

## XI.6 PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network

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### Subcontractors:

- Fortune Wireless, Indianapolis, IN
- Betacom, Inc., Pompano Beach, FL
- United Commercial Real Estate Services, Inc., Lake Mary, FL
- Peek Site-Com, Inc., Auburn, CA
- Jeffrey Rome and Associates, Newport Beach, CA
- Vertical Horizons Contracting, Lincoln, NE
- Telecom, Tower and Power, LLC, Romolus, MI
- Front Range Wireless, Centennial, CO
- Air Products and Chemicals, Inc. (APCI), Allentown, PA

Project Start Date: August 1, 2009  
Project End Date: July 31, 2011

### Objectives

- Install 189 fuel cell systems with 72-hour capacity as back-up power equipment for communications sites in use by Pacific Gas and Electric (PG&E), a California utility, and as critical emergency reserve power for cell sites operated by AT&T.
- Demonstrate that fuel cells are a reliable source of clean back-up power for key communications facilities.
- Transform the market within PG&E and AT&T by moving beyond limited demonstration sites to wider deployments.

### Market Transformation Barriers

This project addresses the barriers to market transformation for stationary backup fuel cell equipment:

- Site Selection: myriad considerations in site selection factor into the adoption of fuel cells for backup equipment.
- Permitting: multiple stakeholders, including authorities having jurisdiction, fire officials, building officials, and landlords, all have varying perspectives and reference a variety of non-harmonized standards for permitting.
- Fueling infrastructure: this program deploys a new model for stationary hydrogen fuel cells, relying on a refillable storage module, in place of the historically used cylinder exchange model. This requires the development of a fueling infrastructure that can deliver bulk compressed hydrogen to small, geographically diverse, remote sites.

### Relevance to the goals of the American Recovery and Reinvestment Act (ARRA) of 2009, and to the goals of U.S. DOE Fuel Cell Technologies' (FCT) ARRA project for accelerating the commercialization and deployment of fuel cells and fuel cell manufacturing, installation, maintenance, and support services.

This project will contribute to achievement of the DOE's objectives for ARRA projects in general, and the FCT projects in particular:

- Create direct and indirect jobs in seven regions across the continental U.S., throughout the supply chain.
- Train and deploy installers of fuel cell systems.
- Increase the number of commercially available fuel cell systems.
- Generate volume for fuel cell supply chain.
- Create and deploy new refillable hydrogen storage for stationary hydrogen fuel cells.
- Create and deploy new hydrogen delivery model for stationary hydrogen fuel cells.
- Expand practical user operating experiences.
- Validate performance.

This project includes milestones to measure progress:

- Survey candidate sites to identify 189 sites for installation.
- Secure all permitting, site acquisition, lease amendments, etc. to proceed with installations.
- Manufacture, ship, install, and commission 189 stationary fuel cell sites.
- Collect data on operation, fuel service, and maintenance.

## Accomplishments

- Submitted required documentation for National Environmental Policy Act (NEPA) clearance, and received a categorical exclusion.
- Submitted a hydrogen safety plan.
- Reviewed database records of 654 candidate AT&T sites to down-select sites based on the feasibility of fuel cell installation and on-site refueling accessibility.
- Performed physical site surveys at 460 candidate AT&T sites to further down-select sites based on the feasibility of fuel cell installation and refueling accessibility.
- Generated and delivered 380 unique quotes for the 180 AT&T sites to be constructed.
- Processed 309 unique purchase orders from AT&T Procurement for equipment, site acquisition (SAC) services, fuel cell installation services, and supplemental shelter direct air cooling equipment and installation services.
- Initiated the SAC process (leasing, zoning/planning, permits, etc.) on 188 AT&T sites.
- Completed the SAC process for 16 AT&T sites.
- Fabricated, integrated, and delivered fuel cell equipment for 132 sites, and hydrogen storage modules (HSMs) for 69 sites.
- Constructed and commissioned eight sites and provided hand-off to the customer.
- Performed physical site surveys at 36 PG&E candidate sites to evaluate the feasibility of fuel cell installation.
- Generated 25 unique scopes of work for PG&E sites to be constructed (customer subsequently selected nine of these viable sites).
- Completed all contract negotiations with PG&E and processed the final purchase order for the installation of fuel cells at nine sites in the PG&E network.
- Fabricated and integrated nine sets of fuel cell equipment for all nine PG&E sites.
- Developed the methodology, and validated the equipment and network architecture required to remotely obtain operational data from the sites in order to satisfy the National Renewable Energy Laboratory (NREL) data gathering obligation.



## Introduction

Market transformation is best achieved by reaching a critical mass in the market that significantly raises awareness and direct experience of the value proposition. With the assistance of this project,

ReliOn is installing 189 fuel cell systems into the telecommunications and utility networks at AT&T and PG&E for back-up power, across nine states, combined with the deployment of a refillable stationary HSM unit and the accompanying refueling logistics platform for 180 AT&T sites. These are real-world, tangible changes to the market resulting in the use of hydrogen-based systems to harden critical communications networks.

## Approach

ReliOn's approach begins with the basic research needed to identify viable candidate sites and then narrow down the list in order to focus efforts on the most viable and critical sites that can be installed and refueled successfully, ensuring that these assets will remain viable for decades. This work is primarily performed by ReliOn personnel. The next task is to secure rights to perform the construction through the use of SAC vendors who structure the leasing and permitting packages to prepare the sites for construction. ReliOn utilizes third parties who are skilled in this profession and will remain part of the project until all SAC activities have been completed.

