

Converting Rutgers Buses to CNG

Addressing Air Pollution through Local Means

Tag Words: Rutgers buses on CNG fuel, Rutgers transportation goes green

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Summary

Our issue is mainly focused on controlling the problem of air pollution, but focusing on a more local issue rather than trying to tackle a larger issue. We feel as though we can have a greater effect if we focus on a more specific issue. Air pollution is one of the more difficult issues to handle because it isn't easy to find a solution without increasing something such as cost. What we decided to do was to propose a conversion of one Rutgers bus to run off a bi-fuel engine (gasoline, CNG) to see if, in fact, this is a worthwhile investment. Studies have shown that CNG gas is more cooperative to the environment, but there are some cost issues that arise with this alternative. So what we are trying to do is to suggest a trial run of a bus that is run of bi-fuel and the administration can evaluate the costs and benefits for the long run and make a decision based on the findings.

The Issue: Air Pollution

(Marlon Romulus)

The overall issue that my group and I are addressing is the problem of air pollution. We have thought of ways to influence a better awareness on the problem of air pollution and to also reduce each student's carbon footprint. Some ideas that came into consideration were:

1. Creating more bicycle paths to encourage more bike-riding to and around campus. We also thought of having a free bike repair service for students who ride bikes to reduce some of the concerns that could arise amongst the students who are deliberating on riding their bikes.

Another service project that we thought of undertaking was to get all the classrooms to get thermostats to avoid wasting energy, thus reducing emissions because of the reduced use of energy.

Although these were good suggestions, the project that we decided to take on is to get our campus buses to run off naturally compressed gas.

Some of the benefits of adopting this new fuel for our buses are:

1. Lower maintenance costs when compared with vehicles powered by other fuels because of increased life of the lubricating oils due to the reduced contamination that CNG provides to the crankcase oils. This leads to a longer engine life and less frequent oil changes. Cost is always a big concern when thinking about changing from one thing to another. Other things pertaining to cost are:

- a. Fuel cost – Researchers say that CNG fuel is 30% less than gasoline on average.

Tax breaks – More state governments are providing users of CNG with tax breaks to provide both an incentive and a reward for using CNG.

2. CNG produces fewer emissions such as carbon dioxide (CO₂), hydrocarbons (UHC), carbon monoxide (CO), nitrogen oxides (NOX), and sulfur oxides (SOX) which will reduce the presence of greenhouse gases in the air:

www.cng.com.sg/environmentally-friendly.html

3. Because CNG is a gas, it will mix easily and evenly in the air in an event of a “spill” or leak. So this takes away from some of the safety concerns that could arise about CNG. It also has a higher ignition temperature so it is least likely to catch on fire in the occurrence of a freak accident.

Some of the ways in that we decided to persuade our administration into using CNG over leaded gas and diesel was to talk to them about how this will help save the environment and also save us money in the long-run. However, there are a few short-term drawbacks on using CNG fuel and we should be prepared to face some of these criticisms during our proposal for CNG. Some of them are:

1. Since CNG vehicles require a greater amount of space for fuel storage than normal gasoline-powered vehicles, there would have to be purchases made for the buses that are compatible for holding the gas tanks used to hold CNG.

Another issue is the availability of the gas, there would have to be stations constructed for the refueling of the buses with CNG which is another expense.

<http://www.ngvglobal.com/images/stories/refueling/CNG-projections-Czech.jpg>

2. The re-fueling of vehicles that run off CNG is a much slower process than that of gasoline. This will conflict with the bus schedules which will then conflict with the rising demand by the students to have more-frequent bus routes. Also, CNG-powered vehicles have a lower MPG rating than gasoline-powered vehicles. This will also conflict with the bus schedules and the students' demand for more frequent bus routes due to the more frequent stops for the slow re-fueling.

