COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION



In the Matter of:

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| APPLICATION OF DELTA NATURAL GAS COMPANY, INC. FOR AN ORDER DECLARING THAT IT IS AUTHORIZED TO CONSTRUCT, OWN AND OPERATE A COMPRESSED NATURAL GAS STATION IN BEREA, KENTUCKY | ) ) ) ) ) ) | CASE NO. 2013-00365 |

# DIRECT TESTIMONY OF

# JOHN B. BROWN

Filed: November 22, 2013

## VERIFICATION

**STATE OF KENTUCKY** )
)
**COUNTY OF CLARK** )

The undersigned, John B. Brown, being duly sworn, deposes and says he is Chief Financial Officer, Treasurer and Secretary of Delta Natural Gas Company, Inc., that he has personal knowledge of the matters set forth in the following testimony, and the answers contained therein are true and correct to the best of his information knowledge and belief.

**John B. Brown**

Subscribed and sworn to before me by John B. Brown, this the 20th day of November, 2013.

My Commission Expires: 6/20/2016

Notary Public, State at Large, Kentucky

OFFICIAL SEAL
EMILY P. BENNETT
NOTARY PUBLIC - KENTUCKY
STATE-AT-LARGE ID # 467350
My Commission Expires June 20, 2016

**Q. Please state your name and business address.**

A. John B. Brown, Delta Natural Gas Company, Inc. ("Delta"), 3617 Lexington Road, Winchester, Kentucky 40391.

**Q. What is your present employment?**

A. I am an accountant, presently employed by Delta as its Chief Financial Officer, Treasurer and Secretary.

**Q. For what period of time have you been so employed?**

A. I was employed by Delta as Manager – Accounting & Finance in April of 1995. I was appointed Controller in March of 1999 and promoted to Vice President – Controller and Assistant Secretary in November, 2005. I was named Chief Financial Officer, Treasurer and Secretary in May, 2007.

**Q. Would you briefly describe your education and professional experience?**

A. I attended Asbury College, Wilmore, Kentucky, from 1985 to 1989, receiving B.A. degrees in accounting and business management with a minor in computer science. I received an MBA degree from the University of Kentucky in 2000. I am a Certified Public Accountant in the state of Kentucky. I was employed by the accounting firm of Arthur Andersen LLP in its Louisville, Kentucky office from 1989 to 1995, specializing in the utility area. Since April, 1995, I have been employed by Delta.

**Q. Generally what are your duties with Delta?**

A. As Chief Financial Officer, Treasurer and Secretary, I am responsible for finance, budget, accounting, tax, internal audit, information technology, accounts payable, human resources, rates, corporate governance and investor relations.

**Q. Are you generally familiar with the business affairs of Delta?**

A. Yes, I am.

**Q. Have you previously provided testimony to the Commission?**

A. Yes, I have been a witness on behalf of Delta in several proceedings, among those are the following general rate cases:

- Case No. 2010-00116 *Application of Delta Natural Gas Company, Inc. for an Adjustment of Rates.*
- Case No. 2007-00089 *Application of Delta Natural Gas Company, Inc. for an Adjustment of Rates.*
- Case No. 2004-00067 *Adjustment of the Rates of Delta Natural Gas Company, Inc.*
- Case No. 1999-176 *Adjustment of Rates of Delta Natural Gas Company, Inc.*
- Case No. 1997-066 *Adjustment of Rates of Delta Natural Gas Company, Inc.*

**Q. Please briefly summarize the scope of your testimony.**

A. I am providing an overview of the benefits that Delta's proposed Compressed Natural Gas Station ("CNG Station") would provide to Kentucky and Delta's customers. I am also addressing Delta's request for the regulatory treatment of the construction and operation of the CNG Station and sponsoring a proposed change to Delta's transportation tariff to accommodate fueling stations for natural gas vehicles on its system.

**Q. Why is Delta proposing to build a CNG Station in its service territory?**

A. While there are several reasons why states have encouraged the development of CNG Station infrastructure, the primary one for Kentucky is to provide its citizens and businesses the opportunity to take advantage of compressed natural gas as a more cost effective transportation fuel. As discussed below, two cities in Kentucky have taken the

lead in opening stations in the state and Delta hopes this proposed project can be used as a model of partnership between the state, the Commission and the utility which will encourage Delta and the other investor-owned utilities in Kentucky to build the infrastructure that will enable compressed natural gas to become a viable transportation fuel choice across this state.

**Q. Do you have an example of a state that has taken advantage of the lower cost of natural gas as a transportation fuel?**

A. Yes, one such example is Utah. In the December 11, 2012 issue of "The Spectrum" published in St. George, Utah, an article entitled "Shift to CNG" cited gasoline prices around $3.47 per gallon in many parts of Southern Utah. The author went on to point out that in Utah alone, there were about 40 CNG Stations selling fuel that costs the equivalent of about $1.50 per gallon of gasoline. That savings is having a significant impact on the families and businesses located in Utah. The article is attached to my testimony as Brown Exhibit I.

**Q. How has the State of Utah become a leader in CNG?**

A. The Utah State Government, the Utah Public Service Commission and the primary natural gas utility in the state partnered to bring low cost CNG to Utah's citizens prompted by legislation passed by the Utah State Legislature in 2009.

**Q. How has the Utah Public Service Commission aided in Utah's progress?**

A. The Utah Public Service Commission, together with the state of Utah, has recognized that the development of a CNG infrastructure is truly in the interest of the public and thus is willing for the public to participate in the cost of developing the infrastructure and operating the stations.

The following is set forth in Utah Code §§ 54-4-13.1 and 54-4-13.4::

> Natural Gas Rate and Cost Recovery Authorization
>
> The Utah Public Service Commission (Commission) may allow a gas corporation to set a natural gas vehicle fuel rate that is less than full cost of service if it is reasonable and in the interest of the public. If the Commission approves such a request, the remaining costs may be spread to other customers of the gas corporation.
>
> The Commission may also allow a gas corporation to recover expenditures directly related to the construction, operation, and maintenance of natural gas fueling stations and related facilities through an incremental surcharge to all of its rate classes. The Commission may allow this only if it finds that the expenditures are reasonable, do not exceed $5 million in any calendar year, are in the interest of the public, and will result in an annual incremental increase in revenue greater than 50% of the corporation's annual revenue requirement for the stations and facilities.

**Q. Other than the possibility of lower transportation fuel costs for Kentuckians, what benefits do you expect for the Company and its customers?**

A. Clearly, Delta's customers could benefit from this CNG Station by fueling their CNG vehicles. Additionally, as quantified in the testimony of Matthew D. Wesolosky, to the extent that Delta is able to convert its fleet to CNG, the Company will experience a reduction in operations expenses, thus saving money for Delta's customers.

In addition, once CNG Stations reach the point that they bring in more revenues than expenses incurred, that margin earned will serve to reduce the revenue requirement in future rate cases.

**Q. Are there other reasons why the Commission should conclude that construction and operation of Delta's proposed CNG Station is in the interest of the public?**

A. Yes. Some additional reasons that have been cited include:

- Using natural gas as a vehicle fuel makes the United States more energy independent.
- Less reliance on foreign oil helps reduce price volatility and the concerns regarding the situation in the Middle East.
- Natural gas is more environmentally friendly. Exhaust emissions from natural gas vehicles are much lower than of gasoline and diesel vehicles.
- Natural gas vehicles are as safe as or safer than traditional gasoline or diesel vehicles.
- Natural gas vehicles require less frequent maintenance than conventional cars and trucks because natural gas burns cleaner than gasoline.
- Natural gas vehicles have longer engine life.
- The fact that natural gas has an octane rating of 130 compared to 93 for the best gasoline gives the opportunity for superior engine performance.

**Q. What has been written recently regarding natural gas vehicles in the United States?**

A. *American Gas*, published by the American Gas Association, featured an article by Paul Stenquist in its October 2013 issue entitled "The Case for NGVs." This article has been attached to my testimony as Brown Exhibit II.

**Q. What other information is readily available about natural gas vehicles?**

A. Please refer to this additional information:

- The US Department of Energy has a website "Alternative Fuels Data Center" that showcases natural gas: http://www.afdc.energy.gov/fuels/natural_gas.html.
- NGV America's mission is to "be the single, national voice for the natural gas vehicle industry and catalyst for collection action." Its discussion of natural gas vehicles can be found at www.ngvc.org/about_ngv/index.html.

- The Kentucky Clean Fuels Coalition's mission is to "link providers and users of fuels across Kentucky to the best information and education available about clean energy technologies." Its information regarding natural gas is located at http://kentuckycleanfuels.org/natural-gas/.
- America's Natural Gas Alliance posted an article on October 23, 2013 entitled "Natural Gas Vehicles, Fueling Stations Becoming Increasingly Available to Public." This article is found at http://anga.us/blog/2013/10/23/natural-gas-vehicles-fueling-stations-becoming-increasingly-available-to-public.
- CNG Now! is also a good source for information about compressed natural gas. See http://www.cngnow.com/what-is-cng/Pages/default.aspx.

**Q. Are there other CNG Stations in Kentucky for public use?**

A. The October 15, 2013 issue of the *Madison Courier* reported that the Carrollton CNG station, opened in September 2013, is one of three public stations in the state. The others are The City of Somerset Fuel Center and Public CNG refueling at Waste Management of Kentucky in Louisville.

**Q. Is the public bearing the cost of construction and operation of these stations?**

A. Carrollton and Somerset, being cities, are able to recover their costs from tax dollars paid to the cities by the public. They have determined that offering CNG Stations to their citizens is in the interest of the public. While Waste Management does not have the ability to fund construction and operation of the station with tax dollars from the public, it currently is operating 43 new CNG refuse trucks in and around Louisville with a goal of placing an additional 80 trucks in service by 2015. Waste Management could justify

building the station based on its own use of CNG. It did not need tax dollars from the public, as in the case of Somerset and Carrollton.

**Q. Who should fund the construction and operation of Delta's proposed CNG Station?**

A. As discussed above, there are several reasons why Kentuckians should invest in building its CNG infrastructure, as has been done in other states. Delta believes that the operation of this station will ultimately benefit its customers and thus it is in the interest of the customers to fund its construction and operation.

**Q. How do you propose for Delta's customers to fund the construction of this CNG Station?**

A. Delta would plan to include the cost of the CNG Station as part of the Company's rate base in its next general rate case application.

**Q. Have any studies been performed which lend support to the inclusion of the CNG Station in Delta's rate base?**

A. Yes. The Science Applications International Corporation prepared a study for the American Gas Foundation in September, 2012 entitled "Natural Gas as a Transportation Fuel – Models for Developing Fueling Infrastructure", attached as Brown Exhibit III. This study divides the models implemented by CNG vendors into three primary categories:

- Commercial models
- Non Rate-based models
- Rate-based models

The infrastructure for CNG filling stations would be included in rate base in the Rate-based Model.

**Q. Why do you believe that the Rate-based Model is the appropriate model in Delta's situation?**

A. The Commercial Model and Non-rate Based Model in the study are better suited for companies in competitive markets who are looking for high rates of return in short time periods. The risk in these models falls either totally or largely on the shareholders. In the Rate-based Model, the infrastructure is included in the LDC's rate base and the LDC is entitled to earn a return on those assets. The revenues and expenses are treated as regulated revenues and expenses. Thus, the LDC's customers benefit from the upside performance of the CNG Station and bear the risk of the downside performance. The Rate-based Model is more appropriate for Delta's proposed CNG Station for the following reasons. First, given the fact that the proposed CNG Station will provide benefit to Delta's customers by reducing operating expenses for fuel for Delta's service vehicles with little chance for material negative impact on the customers' bills, the customers should be willing to participate with Delta's shareholders in moving this project forward. Second, Delta's customers have the opportunity to benefit from a reduced revenue requirement in Delta's next rate case should the CNG Station prove profitable. Third, since there is currently no market for CNG as a motor vehicle fuel in Delta's service territory, the competitive market aspect of the Commercial and Non-rate Based Models is non-existent.

**Q. Has Delta conducted a detailed market analysis relating to its proposed CNG station?**

A. No. There are no other entities offering CNG for sale as motor vehicle fuel in Delta's service territory and, thus, no fleets using CNG. There are no competitors with Delta's

proposed CNG station or other sellers of CNG as a motor fuel to the public in Kentucky other than Waste Management and the two cities identified above in my testimony. The primary use of the CNG to be dispensed at the proposed CNG Station in the near term will be for Delta's service vehicles. We felt, therefore, that a detailed market analysis would not produce meaningful information for Delta's decision making.

**Q. Why did Delta choose Berea as the location for this project?**

A. The Berea location is in close proximity to Interstate 75 but not close to any of the three other public CNG Stations in Kentucky. To create a sustainable CNG infrastructure, CNG must be available as a fuel throughout the interstate system. However, this means that to develop the infrastructure, stations would need to be constructed in rural areas that based on current demand cannot cost justify their construction. As previously mentioned, this is where a rate-based model is critical in the development of the infrastructure.

**Q. In a rate case application, how would the costs of operating the CNG Station be considered?**

A. The expenses, including gas costs, associated with the operation of the CNG Station would be recorded and reported as regulated expense during the test year and be an increase to cost of service in arriving at the revenue requirement in Delta's next general rate case.

**Q. Would gas cost be recorded at Delta's GCR rate?**

A. No. Delta is proposing to separately purchase the gas the CNG Station uses from either local production or from third party gas marketers.

**Q. How would the revenues earned by the station be considered?**

A. The revenues earned by the CNG Station during the test year would be included in test year revenues, reducing any revenue deficiency in Delta's next general rate case application.

**Q. Do you expect in the initial years of operation of the CNG Station for the costs to be greater than the revenues?**

A. Yes. See the Testimony of Matthew D. Wesolosky for quantification of the materiality of the CNG Station given the worst case, with zero customers, and an estimate of the number of customers needed in order for the station to break even.

**Q. How does your proposal comply with KRS 278.508(1)?**

A. KRS 278.508(1) allows for natural gas vehicle fuel sales to not be regulated by the Commission. Delta intends to set market based pricing so that the CNG Station will maximize revenue earned for the benefit of the regulated customers but at the same time be priced competitively with respect to gasoline prices. Unregulated pricing will give Delta the flexibility to do this. The profitability (loss) of the CNG Station will be the revenue earned at the pump less the cost paid for the gas sold, the tariff transportation rate and the other operating and maintenance expenses. As required by KRS 278.508(1), Delta will keep separate records and books of account adequate to allow the Commission to allocate costs and revenues and to perform other acts that will assist the Commission in enforcing the statutory section.

**Q. How will Delta determine the sales price to the public at the CNG Station?**

A. The sales price will be unregulated and adjusted to be competitive with other CNG stations as well as gasoline stations.

**Q. If Delta is proposing that it will own the CNG Station, why is Delta charging the station a transportation rate?**

A. Since the sales to the public from the station will be treated as unregulated, charging the Delta owned station a transportation rate treats the station as if it were an unaffiliated customer and provides Delta the ability to evaluate the profitability of the station as if it were a commercial entity. For example, if the station sold 50 gasoline gallon equivalents ("GGE") at a sales price of $2 per GGE ($2.54 per CCF), a gas cost of $.30 per GGE ($.38 per CCF), a transportation rate of $.13 per GGE ($.16 per CCF) and $5 of other operating costs, the station's profitability would be $74. Failure to charge the station the transportation rate would be to say the profitability of the station was $80, which is misleading since there is cost associated with transporting the gas to the station.

**Q. In the preceding example, in a rate case how much would the station contribute towards Delta's revenue requirement?**

A. In the preceding example, $80 would be contributed towards Delta's revenue requirement. Of the $80, $6.50 (50 GGE x $.13 per GGE) of the transaction would be contributed from Delta's transportation service and the remainder is contributed from the non-regulated activity.

**Q. Will the profit (loss) of the CNG Station as described above be the net impact of the CNG Station on the utility and its customers?**

A. Any loss would be offset by tariff transportation revenues earned by the utility for delivering natural gas to the station. Though the tariff transportation rate is a cost to the station, it is paid to the utility as an added contribution to utility margin.

**Q. How does your proposal comply with KRS 278.508(2)?**

A. KRS 278.508(2) stipulates that the transportation to a station selling fuel to a natural gas vehicle is subject to regulation by the Commission, but such rates can be set as flexible rates. Delta proposes to transport natural gas to the CNG Station pursuant to its Interruptible Service tariff and its Transportation of Gas for Others – On System Utilization tariff, which should be amended to provide for flexible rates and to provide that no customer charge will be paid by stations selling fuel for natural gas vehicles, with a waiver of minimum volume requirements. As amended, the tariffs will provide Delta a fair opportunity to compete with other motor fuels. A copy of the proposed amended tariff sheets is attached to my testimony as Brown Exhibit IV. Delta requests that the Commission approve the amended tariff sheets. This exhibit has been updated from the version filed on October 3, 2013 with the application to reflect the new rates effective October 28, 2013.

**Q. Is this tariff change something Delta needs regardless of whether the CNG Station is approved?**

A. Yes. Delta needs a transportation rate to apply to fueling natural gas vehicles in the event other entities build stations on the system.

**Q. How does your proposal comply with 278.508(3)?**

A. See the testimony of Matthew D. Wesolosky for a calculation of the impact of building and operating the CNG station on Delta's costs. Even with zero customers, the impact on customer bills is immaterial. Delta expects the revenues of the CNG station to offset or exceed the costs as the business grows. The CNG Station would not adversely affect the availability of natural gas to Delta's utility sales customers.

**Q. Is Delta seeking a certificate of public convenience and necessity?**

A. Not unless the Commission determines that one is required. Delta is requesting an order declaring that it is authorized to construct, own and operate a compressed natural gas station at its existing facilities on Glades Road in Berea, Kentucky. If the Commission concludes that a certificate of public convenience and necessity is required, Delta asks that it be granted a certificate of public convenience and necessity authorizing it to construct such compressed natural gas station.

**Q. Do you have any final thoughts regarding this project?**

A. Yes. I believe this project represents an exciting opportunity to move Kentucky forward in a meaningful way at a cost that is immaterial to Delta's customers. Delta is proud to be one of the leaders bringing the benefits of CNG to Kentuckians and looks forward to working through this process with the Commission to make it happen.

**Q. Does this conclude your testimony at this time?**

A. Yes.

Brown Exhibit I

# Shift to CNG

The Spectrum - St. George, Utah
Date: Dec 11, 2012
Start Page: 6
Section: A
Text Word Count: 424

**Document Text**

While gasoline prices have fallen in recent weeks, they still hover near $3.47 per gallon in many parts of Southern Utah. Motorists with sharp eyes probably have noted, however, that compressed natural gas (CNG) costs only about $1.50 per gallon.

That's a huge difference, casting a spotlight on the cheaper alternative fuel that is growing in popularity and, perhaps, could be the key to making the United States more energy independent.

The Spectrum & Daily News published a story Sunday that provided some information about CNG vehicles and how some Southern Utah residents have put vehicles that run on CNG to work for them. The key point of the story was to point out an alternative fuel that is gaining momentum in the western United States.

In Utah alone, about 40 stations have added CNG to the fueling options, with most of them located along the Interstate 15 corridor. Four of them are in the St. George area, and Cedar City has one. Other stations can be found in Panguitch, Price and Vernal. On the other hand, Oregon, Colorado and New Mexico -- states with "green" reputations -- have only two, 15 and four, respectively.

According to the Natural Gas Vehicles for America coalition, about 120,000 natural gas vehicles are traveling on U.S. roads with more joining the ranks every day. That demand has driven the cost up from about 67 cents per gallon just a few years ago, but the expense to refill a tank is still remarkably less than traditional petroleum.

CNG just may be the way to wean the United States off the volatility -- both regarding price and in terms of dangers in the Middle East -- that comes with foreign oil. Some energy experts believe there are large enough quantities of natural gas to fuel our vehicles for more than a century.

That fuel would be more environmentally friendly than traditional petroleum-burning engines and could mean a dramatic reduction in reliance on foreign oil. Take the oil out of the equation, and the United States has fewer reasons to bow to the whims of Middle East countries who make their living selling fuel to our nation.

And making a switch to bi-fuel vehicles -- which still have the ability to burn petroleum as well as CNG -- will buy the nation time for generations to develop new technologies that rely on renewable fuels instead of finite fossil fuels.

More effort should be made to shift the U.S. auto industry and related industries such as refueling stations to CNG.



**Abstract** (Document Summary)

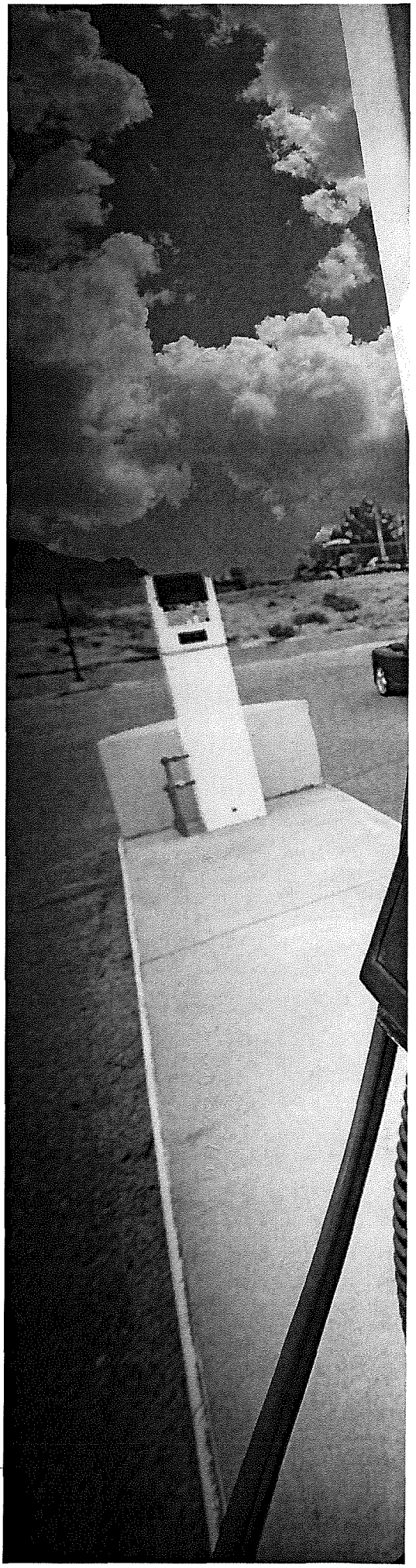
According to the Natural Gas Vehicles for America coalition, about 120,000 natural gas vehicles are traveling on U.S. roads with more joining the ranks every day. [...]making a switch to bi-fuel vehicles -- which still have the ability to burn petroleum as well as CNG -- will buy the nation time for generations to develop new technologies that rely on renewable fuels instead of finite fossil fuels.

Brown Exhibit II

The facts suggest we should all be driving natural gas vehicles. Why aren't we?

BY PAUL STENQUIST

# THE CASE FOR NGVs



Facts do not cease to exist because they are ignored," wrote Aldous Huxley in *Proper Studies*, an examination of human behavior. The observation rings true for those who know even a little bit about natural gas vehicles: Natural gas is a superior fuel to both gasoline and diesel, but its advantages have been largely ignored.

What benefits does natural gas offer, why isn't it more widely used on American roads, and what are its prospects?

## The Economic Advantages

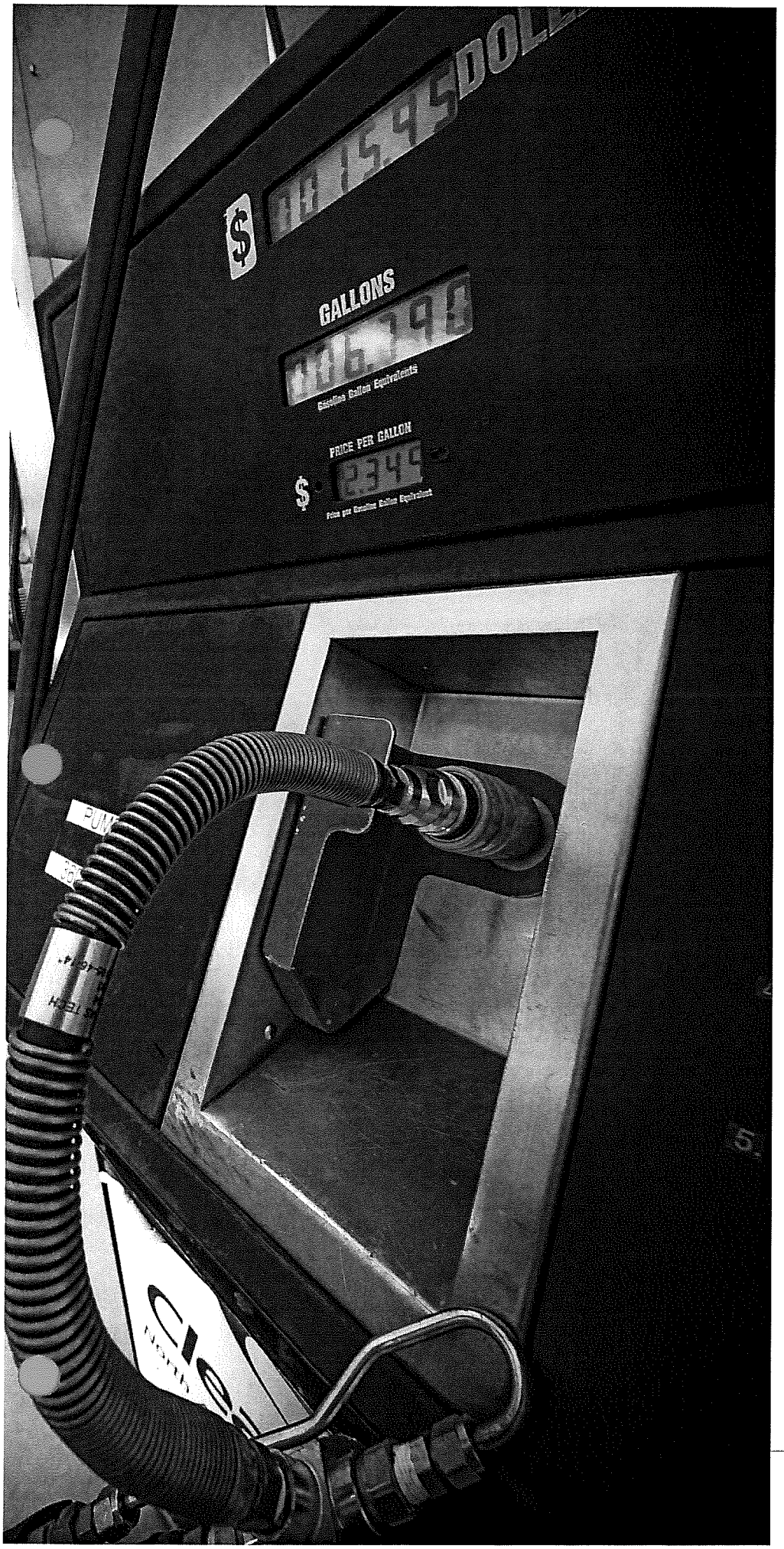
At today's prices, natural gas is much cheaper than gasoline or diesel. If a gasoline-powered vehicle can cover 20 miles on one gallon of gasoline, a natural gas-powered vehicle can do it for about $1.50 less. What's more, natural gas is available in abundance from domestic sources. The supply is not dependent on the good will of other nations, which contributes to price stability.

The facts also show that NGVs require less maintenance than conventional cars and trucks. A study of New York City cabs running on natural gas, cited by *Consumer Reports* in a March 2012 article, found oil changes and tune-ups were less frequent because natural gas burns cleaner than gasoline. It's also less corrosive, so exhaust-system parts last longer. And less maintenance results in lower operating costs.

