

XII.6 PEM Fuel Cell Systems Providing Backup Power to Commercial Cellular Towers and an Electric Utility Communications Network

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Contract Number: DE-EE0000487

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, Romulus, MI
- Front Range Wireless, Centennial, CO
- Air Products and Chemicals, Inc. (APCI), Allentown, PA

Project Start Date: August 1, 2009

Project End Date: December 31, 2011

Objectives

- Install 189 fuel cell cabinets (385 fuel cell systems total) with 72-hour capacity as back-up power equipment for communications sites in use by Pacific Gas & 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

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 United States, 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.

Technical Barriers (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 project 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.

Technical Targets and Milestones

- 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 (385 systems).
- Collect data on operation, fuel service, and maintenance.

Accomplishments

- Reviewed database records of an additional 82 candidate AT&T sites for a total of 736 to down-select sites based on the feasibility of fuel cell installation and on-site refueling accessibility.

- Performed physical site surveys at an additional 60 candidate AT&T sites for a total of 520 to further down-select sites based on the feasibility of fuel cell installation and refueling accessibility.
- Generated and delivered 65 unique quotes for additional services needed to support the 180 AT&T sites to be constructed and 132 replacement quotes for site acquisition and installation services corresponding to replacement sites for 66 previously cancelled sites.
- Processed an additional 178 unique purchase orders (for a total of 487) from AT&T Procurement for 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 an additional 64 AT&T sites for a total of 252 sites.
- Completed the SAC process for an additional 116 AT&T sites for a total of 132 sites.
- Fabricated, integrated, and delivered fuel cell equipment (48 cabinets = 120 systems) for an additional 48 AT&T sites for a total of 180 sites, and hydrogen storage modules (HSMs) for an additional 111 AT&T sites for a total of 180 sites.
- Constructed and commissioned an additional 101 sites (227 systems) for a total of 109 sites (244 systems) and provided hand-off to AT&T.
- Generated an additional unique scope of work for one replacement PG&E site used to replace a site that was unable to be successfully acquired by PG&E's real estate group.
- Constructed and commissioned all nine PG&E sites (9 systems) and provided hand-off to customer.



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 385 fuel cell systems (within 189 cabinets) into the telecommunications and utility networks at AT&T and PG&E for backup 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 program until all SAC activities have been completed.

As a site clears the SAC process, it is then constructed (typically within one month) 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 the DOE/National Renewable Energy Laboratory (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. Since project inception, 66 AT&T sites and one PG&E site have been cancelled and successfully replaced. SAC has been completed on a total of 132 AT&T sites to date with 54 presently undergoing the SAC process. ReliOn has installed 253 fuel cell systems at 118 sites to date (244 systems at 109 sites for AT&T and nine systems at nine sites for PG&E) with 14 more AT&T sites (34 systems) presently in the construction phase and nine more sites (21 systems) pending construction. 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 all PG&E construction is now complete.

Figure 1 shows an AT&T site located in Michigan which has just completed the initial fill of the HSM during the commissioning process. The fill was performed using the newly developed single-axle 'straight truck.' This vehicle makes the fueling of certain remote sites feasible and more efficient due to its reduced size, improved mobility, and higher service pressure in comparison to legacy tube trailers pulled by semi-tractors.



FIGURE 1. Completed AT&T Site in MI Showing 'Straight Truck'

Figure 2 shows a close up of an AT&T site located in Colorado undergoing the initial fill of the HSM during the commissioning process. The leftmost cabinet is the fuel cell equipment enclosure with an adjacent six-cylinder hydrogen storage cabinet. The larger cabinet to the right with the doors open and red cylinders in view is the HSM. The HSM is connected to the system in parallel with the six-cylinder hydrogen storage cabinet, and contains the majority of the fuel capacity.

This project deploys fuel cell systems within 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 presently has systems operating in all eight states. As a California utility, all of PG&E's systems are located within California and they are all presently operational.



FIGURE 2. Fueling of HSM at Completed AT&T Site in CO

As discussed earlier, the SAC activity is a primary task that must be completed before fuel cell system installation construction can commence. Each site's respective SAC activity concludes with an official "notice to proceed" package which is the trigger for the call out of fuel cell equipment from the warehouse for delivery to the site and delivery of the work release package for the installation contractor(s). ReliOn discovered during the past year that the original schedule for the completion of SAC was too optimistic and that the SAC process in general takes twice as long as originally expected. These SAC delays have resulted in the inability to start and complete the construction of sites per the original deployment schedule milestones. Figure 4 shows the project schedule for the completion of AT&T site construction. Note the adjustment made to the schedule goals at the end of the first quarter of 2011. This course correction was put in place to readjust the schedule to conform to the reality of the situation created by the delays in the SAC process. A no-cost contract extension was requested by ReliOn and received from the DOE, extending the contract to December 31, 2011.

