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

Principal Investigator: Ted Barnes
Gas Technology Institute
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Project ID: TI079

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# 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



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# Project Objectives

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

# 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



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# Project Approach

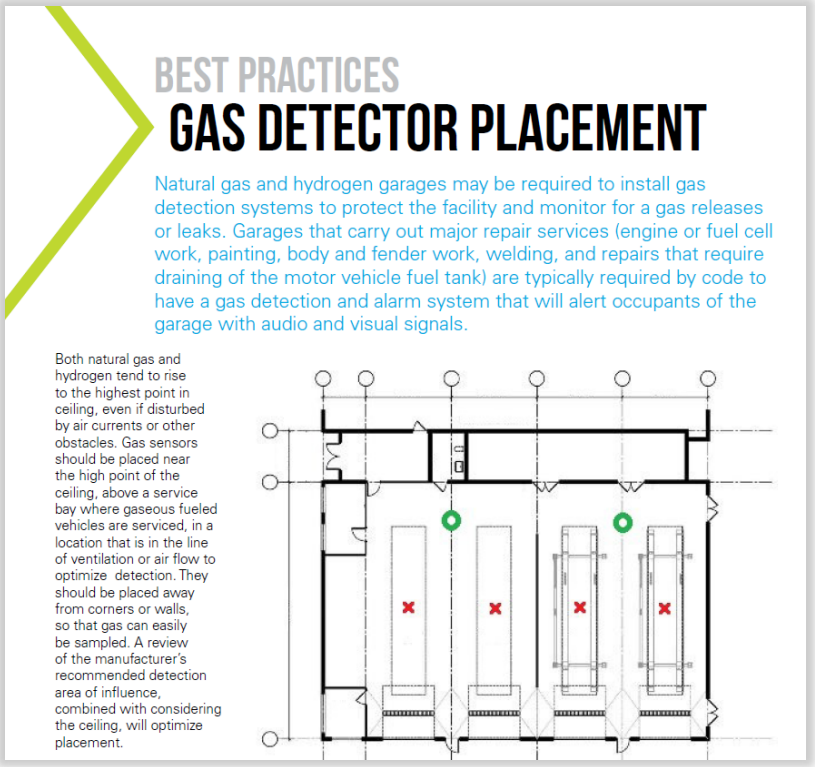
- Coordination with additional US DOE R&D efforts
  - Leveraged reports and information from previous effort performed by NREL
  - Working with Marathon Technical Services to coordinate efforts based on each of our strengths:
    - Locations
    - Timing
    - Fuels
    - Materials
    - Outreach

# Milestones

| Milestone | Description | Status |
|---|---|---|
| **Code Reports Completed** | Propane, Natural Gas, and Hydrogen Code Reports | Completed |
| **Key Issues and Best Practices Report Completed** | Propane, Natural Gas, and Hydrogen - Key Issues and Best Practices Reports | Completed |
| **Program Materials (Go/No Go)** | Curriculum plan and training materials meet project objectives. | Completed |
| **Workshop Locations and Schedules Identified** | Workshop Locations and Schedules | On-going |
| **Success Metrics Completed and Reviewed** | Final Success Metrics | On-going |

# Accomplishments and Progress

- Training Material Development - DONE
  - Technical Reports
  - Educational Materials
  - Best Practices
  - Dedicated website development
    - ***altfuelgarage.org***
- Workshop Development – DONE
  - Morning - Classroom Session
    - Presentation, Q&A, Informal Discussions, Hands-on Equipment Displays
  - Afternoon - Maintenance Facility Tour



# 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 should be different than signals for gas presence. It is also necessary to have instructions near any alarm panel that clearly indicates 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
to configure a methane detec
alarm system is integrated w
and has three states – norma
the Lower Flammability Limit
40% of the LFL. The table sh
and preventive actions taken
detection system

| Condition | Gas Concentration | |
|---|---|---|
| | Normal | 20% LFL |
| Operation Lights – Green | On | Off |
| hts – Amber | Off | On |
| ghts – Red | Off | Off |
| Horns | Off | On – Level 1 |
| larms | Off | Off |
| Advisory | No | Yes |
| ent Callout | No | No |
| n Fans | Manual | On |
| s/Louvers | Manual | Open |
| Gas Valve | Open | Open |
| lding Loads | No | No |
| | | Yes |

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TRAINING FOR COST-EFFECTIVE, CODE-COMPLIANT MAINTENANCE FACILITIES
Contract No. DE-EE007815 (GTI Project Number 22067)

### CODE REQUIREMENTS AND BEST PRACTICES: HYDROGEN

**Report Issued:**
December 31, 2017

**Prepared For:**
Trevelyn Hall
Program Manager
U.S. DOE/NETL

**National Energy Technology Laboratory**
626 Cochrans Mill Road
PO Box 10940
Pittsburgh, PA 15236
304-205-2490
Trevelyn.Hall@netl.doe.gov

**GTI Technical Contact:**
Tyler Manley
Principal Engineer
847-768-0697
Tyler.Manley@gastechnology.org

**Gas Technology Institute**
1700 S. Mount Prospect Rd.
Des Plaines, Illinois 60018
www.gastechnology.org

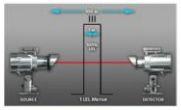
**altfuelgarage.org**

### Code-Compliant Maintenance Facility Modification Training

Gas Technology Institute, Des Plaines, IL
April 5, 2018

### Gas Detection Systems

- There are two main types of combustible gas detectors: infrared and catalytic bead.
  - 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.



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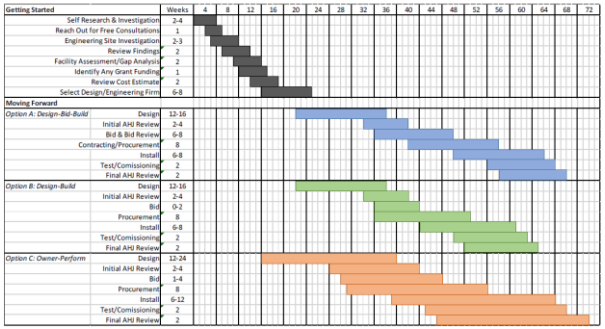
*Typical Schedule*

The figure below shows a range of schedules for a maintenance garage upgrade. All three of the scenarios involve common first steps: basic research, reaching out for initial and often free consultations, site reviews, and selection of the path forward after review of cost estimates. The Design-Bid-Build option includes separate steps of working with a design firm, bidding jobs and equipment, and procuring and installing equipment. A design-build firm is able to accelerate certain steps of the modification. If an owner chooses to undertake the design and modification, there is much more variability in the schedule, and much higher likelihood of unforeseen schedule impacts.




CODE REQUIREMENTS AND BEST PRACTICES: NATURAL GAS Page 44



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# 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