

Experiences with Compressed Natural Gas in Colorado Vehicle Fleets

Case Study Analysis
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Colorado
Energy Office

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Abbreviations and Acronyms:

AFDC – Alternative Fuels Data Center
AFV – Alternative Fuel Vehicle
CEO – Colorado Energy Office (formerly Governor's Energy Office or GEO)
CNG – Compressed natural gas
CNGVC – Colorado Natural Gas Vehicle Coalition
DIA – Denver International Airport
DGE – Diesel gallon equivalent
DOE – U.S. Department of Energy
DOLA – Colorado Department of Local Affairs
GGE – Gasoline gallon equivalent
NREL – National Renewable Energy Laboratory
OEM – Original Equipment Manufacturer
psi – Pounds per square inch of pressure
RFP – Request for proposals
scfm – standard cubic feet per minute

Unit conversions:

Diesel Gallon Equivalent (DGE): One DGE contains 137,380 British thermal units (Btu)
Gasoline Gallon Equivalent (GGE): One GGE contain 124,340 Btu
Source: DOE Alternative Fuels Data Center (AFDC)
http://www.afdc.energy.gov/afdc/progs/fuel_compare.php

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Executive Summary and Key Findings

Summary of Activities

This series of case studies is the product of in-person and telephone interviews with three Colorado fleet managers who use compressed natural gas (CNG) as a vehicle fuel and interviews with other CNG stakeholders. The fleets were selected using criteria that are intended to increase the usefulness of the overall product, including geographic diversity, length of CNG experience, diversity of vehicles, and ownership model. The case studies are based on a framework constructed with broad stakeholder input, designed to provide detailed information on fleet manager experiences with CNG vehicles and fueling infrastructure.

Other sources consulted to develop the information presented in the case studies include engineering economic analyses of CNG refueling systems and vehicles, knowledge and experience of Colorado Energy Office (CEO) staff, published reviews of CNG fleet experiences, national labs, CNG equipment manufacturers and engineering firms, and nonprofit organizations that promote CNG use. The draft case studies were reviewed by several CNG stakeholders prior to publication. The planning, procurement, maintenance, and other practices described in this study reflect those of individual fleets, and should not necessarily be construed as best practices for the industry as a whole. The results provided do not provide a substitute for site-specific analysis of CNG fueling infrastructure or fleet conversion projects. Numerous resources are provided to aid readers in their efforts to evaluate whether CNG is right for them. CEO can help further direct stakeholders to additional resources that address particular questions or challenges in greater detail.

Featured fleets include the following:

- Republic Services (Republic), a private sector waste and environmental management firm with a CNG fleet based in the Denver metro area;
- Denver International Airport (DIA), an airport with more than 15 years of experience with CNG and proven success as a CNG hub; and
- City of Grand Junction, a Western Slope municipality with a public/private partnership to provide public CNG fueling

| | Grand Junction | DIA | Republic |
|--|------------------------------|---------------------------|-----------------------------|
| Sector: | Public | Public | Private |
| Funding: | Grants Internal Other* | Internal | Internal |
| CNG vehicles: | 7 | 221 | 34 |
| Near- to mid-term expansion plans: | 3 trucks on order | Add 25 to 50 vehicles | 144 truck fleet replacement |
| CNG use began: | 2011 | 1995 | 2011 |
| Vehicle types: | Refuse trucks, other | Variety (most light duty) | Refuse trucks |
| Fueling station: | Time-fill and Fast-fill | Fast-fill | Time-fill |
| Public refueling: | Yes | Yes | No |
| Payback period (years): | 10 | 7 | 2 to 3 |
| Fueling station cost: | \$1.3 million | \$1 million** | \$2 million |
| Current annual fuel savings: | \$40,000 | \$136,000 | \$420,000 |
| Maintenance cost changes due to CNG: | Increase (not quantified) | 25% increase | No increase |
| *Vehicle registration fees | | | |
| **Cost for 2006 upgrades; original station costs unknown | | | |

access.

Key Findings

In examining the experiences of the three fleets, several themes emerged that are instructive to the deployment of CNG vehicles and fueling infrastructure:

Decision to use CNG: A project champion is a key to any fleet's CNG deployment, but broad-based long-term support is also needed.

Management considerations: An organizational commitment to sustainable procurement can help tip the scale toward deployment of alternative fuel vehicles, including those that use CNG. For both public and private sector fleets, establishing the business case for CNG is crucial, as are vehicle performance and suitability for the applications in question.

Project accomplishments and metrics: Both DIA and Grand Junction have become catalysts for local expansion of CNG vehicle fleets and novel public/private partnerships because of their CNG fueling stations. Republic has achieved a 50 percent vehicle fuel cost reduction compared to diesel vehicles and has reduced compressor electricity costs by approximately 30 percent through compressor programming and use timing. Republic believes CNG has improved its brand recognition. Quantification of accomplishments and benefits is crucial to measuring success, maintaining organizational support, and building on existing deployment efforts.

Vehicle selection: Fleets are increasingly opting for OEM vehicles. Fleet managers are awaiting the release of more OEM pickups and a larger variety of heavy-duty engines. Availability of light-duty vehicles is still limited, which is a barrier to fleet expansion.

Fueling station design and economics: The design and costs of fueling infrastructure varied widely across the different fleets; fuel storage spheres and other equipment associated with fast-fill stations increase the upfront cost for fast-fill stations for public refueling access at Grand Junction and DIA. The total timeframe for station development ranges from four months to two years. Natural gas distribution system interconnection timeframes are a key variable in that equation.

Field experiences: Drivers and maintenance staff at Grand Junction and Republic are very satisfied with the performance of their newer refuse trucks. Grand Junction and Republic cite labor savings associated with reduced time spent fueling. DIA has a mix of old and new CNG vehicles and has some reported difficulties with fueling tanks in cold temperatures using fast-fill pumps. DIA also cites limits on payload capabilities for CNG pickups as an issue, though they are seeking to address these by buying new trucks with utility bodies. All fleets report some changes in maintenance procedures; maintenance increases appear to be greater for fleets with a wider variety of vehicle types and smaller fleets with more limited staff time to dedicate to new projects

Introduction

The Colorado Energy Office (CEO)¹ has prioritized the diversification of the state’s transportation fuels portfolio as a means of increasing energy security, promoting environmental sustainability, supporting low energy costs for consumers and businesses, and driving job creation and economic development. To that end, Colorado’s significant proven natural gas reserves create an opportunity to increase the use of clean, locally produced transportation fuels. The CEO has specifically identified natural gas as a viable, low-cost alternative to gasoline and diesel in vehicle fleet operations. A number of organizations in Colorado have transitioned their entire fleet or portions thereof to run on compressed natural gas (CNG), including the replacement or conversion of vehicles, the construction of fueling infrastructure, and modifications to maintenance facilities and/or practices.

The CEO commissioned this series of case studies to provide a blueprint for future CNG deployment in the state. The case studies document effective pathways toward realizing the financial, environmental, and other benefits of natural gas as a transportation fuel. The case studies provide information on numerous topics of interest to fleet managers who may be interested in CNG vehicles but have questions about whether it is the right fuel for them:

- Why fleet managers decide to use CNG vehicles,
- How fleet managers address concerns at both the managerial and maintenance staff levels,
- How fleet managers identify and select CNG vehicles that meet the demands of a given application,
- How to design, build and operate fueling stations in a cost-effective manner,
- What are field experiences from the perspective of maintenance staff and drivers,
- How much petroleum use can be displaced through the use of CNG, and
- What are the financial implications of CNG use?

Case Study Format

The case studies address the topics listed above and are organized as follows:

Background: This section provides an overview of the CNG fleet, including a project timeline, types of vehicles,

the setting in which they are used, and the project’s evolution from conception to implementation.

Decision to use CNG: This section addresses the motivation behind the switch to CNG and overall project goals.

Management considerations: This section describes any management considerations or concerns that required resolution prior to project implementation.

Project accomplishments and metrics: This section provides an overview of project accomplishments and metrics for the project. Greater detail is provided in subsequent sections.

Project funding: This section describes funding sources and requirements for the project, any barriers to obtaining funding, and how barriers were overcome.

Vehicle selection: This section describes how the fleet manager and other project participants identified and evaluated vehicles to meet the fleet’s mission requirements.

Fueling station design and economics: This section describes how the organization designed, built, and operated its CNG fueling infrastructure.

Field experiences: This section describes the vehicle field experiences from the perspective of maintenance staff and drivers.

Lessons learned: This section summarizes key lessons learned for the different stages of CNG fleet deployment, including initial feasibility analysis, project approval, concept development and design, vehicle procurement, and operations and maintenance.

Selection of Fleets for Case Study

Criteria used in selecting fleets for study include fleet ownership, geographic location, vehicle type, and longevity of CNG fleet operation. Historically, CNG fleet vehicle implementation has been dominated by public sector fleets and select private sector fleets. Volatility in energy costs and improvements in the availability of CNG vehicles have spurred new interest in CNG by the private sector. Care is taken in these case studies to represent the business case for CNG in a manner informative to both private and public sector fleet managers.

¹ The Governor’s Energy Office (GEO) was renamed the Colorado Energy Office (CEO) in July 2012.

Overview of Fleets Selected

Three fleets were selected to be the subject of these case studies. Republic Services (Republic) was selected because it is a private company and because its rapid adoption of CNG serves as a good illustration of the business case for CNG. Denver International Airport (DIA) proved an interesting subject due to its long history with CNG: the airport started using CNG vehicles when it opened in 1995 and has become a hub for CNG vehicles. Grand Junction, Colorado showcases the perspective of municipalities seeking to control fuel costs and support CNG adoption. Grand Junction also serves as an example of a public/private partnership to provide fueling access to vehicles outside the organization.

Republic Services (Republic). Republic is a national, privately owned waste and environmental management company with 350 locations in the United States. Republic uses CNG at 17 locations and began converting its Denver metro area fleet to CNG in 2011. It currently operates 20 CNG refuse trucks out of 144 total, and anticipates converting at least half of the fleet to CNG in the next two years.

Denver International Airport (DIA). DIA began using CNG vehicles when it opened in 1995. CNG vehicles meet emissions requirements to operate in the airport's two miles of underground tunnels. DIA owns 221 CNG vehicles; 35 percent of its light-duty fleet vehicles are alternative fuel vehicles (AFVs). Most of these use CNG.

City of Grand Junction. Grand Junction began using CNG vehicles in 2011 and currently operates five refuse trucks, a street sweeper, and dump truck. It has three more CNG refuse trucks on order, which will bring the total to eight out of 12 by the end of 2012. Grand Junction partnered with Monument Clean Fuels to provide access to fueling by other fleets and individual drivers.

Case Study: City of Grand Junction

Officials at the City of Grand Junction first began exploring alternatives to diesel fuel in 2007, when they commissioned a study on the potential to recover biogas (or renewable natural gas) from the city’s wastewater treatment operations, refine the gas, and use it in vehicles or inject pipeline-quality gas into the natural gas distribution system. The study findings indicated that the potential biogas resource could support the entire fuel demand of the city’s refuse hauling fleet. However, the cost to recover and upgrade the biogas at that time did not warrant moving forward with a project.

In 2009, the City of Grand Junction faced vehicle fuel budget shortfalls. City managers officials began seeking ways to reduce fleet costs, environmental impacts, and reliance on imported fuels. CNG represented a technically and economically viable substitute for diesel fuel. Refuse trucks once again were the focus of investigation, this time using pipeline quality natural gas, due to the availability of OEM equipment suitable for that application.

Fleet Facts

| | |
|----------------------|---|
| Ownership | Municipal |
| Funding sources | Grants Vehicle registration fees Internal funding |
| Total fleet vehicles | 989 |
| CNG vehicles | 7 |
| CNG use began | 2011 |
| Vehicle types | Refuse trucks (5) Street sweepers (1) Dump truck (1) |
| Refueling station | Time-fill for city vehicles and transit fleet partners Fast-fill public access |

The city’s financial and engineering staff researched available vehicle options and obtained bids from four vendors that offered side-by-side comparisons of CNG and diesel fueled trucks. Initial economic feasibility analysis suggested that CNG savings over diesel fuel would justify the incremental costs of the CNG vehicle purchases. The

City Manager presented the case to the City Council, which approved the purchase of two CNG refuse trucks in 2010.

The number of CNG refuse trucks grew to five by early 2012, and the city soon ordered three more, bringing the number of CNG refuse trucks to eight (out of 12 total refuse trucks) by the end of 2012. The city has also added a CNG street sweeper and dump truck to its fleet.

Vehicles Used in CNG Fleets

| | |
|----------------------|--|
| Vehicle manufacturer | Refuse trucks: Mack TerraPro Street sweeper: Elgin Pelican Dump truck: International |
| OEM or retrofit | OEM |
| Engine manufacturer | Cummins Westport |

The City of Grand Junction also built a time-fill CNG fueling station to serve its CNG vehicles and a publicly accessible fast-fill fueling station. The fast-fill station is operated by a private firm, Monument Clean Fuels.

Decision to Use CNG

Fleet managers seeking to transition to CNG must contend with many questions about cost, performance, and other issues. City of Grand Junction Financial Operations Manager Jay Valentine cited cost savings as the dominant factor in considering the switch to CNG. Mr. Valentine noted that as the emissions performance of diesel technology improved, the cost of diesel trucks increased, thus narrowing the purchase price differential between conventional diesel and CNG-fueled trucks. Reducing vehicle emissions was the second highest factor, with energy security and energy self-sufficiency a close third.

Through the project, the city hoped to serve as a catalyst for increased CNG use in the region. Establishing refueling capacity in the region solves the “chicken or egg” dilemma that can and has impeded growth in CNG use. Without fueling infrastructure, consumers will not purchase CNG vehicles; and investment in refueling infrastructure can be risky without any guarantee of a market for the fuel. By including a publicly accessible fast-fill fueling station in its station design, the City of Grand Junction has made CNG vehicle ownership more feasible for consumers and other fleets.

The location of a fueling station in Grand Junction also moves Interstate 70 closer to being a viable corridor for

natural gas vehicles from Colorado to California, helping to fill a CNG fueling gap between Denver and western Utah.



CNG station locations in Colorado and Utah.
Richfield is 224 miles from Grand Junction.
Source: DOE AFDC

Yellow markers indicate CNG stations

The City of Grand Junction also developed a partnership with Grand Valley Transit, a county transit agency serving Mesa County, which now fuels two CNG buses at the City of Grand Junction's time-fill station.

Management Considerations

Project champions are a key element of any major organizational change. The City of Grand Junction's decision to implement CNG involved efforts from the City Manager's office, City Council, and project champions from multiple departments.

Mr. Valentine said that there was a lack of information at the time about vehicle availability and performance, operations and maintenance, and refueling system options that they could rely upon to guide their efforts.

The initial task was to establish that there was a vehicle option that met their application needs. Mr. Valentine coordinated this effort by soliciting bids for CNG and diesel refuse trucks. The resulting bids established that suitable vehicles were in fact available and quantified the incremental cost for CNG vehicle procurement. Mr. Valentine worked with the City Manager's office to get City Council approval to purchase the vehicles, with the understanding that investment in fueling infrastructure would be part of the overall project.

When the Council approved the purchase of the CNG refuse trucks, site-specific configuration and cost of the

fueling station had not yet been developed. Terry Franklin, now Deputy Manager of the city's Utilities, Street Systems and Facilities Department, championed the technical effort to develop initial fueling station sizing and cost estimates. He relied upon a suite of CNG fueling analysis tools developed by the National Renewable Energy Laboratory (NREL), originally published in 2004, to develop alternative compressor station configurations and costs.² While the capital cost information was relatively dated, it provided a tool to compare the relative capital and operating costs for a variety of system scenarios. Mr. Franklin's efforts aided in the development of grant applications and station design procurement efforts.

One factor that helped convince the City Council to approve the CNG vehicle purchase was inclusion of a reference to a prior City Council resolution known as CORE (Conserving Our Resources Efficiently). This previously approved resolution committed to supporting resource conservation efforts by local government, including energy efficiency and pollution reduction measures that can reduce costs and enhance community sustainability and livability. The fact that CNG fit into a bigger commitment to sustainability that the City of Grand Junction had already established, even if it did not have specific procurement goals or metrics, helped push this project toward implementation.

Project Accomplishments and Metrics

Key accomplishments of the City of Grand Junction's CNG project include ongoing cost savings for the fleet and access to CNG fueling infrastructure for other fleets and the public.

Financial benefits: The City of Grand Junction did not apply a hard financial go/no go decision criterion to this project because it had a significant research, development, and deployment component. There are numerous public and ancillary, yet worthwhile, benefits to the organization and the greater community. Nonetheless, the financial performance of the project has exceeded expectations, with annual fuel cost savings of approximately \$10,000 per year per CNG refuse truck, relative to diesel refuse trucks. This savings estimate compares diesel fuel costs at \$3.33 per gallon in 2011 to the combined costs of operating and maintaining the CNG fueling station. Station operating costs include electricity purchase, natural gas commodity

² NREL, Compressed Natural Gas: A Suite of Tutorials, NREL/CD-540-37146, December 2004, on-line: <http://www.nrel.gov/docs/gen/fy05/37146.pdf>

Grand Junction Project Accomplishments and Metrics

| Metric | Description |
|--|---|
| Annual petroleum offset (DGE) | 34,150 DGE (12 month period from May 2011 – April 2012) |
| Refueling system cost | \$1,358,458 (\$240,457, or 18% paid for by City of Grand Junction) |
| Total cost of CNG vehicles | \$1,072,620 for four refuse trucks |
| Incremental capital cost of CNG vehicles | \$167,187 for four CNG refuse trucks |
| Annual fuel purchase savings | \$40,000 for four CNG refuse trucks |
| Simple payback period | 10 years, based on incremental vehicle cost plus City of Grand Junction investment in refueling system |
| Vehicle performance | Reduced vehicle emissions, noise, and odor Perceived minor power loss on steep hills |
| Maintenance impacts | Marginal increase in truck maintenance costs Fueling system limits ability to measure vehicle fuel efficiency |
| Economic development | Public fast-fill refueling station boosts interest in CNG vehicles Partnership with Grand Valley Transit to use time-fill station to fuel two new CNG buses increases utilization of time-fill station |

purchase, and equipment maintenance, resulting in an estimated CNG cost of \$1.14 to \$1.34 per diesel gallon equivalent (DGE) between January and April 2012.

The city obtained grant funding and other financial support to pay for about 80 percent of the costs to develop the fueling station, and the city used its own funds for the remaining costs. The simple payback period to recover the incremental costs of the CNG refuse trucks and the City of Grand Junction's investment in the fueling station is 10 years, based on fuel cost savings from four refuse trucks. The project payback period will decrease as additional CNG vehicles are added to the fleet.

The positive financial outcome of the Grand Junction CNG fleet is not typical of smaller fleets that develop their own infrastructure. Recent analysis using the CNG Vehicle and Infrastructure Cash-Flow Evaluation (VICE) model developed by NREL suggests that the break-even point for investment in CNG infrastructure is highly sensitive to fleet size.³ The investment required for a time-fill station is smaller than for a fast-fill station. As a result, for smaller fleets the payback period is shorter if the fleet opts for a time-fill system. Grand Junction installed a time-fill system

to serve its own needs and a fast-fill station for public fueling.

Catalyzing deployment: This project resulted in establishment of a public/private partnership with Monument Clean Fuels, which provides public access to a fast-fill fueling station. Availability of publicly accessible fueling infrastructure has spurred increased interest in CNG vehicles in the region. The local Honda dealer, Fuoco Honda, now offers the CNG Honda Civic model for sale to the general public. Honda places stipulations on which dealers can sell CNG models, one of which is having sufficient fueling infrastructure available.⁴ Another partnership is the investment by Grand Valley Transit in two CNG buses that fuel at the city's time-fill pumps, increasing the utilization of the fueling infrastructure. The project can rightly say that it has met its goal of serving as a catalyst for CNG vehicle and fuel demand in the Grand Valley.

Project Funding

Grand Junction purchased its CNG vehicles with its own funds. The CNG fueling station was funded with a combination of city funds, grants, and state vehicle registration fees. Grand Junction was confident in its ability

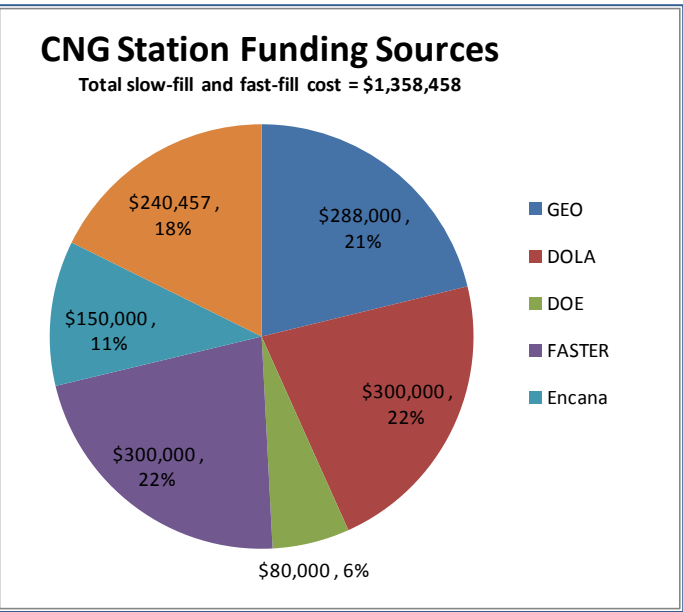
³ NREL, Business Case for Compressed Natural Gas in Municipal Fleets, June 2010.

⁴ Personal interview with Miles Proffitt, Sales Consultant, Fuoco Honda, Grand Junction, Colorado. June 7, 2012.

to secure grants for the fueling station because of the lack of CNG infrastructure in the area.

Overall, the City of Grand Junction paid for 18 percent of the capital cost of the fueling station, which totaled about \$1.4 million. In comparison, fueling infrastructure for a retail gasoline station, including pumps, tanks and other dispensing equipment, totals about \$500,000.⁵

The CEO, the Colorado Department of Local Affairs (DOLA), U.S. Department of Energy (DOE), and Encana all provided grant support to the project. The DOLA grant came from the New Energy Communities Initiative, offered jointly through CEO. The DOE funding came through its Energy Efficiency and Conservation Block Grant Program. Encana is a natural gas producer in Colorado. Additional funding was provided by the Colorado Department of Revenue via the FASTER program. The FASTER program was implemented in Colorado in 2009 and utilizes vehicle registration fees to pay for state road infrastructure.



Vehicle Selection

Schedule: Grand Junction makes vehicle purchase decisions on a staggered schedule based on vehicle age and application. Refuse trucks have a useful life that varies depending on loading technology.

Personal interview with Jason Farrington, Monument Oil, June 16, 2012.

Refuse Truck Useful Life by Configuration

- Side-load: 6 years
- Rear-load: 8 years
- Front-load: 10 years

Grand Junction’s first two CNG trucks replaced existing diesel refuse trucks that were due for replacement. Moving forward, when existing refuse trucks are retired, Grand Junction is replacing them with CNG trucks. Each purchase must be approved by the City Council. There are multiple benefits to a gradual replacement plan for the City of Grand Junction:

1. Gradual fleet replacement places less stress on the budget.
2. Grand Junction can maximize the value of its original vehicle investment.
3. A phased-in approach allows time to scale the fueling infrastructure to meet the demands of the fleet, reducing upfront infrastructure costs.

If a fleet wants to minimize the payback period for investment in fueling infrastructure, the fleet manager needs to take into account both fuel costs and vehicle acquisition costs. Grand Junction did not need to do this because grant funding enabled limited upfront investment in refueling infrastructure.

Equipment specification: Grand Junction chose an OEM equipment package (tractor, engine, and refueling system) rather than opting for a vehicle conversion. Grand Junction also selected dedicated CNG vehicles as opposed to bi-fuel vehicles, which use both natural gas and diesel fuel. This decision was based on availability of dedicated CNG vehicles that met its application needs.

Using OEM equipment means employees only needed to learn one diagnostics system and maintenance equipment purchases are more limited when compared to conversion or bi-fuel systems, which may have engines and diagnostic systems from multiple manufacturers.

Procurement process: The City of Grand Junction issued a request for proposals (RFP) for CNG refuse trucks at the end of 2009. All of the respondents, which included Faris Machinery, Autocar, Peterbilt, Heil, and Labrie, were from Colorado. The city selected Faris Machinery, a local dealer.

Chassis, body, and features were all important considerations in the selection process. Each CNG truck costs about \$42,000 (18%) more than its diesel counterpart. The city initially ordered two trucks in early 2010. They were delivered in February 2011, roughly one year from the order date.



Vehicle choice: 2011 Mack truck with 2011 Wittke body

Incremental cost of CNG vehicle purchase:

The city paid for the first two CNG vehicles from its 2010 budget without any external funding. The city anticipated that fuel savings would offset the incremental cost of the CNG vehicles over time. Since the initial purchase, Grand Junction has purchased and received three additional CNG refuse trucks and purchased three more that are on order. The city also purchased a CNG street sweeper and dump truck. The city will not directly recover the \$6,000 incremental cost of the CNG dump truck within the vehicle’s lifetime because of its modest use profile. The city decided that the energy and environmental benefits of CNG justified the additional purchase costs of the vehicle.

| Price for one diesel vehicle | Price for one CNG vehicle | Incremental cost for CNG vehicle |
|------------------------------|---------------------------|----------------------------------|
| \$226,359 | \$268,155 | \$41,796 |

Fueling Station Design and Economics

Grand Junction operates two CNG stations at its fleet maintenance site: a time-fill station and a fast-fill station. Three 40-horsepower compressors provide compression for both stations.

The time-fill station has 10 dispensers, or time-fill posts, that are used for the refuse trucks, sweeper, and dump truck. The time-fill station consists of a pole, hose, nozzle and associated plumbing and safety equipment. Average monthly fuel throughput for the time-fill station was 2,185 DGE for the most recent 12-month period.

During that period, the maximum throughput in a single month was 3,999 DGE, occurring in April 2012. When a CNG truck comes in for fueling, the driver connects the pump nozzle to the fuel tank. The truck then fuels unattended, reducing labor time needed for fueling. This process takes 2.5 to 3 hours if the truck’s fuel tank is empty.

Grand Junction installed a fast-fill station that is accessible to the public as a condition of grant funding, but also as part of an overall desire to drive CNG vehicle deployment. The fast-fill station is operated by Monument Clean Fuels, a private company selected via an RFP process to be the retail arm of the project. Monument leases the land where the fast-fill station is located. As such, the public refueling station is available at a reduced total capital cost to the private partner, who pays for natural gas, compressor electricity use, and land rental costs while selling CNG to the public.

The fast-fill station looks more like a traditional gas station with a digital display, card reader, and pump nozzle.

The fast-fill station user interface is a military-style card reader system, which means that the card reader is separate from the pump a few feet away. Consumers who are new to the station or unfamiliar with typical fleet fuel tracking systems often have difficulty locating the card reader. Although there is no attendant, fleet employees are nearby and able to help those having difficulty.



Fast fill pump

Anecdotal experience suggests that the fast-fill station can sequentially fuel up to five cars fully, and most of a sixth, an unusual occurrence for the fast-fill pump. After such an

occurrence, the compressor will need to run for 2 to 2.5 hours to refill the storage spheres. Average monthly throughput for the fast-fill station is 661 DGE in the most recent 12 month period, with a maximum of 1,830 DGE for a single month.

The City of Grand Junction’s CNG fueling station connects with Xcel Energy’s natural gas distribution line. Natural gas is delivered at approximately 17 pounds per square inch (psi) of pressure. The City of Grand Junction had to take natural gas from a line located several hundred feet from the fueling location, even though a lower-pressure gas line was closer. According to Xcel, the closer line could not deliver natural gas with sufficient pressure to meet the needs of the compressor station. The line supplying the fueling station is an intermediate-pressure line with a maximum pressure rating of 150 psi, which could under special situations deliver pressures up to 20 psi. This better fit Grand Junction’s needs for CNG compression.

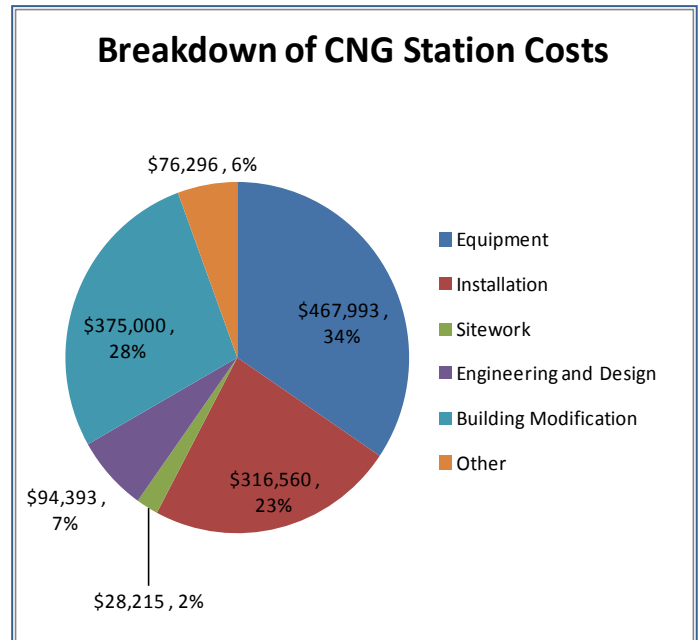
City engineering staff was unclear on the reason for the need to use the line that further away, believed that it may have been associated with the utility’s desire to ensure long-term service to nearby residential customers using the closer natural gas line. This illustrates a need for fleet managers and natural gas providers to communicate clearly and openly about their respective needs in order to ensure an efficient and cost-effective utility interconnection process.

Raymundo Engineering based in Walnut Creek, California, provided design services for the fueling station. The fueling station design/build process, from consultation to installation and construction of the refueling system, took approximately 12 months. GESI, now Mansfield Gas Equipment Systems, provided the fueling equipment, including three Ingersoll-Rand 40 horsepower compressors capable of delivering 174 standard cubic feet per minute (scfm) of gas.⁶ The fast-fill station stores gas in three on-site spherical storage tanks with a combined total volume of 290 GGE. The fueling station commissioning coincided with the arrival of the first CNG refuse trucks in early 2011.

One drawback of the current fueling station configuration is that it does not permit tracking fuel use by vehicle, because the time-fill system has only one fuel flow meter.

⁶ Mansfield Gas Equipment Systems, Recent Projects, online: <http://www.mansfieldgasequipment.com/>

Additional flow meters have not been installed for each pump, due to the additional cost. This could result in missed opportunities for early identification of vehicle maintenance problems.



Costs. The total capital costs of the fueling station were \$1,358,458 and are broken down by component in the chart below.

Equipment, building modifications, and installation costs were the largest cost components of Grand Junction’s CNG station. Engineering and design were budgeted at 7 percent of the total cost, but this process ended up taking longer and being more expensive due to evolving design features that occurred throughout project implementation.

Field Experiences

Vehicle maintenance: There are a variety of changes in preventative maintenance procedures required when switching to CNG vehicles, including oil and other filter changes, specialized spark plug replacement, and changes in equipment diagnostics systems. One specific item cited by Grand Junction fleet supervisor Tim Barker is the need for specialized spark plugs for the refuse trucks. The plugs need changing every 1,500 to 2,000 hours of vehicle use. Each engine requires six spark plugs, costing \$75 each. Another issue is related to the presence of “heavy ends” or “heavy oils” that can separate out from the CNG in the compressors.

There is a specific coalescing filter for the heavy ends on the vehicles that requires daily draining. If it is not drained regularly, in Grand Junction's experience the oil can get into the CNG fuel system and cause maintenance issues. Maintenance technicians at Grand Valley Transit were only draining this oil once per week, which resulted in performance issues. They have since adopted the once-per-day recommendation, and this has addressed the performance issues. In addition, compressor station maintenance procedures include draining oil from the compressor station itself on a daily basis. It is not typical to have to drain the coalescing filters this often. This issue may be caused by one or a combination of factors including:

- Water in the gas that the dryer is not removing,
- Oil carryover from the compressor, and
- Gas quality issues.

As of May 2012, the CNG, diesel, and gasoline vehicles all share the same maintenance shop. Grand Junction is building a new shop and retrofitting the existing one to accommodate new CNG vehicles joining the fleet. New maintenance facilities were not required for Grand Junction's recent addition of CNG vehicles; it is purely coincidence that maintenance facilities are being upgraded at this time to accommodate overall growth in fleet maintenance needs.

Intelligent procurement practices can often save money when a fleet purchases lubricants and specialized parts for CNG vehicles, particularly if the fleet can find non-OEM parts that do not compromise vehicle warranties.

Training requirements: When the project began, the vehicle maintenance technicians and drivers had no previous experience with natural gas fuel or technologies, so there was a learning curve for maintenance and fueling operations. Initially, the fleet manager and maintenance technicians worked together to learn new maintenance procedures from equipment manuals provided by engine manufacturer Cummins Westport. Beyond that, most of the training of new employees is on demand. When an issue arises, an experienced worker will show an untrained worker how to fix the problem. The workers are cross-trained on many systems, thereby engaging all maintenance staff in problem-solving. The fueling equipment manufacturer trained drivers on fueling practices and safety procedures. Such training is part of standard training and system orientation that any equipment vendor will pursue to ensure the success of a project.

Cummins Westport, a CNG engine and fuel system manufacturer, operates a virtual college for engine maintenance, which was a very helpful training tool for the vehicle technicians. Cummins Westport offers training CDs that the maintenance technicians watch during downtime or in dedicated training sessions. Three employees were also sent to an in-person CNG training hosted by Cummins Westport in Las Vegas.

One reported challenge is the inconsistency in maintenance recommendations among different sources, including engine manufacturers, truck manufacturers, and third-party training courses. For example, Cummins Westport suggests different routines than the truck manufacturers and third-party training courses.

Safety: City staff met with the fire marshal to inspect maintenance and fueling facilities and to educate the fire marshal about the fuel dispensing equipment and safety systems. The city's vehicle maintenance department does not have a dedicated CNG safety plan, but the city fire department is in the process of writing one.

Lessons Learned

The City of Grand Junction's CNG vehicle experience provides valuable lessons for other fleet managers who are considering converting to CNG, those who have already committed to CNG and are in the process of concept development and design, and those who are seeking ways to improve operations and maintenance in existing fleets.

Project implementation: Initially, the City of Grand Junction had difficulty finding information about vehicle performance and compressor station sizing and configuration. Grand Junction staff overcame this barrier by working closely with vendors and seeking technical assistance via CNG station sizing/configuration tools available through the National Renewable Energy Laboratory (NREL).

Grand Junction now requires inclusion of hybrid or CNG vehicles as part of its procurement process, which facilitates consideration of CNG options.

Natural gas interconnection costs were higher than anticipated because of a need for increased trenching to a natural gas line that the natural gas provider believed would meet the fueling station's long-term needs. Clear communication between natural gas providers and potential CNG fleets on the needs of both parties could facilitate a shorter, less costly interconnection process. By consulting

with the local utility, a fleet should be able to identify a site location that integrates with the utility's distribution system in the most cost-effective way possible.

A clear understanding of the project's fueling infrastructure requirements (including CNG demand, end users, local market, and team structure) will help in developing system specifications. This can reduce costly engineering design changes and project delays. Grand Junction learned that working with a firm without a local presence can stretch out design timeframes and potentially increase costs. For this project, the engineering costs were approximately 7 percent of the total, which is not unreasonable. However, because of multiple design changes associated with an evolving project purpose, the process was perceived to be more costly than it could have been.

Grand Junction was successful in obtaining grant funding for the project, but in the future, such funding may be less readily available. The city completed the project with the anticipation of growing its CNG fleet size to improve its return on investment. Without grants to defray the fueling infrastructure costs, it is unlikely that the city would have pursued the project using the same approach. One observation was that future projects will need to be more careful to ensure that they can justify their project when refueling infrastructure costs are not funded by grants.

Vehicle maintenance: As with all purchasing processes, fleet managers should shop around when seeking replacement lubricants, filters, and other specialized parts for CNG vehicles. By comparing specifications of OEM parts with those available on-line or other means, crews can reduce vehicle maintenance costs by using non-OEM components to the extent that doing so does not violate the terms of engine warranties.

Engine manufacturer Cummins Westport has numerous training resources and opportunities for vehicle maintenance staff that are a valuable fleet resource.

Fueling station: The Grand Junction fleet staff recommended installing fuel metering equipment for each pump, if it can be done cost-effectively. This would allow for predictive maintenance based on individual vehicles' mileage.

The public/private partnership between Monument Oil and Grand Junction serves as a model to limit financial risks for a private partner seeking to provide public access to a CNG fueling station. This partnership provides a bridge to a future time when the number of CNG vehicles on the road

justifies investment in a purely private sector station. This interim measure ensures that the private sector is leading the effort to market CNG to consumers.

At the publicly accessible fast fill station, a dispenser with an integrated card reader would likely be more user friendly than a dispenser with a detached card reader.

For most fleets, there is a lack of information on how to manage energy use and cost of compressors. There is a significant learning curve required to develop an understanding of how to spread electricity demand from compressors over time to avoid demand charges.

Case Study: Republic Services

Republic Services (Republic) is the second-largest waste management services company in the country and operates in 2,800 communities. Republic has the benefit of having 17 fleets in the process of conversion to CNG operation.

Republic offers the perspective of a private sector company with national reach, where cost-competitiveness and customer satisfaction are paramount, and fleet capital investment decisions are carefully weighed against alternatives by a board of directors.

CNG vehicles currently represent a small portion of Republic's total Denver metro area vehicle fleet. Because of the relatively early stage of implementation of CNG in the Denver area, this case study looks at Republic's experiences through several lenses:

1. Nationwide financial and technical experiences
2. Recent prior experiences with natural gas deployment in the company's Boise, Idaho fleet, which has many operational similarities to the Denver fleet
3. Local implementation in the Denver area.

The company's goal for its Denver fleet is to run 50 percent of its vehicles on CNG in the next 1.5 to two years.

Fleet Facts

| Fleet | Republic Services |
|----------------------|------------------------------|
| Sector | Private |
| Funding sources | Private (Denver metro fleet) |
| Total fleet vehicles | 144 revenue-producing |
| Total CNG vehicles | 20; 14 more coming in 2012 |
| Start of CNG use | February 2011 |
| Vehicle types | Heavy-duty refuse trucks |
| Vehicle manufacturer | Autocar ACX |
| OEM or retrofit | OEM 100% CNG |
| Engine manufacturer | Cummins (ISL-G engines) |

Decision to Use CNG

Republic believes that the switch to alternative fuels, including CNG, is the right thing to do for investors, customers, and the environment. The biggest drivers for CNG were fuel cost reduction, emissions reduction, and fuel cost stability over time. CNG offers lower fuel costs

and better price stability than diesel fuel does. As EPA diesel vehicle NO_x emissions standards began requiring selective catalytic reduction (SCR) technology in 2010, Republic began evaluating less costly emissions compliance options. CNG already complied with NO_x requirements and offered a ready solution. Coincidentally, Cummins Westport began selling CNG engines that offered reliability and performance characteristics that older natural gas engines did not.

Republic's CNG decision-making criteria

- Fleet size: 50 trucks or larger
- Property ownership: Own the property, not lease
- Natural gas infrastructure: Access to natural gas distribution lines within a trenching distance that meets the financial needs of the project
- Zoning/permitting: Processes are not burdensome
- Truck replacement plan: Sufficient number of trucks must need near-term replacement.
- Availability of grants/incentives: Influences investment but is secondary to other factors.

Management Considerations

Republic operates 350 hauling divisions nationally. The company makes large investments at the corporate level and has several levels of approval. Each investment decision is ultimately site-specific and is made within the context of the entire fleet operation. Site-specific cost constraints are applied to items such as gas pipe trenching and zoning/permitting. Once these initial hurdles are overcome, Republic evaluates technical considerations, such as refueling site layout, station design, and parking lot layout, as well as maintenance shop improvements necessary for compliance with local fire and safety codes. A go/no go decision is made taking into account all of these factors.

If a project is approved, Republic negotiates contract terms with Clean Energy Fuels for fueling station development. The development timeline can range from three months to two years until commercial CNG operations commence.

Republic's Denver Area Project Accomplishments and Metrics

| Metric | Description |
|-------------------------------------|---|
| Annual petroleum displacement (DGE) | 260,000 (2012) 1.12 million for entire fleet at full implementation |
| Fueling station cost | \$2 million |
| Incremental CNG truck costs | \$25,000 per truck |
| Annual fuel savings | 2012: \$420,000 Full project: \$1,811,040 |
| Simple payback period | 2 to 3 years |
| Vehicle performance | Better branding Quieter 22% lower GHG emissions |
| Maintenance impacts | Minimal |

CNG vehicle purchase decisions are made via Republic's 10-year fleet replacement planning process. A prerequisite for the Boise fleet was obtaining a contract extension with the city. This was needed to ensure an adequate long-term revenue stream to support Republic's investment in infrastructure. In Colorado's Front Range, waste management companies compete for government, commercial, and industrial clients. As a result, Republic is not dependent on any single client for its revenue stream there. This lessens the risk that loss of a single large customer would negatively impact the returns after the company made the needed investment in CNG infrastructure and facility improvements.

Project Accomplishments and Metrics

Republic's transition to CNG began in Boise in 2009, while the Denver project started in 2011. As such, the Boise fleet is further along. At the end of 2012, Republic expects to have about 34 CNG trucks operating in its Denver metro area location. Republic expects to displace about 260,000 gallons of diesel annually. When the fleet transition is complete, about 1.12 million gallons of diesel will be displaced annually.

Financial impacts: Republic's payback periods for the investment in fleet vehicles and refueling infrastructure usually range from two to three years, and the return on investment capital (ROIC) must exceed 18 percent. The payback period for introduction of CNG vehicles at Republic's Boise location was less than one year, which leaves little room for disagreement in terms of project cost-effectiveness. These payback periods are particularly compelling when considering that in many markets,

contracts with municipalities do not allow capital cost recovery within the first year; instead they require Republic to stagger cost recovery over multi-year periods.

Republic has not yet delivered a large enough number of CNG trucks to its Denver metro fleet to justify a detailed site-specific analysis of commodity costs, taxes, amortization, and electricity costs. Republic usually develops this information after CNG represents 25 percent of the fleet; in Denver that would be 36 CNG vehicles. However, Republic anticipates savings to be similar to those in other locations.

