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CHP Case Studies in the Pacific Northwest

Exit Glacier, Kenai Fjords National Park, Seward, Alaska

National Park Service

National Park Service
U.S. Department of the Interior



5 kW Solid Oxide Fuel Cell



Kenai Fjords, National Park

Site Description

Kenai Fjords National Park is located just outside the town of Seward in South-central

Alaska, 126 miles south of Anchorage. It is a year-round recreation destination offering hiking, kayaking, and a variety of other summer and winter activities. Exit Glacier is the only part of the park that is accessible by car and accommodates 150,000 to 250,000 visitors per year.

The planning for the Nature Visitor/Contact Center at Exit Glacier, Kenai Fjords National Park began in 1992. In 1996, a Development Concept Plan was signed by the Regional Director of the National Park Service. This plan stated that the power for the Nature Center should be provided by solar, wind, hydro or other renewable energy source. In 2002, the funding to proceed with the plan became available

In 2004, the 1600 square foot Exit Glacier Nature Center was finally constructed, providing park visitors with a variety of hands-on exhibits and a book-store operated by the Alaska Natural History Association. In keeping with the aims of the Development Concept, the Nature Center is powered by a solid-oxide fuel cell that uses propane as the source of the hydrogen fuel. Located inside the nature center, the fuel cell features interactive screens to explain fuel cell operation and to show real-time data.

Power generated by the fuel cell flushes toilets, powers videos or other interactive exhibits, and provides heat. The National Park Service hopes that the fuel cell technology will keep the new center now open only during the summer months in operation year-round.

"The Alaska region has been experimenting with fuel cell technology because we have so many areas where we would like to have a minimal amount of power, and there's no way to get power to them," says Sandy Brue, chief of interpretation at Kenai Fjords. "The entire Park Service, the Alaska parks, and Kenai Fjords are interested in alternate fuel sources. This fuel cell will allow us to serve visitors throughout the year more efficiently and offer educational programs where we haven't been able to before."



Acumentrics Solid Oxide Fuel Cell

The Exit Glacier project is the result of a partnership between the Park Service and the Propane Education and Research Council, the Alaska Energy Authority, the Denali Commission, and the energy technology lab at the University of Alaska-Fairbanks. "We're trying to show the public that the technology is there and that, by taking advantage of existing propane delivery in the area, it's transferable

technology," says Tim Hudson, NPS team leader for planning, design, and maintenance in the Alaska region. "It's very efficient and it's very clean."

Plant Configuration

The plant consists of a 5 kW Acumentrics solid oxide fuel cell that uses propane as a fuel source.

The solid oxide fuel cell produces electricity and heat by converting hydrogen and oxygen into water, avoiding emissions associated with traditional combustion, and providing electrical efficiencies of 45-50%. The oxygen comes from air, and the hydrogen is supplied by propane. Propane is well-suited for this application since a distribution system already exists, and the fuel does not have the potential spill and clean-up problems associated with diesel.

Supporting this installation there are underground propane fuel tanks, plus the recent addition of a propane generator and battery system to provide peak power in excess of 5 kW for cycling of the well pump and water pressure system.

The system is part of the interactive display at the Nature Center and data on system operation is provided on-site PERC and to the NPS.

Energy/Financial Analysis

As part of a larger development project, the total costs for the CHP system are difficult to isolate, but the costs are upwards of \$600,000.

As a demonstration project, this funding was provided by a number of sources:

- Federal Funds (\$445,000)
- Propane Energy Research Council (\$135,000)
- Alaska Energy Authority (\$25,000)
- Arctic Energy Design and Testing Laboratory (\$65,000).



Initial Fuel Cell Installation

Operating Experience and Results

The fuel cell was tested in the laboratory in September, 2003. It was installed at Exit Glacier in September 2003, but due to damage it was returned to Acumentrics. A repaired unit was re-installed and dedicated on May 28, 2004. .

The system experienced problems with cracking in the tubes which may have been due to shipping damage and may have been due to the fact that the system was designed for natural gas and not propane.

The system also was designed not to require water input. The intermittent operation upset the water balance requiring a source of conditioned water. The unit was removed, reconfigured and re-installed in 2005. The propane reforming was replaced by a partial oxidation process that eliminated the need for make-up water.

Environmental Profile

The primary purpose of the fuel cell installation in the Park is to show an off-grid power generator with reduced noise and pollution. The fuel cell reduces noise, air emissions, and potential hazardous spills due to the elimination of the use of diesel generators at the site.

Future Plans

The installation of the fuel cell is considered a long-term demonstration project with potential application in the National Park Service throughout Alaska and the entire service.

Organizational Profile

The project is a partnership between the National Park Service, the Propane Energy and Research council, the Denali Commission, the Alaska energy Authority, and the Arctic Energy Technical Development Laboratory. The Fuel cell system was developed by Acumentrics, Corporation.

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