## The Emissions Equation

Another fact: NGVs produce less harmful emissions than conventional vehicles. On its Alternative Fuels Data Center website, the U.S. Department of Energy says, "Natural gas burns cleaner than conventional gasoline or diesel due to its lower carbon content. When used as a vehicle fuel, it can offer lifecycle greenhouse gas emissions benefits over conventional fuels, depending on vehicle type, drive cycle, and engine calibration. In addition, using

PHOTO BY CHIP SIMONS




natural gas may reduce some types of tailpipe emissions."

That statement is backed up by multiple studies. A report prepared for the U.S. Department of Energy and California Energy Commission cited a 30 percent reduction in all greenhouse gases at the tailpipe. And Mercedes-Benz reports that its bi-fuel E 200 produces 20 percent less $CO_2$ on CNG than it does on gasoline.

"Natural gas is a less carbon-intensive fuel," explained Dick Kauling, engineering manager for gaseous fuels at General Motors, in an interview with *American Gas*. "It has fewer carbon molecules than gasoline."

In some parts of the country, where electric vehicles are charged with power provided by utilities burning coal, NGVs have a smaller carbon footprint than EVs. Given the cost of switching to another power source, many of those utilities will continue to burn coal for the foreseeable future. According to a 2012 report by the Union of Concerned Scientists, in some areas an electric car or plug-in hybrid will generate more full-cycle global-warming emissions than the best gasoline-engine subcompact. If that subcompact burns natural gas, its carbon-emissions advantage over the EV becomes even more substantial.

Despite the attention being paid to it, a fully electric national fleet is probably not practical, given the limitations of the grid. Moreover, it might not even be the cleanest alternative. According to *Electric Light & Power*, a publication covering the electric industry, western states, with their high dependence on hydropower, are already near the maximum sustainable generation levels. The Midwest, where utilities burn primarily coal, can support plenty of EVs—but in those areas, NGVs would be the cleaner alternative.

## Smaller Market, Bigger Price

At present, NGVs are more expensive

## CATCH 22

# GIVEN SUFFICIENT VOLUME, THE PRICE OF NGVS COULD BE COMPARABLE TO CONVENTIONAL CARS.

than gasoline-engine vehicles, but the price differential is primarily a function of economies of scale and it may contract as production of NGVs increases. Auto manufacturers are set up to produce conventional vehicles, and the cost of tools and parts required for manufacture is spread out over millions of units. Producing NGVs could require expensive production and parts-sourcing changes. And although the NGV market is growing, it's tiny compared to the overall mix. Last year, out of approximately 15 million vehicles sold in the U.S., about 25,000 were NGVs.

But as share increases, the price of NGVs can be expected to decline. Given sufficient volume, the price of NGVs could be comparable to that of conventional vehicles, Jon Coleman, Ford Motor Co.'s fleet sustainability manager, told *American Gas*. The same may not be true for electric vehicles, as the lithium-ion battery pack adds substantial up-front cost.

But there's a catch. The price of NGVs won't come down until the market grows. But for the NGV market to grow, the price may have to come down. Automakers have invested heavily in hybrid and EV development, effectively subsidizing the products to make them saleable. While the advantages of natural gas as an alternate fuel are obvious, will they pony up again to stimulate a market?

Government has been a prime mover in the EV market, providing tax credits and subsidies. The NATGAS Act, now before Congress, would provide subsidies for the manufacture and purchase of NGVs. But like most congressional legislation, it is stalled.

Kathryn Clay, executive director of the Drive Natural Gas Initiative at AGA, says she isn't hoping for government subsidies. She believes NGVs can make it on their own merits. But she would like to see the government stop subsidizing EVs and level the playing field.

Clay adds that NGVs got a boost when new CAFE standards were finalized in August 2012. The standards, which mandate a 54.5-mpg fleet average by 2025, include multipliers that encourage automakers to build environmentally friendly vehicles. The multipliers allow EVs to be counted twice when calculating CAFE. Each plug-in hybrid and NGV can be counted as 1.6 vehicles. This might encourage automakers to replace part of their gasoline fleet with NGVs.

### Where We Are Now

One reason why NGVs haven't become a major player in the American vehicle fleet is that current offerings aren't as refined as they could be. With the exception of Honda's natural gas-powered Civic, NGVs available in the U.S. are commercial vehicles intended for fleet use. Because the infrastructure doesn't adequately support natural gas refueling, most are bi-fuel models that can use both natural gas and gasoline. That means the engines aren't optimized to get the most out of natural gas, so fuel economy and power may suffer.

Ford is a leading marketer of NGVs in the United States, and while NGV sales are a small fraction of its business, they've increased 350 percent since 2009. Current offerings include a number of medium and heavy-duty vehicles. All Ford NGVs are outfitted by secondary suppliers that fit natural gas hardware to engines that were designed to run on gasoline.

GM offers bi-fuel pickup trucks and a dedicated CNG van. While the van runs on natural gas exclusively, the engine is a gasoline design fitted with components necessary for natural gas operation. Chrysler's Ram 2500 Heavy Duty DNG pickup truck is powered by an engine that was not engineered for natural gas fuel. Gregg Black, Chrysler's senior manager for advanced engine systems, told *American Gas* that engine-management programs adjust variables like spark timing to the fuel in use. But the Ram's engine is not fully optimized for CNG, Black acknowledged.

Honda's Civic Natural Gas is the sole NGV passenger car available in the United States. Powered by a 110-horsepower 1.8-liter engine, it achieves 31-mpg combined fuel economy. With a 12.7:1 compression ratio and heavy-duty components, the NGV engine has been upgraded to a considerable degree, but it's not a clean-sheet design. The car is priced approximately $8,000 higher than a standard Civic. Eric Rosenberg, a Honda assistant manager, told *American Gas* that retail buyers of the NGV now outnumber fleet buyers by about four to one.

### We Could Do Better

Because natural gas is not the same as gasoline, an engine designed to run CNG—or a bi-fuel engine with sophisticated engine management controls and hardware—could be markedly superior to today's retrofits. Natural gas has less energy density than gasoline, so burning it in an engine designed for gasoline is inefficient. Natural gas has an octane rating of 130, while today's gasoline is 93 octane at best. An engine designed from scratch could take advantage of that octane and compensate for reduced energy density. High octane makes natural gas more knock-resistant than gasoline, so a dedicated CNG engine could be designed with a much higher compression ratio and more turbocharger or supercharger boost. That translates to more cylinder pressure and power from a given volume of fuel. Computer studies of combustion and flow could produce engine systems tailored to natural gas, resulting in further improvement. In brief, a purpose-built natural gas engine could be hyper-efficient.

"Whenever you have the opportunity to run 130-octane fuel, a lot can be done to optimize engine operation," said Chrysler's Black. "If you start with a clean sheet, you can optimize more. A dedicated NGV engine would take on its own character."

European and South American drivers know how efficient and powerful NGVs can be, as many of the world's automakers—including the American ones—provide optimized vehicles for those markets. Gasoline is expensive on those continents, and natural gas has long been a less-costly alternative, so many countries have enough CNG refueling stations to adequately support widespread NGV use. NGVs offered outside the U.S. offer a hint of how efficient a fully optimized purpose-built NGV could be if automakers expended the same kind of effort on the development of natural gas engines that they've applied to gasoline engines.

GM has taken an NGV to the next level for the European market, Kauling said. The Opel Zafira's engine is optimized to run on natural gas, with a high compression ratio and turbocharging. The 1.6-liter engine generates 150 horsepower and 155 pound-feet of torque. Its power band is broad, with maximum torque available over a wide range of engine speeds. $CO_2$ emissions are said to be the best for any vehicle in its class. It has gasoline capability, but only as a limp-home mode to make sure drivers aren't stranded when refueling isn't possible. However, in the markets where Zafira is sold, the natural gas infrastructure is well developed.

NGVs have been optimized in additional ways. Audi is expected to launch its bi-fuel A3 Sportback g-tron compact car in Germany later this year. Advances include lightweight natural gas fuel tanks constructed of carbon-fiber-reinforced polymer and lined with a polyamide matrix that natural gas can't permeate. Audi has also made advances in regulating fuel-system gas pressure. An electronic regulator controls gas flow from the tanks to the engine in two stages, providing low-pressure fuel for lower engine speeds and high-pressure fuel when more power is needed.


Mercedes-Benz is also serious about NGVs. The automaker recently introduced a bi-fuel version of its E-Class sedan for the German market. With advanced direct injection, the E 200's 4-cylinder engine generates 156 horsepower. The automaker cites a 20 percent reduction in $CO_2$ emissions when running on natural gas and estimates that given the cost of natural gas and gasoline in Germany, a driver can save more than $100 in fuel costs for every 1,000 miles driven.

## Refueling Revolution

Before NGV sales can reach the volume necessary to affect pricing, refueling options have to improve. The number of commercial refueling stations is growing at 16 percent a year, according to the DOE. As the price and performance of refueling equipment improves, that growth rate should increase. Millions of miles of natural gas pipe are already in place. Connecting those pipes to refueling equipment is a relatively simple proposition.

Many experts believe that advanced, affordable home-fueling equipment is the key to growth. Electric vehicles are gaining acceptance despite the fact that, for the most part, they must be charged at home. And because NGVs offer greater range than EVs, home fueling makes even more sense.

Some products are already available, including the Phill by BRC FuelMaker. This wall-mounted refueling station compresses pipeline gas and enables overnight refueling. It's cost is approximately $5000. A number of companies are working on advanced, affordable stations that would provide faster refueling while conditioning pipeline gas. In conjunction with universities and other suppliers, GE and Eaton Corp. are both developing home CNG refueling stations that would sell for considerably less than current devices.

In a press release from July 20, 2012, Eaton said the device "will be available before the end of 2015 with a target production price of $500." When asked how that would translate to a retail price, James J Michels, Eaton's communications manager, told *American Gas* that the company had not established a selling price. GE, on the other hand has not committed to production or an availability date, but said in a media release, "As part of an ARPA-E program, GE will lead a project to demonstrate an at-home refueling station that meets the agency's cost target of $500 per station and reduces re-fueling times to less than one hour." ARPA-E is a DOE program that awards grants for the development of energy technologies. Both the GE and Eaton effort are funded in part by this program.

If inexpensive home fueling stations do become available, they could alter the NGV landscape. The facts suggest that's a good thing. The automakers have a long way to go to meet the 2025 CAFE standard of 54.5 mpg, and advanced NGVs could help them meet it, AGA's Clay said, adding that "alternative fuel approaches including NGVs, pure electric, gasoline-electric hybrids, and eventually even natural gas-electric hybrids will all be important for auto manufacturers working to meet ever more stringent fuel economy and emission standards."

"I'm excited about the potential of the fuel," said Chrysler's Black. "It will be interesting to see how this works out going forward." ◆

American Gas Foundation

# Natural Gas as a Transportation Fuel

*Models for Developing Fueling Infrastructure*

September 2012

***American Gas Foundation***
400 North Capitol St., NW
Washington, DC 20001
www.gasfoundation.org

# FINAL REPORT
# NATURAL GAS AS A TRANSPORTATION FUEL -- MODELS FOR DEVELOPING FUELING INFRASTRUCTURE

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# Executive Summary

Throughout the nation, there is presently a surge in interest in the development of new natural gas markets as a result of recent large increases in the projected volume of economically viable domestic natural gas due to advances in shale gas extraction technologies. While natural gas supplies nearly a quarter of the primary energy used to power our economy, less than one percent of transportation energy is supplied by natural gas. The mainstreaming of natural gas vehicles (NGVs) offers the potential to help diversify the primary energy used in our transportation sector and to provide attractive new markets for natural gas. As such, many natural gas local distribution companies (LDCs) are currently assessing their approach to NGVs.

In speaking with LDCs that are interested in NGVs but presently have minimal or no NGV programs, the authors observed many were uncertain where to focus their efforts. This report strives to assist the federal and state regulatory agencies, LDCs and the general public in evaluating approaches to NGVs within regulated service territories. Models and associated strategies that can lead to the establishment of natural gas as a mainstream and sustainable transportation fuel are discussed. Examination of viable NGV business models may assist both in the establishment of new NGV programs, and in the further development of existing NGV programs.

Current models implemented by LDCs are divided into three primary categories:

- **Rate-based Models** – These are used by LDCs with NGV activities that are allowed in their rate-base. Under the rate-based model, investment is made by the LDC's investors and is reimbursed through rates charged to the customers, which include a fixed rate of return (ROR) or profit, as set by the regulatory commission. Where, when, and what NGV projects are invested in may be limited by the regulators, and may not be based solely on financial criteria.

- **Non-Rate-based Model** – This model is used by LDCs to conduct activities that directly or indirectly support NGV development, the cost of which is not allowed to be passed on to the LDC's customers. In some cases, the LDC may be able to collect their commission-fixed ROR from these projects when they yield a profit. Typically, LDC investments under this model are relatively modest.

- **Commercial Model** – This model is used by unregulated affiliates of LDCs such as commercial companies under the same parent or holding company, although it is also applicable to unaffiliated commercial companies. Determination to pursue a particular NGV project is based on common commercial investment criteria including return on investment (ROI), ROR, and payback period, which are adjusted based on project risk. While shareholder risks may be greatest under this model, potential profits are not limited.

Hybrids of the above models may also be applied in which two or three of the model types are mixed to provide different services or to be used in different markets. The models applied in a hybrid approach may also shift with time as NGVs gain a greater share of the vehicle market.

Regardless of the model type, all investments carry a risk of loss. While many risks can be listed for any project, three fundamental risks that will likely make or break the ultimate success in developing natural gas as a sustained, mainstream transportation fuel are:

- Endurance of the price spread between natural gas and the competing fuels
- Technological competitiveness of NGVs both compared to conventional and other alternative transportation technologies
- Scale of NGV adoption, whether nationwide or in a defined region or market

A basic understanding of these and other NGV investment risks is a prerequisite to determine how to allocate risk exposure. Allocation of risk to ratepayers through rate-basing NGV projects is supported by the significant public benefits associated with NGV use. These benefits include reduced life cycle emissions compared to conventional transportation fuels, increased national-level energy independence, reduction in the national trade deficit, and increased economic stability associated with reduced exposure to the international price swings of petroleum-based fuels. How these public benefits are valued varies among the states, hence regulatory commission acceptance of rate-basing NGV investments also varies.

In general, states with policies to promote reduction in greenhouse gases and other emissions may be more likely to welcome rate-basing NGV investments as a means of supporting their emissions policies. Since emissions reduction is supported by energy efficiency, states with emissions reduction policies tend to have delinked (i.e., decoupled) natural gas sales and revenue for their regulated LDCs. In these states, obtaining a ruling to exclude NGV fuel from decoupling mechanisms may be needed to harmonize regulatory commission rules with state policy. This may also maximize benefits from NGV expansion.

While the basic NGV business model type affects who may bear the risk of NGV investments, the design of specific strategies within a model determines who the ultimate risk-holders are. Table 1 displays primary and secondary risk holders for strategies within each of the three primary model types.

There is a tendency to design strategies such that risk is shifted to other parties as much as possible, regardless of whether the strategy is designed by an LDC or a commercial company. However, for sustained NGV use, the risk-bearers should be able to mitigate their risks. If NGV operations, including both refueling stations and NGV users, are not economically viable, they are unlikely to provide sustained natural gas demand. As a result, the customer's NGV risks affect the LDC regardless of the level of LDC involvement. Educating customers about their options in risk mitigation measures increases the chances of sustained NGV adoption and associated natural gas load.

Table 1 NGV Strategies and Risk Holders

| Strategy | Risk Holder | |
|---|---|---|
| | Primary | Secondary |
| **Rate-based Model** ***(for regulated LDCs)*** | | |
| LDC-owned public refueling stations, no fuel contract | Ratepayer | LDC shareholder |
| LDC-owned refueling stations (public or private) with anchor customer, take-or-pay contracts | User | Ratepayer |
| LDC compression services tariff for recouping costs from users | User | Ratepayer |
| Low interest loans for vehicle purchases, refueling infrastructure, home refueling devices, etc. | User | Ratepayer |
| Incentives for vehicle purchases, refueling infrastructure, etc. | Ratepayer | LDC Shareholder |
| Expansion or construction of LDC owned liquefaction facilities for LNG wholesale | Ratepayer | LDC Shareholder |
| **Non-Rate-based Model** ***(for regulated LDCs)*** | | |
| Pilot program funded by shareholders, able to receive LDC's ROR | User | LDC Shareholder |
| Grant from State or other entity for compression services at new stations with approved fee to recoup costs from users | User | none |
| **Commercial Model** ***(for unregulated companies/ affiliates)*** | | |
| Company-owned public refueling stations, no fuel contract | Shareholder | User |
| Company-owned refueling stations (public or private) with anchor customer, take-or-pay contracts | User | Shareholder |
| Lease NGVs | User or shareholder -- Depends on contract terms | |
| Transportation of LNG or CNG to refueling stations | User or shareholder -- Depends on contract terms | |

Finally, the ultimate goal of establishing natural gas as a sustained, mainstream transportation fuel may be furthered by consideration of the changing role of the LDC with expansion of NGV markets. Rate-based NGV programs may do much to jump-start NGV adoption. Indeed, they may be an essential component to achieve a sufficient momentum for natural gas to become a mainstream transportation fuel. This may be done without a later sag in NGV use when rate-based programs end if strategies are designed with recognition that the economic benefit of NGV use will need to continue beyond the duration of rate-based programs. This suggests the essential role of commercial operations for building

and operating the NGV fueling infrastructure when rate-based programs are no longer needed. Under circumstances where commercial operations already provide for a significant NGV market, LDC programs can advance NGV market penetration through strategies such as focusing involvement in marginal markets that are not targeted by commercial efforts; establishing incentives for NGV adoption and/or commercial refueling station development; and supporting NGV adoption through educational outreach to targeted markets.

# 1 Introduction

Natural gas (NG) has been a recognized transportation fuel since the early twentieth century, but the expansion in plentiful, cheap crude oil after World War II gave liquid fossil fuels a dominating transportation market share throughout the remainder of the century. In the early 21st Century, we are poised for a shift to a more diversified transportation fuel market. Advances in natural gas extraction technologies are enabling the delivery of abundant, affordable natural gas and the prospect of a shift to greater use of natural gas as a transportation fuel.

While the price of natural gas per unit energy has historically been lower than liquid fossil fuels, this price differential must be large enough to overcome barriers to substantial market penetration by natural gas vehicles (NGV). These barriers include the capital expenses associated with infrastructure development for storage of natural gas in compressed or liquefied form, and the cost premium for lower-production vehicles with more expensive fuel tanks. Additional barriers have included the lagging optimization and availability of NGV. Although these later two obstacles have been reduced in recent years, lingering negative perceptions persist as a result of early-adopters' experience with less-developed, earlier engine and vehicle technologies.

LDCs represent a key group of stakeholders in the natural gas industry that have historically been promoters of NGVs. Many LDCs are currently assessing their approach to this market. In speaking with LDCs that are interested in NGVs but presently have minimal or no NGV programs, the authors observed many were uncertain where to focus their efforts. The objective of this project is to explore models that can lead to the establishment of natural gas as a mainstream and sustainable transportation fuel with consideration of past practices, innovative approaches, and the current and near-term environment. Recognizing the important role LDCs will play in establishing natural gas as a mainstream transportation fuel; this report focuses on models from the perspective of local distribution companies (LDCs). Rate-based LDC projects are emphasized, with additional attention given to supporting strategies for non-rate-based LDCs activities, and for unregulated affiliates of LDCs.

LDCs are defined as companies with monopoly ownership of local gas distribution lines, and as such, are regulated by State utility commissions. As regulated entities, LDCs operate in a unique business environment. All expenditures are reviewed by a State regulatory commission which sets rules on the types and magnitude of expenses for which the LDC can be reimbursed from their rate-base (i.e., customer charges). Expenditures that are deemed "unallowable" are paid for from the LDC's profits. The rate of return (ROR), or profit margin that an LDC can achieve is also set by the regulatory commission. The rules and limits set by regulatory commissions vary among states, and also among LDCs within the same state.

LDCs may or may not have separate but affiliated unregulated companies that provide other functions in the gas industry, such as gas marketing or commercial refueling station construction. Both the

commission-set rules under which an LDC operates and the types of unregulated commercial companies affiliated with an LDC are key considerations in determining their optimal model for NGV activities.

In today's environment LDCs often do not own the gas flowing through their pipelines, and their revenue is determined by either the volume of gas they distribute, or if they are decoupled, by a volume-neutral means established by their regulator. Particularly for LDCs with a distribution system that reaches the full extent of their regulated service territory, developing a mainstream, sustainable NGV market represents a promising means for increasing their system load and related improvements in efficiency.

The vehicle markets initially targeted for NGV adoption are those likely to achieve payback on their vehicle and infrastructure investment within a few years, regardless of the presence of incentives (e.g., tax credits, rebates, etc.). Centrally refueled vehicles with high mileage can receive the economic benefits of natural gas absent the presence of a larger NGV refueling infrastructure. High mileage, centrally-refueled fleets are commonly associated with large distribution warehouses (e.g., Walmart) and delivery services (e.g., FedEx and UPS). While these fleets are comprised primarily of heavy-duty and medium-duty vehicles, there may also be centrally-refueled light-duty markets with high enough fuel use per vehicle to yield a reasonable payback period without incentives (e.g., taxicabs).

In some markets with high levels of fuel consumption, central refueling may not be necessary for favorable NGV economics. An example of this is the long-haul trucking market for which private investors are developing a natural gas refueling infrastructure at truck stops along major corridors and attracting a growing customer base.[1,2] As NGVs become mainstream in the initially targeted markets, the costs of NGV adoption are expected to decrease allowing more favorable economics for additional sectors to enter the NGV market, ultimately including personal passenger cars and home refueling. The rate of NGV adoption, however, may be increased with programs designed to reduce the initial barriers to market entry: vehicle premium costs, refueling station availability, and consumer confidence in NGVs. Market acceleration is necessary in instances when supply infrastructure and fueling demand need to be simultaneously developed to mitigate the risk to ratepayers or shareholders of unused assets

## 1.1 Project Approach

The project was conducted as a series of tasks that first included assessments of the status of the NGV market and recent and current regulations and incentives based on publically available data. Summary findings are presented in Appendix A, largely on a state-by-state basis to assist in comparing different trends and circumstances for the state(s) in which their territory resides.

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1 Margaret Ryan, "Trucks can keep on trucking, LA to Salt Lake", February 7, 2012, AolEnergy. As viewed at: http://energy.aol.com/2012/02/07/lng-trucks-can-keep-on-trucking-la-to-salt-lake/

2 "Supply Chain Fleet Operators Increasingly Turn to Natural Gas Power", March 26, 2012, Seeking Alpha. As viewed at: http://seekingalpha.com/news-article/2285271-supply-chain-fleet-operators-increasingly-turn-to-natural-gas-power

While public literature was reviewed for identification of relevant models, the primary sources for identification and assessment of LDC models for NGVs was a series of telephone interviews with key players in this field. As such, the content of this report is very substantially based on the collective experiences of the interviewees, whose affiliations are listed in Appendix B.

## 1.2 Report Structure

This report is structured to facilitate the customized development of model(s) for a particular LDC and regulated service territory. This structure has been chosen based on the recognition that circumstances vary substantially among LDCs, hence the most appropriate business models also vary. The target audience includes regulators, public policy makers, LDCs and the general public who are evaluating their role in NGV market development, particularly those that have little to no current involvement with NGVs. This report is designed to help guide the development of an NGV model, beginning with identifying their best role under their circumstances.

Common components of models are briefly reviewed in Section 1.3. Section 2 reviews the underlying drivers of all models benefits and risks, with consideration of distinctions between models for LDCs and their unregulated affiliates, and addresses several overarching risks for NGV market expansion. While natural gas pricing relative to conventional fuels is arguably the primary risk, technological competitiveness compared to both conventional fuels and other alternative technologies also has the potential to substantially hinder NGV market growth. The third and final overarching risk discussed in Section 2 is the risk of the development of geographic or market segment islands of NGV use rather than nationwide mainstreaming across market sectors. Both LDCs and their transportation customers will need to be comfortable with the overarching risks discussed in Section 2.

To aid in development of a business model that is customized with the most suitable strategies, readers are first introduced to the basic types of business models an LDC and its affiliates may employ: rate-based, non-rate-based, and commercial. These models are distinguished by who the investors are and who bears the financial risk – multiple model types may be combined to create a hybrid model. Questions are posed and discussed to guide the reader in their selection of an appropriate model (Section 4) and analysis of the best strategies for their circumstances (Section 4). Market research and resulting responses to the questions will help identify the most suitable role in facilitating the sustained development of natural gas as a mainstream transportation fuel.

Finally, Appendix A provides summary graphics and tables of the current status of NGV markets in the US on a state-by-state basis to assist in the assessment of the NGV market in a particular regulated service territory.

## 1.3 Common Components of Models

The basic process of model development is largely the same for both LDCs and their unregulated commercial affiliates. All models begin with defining goals and objectives. For NGV models, this should answer questions such as: Is the organization interested in making a higher absolute return or a higher rate of return? Does it want to have the greater certainty of a return at the regulatory commission's approved rate or does it want to take higher risks to potentially realize higher profits? Setting the public policy, regulatory, and organizational goals will help define the model structure and mode of operation.

After defining goals, in-house capabilities are assessed to identify what can be accomplished most efficiently in-house and what can be accomplished most efficiently out-of-house. A strategy is then developed to build on the competitive advantages of both the organization and any networked affiliates. This process includes some tasks that are common elements of almost all NGV business models, whether they are implemented by an LDC or an unregulated LDC-affiliate. The general process is described in the following section, followed by a discussion of means for measuring and assuring model success.

### *The General Process*

Common components in the process of model development include the following tasks:

1. ***Collection of Regional Information*** – types of commonly collected regional information include:
    - Regional NGV Data – profiles of current NGV fleets in the region including number of vehicles, vehicle types, how they refuel, and whether NGVs and associated fuel use has increased or decreased in recent years. Where applicable, both the number of public NGV refueling stations and delivered fuel volumes should be examined to understand recent trends.
    - Regional Fleet Data – data on regional fleet sizes, vehicle types, and mileage are available for purchase from commercial, for-purchase databases such as FleetSeek.
    - Corridor Development Efforts – regional private efforts to develop natural gas refueling corridors both within the LDC territory and in areas near their territory should be identified and their plans understood.
    - Adjacent LDC Efforts – LDCs with adjacent territory may be contacted to identify potential coordinated programs to create larger contiguous regions with NGV refueling.
2. ***Market Segmentation Analysis*** – the vehicle market is segmented based on typical mileage; vehicle type (e.g., light, medium, or heavy duty); fuel economy; and refueling station type (i.e., public refueling or private central refueling). Feasibility analyses with and without the presence of any current incentives are typically conducted for each segment with increasing levels of detail and variations for segments that consume sufficient or near-sufficient fuel to achieve a reasonable payback period (i.e., less than 3 years). Fuel prices used in the feasibility analyses should reflect a range of reasonable prices.
3. ***Market Competition Assessment*** – the regional presence of and trends in commercial NGV services are important indicators of competition. Where commercial NGV services are growing, an LDC can craft their NGV program to encourage the growing industry, recognizing that

support from commercial companies will be essential for sustained NGV adoption. LDC programs designed to jump-start NGV adoption may choose to focus on areas beyond current commercial NGV investment, whether distinguished geographically, by market segments, or by different services. Alternatively, LDCs may encourage commercial projects through incentives such as zero-interest loans, lease-to-own arrangements, rebates, grants, etc.

4. ***LDC Goals and Customer Identification*** – information collected in the above steps is used to define goals for the LDC in NGV market development. Based on these goals, target customer profiles are developed. For many NGV programs, aggressive marketing based on customer profiling is essential for success.