Republic is realizing savings of about \$8 per engine hour in other CNG deployment locations when amortization of all investment is included. Fuel savings alone per engine hour, compared with diesel, are approximately 60 percent, even when considering a 12 percent reduction in fuel efficiency with CNG. Depreciation/amortization of the compressors, connection to the natural gas network, time-fill fueling infrastructure, and shop improvements add additional cost per engine-hour, but the savings per engine-hour usually remains in the 50 percent range compared to diesel fuel costs. Republic noted that no other alternative currently exists to generate savings of that magnitude. These financial returns are well in excess of Republic's internal targets and the cost of capital.

Other benefits: Republic's customers have been very supportive at every step of the way. Driver acceptance due to decreased odors and cleaner operations has been substantial. For Denver and the surrounding metropolitan area, obtaining new CNG trucks has increased visibility of

Republic's brand. There has been consolidation in the industry in the Denver metro area, and replacing older trucks with new, fully branded and clean CNG vehicles is important to making Republic stand out among its competition.

Emissions benefits from Republic's CNG use are substantial with Republic citing a greenhouse gas emissions reduction of 22% over their diesel trucks.⁷

Project Funding

Republic reviews CNG fueling plans as part of its capital allocation process. Through that process, Republic evaluates cash flow and returns to make funding decisions on competitive needs while considering the business needs of the local divisions.

Republic funded the entire Denver metro area project internally; the total capital cost of the fueling infrastructure and shop improvements was approximately \$2 million. No incentives were used. This is typical, but Republic has received grant support for other projects. For example, Republic received U.S. Department of Energy (DOE) support for the Boise fleet conversion to help pay for fueling infrastructure and public access fueling.

Vehicle Selection

Schedule: At a regional level, Republic annually updates its 10-year truck plan and determines which units should be CNG or diesel as vehicles come due for replacement. Republic selects three to five locations in each region for CNG deployment each year, and then tries to accelerate the truck replacement process in those locations to move two or three years' replacements into a single year. In the

Denver metro area, Republic was unable to accelerate truck replacement due to the unique configurations required by Colorado weight laws. Instead, Republic's normal 10-year replacement schedule is being followed.

⁷ Republic's greenhouse gas emissions reduction is based on a study published by the California Energy Commission:

TIAX LLC. *Full Fuel Cycle Assessment, Well to Wheels Energy Inputs, Emissions and Water Impacts*. Rep. no. CEC-600-2007-003. Sacramento, CA: California Energy Commission, June 2007.

This is an area of ongoing study as there is currently a significant variation in GHG emissions estimates for natural gas.

Equipment specification: Republic purchases trucks with AutoCar chassis, but varies body manufacturers based on the application and sector.

In some residential neighborhoods with alleys and commercial locations in congested areas, Republic needs to purchase some rear-loading trucks that are loaded by hand. Republic also purchases front-load and side-load vehicles that allow both manual and automatic loading.

Fueling Station Design and Economics

Each Republic location is unique. The design of the compressor station, parking and fueling options, and facility upgrades needed to comply with building, fire, and safety codes are completed and approved based upon current and anticipated fleet and business needs.



Truck configurations vary. Shown: automatic loading AutoCar chassis with McNeilus body

All utility connections are sized to handle the complete transition of the fleet to CNG, which often requires interconnection to higher-pressure gas pipelines instead of the local gas distribution network.

The Denver metro fleet fueling station was initially designed to serve 88 trucks, with a concrete pad, electrical, and plumbing for a second compressor skid, which would enable the station to eventually serve 144 trucks after a second phase of development. The station has 88 time-fill pumps. CNG use by Republic refuse trucks ranges from 3.5 to 4.5 DGE per engine hour. Each CNG trucks use 30 to 33 DGE of CNG per day, 12 percent more fuel on a heat input basis than conventional diesel. As of June 2012, total monthly CNG use is averaging about 13,700 DGE per

month at the Denver metro location. By the end of 2012, 260,000 DGE per year, or approximately 25 percent of total vehicle fuel use of 1.12 million gallons per year, is projected to be offset by CNG.



Republic's trucks fueling at CNG station.

Clean Energy designs and constructs Republic's fueling stations, including the one at the location in the Denver area. Republic owns the station, and it has an operations and maintenance (O&M) contract with Clean Energy to monitor and maintain the stations. Clean Energy monitors its CNG fueling stations remotely from its Seal Beach, California, location and provides maintenance on an ongoing basis using local technicians.

With the benefit of previous experience in working with CNG, Republic was able to make the decision move ahead with the Denver station in May 2011 and open the facility for time-fill operation by late September 2011

Republic indicated that it has run into significant differences among utilities in terms of timeframes for interconnection at its various sites around the country. Station interconnection timeframes can range from four months to two years, depending on the regulatory climate, complexity of the development, distance to interconnection to the local distribution network, and other project details.

The utility connection with Xcel Energy in the Denver area was simple, because the gas distribution line in front of the property was large enough with high enough pressure and volume to handle up to about 250 trucks. Just over one year elapsed between the time Republic made the decision to convert to CNG to first fueling of trucks including utility connections, equipment purchase, and construction.

The equipment for Republic's CNG stations is fairly standard and consists of two or three compressors, a dryer, meter set, 60 to 100 DGE of storage, and between 40 and 130 time-fill fueling spots where the trucks park. The Denver metro station has two 250 horsepower (hp) compressors, each with a CNG flow rating of 450 standard cubic feet per minute (scfm), for a total of 900 scfm. Each compressor can deliver 3.25 DGE per minute or about 200 gallons per hour. The trucks fuel simultaneously, usually during late evening or after midnight, when electricity costs are lowest. Each compressor can fuel six to seven trucks simultaneously. The system is designed to be redundant, so that if one compressor is not available, another compressor can handle the fueling needs of the entire fleet. Usually, Republic alternates the compressors, using one on even days and the other on odd days, to minimize the electrical draw and the demand on the electrical grid.

There is no public fueling component to the Denver area CNG station. The site is immediately adjacent to Adams County vehicle maintenance facility, but Republic did not pursue a partnership from the outset because the configuration of the site did not provide easy, safe, and cost-effective access to Republic's property. This is different from the Boise location, where a U.S. Department of Energy (DOE) Clean Cities grant was used in part to fund the station. A requirement of that grant was to include a public fueling component, which is run by Clean Energy.

Costs: All in, CNG costs Republic between \$2 and \$2.25 per DGE at its Denver area location. This is slightly higher than at other Republic locations, primarily due to the slower truck replacement schedule and relatively small number of CNG vehicles at the present time. Republic expects this cost to drop by about \$0.40 per DGE as more trucks are delivered and it can spread the cost of the infrastructure over more fuel each day. Even so, current costs compare favorably with retail diesel costs in EIA's Rocky Mountain Region, which averaged \$3.87 per gallon in 2011. Fuel cost savings per DGE range from \$1.62 to \$1.87, based on 2011 diesel prices.

Republic has invested time in understanding how utilities buy and sell electricity so that it can optimize costs. Nationally, Republic has reduced electricity costs by an estimated 30 percent by timing compressor use. At the Denver area location, as elsewhere, compressor electricity use is metered separately from the facility, so it is not difficult to quantify compressor costs or savings that can be gained through better energy management.

Natural gas hedging provides a means for natural gas customers to protect themselves against a financial loss due to volatility in future natural gas costs. Hedging reduces risk by ensuring predictability of costs, but in the process, it can result in additional transaction fees, price premiums, and other costs. There are many types of hedges, but they are typically divided into two categories:

- Physical: Examples include controlling volume of use and establishing fixed price contracts.
- Financial: Examples include investment in natural gas futures, swaps, options, or weather derivatives.

The benefits and costs of hedging need to be carefully weighed. Republic does not use natural gas hedging to control fuel costs on the commodity side, but rather to recover any fuel cost increases using a fee that is applied across customer invoices.

Field Experiences

Republic has had to make some changes for training, vehicle maintenance, and safety procedures and protocols. The change has not been dramatic, and Republic reports that in the Denver area operations, there is as of yet little measureable change in vehicle maintenance costs.

Vehicle maintenance: From a vehicle performance standpoint, there have been no changes. Maintenance procedure changes were minor and have not posed significant challenges.

Trucks are parked between nine and 12 hours per day at the fueling station. The driver pulls up to the CNG parking spot and connects to the CNG dispenser. The CNG fueling station reduces driver overtime for Republic, because it eliminates 10 to 15 minutes per driver per day spent waiting for the truck to fuel with diesel. According to Republic, when the drivers return in the morning, the trucks are fueled and ready to go.

The CNG trucks do have a slightly reduced driving range compared to the diesel trucks they replace. Nationally, a few of Republic's higher mileage routes have to take on some fuel during the day. However, this is a rare exception rather than the rule. Republic's refuse trucks can operate for a 10- or 11-hour shift on a 60-DGE-capacity tank without needing to refuel.

Training requirements: Drivers receive annual training of approximately one hour per year, including a 15 minute video on fueling procedures and safety, produced by Clean Energy/Avatar.

Technicians receive training from Autocar and Cummins Westport with periodic recertification.

Safety: In accordance with Occupational Safety and Health Administration (OSHA) rules, Republic follows a lock-out tag-out (LO/TO) program for vehicle maintenance to ensure that vehicle engines are not started accidentally when maintenance technicians are working on them. This program has been maintained and has not changed much as a result of CNG vehicle implementation. Welding on units requires extra safety lock out procedures. Tanks are emptied (using a separate natural gas caddy) and removed before torches are used. Arc welding poses particular risks for CNG vehicles. Electric arcs from the vehicle to the fuel system can cause damage to the high-pressure system if not properly grounded.

The Denver area maintenance shop required significant facility safety improvements to meet building code requirements, including an air makeup system with a gas-monitoring system, a demising wall to physically separate the area monitored for gas from the remainder of the maintenance shop, conversion to infrared heating (open flame heating is not permitted), and auto-opening doors, among other ventilation system improvements. The air makeup system ensures that exhaust air from the CNG maintenance area is kept separate from intake air to prevent accumulation of methane gas. The use of a demising wall to physically separate the area where CNG fueling systems are maintained eliminates the need for methane monitoring in the entire maintenance building. In total, these improvements cost about \$250,000. The system has operated well, and there has not been an alarm yet for air quality in the shop area. By comparison, the Boise maintenance shop upgrades cost approximately \$30,000, because the facility was smaller and newer.

Because fire codes vary regionally in their interpretation, Republic consults with a professional engineer (P.E.) to coordinate with fire chiefs and county officials on which facility improvements are required, how to operate CNG equipment, manage any emergency circumstances, and provide general education on safety for tanks (e.g., tanks vent when they exceed certain temperatures) in the event of truck fires. Republic notes that communication with first responders is a critical part of its community partnership practices.

Lessons Learned

It is notable that the financial performance of CNG is such that Republic at a corporate level has consistently opted for

CNG vehicle fleet implementation time and time again. Republic notes that total investment across the company for CNG infrastructure and vehicles has exceeded \$250 million since 2009.

The transition to CNG vehicles was not as significant a maintenance and training transition as many expected, although this depends on the specific fleet circumstances.

CNG vehicle performance for Republic's fleets has been comparable to that of diesel trucks. With few exceptions, the time-fill fueling stations are able to support vehicles working a full shift without the need to fuel during the day. Reduced vehicle noise, emissions, and odor have been positives for drivers and customers, and new trucks have been helpful for improving Republic's brand recognition.

Republic has had significant success in reducing compressor electricity use and costs by programming and timing compressor use.

Station interconnection with the natural gas distribution system is critical to implementing CNG, and fueling station providers should have an understanding of the utility interconnection process before beginning work. Connecting stations with the natural gas distribution system, along with phasing truck replacement, have been the biggest challenges for Republic in implementing CNG. Based on its experiences around the country, Republic recommends doubling the timeframe expected for interconnection in planning for a CNG station, as a general rule of thumb.

Local fire team education is important, as code interpretation varies significantly by locality, and truck fires in the waste industry happen more frequently than one might expect. A number of states have adopted the International Fire Code (IFC), which references the National Fire Protection Association Code 52 Vehicular Gaseous Fuel Systems Code as the standard, although any individual Authority Having Jurisdiction (AHJ) may apply this code differently. Colorado is a home-rule state, in which municipalities can adopt their own codes. Therefore, local CNG fleets need to refer to the codes included or referenced in their local government charters.

Given the significant investment surrounding CNG, Republic's board has ongoing discussions regarding its CNG fleet build-out plans. It is important to include all parts of the organization in the information-gathering and decision-making processes.

CNG fuel use for waste-collection operations in the western U.S. are currently in excess of 25 percent of all gallons consumed. Republic operates in 13 western states (including Texas and Oklahoma). Expectations are to move CNG to a 60 percent share for collection trucks over the next four to five years through the addition of more CNG stations and trucks. As Cummins and other engine manufacturers bring additional options for 12- and 15-liter engines to market, the fleet transition process will accelerate across Republic's operations. Limitations to the conversion process include the ability to manage the conversion process, small displacement size of the ISL-G Westport 9-liter engine, and access to the natural gas distribution network.

Case Study: Denver International Airport

CNG use at Denver International Airport (DIA) began as a way to safely and cost-effectively operate vehicles in DIA’s two miles of underground tunnels. Today, buses, tugs, loaders, baggage carts, light-duty pickups, street sweepers, and a variety of other vehicles all operate on CNG. In all, 221 dedicated CNG vehicles are in use at DIA. In addition, CNG use at DIA has expanded to include many other vehicles operated on the airport’s 53-square-mile territory⁸, such as private rental car and parking shuttles fleets (USAirport Parking, Canopy Airport Parking, WallyPark, and Parking Spot) that operate adjacent to the airport.

Fleet Facts

| | |
|----------------------|---|
| Fleet owner | City and County of Denver |
| Funding sources | Airlines and concessionaires |
| Total fleet vehicles | 1,080 drivable vehicles |
| Total CNG vehicles | 221 |
| Year CNG use began | 1991 Stapleton/ 1995 DIA |
| CNG vehicle types | Light-duty Buses Street sweeper |
| Vehicle manufacturer | Multiple |
| Engine manufacturer | Cummins Westport, GM, Ford, and John Deere |
| OEM or retrofit | Both; new are mostly OEM |

DIA opened in 1995, however, the Stapleton Airport (DIA’s predecessor) began using CNG in 1988. The use of CNG at the airport continued with the opening of DIA and is part of an overall commitment to alternative fuels; 35 percent of all light-duty vehicles at the airport are AFVs, with most of these running on CNG. DIA’s “Green Fleet” also operates electric and hybrid electric vehicles. Currently, all of the CNG vehicles at DIA operate exclusively on CNG as dedicated vehicles. At one time, as many as 68 vehicles were bi-fuel vehicles. These vehicles could not operate on conventional fuels in the tunnel due to the emissions restrictions in the tunnel system. As a result, staff would choose CNG vehicles rather than risk using a vehicle that was not permitted to operate in the tunnel

⁸ Denver International Airport, Do You Know DIA?, on-line: <http://flydenver.com/doyouknowdia>

system. This limited the use of bi-fuel vehicles, so conventional fuel tanks on these vehicles were drained and capped.

The goal for CNG expansion is to increase the number of CNG vehicles by 25 to 50 units in the next several years, provided that DIA can increase the capacity of its fueling infrastructure.



DIA’s CNG Buses

Decision to Use CNG

Victor Lovato, the Assistant Director of Fleet Maintenance at DIA, has overseen most aspects of fleet management first hand. According to Mr. Lovato, the primary driver for CNG use at DIA in the beginning was technical; CNG vehicles can meet emissions requirements for operation in two miles of underground tunnels that link DIA’s three concourses and train maintenance facilities. CNG vehicles were available, clean-burning, and provided fuel cost savings over conventional vehicles. Another key motivation for choosing natural gas was to mitigate the risk of fuel spills in the tunnels. Because natural gas is lighter than air, it would dissipate into the ventilation system instead of pooling in the tunnel. Energy security was also an important factor. For private fleets that serve DIA customers and travelers, CNG has a variety of economic and environmental benefits. Many of the private fleets that operate in the DIA vicinity take advantage of the fueling infrastructure and maintenance support available at the airport. As illustrated in the Grand Junction case study, existing infrastructure can tip the scale in favor of CNG vehicle purchases.

Management Considerations

The decision tree for approving capital expenses for projects at DIA is complex because of the way that DIA

generates revenue. DIA obtains its revenue through landing fees, concession revenues, parking fees, aviation fuel taxes, facility rentals, car rentals, and other fees. As a result, DIA has an obligation to ensure that costs and the quality of services provided to the airlines are competitive. Airport management, the City and County of Denver, airlines, service fleets, and fuel suppliers all work as a team to meet the complex needs of the airlines. This has implications for budget development, vehicle choice, and vehicle replacement intervals.

DIA fleet management provides airport management recommendations on Green Fleet procurements each year. Airlines and the Denver Mayor’s office provide input on budgets. Given DIA’s revenue model, the business case to buy alternative fuel vehicles (AFVs) must also be demonstrable to airline customers. The Mayor’s office also has made a commitment to sustainable development goals, outlined in Greenprint Denver and other city policies. In recent years there have been limited funds available for AFV purchases. However, DIA anticipates spending \$3.5 million over the next four years to replace older CNG vehicles.

Project Accomplishments and Metrics

CNG vehicle technology meets DIA’s specific application needs in a clean and cost-efficient manner. Furthermore,

CNG vehicles and conversion systems are available for the wide variety of fleet applications that DIA requires. Other options for operating safely in underground tunnels are not viable because of DIA’s wide variety of vehicles and economic factors associated with other solutions. Examples of technologies used in other analogous situations are not viable for technical and economic reasons. Seattle, Washington uses diesel/electric hybrid buses in transit tunnels. Hybrid vehicles are not available to meet DIA’s wide range of applications. Costly and complex ventilation schemes such as those used in Chunnel service tunnels in Europe, are not feasible for DIA for financial reasons.

A key accomplishment of DIA’s CNG efforts is its role as a successful catalyst for CNG vehicle deployment by other fleets that serve DIA travelers. DIA provides public access to CNG fueling infrastructure at its rental car fueling station. These accomplishments bolster DIA’s credentials as an environmental leader to the public and to the airlines.

CNG use aids in recertification of DIA’s Environmental Management System (EMS) to the stringent ISO 14001 standard. This EMS standard is one part of DIA’s commitment to aggressively and proactively manage environmental impacts through reduction of emissions of criteria air pollutants and implementation of other energy conservation and pollution minimization measures.

Denver International Airport Project Accomplishments and Metrics

| Metric | Description |
|---|--|
| Annual petroleum displacement | 114,000 GGE/year |
| Annual fuel cost savings (Assumes \$1.75/GGE CNG and \$2.95/GGE costs) | \$136,458 |
| Fueling system capital cost (2006 upgrade) | \$1 million |
| Incremental capital cost of CNG vehicles (based on 4x4 pickup) | 30% higher for CNG |
| Maintenance impacts | 25% higher than gas or diesel |
| Simple payback period ¹ | 7 years |
| Vehicle performance | Reduction in payload for pickups |
| Economic development | Private partnerships with USAirport Parking, Canopy Parking, Parking Spot and WallyPark for refueling access |

¹The numbers above represent only those by operations of the airport’s fleet itself and does not include other vendors that operate a CNG fleet at DIA. There are limitations to any direct economic comparison between conventional and CNG vehicles because of the limited alternatives available at the time of the initial investment. Incremental CNG vehicle purchase and maintenance costs are excluded from the payback analysis because of the lack of a viable alternative. This estimated payback period includes projected fuel cost savings vs. refueling system capital costs

Project Funding

As previously mentioned, DIA does not operate using funding from the City and County of Denver. Operations are funded through airline terminal fees, gate fees, landing fees, and other vendor fees. DIA has used its own funds for the vast majority of CNG vehicle purchases and infrastructure costs. In 2007, it received about \$1 million in grant funding from the Sustainable Technology Environments Program (STEP) Foundation, which it put toward AFV purchases.

Vehicle Selection

Schedule: DIA has established vehicle replacement intervals for CNG vehicles in its fleet; these are used as general guidelines. DIA's fleet management extends the life of some vehicles if they have demonstrated light use or maintenance needs. In other cases, DIA accelerates vehicle replacement schedules due to rapid acceleration in vehicle technologies.

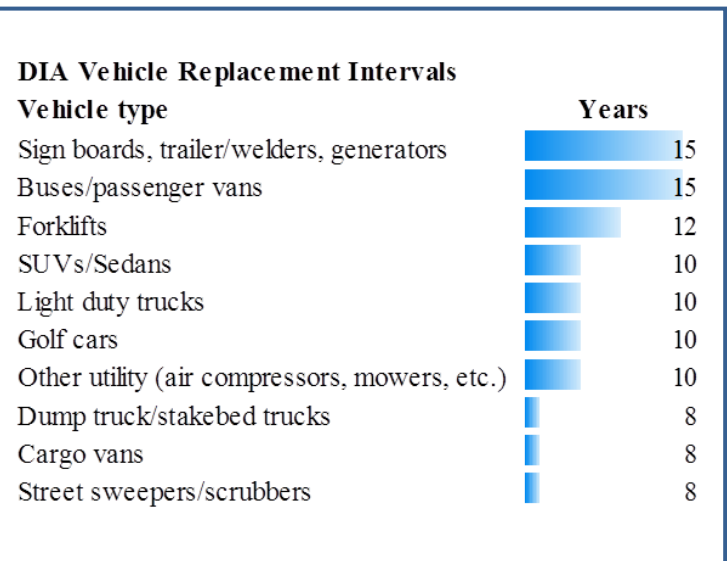
Because of the stringent application needs and increasing performance requirements for many mission-critical pieces of runway maintenance equipment, and because of high daily vehicle mileage (in excess of 300 miles in many cases), DIA's CNG vehicle implementation has been limited mostly to light-duty vehicles and vehicles that operate in the airport tunnel system. One exception is the purchase of two Crosswind CNG street sweeper vehicles.

Annual vehicle mileage varies extensively by vehicle application. Many of the vehicles with highest mileages are security, electrician, or other operational vehicles that log 150 miles or more per day. DIA does not opt for CNG vehicles in these applications due to their specialized mission-critical needs. Many of the vehicles in the CNG fleet are not high mileage vehicles; of the light-duty CNG pickups, average daily vehicle miles traveled is 21 miles per day. This has implications for the payback period for CNG fleet investments, discussed below.

Equipment specification: Many of DIA's existing CNG vehicles are 10 to 12 years old and were converted from gasoline operation to use CNG. DIA outsources vehicle conversions to local companies such as FuelTek, Go Freedom Fuel, and Kois Brothers. DIA is seeking to replace older CNG vehicles with packaged OEM vehicles. In DIA's experience, OEM vehicles are easier and less costly to purchase for a variety of reasons. Operationally, the onboard software and information technology (IT) systems are integrated as packages from major

manufacturers. DIA operates many different makes and models of CNG vehicles. DIA has trained staff and tools and equipment for diagnostics and maintenance of GM vehicles.

Procurement process: DIA fleet managers must purchase vehicles within their annual procurement windows to avoid losing allocated funding in subsequent budget years. If the research and procurement process is complicated, they risk missing the window. Like many municipal governments, DIA uses the Colorado state vehicle contract to procure vehicles, reducing the lead time to purchase vehicles. The vehicle purchase specifications are well defined and purchase orders can be cut right away.⁹ Orders take about three to four months to fulfill. Some vehicle conversions may increase the timeline by an additional month.



⁹ Colorado fleet vehicle purchase contract information is online: <http://oa.mo.gov/gsfm/vehiclecontracts.htm>

Fueling Station Design and Economics

Clean Energy designed and built the CNG fueling infrastructure at DIA and operates six fast-fill stations. Clean Energy owns the station equipment and charges DIA a service fee for maintaining the compressors and delivering CNG to DIA.

The stations that serve the DIA fleet are located on the air side (i.e., on runway service roads or other areas that are not accessible to the public). The public South Terminal station is currently disabled for ongoing hotel construction.

Location, Type, and Number of Fueling Islands

| Station name | Public/ private | #of refueling islands |
|---------------------------|-----------------|-----------------------|
| Fleet Maintenance | Private | 2 |
| Cargo | Private | 2 |
| Concourse A | Private | 1 |
| Concourse B | Private | 2 |
| Concourse C | Private | 1 |
| Rental Car Road | Public | 4 |
| South Terminal (disabled) | Public | 1 |

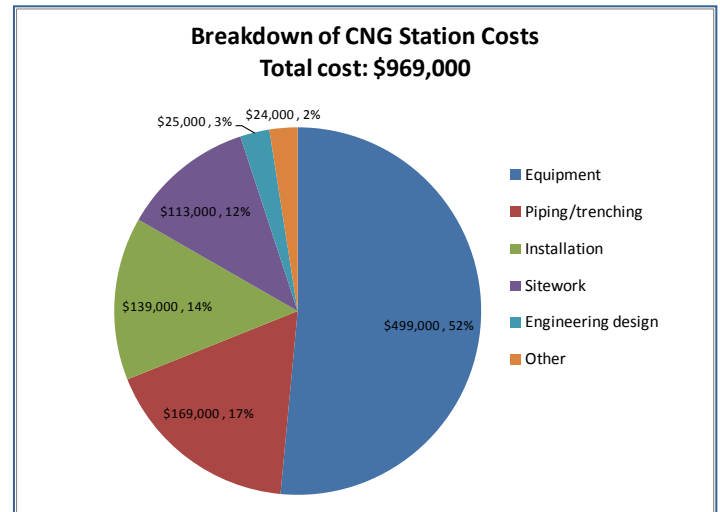
Clean Energy is in the sixth year of a seven-year contract with DIA (with three option years) to maintain the CNG fueling stations and sell fuel to DIA and other airport CNG users. CNG costs, including Clean Energy’s combined service fee and natural gas costs, to DIA are approximately \$1.26 per GGE. The cost of natural gas fluctuates on a monthly basis. DIA also pays for the electricity; at the time of this study, DIA data on compressor electricity usage was not available. Estimated values for compressor station electricity use for a fast-fill fueling station, based on 150 gallons per day of use and a 100 hp compressor, are \$0.49 per GGE; adding this to natural gas and Clean Energy service fee charges results in total delivered CNG cost of \$1.75 per GGE for DIA.

Most of the fast-fill stations operate at 3,600 psi. The fleet maintenance station operates at 3,000 psi. Upgrading this station to 3,600 psi and adding another fueling island (piping to site is already complete) is anticipated to occur in the near- to mid-term.

The capital investment in CNG fueling infrastructure by DIA at the beginning of Clean Energy’s contract in 2006 was nearly \$1 million. This investment resulted in a major

reconfiguration of the refueling infrastructure at DIA. It does not represent the total capital costs for the refueling infrastructure. The original development of DIA’s fueling infrastructure occurred prior to 1995. Information on the original installation costs was not available.

Equipment was the largest line-item cost, as shown in the CNG station cost breakdown below.



Within equipment costs, compressors were the largest component; other major equipment included dryers, dispensers, card readers, and other fuel dispensing equipment. Piping and trenching represented another significant portion of the infrastructure costs. Approximately 1.5 miles of natural gas line was required, with a total trenching distance of about one mile.

Engineering and design costs were relatively minimal, and were incurred only for the installation of the large rental car fueling station. No building modifications were required, as the fueling stations are located outdoors. Site work consisted of limited excavation, compressor pad installation, and system fencing and wall construction.

DIA Refueling System Configuration

| Name | Fleet Maintenance | Rental Car Road | South Cargo | Concourse A | Concourse B | Concourse C |
|---------------------------|-----------------------|--------------------------|-----------------------|-------------------------------|---------------------|---------------------|
| Dispenser type | Retail 2-hose | Greenfield Retail 2-hose | Natural Fuels Fleet | Natural Fuels Fleet | Natural Fuels Fleet | Natural Fuels Fleet |
| Refueling hoses | 2 | 8 | 2 | 2 | 4 | 2 |
| Number of compressors | 2 | 3 | 1 | Shared System 2 Ariel + 1 IMW | | |
| Type of compressor | Ingersoll Rand 0525NG | Ariel | Ingersoll Rand 0520NG | IMW | IMW | IMW |
| Compressor capacity (hp) | 20HP | 500HP | 20HP | 350HP | | |
| Type of storage spheres | Cherco | ASME | CPI | Cherco | Cherco | Cherco |
| Number of storage vessels | 3 | 4 | 3 | 3 | 2 | 1 |

Fueling experience: Fuel use (2011) by DIA vehicles totaled 742,000 GGE, about 15 percent of which was CNG. Buses are the largest fuel users. Use of CNG jumped from 7,000 gallons per month to 9,500 gallons per month in the summer of 2011 due to the conversion of 70 vehicles to CNG operation. DIA purchases natural gas directly from Xcel Energy using a separate agreement from other utility purchases. Natural gas prices fluctuate monthly.

Annual DIA Fleet Vehicle Fuel Use

| Fuel type | Quantity (GGE) |
|-----------|----------------|
| Diesel | 388,000 |
| Gasoline | 240,000 |
| CNG | 114,000 |
| Total | 742,000 |

At the DIA Maintenance site and other private fueling sites, the user enters his or her vehicle and badge number into a keypad located on a pedestal in an enclosed area. The system sends this information to the work order maintenance system. The user interface works well for drivers, and integration with DIA's fleet management IT infrastructure facilitates the collection and analysis of cost and maintenance data.

At public fueling pumps, the look and feel for the dispenser system is similar to that of a retail gasoline fuel pump.

According to Victor Lovato, DIA experiences fleet fueling performance issues in winter when drivers are not able to achieve a complete fill due to the inability to maintain sufficient gas pressure in storage spheres. Vehicle fuel

gauges sometimes are not accurate, and they will dip after vehicles leave the fueling station. In freezing temperatures, tanks may only be half full when trucks leave the pump. Nozzles may freeze and break in the winter. This is a contributing factor to the limited use of CNG in mission critical equipment. Equipment productivity can be limited if snow removal vehicles have to leave the runways for refueling. The fueling station at the maintenance site can serve four or five trucks back to back, but at the end of a shift, one or two trucks might not be filled completely.



DIA Fast-Fill Dispenser

In support of approving fuel contract option years, DIA would like to see several fueling upgrades from Clean Energy, including upgrading the gas pressure at the maintenance facility to 3,600 psi and installation of more storage spheres and refueling pumps.

For all fuel types (not just CNG) DIA has some concerns about the availability of backup power to operate fueling equipment in the event of a power outage.

Field Experiences

Vehicle performance: Because of the long history of CNG use at DIA, it is important to distinguish between issues associated with older vehicles and those of newer ones. Older vehicles (for example, 2002 and older), many of which were conversions, can be more difficult to start in cold weather and have less power, but these are less common issues for newer models.

For CNG pickups, both old and new, available cargo space is a concern. For light-duty pickup trucks, payload is constrained by the 9-gallon tanks that can occupy up to half of the pickup bed. DIA is considering purchasing pickups with utility bodies so they can fit ladders and other larger equipment in the back of CNG trucks.

Vehicle maintenance: DIA technicians perform nearly all maintenance in house except for transmission replacement, which is easier and faster for specialized transmission shops. DIA's CNG New Flyer buses are an exception. DIA has a contract with AMPCO to operate most of these buses. Penske maintains the buses under contract to AMPCO. DIA provides the fueling infrastructure for the buses.

DIA vehicle fleets run 24 hours per day, seven days per week. Maintenance crews are run in two shifts: a Sunday-to-Wednesday crew and a Wednesday-to-Saturday crew. Ten to 12 technicians may work on each shift. Wednesday is an overlap day, where there may be as many as 30 technicians on site. During emergencies, all crews are available. The majority of all technicians are able to work on CNG vehicles, although there are two CNG specialists who conduct detailed diagnostics (especially for non-OEM systems), emissions testing, and troubleshooting. The DIA facility has its own dynamometer to conduct emissions testing for DIA and other airport service vehicles to approve them for use in DIA's underground tunnel system.

Most maintenance for CNG vehicles has gone from preventative maintenance to predictive in nature. For example, technicians are trained to identify the presence of carbon fouling on air intakes. This could be an indication of fuel quality issues that, if left unaddressed, could result in the need for costly injector replacement.

On average, DIA spends an estimated 25 percent more on maintenance for CNG vehicles, mainly for preventative and

predictive maintenance. CNG vehicles receive an annual inspection and emissions testing in support of permitting for tunnel use. For older vehicles, tank replacement and disposal adds to maintenance costs. Metal recyclers will not take tanks unless they are emptied and cut in half. DIA purchased a band saw to cut tanks.

Performance of several vehicle types is notable. DIA's CNG Dixie Choppers are reliable and work well on CNG. These drivable lawnmowers are tasked with keeping grass to less than 6 inches in height to prevent wildlife conflicts on runways. Grounds crews use these highly maneuverable mowers to cut around light "delineators" next to runways. On the other hand, DIA has had difficulties with its two sweeper/scrubber units, which have non-OEM CNG engines used to drive the sweeper units.

Training requirements: DIA operates many different types of CNG vehicles, including OEM and non-OEM equipment. As a result, DIA runs at least six different diagnostics and maintenance systems. DIA trains staff on each of these systems both when the systems are first implemented and on an ongoing basis. Existing staff train new technicians as needed. Total training time is approximately 30 to 40 hours per year per maintenance crew of approximately 10 technicians. High-pressure systems are labeled if they require technicians to have specialized to work on them (e.g., fuel system filter checks and replacement).

Clean Cities has been a key partner for information, training, and equipment demonstrations for DIA, as have the Colorado Natural Gas Vehicle Coalition (CNGVC) and Encana.

Safety: DIA uses vendor-provided and in-house procedures for technicians and drivers that address fueling and maintenance of high-pressure gas systems. DIA has its own fire department training systems and procedures but has had a limited need for new systems or protocols for use with CNG.

Lessons Learned

DIA has a long track record with CNG vehicles, and its fleet is very diverse in terms of vehicle applications. DIA's decision to build out its CNG fleet was based on a technical need for lower-emission vehicles in airport tunnels. Recommendations for fleet managers considering CNG center on the need to build broad-based support for CNG and ensuring that CNG is a match for the organization.

DIA has been very successful in establishing fueling station partnerships with other public entities and private-sector businesses. DIA fueling infrastructure supports several mid-size transit fleets that serve the airport. An assessment performed in 2006 indicated that 52 different entities were using the CNG fueling infrastructure at DIA. These companies included airlines, major shuttle companies, 20 concessionaires and 16 contractors.

Number of Companies Using DIA's CNG Fueling Stations in 2006

| Company type | Number | Description |
|--------------|--------|---|
| Airline | 13 | Multiple airline customers |
| Concession | 20 | Food and beverage, publications, other |
| Contractor | 16 | Janitorial, baggage handling, logistics |
| Federal | 2 | US Customs, US Postal Service |
| Security | 1 | Medical services |

DIA has demonstrated that CNG fueling infrastructure at a transportation hub can drive CNG vehicle purchases and use. It is reasonable to expect that other clusters of fleets can have similar results if they implement CNG, albeit at smaller scales. Co-locating public CNG stations with private fueling stations can occur in a variety of different applications— not just airports. Any location with a convergence of fleets could represent a good opportunity for CNG deployment (county government, airports, waste management, cement delivery, etc.).

The next step for AFV implementation at DIA, budget permitting, is to introduce between 25 and 50 new CNG or bi-fuel vehicles. These next steps are exciting because of the increasing availability of mid-size and larger CNG pickup trucks. A gap that DIA's fleet managers still see moving forward is the availability of light-duty supervisor vehicles and pickups. DIA also hopes to encourage more growth in CNG fuel use through the creative application of incentives for other end users.

Conclusions and Recommendations

CNG Opportunities

Financial: Fuel cost savings from CNG deployment can be significant. Republic has achieved 50 percent fuel cost reductions through CNG deployment across multiple fleets. While this magnitude of savings may not be attainable for all fleets, this is a significant selling point.

Labor cost savings for CNG refueling are not often quantified but can be significant. Both Republic and the City of Grand Junction cited a reduction in employee time spent fueling vehicles at the end of a shift due to use of time-fill stations. Some of this labor cost savings comes in the form of reduced overtime.

Energy management: Some fleets might be able to reduce costs through compressor energy management. Some fleet managers did not have all the necessary knowledge to manage compressor electricity use. Republic cited success nationally in reducing electricity use and cost in this area.

Environmental and other benefits: Ancillary benefits of CNG (e.g., noise and odor reduction, “buy local,” and U.S. energy security) help organizations improve their customer relationships, increase employee satisfaction, and build brand loyalty.

Partnerships: Partnerships with public-sector and private-sector entities using a “hub” model can promote CNG use at major commerce and transportation centers. DIA is a good example, with potential for expansion to other users. Grand Junction’s public/private partnership to provide public CNG fueling demonstrates that these partnerships can operate effectively at smaller scales as well. Partnerships can help create sufficient CNG infrastructure to support private investment in CNG vehicles.

Commercial fleets may be open to co-location of public and private fueling stations depending on the ability to configure appropriate site access and ensure safety.

Fleet managers have also benefited from training, funding, and technical support from a variety of organizations, including but not limited to the Colorado Natural Gas Vehicle Coalition, CEO, Clean Cities, Cummins Westport, and natural gas producers such as Encana, Noble, Chesapeake and Anadarko.

Recommendations for Fleet Managers

All levels of the organization must be dedicated to CNG implementation for the long-term.

CNG has to fit the organization’s business needs and financial goals.

CNG has to fit the applications and vehicle use patterns.

- Develop vehicle specifications for each application.
- High-mileage applications (greater than 300 miles per day) may require refueling during shifts and could reduce productivity if vehicles need to leave the job site.
- Frequent idling poses maintenance problems for CNG vehicles.

Fleet managers must decide whether to phase in CNG or transition all at once.

Conduct as much training as possible for drivers and maintenance staff.

Emphasize predictive maintenance in addition to preventative maintenance.

Municipalities: CNG can help municipalities shore up transportation fuel budgets if fleet sizes are large enough to justify investment in fueling infrastructure.

There is also potential for municipalities to team with private-sector partners for fueling station access. Municipalities can fuel CNG vehicles at private-sector stations, improving the economics for private-sector partners, reducing the need for public capital investment in CNG infrastructure, and reducing municipal fuel costs (relative to those of gasoline and diesel fuel).

Policy: Organizational policies, ranging from a very general statement of support for increasing sustainability to more specific goals for energy efficiency and alternative

fuels, can help tip the balance toward investment in clean energy technologies.

State vehicle purchasing agreements can simplify and accelerate CNG vehicle procurement by providing clear, well-defined vehicle specifications. State purchasing agreements may also offer better pricing. The multi-state Memorandum of Understanding (MOU) signed by Colorado Governor John Hickenlooper and other state governors committing to encourage CNG vehicle procurement may help create markets that increase CNG vehicle availability.

Barriers to CNG Vehicle Deployment

Utility interconnection: Fleets see the difficulty and length of time required to complete natural gas interconnection for refueling as an obstacle to CNG refueling station development.

Fleet managers also have difficulty assessing the impacts of compressor electricity use and demand charges associated with fueling stations, especially when stations do not have dedicated meters.

Fueling: Improvement of performance for fast-fill pumps may be needed for vehicles with higher daily mileage.

Issues include incomplete refueling in winter, accuracy of fuel gauges, ability to acclimate drivers to “think in psi” and concerns about ability to fuel a larger number of vehicles with existing storage capacity. To some extent, these issues may be solved by installation of new fueling technology.

Building modifications: Uncertainty in requirements for building modifications required for CNG use in maintenance facilities could be reduced. This is a difficulty in Colorado because it is a home-rule state, where fire codes can vary by municipality. Early and frequent coordination with the fire marshal should help expedite this process.

Vehicle performance: The perception of performance from past conversion systems still creates skepticism when an organization is considering a transition to CNG. DIA is experiencing some of these performance issues now, because it still has older CNG vehicles in its fleet. However, vehicle performance experiences for both Republic and Grand Junction have been very positive for drivers and customers. Reported vehicle fuel efficiency estimates vary; Republic’s estimate of a 12 percent

reduction in fuel efficiency on a fuel-heat-content basis, compared to diesel vehicles, is based on its significant experience working with newer heavy-duty truck models. There still remains hesitance on Republic’s part to implement CNG trucks at higher elevations due to concerns about operation under full loads at altitude.

Vehicle maintenance: Inconsistencies in recommended maintenance intervals for CNG engines among manufacturers and across vendors and third-party training providers can be frustrating for fleet maintenance managers. CNG vehicle maintenance costs are reported to be equal to or higher than comparable gasoline or diesel vehicles for the fleets in these three case studies.

Estimated impacts on maintenance costs range from none (i.e., CNG use has no significant impact on overall maintenance costs) for Republic to a 25 percent increase for DIA.

Clarity on tank certification and assistance for tank disposal for older vehicles can be improved.

Vehicle availability: Availability of a wider variety of OEM sedans, SUVs, and light-duty pickups that use CNG could increase CNG vehicle purchases.

Expansion of options for CNG vehicles that preserve payload capacity for crew pickups would likely be helpful to fleets seeking to transition to CNG.

The timeframe to fulfill an order for a CNG vehicle can vary significantly depending on the level of customization and desired features for a vehicle.

Training: Perceptions of disruptions in operations and/or significant training requirements for CNG vehicle operators and maintenance staff still are a concern for fleet managers. This is the case despite improved availability of training resources from engine manufacturers and fueling station equipment providers.

Recommendations for Future Outreach and Technical Assistance

Compressor energy management training resources for fleet managers and staff would address a common knowledge gap. Training resources could cover topics such as an overview on electricity markets and how they operate, understanding of demand charges, and how to operate compressors to minimize additional charges.

The electricity usage of compressors can be significant for many stations and often incurs demand charges by electric utilities. These demand charges are typically similar for commercial and industrial customers and are reflective of the cost of service to that customer. With low vehicle usage, the financial impacts of the demand charges can cause the economics of a station to quickly deteriorate. Efficient station design can ameliorate this effect, especially if done in consultation with utility providers. Once stations reach high levels of usage, demand charges typically have much less of an impact on station profitability.

Design assistance and analysis of the costs and feasibility of co-locating public and private fueling stations could result in new partnerships that improve the business case for fueling infrastructure investments.

CEO could play a role in development and dissemination of information on natural gas distribution systems, CNG station interconnection, and other considerations involved in station siting from the natural-gas-provider and end-user perspectives.

CEO can support fleet manager efforts to evaluate the feasibility and cost of transitions to CNG. Efforts can include providing fleet prescreening spreadsheet tools and working with partners such as NREL to develop and disseminate up-to-date economic analysis tools. Other local partners (e.g., CNGVC, Colorado Municipal League, and Clean Cities) can continue to increase efforts with CEO support.

Analysis of successful grant-writing efforts by the City of Grand Junction and re-examination of how grant funding availability may have changed can help in developing realistic recommendations for smaller fleets regarding CNG cost-effectiveness.