<http://bioage.typepad.com/photos/uncategorized/nrell.png>

Considering the drawbacks, this will not be an easy task. Nonetheless, I feel as if this is an achievable project and even if we don't convince the authorities enough to take on this idea, we are implanting the ideas in their head and allowing future presentations for this project by others to have a greater influence.

(Stephante Kent)

Environment:

Natural gas is an extremely important source of energy for reducing pollution and maintaining a clean and healthy environment. In addition to being a domestically abundant and secure source of energy, the use of natural gas also offers a number of environmental benefits over other sources of energy, particularly other fossil fuel. Natural gas is the cleanest of all the fossil fuels that are used in all around the world. Composed primarily of methane, the main products of the combustion of natural gas are carbon dioxide and water vapor, the same compounds we exhale when we breathe. Coal and oil are composed of much more complex molecules, with a higher carbon ratio and higher nitrogen and sulfur contents. This means that when combusted, coal and oil release higher levels of harmful emissions, including a higher ratio of carbon emissions, nitrogen oxides and sulfur dioxide. Coal and fuel oil also release ash particles into the environment, substances that do not burn but instead are carried into the atmosphere and contribute to pollution. The combustion of natural gas, on the other hand, releases very small amounts of sulfur dioxide and nitrogen oxides, virtually no ash or particulate matter, and lower levels of carbon dioxide, carbon monoxide, and other reactive hydrocarbons. use of fossil fuels for energy contributes to a number of environmental problems. As the cleanest of the fossil fuels, natural gas can be used in many ways to help reduce the emissions of pollutants into the atmosphere. Burning natural gas in the place of other fossil fuels emits fewer harmful pollutants into the atmosphere.

**Fossil Fuel Emission
Levels
- Pounds per Billion
Btu of Energy Input**

Pollutant	Natural Gas	Oil	Coal
Carbon Dioxide	117,000	164,000	208,000
Carbon Monoxide	40	33	208
Nitrogen Oxides	92	448	457

Sulfur Dioxide	1	1,122	2,591
Particulates	7	84	2,744
Mercury	0.000	0.007	0.016

Health:

High levels of air pollution can affect our health in many ways with both *short-term* and *long-term* effects. Different groups of individuals are affected by air pollution in different ways. Some of those short term effects cause by air pollution is irritation to the eyes, nose and throat, and upper respiratory infections such as bronchitis and pneumonia. Other symptoms can include headaches, nausea, and allergic reactions. Some of the long term effect by pollution can also include chronic respiratory disease, lung cancer, heart disease, and even damage to the brain, nerves, liver, or kidneys. Continual exposure to air pollution affects the lungs of growing children and may aggravate or complicate medical conditions in the elderly. However, by viewing some of the effects that air pollution can cause, we believe that the best way to limited many of these symptoms is to reduce fossil fuels and purse compressed natural gas.

Costs:

Alternative fuel such, as natural gas has been identified as a great energy base for the future when trying to have a much cleaner environment and reduce in costs. ~~Countries all around the world are now including alternative fuels in their national energy plans~~ because of the effects of fossil fuels and oil. Natural gas has been a elite selection because of all the benefits it has relating to costs and the environment. Natural gas would be much more ~~suitable for Rutgers transportation and urban transportation applications such as buses and trucks in order to reduce air pollution levels and provide cleaner air in densely populated urban areas. Since natural gas is typically a domestically supplied fuel, consumers are able to realize a significant fuel cost savings, making it attractive for personal car use as well.~~

~~Natural Gas~~

Price per kg 0.79 € (\$1.02 USD)

Consumption/100 km 7 kg (15.4 pounds)

Cost per 100 km 5.53 € (\$7.17 USD)

Regular Gasoline

~~Price per liter 1.23 € (\$1.59 USD)~~

~~Consumption/100 km 10 liters (2.6 gallons)~~

~~Cost per 100 km 12.30 € (\$15.95 USD)~~

Savings ~~6.77 € /100 km (\$8.78/62 miles)~~
or 55 percent

The Service Project: Letter

The initial step was to write a letter to the administrative body of Academy Bus Corporation because that is who provides Rutgers with all of their buses. In this letter, we talk about the issue at hand and how we are going about addressing it. We then propose a solution and give details and it and request that they allow us to present to them a presentation about the overall topic. By presenting to them, we feel as though we can influence them to at least take a step in the right direction if they decide not to take on the project that we have suggested.

