



Initiative for Resiliency in  
Energy through Vehicles

# Natural Gas Vehicles and Emergency Response



New York/New Jersey Port Authority natural gas vehicle based at Newark Airport, NJ.

June 2016

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## Natural Gas Vehicles have the potential to help communities during system-wide emergencies and build resilience by diversifying an emergency response fleet.

If a storm or other emergency disrupts a region's primary fuel supply, emergency managers should be able to turn to public and private natural gas vehicle (NGV) fleets to help during the emergency.

By knowing the location of NGV refueling facilities and NGV fleets, emergency managers will be able to better prepare for and respond to disasters.

**Natural gas** is typically used to power medium- and heavy-duty vehicles, such as buses, tractor-trailers, and refuse trucks – all of which perform critical services during emergencies. Converting a portion of the fleet to natural gas or bi-fuel NGVs can ensure that these services are performed in the event of a fuel supply disruption. NGV fleets also often have a dedicated fueling source which, if backed-up by a generator, could provide a consistent fuel supply during emergencies. Natural gas is typically supplied via underground pipeline as well, which is less subject to disruption than gasoline or diesel supplies. In the event that a fleet does not have a dedicated fuel supply, they may use one of the nearly 1,000 public refueling stations nationwide.<sup>1</sup>

NGVs also have economic and environmental benefits that will improve emergency response and other fleets. NGVs can save a fleet tens of thousands of dollars in fuel savings over the lifetime of the vehicle,

compared to conventional gasoline or diesel, and emit 15 to 20 percent less heat-trapping gases than gasoline when burned in today's typical vehicle. In addition, natural gas is domestically produced, and its use can strengthen U.S. energy security.

While NGVs can be a valuable asset during emergency situations, they also are vulnerable to roadway and infrastructure conditions. Refueling sites also may be inoperable during power outages, unless an on-site generator is available. Fleet managers should consult local codes, as well as building and vehicle safety guidelines before converting to NGVs or installing natural gas infrastructure.

The following pages include examples of cities and states that have used natural gas vehicles during emergencies, and provide additional information that fleet and emergency managers should consider when incorporating NGVs into their fleet.

## Natural Gas Vehicles in Disasters

### PROS:

- ✓ Used in light, medium, and heavy duty vehicles that perform critical services during emergencies
- ✓ Bi-fuel NGVs are able to run on two separate fuels
- ✓ Access to established infrastructure network or dedicated fuel source
- ✓ Natural gas is normally supplied via underground pipeline, which is more resilient

### CONS:

- ✗ Refueling sites vulnerable to power outage unless generator is available
- ✗ Fuel most cost-competitive when gasoline and diesel prices are high

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## CASE STUDY

# Port Authority of New York and New Jersey



**This CNG Street Sweeper is one of many alternative fuel vehicles the Port Authority has introduced into its fleet.<sup>2</sup>**

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**During Superstorm Sandy, the Port Authority of New York and New Jersey used Compressed Natural Gas (CNG) vehicles to provide critical services when gasoline was in short supply.**

The Port Authority builds, operates, and maintains transportation and trade infrastructure assets, and the agency's network of aviation, ground, rail, and seaport facilities is amount the busiest in the country. A critical part of this program is providing maintenance, security and support through the Port Authority's Central Automotive Division, including a fleet of over 2,000 vehicles that has been recognized as one of the "Greenest Fleets in America."<sup>3</sup> The Port Authority has been working with the U.S. Department of Energy's local Clean Cities Coalition, the New Jersey Clean Cities Coalition, and Empire Clean Cities and their Empire Green Fleets Program.

One of the key elements in deciding to add CNG to the Port Authority fleet was maintaining fuel diversity as part of an emergency response strategy. During Superstorm Sandy, alternative fueled vehicles were able to provide critical supplies to fleets that were

unable to operate due to the lack of power at traditional gasoline and diesel refueling sites. Recently, a number of new Ford F350 work trucks were purchased through a local dealer, and were fitted to operate on natural gas. The F350s are deployed at public sites, including the Lincoln and Holland Tunnels, LaGuardia, John F. Kennedy and Newark Liberty International airports and the George Washington Bridge. There are total of 56 bi-fuel (gasoline or natural gas) new support vehicles in this fleet, with plans to add an additional 42 vehicles in 2016. These vehicles will be an essential element in emergency response, and the ability to operate on two different fuels increases their usefulness during power outages, and also doubles the range of the vehicle in normal operation.