5. ***Customer Preparation*** – viability of a customer's NGV operations, whether they are refueling station operators or NGV users affects the LDC. If these operations are not economically viable to the customer, they are unlikely to provide sustained natural gas demand. As a result, the customer's NGV risks affect the LDC regardless of the level of LDC involvement. These risks can be mitigated by preparing the customer to better handle their risks. Table 2 lists some of the risks NGV customers face.

Table 2 Risk Considerations for Customers

| Business Risks | Market Risks | Operational/ Technology Risks |
|---|---|---|
| • Fuel supplier dependability<br>• Infrastructure stability<br>• Change in incentives<br>• Negative media reports of a fuel-related incident<br>• Bad business conditions<br>• Structural risk (will a sustainable CNG market develop?) | • NGV price rise<br>• Diesel price drop<br>• Increase in vehicle price differential<br>• Lower salvage value<br>• Poor economic conditions<br>• Competition from other modes of transport | • Reduced vehicle performance<br>• Increased maintenance costs<br>• Reduced vehicle life<br>• Spare parts unavailability<br>• Poor service responsiveness<br>• New, better technologies<br>• Picking the right engine – brand, configuration, etc. |

### *Measuring and Assuring Success*

The definition of success for a model or strategy should be developed along with the business plan and regulatory or public policy goals. This definition should include measureable, realistic targets with specified dates for achievement. Further, data collection to allow tracking of program success should be included in the program plan. Targets for success may be in terms of a return on investment, volume of natural gas use by vehicles, number of NGVs, etc.

Unfortunately, metrics of program success have not been tracked by the LDCs with more established NGV programs that were interviewed for this report. In cases where NGV programs are implemented because they are viewed as beneficial for the general public (such as many state-level alternative fuel and clean fuel incentives) an overriding belief in longer-term program benefits may reduce interest in

data collection for current statistics. This lack of statistics limits assessments of the success of different recent programmatic approaches.

However, if successful programs are defined by consistent increases in natural gas sales for vehicle use, a common component of success appears to be supportive efforts between the state and the LDC. In states with incentive programs for clean or alternative transportation fuels, the selection of NGV over other alternatives may be substantially increased by targeted LDC programs that at a minimum provide information on NGVs and technical assistance for feasibility studies. Recognizing the lack of familiarity most customers have with NGV infrastructure needs, customer selection of other transportation fuel options may be expected in the absence of active LDC programs.

### *Public Data for Program Assessments*

The US Energy Information Administration (EIA) collects a variety of data that could be reasonably used to suggest the success of combined state- and LDC-level NGV programs. However, care should be taken in developing conclusions from these datasets because they sometimes exhibit opposite trends within the same time period. Some of the contradictions and limitations of the different EIA datasets are presented below to facilitate appropriately qualified conclusions.

There are two relevant sources of data within the US DOE that may assist in assessments of NGV use: The EIA Annual Survey of Alternative Fueled Vehicles (Form EIA 886) and The EIA Annual Report of Natural and Supplemental Gas Supply and Disposition (Form EIA-176).

The first of these, the Alternative Fueled Vehicles (AFV) survey, is completed by AFV original equipment manufacturers (OEMs), AFV converters, and operators of federal, state, and utility fleets in addition to some large municipal and private fleets. The survey form (Form 886) requests information on:

- Number and type of AFVs that vehicle suppliers (OEMs and after-market converters) make available
- Number, type, and location of AFVs in the surveyed fleets
- Number of miles traveled by the surveyed AFVs – while the instructions do not address estimated mileage, all fleets do not collect mileage data, hence at least some estimates are likely
- AFV fleet fuel consumption, which as specified in the instructions, may be estimated based on miles traveled and assumed miles per gallon
- Number of retired AFVs

The published AFV Survey report includes data that is estimated for surveyed fleets in addition to fleets and privately owned vehicles that are not part of the survey. Data are grouped by state and vehicle type – data are not available on a respondent level. The fuel consumption estimates are often based on vehicle mileage, EPA estimated fuel economy, and an adjustment factor for on-road use, with additional assumptions on fuel use in bi-fuel vehicles. The modeling methods employed do not account for vehicle

resale across state lines, which may increase in significance depending on the types of incentives for NGV adoption that are available.

The EIA Annual Report of Natural and Supplemental Gas Supply and Disposition (Form EIA-176) is required to be completed by natural gas distribution companies.[3] This survey includes separate reporting of natural gas deliveries to residential, commercial, industrial, electric power, and vehicle fuel use, but does not include separate reporting of natural gas used by the distributor for vehicle use. In addition to typical LDCs, the survey includes distributors that only provide natural gas for vehicle fuels (e.g., Clean Energy, Natural Fuels, Transtar Energy, Blue Fuels, etc.). Data are available on a state-by-state level for each survey respondent. While EIA describes quality control of the data,[4] some year-to-year variations for a single respondent are three orders of magnitude. For example, vehicle fuel deliveries for Oklahoma Natural Gas are shown as 2,118 MMcf in 2006 and 2.8 MMcf in 2007. In a query to Oklahoma Natural Gas, they had no recollection of such a large change in vehicle fuel deliveries, suggesting possible differences in reported units.

Recognizing the assumptions applied to the EIA's AFV survey data and quality control concerns of the natural gas deliveries survey, some comparisons of state-level estimated NGV fuel use from these two databases are shown in Figure 1.1. These different datasets suggest varied trends in NGV fuel use. For example, distribution companies in Utah report increasing deliveries of natural gas for NGVs between 2007 and 2009, while EIA AFV survey estimates suggest decreasing use of natural gas by Utah's NGVs over the same time period.

Further assessment of issues and reconciliation of varied trends in these datasets was beyond the scope of this project.

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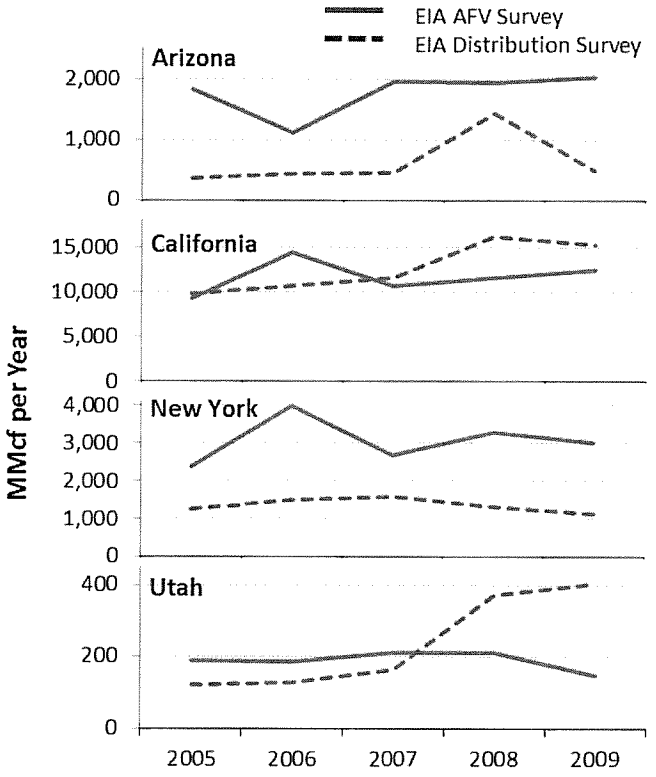
3 Annual Report to Natural and Supplemental Gas Supply and Disposition, Form EIA-176 Instructions. As viewed at: http://www.eia.gov/survey/form/eia_176/instructions.pdf

4 EIA, Natural Gas Data Sources. As viewed at: http://www.eia.gov/dnav/ng/TblDefs/NG_DataSources.html

Figure 1.1 Comparison of EIA Datasets for Natural Gas Use in Vehicles. *




** EIA AFV Survey estimates of fuel use, published in units of gasaline gallon equivalents, were converted to MMcf based on assumptions of 1,027 Btu/cf and 5.119 MMBtu/barrel of gasaline.*

*Saurces: EIA Annual Alternative Fuel Vehicle Survey and EIA Report of Natural and Supplemental Gas Supply and Disposition*

# 2 Benefits and Risks: Underlying Concepts for Model Selection

Models are developed to achieve specific goals with associated benefits. In general terms, the business decision to undertake an investment to achieve these goals is based on a weighing of the project benefits against the risks of investment loss, and comparing the risks and benefits to other investment options. A brief overview of the potential benefits of NGV projects is presented below. This is followed by a discussion of the different approaches to investment risk in LDCs and commercial companies – keeping these differences in mind will help with long-term, coordinated development of NGV markets. The remaining three sections of this chapter discuss three underlying risks to the development of natural gas as a sustainable, mainstream transportation fuel: fuel price, technological competitiveness, and islanding.

## 2.1 Benefits from NGV Projects

The primary benefit of NGV projects to commercial companies are the profits that can be made from this growing market. As such, commercial companies target economically viable projects that minimize risk and maximize the return. Like other public companies, the LDC has a primary interest in maximizing returns to their investors. This has been traditionally achieved by either successfully petitioning the regulatory commission for a rate increase, or by increasing the volume of natural gas delivered, which in turn increases revenue and associated profits. In states where LDC revenue is delinked from sales volume (e.g., decoupled), revenue may be tied to the number and type of customers, specific costs, or some other approach that allows fair compensation for the LDC without discouraging efficiency improvements. LDCs with delinked revenue and sales volume may seek rulings to exclude vehicle fuel deliveries from the decoupling mechanism, as is common for industrial gas deliveries. In most cases, successful NGV programs will increase LDC returns due to efficiency gains, if not also due to sales volume increases.

In addition to volume-associated revenue increases, other benefits the LDC can derive from succeeding in the NGV business may include:

- Increased pipeline system efficiency depending on demand profile and pipeline capacity through provision of a year-round load
- Potential load leveling in markets where transportation fuel volumes are greater in the summer.
- Reductions in lifecycle emissions with use of NGV compared to conventional fuels. Depending on the regional power generation sources, lifecycle emissions may also be lower than for electric vehicles. Emissions benefits may allow NGV users to obtain and sell emission credits.

- Contribute to the national effort for energy security, increased employment, and balance of payments as a result of switches to a domestic fuel.

- Establishment of a new technical area that can stimulate and reward staff.

All but the last of these benefits affect all customer classes or provide broad social benefits, both of which have been considered justification for rate-basing NGV-related investments. Other considerations for rate-basing NGV refueling include prevention of possible price gouging (i.e., charging more than is reasonable for natural gas when there is a large price difference between natural gas and conventional liquid fuels). Price gouging is a particular concern when there is only one commercial operator in an area. Rate-based NGV refueling may also enable similar prices at refueling stations across a region, which can facilitate customer confidence in adopting NGVs.

## 2.2 Commercial versus LDC Approaches to Risk

The risks of an investment are typically handled differently in commercial projects and LDC projects.[5] For commercial projects, investors want a return of their investment, plus a risk-free rate of return, plus a risk premium. The greater the risk, the greater the expected risk premium demanded by the investor. Poorly understood risks typically have the highest risk premiums. While the risks associated with NGVs are being better defined and reduced, the risk premium is still greater than for conventional fueled vehicles. These risk adjusted costs (e.g., cost of capital, higher return) are ultimately passed on to the NGV user in the form of higher pump prices.

For LDC projects, investment risk is handled differently because regulatory commissions typically do not allow risk-premium adjustment to the ROR. As such, LDCs do not include the risk-adjusted costs of capital and can offer lower prices at the pump. This improves their market position by attracting a larger clientele and higher consumption, which effectively lowers their risk of failure. If an LDC venture fails, the risk is borne by ratepayers when the regulatory commission allows the loss to be rate-based, or by the LDC investors when the loss is not deemed allowable by the commission.

While the accounting for risk may be handled differently by commercial companies and LDCs, the fundamental risks themselves are largely the same. These risks include changes in availability of incentives for NGV adoption, changes in taxes, and changes in LDC allowable costs– all of which can be minimized by planning projects that do not depend on long-term continuation of the current regulatory environment to be successful. Other risks include negative media attention due to a fuel-related incident. While the safety record for NGV's is good, as a fuel that the public is less familiar with, any fuel-related incident is likely to raise safety concerns and erode public confidence in NGVs.

Other risks shared by both LDCs and commercial refueling station investors are station underutilization and financial stability of the anchor fleet(s), both of which may be mitigated with proper research and analysis prior to investment, and equipment removal and re-deployment under worst case scenarios.

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5 Investment risk is the probability of a loss multiplied by the expected consequences.

While many risks can be listed for any project, three fundamental risks that will likely make or break the ultimate success in developing natural gas as a sustained, mainstream transportation fuel are:

- Endurance of the price spread between natural gas and the competing fuels (i.e., the fuel pricing paradigm);
- Technological competitiveness of NGVs both compared to conventional and other alternative transportation technologies;
- Scale of NGV adoption, whether nationwide, or in a defined region or market (an island).

Each of these fundamental risks is further discussed in the sections below.

## 2.3 The Fuel Price Paradigm

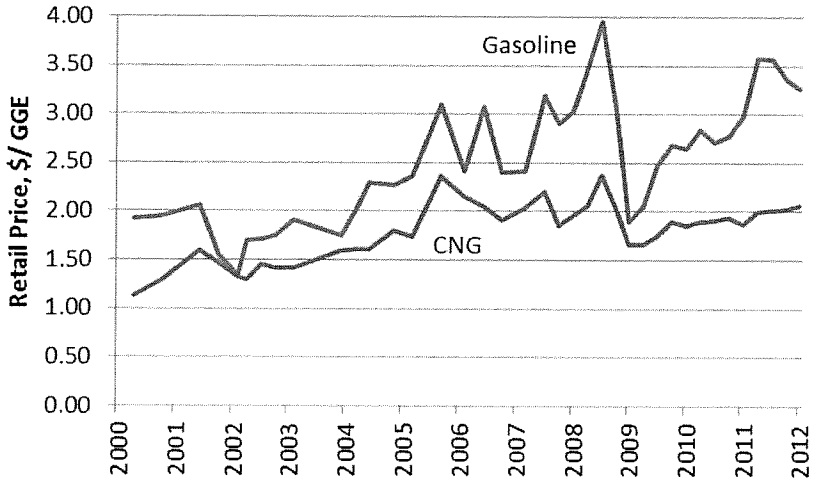
The fuel price paradigm poses a key risk for NGV projects. Throughout the 1990's, retail natural gas prices were below those of conventional transportation fuels on an energy basis, and there were many programs across the nation to promote NGV adoption. Despite this, NGV market establishment met with only limited, niche-market success. From a business economics viewpoint, the price differentials of the 1990s were not sufficient to overcome the shortcomings of NGVs (perceived or real) and to entice enough customers to switch their transportation fuel. This begs the question of whether the current and future fuel price differentials will be sufficient to enable a different result in the current decade.

Ultimately, the LDC and other potential investors will have to answer for themselves the question of whether or not pricing differentials are likely to be sufficient for sustained mainstreaming of NGVs. In seeking this answer, considerations regarding both historical and projected future price differentials between natural gas and liquid petroleum fuels are briefly discussed below.

### *Historical Price Differentials*

Since the turn of the century, the retail price difference between gasoline and CNG at refueling stations has averaged around $0.71 per gasoline gallon equivalent (GGE), with a particularly consistent and relatively large price differential over the past three years (Figure 2.1). The suggested trend of increased price differences between natural gas and liquid petroleum fuels is more strikingly seen by the ratio of spot prices for light sweet crude oil and natural gas (Figure 2.2).

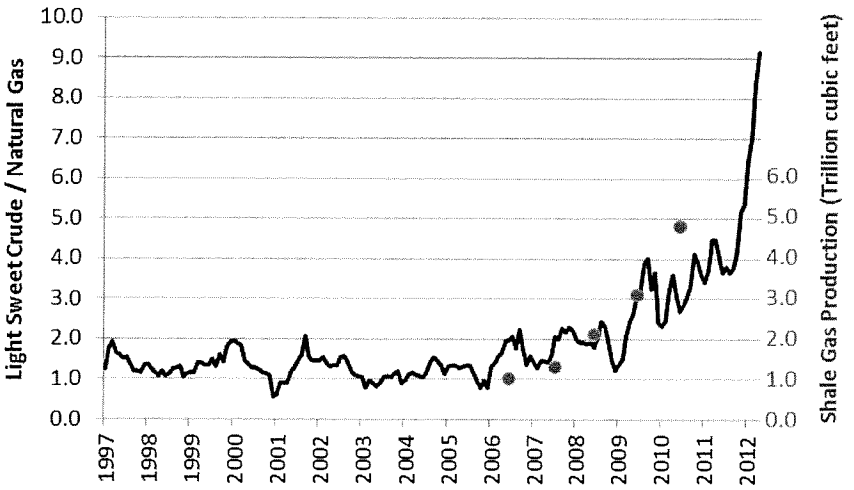
Figure 2.1 Average US Retail Prices* for Gasoline and CNG ($2010) )




* Includes Federal and State motor fuel taxes.

*Source: U.S. Deportment of Energy, Clean Cities Alternotive Fuel Price Report*

Figure 2.2 Spot Market Price ratios of West Texas Intermediate (WTI) Light Sweet Crude and Henry Hub Natural Gas, and US Shale Gas Production




*Source: spot morket prices ond shole gas production os reported by U.S. Energy Informotion Administrotion (EIA)*

A three-year trend is not typically sufficient for acceptance of a long-term change in a price differential (i.e., a new price paradigm). However, the case for price paradigm shift is strengthened by recognition of the expanded production of domestic natural gas from unconventional shale gas sources due to technological advances in hydraulic fracturing and horizontal drilling. Figure 2.2 displays US annual shale gas production from 2006 to 2010 as solid red circles.

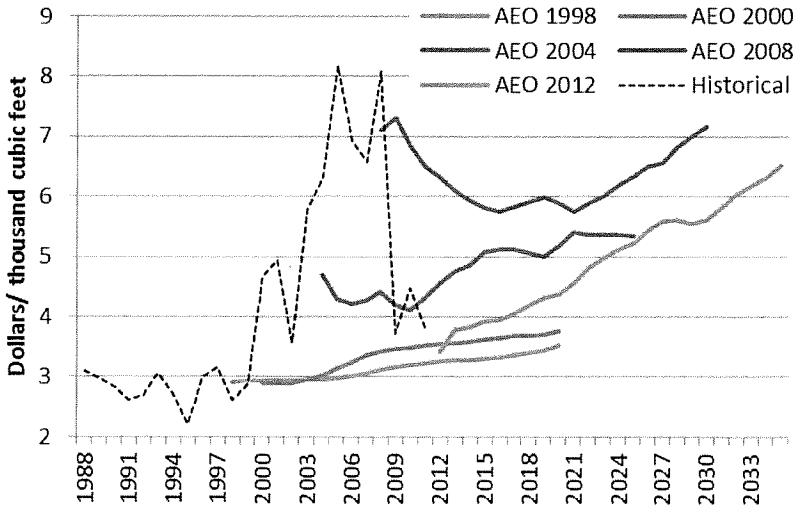
The consistent annual increases in shale gas production in conjunction with estimates of high volumes of economically recoverable domestic shale gas reserves support a continued trend of increasing domestic production of natural gas. In conjunction with slowly decreasing crude oil production, these production trends are commonly thought to be drivers of the pricing trends seen in both Figure 2.1 and Figure 2.2. However, particularly as the price of crude oil increases, domestic shale oil production may also increase, reducing interest in shale gas production and essentially limiting increases in the price differential of these two fuels. Overall, the current short-term trends as indicated in Figure 2.1 cannot confidently suggest a long term shift in the pricing differential of natural gas and liquid petroleum fuels.

### *Forecast Confidence*

Sophisticated price forecast models incorporate recent price differentials in natural gas and liquid petroleum fuels along with both domestic and international economically recoverable reserves and a wide array of other factors. The forecast published annually by the US Energy Information Administration (EIA) is perhaps the most commonly cited of these forecasts.

Figure 2.3 displays historical natural gas wellhead prices (i.e., based on actual prices) along with EIA's forecasts of natural gas prices as published in the years 1998, 2000, 2004, 2008, and 2012. The dashed line represents historical (actual) prices, and the five solid lines represent the forecasts. The substantial changes in these forecasts over the years and their consistently poor ability to accurately forecast relatively near-term prices suggests the difficulties in forecasting, due in no small part to the wide array of factors that affect these prices. This is not to discredit the methodology, it is only to show that energy commodity prices are difficult to forecast correctly, and as a result there is a large element of uncertainty in these projections.

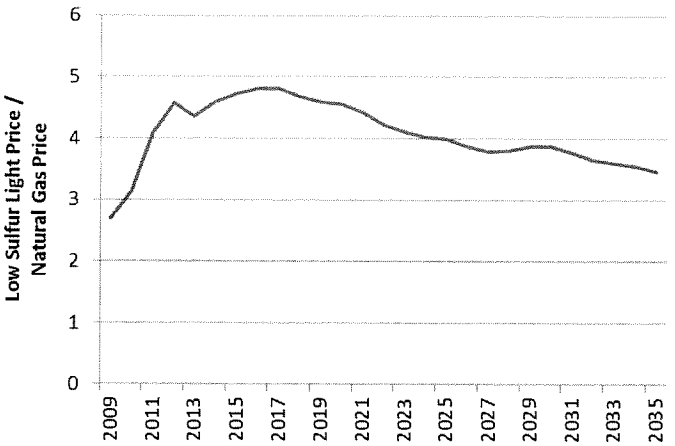
Figure 2.3 Historical and Forecast Prices for Natural Gas, Lower 48 Wellhead Prices (2010$)




*Sources: EIA's Annual Energy Outlook (AEO), 1998, 2000, 2004, 2008, 2012, converted to 2010$ based on cansumer price indices for all urban customers as published by the U.S. Department Of Labor, Bureau of Labor Statistics.*

Recognizing that if divergence of actual prices from forecast prices is similar for both oil and gas, the price differential (critical for NGV adoption) will be maintained, Figure 2.4 displays the ratio of oil to gas for EIA forecast data, with 2009 through 2011 representing historical data. Unfortunately, historical and forecast datasets for liquid petroleum fuels have reflected different price points in the supply/delivery chain making comparison of the ratios of historical actual prices to previous forecast prices problematic.

Figure 2.4 Price Ratios of Forecast Light Sweet Crude and Henry Hub Natural Gas




*Sources: EIA's Annual Energy Outlook (AEO), 2012, data for "Low Sulfur Light Price" per barrel converted to $/MMBtu assuming 5.775 MMBtu per barrel.*

Overall, the difference between actual and forecast prices represents a risk that today's investors in NGV programs must be comfortable with.

## 2.4 Technological Competitiveness

One of the main reasons given for the limited success of past efforts to mainstream NGVs is the immature status of the technology. Indeed, the market expansion efforts of the late 1980 and through the 1990s were hindered by poor performance of vehicles, refueling equipment, and the support infrastructure. At least in part, these were natural growing pains with a new technology.

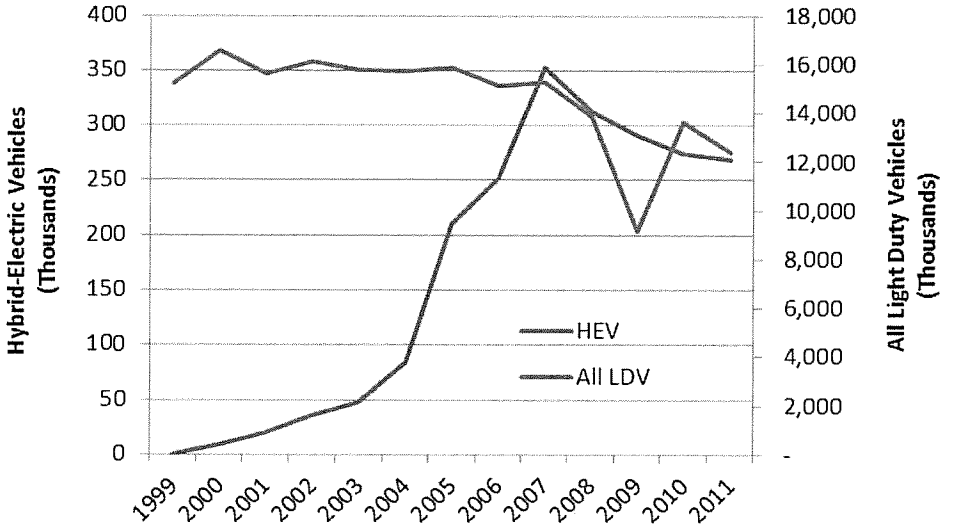
In recent years substantial progress has been made to improve vehicles, fueling systems, and provide a range of OEM vehicle types. While the new breed of engines are claimed to have addressed the issues of the past, few if any currently-offered heavy duty engines have been in service for their expected operating life.

The NGVs available today are impressive in their variety, representing just about every major, heavy duty, truck manufacturer and several well-financed and technologically advanced small volume manufacturers (SVM) and system converters. Prices are all at a premium to their diesel equivalent, with original equipment manufacturer (OEM) heavy-duty vehicles at a premium of $70,000 to $100,000, and

SVM conversions at a premium of $30,000 to $60,000, depending on fuel storage volume and other factors. Mainstream adoption of NGVs requires this premium to be paid back through fuel savings in a minimum period of time (i.e., less than 3 years), and it requires that the user's experience with NGVs to be positive enough for them to want this technology for their next vehicle.

Competing technologies represents another key risk for NGV projects. NGV technology must compete not only with conventional transportation fuels, but also with other alternative propulsion systems. In recent years, hybrid electric powertrains with conventional liquid fuels have proven a very competitive technology in both the light-duty vehicle market and in the transit bus market. Figure 2.5 shows the growth in annual sales of light-duty hybrid vehicles compared to sales of all light-duty vehicles.

Figure 2.5 Annual Sales of Hybrid-Electric Vehicles and All Light-Duty Vehicles




*Sources: Hybrid-Electric Vehicle (HEV) soles from multiple sources os compiled by the Notionol Renewoble Energy Loborotory. All Light-Duty Vehicle soles from U.S. Environmentol Protection Agency (2012). Light-Duty Automotive Technology ond Fuel Economy Trends: 1975 through 2011.*

From 2007 through 2011, hybrids have composed slightly more than two percent of light-duty vehicle sales (and over three percent in 2009, the year with sharp drop in auto sales and Cash-for-Clunker incentives). The hybrid price premium is around $3,000 to $6,000, which is thought to be a substantial factor limiting their market penetration. This compares to a $5,000 to $10,000 premium for light-duty NGVs.

The rapid acceptance of hybrids may increase general comfort with marked changes in mainstream vehicle propulsion systems, which for many decades did not change from a user perspective. However, the addition of propulsion system differences to the list of mainstream, new-purchase vehicle considerations suggests the need for a substantial educational component in the shopping experience.

Although the transportation market may be seeking reductions in the use of liquid petroleum fuels, there are multiple paths for achievement of this goal. In both the light-duty vehicle market and the

transit bus market, as hybrids become more established, the perceived advantages of natural gas may be reduced. In contrast, in the heavy duty vehicle market (with exception of transit buses), natural gas has virtually no competition from another readily available alternative propulsion system.[6]

In the heavy-duty, long-haul trucking market, both CNG and LNG are being promoted in certain regions along with development of a refueling infrastructure along key corridors.[7,8] Aside from refueling infrastructure development, reliability and maintenance are particularly key factors in the long-haul trucking market where operations are often 24/7, with schedules that have little tolerance for delays.

Overall, uncertainties in the maintenance, reliability, and performance of NGVs and their refueling compared to both conventional and other vehicle powertrain types represent significant risks for the mainstreaming of NGVs. Investors in NGV programs should be comfortable with these risks.

