introduction to Exploratory Projects – Completed

In addition to deep research into high-risk, high-impact fundamental science and technology, GCEP also funds smaller exploratory efforts. These exploratory projects can be funded for up to one year, and have budget limits of up to $100,000 each. The goal of these projects is to quickly evaluate the feasibility of a novel concept. If such an investigation proves successful, the investigators may apply for regular GCEP funding.

One exploratory project was completed this year. Professor Chueh and his research group were working on a project entitled "Gas molecules as the next-generation thermoelectric: direct conversion of hot gases to electricity with no moving parts". During this project the researchers have developed an electrochemical heat engine by employing a redox-active working fluid undergoing symmetric electrochemical reactions at the hot and cold ends. Unlike conventional heat engines, electrochemical engines can deliver high power and efficiency at as low as the kilowatt scales, making them attractive for both distributed and centralized heat recovery. Optimal heat-to electricity efficiencies and power densities can be achieved by independently tuning the voltage, the thermal conductivity, and the electrical resistance through materials engineering. Such design flexibility overcomes intrinsic limitations in thermoelectric and thermogalvanic generators. This work has led to submittal of a full GCEP proposal currently under consideration.