http://www.ehow.com/list_5978959_negatives-natural-gas-vehicles.html

http://en.wikipedia.org/wiki/Compressed_natural_gas

<http://www.cleanairnet.org/infopool/1411/article-33909.html>

Service Project Word File

—Converting Rutgers buses to CNG

Addressing Air Pollution through Local Means

—By: Marlon Romulus, Beau Bachety, Stephante Kent

Compressed Natural Gas (CNG)

What is CNG?

CNG is a natural gas under pressure, which remains clear, odorless, and non-corrosive.

Although vehicles can use natural gas as either a liquid or a gas, most vehicles use the gaseous form compressed to pressures above 3,100 PSI.

How is Natural Gas produced?

Most natural gas comes from three types of wells: natural gas-and-condensate wells, oil wells, and coal bed methane wells.

Where does Natural Gas come from?

More than 99% of the Natural Gas used in the United States comes from domestic or other North American sources.

How is Natural Gas stored?

In smaller fueling locations and on vehicles, CNG is stored in thick-walled steel, aluminum, or composite tanks built to last more than 20 years.

What are the benefits of using Natural Gas in transportation?

Natural gas is produced both worldwide and domestically at relatively low cost and is cleaner burning than gasoline or diesel fuel. Natural gas vehicles show an average reduction in ozone-forming emissions of 80% percent compared to gasoline vehicles.

—New York City Transit Hybrid and CNG Transit Buses

A test was conducted by the Metropolitan Transit Authority (MTA) of New York City, comparing the outcomes of using hybrid transit buses (CNG/diesel) against the traditional diesel-powered transit buses.

“Hybrid technology has generally been tested at NYCT in an effort to explore options other than CNG technology. This is because not all of NYCT’s operating depots are cost-effective candidates for CNG infrastructure due to space constraints inside buildings and the proximity of neighboring buildings. In early 2000, NYCT ordered 260 CNG buses in two orders from Orion Bus Industries (order one was 125 buses, order two was 135 buses). At the same time, NYCT made a commitment to purchase two orders of buses with the BAE Systems hybrid propulsion

system from Orion Bus Industries. One order was for 125 buses, the other for 200 buses.”

- K. Chandler and E. Eberts, *Battelle*

- L. Eudy, *National Renewable Energy Laboratory*

—Cost Analysis

Cost-Benefit Analysis

Environmental Benefits of CNG

Health Benefits of CNG Fuel

Air pollution from diesel engines is one of the biggest concerns, especially in areas that struggle to meet air-quality standards. Because it mixes more uniformly in the ignition chamber, natural gas causes more complete combustion and fewer pollution emissions than diesel fuel.

Natural gas is not toxic or corrosive and will not contaminate our ground water.

As with our health concerns, safety is another concern that should be considered:

- Natural gas systems are fully sealed, which prevent spills or evaporative losses. Even if a leak were to somehow occur in a fuel system, the natural gas would dissipate into the air unlike gasoline, which pools on the ground, creating a fire hazard.

- The ignition temperature of CNG of 1,200⁰ Fahrenheit, which is double that of gasoline (600⁰).

It would take a lot more heat to ignite CNG, reducing the likelihood of spontaneous combustion.

In Summation

The underlying idea behind adapting CNG fuel for our buses is to basically cut costs and increase savings, respectively, in the long-run. Rarely does an implementation of this magnitude start having positive effects immediately, so it would be plausible to put the changes into a long-term perspective. The cutting of costs and/or the increase in savings will open up possibilities for the University to expand and become more efficient in other areas which can lead to a positive cycle of innovation for Rutgers and Academy Bus Inc.

