2016 DOE Vehicle Technologies Office Review

Hydrogen Fuel-Cell Electric Hybrid Truck & Zero Emission Delivery Vehicle Deployment

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Project ID: VSS116

Overview

Hydrogen Fuel-Cell Electric Hybrid Truck Project

Timeline

- Start date – October 1, 2012
- End date – September 30, 2017

Budget

- Total funding
  - DOE share: $3,400,823
  - Contractor share: $4,210,524
- Funding Received In FY15:
  - DOE Share: $1,319,987.52
  - Contractor Share: $392,924.04
- FY16 Expected Expenditure:
  - DOE Share: $3,385,877
  - Contractor Share: $2,376,000

Barriers

1. High cost of Class 8 hydrogen fuel-cell electric hybrid trucks
2. Uncertainty related to deploying hydrogen fueling infrastructure and vehicle technologies in typical fleet use
3. Financing vehicles & coordinating multiple funding sources is very complicated

Partners

- Collaborators
  - Original project partners – *Total Transportation Services, Inc (TTSI), Vision Industries Corporation, Air Products,* Environmental Defense Fund.
  - Final project partners – Gas Technologies Institute, US Hybrid (OEM), University of Texas Center for Electromechanics, Environmental Defense Fund.
- Project Lead
  - Houston-Galveston Area Council

Overview

Zero Emission Delivery Vehicle Deployment

Timeline

- Start date – October 1, 2012
- End date – September 30, 2017

Budget

- Total funding
  - DOE share: $2,430,177
  - Contractor share: $2,760,000
- FY15 Expenditure:
  - DOE Share: $208,022.43
  - Contractor Share: $55,783.78
- FY16 Expected Expenditure:
  - DOE share: $1,158,204
  - Contractor share: $849,082
  - Remainder dependent on current Call for Projects

Barriers

1. High cost of low volume orders for all-electric medium-/heavy-duty trucks
2. Uncertainty in production capabilities and timeline for all-electric trucks
3. Fleet acceptance of electric drive vehicle by matching trucks to the correct applications and routes

Partners

- Collaborators
  - Center for Transportation and the Environment
  - Fleet Partner – UPS
  - OEM Partner – Workhorse
- Project Lead
  - Houston-Galveston Area Council

Relevance

Primary Objective: Accelerate introduction and penetration of electric transportation technologies into the cargo transportation sector, specifically:

- 3 hydrogen fuel cell – electric hybrid Class 8 trucks*
- 30 all-electric delivery vehicles (i.e. box trucks, step vans)

Barriers	Project Activities
High cost of vehicles	Provide grant funding to incentivize deployment and testing of medium/heavy-duty zero emission vehicles
Risk associated with uncertain production capabilities and project financing	Restructured the process for granting ZECT funding through H-GAC. Allow fleets to select own OEM.
Financing vehicles & coordinating multiple funding sources is very complicated	Simplification of funding sources—specifically removing state air quality funding that conflicted with original partners' desired financing structure.
Challenges to fleet acceptance related to lack of infrastructure and matching vehicles to appropriate routes or applications	Provide funding for required infrastructure & conduct data collection and analysis on vehicle performance to demonstrate emission reductions

Milestones

Hydrogen Fuel-Cell Electric Hybrid Truck Project

Activity	Timeline	Status
Proposed Revision to Project Scope / Path Forward to DOE	Submitted 2/2014	Completed
Survey of OEMs, Vehicle Providers, and Fleets	5/2014 – 6/2014	Completed
Release Call for Projects; selection of new project partners	8/2014 – 1/2015	Completed
Complete Subcontract with Selected Subrecipient	2/2015-6/2015	Completed
Final Design, Procurement of Components and Build out of ZECT Power System	5/2015-6/2016	Ongoing
Deployment of Vehicles for Testing and Integration of Hydrogen fueling station components	6/2016-2/2017	Future

Milestones

Zero Emission Delivery Vehicle Deployment

Activity	Timeline	Status
Call for Projects *(for fleet partners with all-electric delivery vehicle OEM)*	5/2014 – 5/2016	Ongoing for Remaining Vehicles
Select Partners & Issue Notice to Proceed	6/2014 – 9/2016	Complete (UPS); Ongoing for remaining partners
Purchase & Manufacture of Vehicles	9/2014 – 7/2016	Ongoing
Delivery of Vehicles	10/2015 – 8/2016	Ongoing
Vehicle Testing begins	Stated 11/2015	Ongoing
Full Demonstration of All Vehicles	9/2016– 9/2018	Future

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Approach / Strategy

To be successful, the deployed technologies (both all-electric and hydrogen fuel-cell trucks) must be:

- Available
- Cost effective
- Meet performance expectations for operation and emission reductions

Therefore, current and future activities include:

