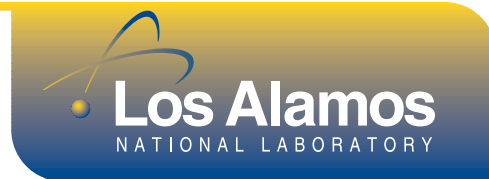


Fuel Cells



Los Alamos National Laboratory has been a leader in fuel cell research and supporting technologies since 1977. Fuel cells work by directly converting the chemical energy in a fuel to electricity, with higher efficiency and reduced environmental impacts compared to fuel combustion and energy conversion in conventional engines or turbines. These highly efficient power conversion systems are fueled by hydrogen, and have virtually zero greenhouse gas emissions. Although transportation has been the focus of some key Los Alamos research, fuel cells can be used in a broad variety of other applications ranging from cell phones, laptop computers, and portable electronics to combined heat and power systems for residential, commercial, and industrial buildings.

In the 1980s, Los Alamos scientists demonstrated how to achieve efficient energy conversion and power density in a proton-exchange membrane, or PEM, fuel cell with very low amounts of precious metal catalysts, improving on

the platinum catalyst fuel cells developed by General Electric for the Gemini space program. Los Alamos scientists also improved the structure and composition of catalyst thin films. By 1988, Los Alamos and General Motors had formed a partnership to perfect a PEM fuel cell for automotive use and improve fuel processing. Through the partnership, which also involved Dow Chemical Co. and Ballard Power Systems, Los Alamos developed diagnostic equipment for single fuel cells, stacks, combustors, and other fuel cell-related components. Throughout the 1990s, Los Alamos led development of better methods to process the fuels needed to operate fuel cell-powered vehicles, including a multi-fuel reformer, which makes it possible for the same fuel cell to use hydrogen derived from gasoline, natural gas, methane, or ethanol. Because even trace amounts of carbon monoxide in the liquid hydrocarbon fuels — gasoline or methanol — that serve as hydrogen fuel sources can hurt fuel cell

performance, Los Alamos developed and is perfecting the preferential oxidizer, or PROX. The PROX device can reduce carbon monoxide levels in hydrocarbon-based fuels from more than 10,000 parts per million to a miniscule 20 parts per million or less.

Los Alamos scientists have invented the Direct Methanol Fuel Cell, which uses methanol as a liquid fuel high-density hydrogen storage medium. In 2000, Los Alamos, in collaboration with Ball Aerospace, demonstrated a complete, stand-alone direct methanol power system for the Department of Energy and the Defense Advanced Research Projects Agency. Los Alamos scientists recently developed a new metallic (tantalum and palladium) membrane through which nothing but pure hydrogen passes, making pure hydrogen for fuel cells faster and less expensively than current systems. Los Alamos and Motorola Labs scientists also have been developing a miniature fuel cell that may one day replace batteries in cell phones or other small electronic devices.

In January 2001, the Los Alamos Fuel Cells for Transportation Program was selected to appear on the Energy 100 — a list of the 100 finest scientific accomplishments in DOE history. A distinguished panel of citizen judges further selected the Los Alamos effort for an Energy @ 23 Award, honoring those 23 accomplishments in DOE's 23 years with the greatest benefit to the American public, contribution to U.S. global competitiveness, and potential for significant future growth.

The momentum of the past 25 years may lead to creation of a Fuel Cell National Resource Center at Los Alamos. As a national user facility for research, development and testing, the Center's role will be to provide national focus and an integrated approach to addressing technical barriers to commercialization of polymer electrolyte membrane fuel cells.



A laboratory-built, fuel-cell powered scooter.



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