Integrating Medium and Heavy Duty Natural Gas Vehicles into Your Fleet

Tuesday, July 24, 2018
• Webinar is being offered through DOE’s Vehicle Technologies Office (VTO) Technology Integration Program and the Better Communities Alliance
  – https://www.energy.gov/eere/vehicles/technology-integration
  – https://betterbuildingsinitiative.energy.gov/bca

• Webinar will be archived within two weeks
  – https://cleancities.energy.gov/webinars#24671
  – https://betterbuildingsinitiative.energy.gov/bca
Question and Answer Session

Please type your questions into the question pane on the control panel
Presenters

- John Gonzales, Senior Engineer, National Renewable Energy Laboratory
- Tracy Ochsner, Assistant Operation Services Director, City of Fort Collins, CO
Integrating Medium- and Heavy-Duty Natural Gas Vehicles into Your Fleet

John Gonzales
July 24, 2018
Technology Integration Program Focus Areas

Light-, Medium-, and Heavy-duty Vehicles

Alternative Fuel Infrastructure

Energy Efficient Mobility Systems and Technologies
Nearly 100 Clean Cities coalitions with thousands of stakeholders, representing ~80% of U.S. population
Natural Gas Properties

- Mixture of hydrocarbons, predominantly methane (CH$_4$)
- High octane rating
- Nontoxic, noncorrosive, and noncarcinogenic
- Not a threat to soil, surface water, or groundwater
- Available as compressed natural gas (CNG) and liquefied natural gas (LNG)
- Lower ozone-forming emissions than gasoline
- Extracted from gas and oil wells
- High ignition temperature: 1,000–1,100 °F
- Comprehensive fuel tank, vehicle, and station design/manufacturing codes & standards.
## Available Medium and Heavy-Duty Vehicles

<table>
<thead>
<tr>
<th>Type</th>
<th>Engine Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 8 (Long-Haul Truck)</td>
<td>8.9 L, 11.9 L</td>
</tr>
<tr>
<td>Class 8 (Short-Haul Truck)</td>
<td>8.9 L, 11.9 L</td>
</tr>
<tr>
<td>Class 6/7 (General Purpose)</td>
<td>6.7 L, 8.9 L, 11.9 L</td>
</tr>
<tr>
<td>Transit</td>
<td>6.7 L, 8.9 L, 11.9 L</td>
</tr>
<tr>
<td>Refuse</td>
<td>8.9 L, 11.9 L</td>
</tr>
<tr>
<td>School Bus</td>
<td>6.7 L, 6.8 L, 8.8 L, 8.9 L</td>
</tr>
<tr>
<td>Street Sweeper</td>
<td>6.0 L, 8.9 L</td>
</tr>
<tr>
<td>StepVan</td>
<td>6.0 L</td>
</tr>
<tr>
<td>Shuttle Bus/Cab Chassis</td>
<td>6.0 L, 6.2 L, 6.8 L</td>
</tr>
<tr>
<td>5500 Series Truck</td>
<td>6.8 L</td>
</tr>
<tr>
<td>4500 Series Truck</td>
<td>6.8 L</td>
</tr>
<tr>
<td>4500 Series Van</td>
<td>6.0 L, 6.8 L</td>
</tr>
<tr>
<td>1 Ton Truck</td>
<td>6.0 L, 6.2 L</td>
</tr>
<tr>
<td>1 Ton Van</td>
<td>3.7 L, 6.0 L, 6.8 L</td>
</tr>
</tbody>
</table>

**Legend:**
- **Cummins Westport:** Blue
- **GM:** Light blue
- **Ford:** Green
- **Roush:** Orange
- **PSI:** Red

*NREL: November 28, 2017*
## Renewable Natural Gas (RNG)

| Production                  | Produced from biomass through a biochemical or thermochemical process  
|                            | Biomass sources include landfills, livestock operations, and wastewater treatment plants |
| Applications                | Interchangeable with conventional natural gas |
| Benefits                    | Advanced biofuel under the Renewable Fuel Standard  
|                            | Generates credits through California’s Low Carbon Fuel Standard program |
| Considerations              | Production costs  
|                            | Lower energy content than gasoline and diesel |
## Liquified Natural Gas (LNG)

<table>
<thead>
<tr>
<th>Production</th>
<th>• Purifying and supercooling natural gas to liquid form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applications</td>
<td>• Long-haul trucking</td>
</tr>
<tr>
<td>Benefits</td>
<td>• High energy content</td>
</tr>
<tr>
<td>Considerations</td>
<td>• High production cost</td>
</tr>
<tr>
<td></td>
<td>• High storage cost</td>
</tr>
</tbody>
</table>
Existing, Offsite, Public Access
- Operated by retailer, utility, or other fleet
- May be an anchor fleet or part of a pool of fleets.

