CITY OF NORMAN ALTERNATIVE FUEL PROGRAM

Prepared by Mike White
Fleet Superintendent
Department of Public Works

ALTERNATIVE FUEL PROGRAM

EXECUTIVE SUMMARY

The City of Norman seeks to be a leader in the implementation of alternative fuel technology. The City's goal is to increase the usage of alternative fuel vehicles (AFVs) each year as technology allows while monitoring each new technological advancement to suit the application and departmental needs. Currently, the capital costs for AFVs are greater than conventional vehicles. In addition, some alternative fuels are also more expensive than conventional unleaded or diesel fuels. The projected budget increase for the alternative fuel vehicle purchases may exceed $90,000 in FYE 2009. In contrast, the projected savings in fuel costs is estimated to be $21,000, or 1.1 percent of the total projected FYE 2009 fuel budget of $2,052,500.

It is recommended that the City purchase three types of Alternative Fuel Vehicles (AFV) (1) Compressed Natural Gas (CNG) vehicles, (2) Flex Fuel vehicles, and (3) B-20 biodiesel fuel capable vehicles. If the City actively pursues these AFV options, an expanded alternative fuel infrastructure must be developed either as a city-owned facility or in partnership with other agencies in Norman.

BACKGROUND

Since 2001, the City has purchased compressed natural gas (CNG), flex fuel, and hybrid vehicles.

Current City Fleet 857 (See attachment for more detailed description)

- 732 Rolling Stock
  - 65 Electric
  - 2 Hybrid
  - 67 CNG
  - 29 Flex Fuel
  - 318 Unleaded
  - 311 Diesel
- 125 Non Rolling Stock
  - 46 Non Fuel
  - 3 Electric
  - 6 CNG
  - 39 Unleaded
  - 31 Diesel

Although the City is not mandated by federal or state regulations to purchase alternative

fuel vehicles (AFVs) or use alternative fuels, considerable efforts have been made since 2001 to analyze available alternative fuel vehicle options for City use. The City has made vehicle and equipment purchasing decisions based upon operational issues, fiscal concerns and responsible environmental stewardship.

When selecting AFVs, consideration is given to the end user application and their operational functions since the size and location of fuel tanks impact the storage, functionality and useful bed space of the vehicles. Other issues include availability of fuel supply, ability to refuel without long delays, driving range between fuel stops, vehicle usage by on-call staff including responding to emergency or disaster situations and the availability of original equipment manufacturer (OEM) vehicles.

HISTORY OF CITY AFVS

Of the alternative fuels available since the year 2000 including methanol, liquid natural gas (LNG), compressed natural gas (CNG), and electric, staff focused on CNG as the most viable fuel due to availability, fuel characteristic and original equipment manufacturer (OEM) vehicle availability. In 2001, the City of Norman purchased seven (7) CNG F-150 Ford Trucks with the assistance of the Association of Central Oklahoma Governments (ACOG) Clean Cities Program rebate. In subsequent years the City's AFV program expanded to include two (2) hybrids and twenty-nine (29) flex fuel vehicles. All other vehicles purchased are compliant with new EPA emissions standards.

The City's current fleet of AFVs was selected based on availability of a local fuel supply and OEM availability. The fleet consists of CNG pickup trucks, hybrid sedans and electric vehicles. City CNG vehicles currently acquire fuel from the Oklahoma Natural Gas (ONG) fueling facility located at 625 North Berry Road at a cost of $1.01 per gallon. The cost at ONG has remained the same for the last three (3) years. A secondary location is located at the University of Oklahoma Fleet Services located at 2805 S. Jenkins Avenue at a current cost of $0.73 per gallon. The CNG vehicle purchases have not increased since 2002 due to the lack of a CNG infrastructure and limited technician training. A certified technician is required to work on all CNG vehicles. The City of Norman has two certified technicians and is in the process of increasing the number of certified technicians to at least 50 percent by the end of FYE 2010. Currently, Staff is pursuing the addition of a slow fill CNG infrastructure.