A recent study done by the California Energy Commission concludes that CNG vehicles produce up to 29% less greenhouse gas emissions than comparable gasoline vehicles and up to 22% less than comparable diesel vehicles. The bottom line is that natural gas-powered vehicles are dramatically better for the environment than common substitute fuels.

— Why should you care? More and more people are becoming aware of the problems with our environment and are starting to feel the influence of the “going green” movement. If you adapt a “greener fuel”, environmentalists and also non-environmentalists will favor your products because you’re not only showing a concern towards the environment, but also to the health and well-being of the community.

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Beau Bachety
Stephante Kent
1 Scarlet Knight Way
Piscataway, NJ 08854

Tom Scullin
Academy Bus Inc.
111 Paterson Ave.
Hoboken, NJ 07030

Dear Mr. Scullin,

My name is Marlon Romulus and I am a senior at Rutgers University. I am currently enrolled in an ethics class and I have chosen to focus on the problems of air pollution and how it can be reduced starting from taking care of the problem locally. My professor is Julie Fagan and my other group members are Beau Bachety and Stephante Kent who are also students at Rutgers. We feel as though as if we can start with the issue within the Rutgers University institution, it can lead to bigger and more significant changes to other areas. We are aware that you are the suppliers of the buses to Rutgers and I am writing you this letter to request a meeting to discuss converting the Rutgers University bus lines to run off of CNG fuel. We would like to present to you our concerns, benefits and also costs that are involved in taking on a project such as converting one bus to a bi-fuel vehicle (diesel/CNG) which would cost approximately \$5,000. I do understand that this is probably not the first letter you have received about undertaking the task of converting your bus lines to CNG fuel, but it would be much appreciated if you would meet with us about this issue. You can contact me at 516-343-3789, or my project partners Beau Bachety at 516-375-0911 and Stephante Kent at 609-742-6835 or our professor, Dr. Julie Fagan at Fagan@rci.rutgers.edu for any questions or comments. Thank you for your time.

Regards,

Marlon Romulus
Beau Bachety
Stephante Kent
Rutgers University

Editorials

Marlon Romulus
Ethics in Society
Julie Fagan
March 24, 2010
Editorial

Marlon Romulus – Air Pollution Group

Compressed Natural Gas is another fossil fuel that can be used as a substitute for gasoline or diesel. Although it does still produce greenhouse gases, it is considered to be more environmentally cleaner and a better alternative fuel than to its other limited resource counterparts because it produces fewer pollutants. If we as a society adapt CNG as our main means of powering automobiles, boats, and other machines that use the internal combustion engine, we are essentially taking a step in the right direction in preserving our environment.

As I evaluate the effects of using CNG as our main source of fuel, I begin to see that it does come with some costs as well as benefits. When taking on a project as big as this one, we have to consider the worthiness of it. In other words, with the major costs in re-manufacturing of our cars, buses, boats, and planes and the costs for the construction of new infrastructure and technologies to fuel them, will the benefits still outweigh the costs? If we're looking towards the long-term, will we begin to reap the rewards of investing in CNG machinery before other more cost-effective and environmentally friendly methods of power are discovered and/or invented? But then again, the benefits of adopting CNG as our main fuel will outweigh the costs if we just simply choose to postpone implementing the new technology if one were to be available for immediate use. This would then give more time to improve the newer technology by doing more research and development to make it even more of a benefit to society while we are still using CNG. These were some of the thoughts that popped into my head after reading more about CNG and thinking to myself, "Why aren't we using this yet?" I think the reasons that I stated above could be some diversions if CNG were to be mentioned to administration.

While I still like the benefits that come with using a CNG-powered machine such as lower maintenance costs, no mess from "spills", and lower emissions; it's hard to predict how much this will benefit society in the long run given the costs and the amount of re-structuring and re-planning that has to be done to allow the use of CNG. Even considering this unknown, I think it is still in the best interest of society to take on a project such as this one because it shows that we're taking on the initiative to save the environment, even if it could be by a small margin.

