Training for Cost-Effective, Code-Compliant Gaseous Fuel Maintenance Facilities

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Gas Technology Institute
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This presentation does not contain any proprietary, confidential, or otherwise restricted information.
Overview

Timeline
- Start: 10 / 2016
- End: 09 / 2018
- Progress: 75% Complete

Barriers
- High upfront cost of alternative fuel vehicle programs
- Consumers lack of technical experience with new fuels

Budget
- Total Project Budget: $835,000
  - Total Federal Share: $750,000
  - Total Federal Share Spent*: $423,000 (56%)
  - Total Recipient Share: $85,000
  - Total Recipient Share Spent*: $41,000 (48%)

* As of 3/31/18

Partners
- Gas Technology Institute (GTI)
- Clean Energy Fuels - Facilities Modification Services
- Frontier Energy - California Fuel Cell Partnership
- Superior Energy Services
- Clean Cities Coalitions
# Project Objectives

<table>
<thead>
<tr>
<th>VTO Integration Goals</th>
<th>Project Team Objectives</th>
<th>Period Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Increase <strong>National Security</strong> by reducing barriers to the use of alternative fuels</td>
<td>• Create materials to educate stakeholders on cost-effective, code compliant alt. fuel maintenance facilities. Provide technical reports, and presentations.</td>
<td>• Complete program materials (Go/ No-Go – accomplished)</td>
</tr>
<tr>
<td>2. Promote <strong>Economic Growth</strong> by increasing opportunities related to advanced vehicle technologies</td>
<td>• Provide hands-on experiences to reduce misconceptions by consumers and code officials.</td>
<td>• Workshop held with classroom training and facility tour</td>
</tr>
<tr>
<td>3. <strong>Affordability</strong> for Businesses</td>
<td>• Provide best practices and lessons learned of cost saving measures utilized in past projects</td>
<td>• Best practices created</td>
</tr>
</tbody>
</table>
Project Approach

Task 1.1

- **Material Development (Natural Gas, Hydrogen, and Propane)**
  - Develop technical basis of training materials
  - Creation of training curriculum by education professionals

Task 1.2

- **Training Program Review, Planning, and Development**
  - Workshop Development/Planning
  - Dedicated Project Website
  - Instructor-led Training Module
  - Video and Interactive Elements
  - Instructor Guide and Student Handbook

Task 2.1

- **Training Program Implementation**
  - Establish and implement workshop events
  - Establish web-based information sources
  - Record metrics on program success
Project Approach

• Coordination with additional US DOE R&D efforts
  — Leveraged reports and information from previous effort performed by NREL
  — Working with Marathon Technical Services to coordinate efforts based on each of our strengths:
    o Locations
    o Timing
    o Fuels
    o Materials
    o Outreach
# Milestones

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code Reports Completed</td>
<td>Propane, Natural Gas, and Hydrogen Code Reports</td>
<td>Completed</td>
</tr>
<tr>
<td>Key Issues and Best Practices Report Completed</td>
<td>Propane, Natural Gas, and Hydrogen - Key Issues and Best Practices Reports</td>
<td>Completed</td>
</tr>
<tr>
<td>Program Materials (Go/No Go)</td>
<td>Curriculum plan and training materials meet project objectives.</td>
<td>Completed</td>
</tr>
<tr>
<td>Workshop Locations and Schedules Identified</td>
<td>Workshop Locations and Schedules</td>
<td>On-going</td>
</tr>
<tr>
<td>Success Metrics Completed and Reviewed</td>
<td>Final Success Metrics</td>
<td>On-going</td>
</tr>
</tbody>
</table>
Accomplishments and Progress

• Training Material Development - DONE
  – Technical Reports
  – Educational Materials
  – Best Practices
  – Dedicated website development
    o altfuelgarage.org

• Workshop Development – DONE
  – Morning - Classroom Session
    o Presentation, Q&A, Informal Discussions, Hands-on Equipment Displays
  – Afternoon - Maintenance Facility Tour

BEST PRACTICES
GAS DETECTOR PLACEMENT

Natural gas and hydrogen garages may be required to install gas detection systems to protect the facility and monitor for gas releases or leaks. Garages that carry out major repair services (engine or fuel cell work, painting, body and fender work, welding, and repairs that require draining of the motor vehicle fuel tank) are typically required by code to have a gas detection and alarm system that will alert occupants of the garage with audio and visual signals.
ALTERNATIVE FUEL VEHICLE MAINTENANCE GARAGE TRAINING
WORKSHOP SERIES

BEST PRACTICES
ALARM SYSTEM

Visual signals should be unique for each prescribed action, and for each emergency scenario, signals for actual fires and signal for the alarm system itself. It is also necessary to have instructions near any alarm panel that clearly indicate which action should be carried out for each visual signal. Visitors to the facility also need to know what actions to take during an emergency.

The table below lists a typical configuration for a methane-specific alarm system. It has three levels of alarm: Green, Amber, and Red. Each level indicates a different level of response.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Gas Detection</th>
<th>Normal</th>
<th>20% LFL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Lights</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Amber</td>
<td>Off</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>Red</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Horns</td>
<td>Off</td>
<td>On - Level 1</td>
<td></td>
</tr>
<tr>
<td>Warning Lights</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Advisory</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Exit Count</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Gas Sensors</td>
<td>Manual</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>Gas Valves</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>Ventilation</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Gas Detection Systems

- Infrared detectors are available as either a point-type monitor or an open-path design.
- Catalytic bead detectors are not recommended because they require more frequent calibration and have a shorter life before internal components must be replaced.

CODE REQUIREMENTS AND BEST PRACTICES: HYDROGEN

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Prepared For: Program Manager,
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Typical Schedule

The figure below shows a range of schedules for a maintenance garage. The schedule is based on the expected maintenance requirements of the equipment. It incorporates factors such as the expected operating hours, the frequency of maintenance inspections, and the type of maintenance required.

- 0-500 hours: Initial inspection
- 500-1000 hours:中级 inspection
- 1000-1500 hours: Detailed inspection
- 1500-2000 hours: Comprehensive inspection

Ensure all equipment is properly maintained to prevent breakdowns and ensure safety.

altfuelgarage.org
Accomplishments and Progress

> Conduct Workshops - ONGOING

Previous GTI technical training classes and equipment – photos provide by GTI
Collaborations

• **Gas Technology Institute** (Prime)
  – Technical/Management
  – Education/Communication Group

• **Subject Matter Experts**
  – Natural Gas: **Clean Energy Fuels** – Facilities Modification Services
  – Hydrogen: **Frontier Energy** – California Fuel Cell Partnership
  – Propane: **Superior Energy Services**

• **Clean Cities Coalitions** (Outreach)

• Collaboration with additional DOE R&D efforts
Overall Impact

- Directly addressing a critical barrier to alternative fuel adoption — **unnecessary costs and restrictions in garage upgrades are often the deciding factor against alternative fuel adoption**
  - Outreach
    - Wide audience: code officials, fire marshals, AHJs, fleets, decision makers, station designers, municipalities
    - Workshop and material information sent to thousands of stakeholders; over 3500 LinkedIn views
  - Disseminating materials
    - Reports, best practices, presentations, and video downloads from website
  - Workshops/Facility Tours
    - Workshops completed
Summary

• Goal
  — Create materials and provide workshops to educate stakeholders on **cost-effective, code compliant** alternative fuel maintenance facilities.

• Collaborations
  — Worked with industry-leading experts and educational professionals
  — Leveraged additional DOE programs

• Accomplishments/Impacts
  — Workshops held with hands-on, interactive training
  — Materials disseminated through dedicated website