CNG and CH2 Station Design Considerations

Southern California Clean Vehicle Technology Expo
Ontario Convention Center
Ontario, California

October 11, 2006

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Sponsored by:
South Coast Air Quality Management District
Introduction to
Marathon Technical Services
Overview of Services
**Flexible Contract Approach**
- Design/Build
- Detailed Design/Construction Support
- Design/Build/Operate/Maintain fuel supply contract
- On-going support

**Station Design Services**
- Project Definition and Sizing
- Electrical / Mechanical / Civil Design
- Detailed Equipment / Installation spec’s
- Engineering Estimate
- Bid Period Assistance
- Regulatory Approval Submissions
- Contractor Submittal Review
- Site Inspection / Supervision
- Equipment Inspection and Testing
- Noise Analysis
Facility Modifications

Marathon will provide concept level, or detailed design for facility upgrades. These upgrades may include:

• HVAC
• Electrical
• Structural
• Gas Detection
Accident Investigation and Reconstruction

Marathon's experience in incident investigation contributes to the safety and integrity of our station design and facility modifications.

Deflagration in an indoor fueling facility. Marathon provided investigation and redesign services for the facility.

Rupture of a 200 psi vessel causing the destruction of the CNG compressor.
Training and Industry Resource

• **CNG Industry Best Practices**—Suite of CD based training modules funded by US DOE and GTI and distributed free of charge through NREL.

• We have trained staff from most of the CNG station equipment manufacturers, CNG industry consultants (our competitors) and many CNG Station owners and operators.

• Authored or coauthored technical publications for the CNG Industry on behalf of gas industry groups.

• Customized Standard Operating Procedures (SOPs).
Compressed Natural Gas (CNG) and Compressed Hydrogen Fueling Station Project Steps
Sizing Steps:

1. Define the fill shift (eg. One hour, overnight, or periodically throughout the day).
2. Determine the total fuel dispensed per fill shift.
3. Be careful not to under-estimate or over estimate time available and fuel dispensed—this could result in under-sizing (leading to poor fills or overtime) or over-sizing (leading to station reliability issues and increased power costs).
Sizing Steps:

4. Provide fleet data to your consultant or turnkey contractor.
5. Computerized station sizing tools are also available but some level of experience in station design is recommended before use.
6. Evaluate station options:
   • Time Fill
   • Cascade Fast Fill
   • Buffer Fast Fill
   • L/CNG
Gas Dryer

NG Utility Main

Temperature Compensation

100% Full

100% Full

100% Full

Time-Fill Fueling Station Simulation
Vehicle Refueling Appliances (VRAs) are used in a wide variety of applications both as time-fill (direct fill from unit), or with a small cascade storage to allow limited fast-filling.

Commercial applications fuel 1-2 vehicles over an 8 hour period. This model has approximately 2 scfm flow.
Cascade Fast-Fill Fueling Station Simulation
Cascade Fast-Fill Station Components

- Single tower natural gas dryer with manual regeneration
- Electric drive CNG compressor package
- Two hose fueling dispenser with internal sequencing
- 3 bank CNG storage cascade
- Natural gas utility service

Courtesy GreenField
Combination Time-Fill and Cascade
Buffered Fast-Fill Fueling Station Simulation

NG Utility Main

Gas Dryer

Compressors

Buffer Storage

Temperature Compensation
Buffered Fast-Fill Fueling Installations

Large state-of-the-art Buffer Fast-Fill Fueling Station, Atlanta Georgia.

Courtesy ANGI

Four 1000 scfm compressors, 70,000 scf Buffer capacity, five fast-fill hoses. Installation sized for 200 transit bus fleet.
Liquefied to Compressed Natural Gas (L/CNG) is CNG made from LNG. L/CNG is still relatively new to the market. This technology does not require the natural gas service to the site, the gas filtration and drying equipment and the gas compressor(s).

Liquefied natural gas is stored on site in one or more storage tanks (Cryogenic Thermos) with up to 10,000 US gallons per tank.

LNG is converted to CNG by flowing it through a “vaporizer”. The vaporizer uses ambient heat to vaporize or boil the liquid into gaseous form.

Using current technology it is not possible to maintain odorant in LNG. Odorant is required by code and must be injected into the gas after it has vaporized.

L/CNG can be dispensed through a conventional Time-Fill, Cascade Fast-Fill, or Buffer Fast-Fill dispensing system.

LNG is pumped up to 4000 or 5000 psig using 1 or more high pressure Cryogenic Pumps.
L/CNG Fueling Installations

LNG Storage Tanks

LNG Storage Tanks

Vaporizer

Concrete LNG Containment Wall

CNG Dispenser not shown (behind bus)
Project Steps:

1. Determine whether a consultant will be hired or whether a design-build contractor will be selected (consultant still recommended). “Fuel Provider” contractors are another option that relieves the owner of maintenance responsibility. This approach is most commonly used on LNG, L/CNG and H2 projects, but has also been used on Transit and other CNG stations. The fuel cost includes O&M (except power).
Project Steps:

2. Sizing and selection of station type.
3. Conceptual design/layout identify site limitations or considerations.
4. Determination of utility requirements-new gas, power, phone and Internet services to the site.
Project Steps:

5. Preliminary visit to regulatory agencies—adjust design as required.
6. Issue equipment and installation specifications and drawing package—detail is equally important with design-build approach.
Project Steps:

7. Station construction. (between 3 and 12 months)
8. Station commissioning and testing—Alt-fuel vehicles are required to test the station. (between 2 weeks and 3 months).
9. Final regulatory approval.
10. Operations begin—spare parts should be in inventory by this point. Expect a "shake out" period of several weeks—longer with larger stations.
CNG, LNG, L/CNG and H2 station projects often span more than a year from inception to final commissioning.

Plan Early!!
Transit Customers

- GWINNETT COUNTY TRANSIT
- METRO
- NEW YORK CITY DOT
- NJ TRANSIT
- MARTA
- New York Bus Service
- Queens Surface Corp.
- Regional Transit
Other Customers

U.S. Department of Energy

City of Santa Monica

conEdison, inc.

SYSTRA

Atlanta Gas Light Company