# *NATIONAL FUEL GAS DISTRIBUTION CORPORATION*

# PARTNERSHIP FOR NGV PROGRAM

REPORT TO THE NEW YORK STATE
PUBLIC SERVICE COMMISSION

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# I. Background

On June 28, 2011, National Fuel Gas Distribution Corporation ("National Fuel" or the "Company") filed a proposal with the New York State Public Service Commission ("NYPSC" or "Commission") to allow the Company to promote the development of Natural Gas Vehicle ("NGV") applications in its New York service territory, by permitting the Company to buy down (reduce) the initial cost of installing NGV equipment at customer facilities and/or purchase of NGVs. On November 18, 2011, the NYSPC issued an Order in Case 11-G-0348 ("the 2011 Order"), approving the Partnership for NGV Pilot Program.

On December 9, 2014, the Company filed revisions to P.S.C. No. 8 – Gas to extend its Partnership for NGV Pilot Program to March 31, 2018. On May 15, 2015, the NYPSC issued an Order (Case 14-G-0551) ("the 2015 Order"), approving the extension.

On December 19, 2017, the Company filed revisions to P.S.C. No. 9 – Gas to continue the Partnership for NGV Pilot Program, and concurrently make the program tariff permanent. On November 15, 2018, the P.S.C. issued an Order (Case 17-G-0799) to make the NGV Pilot Program a permanent program as of December 1, 2018.

This report is being filed in accordance with the 2011, 2015, and 2018 Orders.

# II. Program Overview

## A. Program Design

National Fuel's Partnership for NGV Program is designed to improve the customer's NGV project economics, by reducing the payback requirements of the customer, through a one-time cost buy down of an NGV Refueling Station facility installation and/or the purchase of NGVs. The buy down for NGV facilities would be recovered from the customer, through future incremental transportation or sales service charges, which are paid to Distribution by the customer. This method assures that buy down costs will be borne by NGV customers on a project-by-project basis.

In accordance with the Orders outlined above, the Company implemented this program on a pilot basis for roughly six years, until it was made a permanent program as of December 1, 2018. The program originally had an annual buy down cap of $1,000,000 per year, for a total program cap of $3,500,000. The subsequent Order established a $3,000,000 cap for 3 years. National Fuel expects that typical buy down per customer will be in the range of $10,000 to $200,000. All participating customers must sign a performance contract with a term of up to six years and will be required to provide security to cover the Company's buy down amount.

## B. Program Objectives and Benefits

The Partnership for NGV program was developed in response to requests from customers and our NGV partners that were actively involved in the installation and operation of NGV facilities/vehicles for customers. Customers and our NGV partners urged National Fuel to become directly involved in improving the marketability of NGVs.

The objectives of the Partnership for NGVs program include the following:

1. Improve project economics to meet the customer's payback requirements.
2. Develop flexible rates designed to meet project requirements.
3. Provide a one-time cost buy down for NGV facilities.
4. Develop a set of measurable deliverables to evaluate the effectiveness of the NGV program and report back to the Commission.
5. Costs to be borne entirely by each project.

Promoting the development of NGVs would benefit Distribution from the high load factor and incremental volumes generated by NGV customers. This type of increased load helps Distribution spread out system fixed costs over larger throughput and improves utilization of the system during the off-peak shoulder and summer months. The overall system improvement then is beneficial for Distribution's ratepayers.

For compressed natural gas customers, NGVs allow them to reduce their overall fuel costs while enhancing our environment and national energy security. NGVs would promote the state's ongoing efforts to maintain and attract employers to New York through reduced operational business costs and increased competitive position.

The New York State Energy plan recognized New York's leadership role in developing NGVs. New York can work with other states, and with transportation and energy associations, to influence vehicle manufacturers to produce alternative fuel vehicles of all types (light-duty and heavy-duty). Having a variety of vehicle types to meet their needs will allow public and private sector fleets to expand their use of these vehicles.

## C. Program Regulatory Reporting Requirements

The reporting requirements, found in Appendix II of the 2011, 2015 and 2018 Orders, are:

1. Documentation and Verification of Project Economics
National Fuel will collect data on refueling facility/vehicle costs, O&M costs, and displaced gasoline/diesel fuel costs to calculate the actual customer payback achieved. These actual costs will be compared to the estimated pro-forma costs, and the results will be used to further refine our analysis on future projects.

2. Evaluation of Performance and Impact of NGVs on the Environment National Fuel will analyze the impact of the NGV project on reducing harmful emissions to the atmosphere.

3. Demonstration of the Reliability of NGVs
National Fuel will monitor the performance of the NGV project to develop a profile of the operational aspects of NGV refueling stations and vehicles, as well as the frequency of planned vs. unplanned maintenance. This will be used to develop a better understanding of NGV refueling stations and vehicle reliability, as well as provide testimonials for future customers questioning NGV reliability.

4. Development of NGV "Best Practices Guide"
National Fuel will monitor the startup of the NGV refueling station and/or new vehicles to document the process and establish a "best practices" procedure guide. The results will be shared with customers and our NGV partners to improve the startup procedures for future installations.

5. Introduction of NGVs to Interested Parties
National Fuel will introduce the NGV concept and associated technologies to design engineers, mechanical/electrical contractors, service companies, legislators, government agencies, etc. Educating these entities on the features and benefits of NGVs will further encourage the advancement of NGVs in western New York.

6. Measurement of Customer Acceptance and Awareness
National Fuel will survey key personnel from each customer to determine customer satisfaction with the NGV project and identify areas of concern or weakness in the design, installation, and operation. This information will be used to improve future installations and increase the awareness of these issues for prospective customers.

7. Collection of Operating/Load Data
National Fuel will collect data on project operating information such as the number of vehicles fueled, miles vehicles driven, natural gas used, gasoline/diesel displaced, cost of natural gas and gasoline/diesel, etc.

## D. NGV Market Overview

Natural gas has been used as a transportation fuel for decades. Although NGVs have become popular over the past few years in our service territory, there are some obstacles to sustaining growth. The decrease in prices of diesel and gasoline, combined with relatively consistent natural gas prices (Figure 1), has increased the payback period for natural gas vehicles. Despite the converging fuel prices, growing environmental concerns and the need to reduce our dependence on imported oil have caused our NGV market to increase, especially among large commercial fleets. National Fuel has seen several large customers convert large portions of their fleet to NGVs in recent years. Some of these customers include [redacted]. Due to these conversions, National Fuel has seen a dramatic increase in natural gas usage over the past few years. However, that growth has slowed somewhat due to a decrease in diesel and gasoline prices mentioned earlier. Figure 2 on the following page illustrates this continued growth for the customers in the NGV Program.