New, Onsite, Private Access
- Exclusive use by your fleet
- Fast-fill and/or time-fill.

New, Onsite, Public Access
- Built outside of restricted areas
- Benefit from economy of scale
- Promotes public use of natural gas vehicles
- Must have fast-fill capabilities for public.

Helpful Resource:
VICE 2.0: Vehicles and Infrastructure Cash-Flow Evaluation Model allows fleet managers to assess the financial soundness of converting their vehicles to run on CNG, including the cost of building a new station.

Image: NREL Image Gallery #28496
**Infrastructure: CNG Fueling**

- **Time-Fill Station**
  - Good for centrally-based fleets with consistent schedules
  - CNG is dispensed slowly, often overnight
  - Lower cost investment

- **Fast-Fill Station**
  - Fueling takes place in minutes
  - Necessary for public-access stations
  - Good for vehicles with little downtime

• Involved extensive collaboration with fleets and industry
• Answers recurring requests received by Technical Assistance for help locating, deciphering, and complying with CNG facility codes
Reviews all aspects of indoor CNG vehicle maintenance facility protection:

- Initial facility assessment
- Code compliance and requirements
- Specific design criteria.

https://www.nrel.gov/docs/fy17osti/67371.pdf
Best Practices for Working with Local Codes Officials
Codes & Standards Agencies

Develop Codes
- International Building Code
- International Electric Code
- International Mechanical Code
- NFPA 52 – Vehicular Gaseous Fuel Systems Code
- NFPA 88A – Standard for Parking Structures
- National Electric Code
- National Fire Code
- National Mechanical Code

Local Governing Bodies
Decide which codes (and versions of codes) are applicable in their jurisdiction

AHJs
Ensure the applicable codes are met

Understanding Building Code Roles and Responsibilities
Best Practices for Working with AHJs

• Establish an open dialog
• Engage early and often
  – Prevents costly and time-consuming re-work
  – Helps smooth the permitting process and avoids delays
  – Allows for immediate purchase of long-lead equipment items.
• Involved extensive collaboration with fleets and industry
• Answers recurring requests received by Technical Assistance for help understanding the options available.
What is an OEM

- Original Equipment Manufacturer
- Usually describes a major vehicle manufacturer
- Not to be confused with a system/kit manufacturer.
What is a conversion

• A process that modifies an existing engine:
  – To an alternative fuel like natural gas, propane, E85 or hybrid power
  – Can be Dedicated, Bi-fuel, Dual-fuel, Hybrid (plug-in or hydraulic assist)
  – NFPA 52, 58, and CSA as guiding documents.
Additional Training Resources

- Alternative Fuel Vehicle Workplace Safety Programs (2016 DOE Funding Opportunity)
  - **Gas Technology Institute (GTI)** will create training and guidance materials for garage facility upgrades and building modifications for facilities that service natural gas, propane, and hydrogen vehicles.
  - **Marathon Technical Services USA, Inc.** will develop a unified reference guide of design requirements, and provide in-person training and tours that showcase best practices for garage/maintenance facilities that service natural gas, propane, and hydrogen vehicles.
Technical and Problem Solving Assistance

We capture lessons learned and best practices to:

• Address permitting & safety issues
• Identify chronic vehicle or infrastructure field problems
• Help with incident investigations.

Tiger Teams

• Work with Clean Cities coalitions and stakeholders
• Tackle challenges for alternative fuel vehicle projects
• Contact John Gonzales at john.gonzales@nrel.gov

Technical Response Service

• Research and respond to general and technical inquiries
• Educate policymakers and government officials
• Provide expert, reliable, vetted resources
• Email technicalresponse@icf.com or call 800-254-6735 with technical questions
• 48-hour standard response (indicate if you need it sooner).
Considerations and Lessons Learned

Technical Assistance
– Industry working groups continually make improvements
– Clean Cities Technical Assistance Project (Tiger Teams)
Considerations and Lessons Learned

Technical Assistance
– Direct consultation with manufacturers
– Clean Cities Technical Assistance Project (Tiger Teams)
Information & Tools: Alternative Fuels Data Center

 ✓ Specific information on fuels, vehicles, technologies, and strategies
 ✓ Tools
 ✓ Publications
 ✓ State-specific information

afdc.energy.gov
Questions?

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