## 2.5 Island Sustainability and National Infrastructure

Goals for the establishment of natural gas as a sustainable mainstream transportation fuel across market sectors include the development of a public refueling infrastructure that provides fuel across the nation within a comfortable drive range of standard vehicles. If this vision is not fully realized, NGVs may alternatively become mainstreamed in limited geographic areas and/or in a selected market sectors or subsectors. This partial mainstreaming, or islanding, of NGVs presents another risk for NGV projects.

Island markets have evolved with success, as exemplified by diesel fuel, which almost entirely replaced gasoline in long-haul trucks, buses, heavy-duty construction equipment, and other heavy-duty applications. However in the US, diesel has remained a minor player in light-duty vehicles, especially in passenger cars. California was established as a CNG island in the mid-1990s, aided by various state policies and regulations. The California CNG island remains viable and expanding today. More recently, southern California has become a geographic and market subsector island for heavy duty LNG trucks, particularly in the Long Beach area. This is primarily due to state policies promoting low emission vehicles and recent alternative fueled truck goals (with associated incentives) set by the Ports of Long Beach and Los Angeles.

While NGV island markets, either geographic or market sector, may be successful, the growth and sustainability of these islands are less certain. If the islands are not sufficiently close, they may be

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6 It should be noted that fuel cell technology (which can use natural gas) poses a potential future competitor for internal combustion natural gas engines. Barring a series of technological breakthroughs that include substantial reductions in fuel cell cost, this technology is not viewed as a potential mainstream competitor within the decade.

7 Margaret Ryan, "Trucks can keep on trucking, LA to Salt Lake", February 7, 2012, AolEnergy. As viewed at: http://energy.aol.com/2012/02/07/lng-trucks-can-keep-on-trucking-la-to-salt-lake/

8 "Supply Chain Fleet Operators Increasingly Turn to Natural Gas Power", March 26, 2012, Seeking Alpha. As viewed at: http://seekingalpha.com/news-article/2285271-supply-chain-fleet-operators-increasingly-turn-to-natural-gas-power

insufficient for mainstreaming natural gas as a transportation fuel. Some of the reasons for the limitations of geographic island markets include the following:

- They require substantial use of bi-fuel or more conventional-fueled vehicles for traveling beyond the boundaries of island;
- Their use of conventional fuels in bi-fuel NGVs detracts from the price advantage offered by CNG or LNG;
- They present a reduced attractiveness to own or operate NGVs;
- Their small size may delay or discourage the development of support infrastructure (e.g., service, parts);
- They may be particularly vulnerable (threatening sustainability) if they are based on local incentives, which can and usually do expire.

Market sector or subsector islands share some of the same limitations and potential limitations of geographically defined islands. For example, the early and rapid growth of CNG and LNG transit buses did not lead to the expansion of the nearby infrastructure, nor did it lead to significant adoption of NGV in the area. In fact, the nature of fueling operations at transit agencies made the refueling infrastructure inaccessible to the general public. Furthermore, even though the use of CNG and LNG in transit buses is among the most economical NGV applications, their share of the transit market has eroded from about 30 percent of the market in the late 1990s to below 20 percent in 2010. This is partially the result of competition from hybrid electric buses, and partially due to the small size of the market, which has made the development of a competitive support infrastructure difficult and limited the benefits of economies of scale. (Other factors, including maintenance and performance issues were also contributing factors.)

Overall, geographical or market sector island markets may contribute to the sustainable mainstreaming of natural gas as a transportation fuel if their island status exists only for a short time. When a fuel island stops growing or otherwise becomes stagnant, user confidence can be eroded by the inefficiencies (as noted above), and shortcomings result in disengagement from the market.

# 3 Identifying Models

Ultimately, a model should have defined goals with clear objectives to achieve these goals, along with measureable targets for success. For LDC's considering development of NGV programs, these goals, objectives, and targets are not fully defined – and may not even be partially defined. The purpose of this chapter is to provide a series of questions with related discussions to assist an LDC in determining both the basic type of model(s) most appropriate for their organization, and the most appropriate role for their company with respect to NGV market development.

The discussion presented in this chapter assumes that LDCs have an overall interest in the long-term, economically sustainable development of NGVs, and that this interest overrides interest in maximizing nearer-term revenue and profits. Further, it should be recognized that there is no approach to market expansion that is without concerns, but thoughtfully designed strategies can do much to mitigate these concerns.

The general process for model development as presented in this chapter begins with identification of the appropriate model types (i.e., rate-based, non-rate-based, and commercial) to pursue based on an LDCs internal approaches to investment and the associated regulatory environment. Goals and objectives may then be determined from an assessment of the local environment with respect to both realistic market potential and competition. Both risks and benefits are considered throughout this process.

## 3.1 Types of Models

Models applied by LDCs fall within three general categories: rate-based, non-rate-based, and commercial – the latter of which is applied by an unregulated LDC affiliate rather than the LDC itself. These categories are distinguished by who the investors are and who bears the financial risk. Model types may be combined to create hybrid models customized to a particular LDC and its affiliates. Assuming a goal of long-term sustainable NGV market development, the preferred NGV business model(s) for a particular company is affected by their approach to investment risk, and their confidence in the approach of "seeding" or "jump-starting" new markets.[9] Descriptions of each of the three basic model categories are provided in below:

- **Rate-based Model** – This model is used by LDCs with NGV activities that are allowed in their rate-base. Expenses are typically capped, or have an expiration date, or both. Allowable activities may

9 There are examples of both successful and unsuccessful "seeding" of markets. Successes have been repeatedly seen in the pharmaceutical industry. In contrast, seeding the E85 market with refueling stations and flexible fuel vehicles has had modest success – unfavorable fuel price differentials have undoubtedly been an important factor.

range from marketing, education, demonstration and testing, to financing and infrastructure build-out. Under the rate-based model, investment is made by the LDC's investors but is reimbursed by the customers with a fixed ROR as set by the regulatory commission. Where, when, and what NGV projects are invested in may not be based solely on financial criteria, and may be limited by the regulators.

Risk is typically borne in whole or in part by the LDC's customers. If losses occur, they are covered by either the ratepayers or the LDC investors, depending on regulatory commission rulings. LDC investors generally assume less risk under this model compared to the other models, but their potential profit is the fixed ROR, as set by the regulators.

The manner in which risk is handled under the rate-based model allows lower consumer prices, but also carries the risk that some customer operations may not be viable with a later shift to higher commercial fuel prices (an inevitable result of LDC programs that are limited in duration). Carefully designed programs can address these and other commercial concerns through strategies such as:

- ***LDC targeting of marginal markets that are not currently targeted by commercial efforts.*** These marginal markets may be geographic or by market sector. This approach may effectively help jump-start NGV adoption, with the higher risks of developing fringe markets carried by the ratepayers in exchange for the general public benefits of NGV adoption. Long-term success of these programs depends on later cost shifts of either fuel or vehicles that will make the economics of NGVs more favorable in the future. This approach may include the transferring of some LDC services to commercial companies when economics become more favorable. If more favorable economic conditions do not develop, marginal markets may need continued subsidies to remain viable, or be lost from the NGV market with potential associated negative media.
- ***LDC incentives for NGV adoption and/or commercial refueling station development.*** As above, incentives may encourage NGV adoption by users for whom NGVs would not otherwise be economically viable, or for whom the economic benefit is likely, but a larger benefit is needed to entice NGV adoption. Greater certainty in sustained NGV use can be promoted by requiring economic feasibility without incentives to be a condition of obtaining the incentive. This type of jump-starting may help to more quickly develop a robust NGV market and infrastructure without negative impacts on market competition within the NGV industry.
- ***LDC support of NGV adoption through educational outreach.*** LDC efforts can provide information regarding NGVs to targeted markets, provide assistance with independent economic feasibility assessments, and serve as example early-adopters through conversion of their own fleets to natural gas.

- **Non-Rate-based Model** – This model is used by LDCs to conduct activities that directly or indirectly support NGV development, the cost of which is not allowed to be passed on to the LDC's customers. In some cases, the LDC may be able to collect their commission-fixed ROR on these shareholder investments. These activities may be the same as those listed under the rate-based model, but have been ruled as unallowable by the regulatory commission due to differing circumstances (e.g., commission policies, presence of similar active commercial services, etc.). Under the non-rate-based model, both investment and risk of NGV projects is borne by the LDC's shareholders. Typically, LDC investors do not make large investments into NGV projects under this model because they may assume all project risks, and do so with a ROR that is capped by the regulatory commission.

- **Commercial Model** – This model is used by unregulated affiliates of LDCs such as commercial companies under the same parent or holding company, although it is also applicable to unaffiliated commercial companies. These firms are typically involved in NGV infrastructure build-out. The NGV project investors are the same as the company investors. Determination to pursue a particular NGV project is based on common commercial investment criteria including return on investment (ROI), ROR, and payback period, which are adjusted based on project risk. Under the commercial model, risk is borne by the company's investors. In exchange, their potential profit is whatever the market will bear.

Hybrids of the above models may also be applied in which two or three of the above model types are mixed for the same or different activities, which may shift as NGVs gain a greater share of the vehicle market.

## 3.2 Questions for Model Selection

The following questions and responses should help identify which model types should be explored for a particular LDC. Many organizational structures are conducive to more than one general model type. In the early stages of model development, model options should be kept broad, and recognize that where multiple models are applicable, all models may not begin at the same time, but they should all be designed to maximize overall, long-term success.

### *Should the rate-based model be pursued?*

While there are many ways an LDC may consider whether or not to pursue rate-based NGV projects, any NGV investment decision, including the conversion of their own fleet, is strongly influenced by the LDC goal for increasing load, market characteristics of fleets in their territory, and the regional price differential between natural gas and conventional fuels. These factors can be considered through the following steps:

1. Establish the amount of transportation fuel load that the LDC would currently like to achieve based on their system capacity and current load curves.

2. Develop a series of economic feasibility studies for various market sectors (i.e., fleet types) to determine the volume of fuel they would need and the maximum price each sector can pay for natural gas to still be an attractive, competitive fuel.

3. Compare the LDC's transportation fuel load goals to the sum of transportation fuel volumes for all fleets that can pay maximum fuel prices at or above commercial refueling station prices and still be economically viable. If these volumes are at or above the LDC's transportation fuel load goal, the goal may be achieved through a commercial model, with or without the assistance of the LDC. LDC support may range from customer education to incentives for NGV adoption. The magnitude of support, and whether these are rate-based or unallowable activities (investments) will indicate whether or not the LDC should petition the regulatory commission for rate-basing their NGV program. Otherwise, if the volumes indicated by the analysis conducted in this step are below the LDC's transportation load goal, proceed to Step 4.

4. Compare the LDC's transportation fuel load goals to the sum of transportation fuel volumes for all fleets that can pay maximum fuel prices at or above LDC refueling station prices and still be

economically viable. If these volumes are at or above the LDC's transportation fuel load goals, rate-basing the LDC's NGV-related activities is likely needed to obtain their load goal in a timely manner – potential rate-based strategies are discussed Section 4. If the LDC's load goal cannot be met with LDC refueling prices, the transportation load goal they have set is too high.

Table 3 displays a hypothetical, high-level feasibility assessment of an LDC station open to the public, a similar sized commercial retail station, and a smaller retail station. This table exemplifies the significant pump price differences that are feasible at LDC refueling stations versus commercial stations. It also exemplifies the lower pump prices that can be achieved at larger retail stations versus smaller stations.

Table 3 Hypothetical Economic Analysis of LDC and Commercial Fast-Fill NGV Refueling Stations

| | LDC | Large Retailer | Small Retailer |
|---|---|---|---|
| Total Non-land Capital Costs ($) | $1,000,000 | $1,000,000 | $600,000 |
| Less: Incentives ($) | $100,000 | $100,000 | $100,000 |
| Net Capital Costs ($) | $900,000 | $900,000 | $500,000 |
| Estimated Salvage Value @ 10% ($) | $100,000 | $100,000 | $60,000 |
| Natural Gas Cost ($/GGE) *(includes transport and local distribution)* | $0.68 | $0.68 | $0.68 |
| Total Natural Gas Cost ($/year) | $204,000 | $204,000 | $102,000 |
| Electricity Charge ($/GGE) | $0.06 | $0.10 | $0.12 |
| Total Electricity Cost ($/year) | $18,000 | $30,000 | $18,000 |
| Equipment Maintenance/Admin. ($) | $54,000 | $60,000 | $30,000 |
| Marketing ($) | $10,000 | $30,000 | $20,000 |
| Insurance ($) | $15,000 | $25,000 | $20,000 |
| Credit Card Fees ($) | $8,550 | $23,400 | $12,600 |
| Federal Motor Fuel Tax at $0.184/GGE ($) | $55,200 | $55,200 | $27,600 |
| State Tax Motor Fuel Tax at $0.15/GGE ($) | $45,000 | $45,000 | $22,500 |
| Depreciation Expenses ($) (straight line method) | $53,333 | $53,333 | $29,333 |
| Years of depreciation | 15 | 15 | 15 |
| Interest Expense/ Cost of Capital ($) | $18,000 | $72,000 | $40,000 |
| interest rate | 2% | 8% | 8% |
| Total Expenses ($) | $481,083 | $597,933 | $322,033 |
| Total Quantity Gas Sold (GGE) | 300,000 | 300,000 | 150,000 |
| Price at pump, includes taxes ($/GGE) | $1.90 | $2.60 | $2.80 |
| Total Revenue ($) | $570,000 | $780,000 | $420,000 |
| Annual Net Income ($) | $88,917 | $182,067 | $97,967 |
| ROI | 9.88% | 20.23% | 19.59% |

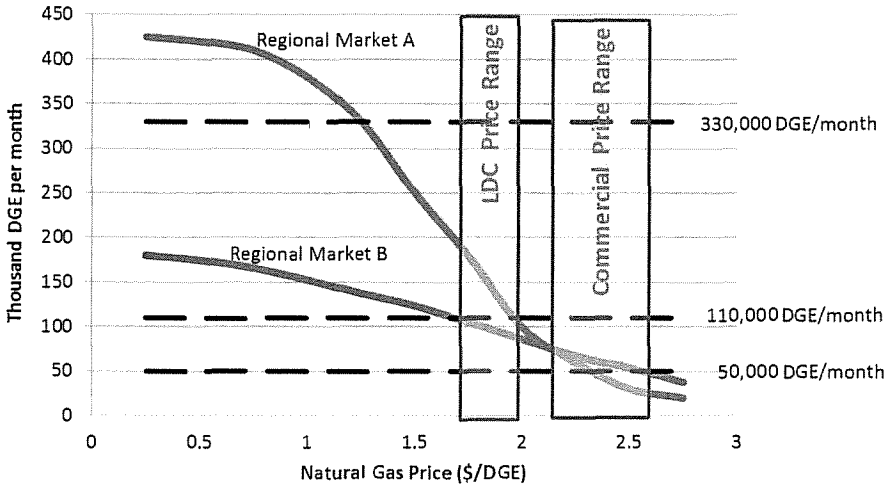
As an example, consider two market scenarios, one in which there is a larger number of potential NGV fleets but they are very price-sensitive (Regional Market A), and another in which there are fewer potential NGV fleets but they are less price-sensitive (Regional Market B). Next, consider the following different examples of LDC goals and feasibility study results (visually exemplified in Figure 3.1):

- The LDC transportation fuel load goal is 50,000 DGE per month. Feasibility studies suggest this goal can be achieved with prices at or below $2.30/DGE in Market A and at or below $2.60/DGE

in Market B, both of which are within the range of commercial prices. Under both of these market scenarios, the LDC goal can be reached by supporting the commercial operators through activities such as providing NGV information.

- The LDC transportation fuel load goal is 110,000 DGE per month. Feasibility studies suggest this can be achieved with prices at or below $2.00/DGE in Market A and at or below $1.70 in Market B. Market A is within the price range estimated for LDC refueling stations, but is lower than prices estimated at commercial stations. In contrast, Market B is about at the limit of prices estimated for the LDC and below that of the commercial refueling stations. Under this scenario, the LDC goal can be reached in Market A, and possibly in Market B. The commercial prices would not be viable for this volume in either market.
- The LDC transportation fuel load goal is 330,000 DGE per month. Price range estimates at both LDC and commercial refueling stations are too high to achieve this goal in Markets A and B.

Figure 3.1 Examples of Demand versus Price and LDC Load Goals




When commercial prices are too high for economic feasibility, such as for both Markets A and B to achieve a monthly load of 110,000 DGE/month, the LDC may either:

- Delay or forego the opportunity
- Seek regulatory approval to provide incentives (note that Market B would require very little incentive to be viable)
- Adjust the load goal

Theoretically, proposed incentives should be less costly than the total benefits from added use of NGVs.

It should be noted that in cases where the LDC over-stimulates the market by providing refueling at LDC prices (e.g., Market A for achievement of more than 110,000 DGE/month), the results may or may not be desirable. The desirable case is obvious – more gas is sold. The undesirable may occur under a variety of situations when the goal represents a firm limit (e.g., available or allowable capacity, funding for build-out, etc.). Further, to avoid later disgruntled customers, the LDC will need to continue

providing fuel at LDC prices until the differential between commercial natural gas and conventional transportation fuels is sufficient to allow customer-fleet viability at commercial prices.

### *Should the non-rate-based model be pursued?*

The most beneficial actions pursued under this path will depend on both the budget and the current status of NGV markets in the LDC territory. As with consideration of rate-based programs, a careful analysis of current and potential NGV markets in the LDC territory should be conducted. The results of this analysis, along with identification of the available budget for unallowable NGV-related expenses will indicate what types of programs may be most beneficial.

### *Should the commercial model be pursued?*

Assuming a continued favorable price differential between natural gas and conventional transportation fuels, the commercial model is the most dependable path for long-term, continuous, economically sustainable expansion of NGV markets because it does not depend on regulatory approval. As such, the commercial model can also offer the greatest returns. However, the commercial model can only be implemented by unregulated companies, such as commercial affiliates of an LDC. With the deregulation of the gas industry, any LDC can establish or purchase a separate, unregulated company for these purposes. Pursuit of this path indicates a strong commitment to NGVs.

Commercial affiliates of an LDC may provide services that an LDC is either told (by regulators) to not pursue, or chooses to not pursue. Some LDC officials interviewed believe that market competition is essential for both the establishment and sustainment of natural gas as a mainstream transportation fuel. This belief suggests a more limited role for regulated LDCs, essentially excluding them from providing refueling services due to the advantages provided the LDC, which result in lower prices at the pump making it difficult for commercial firms to compete. This can prevent commercial firms from entering the market, or if already active, can lead to market abandonment, and create other market disruptions including monopoly-like market conditions.

Organizations using the commercial model are competitive, profit-oriented, and target economically viable projects that minimize risk and maximize the return. They make their investment decisions on company-specific, risk adjusted, criteria such as: defined expected return on investment (net present value of an income stream), payback period (usually between 2 and 4 years), rate of return (commonly above 15 percent), or some combination of each.

The component that is most strikingly different in the commercial and rate-based models is the way in which risk is perceived, internalized, and compensated. Another significant difference is that unregulated commercial firms have much greater flexibility in adjusting their investment criteria. This flexibility allows consideration of the firm's long-term return and associated portfolio income over individual project income. Investment criteria may be loosened in response to the need or desire to enter a specific market; to attain a competitive position; or to attract a new market (e.g., refuse hauling).

This differing treatment of risk and investment criteria flexibility accounts for the price difference typically seen between commercial refueling stations and LDC-owned refueling stations.

# 4 Identifying Strategies

Strategies for each of the three basic model types described above (i.e., rate-based, non-rate-based, and commercial models) are address separately below. Examination of strategies begins with consideration of questions, the answers to which will help focus on the strategies that may be most appropriate under a particular LDC, or LDC affiliate's circumstances. In cases where a hybrid model may be most effective, strategies for each considered basic model types should be considered and coordinated.

## 4.1 Rate-based Model Strategies

Strategies used in rate-based models for NGV market development are typically proposed by the LDC, may be modified based on regulatory commission concerns, and are ultimately accepted or rejected in a commission ruling. The ultimate ruling is affected by the regulatory commission's approach to gas market expansion; their confidence in the assessment of NGV market potential as presented in the LDC's petition (i.e., risk); as well as comments received on the petition.

For LDCs with traditional, volume-based revenues, the advantages of NGV market expansion are obvious. However, roughly one-third of the states have delinked (e.g., decoupled) LDC revenue and sales volume. Of these states, only California and Massachusetts include industrial volumes in their decoupling mechanism.[10] As such, there is substantial precedent for excluding particular end-use categories from decoupling or other delinking mechanisms. This exceptional treatment for vehicle fuel use may be of greatest interest in states that have policies for greenhouse gas reduction due to the lifecycle emissions reductions associated with natural gas versus conventional transportation fuels.

Commission approved strategies are often quite limited in their ability to be altered without a subsequent petition process, as such, there is generally less frequent modification of approved rate-based strategies compared to commercial strategies that have unrestrained flexibility. The questions provided below are to help in the selection of strategies that may be used under the rate-based model. The discussion provided under each of these questions includes examples of LDC strategies that are currently being used. Table 4 lists these examples along with their allocation and relative level of risk.

10 Glatt, Sandy and Myka Dunkle, July 2010. Natural Gas Revenue Decoupling Regulation: Impacts on Industry. US DOE State Policy Series. As viewed at http://www1.eere.energy.gov/manufacturing/states/pdfs/nat-gas-revenue-decoupling-final.pdf

Table 4 Allocation of Risk Under Example Rate-based Strategies

| Strategy (Based on risk exposure by LDC) | Risk Holder [1] | | | Example LDC |
|---|---|---|---|---|
| | LDC Shareholder | Other Ratepayer | User | |
| LDC-owned public refueling stations, no fuel contracts | Minimal | Primary | None | Questar Gas |
| LDC-owned public refueling stations, take-or-pay fuel contracts | Minimal | Secondary | Primary | Piedmont Natural Gas Company, Inc. |
| LDC compression services with tariff for recouping of costs from users | Minimal | Secondary | Primary | Southern California Gas |
| Grants, rebates, or loans for vehicle purchases; facility upgrades; refueling stations; training | Minimal | Secondary | Primary | FortisBC |

[1] Primary bearer of risk; Secondary bearer of residual risk; and Minimal risk (i.e., impact of loss on ROR)

### *What is the current level of state or regional support for promotion of natural gas as a transportation fuel?*

Both policy statements and actions in terms of funded programs should be considered to indicate the level of state or regional interest in developing natural gas as a transportation fuel. Regulatory commissions in states that demonstrate a high level of interest in NGV expansion may be more likely to support LDC petitions for rate-basing of NGV programs. As such, the level of state or regional policies and regulations addressing natural gas vehicles can enable rate-based LDC strategies for expansion of NGV markets. Some key rate-based strategies and examples are discussed below.

#### *Rate-based Refueling Infrastructure Below the Cost of Service*

Given the limited use of below cost-of-service strategies, clear indicators of where this strategy may be most successful are not defined, however, it is reasonable to suggest that states with policies and associated regulations that support growth of NGV (or "clean fuel") markets may be the most likely to allow this strategy. The policies driving these regulations may be for goals to reduce emissions (i.e., greenhouse gases), improve energy security (i.e., use of domestic fuels), or increase domestic employment. Examples of strategies for rate-based refueling prices below the cost of service are seen in Utah and British Columbia, as described below: Utah is the only state that currently has NGV refueling below the cost of service. A less-than-full cost of service rate was established for all natural gas refueling stations in Utah as a result of legislation passed by Utah State Legislature in 2009. The legislation provided the public service commission with authority to establish NGV refueling rates that are less than the full cost-of-service and to spread the remaining costs to other customers (Utah Code, 54-4-13.1).

There are many other regulations in Utah that support a policy of promoting natural gas as a transportation fuel, although many of these policies address natural gas as one of several qualified clean fuels. Since the 1990's, a provision in the Utah Code allows establishment of the mandated use of clean

fuels (including natural gas) by centrally refueled fleets with 10 or more vehicles (Utah Code, 19-02-105.3). Further, the state offers an income tax credit for purchase of "clean fuel" vehicles; has an ongoing grant and loan program for purchase of NGVs; has High Occupancy Vehicle (HOV) lane exemptions for clean-fuel vehicles; and has provided for public access to state CNG refueling stations when commercial stations are not in the area.

The LDC in Utah, Questar, views these programs as support for jump-starting the NGV market – the current policies and regulations are intended to be temporary. Questar's rates get reviewed annually and as such can be suspended. A Questar official interviewed for this project estimates that when the favorable NGV rate are suspended, CNG prices at Utah natural gas refueling stations are expected to increase by about $0.20 per GGE.[11] This is a relatively low price increase largely due to the fact that many of the stations were built and depreciated a long time ago and were later refurbished with the aid of federal funds. Further, the new stations were built with Federal grants paying for up to 70% of their cost. More realistic differences between LDC and commercial station pump prices are presented in the examples shown in Table 3 Hypothetical Economic Analysis of LDC and Commercial Fast-Fill NGV Refueling Stations (above). The small estimated prices increase at Questar, may provide little risk that current NGV users will abandon NGVs. This is particularly the case since commercial stations in the Questar service area are charging prices that are between the Questar price ($1.50/GGE) and $2.00/GGE. However, in other areas where the deregulated price difference may be higher, those with marginal economics (i.e., due to low fuel use) may cease to have sufficient economic benefits from NGVs.

While the subsidy of natural gas pump prices is not now scheduled to end, Questar is strongly signaling their dedication to the NGV market and confidence that the economics of NGV adoption can be acceptable without subsidies by their establishment of a non-regulated affiliate. Their new affiliate is currently searching for their first commercial opportunity, and to the extent allowable, may draw from Questar's experience. If successful, Questar will ultimately be implementing a hybrid model with a rate-based jump-starting of the Utah NGV market followed by likely modification of their rate-based model in addition to establishment of a non-regulated affiliate to implement a commercial model. As this shift occurs, the bulk of NGV risk will move from the ratepayers to the commercial company investors and their contract partners.

A second example of a large rate-based NGV program was approved in May 2012, when the Lieutenant Governor in Council of British Columbia, Canada ordered regulations under the existing Clean Energy Act for greenhouse gas reductions through public utility natural gas vehicle programs.[12] The new regulations enable FortisBC to rate-base expenditures and to offer incentives for fleets such as buses,

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11 Telephone interview, April 25, 2012 and June 12, 2012.

12 Documents as posted by the British Columbia Utilities commission: Letter from the Utility Commission to FortisBC dated May 17, 2012; and Letter to the Utility Commission from FortisBC dated May 16, 2012 with attachment of the May 14, 2012 order of the Lieutenant Governor in Council. As viewed at: http://www.bcuc.com/Documents/Proceedings/2012/DOC_30671_05-17-2012_Request-Comments-Section-18-CEA.pdf

trucks or ferries to adopt natural gas as a transportation fuel. Total program expenditures may be up to $104.5 million by April 1, 2017 (the program's end date).

Incentives in the FortisBC program may include grants for zero-interest loans for the price difference between NGVs and comparable conventional-fueled vehicles, and grants for training and upgrades to maintenance facilities to safely maintain natural gas powered vehicles. FortisBC is also prescribed to purchase or build, and operate compressed natural gas or liquefied natural gas fuelling stations at which at least 80% of the energy provided is under take-or-pay contracts with a minimum term of 5 years. FortisBC believes that as natural gas use as a heavy-duty transportation fuel matures, incentives will no longer be necessary.