The Port Authority has also partnered with Clean Energy Fuels to build public access CNG refueling stations at Newark, LaGuardia, and JFK airports, and on Port Authority headquarters in Jersey City, NJ. These sites are supported by natural gas generators which are able to provide backup power during disaster recovery.

Integrating CNG vehicles into the Port Authority fleet has lowered both emissions and operating costs while maintaining critical services. According to Aldo Nuzzolese from the Port Authority's Central Automotive Division, the addition of these vehicles will eliminate over 156 tons of emissions, and save over \$650,000 in operating costs over the life of the vehicles. This directly ties into the Port Authority's mission to green their fleet, diversify their fuel sources through the use of alternative fuels, and save on operating costs.

# Natural Gas Jitneys in Atlantic City



**Jitney minibuses assisted with evacuation and transportation needs during and after Superstorm Sandy.<sup>4</sup>**

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**Natural gas minibuses - known locally as “jitneys” - were called into action during and after Superstorm Sandy hit the shores of Atlantic City, New Jersey in November, 2012.**

As the storm was building, the demand for gasoline spiked along the eastern seaboard as thousands evacuated, and others stocked up on fuel. During and after the hurricane, power outages and supply chain disruptions led to gasoline shortages, which compromised recovery efforts. However, Atlantic City turned to its fleet of 190 natural gas jitneys, which were largely unaffected by the storm.

Atlantic City’s main form of public transportation is a fleet of owner-operated minibuses called Jitneys. With help from a New Jersey Clean Cities Recovery Act grant, in which more than 300 vehicles belonging to 15 public and private fleets were transitioned to CNG and 6 CNG fueling stations were constructed across the state, Atlantic City replaced its aging jit-

neys with new models running on natural gas. When Superstorm Sandy hit the east coast, these vehicles were used for the evacuation, and because they had a dedicated refueling tank, were able to operate throughout the storm. Importantly, these vehicles were included in Atlantic City’s Emergency Plan, which allowed for rapid coordination and deployment in the lead-up to Sandy. A total of 30 jitneys evacuated residents, transported clinic patients to medical treatments, and helped others gather emergency goods.

The Jitneys proved useful during Superstorm Sandy, and have been an asset to Atlantic City during emergencies and normal operation. According to Frank Bechtel, an owner and driver of an Atlantic City Jitney, “We never had an issue where a bus couldn’t perform an emergency service or a convenience service because we weren’t going to be able to get fuel. [We had] a complete, uninterrupted compressed natural gas supply.”

While these vehicles were of critical use during an emergency, the Association invested in NGVs for economic and environmental reasons. The Jitney Association in Atlantic City uses 540,000 gallons of fuel per year, and the Association estimates that they save about \$1 million a year in fueling costs, compared to the price of gasoline. The cost-savings helped make the case for converting the Jitneys to natural gas, and the dedicated fueling source, independence from gasoline, and inclusion in the local emergency plan is what prompted the Jitneys to be pressed into action to perform critical emergency services.

## CASE STUDY

# Trussville, Alabama



**Mayor Gene Melton fueling his Tahoe with CNG.**

**The City of Trussville, Alabama has approximately 59 vehicles that run on natural gas, as well as a centralized fueling station with a stand-alone generator that can maintain a steady fuel supply during an emergency.**

In 2009, the City committed to convert the city's fleet to compressed natural gas and biofuel vehicles. Under the agreement, the local utility, Trussville Gas & Water, put together a plan of action to build a public CNG station with a local oil company at a recently-built name-brand service station at a key interstate interchange. Under the agreement, the utility loaned the local oil company the money to install the CNG station in return for controlling the price of natural gas until the station was fully repaid. Once fully re-

paid, the service station will assume full rights to the station, and Trussville Gas & Water would be the sole provider of natural gas for the site.

In addition, the service station installed a standalone generator that runs on natural gas, which can provide backup power to the service station during an emergency. This generator will provide electricity not only to the CNG station, but to the other gas pumps servicing the station as well.

The City of Trussville also purchased a significant number of natural gas vehicles, including 42 CNG vehicles for the police department, two CNG vehicles for the fire department, and 12 for public works, inspections, administrations and parks departments. In total, Trussville has approximately 59 vehicles that run on CNG.