**Figure 1**

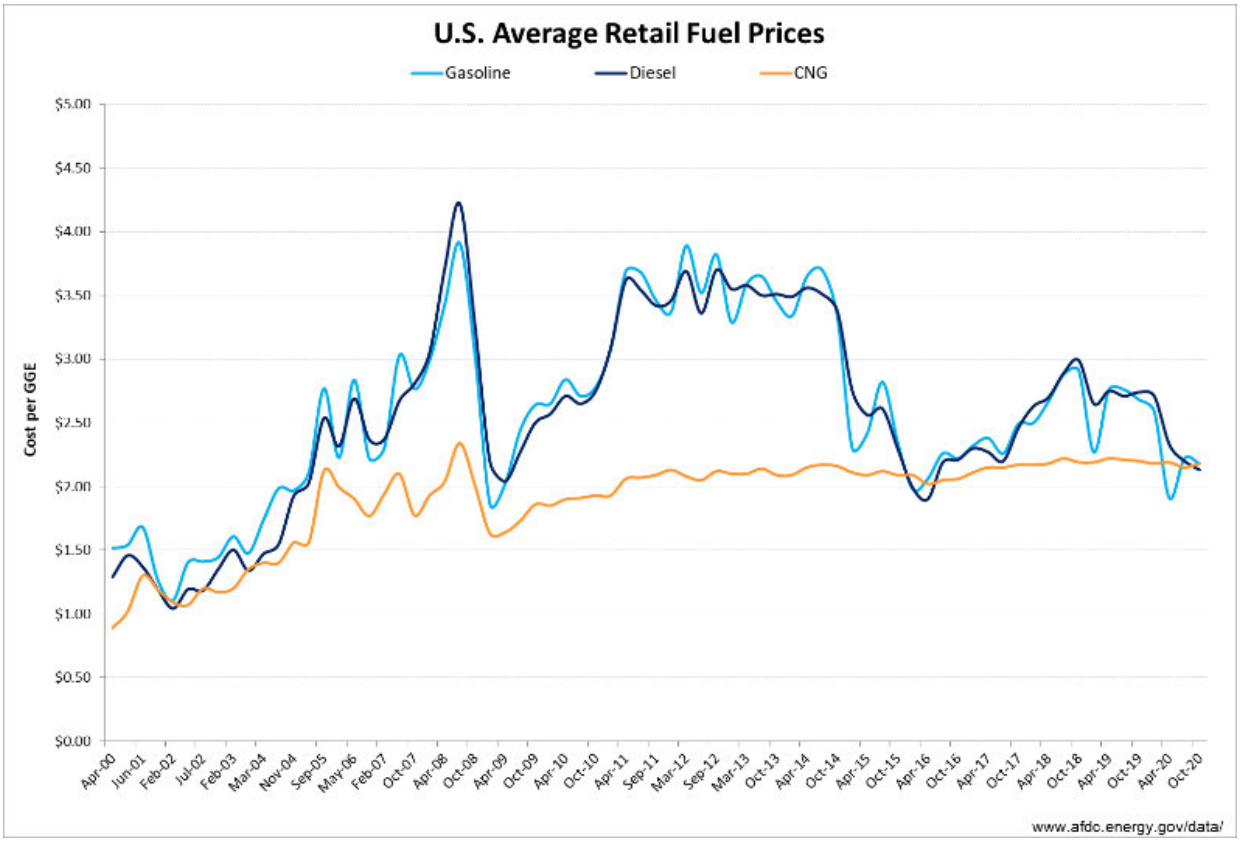
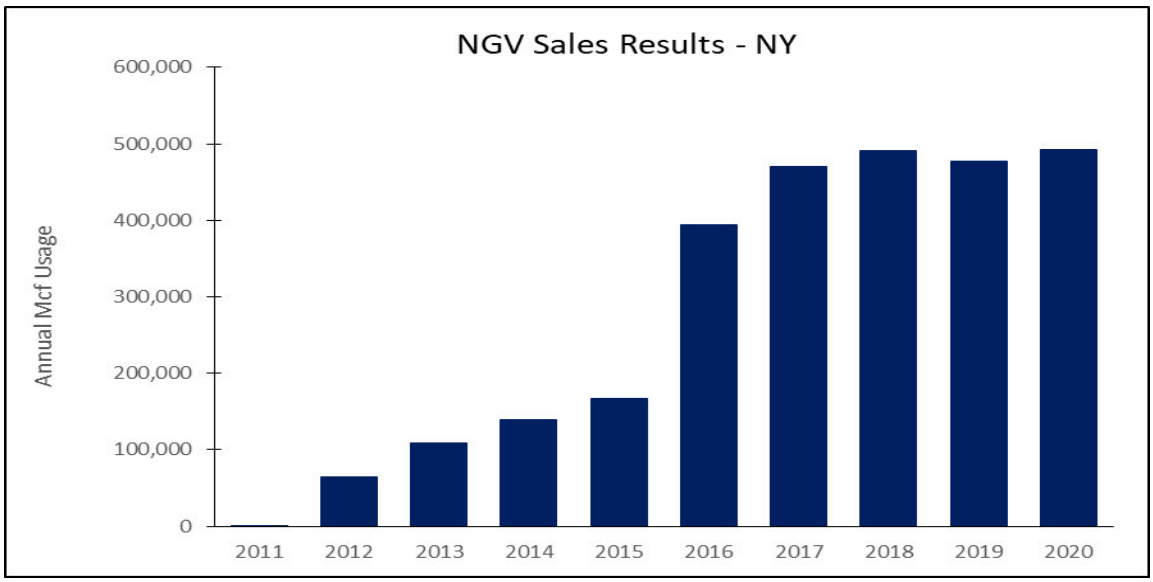


**Figure 2**




The market penetration of NGVs in our NY service territory has made progress in recent years. Several NGV options are now more commonly available compared to past years. These include Heavy Duty vehicles and some select Medium Duty sectors. The Medium Duty vehicles include short-haul delivery trucks, transit buses, and shuttle buses. The Heavy Duty vehicles include transit buses, shuttle, and school buses, tractor trailer trucks, and garbage trucks. However, all of these natural gas vehicles come with an added cost when compared to their gasoline or diesel counterparts. On top of the vehicle's purchase price, Medium Duty vehicles can cost an additional $15,000 to $20,000, and the Heavy Duty vehicles an additional $30,000.

As more vehicles enter the market, we continue to see NGV refueling stations being built to satisfy this market. There are two primary types of stations, time-fill, and fast-fill. The time-fill station is recommended for private fleets with vehicles that return to a central location overnight. The refueling time usually takes 6 to 8 hours, and these stations can cost between $100,000 and $1 million. The fast-fill station is recommended for a public station. The refueling time is usually between 3 and 7 minutes, and these stations can cost $500,000 to $4 million. However, in addition to a time-fill station, some private fleets include a fast fill station option.

At this point in time, these incremental costs, combined with operating fuel prices, result in long payback periods that limit the number of viable projects in National Fuel's service territory.

National Fuel currently has six public access stations and [redacted] in our service territory. The public access stations include:

- American Natural Gas – Former NFG Station at Mineral Springs
- Waste Management – Clean N' Green
- HPW Energy
- American Natural Gas – Try-It Distributing
- Clean N' Green CNG Technologies Corp.
- NEXUS Natural Gas/US Venture

The private access stations include:

The following map illustrates the locations of various CNG stations:

## III. Program Results

### A. Customer Participation

Customer and NGV Partner response to the Partnership for NGV Program continues to be positive and enthusiastic. Customers appreciate the funding and see significant value in National Fuel's direct involvement in promoting and demonstrating a firm commitment to the NGV technology. NGV Partners value National Fuel's participation not only as a means of improving project economics but also because it boosts the credibility of NGV technology as a long-term, reliable alternative to the customer's traditional transportation fuel, as well as increasing the customer's comfort level with NGV technology.

National Fuel's Energy Services Department administers the NGV Program and has been promoting it as a tool to boost the economics of NGV projects. Energy Services conducts preliminary NGV feasibility assessments for its customers and incorporates the NGV Program as an integral piece of its sales and marketing activities.

At the end of 2020, National Fuel had four fully-operational customers under the program. Four of the program participants satisfied their contractual obligations.

1. 

2. [redacted]

[redacted]

3. [redacted]

[redacted]

4. [redacted]

5. [redacted]

6. [redacted]

7. [redacted]

8. [redacted]

**B.** [redacted]

## C. Evaluation of Performance and Impact of NGVs on the Environment

According to the U.S. Department of Energy website, "Natural gas burns cleaner than conventional gasoline or diesel due to its lower carbon content. When used as a vehicle fuel, it can offer life cycle greenhouse gas (GHG) emissions benefits over conventional fuels, depending on vehicle type, drive cycle, and engine calibration. In addition, using natural gas may reduce some types of tailpipe emissions."[1]

In fact, according to the NGVAmerica website, "medium and heavy duty natural gas engines were the first engines to satisfy U.S. Environmental Protection Agency's (EPA) demanding 2010 emission standards for nitrogen oxides (NOx).[2] Many sources suggest that heavy duty vehicles using CNG instead of Diesel produce 70-90% less Carbon Monoxide (CO), 50-75% less non-methane organic gas (NMOG), 75-95% fewer Nitrogen Oxides (NOx), and 20-30% less Carbon Dioxide (CO2) once consumed, while also producing 50% less noise than a diesel engine. With these numbers, converting just one refuse truck from diesel to natural gas reduces as much pollution as taking 325 cars off the road.[3]

The table below shows end use CO2 pounds per gallon equivalent for Diesel and CNG[4]. The end use CO2 Emissions (lbs/gallon) for CNG is 7.77 lbs/gallon less, which has a significant environmental impact.

| **Diesel CO2 Emission** | |
|---|---|
| CO2 Emission(lbs/gallon) | 22.40 |

| **Compressed Natural Gas (CNG) CO2 Emission** | |
|---|---|
| CO2 Emission(lbs/gallon) | 14.63 |

Appendix C shows the environmental impact that NGV Program customers were responsible for during the 2020 calendar year.

[1] U.S. Department of Energy, Energy Efficiency & Renewable Energy, Alternate Fuels Data Center

[2] § NGVAmerica, NGVs and the Environment, www.ngvc.org/about_ngv/ngv_environ html

[3] NGV America NGVs and the Environment, www ngvc.org/about_ngv/ngv_environ.html

[4] https://www.eia.gov/tools/faqs/faq.php?id=307&t=11

As shown in Appendix C, these eight customers would have used 3,719,826 gallons of diesel/gasoline in 2020. Figure 4 shows a breakdown by year of the gallons of diesel/gasoline that have been displaced as a result of these customers converting to CNG. After converting to CNG, these same customers experienced an end-use CO2 reduction of 11,562 MTCO2e in 2020. Overall end-use CO2 reductions for the program amount to 64,975 MTCO2e. Figure 5 shows a breakdown by year of end-use CO2 reduction as a result of these customers converting to CNG.