Continuing and expanding community forums for fleet managers and other CNG users to share information will result in shared benefits.

There is additional room to disseminate information on safety procedures and issues surrounding CNG. This can be used to reduce burdens of developing internal environmental, health, and safety procedures. This information also can be adapted for use by local first responders.

Wider availability of publically accessible fueling infrastructure will encourage CNG use by fleets. The fueling infrastructure can be co-located with an existing vehicle fleet to reduce the capital investment required to provide this service. This is particularly true outside of major metropolitan areas and for on-road trucking and logistics fleets that need reliable refueling access. The infrastructure does not need to be associated with an existing fleet, but until there is a sufficient concentration of CNG vehicles, the economics for stand-alone fueling station development will remain challenging.

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Additional Resources

- Business Case for Compressed Natural Gas in Municipal Fleets. NREL: http://www.afdc.energy.gov/afdc/progs/view_citation.php?10676/CNG
- Refuse Hauler Fleet Experiences. NREL: http://www.afdc.energy.gov/afdc/fleets/refuse_haulers_experiences.html
- Greening Garbage Trucks: Trends in Alternative Fuel use, 2002-2005. INFORM: <http://www.informinc.org/ggt.php>
- Guide to Available Natural Gas Vehicles and Engines, NGVAMERICA <http://www.ngvamerica.org/pdfs/marketplace/MP.Analyses.NGVs-a.pdf>
- U.S. DOE AFDC: <http://www.afdc.energy.gov/afdc/>

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Appendices

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Appendix A. Multi-State CNG MOU



Memorandum of Understanding

This Memorandum of Understanding (MOU) describes a coordinated effort between Oklahoma, Colorado, Wyoming, and Pennsylvania (States) to attract automobile manufacturers in the U.S. to develop a functional and affordable original equipment manufacturer (OEM) fleet natural gas vehicle (NGV) that will also meet public demand. The States recognize the benefits and unique attributes of clean burning natural gas and understand the significant opportunity compressed natural gas (CNG) presents to save State and taxpayer dollars by encouraging an energy future that utilizes domestic energy resources to fuel our nation's transportation needs. Through the joint solicitation of a Multi-State Request for Proposal (Joint-RFP) that aggregates annual State fleet vehicle procurements, the States will endeavor to provide a demand base sufficient to support the design, manufacture, and sale of functional and affordable OEM NGVs by automotive manufacturers in the United States.

In anticipation of soliciting a Joint-RFP, the States will endeavor to coordinate with local agencies, municipalities, and companies to determine the number of NGVs each State can commit to purchase and the required specifications necessary to meet fleet needs. The Joint-RFP shall require that the ultimate cost of an OEM NGV should be comparably priced to an equivalent gasoline powered model and that warranty and reliability concerns are not compromised. Simultaneously, the States understand the need for continued development and expansion of CNG fueling infrastructure and should endeavor to encourage private investment, predicated on demonstrating an anticipated increase in State NGVs, to meet growing demand.

Pursuant to the terms of the Joint-RFP, to be executed at a later date, the States intend, where practical, to transition new fleet vehicle acquisitions, in committed volumes, to a resulting OEM NGV. Such future acquisitions should, when economically feasible, rely on traditional distribution channels that incorporate local businesses in procurement processes. In continued recognition of the benefits of CNG, the States should also endeavor to pursue fleet vehicle conversions to CNG, where economically compelling, based on a life-cycle cost analysis. The States will also reach out to fellow Governors to determine broader interest and participation in the principles and process outlined in this MOU.

This MOU embodies the principle understandings of the States but shall not create any legal relationship, rights, duties, or obligations binding or enforceable at law or in equity. Notwithstanding the foregoing, each State shall in good faith endeavor to reach a mutually agreeable and economically beneficial Joint-RFP, as contemplated herein. This MOU does not create additional state power, enhance existing state power, or interfere with federal authority or law. This MOU shall continue to demonstrate the States' understanding until execution of the Joint-RFP, or until otherwise discontinued by either State.

Set forth this 9th day of November, 2011 by:

State of Oklahoma


Mary Fallin, Governor

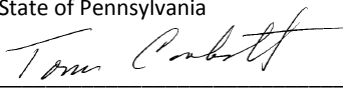
State of Colorado


John Hickenlooper, Governor

State of Wyoming


Matthew H. Mead, Governor

State of Pennsylvania


Tom Corbett, Governor

Appendix B. Partial List of CNG Fleets in Colorado

This list was developed as an initial source of information for screening fleets for participation in the case studies and has since been updated to add more fleets. This is not a comprehensive list of CNG vehicle fleets in Colorado.

| Fleet | Geographic region | City | Industry/ application |
|---------------------------------------|-------------------|----------------|----------------------------|
| City of Fort Collins | Front Range | Fort Collins | Transit |
| RTD Denver | Front Range | Denver | Transit |
| Grand Valley Transit | Western Slope | Mesa | Transit |
| Roaring Fork Transportation Authority | Mountains | Aspen | Transit |
| Republic Services Inc. | Front Range | Denver | Refuse |
| Alpine Waste Solutions | Front Range | Commerce City | Refuse |
| City of Grand Junction | Western Slope | Grand Junction | Municipal |
| Denver International Airport | Front Range | Denver | Airport |
| USAirport Parking | Front Range | Denver | Airport parking |
| Canopy Airport Parking | Front Range | Denver | Airport parking |
| UPS | Front Range | Commerce City | Parcel |
| City of Fort Collins | Front Range | Fort Collins | Transit |
| Rocky Mountain National Park | Mountains | Estes Park | Federal |
| Boulder Valley School District | Front Range | Boulder | School Buses |
| Arrupe Jesuit High School | Front Range | Denver | School Buses |
| Denver Bike Sharing | Front Range | Denver | Maintenance |
| Western Energy Alliance | Front Range | Denver | Other |
| Quiero Arepas Food Truck | Front Range | Denver | Food Service |
| Denver Zoo | Front Range | Denver | Other |
| Loveland Ready Mix | Front Range | Loveland | Cement |
| Wally Park | Front Range | Denver | Airport parking |
| City of Arvada | Front Range | Arvada | Municipal |
| GSA Fleet Management | Front Range | Lakewood | Federal |
| Encana | Western Slope | Rifle | Crew vehicles, supervisory |
| Noble Energy | Northeast | Greeley | Various |
| Pioneer Natural Resources | Southeast | Trinidad | Various |

Appendix C. Summary of Vehicle Fleets in Colorado

Summary of Total Vehicles in Fleets by County in Colorado

| County | Total vehicles | Average total number of vehicles per fleet |
|------------|----------------|--|
| DENVER | 41,200 | 170 |
| ARAPAHOE | 17,724 | 145 |
| WELD | 15,342 | 88 |
| ADAMS | 9,331 | 40 |
| JEFFERSON | 5,607 | 47 |
| EL PASO | 3,412 | 26 |
| MESA | 3,170 | 30 |
| DOUGLAS | 2,411 | 45 |
| BOULDER | 1,693 | 35 |
| LARIMER | 1,589 | 17 |
| PUEBLO | 938 | 18 |
| MONTEZUMA | 783 | 28 |
| GARFIELD | 592 | 16 |
| MORGAN | 540 | 16 |
| LA PLATA | 496 | 12 |
| RIO GRANDE | 443 | 13 |
| LOGAN | 329 | 11 |
| YUMA | 301 | 13 |
| LAS ANIMAS | 297 | 15 |
| KIT CARSON | 275 | 8 |
| EAGLE | 251 | 17 |
| MONTROSE | 249 | 11 |
| FREMONT | 248 | 14 |
| ROUTT | 231 | 23 |
| PHILLIPS | 230 | 11 |
| RIO BLANCO | 207 | 17 |
| ALAMOSA | 199 | 12 |
| OTERO | 188 | 10 |
| DELTA | 159 | 9 |
| PROWERS | 158 | 10 |
| CHEYENNE | 155 | 22 |
| SUMMIT | 130 | 19 |
| GUNNISON | 127 | 16 |
| BROOMFIELD | 98 | 12 |

| County | Total vehicles | Average total number of vehicles per fleet |
|-------------|----------------|--|
| CHAFFEE | 96 | 11 |
| LINCOLN | 79 | 16 |
| WASHINGTON | 72 | 9 |
| SAN MIGUEL | 70 | 12 |
| CONEJOS | 67 | 5 |
| CUSTER | 55 | 28 |
| MOFFAT | 54 | 8 |
| ARCHULETA | 53 | 9 |
| GRAND | 48 | 10 |
| PARK | 40 | 13 |
| BACA | 38 | 8 |
| HUERFANO | 30 | 8 |
| PITKIN | 24 | 12 |
| SEDGWICK | 24 | 5 |
| JACKSON | 23 | 3 |
| ELBERT | 20 | 4 |
| COSTILLA | 19 | 10 |
| KIOWA | 17 | 6 |
| BENT | 16 | 8 |
| TELLER | 15 | 15 |
| OURAY | 13 | 13 |
| LAKE | 6 | 6 |
| CLEAR CREEK | 5 | 3 |
| Grand Total | 109,987 | 56 |

Based on summary of FleetSeek vehicle fleet database

Summary of Colorado Vehicle Fleets by Sector

| Sector | Total vehicles | Number of fleets by company description | Average number of vehicles |
|--------------------------------|----------------|---|----------------------------|
| Construction or Mining | 16,346 | 418 | 39 |
| Services | 22,171 | 290 | 76 |
| General Freight | 3,769 | 223 | 17 |
| Retail / Wholesale | 20,055 | 170 | 118 |
| Food Products | 4,497 | 156 | 29 |
| Agricultural Commodities | 496 | 107 | 5 |
| Heavy Hauling | 967 | 74 | 13 |
| Bulk Commodities | 978 | 68 | 14 |
| Petroleum Prod. / Distribution | 2,070 | 67 | 31 |
| Refrigerated Solids | 1,368 | 62 | 22 |
| Mfg & Processing | 2,402 | 58 | 41 |
| Building Materials | 231 | 51 | 5 |
| Household Goods | 1,257 | 48 | 26 |
| Public Utility | 29,345 | 43 | 682 |
| Sanitation | 2,052 | 42 | 49 |
| Petroleum Products | 319 | 22 | 15 |
| Tank Truck | 311 | 21 | 15 |
| Motor Vehicle | 822 | 15 | 55 |
| Package | 177 | 8 | 22 |
| Forest Products | 11 | 4 | 3 |
| Mobile Homes | 21 | 4 | 5 |
| Refrigerated Liquids | 220 | 3 | 73 |
| Hazardous Products | 61 | 2 | 31 |
| Armored | 35 | 1 | 35 |
| Horse Carrier | 6 | 1 | 6 |
| Grand Total | 109,987 | 1,958 | 56 |

Based on summary of FleetSeek vehicle fleet database

Appendix D. Case Study Framework

CNG Case Study Framework

Background

Interviewer to fill as much information as possible prior to interview.

- a. **Fleet company/agency name:**
- b. **Fleet contact name:**
- c. **Title:**
- d. **Email address:**
- e. **Phone number:**
- f. What **fleet application/Industry** category does the project fall into? (circle all that apply)

- | | |
|----------------------------|----------------|
| Airports | Refuse Haulers |
| Local Delivery | School Buses |
| Long-Haul Delivery | Shuttle Buses |
| Municipal | Taxis |
| Parks | Transit Buses |
| Police/Traffic Enforcement | Other Explain: |

Fleet Profile

This section asks basic questions about the fleet being featured in this case study.

- a. **Total number of vehicles in the fleet (conventional and alternative):**
- b. **Total number of CNG vehicles in fleet:**
- c. **Year the fleet began using alt fuels, AFVs, advanced technologies:**
- d. **Year the fleet began using CNG specifically:**
- e. **What vehicle category does the project fall into?**
 - Light-Duty Vehicles (< 8,500 lb. GVWR)
 - Medium-Duty (approximately 8,501-25,999 lb. GVWR)
 - Heavy-Duty Vehicles (>26,000 lb. GVWR)
 - Off-Road Vehicles, Explain: _____
- f. **Make/model of CNG vehicles (Use reverse if needed – request inventory in advance for large/diverse fleets)**
- g. **Number of OEM vs. Retrofit CNG:**
- h. **Number of Dedicated CNG vs. Bi-fuel:**

Project Motivation and Organizational Buy-In

This section asks questions about what motivated you to implement the project featured in this case study, as well as how the project was implemented.

- a. **Motivation: Please rank the following in order of importance in motivating you to do this project:**
(rank on a scale of a 1-5, 1 being most important, 5 being least important)

___ Energy security
___ Cost savings
___ Lower emissions
___ Economic development
___ Other: _____

- b. **Goals:** Describe the **overall** goals of the project. (50-100 words)
- c. **Management Consideration:** Who did you have to involve in the decision making process?
- d. **Management Buy-In:** How did you educate key decision makers on the benefits and risks of the project?
- e. **Concerns:** What were the primary concerns (Specific or general) that management expressed? How were these addressed? Were they resolved? If so, how?

Accomplishments and Project Metrics

This section asks questions about project accomplishments and reduction results.

- a. **Accomplishments:** Describe the accomplishments of the project. (100-200 words)
- b. **Petroleum Reduction:** How much petroleum did this/will this project reduce (in gallons or GGE)?
- c. **Emissions:** If applicable, how much emissions did this/will this project reduce? What tool did you use to do this?
- d. **Financial impacts, fueling:** What are the yearly fuel savings due to this project compared with a diesel/gasoline option?
- e. **Financial impacts, overall:** How much money has this project saved or cost the fleet compared with a diesel/gasoline option?
- f. **ROI:** What is the return of investment/payback period for this project?
- g. **Benefits:** What non-financial benefits did the fleet enjoy as a result of implementing this project? (e.g., behavioral changes, public image, trend setting, etc.)

Vehicle Selection

This section asks questions about the process for selecting CNG vehicles for the fleet.

- a. **Use of conversion or OEM solution:** Discuss decision to convert vehicles or buy from OEMs. If conversion, did you do conversion in-house? If so did you have to do training? If not, who did it?
- b. **Bi-fuel or dedicated natural gas vehicles:** Discuss fuel flexibility for vehicles used
- c. **Brand selection for both OEM and Conversion:** What were your important considerations regarding OEM vs. Converting vehicles? What did you end up choosing, why, and are you satisfied? How many of each?
- d. **Decision process:** How did you sort through and decide on the choices in an emerging industry? (information is usually limited, sources are harder to find, requires more effort on behalf of the buyer)
- e. **CNG or LNG:** Did you pick CNG or LNG vehicles, and why? How many of each? What manufacturers and technologies?
- f. **Vehicle performance:** What aspects of vehicle performance are you most happy with? Least? What is general level of satisfaction?
- g. **Availability and vendors:** Were there issues with availability of vehicles? Who are vendors?
- h. **Application considerations:** How specific were your application needs? How much did this affect your decision?
- i. **Partnerships:** When purchasing the vehicles, did you partner with any other fleets for vehicle/equipment buying power, training, etc?

Station Design and Economics

This section asks questions about factors related to refueling station selection, siting and performance.

- a. **Do you use in-house or market (public station) refueling stations?**
What was motivation behind choice? How well does it work?
- b. If public: How closely did you work with the public station during the exploratory and implementation phases? (did they affect sizing, technology, pace, etc)
- c. **System sizing (if applicable):** Describe compressor and storage system size/configuration

- d. **Siting and permitting (if applicable):** Did you encounter any special issues associated with building codes, siting or permitting when developing the refueling station?
- e. **What was your biggest unexpected issue?**
- f. **Vendors (if applicable):** Who were the system vendors?
- g. **Partnerships:** When designing the stations, did you partner with any other fleets for fueling equipment buying power, training, etc?
- h. **Energy use and cost (if applicable):** How do you manage electricity and natural gas demand at the pumps? Have you experienced any peak demand charges associated with the refueling station?
- i. **Fuel and O&M costs:** Please break down commodity costs, taxes, amortization, utility expenses including connection.
- j. **Commodity price hedging/forecasting:** Are any strategies employed to hedge against price increases? What's the term (length) of your fuel price contract and is your price tied to any other commodities?
- k. **Station throughput (if applicable):** What volume of fuel is used and what is the refueling frequency? Was your station built to accommodate any future growth? Speed: Fast Fill or Slow Fill? How did you determine, cost differences, etc?
- l. **How satisfied are you with the cost, availability and speed of fueling?**

Funding

This section investigates the steps needed to fund the project (pre-project, not ROI, etc)

- a. **How was the project funded?** Detail public and private financial contributions, including any loans or grants. If a grant was involved, what kind of grant was it? Would the project have occurred without it?
- b. **Barriers:** What were some of the bigger financing barriers? How were these overcome?
- c. **Vehicle purchase incentives:** Did you leverage any incentives (grants, rates, breaks, etc) when purchasing the vehicles?
- d. **Station installation incentives:** If applicable, did you leverage any incentives (grants, rates, breaks, etc) when installing the fueling stations?
- e. **Other incentives:** Are there any other financial incentives or “vehicles” at work?
- f. **Forecasting:** What financial forecasting tools were used in these decisions? ROI, NPV, etc
- g. **Financing Team:** What team members were involved in the funding aspects of this project?

Project Implementation

This section investigates the steps needed to actually get the project moving once fueling and organizational buy-in have been addressed.

- a. **Process:** Describe the project implementation process from the go/no go decision, design, construction and commissioning.
- b. **Barriers:** Describe the barriers you encountered during the project's implementation and how they were overcome. (100-200 words)
- c. **Rollout Schedule:** specific to logistics, what was your vehicle purchase/phase-in schedule? What influenced this/ (Funding, maintenance capacity, normal vehicle turnover, fueling, etc) Were fueling decisions influenced by, or affected by, this schedule?
- d. **Station Schedule:** Did you factor in your pace for rolling out CNG vehicles in construction of refueling stations and/or coordination with public CNG stations? How did it work?
- e. **Project Timeline:** What was the overall project timeline, from approval to operational?
- f. **Checkpoints:** What were your checkpoints and success gauges?
- g. **Safety Procedures:** What internal safety and emergency response procedures were affected, and how?
- h. **First Responders:** How involved were your local first responders? What provisions to handle NGVs?
- i. **Other Fleets:** For project implementation, did you leverage any partnerships with other fleets for project support, buying power, training, maintenance, fueling, etc?

Maintenance

This section asks questions about any needed facility or procedural changes associated with the CNG fleet implementation process.

- a. **Vehicle maintenance facility upgrades:** Were any needed? What were they? How well does maintenance facility perform?
- b. **Maintenance procedural changes:** What were changes in maintenance procedures? How were they rolled out and what has been the impact of them on operations?
- c. **Worker training:** How were workers trained in maintenance and safety changes? How long did it take? Were there valuable resources that could be applied in other cases? Was it "one and done" or is training a continual process (Specific to the NGVs)

- d. **Reliability vs. gasoline or diesel models:** What have been impacts on overall vehicle reliability? Are there specific issues that are significantly better or worse?
- e. **Lifetime Expectations:** Is the expected replacement rate of the NGVs longer or shorter than compared to their counterparts?
- f. **Lifetime Costs:** Compared to their counterparts, are the lifetime maintenance costs expected to be higher or lower?
- g. **Unexpected:** Describe any unexpected savings or expenses:
- h. **Vendors:** What changes or new vendor relationships were needed?

Lessons Learned and Next Steps

This section asks questions about lessons learned from the project and what the fleet has planned next.

- a. **Lessons Learned:** Describe what was learned from implementing this project? By category:

Optimizing cost savings/reducing implementation costs

Project implementation

Vehicle choice

Maintenance

Refueling

- b. **Best Practices:** How have these lessons been turned into best practices for the organization, and how effectively have they been implemented?
- c. **Advice:** What advice can you offer other fleets who want to implement a similar project?
- d. **Plans:** Do you plan to grow what's been implemented or do you have any future plans for petroleum reduction?

Thank you! Thank you for providing thoughtful concise answers to the questions in this questionnaire. The information provided will help GEO build a useful database of case studies that will provide other fleets with real-world information about how to implement successful alternative transportation projects in Colorado.

Appendix E. Results of Grand Junction CNG/Diesel Vehicle Bids

| | | Price Ea | Ext Price | Make & Model | Tax Credit Rec'd | Tax credit to City | Trade in 3025 | Trade in 3029 | Trade in 3277 | Total for all deducts |
|--|--------|--------------|--------------|----------------------------------|-------------------|--------------------|---------------|---------------|---------------|-----------------------|
| Transwest Trucks Commerce City, CO | CNG | \$276,852.00 | \$830,556.00 | 2011 Autocar w/Heil | N/A | \$0.00 | \$30,000.00 | \$30,000.00 | \$30,000.00 | \$740,556.00 |
| | Diesel | \$234,159.00 | \$702,477.00 | 2011 Autocar w/Heil | N/A | \$0.00 | \$30,000.00 | \$30,000.00 | \$30,000.00 | \$612,477.00 |
| | CNG | \$247,764.00 | \$743,292.00 | 2011 Autocar w/Bridgeport | N/A | \$0.00 | \$20,000.00 | \$20,000.00 | \$20,000.00 | \$683,292.00 |
| | Diesel | \$212,892.00 | \$638,676.00 | 2011 Autocar w/Bridgeport | N/A | \$0.00 | \$20,000.00 | \$20,000.00 | \$20,000.00 | \$578,676.00 |
| Grand Jct Peterbilt, Fruita, CO | CNG | \$279,863.00 | \$839,589.00 | Peterbilt 320 w/Heil | ?? | \$0.00 | \$30,000.00 | \$30,000.00 | \$30,000.00 | \$749,589.00 |
| | Diesel | \$274,363.00 | \$823,089.00 | Peterbilt 320 w/Heil | N/A | \$0.00 | \$30,000.00 | \$30,000.00 | \$30,000.00 | \$733,089.00 |
| Western Colo Truck Center/ Mesa Mack | CNG | \$300,552.00 | \$901,656.00 | 2011 Mack w/2010 Heil | \$32,000.00 | \$8,000.00 | \$40,280.00 | \$40,280.00 | \$40,280.00 | \$772,816.00 |
| | Diesel | \$255,047.00 | \$765,141.00 | 2011 Mack w/2010 Heil | N/A | \$0.00 | \$40,280.00 | \$40,280.00 | \$40,280.00 | \$644,301.00 |
| | CNG | \$319,285.00 | \$957,855.00 | 2011 Mack w/2010 New Way | \$32,000.00 | \$8,000.00 | \$40,250.00 | \$40,250.00 | \$40,250.00 | \$829,105.00 |
| | Diesel | \$272,341.00 | \$817,023.00 | 2011 Mack w/2010 New Way | N/A | \$0.00 | \$40,250.00 | \$40,250.00 | \$40,250.00 | \$696,273.00 |
| | CNG | \$271,464.00 | \$814,392.00 | 2011 Mack w/2010 Bridgeport | \$32,000.00 | \$8,000.00 | \$40,250.00 | \$40,250.00 | \$40,250.00 | \$685,642.00 |
| | Diesel | \$233,780.00 | \$701,340.00 | 2011 Mack w/2010 Bridgeport | N/A | \$0.00 | \$40,250.00 | \$40,250.00 | \$40,250.00 | \$580,590.00 |
| Faris Machinery <i>ough</i> <i>Two</i> → | CNG | \$284,691.00 | \$854,073.00 | 2010 Autocar w/2010 Labrie | Not Participating | \$0.00 | \$20,000.00 | \$20,000.00 | \$20,000.00 | \$794,073.00 |
| | Diesel | \$245,359.00 | \$736,077.00 | 2010 Autocar w/2010 Labrie | N/A | \$0.00 | \$20,000.00 | \$20,000.00 | \$20,000.00 | \$676,077.00 |
| | CNG | \$286,703.00 | \$860,109.00 | 2010 Peterbilt 320 w/2010 Labrie | Not Participating | \$0.00 | \$20,000.00 | \$20,000.00 | \$20,000.00 | \$800,109.00 |
| | Diesel | \$246,185.00 | \$738,555.00 | 2010 Peterbilt 320 w/2010 Labrie | N/A | \$0.00 | \$20,000.00 | \$20,000.00 | \$20,000.00 | \$678,555.00 |
| | CNG | \$308,391.00 | \$925,173.00 | 2011 Mack w/2010 Labrie | \$32,000.00 | \$8,000.00 | \$40,280.00 | \$40,280.00 | \$40,280.00 | \$796,333.00 |
| | Diesel | \$266,247.00 | \$798,741.00 | 2011 Mack w/2010 Labrie | N/A | \$0.00 | \$40,280.00 | \$40,280.00 | \$40,280.00 | \$677,901.00 |

Winning bid (price is for 2 vehicles)

Appendix F. CNG Station Design Bid Documents from City of Grand Junction



**Request for Proposal
RFP-3201-10-SDH
City of Grand Junction CNG Fill Station Design Services**

RESPONSES DUE:

March 23, 2010 Prior to 2:00 p.m.
City Clerk's Office
250 N. 5th Street
Grand Junction, CO 81501

PURCHASING REPRESENTATIVE:

Scott Hockins
Purchasing Supervisor
scotth@gjcity.org
Phone (970) 244-1484

TECHNICAL/SCOPE OF SERVICES QUESTIONS:

Bret Guillory, PE, CFM
Utility Engineer
bretg@gjcity.org
Phone (970) 244-1590

February 19, 2010

This solicitation has been developed specifically for a Request for Proposal intended to solicit competitive responses for the **City of Grand Junction CNG Fill Station Design Services**, and may not be the same as previous City of Grand Junction solicitations. All offerors are urged to thoroughly review this solicitation prior to submitting. Submittal by **FAX IS NOT ACCEPTABLE** for this solicitation.

REQUEST FOR PROPOSAL

City of Grand Junction CNG Fill Station Design Services

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REQUEST FOR PROPOSAL

RFP-3201-10-SDH

City of Grand Junction CNG Fill Station Design Services

SECTION 1.0: ADMINISTRATIVE INFORMATION & CONDITIONS FOR SUBMITTAL

- 1.1 Issuing Office:** This Request for Proposal (RFP) is issued for the City of Grand Junction (City) by the Purchasing Division, on behalf of City of Grand Junction, Public Works and Planning. All contact regarding this RFP is directed to:

RFP QUESTIONS & SUBMITTALS:

Scott Hockins, Purchasing Supervisor
City of Grand Junction
250 N 5th Street
Grand Junction, CO 81501
970-244-1484

SCOPE OF SERVICES DETAILS:

Bret Guillory, PE, CFM Utility Engineer
City of Grand Junction
250 N 5th Street
Grand Junction, CO 81501
970-244-1590

- 1.2 Purpose:** The purpose of this RFP is to obtain competitive proposals from qualified individuals or firms, interested in providing recommendations, and design for a CNG Fill Station that will allow for utilization of a slow fill station with future expansion to fast fill station.
- 1.3 Compliance:** All participating Offerors, by their signature hereunder, shall agree to comply with all conditions, requirements, and instructions of this RFP as stated or implied herein. Should the City of Grand Junction omit anything from this packet which is necessary to the clear understanding of the requirements, or should it appear that various instructions are in conflict, the Offerors shall secure instructions from the Purchasing Division prior to the date and time of the submittal deadline shown in this RFP.
- 1.4 Submission:** Please refer to section 5.0 for what is to be included. Each proposal shall include **three (3) copies** and **one (1) electronic copy**, placed in a sealed envelope and marked clearly on the outside with the consultant's name "**RFP-3201-10-SDH City of Grand Junction CNG Fill Station Design Services.**" For proper comparison and evaluation, the City requests that proposals be formatted as directed in Section 5.0 "Preparation and Submittal of Proposals." Submittals received that fail to follow this format may be ruled non-responsive.
- 1.5 Proposal Deadline:** Proposals are due by March 23, 2010 prior to 2:00pm in the City Clerk's Office at 250 N. 5th Street, Grand Junction, CO 81501.
- 1.6 Altering Proposals:** Any alterations made prior to opening date and time must be initialed by the signer of the proposal, guaranteeing authenticity. Proposals cannot be altered or amended after submission deadline.
- 1.7 Withdrawal of Proposal:** A proposal must be firm and valid for award and may not be withdrawn or canceled by the Offeror prior to the sixty-first (61st) day following the submittal deadline date and only prior to award. The Offeror so agrees upon submittal of their proposal. After award this statement is not applicable.

- 1.8 Acceptance of Proposal Content:** The contents of the proposal of the successful Offeror shall become contractual obligations if acquisition action ensues. Failure of the successful Offeror to accept these obligations in a contract shall result in cancellation of the award and such vendor shall be removed from future solicitations.
- 1.9 Exclusion:** No oral, telegraphic, or telephonic proposals shall be considered.
- 1.10 Addenda:** All Questions shall be submitted in writing to the appropriate person as shown in Section 1.1 within the timeframe shown in Section 4.3. Any interpretations, corrections and changes to this RFP or extensions to the opening/receipt date shall be made by a written Addendum to the RFP by the City Purchasing Division, on behalf of the Public Works Engineering Division. Sole authority to authorize addenda shall be vested in the City of Grand Junction Project Manager and the Purchasing Representative. Addenda will be issued electronically through Bidnet at www.rockymountainbidsystem.com to all who are known to have received a copy of the RFP. Offerors shall acknowledge receipt of all addenda in their proposal.
- 1.11 Exceptions and Substitutions:** All proposals meeting the intent of this RFP shall be considered for award. Offerors taking exception to the specifications shall do so at their own risk. The City reserves the right to accept or reject any or all substitutions or alternatives. When offering substitutions and/or alternatives, Offeror must state these exceptions in the section pertaining to that area. Exception/substitution, if accepted, must meet or exceed the stated intent and/or specifications. The absence of such a list shall indicate that the Offeror has not taken exceptions, and if awarded a contract, shall hold the Offeror responsible to perform in strict accordance with the specifications or scope of work contained herein.
- 1.12 Confidential Material:** All materials submitted in response to this RFP shall ultimately become public record and shall be subject to inspection after contract award. "Proprietary or Confidential Information" is defined as any information that is not generally known to competitors and which provides a competitive advantage. Unrestricted disclosure of proprietary information places it in the public domain. Only submittal information clearly identified with the words "**Confidential Disclosure**" and placed in a separate envelope shall establish a confidential, proprietary relationship. Any material to be treated as confidential or proprietary in nature must include a justification for the request. The request shall be reviewed and either approved or denied by the Purchasing Manager. If denied, the proposer shall have the opportunity to withdraw its entire proposal, or to remove the confidential or proprietary restrictions. Neither cost nor pricing information nor the total proposal shall be considered confidential or proprietary.
- 1.13 Response Material Ownership:** All proposals become the property of the City of Grand Junction upon receipt and shall only be returned to the proposer at the City's option. Selection or rejection of the proposal shall not affect this right. The City shall have the right to use all ideas or adaptations of the ideas contained in any proposal received in response to this RFP, subject to limitations outlined in the section 1.12 entitled "Confidential Material". Disqualification of a proposal does not eliminate this right.

1.14 Minimal Standards for Responsible Prospective Offerors: A prospective Offeror must affirmably demonstrate their responsibility. A prospective Offeror must meet the following requirements:

- Have adequate financial resources, or the ability to obtain such resources as required
- Be able to comply with the required or proposed completion schedule
- Have a satisfactory record of performance
- Have a satisfactory record of integrity and ethics
- Be otherwise qualified and eligible to receive an award and enter into a contract with the City of Grand Junction

1.15 Open Records: Proposals shall be received and publicly acknowledged at the location, date, and time stated herein. Offerors, their representatives and interested persons may be present. Proposals shall be received and acknowledged only so as to avoid disclosure of process. However, all proposals shall be open for public inspection after the contract is awarded. Trade secrets and confidential information contained in the proposal so identified by offer as such shall be treated as confidential by the City to the extent allowable in the Open Records Act.

1.16 Sales Tax: City of Grand Junction is, by statute, exempt from the State Sales Tax and Federal Excise Tax; therefore, all fees shall not include taxes.

SECTION 2.0: GENERAL CONTRACT TERMS AND CONDITIONS

2.1 Acceptance of RFP Terms: A proposal submitted in response to this RFP shall constitute a binding offer. Acknowledgment of this condition shall be indicated on the Letter of Interest by the autographic signature of the Offeror or an officer of the Offeror legally authorized to execute contractual obligations. A submission in response to the RFP acknowledges acceptance by the Offeror of all terms and conditions including compensation, as set forth herein. An Offeror shall identify clearly and thoroughly any variations between its proposal and the City's RFP requirements. Failure to do so shall be deemed a waiver of any rights to subsequently modify the terms of performance, except as outlined or specified in the RFP.

2.2 Amendment: No oral statement of any person shall modify or otherwise change, or affect the terms, conditions or specifications stated in the resulting contract. All amendments to the contract shall be made in writing by the City Purchasing Division.

2.3 Assignment: The Consultant shall not sell, assign, transfer or convey any contract resulting from this RFP, in whole or in part, without the prior written approval from the City.

2.4 Compliance with Laws: Proposals must comply with all Federal, State, County and local laws governing or covering this type of service and the fulfillment of all ADA (Americans with Disabilities Act) requirements.

- 2.5 Confidentiality:** All information disclosed by the City to the Consultant for the purpose of the work to be done or information that comes to the attention of the Consultant during the course of performing such work is to be kept strictly confidential.
- 2.6 Conflict of Interest:** No public official and/or City employee shall have interest in any contract resulting from this RFP.
- 2.7 Contract:** This Request for Proposal, submitted documents, and any negotiations, when properly accepted by the City of Grand Junction, shall constitute a contract equally binding between the City and Consultant. No different or additional terms shall become a part of this Contract with the exception of an Amendment.
- 2.8 Project Manager:** The Project Manager, on behalf of the City, shall render decisions in a timely manner pertaining to the work proposed or performed by the Consultant. The project manager shall be responsible for approval and/or acceptance of any related performance of the Scope of Services.
- 2.9 Contract Termination:** This contract shall remain in effect until any of the following occurs: (1) contract expires; (2) completion of services; (3) acceptance of services or, (4) for convenience terminated by either party with a written *Notice of Cancellation* stating therein the reasons for such cancellation and the effective date of cancellation.
- 2.10 Employment Discrimination:** During the performance of any services per agreement with the City, the Consultant, by submitting a Proposal, agrees to the following conditions:
- 2.10.1** The Consultant shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, age, handicap, or national origin except when such condition is a legitimate occupational qualification reasonably necessary for the normal operations of the Consultant. The Consultant agrees to post in conspicuous places, visible to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
- 2.10.2** The Consultant, in all solicitations or advertisements for employees placed by or on behalf of the Consultant, shall state that such Consultant is an Equal Opportunity Employer.
- 2.10.3** Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.
- 2.11 Ethics:** The Offeror shall not accept or offer gifts or anything of value nor enter into any business arrangement with any employee, official, or agent of the City.
- 2.12 Failure to Deliver:** In the event of failure of the Consultant to deliver services in accordance with the contract terms and conditions, the City, after due oral or written notice, may procure the services from other sources and hold the Consultant responsible for any costs resulting in additional purchase and administrative services. This remedy shall be in addition to any other remedies that the City may have.

- 2.13 Failure to Enforce:** Failure by the City at any time to enforce the provisions of the contract shall not be construed as a waiver of any such provisions. Such failure to enforce shall not affect the validity of the contract or any part thereof or the right of the City to enforce any provision at any time in accordance with its terms.
- 2.14 Force Majeure:** The Consultant shall not be held responsible for failure to perform the duties and responsibilities imposed by the contract due to legal strikes, fires, riots, rebellions, and acts of God beyond the control of the Consultant, unless otherwise specified in the contract.
- 2.15 Indemnification:** Consultant shall defend, indemnify and save harmless the City of Grand Junction, State of Colorado, and all its officers, employees, insurers, and self-insurance pool, from and against all liability, suits, actions, or other claims of any character, name and description brought for or on account of any injuries or damages received or sustained by any person, persons, or property on account of any negligent act or fault of the Consultant, or of any Consultant's agent, employee, subcontractor or supplier in the execution of, or performance under, any contract which may result from proposal award. Consultant shall pay any judgment with cost which may be obtained against the City growing out of such injury or damages.
- 2.16 Independent Consultant:** The Consultant shall be legally considered an Independent Consultant and neither the Consultant nor its employees shall, under any circumstances, be considered servants or agents of the City of Grand Junction. The City shall be at no time legally responsible for any negligence or other wrongdoing by the Consultant, its servants, or agents. The City shall not withhold from the contract payments to the consultant any federal or state unemployment taxes, federal or state income taxes, Social Security Tax or any other amounts for benefits to the consultant. Further, the City shall not provide to the Consultant any insurance coverage or other benefits, including Workers' Compensation, normally provided by the City for its employees.
- 2.17 Nonconforming Terms and Conditions:** A proposal that includes terms and conditions that do not conform to the terms and conditions of this Request for Proposal is subject to rejection as non-responsive. The City of Grand Junction reserves the right to permit the Offeror to withdraw nonconforming terms and conditions from its proposal prior to a determination by the City of non-responsiveness based on the submission of nonconforming terms and conditions.
- 2.18 Ownership:** All plans, prints, designs, concepts, etc., shall become the property of the City of Grand Junction.
- 2.19 Oral Statements:** No oral statement of any person shall modify or otherwise affect the terms, conditions, or specifications stated in this document and/or resulting agreement. All modifications to this request and any agreement must be made in writing by the City of Grand Junction.
- 2.20 Patents/Copyrights:** The Consultant agrees to protect the City of Grand Junction from any claims involving infringements of patents and/or copyrights. In no event shall the City

be liable to a Consultant for any/all suits arising on the grounds of patent(s)/copyright(s) infringement. Patent/copyright infringement shall null and void any agreement resulting from response to this RFP.

2.21 Remedies: The Consultant and City agree that both parties have all rights, duties, and remedies available as stated in the Uniform Commercial Code.

2.22 Venue: Any agreement as a result of responding to this RFP shall be deemed to have been made in, and shall be construed and interpreted in accordance with, the laws of the City of Grand Junction, Mesa County, Colorado.

SECTION 3.0: INSURANCE REQUIREMENTS

3.1 Insurance Requirements: The Consultant agrees to procure and maintain, at its own cost, policy(s) of insurance sufficient to insure against all liability, claims, demands, and other obligations assumed by the Consultant pursuant to this Section. Such insurance shall be in addition to any other insurance requirements imposed by this Contract or by law. The Consultant shall not be relieved of any liability, claims, demands, or other obligations assumed pursuant to this Section by reason of its failure to procure or maintain insurance in sufficient amounts, durations, or types.

3.2 Consultant shall procure and maintain and, if applicable, shall cause any Subcontractor of the Consultant to procure and maintain insurance coverage listed below. Such coverage shall be procured and maintained with forms and insurers acceptable to The City of Grand Junction. All coverage shall be continuously maintained to cover all liability, claims, demands, and other obligations assumed by the Consultant pursuant to this Section. In the case of any claims-made policy, the necessary retroactive dates and extended reporting periods shall be procured to maintain such continuous coverage. Minimum coverage limits shall be as indicated below unless specified otherwise in the Special Conditions:

General Liability insurance with minimum combined single limits of:

ONE MILLION DOLLARS (\$1,000,000) each occurrence and
ONE MILLION DOLLARS (\$1,000,000) per job aggregate.

The policy shall be applicable to all premises and operations. The policy shall include coverage for bodily injury, broad form property damage (including completed operations), personal injury (including coverage for contractual and employee acts), blanket contractual, products, and completed operations. The policy shall include coverage for explosion, collapse, and underground hazards. The policy shall contain a severability of interests provision.

Professional Liability & Errors and Omissions Insurance policy with a minimum of \$1,000,000 per claim. This policy shall provide coverage to protect the contractor against liability incurred as a result of the professional services performed as a result of responding to this RFP.

- 3.3** The policies required by paragraphs above shall be endorsed to include the City and the City's officers and employees as additional insured. Every policy required above shall be primary insurance, and any insurance carried by the City, its officers, or its employees, or carried by or provided through any insurance pool of the City, shall be excess and not contributory insurance to that provided by Consultant. No additional insured endorsement to any required policy shall contain any exclusion for bodily injury or property damage arising from completed operations. The Consultant shall be solely responsible for any deductible losses under any policy required above.

SECTION 4.0: SCOPE OF SERVICES

- 4.1. Background:** The City of Grand Junction is interested in installing a CNG fill station that can be utilized for new CNG fueled solid waste vehicles. The City has purchased four CNG fueled solid waste disposal trucks. A slow fill CNG fueling station will be needed to provide fuel to the new trucks. The City is interested in partnering with a private venture that will include future expansion of the fueling station to include a fast fill component.

Therefore, the City of Grand Junction, Purchasing Division is requesting proposals from Consulting Civil Engineers to provide design services, prepare construction drawings and bid documents for CITY OF GRAND JUNCTION CNG FUELING STATION PROJECT. The project calls for the following:

1. Design of a CNG slow fill fueling station that will be modified at a future date to include fast fill fueling options.
2. Design considerations shall include redundancy in the system in that this will be the only source of fuel in Western Colorado.
3. The system shall be capable of supplying a minimum of 150 diesel gallon equivalents (DGE) in a 14 hour period from the slow fill site, along with capability to expand to 1,000 DGE's in the future.

The Consultant shall be responsible for the evaluating alternatives, providing design for the select alternative including; design, final CAD drawing, bid documents, and other related services which are included in the following scope of work:

The design and evaluation effort shall include design for a slow fill station that will be suitable for current and minor expansion to service City Solid Waste needs, including future expansion of the fueling facilities and site to include fast fill at an adjacent site. This effort will also include design and specification for a maintenance facility adjacent to the fill station location. The facility will include appurtenances suitable for maintenance of CNG fueled vehicles, and be sized to allow for maintenance of two solid waste vehicles simultaneously. As an alternate to a new structure we will be interested in remodeling two bays in the existing Fleet Maintenance service building to allow for maintenance of CNG vehicles. We would like evaluation of these two alternatives included with this proposal.

The City would like to complete construction of this improvement in late summer of 2010.

4.2. Consultants Responsibilities: The scope of work shall include the following components:

4.2.1. Task One: Project Coordination.

4.2.1.1. Work Task Coordination: The Consultant PM shall assign and coordinate all work tasks being accomplished, including those to be performed by sub consultants, to ensure project work is completed on schedule.