- Providing remaining grant funding to selected partners to provide incentive for vehicle deployment and reduce barriers due to incremental costs of advanced technologies
- Completing Call for Projects for the Electric Delivery Vehicle project to identify fleet and OEM partners for remaining vehicle commitment
- Begin/continue manufacture, deployment, vehicle monitoring, data collection, and performance / benefits analysis

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Accomplishments & Progress

Project Outcomes for FY15

- *Hydrogen Fuel-Cell Electric Hybrid:*
  - Received DOE approval for modification of project to approve revised project budget for replacement project partners
  - Started to purchase parts and equipment in preparation for vehicle manufacturing
  - *Next Steps* – Continue equipment purchases and begin to manufacture and deployment of three hydrogen-electric hybrid Class 8 drayage trucks
- *Zero Emission Delivery Vehicles:*
  - Finalized contract with UPS, began manufacture of 18 Workhorse medium duty delivery vehicles, and deployed one vehicle in Nov. 2015
  - Continued Call for Projects to select partners for deployment of at least 12 additional trucks
  - *Next Steps* – Complete manufacture and deployment of UPS project vehicles; solicitation of partners for remaining 12 vehicles

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Response to Previous Years Comments

Comment from 2015 AMR	Response
“The reviewer noted that difficulties in obtaining vehicles (and partners) is indicative of the technology readiness for this type of vehicle mission.”	It appears that this is changing somewhat as both projects are now associated with partners and OEMs with significant experience in producing similar vehicle. With funding issues resolved, we anticipate program progress with minimal disruption.
“The reviewer pointed out that there was a problem with the initial partners. This project could use additional support and technical knowhow from a large OEM.”	As part of the reorganized class-8 hydrogen project, H-GAC has brought in an additional partner, GTI, to provide organizational support and coordination. On the delivery project, this role is played by CTE. In both cases, the project is working with a experienced OEM.
“The reviewer stated that the approach described is solid and hopefully can produce meaningful data for hydrogen fuel cell and EV hybrid acceptance into the field.”	With both projects now underway and with monitoring underway for the delivery project,

Collaboration

- Contract Lead – Houston-Galveston Area Council
- ***Zero Emission Delivery Truck***
  - Project Administration & Technology Partner – Center for Transportation and the Environment
  - Fleet Partner – UPS
  - OEM Partner – Workhorse
  - *Remaining Fleet/OEM partners will be selected through call for projects.*
- ***Hydrogen Fuel-Cell Electric Hybrid Truck Project***
  - Project Administration & Technology Partner – Gas Technology Institute
  - Fleet Partner – Richardson Companies
  - OEM Partner – US Hybrid
  - Additional Technical/Outreach Partners – University of Texas CEM, Environmental Defense Fund.

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Remaining Challenges & Barriers

1) ***Addressing Project Delays***

   - Ensure timely vehicle/infrastructure deployment for both projects

2) ***Reducing risks associated with uncertainty related to production of vehicles***

   - Electric Delivery Vehicle project structured to permit fleet to select OEM based on needs; technical partner offers assistance for selection if requested.

3) ***Finding additional local fleet partners***

   - Solicitation of remaining project partners for the final 12 vehicles for the Electric Delivery Vehicle project

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Future Work

Next Steps for FY16

- *Hydrogen Fuel-Cell Electric Hybrid:*
  - Complete ZECT and infrastructure system design
  - Complete procurement of critical components for vehicle and infrastructure
  - Manufacture ZECT powertrain system
  - Integrate ZECT and hydrogen fueling station components, deploy vehicles.

- *Zero Emission Delivery Vehicles:*
  - Complete Call for Projects to select partners for deployment of remaining 12 trucks
  - Complete delivery and deployment of all 18 Workhorse Electric vehicles for UPS
  - Begin two-year performance monitoring period for all 18 Workhorse Electric vehicles deployed with UPS

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Summary

Hydrogen Fuel-Cell Electric Hybrid Truck Project

- After substantial delays caused by challenges of multiple funding sources (federal, state and private), H-GAC is moving forward with a simplified project budget and new partners selected through a call for projects process.
- The current project team includes a simplified contract structure and the assistance of an administrative and technical partner (Gas Technology Institute).
  - The fleet partner included in the proposal has past experience with H-GAC vehicle replacement projects
- With the completion of subagreement with GTI, H-GAC and partners are now working towards the deployment of three hydrogen-hybrid electric class-8 drayage vehicles, manufactured by US Hybrid
  - US Hybrid has successfully procured six such vehicles at California ports.

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Summary

Zero Emission Delivery Vehicle Deployment

- H-GAC conducted a Call for Projects to select new project partners (fleets in partnership with selected OEM) for deployment of 30 trucks in the Houston region
- This resulted in H-GAC selecting a UPS proposal to deploy 18 Workhorse manufactured Vehicles
- H-GAC is still searching for additional fleet partners who will purchase vehicles from selected OEMs for delivery and deployment
    - H-GAC and CTE continue to conduct outreach to area fleet to complete the deployment of these 12 remaining trucks

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