WVU Hydrogen Fuel Dispensing Station

Final Report

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DISCLAIMER

ABSTRACT

The scope of this project was changed during the course of the project. Phase I of the project was to construct a site similar to the site at Central West Virginia Regional Airport in Charleston, WV to show that duplication of the site was a feasible method of conducting hydrogen stations. Phase II of the project was necessitated due to a lack of funding that was planned for the development of the station in Morgantown. The US Department of Energy determined that the station in Charleston would be dismantled and moved to Morgantown and reassembled at the Morgantown site. This necessitated storage of the components of the station for almost a year at the NAFTC Headquarters which caused a number of issues with the equipment that will be discussed in later portions of this report. This report will consist of PHASE I and PHASE II with discussions on each of the tasks scheduled for each phase of the project.

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EXECUTIVE SUMMARY

This project had flaws that prevented it from operating as was originally planned. The duplication of station architecture to determine the validity of that architecture did not occur with the lack of sufficient funds to purchase the components of a new station. The move of equipment did not occur in a timely manner due to the availability of the funding for budget period 2. These two things unknowingly doomed the objectives of the project.

What did occur was that it was determined that leaving hydrogen production equipment setting for an extended period can cause significant issues to develop as that system is brought back online. The system can and did develop issues that were unforeseen by the team and product manufacturers. It also showed the need for a trained maintenance expert available on short notice at the facility. With the system that was established, having to work through distance issues caused delays in the repair and operation of the station.

With the testing that was done and the hydrogen that was produced, it appeared that electrolysis can be used to create hydrogen, but it was extremely cost ineffective. The cost of a gallon equivalent of hydrogen was significantly higher than gasoline and extremely higher than natural gas or propane. The significant portion of the cost was the electricity needed to make the reaction occur. From this prospective, further study is needed on the cost factors for electrolysis generation of hydrogen as an automotive fuel.

PHASE I – Initial project with replication of the Charleston, WV site in Morgantown, WV

PROJECT SUMMARY

The National Alternative Fuels Training Consortium (NAFTC), together with its partners, proposed to install a *Hydrogen Fuel Dispensing Station* at West Virginia University. This hydrogen fuel dispensing station project would begin with site development and installation of some of the key equipment needed for a research, development, test and evaluation (RDT&E) platform that will produce and dispense hydrogen fuel (H2). The site development and installation of some major pieces of station equipment would move USDOE, West Virginia and West Virginia University closer to creating hydrogen corridor by taking steps to establish a second, northern terminus along the I-79 corridor.

The *WVU Hydrogen Fuel Dispensing Station* would duplicate the design and performance of the Yeager Airport Hydrogen Fueling Station by using modular layout and an open architecture. This open architecture would support the evaluation of components, devices, subsystems and systems for hydrogen energy. As with the Yeager Airport Hydrogen Station, a modular layout would allow for site flexibility and adaptability.

The scope of the project is to complete the site development and preliminary purchase of some equipment necessary to establish an RDT&E Hydrogen Fueling Platform at West Virginia University. The site for the *Hydrogen Fueling Dispensing Station* was identified near the Bicentennial House, located on Mileground Drive in Morgantown, WV.

Included in this scope are the following tasks:

1. Site survey and site preparation, including electrical supply, water, and concrete pad installation;
2. Purchase and installation of a building and weather cover, as well as skids and a mezzanine, to house the hydrogen fuel dispensing station components;
3. Procurement of several equipment components, including an electrolyzer, buffer tank and chiller; compressor; high pressure storage composite tanks; electrical equipment and lighting; and grounding and lightning protection. These components will be used to construct the initial components and structure of the hydrogen fuel dispensing station so additional components can be procured and installed quickly.

PROJECT OBJECTIVES AND PURPOSE

Hydrogen has generally been accepted as one of the future fuels to provide a cleaner environment and reduce U.S. dependence on imported fuels. Demonstration projects showcasing the successful application of emerging hydrogen technologies are necessary to prepare for wider acceptance and usage of hydrogen fuel. Starting in 2006, the U.S. Department of Energy (USDOE) National Energy Technology Laboratory (NETL) launched its Hydrogen Initiatives to expand the introduction of Hydrogen-from-Coal technologies. This effort is unique in that it will support the use of fossil energy as a source of hydrogen fuel. NETL envisions that in the long term, hydrogen will be produced from coal, or alternatively, coal will provide the electricity necessary for the production of hydrogen via electrolysis. The hydrogen program will boost the coal industry's use of coal as a central production hydrogen source.

The objective of the NETL's program is to demonstrate that hydrogen is a safe and competitive alternative to petroleum. To support the objectives of the program and for this endeavor to be successful, awareness of how hydrogen can be integrated into the Nation's infrastructure, training, outreach and education must be included. These awareness measures must include the general public, state and local government officials, code enforcement officials, first responders, educators, public and post-secondary school students, defense applications, business potential end users of hydrogen vehicles and stationary applications, and others interested in the future of hydrogen in the United States.

Objectives include conducting research, development, test and evaluation (RDT&E) of advanced operating instruments and equipment, studying the operation and reliability of hydrogen fueling, monitoring the performance of the hydrogen fueled vehicles, promoting the general acceptance of hydrogen by the public, evaluating policy issues related to promoting a hydrogen economy, developing a connection to industry, and assessing other infrastructure issues associated with deploying hydrogen fuel in the transportation sector.

The purpose of this *Hydrogen Fuel Dispensing Station* project at West Virginia University shall begin with site development and installation of some of the key equipment needed for a RDT&E platform that will produce and dispense hydrogen fuel (H_2). The *WVU Hydrogen Fuel Dispensing Station* will duplicate the design and performance of the Yeager Airport Hydrogen Fueling Station by using modular layout and an open architecture. This open architecture will support the evaluation of components, devices, subsystems and systems for hydrogen energy. As with the Yeager Airport H_2 Station, a modular layout will allow for site flexibility and adaptability. The site development and installation of some major pieces of station equipment will move USDOE, West Virginia and West Virginia University closer to creating hydrogen corridor by taking steps to establish a second, northern terminus along the I-79 corridor.

The program has the potential impact of educating target audiences (beginning first in the State of West Virginia) about the safe use of hydrogen and the fossil fuel-to-hydrogen programs. The potential impact of this program will not only make hydrogen acceptable to the citizens of West Virginia, but could readily make West Virginia a leader in the use of hydrogen. This program can then be duplicated in other areas.

The program has the support of West Virginia University (WVU); the National Research Center for Coal & Energy at WVU; the National Alternative Fuels Training Consortium (NAFTC) at WVU; WVU Facilities Management; the West Virginia Division of Energy; the West Virginia State Fire Marshal; the West Virginia Fire Extension Service; the West Virginia Hydrogen Working Group; and the County Commissioner's Association of West Virginia.

