VIII.C Refueling Technology Development and Demonstration

VIII.C.1 NextEnergy Microgrid and Hydrogen Fueling Facility*

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Start Date: January 3, 2005
Projected End Date: October 10, 2007

**Congressionally directed project*

Objectives

- To support the DOE "Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project" in the greater Detroit area.
- To integrate, within a core urban environment, critical hydrogen infrastructure components and systems for multi-use operations.
- To optimize integrated, system-based solutions to advance hydrogen infrastructure for vehicular and stationary distributed power generation use.
- To provide a flexible "test" platform to advance the development and validation of commercial-type on-site hydrogen generation technologies.

Technical Barriers

This project addresses the following technical barriers from the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- Section 3.5.4.2 Barriers C&E. Directly addresses Technology Validation in the areas of Hydrogen Refueling Infrastructure and Codes and Standards
- Section 3.1.4.2.1 Barriers A–F and Section 3.1.4.2.2 Barriers G&H. Indirectly addresses Hydrogen Production by providing a flexible validation platform for all types of hydrogen generators.
- Section 3.7.4.2 Barriers A, B, D. Directly addresses Safety by providing safety data based on real operating experience.

Contribution to Achievement of DOE Technology Validation Milestones

This project will contribute to achievement of the following DOE technology validation milestones from the Technology Validation section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

Milestone 1: Make awards to start fuel cell vehicle / infrastructure demonstration activity and for hydrogen co-production infrastructure facilities.

NextEnergy Center (NEC) received an award to construct a facility that will provide fuel cell vehicle infrastructure and hydrogen co-production infrastructure. Phase 1 of 5 phases is complete and Phase 2 is in the design stage (See Figures 1 and 2).

Milestone 6: Validate vehicle refueling time of 5 minutes or less.

In cooperation with a global energy company and an OEM vehicle manufacturer, NEC will provide a flexible demonstration facility that will contribute data to this milestone. Initial data is scheduled to be available in late 2005.

Milestone 11: Validate cost of producing hydrogen in quantity of $3.00/gge untaxed.

NEC will provide a flexible demonstration facility that will evaluate several on-site hydrogen generation technologies and provide detailed data on their operation, including the cost of production on a gge basis. Initial data is scheduled to be available in late 2006.

Milestone 15: Validate co-production system using 50 kW PEM fuel cell; hydrogen produced at $3.60/gge and electricity at 8 cents/kWh.

NEC will provide a flexible demonstration facility that will be able to incorporate all of the technologies noted above and provide detailed data on their operation, including the cost of production. Although we do not have specific plans to install the exact configuration noted above at this time, the NEC facility is capable of easily accommodating such a configuration.

Milestone 16: Demonstrate prototype energy station for 6 months; projected durability >40,000 hours; electrical energy efficiency >40%; availability >0.80.

NEC will provide a flexible demonstration facility that will be able to be configured to collect data to contribute to this milestone. The NEC facility includes several electrical generation technologies and an integrated combined heat and power (CHP) system that is monitored and controlled via several computer-based systems.

Milestone 17: Validate prototype energy station for 12 months; projected durability >40,000 hours; electrical energy efficiency >40%; availability >0.85.

NEC will provide a flexible demonstration facility that will be able to be configured to collect data to contribute to this milestone. The NEC facility includes several electrical generation technologies and an integrated CHP system that is monitored and controlled via several computer-based systems.

Milestone 19: Complete Power Park demonstrations and make recommendations for business case economics.

NEC's facility is an integrated set of demonstration platforms that include the capability to fuel a hydrogen-powered vehicle at 350 barg, with the capability to accommodate 700 barg in the future; the capability to generate and store on-site hydrogen using multiple fuel feedstocks; the capability to interconnect up to 8 diverse electrical generation technologies and feed the output to a combination of the NEC on-site loads and adjacent buildings via a 480-V to 4160-V microgrid and the local electric utility grid; and the capability to recover the waste heat from the electrical generation prime movers via a CHP system and provide local hot

water heating and absorption chilling. Based on this integrated facility, NEC will be able to contribute data to fulfill this milestone.

NOTE: NEC will also contribute to *Milestone 18: Demonstrate pyrolysis system for waste biomass.* However, NEC is pursuing this work under a Department of Defense award as part of the Advanced Mobile Microgrid System program.