**FIGURE 4**

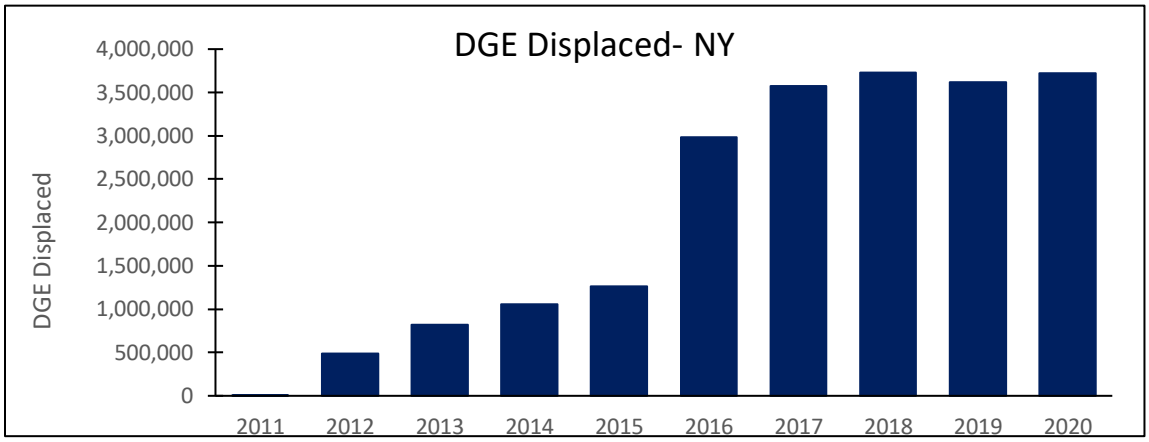
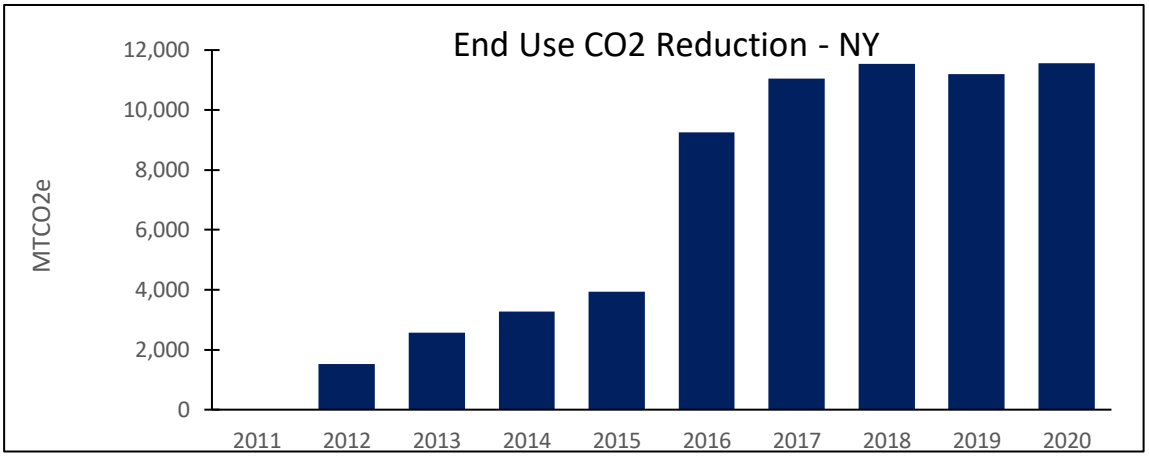



**FIGURE 5**




There is potential for further significant GHG emission reductions by utilizing renewable natural gas (RNG) in conjunction with CNG vehicles. According to a 2018 market assessment study report conducted by [redacted], a leading national NGV marketing consultant, for the Company, there is a Technical Potential of 6.8 Bcf and an Economic Potential of 3 Bcf for CNG in National Fuel's NY service territory. Combined with the potential for readily available carbon-neutral RNG in National Fuel's territory, further significant GHG emission reductions could be achieved by converting heavy-duty fleets in the NY service territory to CNG.

## D. Demonstration of the Reliability of NGVs

As the surveys indicate, participants encountered varying degrees of challenges with their refueling station and/or their CNG vehicles. However, there have been fewer issues in the past few years and several program participants added new CNG vehicles to their fleet in 2020.

[redacted]
With the initially purchased CNG truck, the customer experienced a gravy-like liquid coming out of the fuel filter. It was assumed to be oil leaking through the compressor into the natural gas. This problem caused the customer to replace oil filters at a more frequent rate than expected. After the addition of the seven new trucks, there were additional maintenance issues. The CNG trucks ran less efficiently in the winter than in summer and the customer refueled more often as a result. During the winter the customer also determined that it was necessary to allow the trucks to warm-up for thirty minutes before driving, as opposed to only fifteen minutes of warm-up time for their diesel trucks. These problems surfaced more frequently when the temperature fell below twenty-five degrees Fahrenheit. In 2019, the customer also expressed that maintenance costs over the past couple of years are an average of three times higher for their CNG vehicles. This is due to a combination of more maintenance issues for their CNG trucks, parts and labor being more expensive, and the downtime being significantly longer due to the availability of parts. To mitigate issues with the CNG trucks, [redacted] worked to coordinate more closely with their partners to ensure trucks are flagged for scheduled preventative maintenance. However, due to these issues and the maintenance costs associated with CNG vehicles, [redacted] ceased utilizing CNG vehicles in the April of 2019.

[redacted]
The CNG vehicles have experienced some problems with electronic sensors, cracked exhaust manifolds, piston heads and turbos. In 2017, they experienced a problem with the EGR coolers and ignition boxes. In the past year, the customer has continued to actively work with the manufacturer to resolve repetitive issues with the pistons in their 9 liter engines.

[redacted]
The customer has a ten year lease agreement with a third party to build/own/operate/maintain the refueling station. To date, the station has operated very well. The customer is pleased with the quality of gas coming through, and the station has never gone down since it went into operation. They noted the ability to fuel their trucks 100% of the time since the installation of the NGV station.

The CNG vehicles have provided some issues, but many have been resolved. The CNG trucks had some problems in the cold weather when they were put in service in 2014. The engine air intakes would experience ice crystallization,

which negatively affected CNG vehicle performance. The problem was addressed by placing a cover on the front grill of the truck to minimize crystallization and the trucks operated much more efficiently in the winter. The customer also stated that when the temperature drops below 20 degrees, the trucks need to be warmed up for about twenty minutes, which is longer than their diesel trucks.

In 2019, the customer still experienced some cold weather issues, but most of these issues were a result of ignoring the specified cold-weather warm up guidelines that specify allowing the engine to warm up gradually at a regular idle.

[redacted] fulfilled their contractual obligations and did not report CY 2020 data.

[redacted]
When the trucks were placed into service in 2011, the customer experienced frozen nozzles at truck dispensers during cold weather. The CNG trucks also experienced operational problems during extreme cold and extreme temperature swings. The customer began warming up the trucks for about thirty minutes to address this issue and have also utilized front grill covers during the winter to solve the problem. The refueling station also experienced minor oil leaks, frequent valve changes, and contaminated oil in the gas compressor at times. After installing a dryer they were able to get rid of the moisture issues in the compressor. There have been issues with the [redacted] engines malfunctioning as well. It takes approximately 5 days for [redacted] to rebuild an engine and get the truck back on the road. The customer has been changing the spark plugs more often and seeing more problems with sensors, resulting in them being changed more frequently as well. The trucks are not getting the mileage that [redacted] initially estimated and they had to add an extra fuel tank on to each truck to get the required mileage. On a positive note, the oil replacement interval has been lengthened due to utilizing clean-burning natural gas versus diesel fuel. Throughout the 2015 and 2016 calendar years, the biggest issues with the CNG vehicles were piston failures on the 9 liter engines. [redacted] is releasing a steel piston in the near future, which [redacted] believes will eliminate the problem. In 2017, [redacted] reported continuing issues with the 9 liter engines blowing. In 2019, [redacted] reported that problems with the engines due to piston issues continued, but that everything else has been operating well with the trucks and stations. They will continue to work with the manufacturer to see if the problem can be resolved.

[redacted] fulfilled their contractual obligations and did not report CY 2020 data.

[redacted]
In 2015, the customer experienced some problems with their CNG station. There was a vibration issue with the station equipment that required them to undertake costly repairs during the first year and a half of their project. These costly compression equipment issues have continued in the current year and are skewing the project economics. Due to this, their station maintenance costs over the course of the past 4 years were more costly than anticipated. In 2019, the customer moved away from the supplier of the initial compression and related dispensing equipment and it has been operating better. In 2020, the customer is happy that the CNG vehicles have been operating well overall.

[redacted]
[redacted] has a 6.5-year lease with [redacted] for the CNG trucks. Original issues with the trucks were cleared up during the testing phase in 2015, but [redacted] experienced more problems when the CNG vehicles were in constant operation. During the initial years, there were communication issues between the transmission and engine that caused shifting and economy problems. Additionally, several repairs to the electrical system and PRD components were required. One of the main issues [redacted] faced during 2015 and 2016 was with the original Quantum fuel system, but they have since moved to a pre-assembled system that uses fiberglass to eliminate the issue of corrosion. In the current year, [redacted] also reported issues with motors "running hot" and "valve issues," but the majority of these issues have been linked to a lack of close adherence to regularly scheduled preventative maintenance oil changes and coolant changes/top-offs. Overall, many of the issues [redacted] reported in 2019 were minor issues that could be resolved or lessened by adhering to preventative maintenance schedules and operational procedures. However, their usage dropped significantly in 2019 due to more serious reliability issues that they were experiencing with the [redacted] vehicles. Due to these issues and the complexity of repairs, malfunctioning CNG trucks were off the road for quite some time, which lead to a drop in their CNG usage in 2019.