4.2.1.2. Project Team Coordination: The City PM and the Consultant PM shall maintain ongoing communication about the project on a frequent and regular basis. Each PM shall provide the other with

- Copies of pertinent written communications, including electronic (email) correspondence
- Early identification of potential problems or concerns

4.2.1.3. Progress Meetings: It is anticipated that this effort will have a short time frame with design of the station estimated to be completed within one month. Two meetings will be conducted to coordinate efforts and maintain the schedule for the project. The meetings shall focus on the following topics:

- Activities completed since the last meeting
- Problems encountered or anticipated
- Late activities/activities slipping behind schedule
- Solutions for unresolved or newly identified problems
- Schedule of upcoming activities
- Information on items required/comments from City of Grand Junction.

Meetings may be conducted via conference call.

4.2.2. Task Two: Design Plans and Construction Bid Documents: The consultant will prepare final design plans and bid documents. These shall be submitted to the City for review and approval. Review of the documents and plans will be completed by the City of Grand Junction Utility Engineer and Deputy Director of Utilities and Streets Systems for the City of Grand Junction. The final plans, and construction bid documents shall be stamped by a professional engineer registered in the State of Colorado. This is to be accomplished allowing for adequate public advertisement of the project (30 days) and award by City Council (2 weeks following advertisement period) to allow construction to occur during the months of August and September, 2010.

City provided Materials

The City will provide copies of the following information:

- Survey of the site including location of all existing utilities, and adequate horizontal and vertical control.
- Base mapping for the site (provided in Auto CADD version 2010).

4.2.3 Task Three: Final Bid Documents and Drawings: The consultant will prepare Special Provisions and Special Conditions for the final bid documents including the following specifications: gas supply and connections, gas components, electrical component listing, electrical materials and contacts, electrical conduit (above and below ground), electrical component and listings, mechanical and piping, codes and standards for compliance, general performance specifications, start up and testing procedures, and all other specification needed to provide a complete bid package. All specifications shall be provided in accordance with the City of Grand Junction Standard Contract Documents for Capital Improvements Construction, Revised February 2009. The City will compile final bid documents utilizing Special Provisions and Special Conditions furnished by the consultant. These documents shall be complete and adequate to obtain competitive construction bids for the CNG Fill Station project.

Construction drawings for the project shall include the following: Title page, area layout(s), gas schematic diagram(s) including the process and instrument diagram, electrical single line diagram, mechanical layout, safety sign descriptions and location, and other drawings as needed to provide a complete bid package.

The consultant will also provide the City with an engineering estimate of cost to construct the project that will be used to evaluate adequacy of currently budgeted funds.

4.2.3.1 Reproduction: The Consultant will plot, print, and reproduce the final construction drawings and contract documents in the following quantities:

| | |
|---|---|
| 11 x 17 (half size): | 1 copy plus 1 original (not bound) |
| 22 x 34 (full size): | 1 copy plus 1 reproducible set |
| Contract Documents : | 1 original (Wet stamped by Colorado PE) |
| (Special Provisions and Special Conditions) | |

The contract documents shall be provided unbound. Printing shall be single sided. Specifications shall be provided in electronic format (Word 2007), drawings shall be provided in electronic format (Auto CADD version 2010) or compatible Auto CADD version.

4.2.3.2 Authentication: The Consultant's Professional Engineer responsible for the project design shall affix his stamp and signature to one copy of the final drawings, and bid documents.

4.3 Project Time Schedule: Offeror **must** provide with proposal submittal a time schedule for completion of the Project "Scope of Services." The preferred project schedule is depicted below.

| | |
|-------------------------|--|
| March 8, 2010 at 2:00pm | On Site Meeting and Tour at 333 West Ave, Bldg A |
| March 15, 2010 | Last day to Submit Technical Questions |
| March 23, 2010 | Proposals Due |
| March 24, 2010 | Selection of Consultant |
| April 7, 2010 | City Council Award (if needed) |
| April 8, 2010 | Notice to Proceed |

May 10, 2010
June 1, 2010
June 14, 2010
September 15, 2010

Final Design Complete
Open Bids for Construction
Award Construction Contract
Complete Construction

SECTION 5.0: PREPARATION AND SUBMITTAL OF PROPOSALS

- 5.1** Offerors are required to provide **three (3) copies** of their proposal in written format and **one (1) copy in electronic format**, compatible with Microsoft Office Word 2007. Offerors are required to indicate their interest in this Project, show their specific experience and address their capability to perform the Scope of Services in the Time Schedule as set forth herein. For proper comparison and evaluation, the City requests that proposals be formatted **A** to **G**. Proposals must contain all of the following information to satisfy the requirements of this RFP:
- A. Cover Letter:** Cover letter shall be provided which succinctly explains the Consultant's interest in the project. The letter shall contain the name/address/phone number and email address of the person who will serve as the firm's principal contact person with City's Contract Administrator and shall identify individual(s) who will be authorized to make presentations on behalf of the firm. The statement shall bear the signature of the person having proper authority to make formal commitments on behalf of the firm.
 - B. Qualifications of Firm/Project Team:** Provide names, titles and responsibilities of key personnel who will be responsible for the management and design of this project. Include qualifications, experience of each, and length of time with the company.
 - C. Strategy and Implementation Plan:** Describe your (the consultant's) interpretation of the City's objectives with regard to this RFP. Describe the proposed strategy and/or plan for achieving the objectives of this RFP. Offeror may utilize a written narrative or any other printed technique to demonstrate his/her ability to satisfy the Scope of Services. The narrative should describe the firm's particular abilities and qualifications related to this project. If the firm has multiple office locations, specify which office shall complete the primary design work. Interested firms shall demonstrate previous experience with planning and development of all design work associated with CNG Fueling Stations.
 - D. References:** Provide a list and description of other projects designed by your firm or by key personnel that are similar or pertinent to this project. Provide references and contact information of owner for the projects. List should include a brief description of each project.
 - E. Outside Consultants:** List any outside consultants or firms who might perform services for this project. Provide resumes of key individuals and describe what services that each outside firm would provide, and at least three previous projects demonstrating the firm's capability to perform these services.
 - F. Capacity:** Address your firm's capacity and depth to complete the Final Design scope by May 2, 2010 assuming a notice to proceed date of April 2, 2010.

- G. Cost not to Exceed Proposal:** Cost proposals shall be submitted for tasks 1, 2 and 3 only. The City intends to enter into a contract with the selected Consultant for sections 1, 2 and 3 only. At the conclusion of tasks 1, 2 and 3 the City may choose to negotiate with the Consultant for construction services associated with this project.

SECTION 6.0: EVALUATION CRITERIA AND FACTORS

- 6.1 Evaluation:** An evaluation team shall review all responses and select the proposal or proposals that best demonstrate the capability in all aspects to perform the scope of services and possess the integrity and reliability that will ensure good faith performance.
- 6.2 Intent:** Only respondents who meet the qualification criteria will be considered for selection. Therefore, it is imperative that the submitted proposal clearly indicate the firm's ability to provide the services described herein.

Submittal of evaluations will be done in accordance with the criteria and procedure defined herein. Companies considered for selection will be chosen on the basis of their apparent ability to best meet the overall expectations of the City. The City reserves the right to reject any and all submittals. The following parameters will be used to evaluate the submittals (in no particular order of priority):

- Responsiveness of submittal to the RFP
- Understanding of the project and the objectives
- Necessary resources
- Experience
- Required skills
- Demonstrated capability
- References

- 6.3 Award:** The contract for tasks 1, 2 and 3 will be awarded to the firm that is deemed most qualified to perform the scope of services based on the project team qualifications, prior experience working together, approach to the project, ability to complete the project in the necessary time frame, location of firm and workforce, and references. Firms shall be ranked or disqualified based on the above. Cost proposals will be evaluated as part of the selection process. The lowest cost proposal does NOT guarantee that Consultant shall be selected. The City reserves the right to consider all of the information submitted in selecting the project Consultant.

End RFP

***CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND PLANNING
ENGINEERING DIVISION***

BID DOCUMENTS

FOR

CNG Slow-Fill Station & Shop Bay Upgrades

IFB-3248-10-SDH



July, 2010

Book No. ____

CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND PLANNING
ENGINEERING DIVISION

BID DOCUMENTS
FOR
CNG Slow-Fill Station & Shop Bay Upgrades

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BID INFORMATION

INVITATION TO BID

The City of Grand Junction will receive sealed bids at the Office of the City Clerk at City Hall, 250 North Fifth Street, Grand Junction, Colorado, 81501, prior to 2:30 p.m. on July 20, 2010 for CNG Slow-Fill Station & Shop Bay Upgrades. All bids will be opened and read aloud at the City Auditorium immediately following the submittal deadline. The project generally consists of installation of 100 SCFM gas meter, 500 SCFM gas dryer, two - 50 SCFM gas compressors (40 hp each), 10 – time fill dispenser hose drops, site grading, equipment pads, fencing/barricades, telephone system, associated electrical and gas plumbing, alarm system and associated appurtenances; Retrofitting two existing bay areas with; new partition wall & interior man door, explosion proof receptacles, gas detection alarm system, exterior bay door, motor operator(s), combustible gas sensor, HVAC modifications, plumbing, associated work and appurtenances.

Plans, Specifications and other Bid Documents may be reviewed at the Administration Office of the Department of Public Works and Planning at City Hall. Copies thereof may be obtained for a non-refundable sum of \$75 per set.

The March 2010 edition of the “City Standard Contract Documents for Capital Improvements Construction” is also available for purchase.

For additional technical information, please contact Bret Guillory, PE, Utility Engineer at the Department of Public Works and Planning (970-244-1590).

For contractual information, please contact Scott Hockins, Purchasing Supervisor (970-244-1484).

A pre-bid meeting will be held at 2:00 p.m. on July 13, 2010, in the Executive Conference Room, Room 242, at City Hall. Attendance at the meeting is not mandatory but is strongly recommended.

The City Clerk’s Office will stamp the date and mark the time received on all bids. Bids not received prior to the date and time indicated on the Invitation to Bid will not be considered. The City is not responsible for delays occasioned by the U.S. Postal Service, the internal mail delivery system of the City, or any other means of delivery employed by the Bidder.

Each Bid shall be submitted on a form furnished by the City and must be accompanied by a certified check, cashier’s check or Bid Bond in an amount not less than 5% of the amount of the Bid and made payable to the City of Grand Junction, Colorado. The successful Bidder will be required to furnish a Performance Bond and a Labor and Material Payment Bond, both in the amount of 100% of the total Contract amount, in conformity with the requirements of the Contract Documents and on forms provided by the City.

Contractors submitting bids over \$50,000 must be prequalified in accordance with the City's "Rules and Procedures for Prequalification of Contractors." Bids received from non-prequalified contractors will not be opened. Application forms for prequalification are available at the Administration Office of the Department of Public Works and Planning (970-256-4126).

Contractors submitting bids shall also supply company information as described in Section 13 of the Instruction to Bidders.

CITY OF GRAND JUNCTION, COLORADO

Scott Hockins, Purchasing Supervisor

CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND PLANNING
ENGINEERING DIVISION

INSTRUCTIONS TO BIDDERS

The following instructions are given for the purpose of guiding Bidders in properly preparing their bids and constitute a part of the *Contract Documents* and shall be strictly complied with.

1. Definitions and Terms. See Article I, Section 3 of the General Contract Conditions in the *Standard Contract Documents for Capital Improvements Construction*.
2. Copies of Bid Documents. Complete sets of the *Bid Documents* may be reviewed at the Administration Office of the Department of Public Works and Utilities at City Hall, 250 North 5th Street, Grand Junction, Colorado 81501. Copies thereof may be obtained for the non-refundable sum stated in the Invitation to Bid.

Complete sets of *Bid Documents* shall be used in preparing Bids; neither City nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of *Bid Documents*.

City and Engineer in making copies of *Bid Documents* available on the above terms do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

3. Prequalification of Bidders: Contractors submitting bids over \$50,000 must be prequalified in accordance with the City's "Rules and Procedures for Prequalification of Contractors." Application forms for prequalification are available at the Administration Office of the Department of Public Works and Utilities. Contractors who are currently prequalified with the Colorado Department of Transportation (CDOT) will meet the requirements for prequalification by the City, unless the City has information or basis to the contrary. Application forms for Contractor prequalification are available at the Administration Office of the Department of Public Works and Utilities, City Hall, 250 North 5th Street, Grand Junction, CO, 81501.
4. Liquidated Damages for Failure to Enter Into Contract. Should the Successful Bidder fail or refuse to enter into the Contract within ten Calendar Days from the issuance of the Notice of Award, the City shall be entitled to collect the amount of such Bidder's Bid Guaranty as Liquidated Damages, not as a penalty but in consideration of the mutual release by the City and the Successful Bidder of all claims arising from the City's issuance of the Notice of Award and the Successful Bidder's failure to enter into the Contract and the costs to award the Contract to any other Bidder, to re-advertise, or otherwise dispose of the Work as the City may determine best serves its interest.

5. Time of Completion. Time is of the essence with respect to the time of completion of the Project and any other milestones or deadline which are part of the Contract. It will be necessary for each Bidder to satisfy the City of its ability to complete the Work within the Contract Time set forth in the Contract Documents.
6. Examination of Contract Documents and Site. Before submitting a Bid, each Bidder shall:
 - a. Examine the *Contract Documents* thoroughly;
 - b. Visit the site to familiarize itself with local conditions that may in any manner affect cost, progress, or performance of the Work;
 - c. Become familiar with federal, state, and local laws, ordinances, rules, and regulations that may in any manner affect cost, progress or performance of the Work;
 - d. Study and carefully correlate Bidder's observations with the *Contract Documents*, and;
 - e. Notify the Engineer of all conflicts, errors, ambiguities or discrepancies in or among the *Contract Documents*

On request, the City will provide each Bidder access to the site to conduct such investigations and tests as each Bidder deems necessary for submission of a Bid. It shall be the Bidder's responsibility to make or obtain any additional examinations, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the physical conditions (including without limitation, surface, subsurface and underground utilities) at or contiguous to the site or otherwise which may affect cost, progress or performance of the work and which the Bidder deems necessary to determine its Bid for performing the work in accordance with the time, price and other terms and conditions of the Contract Documents. Location of any excavation or boring made by Bidder shall be subject to prior approval of City and applicable agencies. Bidder shall fill all holes, restore all pavements to match the existing structural section and shall clean up and restore the site to its former condition upon completion of such exploration. The City reserves the right to require the Bidder to execute an access agreement with the City prior to accessing the site.

The lands upon which the Work is to be performed, rights of way, and access thereto, and other lands designated for use by Contractor in performing the Work, are identified on the Drawings.

Information and data reflected in the *Contract Documents* with respect to underground utilities at or contiguous to the site are based upon information and data furnished to the City and the Engineer by the owners of such underground utilities or others, and the City does not assume responsibility for the accuracy or completeness thereof, unless it is expressly provided otherwise in the *Contract Documents*.

By submission of a Bid, the Bidder shall be conclusively presumed to represent that the Bidder has complied with every requirement of these Instructions to Bidders, that the *Contract Documents* are not ambiguous and are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the Work.

7. Interpretations. All questions about the meaning or intent of the *Contract Documents* shall be submitted to the Purchasing Supervisor in writing.

Written comments or questions must be received by the Engineer at least forty-eight (48) hours (excluding Saturdays, Sundays, and Holidays) prior to the time set for Bid Opening.

If questions received by the Engineer or Purchasing Supervisor are deemed to be sufficiently significant and received sufficiently in advance of the Bid opening, an Addendum to the *Bid Documents* may be issued. Otherwise, a written copy of the question and decision or interpretation will be posted in the Engineer's office. It shall be the responsibility of each Bidder to make itself aware of all such posted questions and decisions or interpretations and, by submitting a Bid, each Bidder shall be conclusively be deemed to have such knowledge. After Bid Opening, all Bidders must abide by the decision of the Engineer as to all such decisions or interpretations. Bidders may not rely upon oral interpretations of the meaning of the plans, specifications or other bid documents and any oral or other interpretations or clarifications will be without legal force or effect.

8. Quantities of Work. Materials or quantities stated as unit price items in the Bid are supplied only to give an indication of the general scope of the Work. The City does not expressly or by implication agree that the actual amount of Work or material will correspond therewith, and reserves the right after award to increase or decrease the quantity of any unit item of the Work without a change in the unit price except as set forth in Article VIII, Section 70 of the *General Contract Conditions*. The City also reserves the right to make changes in the Work (including the right to delete any bid item in its entirety or add additional bid items) as set forth in Article VIII, Sections 69 through 71 of the *General Contract Conditions*.

9. Substitutions. The materials, products and equipment described in the *Bid Documents* shall be regarded as establishing a standard of required performance, function, dimension, appearance, or quality to be met by any proposed substitution. No substitution will be considered prior to receipt of Bids unless the Bidder submits a written request for approval to the Engineer at least ten (10) days prior to the date for receipt of Bids. Such requests for approval shall include the name of the material or equipment for which substitution is sought and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for evaluation, including samples if requested. The Bidder shall set forth changes in other materials, equipment, or other portions of the Work including changes of the work of other contracts, which incorporation of the proposed substitution would require to be included. The Engineer's decision of approval or disapproval of a proposed substitution shall be final. If the Engineer approves a proposed substitution before receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

10. Bid Guaranty. Each Bid shall as a guaranty of good faith on the part of the Bidder be accompanied by a Bid Guaranty consisting of: a certified or cashier's check drawn on an approved national bank or trust company in the State of Colorado, and made payable without condition to the City; or a Bid Bond in the form set forth in the *Bid Documents* executed by an approved corporate surety in favor of the City. The amount of the Bid Guaranty shall not be less than 5% of the total Bid amount.

Once the City issues a Notice of Award, the apparent Successful Bidder has ten (10) Calendar Days to enter into a Contract in the form prescribed and to furnish the required Performance and Payment Bonds. Failure to do so will result in forfeiture of the Bid Guaranty to the City as Liquidated Damages.

Bid Guaranties for all except the three lowest qualified Bids shall be returned within five (5) Working Days of Bid Opening. When the Successful Bidder files satisfactory Performance and Payment Bonds and Certificates of Insurance, the Bid Guaranties of the three lowest Bidders shall be returned.

Each bidder shall guaranty its total bid price for a period of sixty-five (65) Calendar Days from the date of the bid opening. Except for forfeiture due to reasons discussed above, Bid Guaranties of all Bidders shall be returned to them within sixty-five (65) Calendar Days from the date of Bid Opening.

11. Bid Form. The Bid Form, provided by the City, must be completed in ink or by typewriter.

The Bidder shall specify a unit price in figures for each pay item for which a quantity is given and shall provide the products (in numbers) of the respective unit prices and quantities in the Extended Amount column. The total Bid price shall be equal to the sum of all extended amount prices. When an item in the Bid Schedule provides a choice to be made by the Bidder, Bidder's choice shall be indicated in accordance with the specifications for that particular item and thereafter no further choice shall be permitted.

Where the unit of a pay item is lump sum, the lump sum amount shall be shown in the "extended amount" column and included in the summation of the total Bid.

All blank spaces in the Bid Form must be properly filled out.

Bids by corporations must be executed in the corporate name by the president or vice president or other corporate office accompanied by evidence of authority to sign. The corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

Bids by partnerships must be executed in the partnership name and signed by a partner whose title must appear under the signature and the official address of the partnership must be shown below the signature.

All names must be typed or printed below the signature.

The Bid shall contain an acknowledgement of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

The address to which communications regarding the Bid are to be directed must be shown.

12. Irregular Bids. A Bid will be considered irregular and may be rejected for the following reasons:

- a. Submission of the Bid on forms other than those supplied by the City;
- b. Alteration, interlineation, erasure, or partial detachment of any part of the forms which are supplied herein;
- c. Inclusion of unauthorized additions conditional or alternate Bids or irregularities of any kind which may tend to make the Bid incomplete, indefinite, or ambiguous as to its meaning;
- d. Failure to acknowledge receipt of any or all issued Addenda;
- e. Failure to provide a unit price or a lump sum price, as appropriate, for each pay item listed except in the case of authorized alternative pay items;
- f. Failure to list the names of Subcontractors used in the Bid preparation as required in the Bid Form;
- g. Submission of a Bid that in the opinion of the Purchasing Manager is unbalanced so that each item does not reasonably carry its own proportion of cost or which contains inadequate or unreasonable prices for any item;
- h. Tying of the Bid with any other bid or contract; and
- i. Failure to calculate Bid prices as described herein.

13. Submission of Bids. The completed Bid Form and Bid Guaranty shall be submitted at the time and place indicated in the Invitation to Bid and must be in a ten-inch by thirteen-inch opaque sealed envelope marked SEALED BID with the project title and the name and address of the Bidder.

Each Bidder submitting a sealed bid shall submit a second sealed envelope containing the following information:

- i. Equipment costs for the following items:
 - 1) Electric Switch Gear and Lighting
 - 2) Gas Compressor
 - 3) Gas Dryer/Filtration Unit
 - 4) Time Fill Assemblies

- ii. Minimum working experience including the following:
 - 1) Five (5) CNG Stations of similar size (up to 500 SCFM) within the past 3 (three) years.
 - 2) List of names and addresses for material suppliers for project being bid.

iii. Buy America Certification

This information shall be supplied at the time the bidder submits their bid for the project; in a ten-inch by thirteen-inch opaque sealed envelope marked MINIMUM WORK EXPERIENCE, EQUIPEMENT COSTS, & BUY AMERICA CERTIFICATION. The envelope shall also display the project title and the bidder name and address.

- 14. Modification and Withdrawal of Bids Before Opening. Bids may be modified or withdrawn by an appropriate document duly executed and delivered to the place where Bids are to be submitted at any time prior to Bid Opening.
- 15. Opening of Bids. Bids will be opened and read aloud at the time and place stated in the Invitation to Bid. All Bidders, their representatives, and other interested parties are encouraged to attend the Bid Opening.

Within five (5) Working Days after Bid Opening, all Bids will be tabulated and copies sent to all Bidders. The bid tabulation sheet(s) will be available to the public.

- 16. Disqualification of Bidders. A Bid will not be accepted from, nor shall a Contract be awarded to, any person, firm, or corporation that is in arrears to the City, upon debt or contract, or that has defaulted, as surety or otherwise, upon any obligation to the City, or that is deemed irresponsible or unreliable.

Bidders may be required to submit satisfactory evidence that they are responsible, have a practical knowledge of the project bid upon and that they have the necessary financial and other resources to complete the proposed Work.

Either of the following reasons, without limitation, shall be considered sufficient to disqualify a Bidder and Bid:

- a. More than one Bid is submitted for the same Work from an individual, firm, or corporation under the same or different name; and
 - b. Evidence of collusion among Bidders. Any participant in such collusion shall not receive recognition as a Bidder for any future work of the City until such participant has been reinstated as a qualified bidder.
- 17. Withdrawal of Bids After Opening. No Bid may be withdrawn by any bidder for sixty-five (65) Calendar Days after the Bid Opening.

18. Evaluation of Bids and Bidders. The City reserves the right to:

- reject any and all Bids,
- waive any and all informalities,
- negotiate final terms with the Successful Bidder, and
- disregard any and all nonconforming, nonresponsive or conditional Bids.

Discrepancies between words and figures will be resolved in favor of words. Discrepancies between Unit Prices and Extended Prices will be resolved in favor of the Unit Prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. The corrected extensions and totals will be shown in the tabulation of Bids.

The City may consider the qualifications and experience of Subcontractors and other persons and organizations (including those who are to furnish the principal items of material or equipment) proposed for those portions of the work as to which the identity of Subcontractors and other persons and organizations must be submitted. Operating costs, maintenance considerations performance data, and guarantees of materials and equipment may also be considered by the City.

The City will conduct such investigations as deemed necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of the Bidders, proposed Subcontractors and other persons and organizations to do the Work in accordance with the *Contract Documents* to the City's satisfaction within the Contract Time.

The Bidder shall furnish the City all information and data requested by the City to determine the ability of the Bidder to perform the Work. The City reserves the right to reject the Bid if the evidence submitted by, or investigation of such Bidder fails to satisfy the City that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the Work contemplated therein.

By submitting a Bid, each Bidder authorizes the City to perform such investigation of the Bidder as the City deems necessary to establish the responsibility, qualifications and financial ability of the Bidder and, by its signature thereon, authorizes the City to obtain reference information concerning the Bidder and releases the party providing such information and the City from any and all liability to the Bidder as a result of such reference information so provided.

The City reserves the right to reject the Bid of any Bidder who does not pass any evaluation to the City's satisfaction.

If the Contract is to be awarded, it will be awarded to the Bidder who, by evaluation, the City determines will best meet the City's interests.

The City reserves the right to accept or reject the Work contained in any of the Bid Schedules or alternates, either in whole or in part.

19. Award of Contract. Unless otherwise indicated, a single award will be made for all the bid items in an individual bid schedule. In the event that the Work is contained in more than one Bid Schedule, the City may award Schedules individually or in combination. In the case of two Bid Schedules which are alternative to each other, only one of such alternative Schedules will be awarded. Within forty-five (45) Calendar Days of Bid Opening, the City will issue a Notice of Award to the Successful Bidder which will be accompanied by four (4) unsigned copies of the Contract and the Performance and Payment Bond forms. Within ten (10) Calendar Days thereafter, the Successful Bidder shall sign and deliver four (4) copies of the Contract, Performance Bond, Payment Bond and Certificates of Insurance to the City. Within ten (10) Calendar Days thereafter, the City will deliver two (2) fully executed counterparts of the Contract to the Contractor. No contract shall exist between the Successful Bidder and the City and the Successful Bidder shall have no rights at law or in equity until the Contract has been duly executed by the City.

The Successful Bidder's failure to sign and submit a Contract and other documents set forth in this Paragraph within the prescribed time shall be just cause of annulment of the award, and forfeiture of the Bid Guaranty. The award of Contract may then be made to the next qualified Bidder in the same manner as previously prescribed.

20. Insurance. The Contractor shall secure and maintain such insurance policies as will provide the coverage and contain other provisions specified in the General Contract Conditions, or as modified in the Special Contract Conditions.

The Contractor shall file four (4) copies of the policies or Certificates of Insurance acceptable to the City with the Purchasing Supervisor within ten (10) Calendar Days after issuance of the Notice of Award. These Certificates of Insurance shall contain a provision that coverage afforded under the policies shall not be canceled unless at least thirty (30) Calendar Days prior written notice has been given to the City.

21. Sales and Use Taxes. The Contractor and all Subcontractors are required to obtain exemption certificates from the Colorado Department of Revenue for sales and use taxes in accordance with the provisions of the General Contract Conditions. Bids shall reflect this method of accounting for sales and use taxes on materials, fixtures and equipment.

22. Affirmative Action. In executing a Contract with the City, the Contractor agrees to comply with Affirmative Action and Equal Employment Opportunity regulations presented in the General Contract Conditions.

23. Preconstruction Meeting. Prior to the commencement of construction activities, a preconstruction meeting shall be held which shall include the Contractor, representatives of the City, utility companies and others effected by or involved in the project. Attendance by the Contractor is mandatory.

24. Pre-Bid Meeting. See the Special Conditions for details of pre-bid meeting (if any).

BID FORMS

CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND PLANNING
ENGINEERING DIVISION

BID FORM
FOR
CNG Slow-Fill Station & Shop Bay Upgrades

TO: The City of Grand Junction
250 North Fifth Street
Grand Junction, Colorado 81501-2668

The undersigned Bidder, having thoroughly examined the Construction Drawings, Specifications, and other Bid Documents; having investigated the location of, and conditions affecting the proposed work, and being acquainted with and fully understanding the extent and character of the Work covered by this Bid; and all other factors and conditions affecting or which may be affected by the Work:

HEREBY PROPOSES and agrees, if this Bid is accepted, to enter into a Contract with the City on the form included in the *Contract Documents* and to furnish all required materials, tools, equipment, and plant; to perform all necessary labor and superintendence; and to undertake and complete the Work or approved portions thereof, in full accordance with and in conformity with the Construction Drawings, Specifications, and all other Contract Documents hereto attached or by reference made a part hereof, and for the following prices.

Bid Schedule: CNG Slow Fill Station & Shop Bay Upgrades

| Item No. | CDOT, City Ref. | Description | Quantity | Units | Unit Price | Total Price |
|----------|-----------------|---|----------|----------|-------------|---------------------|
| 1 | *SP | Packaged Compressor Unit | 1. | Lump Sum | \$ _____ | \$ _____ |
| 2 | *SP | Natural Gas Dryer | 1. | Lump Sum | \$ _____ | \$ _____ |
| 3 | *SP | Time Fill Post | 10. | Each | \$ _____ | \$ _____ |
| 4 | *SP | Remote System Notification | 1. | Lump Sum | \$ _____ | \$ _____ |
| 5 | *SP | Instrumentation & Controls, Piping/Tubing | 1. | Lump Sum | \$ _____ | \$ _____ |
| 6 | *SP | Methane Detection System | 1. | Lump Sum | \$ _____ | \$ _____ |
| 7 | *SP | Shop Bay Upgrades | 1. | Lump Sum | \$ _____ | \$ _____ |
| 8 | *SP | Site Work | 1. | Lump Sum | \$ _____ | \$ _____ |
| 9 | 625 | Survey | 1. | Lump Sum | \$ _____ | \$ _____ |
| 10 | 620 | Portable Sanitary Facility | 1. | Each | \$ _____ | \$ _____ |
| 11 | 626 | Mobilization | 1. | Lump Sum | \$ _____ | \$ _____ |
| MCR | | Minor Contract Revisions | 1. | Lump Sum | \$25,000.00 | <u>\$ 25,000.00</u> |

*SP = See Special Provisions

Bid Amount: \$ _____

The undersigned Bidder hereby agrees to execute the Contract in conformity with this Bid, to have ready and furnish the required Payment and Performance Bonds, executed by a Surety acceptable to the City and provide Certificates of Insurance evidencing the coverage and provisions set forth in Contract within ten (10) Calendar Days of the City's issuance of a Notice of Award.

The _____, a corporation of the State of _____, is hereby proposed as Surety on said Performance and Payment Bonds. If such Surety is not approved by the City, another and satisfactory Surety will be proposed.

Enclosed herewith is a Bid Guaranty as defined in the attached Instructions to Bidders in the amount of _____ which Bid Guaranty the undersigned Bidder agrees to be paid to and become the property of the City, as Liquidated Damages and not as a penalty should the Bid be accepted, the Contract Notice of Award issued, and should the Bidder fail or refuse for any reason to enter into the Contract in the form prescribed. The Bidder shall furnish the required Bonds and Insurance Certificates within ten (10) Calendar Days of issuance of the Notice of Award.

The following persons, firms or corporations are interested as joint ventures, partners or otherwise with the undersigned Bidder in this proposal:

Name: _____

Address: _____

Name: _____

Address: _____

If there are no such persons, firms or corporations, please so state in the following space. _____

The undersigned Bidder proposes to subcontract the following portion of Work:

| <u>Name & address of Sub-Contractor</u> | <u>Description of work to be performed</u> | <u>% of Contract</u> |
|---|--|--------------------------|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

The undersigned Bidder acknowledges the right of the City to reject any and all Bids submitted and to waive informalities and irregularities therein in the City's sole discretion.

By submission of the Bid, each Bidder certifies, and in the case of a joint Bid each party thereto certifies as to his own organization, that this Bid has been arrived at independently, without collusion, consultation, communication, or agreement as to any matter relating to this Bid with any other Bidder or with any competitor.

The Work shall be completed within the Contract Time as specified in the Special Conditions.

Bidder hereby acknowledges receipt of Addenda Numbers: ____, ____, ____, ____.

By submission of a Bid, the Bidder shall be conclusively presumed to represent that the Bidder has complied with every requirement of the "Instructions to Bidders".

Bidder, by his signature hereon, hereby authorizes the obtaining of reference information containing the Bidder's qualifications, experience and general ability to perform the work and hereby releases the party providing such information and the City from any and all liability to Bidder as the result of such reference information being provided. Bidder further waives any right to receive copies of information so provided to the City.

Bidder agrees to perform all Work described in the Contract Documents for the unit prices or the lump sum as shown on the Bid Form, and acknowledges that the quantities shown on the Bid Schedule are approximate only and are intended principally to serve as guides for the purpose of comparing and evaluating Bids.

It is further agreed that any quantities of work to be performed at unit prices and material to be furnished may be increased or decreased as may be considered necessary in the opinion of the City, to complete the Work fully as planned and contemplated, and that all quantities of Work, whether increased or decreased, are to be performed at the unit prices set forth in the Bid, except as otherwise provided for in the Contract Documents.

It is further agreed that any lump sum prices may be increased to cover additional work ordered by the City, but not shown on the Plans or required by the Specifications, in accordance with the provisions of the Contract Documents. Similarly, they may be decrease to cover deletions of work so ordered.

By submitting a Bid, the Bidder acknowledges that the bid process is solely intended to serve the public interest in achieving the highest quality of services and goods at the lowest price, and that no right, interest or expectation shall inure to the benefit of the Bidder as the result of any reliance or participation in the process.

The undersigned Bidder further grants to the City the right to award this Contract on the basis of any possible combination of base bids and alternate(s) (if any) that best suit the City's needs.

Dated this _____ day of _____, 20__.

Bidder: _____

Address: _____

Signature: _____

Name printed: _____

Title: _____

If a corporation:

State of incorporation: _____

Attest: _____

(seal)

BID BOND

KNOW ALL MEN BY THESE PRESENTS,

that we, _____ (___ an individual, ___ a partnership, ___ a corporation incorporated in the State of _____) as Principal, and _____ (incorporated in the State of _____) as Surety, are held and firmly bound unto the City of Grand Junction, Colorado, (hereinafter called "City") in the penal sum of _____ dollars (\$ _____), lawful money of the United States, for the payment of which sum we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that WHEREAS the Principal has submitted the accompanying Bid dated _____ for construction of _____ (the Project) for the City and

WHEREAS, the City has required as a condition for receiving said Bid that the Principal deposit with the City either a cashier's check or a certified check equivalent to not less than five percent of the amount of said Bid or in lieu thereof furnish a Bid Bond for said amount conditioned that in event of a failure to execute the proposed Contract for such construction and to provide the required Performance and Payment Bonds and Insurance Certificates if the Contract be awarded to the Bidder, that said sum be paid immediately to the City as Liquidated Damages and not as a penalty for the Principal's failure to perform.

NOW, THEREFORE, if the Principal shall, within the period specified therefore, on the attached prescribed forms presented to the Bidder for signature, enter into a written Contract with the City in accordance with said Bid as accepted, and give Performance and Payment Bonds with good and sufficient Surety, or Sureties, as may be required upon the forms prescribed by the City, for the faithful performance and the proper fulfillment of said Contract, provide Certificates of Insurance as required by said Contract, and provide all other information and documentation required by the Contract Documents, then this obligation shall be void and of no effect, otherwise to remain in full force and effect. In the event suit is brought upon this bond by the City and the City prevails, the principal and surety shall pay all costs incurred by the City in such suit, including reasonable attorneys' fees and costs to be fixed by the Court.

IN WITNESS WHEREOF, the above bound parties have executed this instrument under their several seals the name and corporate seal of each corporate party being hereto affixed and duly signed by its undersigned representative pursuant to authority of its governing board.

Dated this _____ day of _____, 20__.

Principal: _____

Address: _____

Signed: _____

(seal)

Title: _____

Surety: _____

Address: _____

Signed: _____

(seal)

Title: _____

INSTRUCTIONS FOR COMPLETING BID BOND

1. The full legal name and residence of each individual executing this Bond as Principal must be inserted in the first paragraph.
2. If the Principal is a partnership, the full name of the partnership and all individuals must be inserted in the first paragraph which must recite that individuals are partners composing the partnership, and all partners must execute the Bond as individuals.
3. The State of incorporation of each corporate Principal or Surety to the Bond must be inserted in the first paragraph and the Bond must be executed under the corporate seal of said party attested by its secretary or other appropriate officer.
4. Attach a copy of the power-of-attorney for the Surety's agent.

SPECIAL CONDITIONS

CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND PLANNING
ENGINEERING DIVISION

CNG Slow-Fill Station & Shop Bay Upgrades

SPECIAL CONDITIONS

The performance of the Work for this Project shall conform to the General Contract conditions presented in the City of Grand Junction's *Standard Contract Documents for Capital Improvements Construction*, March 2010, except as specifically modified or supplemented herein or on the Construction Drawings.

- SC-1** **Project Description:** The project generally consists of the installation of 100 SCFM gas meter, 500 SCFM gas dryer, two -50 SCFM gas compressors (40 hp each), 10 – time fill dispenser hose drops, site grading, equipment pads, fencing/barricades, telephone system, associated electrical and gas plumbing, alarm system and associated appurtenances; Retrofitting two existing bay areas with; new partition wall & interior man door, explosion proof receptacles, gas detection alarm system, exterior bay door, motor operator(s), gas detection panels, combustible gas sensor, HVAC modifications, plumbing, associated work and appurtenances.
- SC-2** **Project Engineer:** The Project Engineer for the Project is Bret Guillory, who can be reached at (970) 244-1590 All notices, letters, submittals, and other communications directed to the City shall be addressed and mailed or delivered to:
- City of Grand Junction
Department of Public Works and Planning
Attn: Bret Guillory PE, Utility Engineer
250 North Fifth Street
Grand Junction, CO 81501
- SC-3** **Pre-Bid Meeting:**
There will be a pre-bid meeting for this project. The pre-bid meeting is not mandatory but attendance is strongly recommended. A pre-bid meeting will be held at 2:00 p.m. on Tuesday, July 13, 2010, in the Public Works and Planning Executive Conference Room, 250 North 5th Street.
- SC-4** **Affirmative Action:** The Contractor is not required to submit a written Affirmative Action Program for the Project.
- SC-5** **Time of Completion:** The scheduled time of Completion for the Project is **91 Calendar Days** from the starting date specified in the Notice to Proceed.

Completion is achieved when site clean-up and all punch list items (resulting from the final inspection) have been completed. Completion shall have the meaning set forth in Article I, Section 3 (Definitions and Terms) of the General Contract Conditions.

The anticipated schedule for the Project is as follows:

| | |
|---|-------------------|
| Bid Opening: | July 20, 2010 |
| City Council approval: | August 2, 2010 |
| Notice of Award: | August 3, 2010 |
| Contractor delivers Contract, Bond and Insurance Cert. | August 9, 2010 |
| Preconstruction meeting: | August 9, 2010 |
| Begin work: | August 16, 2010 |
| Final Completion: | November 15, 2010 |
| • City observed holidays during construction period: | |
| Labor Day | September 6, 2010 |

SC-6 Liquidated Damages:

If the Contractor does not achieve Final Completion by the required date, whether by neglect, refusal or any other reason, the parties agree and stipulate that the Contractor shall pay liquidated damages to the City for each such day that final completion is late. As provided elsewhere, this provision does not apply for delays caused by the City. The date for Final Completion may be extended in writing by the Owner.

The Contractor agrees that as a part of the consideration for the City's awarding of this Contract liquidated damages in the daily amount of **\$500.00** is reasonable and necessary to pay for the actual damages resulting from such delay. The parties agree that the real costs and injury to the City for such delay include hard to quantify items such as: additional engineering, inspection and oversight by the City and its agents; additional contract administration; inability to apply the efforts of those employees to the other work of the City; perceived inefficiency of the City; citizens having to deal with the construction and the Work, rather than having the benefit of a completed Work, on time; inconvenience to the public; loss of reputation and community standing for the City during times when such things are very important and very difficult to maintain.

The Contractor must complete the Work and achieve final completion included under the Bid Schedule in the number of consecutive calendar days after the City gives is written Notice to Proceed. When the Contractor considers the entire Work ready for its intended use, Contractor shall certify in writing that the Work is substantially complete. In addition to the Work being substantially complete, Final Completion date is the date by which the Contractor shall have fully completed all clean-up, and all items that were identified by the City in the inspection for final completion. Unless otherwise stated in the Special Conditions, for purposes of this liquidated damages clause, the Work shall not be finished and the Contract time shall continue to accrue until the City gives its written Final Acceptance.

If the Contractor shall fail to pay said liquidated damages promptly upon demand thereof after having failed to achieve Final Completion on time, the City shall first look to any

retainage or other funds from which to pay said liquidated damages; if retainage or other liquid funds are not available to pay said liquidated damages amounts, the Surety on the Contractor's Performance Bond and Payment Bond shall pay such liquidated damages. In addition, the City may withhold all, or any part of, such liquidated damages from any payment otherwise due the Contractor.

Liquidated damages as provided do not include any sums to reimburse the City for extra costs which the City may become obligated to pay on other contracts which were delayed or extended because of the Contractor's failure to complete the Work within the Contract Time. Should the City incur additional costs because of delays or extensions to other contracts resulting from the Contractor's failure of timely performance, the Contractor agrees to pay these costs that the City incurs because of the Contractor's delay, and these payments are separate from and in addition to any liquidated damages.

The Contractor agrees that the City may use its own forces or hire other parties to obtain Substantial or Final Completion of the work if the time of completion has elapsed and the Contractor is not diligently pursuing completion. In addition to the Liquidated Damages provided for, the Contractor agrees to reimburse the City for all expenses thus incurred.

SC-7 **Working Days and Hours:** The working days and hours shall be as stated in the General Contract Conditions, Section VI, or as mutually agreed upon in the preconstruction meeting.

SC-8 **Permits:**
The following permits are required for the Project and will be obtained by the City at no cost to the Contractor:

- *None*

The following permits are required for the Project and shall be obtained and paid for by the Contractor, with the costs included in the total bid price for the Project:

- Mesa County Building Permit

SC-9 **Insurance Limits:** The minimum insurance limits for the Project are as stated in the General Contract Conditions.

SC-10 **City Furnished Materials:** The City will furnish the following materials for the Project:
AutoCAD site drawings, if necessary, for survey stake-out

SC-11 **Project Newsletters:** Project news letters will not be required for this project.

SC-12 **Project Sign:** Project signs, if any, will be furnished and installed by the City.

SC-13 **Authorized Representatives of the City:** Those authorized to represent the City shall include engineers and inspectors employed by the City, only.

SC-14 **Uranium Mill Tailings:** It is anticipated that radioactive mill tailings will not be encountered on this project.

SC-15 **Fugitive Petroleum or Other Contamination:** It is anticipated that soil contamination from fugitive petroleum or other contaminants will not be encountered with the Project.

SC-16 **Traffic Control:** The Contractor shall provide and maintain traffic control in accordance with the approved Traffic Control Plan and the *Manual on Uniform Traffic Control Devices*. The Contractor shall present the construction schedule and the traffic control plan at the preconstruction meeting for review and approval. The following guidelines and limitations shall apply to the traffic control:

Access from Riverside Parkway:

Signage in accordance with MUTCD shall be provided for truck access from the Riverside Parkway to the project site.