Approach

Develop the hydrogen station in 5 phases to match the forecasted needs of the station's users:

Phase 1 – Supply hydrogen to the NextEnergy Center microgrid via tube trailers to fuel the hydrogen-based products (i.e., fuel cells and engine-generator sets).

Phase 2 – Supply hydrogen to a packaged vehicle fueling system via tube trailers (in cooperation with a vehicle OEM and global energy supplier).

Phase 3 – Install permanent storage and the associated equipment such as the gas control panel, the hydrogen compressor, the electrical switch gear, and control and communication equipment.

Phase 4 – Install 5 hydrogen generator "test bays" and fill one test bay with equipment that will allow NextEnergy to produce ultra-high purity hydrogen on-site for use in OEM "fuel cell" vehicles.

Phase 5 – Install one additional high-purity on-site hydrogen generator.

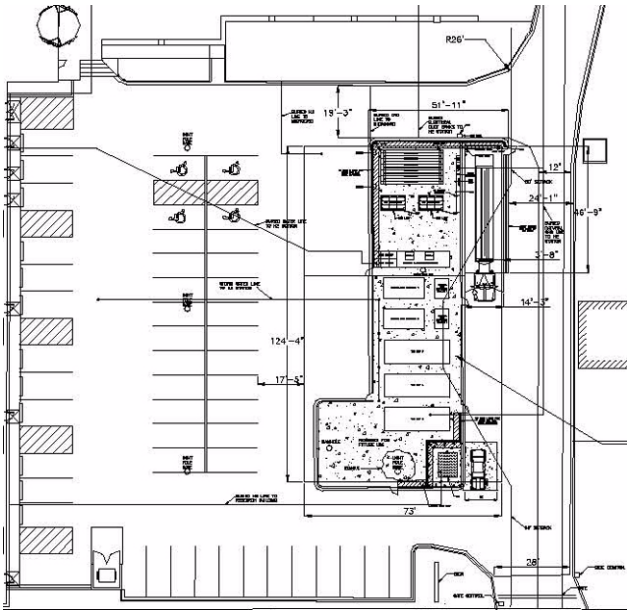

Figure 1. NextEnergy Center Site Plan, Including Hydrogen Station

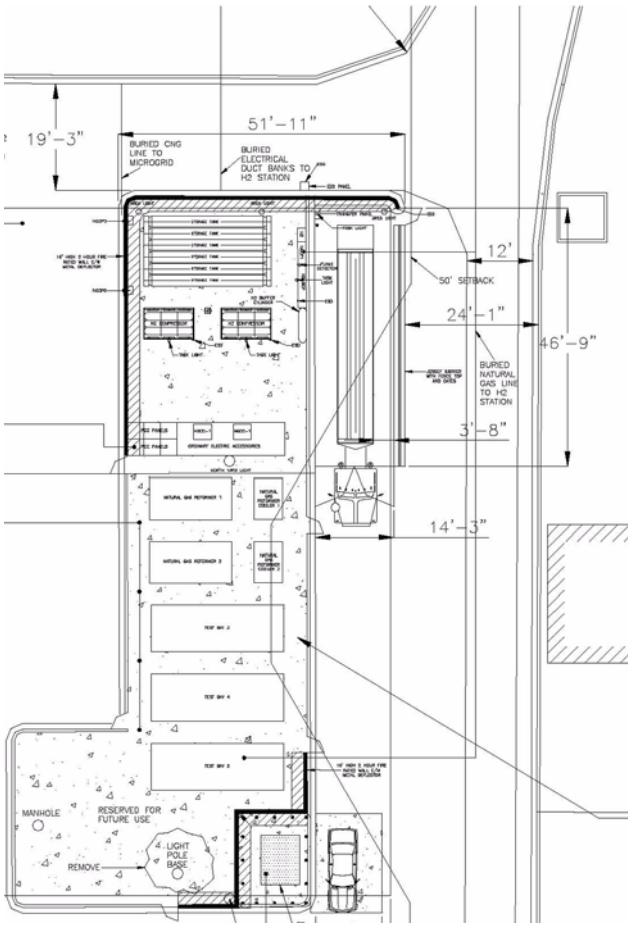

Figure 2. Hydrogen Station Phases 1 - 5