The city purchased the public safety vehicles through a state bid, and converted the vehicles to CNG use for \$10,400 each. While the conversion cost was significant, the city was able to recoup the incremental cost within the first 24 months of ownership. The city saved approximately \$150,000 in the first full year of service through fuel savings, and continues to experience savings, even with the currently low gasoline prices.

## Case Study Takeaways

Natural gas vehicles have helped cities across the country recover from natural disasters. Natural gas is delivered via underground pipeline, and sites with backup generators can ensure continuous fuel supply even during emergencies. Cities that have purchased natural gas vehicles are also saving

money on fuel, and improving emissions within their communities. From New York to Alabama and beyond, communities are increasingly turning to natural gas vehicles and other alternative fuels to assist with disaster preparation and relief.

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## BACK TO BASICS

# What You Need to Know About Natural Gas Vehicles



**Buses all over the country run on natural gas. The top of the bus is used for additional fuel storage.**

Natural gas is a mixture of hydrocarbons (primarily methane) that accounts for about a quarter of the energy used in the U.S. About one-third of natural gas goes to residential and commercial uses, one third to industrial uses, and one-third to electric power production. Only about one-tenth of one-percent of natural gas is used for transportation fuel in the U.S., although that number is climbing.

Natural gas is used in vehicles in two forms: compressed natural gas (CNG) and liquefied natural gas (LNG). CNG is produced by compressing natural gas to less than one percent of its volume at standard atmospheric pressure. CNG is stored onboard a vehicle in a compressed gaseous state within cylinders at a pressure of 3,600 pounds per square inch. CNG is used in light-, medium-, and heavy-duty applications, and gets about the same fuel economy as a conventional gasoline vehicle.

LNG is produced by purifying natural gas and cooling it to -260 degrees Fahrenheit to turn it into a liquid. LNG is more expensive to produce and store than CNG, and therefore has limited commercial applications. LNG must be kept at cold temperatures and is stored in double-walled, vacuum-insulated pressure vessels. LNG is suitable for long-range trucks because liquid is more dense than gas, and therefore more energy can be stored by volume in a given tank. This extended range capability makes the fuel appropriate for medium- and heavy-duty vehicles.

NGVs have similar power, acceleration, and cruising speed as gasoline or diesel vehicles. The driving range of NGVs is typically less than comparable gasoline or diesel vehicles, because less overall energy content can be stored in the same size tank. Extra natural gas storage tanks or the use of LNG can help increase range for larger vehicles, although this can increase cost.

## BACK TO BASICS Refueling Stations



**Natural gas dispensers look and work just like traditional gas dispensers.**

When deciding to purchase NGVs, fleet managers should also consider where the nearest natural gas refueling station is located, and whether their fleet needs to install additional infrastructure. A map of all natural gas refueling stations can be found at the Alternative Fuel Station Locator website, and additional private stations may be found throughout your community.<sup>5</sup> Several companies have recently entered the emerging market for mobile fueling of CNG, where they would bring the fuel to your vehicles, although this may not be available in all locations.

If additional infrastructure is needed, a fleet manager may choose to install a CNG or LNG station on site. There are two types of CNG stations: fast-fill and time-fill. Typically retail stations use fast-fill, as drivers filling up at a fast-fill station experience similar

fill times to a conventional gasoline fueling station (less than 5 minutes for a 20 gallon equivalent tank). Fleets that have central fueling and the ability to fill overnight use time-fill, since vehicles may take several minutes to many hours to fill, depending on the number of vehicles, compressor size, and the amount of buffer storage.<sup>6</sup>

While LNG is typically used for long-haul trucking, specialized emergency management fleets may use LNG vehicles. LNG stations are structurally similar to gasoline and diesel stations. LNG is stored and dispensed as a super-cooled, liquefied gas, and protective clothing, face shield, and gloves are required when fueling the vehicle. There are three options for LNG fueling: mobile, containerized, and customized large stations.

The cost of installing natural gas infrastructure varies based on size, capacity and type of natural gas it dispenses. For example, a fast-fill CNG station that serves up to four sedans/pickups per day will cost about \$45,000–\$75,000. A time-fill station serving two utility service trucks or four delivery vehicles will cost about \$35,000–\$50,000.<sup>7</sup>

If a fleet manager is considering installing a natural gas station, they will also need to consider additional safety features and regulatory requirements for fueling maintenance facilities. The National Renewable Energy Laboratory has a list of all natural Gas Vehicle and Infrastructure Codes and Standards, which should be referenced before installing a station.<sup>8</sup>

To estimate the cost of installing a natural gas station on-site and learn more about installing infrastructure, fleet managers should contact their local Clean Cities Coordinator to learn more about alternative fuel options and retailers.