As in the Questar example, the aim of FortisBC's rate-based NGV programs is to increase the rate of NGV adoption over the rate seen in recent years. In the BC case, there are already more than 20 public refueling stations operating in the province. The details of FortisBC strategies are not yet determined and the impact on the existing CNG stations and the current users of those stations is not yet known. If loss of commercial refueling stations becomes a concern, a variety of different strategies may provide mitigation. Examples include locating LDC refueling stations beyond the areas served by existing commercial stations; seeking a lower rate for commercial refueling stations to put their prices on or near parity with LDC station prices; or exploring the potential for public-private partnerships in the establishment of new stations and/or in the purchase of existing stations through the program's set end date.

***Rate-based Refueling Infrastructure with Amortized, Full Cost-of-Service***

A rate-based refueling station or rate-based compression for a refueling station with fuel priced to include full cost of service with amortized capital expenditures typically provides a modest economic incentive for NGV adoption beyond the economic incentive available from commercial refueling stations. The fuel pricing advantage of rate-based stations versus commercial stations is due to different accounting and valuation of investment risks. A rate-based refueling infrastructure with amortized, full cost-of-service may accelerate NGV adoption beyond the growth rate that would be seen with commercial (non-regulated) refueling.

An example of the amortized, full cost-of-service strategy is being implemented by Piedmont Natural Gas. Influenced by Hurricane Katrina, Piedmont saw a need to mitigate their exposure to a single fuel used in their vehicles and considered NGV as a risk-mitigation option. In 2011, Piedmont committed to having one-third of their fleet run on CNG, build stations accessible to the public, and attract nearby fleets to use CNG. Their program is just beginning to build NGV fueling infrastructure at customer sites under firm fuel purchase contracts. The contracts, referred to as Minimum Margin Agreements, must have terms of at least 5 years, and include minimum purchase volumes so that the customer pays the full cost of the facilities Piedmont's tariff has a rider for CNG sales service that allows a charge, in addition to a base margin rate, to explicitly recover the refueling station compression costs.

Under Piedmont's strategy, when consumption is below the contracted volume, the customer pays the difference (i.e., true-up). If fuel consumption exceeds the contracted volume, the difference can be credited to the following year's minimum margin amount when the Minimum Margin Agreement

expires, customers can choose whether or not to continue with the service; if the customer declines, the compressor, dispenser and meter can be redeployed to continue cost recovery of the equipment from another CNG customer.

The lower fuel prices available at Piedmont's refueling stations may encourage more customers to adopt NGVs in the near-term, but after some years, Piedmont's role in the stations could, of course, change. Designing strategies to reduce the chances of customers losing sufficient economic benefits of NGV use while later shifting to commercial fuel prices can facilitate a smoother future transition to commercial ownership of refueling stations. A second example of a rate-based refueling infrastructure investment with amortized full cost-of-service is currently being sought by Southern California Gas Company (SoCalGas). The SoCalGas version of this strategy varies in details. Under the proposal, SoCalGas will provide CNG to the customer with compression equipment located on the customer's site. The compression equipment will be owned and operated by SoCalGas. All equipment beyond the point of CNG delivery (dispensers, card readers, etc.) will be fully owned and operated by the customer.[13] SoCalGas will recoup their investment and compression equipment maintenance and operation costs through a tariff that capture the full cost of providing compression service.

Should SoCalGas be successful in receiving approval of this tariff, it will allow development of an NGV fueling infrastructure using ratepayer funds for the investment with a time-phased repayment through the compression tariff. This would constitute a blanket, system-wide ability for the utility to invest into NGV infrastructure without limits on time or funding. As such, it would be a very powerful tool in building out NGV infrastructure. (This service would not be offered to residential customers, and thus would not affect home refueling.)

### *What is the current level of LDC shareholder interest in investing in natural gas as a transportation fuel?*

Shareholder interest in investing in NGV projects is important to understand in developing strategies for both rate-based and non-rate-based NGV business models. Shareholder willingness to take on some of the risk associated with NGV programs may increase the level of comfort the regulatory commission has with passing NGV risk on to the ratepayers. Particularly when the regulatory commission is reluctant to have ratepayers carry the risk of NGV investments (i.e., through allowing these investments in the rate-base), their view of this risk may be reduced by specifying that some or all of any program losses would be taken from profits (i.e., the shareholders) rather than from the rate-base.

Alternatively, shareholders may offer to fund a pilot program that if successful, will be used to develop a rate-based NGV program. This is the strategy that is currently being employed by National Fuel Gas Distribution Corporation. In brief, National Fuel obtained received approval from their regulatory commission for shareholders to invest a capped amount on an NGV program to be designed by National

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13 Application Of Southern California Gas Company To Establish A Compression Services Tariff, Before The Public Utilities Commission of The State Of California; In the Matter of the Application of Southern California Gas Company (U 904 G) to establish a Compression Services Tariff; Application 11-11-___; (Filed November 3, 2011), Page 1 and 2.

Fuel. A return on the shareholder investment is allowed up to the LDCs standard fixed rate, while any loss of investment is carried by the shareholder. The regulatory commission will review the pilot program's progress and later determine if results are favorable enough to allow a similar, larger rate-based program. As such, at this time, the National Fuel program is a non-rate-based program (it is further described under non-rate-based strategies, Section 4.2).

### *What currently rate-based programs can be easily extended to include NGV programs?*

Extension of currently rate-based activities to include some NGV-related actions may be acceptable for undertakings such as provision of general information on NGVs (e.g., on websites) and responding to inquiries from potential NGV users. Additionally, converting the utility fleet to natural gas based on cost saving may also be allowable, with the side effect of providing a good marketing tool. These types of actions may be started prior to full establishment of other aspects of a model for NGV programs.

## 4.2 Non-Rate-based Model Strategies

Strategies used in non-rate-based models for NGV market development depend on shareholder investment, the level of which may vary depending on whether or not the regulatory commission allows a ROR on these investments. The questions asked below are to help in the selection of strategies that may be used under non-rate-based the model. The discussion provided under each of these questions includes examples of LDC strategies that are currently being used. Table 5 lists these examples along with their allocation and relative level of risk.

Table 5 Allocation of Risks Under Example Non-Rate-based Strategies

| Strategy (Based on risk exposure by LDC) | Risk Holder [1] | | | Example LDC |
|---|---|---|---|---|
| | LDC Shareholder | Other Ratepayer | User | |
| Pilot program funded by shareholders, able to receive the LDC's ROR | Secondary) | None | Primary | National Fuel Gas Distribution Corporation |
| Universal Fund grant for compression services at new stations with approved fee to recoup costs from users | None | None | Primary | The Atlanta Gas Light |

[1] Primary bearer of risk; Secondary bearer of residual risk; and Minimal risk (i.e., impact of loss on ROR)

### *Are there funds available that do not require payback or for low-interest loans?*

Funds outside the rate-base and independent from shareholder funds may be available for investing in NGV programs. Examples of these funds include grants and other state or regulatory commission controlled funds. Grants may be available from federal sources such as through the Clean Cities Program, or from state energy or environmental agencies. They may take a variety of forms including low-interest loans, tax incentives, and reimbursements for NGV conversion costs and refueling infrastructure. These incentives may be used by the LDC in conversion of their own fleet to natural gas, and may also be promoted by the LDC to their customers.

An on-going federal program known to provide funding to promote NGV adoption is the US Department of Energy's Clean Cities Program. A Clean Cities grant was used to finance construction of seven new NGV refueling stations in Utah as part of a larger effort to refurbish and expand the state's NGV refueling infrastructure in response to high gasoline prices in 2008.

While state grant sources are more likely in states with a policy to promote natural gas as a transportation fuel, there may be other unique funding sources. An example of a unique, potential state-level funding source is a Universal Service Fund (USF), as is being used by Atlanta Gas Light (AGL). Universal Service Funds have been established in several states (e.g., GA, MD, OH, NJ) as part of utility

restructuring for the purpose of providing assistance to low-income and hardship customers. Ratepayers are charged a designated fee that is deposited into the USF, which is administered by the regulatory commission. The regulations controlling USF use are broader in Georgia than in other states. In Georgia, one of the purposes of the USF is to extend and expand services in the public interest (Rules and Regulations of the State of Georgia, 515-7-5-.03).

AGL submitted an application with a detailed plan for use of funds from the USF to begin a CNG refueling infrastructure in Georgia. The plan was further developed in cooperation with the area's government representatives, and took about 14 months to receive approval for $11.57 million in program funds. The AGL program will be accomplished in multiple stages through revenue recirculation. In the first phase, now in process, a network of 9 CNG fueling stations will be constructed. AGL will install, own, and maintain CNG equipment for project developers, and the developers will provide land, dispensers, card-readers, and retailer functions. AGL will bill the CNG retailers for distribution and compression services under a new rate that includes their delivery charge and two additional charges. One of these charges is to recover AGL's operations and maintenance costs. The second charge, based on CNG equipment use, will be used to build a fund for Phase II activities.

Phase II funds (from Phase I refueling stations fees) will be used for three purposes. 1) to upkeep and eventually replace Phase I refueling equipment, 2) to buy-down 50% of the estimated cost of leases for 500 home refueling stations, and 3) to fund additional CNG refueling stations similar to the process in Phase I. It is the station owner's responsibility to find and sign up customers for a certain percentage of the capacity, which is a condition for receiving funding for the station. In Phase 2, a portion of the proceeds from Phase 1 of the program would also allow AGL to offer "affordable low-cost leases" of home refueling appliances to individuals and small businesses who own CNG vehicles.

If no grants or similar funding for initiating an NGV program are available, LDC may consider requesting such funds from well-endowed non-governmental organizations with stated interest in the environment or in promotion of domestic fuels or other natural gas stakeholders (e.g., producers). Absent federal programs for seeding the NGV infrastructure, other stakeholders can conceptually pool resources to help create corridors of NGV refueling infrastructure. With a program design similar to that used by AGL, the seed funds are recycled for new investments through a fee structure. As long as these programs are fashioned such that no expense or risk is carried by ratepayers and NGV-related fees are only applied to those receiving these services, ratepayers can receive the general benefits of project success with none of the risks. Under these conditions, a regulatory commission is less likely to have objections to the addition of fees for specific costs of service.

### *How much are LDC shareholders willing to invest in NGV programs?*

The amount of funds that shareholders are willing to invest in NGV programs essentially establishes the minimum budget an LDC may have for promotion of NGVs. Examples of relatively low-cost programs include:

- Provision of information on NGVs as through websites and mailings to targeted customers, and responses to inquiries from potential NGV users

- Offering technical assistance in feasibility assessments of NGV adoption
- Conversion of the LDC fleet to natural gas for cost saving and marketing

When shareholders are willing to make a more substantial investment in NGVs they may consider funding a pilot program to strengthen a future petition to the regulatory commission for a rate-based program (as is being done by National Fuel). Alternatively, if the LDC can obtain approval for receiving a return on a program financed by shareholders, the program may continue without rate-basing.

In the case of National Fuel Gas Distribution Corporation, the New York Public Service Commission approved a shareholder financed (shareholder risk-exposed), pilot NGV program to help make the case for a future ratepayer funded NGV program. The LDC shareholders are allowed to spend up to $3.5 million to either fund refueling stations and/or aid in the purchase of NGVs. The capital investment is recoverable through a capital recovery rate, backed by a take-or-pay contract for a minimum quantity of future fuel purchases. The ROR on the investment will be the approved LDC ROR, set to be recovered within 6 years of project funding, with the returns excluded from the decoupling mechanism.[14] The pilot program is to expire on March 31, 2015.

At this early stage, the measurable success of this model is in the planning. Before National Fuel committed to the development of an NGV program, it explored the potential for NGV's in its service area. It purchased detailed fleet market data by zip code, type of vehicles, their size, and other characteristics. National Fuel approached each candidate customer to explore the NGV option in detail. The findings, which included that financing of NGVs may be needed, were included in the petition to the regulators. To simplify the process, National Fuel requested that this program be made part of an existing Distributed Generation program. The petition was approved with added program tracking and reporting requirements to allow for future program determination, which can include a rate-based NGV program.

14 The existing NGV usage is included in the RDM (Revenue Decoupling Mechanism), but NGV Pilot Program usage will not be similarly included. http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={3033B874-D2F6-41B4-85AC-87163B212B4C}, Page 6.

## 4.3 Commercial Model Strategies

As unregulated entities, the strategies applied by commercial companies can often be much more tailored to project-specific needs and varied levels of partnering (i.e., means distributing risk) than can be applied in an LDC's projects. Within the commercial operating environment, firms use an assortment of investment options and many tools in a variety of combinations to form a project-specific strategy designed to achieve their goals. The strategy options, the key questions being answered, and the tools available to enact the strategy are presented in Table 6. A discussion of each question is provided in Sections 4.3.1 through 4.3.6.

Table 6 Common Investment Options for Commercial Firms Investing Into NGV Infrastructure or NGVs

| Investment Type | Type Of Project | Financing | Ownership Relationship | Associated Functions | Associated Activities |
|---|---|---|---|---|---|
| What investment opportunities are being considered? | What projects are most appropriate to meet objective? | How should the project be financed? | What should be the ownership structure? | What developmental functions should the firm perform? | What project activities should the firm engage in? |
| **Refueling Infrastructure**<br>- NGV refueling station<br>- Transportation Service for LNG, CNG, or RNG<br>- Build LNG or RNG capacity | - Own equipment<br>- Own land<br>- Partner in either/both<br>- Lease either/both<br>- Rent for fuel contract<br>- Build for resale<br>- Build to operate | - Equity<br>- Debt<br>- Partner<br>- Venture<br>- Grant<br>- Incentives<br>- Securitize<br>- Guarantor<br>- Credit | - Equity owner<br>- Debt financier<br>- General partner<br>- Limited partner<br>- Venture capitalist<br>- Franchisee<br>- Franchisor | - Plan<br>- Site<br>- Engineer<br>- Construction Management<br>- Build<br>- Test/Launch<br>- Finance | - Operate<br>- Maintain<br>- Manage/support<br>- Fueling service<br>- Consult & Train<br>- Supply NG<br>- Hedge<br>- Insure<br>- Use |
| **NGVs** separately or with investment in refueling infrastructure | - Own NGVs<br>- Own NGV part only<br>- Lease vehicle<br>- Lease NGV part only<br>- Lease to own<br>- Partner w/fleet | | | - Convert vehicles<br>- Refurbish facilities<br>- Inspect fuel systems<br>- Finance facility<br>- Manage fleet | |

Source: SAIC

*RNG refers to renewable natural gas, such as generated from agricultural waste or landfills.

In an organization that uses a rigorous evaluation process, the decision-making is done on a project-specific basis to yield a project-specific strategy. If a strategy works well, it may be formalized and may become the firm's application-specific or area-specific model. Formalized approaches are always company specific and not optimal for another firm with different objectives, strengths, weaknesses, etc.

As such, formalized commercial strategies are not presented, but examples that are loosely based on industry experience are presented in sidebars.

### *What investment opportunities are being considered?*

The investment opportunities considered will likely be based on a market and capability assessment to determine where competitive advantage, profit potential, and investor interest is greatest. The choices are generally between opportunities for supporting the refueling infrastructure, and/or expanding NGV use. Refueling infrastructure opportunities may address private or retail refueling stations, or transport of fuel (i.e., CNG or LNG) to refueling stations, and/or building production capacity of LNG and/or RNG. For example, commercial firms may consider partnering with LDCs for shared use of LNG facilities that are typically used by LDCs for peak-shaving and are drawn from on only a few days each year. Similarly, a firm may partner with a municipality to build capacity to produce RNG. (See sidebar, Example 1.)

### *What projects are most appropriate to meet the objective?*

There can be a number of different projects a commercial company can elect to take part in when investing in NGV markets. For example, to invest in NGV refueling stations it can own land, build stations in response to a specific demand (e.g., private fleet station) or as a speculative venture (e.g., public station), lease it for a fee, operate it, lease it under a fuel purchase agreement, sell it, or some combination of these and other projects. The selection of the right project should be based on a series of assessments, which include a determination of which projects can meet the objectives, what is in demand, where does the firm have the competitive advantage, what is the income stream, what is the risk exposure, is the risk controllable, and other evaluations. This assessment approach is most applicable when an LDC affiliate is

## Example 1: LNG Production

Clean Energy Fuels Corporation (CEFC) is engaged in a program to make LNG available at 150 truck stops for use in LNG trucks. This program requires small, but increasing supplies of LNG to serve a small, but fast-expanding trucking market.

Clean Energy had the option to build, buy, or lease capacity to produce LNG, or contract for supplies of LNG. After examining available national resources, CEFC determined that its near-term requirement for the central region can be met by a peak-shaving facility in Omaha, NE. It decided that the type of project most feasible to meet their objective is to contract for the product from an existing facility.

On May 4, 2012 CEFC and Omaha's Metropolitan Utilities District (MUD) entered into a 15-year agreement for CEFC to purchase LNG to serve the area represented by a 200 mile radius from the Omaha facility. The MUD facility is used only several days a year to supplement available supplies. The rest of the time, it is an unutilized asset.

The agreement allows MUD to increase utilization, and if needed to increase the unit capacity through investment from CEFC. The utility benefits by improving system efficiency that will benefit the ratepayers, and by increasing its earnings.

considering market entry or when they have developed an opportunity. However, very often the project is defined by a potential client.

The selection of a project is critical to meeting goals and defining how the firm will monetize their participation (investment). For example:

- Leasing a private CNG refueling station for a fleet, collateralized by a minimum fuel use contract defines the floor for fuel use. The income stream can be defined when it is a fixed fuel price contract, or indexed fuel price contract, or if the fuel price is hedged. With the proper due diligence this can be a low, to moderately risky venture, which can attract low-cost capital, incentivize investors, and may offer for opportunities to participate in other ways.
- Owning and operating a public CNG refueling station does not provide a predicable income without a contracted anchor customer. This will make it difficult to raise funds and capital, which will likely demand a higher return, and result in higher pump prices.

Clearly, the project will influence the financing and the ownership relationship, as addressed below.

### *How should the project be financed?*

Financing may be the most influential, important, and revealing strategy of the commercial model. It is influential because it can make or break the venture; important because it is helps to define the return; and telling because it reflects the level of perceived risk. The key financing options are listed in Table 6. Depending on the project, the risk level of NGV investments vary widely, but all require some level of equity capital, and most are structured from multiple financial instruments.

- **A low risk project** can have a high debt to equity ratio, such as 80/20, or a D/E of 4. This would form a simple structure where the investor can receive a low-interest loan and be able to leverage the return, and consequently charge a lower pump price.

## Example 2: Vehicle Leasing

An independent CNG fueling equipment supplier identified a fleet with operating characteristics that are very amenable to the use on CNG. However, the fleet operator was not sufficiently familiar with CNG and lacked the capital to make the large investment to convert the vehicles in large-enough numbers to justify the construction of the fueling infrastructure. The equipment company astutely observed that the first issue is to build confidence for the fleet operator.

The fueling company developed a strategy that would address the firm's financial shortcomings and build the needed confidence to convert to CNG. It reached an agreement with the fleet operator to lease CNG vehicles, and run them all times on CNG. The fueling company would cover the CNG component of the lease, and the difference between the cost of diesel and CNG. As compensation for using the fuel, the fleet operator receives 10% off the would-be average monthly diesel cost. This allows the fueling company to receive the full spread between the fuels to cover their part of the lease, fueling infrastructure and share the profit with the fleet.

- **A medium risk project** will demand a lower debt to equity ratio, such as 50/50, or a D/E of 1. Under these circumstances, the debt will command a higher interest or dividend. This structure causes two important impacts: it makes it more difficult to raise equity, and the equity investors will demand a higher return. The debt-side has similar consequences, and jointly, the equity- and debt-side of the structure reduce the leverage and increases the cost of money, which lowers the rate of return on the project. Consequently, and as a compensatory measure, the price at the pump will be higher than for low risk projects.
- **A high risk project** may be able to have the same D/E as a medium risk project, but it will likely require some form of risk mitigating measures, such as loan securitization or loan guarantees. In addition, or alternatively, it may require the participation of venture capitalists, who generally take a disproportionally high equity position for the same equity contribution (e.g., for 10% of the funds, they may want to receive 20% of the equity ownership). This type of structure intensifies the dilution, cost, profit, and pump price effects described above. It is not uncommon for such high-risk projects to dissolve before or shortly after implementation.

A variety of other tools that are often used in NGV projects including grants, emission credits, vehicle incentives, tax credits, accelerated depreciation, etc. Each of these can have an important role in making a project work and should be sought out in any financing strategy.

### *What should be the ownership structure?*

For both refueling infrastructure and NGV projects, the commercial affiliate may be an equity owner, debt financier, general or limited partner, venture capitalist or may be a franchisee (e.g., a representative of a packaged refueling module) or franchisor (e.g., selling a branded home vehicle refueling devices through franchised outlets). The discussion above described the role of the owner, how an ownership position can arise,

## Example 3: The Packaged Refueling Module

An LDC affiliate has extensive experience in the gas distribution systems and compression equipment, and it determined to utilize its expertise in the NGV business. The firm's goals were set to include: fast growth, a national reach, and a ROR above 15%. It determined that their investment of choice is in CNG refueling infrastructure.

After further evaluation it determined that the types of projects it can compete successfully are those that utilize pre-packaged refueling modules. It further determined that starting such a business would take too long and too much capital. The firm found an opportunity to become a regional distributor of an imported, reputable, modular CNG system, which was ready for the US market. The franchise fee represented only a small fraction of the firm's intended capital expenditures.

As a franchisee, the firm noticed that it has the option of participating in the refueling infrastructure business in different ownership roles. Entrance into shared ownership roles helped with the sale of the equipment and build a steady stream of income by collecting rent as a limited partner; profits as a general partner; and interest and dividends as a debt financier.

The firm is now evaluating the purchase of their own equipment to rent to a fleet through the use of a minimum quantity fuel purchase contract. While the firm did not achieve national reach, it has exceeded its planned ROR.

and the impact it has on a project. The relevance of the ownership role is illustrated in the sidebar for Example 2.

### *What developmental functions should the firm perform?*

A commercial affiliate should consider its function or activities in both developmental and operational stages of each project. These roles will be determined in part by the needs of the client organization and by firm's capabilities, interests, and the ability to increase their return. Capabilities should be carefully considered in designating functions, with recognition that partnering in the development stage can sometimes better ensure that these needed functions are performed well, on time and within budget.

During the developmental stages of refueling infrastructure projects, examples of needed functions include planning, site selection and preparation, engineering, construction and construction management, testing, and in many cases financing. For NGV project, examples of needed functions during the developmental stage include fleet management, vehicle purchasing or conversion of vehicle, refurbishment of facilities to meet safety standards for natural gas use, and inspection of vehicle fuel systems and facilities.

### *What project activities should the firm engage in?*

After development, the project may require operational and other support, which may be delivered during an initialization period, or continue throughout the project. If these capabilities are not part of the project team, they may be contracted from firms that specialize in these services. These activities can include fueling operations, maintenance of the refueling equipment and associated infrastructure (lights, safety systems, perimeter protection, electrical, etc.), management or provision of technical support, training and consulting, arrangements for gas supply, provision of fuel price hedging services, etc. A similar set of services may be provided on the vehicle side of the project.

# Appendix A
# NGV Market Analyses

# Natural Gas as a Transportation Fuel

## *Business Models for Mainstreaming*

Mid-Project Presentation -- Final

Prepared for the American Gas Foundation
By SAIC

April 18, 2012

# Table of Contents

# 1. Project Objectives

## *Primary Objective*

*To identify business models that could be used to help establish NG as a sustainable, mainstream transportation fuel.*

# 2. Tasks and Status

- Update, Current Status, Regulatory Review (Tasks 1, 2, and 3)
  - *Status of industry, current practices, incentives*
  - *Effectiveness of recent and existing business models*
  - *Identify issues to define drivers and impediments*
  - *Future legislative/ regulatory landscape*

***Statistical aspects summarized in next slides***

- Model Development
  *Define candidate models*

***Based on industry interviews (summary later in this presentation)***

- Model Evaluation and Implementation Requirements

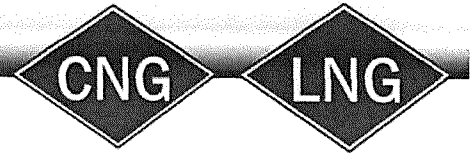
***Next phase of this project***

# 3. Market Data Source

## *Primary Data Source for NG Vehicle and Fuel Sales*

- DOE EIA annual survey of AFVs:
  - *Any organization supplying AFVs for use in U.S.*
  - *Selected organizations using AFVs in the U.S.*
- Includes data on vehicles numbers, fuel consumption, weight class, vehicle type (body configuration), and fuel configuration (dedicated or bifuel)
- Reported annually in "Alternatives to Transportation Fuels" (EIA, ATF)
  - *Most recent publication for 2009 data (EIA ATF 2009)*

# 3. Market Status Overview




- Greatest numbers of NGVs are LDVs
- NGVs have greatest penetration in the transit market (HDV)
- 2005 to 2009 – NGV # decreased by 3%, NGV fuel use increased 18%
  - Lower fuel consumption vehicles exited market
  - Higher fuel consumption vehicles entered market

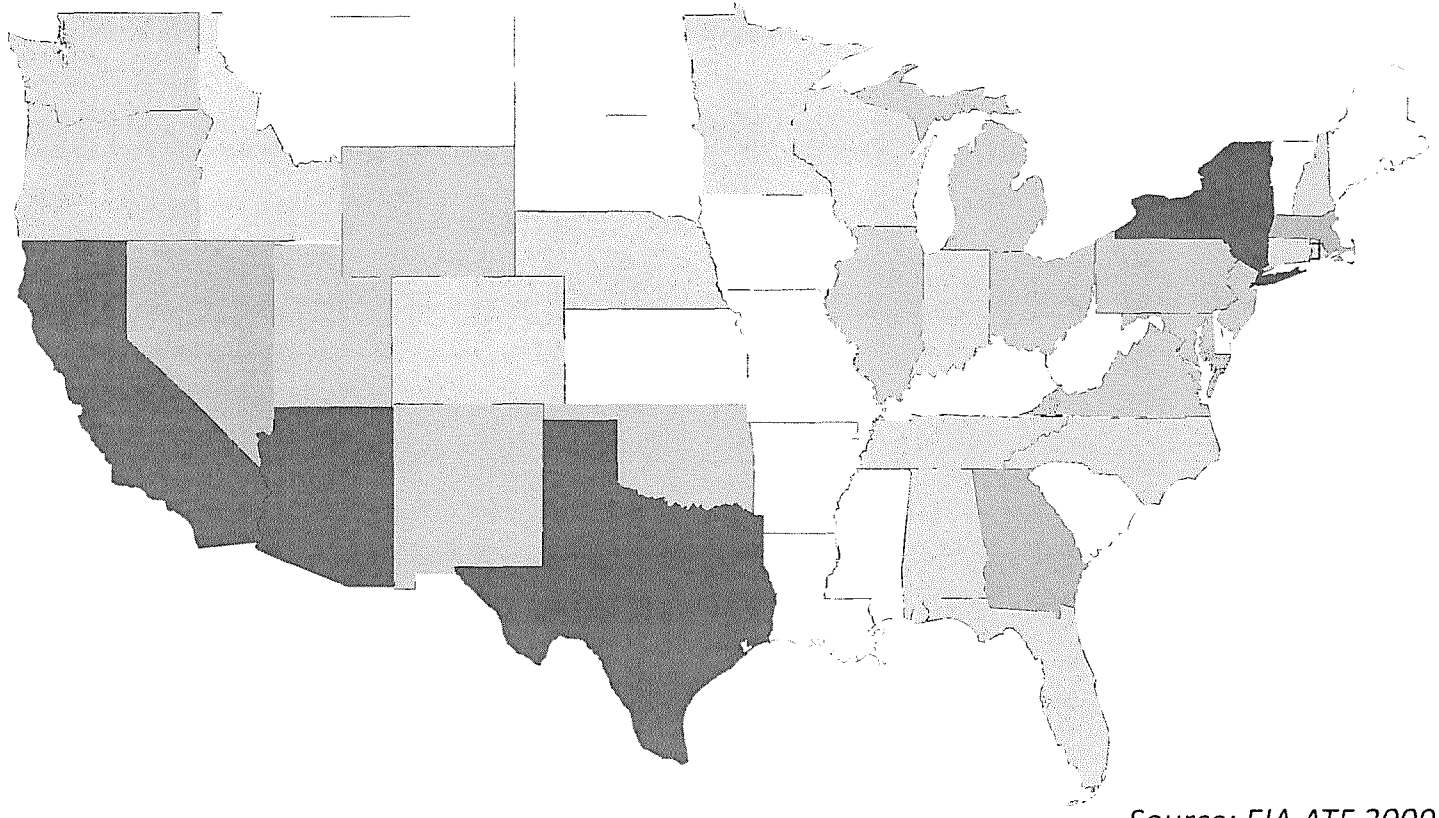
*Does not reflect recent growth due to recent expanded fuel price differentials*

