

# Accelerating Acceptance of Fuel Cell Backup Power Systems



Project ID: ARRAH2007  
Rick Cutright, Interim Program Manager  
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# Project Overview

## ■ Timeline

- Start: June 1, 2009
- Finish: December 31, 2011
- 38% complete

## ■ Budget

- DOE: \$2.7 MM
- Cost-share: \$2.7 MM

## ■ Barriers

- Cost
- Affordability
- System reliability
- Market volume

## ■ DoD Partners

- Warner Robins AFB
- Construction Engineering Research Laboratory (CERL)

# Relevance

- Demonstrate market viability and increase market pull of hydrogen and fuel cell systems within our government customers/partners
- 15-30% of Plug's technical staff are supported by this funding effort
- Large automotive supply base is delivering stack, reformer and balance of plant components
- Deploy 20 GenSys hybrid hydrogen start/LPG or natural gas run units that provide economically viable backup power in excess of 72 hours
  - Increase distributed power generation
  - Improve reliability and efficiency of mission critical backup power
  - Decrease fossil fuel dependencies for power generation

# Approach

**GenCore**

## Backup Power

- Hydrogen fueled
- Start time < 1 minute
- Run time = 4 hours

**GenSys**

## Extended Backup Power

- Hydrogen and LPG fueled
- Start time < 1 minute
- Run time = indefinite

**GenSys**

## Continuous Power

- LPG fueled
- Start time = 3 hours
- Run time = indefinite



# Approach









- **Cost Analysis and Commercialization Study** 85% complete
- **Site Planning and Applications Engineering** 30% complete
- **Site Specific Engineering Development** 0% complete
- **Systems Builds and Factory Testing** 20% complete

**Go/No Go:** After 20 simulated extended run power outage profiles, the system must be able to produce 6kW of DC power at a combined efficiency of >24% using propane available at Plug Power's Latham facility

- **Fleet Operation and Managed Services** 0% complete
- **Project Closeout** 0% complete
- **Program Management** 38% complete

# Cost Analysis

- The GenSys offers economic as well as environmental benefits over the incumbent diesel generator technology
- Near threefold advantage in system life with only 20-25% higher maintenance costs than a diesel generator
- The GenSys offers the customer a 20 to 30% decrease in power generation expense

Telecom Cell Tower Application Comparison (4.5 kW Case)		
GenSys System	Features	Diesel Generator
43,800 Hours (5 Years)	System Life 	15,000 Hours (1.71 Years)
System, Inverter, Batteries 2.4% less	5-Year Capital Costs 	3 Generators, AMF Panel, PIU, SMPS, Batteries 2.4% more
Range: 20% to 32% 4.5 kW Point: 29.1% (BOL)	Efficiency $\frac{P_{out}}{P_{in}}$	Range: 7% to 21% 4.5 kW Point: 18.5% (BOL)
LPG, potential to run on a range of hydrocarbons	Fuel Type 	Diesel
75-85% less fuel expense than diesel generator	5-Year Fuel Costs 	75-85% more fuel expense than fuel cell
Comparable maintenance 20-25% more than DG	5-Year Maintenance Costs 	Comparable maintenance 20-25% less than FC
>99%	Reliability / Availability 	>99%
7.0 metric tons of C, 0.4 g of NO <sub>x</sub> , 0.06 g of SO <sub>x</sub> , 0.51 g of CO annually	Emissions to Environment 	14.4 metric tons of C, 743 g of NO <sub>x</sub> , 49 g of SO <sub>x</sub> , 160 g of CO annually
65 dBA at 3 m	Noise Level 	75 dBA sheltered 92 dBA unsheltered

BOL= Beginning of Life

# Technical Accomplishments- Cost Analysis

- An economically viable path to 72 hours worth of backup power with a pure hydrogen solution was not determined
- Focus shifted to the success of a hydrogen start with LPG/natural gas run
- This solution provides the economics needed for a flexible backup power solution

# Technical Accomplishment- Site Selection

- Plug Power visited DDWG for site review in March 2010
  - DDWG requires extended backup to enable base service operations
  - Server room and the HVAC
  - Hydrogen availability on the base is not an issue, but proximity and logistics may be difficult and costly
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- DOE has agreed to closeout the DE-FG36-07GO17017 program and include the CERL demonstration in this program



