

2005 DOE Hydrogen, Fuel Cells & Infrastructure Technologies Program Review

NextEnergy Microgrid and Hydrogen Fueling Facility

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NextEnergy Center
May 25, 2005



Overview

Timeline

- Project start date: January 3, 2005
- Project end date: October 10, 2007
- Percent Complete: 17% at April 29, 2005

Partners

- DOE
- State of Michigan
- City of Detroit
- Wayne State University

Budget

- Total Project Funding: \$3,923,995.00
 - DOE Share \$1,926,744.00
 - Contractor Share \$1,997,251.00
- FY04 Funding Received: \$0
- FY05 Funding: \$774,855.00

Overview

Barriers

The NextEnergy Hydrogen Station will contribute to alleviating the DOE listed barriers related to:

- **Technology Validation:** directly in the areas of Hydrogen Refueling Infrastructure and Codes and Standards (Section 3.5.4.2 Parts C & E).
- **Hydrogen Production:** indirectly by providing a flexible validation platform for all forms of hydrogen generators (Section 3.1.4.2.1 Parts A – F and Section 3.1.4.2.3 Parts G & H).
- **Safety:** directly by providing safety data based on real operating experiences of this multi-use, multi-feedstock platform (Section 3.7.4.2 Parts A, B, D).

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.

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 & engine-generator sets).
 - Phase 2 – supply hydrogen to a packaged vehicle fuelling system via tube trailers (in co-operation 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 & communication equipment.

Approach

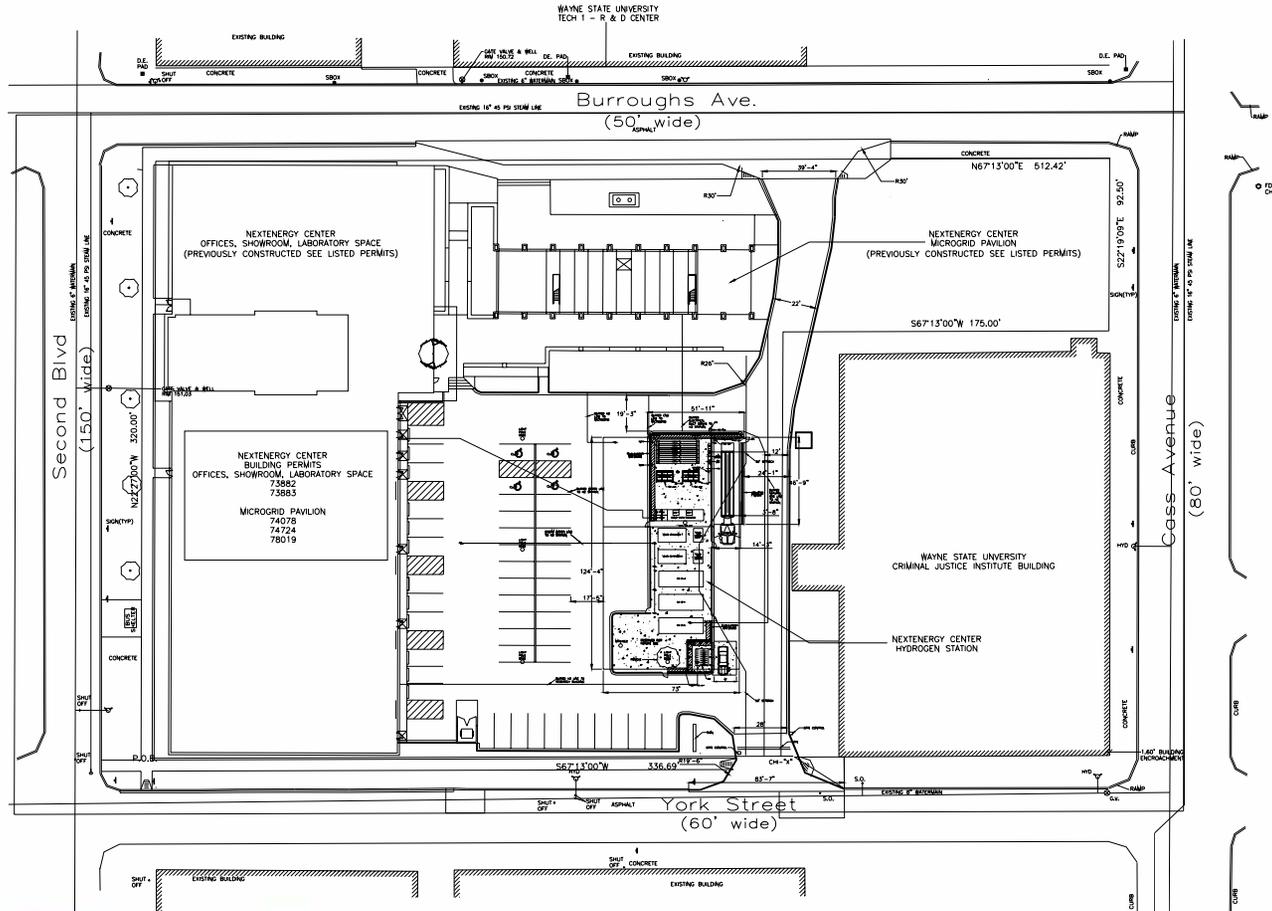
- Phase 4 – install 5 hydrogen generator “test bays” and fill one test bay with equipment that will allow NextEnergy to produce ultra-high purity hydrogen on-site for use in OEM “fuel cell” vehicles.
- Phase 5 – install one additional high purity on-site hydrogen generator.

