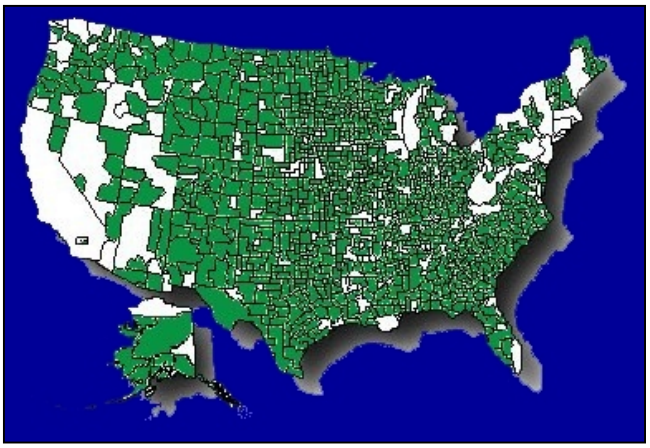
Office of
ELECTRIC TRANSMISSION & DISTRIBUTION
ELECTRIC DISTRIBUTION TRANSFORMATION PROGRAM

National Rural Electric Cooperative Association

Residential Fuel Cell Demonstration Program

Background

There are approximately 1,000 rural electric cooperatives in 47 states. They provide about 10% of the U.S. power supply and serve more than 35 million customers. These co-ops represent 45% of the distribution lines and 75% of the land mass served by the grid. They have low customer density, long distribution lines, and sizeable potential load growth.



Service areas of rural electric co-ops in the U.S.

Because of these factors, distributed resources (DR) and, in particular, fuel cells have captured the interest of rural electric co-ops and their customers.

The Department of Energy, the National Rural Electric Cooperative Association's Cooperative Research Network, Energy Signature Associates, and others have worked together to develop a residential fuel cell demonstration program.

Approach

The objectives of the program are to:

- Understand the potential benefits of DR
- Identify and resolve possible barriers to the implementation of DR, including permitting, interconnection, and other concerns
- Provide experience and tools for rural electric co-ops to use in planning, decision making, and implementation
- Benchmark residential fuel cell technology.

Handbook for Co-Ops

The partners developed a guide for rural electric co-ops engaged in the field-testing of equipment and assessment of related application and market issues. The handbook provides the background that co-ops will need to make decisions and implement successful projects of their own.

Implementation and Reporting

Project participants need to have simple, efficient ways to communicate about project planning and decisions at key milestones such as site selection, installation, and commissioning. For example, site selection includes the site profile, energy survey, grid and fuel interconnection plans, and an environmental checklist. Operational reporting includes incident reports, meter readings, and logs of power quality and performance.

Site Selection Issues

Site selection issues include fuel availability and customer loads. For example, will the system use natural gas or propane? What are the annual loads and patterns? Will the system be grid-independent, grid-parallel (connected), or dual mode?

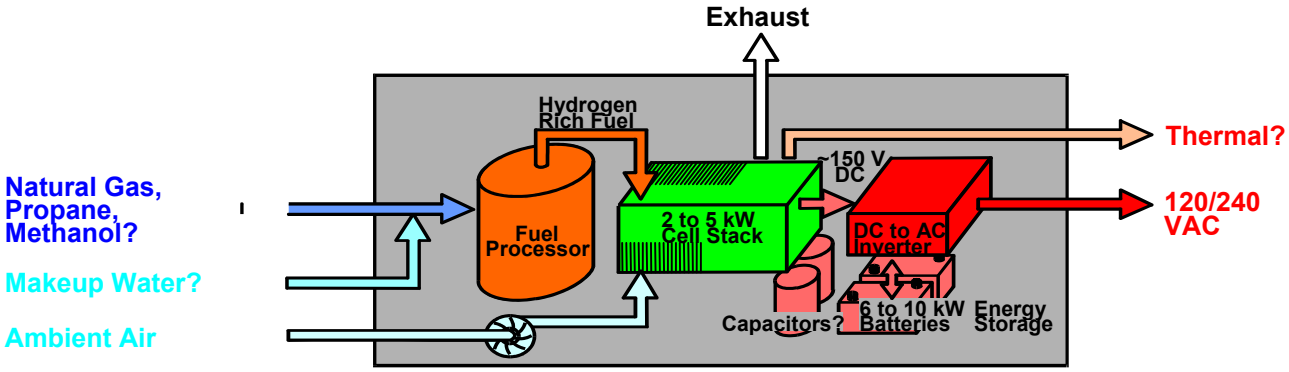
Interconnection and Power Quality Issues

Interconnection and power quality issues are explained for off- and on-grid configurations. The system needs to connect to multiple interfaces. Fuel metering and electrical metering are required. A water supply may be needed, and, depending on water quality, water conditioning may be necessary. Water recovery and thermal recovery are encouraged. All of these factors influence how the system is instrumented and monitored.

Interconnection Handbook

Because the technologies are new and manufacturing volumes are still low, initial system cost can be high. Actual customer loads can be hard to predict. Thermal recovery can greatly improve system economics, and individual customer load profiles can greatly affect system economics.

The handbook walks the project developer through each of these subjects and explains how to evaluate and decide on the best approach.



Typical residential fuel cell configuration

Demonstration and Field Evaluation

The residential fuel cell demonstration and evaluation project is now under way. This project has involved educating, building relationships, and evaluating the best candidate co-ops for initial implementation. Sites have been selected, and data systems have been developed to monitor and report on the effort.

Multiple manufacturers provided equipment options, and these have been evaluated. Features (and the pros and cons) vary significantly. Manufacturer ability to deliver has been a challenge but is improving.

The planning for several sites is complete. Two sites are deployed. The lessons learned are many.

Initial issues the demonstration program is grappling with include:

- Pre-installation test protocols
- Grid profiles
- Grid interconnect plans
- Micro-distribution plans
- Component and system designs and lifetimes
- Code issues
- Installation costs
- Market application issues
- Co-op market implications.

As the project proceeds and the participants learn what is needed, they are developing a library of useful tools that includes model agreements, sample reports, and applications for services.

Publications

Torrero, E; McClelland, R. "Residential Fuel Cell Demonstration Handbook." NREL/SP-560-32455. July 2002.

National Rural Electric Cooperative Association. "Distributed Generation Interconnnection Tool Kit." http://nreca.org/nreca/leg_reg/DGToolKit/index.html. NRECA online. June 2002.

Publications are available on the NREL publications database, http://www.nrel.gov/publications/.

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