



TECHNOLOGY FOCUS AREA **SHIPBOARD FUEL CELL POWER PLANT**

FCE is also pursuing shipboard power generation applications for its DFC® carbonate fuel cell technology. A principal goal of this program was to demonstrate that commercially developed fuel cell technology can utilize naval logistic fuels and operate in a marine environment. Fuel cell based marine power plants possess the potential of superior performance with optimized fuel efficiency and environmental impact. These power generation systems have the potential to substantially increase system efficiencies particularly under partial loading conditions. Fuel cell operational capability provides low audible and thermal signatures compared to other alternatives. Because of the unique ability to reform fuel within the cell stack, DFC® plants can provide thermal efficiency approaching 50 percent over a wide range of operating power. In addition, this technology provides the potential for lower maintenance, lower costs, and lower emissions than other comparable power generation systems.

The Office of Naval Research (ONR) and the Naval Sea Systems Command (NAVSEA) are conducting an advanced technology development program to develop and demonstrate fuel cell electric power generators for future surface ship applications. This program leverages knowledge gained through early technology demonstration efforts initiated under the ONR Ship Service Fuel Cell Program.

Under the Ship Service Fuel Cell Program, FCE developed a conceptual design for a modular 2.5 MW first generation marine rated DFC® power plant and conducted critical system component testing. The key feature of this design is the ability to operate with high sulfur distillate fuels and internal process water recovery for water neutral operation. A logistic fuel processing Balance of Plant (BOP) module for a 0.5 MW demonstrator was designed and constructed. Process and Control testing at FCE verified conversion of high sulfur content Navy logistic fuels to anode fuel gas with composition transparent to the internal reforming carbonate fuel cell stack. For factory testing at FCE's Danbury, CT facility, the BOP module was integrated with a commercial design DFC® fuel cell stack. The integrated demonstrator power plant was operated at Danbury and NAVSEA Philadelphia for over 1,000 hours producing 18 megawatt hours of electric power output. The operational testing verified sulfur removal from the high sulfur logistic fuel and on board process water recovery for fuel reforming.

FCE also participated in an ONR next generation naval fuel cell development program aimed at reducing the size and weight of the first generation ships service fuel cell power plant. On this program, FCE evaluated options for scaling its high temperature polymer electrolyte fuel cell technology to power levels required for ships service power generators, and developed approaches for minimizing size and weight of the logistic fuel processing system.



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