Technical Accomplishments / Progress / Results

- Engineering design commenced January 3, 2005.
- Engineering design for Phase 1 completed February 1, 2005.
- Preliminary engineering design, equipment specification and installation specification for Phases 1 through 5 completed to support the revised Project Budget submitted to DOE March 28, 2005.
- Phase 1 work on track to be completed April 29, 2005.

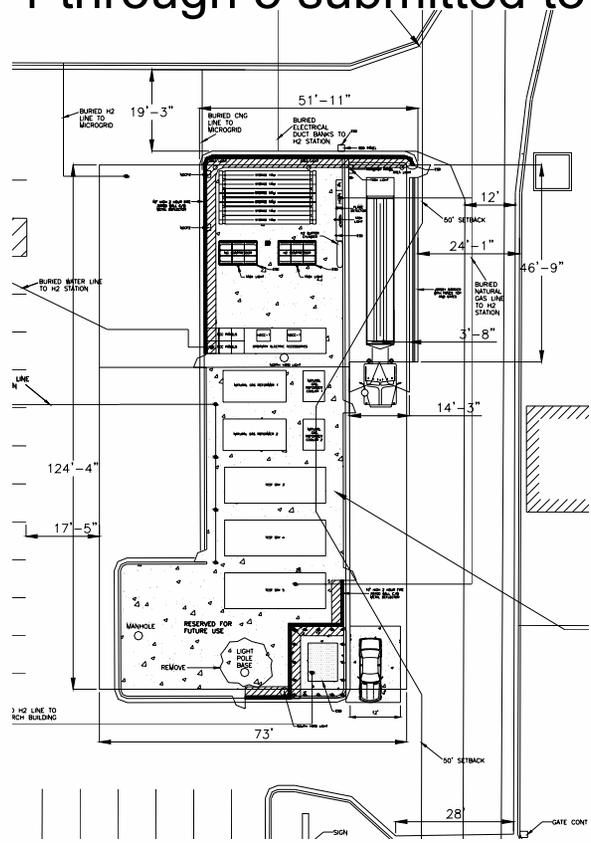
Technical Accomplishments / Progress / Results

Revised budget for Phase 1 through 5 submitted to DOE March 28, 2005



Technical Accomplishments / Progress / Results

Preliminary engineering design and equipment & installation specification for Phases 1 through 5 submitted to DOE March 28, 2005