Beau Bachety
Ethics in Society
Julie Fagan
March 24th, 2010
Editorial - Air Pollution

At Rutgers University in Piscataway, NJ the transportation buses are ran on diesel fuel which is causing lots of air pollution at the school. People don't realize that when they are standing waiting for the bus and the bus is idle that they are breathing in a lot of pollutants. This can be an extremely harmful and major problem at Rutgers.

Along with two of my other friends here at Rutgers I felt that air pollution is an issue that needs to be addressed right away. To save the environment we feel that it would benefit everyone at Rutgers if the buses were ran on Compressed Natural Gas also known as CNG rather than diesel fuel. CNG is a more environmentally clean alternative to other fuels like gasoline, diesel, or propane fuel. CNG produces significantly lesser emissions of pollutants like carbon dioxide, hydrocarbons, carbon monoxide, nitrogen oxides, sulfur oxides and particulate matter. Also CNG fuel costs less in the long run than diesel. At 25 cents per gallon savings, the typical CNG bus could pay for itself in just a little more than 3 years. Greater savings in fuel cost can result in even quicker paybacks. The incremental cost of diesel buses is estimated to be about twice that of CNG buses.

To fix this problem at Rutgers we plan to set up meeting with the head of Academy buses and propose are ideas to them. There are ways more positives to using CNG compared to diesel fuel. By us proposing our ideas we hope to get them to switch at least one of their buses to natural gas just so they could test it out. If they like what they see then maybe they could switch all of their buses to CNG operated. This would benefit everybody at Rutgers because people would no longer be breathing in this harmful air. If Rutgers wants to create the healthiest and safest environment for everyone then they must do something about this problem. Rutgers as a whole would be a better place and feel a lot cleaner if Naturally Compressed Gas buses were running around campus.

Stephante Kent
Ethics in society
Julie Fagan
Editorial
March 23, 2010

Most of the major machines and transportation that society uses today is based off the resource of fossil fuels and diesel. However, that particular resource such as oil is has been a threat to the environment; it is causing massive air pollution throughout the world by the many regions that use it abundantly. This resource is not only a hazard to the environment, but it is becoming very pricing and limited around the world. Based on the causes of oil, I have come to the realization that compressed natural gas (CNG) would be the next best direction when considering the reforming of the masses of machines and forms of transportation. Why should we lean towards compressed natural gas? Well Compressed natural gas is natural gas under Although vehicles can use natural gas .corrosive-and non ,odorless ,pressure which remains clear s use the gaseous form compressed to pressures above most vehicle ,as either a liquid or a gas -and-natural gas :Most natural gas comes from three types of wells .pounds per square inch 3,100 compressed natural gas is ,Therefore .and coal bed methane wells ,oil wells ,condensate wells It is a better asset because it provides .uable as a resource then oil in the long runmuch more val .a more efficient process in transportation and machines allowing for a cleaner environment st through a pro but ju ,Compressed natural gas also will allow for the same production as oil .environmental way

In regard to transportation compressed Natural gas is the best fit for now and the future .buses and heavy duty trucks ,of cars Also an alternative fuel vehicle such as compressed natural gas produces little or no evaporative emissions during fueling and use. In gasoline vehicles, evaporative and fueling emissions can account for at least 50% of a vehicle's total hydrocarbon emissions. However, every per unit of energy of natural gas contains less carbon than any other fossil fuel, and produces lower carbon dioxide (CO₂) emissions per vehicle mile traveled. While compressed natural gas vehicles do emit methane, another principle greenhouse gas, any increase in methane emissions is more than offset by a substantial reduction in CO₂ emissions compared to other fuels. Therefore, compressed natural gas creates less harm to the environment than many of current resources society is using for production. As a group understand and believe that compressed natural gas will allow for a more efficient way of producing energy around the university and throughout the country.