

# Fuel Cells

Fuel cells produce electricity through the electrochemical reaction of hydrogen and oxygen (or air). Fuel cells enjoy higher efficiencies than internal combustion engines, produce little or no emissions, offer fuel flexibility, and generate little noise. High efficiency fuel cells are well suited to meet the demands for distributed power generation and commercial transportation applications. Fuel cell technology also holds immense potential for military applications, including propulsion systems for unmanned undersea and aerial vehicles, portable fuel cell systems for mobile warfare, power for fleet vehicles and weapon systems, and reliable digital quality power for critical operations. In spite of the immense promise of proton exchange membrane fuel cells (PEMFCs), issues such as durability, reliability, cost, and integration of stacks into reliable power systems need additional development if the promise is to be met.

In keeping with its mandate to develop alternatives to imported fossil fuels, the Hawaii Natural Energy Institute (HNEI) has established a major fuel cell research and development program. This effort builds on HNEI's highly successful research on hydrogen production from renewable resources and bolsters the State of Hawaii's goals of reducing its heavy dependence on imported fossil fuels for electricity and transportation. For more details see the [Hydrogen](#) <sup>[1]</sup> research area of our website.

HNEI has been involved in research and development activities dealing with fuel cells for the last 10 years. Activities have been primarily involved with testing of individual proton exchange membrane fuel cells (PEMFCs) at HNEI's Hawaii Sustainability Energy Research Facility (HiSERF) in the Kakaako district of Honolulu. This facility is a state-of-the-art research facility to characterize fuel cell performance and reliability. However, other work conducted at the HiSERF and elsewhere has included research efforts conducted in the development of bio-fuel cells and biocarbon fuel cells, studies concerned with the use of fuel cells in support of electrical grid stability, use of fuel cells for helium recovery from rocket test systems, and development of an equation-based, object-oriented (EOO) fuel cell model library.

Specific HNEI research areas involving fuel cells include the following items. Clicking on each of these will provide details on the types of activities involved.

- [Fuel Cell Testing](#) <sup>[2]</sup>
- [Bio-Fuel Cells](#) <sup>[3]</sup>
- [Biocarbon Fuel Cells](#) <sup>[4]</sup>
- [Fuel Cells for Grid Support](#) <sup>[5]</sup>
- [Helium Recovery from Rocket Test Systems](#) <sup>[6]</sup>
- [EOO Fuel Cell Model Library](#) <sup>[7]</sup>

For general information regarding the entire fuel cell research area at HNEI contact [Richard Rocheleau](#) <sup>[8]</sup>, Director of HNEI.

**Source URL:** <http://www.hnei.hawaii.edu/research/fuel-cells>

**Links:**

- [1] <http://www.hnei.hawaii.edu/research/hydrogen>
- [2] <http://www.hnei.hawaii.edu/research/fuel-cells/fuel-cell-testing>
- [3] <http://www.hnei.hawaii.edu/research/fuel-cells/bio-fuel-cells-overview>
- [4] <http://www.hnei.hawaii.edu/research/renewable-resources-research-activities#biocarbonfuelcells>
- [5] <http://www.hnei.hawaii.edu/research/fuel-cells/fuel-cells-grid-support>
- [6] <http://www.hnei.hawaii.edu/projects/helium-recovery-rocket-test-systems>
- [7] <http://kdavies4.github.io/FCSys>
- [8] <http://www.hnei.hawaii.edu/staff/richard-e-rocheleau>