In 2020, the customer reported more service issues from the first generation trucks. The biggest challenge has continued to be the transmission and engine not communicating properly. This caused a host of issues including check engine lights, engine loss of power, lurching, improper shifting, and transmission shifting/ clutch issues. [redacted] is excited that there is new technology available that will address these issues and will allow them to continue using CNG vehicles for their entire fleet. These newer trucks are also zero emission, which helps them achieve their goal of being environmentally responsible.

They reported that the fuel station has operated flawlessly. [redacted] specifically noted that the twin 400 HP [redacted] compressors have provided the accelerated flow rate to keep their trucks on the road.

[redacted] converted a portion of their fleet to CNG in 2016 and added more vehicles throughout 2017and 2018. In 2019, they added 23 more CNG busses to their fleet. This represents the maximum number that can be safely and efficiently stored, maintained, and refueled at the [redacted] Bus Maintenance Facility. The busses are operating well and [redacted] may make more CNG bus purchases as part of their systematic bus replacement program once current CNG busses reach the end of their useful life.

[redacted]
The customer has 55 CNG buses in their fleet and has been operational throughout 2016. The main issue reported with the vehicles in 2016 was that the system was not user-friendly or intuitive for the drivers. An example of this is the poor placement of the emergency shutoff button. This placement has led to the button being used by mistake. Over time, drivers have become used to the CNG buses and in 2020, the CNG vehicles operated well.

## E. Development of NGV "Best Practices Guide"

Appendix E, The Customer Satisfaction Survey, contains the results of the interviews with key personnel at the NGV program installations. This information was used to monitor and document the design, installation, operation, and utility support phases for these projects. See Section G of this report for a detailed discussion of the results of these surveys.

As the surveys indicate, participants encountered varying degrees of challenges during the design, installation, purchase/conversion and start-up/operation phases of their NGV projects.

Design of NGV station: concerns consist of cold weather consideration (pressure variations), natural gas dryer capacity and design, fueling post layout and fill post metering. Most of these concerns take place during the installation phase. Since then, installations have made appropriate design changes.

In regards to potential issues related to gas composition, Energy Services should reinforce to prospective station operators that their design team should be requesting localized gas composition data from National Fuel, to ensure the station is properly designed to operate as intended. Among others, assumptions that our system supply aligns with the interstate pipeline standard of 7 pounds of water vapor content, is not a safe presumption. Parts of the distribution system, at certain times of the year, may run higher than that amount. Gas pressure specifications should be checked on-site to ensure there are no challenges, such as the ones [redacted] experienced.

Installation of NGV station: concerns include moisture in the fuel/fuel filters and

the credit card readers at the point of sale machines. These concerns were corrected quickly. Customers felt the installations were built well and on-time. However, the customers recommend that local personnel get actively involved in the planning and construction processes.

Purchase/conversion of CNG vehicles: concerns included some delays in the receipt of the vehicles. The delays ranged from one month to seven months. Some other concerns include the sizing of the fuel tanks and the reluctance from the vehicle drivers. The customers agree on the importance of sizing the fuel tank correctly. Based on the ambient temperature outside, the amount of fuel dispensed for a full fill can be significantly impacted, resulting in a reduced mileage range available. This should be accounted for in the cold weather climates.

Start-up and operation of NGV station and vehicles: concerns with the NGV stations included minor oil leaks, valve changes, oil in the gas compressor and frozen nozzles during extreme cold. Customers utilizing public refueling stations have also reported stations being down for a day or two without notice. Mechanical work included water/temperature sensors, exhaust manifolds, piston heads, turbos, oil-like substance in filters and extreme cold weather disruptions. Recently, there have been issues with electrical systems and the pistons in the nine-liter engine systems. These are typically addressed by NGV station installers and engine manufacturers and have been resolved.

This is not surprising given the complex engineering required to design and install a CNG system, and the intricacies that can arise in commissioning any significant mechanical and electrical system.

To improve CNG vehicle operation, it is essential to adhere to a strict preventative maintenance schedule and follow specified manufacturer operational guidelines. These range from daily tasks such as draining the low-pressure coalescing fuel filter and allowing the vehicle to warm up gradually in cold weather, to regular PM like checking/topping off coolant levels, oil changes, and spark plug changes.

While improvements are underway, customer surveys show that NGV remains a viable technology for suitable applications. Most of these projects encountered few, or no concerns, during their respective design, installation, purchase/conversion of vehicles and start-up process.

Based on the results of all the customer surveys over the last few years, National Fuel has started to develop a Best Practices Guide to share with future prospective NGV customers and contractors. The Guide can be found in Appendix D of this report.

**F. Introduction of NGVs to Interested Parties**

Most of the program participants have allowed potential NGV customers to visit their installation sites. Nothing can replace seeing an NGV installation in person and having the ability to talk to the operating personnel to answer questions about any concerns the customer may have.

National Fuel completed the installation of an upgraded NGV refueling station at its Mineral Spring Works Service Center (MSW) in West Seneca, NY. The MSW refueling station was enhanced to accommodate the increased volume of tractor-trailer customers. The MSW refueling station upgraded its existing compressor capacity from 262 scfm @ 3,000 psi to 470 scfm @ 4,600 psi. This allows the customer to receive a full tank of fuel when refueling. The storage capacity and standard flow rates were increased to expedite the refueling time. The MSW standard flow rates were increased, from 2 gallons gas equivalent (GGE) per minute, to two separate flow rate pumps - 4.5 GGE per minute and 7.5 GGE per minute, respectively. [redacted]

National Fuel has also turned over the day-to-day retail billing operation of the CNG station at MSW to a third party, [redacted] Restrictions in the Company's New York tariff limited the rate the Company can charge for CNG at this location, but [redacted] is not subject to these tariff limitations. [redacted] can charge market-based pricing to NGV customers. This transition was completed in the fall of 2017.

Over the past few years, National Fuel has been involved in several outreach and education initiatives:

- Energy Services developed an NGV sales and marketing brochure to assist with sales calls and training sessions.
- The Company has developed a section of the corporate website dedicated to the education of prospective NGV customers. This also includes a map of current western New York CNG refueling stations open to the public.
- Energy Services has taken a lead role in a local advocacy organization, Clean Communities of WNY (CCWNY), as a member of the steering committee.
- The Company developed and participated in numerous events, including the 2013-2017 Buffalo Auto Shows, CNG 101 training workshops, customer open houses, and tours of existing refueling stations, all of which helped promote the economic and environmental benefit of converting to natural gas vehicles.
- Energy Services has been able to develop relationships with consultants, equipment vendors, suppliers, contractors, trade groups, and funding agencies. These resources have proven to be invaluable

when developing the NGV market.

- Energy Services worked with [redacted] and [redacted] to enhance their station grand opening ceremonies to improve turnout and outreach of events.
- The Company utilized [redacted], an online database of company fleets sorted by county, to locate potential customers in our service territory.
- Energy Services has kept county Economic and Industrial Development Agencies aware of the NGV Program by sending out letters and brochures describing the program.
- Through research, development, and demonstration funding, Energy Services purchased an NGV demonstration vehicle. The [redacted] (pictured below), has been driven to, and displayed at events, to promote natural gas vehicles to customers and businesses.


- In 2017, Energy Services contracted with [redacted], a leading national NGV marketing consultant, to conduct a comprehensive market assessment study of National Fuel's NGV market in our NY service territory. This includes estimates of the technical, economic, and achievable market potential, as well as the development of targeted prospect lists and a sales screening tool to estimate NGV economics for individual customers. This study was completed in September 2018 and Energy Services is utilizing it to develop a prospect list to market NGVs to.
- The Company regularly funds NGV-related studies through GTI's Utilization Technology Development (UTD), including NGV Fueling Appliance Prototype Testing and Evaluations (2.12.E.2), Modular CNG Storage System Investigations (2.15.H), Virtual Pipeline Market Study and Technical Assessment (2.18.J), etc. More information on the 2018 – 2019 projects can be found in the UTD Annual Research Project Summaries (https://www.utd-co.org/Documents/UTD-Annual-Report-Project-Summaries-2018-2019.pdf).