TENTATIVE PROJECT SCHEDULE

Activity	Completion Date
Anticipated project start date	11/1/2010
Project kick-off meeting with USDOE NETL	11/31/2010
Architectural & engineering design study	12/31/2010
Completion of Construction Readiness Review of the pre-installation activities plan	3/31/2011
Construction bid process completed	3/31/2011
Equipment orders placed with appropriate vendors	3/31/2011
Groundbreaking event	4/30/2011
Site Development & Construction completed	9/30/2011
Equipment delivery completed	9/30/2011
Project-related progress reports and expense reports	Quarterly
Final report delivered	1/30/2012

TASKS TO BE PERFORMED

A discussion will follow each task explaining what occurred and providing details about the project.

Task 1: Project Management and Planning. Project planning will include a project kick-off meeting with USDOE NETL.

Subtask 1.1: Project Kick-off Meeting. A kick-off meeting will be conducted to plan and coordinate all project activities. This meeting will include representatives from USDOE NETL; the NAFTC; WVU Facilities Management; Kim Reidlein, design and installation consultant; and other relevant parties and organizations.

DISCUSSION: A project kick-off meeting was held with appropriate personnel in attendance. As the site was determined to be the Mileground site in Morgantown, discussion centered on what was needed to prepare this site for the facility to be used to house the hydrogen station. Providers for the building were discussed as the provider that supplied the building in Charleston, WV was not available at this time. Plans for the structure were used to begin putting out bid requests.

Task 2: Pre-Installation. The performance objective of this Task is for West Virginia University to prepare a pre-installation activities plan which includes, but is not limited to site specifics; community interface and education; and purchasing.

Task 2.1: Prepare a pre-installation plan that includes, but is not limited to:

- Site specifics of:
  - Use arrangement
  - Utility connectivity and contractual details
  - Installation and use permitting
  - Signage
  - Security and safety
  - Insurance and liability protection
  - Preparation
  - Management
  - Crisis and communications
- Community interface and education
- Architectural and engineering design study
- Purchasing plan

DISCUSSION: The pre-installation plan was started by the NAFTC staff. Working with the WVU Facilities office, this plan began developing all of the requirements for the placement of the station on the Mileground site. A contract was put in place with Kim Redlein to be the key consultant for the project. The WV State Historical Preservation Office conducted a review of the site to determine if there would be an issue with proximity to the WVU Farmhouse located adjacent to the station property. Clearance was received to use the site.

The NAFTC began development of a Construction Readiness Review of pre-installation activities which required determination of the equipment to be used in the establishment of the station. The NAFTC began receiving quotes for the materials to be used in the construct of the station using the Charleston site as a guide for the necessary items.

Decision Point 1: WVURC is not authorized to proceed into Task 3 without the written approval of the Contracting Officer (CO). The CO approval will be based on the completion of the Construction Readiness Review (CRR) including sign-off of the Pre-Installation Activities Plan, as identified in Task 2.1. The Pre-Installation Activities Plan reviewers shall consist of the Federal Project Manager (FPM), the NAFTC Principle Investigator, WVU Facilities Management, and the design/installation consultant at a minimum.

DISCUSSION: At this point, the project changed significantly. US DOE informed the NAFTC that funding for continuation of the project as planned would not be available. Funds would not be available to purchase the hydrogen fuel development and dispensing equipment to place in the building. Funds would also not be available for follow on activities, such as vehicles for testing or other activities such as education and outreach plans.

After significant discussions with the US DOE, the NAFTC, WVU, and Central West Virginia Regional Airport Authority, a determination was made by the US DOE that the station in Charleston, WV would be dismantled and moved to Morgantown, WV and then reassembled when the WVU structure was completed.

This required a complete redevelopment of the plan for the establishment of the station and all of the requirements for work to be completed.

Task 3: Installation. The performance objective of this Task is to proceed with preliminary installation of the Hydrogen Fuel Dispensing Station. Architectural/engineering study; purchasing, assembly, integration and site development shall be completed after approval of the minutes of the construction readiness review.

Task 3.1: Conduct site development activities for the Hydrogen Fuel Station Dispenser project.

Subtask 3.1.1: Subcontract site development work with a local contractor. This work will include site survey; site preparation; utility and water supply; concrete pad installation for building and fuel dispenser platform; and installation of the building and weather cover.

Task 3.2: Purchase equipment that will be installed at the Hydrogen Fuel Dispensing Station.

Subtask 3.2.1: Purchase FuelGen 12 electrolyzer and matching chiller and 20 bar rated buffer tank package from Proton Energy Systems, capable of a hydrogen production rate of 12.94 kg in a 24 hour period.

Subtask 3.2.2: Purchase supply tested and validated bolt-in, lightweight fuel storage from Dynetek Industries, Ltd. with a storage capacity of 53.63.7 Kg of hydrogen at a settled service pressure of 450 bar (6527 psig) with a maximum fill pressure of 563 bar (8158 psig). (This fuel storage will include a 6-cylinder complete fuel system that

consists of a 6 x W303H450G6N storage module; control panel and a fill panel assembly for each module; and a plumbing and mounting frame.)

Subtask 3.2.3: Purchase a compressor (PDC3 Model #12506000) from PDC, Inc., capable of hydrogen compression to 6,000 psig.

Subtask 3.2.4: Purchase skids and mezzanine to be used within the Hydrogen Fuel Dispensing Station storage building.

Subtask 3.2.5: Purchase and install an open architecture, pre-engineered steel building to house station equipment plus a weather cover for the dispenser island.

Subtask 3.2.6: Purchase electrical equipment and lighting to support the Hydrogen Fuel Dispensing Station project.

Subtask 3.2.7: Purchase grounding and lightning protection equipment to support the Hydrogen Fuel Dispensing Station project.

Task 3.3: Installation of the building and weather cover, as well as applicable equipment to support the Hydrogen Fuel Dispensing station project.

The performance objective of Task 3 is to proceed with installation of the Hydrogen Fuel Dispensing Station. Purchasing, assembly, integration and site construction shall be completed. In this Task the following shall be completed:

- Multi-tiered testing (including vendor tests prior to shipment)
- Regulatory interactions, filings, document approvals
- Regular configuration management confirmations
- Purchasing
- Assembly and integration on site

Throughout the subtasks, the contractor shall maintain a value engineering program following essential value engineering principles (particularly during the construction phase). At a minimum, the following activities shall be conducted:

- Utilize open architecture from the Charleston Hydrogen Station
- Maximize use of off-the-shelf equipment
- Maximize the coverage from vendor warranties
- Maximize the use of vendor supplied control software
- Ensure equipment accessibility in the mechanical layout
- Ensure, to the extent practical, the ability to visually inspect primary functional equipment

DISCUSSION: Task 3 was not begun due to the change of programming for the establishment of the station.

Task 4: Project Management and Reporting. Reports and other deliverables will be provided in accordance with the Federal Assistance Reporting Checklist following the instructions included therein.

USDOE Program Reviews will be held in Morgantown, WV. A USDOE Project Review will be held at either USDOE NETL-Morgantown or the NAFTC. Project site visits will be conducted as needed and the schedule will be coordinated with USDOE NETL.

The periodic, topical, and final reports shall be submitted in accordance with the Federal Assistance Reporting Checklist and the instructions accompanying the checklist.

DISCUSSION: This task was modified and is included in the PHASE II of the project.