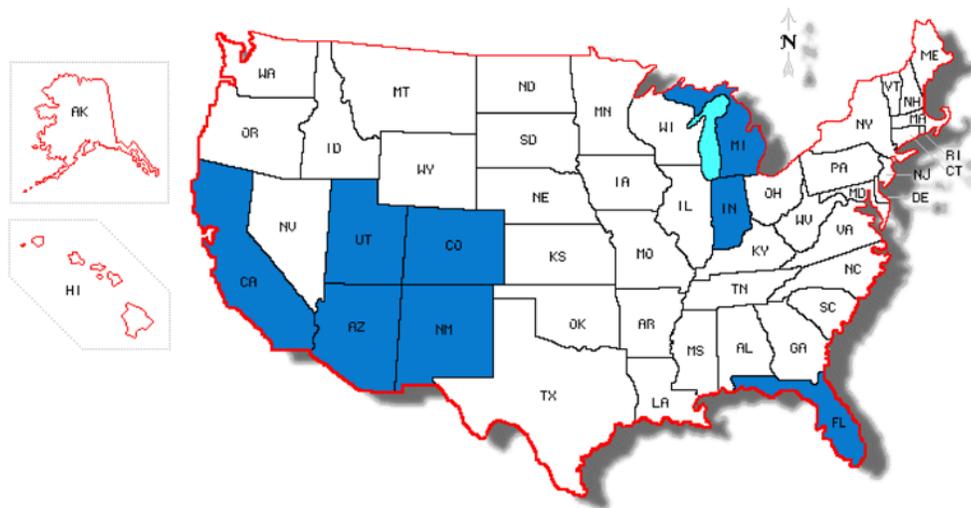


FIGURE 3. States Benefiting from the AT&T/PG&E Regional Fuel Cells

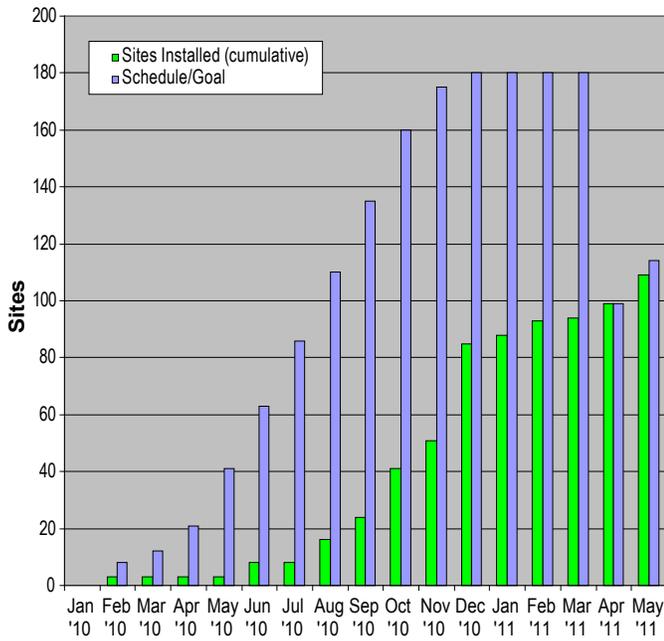


FIGURE 4. SAC Initiation Progress Through 6/1/2011 for 180 AT&T Sites

Conclusions and Future Directions

During the past year of effort, ReliOn learned that the drop out rate of sites undergoing SAC was higher than expected. One in three sites has been cancelled due to circumstances beyond ReliOn’s control, resulting in a cycle of additional replacement site reviews, physical site

surveys, quote and purchase order modifications, and re-submittal of sites into the SAC process. This additional activity has added cost and stretched ReliOn resources dedicated to the project. It was also discovered that the SAC process takes longer on average than originally estimated by subcontractors. Where two months was originally considered an adequate gestation period for the process, it was discovered that six months is a more typical average time to acquire the site.

Tasks planned for the remainder of the project through the end of 2011 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 & 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.
- Continue to generate and provide all DOE reports per the required schedule.

FY 2011 Publications/Presentations

1. Blanchard, J. “A Roadmap for Tier 1 Telecom Carrier Fuel Cell Installation”, OSP Expo, San Antonio, Texas, October 13, 2010. (Oral Presentation)