STATE OF THE ART OF RESIDENTIAL FUEL CELL MARKET AND IMPLEMENTATION ISSUES

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BACKGROUND

Dispersed generation and its companion residential fuel cell technology have attracted increased interest by rural electric cooperatives and their customers. This is in part due to the rural co-ops inherent low customer density, long distribution lines typically costing $15,000 per mile for a single phase distribution or customer service line, and potential load growth patterns. The latter driving force includes increased emphasis on power quality and reliability as customers, including high tech industry and the home office, are increasingly attracted into the rural environment.

Indeed because of these factors, rural electric co-ops and their customer-owners are considered to be a key early entrance market for residential fuel cell technology. Obviously, one factor of keen interest to fuel cell technology developers is the potential to offset the $15,000 per mile service cost for remote sites against the admittedly high capital cost of today's residential fuel cell technology. Other factors include the deferral of transmission line upgrades to remote growth pockets and, in some areas of the country, customer mitigation of the impact of severe weather induced outages such as ice storms or hurricanes, particularly as power critical applications and home offices multiply on rural grids.

Thus, the NRECA's Cooperative Research Network has launched a residential fuel cell demonstration program at selected co-op sites across the country. Since this program complements an earlier CRN program involving a transportable 200 kW fuel cell at various commercial sites, the rural co-ops are well placed to assess various aspects of applying fuel cell technology in real-world applications.

APPLICATION AND TECHNOLOGY OVERVIEW

Although a fuel cell stack is a relatively straightforward DC generator, a practical fuel cell power plant incorporates a fuel processor, a DC to AC converter, possible battery storage, and needs a fairly intelligent control system to manage these subsystems and their integration. The currently planned co-op demonstration units use PEM, proton exchange membrane, technology. This technology, which is the only one currently available, requires a well processed stream of natural gas, propane, or similar fuels like methanol. In contrast, the currently commercial, but larger sized PAFC, phosphoric acid electrolyte, fuel cells require less fuel processing severity since these stacks operate at 350 °F, rather than at the 170 °F PEM plastic membrane limitation. In contrast future technologies out 10 years or so will likely be solid oxide units running at around 1500 °F. Such units are likely to use much simpler fuel processing. While each will likely have similar emissions as best as can be determined at this time, each poses different construction components and related profiles.

As this related technology overview will indicate, difficult cost versus production volume constraints will need to be hurdled if the manufacturers are to meet projected pricing. Thus, in the foreseeable 5 to 10 year future, such residential fuel cell power plants are much more likely to be utilized for specialized needs, like remote applications and backup power security, rather than for widespread universally applicable power generation.

This presentation will also examine the likely related emissions and comparative source-to-customer efficiencies, as well as related issues and their relationship to the fuel cell type. In addition, the relative economics will be reviewed so that the user can gain a perspective as to near and longer term market prospects.