Technical Accomplishments / Progress / Results

Revised budget for Phases 1 through 5 submitted to DOE March 28, 2005

APPLICATION FOR FEDERAL ASSISTANCE		Version 9/03	
1. TYPE OF SUBMISSION: Application <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Non-construction		2. DATE SUBMITTED March 15, 2005	Applicant Identifier
<input type="checkbox"/> Pre-application <input type="checkbox"/> Construction <input type="checkbox"/> Non-Construction		3. DATE RECEIVED BY STATE	State Application Identifier
		4. DATE RECEIVED BY FEDERAL AGENCY	Federal Identifier
3. APPLICANT INFORMATION			
Legal Name: NextEnergy Center		Organizational Unit:	
Organizational DUNS: 135963838		Department:	
Address: Street: 3011 W. Grand Blvd. Suite 320		Division:	
City: Detroit		Name and telephone number of person to be contacted on matters involving this application (give area code)	
County: Wayne		Prefix: Ms. First Name: Lori	
State: MI Zip Code: 48202		Middle Name: Elizabeth	
Country: USA		Last Name: Koenig	
		Suffix:	
4. EMPLOYER IDENTIFICATION NUMBER (EIN): 02 - 0648628		Email: lorik@nextenergy.org	
5. TYPE OF APPLICATION: If Revision, enter appropriate letter(s) in boxes (See back of form for description of letters.) <input checked="" type="checkbox"/> New <input type="checkbox"/> Continuation <input type="checkbox"/> Revision Other (specify) <input type="checkbox"/> <input type="checkbox"/>		Phone Number (give area code) 313-873-9280 FAX Number (give area code) 313-873-9256	
10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER: 811 - 0617		7. TYPE OF APPLICANT: (See back of form for Application Types) <input type="checkbox"/> Nonprofit Org. (Other than Inst. of Higher Edu) Other (specify)	
11. AREAS AFFECTED BY PROJECT (Cities, Counties, States, etc.) City of Detroit, State of Michigan		9. NAME OF FEDERAL AGENCY: Department of Energy	
12. TITLE (Name of Program) Renewable Energy Research and		11. DESCRIPTIVE TITLE OF APPLICANTS PROJECT: NextEnergy Center Microgrid and Hydrogen Fueling Facility	
13. PROPOSED PROJECT Start Date 09/03 Ending Date 03/08		14. CONGRESSIONAL DISTRICTS OF: a. Applicant MI-13 Carolyn Cheeks Kilpatrick b. Project MI-13 Carolyn Cheeks Kilpatrick	
15. ESTIMATED FUNDING:		16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?	
a. Federal	\$ 1,926,744.00	a. YES <input type="checkbox"/> THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER PROCESS FOR REVIEW ON DATE:	
b. Applicant	\$ 1,997,251.00	b. NO <input checked="" type="checkbox"/> PROGRAM IS NOT COVERED BY E.O. 12372	
c. State	\$.00	<input type="checkbox"/> OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW	
d. Local	\$.00	17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT? <input type="checkbox"/> Yes If "Yes," attach an explanation. <input checked="" type="checkbox"/> No	
e. Other	\$.00		
f. Program Income	\$.00		
g. TOTAL	\$ 3,923,995.00		
18. TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT. THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES.			
a. Authorized Representative			
Prefix Ms. First Name Lori		Middle Name Elizabeth	
Last Name Koenig		Suffix	
b. Title Chief Financial Officer		c. Telephone Number (give area code) 313-873-9280	
Email: lorik@nextenergy.org		Fax Number (give area code) 313-873-02	
c. Signature of Authorized Representative		e. Date Signed	

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Standard Form 424 (Rev. x-xxx)
Prescribed by OMB Circular A-102

Technical Accomplishments / Progress / Results

Phase 1 work on track to be completed April 29, 2005



Technical Accomplishments / Progress / Results

Phase 1 work on track to be completed April 29, 2005



Responses to Previous Year Reviewer's Comments

- 1. When will NextEnergy complete the management planning for the Hydrogen Station and begin the engineering design and construction work?**

NextEnergy's view of the mission of the Hydrogen Station has shifted from a static equipment design complemented with a liquid hydrogen storage system to one of a more dynamic equipment design that will facilitate the research and development efforts of any on-site hydrogen generator manufacturer who chooses to work with us.

This change has been reflected in the current design and captured in the revised budget submission submitted to DOE on March 28, 2005. Work is now underway and construction of Phase 1 should be completed by April 29, 2005.

Responses to Previous Year Reviewer's Comments

2. How is the Hydrogen Station integrated into the rest of the NextEnergy Center?

The NextEnergy Center has 4 major components:

- The Exhibition, Auditorium and Training area.
- The Laboratory area with up to 7 discrete labs.
- The Microgrid with 8 “test bays” with the capability to generate up to 1 megawatt of 3 phase electrical power.
- The Hydrogen Station with 5 “test bays” with the capability to generate hydrogen on-site, to accept purchased hydrogen, to store up to 400kg at 250 barg in gaseous form, to dispense hydrogen to vehicles, to supply hydrogen to the Microgrid and to supply hydrogen to the 7 labs.

Responses to Previous Year Reviewer's Comments

3. Is NextEnergy capable of handling 10,000 psig (700 barg) hydrogen for vehicles?

Yes, the current design specifies dispensing at 5,000 psig (350 barg). We are accomplishing this task by utilizing a packaged vehicle fueler that accepts hydrogen at up to 2,400 psig (165 barg).

In the future, we are positioned to “unplug” the 350 barg fueler and “plug in” a 700 barg fueler. The remainder of the upstream assets will remain unchanged.

Responses to Previous Year Reviewer's Comments

4. Has NextEnergy embarked on an education and outreach program?

Yes, NextEnergy has engaged several Authorities Having Jurisdiction including the State of Michigan Fire Marshal's Office and Department of Environmental Quality and the City of Detroit Fire Marshal's Office and Building Department.

NextEnergy is working with the following institutions to deliver alternative energy credit courses; the University of Michigan, Wayne State University, Oakland University, Lawrence Technical University, Kettering University, Northwest Michigan College and Lansing Community College.

Future Work (through May 31, 2006)

- Complete Phases 2 & 3.
- Complete the Engineering Design, Equipment Selection and Procurement for Phase 4.

