Exploring the Intersection of Hydrogen Fuel Cell and Natural Gas Vehicles Workshop

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EERE Areas of Focus

- **Sustainable TRANSPORTATION**
- **Renewable ELECTRICITY GENERATION**
- **Energy Saving HOMES, BUILDINGS, & MANUFACTURING**
“All of the Above” for Sustainable Transportation

Hydrogen and Fuel Cells

- Efficiency Improvement
- Fuel Diversification
- Domestic & Renewable Sources
- Reduced GHG

Vehicles

Bioenergy

National Energy Goals & Climate Action Plan
Reduce oil imports by 50% by 2020, compared to 2008
Reduce GHG emissions 17% below 2005 levels by 2020
Natural Gas Use in Transportation Sector is Projected to Grow Exponentially

Transportation is projected as **fastest growing** sector for gas consumption

~12% projected annual growth from 2012 to 2040

Heavy duty trucks - **fastest growing** segment in transportation for NG consumption

>900K stock of vehicles and heavy duty trucks running partially or fully on natural gas by 2040

>100K vehicles running fully on NG

Source: EIA, Annual Energy Outlook 2014
Largest AFV petroleum reductions come from CNG

Significant petroleum savings (~230M GGE) with CNG
NG price stability has an advantage over gasoline and diesel fuels. CNG low and stable price serve as a powerful market motivator. Domestic truck/bus OEMs now have LNG and CNG models serving important niche markets.
Hydrogen Preview: Fuel Cell Cars are Here

FCEVs on display at North American auto shows.

Honda Fuel Cell Electric Vehicle

Hyundai’s first mass-produced Tucson Fuel Cell SUVs arrive in Southern California May 20, 2014

Lease includes H₂ and maintenance.
Program Success in Distributed NG Reforming:

- Completed R&D phase
- Showed H\_2 from NG can be competitive with gasoline at high volumes
- Goal < $4/gge by 2020*

*Including delivery and dispensing at the pump

Co-Launched Public-Private Partnership

**Mission:** To promote the commercial introduction and widespread adoption of FCEVs across America through creation of a public-private partnership to overcome the hurdle of establishing hydrogen infrastructure.

**Current partners include (additional in process):**
## Examples of Challenges for CNG and H₂

### Technical Challenges
- Storage (on-board vehicles and at stations)
- Delivery
- Compression
- Dispensing
- Cost and Reliability

### Market Challenges
- Infrastructure (station siting, lead times)
- Insufficient part inventories
- Lack of standardization of parts (meters, valves, hoses, nozzles)
- Financing: ROI during early years can be negative, and future demand is difficult to predict

Are there any synergies between CNG and H₂ that can address these challenges?
Efforts to advance the development and use of NG technologies

Clean Air Power

Performance = the base diesel engine
Average duty-cycle diesel substitution factor of 60%.

ANL

Enable >50% petroleum displacement, improved efficiency relative to gasoline base engine and improved power density over comparable CNG port fuel injection technology.

$1M (DOE funded) project + cost share of $250k
Two projects focusing on NG being directly injected and the gasoline being port injected to result in a more efficient way of using NG/gasoline dual fuel.
Workshop Objectives, Goals, Desired Outcomes

Overall Objective:
• Accelerate the use of both natural gas and hydrogen for on road transportation

Goals:
• Identify synergies between natural gas and hydrogen fuels
• Identify key technical and non technical challenges which prevent or delay the widespread deployment of natural gas and hydrogen technologies

Desired Outcomes:
• Identify and prioritize opportunities to address key challenges and synergies between natural gas and hydrogen
• Determine roles and opportunities to partner across both government and industry stakeholders
Thank you