## G. Measurement of Customer Acceptance and Awareness

The results of interviews conducted with participants are provided in Appendix E, the Customer Satisfaction Surveys. To assist in the charts below, the following rating key from the survey can be used:

Rating
1 – Very Poor
2 – Poor
3 – Fair
4 – Good
5 – Very Good

| [redacted] | Rating |
|---|---|
| **Initial Results** | |
| 1) Design of NGV Refueling Station | 4 |
| 2) Installation of NGV Refueling Station | 5 |
| 3) Purchase/Conversion of CNG Vehicles | 5 |
| 4) Utility NGV Support | 5 |
| | |
| **2020 Operating Results** | |
| 5) NGV Operation & Maintenance | 3 |
| Refueling Station | 3 |
| CNG Vehicles | 3 |
| 6) NGV Economics | 3 |
| 7) Overall NGV Project | 3 |
| 8) Future NGV Plans | 5 |

| [redacted] | Rating |
|---|---|
| **Initial Results** | |
| 1) Design of NGV Refueling Station | 5 |
| 2) Installation of NGV Refueling Station | 5 |
| 3) Purchase/Conversion of CNG Vehicles | 4 |
| 4) Utility NGV Support | 5 |
| | |
| **2020 Operating Results** | |
| 5) NGV Operation & Maintenance | 3 |
| Refueling Station | 4 |
| CNG Vehicles | 2 |
| 6) NGV Economics | 5 |
| 7) Overall NGV Project | 4 |
| 8) Future NGV Plans | 5 |

| [redacted] | Rating |
|---|---|
| **Initial Results** | |
| 1) Design of NGV Refueling Station | 5 |
| 2) Installation of NGV Refueling Station | 5 |
| 3) Purchase/Conversion of CNG Vehicles | 5 |
| 4) Utility NGV Support | 5 |
| | |
| **2020 Operating Results** | |
| 5) NGV Operation & Maintenance | 5 |
| Refueling Station | 5 |
| CNG Vehicles | 5 |
| 6) NGV Economics | 5 |
| 7) Overall NGV Project | 5 |
| 8) Future NGV Plans | 3 |

| [redacted] | Rating |
|---|---|
| **Initial Results** | |
| 1) Design of NGV Refueling Station | 5 |
| 2) Installation of NGV Refueling Station | 5 |
| 3) Purchase/Conversion of CNG Vehicles | 3 |
| 4) Utility NGV Support | 4 |
| | |
| **2020 Operating Results** | |
| 5) NGV Operation & Maintenance | 5 |
| Refueling Station | 5 |
| CNG Vehicles | 5 |
| 6) NGV Economics | 5 |
| 7) Overall NGV Project | 5 |
| 8) Future NGV Plans | 3 |

**Summary**

Overall, National Fuel is encouraged by the positive response to the Company's support of customer NGV projects. While there are some concerns about CNG vehicles and refueling stations, which require additional work and troubleshooting, National Fuel is able to provide value through NGV funding and adequate infrastructure.

## H. Collection of Operating/Load Data

[redacted] fulfilled its contractual obligations in the NGV Program. They did not provide CY 2020 data for this report.

[redacted]
The customer had 71 vehicles in their CNG fleet in 2020 and experienced an average gas cost savings per DGE of $0.88. This provided an annual fuel savings of $491,434 for the entire fleet in 2020. Overall fuel savings for [redacted] is $5,787,036.

Appendix F provides a detailed breakdown of operating and load information.

[redacted] fulfilled its contractual obligations in the NGV Program. They did not provide CY 2020 data for this report.

[redacted] fulfilled its contractual obligations in the NGV Program. They did not provide CY 2020 data for this report.

[redacted]
The customer had 45 vehicles in their CNG fleet in 2020 and experienced an average gas cost savings per DGE of $0.82. This provided an annual fuel savings of $230,233 for the entire fleet in 2020. Overall fuel savings for [redacted] is $727,436.

Appendix F provides a detailed breakdown of operating and load information.

[redacted]
The customer had 48 vehicles in their CNG fleet in 2020 and experienced an average gas cost savings per DGE of $1.26. This provided an annual fuel savings of $1,397,880 for the entire fleet in 2020. Overall fuel savings for [redacted] is $8,846,417.

Appendix F provides a detailed breakdown of operating and load information.

[redacted]
The customer had 109 vehicles in their CNG fleet in 2020 and experienced an average gas cost savings per DGE of $1.30. This provided an annual fuel

savings of $1,608,896 for the entire fleet in 2020. Overall fuel savings for [redacted] is $4,209,572.

Appendix F provides a detailed breakdown of operating and load information.

[redacted]
The customer had 55 vehicles in their CNG fleet in 2020 and experienced an average gas cost savings per GGE of $1.47. This provided an annual fuel savings of $64,157 for the entire fleet in 2020. Overall fuel savings for [redacted] is $1,360,446.

Appendix F provides a detailed breakdown of operating and load information.

Summary

These customers consumed 491,944 Mcf of natural gas in 2020. With fuel savings averaging around $1.28, between diesel/gas and CNG in 2020, customers saved $5,220,172 on fuel in 2020. Overall, customers saved $30,040,493 on fuel costs, through their participation in the Company's program.

Appendix F provides a detailed breakdown of operating and load information.

## IV. Conclusion

Overall, National Fuel is pleased with the NGV Program to date, and the customer and emission reduction benefits it has facilitated. Customers have responded very favorably to this initiative, citing the availability of the "buy down" as an important factor in making their projects a reality.

Between now and the next annual report, the Company will continue to promote the program, as well as continue to monitor the NGV refueling installations and vehicle conversions, until their contractual reporting commitments expire. An emphasis will be placed on timely data collection and evaluation processes, ensuring the highest level of data accuracy and a meaningful evaluation of the program by the Commission.

Finally, although the payback periods are lengthening due to the decline in diesel prices, National Fuel will continue to promote the feasibility of NGVs in our service territory, from both an economic and environmental perspective. The Company will also continue to educate potential customers through outreach and education events.

# V. Appendices

## Appendix A: Program Results Summary Table

# APPENDIX A - PROGRAM RESULTS SUMMARY

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **NATIONAL FUEL GAS DISTRIBUTION CORP.** | | | | | | | | | | |
| **Natural Gas Vehicle (NGV) Program** | | | | | | | | | | |
| **Report to the NY Public Service Commission** | | | | | | | | | | |
| | | | | | | | | | | |
| **Reporting Period: January 1, 2020 December 31, 2020** | | | | | | | | | | |
| | | | | | | | | | | |
| **I. NFGDC Pilot Program Information** | | | | | | | | | | |
| | | | | | | | | | | |
| **Program Participant** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | **Program Totals** |
| | | | | | | | | | | |
| Location | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | |
| Month/Year Program Contract started | June 2012 | February 2013 | March 2013 | August 2014 | June 2015 | December 2015 | April 2016 | January 2017 | | |
| Estimated Annual Incremental Volume (Mcf) | 48,789 | 1,388 | 46,971 | 15,241 | 52,500 | 156,000 | 98,000 | 109,000 | | **527,889** |
| Estimated Annual Incremental Margin | $ 67 017 | $ 14 732 | $ 56 999 | $ 29 586 | $ 76 964 | $ 108 342 | $ 76 253 | $ 77 138 | | **$ 507,031** |
| Buydown Amount | $ 160,000 | $ 16,000 | $ 180,000 | $ 86,195 | $ 146,000 | $ 387,401 | $ 200,000 | $ 284,721 | | **$ 1,460,317** |
| Simple Payback on Buydown (years) | 2.4 | 1.1 | 3.2 | 2.9 | 1.9 | 3.6 | 2.6 | 3.7 | | |
| | | | | | | | | | | |
| **II. NGV Project Information** | | | | | | | | | | |
| | | | | | | | | | | |
| **A. Vehicles** | | | | | | | | | | |
| 1. Number of CNG Vehicles | | | | | | | | | | |
| - Estimated number for buydown | 45 | 1 | 44 | 43 | 24 | 55 | 200 | 70 | | **482** |
| - Actual number as of 12/31/20 | 71 | 0 | N/A | N/A | 45 | 48 | 55 | 109 | | **328** |
| | | | | | | | | | | |
| 2. Type of CNG Vehicles | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | |
| | | | | | | | | | | |
| 3. CNG Vehicle Manufacturer | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | N/A | N/A | | |
| | [redacted] | [redacted] | [redacted] | [redacted] | | [redacted] | | | | |
| | | | | | | | | | | |
| **B. Refueling Station** | | | | | | | | | | |
| 1. Type of Refue ing Station Used | Own Private Station | NFG Public Station | Own Public Station | Own Public Station | Own Pub ic Station | Own Private Station | Own Pub ic Station | Own Private Station | | |
| 2. Refueling Station Manufacturer | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| *Customers satisfied their contractual obligation and did not report CY 2020 numbers | | | | | | | | | | |