# 3. Market -- Annual GGE Sales By State

CNG LNG

Thousand GGE of Natural Gas (2009)

- >15,000
- 5,000 to 10,000
- 1,000 to 5,000
- 100 to 1,000
- <100



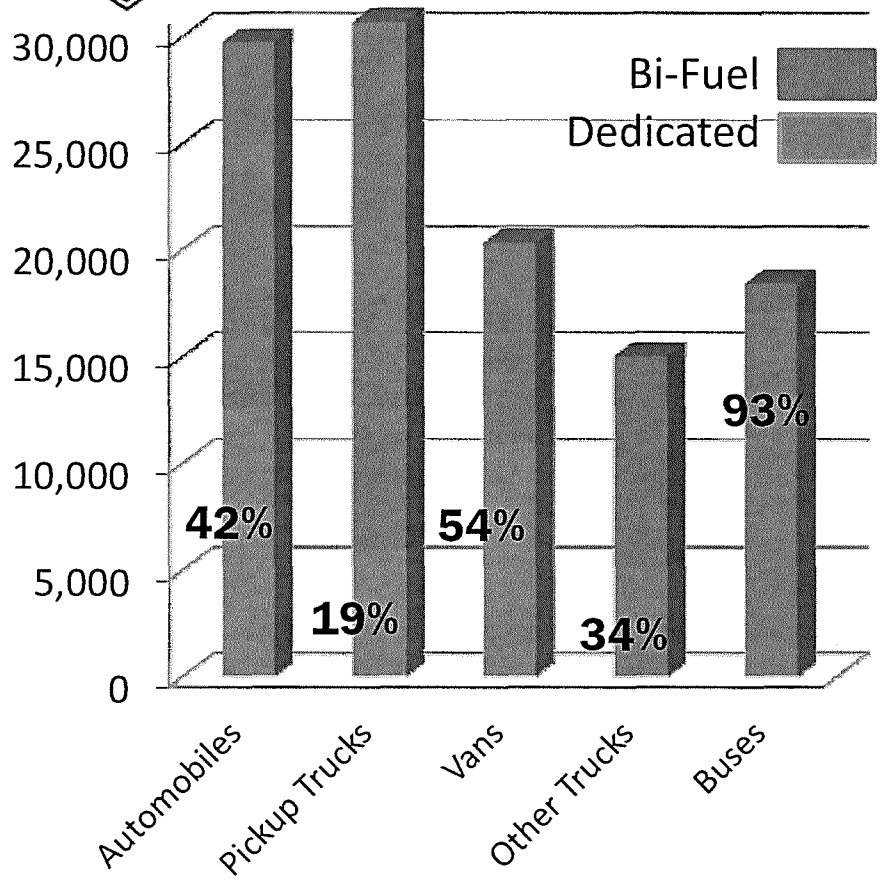
**Top States**

CA
NY
TX
AZ
GA
DC
MA

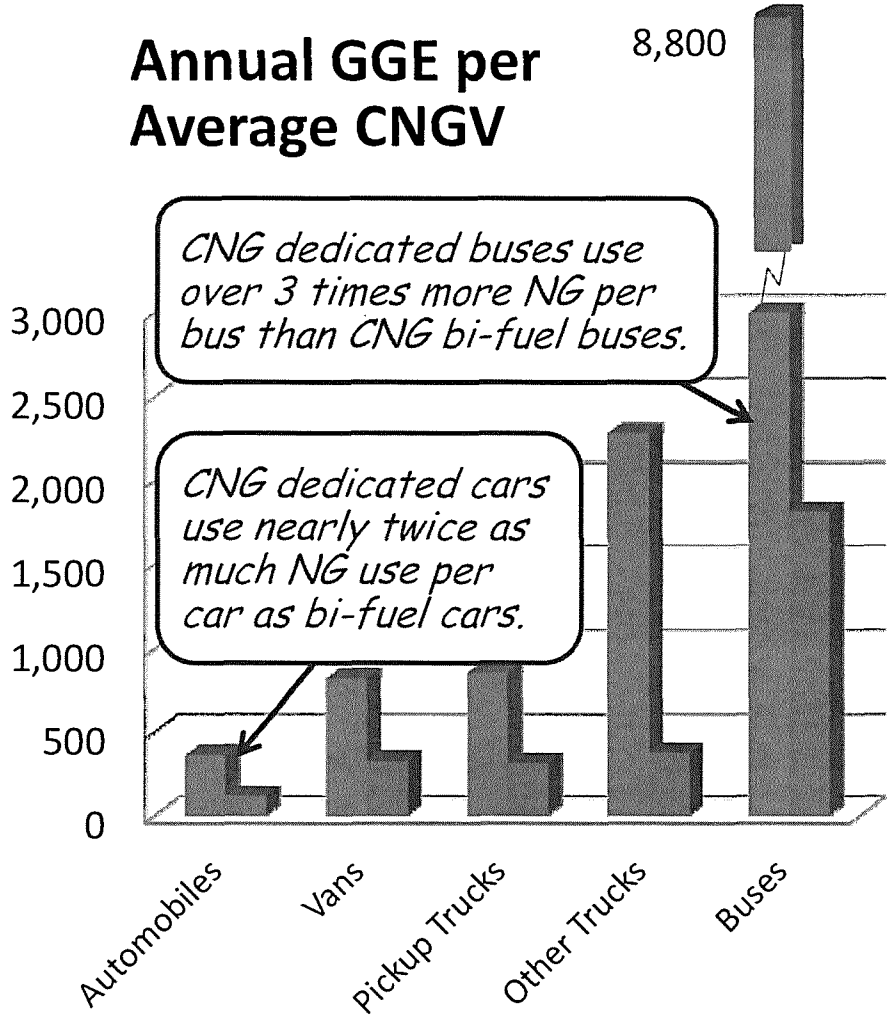
*Source: EIA ATF 2009*

# 3. Market – CNG Use by System Configuration

## Number of Vehicles




## Annual GGE per Average CNGV

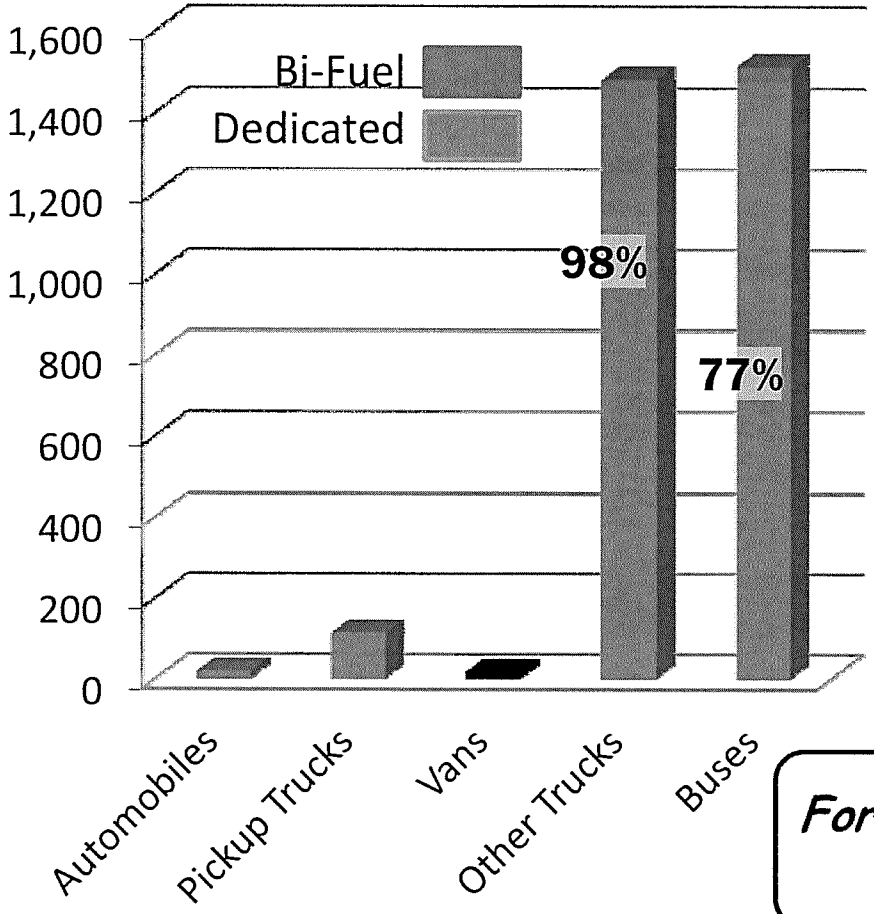



*Generally, dedicated vehicles use more than twice as much NG as bifuel*

*Source: EIA ATF 2009*

# 3. Market– LNG Use by System Configuration

## Number of Vehicles




## Annual DGE per Average LNGV

Less than 200 combined LNG cars, PU's, and vans

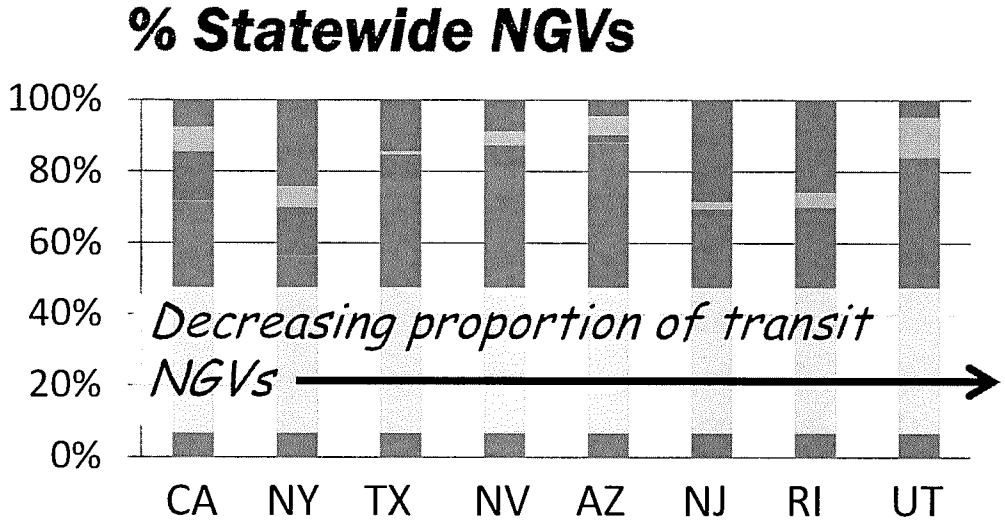
*(not enough for confident fuel use stats by configuration)*

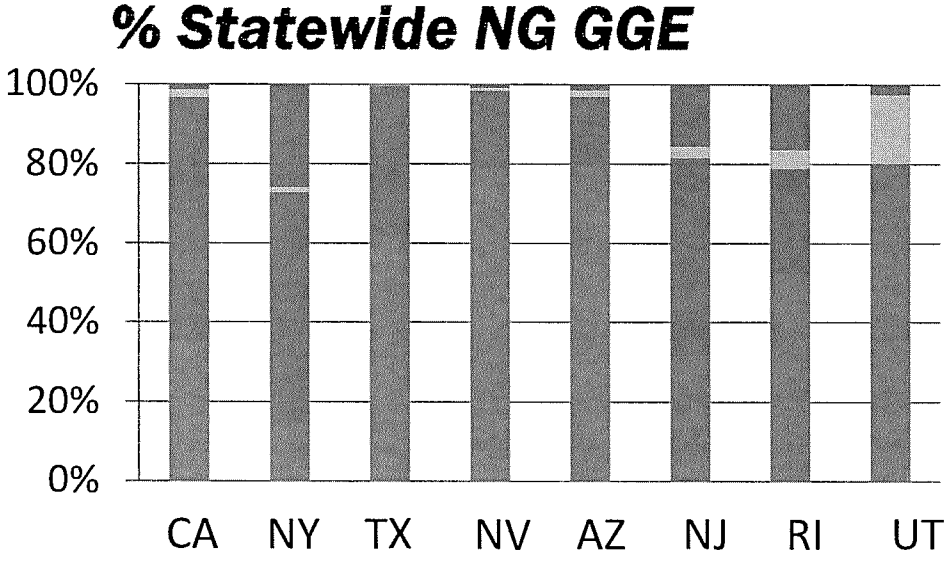
- LNG bi-fuel buses are too few for confident fuel use stats.
- LNG bi-fuel "other trucks" use about 20% more LNG per truck than dedicated LNG trucks.

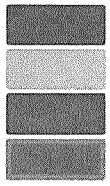
***For LNG use, bi-fuel trucks may be similar to dedicated (not true for buses)***

*Source: EIA ATF 2009*

# 3. Market – Owner Categories in Top States




- *Transit uses more fuel per vehicle than other owner types*
- *Fuel use per transit bus may be lower in more rural states*
- *Clean Cities Program promotes transit NGV in larger cities.*

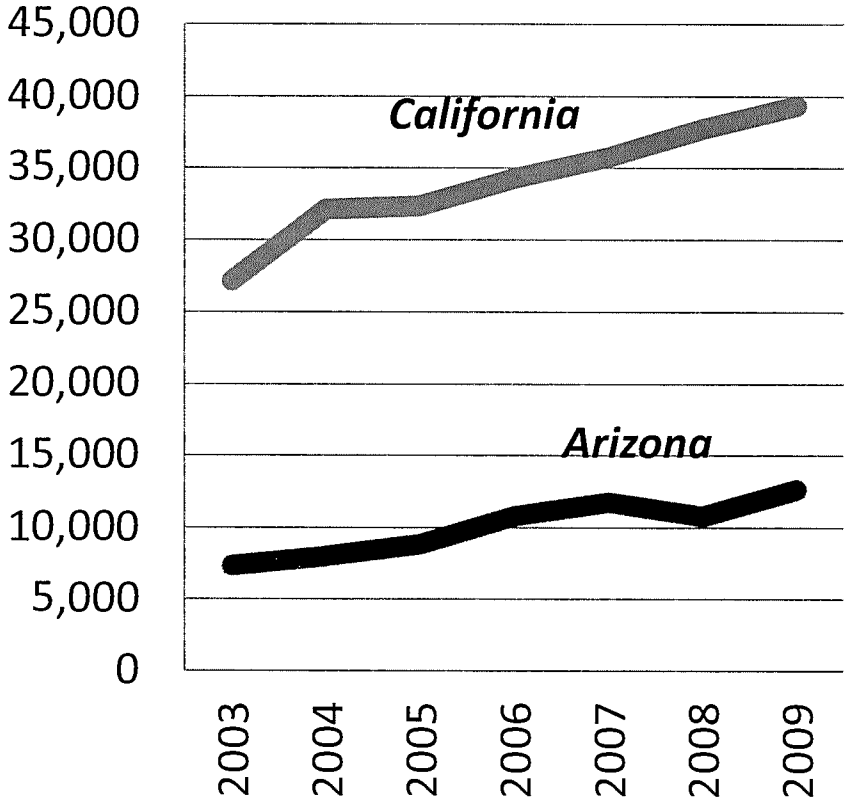
*Source: EIA ATF 2009*

# 3. Market -- Trends in Top Statewide Fleets

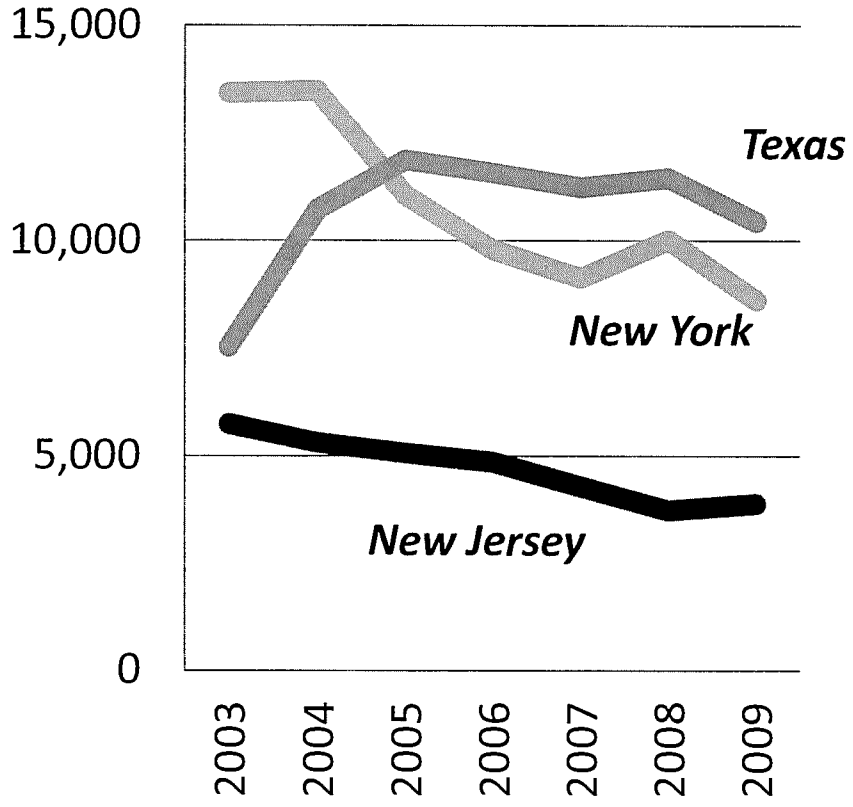


## Number of NGV s, 2003 to 2009

### Current Largest Two Fleets




### Next Three Largest Fleets



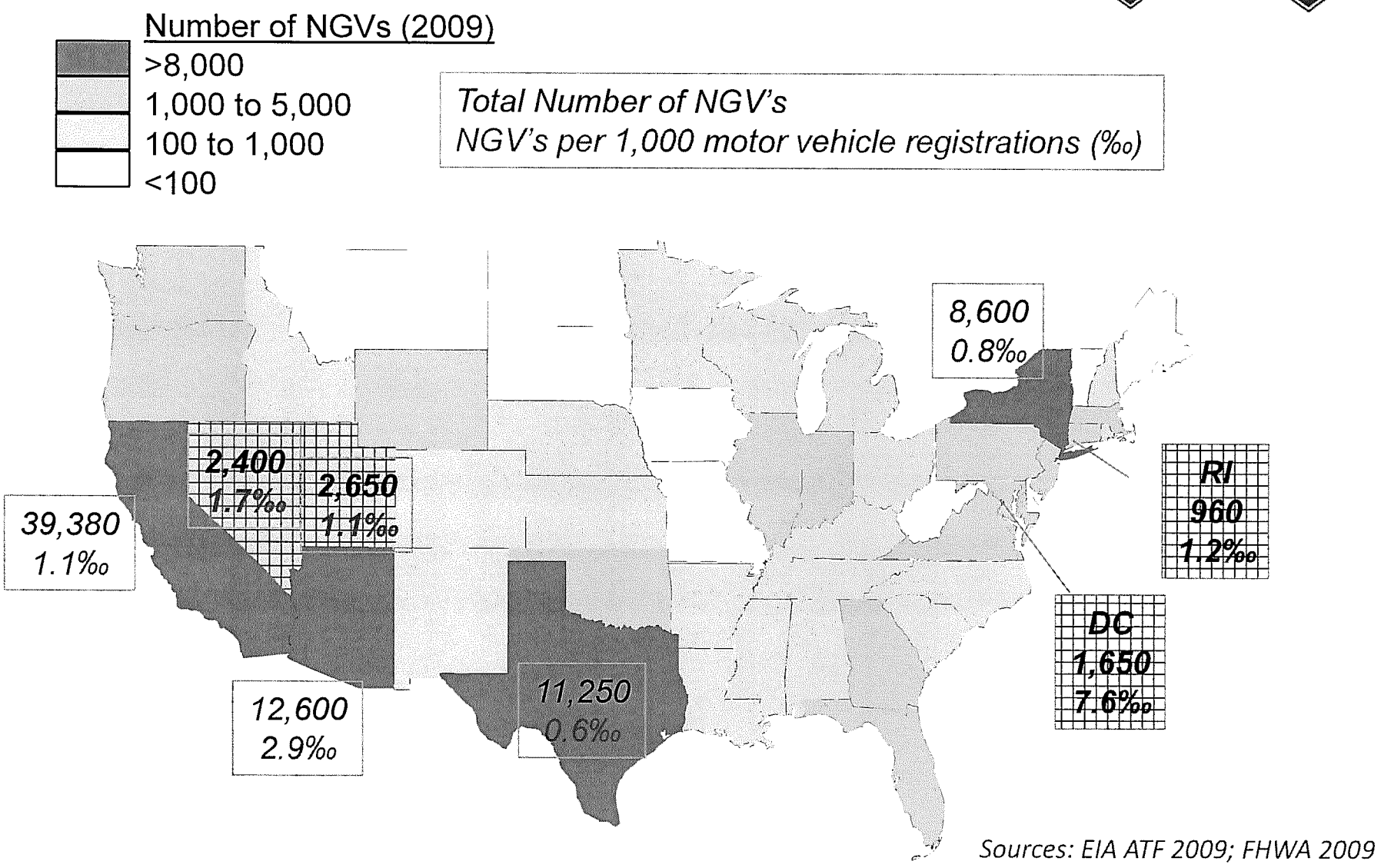

*Source: EIA ATF 2003 -- 2009*

# 3. Market -- Penetration Assessment

- FHWA collects data on vehicle registrations by vehicle type and State *(FHWA 2009)*.
- Market penetration of NGVs indicated by the ratio of NGVs to registered vehicles
- Examination of NGV penetration and incentives by state can indicate combination of incentives that have yielded greatest market penetration

# 3. Market – NGV Penetration by State

CNG LNG




Sources: EIA ATF 2009; FHWA 2009

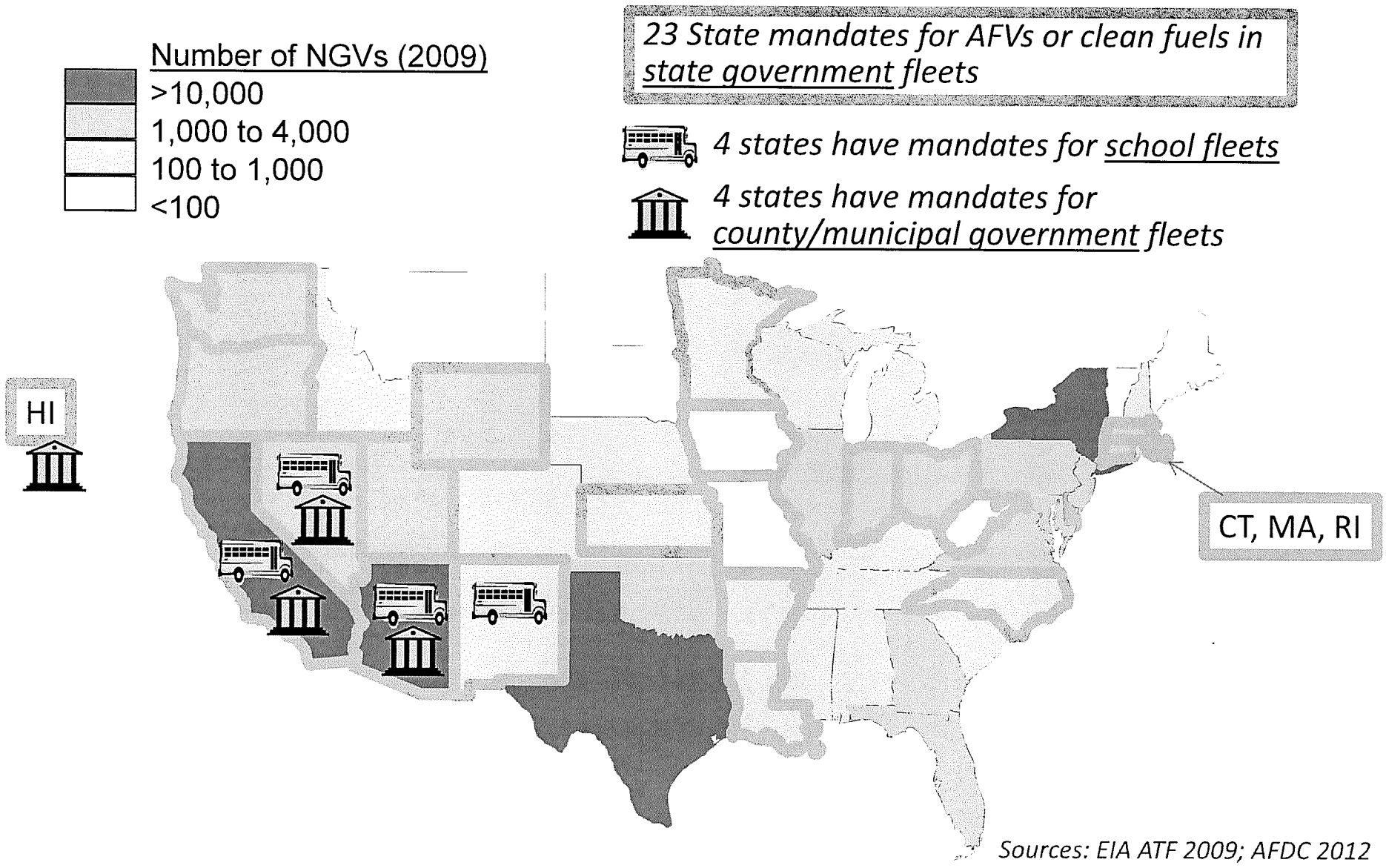
# 3. Market -- Incentives Assessment



- DOE's Alternative Fuel and Advanced Vehicle Data Center (AFDC)
  - Collects AFV-related information on:
    - State incentives (i.e., grants, rebates, tax deductions and exemptions, HOV exemptions, etc.)
    - State mandates
    - Utility and private incentives
    - Laws and regulations
  - Continual updates
- State-by-state review of AFDC conducted in March 2012 *(AFDC 2012).*
  - Assessment of previous-year incentives was beyond the scope of this study, thus confident relationships between market penetration and incentives could not be determined.

