Alternative Light-Duty Vehicles: The Role of Infrastructure

Matteo Muratori

6th Annual OPIS LCFS & Carbon Markets Workshop
December 8th, 2017
San Francisco, California

NREL/PR-5400-70594
Transportation is dominated by petroleum and personal vehicles.

U.S. transportation energy sources/fuels, 2016

- **Gasoline** (petroleum): 55% (21%)
- **Jet fuel** (petroleum): 12%
- **Natural gas**: 4%
- **Biofuels**: 5%
- **Other**: 4%

- **Light Trucks**: 30%
- **Cars & Motorcycles**: 28%
- **Other Trucks**: 19%
- **AirCRAFT**: 9%
- **Boats & Ships**: 5%
- **Trains & Buses**: 3%
- **Military (All Uses)**: 3%
- **Pipeline Fuel**: 2%
- **Lubricants**: 1%

Source: U.S. Energy Information Administration, Annual Energy Outlook 2010, Reference Case, Table 45

Note: Sum of individual components may not equal 100% because of independent rounding.

1 Based on energy content
2 Motor gasoline and aviation gas; excludes ethanol
3 Excludes biodiesel
4 Electricity, liquefied petroleum gas, lubricants, residual fuel oil, and other fuels

Source: U.S. Energy Information Administration, Monthly Energy Review, Tables 2.5 and 3.8c, April 2017, preliminary data
Several alternative fuel vehicles are proposed for the future.

Petroleum fuel refueling network:

- Approximately 130,000 convenience stores (2015 NACS Retail Fuels Report) sell liquid fuels to support the fleet of ~264M personal vehicles in the U.S.
- 1 station per ~2000 vehicles

Electricity and hydrogen networks:

- 0.6M PEVs served by ~16,000 public stations (not including residential plugs)
- At the end of 2016, 33 retail HRSs served approximately 1,000 FCEVs in the United States
To reach a competitive market, commercial alternative fuel station have to transition through a “valley of death”, as vehicle adoption increases and the network achieves good utilization levels and economies of scale.

While the majority of plug-in electric vehicles charging is expected to come from residential plugs, a network of public stations is still required for those adopters that cannot reliably charge at home, to enable long-distance travel, and to cope with range anxiety.
A recent EERE report from NREL shows that about 8,100 DCFC stations are required to provide a minimum level of nationwide coverage in the communities where 81% of people live.
FCEV would require a network of refueling stations similar to the “gasoline model”. A recent H2USA report from NREL shows how many stations are needed to support 60M FCEVs.
Thank you!

More info: Matteo.Muratori@NREL.gov