## Appendix B: Documentation and Verification of Project Economics

# APPENDIX B - ANNUAL SUMMARY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **NATIONAL FUEL GAS DISTRIBUTION CORP.** | | | | | |
| **Natural Gas Vehicle (NGV) Program** | | | | | |
| **Report to the NY Public Service Commission** | | | | | |
| | | | | | |
| | | | | | |
| **Reporting Period: January 1, 2020 - December 31, 2020** | | | | | |
| | | | | | |
| | | | | | |
| **I. Customer Pro Forma Economics** | | | | | |
| | | | | | |
| **A. Estimated Capital Costs** | | | | | |
| 1. NGV Refueling Station Installed Cost | $ 2,000,000 | | | $ 2,000,000 | |
| 2. Total CNG Vehicle Incremental Cost | | | | | |
| - Per Vehicle | $ 45,000 | | | $ 30,000 | |
| - Total Vehicles over 6 years | 24 | | | 55 | |
| - Total Cost | 1,080,000 | | | 1,650,000 | |
| 3. Total NGV Project Cost | **$ 3,080,000** | | | **$ 3,650,000** | |
| 4. Grants | | | | | |
| - NYSERDA / NYPA / ESD | $ 1,000,000 | | | $ - | |
| - NFGDC | $ 146,000 | | | $ 387,401 | |
| - Total | $ 1,146,000 | | | $ 387,401 | |
| 5. Net NGV Project Cost | **$ 1,934,000** | | | **$ 3,262,599** | |
| | | | | | |
| **B. Estimated Annual Fuel Usage** | | | | | |
| 1. Individual Vehicle | | | | | |
| - Mileage | 15,737 | Miles | | 115,000 | Miles |
| - Miles per gallon | 5 | Miles per gallon | | 5 | Miles per gallon |
| - Annual Diesel Usage | 3,147 | Gallons | | 23,000 | Gallons |
| - Equivalent Natural Gas Usage | 437.5 | Mcf | | 3,197 0 | Mcf |
| | | | | | |
| 2. Total Fleet | | | | | |
| - # of Vehicles | 24 | Vehicles | | 55 | Tractor/Trailer Trucks |
| - Annual Diesel Usage | 75,539 | Gallons | | 1,265,000 | Gallons |
| - Equivalent Natural Gas Usage | 10,500 | Mcf | | 175,836 | Mcf |
| | | | | | |
| **C. Estimated Annual Fuel Savings** | | | | | |
| 1. Fuel Costs | | | | | |
| - Current Diesel Cost | $ 4.10 | per Gallon | | $ 4.10 | per Gallon |
| - Estimated Natural Gas Cost | $ 8.00 | per Mcf | | $ 8.00 | per Mcf |
| - Equivalent Diesel Cost | $ 1.11 | per DGE | | $ 1.11 | per DGE |
| - Unit Savings | $ 2.99 | per DGE | | $ 2.99 | per DGE |
| | | | | | |
| 2. Current Diesel Fuel Costs | | | | | |
| - Individual Vehicle | $ 12,905 | | | $ 94,300 | |
| - Total Fleet | $ 309,710 | | | $ 5,186,500 | |
| | | | | | |
| 3. New Natural Gas Costs | | | | | |
| - Individual Vehicle | $ 3,500 | | | $ 25,576 | |
| - Total Fleet | $ 84,000 | | | $ 1,406,689 | |
| | | | | | |
| 4. Refueling Station Maintenance Costs | $ 15,108 | | | $ 100,000 | |
| | | | | | |
| 5. Annual Savings | | | | | |
| - Individual Vehicle | $ 9,405 | | | $ 68,724 | |
| - Total Fleet | **$ 210,602** | | | **$ 3,679,811** | |
| | | | | | |
| **D. Estimated Simple Payback** | | | | | |
| 1. Before NGV Grants | 14.6 | Years | | 1 0 | Years |
| 2. After NGV Grants | 9.2 | Years | | 0 9 | Years |
| | | | | | |

# APPENDIX B - ANNUAL SUMMARY REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| **NATIONAL FUEL GAS DISTRIBUTION CORP.** | | | | | | |
| **Natural Gas Vehicle (NGV) Program** | | | | | | |
| **Report to the NY Public Service Commission** | | | | | | |
| | | | | | | |
| | | | | | | |
| **Reporting Period: January 1, 2020 - December 31, 2020** | | | | | | |
| | | | | | | |
| **II. Actual Customer Economics - 2020** | | | | | | |
| | | | | | | |
| **A. Capital Costs** | | | | | | |
| 1. NGV Refueling Station Installed Cost | $ | 1,700,000 | | | $ | 2,000,000 | |
| 2. Total CNG Vehicle Incremental Cost | | | | | | | |
| - Per Vehicle | $ | 25,000 | | | $ | 30,000 | |
| - Total Vehicles over 6 years | | 12 | | | | 55 | |
| - Total Cost | | 300,000 | | | | 1,650,000 | |
| 3. Total NGV Project Cost | **$** | **2,000,000** | | | **$** | **3,650,000** | |
| 4. Grants | | | | | | | |
| - NYSERDA / NYPA | $ | 570,000 | | | | | |
| - NFGDC | $ | 146,000 | | | $ | 387,401 | |
| - Total | $ | 716,000 | | | $ | 387,401 | |
| 5. Net NGV Project Cost | **$** | **1,284,000** | | | **$** | **3,262,599** | |
| | | | | | | | |
| **B. Annual Fuel Usage** | | | | | | | |
| 1. Individual Vehicle | | | | | | | |
| - Mileage | | 31,111 | Miles | | | 102,238 | Miles |
| - Miles per gallon | | 6.0 | Miles per gallon | | | 5 | Miles per gallon |
| - Annual Diesel Usage | | 5,586 | Gallons | | | 22,117 | Gallons |
| - Equivalent Natural Gas Usage | | 741 | Mcf | | | 2,933 | Mcf |
| | | | | | | | |
| 2. Total Fleet | | | | | | | |
| - # of Vehicles | | 45 | Tractor/Trailer Trucks | | | 48 | Tractor/Trailer Trucks |
| - Annual Diesel Usage | | 251,382 | Gallons | | | 1,061,625 | Gallons |
| - Equivalent Natural Gas Usage | | 33,335 | Mcf | | | 140,779 | Mcf |
| | | | | | | | |
| **C. Annual Fuel Savings** | | | | | | | |
| 1. Fuel Costs | | | | | | | |
| - Avg. Diesel Cost for 2019 | $ | 2.81 | per Gallon* | | $ | 2.50 | per Gallon |
| - Estimated Natural Gas Cost | $ | 14.32 | per Mcf | | $ | 8.92 | per Mcf |
| - Equivalent Diesel Cost | $ | 1.99 | per DGE | | $ | 1.24 | per DGE |
| - Unit Savings | $ | 0.82 | per DGE | | $ | 1.26 | per DGE |
| | | | | | | | |
| 2. Current Diesel Fuel Costs | | | | | | | |
| - Individual Vehicle | $ | 15,722 | | | $ | 55,286 | |
| - Total Fleet | $ | 707,472 | | | $ | 2,653,743 | |
| | | | | | | | |
| 3. New Natural Gas Costs | | | | | | | |
| - Individual Vehicle | $ | 10,605 | | | $ | 26,164 | |
| - Total Fleet | $ | 477,239 | | | $ | 1,255,862 | |
| | | | | | | | |
| 4. Refueling Station Maintenance Costs | $ | - | | | $ | - | |
| | | | | | | | |
| 5. Annual Savings | | | | | | | |
| - Individual Vehicle | $ | 5,116 | | | $ | 29,123 | |
| - Total Fleet | **$** | **230,233** | | | **$** | **1,397,880** | |
| | | | | | | | |
| *Customers satisfied their contractual obligation and did not report CY 2020 numbers | | | | | | | |