CURRENT STATE OF THE INDUSTRY

The Detroit Auto Show held in January, 2009 provided an indication of the alternative fuel vehicles available in the next several years. The most visible and promoted were hybrid vehicles by all major manufacturers. Several manufacturers debuted plug-in hybrid vehicles that will become available in limited production in 2009. Only one manufacturer continues to produce a dedicated CNG passenger vehicle, Honda Civic.

In addition, only one manufacturer produces a hydrogen powered vehicle in limited numbers, also Honda Civic.

According to the Clean Cities Seminar held at Chesapeake Energy Corporation in May, 2008, Oklahoma is the second largest natural gas producer in the United States and the price of natural gas will remain stable without a significant increase in the near future.

CNG continues to be a viable option for medium and heavy duty trucks yet automobile manufacturers have limited production of CNG vehicles. Therefore, after market conversion kits will have to be added to the vehicle by a state certified installation facility in order to maintain existing warranties.

FUEL SAVING DEVICES AND ADDITIVES

Some vendors are promoting these devices and additives. The Federal Trade Commission (FTC) offers a fact sheet regarding these devices and found that even in instances in which such devices provided savings, the savings were minimal. The U.S. Environmental Protection Agency (EPA) has tested more than 100 devices and additives and has not found any that significantly increase fuel economy. Several were found to offer small improvement in fuel economy but also resulted in increased exhaust emissions. Also, installation of these devices may cause engine damage and may be considered illegal tampering (or void vehicle warranty) as cited in the FTC fact sheet mentioned above.

RETROFITTING VEHICLES TO OPERATE ON CNG

The availability of new light-duty OEM compressed natural gas vehicles has declined in recent years; however, it is possible to convert a conventional engine to one that can run on an alternative fuel, such as natural gas. Certified installers can reliably retrofit some light-duty vehicles for natural gas operation. A converted vehicle is one that was originally designed to operate on gasoline or diesel and has been altered to run on an alternative fuel; however, the retrofit comes at a significant additional cost (i.e., the purchaser must pay extra for the retrofit). An after-market conversion may only be performed on a vehicle if a Certificate of Conformity or California Air Resources Board (CARB) certification has been issued for that specific vehicle or engine. The City may direct future purchases and specifications to include these after-market conversions. The average cost of a conversion kit for a light truck is $15,000, or approximately 75% of the average purchase price for that same truck of $20,000. On heavy duty trucks up to 60,000 GVW, the average cost of a conversion kit is up to $50,000 or approximately 45% of the average purchase price for that same truck of $110,000.

FUEL OPTIONS

Ultra low sulfur diesel fuel has a much lower sulfur content (15 ppm) than the previous U.S. on-highway standard for low sulfur diesel (500 ppm), which not only

reduces emissions of sulfur compounds but also allows advanced emission control systems to be fitted that would otherwise be poisoned by these compounds. Engines will no longer have to be redesigned to cope with higher sulfur content and may use advanced emissions control systems. The city currently purchases ultra low diesel fuel.

Low sulfur diesel fuel combined with diesel engine emission devices continues to be used in most fleets; however, according to the Energy Independence and Security Act of 2007, federal and state mandates in the future will require the purchase of cleaner burning engines to meet emission pollution requirements. When purchasing heavy trucks not available with alternative fuel capabilities, specifications are written to ensure we meet current and future mandates.

Compressed Natural Gas (CNG) remains a viable fueling option for our existing CNG light trucks and in our heavy duty refuse vehicles. In regards to CNG vehicles, there is a 40% reduction in drivable miles per tank of fuel. Sanitation trucks may need to adjust their routes to accommodate the smaller fuel tank capacity. CNG requires a separate fueling infrastructure, which the City will need to develop. The current cost analysis of this option for a typical light truck is as follows:

Increased vehicle cost:	$15,000.00
Annual fuel cost savings:	$ 2,500.00
Cost recovery period:	6 years

Propane remains the fuel of choice for forklifts.

Liquid Natural Gas (LNG) was ruled out as a fueling option due to the characteristic of the fuel and the infrastructure requirements.