# 3. Market -- State Mandates






Sources: EIA ATF 2009; AFDC 2012

# 3. Market -- Utility Rates



| State | NGV Rate-Related Regulations |
|---|---|
| California | Varied discounted refueling rates for specified groups (e.g., home refuelers, etc.) |
| Utah | PSC allows NGV fuel rates that are less than full cost of service with the remaining costs spread to other customers |
| Georgia | Allows cost of service fee for CNG fuel |
| Texas | Assures "competitively priced" NGV fuel for schools and local public entities |
| Kentucky<br>Louisiana<br>Mississippi<br>Massachusetts | NGV fuel sales are not regulated<br>*(MA further states that NGV refueling investments cannot increase NG costs for non-motor fuel applications)* |

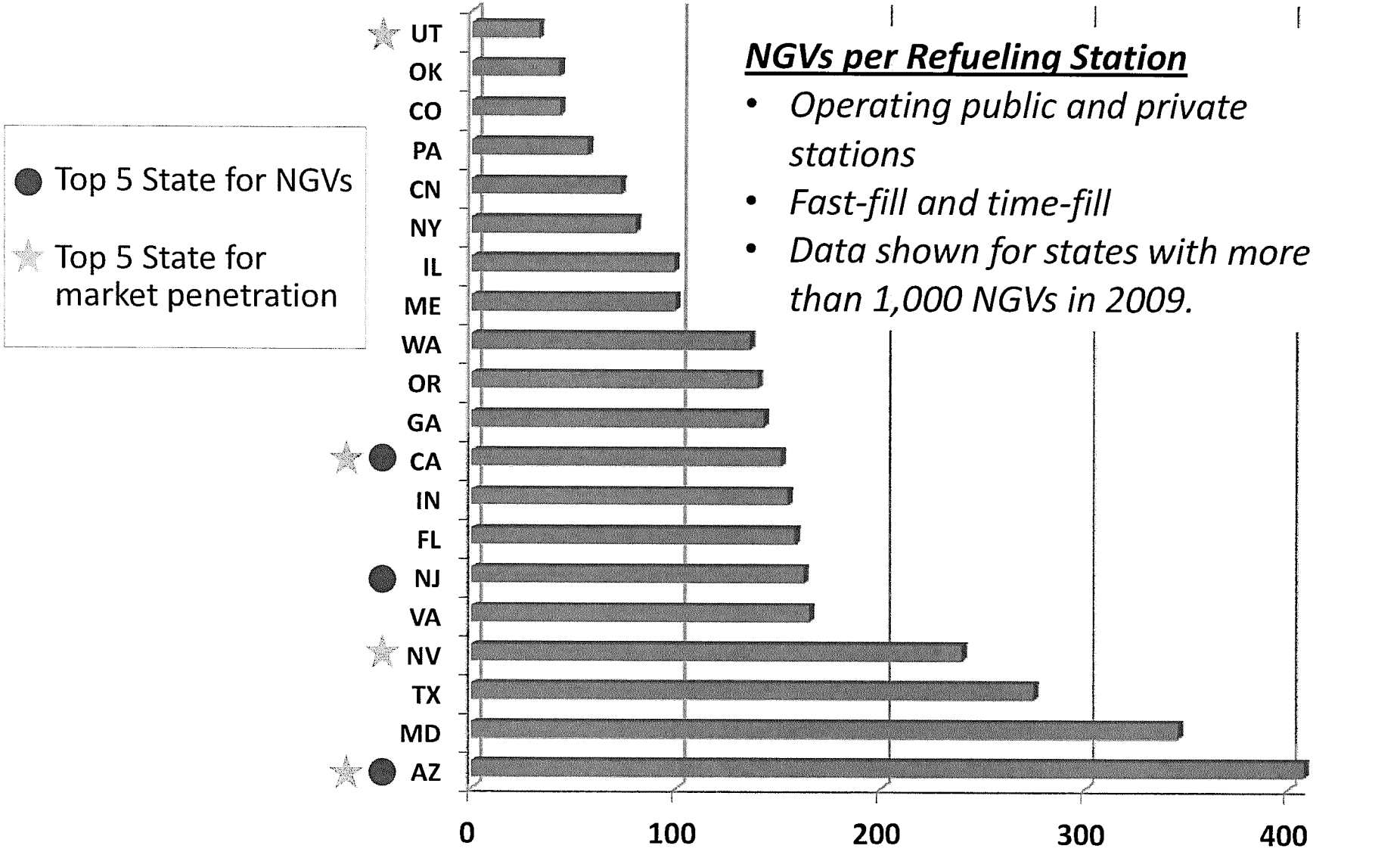
*Source: AFDC 2012*

# 3. Market -- Refueling Station Assessment

- DOE's Alternative Fuel and Advanced Vehicle Data Center (AFDC)
  - Refueling station list by state
    - Public and private stations
    - Distinguishes fast-fill and time-fill
    - Operational and planned
  - Continual updates
  - Reviewed in March 2012 *(AFDC 2012)*

# 3. Market -- Number of NGVs per Station






*Sources: EIA ATF 2009; AFDC 2012*

# 4. Business Model

- **Business models considered focus on LDC applications**
  - Fuels supply, fuel infrastructure, Fuel-related services, etc.

- **M dels presented below reflect:**
  - Preliminary Observations – based on 15 interviews and literature

# 4. Business Model -- Interviews

| Completed | | Planned |
|---|---|---|
| 1. AGL Resources | 9. New Jersey Nat. Gas | 1. Sempra |
| 2. Canadian NGV Assoc. | 10. NiSource | 2. Pioneer |
| 3. CenterPoint | 11. Piedmont NG | 3. Clean Energy |
| 4. Chesapeake | 12. PSE&G | 4. Mountaineer Gas |
| 5. DTE Energy | 13. TECO Energy | 5. Questar |
| 6. EnCana | 14. UIL (So Conn Gas) | 6. MDU Utilities |
| 7. Integrys | 15. Washington Gas | 7. Other, TBD |
| 8. National Fuel | | |

# 4. Business Model -- General Categorization

1. Commercial Models
2. Rate-based Models
3. Non-Rate-based Models
4. Hybrid Models

# 4. Business Model -- Commercial

## General Characteristics of Commercial Models

- **Used by Commercial Firms** (including unregulated subsidiaries of utilities and utility holding companies)
- **General Profile -** Competitive, unregulated, profit oriented, preference for non-rate-based areas, target economically viable projects and risk minimization
- **Investment** - based on common commercial requirements (ROI, Payback, Risk/return, Market Expansion, etc.)
- **Markets -** Targeted marketing to large fleets with high fuel usage (trucking, transit), do not rely on incentives

# 4. Business Model -- Commercial

## Key Activities In Commercial Models

- Contract to build fueling stations (with or without operation or maintenance agreements)
- Fueling capacity for fixed fee
- Fuel under tariff with guaranteed minimum fuel usage
- Other considerations

- **Examples:** *Integrys, TECO, Gaz Métro*
- **Commercial Matrix Model –** at least one organization, *Clean Energy Fuels,* uses a matrix model (vertical and horizontal integration) across products and services, and for multiple fuels

# 4. Business Model – Rate-Based

## Rate-based Models

- Some or all NGV-related activities are allowed in the utility rate structure.

## Example Activities in Rate-based Models

- Build-out of refueling infrastructure
- Provide infrastructure-related services (e.g., compression or dispensing equipment O&M)
- Marketing and educational activities
- Financing of NG supply and vehicle-related investments
- Application of favorable NG for transportation rates, etc.

# 4. Business Model – Rate-Based

## Example LDCs

- **Atlanta Gas Light (AGL)** - uses a Universal Service Fund as seed for funding CNG infrastructure. Service charges will be recycled into additional NG projects for transportation.
- **Southern California Gas** - plans to provide compressed NG to fleets and recoup the cost through the use of approved compression rates.
- **Southern Connecticut Gas, Connecticut Natural Gas, and Yankee Gas** use a 2006 regulatory decision to promote the use of NG in transportation through the use of a rate adjustment mechanism called "developmental rates". Allows near-feasible commercial NG projects a rate that makes the investment feasible.
- **National Fuels Gas Distr. (NY)**– has PUC approval to defray the cost of NGVs and fueling infrastructure. The return to the ratepayers is guaranteed by fuel purchase contracts, backed by a letter of credit, with a payback of no longer than 6 years

# 4. Business Model – Rate-Based

## Some Characteristics of Rate-based Models

- **Used by LDCs to:** increase throughput and revenue, stimulate market, help attain environmental goals, meet State or PUC goals, improve seasonal load balance, assist in meeting national energy goals, etc.
- **LDC General Profile -** operate in rate-based service area, looking for viable opportunities to obtain a just return to the ratepayers, acts to minimize risk to the ratepayers through prudent agreements and by shifting all or the bulk of the risk to the NG user/client
- **Investment** – generally, based on common commercial requirements (ROI, payback, etc.) manage risk but return is not risk-adjusted, support market expansion for NG, etc.
- **Market Segments** – active, and often targeted, marketing to large fleets with high fuel usage (trucking, transit, municipal fleets), but encourage public access and support small users.

# 4. Business Model – Non-Rate-Based

## Non-Rate-based Models

- Where LDCs cannot rate-base specific NGV-related activities, but can engage in some activities that directly or indirectly support NGV development (allowed activities vary).

## Example Activities in Non-Rate-based Models

- General marketing and information activities which may include NGV-related information
- Respond to inquiries from potential NGV users
- Convert utility fleet to NG for cost saving and marketing
- Use grant funds issued specifically for increasing NGV use, for improving the environment, etc.
- Engage in NGV-related activities that are accounted for as "unallowable" and charged against the profits

# 4. Business Model – Non-Rate-Based

## Some Characteristics of Non-Rate-based Models

- **Used by LDCs to:** explore the NGV market, build a case for the PUC to rate-base NG for transportation, encourage third party investment to increase throughput and revenues, help attain environmental goals, improve seasonal load balance, assist with national energy goals, etc.
- **LDC General Profile** – Growth-oriented utilities looking to open new markets and grow their business, looking for viable opportunities, seek to minimize risk, use it as a fuel diversification strategy, etc. May look for, and benefit from, teaming with commercial partners.
- **Investment** - based on the exploratory and developmental theme, proof of business concept, for ultimate throughput expansion, etc.
- **Markets –** May or may not include active marketing. If active marketing is conducted, targets large fleets with high fuel usage (trucking, transit).

# 4. Business Model – Non-Rate-Based

## Example LDCs

- **Washington Gas Co –** exploring the re-establishment of the NGV business. Engages in exploratory activities and support to interested parties. Considering partial utility fleet conversion.
- **CenterPoint Energy --** a holding company, exploring the opportunities for each of their utilities in 5 states.
- **Others**

# 4. Business Model – Hybrid

**Hybrid Models – incorporate features of at least two of the above models.**

- Some LDCs are using or considering use of hybrid models at LDC and holding company levels
- Examples incorporate varied features
- Analysis of hybrid models will be conducted in the next phase of this project

# 4. Business Model -- Emerging Themes

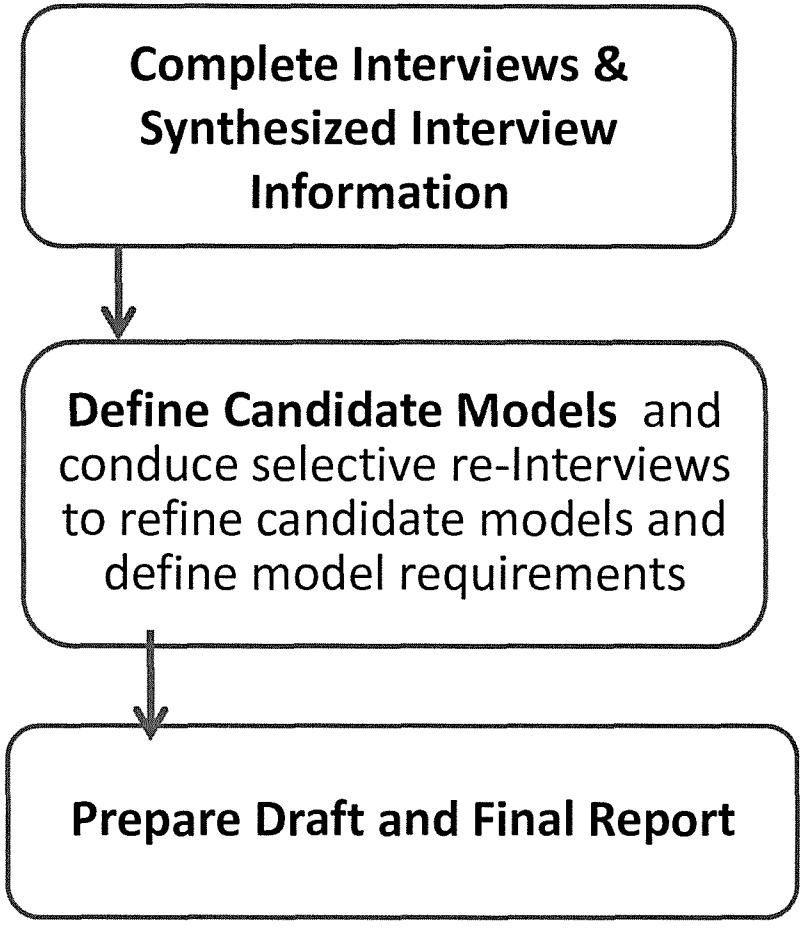
***The Emerging Themes to Date are Summarized Below:***

- *Rate-based investment use business criteria to assure returns to the ratepayers.*
- *Commercial investment may elect to seek risk-adjusted returns.*
- *Models consider past NGV experience and are designed to manage and prepare the LDC and customer to survive risks, e.g.,*
  - ***Customer risks*** *(e.g., use due diligence and solid contracts)*
  - ***Fuel price spread risk*** *(e.g., consider hedging)*
  - ***Technology risks*** *– availability, system reliability, supplier dependability, performance, training, etc., are part of many models.*
  - ***Event risk*** *– major vehicle or fueling incident, hurricanes, distribution constraints, suspension of incentives, etc., are themes found in discussions.*

# 4. Business Model -- Emerging Themes

- *All models use targeted, informed marketing to pick best customers early*
- *Non-Rate-based LDC model may be effective to launch the NGV business. However, it is limited in what it can accomplish, and has a limited amount of time and resources to be effective in a competitive environment*
- *There is caution to use incentives wisely, and avoid becoming incentive-dependent*
- *In the long-term, all parts of the NG for transportation business will need to be commercially viable, on it's own merits*

# 5. Next Steps


Complete Interviews & Synthesized Interview Information
Define Candidate Models and conduce selective re-Interviews to refine candidate models and define model requirements
Prepare Draft and Final Report

# Appendix B
# List of Interviewed Organizations

Organizations interviewed between March and June, 2012.

1. AGL Resources
2. Apache
3. Canadian NGV Assoc.
4. CenterPoint
5. Chesapeake
6. Clean Energy
7. DTE Energy
8. EnCana
9. FortisBC
10. Integrys
11. Los Angeles County MTA
12. National Fuel
13. New Jersey Nat. Gas
14. NiSource
15. Orange County Transit
16. Piedmont NG
17. PSE&G
18. Questar
19. TECO Energy
20. Trillium
21. UIL (So Conn Gas)
22. Washington Gas

## CLASSIFICATION OF SERVICE – RATE SCHEDULES
## INTERRUPTIBLE SERVICE

APPLICABILITY

Applicable within all areas served by Delta. See Tariff Sheet No. 17.

AVAILABILITY

Available for use by interruptible customers.

CHARACTER OF SERVICE

Interruptible - within the reasonable limits of the Company's capability to provide such service.

RATES

| | Base Rate | + | Gas Cost Recovery Rate (GCR) ** | = | Total Rate | | |
|---|---|---|---|---|---|---|---|
| Customer Charge | $ 250.00000 | | | | $ 250.00000 | | |
| 1 - 10,000 Ccf | $ 0.16000 | | $ 0.75920 | | $ 0.91920 | /Ccf | (R) |
| 10,001 - 50,000 Ccf | $ 0.12000 | | $ 0.75920 | | $ 0.87920 | /Ccf | (R) |
| 50,001 - 100,000 Ccf | $ 0.08000 | | $ 0.75920 | | $ 0.83920 | /Ccf | (R) |
| Over 100,000 Ccf | $ 0.06000 | | $ 0.75920 | | $ 0.81920 | /Ccf | (R) |

Special Conditions - All customers having a connected load in excess of 2,500,000 Btu input per hour may be required to enter into an Interruptible Sales Agreement. Determinations of those customers so required shall be based on peak day use as well as annual volume and shall be at the sole discretion of the Company. In order to provide a fair opportunity to compete with other motor fuels, the customer charge and Pipe Replacement Program charge may be waived by Delta at its sole discretion for compressed natural gas fueling station customers. (T) (T) (T) (T)

Any customer required to enter into an Interruptible Agreement shall be permitted to purchase or transport gas under the Interruptible Rate Schedule as set forth on Sheet No. 5. Gas requirements, minimum charges and other specific information shall be set forth in the Agreement.

Interruptible rates are also subject to a Pipe Replacement Program charge of $89.72, as determined in accordance with the Pipe Replacement Program Rider as set forth on Sheet 43 of this tariff.

** The "Gas Cost Recovery Rate (GCR)" as shown above, is an adjustment per Ccf determined in accordance with the "Gas Cost Adjustment Clause" as set forth on Sheets No. 13 and 14 of this tariff.

**DATE OF ISSUE: October 23, 2013**
**DATE EFFECTIVE: October 28, 2013 (Final Meter Reads)**
**ISSUED BY: Glenn R. Jennings, Chairman of the Board, President and CEO**

**Issued by Authority of an Order of the Public Service Commission of KY in Case No. 2013-00355 dated October 21, 2013.**

CLASSIFICATION OF SERVICE – RATE SCHEDULES
INTERRUPTIBLE SERVICE

TERMS AND CONDITIONS

For a customer that is utilizing transportation service and has under deliveries of transportation gas to Delta's system, and/or requests to revert to the Small Non-Residential, Large Non-Residential or Interruptible Service rate schedule, Delta may require a written contract providing for a continuance of service under the Small Non-Residential, Large Non-Residential or Interruptible Service rate schedule for a minimum term of twelve months beginning with the date service reverts to the Small Non-Residential, Large Non-Residential or Interruptible Service rate schedule.

DATE OF ISSUE: October 23, 2013
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## CLASSIFICATION OF SERVICE – RATE SCHEDULES
## TRANSPORTATION OF GAS FOR OTHERS ON SYSTEM UTILIZATION

APPLICABILITY

Applicable within all areas served by Delta. See Tariff Sheet No. 17.

AVAILABILITY

Available to small non-residential, large non-residential, ~~and~~ interruptible and compressed natural gas fueling station customers who have purchased natural gas elsewhere, obtained all requisite authority to transport such gas to Delta's facilities and request Delta to utilize its facilities to transport such customer-owned gas to place of utilization. Any such transportation service shall be subject to the terms and conditions set forth herein and to the reserved right of Delta to decline to initiate such service whenever, in Delta's sole judgment, the performance of the service would be contrary to good operating practice or would have a detrimental impact on other customers of Delta. Such detrimental impact may include under deliveries of transportation gas to Delta's system or switching by the transportation customer to Delta's Small Non-Residential, Large Non-Residential or Interruptible Service rate schedules. (T) (T)

RATE

A transportation charge comprised of the following components will be applied to each Ccf, or in the case of measurement based on heating value, each dekatherm (Dth) of gas transported hereunder:

(1) Delta's Base Rate for gas sold as set forth in Delta's Small Non-Residential, Large Non-Residential and Interruptible Rate Schedules; plus

(2) Where the pipeline suppliers transportation, compression or other similar charges are billed to Delta, the cost per Ccf or Dth, as applicable, of such charges; plus

(3) A take-or-pay recovery component of $(0.0000)

(4) For compressed natural gas fueling station customers, in order to provide a fair opportunity to compete with other motor fuels, Delta may negotiate at Delta's sole discretion with such customers a fixed base rate that is no more than the maximum Base Rate set forth in Delta's Interruptible Service Rate Schedule, but is no less than the minimum Base Rate set forth in Delta's Interruptible Service Rate Schedule. (T) (T) (T) (T)

**DATE OF ISSUE:** November 8, 2010
**DATE EFFECTIVE:** October 22, 2010
**ISSUED BY:** Glenn R. Jennings, Chairman of the Board, President and CEO

**Issued by Authority of an Order of the Public Service Commission of KY in Case No. 2010-00116 dated October 21, 2010.**

## CLASSIFICATION OF SERVICE – RATE SCHEDULES
## TRANSPORTATION OF GAS FOR OTHERS ON SYSTEM UTILIZATION

GAS SOLD TO CUSTOMER

Monthly gas deliveries to customer in excess of scheduled transportation volumes will be billed by Delta and paid by customer in accordance with Delta's Standby Service Rate Schedule.

TERMS AND CONDITIONS

Service hereunder shall be performed under a written contract between customer and Delta setting forth specific arrangements as to term of the contract, volumes to be transported, points of delivery, methods of metering, timing of receipts and deliveries of gas by Delta, timing constraints relative to under deliveries and/or switching to Delta's Small Non-Residential, Large Non-Residential or Interruptible Service rate schedules, the availability of discounts in special situations and any other matters relating to individual customer circumstances.

At least ten (10) days prior to the beginning of each month, customer shall provide Delta with a schedule setting forth daily volumes of gas to be delivered into Delta's facilities for customer's account. Customer shall give Delta at least twenty-four (24) hours prior notice of any subsequent changes to scheduled deliveries. Delivery of gas transported hereunder will be effected as nearly as practicable on the same day as the receipt thereof. Delta will not be obligated to utilize underground storage capacity in performance of the service provided herein.

All gas volumes delivered hereunder shall shrink by 2% to cover line loss and measurement differences when no compression is being used in the transportation. When compression is required in the transportation, all gas volumes delivered hereunder shall shrink an additional amount equivalent to fuel usage.

It shall be the customer's responsibility to make all necessary arrangements, including regulatory approvals, required to deliver gas transported under this tariff.

Delta reserves the right to refuse to accept gas that does not meet Delta's quality specifications.

CLASSIFICATION OF SERVICE – RATE SCHEDULES
TRANSPORTATION OF GAS FOR OTHERS ON SYSTEM UTILIZATION

Volumes of gas transported hereunder will be determined in accordance with Delta's measurement base.

Customer owned gas transported hereunder for an interruptible customer will be subject to interruption in accordance with normal interruption procedures applicable to such rate schedule. Such customers must agree in writing to cause deliveries of customer-owned gas into Delta's facilities to cease upon notification by Delta of the necessity to interrupt or curtail the use of gas.

Delta shall have the right at any time to curtail or interrupt the transportation or delivery of gas to interruptible customers hereunder when, in Delta's sole judgment, such curtailment or interruption is necessary to enable Delta to maintain deliveries to customers of higher priority or to respond to any emergency. During such periods, Delta shall have the right to purchase any transportation gas delivered into Delta's system for the account of the customer at the actual cost the customer paid for such gas.

Delta may execute special transportation contracts with anyone after said contract has been filed with and accepted by the Public Service Commission.

This transportation is available to any customer with a daily nominated volume (the level of daily volume in Ccf as requested by the customer to be transported and delivered by the Company) which averages a minimum of 250 Ccf of gas per day for the billing period on an individual service at the same premise who has purchased their own supply of natural gas and require transportation by the Company to the point of utilization subject to suitable service being available from existing facilities. In order to provide a fair opportunity to compete with other motor fuels, this minimum volume requirement may be waived by Delt at its sole discretion for compressed natural gas fueling station customers. (T) (T) (T)

For a customer that is utilizing transportation service and has under deliveries of transportation gas to Delta's system, and/or requests to revert to the Small Non-Residential, Large Non-Residential or Interruptible Service rate schedule, Delta may require a written contract providing for a continuance of service under the Small Non-Residential, Large Non-Residential or Interruptible Service rate schedule for a minimum term of twelve months beginning with the date service reverts to the Small Non-Residential, Large Non-Residential or Interruptible Service rate schedule.

DATE OF ISSUE: November 8, 2010
DATE EFFECTIVE: October 22, 2010
ISSUED BY: Glenn R. Jennings, Chairman of the Board, President and CEO

Issued by Authority of an Order of the Public Service Commission of KY in
Case No. 2010-00116 dated October 21, 2010.

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

| | | |
|---|---|---|
| APPLICATION OF DELTA NATURAL GAS COMPANY, INC. FOR AN ORDER DECLARING THAT IT IS AUTHORIZED TO CONSTRUCT, OWN AND OPERATE A COMPRESSED NATURAL GAS STATION IN BEREA, KENTUCKY | ) ) ) ) ) ) | CASE NO. 2013-00365 |

# DIRECT TESTIMONY OF

# JONATHAN W. MORPHEW

Filed: November 22, 2013

## VERIFICATION

**STATE OF KENTUCKY** )
)
**COUNTY OF CLARK** )

The undersigned, Jonathan W. Morphew, being duly sworn, deposes and says he is Manager – Engineering of Delta Natural Gas Company, Inc., that he has personal knowledge of the matters set forth in the following testimony, and the answers contained therein are true and correct to the best of his information knowledge and belief.

**Jonathan W. Morphew**

Subscribed and sworn to before me by Jonathan W. Morphew, this the 21st day of November, 2013.

My Commission Expires: 6/20/16

Notary Public, State at Large, Kentucky

OFFICIAL SEAL
EMILY P. BENNETT
NOTARY PUBLIC - KENTUCKY
STATE-AT-LARGE ID # 467350
My Commission Expires June 20, 2016

Q. **Please state your name and business address.**

A. Jonathan W. Morphew, Delta Natural Gas Company, Inc. ("Delta"), 3617 Lexington Road, Winchester, Kentucky 40391.

**Q. What is your present employment?**

A. I am the Manager of Engineering for Delta.

**Q. For what period of time have you been so employed?**

A. I have been employed by Delta for over 26 years. I began work for Delta in the Engineering Department on May 26, 1987.

**Q. Would you briefly describe your education and professional experience?**

A. I attended Morehead State University from August of 1981 to May of 1985, receiving a Bachelor of Science Degree in Industrial Technology. From May of 1985 to August of 1986, I was employed in the Engineering Department of Nucor Steel, in Grapeland, Texas. From August of 1986 to May of 1987 I was employed by Palmer Engineering, a civil engineering firm located in Winchester, Kentucky. Since May of 1987, I have been employed in the Engineering Department of Delta in Winchester, Kentucky.

**Q. Generally what are your duties with Delta?**

A. As Manager of Engineering, I am responsible for all engineering research, planning and design. In addition to the engineering function, I oversee and coordinate all technical services, including the functions of our Corrosion and Measurement & Regulation groups. Additional functions include inventory management, fleet vehicle purchasing, sales and maintenance, as well as corporate facilities maintenance.

**Q. Are you generally familiar with the business affairs of Delta?**

A. Yes, I am.

**Q. Have you previously provided testimony to the Commission?**

A. I have not.

**Q. Please briefly summarize the scope of your testimony.**

A. In my testimony, I sponsor all items pertaining to the planning and design for the construction of a Compressed Natural Gas station ("CNG"), to be located in Berea, Kentucky.

**Q. What is the exact location of the proposed CNG station?**

A. The address of the proposed CNG station is 129 Glades Road, Berea, Kentucky 40403.

**Q. What steps were taken for you to plan and design the proposed CNG station?**

A. The proposed CNG station was planned and designed by me and persons under my supervision. For the past year, Delta personnel made visits to various CNG stations owned and operated by other companies. We conducted interviews with members from their Engineering and Operations personnel. We gathered information that assisted in determining the type and size of facilities required and determining potential vendors capable of supplying Delta's needs. Upon completion of our visits, Delta's Engineering team designed the project, discussed the project with equipment vendors and obtained pricing from qualified vendors for the construction of the station.

**Q. Give a general description of the CNG Station and its associated components.**

A. The CNG Station will provide natural gas as a fuel to vehicles, both passenger and commercial in nature. Some of the key components of the station are as follows:

- Master meter – measures gas usage for the entire CNG station;
- Gas dryer – provides filtering and moisture removal of natural gas used;
- Gas compressors – provides natural gas at sufficient pressure and volume;

- Storage vessels – provides on-demand capacity for fueling;
- Dispensers – provides fueling capability for vehicles;
- Card readers – provides for payment and activation of dispensers.