PHASE II – Modified project with move of the hydrogen production equipment from the Charleston, WV site to the Morgantown, WV site.

This change necessitated changing the following items in the Project Management Plan:

B. PROJECT SCOPE

The scope of this project will include the selection, approval, and preparation of a site to construct the concrete pads and open-architecture building needed to house hydrogen processing and dispensing equipment. The real property provided by West Virginia University to construct the hydrogen station will be used as In-Kind cost sharing on this project.

The project will then move into a site development phase that includes the design and construction of the station. This phase will include the civil engineering design necessary for surveying, use configuration, utility taps, drainage, and permitting. Design drawings (shop drawings) for the modular open-architecture building have been provided by DOE and will be used, along with site specific civil engineering designs, to compile a bid package. Site development will then be completed by a general contractor via an open bid process and subsequent contract.

Upon completion of site development the project will move forward with the assembly of the hydrogen processing and dispensing equipment. The USDOE will provide the NAFTC with the major pieces of equipment and other materials from the Yeager Airport fueling station necessary to produce and dispense gaseous hydrogen. Any items required to complete the installation will be the responsibility of the NAFTC through this cooperative agreement. The NAFTC will receive and provide storage for this equipment before the site development is complete. These items of equipment will be assembled and installed by contractor/consultant Kim Redlein or other appropriate individual(s) when site development and construction of the building are complete.

Following assembly and operation verification of the hydrogen processing and dispensing equipment, the NAFTC will review security and safety protocols with community first responders in coordination with WVU Police and the WVU office of Environmental Health and Safety. Once the safety review of the station has been complete, the commissioning of the station will be made public and refueling of hydrogen vehicles can begin.

During operation of the station, regularly scheduled preventative maintenance (PM) will be executed under a maintenance contract with consultant/contractor Kim Redlein or other appropriate individual(s). The NAFTC will budget funds for parts which may be needed during the regularly scheduled PM’s.

Recording station dispensing activity, generating utility PO’s, supervising refueling, and quarterly reporting will be provided for approximately 12 months (and no later than 30 September 2013) after the commissioning of the station.

WVURC will coordinate applicable security and emergency planning related to the Hydrogen Station with fire, police, and other first responders from applicable State, county, and local authorities, including the University Police Department.

WVURC will approve of, and train, all personnel who will use the Hydrogen Station and the Equipment.

WVURC will establish procedures to operate the Hydrogen Station.

MILESTONE LOG

The milestones listed below and in the Project Timeline reflect completion of major tasks.

Milestone 1: Project Start-up Activities
Anticipated Completion Date: 1/30/2011

Milestone 2: Pre-Installation Activities
Anticipated Completion Date: 5/31/2011

Milestone 3: Site Confirmation and Preparation Activities
Anticipated Completion Date: 9/30/2011

Milestone 4: Receipt and Storage of Hydrogen Processing Equipment
Anticipated Completion Date: 10/31/2011

Milestone 5: Construction Bid Process
Anticipated Completion Date: 8/15/2012

Milestone 6: Construction Completed
Anticipated Completion Date: 10/31/2012

Milestone 7: Hydrogen Processing Equipment Assembly
Anticipated Completion Date: 11/31/2012

Milestone 8: Station Commissioning
Anticipated Completion Date: 12/1/2012

Milestone 9: Operation of Station
Anticipated Completion Date: 9/30/13

C. TASKS TO BE PERFORMED

Task 1: Project Start-Up Activities. Project planning will include a project kick-off meeting with USDOE NETL, as well as purchasing and contracting planning meetings.

Subtask 1.1: Project Kick-off Meeting. A kick-off meeting will be conducted to plan and coordinate all project activities. This meeting will include representatives from USDOE NETL and the NAFTC.

Subtask 1.2: WVU Procurement Conference

Subtask 1.3: Develop Purchasing Plan

Subtask 1.4: Initiate service agreement with Consultant Kim Redlein (or other appropriate individual)

DISCUSSION: These activities were completed during PHASE I of the project with no signification issues.

Task 2: Pre-Installation Activities. The performance objective of this Task is for West Virginia University to prepare a pre-installation activities plan.

Subtask 2.1: Review SOW and service agreement details. Finalize service agreement with consultant Kim Redlein (or other appropriate individual)

Subtask 2.2: WVU Facilities Meeting

Subtask 2.3: WVU EH&S Meeting and conference with consultant Kim Redlein

DISCUSSION: These activities were completed during PHASE I of the project with no signification issues. All of the issues that were brought to light were handled during the meetings and preparations were made to complete the project.

Task 3: Site Preparation. Site preparation will include a review of project plans by the WV State Historic Preservation Office (SHPO), an archeology survey of the site, review of the project by the Monongalia County Historic Landmark Commission, and a publication of a public notice.

Subtask 3.1: WV SHPO Review of Project Site

Subtask 3.2: Bid Phase 1 archeological survey

Subtask 3.3: Obtain Phase 1 archeological survey

Subtask 3.4: WV SHPO Review of Phase 1 Archeological Survey

Subtask 3.5: Mon Historic landmark Commission Review

Subtask 3.6: Revisions of Phase 1 Survey

Subtask 3.7: WV SHPO Revisions Review and Concurrence

Subtask 3.8: Publication of Public Notice

Subtask 3.9: Complete new project management plan (PMP) to submit with extension

DISCUSSION: The items in Task 3 were completed by the NAFTC and provided to the US DOE. This triggered a Go/No-Go decision by the US DOE and release of the funds necessary to complete the project. All of the information needed for this was provided to the US DOE project officer under separate cover. A revised Project Management Plan was provided to the US DOE project officer in the 2nd Quarter, 2012.

Task 4: Construction Bid Process. The construction bid process includes developing AutoCAD renderings, obtaining civil engineering work, compiling the bid package and biding the site work and building construction to a general contractor, and preparing construction readiness review documentation.

Subtask 4.1: Develop AutoCAD Drawings
Subtask 4.2: Obtain Civil Engineering Services
Subtask 4.3: Compile Bid Package
Subtask 4.4: Begin Bid Process
Subtask 4.5: Execute Revised Assembly Contract with consultant Kim Redlein (or other appropriate individual)
Subtask 4.6: Execute Contract with general contractor
Subtask 4.7: Complete Construction Readiness Review

DISCUSSION: The development of the bid package and bids took an extraordinary amount of time due to the financial issues and the amount of funding available. The bid package was sent out and bids were received as required by the WVU procurement process. When the bids were received and opened, the lowest bid exceeded the funding available by over $100,000. This required an adjustment of the project. All of the asphalt for the parking ramps was removed and other changes were made. A drain water retention device was installed as a requirement of WVU and a rebid was completed. This process took from the 1st Quarter, 2012 until the 3rd Quarter 2012 to complete. The final bid was supplied to the US DOE for project review and permission to continue with the project in the 3rd Quarter, 2012. The permission to continue and release of funds was received from the US DOE in the 1st Quarter, 2013. At that time, WVU Facilities and Procurement executed a contract with March-Westin Construction Company. A construction readiness review was conducted prior to the start of work on the station with all parties.

