CNG Fueling Infrastructure and Site Planning Considerations for P3NGV June 2013

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AGT Company Overview

- Established in 1995. Most members of our CNG team have over 15 years industry experience.
- Proven in house capability and experience to design, engineer, build and maintain turnkey Natural Gas Vehicle (NGV) fueling facilities.
- Built in excess of 75 NGV fueling facilities.
- Built the 1st Liquid/Compressed Natural Gas (LCNG) station east of the Mississippi in CT.
- Aligned with several leading equipment manufacturers to apply the most appropriate equipment to a particular project, from Home Refueling Appliances (HRA) through Vehicle Refueling Appliances (VRA) to larger stations.
- Seven (7) service technicians on staff, available 24/7.
- Full system refurbishing capability.
Presentation Overview

- The aim of today’s presentation is to provide basic information on natural gas fueling stations.

- Areas covered will include station types, information on the major components used in typical fueling stations, and an overview of site selection criteria.
Facts About Natural Gas

- Natural gas is an inherently clean fuel
  - Natural gas is mostly methane with one carbon atom (CH4)
  - (Diesel – C14H30; Gasoline – C8H18; Propane – C3H8)
  - Less NOx, PM (soot) and greenhouse gases than petroleum fuels

- Natural gas is very safe
  - Lighter than air… dissipates when released
  - High ignition temperature: 1000+ Deg F
  - Limited range of air/fuel combustion ratio (5-15%)
  - Colorless, odorless, non-toxic substance
  - Doesn’t leak into groundwater
  - Comprehensive fuel tank, vehicle and station design and manufacturing codes & standards
Facts About Natural Gas

• Compressed Natural Gas (CNG)

  – Gas delivered to site by local gas utility pipeline, where it is compressed and stored onsite at a pressure of 4500 PSI; and/or distributed directly to the vehicles.

  – Onboard vehicle cylinders store @ 3600 PSI; 4 types of onboard cylinders; all meet same safety standard.
    • Type I (all metal)
    • Type II (metal liner, partial wrap)
    • Type III (metal liner, full wrap)
    • Type IV (plastic liner, full wrap)
Facts About Natural Gas

• Liquefied Natural Gas (LNG)

  – Gas delivered to site by tanker truck in a liquid state @-260°F and pressures between 75 - 120 PSI, typically in 10,000 gallon increments.

  – Onboard vehicle cylinders store @ ± 100 PSI in double wall, insulated tanks similar to a thermos bottle.
CNG Fuel Station Types

• **Time-fill:**
  CNG is dispensed slowly directly to vehicles’ onboard storage tanks. Lower cost station investment. Best for fleets that return to central lot and sit idle overnight or for extended periods and do not need fast fill capability.

• **Fast-fill:**
  Similar to liquid fueling station, same fill rates and times. A MUST for public access. Also good for larger fleets where fueling turn-around time is short.

• **Combination-fill:**
  Comprises both time-fill and fast-fill. Often good for fleets that can fuel on time-fill but need occasional “top off” or want/need ability to provide public access.
Time Fill Fueling Station

NG Utility Main

Gas Dryer

Compressor

Temperature Compensation

75% Full

50% Full

25% Full

1

2

3
Fast Fill Fueling Station

NG Utility Main

Gas Dryer

Compressor

Priority Fill System

Storage Bypass

Temperature Compensation

Sequencing Valves

1-Low

2-Med

3-High
Combination Fill Fueling Station

NG Utility Main

Compressor

Gas Dryer

Priority & Time Fill Temperature Compensation System

Sequencing Valves

1-

2-Mid

3-High

1-Low
CNG Station Options

• Station Location Options:
  – Offsite – use existing public access station if available, convenient and of sufficient capacity.
    • May be operated by the Gas Utility, another fleet or independent retailer. Initial development usually driven by an ‘anchor’ fleet that justifies investment.
  – Onsite - private access only
  – Onsite - with public access “outside the fence”

• Ownership & operations options (throughput, funding and risk tolerance drive decision):
  – Fleet owned & operated station
  – Fleet owned/leased station but contracted out operations for a fee (usually on a Gasoline Gallon Equivalent (GGE) basis)
  – Outsource station to an independent fuel provider and negotiate a gas contract price
CNG Station Design Considerations

How Much Fuel in How Much Time?

– What is the projected number of vehicles per day and what is the required fuel per vehicle?

– What are the fueling patterns?
  • Are all fueled at once?
  • Can they be staggered throughout the day?

– What is the maximum *daily* flow and maximum *hourly* flow
  • This affects equipment selection and/or storage amount, especially when designing CNG station

– Is backup CNG fueling available nearby (even if only on an emergency basis) or is design redundancy required?
Station Design/Cost Considerations

Station Design/Cost Factors *other than* Fuel vs. Time

- **Real estate**
  - Location:
    - Urban/Suburban/Rural and cost of land
    - Competition with other commercial businesses for prime locations
    - Traffic access
  - Size of property
    - Required space for equipment footprint
    - Required space for vehicle traffic (including # of islands, vehicle entry/exit)
  - Site Development
    - Remediation of existing fueling site
    - Permits, Codes & Regulations
Station Design/Cost Considerations

Station Design/Cost Factors Impacted by Fuel vs. Time

• Fueling equipment needs/costs
  – Compression:
    • Electric drive or gas engine drive
      – Size of electric service?
      – Inlet gas psi and peak flow rates
    • Sizing (HP and flow in Standard Cubic Feet per Minute (SCFM) is critical
    • Enclosures for sound attenuation
    • Sophistication of controls
  – GGE/hr = 0.5 x SCFM (@ rated inlet psi)
    • Ex: 200 SCFM compressor = ~100 GGE/hr
    • Ex: 75 SCFM compressor = ~35-37 GGE/hr
Station Design/Cost Considerations

Station Design/Cost Factors Impacted by Fuel vs. Time

• Fueling equipment needs/costs
  – CNG Storage:
    • Is it needed? If so, what is balance between compression capacity and storage needs
    • Peak storage requirements and dispensing projections
    • Cascade vs buffer system
    • Type of storage containers (Spheres or cylinders)
    • Available space
Station Design/Cost Considerations

Station Design/Cost Factors Impacted by Fuel vs. Time

• Fueling equipment needs/costs
  – Natural gas dryers:
    • Projected volume and flow rates
    • Inlet gas pressure and potential variance from spec
    • Moisture content (gas analysis) and historical variances from spec
    • Manual vs automated regeneration
    • Single tower versus dual towers
Station Design/Cost Considerations

- Fueling Equipment Needs/Costs
  - Dispensers and Fuel Management:
    - Time fill posts? Fast Fill dispensers? Both?
    - Number and type to meet expected vehicle types/counts
    - Fuel metering/data capture, payment system?
    - CCs/pmt cards, training video (e.g. in CA)?
Station Example – Home Refueling
Station Example – VRA
Station Example – Municipal (Expandable)
Station Example - DPW
Station Example - Utility
Station Example – Public Access
Station Examples - Retail
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