The station will be equipped with two dispensers and two card readers to provide natural gas simultaneously to four vehicles at any given time. Natural gas will be supplied at the appropriate pressure and volume by one compressor. The second compressor is equal in size and used for backup in the event the first compressor needs to be removed from service for maintenance or repair. One compressor can deliver natural gas at a rate of seven gasoline gallon equivalent ("GGE"), per minute. There will also be three storage vessels to provide greater capacity for fueling. These vessels will be able to provide forty GGE each. The compression and storage units will be located behind the CNG station and Delta's existing facilities on Glades Road. The natural gas used for this station will be measured twice. There will be a master meter measuring all natural gas entering the facility, prior to compression for vehicle fueling. It will be measured again through the dispensers as it is supplied to each vehicle. To insure quality, all natural gas delivered through the station will be filtered for particulate matter and dehydrated to remove any moisture prior to entering any vehicle.

Each dispenser is equipped with two hoses. Each hose has a nozzle similar to a gasoline hose. When a vehicle pulls up to the dispenser, the operator must first connect the hose to the vehicle. Once connected, the connector valve on the nozzle is turned, locking the dispenser hose to the vehicle. The operator's credit card is then swiped for authorization. The dispenser switch is turned on and natural gas begins to flow into the vehicle. There is no danger of overfilling the vehicle. The dispenser senses the pressure as it rises in the

vehicle tank. Once the tank pressure has reached maximum level, the dispenser stops supply to the hose. The locking valve on the nozzle is then turned back to the original position, unlocking it from the vehicle. The nozzle can then be safely removed from the vehicle and returned to the dispenser. The dispenser is then ready for the next transaction.

The CNG station will be equipped with concrete or asphalt, entry and exit driveways. It will also contain a canopy equipped with electric lighting, facilitating twenty-four hour access for fueling (See Morphew Exhibit 1). All pricing and capacities will be indicated in GGE on the dispensers. Signage will also be provided in front of the station indicating the price of natural gas in GGE.

**Q. By what methods will the accuracy of the natural gas measurement be assured?**

A. Measurement data from the dispensers can be compared to the master meter at the inlet of the CNG station. The master meter will be removed from service periodically for accuracy testing as well. The dispensers will also be tested by the Department of Agriculture – Weights and Measures.

**Q. What will be the hours of operation of the CNG Station?**

A. The station will provide service twenty-four hours each day, seven days per week.

**Q. What permitting will be required for the construction of the CNG Station?**

A. A "Permit to Construct" will be required by the City of Berea. Approval for operation will be required by the Public Protection Cabinet – State Fire Marshall, prior to energizing the station. Delta will make timely applications for these permits.

**Q. Will the CNG Station require continual human occupancy for operation?**

A. It will not. The CNG Station is designed to provide natural gas to vehicles without the assistance or need for a Delta employee to be present.

**Q. How many vehicles will the CNG Station fuel simultaneously?**

A. The CNG Station is designed to fuel four vehicles simultaneously, utilizing two dispensers. One dispenser can fuel two passenger vehicles simultaneously. The second dispenser can fuel a passenger vehicle and/or a commercial vehicle simultaneously.

**Q. How many vehicles does Delta intend to equip with CNG capability?**

A. We anticipate upgrading up to eleven vehicles as soon as practical, once the CNG station is in operation. The number of CNG vehicles in our fleet may increase as we evaluate subsequent vehicle purchases/replacements, as they occur. Potentially, we have another twenty-two vehicles in our fleet that can be converted or replaced with new CNG vehicles, as time allows.

**Q. Has there been any discussion with potential customers to determine the demand for a CNG station?**

A. Yes. Delta has had discussions with the City of Berea, Berea College and the Madison County public school systems, regarding the conversion of their fleet vehicles to CNG. Each have expressed interest in the concept if CNG becomes available.

**Q. What vehicles are offered with a CNG option?**

A. Honda, Ford and Chevrolet offer a number of vehicles suitable for passenger and commercial use. Honda offers the Civic passenger car, CNG equipped. Ford offers its E-Series vans and wagons CNG equipped. It also offers F-Series trucks from the F-250, up to the F-650. Ford anticipates its F-150 will be offered as CNG equipped sometime in

2015. Chevrolet offers CNG equipped trucks and vans starting with its 2500 series, up to its 4500 series. All vehicles mentioned are also equipped for dual fuel operation, rendering them operational by gasoline as well.

**Q. Will the public have access to the CNG Station?**

A. Yes. The CNG Station is designed to provide natural gas to both Delta vehicles and public vehicles as well.

**Q. Should interrupting CNG service be needed for safety reasons, can the public do so with relative convenience?**

A. Yes. An Emergency Shutdown button will be installed near each Dispenser, and at the compressor and storage location. In the event of any emergency, any of the buttons can be pressed and render the CNG Station inoperable.

**Q. Aside from the cost of natural gas and the related transportation costs Mr. Brown discusses in his testimony, what additional operating costs are associated with the operation of the CNG station?**

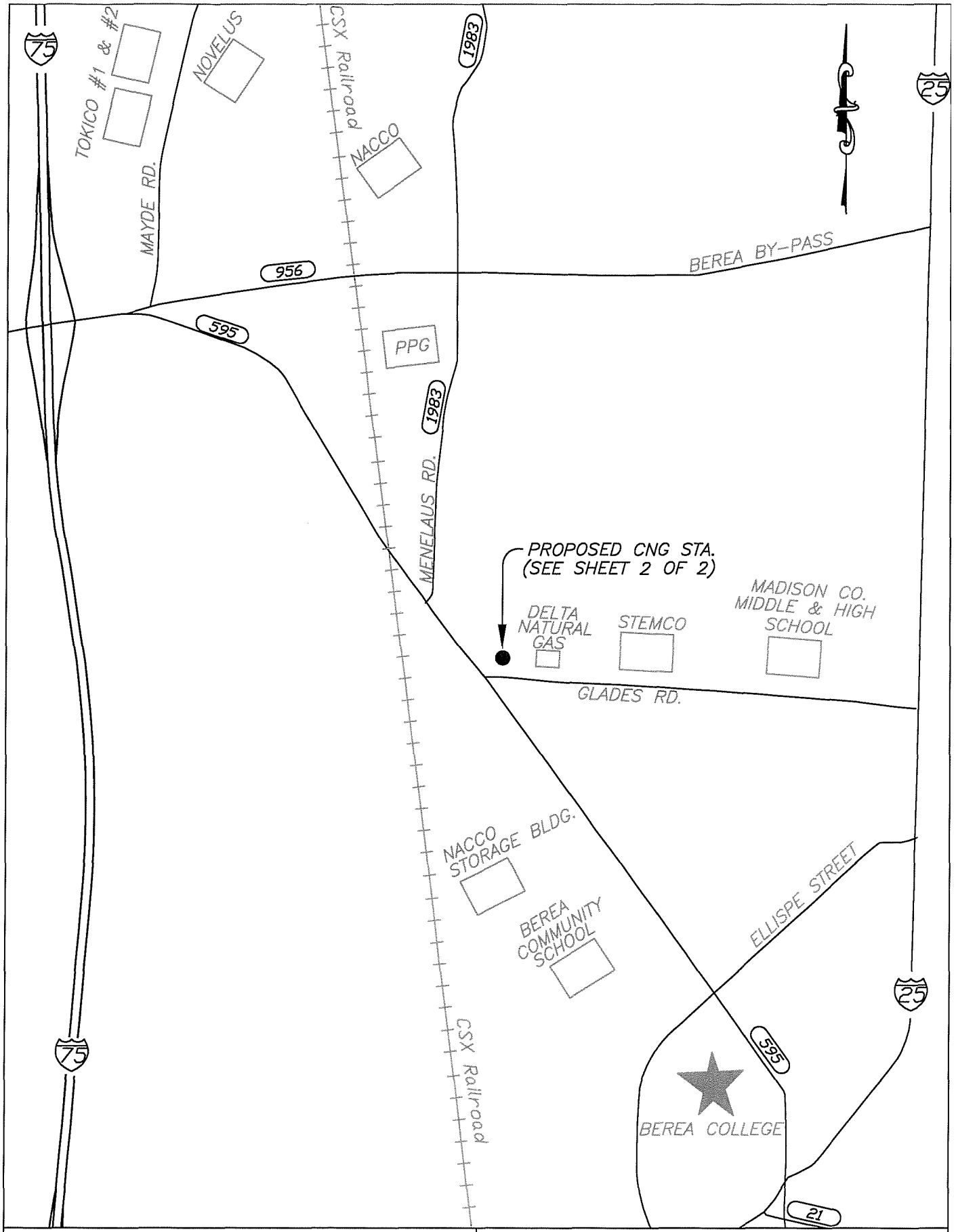
A. It is estimated that annual operating costs will be approximately $20,000. The operation expenses will include electric service, dispenser repairs, compressor oil and filter changes and natural gas filter replacements.

**Q. Describe the schedule for construction of the project.**

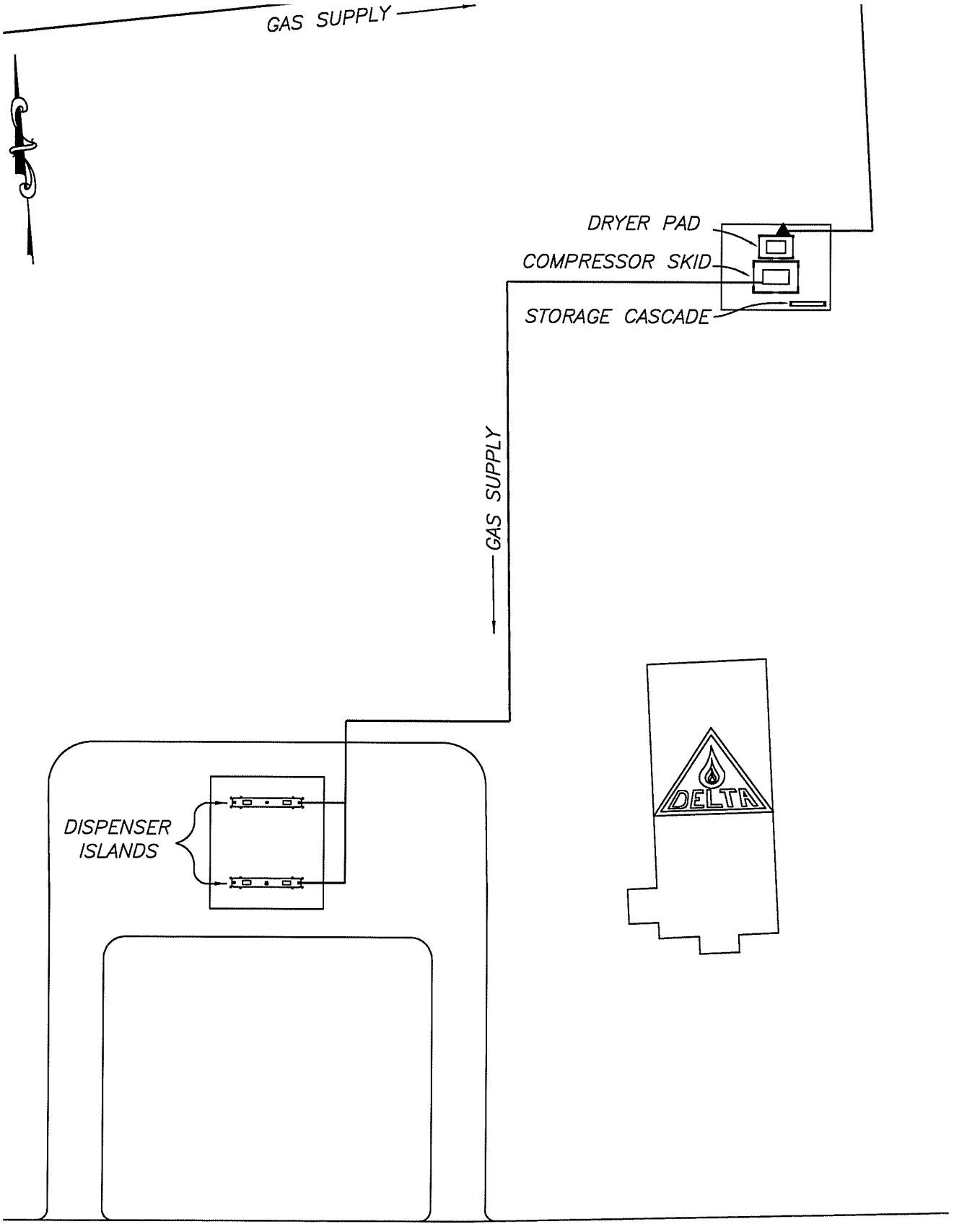
A. The key components of the facility have a projected delivery of twenty four weeks upon receipt of order. Site work including, grading, drainage, installation of conduits, preliminary wiring and other general site construction can be performed prior to equipment delivery. Our goal is to energize the station within 180 days of authorization to commence work, depending on weather conditions.

**Q. Does this conclude your testimony at this time?**

A. Yes it does.




| | |
|---|---|
| LATITUDE: 37°35'15" | USGS QUADRANGLE: Berea, Ky |
| LONGITUDE: 84°17'50" | **"MORPHEW EXHIBIT I"** |




BEREA - PROP. CNG STATION

**"MORPHEW EXHIBIT I"**

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

**In the Matter of:**

| | | |
|---|---|---|
| APPLICATION OF DELTA NATURAL GAS COMPANY, INC. FOR AN ORDER DECLARING THAT IT IS AUTHORIZED TO CONSTRUCT, OWN AND OPERATE A COMPRESSED NATURAL GAS STATION IN BEREA, KENTUCKY | ) ) ) ) | CASE NO. 2013-00365 |

# DIRECT TESTIMONY OF

# MATTHEW D. WESOLOSKY

**Filed: November 22, 2013**

VERIFICATION

STATE OF KENTUCKY )
)
COUNTY OF CLARK )

The undersigned, Matthew D. Wesolosky, being duly sworn, deposes and says he is Vice President - Controller of Delta Natural Gas Company, Inc., that he has personal knowledge of the matters set forth in the following testimony, and the answers contained therein are true and correct to the best of his information knowledge and belief.

**Matthew D. Wesolosky**

Subscribed and sworn to before me by Matthew D. Wesolosky, this the 20th day of November, 2013.

My Commission Expires: 6/20/16

Notary Public, State at Large, Kentucky

OFFICIAL SEAL
EMILY P. BENNETT
NOTARY PUBLIC - KENTUCKY
STATE-AT-LARGE ID # 467350
My Commission Expires June 20, 2016

**Q. Please state your name and business address.**

A. My name is Matthew D. Wesolosky. My business address is 3617 Lexington Road, Winchester, Kentucky, 40391.

**Q. By whom and in what capacity are you employed?**

A. I am employed by Delta Natural Gas Company, Inc. ("Delta") as Vice President – Controller.

**Q. Please describe your professional and educational background.**

A. I received a Bachelor's of Science in Accounting from the University of Kentucky in 1999. I am a Certified Public Accountant in the State of Kentucky. From 1998 through 2001, I worked at Delta as the Accounting Systems Analyst/Coordinator. From 2001 through 2005, I worked in public accounting, including two years at PricewaterhouseCoopers specializing in the utilities industry. From 2005 through 2007, I worked at Delta as the Manager – Internal Controls. From 2007 through 2010, I was employed by Delta as the Manager – Accounting & IT. In 2010 I was named Delta's Vice President – Controller.

**Q. Generally, what are your duties with respect to Delta?**

A. I manage the daily operations of the Accounting and Information Technology Departments. My duties include maintaining Delta's accounting records to ensure the records properly reflect the financial position of the Company in accordance with generally accepted accounting principles and other regulatory requirements. This includes overseeing customer accounting and billing, payroll, property accounting, gas accounting, income tax and corporate accounting functions. Additionally, I routinely

work with Deloitte, whom Delta retains as its independent certified public accounting firm.

**Q. Have you testified previously before the Commission?**

A. Yes, I have been a witness on behalf of Delta in the following proceedings:

- Case No. 2010-00116, *Application of Delta Natural Gas Company, Inc. for an Adjustment of Rates*,
- Case No. 2008-00062, *Application of Delta Natural Gas Company, Inc., for Approval of A Customer Conservation/Efficiency Program and Demand Side Management Cost Recovery Mechanism*, and
- Case No. 2007-00089, *Application of Delta Natural Gas Company, Inc. for an Adjustment of Rates*.

**Q. Are you generally familiar with the business affairs of Delta?**

A. Yes I am.

**Q. What is the purpose of your testimony?**

A. In my testimony, I discuss the financial aspects of constructing and operating a proposed compressed natural gas ("CNG") station on Glades Road in Berea, Kentucky, and the impact such a project would have on the rates of Delta's customers.

**Q. What is the estimated cost to construct the CNG station?**

A. The estimated cost to construct the proposed CNG facility is approximately $1.3 million. Wesolosky Exhibit I provides a detailed breakdown of the cost associated with constructing the CNG station. The testimony of Mr. Jonathan Morphew provides additional detail on the individual components of the station.

**Q. How did Delta estimate the cost to construct the CNG station?**

A. Delta met with both vendors of CNG equipment, as well as other utilities that operate CNG stations. As a result of this process, Delta determined the design of the station and the equipment requirements. The estimated cost is based on vendor pricing to construct a CNG station which could fill up four vehicles simultaneously.

**Q. How does Delta intend to finance the construction of the CNG station?**

A. Similar to its other capital expenditures, Delta would finance the project through either internally generated cash, short-term borrowings under Delta's bank line of credit or a combination thereof.

**Q. Aside from the gas costs and transportation cost that Mr. Brown discusses in his testimony, are there additional operating expenses for the CNG station?**

A. As discussed in the testimony of Mr. Morphew, it is estimated that annually, it will cost $20,000 to operate the station. The station is unmanned with the primary operating expense being electricity to power the station.

**Q. How would constructing the proposed CNG station impact customer rates?**

A. To determine the maximum potential impact to rates, Delta calculated the proposed CNG station's impact on Delta's revenue requirement, assuming no sales from the station (Wesolosky Exhibit II). The calculation assumes a cost of construction of $1,293,000 as calculated in Exhibit I. Using a thirty-three year book depreciable life for the station and a seven-year MACRS depreciable life, the rate base at the end of the first year for the station would be $1,197,000. Utilizing the cost of capital assumptions approved by the Commission in Delta's last general rate case (Case No 2010-00116), Delta would annually earn a return of approximately $95,000 ($153,000 when grossed up for income

taxes). The impact to Delta's cost of service would be approximately $75,000 annually which includes depreciation, property taxes and operating costs. In total, as a result of constructing the CNG station, Delta's annual revenue requirement would increase by $228,000. For Delta's fiscal year-ended June 30, 2013, approximately 51,592,000 CCF were billed under Delta's retail and firm on-system transportation tariffs. Assuming similar volumes, Delta's volumetric rate would increase $.004 per CCF.

**Q. What impact would this have on a residential customer?**

A. In fiscal 2013, Delta's average residential customer consumed 560 CCF per year. Using the maximum potential impact to customer rates, as calculated above, this would equate to $2.24 per year.

**Q. If the preceding calculation assumes no sales from the station, what level of sales could be expected from the station?**

A. As Delta's fleet vehicles in the area surrounding the station require replacement, Delta will purchase CNG vehicles. As discussed in the testimony of Mr. Morphew, Delta anticipates replacing eleven fleet vehicles in the near-term with the potential for an additional twenty-two fleet vehicles. In the short-term, Delta cannot predict what the CNG demand will be from external customers. Mr. Morphew states Delta has been in discussions with local entities with vehicle fleets who have interest in converting existing vehicles to CNG or when vehicles are replaced, purchasing CNG vehicles.

**Q. Will Delta experience reduced operating costs as a result of using the CNG station for its own vehicles?**

A. Yes. The annual fuel cost for a CNG vehicle is lower than a vehicle which uses gasoline. For example, on average Delta's service vehicles drive 18,000 miles per year with an

average fuel economy of 12 mpg. This equates to 1,500 gallons of gasoline per vehicle per year. Assuming an average fuel price of $3.29 per gallon of gasoline the total fuel cost for a vehicle is $4,935.

According to the U.S. Department of Energy[1], one gallon of gasoline equals 126.67 cubic feet of natural gas (1.27 CCF). Therefore, for the same vehicle 1,900 CCF of natural gas would be purchased on an annual basis. Assuming an average natural gas price of .38 per CCF, the total fuel cost for a Delta owned CNG vehicle would be $722, representing a savings of approximately $4,200 per vehicle per year. Delta intends to purchase eleven vehicles in the short-term which would equate to a total savings of $46,200. These savings are not included in the calculation of the revenue requirement above.

**Q. What volume of sales would be necessary for the CNG station to break even?**

A. Of the $228,000 annual revenue requirement, Delta can expect a savings of $46,200 by using CNG to fuel its local fleet, thus leaving $181,800 of revenue requirement to come from external customers. Assuming a $2 per gasoline gallon equivalent ("GGE") price at the pump ($2.54 per CCF) and an estimated gas cost of $.30 per GGE ($.38 per CCF), each GGE sold would provide $1.70 towards the annual revenue requirement, thus requiring an additional 107,000 GGE (136,000 CCF) in sales to break even. If the average fleet vehicle uses 1,500 GGE per year, an additional seventy-two fleet vehicles would be required for the station to break-even.

[1] http://www.afdc.energy.gov/fuels/fuel_comparison_chart.pdf

**Q. Aside from fleet vehicles, how much revenue would be generated by the average CNG vehicle?**

A. According to the 2011 U.S. Department of Transportation 2011 Highway Statistics[2], in 2011 the average light duty vehicle consumed 530 gallons of gasoline annually. Assuming the same $1.70 per GGE contribution towards the revenue requirement, an average light-duty vehicle would contribute $900 annually.

**Q. Since compressed natural gas is considered an alternate fuel, are there any tax incentives available?**

A. Yes. Through the Kentucky Economic Development Finance Authority, there is the Incentives for Energy Independence Act Tax Incentive Program. The program offers sales, payroll and income tax incentives. Delta has applied for incentives under the program; however, the availability or amount of such incentives to Delta is not yet known. Any incentives received will be used to offset the total project cost.

**Q. Does this conclude your testimony at this time?**

A. Yes it does.

[2] http://www.fhwa.dot.gov/policyinformation/statistics/2011/vm1.cfm

Delta Natural Gas Company, Inc.
Case No. 2013 -00365
Testimony of Matthew D. Wesolosky
Wesolosky Exhibit I

Estimated CNG Project Cost

| | | Unit Price | Qty | Extended Price |
|---|---|---|---|---|
| 1 | Two Compressors (972 SCFM (7.4 GGE/Minute) | $ 184,500 | 2 | $ 369,000 |
| 2 | Automatic Regenerative Dryer | 98,650 | 1 | 98,650 |
| 3 | Storage Sphere 3 pack | 93,750 | 1 | 93,750 |
| 4 | Priority/Sequential Panel | 37,900 | 1 | 37,900 |
| 5 | CNG Dispenser | 38,225 | 1 | 38,225 |
| 6 | CNG Dispenser (large vehicle) | 41,880 | 1 | 41,880 |
| 7 | Card Reader | 13,500 | 1 | 13,500 |
| 8 | Additional Card Reader | 6,800 | 1 | 6,800 |
| 9 | Signage | 20,000 | 1 | 20,000 |
| 10 | Dispenser Canopy | 39,600 | 1 | 39,600 |
| 11 | Vertical Discharge Cover | 6,500 | 2 | 13,000 |
| 12 | Materials for Site Preparation (concrete, asphalt) | 338,000 | 1 | 338,000 |
| 13 | **Equipment** | | | **$ 1,110,305** |
| 14 | Installation & Site Prep | 112,000 | 1 | 112,000 |
| 15 | Survey, Engineering & Geo-technical Survey | 56,100 | 1 | 56,100 |
| 16 | Freight | 9,700 | 1 | 9,700 |
| 17 | Training | 5,000 | 1 | 5,000 |
| 18 | **Labor** | | | **$ 182,800** |
| 19 | **Project Cost** | | | **$ 1,293,105** |

**Delta Natural Gas Company, Inc.**
**Case No. 2013 -00365**
**Testimony of Matthew D. Wesolosky**
**Wesolosky Exhibit II**
**Schedule I**
**Impact of CNG Station on Customer Rates**

| | | | |
|---|---|---|---|
| 1 | Total capital expenditures (per Exhibit I) | $ | 1,293,105 |
| 2 | Less: | | |
| 3 | Accumulated depreciation (Schedule II) | | (42,672) |
| 4 | Accumulated deferred income taxes (Schedule II) | | (53,926) |
| 5 | Net Rate Base | | 1,196,506 |
| | | | |
| 6 | WACOC, per case no 2010-00116 | | 7.97025% |
| 7 | Allowed Return | | 95,365 |
| 8 | Tax expansion factor, w PSC (per Case No. 2010-00116) | | 1.60658 |
| 9 | Return, grossed up for income taxes | $ | 153,212 |
| 10 | Cost of service items (Schedule III) | | 75,170 |
| **12** | **Impact to Delta's Revenue Requirement** | **$** | **228,382** |
| | | | |
| 13 | Fiscal 2013 CCF Billed | | |
| 14 | Retail | | 30,556,680 |
| 15 | Firm on-system transportation | | 21,035,290 |
| **16** | **Total throughput** | | **51,591,970** |
| | | | |
| **17** | **Estimated impact to Delta's volumetric rate, per CCF (line 12/line 16)** | **$** | **0.004** |

**Delta Natural Gas Company, Inc.**
**Case No. 2013 -00365**
**Testimony of Matthew D. Wesolosky**
**Wesolosky Exhibit II**
**Schedule II**
**Calculation of Depreciation and Deferred Income Taxes**

| | | | Book | Tax | Cumulative Timing Difference |
|---|---|---|---|---|---|
| 1 | Investment | $ 1,293,105 | | | |
| 2 | Depreciation Rate | | 3.30% | 14.29% {1} | |
| 3 | Depreciation Expense | | (42,672) | (184,733) | |
| 4 | Net Book Value (line 1 - line 3) | | 1,250,433 | 1,108,372 | (142,061) |
| 5 | Statutory Tax Rate (see below) | | | | 37.96% |
| 6 | Deferred Income Tax Liability (line 4 x line 5) | | | | (53,926) |

7 Calculation of Statutory Tax Rate

| | | |
|---|---|---|
| 8 | Federal Tax Rate | 34.00% |
| 9 | State Tax Rate | 6.00% |
| 10 | Federal Benefit of State Taxes | -2.04% |
| 11 | | 37.96% |

{1} Assumes seven year life under MACRS depreciation.

**Delta Natural Gas Company, Inc.**
**Case No. 2013 -00365**
**Testimony of Matthew D. Wesolosky**
**Wesolosky Exhibit II**
**Schedule III**
**CNG Station Cost of Service**

| | | | Total Cost of Service Impact |
|---|---|---|---|
| 1 | Increased depreciation expense (schedule II) | | $ 42,672 |
| 2 | Other operation and maintenance expense | | $ 20,000 |
| 3 | Property tax expense (see below) | | $ 12,498 |
| **4** | **Total Cost of Service Impact** | | **$ 75,170** |
| 5 | **Calculation of property tax expense** | | |
| 6 | Total capital expenditures (Schedule I) | | $ 1,293,105 |
| 7 | Ad valorem tax rate (line 11) | | 0.9665% |
| | | | $ 12,498 |
| 8 | *Per Case 2010-00116, FR10(6)(h) Tab 27, Schedule 5.1* | | |
| 9 | Total taxable value | 144,250,000 | |
| 10 | Property tax expense | 1,394,198 | |
| 11 | Average ad valorem tax rate | 0.9665% | |