Task 5: Receipt and Storage of Hydrogen Equipment. The receipt and storage of hydrogen equipment involves receiving the hydrogen processing equipment provided DOE and off-loading for storage at the NAFTC facility.

Subtask 5.1: Rent forklift with a 6000lbs capacity
Subtask 5.2: Receive, off-load, and store hydrogen processing equipment that will be provided by the USDOE.

DISCUSSION: The hydrogen processing equipment was removed from the station at Charleston, WV by Kim Redlein under a contract with the US DOE in the 1st Quarter, 2012. The equipment was loaded on a flatbed trailer and moved to the NAFTC, where it was off-loaded and stored at the NAFTC headquarters facility. The equipment included:

Hydrogen Equipment Item	Manufacturer	Model Number	Serial Number
Electrolyzer	Proton Energy	FuelGen 12, Series 12, 15 BARG Part # 54-0105-0005	FG 0428090007
Buffer Tank	CVIP	NB 334	3943V01
Chiller	Dry Coolers	PAC-104RH-1R-30PE-1.5-1.5P	J-4522
Compressor	PDC Machines, INC.	PDC-3-1250-6000	Job No: 1162-0309
Priority Fill Panel	Kraus Global	KAF3P30N3	1--8814
Dispenser	Kraus Global	SHM 3HRN	1--6527
6 Composite Storage Tanks	DyeCell	W303TDG450G6N	Q3498 Q3497 Q3505 Q3494 Q3491 Q3492

Task 6: Construction. The construction tasks include excavation and site preparation, utility connectivity, building construction, and installation of signage.

Subtask 6.1: Excavation and site/utility preparation
Subtask 6.2: Building Construction
Subtask 6.3: Install Signage

DISCUSSION: The construction on the structure began during the 2nd Quarter of 2013. March-Westin Construction Company was contracted by WVU to perform the site preparation and construction of the site. WVU Facilities would install signage after completion of the facility. The construction on the site continued until the 4th Quarter of 2013. Completion of the site and handover to WVU Facilities was completed in the 1st week of September, 2013. Pictures taken during construction are included at the end of this document. No abnormal issues with the construction arose during the project, except for weather. An unusually wet summer slowed completion of the project slightly. At the end of the 1st week of September the structure was ready for installation of the components of the station.

Task 7: Equipment Assembly. Equipment assembly involved renting a 6000lbs forklift and flatbed truck, moving the equipment from the NAFTC to Station site, and the assembly of the equipment by consultant Kim Redlein and his URS subcontracted technicians.

Subtask 7.1: Rent forklift and flatbed truck
Subtask 7.2: Move equipment from storage to site
Subtask 7.3: Equipment assembly and storage
Subtask 7.4: Review safety protocol with first responders

DISCUSSION: Equipment assembly began the second week of September 2013. The NAFTC monitored the construction process and planned the actual assembly of the hydrogen processing equipment to begin immediately upon completion of the facility and handover by WVU Facilities. Kim Redlein arrived to begin the process of moving the equipment from the NAFTC Headquarters to the hydrogen station site. The NAFTC had forklifts and vehicles ready for loading and unloading the equipment which occurred in one day for all of the major items of equipment. Pictures are included at the end of this report.

During the down time during construction, Kim Redlein, in his discussions with the equipment manufacturer had determined that the cell stacks in the electrolyzer needed to be refurbished and the stacks were returned to the manufacturer, refurbished and returned to the NAFTC, until they were installed in the process of assembling the station.

Minor issues were determined during the installation that were easily taken care of with local equipment and supply sources.

During the process of assembling the site, several conversations were conducted with first responder personnel, including code enforcement and sign-off by the fire safety personnel in Morgantown, WV. Constant contact with these individuals and keeping them informed of the project made the approvals go very smoothly.

Task 8: Station Commissioning. Station commissioning will include review of safety protocol with community first responders, execution of a maintenance contract with Kim Redlein (or other appropriate individual), refueling the first hydrogen vehicle, and presentation at a hydrogen conference.

Subtask 8.1: Execute maintenance contract with consultant Kim Redlein (or other appropriate individual)

Subtask 8.2: Refuel first hydrogen vehicle

DISCUSSION: The establishment of the station was completed and the first vehicle was refueled during the 3rd week of September 2013. Several minor issues were discovered and repaired, but overall, the movement of the components and reinstallation was a major success. Kim Redlein indicated that with the installation the second time, all of the issues with the initial installation at Yeager Airport were dealt with prior to beginning the installation project. During the operation of the station for the first quarter of the new station, only minor problems were discovered. One electronic valve had to be replaced because of an issue with solenoid sticking and a water line had a break. A contract for maintenance of the station was instituted with Kim Redlein. He has an assistant in Morgantown that will help with the maintenance of the station.

Task 9: Station Maintenance. Preventative maintenance will be performed on the hydrogen processing equipment at regularly scheduled intervals by consultant Kim Redlein (or other appropriate individual) after installation complete. This is planned for quarterly maintenance.

DISCUSSION: The maintenance of the station for the remainder of the project was a continuing problem. Numerous issues developed as the project progressed. During a review, it was determined that this was primarily a result of the lengthy period that elapsed with the equipment not in use and stored at the NAFTC. This resulted in unforeseen issues developing with electrical components, valves and hoses that needed to be repaired or replaced. This will be discussed further in the last section of discussion.

Task 10: Station Operation. Station operation will include the reoccurring duties of recording of dispensing station activities, generation of utility PO's, supervising refueling, and quarterly and final reporting.

Subtask 10.1: Recording station dispensing data

Subtask 10.2: Generate utility PO's

Subtask 10.3: Supervise refueling

DISCUSSION: The operation of the station during the final year of the project was extremely sporadic. This was a result of two major issues. The operation of the station was contingent upon the operation of the vehicles from the Yeager airport project and the actual components of the station. The almost two years that the vehicles were not in operation caused a significant number of issues as was determined during the initial fueling of the vehicles at the Morgantown station. Vehicles would not take a fuel fill of fuel and one vehicle even had a fuel line disconnected in the system. This was the first opportunity to fuel them and operate them. Not having the vehicles available hindered the determination of the station issues and vice-versa. This resulted in the poor operational statistics for the station during the remainder of the project. This will be discussed in the next section.

GENERAL DISCUSSION:

The change of scope of this project provided a number of challenges for the completion of the project.

1. The lack of funding to complete the project as initially planned ultimately led to a much degraded project. The lack of time to complete the tasks in this project and the associated vehicle project did not provide the data necessary to determine the initial goals of the project.
2. The lengthy time of the inactivity of the components of the station moved from Charleston to Morgantown resulted in failure of components that was not envisioned during the planning and in the decision to make this move occur. Additional input was needed from the equipment manufacturers about what was planned and how it would affect the actual operation of the equipment once it was reinstalled.
3. With the change of scope, determination if this equipment could be readily duplicated in other hydrogen production facilities across the country was not made. It would seem that with the ability to put the equipment in operation at the Morgantown facility, that it would in fact be possible. Without the actual attempt though, there is no empirical data to definitely state that it could occur.
4. With the outcomes that occurred, it would have been preferential to leave the equipment operating at the Charleston location and not begin to move until the Morgantown facility had been completed and then moved from the Charleston facility to the Morgantown facility directly without storage for an extended period.
5. Having a consultant under contract for maintenance was needed with the issues that developed with the station and having a Morgantown associate was very helpful. It would have been better if there had been a member of the WVU or NAFTC that would have been that associate. They would have had potentially more time to work with the facility during the day as the associate used normally had to work after hours, when NAFTC and other personnel were not available. For future projects, this needs to be considered.