SC-17 **Work Location Schedules:**

1. The Contractor will be allowed to work on any day with exception of weekends or City observed holidays.

SC-18 **Stormwater Management Plan:**

Existing curbside storm drain inlet basins are located along the Riverside Parkway, each inlet that may receive storm water runoff from the disturbed site shall receive stormwater protection in the form of a “Silt Sack” or “Filter Sock” before digging in the area begins. The inlet basin stormwater protection devices shall remain in place until the Contractor has completed the site work operations and the street has been swept clean. The Contractor shall also be responsible for maintaining the inlet basin protection device throughout construction and periodically inspecting the inlet basin protection device during construction. In addition, after every rainfall and/or snowmelt event the Contractor shall inspect all inlet basin protection devices on the project. The Contractor shall be responsible for either cleaning or replacing the inlet basin protection device when the capacity of the protection device has reached 50% of its full capacity. The Contractor shall take into account the associated maintenance cost in the specific pay item.

Street sweeping shall be periodically completed in the traffic lanes where material from the construction site has been tracked by vehicles. The street sweeping machine shall be capable of both sweeping and vacuuming up the roadway dirt. A machine that only sweeps will not be accepted and will not be paid for. The Contractor shall submit for approval a description of the street cleaning machine to be used prior to cleaning the street. Street sweeping will be paid for by the hour as shown in the Bid Schedule.

The Contractor shall provide an acceptable method of mitigating sediment transport from excavation spoil piles in the event of a rainstorm and/or snow melt event.

All vehicle and equipment maintenance and fueling shall be performed in a designated area within the construction area that will not interfere with roadway

traffic operations unless traffic control is provided. The fueling area shall exhibit Best Management Practices in order to minimize and/or eliminate the potential of fuel spillage. Any spillage of fuel onto the ground shall be immediately cleaned up and any contaminated soil disposed of properly at the Mesa County Landfill. Documentation of spills, leaks and overflows that result in the discharge of pollutants, including logging and reporting of the spill is required to the Water Quality Control Division at their toll-free 24-hour environmental emergency spill reporting line – 1-877-518-5608.

The Contractor shall clear the site of all on-site waste daily, including scrap from construction materials.

Concrete trucks will be required to wash out in a portable concrete washout pool supplied by the Contractor or the concrete truck can wait to washout back at the concrete batching facility. The Contractor will be responsible for maintaining the washout pool. The washout pool shall be cleaned out and/or replaced when the washout pool reaches 50% of total capacity. The concrete washout pool needs to be dynamic and durable in its ability to be moved with the progress of construction.

The Contractor shall clear the site of all trash and litter daily. Portable toilets will be maintained (cleaned and emptied) by a local supplier.

SC-19 **Construction Equipment Storage:**

During construction the Contractor will be allowed to store construction equipment and/or construction materials within the fenced area adjacent to the site.

SC-20 **Schedule of Submittals:**

The Contractor shall provide these specific submittals at the preconstruction meeting:

- Hourly rate table for labor and equipment to be used on this project.
- Traffic Control Plan
- Construction Schedule
- Equipment – Electric Switch Gear, Lighting, Gas Meter, Compressor, Dryer/Filtration Unit, Time Fill Assemblies.
- Fittings/connectors
- Electrical Panel
- Concrete Washout Facility
- Base course gradation, Proctor Curve (Class 6)
- Concrete mix design, Class B

SC-21 **Discrepancy between Bid Schedule and Construction Notes:** In the event of a discrepancy between a Pay Item description in the Bid Schedule and the description for the same Pay Item in the drawings/construction notes; the language in the Bid Schedule shall govern or supersede that found elsewhere.

SC-22 **Existing Utilities and Structures:** The location of existing utilities and structures shown on the Plans are approximate. It is the responsibility of the Contractor to locate and protect all structures and utilities in accordance with General Contract Condition

Section 37. The Contractor shall coordinate with the utility companies any necessary relocation of utilities and schedule his work accordingly.

SC-23 **Incidental Items:** Any item of work not specifically identified or paid for directly, but which is necessary for the satisfactory completion of any paid items of work, will be considered as incidental to those items, and will be included in the cost of those items.

SC-24 **Buy America Requirement:** This project is being funded, in part, by EECBG (Energy Efficiency and Conservation Block Grant) through the American Recovery and Reinvestment Act of 2009 and is subject to the Buy American Requirement.

Buy American Requirement - Construction. ARRA §1605. All iron, steel and manufactured goods used in any ARRA Project for the construction, alteration, maintenance, or repair of a public building or public work shall be produced in the United States in a manner consistent with United States obligations under international agreements. This requirement can be waived only by the awarding Federal Agency in limited situations.

Bid must include a letter of certification that the goods and materials proposed for the project are in compliance with the Buy American provision of ARRA.

SC-25 **Davis-Bacon Wage Restrictions:** Davis Bacon wage restrictions will be required for this project. Wage rates will be based on;

General Decision Number CO100012, 06/04/2010, CO12 for Heavy construction,

General Decision Number CO100014, 06/04/2010, CO14 for Highway construction,

General Decision Number CO100007, 06/04/2010, CO7 for Building construction,

All three general decisions to be used by the Contractor are subject to approval by the Department of Labor.

SPECIAL PROVISIONS

CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND PLANNING
ENGINEERING DIVISION

**CNG Slow-Fill Station & Shop Bay Upgrades
SPECIAL PROVISIONS**

GENERAL:

The descriptions of the pay items listed in the Bid Schedule for this Project may not agree with those listed in the Standard Specifications. Payment for all Work performed, as required in the Contract Documents, will be in accordance with the items and units listed in the Bid Schedule.

STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION:

The *City of Grand Junction Standard Specifications for Road and Bridge Construction* are hereby modified or supplemented for this Project by the following modifications to *The Standard Specifications for Road and Bridge Construction*, State Department of Highways, Division of Highways, State of Colorado:

SP-1 PACKAGED COMPRESSION UNIT

General:

Materials for the Natural Gas Compression Unit shall be as described in Section 2.2 of the Technical Specifications included in Appendix B, and appropriate plan sheets.

Method of Measurement – By Lump Sum

Basis for Payment - Includes all work and materials needed for installation of the natural gas packaged compression unit, electric motors, enclosure, system connections, required to provide a complete working unit as described in the Standard Contract Documents, Technical Specifications, and Project Plan Set.

SP-2 NATURAL GAS DRYER

General:

Materials for the Natural Gas Dryer Unit shall be as described in Section 2.3 of the Technical Specifications included in Appendix B, and appropriate plan sheets.

Method of Measurement – By Lump Sum

Basis for Payment - Includes all work and materials needed for installation of the natural gas dryer skid, molecular sieve, adsorption tower and filters, regeneration system, dewpoint

monitoring system, enclosure, and system connections required to provide a complete working unit as described in the Standard Contract Documents, Technical Specifications, and Project Plan Set.

SP-3 TIME FILL POSTS

General:

Materials for the Time Fill Posts shall be as described in Section 2.4 of the Technical Specifications included in Appendix B, and appropriate plan sheets.

Method of Measurement – By Each

Basis for Payment - Includes all work and materials needed for installation of the time fill posts, hose breakaways, twin-hose assembly, fueling nozzle, isolation and bleed valves, and system connections, required to provide a complete working unit as described in the, Standard Contract Documents, Technical Specifications, and Project Plan Set.

SP-4 REMOTE SYSTEM NOTIFICATION

General:

Materials for the Remote System Notification shall be as described in Section 2.5 of the Technical Specifications included in Appendix B, and appropriate plan sheets.

Method of Measurement – By Lump Sum

Basis for Payment - Includes all work and materials needed for installation of the auto dialer to allow remote notification of station shutdowns as described in the Standard Contract Documents, Technical Specifications, and Project Plan Set.

SP-5 INSTRUMENTATION & CONTROLS, PIPING / TUBING

Clarification:

Instrumentation and Controls, Piping / Tubing materials that are needed for various equipment shall conform to sections 2.6 and 2.7 of the Technical Specifications included in Appendix B, and as identified on appropriate Plan Sheets.

Method of Measurement – There will be no separate measurement for these items.

Basis for Payment - There will be no separate payment for these items. Payment shall be included in the other bid schedule items as applicable.

SP-6 METHANE DETECTION SYSTEM

General:

Materials for the Methane Detection System shall be as described in Section 16700 of the Technical Specifications included in Appendix B, and appropriate Plan Sheets.

Method of Measurement – By Lump Sum

Basis for Payment - Includes all work and materials needed for installation of the Methane Detection System for both the time fill station and shop bay upgrades to allow control of electrical components, and remote notification of station shutdowns as described or shown in the Standard Contract Documents, Technical Specifications, and Project Plan Set.

SP-7 SHOP BAY UPGRADES

General:

Materials for the modification to the existing shop bays shall be as described on the Plan Sheets and shall meet all requirements of the Mesa County Building Code, Technical Specifications included in Appendix B, and appropriate Plan Sheets.

Method of Measurement – By Lump Sum

Basis for Payment - Includes all work and materials needed for modification of the two shop bays including demolition of wall(s), installation of wall(s), Gas alarm Ventilation, installation of over head garage door(s) and motor(s), man door, motor operators for doors, demolition of existing Unit Heaters (deliver removed units to city), connection to the Methane Detection System, and all other; Electrical, HVAC, Plumbing modifications as described or shown in the Standard Contract Documents, Technical Specifications, and Project Plan Set.

SP-8 SITE WORK

General:

Materials for the site work shall be as described on the Plan Sheets and shall meet all requirements of the Mesa County Building Code, City of Grand Junction Standard Contract Documents, Technical Specifications included in Appendix B, and appropriate Plan Sheets.

Method of Measurement – By Lump Sum

Basis for Payment - Includes all work and materials needed for grading, concrete flat work, fencing, barricades, bollards, gates, light poles & luminaires, motion lights, outlets, conduits, distribution gear, electrical panels, described or shown in the Standard Contract Documents, Technical Specifications, and Project Plan Set.

STANDARD SPECIFICATIONS FOR CONSTRUCTION OF WATER LINES, SANITARY SEWERS, STORM DRAINS, UNDERDRAINS AND IRRIGATION SYSTEMS

The City of Grand Junction *Standard Specifications for Construction of Water Lines, Sanitary Sewers, Storm Drains, Underdrains and Irrigation Systems* are hereby modified for this Project as follows:

No Change

Appendix A
Project Submittal Form

PROJECT SUBMITTAL FORM

PROJECT: CNG Slow-Fill Station & Shop Bay Upgrades

CONTRACTOR:

Project Engineer: Bret Guillory

| Description | Date Received | Re-submittal Requested | Re-submittal Received | Date Accepted |
|-------------|---------------|------------------------|-----------------------|---------------|
|-------------|---------------|------------------------|-----------------------|---------------|

SITE CONSTRUCTION

| | | | | |
|--|--|--|--|--|
| Base course gradation, Proctor curve (Class 6) | | | | |
| Concrete mix design, Class B | | | | |

COMPRESSOR, DRYER, METERING & FILL STATION CONSTRUCTION

| | | | | |
|-------------------------------------|--|--|--|--|
| Gas Dryer/Filtration Unit | | | | |
| Gas Compressor Unit | | | | |
| Gas Meter | | | | |
| Gas Dispensing Equipment | | | | |
| Bill of Materials | | | | |
| Gas Detection Control System | | | | |
| Overhead & Man Doors | | | | |
| Motors/ Operators for Overhead Door | | | | |
| | | | | |
| Conduit materials (all sizes) | | | | |

EROSION CONTROL / STORMWATER MANAGEMENT

| |
|--|
| |
|--|

| | | | | |
|-----------------------------|--|--|--|--|
| Inlet Basin Protection | | | | |
| Concrete Washout | | | | |
| | | | | |
| PERMITS, PLANS, OTHER | | | | |
| Traffic Control Plan(s) | | | | |
| Mesa County Building Permit | | | | |
| | | | | |
| | | | | |

Appendix B
Technical Specifications

**TECHNICAL SPECIFICATIONS FOR
CNG SLOW – FILL
STATION & SHOP BAY
UPGRADES
MUNICIPAL SERVICE CENTER
CITY OF GRAND JUNCTION, COLORADO**

PREPARED BY:

**Raymundo Engineering Company, Inc.
390 N. Wiget Lane, Suite 150
Walnut Creek, CA 94598**

June 8, 2010

SECTION 08331

GARAGE DOOR MOTOR OPERATORS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Provide motor operators to existing garage doors as shown on drawings. Operators shall be suitable for Class 1, Division 2 areas. Operators shall be activated by new manual open-close-stop push-buttons or upon gas detection. Service and repair doors as required for proper operation.
- B. Provide explosion–proof electrical sensing system, with cord reel, to the bottom edge of door to sense obstruction and signal the motor operator to stop and open the door. The sensing device for entrapment protection (safety edge type) shall meet current codes.

1.2 SUBMITTALS

- A. Shop drawings and manufacturer's data: Submit shop drawings showing general arrangement and details of mounting electrical connections, installation details.
- B. Operation and maintenance data including instructions on installation, operations, maintenance, pulley adjustment, safety information, cleaning, troubleshooting guide, parts list, warranty, and electrical wiring diagrams. The manual shall include a preventive maintenance program that lists maintenance tasks and their frequency for proper maintenance of the garage door motor operators and safety edge systems.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.
- B. Storage: Store materials in a dry area indoor, protected from damage, and in accordance with manufacturer's instructions. For long term storage follow manufacturer's Installation, Operations, and Maintenance Manual.
- C. Handling: Handle and lift motor operators in accordance with the manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer.

1.4 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- B. The warranty of this equipment is to be free from defects in material and workmanship for a period of one year from Owner's acceptance of the Project. Any units or parts which prove defective during the warranty period will be replaced at the Manufacturers option when returned to Manufacturer, transportation prepaid.

PART 2 – PRODUCTS

2.1 ACCEPTABLE SUPPLIERS

- A. Overhead Door Company
- B. Or approved equal

2.2 MOTOR OPERATING MECHANISM

- A. Motor operator shall be UL listed operator suitable for use in Class 1, Division 2 areas. Operator shall have a floor level disconnect with electrical interlock for manual chain hoist operation. Operator shall also have full overload protection, heavy duty reversing controller, electric solenoid brake, right or left-hand vertical mount (Owner shall specify mounting side), and gear type power train assembly.
- B. Motors shall be continuous duty, high starting torque, instant reversing commercial door operator designed for use with heavy duty rolling doors. Motor voltage shall be as shown on the drawings.
- C. Door operator shall be activated either by manual push button station or automatically by gas detection.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The contractor shall install motors and door safety systems complete with necessary hardware and specific features to effectively open and close openings; use competent mechanics skilled in overhead coiling door installation, and work under direct supervision of door manufacturer's authorized representative in accordance with manufacturer's instructions; adjust each door for smooth operation; and lubricate all parts requiring lubrication. A retractable cord reel shall be used to restrain and protect the control line for the safety edge system.

- B. The Contractor shall return three months and twelve months after installation of the door motor operators to readjust each door system for smooth operation and to lubricate all parts requiring lubrication.

END OF SECTION

DIVISION 9 - FINISHES

SECTION 09910 - PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. These specifications include painting above ground bare metal surfaces (except stainless steel) such as station piping, supports, and vents.

1.2 COLORS AND SAMPLES SUBMITTAL

- A. Samples: Before beginning work, prepare for Owner's approval a sample of each color and finish required. Such approved samples shall constitute standards for color and finish for acceptance or rejection of completed work. All work shall match the approved colors and samples.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Manufacturers: Materials are specified by brand names to establish a standard of quality, or by performance requirements, appearance, and general description of product. Materials shall be Fuller-O'Brien, Kelley-Moore, Glidden, or equal. The term "paint" as used herein includes enamels, paints, stains, varnishes, emulsions, lacquers and sealers. The term "painting" as used herein means the application of such materials.
- B. List of Materials: Submit a complete list of all materials proposed for use, together with manufacturer's specifications.
- C. Unsuitability of Specified Products: No claim by the Contractor concerning the unsuitability of any material specified or inability to produce first class work with same will be entertained unless such claim is made in writing to the Owner's Representative before the work is started.
- D. Color and Life of Film: Colors of all surfaces finished under this section shall, at the end of one (1) year, have remained free from serious fading, and variations, if any, shall be uniform. All materials shall have their original adherence at the end of one (1) year and there shall be no evidence of blisters, running, peeling, scaling, chalking, streaks or stains at the end of this period. Washing with alkali-free soap and water shall remove surface dirt without producing any deteriorating effects.

- E. All paint and priming products, whether shop or field applied, shall be lead, chromium, and cadmium free. In addition, these products and all other material used shall comply with local, regional, state, and Federal air quality rules.

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE

- A. All painting materials shall be delivered to the site in the manufacturer's original containers with labels intact and seals unbroken. They shall be kept in a locked, well-ventilated storage place assigned for this purpose. Receiving, opening, and mixing of all paint materials shall be done in this room. Storage space shall be kept clean and neat. Oily rags shall be removed and disposed of each day and all other necessary precautions shall be taken to avoid danger of fires.

3.2 WEATHER AND TEMPERATURE

- A. Surfaces shall be painted only when they are free from moisture. No painting on exterior surfaces shall be done less than 72 hours of actual drying weather after a rain, nor during periods of dew or fog. Receiving surfaces shall be properly dried out before proceeding with the work. No painting shall be done when temperature is below 50°F, except when specifically directed otherwise in writing by the Owner's Representative. Clear sealer shall not be applied when air temperature is less than 70°F.

3.3 SCAFFOLDING, DROP CLOTHS AND PROTECTION OF WORK

- A. Furnish, maintain and remove all scaffolding, ladders and planks required for this work and all drop cloths for the protection of concrete walks, floors, prefinished materials, fixtures, etc. Painted and finished surfaces subject to damage or defacement due to other work shall be properly protected and covered. Contractor shall be responsible for any and all damage to painted work and to that of other work caused by operations under this section.

3.4 PREPARATION OF SURFACES

- A. No painting or finishing shall be started until the surfaces to be painted or finished are in proper condition in every respect. Surfaces that cannot be properly prepared for finishing shall not be painted or finished until they are rectified, unless otherwise instructed by the Owner's Representative.
- B. Surfaces to be painted shall be clean and free of dirt, dust and any other substances which might interfere with the functioning of the painting

system. All surfaces to be painted shall be in proper condition to accept and assure the proper adhesion and functioning of the particular painting system or coating specified. Concrete surface shall be hydroblasted prior to painting.

- C. All steel and ferrous metal surfaces to be painted shall be primed before installation. Bolts, welds and places prime coat has been damaged shall be wire-brushed to remove all loose paint, rust and scale and then given one (1) coat of Ferrous Metal Primer.
- D. Prime coats and finish coats for any one paint system shall be the products of the same manufacturer.
- E. All surface defects and all cracks more than 1/16-inch wide shall be filled to match adjacent areas.

3.5 WORKMANSHIP AND APPLICATION

- A. All painting shall be done by skilled and experienced personnel. All workmanship shall be of the highest quality and to the complete satisfaction of the Owner's Representative.
- B. All materials shall be applied in accordance with the manufacturer's directions, and materials shall be thinned only for proper workability and in compliance with the manufacturer's specifications. All material shall be evenly brushed or smoothly flowed on without runs or sagging and free from drips, ridges, laps and brush marks. Insure that all coats are thoroughly dry before applying succeeding coats. Sand surfaces between coats as necessary to produce a smooth finish.
- C. Painting shall include all exposed surfaces of every member. Parts to paint, which are inaccessible after installation, shall be painted before installation. Priming shall include all sides, edges and cut ends.
- D. Completed painted surfaces shall be free of blistering, running, peeling, scaling, streaks and stains and the colors of all surfaces shall remain free from fading.
- E. Spray painting is not permitted unless prior written approval by the Owner's Representative is obtained.

3.6 EXTERIOR PAINTING

A. Bare Metal Surface

Prime Coat: Metal primer (1 coat)

Finish Coat: Alkyd Enamel, Semi-Gloss (2 coats)

3.7 APPROVAL OF FINAL COLORS AND FINISHES

- A. Final coat of paint shall not be applied until the colors and finishes have been approved by the Owner's Representative.

3.8 CLEANING AND TOUCH-UP

- A. Upon completion of the painting work, Contractor shall remove from the premises and dispose of all scaffolding and equipment, surplus material, empty containers, and other debris resulting from these operations. The station and surrounding areas shall be left clean and neat in all respects.
- B. Contractor shall clean and retouch this work as necessary for a first class job acceptable to the Owner's Representative.
- C. Contractor shall leave all floors and walks, hardware, and any other surfaces clean and free from any paint, spattering, smears, or smudges which are the result of this operation.

3.9 WEATHERING OF EXTERIOR WORK

- A. The Contractor shall give special attention to the quality of exterior paints and their application, insuring that weathering of such work shall not cause dripping, bleeding, running, leeching, or any other such undesirable effects which cause staining and defacement of adjacent surfaces.

3.10 MAINTENANCE SUPPLIES

- A. Furnish Owner with one (1) gallon of each kind and color of finish coats used in the project. Furnish such paint in fully labeled and identified one (1) gallon containers as necessary to make a thoroughly complete job in every respect.

END OF SECTION

DIVISION 11 - EQUIPMENT

SECTION 11500 - CNG VEHICLE FUELING EQUIPMENT

PART 1 - GENERAL

1.1. WORK INCLUDED

- A. This specification covers design, manufacture, and delivery of compressed natural gas (CNG) vehicle fueling equipment. The fueling equipment shall be packaged in a small footprint and use reliable components to reduce possible downtime. The CNG fueling system shall consist of, but not be limited to, the following:
1. Dual compressor with electric motor drives and sound attenuating enclosure. The compressors shall be equipped with the following: closed-loop gas recovery system with an ASME-rated tank, electric motors, inlet and outlet coalescing filters, automatic condensate drain system, safety controls, and control panel with PLC.
 2. One single tower gas dryer with onboard regeneration system.
 3. Ten CNG time-fill posts including hose breakaways and fueling nozzles.

1.2. CODES AND STANDARDS

- A. All equipment and the entire packaged fueling system shall comply with the latest revisions of applicable codes and standards. All materials shall be new (i.e., not previously used and manufactured within six months of equipment delivery). As a minimum, the equipment shall comply with the latest edition of the following codes and standards in effect at the time of bid:
1. American National Standards Institute (ANSI)
 - a. ANSI/NGV 1, Standard for Compressed Natural Gas Vehicle Fueling Connection Devices
 - b. ANSI/NGV 4.1, NGV Dispensing Systems
 - c. ANSI/NGV 4.2, Hoses for Natural Gas Vehicles and Dispensing Systems
 - d. ANSI/NGV 4.4, Breakaway Devices for Natural Gas Dispensing Hoses and Systems
 - e. ANSI/NGV 4.6, Manually Operated Valves for Natural Gas Dispensing Systems
 - f. ANSI/NGV 4.7, Automatic Pressure Operated Valves for Natural Gas Dispensing Systems

- g. ANSI/NGV 4.8, NGV Fueling Station Reciprocating Compressor Guidelines
 - h. ANSI Z535.2, Environmental and Facility Signs
2. American Petroleum Institute (API)
 - a. API Recommended Practice 520 – Sizing, Selection, and Installation of Pressure Relieving Devices in Refineries
 3. American Society of Mechanical Engineers (ASME)
 - a. Boiler and Pressure Vessel (B&PV) Code
 - i. Section V - Nondestructive Examination
 - ii. Section VIII, Division I - Pressure Vessels
 - iii. Section IX - Welding and Brazing Qualifications
 - b. ASME A13.1, Scheme for the Identification of Piping Systems
 - c. ASME B16.25, Buttwelding Ends
 - d. ASME B31.1, Power Piping
 - e. ASME B31.3, Process Piping
 4. American Society for Nondestructive Testing (ASNT)
 - a. SNT-TC-1A Recommended Practice
 5. American Welding Society (AWS)
 - a. A5.1 Covered Carbon Steel Arc Welding Electrodes
 - b. A5.5 Low Alloy Steel Covered Arc Welding Electrodes
 6. International Code Council (ICC)
 - a. International Building Code (IBC)
 - b. International Fire Code (IFC)
 - c. International Mechanical Code (IMC)
 - d. International Plumbing Code (IPC)
 7. National Fire Protection Association (NFPA)
 - a. NFPA 52 Vehicular Gaseous Fuel Systems Code
 - b. NFPA 54 National Fuel Gas Code
 - c. NFPA 70 National Electrical Code (NEC)
 - d. NFPA 704 Identification of the Hazards of Materials for Emergency Response
 8. Society of Automotive Engineers (SAE)

- a. J1616 Recommended Practice for CNG Vehicle Fuel
9. Underwriters Laboratories Inc. (UL)
- a. UL 508 Industrial Control Equipment
 - b. UL 508A Industrial Control Panels
 - c. UL 1604 Electrical Equipment for Use in Class I and II, Division 2, and Class III Hazardous (Classified) Locations
10. U.S. Department of Labor (OSHA)
- a. Title 29 CFR Part 1910 - Occupational Health and Safety Standards
11. U. S. Department of Transportation (DOT)
- a. Title 49 CFR Part 192 - Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards

1.3. QUALITY ASSURANCE

- A. All equipment shall be permanently affixed and accessible for maintenance and operation in accordance with all code requirements. Supports for all equipment shall conform to seismic requirements.
- B. The Contractor shall notify the Owner's Representative no later than 10 working days prior to factory testing of the compressor systems to allow the Owner's Representative the option to witness the test prior to shipment. Witnessing of the testing does not relieve the Contractor of the responsibility to comply with the specifications.
- C. All paint and priming products, whether shop or field applied shall be lead, chromium, and cadmium free. In addition, these products and all other materials used shall comply with local, regional, state and federal air quality rules and regulations, especially those of the local air quality management district.
- D. All materials and surfaces exposed to the exterior, unless otherwise pre-finished or otherwise treated with a corrosion-resistant finish, shall receive a three-coat shop-applied paint system.
- E. The CNG compressor including control system and dryer (dew point meter) shall be factory-inspected and certified by a Nationally Recognized Testing Laboratory for compliance with NFPA 52, NFPA 70, UL508, UL508A and UL1604 or equal. Certification by the third party inspection

firm shall be evidenced by the submittal of the inspection report and the application of a sticker on the equipment.

1.4. SUBMITTALS

- A. Within four (4) weeks of receipt of the Notice to Proceed, submit four copies of the following drawings and data for review. Submittal drawings and data shall be certified by the respective equipment manufacturer that the drawing(s) and data accurately represent the final product/system in all respects.
 - 1. For each equipment system or assembly: general arrangement drawing, process and instrumentation diagram, mechanical fabrication/assembly drawing, electrical elementary diagram, wiring diagram, electrical control assembly drawing, and installation instructions. Equipment arrangement drawings shall clearly identify the precise location, number, and size of customer connections, weight of equipment, and anchor bolt size and pattern for attachment of equipment to foundation.
 - 2. Station/compressor unit controller ladder logic diagrams.
 - 3. Mechanical and electrical bills of material.
- B. No fabrication or material purchase shall start until drawings are reviewed and accepted by the Owner's Representative. Individual equipment systems may be released for fabrication upon Owner's Representative's acceptance of their corresponding, certified shop drawings.
- C. Submit equipment record drawings as described in Article 3.3
- D. Submit operating and maintenance manuals as described in Article 3.4.

1.5. PROJECT CONDITIONS

- A. Natural Gas
 - 1. Specific Gravity : 0.6
 - 2. Temperature : 40-60°F
 - 3. Heating Value : 950 – 1,100 BTU/SCF
 - 4. Moisture Content : 7 lb/MMSCF max.
 - 5. Typical Gas Composition : 93% C₁

- : 4% C₂
- : 1% C₃ +
- : 1% N₂
- : 1% CO₂

(Note: Actual gas composition may vary)

- 6. Gas Pressure at Station Inlet : 25 psig

B. Electric Service

- 1. The new switchboard shall serve the electrical power requirements of the compressor and dryer systems. Motor loads for the compressor and dryer systems shall be designed based on 480 VAC, 3-phase, 60 hertz service.

C. Design Conditions

- 1. Site Conditions:
 - a. Elevation : 4,600 ft amsl
 - b. Ambient Temperatures : 20-110 °F
- 2. Maximum Station Inlet Piping Pressure Drop : 1 psi
- 3. Compressors:
 - a. Inlet Gas Pressure : 20 psig
 - b. Discharge Gas Pressure : 4,500 psig
 - c. Number of Compressors : 2
 - d. Design Gas Flow Rate ea Compressor : 56 scfm
 - e. Total Compression Capacity : 116 scfm
- 4. Dryer System:
 - a. Inlet Gas Moisture Content : 7 lb./MMSCF (max)
 - b. Outlet Gas Moisture Content : 0.25 lb./MMSCF or less
 - c. Minimum Thru-put : 500 scfm
 - d. Inlet Gas Pressure : 25 psig
 - e. Maximum Pressure Drop : 4 psi
 - f. Minimum Desiccant Charge : 650 lbs
- 5. All equipment and structures shall be designed, fabricated, and supported to comply with the latest edition of the International Building Code including seismic requirements.

PART 2 - PRODUCTS

2.1. GENERAL

- A. The fueling equipment shall be designed for continuous operation and shall meet vehicle fueling needs upon user demand around the clock. The operation of the fueling system shall be automatic (shall start-up and stop automatically) with provisions for manual operation/intervention. In the event of an alarm or emergency shutdown, on-site manual intervention shall be required to reset the compressor.
- B. All materials shall be non-combustible or fire-rated.
- C. Sufficient access shall be provided to perform major work on the compressor, including the removal of driver. All electric panels shall have the necessary clearances in front of openings as required by code. Sufficient access may be provided by removal of all or part of the compressor enclosure(s).
- D. All equipment mounting shall comply with design requirements of appropriate sections of IBC and seismic requirements. Equipment skids and mounts shall be of welded steel construction and shall have lifting lugs. Skids and equipment mounts shall accommodate anchoring to a concrete foundation using an adhesive-filled, drilled in-place anchor system.
- E. All gas containing components shall be protected by pressure relief valves set at or below each component's maximum allowable working pressure.
- F. All electrical controls shall be pre-wired to a single terminal strip in a junction box. The terminal strip shall be clearly labeled, ready for field termination. The junction box shall have skid edge conduit connections.
- G. All drain connections shall be piped to the skid edge and plugged.
- H. Gas inlet and outlet lines shall be terminated at the skid edge.
- I. All non-stainless steel components shall be primed and painted.

2.2. PACKAGED COMPRESSION UNIT

- A. Natural Gas Compressor System
 - 1. Acceptable Packager/Manufacturer Team:
 - a. Ingersoll-Rand
 - b. Or approved equal

2. The system shall be a self-contained electric-driven package, consisting of two electric motor driven compressors, controls, auxiliary systems, and safety devices. The compressor shall be designed specifically to compress natural gas. No converted gas engine or air compressor shall be used.
3. Compressor shall have individually flanged bolted compression and guide cylinders to facilitate servicing the cast-iron piston rings on all four stages.
4. Compressor shall be designed for smooth operation by the aluminum double-acting piston on the first and second stages balancing with the third stage steple piston and fourth stage self-aligning piston.
5. Splash lubrication shall be provided with a low crankcase oil level switch.
6. A thermostatically controlled crankcase heater shall maintain the correct oil viscosity.
7. Compressor shall have single piece connecting rods, mechanical oil seal on drive shaft, and a precision balanced overhung crankshaft with replaceable crankpin bushing.
8. Air cooled finned tube intercoolers and aftercooler shall be provided.
9. Compressor inlet train shall include pulsation tank, coalescing filter, solenoid valves, and individual manual isolation valves. Discharge train shall include coalescing filter.
10. The closed loop recovery system shall include an ASME rated tank, ASME relief valve, pressure gauge, and manual drain valve.
11. Compressor system shall have an automatic condensate drain system collected by separators. Condensate shall drain into the recovery tank.
12. Electric shutdown controls shall be provided for the following: low/high inlet pressure, high discharge pressure, discharge control pressure, high fourth stage discharge temperature, excessive motor starts, low crankcase oil level, main motor/starter overload, emergency shutdown switch.

13. A Frank W. Murphy Mfr or approved equal CNG Level II control panel shall be provided for automatic start/stop operation with alternating lead/lag control. Control panel shall be weather-tight and suitable for use in Class 1, Division 2, Group D locations. Control panel shall include an LCD annunciator panel and switchgauges.
14. Locations of gas inlet and outlet connections shall be as shown in the Owner's station design drawings.

C. Electric Motors

1. Motor shall be 460VAC, 3 phase, 60 Hz, totally enclosed fan cooled, and suitable for use in Class 1, Division 2, Group D locations.
2. Each motor shall have V-belt drive, belt tightener, full-voltage motor starter, and totally enclosed metal belt guard with antistatic belts.

D. Enclosure

1. A totally enclosed weather-proof and sound attenuating metal enclosure accessible from all sides by means of lockable hinged and removable doors shall be provided. All materials shall be non-combustible or fire-rated materials. Exterior surface shall be finished with the manufacturer's recommended coating system.
2. A gas detection sensor shall be provided to initiate an alarm at 25% LEL and a station emergency shutdown at 50% LEL. Acceptable gas detection manufacturers are:
 - a. Sierra Monitor
 - b. Or approved equal

E. Additional Requirements

1. Refer to Articles 2.6 and 2.7 for additional requirements for piping/tubing and instrumentation/controls, respectively.

2.3. NATURAL GAS DRYER

A. Acceptable Manufacturer:

1. Xebec
2. Or approved equal

B. The natural gas dryer shall be a skid-mounted single-tower dryer with a regenerative system. Dryer shall be sized for the quoted capacity with the gas analysis and process conditions specified in Article 1.5, Paragraphs A and C.

C. Molecular Sieve

1. Adsorbent shall be molecular sieve 3A with a minimum life of 5 years. The tower shall be loaded with a minimum of 650 pounds of desiccant.
2. The sieve shall minimize adsorption or desorption of odorants, CO₂, H₂S, and other components or trace elements from natural gas.

D. Adsorption Tower and Filters

1. The dryer shall consist of a single tower with a regenerator. Dryer shall be located on the suction side of the compressor. Pressure drop across the dryer skid (between the skid inlet and outlet flange connections) shall not exceed 4 psi. Skid isolation and bypass valves shall be provided and shall be ball valves. The inlet and outlet skid connections shall be 3" rated ANSI 150 flanges. Piping system including welding shall be in accordance with either ASME B31.1 Power Piping or ASME B31.3 Process Piping.
2. The adsorption tower shall be rated at 150 psig and 500°F. The tower shall have a safety relief valve with appurtenances to allow for testing. Contractor shall submit calculation on relief valve sizing for review and acceptance prior to purchase. The tower shall be fitted with desiccant fill and drain ports to allow desiccant transfer without disassembling piping. Locally-mounted adsorption tower pressure and differential pressure gauges shall be provided.
3. A coalescing filter shall be provided for the adsorption tower inlet. The filter shall be sized to capture liquid slugs and capture aerosol and solid particles greater than 0.01 micron (Grade XP). The filter shall be equipped with a differential pressure indicator and manual liquid drain to a common drain. A particulate filter rated for 1 micron (Grade ZHTNX) shall be provided for the adsorption tower outlet. A differential pressure indicator shall be provided. Filters shall possess ASME rating or Canadian Registration Number approval. Both filters shall allow replacement of the filter element without removing the filter from the piping.

E. Regeneration System

1. Operator-attended regeneration shall be manually initiated by a panel-mounted push button after the manually operated isolation valves are correctly positioned. The regeneration time shall be approximately six hours. Regeneration gas flow shall be in a downward direction through the desiccant bed. The regeneration system shall comprise a blower, low-Watt regeneration heater, cooler, separator and accumulator tank as well as related piping, wiring and controls.
2. The gas blower shall be a vane- or lobe-type with an electric motor rated in accordance with NFPA 70. Blower/motor shall be installed in an ASME "U" or "UM" stamped carbon steel pressure vessel with the same pressure rating as the dryer vessel. The horizontal blower bell housing shall be fitted with stainless steel glides mating stainless steel runners fitted to the support skid to permit removal from the blind flange with minimal effort by one person. Suitable anchoring of the blower housing shall be provided to support the blower housing once installed.
3. The gas heater shall use incoloy sheathed, low-Watt-density electric heating elements mounted inside an insulated heating chamber. The heater bundle shall be furnished with a thermocouple and temperature switch for heater sheath over-temperature alarm and shutdown. A heater high outlet temperature switch shall be furnished at the heater outlet. The heater vessel shall be an ASME "U" or "UM" stamped carbon steel pressure vessel with the same pressure and temperature rating as the desiccant chamber.
4. An air-to-gas fin tube aftercooler complete with electric motor and non-sparking fan blades with motor in compliance to Class 1, Div. 2, Group D electrical class shall be provided. A high-efficiency coalescing-separator with two-piece aluminum bowl and head construction shall be provided. It shall include a carbon steel condensate reservoir and a manual drain valve piped to the skid edge. The reservoir shall have a liquid capacity for at least two regeneration cycles.

F. Dewpoint Monitoring

1. The dewpoint monitoring system shall generate alarm signals when the dew point at the dryer outlet begins to deteriorate. The first alarm set point shall indicate the dryer outlet dew point has started to deteriorate. The second alarm set point shall indicate the need for regeneration of the system. The dryer outlet dewpoint shall be presented on the NEMA 4 panel text display.

G. Additional Requirements

1. A 3/8" stainless steel tubing run shall be provided at the dryer to supply power gas to operate the pneumatic actuator on the station inlet shutoff valve located upstream of the dryer. Activation of the station emergency shutdown system shall close the shutoff valve. Tubing shall be run to skid edge.
2. System shall be pressure and functionally tested at the factory.
3. Refer to Articles 2.6 and 2.7 for additional requirements related to instrumentation/controls and piping/tubing, respectively.

2.4. TIME FILL POSTS

A. General

1. Provide ten (10) time-fill posts. Each post shall include a manually operated isolation valve, bleed valve, breakways (one on each hose), dual fill hoses, hose retractor, and fill nozzle.

B. Fill Post Requirements

1. Post shall be 2"x2" steel tube. Vent gas shall exit at the top of the post. Top of installed post shall be a minimum of ten (10) feet above grade.
2. Hose breakaways for CNG supply and vent lines shall be in-line type.
3. Twin-hose assembly (supply and vent hoses) shall be rated at 5,000 psig and shall be electrically conductive. Hose assembly shall be a minimum 20 feet in length. Hoses shall be distinctly marked either by the manufacturer's permanently attached tag or by distinct markings indicating the manufacturer's name or trademark, natural gas service, and working pressure.
4. Fueling nozzle shall be a 3,600 psig Type 2, NGV-1 compatible coupling by Staubli or approved equal.
5. Point of connection to each fill post shall be 3/8" stainless steel tubing. Each post shall include a manually operated isolation and bleed valves.

2.5 REMOTE SYSTEM NOTIFICATION

- A. An autodialer shall be provided to allow remote notification of station shutdowns. Autodialer shall be as specified in Specification Section 16700.

2.6 INSTRUMENTATION AND CONTROLS

- A. All pressure gauges shall conform to the following requirements:
 - 1. All gauges shall read at least 1.2 times the system design pressure (NFPA 52).
 - 2. Accuracy, including hysteresis, shall $\pm 0.5\%$ of full scale or better.
 - 3. Rear blowout protection shall be provided.
 - 4. All gauges shall be waterproof and oil-filled.
 - 5. The dial shall have a minimum diameter of 4-1/2 inches.
- B. All temperature gauges shall conform to the following requirements:
 - 1. Accuracy shall be within $\pm 1\%$ of the full scale or better.
 - 2. The dial shall have a minimum diameter of 2-1/2 inches.
- C. All instrument components interfacing with natural gas shall be made of material compatible with odorized natural gas. No copper metal or alloys containing more than 70% copper shall be used in natural gas service.
- D. All gauges and manually-operated valves shall be located no higher than five (5) feet above grade except gas dryer regeneration inlet valve.

2.7 PIPING / TUBING

- A. Piping and tubing systems shall be rated for the maximum pressure and temperature to which they will be subjected under normal operating conditions and be properly supported and protected to prevent damage from vibration during shipment, operation, and maintenance. Piping and tubing systems shall be installed in a neat and orderly arrangement, adapting to the contours of the skid package. Piping and tubing systems shall not obstruct access openings. Where practical, piping and tubing shall be installed beneath the skid deck. Supports shall not be welded directly to piping or tubing.

- B. Piping design, inspection, and testing shall be in accordance with ANSI/ASME B31.3. Piping shall be seamless and conforming to ASTM A106, Gr.B. Cast iron or semi-steel piping shall not be used. Testing shall be pneumatic.
- C. Threaded gas pipe connections may be used on 1-1/2 inch nominal pipe size and smaller for piping systems with a maximum operating pressure no greater than 150 psig. Otherwise, such piping shall be socket- or butt-welded. Piping larger than 1-1/2 inch nominal pipe size shall be butt-welded.
- D. Tubing and tube fittings shall be stainless steel. All tubing and tube fittings shall be rated for at least 6,000 psig working pressure. All tubing fittings used throughout the station system (compressor skids, dispensers, storage, and inter-skid connections) shall be Swagelok 316 stainless steel, or approved equal.
- E. Stainless steel tubing shall be seamless and bright annealed, ASTM SA-213, type 316. The maximum hardness of the stainless steel tubing shall be no more than Rockwell hardness of 80.
- F. Piping shall be prepared and painted in accordance with manufacturer's standards.
- G. Personnel installing tubing and tube fittings shall be trained and certified by the tube-fitting manufacturer. All tubing shall be installed neatly and in a workmanlike manner. All tubing shall be properly anchored, supported, and/or pitched. All tubing shall run true to the vertical and horizontal axes of the skid. All valves shall be accessible for easy operation and maintenance. Teflon paste and Teflon tape impregnated with nickel shall be used to seal tube fitting pipe thread connections.
- H. All drain lines shall be brought to skid edge and allow draining into a container placed on the ground next to the skid.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Install equipment on concrete foundations or pads in accordance with the equipment manufacturer's installation instructions and Contract Documents. The surface finish and slope of the concrete foundation shall be as specified by the equipment manufacturer's instructions. If an adhesive anchor system is used, then the installation of the anchors shall be inspected and approved in accordance with the IBC.

- B. The Contractor shall complete all equipment connections and provide a fully operational system. Flexible connectors rated for the intended service shall be provided for all piping and conduit connections to vibrating equipment.

