Natural Gas For Transportation: Prospects For Security And Environmental Benefits

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Natural Gas Based Fuels

- MIT Study on Future of Natural Gas considered both direct and indirect use:
  - CNG
  - LNG
  - Conversion to liquid fuels (particularly methanol)
- Emphasis on requirements for economic attractiveness

CNG

- Fuel cost savings
  (gasoline- CNG price on energy basis)

- Incremental cost relative to
  gasoline or diesel engine vehicle

- Requirement for attractive payback time
  (e.g. 3 yrs)

CNG: Near Tern Market Potential And Impact

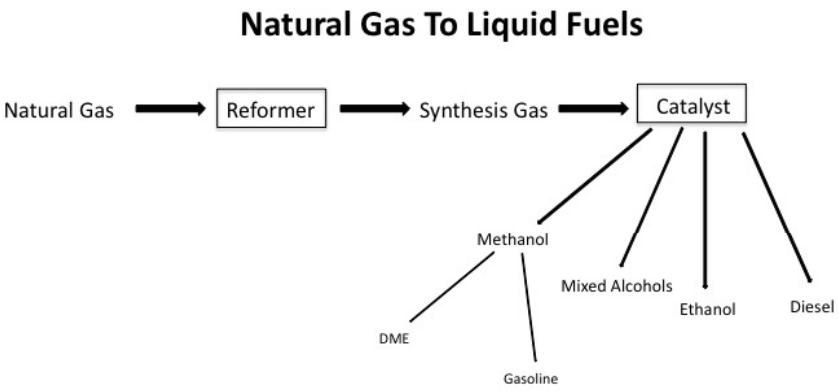
- High mileage/yr vehicle market segments
  - Short range, heavy duty vehicles
  - High mileage light duty vehicles (fleets)
- Potential impact (100 % market penetration)
  - ~ 1.3 million barrels oil/day replaced
    (using ~ 2.5 tcf/yr of nat gas)
  - Reduce GHG from vehicles by
    ~ 2 % (25 % CO2 reduction)
    < 2 % when methane emissions included

LNG Long Haul Trucks

- Challenges
  - High incremental cost (e.g $ 70,000)
  - Operational limitations of using super cold fuel (-162 degrees C)
  - Infrastructure requirements
  - Assurance of price competition between fuel suppliers
  - Reduced resale value

Hub to Hub Potential For Long Haul LNG Trucks

- Mitigates challenges
- Refueling at facilities owned by companies
- Potential impact (100 % penetration)
  - Reduce oil consumption by ~ 0.4 million barrels/day (using ~ 0. 8 tcf/yr of nat gas)
  - Reduce GHG emissions per truck by 10 -15 % (not including methane emissions from natural gas production – distribution)



Methanol Production Cost

- Natural gas @ $ 4/MMBTU:
  methanol produced for ~ $ 1.30 /gge
  (~ $1.00/gge less than present gasoline price)

- Natural gas @ $ 6/MMBTU :
  methanol produced for ~ $ 1.60/gge

gge- gasoline gallon equivalent

Methanol Powered Vehicles

- Light Duty
  - Tri- flex fuel (methanol, gasoline, ethanol)
  - Minimal extra cost ($ 100- 200)
  - Open fuel standard
- Heavy Duty
  - Operation on methanol –gasoline mixtures
  - Lower vehicle cost than diesel
    ($10-15,000 lower- less expensive exhaust treatment, less expensive fuel injectors)
- Lower fuel cost (e.g $ 5,000 less per year)

Barriers

- Risk of building US natural gas to methanol conversion plants
- Aversion of automobile and oil companies
- Concerns raised about health and environmental effects

Summary

- Main potential benefit is improved energy security
- Modest potential impact of CNG and LNG. Impact limited by economic and operational issues
- Large potential energy security impact of methanol because of favorable economics/ readiness for deployment