Overall, the project did not work as planned due to the change of scope because of the funding issues. For future projects of this type, that consideration needs to be included in the planning and if full funding is not available, consideration needs to be given to not beginning the project.

Financial Report

FY 1:

Baseline Reporting Quarters **Year 1 Start: 10/1/10** **Ends: 09/30/11**

	Q1	Q2	Q3	Q4
Baseline Cost Plan *(From SF424A, Section D)*				
Federal Share	$ 222,000.00	$ 404,000	$ 322,000	$ 206,000
Non-Federal Share	$ -	$ 0	$ -	$ 288,500
Total Planned *(Federal and Non-Federal)*	$ 222,000.00	$ 404,000	$ 322,000	$ 495,500
Cumulative Baseline Cost	**$ 222,000.00**	**$ 626,000**	**$ 948,000**	**$ 1,442,500**
Actual Incurred Costs				
Federal Share	$ 9,370.00	$ 21,024	$ 39,481	$ 40,767
Non-Federal Share	$ -	$ -	$ -	$ 0
Total Incurred Costs-Quarterly *(Federal & Non-Federal)*	$ 9,370.00	$ 21,024	$ 39,481	$ 40,767
Cumulative Incurred Costs	**$ 9,370.00**	**$ 30,394**	**$ 69,875**	**$ 110,642**
Variance				
Federal Share	$ 212,630.00	$ 382,976	$ 282,519	$ 165,233
Non-Federal Share	$ -	$	$	$ 288,500
Total Variance - Quarterly *(Federal and Non-Federal)*	$ 212,630.00	$ 382,976	$ 282,519	$ 453,733
Cumulative Variance	**$ 212,630.00**	**$ 595,606**	**$ 878,125**	**$ 1,331,858**

FY 2:

Baseline Reporting Quarters **Year 2 Start: 10/1/11** **Ends: 09/30/12**

	Q1	Q2	Q3	Q4
Baseline Cost Plan *(From SF424A, Section D)*				

Federal Share	$	$	$	$
Non-Federal Share	$	$	$	$
Total Planned *(Federal and Non-Federal)*	$	$	$	$
Cumulative Baseline Cost	**$**	**$**	**$**	**$**
Federal Share	$ 48,589	$ 33,051	$ 38,961	$ 32,181
Non-Federal Share	$ -	$ -	$ -	$ -
Total Incurred Costs-Quarterly *(Federal & Non-Federal)*	$ 48,589	$ 33,051	$ 38,961	$ 32,181
Cumulative Incurred Costs	**$ 159,231**	**$ 192,282**	**$ 231,243**	**$ 263,424**
Variance				
Federal Share	$ -48,589	$ -33,051	$ - 38,961	$ -32,181
Non-Federal Share	$ -	$	$	$ 0
Total Variance - Quarterly *(Federal and Non-Federal)*	$ -48,589	$ -39,051	$ -38961	$ -32,181
Cumulative Variance	**$ 1,283,269**	**$ 1,250,218**	**$ 1,211,257**	**$ 1,243,438**

Baseline Reporting Quarters **Year 3 Start: 10/1/12 Ends: 09/30/13**

	Q1	**Q2**	**Q3**	**Q4**
Baseline Cost Plan *(From SF424A, Section D)*				
Federal Share	$	$	$	$
Non-Federal Share	$	$	$	$
Total Planned *(Federal and Non-Federal)*	$	$	$	$
Cumulative Baseline Cost	**$**	**$**	**$**	**$**
Federal Share	$	$ 3,639	$231,290	191,695
Non-Federal Share	$	$288,500	0	0
Total Incurred Costs-Quarterly *(Federal & Non-Federal)*	$	$ 292,139	$231,290	191,695
Cumulative Incurred Costs	**$**	**$ 556,563**	**$ 787,853**	**979,548**

Variance				
Federal Share	$	$	$	$
Non-Federal Share	$	$	$	$
Total Variance - Quarterly *(Federal and Non-Federal)*	$	$	$	$
Cumulative Variance	**$**	**$**	**$**	**$**

Baseline Reporting Quarters **Year 4 Start: 10/1/13 Ends: 09/30/14**

	Q1	**Q2**	**Q3**	**Q4**
Baseline Cost Plan *(From SF424A, Section D)*				
Federal Share	$	$	$	$
Non-Federal Share	$	$	$	$
Total Planned *(Federal and Non-Federal)*	$	$	$	$
Cumulative Baseline Cost	**$**	**$**	**$**	**$**
Federal Share	$79,116	$ 113,721	$ 33,399	$86,087
Non-Federal Share	$ 0	$ 0	$	$
Total Incurred Costs-Quarterly *(Federal & Non-Federal)*	$ 79,116	$ 113,721	$ 33,399	$86,087
Cumulative Incurred Costs	**$ 1,058,664**	**$ 1,172,385**	**$ 1,205,784**	**$1,291,871**
Variance				
Federal Share	$	$	$	$
Non-Federal Share	$	$	$	$
Total Variance - Quarterly *(Federal and Non-Federal)*	$	$	$	$
Cumulative Variance	**$**	**$**	**$**	**$**

Milestones

FY1:

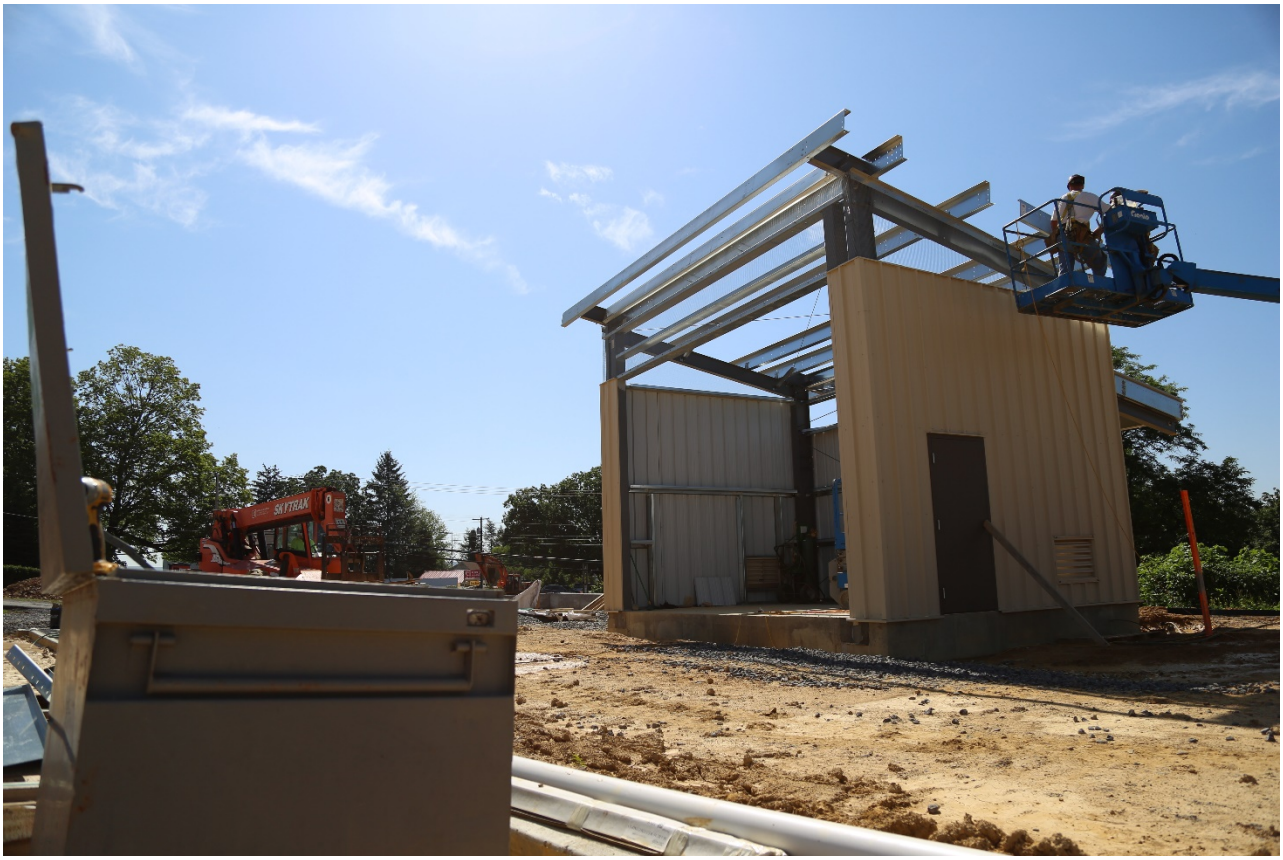
Project Milestone Description	Q1	Q2	Q3	Q4	Planned Start Date	Planned End Date	Actual Start Date	Actual End Date	Comments *(Notes, explanation of deviation from plan)*
Anticipated project start date					11/1/2010	9/30/2011	11/1/2010	9/30/2011	Completed
Project kick-off meeting with USDOE NETL					11/1/2010	11/31/2010	10/1/2010	10/1/2010	Completed
Architectural & engineering design study					11/1/2010	12/31/2010	6/30/2011	10/31/2011	Completed
Development of pre-installation activities plan					11/1/2010	2/28/2011	10/1/2010	1/31/2012	Completed
Completion of Construction Readiness Review of the pre-installation activities plan					3/1/2011	3/31/2011	11/1/2011	1/31/2012	Completed
Construction bid process completed					1/1/2011	3/31/2011	1/1/2011	2/15/2013	Completed
Equipment orders placed with appropriate vendors					3/1/2011	3/31/2011			No longer needed as DOE is providing the equipment.
Groundbreaking event					4/1/2011	4/30/2011			Canceled with the change of scope of the project.
Site Development & Construction completed					6/1/2010	9/30/2011	3/1/2013	8/31/2013	This was received in April and may be moved to July per WVU Facilities
Equipment delivery completed					6/1/2010	9/30/2011	8/25/2011	4/15/2011	Completed. Stack received.
Project-related progress reports and expense reports					11/1/2010	9/30/2011	12/31/2013		Submitted as required by project documentation.
Completion of Final Report					9/30/2010	12/30/2011			

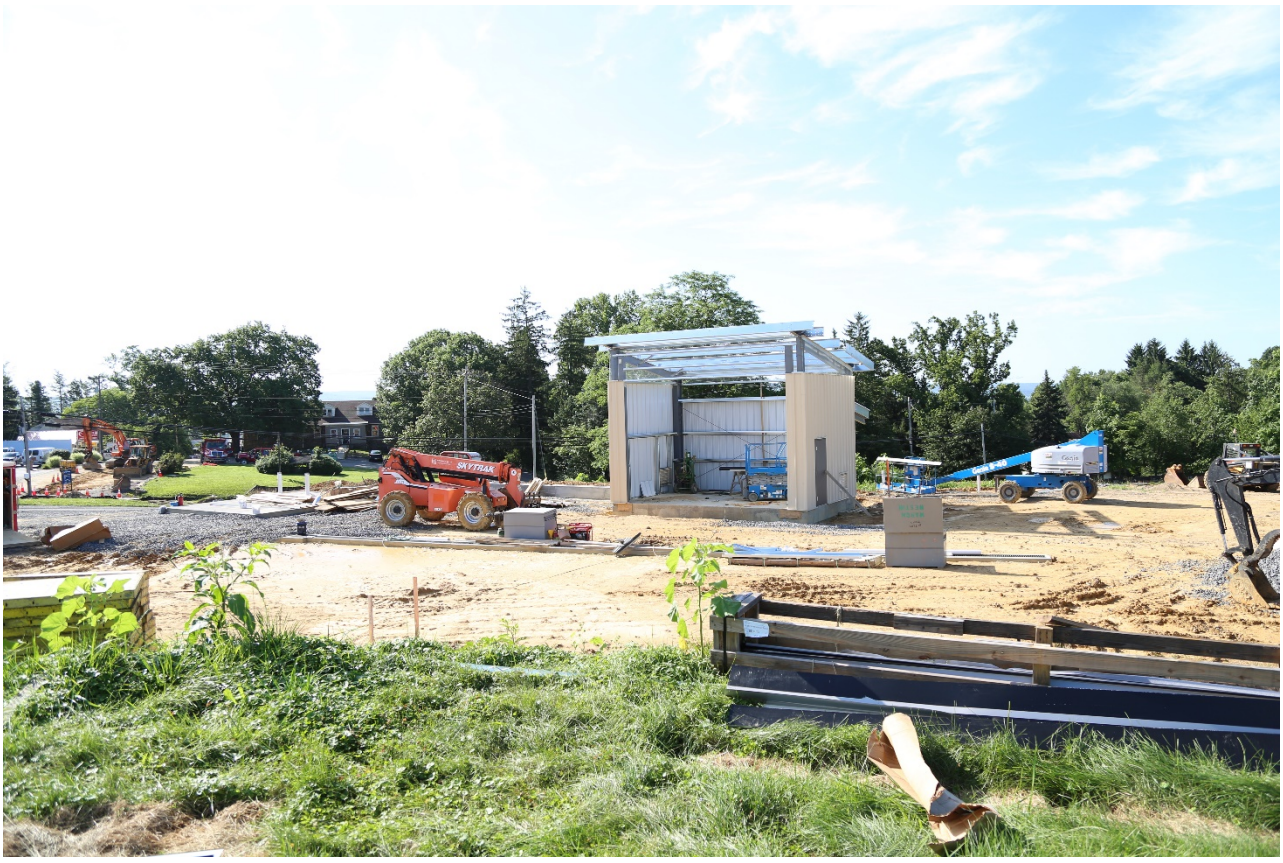
FY2-4:

Project Duration: 10/01/11 - 09/30/14

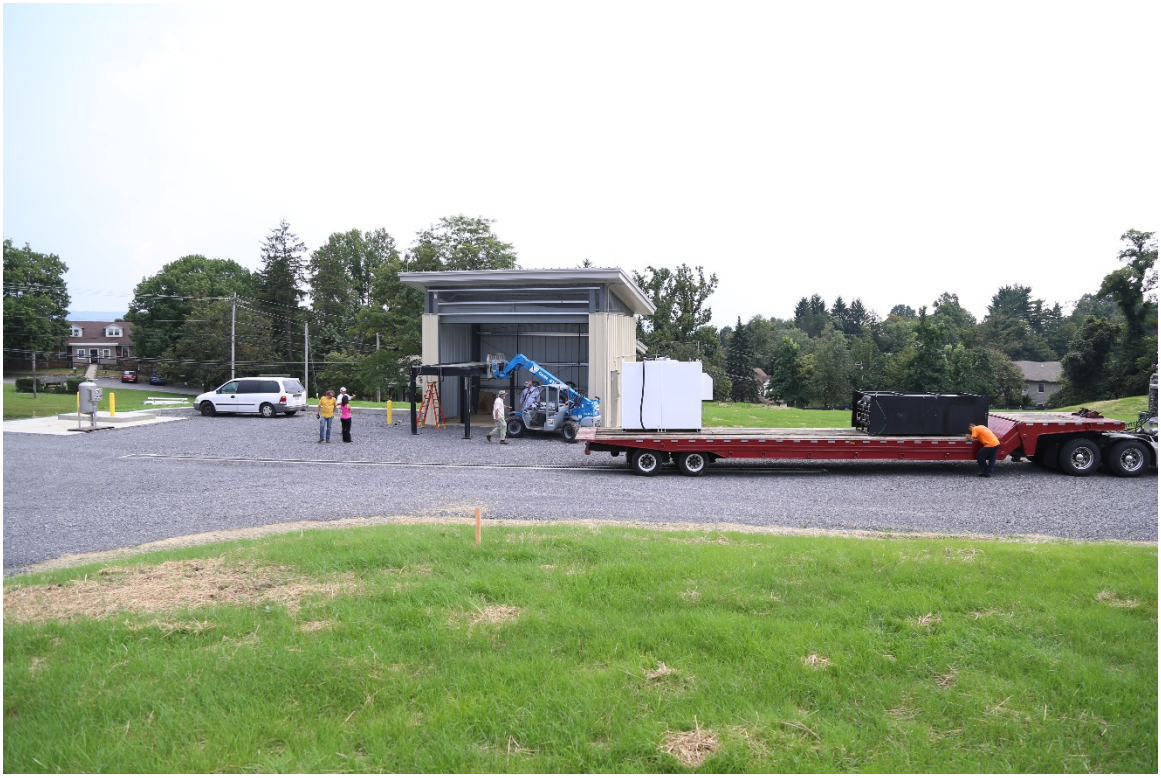
Project Milestone Description	**Q1**	**Q2**	**Q3**	**Q4**	**Planned Start Date**	**Planned End Date**	**Actual Start Date**	**Actual End Date**	**Comments** *(Notes, explanation of deviation from plan)*
Receipt and Storage of Hydrogen Processing Equipment					10/31/2011	10/30/2011	9/7/2011	9/7/2011	Equipment delivered early September
Construction Bid Process					11/30/2011	12/31/2011	3/31/2012	4/15/2013	Final Bid received. Forwarded to US DOE Project Officer for permission to proceed.
Construction Completed					4/30/2012	5/30/2012	8/31/2013	10/15/2013	Completed
Hydrogen Processing Equipment Assembly					11/1/2010	2/28/2011	9/15/2013	10/15/2013	Completed
Station Commissioning					6/1/2012	6/2/2012	10/1/2013	10/15/2013	Completed
Station Operation					10/1/2013	12/31/2014	10/15/2013	10/31/2015	Completed