3.2 TESTING, STARTUP, AND TRAINING

- A. Prior to shipment, the CNG compressor shall be operated for a minimum of four (4) continuous hours and functionally tested. The test shall include, but not be limited to, operation of the compressor, all control, safety shutdown and alarming systems, etc.
- B. The installed fueling equipment shall undergo a witnessed system test. At least two (2) weeks prior to the system test, the Contractor shall submit to the Owner's Representative draft Maintenance and Operating Manuals. During the testing of the mechanical, instrumentation and electrical equipment by the Contractor, the Contractor shall make available representatives of the manufacturers of all of the major equipment or other qualified persons who shall instruct the Owner's personnel in the operation and maintenance thereof. Natural gas shall be used for the system test. Piping and tubing shall be purged with nitrogen prior to introducing natural gas. The tests shall include, but not be limited to, the items listed below:
 - 1. Run test fueling station for proper operation. This includes calibrating all instrumentation.
 - 2. Test the ESD system.
 - 3. Test compressor control panel and shutdowns.
 - 4. Test dryer system.
 - 5. Test time-fill dispensing system.
 - 6. Any discrepancies found as a result of these inspections and tests shall be corrected by the Contractor at no cost to the Owner (including the cost for making all the corrections and repeating the tests within two (2) weeks.)
- C. Acceptance by the Owner's Representative of the fueling stations and associated items furnished by Contractor under this specification shall occur only after the following requirements have been met:
 - 1. It has been demonstrated to the satisfaction of the Owner Representative that the fueling stations as a whole, meet and conform to the requirements of the Specification and drawings.

2. All testing required by this Specification have been successfully completed and have been accepted by the Owner's Representative.
 3. The date of acceptance of the fueling stations shall be the date of the written notice of its acceptance by the Owner's Representative to Contractor. All warranties and/or guarantees referred to or implied in this Specification shall commence on that acceptance date.
 4. Acceptance by the Owner's Representative of the witnessed test shall not release Contractor from any of its warranty obligations, or any other obligation, under this Specification.
- D. Contractor shall provide two (2) formal training classes in station operation, service, and maintenance. Factory service representatives shall instruct the Owner's designated operating and maintenance personnel in the operation, adjustment, and maintenance of all equipment and systems. Training shall include classroom and "hands-on" activities. The basis of instruction shall be the station operating and maintenance manual.

3.3 EQUIPMENT RECORD DRAWINGS

- A. The Contractor shall update the certified shop drawings to reflect any Contractor-approved field modifications subsequent to delivery from the factory. The latest revision of the shop drawings shall be incorporated into the station operating and maintenance manuals. Drawings shall be provided in both hard copy and electronic formats.

3.4 OPERATING AND MAINTENANCE MANUALS

- A. All product data and related information appropriate for Owner's maintenance and operation of all products and systems provided under this Contract shall be compiled into an integrated operating and maintenance manual. The manual shall include written test reports documenting performance and operational data. The PLC program listing shall be included in the manual. Submit one copy of the draft manual for review by the Owner's Representative. Submit three copies of the final manual after acceptance by the Owner's Representative.

3.5 WARRANTY SERVICE

- A. Contractor shall provide a one-year warranty covering parts and labor. The warranty period shall begin upon acceptance of the station by the Owner.

END OF SECTION

DIVISION 15 - MECHANICAL

SECTION 15190 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

Identification of station interconnecting piping/tubing and off-skid mechanical devices installed under the work of the project.

1.2 RELATED SECTIONS

A. Section 09910 - Painting

1.3 REFERENCES

The following documents form a part of these specifications to the extent stated herein. Unless otherwise indicated, use the issue in effect on the date of request for quotation. Bring any conflicts between specifications, drawings, and the referenced documents to the attention of the Owner in writing, for resolution before taking any related action. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

A. American Society of Mechanical Engineers (ASME)

1. ASME A13.1 Scheme for the Identification of Piping Systems

1.4 SUBMITTALS

A. Submit product data and manufacturer's installation instructions under provisions of the General Conditions.

B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Seton, or equal.

B. Substitutions: Under provisions of the General Conditions.

2.2 MATERIALS

- A. Color Coding: ASME - A13.1 unless specified otherwise.
- B. Plastic Nameplates: Laminated two-layer plastic with engraved black letters on light, contrasting background color.
- C. Plastic Tags: Laminated three-layer (double-sided) plastic with engraved black letters on light, contrasting background color. Tag size at least 1-1/2 inch diameter
- D. Stencils: With clean-cut symbols and letters of following size:

| OUTSIDE DIAMETER INSULATION OR PIPE | COLOR FIELD LENGTH | LETTER HEIGHT |
|--|-----------------------|------------------|
| 3/4" - 1-1/4" | 8" | 1/2" |
| 1-1/2" - 2" | 8" | 3/4" |
| over 2-1/2" | 12" | 1-1/4" |
| Equipment | --- | 2-1/2" |

- E. Stencil Paint: Semi-gloss enamel; in accordance with Section 09910.
- F. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed. Markers shall be weatherproof and fade/UV resistant.
- G. Plastic-Tape Pipe Markers: Flexible, vinyl-film tape with pressure-sensitive adhesive backing and printed markings. Markers shall be weatherproof and fade/UV resistant.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive of identification materials.
- B. Prepare surfaces in accordance with Section 09910 for stencil painting.

3.2 INSTALLATION

- A. Plastic Nameplates: Install with corrosion-resistant mechanical fasteners, or adhesive.
- B. Plastic Tags: Install with corrosion-resistant chain.
- C. Stencil Painting: Apply in accordance with Section 09910.
- D. Plastic Pipe Markers: Install in accordance with manufacturer's instructions.
- E. Plastic-Tape Pipe Markers: Install completely around pipe in accordance with manufacturer's instructions.

3.3 IDENTIFICATION SCHEDULE

- A. Equipment: Identify with plastic nameplates. Small devices, such as in-line pumps, may be identified with plastic tags.
- B. Controls: Identify control panels and major control components outside of panels with plastic nameplates.
- C. Valves: Identify valves in main and branch piping with tags.
- D. Piping: Identify piping with vinyl markers or stenciled painting. Vinyl markers shall be weatherproof and fade/UV resistant. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not more than 20 feet apart on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

DIVISION 15 - MECHANICAL

SECTION 15410 - GAS PIPING AND TUBING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work of this Section includes the furnishing of all labor, minor materials, equipment, tools, and services needed to complete all natural gas, compressed air, lube oil piping and tubing shown on the Drawings and as specified herein. It also includes all materials, labor, etc., neither specifically mentioned nor shown, but which can reasonably be inferred as being necessary for a complete installation. The work shall be properly adjusted and fully operable.

1.2 DRAWINGS:

- A. Drawings showing location of equipment, piping, tubing, etc., are diagrammatic and job conditions will not always permit their installation in the location shown. The drawings show the general arrangement of all piping, tubing, equipment, etc., and shall be followed as closely as existing conditions, actual building construction, and the work of other trades will permit. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. The Contractor shall investigate the conditions affecting the work and shall arrange the work accordingly providing such fittings, valves and accessories as may be required to meet conditions at no additional cost to the Owner. When job conditions do not permit installation of equipment, piping, etc., in the locations shown, it shall be brought to the Owner's Representative's attention immediately and the relocation determined in a joint conference and the relocation shall be at no additional cost to the Owner. The Contractor shall be held responsible for the relocation of any items without first obtaining the Owner's Representative's approval. Contractor shall remove and relocate such items at Contractor's expense if so directed by the Owner's Representative.
- B. Execute work mentioned in the specifications and not shown on the drawings, or vice versa, the same as if specifically mentioned in both.

1.3 RECORD DRAWINGS:

- A. Contract Drawings and Shop Drawings shall be updated and maintained as record documents.

1.4 CODE RULES AND SAFETY ORDERS:

- A. Provide all work and materials in full accordance with the latest rules and regulations at the time of bid of at least the following codes and standards:
1. American Petroleum Institute (API)
 - a. API Recommended Practice 520, Sizing, Selection, and Installation of Pressure Relieving Devices in Refineries
 2. American Society of Mechanical Engineers (ASME)
 - a. ASME Boiler and Pressure Vessel (B&PV) Code
 - b. Section VIII, Division I - Pressure Vessels
 - c. Section V, Nondestructive Examination
 - d. Section IX, Welding and Brazing Qualifications
 - e. ASME A13.1, Scheme for the Identification of Piping Systems
 - f. ASME B16.25, Buttwelding Ends
 - g. ASME B31.3, Process Piping
 3. American Society for Nondestructive Testing (ASNT)
 - a. SNT-TC-1A Recommended Practice
 4. American Welding Society (AWS)
 - a. A5.1 Carbon Steel Electrodes for Shielded Metal Arc Welding
 - b. A5.4 Stainless Steel Electrodes for Shielded Metal Arc Welding
 - c. A5.5 Low Alloy Steel Electrodes for Gas Shielded Metal Arc Welding
 5. International Code Council (ICC)
 - a. International Building Code (IBC)
 - b. International Fire Code (IFC)
 - c. International Mechanical Code (IMC)
 - d. International Plumbing Code (IPC)
 6. National Fire Protection Association (NFPA)
 - a. NFPA 52 Vehicular Fuel Systems Code
 - b. NFPA 54 National Fuel Gas Code
 - c. NFPA 70 National Electrical Code (NEC)
 - d. NFPA 704 Identification of the Hazards of Materials for Emergency Response
 7. Society of Automotive Engineers (SAE)

- a. SAE J1616 Recommended Practice for CNG Vehicle Fuel
- 8. Underwriters Laboratories Inc. (UL)
 - a. UL 508 Industrial Control Equipment
 - b. UL 508A Industrial Control Panels
 - c. UL 1604 Electrical Equipment for Use in Class I and II, Division 2, and Class III Hazardous (Classified) Locations.
- 9. U.S. Department of Labor
 - a. Title 29, Code of Federal Regulations (CFR) Part 1910 Occupational Health and Safety Standards

1.5 PRODUCT HANDLING:

- A. Protection: Use all means necessary to protect all materials before, during, and after installation and to protect the work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

1.6 EXISTING MATERIALS:

- A. Existing equipment, piping, wiring, construction, etc. which interferes with work of this contract shall be brought to the attention of the Owner's Representative. Damaged items shall be replaced with new material to match existing.
- B. Perform all cutting of existing surfaces as required by work of this contract. After installation of the work of this contract is complete, repair and finish all surfaces to match adjacent areas. All new and existing work shall be thoroughly bonded and joined together.
- C. Removed materials which will not be reused and which are not claimed by the Owner shall become the property of the Contractor and shall be removed from the premises. Consult Owner before removing any material from premises. Materials claimed by Owner shall be removed carefully to prevent damage and delivered to the site where directed.

1.7 CARE AND CLEANING:

- A. All broken, damaged, or otherwise defective parts shall be repaired or replaced without additional cost to the Owner, and entire work left in a condition satisfactory to Owner's Representative. At completion, carefully clean and adjust all equipment, fixtures, and trim installed as part of this

work, and systems and equipment shall be left in satisfactory operating condition.

- B. All surplus materials and debris resulting from this work shall be cleaned out and removed from site.

1.8 SAFETY AND WORK CONDITIONS:

- A. All OSHA rules and regulations concerning handling of materials and all work related activities shall be strictly adhered to.

1.9 SUBMITTALS:

- A. The Contractor shall provide a complete list of materials and equipment proposed to the Owner for acceptance. The list shall include for each item: the manufacturer, the manufacturer's catalog number, catalog cuts or drawings, test certificates for pipe and tubing, the rating, capacity, size, etc. Test certificates for pipe shall include the items specified in API Specification 5L, Supplementary Requirement 15.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. PIPING AND TUBING:

1. Provide each item listed herein or shown on drawings of quality noted or equal. All material shall be new, full weight, standard in all respects and in first-class condition. Insofar as possible, all materials used shall be of the same brand or manufacture throughout for each class of material or equipment.
2. All pipe shall be steel, seamless, standard, ASTM A-106 Grade B or 316 stainless steel, seamless, as shown on the drawings. All pipe shall comply with the requirements of ASME B31.3 based on the operating pressures indicated on the drawings. Underground warning tape shall be, TERRA TAPE, EXTRA STRENGTH 540 labeled with the words, "CAUTION GAS LINE BURIED BELOW."
3. All tubing shall be ASTM A-213, type 316 stainless steel, fully-annealed, seamless, Maximum Rockwell Hardness B-80. Tubing is to be free of scratches and suitable for bending. Where the following Nominal OD tubing is specified, the corresponding minimum wall thickness shall be used for CNG service:

| Nominal OD | Minimum Wall Thickness |
|------------|------------------------|
|------------|------------------------|

| | |
|------|-------|
| 1/4" | .035" |
| 3/8" | .049" |
| 1/2" | .065" |
| 3/4" | .109" |

4. Contractor shall provide all materials for repair or replacing of existing substructures, such as water service, sewer laterals, or any other facilities that are cut or damaged by Contractor.
 5. Electrodes and related material required for Contractor's welding operations. Electrodes shall fully comply with all requirements contained in AWS Specifications, including but not limited to Specification for Carbon Steel Covered Arc Welding Electrodes AWS 5.1, AWS Specification for low-Alloy Steel covered Arc-welding Electrode AWS A5.5, and shall produce field welding results, which fully comply with test requirements listed above. Welding rods shall be delivered to the job site in unopened metal containers.
- B. The Contractor shall be responsible for pickup, transportation, off loading and storing materials, and providing all equipment and manpower necessary to complete the work as specified herein.
1. Contractor shall be solely responsible for delivering the required quantities of proper, usable materials to the various points of installation within sufficient time to permit construction of the CNG Fueling station in accordance with the Construction Schedule.
 2. Precautions shall be taken to prevent deterioration effects of weather on the materials. Materials shall be stored by Contractor in a secure area either on or off the job site.
 3. Salvage material will consist of all items to be removed or otherwise not reused. The Contractor shall assume full responsibility for proper disposal.

PART 3 - EXECUTION

3.1 PIPE/VENT INSTALLATION:

- A. The welding of any fittings required to tie in the new gas piping to the new gas meter set, shall be performed by the Contractor.
- B. The tie-in shall be performed by the Contractor.
- C. A fully-charged fire extinguisher shall be immediately available at each location where welding or cutting will be done.

- D. All steel pipe fittings shall be threaded or butt-welded as specified In the drawings.
- E. Piping shall be labeled describing contents and flow direction.
- F. Pipes shall be supported as shown in the drawings by pipe supports with U-bolts over the pipe.
- G. Vent stacks shall be at least ten (10) feet above grade. A 1/8-inch weep hole shall be drilled at the bottom of each vent stack.

3.2 TUBING, TUBE FITTINGS, VALVES AND GAUGES:

- A. Material used in the system must be selected to minimize the potential for internal corrosion. No copper or an alloy containing more than 70% copper shall be used in natural gas service. No cast iron or semi-steel material shall be used. Also prohibited is galvanized pipe and fittings, and aluminum pipe, tubing, and fittings except as permitted by NFPA 52.
- B. All tubing shall be in accordance with Article 2.1A, Paragraph 3. All tube fittings shall be Swagelok, 316 stainless steel.
- C. All valves shall be tagged in accordance with Section 15190 - Mechanical Identification.
- D. Tubing shall be installed to withstand vibration, expansion, and contraction. Consideration should be given to seismic loading when bending and securing tubing. All valves shall be accessible for easy operation and maintenance.
 - 1. Contractor shall use certified tubing installers. It shall be the responsibility of Contractor to have tubing installer trained and certified by a tube fitting manufacturer to install tube and required fittings per the manufacturer's installation instructions.
 - 2. Teflon paste and Teflon tape impregnated with nickel shall be used to seal tube fitting pipe thread connections.
- E. Tubing shall be labeled describing contents and flow direction.
- F. Risers for buried steel piping shall be placed in a PVC sleeve.
- G. Contractor shall support and protect tubing against damage. Tubing shall be supported every five feet. Contractor shall install removeable stainless steel thresholds over tubing for protection from foot traffic.

3.3 WELDING:

- A. All welding shall be done in accordance with the latest edition of ASME B31.3 Chemical Plant and Petroleum Refinery Piping, ASME Boiler Pressure Vessel Code Section IX, and ASME/ANSI B16.25 Buttwelding Ends. Each welder shall be tested and qualified for the type and method of welding to be done in accordance with the above codes and standards. Each welder must provide to the Owner's Representative:
 - 1. A qualification record signed by an authorized officer of the testing laboratory, or welding inspector and the Contractor's authorized representative, or,
 - 2. Previous welding certification (active certification within the previous six months) may be submitted to the Owner's Representative.
- B. All field joints on pipe installed in the CNG Fueling station shall be welded, including fittings and accessories. Welding may be done by Shielded Metal-Arc Welding, Submerged Arc Welding, or Gas Metal-Arc Welding Process, using a manual, semi-automatic, or automatic welding technique or combination of these techniques.
- C. At the end of the workday, all open ends of completed pipe sections and sections that have been lined up and not welded, shall be securely closed by the Contractor by means of approved covers which will keep foreign matter out of the pipeline such as water, trash, small animals or other objects. These covers shall be put in place and shall remain in place until the respective section becomes a part of a larger section. The covers shall not be tack welded to the pipe.
- D. The Contractor shall have fire-fighting equipment available while cutting and/or welding. Fire control equipment may include but not be limited to water trucks, water pumps, fire extinguishers, mats under welders, etc.
- E. Hot or cold bending of any pipe is not permitted.
- F. No miter welds will be permitted in the construction of any piping.

3.4 CATHODIC PROTECTION:

- A. All buried carbon steel portions of the piping system must be isolated and cathodically protected to insure a -850 millivolt pipe to soil potential for a minimum of 30 years. Conductors shall be attached to gas pipes by thermite welding. Soil resistivity test is the responsibility of the Contractor.
- B. Contractor shall provide all materials including, but not limited to, prepackaged anodes, test station (with leads, wire, terminal board, and

fittings), valve box with cover suitable for H-20 traffic loading, and cad weld thermite cartridges for a complete cathodic protection system.

3.5 FIELD COATING OF BURIED PIPE:

- A. Specifically, the work to be performed under this section is the furnishing and application of protective coatings to all pipe, conduit, field joints, damaged pipe wrap, tees, ells, fittings, and any other bare metal surfaces to be buried. No galvanized pipe shall be buried.
- B. Contractor shall purchase plastic-coated pipe when available. If plastic-coated pipe is not available, Contractor shall field-wrap all buried pipe. The field coating of bare pipe shall be considered a normal part of the pipe installation.
- C. The Contractor is required to repair all damaged wrap or defects prior to lowering into the ditch. The field coating of bare pipe and/or damaged wrap shall be considered a normal part of the pipe installation.
- D. Contractor will be responsible for the condition of the pipe coating at the time he takes possession of the pipe.
- E. The wrapped pipe shall be visually inspected by the Contractor. Poor wrap shall be removed and repaired. The Owner shall have the opportunity to perform holiday test of factory and field-wrapped pipe.
- F. Prior to application, all surfaces to which a protective coating is to be applied shall be thoroughly dried and cleaned of all paint, rust, scale, grease, dirt, and foreign matter.
- G. Cold-applied tape and primer must be used on all field joints, damaged plant wrap, tees, ells, fittings, and any other bare metal surfaces to be buried, unless otherwise specified. See Article 3.5, Paragraph N, for approved tape and primer. Method of application for wrapping and wrap repair shall be in accordance with approved manufacturer's procedure.
- H. At points where pipe or steel conduit emerges from or enters the ground, the wrap shall extend 2 inches above the finished ground level.
- I. If the field wrappings with tape of fittings and valves not furnished coated is unsatisfactory because of irregular surfaces, the Contractor may, with the consent of the Owner's Representative, elect to apply PPG Industries Coal Cat WC 40101, Royston Laboratories Roskote 201, Coal Tar Epoxies. The application shall be made in accordance with manufacturer's recommendations to obtain a thickness of 8 mils or more.

- J. All exposed above-ground bare metal surfaces, unless otherwise specified shall be painted with one prime coat, and two finish coats (Section 09910) of semi-gloss silicone alkyd (minimum 2 mils dry film thickness.) Care shall be taken to prevent abrasion or scarring of the prime coat. Any damage to the primer shall be repaired before subsequent coats are applied. The prime coat shall be thoroughly dry before the paint coat is applied. Paint shall be applied at a coverage rate as recommended by the manufacturer. Owner shall specify color of finish coat.
- K. Contractor shall furnish all materials for all field coating operations. Material shall be per Article 3.5, Para M. The field coating materials shall be considered a normal part of the NGV fueling station installation.
- L. Contractor shall field-wrap all damaged wrap on buried steel conduit. The field coating of buried bare steel conduit shall be considered a normal part of the pipe installation.
- M. Cold-applied tapes and primers approved for below-ground installations are listed below according to their brand names, identification numbers, tape width, and the pipe sizes on which the tapes are used.
- N. Acceptable Manufacturer:
 - 1. Primer – Polyken 1027; Pipe Coating – Polyken 930-35
- O. Two-inch wide tape shall be used for all fittings and multi-directional wrapping.
- P. Joints and fittings require two layers of wrap. The tape shall be applied with a 60% overlap.
- Q. Materials for above-ground protective coating shall be per industry standard.
- R. Contractor shall collect and haul away from jobsite all wrapping wastes, such as scrap tape, primer, cans, etc.

3.6 CLEANUP:

- A. Working areas and adjacent areas used in the performance of the work shall be left in a neat and presentable condition. All debris shall be collected and disposed of to the satisfaction of the Owner.
- B. Contractor shall restore the construction site daily so as to leave the surface of the ground as normal as practicable. Contractor shall leave the soil and yard in a condition satisfactory to the Owner's Representative.

This will include, but not be limited to street sweeping, temporary and permanent paving, and plating to allow safe flow of traffic.

- C. Clean up by Contractor shall include purging of all pipe and tubing installed as part of this project prior to placing in operation. Purpose of purging is to remove any sand, dirt, weld slag, burrs, and other foreign material to avoid plugging and damaging the equipment.

END OF SECTION

DIVISION 15 - MECHANICAL

SECTION 15991 - TESTING AND STARTUP

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Facility Pressure Testing
- B. Facility Startup

1.2 RELATED SECTIONS

- A. Section 15410 - Gas Piping and Tubing

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 FACILITY PRESSURE TEST

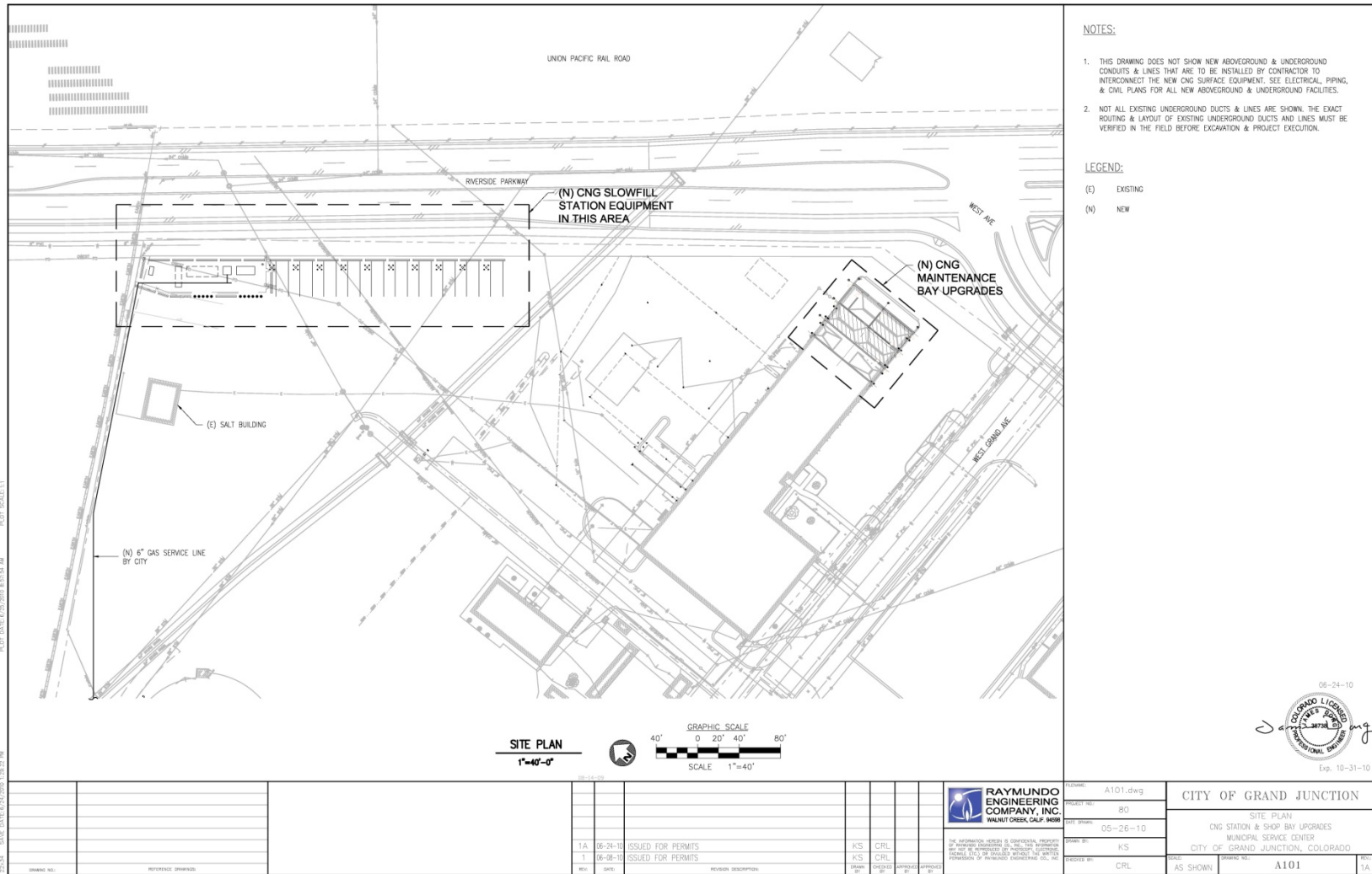
- A. The Contractor shall be responsible for arranging and performing all tests of the CNG fueling system as required by the applicable codes, regulatory agencies and this specification.
- B. A pressure test in accordance with ASME B31.3 Paragraph 345.5.5 shall be performed on the completed interconnecting piping and tubing system prior to tying to the gas meter. A minimum test pressure as shown on the drawings shall be maintained for at least four hours. Nitrogen shall be used as the pressure test fluid. All testing will be done in the presence of the Contractor, Owner's Representative, and regulatory agencies (if necessary).
- C. Pressure tests of the piping system shall be recorded on a pressure recording device (e.g., chart recorder) in the presence of the Owner's Representative. Proof of pressure recording device calibration within six (6) months prior to the test is required. The Owner's Representative must initial all Pressure Test records and witness all Pressure Tests.
- D. The testing, to the extent the schedule permits, shall be organized to minimize the number of separate tests. If possible, the entire system shall be tested as a single testing segment.

- E. Upon completion of any test, all test records shall become the property of the Owner. The Contractor shall forward to the Owner's Representative copies of test records indicating that all piping has been strength- or pressure-tested. Test records shall be signed and dated by the Owner's Representative upon witnessing and verifying said test. It is the responsibility of the Contractor to ensure that all representatives of the permitting agencies that may be required to witness testing are given at least one (1) week notice prior to any testing of the CNG Fueling Station.
- F. If a tested section fails to maintain the specified test pressure, the Contractor shall determine the location of the leakage or failure. The contractor shall remove the defective section and install, with new material, a replacement section prior to reinitiating the test. The section shall be retested in its entirety for at least four hours. The defective section shall remain the property of the Owner.
- G. The system, after completion of the required leak or strength test, shall remain pressurized until the Owner's Representative is on site. Depressurization of the system shall only commence after authorization from the Owner's Representative. If the system fails to maintain pressure during the period subsequent to the test, damage to the system must be suspected and the system must be retested.
- H. The Owner shall not be held liable for any additional costs associated with damages, repair, retesting, investigation, etc., arising from failures due to inferior workmanship, and/or materials furnished by the Contractor which prove to be defective until testing.
- I. Once the facilities are successfully pressure-tested, the Contractor shall not perform any maintenance or further work on the facilities without the express written permission of the Owner's Representative.

3.2 FACILITY STARTUP

- A. The installed fueling station shall undergo a witnessed system test. Contractor shall provide assistance as needed during system testing. Natural gas shall be used for the system test. Piping and tubing shall be purged with nitrogen prior to introducing natural gas. The tests shall include, but not be limited to, the items listed below:
 - 1. Run test fueling station for proper operation. This includes calibrating all instrumentation.
 - 2. Test the ESD system.
 - 3. Test compressor control panels and shutdowns.

Appendix G. Design Documents from City of Grand Junction



Sample layout only: more detailed design drawings too large to include in report document

Appendix H. DIA Refueling System 2006 Upgrade Cost Estimates

Refueling system estimated capital costs (2006 "minimum" estimate) from DIA

| Item | Fleet Maintenance | Rental Car Road | Concourse A/B/C | Total |
|--------------------|-------------------|------------------|------------------|------------------|
| Equipment | \$15,000 | \$446,000 | \$38,000 | \$499,000 |
| Piping/trenching | \$14,000 | \$37,000 | \$118,000 | \$169,000 |
| Installation | \$14,000 | \$113,000 | \$12,000 | \$139,000 |
| Sitework | \$15,000 | \$98,000 | \$- | \$113,000 |
| Engineering design | \$- | \$25,000 | \$- | \$25,000 |
| Other | \$2,000 | \$20,000 | \$2,000 | \$24,000 |
| Total | \$60,000 | \$739,000 | \$170,000 | \$969,000 |

Piping/trenching distance

| Trenching feet from origin | # pipes | Size (inches) |
|----------------------------|---------|---------------|
| 141 | 2 | 1 |
| 202 | 3 | 1 |
| 105 | 2 | 1 |
| 180 | 3 | 1 |
| 105 | 3 | 1 |
| 108 | 2 | 1 |
| 105 | 3 | 1 |
| 115 | 2 | 1 |
| 201 | 3 | 1 |
| 165 | 3 | 1 |
| 207 | 2 | 1 |
| 282 | 3 | 1 |
| 25 | 3 | 1 |
| 30 | 2 | 1 |
| 3168 | 1 | 2 |
| | feet | miles |
| Pipe length (total) | 8,375.0 | 1.6 |
| Trenching | 5,139.0 | 1.0 |

Appendix I. CNG Engine and Vehicle Availability

OEM Availability - Summary

| North America | | | | | |
|--------------------|-------------------------------------|--------------|-------|---------|---|
| OEM | Model | Segment | ISL G | ISX12 G | Comments |
| Freightliner Truck | Business Class M2 112 (Class 7/8) | MD/HD Truck | X | | Applications: 6X4 Tractor (LNG, CNG), CNG - 4X2 Tractor, 6X2, 4X2 Truck, Vocational |
| | Cascadia | HD Truck | | X | ISX12 G - Mid 2013 |
| Kenworth | W900S | MD/HD Truck | X | X | Vocational/Mixer |
| | T440 / T470 | MD/HD Truck | X | | Local & regional haul, vocational. |
| | T660 | HD Truck | | X | ISX12 G - Mid 2013 |
| Peterbilt | Model 384 | MD/HD Truck | X | X | Model 384 - Tractor |
| | Model 365 | MD/HD Truck | X | X | ISX12 G - Mid 2013 |
| Volvo | VNM | MD/HD Truck | X | | |
| | VNL | HD Truck | | X | ISX12 G - Mid 2013 |
| Mack | Pinnacle | HD Truck | | X | ISX12 G - Mid 2013 |
| | Granite | HD Truck | | X | ISX12 G - Mid 2013 |
| International | TranStar | MD/HD Truck | X | | New 2012 |
| American LaFrance | Condor | Refuse | X | | |
| AutoCar | ACX | Refuse | X | X | ISX12 G - Mid 2013 |
| Crane Carrier | LCF | Refuse | X | | |
| Peterbilt | 320 | Refuse | X | X | ISX12 G - Mid 2013 |
| Mack | TerraPro Low Entry | Refuse | X | | |
| Mack | TerraPro Cab Over | Refuse | X | | |
| NABI | 35 LFW/40 LFW/60 BRT | Urban Bus | X | | |
| New Flyer | 30 LF/35 LF/40 LF | Urban Bus | X | | |
| Orion | Orion V HF/Orion VII LF | Urban Bus | X | | |
| Foton | City - L40 CNG | Urban Bus | X | | |
| Gillig | LF | Urban Bus | X | | New 2011 |
| MCI | Commuter Coach 40/45 | Motor Coach | X | | New 2011 |
| DesignLine | Commuter Coach 40/45 | Motor Coach | X | | New 2012 |
| El Dorado National | Axess/E-Z Rider II/Transmark RE/XHF | Shuttle | X | | |
| Blue Bird | All American | School Bus | X | | |
| Thomas Bus | Saf-T Liner | School Bus | X | | |
| Capacity | TJ9000 , TJ5000 | Yard Spotter | X | | |
| AutoCar | Xspotter | Yard Spotter | X | | |

June, 2012



Available NGV Aftermarket Conversion Systems

The information contained in this document covers aftermarket conversion systems that consumers and businesses may purchase in order to modify new or used vehicles so that they can operate on natural gas. Some of these systems may be ordered directly through automotive dealerships when placing an order for a new vehicle. However, all of the systems listed here are aftermarket from the standpoint that they are offered as modifications to original equipment manufacturer (OEM) gasoline or diesel fueled vehicles.

The information is organized by certified or approved light-duty and heavy-duty chassis vehicles, as well as by certified or approved heavy-duty engines. The individual sheets are further organized by OEM (e.g., Chrysler, Ford, or GM), model year, and engine size, so that persons interested in a conversion system for a particular vehicle may quickly locate it. All of the systems listed have been either certified or approved by the U.S. Environmental Protection Agency (EPA) or the California Air Resources Board (CARB). Please do not contact NGV America regarding the availability of aftermarket systems. NGV America does not sell conversion systems or provide any services related to the installation of such systems.

Please review the listings of available systems and also the websites of the companies who offer them. All of these companies are dealing with a large number of inquiries and a significant demand for NGVs, so please review all available materials before making inquiries about particular vehicles, systems, or engines.

For future updates of this document, visit the NGV America site here:
http://www.ngvamerica.org/about_ngv/available_ngv.html

| OEM | Original Model Year | Eng Disp | Conversion Models Covered | Converted to Operate On | Original Fuel | Conversion MFR | OEM Test Group | OEM Evap Families | Conversion Certificate Number | Conversion Evap Family | Conversion Test Group | Compliance Status |
|----------|---------------------|----------|--|-------------------------|---------------|---------------------------|----------------|--|-------------------------------|------------------------|-----------------------|-------------------|
| Chrysler | 2012 | 3.6 | NatGasCar: Grand Caravan, Ram C/V, Routan, Town & Country | CNG | Gasoline/E85 | Nat Gas Car LLC | CCRJI03.6VPA | CCRXR0150RMA | CNATJ03.6VPB-014 | CNATR0150RM1 | CNATJ03.6VPB | EPA Cert |
| Chrysler | 2012 | 3.6 | NatGasCar: Journey | CNG | Gasoline/E85 | Nat Gas Car LLC | CCRJI03.6VPA | CCRXR0153PMA | CNATJ03.6VPB-015-R01 | CNATR0153PM1 | CNATJ03.6VPB | EPA Cert |
| Chrysler | 2012 | 3.6 | NatGasCar: 200, 200 Convertible, Avenger | CNG | Gasoline/E85 | Nat Gas Car LLC | CCRJI03.6VPA | CCRXR0130PMA | CNATJ03.6VPB-016-R01 | CNATR0130PM1 | CNATJ03.6VPB | EPA Cert |
| Chrysler | 2012 | 3.6 | NatGasCar: Grand Caravan, Ram C/V, Routan, Town & Country | CNG or gasoline/E85 | Gasoline/E85 | Nat Gas Car LLC | CCRJI03.6VPA | CCRXR0150RMA | CNATJ03.6VPA-011 | CNATR0150RMA | CNATJ03.6VPA | EPA Cert |
| Chrysler | 2012 | 3.6 | NatGasCar: 200, 200 Convertible, Avenger | CNG or gasoline/E85 | Gasoline/E85 | Nat Gas Car LLC | CCRJI03.6VPA | CCRXR0130PMA | CNATJ03.6VPA-012-R01 | CNATR0130PMA | CNATJ03.6VPA | EPA Cert |
| Chrysler | 2012 | 3.6 | NatGasCar: Journey | CNG or gasoline/E85 | Gasoline/E85 | Nat Gas Car LLC | CCRJI03.6VPA | CCRXR0153PMA | CNATJ03.6VPA-013-R01 | CNATR0153PMA | CNATJ03.6VPA | EPA Cert |
| Chrysler | 2012 | 4.7 | NatGasCar: Ram 1500 2WD, Ram 1500 4WD | CNG | Gasoline/E85 | Nat Gas Car LLC | CCRXT04.7UPA | CCRXR0190RKA | CNATT04.7UPB-006 | CNATR0190RK1 | CNATT04.7UPB | EPA Cert |
| Chrysler | 2012 | 4.7 | NatGasCar: Ram 1500 2WD, Ram 1500 4WD | CNG | Gasoline/E85 | Nat Gas Car LLC | CCRXT04.7UPA | CCRXR0225RKA | CNATT04.7UPB-007 | CNATR0225RK1 | CNATT04.7UPB | EPA Cert |
| Chrysler | 2012 | 4.7 | NatGasCar: Ram 1500 2WD, Ram 1500 4WD | CNG or gasoline/E85 | Gasoline/E85 | Nat Gas Car LLC | CCRXT04.7UPA | CCRXR0190RKA | CNATT04.7UPA-004 | CNATR0190RKA | CNATT04.7UPA | EPA Cert |
| Chrysler | 2012 | 4.7 | NatGasCar: Ram 1500 2WD, Ram 1500 4WD | CNG or gasoline/E85 | Gasoline/E85 | Nat Gas Car LLC | CCRXT04.7UPA | CCRXR0225RKA | CNATT04.7UPA-005 | CNATR0225RKA | CNATT04.7UPA | EPA Cert |
| Chrysler | 2011 | 3.6 | NatGasCar: Grand Caravan, Routan, Town & Country | CNG | Gasoline/E85 | Nat Gas Car LLC | BCRXJ03.6UPA | BCRXR0150RKA | CNATJ03.6UPB-001 | CNATR0150RK1 | CNATJ03.6UPB | EPA Cert |
| Chrysler | 2011 | 3.6 | NatGasCar: 200, 200 Convertible, Avenger | CNG | Gasoline/E85 | Nat Gas Car LLC | BCRXJ03.6UPA | BCRXR0130PKA | CNATJ03.6UPB-002 | CNATR0130PK1 | CNATJ03.6UPB | EPA Cert |
| Chrysler | 2011 | 3.6 | NatGasCar: Journey | CNG | Gasoline/E85 | Nat Gas Car LLC | BCRXJ03.6UPA | BCRXR0153PKA | CNATJ03.6UPB-003 | CNATR0153PK1 | CNATJ03.6UPB | EPA Cert |
| Chrysler | 2011 | 3.6 | NatGasCar: 200, 200 Convertible, Avenger | CNG or gasoline/E85 | Gasoline/E85 | Nat Gas Car LLC | BCRXJ03.6UPA | BCRXR0130PKA | CNATJ03.6UPA-008 | CNATR0130PKA | CNATJ03.6UPA | EPA Cert |
| Chrysler | 2011 | 3.6 | NatGasCar: Grand Caravan, Routan, Town & Country | CNG or gasoline/E85 | Gasoline/E85 | Nat Gas Car LLC | BCRXJ03.6UPA | BCRXR0150RKA | CNATJ03.6UPA-009 | CNATR0150RKA | CNATJ03.6UPA | EPA Cert |
| Chrysler | 2011 | 3.6 | NatGasCar: Journey | CNG or gasoline/E85 | Gasoline/E85 | Nat Gas Car LLC | BCRXJ03.6UPA | BCRXR0153PKA | CNATJ03.6UPA-010 | CNATR0153PKA | CNATJ03.6UPA | EPA Cert |
| Chrysler | 2011 | 4.7 | 01: Dodge Dakota, Dodge Ram 1500, Mitsubishi Raider | CNG | Gasoline | Nat Gas Car LLC | BCRXT04.7UPA | BCRXR0180RKA; BCRXR0190RKA; BCRXR0225RKA | BNATT04.7UPF-004 | BNATR0180RKA | BNATT04.7UPF | EPA Cert |
| Chrysler | 2010 | 4.7 | 01: Dodge Dakota, Dodge Ram 1500, Mitsubishi Raider | CNG | Gasoline | Nat Gas Car LLC | ACRXT04.7UPC | ACRXR0180RKA; ACRXR0190RKA; ACRXR0225RKA | BNATT04.7UPD-002 | BNATR0180RKA | BNATT04.7UPD | EPA Cert |
| Chrysler | 2011 | 4.7 | 01: Dodge Dakota, Dodge Ram 1500, Mitsubishi Raider | CNG or gasoline | Gasoline | Nat Gas Car LLC | BCRXT04.7UPA | BCRXR0180RKA; BCRXR0190RKA; BCRXR0225RKA | BNATT04.7UPE-003 | BNATR0180RKA | BNATT04.7UPE | EPA Cert |
| Chrysler | 2010 | 4.7 | 01: Dodge Dakota, Dodge Ram 1500, Mitsubishi Raider | CNG or gasoline | Gasoline | Nat Gas Car LLC | ACRXT04.7UPC | ACRXR0180RKA; ACRXR0190RKA; ACRXR0225RKA | BNATT04.7UPB-001 | BNATR0180RKA | BNATT04.7UPB | EPA Cert |
| Ford | 2012 | 2.0 | Altech-Eco Corporation: Transit Connect Van, Transit Connect Wagon FWD | CNG | Gasoline | Altech-Eco Corporation | CFMXT02.01DW | CFMXR0125NBB | CAECT02.01DB-019 | CAECR0125NB2 | CAECT02.01DB | EPA Cert |
| Ford | 2012 | 2.0 | Altech-Eco Corporation: Transit Connect Van, Transit Connect Wagon FWD | CNG or gasoline | Gasoline | Altech-Eco Corporation | CFMXT02.01DW | CFMXR0125NBB | CAECT02.01DW-020 | CAECR0125NBB | CAECT02.01DW | EPA Cert |
| Ford | 2012 | 2.0 | BAF Technologies: Ford Transit Connect | CNG | Gasoline | BAF Technologies | CFMXT02.01DW | CFMXR0125NBB | CBAFT02.01DW-002 | CBAFR0000001 | CBAFT02.01DW | EPA Cert, CARB |
| Ford | 2012 | 5.0 | AEC: F150 Pickup 2WD Altech-Eco Corporation: F150 Pickup 4WD | CNG | Gasoline/E85 | Altech-Eco Corporation | CFMXT05.03DD | CFMXR0265NBV | CAECT05.03DA-014 | CAECR0265NB1 | CAECT05.03DA | EPA Cert |
| Ford | 2012 | 5.0 | AEC: F150 Pickup 2WD Altech-Eco Corporation: F150 Pickup 4WD | CNG or gasoline/E85 | Gasoline/E85 | Altech-Eco Corporation | CFMXT05.03DD | CFMXR0265NBV | CAECT05.03DD-013 | CAECR0265NBV | CAECT05.03DD | EPA Cert |
| Ford | 2012 | 5.0 | IA Bi-Fuel CNG - Ford: F150 Pickup 2WD, F150 Pickup 4WD | CNG or gasoline/E85 | Gasoline/E85 | IMPICO Technologies, Inc. | CFMXT05.03DD | CFMXR0265NBV | CZ9XT05.0BNA-005 | CZ9XR0265CB1 | CZ9XT05.0BNA | EPA Cert |
| Ford | 2012 | 5.4 | BAF Technologies: E350 Cutaway | CNG | Gasoline/E85 | BAF Technologies | CFMXE05.4AFD | | CBAFD05.4AFD-009 | CBAFR0000001 | CBAFD05.4AFD | EPA Cert |
| Ford | 2012 | 5.4 | BAF Technologies: Ford E-Series Van | CNG | Gasoline/E85 | BAF Technologies | CFMXT05.45HK | CFMXR0265NBD; CFMXF0265NBS | CBAFT05.45HK-001 | CBAFR0000001 | CBAFT05.45HK | EPA Cert |