# What to Consider When Installing a Natural Gas Station

## 1. Is a natural gas station needed?

There are a growing number of publicly available natural gas stations across the U.S. Check out the [Alternative Fueling Station Locator](#) to see stations near you.

## 2. Is your site suitable for natural gas fueling?

Contact your local natural gas utility to determine whether a station is feasible for your site.

## 3. What permits and inspections are needed?

Most jurisdictions require permitting and inspections, as well as adherence to local zoning requirements if new facilities are added to the property.

## 4. Are funding or financing options available?

Public/private partnership, private equity, grants, and tax incentives may be available to help pay for your station.

## 5. What should be considered when choosing a vendor?

Design specificity, fuel availability and pressure, operations and maintenance, and local building codes should all be discussed before deciding on a vendor.<sup>9</sup>

**To learn more about the costs and processes of installing a natural gas fueling station, contact your local Clean Cities Coordinator.<sup>10</sup>**



## BACK TO BASICS Costs

Maintenance costs for NGVs are typically equal to or lower than maintenance costs for conventional vehicles, and the fuel savings is significant. The cost of natural gas fuel is approximately \$.50 to \$1.00 less per gallon (on average), and the greatest savings are being seen in heavy-duty, high mileage fleets. These vehicles consume enough fuel for owners and operators to see a pay back in as little as 18-24 months.

While the fuel cost savings could be substantial, NGVs typically cost more upfront than gasoline or diesel vehicles, due to the cost of high-pressure and insulated fuel tanks. To calculate the total cost of ownership and payback period for NGVs compared to gasoline or diesel vehicles, fleet managers can use the U.S. Department of Energy's Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool. AFLEET examines both the environmental and economic costs and benefits of alternative fuel and advanced vehicles. An example of the type of information that AFLEET provides is provided in the box below.

Incentives may also be available that can help offset the upfront cost for the vehicle and provide addition-

al savings. For example, the federal Alternative Fuel Excise Tax Credit in the amount of \$.50 per gallon is available for natural gas and other alternative fuels that are used to operate a motor vehicle. Tax exempt entities such as state and local governments that dispense qualified fuel from an on-site fueling station for use in vehicles qualify for the incentive. In addition, and Alternative Fuel Infrastructure Tax Credit is also available for up to 30% (up to \$30,000) of the purchase and installation costs.<sup>11</sup> For more information about the tax credits, and for a list of available incentives in your state, please visit the Alternative Fuel Data Center's website.<sup>12</sup>

Using AFLEET and other tools can help fleet and emergency managers model the economic and environmental costs and benefits of switching to alternative fuels, and compare emissions and cost savings across a variety of conventional and clean fuel vehicles. These tools can both help fleet managers plan for new vehicle acquisitions, and also provide information to city councils, planning boards, and others who may be skeptical of long-term savings associated with alternative fuels.

### Cost Comparison - CNG Trucks vs. Gasoline Trucks

KEY ASSUMPTIONS	Gasoline Trucks	CNG Trucks
Annual Mileage	24,000 miles	24,000 miles
Fuel Economy	13 MPGGE	11.7 MPGGE <sup>13</sup>
Maintenance and Repair	\$.18/mile	\$.18/mile
Fuel price	\$3.56/GGE <sup>14</sup>	\$2.21/GGE <sup>15</sup>
COST OF OWNERSHIP	Gasoline Trucks	CNG Trucks
Purchase Price	\$30,500	\$43,000
Annual Fuel Cost	\$6,572	\$4,533
Annual Maintenance Cost	\$4,441	\$4,441
ANNUAL OPERATING SAVINGS	\$0	\$2,039

**RESULTS:** Annual operating savings for CNG vs. gasoline trucks is \$2,039, with a payback period of 6.1 years.

## BACK TO BASICS Other Benefits of Natural Gas Vehicles

Fleets, including fleets involved with emergency preparedness, are adopting NGV technology because of other environmental and energy security benefits. In 2013, the U.S. imported about 33 percent of the petroleum it consumed, and transportation accounted for more than 70 percent of total U.S. petroleum consumption. Using NGVs and other domestically produced fuels can help minimize petroleum consumption. In the U.S., NGVs offset the use of about 500 million gallons of gasoline in 2014.