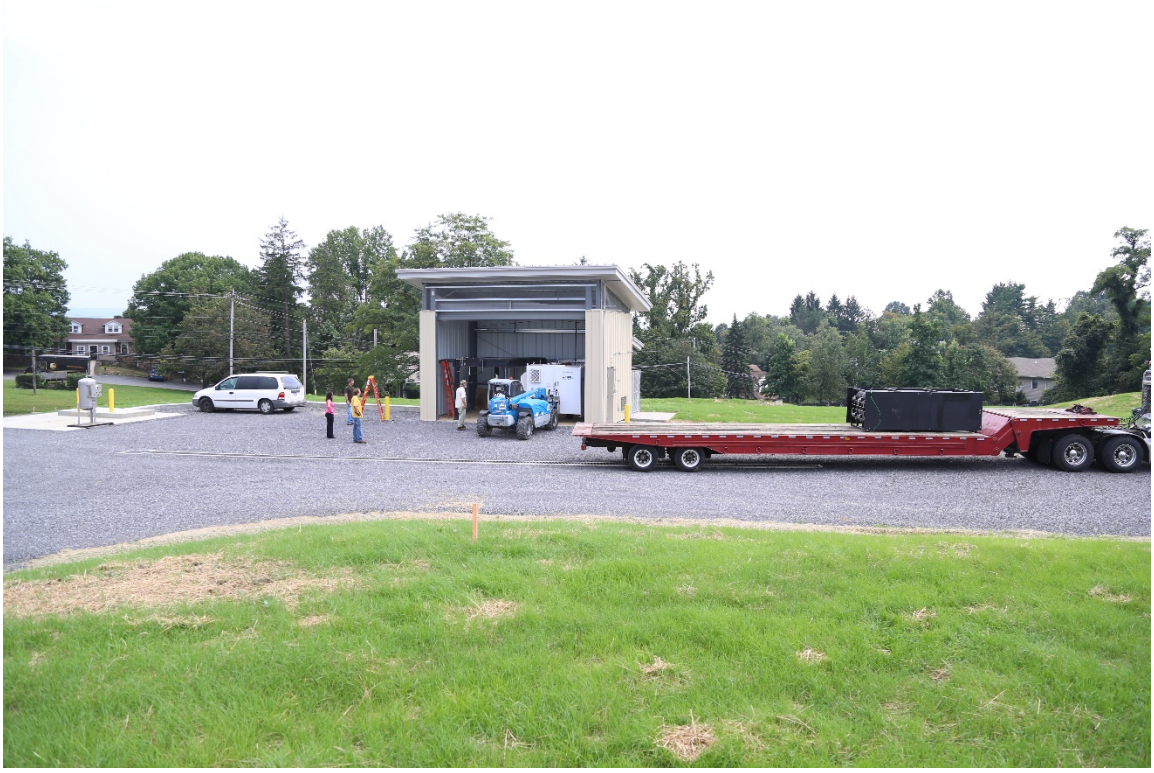
PHOTOS CONSTRUCTION PHASE



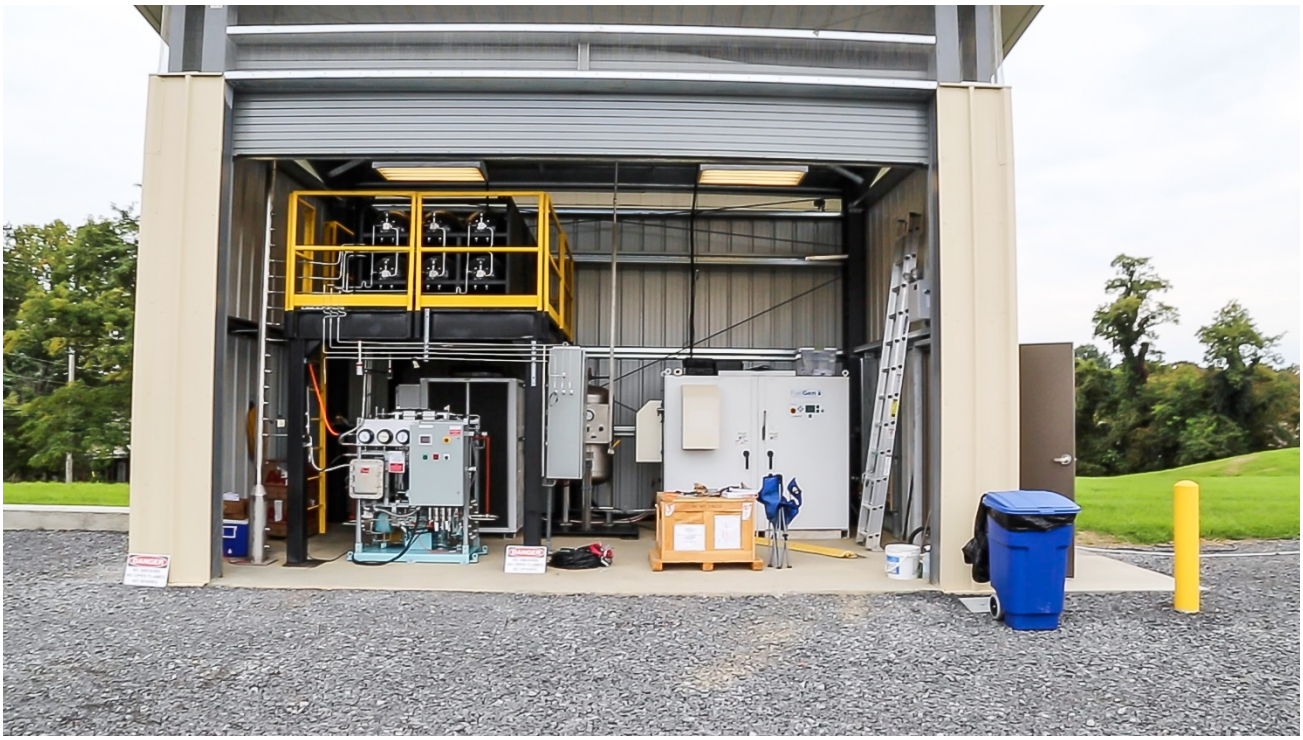


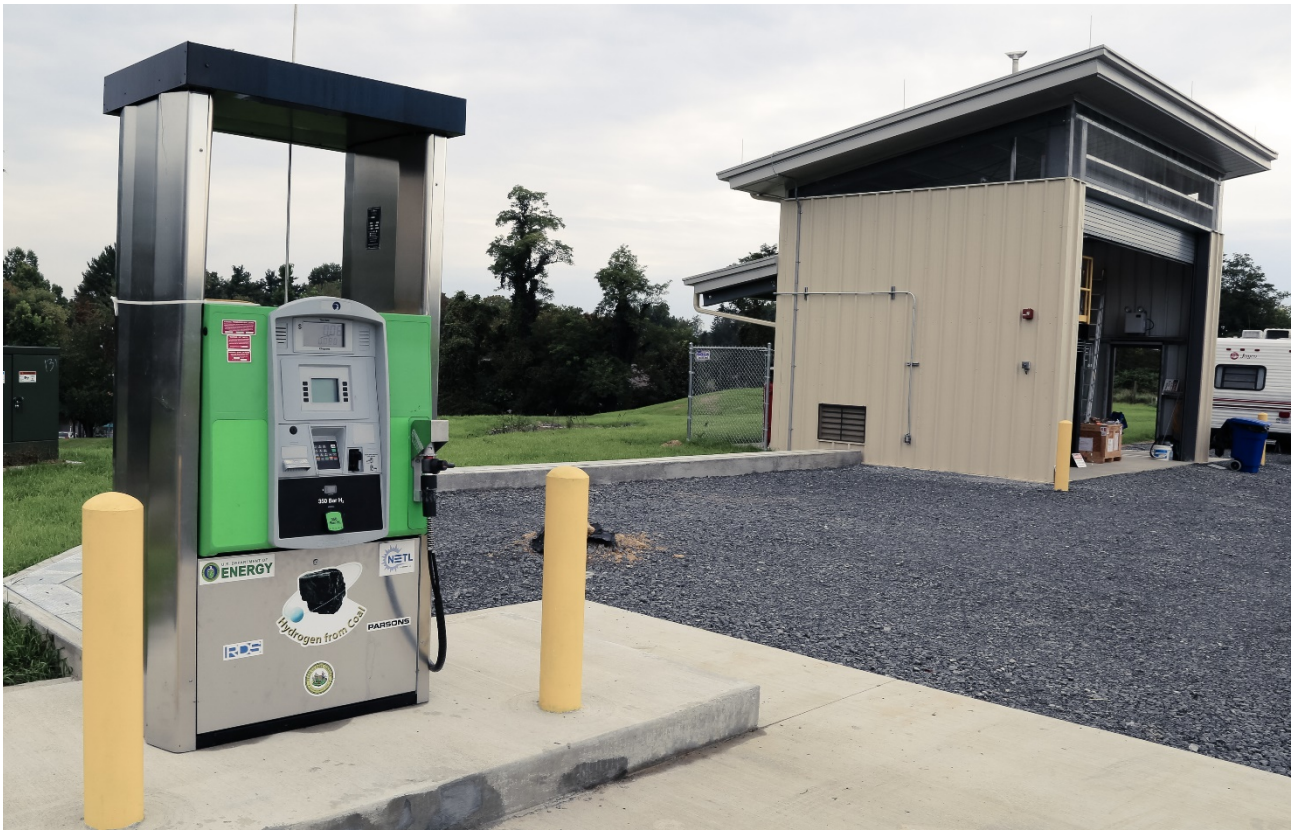
PHOTOS INSTALLATION OF HYDROGEN COMPONENTS





PHOTOS MORGANTOWN WV HYDROGEN STATION





COMMISSIONING MORGANTOWN, WV HYDROGEN STATION