| OEM | Original Model Year | Eng Disp | Conversion Models Covered | Converted to Operate On | Original Fuel | Conversion MFR | OEM Test Group | OEM Evap Families | Conversion Certificate Number | Conversion Evap Family | Conversion Test Group | Compliance Status |
|------|---------------------|----------|--|-------------------------|---------------|--------------------------------|--|---|-------------------------------|------------------------|-----------------------|-------------------|
| Ford | 2012 | 5.4 | Landi Renzo USA: E150 VAN CNG, E150 WAGON CNG, E250 VAN CNG, E350 CUTAWAY CNG, E350 VAN CNG, E350 WAGON CNG | CNG | Gasoline/E85 | Landi Renzo USA Corporation | CFMXT05.45HK | CFMXXR0265NBD; CFMXXF0265NBS | CLDRT05.4A11-001-R01 | CLDRT0000A11 | CLDRT05.4A11 | EPA Cert, CARB |
| Ford | 2012 | 6.2 | Altech-Eco Corporation: F250 2WD Bed Delete, F250 4WD Bed Delete, F350 4WD Bed Delete, F350 2WD, F350 2WD Bed Delete, F350 4WD | CNG | Gasoline/E85 | Altech-Eco Corporation | CFMXT06.27HL | CFMXXF0250NBS | CAECT06.27HA-010 | CAECF0250NB3 | CAECT06.27HA | EPA Cert |
| Ford | 2012 | 6.2 | Altech-Eco Corporation: F250 Pickup 2WD, F250 Pickup 4WD, F350 2WD, F350 4WD | CNG | Gasoline/E85 | Altech-Eco Corporation | CFMXT06.27HL | CFMXXR0250NBS | CAECT06.27HA-011 | CAECR0250NB3 | CAECT06.27HA | EPA Cert |
| Ford | 2012 | 6.2 | Altech-Eco Corporation: F350 Incomplete 2WD, F350 Incomplete 4WD | CNG | Gasoline/E85 | Altech-Eco Corporation | CFMXT06.27HL | CFMXXF0265GAS | CAECT06.27HA-012 | CAECF0265GA1 | CAECT06.27HA | EPA Cert |
| Ford | 2012 | 6.2 | Altech-Eco Corporation: F250 2WD Bed Delete, F250 4WD Bed Delete, F350 4WD Bed Delete, F350 2WD, F350 2WD Bed Delete, F350 4WD | CNG or gasoline/E85 | Gasoline/E85 | Altech-Eco Corporation | CFMXT06.27HL | CFMXXF0250NBS | CAECT06.27HL-007 | CAECF0250NB2 | CAECT06.27HL | EPA Cert |
| Ford | 2012 | 6.2 | Altech-Eco Corporation: F250 Pickup 2WD, F250 Pickup 4WD, F350 2WD, F350 4WD | CNG or gasoline/E85 | Gasoline/E85 | Altech-Eco Corporation | CFMXT06.27HL | CFMXXR0250NBS | CAECT06.27HL-008 | CAECR0250NB2 | CAECT06.27HL | EPA Cert |
| Ford | 2012 | 6.2 | Altech-Eco Corporation: F350 Incomplete 2WD, F350 Incomplete 4WD | CNG or gasoline/E85 | Gasoline/E85 | Altech-Eco Corporation | CFMXT06.27HL | CFMXXF0265GAS | CAECT06.27HL-009 | CAECF0265GAS | CAECT06.27HL | EPA Cert |
| Ford | 2012 | 6.2 | BAF Technologies: Ford F250/350 | CNG | Gasoline/E85 | BAF Technologies | CFMXT06.27HL | CFMXXR0250NBS; CFMXXF0250NBS; CFMXXF0265GAS | CBAFT06.27HL-003 | CBAFR0000001 | CBAFT06.27HL | EPA Cert |
| Ford | 2012 | 6.2 | IA Dedicated CNG - Ford: Ford F250 Pickup 2WD, Ford F250 Pickup 4WD, Ford F350 Pickup 2WD, Ford F350 Pickup 4WD | CNG | Gasoline/E85 | IMPSCO Technologies, Inc. | CFMXT06.27HL | CFMXXR0250NBS; CFMXXF0250NBS; CFMXXF0265GAS | CZ9XT06.2DCE-014 | CZ9XR0000DCE | CZ9XT06.2DCE | EPA Cert |
| Ford | 2012 | 6.2 | IA Bi-Fuel CNG - Ford: F250 PICKUP 2WD, F250 PICKUP 4WD, F350 4WD, F350 2WD | CNG or gasoline/E85 | Gasoline/E85 | IMPSCO Technologies, Inc. | CFMXT06.27HL | CFMXXR0250NBS | CZ9XT06.2BC2-015 | CZ9XR0250BCC | CZ9XT06.2BC2 | EPA Cert |
| Ford | 2012 | 6.2 | IA Bi-Fuel CNG - Ford: F250 2WD Bed Delete, F250 4WD Bed Delete, F350 4WD, F350 2WD, F350 2WD Bed Delete, F350 4WD Bed Delete | CNG or gasoline/E85 | Gasoline/E85 | IMPSCO Technologies, Inc. | CFMXT06.27HL | CFMXXF0250NBS | CZ9XT06.2BC2-016 | CZ9XF0250BCA | CZ9XT06.2BC2 | EPA Cert |
| Ford | 2012 | 6.2 | IA Bi-Fuel CNG - Ford: F350 INCOMPLETE 2WD, F350 INCOMPLETE 4WD | CNG or gasoline/E85 | Gasoline/E85 | IMPSCO Technologies, Inc. | CFMXT06.27HL | CFMXXF0265GAS | CZ9XT06.2BC2-017 | CZ9XF0265BCB | CZ9XT06.2BC2 | EPA Cert |
| Ford | 2012 | 6.2 | Landi Renzo USA: F250 PICKUP 2WD, F350 2WD, F350 4WD, F350 PICKUP 4WD | CNG or gasoline/E85 | Gasoline/E85 | Landi Renzo USA Corporation | CFMXT06.27HL | CFMXXR0250NBS | CLDRT06.2C20-002 | CLDRR0250NBS | CLDRT06.2C20 | EPA Cert |
| Ford | 2012 | 6.2 | Landi Renzo USA: F350 INCOMPLETE 2WD, F350 INCOMPLETE 4WD | CNG or gasoline/E85 | Gasoline/E85 | Landi Renzo USA Corporation | CFMXT06.27HL | CFMXXF0265GAS | CLDRT06.2C20-003 | CLDRF0265GAS | CLDRT06.2C20 | EPA Cert |
| Ford | 2012 | 6.2 | Landi Renzo USA: F250 2WD BED DELETE, F250 4WD BED DELETE, F350 2WD, F350 2WD BED DELETE, F350 4WD, F350 4WD BED DELETE | CNG or gasoline/E85 | Gasoline/E85 | Landi Renzo USA Corporation | CFMXT06.27HL | CFMXXF0250NBS | CLDRT06.2C20-004 | CLDRF0250NBS | CLDRT06.2C20 | EPA Cert |
| Ford | 2012 | 6.2 | Ford: F250/350 trucks | CNG | Gasoline/E85 | PowerFuel CNG Conversions, LLC | CFMXT06.27HL | CFMXTF0250NB; FMXTF0250NBS | DPRFT06.2HL4-010 | DPRFF0250N2D | DPRFT06.2HL4 | EPA Cert |
| Ford | 2012 | 6.2 | Ford: F250/350 trucks | CNG | Gasoline/E85 | PowerFuel CNG Conversions, LLC | CFMXT06.27HL | CFMXXR0250NBS | DPRFT06.2HL4-011 | DPRFR0250N2D | DPRFT06.2HL4 | EPA Cert |
| Ford | 2012 | 6.2 | Ford: F250/350 trucks | CNG | Gasoline/E85 | PowerFuel CNG Conversions, LLC | CFMXT06.27HL | CFMXXF0265GAS | DPRFT06.2HL4-012 | DPRFF0265G2D | DPRFT06.2HL4 | EPA Cert |
| Ford | 2012 | 6.2 | Ford: F250/350 trucks | CNG or gasoline/E85 | Gasoline/E85 | PowerFuel CNG Conversions, LLC | CFMXT06.27HL | CFMXXR0250NBS | DPRFT06.2HL3-007 | DPRFR0250N2S | DPRFT06.2HL3 | EPA Cert |
| Ford | 2012 | 6.2 | Ford: F250/350 trucks | CNG or gasoline/E85 | Gasoline/E85 | PowerFuel CNG Conversions, LLC | CFMXT06.27HL | CFMXTF0250NB; FMXTF0250NBS | DPRFT06.2HL3-008 | DPRFF0250N2S | DPRFT06.2HL3 | EPA Cert |
| Ford | 2012 | 6.2 | Ford: F250/350 trucks | CNG or gasoline/E85 | Gasoline/E85 | PowerFuel CNG Conversions, LLC | CFMXT06.27HL | CFMXXF0265GAS | DPRFT06.2HL3-009 | DPRFF0265G2S | DPRFT06.2HL3 | EPA Cert |
| Ford | 2012 | 6.2 | Ford: F250 Pickup 2WD, F250 Pickup 4WD, F350 2WD, F350 4WD | CNG or gasoline/E85 | Gasoline/E85 | Westport Light Duty Inc. | CFMXT06.27HL | CFMXXR0250NBS | CJNPT06.2CNG-001 | CJNPR0250NBS | CJNPT06.2CNG | EPA Cert |
| Ford | 2012 | 6.2 | Ford: F250 2WD Bed Delete, F250 4WD Bed Delete, F350 2WD, F350 2WD Bed Delete, F350 4WD, F350 4WD Bed Delete | CNG or gasoline/E85 | Gasoline/E85 | Westport Light Duty Inc. | CFMXT06.27HL | CFMXXF0250NBS | CJNPT06.2CNG-002 | CJNPF0250NBS | CJNPT06.2CNG | EPA Cert |
| Ford | 2012 | 6.2 | Ford: F350 Incomplete 2WD, F350 Incomplete 4WD | CNG or gasoline/E85 | Gasoline/E85 | Westport Light Duty Inc. | CFMXT06.2HL | CFMXXF0265GAS | CJNPT06.2CNG-003 | CJNPF0265GAS | CJNPT06.2CNG | EPA Cert |
| Ford | 2012 | 5.4, 4.6 | Altech-Eco Corporation: E250 Cutaway, E350 Cutaway | CNG | Gasoline/E85 | Altech-Eco Corporation | CFMXT05.45HK; CFMXT04.65H9 | CFMXXF0265NBS | CAECT05.45HB-015 | CAECF0265NB1 | CAECT05.45HB | EPA Cert |
| Ford | 2012 | 5.4, 4.6 | AEC: E350 Van Altech-Eco Corporation: E150 Van, E150 Wagon, E250 Van, E350 Van, E350 Wagon | CNG | Gasoline/E85 | Altech-Eco Corporation | CFMXT05.45HK; CFMXT05.45HL; CFMXT04.65H9 | CFMXXR0265NBD | CAECT05.45HB-016 | CAECR0265NB3 | CAECT05.45HB | EPA Cert |

| OEM | Original Model Year | Eng Disp | Conversion Models Covered | Converted to Operate On | Original Fuel | Conversion MFR | OEM Test Group | OEM Evap Families | Conversion Certificate Number | Conversion Evap Family | Conversion Test Group | Compliance Status |
|------|---------------------|----------|--|-------------------------|---------------|---------------------------|--|---|-------------------------------|------------------------|-----------------------|-------------------|
| Ford | 2012 | 6.2, 5.4 | BAF_Bifuel: E250/350 | CNG or gasoline/E85 | Gasoline/E85 | BAF Technologies | CFMXT05.45HK | CFM XR0265NBD | CBAFT06.254B-004 | CBAFR0265NBD | CBAFT06.254B | EPA Cert |
| Ford | 2012 | 6.2, 5.4 | BAF_Bifuel: E250/350 | CNG or gasoline/E85 | Gasoline/E85 | BAF Technologies | CFMXT05.45HK | CFM XF0265NBS | CBAFT06.254B-005 | CBAFF0265NBS | CBAFT06.254B | EPA Cert |
| Ford | 2012 | 6.2, 5.4 | BAF_Bifuel: F250/350; E250/350 | CNG or gasoline/E85 | Gasoline/E85 | BAF Technologies | CFMXT06.27HL | CFM XF0265GAS | CBAFT06.254B-006 | CBAFF0265GAS | CBAFT06.254B | EPA Cert |
| Ford | 2012 | 6.2, 5.4 | BAF_Bifuel: F250/350; E250/350 | CNG or gasoline/E85 | Gasoline/E85 | BAF Technologies | CFMXT06.27HL | CFM XR0250NBS | CBAFT06.254B-007 | CBAFR0250NBS | CBAFT06.254B | EPA Cert |
| Ford | 2012 | 6.2, 5.4 | BAF_Bifuel: F250/350; E250/350 | CNG or gasoline/E85 | Gasoline/E85 | BAF Technologies | CFMXT06.27HL | CFM XF0250NBS | CBAFT06.254B-008 | CBAFF0250NBS | CBAFT06.254B | EPA Cert |
| Ford | 2011 | 2.0 | Altech-Eco Corporation: Transit Connect | CNG | Gasoline | Altech-Eco Corporation | BFMXT02.01DV | BFM XR0125NBB | CAECT02.01DA-018 | CAECR0125NB2 | CAECT02.01DA | EPA Cert |
| Ford | 2011 | 2.0 | Altech-Eco Corporation: Transit Connect | CNG or gasoline | Gasoline | Altech-Eco Corporation | BFMXT02.01DV | BFM XR0125NBB | CAECT02.01DV-017 | CAECR0125NBB | CAECT02.01DV | EPA Cert |
| Ford | 2011 | 2.0 | BAF Technologies: Ford Transit Connect | CNG | Gasoline | BAF Technologies | BFMXT02.01DV | BFM XR0125NBB | BBAFT02.01DV-003 | BBAFR0000001 | BBAFT02.01DV | EPA Cert, CARB |
| Ford | 2011 | 2.0 | CNG - Dedicated Ford: Ford Transit Connect | CNG | Gasoline | EvoTek LLC | BFMXT02.01DV | BFM XR0125NBB | BETKT02.0N1A-002 | BETKR0000N1A | BETKT02.0N1A | EPA Cert |
| Ford | 2011 | 2.5 | Altech-Eco Corporation: Fusion, Fusion S FWD, Milan, Milan S FWD | CNG | Gasoline | Altech-Eco Corporation | BFM XV02.5VEN | BFM XR0155GAV | BAECV02.5VEB-022 | BAECR0155GA1 | BAECV02.5VEB | EPA Cert |
| Ford | 2011 | 2.5 | Altech-Eco Corporation: Escape 4WD, Escape FWD, Mariner 4WD, Mariner FWD, Tribute 4WD, Tribute FWD | CNG | Gasoline | Altech-Eco Corporation | BFMXT02.51EN | BFM XR0125NBV | BAECV02.5VEB-023 | BAECR0125NB1 | BAECV02.5VEB | EPA Cert |
| Ford | 2011 | 2.5 | Altech-Eco Corporation: Fusion, Fusion S FWD, Milan, Milan S FWD | CNG or gasoline | Gasoline | Altech-Eco Corporation | BFM XV02.5VEN | BFM XR0155GAV | BAECV02.5VEN-020 | BAECR0155GAV | BAECV02.5VEN | EPA Cert |
| Ford | 2011 | 2.5 | Altech-Eco Corporation: Escape 4WD, Escape FWD, Mariner 4WD, Mariner FWD, Tribute 4WD, Tribute FWD | CNG or gasoline | Gasoline | Altech-Eco Corporation | BFMXT02.51EN | BFM XR0125NBV | BAECV02.5VEN-021 | BAECR0125NBV | BAECV02.5VEN | EPA Cert |
| Ford | 2011 | 2.5 | CNG - Dedicated Ford / Lincoln / Mercury: Ford Escape 4WD, Ford Escape FWD, Mazda Tribute 4WD, Mazda Tribute FWD | CNG | Gasoline | EvoTek LLC | BFMXT02.51EN | BFM XR0125NBV | BETKT02.5C1A-007 | BETKR0000E1H | BETKT02.5C1A | EPA Cert |
| Ford | 2011 | 2.5 | CNG - Dedicated Ford / Lincoln / Mercury: Ford Fusion, Ford Fusion S | CNG | Gasoline | EvoTek LLC | BFM XV02.5VEN | BFM XR0155GAV | BETKV02.5C1A-008 | BETKR0000E1I | BETKV02.5C1A | EPA Cert |
| Ford | 2011 | 3.7 | CNG - Dedicated Ford / Lincoln / Mercury: Ford F150 4WD, Ford F150 Pickup 2WD | CNG | Gasoline/E85 | EvoTek LLC | BFMXT03.73DP | BFM XR0265NBV | BETKT03.7N1A-012 | BETKR0000E1F | BETKT03.7N1A | EPA Cert |
| Ford | 2011 | 4.6 | CNG - Dedicated Ford / Lincoln / Mercury: Crown Victoria FFV, Crown Victoria Police FFV, Grand Marquis FFV, Town Car FFV | CNG | Gasoline/E85 | EvoTek LLC | BFM XV04.6VDF; BFM XV04.6VHF | BFM XR0115GAA | BETKV04.6N1A-006 | | BETKV04.6N1A | EPA Cert |
| Ford | 2011 | 4.6 | Bi-Fuel CNG - Ford / Lincoln / Mercury: Crown Victoria, Crown Victoria Police, Grand Marquis, Town Car | CNG or gasoline/E85 | Gasoline/E85 | EvoTek LLC | BFM XV04.6VDF; BFM XV04.6VHF | BFM XR0115GAA | BETKV04.6BCA-010 | BETKR0115E1J | BETKV04.6BCA | EPA Cert |
| Ford | 2011 | 4.6 | Go Natural CNG: Crown Victoria, Crown Victoria Police, Grand Marquis, Town Car | CNG | Gasoline/E85 | Go Natural CNG, LLC | BFM XV04.6VDF | BFM XR0115GAA | CGNLV04.6F1B-004 | CGNLR0115F1B | CGNLV04.6F1B | EPA Cert |
| Ford | 2011 | 4.6 | Go Natural CNG: Crown Victoria, Crown Victoria Police, Grand Marquis, Town Car | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | BFM XV04.6VDF | BFM XR0115GAA | CGNLV04.6F2B-005 | CGNLR0115F2B | CGNLV04.6F2B | EPA Cert |
| Ford | 2011 | 5.0 | AEC: F150 Pickup 2WD Altech-Eco Corporation: F150 Pickup 4WD | CNG | Gasoline/E85 | Altech-Eco Corporation | BFMXT05.03DD | BFM XR0265NBV | BAECT05.03DA-030-R01 | BAECR0265NB1 | BAECT05.03DA | EPA Cert |
| Ford | 2011 | 5.0 | AEC: F150 Pickup 2WD Altech-Eco Corporation: F150 Pickup 4WD | CNG or gasoline/E85 | Gasoline/E85 | Altech-Eco Corporation | BFMXT05.03DD | BFM XR0265NBV | BAECT05.03DD-031 | BAECR0265NBV | BAECT05.03DD | EPA Cert |
| Ford | 2011 | 5.0 | IA Bi-Fuel CNG - Ford: F150 Pickup 2WD, F150 Pickup 4WD | CNG or gasoline/E85 | Gasoline/E85 | IMPSCO Technologies, Inc. | BFMXT05.03DD | BFM XR0265NGV | BZ9XT05.0BNA-052 | BZ9XR0265CB1 | BZ9XT05.0BNA | EPA Cert |
| Ford | 2011 | 5.4 | AEC: E350 Van Altech-Eco Corporation: E150 Van, E150 Wagon, E250 Van, E350 Van, E350 Wagon | CNG | Gasoline/E85 | Altech-Eco Corporation | BFMXT05.45HK; BFMXT05.45HL | BFM XR0265NBD | CAECT05.45HA-001 | CAECR0265NBD | CAECT05.45HA | EPA Cert |
| Ford | 2011 | 5.4 | Altech-Eco Corporation: E350 Cutaway | CNG | Gasoline/E85 | Altech-Eco Corporation | BFMXT05.45HK; BFMXT05.45HL | BFM XF0265NBS | CAECT05.45HA-002 | CAECF0265NBS | CAECT05.45HA | EPA Cert |
| Ford | 2011 | 5.4 | BAF Technologies: Ford E-Series Van and Club Wagon 150, 250, 350, E 350 Cutaway | CNG | Gasoline/E85 | BAF Technologies | BFMXT05.45HK | BFM XR0265NBD; BFM XF0265NBS | BBAFT05.45HK-004 | BBAFR0000001 | BBAFT05.45HK | EPA Cert, CARB |
| Ford | 2011 | 5.4 | CNG - Dedicated Ford: Ford Econoline 250/350 | CNG | Gasoline/E85 | EvoTek LLC | BFMXT05.45HL; BFMXT05.45HK | BFM XR0265NBD | BETKT05.4N1A-001 | BETKR0000N1B | BETKT05.4N1A | EPA Cert |
| Ford | 2011 | 5.4 | Go Natural CNG: Expedition 2WD, Expedition 4WD, Navigator 2WD, Navigator 4WD | CNG | Gasoline/E85 | Go Natural CNG, LLC | BFMXT05.44HY; BFMXT05.44BC | BFM XR0265NBC | BGNLT05.4F3B-018-R01 | BGNLR0265F3B | BGNLT05.4F3B | EPA Cert |
| Ford | 2011 | 5.4 | Go Natural CNG: E150 Van, E150 Wagon, E250 Van, E350 Cutaway, E350 Van, E350 Wagon, Expedition 2WD, Navigator 2WD | CNG | Gasoline/E85 | Go Natural CNG, LLC | BFMXT05.45BR; BFMXT05.45HK; BFMXT05.45HL | BFM XR0265NBC; BFM XR0265NBD; BFM XF0265NBS | CGNLT05.4F1B-002 | CGNLR0000000 | CGNLT05.4F1B | EPA Cert |
| Ford | 2011 | 5.4 | Go Natural CNG: E350 Van | CNG or gasoline | Gasoline | Go Natural CNG, LLC | BFMXT05.45HL | BFM XR0265NBD | BGNLT05.4F9B-016 | BGNLR0265FAB | BGNLT05.4F9B | EPA Cert |

| OEM | Original Model Year | Eng Disp | Conversion Models Covered | Converted to Operate On | Original Fuel | Conversion MFR | OEM Test Group | OEM Evap Families | Conversion Certificate Number | Conversion Evap Family | Conversion Test Group | Compliance Status |
|------|---------------------|----------|--|-------------------------|---------------|--------------------------------|--|--|-------------------------------|------------------------|-----------------------|-------------------|
| Ford | 2011 | 5.4 | Go Natural CNG: Expedition 2WD, Expedition 4WD, Navigator 2WD, Navigator 4WD | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | BFMXT05.44BC | BFMXR0265NBC | BGNLT05.4F4B-005 | BGNLR0265F4B | BGNLT05.4F4B | EPA Cert |
| Ford | 2011 | 5.4 | Go Natural CNG: Expedition 2WD, Expedition 4WD, Navigator 2WD, Navigator 4WD | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | BFMXT05.44HY | BFMXR0265NBC | BGNLT05.4F5B-006 | BGNLR0265F5B | BGNLT05.4F5B | EPA Cert |
| Ford | 2011 | 5.4 | Go Natural CNG: E350 Cutaway | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | BFMXT05.45HK | BFMXF0265NBS | BGNLT05.4F6B-008 | BGNLF0265FDB | BGNLT05.4F6B | EPA Cert |
| Ford | 2011 | 5.4 | Go Natural CNG: E150 Van, E150 Wagon, E250 Van, E350 Van, E350 Wagon | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | BFMXT05.45HK | BFMXR0265NBD | BGNLT05.4F6B-009 | BGNLR0265FCB | BGNLT05.4F6B | EPA Cert |
| Ford | 2011 | 5.4 | Go Natural CNG: Expedition 2WD, Navigator 2WD | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | BFMXT05.45BR | BFMXR0265NBC | BGNLT05.4F6B-010 | BGNLR0265FBB | BGNLT05.4F6B | EPA Cert |
| Ford | 2011 | 5.4 | IA Bi-Fuel CNG - Ford: Ford E150 Van, Ford E150 Wagon, Ford E250 Van, Ford E350 Van, Ford E350 Wagon | CNG or gasoline/E85 | Gasoline/E85 | IMPSCO Technologies, Inc. | BFMXT05.45HK | BFMXR0265NBD | BZ9XT05.4CB1-057 | BZ9XR0265BCC | BZ9XT05.4CB1 | EPA Cert |
| Ford | 2011 | 5.4 | Landi Renzo USA: E150 VAN CNG, E150 WAGON CNG, E250 VAN CNG, E350 CUTAWAY CNG, E350 VAN CNG, E350 WAGON CNG | CNG | Gasoline | Landi Renzo USA Corporation | BFMXT05.45HK | | BLDRT05.4A10-001 | BLDRT0000A10 | BLDRT05.4A10 | EPA Cert, CARB |
| Ford | 2011 | 5.4 | Landi Renzo USA: E150 VAN CNG, E150 WAGON CNG, E250 VAN CNG, E350 CUTAWAY CNG, E350 VAN CNG, E350 WAGON CNG | CNG | Gasoline/E85 | Landi Renzo USA Corporation | BFMXT05.45HK | BFMXR0265NBD; BFMXF0265NBS | BLDRT05.4A11-003 | BLDRT0000A11 | BLDRT05.4A11 | EPA Cert, CARB |
| Ford | 2011 | 6.2 | Altech-Eco Corporation: F250 Pickup 2WD, F250 Pickup 4WD, F350 2WD, F350 4WD | CNG | Gasoline/E85 | Altech-Eco Corporation | BFMXT06.27HL | BFMXR0250NBS | BAECT06.27HA-027 | BAECR0250NB3 | BAECT06.27HA | EPA Cert |
| Ford | 2011 | 6.2 | Altech-Eco Corporation: F250 2WD Bed Delete, F250 4WD Bed Delete, F350 4WD Bed Delete, F350 2WD, F350 2WD Bed Delete, F350 4WD | CNG | Gasoline/E85 | Altech-Eco Corporation | BFMXT06.27HL | BFMXF0250NBS | BAECT06.27HA-028 | BAECF0250NB3 | BAECT06.27HA | EPA Cert |
| Ford | 2011 | 6.2 | Altech-Eco Corporation: F350 Incomplete 2WD, F350 Incomplete 4WD | CNG | Gasoline/E85 | Altech-Eco Corporation | BFMXT06.27HL | BFMXF0265GAS | BAECT06.27HA-029 | BAECF0265GA1 | BAECT06.27HA | EPA Cert |
| Ford | 2011 | 6.2 | Altech-Eco Corporation: F250 Pickup 2WD, F250 Pickup 4WD, F350 2WD, F350 4WD | CNG or gasoline/E85 | Gasoline/E85 | Altech-Eco Corporation | BFMXT06.27HL | BFMXR0250NBS | BAECT06.27HL-024 | BAECR0250NB2 | BAECT06.27HL | EPA Cert |
| Ford | 2011 | 6.2 | Altech-Eco Corporation: F250 2WD Bed Delete, F250 4WD Bed Delete, F350 4WD Bed Delete, F350 2WD, F350 2WD Bed Delete, F350 4WD | CNG or gasoline/E85 | Gasoline/E85 | Altech-Eco Corporation | BFMXT06.27HL | BFMXF0250NBS | BAECT06.27HL-025 | BAECF0250NB2 | BAECT06.27HL | EPA Cert |
| Ford | 2011 | 6.2 | Altech-Eco Corporation: F350 Incomplete 2WD, F350 Incomplete 4WD | CNG or gasoline/E85 | Gasoline/E85 | Altech-Eco Corporation | BFMXT06.27HL | BFMXF0265GAS | BAECT06.27HL-026 | BAECF0265GAS | BAECT06.27HL | EPA Cert |
| Ford | 2011 | 6.2 | BAF Technologies: Ford F250/350 | CNG | Gasoline | BAF Technologies | BFMXT06.27HL | BFMXR0250NBS; BFMXF0250NBS; BFMXF0265GAS | BBAFT06.27HL-005 | BBAFR0000001 | BBAFT06.27HL | EPA Cert |
| Ford | 2011 | 6.2 | CNG - Dedicated Ford: Ford F250/F350 | CNG | Gasoline/E85 | EvoTek LLC | BFMXT06.27HL | BFMXR0250NBS; BFMXF0250NBS; BFMXF0265GAS | BETKT06.2N2A-003 | BETKR0000E1C | BETKT06.2N2A | EPA Cert |
| Ford | 2011 | 6.2 | CNG - Dedicated Ford / Lincoln / Mercury: F150 Raptor Pickup 4WD, Ford F150 4WD, Ford F150 Pickup 2WD | CNG | Gasoline | EvoTek LLC | BFMXT06.24D2 | BFMXR0265NBV | BETKT06.2DNH-013 | BETKR0000HDT | BETKT06.2DNH | EPA Cert |
| Ford | 2011 | 6.2 | Bi-Fuel CNG - Ford / Lincoln / Mercury: Ford F250/F350 | CNG or gasoline | Gasoline/E85 | EvoTek LLC | BFMXT06.27HL | BFMXF0250NBS | BETKT06.2B2A-009 | BETKR0000E1D | BETKT06.2B2A | EPA Cert |
| Ford | 2011 | 6.2 | Ford: F250/350 trucks | CNG | Gasoline/E85 | PowerFuel CNG Conversions, LLC | BFMXT06.27HL | BFMXF0250NBD | DPRFT06.2HL2-004 | DPRFF0250NBD | DPRFT06.2HL2 | EPA Cert |
| Ford | 2011 | 6.2 | Ford: F250/350 trucks | CNG | Gasoline/E85 | PowerFuel CNG Conversions, LLC | BFMXT06.27HL | BFMXF0265GAS | DPRFT06.2HL2-005 | DPRFF0265GAD | DPRFT06.2HL2 | EPA Cert |
| Ford | 2011 | 6.2 | Ford: F250/350 trucks | CNG | Gasoline/E85 | PowerFuel CNG Conversions, LLC | BFMXT06.27HL | BFMXR0250NBD | DPRFT06.2HL2-006 | DPRFR0250NBD | DPRFT06.2HL2 | EPA Cert |
| Ford | 2011 | 6.2 | Ford: F250/350 trucks | CNG or gasoline/E85 | Gasoline/E85 | PowerFuel CNG Conversions, LLC | BFMXT06.27HL | BFMXR0250NBS | DPRFT06.2HL1-001 | DPRFR0250NBS | DPRFT06.2HL1 | EPA Cert |
| Ford | 2011 | 6.2 | Ford: F250/350 trucks | CNG or gasoline/E85 | Gasoline/E85 | PowerFuel CNG Conversions, LLC | BFMXT06.27HL | BFMXF0250NBS | DPRFT06.2HL1-002 | DPRFF0250NBS | DPRFT06.2HL1 | EPA Cert |
| Ford | 2011 | 6.2 | Ford: F250/350 trucks | CNG or gasoline/E85 | Gasoline/E85 | PowerFuel CNG Conversions, LLC | BFMXT06.27HL | BFMXF0265GAS | DPRFT06.2HL1-003 | DPRFF0265GAS | DPRFT06.2HL1 | EPA Cert |
| Ford | 2011 | 5.4, 4.6 | Altech-Eco Corporation: E150 Van, E150 Wagon, E250 Van, E350 Van, E350 Wagon | CNG | Gasoline/E85 | Altech-Eco Corporation | BFMXT05.45HK; BFMXT05.45HL; BFMXT04.65H9 | BFMXR0265NBD | BAECT05.45HA-032 | BAECR0265NB3 | BAECT05.45HA | EPA Cert |
| Ford | 2011 | 5.4, 4.6 | Altech-Eco Corporation: E250 Cutaway, E350 Cutaway | CNG | Gasoline/E85 | Altech-Eco Corporation | BFMXT05.45HK; BFMXT04.65H9 | BFMXF0265NBS | BAECT05.45HA-033 | BAECF0265NB1 | BAECT05.45HA | EPA Cert |

| OEM | Original Model Year | Eng Disp | Conversion Models Covered | Converted to Operate On | Original Fuel | Conversion MFR | OEM Test Group | OEM Evap Families | Conversion Certificate Number | Conversion Evap Family | Conversion Test Group | Compliance Status |
|------|---------------------|----------|---|-------------------------|---------------|------------------------|----------------------------|--|-------------------------------|------------------------|-----------------------|-------------------|
| Ford | 2011 | 5.4, 6.2 | BAF_Bifuel: F250/350; E250/350 | CNG or gasoline/E85 | Gasoline/E85 | BAF Technologies | BFMXT06.27HL; BFMXT05.45HK | BFMXR0250NBS; BFMXF0250NBS; BFMXF0265GAS; BFMXR0265NBD; BFMXF0265NBS | BBAFT06.254B-006-R01 | BBAFR0000002 | BBAFT06.254B | EPA Cert |
| Ford | 2010 | 2.0 | Altech-Eco Corporation: Transit Connect | CNG | Gasoline | Altech-Eco Corporation | AFMXT02.01DV | AFMXR0125NBB | AAECT02.01DA-008 | AAECR0125NB1 | AAECT02.01DA | EPA Cert |
| Ford | 2010 | 2.0 | Altech-Eco Corporation: Focus | CNG | Gasoline | Altech-Eco Corporation | AFMXV02.0VZX | AFMXR0110GCX | AAECV02.0VZA-002 | AAECR0125NC1 | AAECV02.0VZA | EPA Cert |
| Ford | 2010 | 2.0 | Altech-Eco Corporation: Focus | CNG | Gasoline | Altech-Eco Corporation | AFMXV02.0VDX | AFMXR0125NAA | AAECV02.0VZA-003 | AAECR0125NA1 | AAECV02.0VZA | EPA Cert |
| Ford | 2010 | 2.0 | Altech-Eco Corporation: Focus | CNG | Gasoline | Altech-Eco Corporation | AFMXV02.0VEC | AFMXR0110GAA | BAECV02.0VEA-019 | BAECR0110GA1 | BAECV02.0VEA | EPA Cert |
| Ford | 2010 | 2.0 | Altech-Eco Corporation: Transit Connect | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXT02.01DV | | AAECT02.01DV-007 | AAECR0125NBB | AAECT02.01DV | EPA Cert |
| Ford | 2010 | 2.0 | Altech-Eco Corporation: Focus | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXV02.0VDX | AFMXR0125NAA | AAECV02.0VZX-004 | AAECR0125NAA | AAECV02.0VZX | EPA Cert |
| Ford | 2010 | 2.0 | Altech-Eco Corporation: Focus | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXV02.0VZX | AFMXR0125NCX | AAECV02.0VZX-001 | AAECR0125NCX | AAECV02.0VZX | EPA Cert |
| Ford | 2010 | 2.0 | Altech-Eco Corporation: Focus | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXV02.0VEC | AFMXR0110GAA | BAECV02.0VEC-018 | BAECR0110GAA | BAECV02.0VEC | EPA Cert |
| Ford | 2010 | 2.0 | CNG - Dedicated: Ford Transit Connect | CNG | Gasoline | EvoTek LLC | AFMXT02.01DV | AFMXR125NBB | AETKT02.0N1A-002 | AETKR0000N1A | AETKT02.0N1A | EPA Cert |
| Ford | 2010 | 2.0 | CNG - Dedicated: Ford Focus | CNG | Gasoline | EvoTek LLC | AFMXV02.0VEC; AFMXV02.0VZX | AFMXR0110GAA; AFMXR0125NCX | AETKV02.0N1A-003 | AETKR0000N1C | AETKV02.0N1A | EPA Cert |