Future Work (through May 31, 2006)

NextEnergy Construction Schedule					July	July	January	July	January	July	January	July	January	July	January	July				
ID	Task Name	Duration	Start	Finish	06/20	09/12	11/20/05	02/27	05/22	08/14	11/06	01/29	04/23	07/16	10/08	12/31	03/25	06/17	09/09	12/02
1	Project Start	7.16 days	Mon 01/03/05	Mon 10/10/07	[Gantt bar]															
2	Phase One	86 days	Mon 01/03/05	Fri 04/29/05	[Gantt bar]															
3	Phase 1 detailed design and Phase 2, 3, 4, 5 preliminary design for B.O.E. filing	41 days	Mon 01/03/05	Mon 02/28/05	[Gantt bar]															
4	Equipment Selection & Procurement	24 days	Tue 02/15/05	Fri 03/18/05	[Gantt bar]															
5	Build Out	20 days	Mon 03/21/05	Fri 04/15/05	[Gantt bar]															
6	Start-Up, Commissioning & Site Acceptance Testing	10 days	Mon 04/18/05	Fri 04/29/05	[Gantt bar]															
7	Phase Two	160 days	Mon 06/06/05	Fri 12/30/05	[Gantt bar]															
8	Detailed Design	40 days	Mon 06/06/05	Fri 07/29/05	[Gantt bar]															
9	Equipment Selection & Procurement	65 days	Mon 08/01/05	Fri 10/28/05	[Gantt bar]															
10	Build Out	25 days	Mon 10/31/05	Fri 12/02/05	[Gantt bar]															
11	Start-Up, Commissioning & Site Acceptance Testing	20 days	Mon 12/05/05	Fri 12/30/05	[Gantt bar]															
12	Phase Three	240 days	Mon 07/10/06	Fri 06/02/06	[Gantt bar]															
13	Detailed Design	85 days	Mon 07/10/06	Fri 10/28/06	[Gantt bar]															
14	Equipment Selection & Procurement	85 days	Mon 10/31/05	Fri 02/24/06	[Gantt bar]															
15	Build Out	55 days	Mon 02/27/06	Fri 05/12/06	[Gantt bar]															
16	Start-Up, Commissioning & Site Acceptance Testing	15 days	Mon 05/15/06	Fri 06/02/06	[Gantt bar]															
17	Phase Four	241 days	Mon 10/31/05	Mon 10/30/06	[Gantt bar]															
18	Detailed Design	65 days	Mon 10/31/05	Fri 01/27/06	[Gantt bar]															
19	Equipment Selection & Procurement	85 days	Mon 01/30/06	Fri 05/26/06	[Gantt bar]															
20	Build Out	65 days	Mon 06/05/06	Fri 09/01/06	[Gantt bar]															
21	Start-Up, Commissioning & Site Acceptance Testing	21 days	Mon 09/04/06	Mon 10/02/06	[Gantt bar]															
22	Phase Five	268 days	Mon 10/09/06	Mon 10/10/07	[Gantt bar]															
23	Detailed Design	55 days	Mon 10/09/06	Fri 12/22/06	[Gantt bar]															
24	Equipment Selection & Procurement	80 days	Mon 02/12/07	Fri 06/01/07	[Gantt bar]															
25	Build Out	65 days	Mon 06/04/07	Fri 08/31/07	[Gantt bar]															
26	Start-Up, Commissioning & Site Acceptance Testing	21 days	Mon 09/03/07	Mon 10/01/07	[Gantt bar]															

Publications and Presentations

- NextEnergy has referred to the Hydrogen Station in several overview-type presentations including presentations to several state and local Authorities Having Jurisdiction, the U.S. Department of Defense, several Michigan universities and colleges, local chapters of professional societies and two national labs.
- NextEnergy has used the specific design parameters of the Hydrogen Station in presentations to the State of New Mexico and the State of Oklahoma.
- NextEnergy has not released any operating data about this facility.

Hydrogen Safety

The most significant hydrogen hazard associated with this project is:

Shear failure of the hydrogen piping between the Gas Control Panel and Storage

Hydrogen Safety

Our approach to deal with this hazard is:

- Comply with all codes and standards for the design, construction and operation & maintenance of this station including designating this area as a Class 1, Division 2 electrical zone.
- Multiple piping lines to diversify the risk of all storage being dedicated to one pathway.
- Normally closed / fail closed actuators.
- Tubing and fittings designed for this application and tested to ASME 31.3
- Physical barriers to restrict access to this area.
- Mechanical protection of this piping.

Hydrogen Safety

Our approach to deal with this hazard is (continued):

- O&M procedures that limit access to this area to “authorized persons” and mandatory work permitting.
- Continuous monitoring of the mass of hydrogen in storage including alarming and closed loop control if an unexpected discharge of hydrogen is detected.