**Defense Distribution Depot-  
Warner Robins AFB  
(DDWG), Georgia**



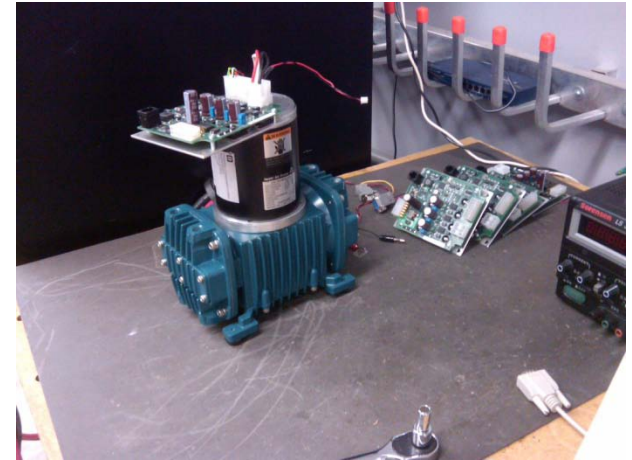
# Technical Accomplishments- System Build



Reformer Qualification Testing



Stack Qualification Testing



Motor Controller Development and Qualification Testing

Module testing and qualification for Fleet #1

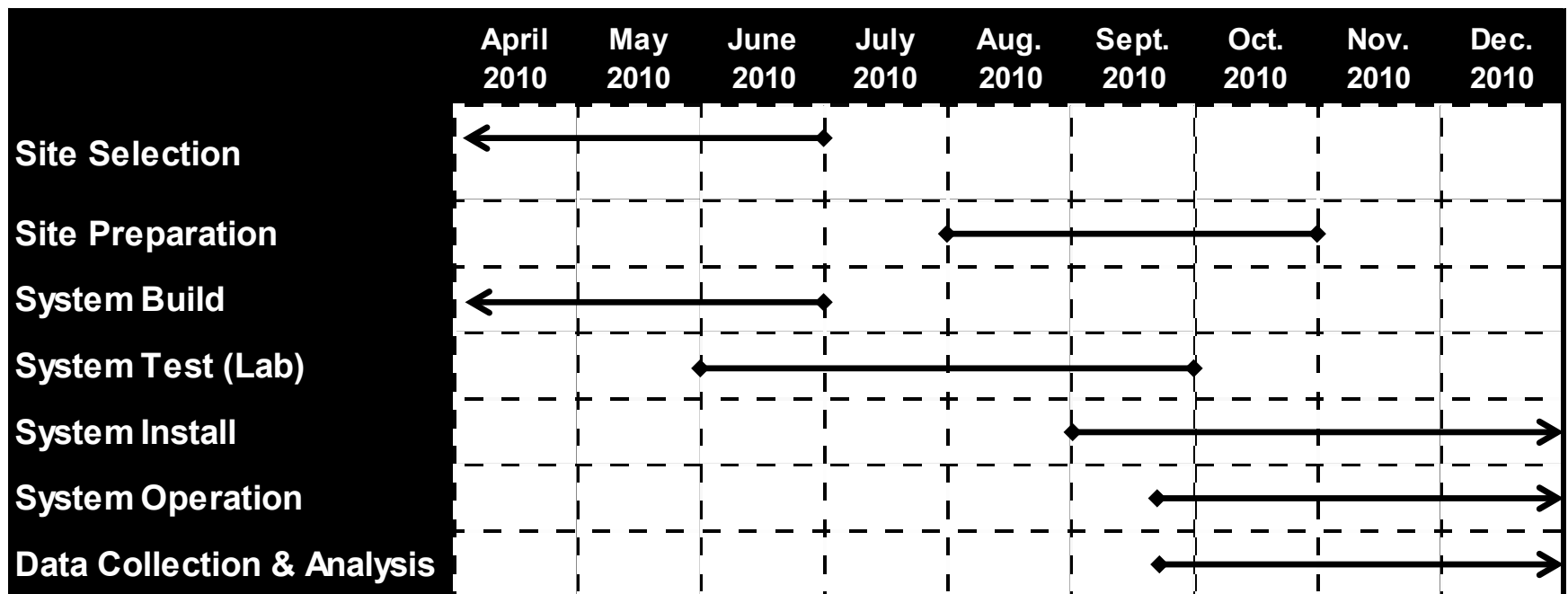
# Technical Accomplishments- System Build



Fleet #1- First 5 systems under build and starting debug

# Proposed Future Work

- Plug Power intends to have site selection completed this quarter
- Assembly and debug will continue on the first fleet of units
- Initiate the structured load cycle testing



# Summary

**Relevance:** Demonstrate market viability by deploying 20 GenSys units

**Approach:** Leverage technology from two existing products to create GenSys extended backup power

## **Technical Accomplishments and Progress:**

- Engaged CERL in site selection
- Discussed site requirements with DDWG
- Began system assembly and debug

## **Technology Transfer/Collaborations:**

- CERL, Warner Robins AFB

## **Activities for Future:**

- Site a unit at CERL
- Continue site discussion with DDWG
- Complete site selection



**HEADQUARTERS**

968 Albany Shaker Road  
Latham, New York 12110  
Phone: (518) 782-7700

[www.plugpower.com](http://www.plugpower.com)