| OEM | Original Model Year | Eng Disp | Conversion Models Covered | Converted to Operate On | Original Fuel | Conversion MFR | OEM Test Group | OEM Evap Families | Conversion Certificate Number | Conversion Evap Family | Conversion Test Group | Compliance Status |
|------|---------------------|----------|---|-------------------------|-------------------|---------------------------|--|---|-------------------------------|------------------------|-----------------------|-------------------|
| Ford | 2010 | 2.0 | IMPSCO Technologies, Inc.: Ford Transit Connect | CNG or gasoline | Gasoline | IMPSCO Technologies, Inc. | AFMXT02.01DV | AFMXR0125NBB | CZ9XT02.0FFA-001 | CZ9XR0125FFA | CZ9XT02.0FFA | EPA Cert |
| Ford | 2010 | 2.5 | Altech-Eco Corporation: Fusion, Milan | CNG | Gasoline | Altech-Eco Corporation | AFMXV02.5VEF | AFMXR0155GAV | BAECV02.5VEA-001 | BAECR0155GA1 | BAECV02.5VEA | EPA Cert |
| Ford | 2010 | 2.5 | Altech-Eco Corporation: Fusion FWD, Fusion S FWD, Milan FWD, Milan S FWD | CNG | Gasoline | Altech-Eco Corporation | AFMXV02.5VEN | AFMXR0155GAV | CAECV02.51EA-005 | CAECR0155GA1 | CAECV02.51EA | EPA Cert |
| Ford | 2010 | 2.5 | Altech-Eco Corporation: Escape 4WD, Escape FWD, Mariner 4WD, Mariner FWD, Tribute 4WD, Tribute FWD | CNG | Gasoline | Altech-Eco Corporation | AFMXT2.51EN | AFMXR0125NBV | CAECV02.51EA-006 | CAECR0125NB1 | CAECV02.51EA | EPA Cert |
| Ford | 2010 | 2.5 | Altech-Eco Corporation: Fusion, Milan | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXV02.5VEF | AFMXR0155GAV | BAECV02.5VEF-002 | BAECR0155GAV | BAECV02.5VEF | EPA Cert |
| Ford | 2010 | 2.5 | Altech-Eco Corporation: Fusion FWD, Fusion S FWD, Milan FWD, Milan S FWD | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXV02.5VEN | AFMXR0155GAV | CAECV02.51EN-003 | CAECR0155GAV | CAECV02.51EN | EPA Cert |
| Ford | 2010 | 2.5 | Altech-Eco Corporation: Escape 4WD, Escape FWD, Mariner 4WD, Mariner FWD, Tribute 4WD, Tribute FWD | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXT02.51EN | AFMXR0125NBV | CAECV02.51EN-004 | CAECR0125NBV | CAECV02.51EN | EPA Cert |
| Ford | 2010 | 4.6 | Altech-Eco Corporation: F150 Pickup 2WD, F150 Pickup 4WD, F150 SFE 2WD | CNG | Gasoline | Altech-Eco Corporation | AFMXT04.64D3; AFMXT04.63DF; AFMXT04.63D2 | AFMXR0265NBC | BAECT04.64DB-017 | BAECR0265NB2 | BAECT04.64DB | EPA Cert |
| Ford | 2010 | 4.6 | BAF Technologies: Town Car, Crown Victoria, Grand Marquis, Town Car Limo | CNG | Gasoline/E 85 | BAF Technologies | AFMXV04.6VDF; AFMXV04.6VE3 | AFMXR0115GAA | ABAFV04.61FN-003 | ABAFR0000001 | ABAFV04.61FN | EPA Cert, CARB |
| Ford | 2010 | 4.6 | CROWN VICTORIA, CROWN VICTORIA POLICE, GRAND MARQUIS, TOWN CAR | CNG | Gasoline, Ethanol | Go Natural CNG | AFMXV04.6VDF | AFMXR0115GAA | | CGNLR0115F1A | CGNLRV04.6F1A | Int Appr |
| Ford | 2010 | 4.6 | Mustang | CNG | Gasoline | Go Natural CNG | AFMXV04.6VDM | AFMXR0125NCA | | CGNLR0125F1A | CGNLRV04.6F1A | Int Appr |
| Ford | 2010 | 4.6 | Go Natural CNG: Crown Victoria, Crown Victoria Police, Grand Marquis, Town Car | CNG or gasoline | Gasoline/E 85 | Go Natural CNG, LLC | AFMXV04.6VDF | AFMXR0115GAA | BGNLV04.6F2A-001 | BGNLR0115F2A | BGNLV04.6F2A | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F350 INCOMPLETE 2WD, F350 INCOMPLETE 4WD | CNG | Gasoline | Altech-Eco Corporation | AFMXD05.47V8 | AFMXF0120GAS | BAECD05.46VA-003 | BAECF0120GA1 | BAECD05.46VA | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F250 2WD BED DELETE, F250 4WD BED DELETE, F350 2WD, F350 2WD BED DELETE, F350 4WD, F350 4WD BED DELETE | CNG | Gasoline | Altech-Eco Corporation | AFMXD05.46VX; AFMXD05.47V8; AFMXD05.47VT | AFMXF0250NBS | BAECD05.46VA-004 | BAECF0250NB1 | BAECD05.46VA | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F350 INCOMPLETE 2WD, F350 INCOMPLETE 4WD | CNG | Gasoline | Altech-Eco Corporation | AFMXD05.46VX; AFMXD05.47V8; AFMXD05.47VT | AFMXF0260GAS | BAECD05.46VA-005 | BAECF0260GA1 | BAECD05.46VA | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F250 PICKUP 2WD, F250 PICKUP 4WD, F350 2WD, F350 4WD | CNG | Gasoline | Altech-Eco Corporation | AFMXD05.46VX | AFMXR0250NBS | BAECD05.46VA-006 | BAECR0250NB1 | BAECD05.46VA | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F250 2WD BED DELETE, F250 4WD BED DELETE, F350 2WD BED DELETE, F350 4WD BED DELETE | CNG | Gasoline | Altech-Eco Corporation | AFMXD05.46VR | AFMXF0250NBS | BAECT05.46VB-013 | BAECF0250NB1 | BAECT05.46VB | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F250 PICKUP 2WD, F250 PICKUP 4WD, F350 2WD, F350 4WD | CNG | Gasoline | Altech-Eco Corporation | AFMXD05.46VR | AFMXR0250NBS | BAECT05.46VB-014 | BAECR0250NB1 | BAECT05.46VB | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: E150 Van, E150 Wagon, E250 Van, E350 Van, E350 Wagon | CNG | Gasoline/E 85 | Altech-Eco Corporation | AFMXT05.45H4; AFMXT05.45HJ | AFMXR0265NAD | BAECT05.46VB-015 | BAECR0265NA1 | BAECT05.46VB | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: E350 Cutaway | CNG | Gasoline/E 85 | Altech-Eco Corporation | AFMXT05.45H4; AFMXT05.45HJ | AFMXF0265NAS | BAECT05.46VB-016 | BAECF0265NA1 | BAECT05.46VB | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F250 2WD BED DELETE, F250 4WD BED DELETE, F350 2WD BED DELETE, F350 4WD BED DELETE | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXD05.46VX; AFMXD05.46VR | AFMXF0250NBS | BAECD05.46VX-010 | BAECF0250NBS | BAECD05.46VX | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F350 INCOMPLETE 2WD, F350 INCOMPLETE 4WD | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXD05.46VX; AFMXD05.46VR | AFMXF0260GAS | BAECD05.46VX-011 | BAECF0260GAS | BAECD05.46VX | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F250 PICKUP 2WD, F250 PICKUP 4WD, F350 2WD, F350 4WD | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXD05.46VX; AFMXD05.46VR | AFMXR0250NBS | BAECD05.46VX-012 | BAECR0250NBS | BAECD05.46VX | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F350 INCOMPLETE 2WD, F350 INCOMPLETE 4WD | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXD05.47V8 | AFMXF0120GAS | BAECD05.47V8-007 | BAECF0120GAS | BAECD05.47V8 | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F350 2WD, F350 2WD BED DELETE, F350 4WD, F350 4WD BED DELETE | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXD05.47V8; AFMXD05.47VT | AFMXF0250NBS | BAECD05.47V8-008 | BAECF0250NBS | BAECD05.47V8 | EPA Cert |
| Ford | 2010 | 5.4 | Altech-Eco Corporation: F350 INCOMPLETE 2WD, F350 INCOMPLETE 4WD | CNG or gasoline | Gasoline | Altech-Eco Corporation | AFMXD05.47V8; AFMXD05.47VT | AFMXF0260GAS | BAECD05.47V8-009 | BAECF0260GAS | BAECD05.47V8 | EPA Cert |
| Ford | 2010 | 5.4 | BAF Technologies: F-150, Expedition, Navigator | CNG | Gasoline | BAF Technologies | AFMXT05.44BC | AFMXR0265NBC | ABAFV05.41FN-002 | ABAFR0000001 | ABAFV05.41FN | EPA Cert, CARB |
| Ford | 2010 | 5.4 | BAF Technologies: Econoline E150, 250, 350, E150 Club Wagon, E350 Club Wagon, E350 Cutaway | CNG | Gasoline | BAF Technologies | AFMXT05.45H4 | | ABAFV05.42FN-001 | ABAFR0000001 | ABAFV05.42FN | EPA Cert, CARB |
| Ford | 2010 | 5.4 | CNG - Dedicated: Ford Econoline 250/350 | CNG | Gasoline | EvoTek LLC | AFMXT05.45H4 | AFMXR0265NAS | AETKT05.4N1A-001 | AETKR0000N1A | AETKT05.4N1A | EPA Cert |
| Ford | 2010 | 5.4 | Go Natural CNG: Expedition 2WD, Expedition 4WD, F150 2WD, F150 4WD, Navigator 2WD, Navigator 4WD | CNG | Gasoline/E 85 | Go Natural CNG, LLC | AFMXT05.44ET; AFMXT05.44HY; AFMXT05.44BC | AFMXR0265NBC | BGNLT05.4F1A-017 | BGNLR0265F1A | BGNLT05.4F1A | EPA Cert |
| Ford | 2010 | 5.4 | Go Natural CNG: E150 Van, E150 Wagon, E250 Van, E350 Cutaway, E350 Van, E350 Wagon, Expedition 2WD, F250 2WD Bed Delete, F250 4WD Bed Delete, F250 Pickup 2WD, F250 Pickup 4WD, F350 2WD, F350 2WD Bed Delete, F350 4WD, F350 4WD Bed Delete, F350 Incomplete 2WD, F350 Incomplete 4WD, Navigator 2WD | CNG | Gasoline/E 85 | Go Natural CNG, LLC | AFMXD05.46VR; AFMXD05.46VX; AFMXT05.45B8; AFMXT05.45HJ; AFMXT05.45H4 | AFMXF0250NBS; AFMXR0250NBS; AFMXF0260GAS; AFMXR0265NBC; AFMXF0265NAS; AFMXR0265NAD | CGNLT05.4F1A-001 | CGNLR0000000 | CGNLT05.4F1A | EPA Cert |
| Ford | 2010 | 5.4 | Go Natural CNG: F250 2WD Bed Delete, F250 4WD Bed Delete, F350 2WD Bed Delete, F350 4WD Bed Delete | CNG or gasoline | Gasoline | Go Natural CNG, LLC | AFMXD05.46VR; AFMXD05.46VX | AFMXF0250NBS | BGNLD05.4F7A-007 | BGNLF0250FAA | BGNLD05.4F7A | EPA Cert |

| OEM | Original Model Year | Eng Disp | Conversion Models Covered | Converted to Operate On | Original Fuel | Conversion MFR | OEM Test Group | OEM Evap Families | Conversion Certificate Number | Conversion Evap Family | Conversion Test Group | Compliance Status |
|------|---------------------|----------|--|-------------------------|-------------------|--------------------------|----------------------------|-------------------|-------------------------------|------------------------|-----------------------|-------------------|
| Ford | 2010 | 5.4 | Go Natural CNG: F350 Incomplete 2WD, F350 Incomplete 4WD | CNG or gasoline | Gasoline | Go Natural CNG, LLC | AFMXD05.46VX | AFMXF0260GAS | BGNLD05.4F7A-011 | BGNLF0260FBA | BGNLD05.4F7A | EPA Cert |
| Ford | 2010 | 5.4 | Go Natural CNG: F250 Pickup 2WD, F250 Pickup 4WD, F350 2WD, F350 4WD | CNG or gasoline | Gasoline | Go Natural CNG, LLC | AFMXD05.46VR; AFMXD05.46VX | AFMXR0250NBS | BGNLD05.4F7A-012 | BGNLR0250FCA | BGNLD05.4F7A | EPA Cert |
| Ford | 2010 | 5.4 | Go Natural CNG: Expedition 2WD, Expedition 4WD, F150 2WD, F150 4WD, Navigator 2WD, Navigator 4WD | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | AFMXT05.44BC | AFMXR0265NBS | BGNLT05.4F2A-003 | BGNLR0265F2A | BGNLT05.4F2A | EPA Cert |
| Ford | 2010 | 5.4 | Go Natural CNG: Expedition 2WD, Navigator 2WD | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | AFMXT05.45BR | AFMXR0265NBS | BGNLT05.4F3A-013-R02 | BGNLR0265FDA | BGNLT05.4F3A | EPA Cert |
| Ford | 2010 | 5.4 | Go Natural CNG: E150 Van, E150 Wagon, E250 Van, E350 Van, E350 Wagon | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | AFMXT05.45HJ; AFMXT05.45H4 | AFMXR0265NAD | BGNLT05.4F3A-014-R02 | BGNLR0265FEA | BGNLT05.4F3A | EPA Cert |
| Ford | 2010 | 5.4 | Go Natural CNG: E350 Cutaway | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | AFMXT05.45HJ; AFMXT05.45H4 | AFMXF0265NAS | BGNLT05.4F3A-015-R02 | BGNLF0265FFA | BGNLT05.4F3A | EPA Cert |
| Ford | 2010 | 5.4 | Go Natural CNG: Expedition 2WD, Expedition 4WD, F150 2WD, F150 4WD, Navigator 2WD, Navigator 4WD | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | AFMXT05.44ET | AFMXR0265NBS | BGNLT05.4F4A-004-R01 | BGNLR0265F4A | BGNLT05.4F4A | EPA Cert |
| Ford | 2010 | 5.4 | Go Natural CNG: Expedition 2WD, Expedition 4WD, Navigator 2WD, Navigator 4WD | CNG or gasoline/E85 | Gasoline/E85 | Go Natural CNG, LLC | AFMXT05.44HY | AFMXR0265NBS | BGNLT05.4F6A-002 | BGNLR0265F6A | BGNLT05.4F6A | EPA Cert |
| Ford | 2010 | 5.4 | IMPCO Technologies, Inc.: Ford E350 CUTAWAY FFV | CNG or gasoline/E85 | Gasoline/E85 | IMPCO Technologies, Inc. | AFMXT05.45H4 | AFMXF0265NAS | BZ9XT05.4F2A-032 | BZ9XF0265F2A | BZ9XT05.4F2A | EPA Cert |
| Ford | 2010 | 5.4 | IMPCO Technologies, Inc.: FORD EXPEDITION 2WD FFV, FORD EXPEDITION 4WD FFV, FORD F150 FFV 2WD, FORD F150 FFV 4WD, LINCOLN NAVIGATOR 2WD FFV, LINCOLN NAVIGATOR 4WD FFV | CNG or gasoline | Gasoline | IMPCO Technologies, Inc. | AFMXT05.44BC | AFMXR0265NBS | BZ9XT05.4F4A-038 | BZ9XR0265FFA | BZ9XT05.4F4A | EPA Cert |
| Ford | 2010 | 5.4 | IMPCO Technologies, Inc.: Ford E150 VAN FFV, Ford E150 WAGON FFV, Ford E250 VAN FFV, Ford E350 VAN FFV | CNG or gasoline/E85 | Gasoline/E85 | IMPCO Technologies, Inc. | AFMXT05.45H4 | AFMXR0265NAD | BZ9XT05.4F2A-031 | BZ9XR0265F2A | BZ9XT05.4F2A | EPA Cert |
| Ford | 2010 | 5.4 | IMPCO Technologies, Inc.: Ford E350 CUTAWAY FFV | CNG or gasoline/E85 | Gasoline/E85 | IMPCO Technologies, Inc. | AFMXT05.45HJ | AFMXF0265NAS | BZ9XT05.4F6A-042 | BZ9XF0265F2A | BZ9XT05.4F6A | EPA Cert |
| Ford | 2010 | 5.4 | IMPCO Technologies, Inc.: Ford E150 VAN FFV, Ford E150 WAGON FFV, Ford E250 VAN FFV, Ford E350 VAN FFV, Ford E350 WAGON FFV | CNG or gasoline/E85 | Gasoline/E85 | IMPCO Technologies, Inc. | AFMXT05.45HJ | AFMXR0265NAD | BZ9XT05.4F6A-043 | BZ9XR0265F2A | BZ9XT05.4F6A | EPA Cert |
| Ford | 2010 | 5.4 | IMPCO Technologies, Inc.: FORD EXPEDITION 2WD FFV, FORD EXPEDITION 4WD FFV, FORD F150 FFV 2WD, FORD F150 FFV 4WD, LINCOLN NAVIGATOR 2WD FFV, LINCOLN NAVIGATOR 4WD FFV | CNG or gasoline/E85 | Gasoline/E85 | IMPCO Technologies, Inc. | AFMXT05.44ET | AFMXR0265NBS | BZ9XT05.4FFA-016 | BZ9XR0265FFA | BZ9XT05.4FFA | EPA Cert |
| Ford | 2010 | 5.4 | NGV Conversion, Inc.: E-Series Van, complete or incomp | CNG | Gasoline/E85 | NGV Motori | AFMXT05.45HJ | AFMXR0265NAD | BNGCT05.45HJ-003 | BNGCR0000001 | BNGCT05.45HJ | EPA Cert |
| Ford | 2010 | 6.8 | E-450 | CNG | Gasoline | BAF Technologies | AFMXE06.8BWV | AFMXF0265NAT | BAF-ONHWY-10-01 | ABAFF0000001 | ABAFE06.89FN | EPA Cert |
| Ford | 2010 | 6.8 | FORD: E350 VAN, E350 WAGON | CNG or gasoline/E85 | Gasoline/E85 | PARNELL USA, INC | AFMXT06.85HG | AFMXR0265NAD | BPRLT06.85HG-002 | BPRLR0265NAD | BPRLT06.85HG | EPA Cert |
| Ford | 2009 | 2.0 | Altech-Eco Corporation: Focus | CNG or gasoline | Gasoline | Altech-Eco Corporation | 9FMXV02.0VD4; 9FMXV02.0VDX | 9FMXR0125NAA | AAECV02.0VDF-005 | AAECR0125NAA | AAECV02.0VDF | EPA Cert |
| Ford | 2009 | 2.0 | Altech-Eco Corporation: Focus | CNG or gasoline | Gasoline | Altech-Eco Corporation | 9FMXV02.0VZP; 9FMXV02.0VZX | 9FMXR0125NCX | AAECV02.0VDG-006 | AAECR0125NCX | AAECV02.0VDG | EPA Cert |
| Ford | 2009 | 2.0 | NGV Conversion, Inc.: FOCUS | CNG | Gasoline | NGV Conversion, Inc. | 9FMXV02.0VZP; 9FMXV02.0VZX | 9FMXR0125NCX | ANGCV02.0VZP-002 | ANGCR0000CNG | ANGCV02.0VZP | EPA Cert |
| Ford | 2009 | 2.0 | NGV Conversion, Inc.: FOCUS | CNG | Gasoline | NGV Conversion, Inc. | 9FMXV02.0VZP; 9FMXV02.0VZX | 9FMXR0125NCX | BNGCV02.0VZP-002 | BNGCR0000CNG | BNGCV02.0VZP | EPA Cert |
| Ford | 2009 | 4.6 | Town Car, Crown Victoria, Grand Marquis | CNG | Gasoline | BAF Technologies | 9FMXV04.6VDF; 9FMXV04.6VE3 | 9FMXR0115GAA | BBAFV04.61CN-002 | BBAFR0000001 | BBAFV04.61CN | EPA Cert, CARB |
| Ford | 2009 | 4.6 | BAF Technologies: Town Car/Crown Victoria | CNG | Gasoline | BAF Technologies | 9FMXV04.6VDF; 9FMXV04.6VE3 | 9FMXR0115GAA | BBAFV04.61FN-001 | BBAFR0000001 | BBAFV04.61FN | EPA Cert |
| Ford | 2009 | 4.6 | CROWN VICTORIA, CROWN VICTORIA POLICE, GRAND MARQUIS, TOWN CAR | Gasoline/E85/CNG | Gasoline, Ethanol | Go Natural CNG | 9FMXV04.6VDF | 9FMXR0115GAA | | CGNLR0115F29 | CGNLV04.6F29 | Int Appr |
| Ford | 2009 | 4.6 | CROWN VICTORIA, CROWN VICTORIA POLICE, GRAND MARQUIS, TOWN CAR | CNG | Gasoline, Ethanol | Go Natural CNG | 9FMXV04.6VDF | 9FMXR0115GAA | | CGNLR0115F19 | CGNLV04.6F19 | Int Appr |
| Ford | 2009 | 5.4 | F-150, EXPEDITION, NAVIGATOR | CNG | Gasoline | BAF Technologies | | | EO A-364-0018 | 9BAFR0000001 | 9BAFT05.41CN | CARB |
| Ford | 2009 | 5.4 | E-150 CLUB WAGON, E-350 CLUB WAGON, E-150 VAN, E-250 VAN, E-350 VAN, E-350 CUTAWAY | CNG | Gasoline | BAF Technologies | | | EO A-364-0015 | 9BAFR0000001 | 9BAFT05.40CN | CARB |
| Ford | 2009 | 5.4 | F-250 2WD, F-250 4WD, F-350 WD, F-350 4WD | CNG | Gasoline | BAF Technologies | | | EO A-364-0017 | 9BAFR0000001 | 9BAFD05.43CN | CARB |
| Ford | 2009 | 5.4 | F150 2WD, F150 4WD, NAVIGATOR 2WD, NAVIGATOR 4WD, EXPEDITION 2WD, EXPEDITION 4WD | Gasoline/E85/CNG | E85 | Go Natural CNG | 9FMXT05.44ET | 9FMXR0265NBR | | BGNLR0265F29 | BGNLT05.4F29 | Int Appr |

| OEM | Original Model Year | Eng Disp | Conversion Models Covered | Converted to Operate On | Original Fuel | Conversion MFR | OEM Test Group | OEM Evap Families | Conversion Certificate Number | Conversion Evap Family | Conversion Test Group | Compliance Status |
|------|---------------------|----------|---|-------------------------|---------------|--------------------------|--|---|-------------------------------|------------------------|-----------------------|-------------------|
| Ford | 2009 | 5.4 | F250 BED DELETE 2WD, F250 BED DELETE 4WD, F350 BED DELETE 2WD, F350 BED DELETE 4WD | Gasoline/CNG | Gasoline | Go Natural CNG | 9FMXD05.46R6 | 9FMXF0250NBS | | BGNLF0250FA9 | BGNLD05.4F49 | Int Appr |
| Ford | 2009 | 5.4 | F350 INCOMPLETE 2WD, F350 INCOMPLETE 4WD | Gasoline/CNG | Gasoline | Go Natural CNG | 9FMXD05.46R6 | 9FMXF0260GAS | | BGNLF0260FB9 | BGNLD05.4F49 | Int Appr |
| Ford | 2009 | 5.4 | F250 PICKUP 2WD, F250 PICKUP 4WD, F350 2WD, F350 4WD | Gasoline/CNG | Gasoline | Go Natural CNG | 9FMXD05.46R6 | 9FMXR0250NBS | | BGNLR0250FC9 | BGNLD05.4F49 | Int Appr |
| Ford | 2009 | 5.4 | E350 CUTAWAY | Gasoline/EB5/CNG | Gasoline/E85 | Go Natural CNG | 9FMXT05.45H4 | 9FMXF0265NAS | | BGNLF0265FF9 | BGNLT05.4F89 | Int Appr |
| Ford | 2009 | 5.4 | EXPEDITION 2WD, NAVIGATOR 2WD | Gasoline/EB5/CNG | Gasoline/E85 | Go Natural CNG | 9FMXT05.45BR | 9FMXR0265NBR | | BGNLR0265FD9 | BGNLT05.4F89 | Int Appr |
| Ford | 2009 | 5.4 | E150 VAN, E150 WAGON, E250 VAN, E350 VAN, E350 WAGON | Gasoline/EB5/CNG | Gasoline/E85 | Go Natural CNG | 9FMXT05.45H4 | 9FMXR0265NAS | | BGNLR0265FE9 | BGNLT05.4F89 | Int Appr |
| Ford | 2009 | 5.4 | F150 2WD, F150 4WD, NAVIGATOR 2WD, NAVIGATOR 4WD, EXPEDITION 2WD, EXPEDITION 4WD | CNG | FFV | Go Natural CNG | 9FMXT05.44ET | 9FMXR0265NBR | | BGNLR0265F19 | BGNLT05.4F19 | Int Appr |
| Ford | 2009 | 5.4 | Go Natural CNG: E150 Van, E150 Wagon, E250 Van, E350 Cutaway, E350 Van, E350 Wagon, Expedition 2WD, F250 2WD Bed Delete, F250 4WD Bed Delete, F250 Pickup 2WD, F250 Pickup 4WD, F350 2WD, F350 2WD Bed Delete, F350 4WD, F350 4WD Bed Delete, F350 Incomplete 2WD, F350 Incomplete 4WD, Navigator 2WD | CNG | Gasoline/E85 | Go Natural CNG | 9FMXD05.46R6; 9FMXT05.45BR; 9FMXT05.45H4 | 9FMXF0260GAS; 9FMXF0250NBS; 9FMXR0250NBS; 9FMXR0265NBR; 9FMXR0265NAS; 9FMXF0265NAS | CGNLT05.4F19-003 | CGNLR0000000 | CGNLT05.4F19 | EPA Cert |
| Ford | 2009 | 5.4 | IMPCO Technologies, Inc.: FORD EXPEDITION 2WD FFV, FORD EXPEDITION 4WD FFV, FORD F150 FFV 2WD, FORD F150 FFV 4WD, LINCOLN NAVIGATOR 2WD FFV, LINCOLN NAVIGATOR 4WD FFV | Gasoline/EB5/CNG | Gasoline/E85 | IMPCO Technologies, Inc. | 9FMXT05.44ET | 9FMXR0265NBR | BZ9XT05.4FF9-014 | BZ9XR0265FF9 | BZ9XT05.4FF9 | EPA Cert |
| Ford | 2009 | 6.8 | E-450 | CNG | Gasoline | BAF Technologies | 9FMXE06.8BWV | 9FMXF0265NAT | BAF-ONHWY-09-01 | 9BAFF0000001 | 9BAFE06.89FN | EPA Cert |
| Ford | 2009 | 6.8 | E450, E450 CUTAWAY, E450 INCOMPLETE CHASSIS | CNG | Gasoline | NGV Motori | 9FMXE06.8BWK | 9FMXF0265NAT | | BNGCR0000001 | BNGCT06.8NG2 | Int Appr |
| Ford | 2009 | 6.8 | E450 | CNG | Gasoline | NGV Motori | 8FMXH06.8A54 | 8FMXE0265GAT | | BNGCR0000001 | BNGCT06.8NG3 | Int Appr |
| Ford | 2009 | 6.8 | E450, E450 CUTAWAY, E450 INCOMPLETE CHASSIS | CNG | Gasoline | NGV Motori | 9FMXE06.8AFA | 9FMXF0265NAT | | BNGCR0000001 | BNGCT06.8NG4 | Int Appr |
| Ford | 2008 | 4.0 | FORD RANGER 4X2, FORD RANGER 4X4, MAZDA B4000 4X2, MAZDA B4000 4X4 | Gasoline/CNG | Gasoline | Auto Gas America | 8FMXT04.02EG | 8FMXR0165GBL | | CAGTR0165GBL | CAGTT04.0008 | Int Appr |
| Ford | 2008 | 4.6 | FORD CROWN VICTORIA, MERCURY GRAND MARQUIS, LINCOLN TOWN CAR | CNG | Gasoline | NGV Motori | 8FMXV04.6VE9, 8FMXV04.6VEF, 8FMXV04.6VE3 | 8FMXR0115GAK | | BNGCR0000CNG | BNGCV04.6VE9 | Int Appr |
| Ford | 2008 | 5.4 | F-150 4X2, F-150 4X4, MARK-LT 4X2, MARK-LT 4X4, F150 STX SE 4X2 | Gasoline/CNG | Gasoline | Auto Gas America | 8FMXT05.44HA | 8FMXR0240NBR | | CAGTR0240NBR | CAGTT05.4008 | Int Appr |
| Ford | 2008 | 5.4 | Ford: F250/F350 trucks | CNG or gasoline | Gasoline | FuelTek Conversion Corp. | 8FMXK05.46RG | 8FMXR0250NBS | CFTKE05.46RG-001 | CFTKR0250NBS | CFTKE05.46RG | EPA Cert |
| Ford | 2008 | 5.4 | Ford: F250/F350 trucks | CNG or gasoline | Gasoline | FuelTek Conversion Corp. | 8FMXK05.46RG | 8FMXE0265GAS | CFTKE05.46RG-002 | CFTKE0265GAS | CFTKE05.46RG | EPA Cert |
| Ford | 2008 | 5.4 | Ford: F250/F350 trucks | CNG or gasoline | Gasoline | FuelTek Conversion Corp. | 8FMXK05.46RG | 8FMXE0250GAS | CFTKE05.46RG-003 | CFTKE0250NBS | CFTKE05.46RG | EPA Cert |
| Ford | 2008 | 5.4 | NGV Conversion, Inc.: E-Series Van, complete or incomp | CNG | Gasoline | NGV Conversion, Inc. | 8FMXT05.45H2 | 8FMXR0265GAS; 8FMXE0265GAS | ANGCT05.45H2-001 | ANGCR0000CNG | ANGCT05.45H2 | EPA Cert |
| Ford | 2008 | 5.4 | NGV Conversion, Inc.: E-Series Van, complete or incomp | CNG | Gasoline | NGV Conversion, Inc. | 8FMXT05.45H2 | 8FMXR0265GAS; 8FMXE0265GAS | BNGCT05.45H2-001 | BNGCR0000CNG | BNGCT05.45H2 | EPA Cert |
| Ford | 2008 | 6.8 | E450 | CNG | Gasoline | NGV Motori | 8FMXH06.8BST | 8FMXE0265GAT | | BNGCR0000001 | BNGCT06.8NG1 | Int Appr |

| OEM | Original Model Year | Eng Disp (L) | Conversion Models Covered | Converted to Operate On | Original Fuel | Conversion Manufacturer | OEM Engine Families(s) | OEM Evap Families (if applicable) | Conversion Exhaust Certificate Number | Conversion Evap Family | Conversion Engine Family | Compliance Status |
|-------------|---------------------|--------------|---------------------------|-------------------------|---------------|----------------------------|---|-----------------------------------|---------------------------------------|------------------------|--------------------------|-------------------|
| Caterpillar | 2004 to 2006 | 15.2 | C15 | Diesel or Diesel/CNG | Diesel | American Power Group, Inc. | 4CPXH0928EBK, 5CPXH0928EBK, 6CPXH0928EBK | | | | BAPGH15.2CP4 | OUL |
| Caterpillar | 2004 to 2006 | 11.1, 12.5 | C11, C13 | Diesel or Diesel/CNG | Diesel | American Power Group, Inc. | 4CPXH0680EBK, 4CPXH0763EBK, 5CPXH0680EBK, 5CPXH0763EBK, 6CPXH0680EBK, 6CPXH0763EBK | | | | CAPGH12.5CP4 | OUL |
| Caterpillar | 1998 to 2003 | 10.3, 11.9 | C-10, C-12 | Diesel or Diesel/CNG | Diesel | American Power Group, Inc. | WCPXH0629ERK, WCPXH0729ERK, XCPXH0629ERK, XCPXH0729ERK, YCPXH0629ERK, YCPXH0729ERK, 1CPXH0629ERK, 1CPXH0729ERK, 2CPXH0629ERK, 2CPXH0729ERK, 3CPXH0629EBV, 3CPXH0629EBX, 3CPXH0729EBV, 3CPXH0729EBY | | | | CAPGH11.9CP4 | OUL |
| Caterpillar | 1998 to 2003 | 14.6, 15.8 | C-15, C-16 | Diesel or Diesel/CNG | Diesel | American Power Group, Inc. | WCPXH0893ERK, WCPXH0967ERK, XCPXH0893ERK, XCPXH0967ERK, YCPXH0893ERK, YCPXH0967ERK, 1CPXH0893ERK, 1CPXH0967ERK, 2CPXH0893ERK, 2CPXH0967ERK, 3CPXH0893EBV | | | | CAPGH15.8CP4 | OUL |
| Caterpillar | 1998 to 2002 | 11.9 | C-12 | Diesel/CNG | Diesel | Clean Air Power, Inc. | WCPXH0729ERK, XCPXH0729ERK, YCPXH0729ERK, 1CPXH0729ERK, 2CPXH0729ERK | | | | BCLAH0729E6J | OUL |
| Caterpillar | 1998 to 2002 | 14.6 | C-15 | Diesel/CNG | Diesel | Clean Air Power, Inc. | WCPXH0893ERK, XCPXH0893ERK, YCPXH0893ERK, 1CPXH0893ERK, 2CPXH0893ERK | | | | CCLAH0893E6J | OUL |

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|---------------------|--------------|--|--|---------------------|----------|----------------------------|--|--|---------------|--------------|----------|
| Cummins | 2004 to 2009 | 14.9 | ISX | Diesel/CNG | Diesel | EcoDual Group LP | 9CEXH0912XAK, 9CEXH0912XAL, 9CEXH0912XAM, 8CEXH0912XAK, 8CEXH0912XAL, 8CEXH0912XAM, 7CEXH0912XAK, 7CEXH0912XAL, 7CEXH0912XAM, 6CEXH0912XAK, 6CEXH0912XAL, 6CEXH0912XAM, 6CEXH0912XAH, 6CEXH0912XAJ, 5CEXH0912XAH, 5CEXH0912XAJ, 4CEXH0912XAH, 4CEXH0912XAJ | | | BEDGE14.9ISX | OUL |
| Daimler Chrysler AG | 2006 | 6.37 | OM 906 | CNG | Diesel | NGV Motori | 6MBXH6.37DJA | | | BNGCH6.37DJD | Int Appr |
| Daimler Chrysler AG | 2005 | 6.37 | OM 906 | CNG | Diesel | NGV Motori | 5MBXH6.37DJA | | | BNGCH6.37DJC | Int Appr |
| Daimler Chrysler AG | 2004 | 6.37 | OM 906 | CNG | Diesel | NGV Motori | 4MBXH6.37DJA | | | BNGCH6.37DJB | Int Appr |
| Daimler Chrysler AG | 2003 | 6.37 | OM 906 | CNG | Diesel | NGV Motori | 3MBXH6.37DJA | | | BNGCH6.37DJA | Int Appr |
| Detroit Diesel | 2004 to 2009 | 12.7 L, 14.0 L, 12.8, 14, 14.8 | SERIES 60 12.7L, SERIES 60 14L, OM460LA, MBE 4000, DD15, DD13 | Diesel/CNG + Diesel | Diesel | American Power Group, Inc. | 4DDXH12.7EGY, 4DDXH14.0ELY, 5DDXH12.7EGY, 5DDXH14.0ELY, 6DDXH12.7EGY, 6DDXH14.0ELY, 7DDXH12.8DJA, 7DDXH14.0ELY, 8DDXH12.8DJA, 8DDXH12.8TER, 8DDXH14.0ELY, 8DDXH14.8EEY, 9DDXH12.8DJA, 9DDXH12.8DJD, 9DDXH12.8FED, 9DDXH12.8FEY, 9DDXH12.8TER, 9DDXH14.0ELD, 9DDXH14.0ELY, 9DDXH14.8EED, 9DDXH14.8EEY | | | CAPGH14.8DD8 | OUL |
| Ford | 2012 | 6.8 | V-10/285 hp | CNG | Gasoline | BAF Technologies | | | EO A-364-0031 | CBAFE06.83NN | CARB |
| Ford | 2012 | 6.8 | V-10, 242 hp | CNG | Gasoline | BAF Technologies | | | EO A-364-0032 | CBAFE06.89NN | CARB |
| Ford | 2012 | 6.8 | E450, 251 hp | CNG | Gasoline | IMPACO Technologies | | | EO A-328-0052 | CZ9XE06.8CA1 | CARB |

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|----------------|------|-----|--|-----------------|----------|---------------------|--------------|--------------|-------------------|--------------|--------------|----------------|
| Ford | 2012 | 6.8 | F450, 308 hp | CNG | Gasoline | IMPCO Technologies | | | EO A-328-0053 | | CZ9XE06.8CA2 | CARB |
| Ford | 2011 | 6.8 | V-10/231 hp | CNG or HCNG | Gasoline | BAF Technologies | | | EO A-364-0025 | | BBAFE06.89CH | CARB |
| Ford | 2011 | 6.8 | V-10/285 hp | CNG | Gasoline | BAF Technologies | | | EO A-364-0027 | | BBAFE06.83NN | CARB |
| Ford | 2011 | 6.8 | V-10, 242 hp | CNG | Gasoline | BAF Technologies | | | EO A-364-0028 | | BBAFE06.89NN | CARB |
| Ford | 2011 | 6.8 | E450, 251 hp | CNG | Gasoline | IMPCO Technologies | | | EO A-328-0046 | | BZ9XE06.8C1A | CARB |
| Ford | 2011 | 6.8 | F450, 308 hp | CNG | Gasoline | IMPCO Technologies | | | EO A-328-0047 | | BZ9XE06.8C2A | CARB |
| Ford | 2010 | 6.8 | E-450, 242 hp, 285 hp | CNG | Gasoline | BAF Technologies | AFMXE06.8BWX | AFMXF0265NAT | BAF-ONHWY-10-01 | ABAFF0000001 | ABAFE06.89FN | EPA Cert, CARB |
| Ford | 2009 | 6.8 | E-450 | CNG | Gasoline | BAF Technologies | 9FMXE06.8BWX | 9FMXF0265NAT | BAF-ONHWY-09-01 | 9BAFF0000001 | 9BAFE06.89FN | EPA Cert, CARB |
| Ford | 2009 | 6.8 | V-10/231 hp | CNG or HCNG | Gasoline | BAF Technologies | | | EO A-364-0020 | | 9BAFE06.89CH | CARB |
| General Motors | 2012 | 6 | Engine V8/ model 605840211, engine codes 20,30,40,50,60 | CNG | Gasoline | Greenkraft Inc | | | EO A-398-0002 | | CGKTE06.0GM1 | CARB |
| General Motors | 2012 | 6 | Engine V8/ model 605851111, engine codes 20,30,40,50,60 | CNG | Gasoline | Greenkraft Inc | | | EO A-398-0003 | | CGKTE06.0GM2 | CARB |
| General Motors | 2012 | 6 | Van 265 hp | CNG | Gasoline | IMPCO Technologies | | | EO A-328-0051 | | CZ9XE06.0DCA | CARB |
| General Motors | 2011 | 4.8 | Van 237 hp | CNG | Gasoline | IMPCO Technologies | | | EO A-328-0044 | | BZ9XE04.8C1A | CARB |
| General Motors | 2011 | 6 | Engine models 605840211, engine codes 20,30,40,50,60 | CNG | Gasoline | Greenkraft Inc | BGMXE06.0584 | N/A | GKT-ONHWY-11-01.1 | N/A | BGKTE06.0GM1 | EPA Cert, CARB |
| General Motors | 2011 | 6 | GM 6.0L/266 hp | CNG | Gasoline | Baytech Corporation | | | EO A-330-0230 | | BBYTE06.0613 | CARB |
| General Motors | 2011 | 6 | Van 265 hp | CNG | Gasoline | IMPCO Technologies | | | EO A-328-0045 | | BZ9XE06.0C1A | CARB |
| General Motors | 2010 | 6 | GM 6.0L/266 hp | CNG | Gasoline | Baytech Corporation | | | EO A-330-0218 | | ABYTE06.0613 | CARB |
| General Motors | 2010 | 8.1 | GM 8.1L/283 hp | CNG | Gasoline | Baytech Corporation | | | EO A-330-0221 | | ABYTE08.1C13 | CARB |
| General Motors | 2010 | 8.1 | GM 8.1L/256 hp | CNG | Gasoline | Baytech Corporation | | | EO A-330-0222 | | ABYTE08.1C12 | CARB |
| General Motors | 2009 | 6 | GM 6.0L/266 hp | CNG | Gasoline | Baytech Corporation | | | EO A-330-0205 | | 9BYTE06.0613 | CARB |
| General Motors | 2009 | 6 | GM 6.0L/266 hp CNG, 287 hp gasoline | CNG or Gasoline | Gasoline | Baytech Corporation | | | EO A-330-0216 | | 9BYTE06.0623 | CARB |
| General Motors | 2009 | 8.1 | GM 8.1L/283 hp | CNG | Gasoline | Baytech Corporation | | | EO A-330-0208-1 | | 9BYTE08.1C13 | CARB |
| General Motors | 2009 | 8.1 | GM 8.1L/256 hp | CNG | Gasoline | Baytech Corporation | | | EO A-330-0211 | | 9BYTE08.1C12 | CARB |
| General Motors | 2009 | 8.1 | GM 8.1L/283 hp CNG, 317 hp gasoline | CNG or Gasoline | Gasoline | Baytech Corporation | | | EO A-330-0212 | | 9BYTE08.1C23 | CARB |
| General Motors | 2009 | 8.1 | Workhorse Custom Chassis W30, W62 (283 hp CNG, 317 hp gasoline) | CNG or Gasoline | Gasoline | Baytech Corporation | | | EO A-330-0213 | | 9BYTF0407000 | CARB |
| General Motors | 2009 | 8.1 | C4: Chevrolet Kodiak C4500, GMC Topkick C4500; 283 hp CNG, 317 hp gasoline | CNG or Gasoline | Gasoline | Baytech Corporation | | | EO A-330-0213 | | 9BYTF0300998 | CARB |

| Company | Address | Name | Telephone | E-Mail | Website |
|--------------------------------|--|------------------|------------------|--|--|
| Altech-Eco | 101 Fair Oaks Road, Arden, NC 28704 | Mike Cerven | 828-654-8300 | mikecerven@altecheco.com | http://altecheco.com/ |
| American Power Group, Inc. | 2503 E Poplar Street, Algona, IA 50511 | Ed Wolf | 515-395-1360 | ewolf@americanpowergroupinc.com | www.americanpowergroupinc.com |
| BAF Technologies | 2415 Beatrice Street, Dallas, TX 75208 | Brent Pope | 214-231-1450 | bpope@baftechnologies.com | www.baftechnologies.com |
| CNG Store (dba Auto Gas Store) | 1596 West 2650 S, Ste 103. Ogden UT 84401 866-931-8940 | | 866-931-8940 | support@autogasamerica.com | www.autogasamerica.com |
| EcoDual | 601 Bay Street, Beaufort, SC 29902 | Doug Thomson | 617-855-7999 | doug.thomson@ecodual.com | www.ecodual.com |
| Go Natural CNG | 2023 South 625 West, Woods Cross, Utah 84087 | Lucas Kjar | 801-281-4766 | lkjar@gonaturalcng.com | www.gonaturalcng.com |
| GreenKraft | | | | | http://greenkraftinc.com/ |
| High Pressure Group | 1468 James Road, Gardnerville, NV 89460 | Trent Colbert | 775-455-4059 | info@highpressuregroup.com | |
| IMPACO Automotive/Evotek | 1274 South State Road 32, Union City, IN 47390 | Beverly Osborne | 765-305-2091 | BOsborne@impcoautomotive.com | http://www.impcoautomotive.com/ |
| Landi Renzo USA/Baytech | 23535 Telo Avenue, Torrance, CA 90505 | Gianluca Maso | 310-283 8661 | gmaso@landiusa.com | http://landiusa.com |
| NatGasCar | 17000 St. Clair Avenue, Cleveland, OH 44110 | Joe Wray | 216-692-3700 | jwray@natgascar.com | www.natgascar.com |
| NGV Motori | 5589 Callcott Way Suite 1416, Alexandria VA 22312 | Michelle Guzzone | 866-636-2289 | michelle@ngvus.com | www.ngvus.com |
| Venchurs Vehicle Systems | 100 Industrial Dr. Adrian, MI 49221 | Jason Boisher | 517-266-5788 | jboisher@venchurs.com | http://www.venchurscng.com/ |
| Westport LD | | John Howell | 734-233-6869 | jhowell@westport.com | http://www.westport-ld.com/ |

Please visit company websites for information on specific availability and ordering systems before contacting directly.

Appendix J. Training Material Information

Cummins-Westport Natural Gas Academy provides ideas and links to other sources of data and information on natural gas as a fuel and natural gas engines: <http://www.cumminswestport.com/natural-gas-academy> .

The screenshot shows the Cummins Westport website's 'Natural Gas Academy' page. At the top left is the Cummins Westport logo. To the right are links for Home, Contact Us, Newsletter, and A- A+. The main heading is 'Cummins Westport The Natural Choice' with a red arrow icon. Below this is a navigation bar with links: About Us, Engines, Customer Care, Find a Natural Gas Truck or Bus, **Natural Gas Academy**, Download Brochures, and Newsroom. The main banner image shows a man in a blue shirt and cap holding a clipboard, looking up. Below the banner is a section titled 'Natural Gas Academy' with a list of links: Natural Gas Academy, Natural Gas Academy Videos, Learn About Natural Gas, Natural Gas as Fuel, Incentives, and Links. To the right of this list is a paragraph describing the academy as a resource for learning about natural gas as a clean burning fuel, with links to videos, information, and other industry sources. Below the text are social sharing buttons for Like (1), Tweet (2), +1 (1), and Share (1). To the right of the text is a 'Academy Videos' section with a man's image. Below that is an 'Engines' section with a red engine image.

Cummins Virtual College also provides CDs, DVDs and other virtual training options.

Cummins can provide on-site training to meet specific customer needs.

Cummins also offers training via its network of distributors. You can search for service partners on-line: <http://wsl.cummins.com/ServiceLocator/jsp/controller.jsp?action=servicelocator>

Cummins QuickServe Store allows users to purchase publications and training resources. The following graphic shows available training resources.

Service Training

Service Training Search

Search: Bulletin Number Search:

Category: Bulletin Number:

Engine:

Search Result

| Bulletin Number | Engine Series | Format | Description | Language | Price |
|-------------------------|---------------|--------|--|----------|----------|
| 3898627 | Natural Gas | CD-ROM | Cummins Virtual College - Natural Gas Familiarization | ENGLISH | \$83.60 |
| 4091845 | Natural Gas | CD-ROM | Cummins Virtual College - Alternative Fuels | ENGLISH | \$691.60 |
| 4091900 | Natural Gas | CD-ROM | Cummins Virtual College - (AF-1) Alternative Fuels - Natural Gas | ENGLISH | \$76.00 |
| 4091901 | Natural Gas | CD-ROM | Cummins Virtual College - (AF-2) Alternative Fuels - Natural Gas | ENGLISH | \$76.00 |
| 4091902 | Natural Gas | CD-ROM | Cummins Virtual College - (AF-3) Alternative Fuels - Natural Gas | ENGLISH | \$76.00 |
| 4091903 | Natural Gas | CD-ROM | Cummins Virtual College - (AF-4) Alternative Fuels - Natural Gas | ENGLISH | \$76.00 |

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Source: Cummins QuickServe Store: https://store.cummins.com/store/catalogue/servicetraining.html?category_id=16
 Accessed July 3, 2012.