# APPENDIX B - ANNUAL SUMMARY REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| **NATIONAL FUEL GAS DISTRIBUTION CORP.** | | | | | | |
| **Natural Gas Vehicle (NGV) Program** | | | | | | |
| **Report to the NY Public Service Commission** | | | | | | |
| | | | | | | |
| | | | | | | |
| **Reporting Period: January 1, 2020 - December 31, 202** | | | | | | |
| | | | | | | |
| | | | | | | |
| **I. Customer Pro Forma Economics** | | | | | | |
| | | | | | | |
| **A. Estimated Capital Costs** | | | | | | |
| 1. NGV Refueling Station Installed Cost | | $ 6,027,439 | | | $ 2,000,000 | |
| 2. Total CNG Vehicle Incremental Cost | | | | | | |
| - Per Vehicle | | $ 60,000 | | | $ 15,000 | |
| - Total Vehicles over 6 years | | 70 | | | 200 | |
| - Total Cost | | 4,200,000 | | | 3,000,000 | |
| 3. Total NGV Project Cost | | **$ 10,227,439** | | | **$ 5,000,000** | |
| 4. Grants | | | | | | |
| - NYSERDA / NYPA / ESD | | $ - | | | $ 2,000,000 | |
| - NFGDC | | $ 284,721 | | | $ 200,000 | |
| - Total | | $ 284,721 | | | $ 2,200,000 | |
| 5. Net NGV Project Cost | | **$ 9,942,718** | | | **$ 2,800,000** | |
| | | | | | | |
| **B. Estimated Annual Fuel Usage** | | | | | | |
| 1. Individual Vehicle | | | | | | |
| - Mileage | | 25,785 | Miles | | 25,000 | Miles |
| - Miles per gallon | | 4 | Miles per gallon | | 8 | Miles per gallon |
| - Annual Diesel Usage | | 5,428 | Gallons | | 3,125 | Gallons |
| - Equivalent Natural Gas Usage | | 754.5 | Mcf | | 434.4 | Mcf |
| | | | | | | |
| 2. Total Fleet | | | | | | |
| - # of Vehicles | | 397 | Transit Buses | | 200 | Metro Link Buses |
| - Annual Diesel Usage | | 1,688,168 | Gallons | | 625,000 | Gallons |
| - Equivalent Natural Gas Usage | | 1,273,717,148 | Mcf | | 86,876 | Mcf |
| | | | | | | |
| **C. Estimated Annual Fuel Savings** | | | | | | |
| 1. Fuel Costs | | | | | | |
| - Current Diesel Cost | | $ 1 85 | per Gallon | | $ 2.52 | per Gallon |
| - Estimated Natural Gas Cost | | $ 6.40 | per Mcf | | $ 5.13 | per Mcf |
| - Equivalent Diesel Cost | | $ 0 89 | per DGE | | $ 0.71 | per GGE |
| - Unit Savings | | $ 0 96 | per DGE | | $ 1.81 | per GGE |
| | | | | | | |
| 2. Current Diesel Fuel Costs | | | | | | |
| - Individual Vehicle | | $ 10,042 | | | $ 7,875 | |
| - Total Fleet | | $ 3,986,595 | | | $ 1,575,000 | |
| | | | | | | |
| 3. New Natural Gas Costs | | | | | | |
| - Individual Vehicle | | $ 4,829 | | | $ 2,228 | |
| - Total Fleet | | $ 1,917,025 | | | $ 445,672 | |
| | | | | | | |
| 4. Refueling Station Maintenance Costs | | $ 280,627 | | | $ 100,000 | |
| | | | | | | |
| 5. Annual Savings | | | | | | |
| - Individual Vehicle | | $ 5,213 | | | $ 5,647 | |
| - Total Fleet | | **$ 1,788,942** | | | **$ 1,029,328** | |
| | | | | | | |
| **D. Estimated Simple Payback** | | | | | | |
| 1. Before NGV Grants | | 5.7 | Years | | 4.9 | Years |
| 2. After NGV Grants | | 5.6 | Years | | 2.7 | Years |
| | | | | | | |

# APPENDIX B - ANNUAL SUMMARY REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| **NATIONAL FUEL GAS DISTRIBUTION CORP.** | | | | | | |
| **Natural Gas Vehicle (NGV) Program** | | | | | | |
| **Report to the NY Public Service Commission** | | | | | | |
| | | | | | | |
| | | | | | | |
| **Reporting Period: January 1, 2020 - December 31, 202** | | | | | | |
| | | | | | | |
| **II. Actual Customer Economics - 2020** | | | | | | |
| | | | | | | |
| **A. Capital Costs** | | | | | | |
| 1. NGV Refueling Station Installed Cost | | $ 6,074,288 | | | $ 2,000,000 | |
| 2. Total CNG Vehicle Incremental Cost | | | | | | |
| - Per Vehicle | | $ 54,246 | | | $ 15,000 | |
| - Total Vehicles over 6 years | | 70 | | | 200 | |
| - Total Cost | | 3,797,220 | | | 3 000 000 | |
| 3. Total NGV Project Cost | | **$ 9,871,508** | | | **$ 5,000,000** | |
| 4. Grants | | | $ - | | | |
| - NYSERDA / NYPA | | $ - | | | $ 2,000,000 | |
| - NFGDC | | $ 284,721 | | | $ 200,000 | |
| - Total | | $ 284,721 | | | $ 2,200,000 | |
| 5. Net NGV Project Cost | | **$ 9,586,787** | | | **$ 2,800,000** | |
| | | | | | | |
| **B. Annual Fuel Usage** | | | | | | |
| 1. Individual Vehicle | | | | | | |
| - Mileage | | 31,635 | Miles | | 25,000 | Miles |
| - Miles per gallon | | 4 | Miles per gallon | | 6 | Miles per gallon |
| - Annual Diesel Usage | | 11,030 | Gallons | | 1,471 | Gallons |
| - Equivalent Natural Gas Usage | | 1,463 | Mcf | | 171 | Mcf |
| | | | | | | |
| 2. Total Fleet | | | | | | |
| - # of Vehicles | | 109 | Buses | | 55 | Buses |
| - Annual Diesel Usage | | 1,202,303 | Gallons | | 80,912 | Gallons |
| - Equivalent Natural Gas Usage | | 159,434 | Mcf | | 9 398 | Mcf |
| | | | | | | |
| **C. Annual Fuel Savings** | | | | | | |
| 1. Fuel Costs | | | | | | |
| - Avg. Diesel Cost for 2019 | | $ 2.13 | per Gallon | | $ 2.25 | per Gallon |
| - Estimated Natural Gas Cost | | $ 5 97 | per Mcf | | $ 6.15 | per Mcf |
| - Equivalent Diesel Cost | | $ 0 83 | per DGE | | $ 0.78 | per GGE |
| - Unit Savings | | $ 1 30 | per DGE | | $ 1.47 | per GGE |
| | | | | | | |
| 2. Current Diesel Fuel Costs | | | | | | |
| - Individual Vehicle | | $ 23,495 | | | $ 3,310 | |
| - Total Fleet | | $ 2,560,906 | | | $ 182,051 | |
| | | | | | | |
| 3. New Natural Gas Costs | | | | | | |
| - Individual Vehicle | | $ 8,734 | | | $ 1,052 | |
| - Total Fleet | | $ 952,010 | | | $ 57,840 | |
| | | | | | | |
| 4. Refueling Station Maintenance Costs | | $ 316,737 | | | $ 60,000 | |
| | | | | | | |
| 5. Annual Savings | | | | | | |
| - Individual Vehicle | | $ 14,761 | | | $ 2,258 | |
| - Total Fleet | | **$ 1,292,159** | | | **$ 64,211** | |
| | | | | | | |
| *Customers satisfied their contractual obligation and did n | | | | | | |

## Appendix C: Evaluation of the Impact of NGVs on the Environment

# APPENDIX C - Evaluation of Impact of NGVs on the Environment

| | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
|---|---|---|---|---|---|---|---|---|---|
| **2020** | | | | | | | | | |
| CNG Usage (Mcf) | 69,752 | 61,875 | 17,371 | 140,779 | 159,434 | 9,398 | 33,335 | - | **491,944** |
| Diesel Gallon Equivalent | 526,005 | 466,604 | 130,996 | 1,061,625 | 1,202,303 | 80,912 | 251,382 | - | **3,719,826** |
| End Use CO2 Emmission Reduction (MT) | 1,640 | 1,454 | 408 | 3,309 | 3,748 | 220 | 784 | - | **11,562** |
| | | | | | | | | | |
| **Total Program** | | | | | | | | | |
| CNG Usage (Mcf) | 499,248 | 514,946 | 138,746 | 813,430 | 561,850 | 99,316 | 130,264 | 46,805 | **2,804,605** |
| Diesel Gallon Equivalent | 3,764,865 | 3,883,245 | 1,046,294 | 6,134,134 | 4,236,951 | 855,055 | 982,330 | 352,962 | **21,255,837** |
| End Use CO2 Emmission Reduction (MT) | 11,735 | 12,104 | 3,261 | 19,120 | 13,206 | 2,327 | 3,062 | 160 | **64,975** |

*Figures are for gasoline gallon equivalent

## Appendix D: NGV Equipment “Best Practices” Guide

# APPENDIX D - NGV Equipment "Best Practices" Guide

## I. Background

National Fuel has learned a number of lessons throughout the course of the NGV Pilot Program that are set forth here.

## II. Lessons Learned

### A. Design of NGV station

In regards to potential problems regarding gas quality, the design team should request localized gas composition data from their gas utility in order to ensure the station is properly designed to operate as intended. Assumptions that the utility system supply aligns with the interstate pipeline standard of 7 lbs. of water vapor content is not a safe assumption. Parts of our system at certain times of the year can reach as high as 25 or 30 lbs.

Any time-fill refueling installation should consider individual fill post metering. This will assist the customer in monitoring the vehicle's performance.

### B. Installation of NGV station

Problems included some startup issues such as moisture in the fuel/fuel filters and credit card readers.

The credit card system should also be set up to accept charges up to $150.00. Several customers are fueling large tractors. These vehicles will require a higher amount fuel than the typical car or small truck.

The customers felt the installations should actively involve the local personnel in the planning and construction process. This can assist them in troubleshooting any issues.

### C. Purchase/conversion of CNG vehicles

Some problems included delays in the receipt of the vehicles. The delays ranged from one month to seven months.
Other problems involved the reluctance of the drivers. This can be resolved by educating and training the drivers. Many of the drivers assumed that natural gas was more dangerous than diesel fuel. Once they were trained properly, the

drivers were more comfortable driving the NGV's.

