Fuel Cell Technology Challenges

Cost and durability are the major challenges to fuel cell commercialization. However, hurdles vary according to the application in which the technology is employed. Size, weight, and thermal and water management are barriers to the commercialization of fuel cell technology. In transportation applications, these technologies face more stringent cost and durability hurdles. In stationary power applications, where cogeneration of heat and power is desired, use of PEM fuel cells would benefit from raising operating temperatures to increase performance. The key challenges include:

- **Cost.** The cost of fuel cell power systems must be reduced before they can be competitive with conventional technologies. Currently, the costs for automotive internal-combustion engine power plants are about $25–$35/kW; for transportation applications, a fuel cell system needs to cost $30/kW for the technology to be competitive. For stationary systems, the acceptable price point is considerably higher ($400–$750/kW for widespread commercialization and as much as $1000/kW for initial applications). For more information, see *Cost Analysis of Fuel Cell Systems for Transportation* (PDF 531 KB), presentation by the Fuel Cell Tech Team, TIAX LLC, October 20, 2004. Download Adobe Reader.
- **Durability and Reliability.** The durability of fuel cell systems has not been established. For transportation applications, fuel cell power systems will be required to achieve the same level of durability and reliability of current automotive engines [i.e., 5,000-hour lifespan (150,000 miles)] and the ability to function over the full range of vehicle operating conditions (40°C to 80°C). For stationary applications, more than 40,000

hours of reliable operation in a temperature at -35°C to 40°C will be required for market acceptance.

- **System Size.** The size and weight of current fuel cell systems must be further reduced to meet the packaging requirements for automobiles. This applies not only to the fuel cell stack, but also to the ancillary components and major subsystems (i.e., fuel processor, compressor/expander, and sensors) making up the balance of power system.
- **Air, Thermal, and Water Management.** Air management for fuel cell systems is a challenge because today's compressor technologies are not suitable for automotive fuel cell applications. In addition, thermal and water management for fuel cells are issues because the small difference between the operating and ambient temperatures necessitates large heat exchangers.
- **Improved Heat Recovery Systems.** The low operating temperature of PEM fuel cells limits the amount of heat that can be effectively utilized in combined heat and power (CHP) applications. Technologies need to be developed that will allow higher operating temperatures and/or more-effective heat recovery systems and improved system designs that will enable CHP efficiencies exceeding 80%. Technologies that allow cooling to be provided from the low heat rejected from stationary fuel cell systems (such as through regenerating dessiccants in a desiccant cooling cycle) also need to be evaluated.

A detailed list of the barriers to fuel cell commercialization and the technical targets to meet these challenges and guide the development of fuel cell technologies and systems for transportation, stationary, and portable applications are presented in the Fuel Cell Section of the *Program's Multi-Year Research* (PDF 678 KB), Development, and Demonstration Plan. Download Adobe Reader.

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