NGVs can also offer life cycle greenhouse gas emissions benefits over conventional fuels. Increasingly stringent emissions regulations have narrowed the gap between tailpipe emissions benefits from NGVs and conventional vehicles with modern emissions controls, although NGVs continue to provide emissions benefits when replacing older conventional vehicles. NGVs emit 10 to 20 percent less heat-trapping gases than gasoline when burned in today's typical vehicle, though the GHG emissions impacting the NGV lifecycle depend heavily on production-phase methane fuel leakage. Using renewable natural gas (also known as biomethane) can also reduce greenhouse gas emissions by more than 80 percent compared to gasoline.

To estimate the energy and emissions impacts of natural gas vehicles, fleet managers can use the U.S. Department of Energy's Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model (GREET). GREET is a full life-cycle model that allows fleet managers and others to evaluate various vehicle and fuel combinations and evaluate their environmental impacts.<sup>16</sup> For more information about

### Renewable Natural Gas

Renewable natural gas (biomethane) is produced from organic materials (such as waste from landfills and livestock), and is considered an advanced biofuel under the renewable fuel standard. Once cleaned, it can use the existing natural gas distribution system and must be compressed or liquefied for use in vehicles.

Capturing biogas from landfills and livestock operations reduces emissions by preventing methane release into the atmosphere. Methane is 25 times stronger than carbon dioxide as a greenhouse gas.



**Anaerobic digesters convert organic matter such as food waste, oils, sewage and more to produce renewable natural gas. This takes advantage of energy stored in organic matter which may otherwise go to waste.**

environmental costs and benefits associated with natural gas, see Argonne National Laboratory's "Hydraulic Fracturing and Shale Gas Production: Technology, Impacts, and Regulations."<sup>17</sup>

## Conclusion

Jurisdictions are making the deliberate choice to incorporate NGVs into their fleets to improve system resilience and save money over the lifetime of the vehicle. Natural gas is typically used to power larger vehicles, which provide critical assistance during and after disasters. Many fleets also install private fueling

stations or have access to a nearby public site which, if backed-up by a natural gas generator, can provide fuel even during supply disruptions. Incorporating NGVs into emergency plans and local fleets can lead to greater fuel diversity and a more resilient transportation system.



## Ready to Get Under the Hood?

*Resources to Help Fleets Get Started and Connected with Existing Natural Gas Users*

### The Initiative for Resiliency in Energy through Vehicles (iREV)

NASEO's iREV initiative supports state and local emergency management decision makers by providing tools and information on alternative fuel vehicles and their use in emergency management and response. iREV is led by the National Association of State Energy Officials and supported by the U.S. Department of Energy Clean Cities Program. Visit [www.naseo.org/irev](http://www.naseo.org/irev) for more information.

### U.S. Department of Energy Clean Cities Program

The Clean Cities program advances the nation's economic, environmental, and energy security by supporting local actions to cut petroleum use in transportation. Nearly 100 local coalitions serve as the foundation of the Clean Cities program by working to cut petroleum use in communities across the country. Visit [cleancities.energy.gov](http://cleancities.energy.gov) for more information and to find contact information for your local coordinator.

### Natural Gas Vehicles for America

NGVA is a national organization dedicated to the development of a growing, profitable, and sustainable market for vehicles powered by natural gas or biomethane. NGVA offers credible data-driven information, educates fleets, consumers and the general public about vehicle availability and benefits, and supports member companies through the provision of tools, materials, information, data and other services. More information about NGVA is available at <http://ngvamerica.org>.

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## Endnotes

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## Images

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Cover Barry Carr, Clean Communities of Central New York

Page 3: The Port Authority of New York & New Jersey <http://www.panynj.gov/about/greening-vehicles-equipment.html>

Page 4: *Ibid.*

Page 5: New Jersey Clean Cities

Page 6: Alabama Clean Fuels Coalition

Page 7: Mario Roberto Duran Ortiz [https://commons.wikimedia.org/wiki/File:Metrobus\\_powered\\_with\\_CNG\\_5198\\_DCA\\_03\\_2009.jpg](https://commons.wikimedia.org/wiki/File:Metrobus_powered_with_CNG_5198_DCA_03_2009.jpg)

Page 8: Mike Mozart <https://www.flickr.com/photos/jeepersmedia/albums/72157645649240352>

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