The customers agreed on the importance of sizing the fuel tank correctly. Based on the ambient temperature outside, the mileage can be significantly impacted. This should be accounted for in the cold weather climates.

## D. Start-up and operation of NGV station and vehicles

Any station design should consider cold weather variations. One customer experienced frozen nozzles at the truck dispensers. This was corrected during the previous winter but has reoccurred this past winter. Some minor oil leaks, valve changes and oil leaking into the gas compressor were discovered during operation.

The vehicles experienced a fair amount of problems. The problems ranged from water/temperature sensors, exhaust manifolds, turbos, oil like substance in filters and extreme cold weather disruptions.

Some customers discovered a gravy-like substance coming out of their oil filters. The substance was determined to be oil leaking through the compressor into the natural gas. This problem appears to be corrected with the newly designed stations.

During extremely cold weather, ice crystallization has occurred in the air intake from the intercooler. This caused the trucks to not operate properly. The resolution was to place a cover on the front grill of the truck to minimize the crystallization. It is also important to allow the CNG truck to warm up gradually per the manufacturer's guidelines in cold weather. Drivers should avoid "gunning" the engine to try and warm the vehicle up faster as this causes large volumes of already cold air to flow across the charge air cooler, which further reduces the temperature of the engine. During cold weather, CNG trucks should be gradually warmed up with the engine at an idle.

Another factor affecting the economics of these NGV projects is the diesel fuel trucks operated about 20% more efficient than the CNG trucks. The diesel trucks got about 5 to 6 miles per gallon and the

CNG trucks are getting 3.5 to 4 miles per gallon. This needs to be accounted for when analyzing the projected payback.

There has also been an issue with pistons in the 9 liter engines. [redacted] is coming out with the steel version of the piston, which they believe will solve the issue. Going forward, it is important to stay up to date on common problems that several customers are experiencing. In this case, we can relay the information gleaned from one customer to any others who are experiencing similar issues.

To improve CNG vehicle operation, it is essential to adhere to a strict preventative maintenance schedule and follow all provided operational guidelines. With CNG vehicles, it is essential to follow the established preventative maintenance and operational guidelines. These range from daily tasks such as draining the low-pressure coalescing fuel filter and allowing the vehicle to warm up gradually in cold weather, to regular PM like checking/topping off coolant levels, oil changes, and spark plug changes.

## Appendix E: Measurement of Customer Acceptance and Awareness

# APPENDIX E: Measurement of Customer Acceptance and Awareness

| | [redacted] | [redacted] | [redacted] | [redacted] |
|---|---|---|---|---|
| **Initial Results** | | | | |
| 1) Design of NGV Refueling Station | 4 | 5 | 5 | 5 |
| 2) Installation of NGV Refueling Station | 5 | 5 | 5 | 5 |
| 3) Purchase/Conversion of CNG Vehicles | 5 | 4 | 5 | 3 |
| 4) Utility NGV Support | 5 | 5 | 5 | 4 |
| **2018 Operating Results** | | | | |
| 5) NGV Operation & Maintenance | 3 | 3 | 5 | 5 |
| Refueling Station | 3 | 4 | 5 | 5 |
| CNG Vehicles | 3 | 2 | 5 | 5 |
| 6) NGV Economics | 3 | 5 | 5 | 5 |
| 7) Overall NGV Project | 3 | 4 | 5 | 5 |
| 8) Future NGV Plans | 5 | 5 | 3 | 3 |

**Scale:**

1 - Very Poor
2 - Poor
3 - Fair
4 - Good
5 - Very Good

## Appendix F: Collection of Operating/Load Data

# APPENDIX F - Collection of 2020 Operating/Load Data

| | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | Total/Average |
|---|---|---|---|---|---|---|---|---|---|
| **Fuel Costs** | | | | | | | | | |
| Avg. Diesel Cost (per gallon) | $ 2.06 | $ 3.13 | $ 3.05 | $ 2.50 | $ 2.13 | $ 2.25 | $ 2.81 | $ - | $ 2.24 |
| Avg. Natural Gas Cost (per Mcf) | $ 8.49 | $ 5.11 | $ 6.70 | $ 8.92 | $ 5.97 | $ 6.15 | $ 14.32 | $ - | $ 6.96 |
| Avg. Natural Gas Cost (per DGE) | $ 1.18 | $ 0.71 | $ 0.93 | $ 1.24 | $ 0.83 | $ 0.78 | $ 1.99 | $ - | $ 0.96 |
| Avg. Gas Cost Savings (per DGE) | $ 0.88 | $ 2.42 | $ 2.12 | $ 1.26 | $ 1.30 | $ 1.47 | $ 0.82 | $ - | $ 1.28 |
| **Individual Vehicle** | | | | | | | | | |
| Avg. Annual Miles per Vehicle | 24,385 | 2,080 hours | 12,000 | 102,238 | 31,635 | 25,000 | 31,111 | - | 226,369 |
| Natural Gas Usage (Mcf) | 982 | 1,316 | 404 | 2,933 | 1,463 | 171 | 741 | - | 8,010 |
| Diesel Gallons Displaced | 7,409 | 9,928 | 3,046 | 22,117 | 11,030 | 1,471 | 5,586 | - | 60,588 |
| Annual Fuel Savings | $ 6,922 | $ 24,349 | $ 6,585 | $ 29,123 | $ 14,761 | $ 2,257 | $ 5,116 | $ - | $ 89,113 |
| **Total Fleet** | | | | | | | | | |
| Number of Vehicles | 71 | 47 | 43 | 48 | 109 | 55 | 45 | - | 418 |
| Natural Gas Usage (Mcf) | 69,752 | 61,875 | 17,371 | 140,779 | 159,434 | 9,398 | 33,335 | - | 491,944 |
| Diesel Gallons Displaced | 526,005 | 466,604 | 130,996 | 1,061,625 | 1,202,303 | 80,912 | 251,382 | - | 3,719,826 |
| Annual Fuel Savings | $ 491,434 | $ 1,144,420 | $ 283,152 | $ 1,397,880 | $ 1,608,896 | $ 64,157 | $ 230,233 | $ - | $ 5,220,172 |
| **Overall Fuel Savings** | | | | | | | | | |
| **Entire Program** | **$ 5,787,036** | **$ 7,294,631** | **$ 1,308,032** | **$ 8,846,417** | **$ 4,209,572** | **$ 1,360,446** | **$ 727,436** | **$ -** | **$ 30,040,493** |
| 2020 | $ 491,434 | $ 1,144,420 | $ 283,152 | $ 1,397,880 | $ 1,608,896 | $ 64,157 | $ 230,233 | $ - | $ 5,220,172 |
| 2019 | $ 822,061 | $ 999,395 | $ 308,352 | $ 1,637,953 | $ 1,223,626 | $ 298,179 | $ 199,141 | $ 11,601 | $ 5,500,309 |
| 2018 | $ 904,654 | $ 931,843 | $ 185,502 | $ 1,887,963 | $ 971,663 | $ 456,934 | $ 136,733 | $ 36,872 | $ 5,512,164 |
| 2017 | $ 594,861 | $ 803,067 | $ (17,618) | $ 2,078,660 | $ 405,387 | $ 414,530 | $ 117,893 | $ 64,319 | $ 4,461,098 |
| 2016 | $ 464,856 | $ 592,976 | $ 10,934 | $ 1,621,416 | | $ 126,646 | $ 30,323 | $ 79,944 | $ 2,927,095 |
| 2015 | $ 226,997 | $ 733,731 | $ 44,282 | $ 222,545 | | | $ 13,114 | $ 80,069 | $ 1,320,738 |
| 2014 | $ 1,174,908 | $ 1,067,339 | $ 242,394 | | | **N/A** | | $ 146,149 | $ 2,630,790 |
| 2013 | $ 1,107,264 | $ 1,021,860 | $ 251,034 | | | | | $ 87,968 | $ 2,468,126 |

*Customers satisfied their contractual obligation and did not report CY 2020 numbers

**[redacted] numbers are per GGE

## Appendix G: NGV – Related Articles, Press Releases, Etc.

- Business First article (4/9/2014) on NGV Pilot
- Business First article (4/25/2014) on NGV Pilot
- Cheektowaga Bee article (2/6/2014) on NGV Pilot
- National Fuel article on [redacted] NGV project
- NYSERDA article (2/22/2012) on [redacted] NGV project
- West Seneca Bee article (10/27/2011) on [redacted] NGV project
- Sonwil Distribution Press Release (1/2/2014) on NGV project
- Business First article (5/10/2013) on [redacted] NGV project
- NYSERDA article (12/13/2013) on [redacted] NGV project
- Business First article (9/1/2015) on [redacted] NGV project
- Buffalo News article (8/30/2015) on [redacted] NGV project
- Business First article (9/2/2015) on [redacted] NGV project
- Buffalo News article (8/31/2015) on [redacted] CNG Station projects