As a site clears the SAC process, it is then constructed (typically within 15 business days) and brought on-line as a fully functional back-up power system. Installation construction is performed only after the SAC vendor has secured the installation and operating rights for each site. ReliOn utilizes third parties to perform installation construction, yet retains the roles of project management and supervision. ReliOn partnered with an established hydrogen provider, APCI, an industry expert in hydrogen storage and delivery for the development and production of the HSM. Once the sites are installed, fueled and operational, they are monitored remotely for data collection. ReliOn personnel collect and report fuel cell operational data to NREL. The use of both ReliOn and third party resources maximizes the effectiveness of the project, creates or retains jobs across a breadth of companies and regions, and delivers the maximum amount of infrastructure for the given financial investment.

## Results

To date, ReliOn has completed the site qualification stage for the entire project. This has allowed for the successful initiation of SAC activities on all target sites, plus a few reserve sites as contingencies for sites that may fail to complete the SAC process due to unforeseen circumstances. SAC has been completed on the first 16 AT&T sites. ReliOn has installed fuel cells at eight sites to date with eight more sites pending construction. Of the eight sites installed, three systems are installed in Colorado and five systems installed in Utah. This ongoing process of SAC approval and site construction

has resulted in the continuous need for labor and has secured multiple jobs. PG&E performed the SAC of their nine sites using their internal real estate and legal department resources, and PG&E construction will commence in August of 2010.

Figure 1 shows the first site completed within the project. This is an AT&T site located in Arvada, CO. This fuel cell system is on-line and fully operational. The leftmost cabinet is the fuel cell equipment enclosure with an adjacent 6-cylinder hydrogen storage cabinet. The larger cabinet to the right is the HSM. The HSM is connected to the system in parallel with the 6-cylinder hydrogen storage cabinet, and contains the majority of the fuel capacity.

Figure 2 shows the second site completed within the project. This is an AT&T site located in Byers, CO. The photograph shows the HSM cabinet receiving its initial fueling from the bulk hydrogen refueling vehicle.



FIGURE 1. Completed AT&T Site (Arvada, CO)



FIGURE 2. Completed AT&T Site (Byers, CO) Undergoing Initial Fill of the HSM

This project deploys fuel cell systems into eight states as shown in Figure 3, though it promotes jobs and supports business in other states which are the home bases of various subcontractors. AT&T will have systems operating in all eight states. As a California utility, all of PG&E’s systems are located within California. As discussed earlier, the SAC activity is a primary task which must be completed before fuel cell system installation construction can commence. Figure 4 shows the original schedule for the AT&T SAC activity, and progress made towards this goal. Delays in ‘SAC Initiation’ during the months of February and March were the result of end-user corporate approval processes which were completed at the beginning of the second quarter of 2010. Once ReliOn received approval to proceed, sites were released to begin the SAC process, and the schedule was recovered.

**Conclusions and Future Directions**

During the past year of effort, ReliOn has learned that the initial site identification process is much more



FIGURE 3. States Benefiting from the AT&T/PG&E Regional Fuel Cells

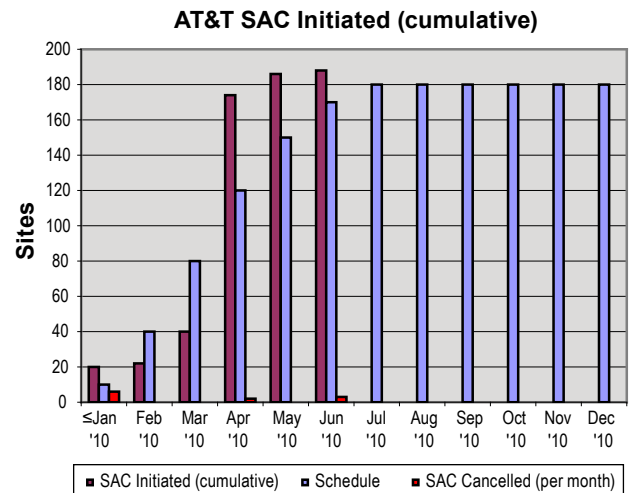


FIGURE 4. SAC Initiation Progress through 6/2010 for 180 AT&T Sites

involved than originally anticipated. Many sites that the ReliOn field survey engineer qualified as serviceable based on an acceptance rubric provided by APCI for refueling vehicle access were subsequently rejected during secondary surveys by APCI drivers who provide the refueling service. This required the refueling vendor to be much more involved in the site selection and qualification process from the beginning. It was also discovered that the SAC process takes longer on average than original estimated by subcontractors. Where originally two months was considered an adequate gestation period for the process, in reality it was discovered that three to four months is more typical. Tasks planned for the next year include:

- Complete the SAC process for all remaining sites within the project.
  - This activity includes working with the local authorities having jurisdiction to educate them on hydrogen safety, fuel cells, and codes and standards to resolve any questions/issues that arise during SAC.

- Construct all remaining sites and commission the equipment for hand-off to the customer/end-user.
- Obtain and report operational data to fulfill the DOE/NREL data reporting requirement.

### **FY 2010 Publications/Presentations**

1. Cohen, M.S., Kenny, K.P., “Hydrogen Delivery and Storage Options for Backup Power and Off-Grid Primary Power Fuel Cell Systems: Two Years Later”, IEEE INTELEC Conference, Orlando, FL, June 9, 2010. (Paper and Oral Presentation)