Flexible Fuel Vehicle (FFV) is an alternative fuel vehicle with a multi-fuel engine that can typically use Ethanol/E85 or Unleaded. This continues to be a viable solution for police patrol vehicles.

Ethanol or E85 is an alternative fuel as defined by the U.S. Department of Energy. E85 is the term for motor fuel blends of 85 percent ethanol and 15 percent gasoline. E85 is designed for use in flexible fuel vehicles (FFVs). Ethanol has 66% of the BTU value of gasoline, lowering the miles per gallon when blended with gasoline. In turn, it takes 1.4 gallons of E85 to do the same work as a gallon of gasoline. The City currently operates some light-duty flexible fuel vehicles. FFVs may operate on either E85 and/or gasoline interchangeably. The City's FFVs are operated with unleaded gasoline, as E85 has limited availability in Oklahoma, and requires a separate fueling infrastructure, which the City would need to develop.

E10 is a blend of 10 percent ethanol and 90 percent gasoline. It is approved for use in any make or model of gasoline powered vehicle sold in the U.S. Many automakers

recommend its use because of its high performance and clean burning characteristics. According to the Department of Energy, a complete tank cleaning by a contractor at an estimated cost of $2,000 would have to take place before switching underground fuel storage tanks to E10 to eliminate any excess moisture that may exist. Red Rock Distributing Company, the City's fuel provider has listed several positive and negative aspects of E10.

Positive

1. Fuel cost may decrease depending on daily market value of unleaded
2. Fuel octane rating increases
3. Harmful gasoline emissions decrease
4. Will not cause long-term engine damage

Negative

1. Easily absorbs water from storage tanks
2. Has a shelf life of less than 90 days
3. Acts as a solvent with fuel tanks, lines, pumps and other fuel related equipment.
4. Deteriorates aluminum, plastic, rubber, and some fiberglass due to ethanol's corrosive properties.
5. E10 consistently reduces miles per gallon by 2% to 3%

Hybrid vehicles seem to be an interim solution until a more viable AFV is developed. The hybrid vehicle generally obtains an increase in vehicle miles per gallon (MPGs) while reducing emission at low speeds. The City will purchase hybrid vehicles as replacements in areas where these vehicles can be effectively used. The current cost analysis of this option for a typical medium-sized passenger vehicle is as follows:

Increased vehicle cost:	$4,000.00
Annual fuel cost savings:	$ 225.00
Cost recovery period:	18 years

Plug-in hybrid vehicles are on the horizon with only limited production of the plug-in hybrids expected in 2009.

Hydrogen vehicles are touted as producing no emissions, but will require an expensive fueling infrastructure. A limited number of hydrogen vehicles are being produced in 2009; this AFV is several years away from being a viable option for City vehicles.

Biodiesel is a domestic, renewable fuel that can be made from vegetable oils, animal fats, or recycled restaurant greases. Pure biodiesel is known as **B-100** and is considered an alternative fuel. It is not the same as raw vegetable oil. It contains no petroleum, but can be blended with any level of petroleum to create a biodiesel blend. The most common blend is **B-20**, (20% biodiesel and 80% diesel). B-

20 can be used in nearly all diesel equipment and is compatible with most storage and distribution equipment without impacting engine warranty. B-20 works as a cleaning agent in diesel systems and may initially cause minor fuel issues such as increased fuel filter replacement needs and cause fuel injectors and pumps to fail, causing more downtime to vehicles. B-20 and lower-level blends generally do not require engine modifications. While B-20 comes with an increased cost, it does reduce the dependency of foreign oil and supports green efforts.
In 2008, the City of Thousand Oaks, California stated that they used B-100 biodiesel at their Hill Canyon Treatment Plant, and experienced issues with low-temperature gelling in the storage tank, which created problems with engine components such as injector pumps, hoses and gaskets in most of the equipment. As a result of the problems experienced with B-100 biodiesel they discontinued its use. We do not believe this is a viable option at this time.

However, City staff does believe B-20 biodiesel will work in our existing diesel fueled equipment except emergency equipment using diesel due to the liability of altering the fuel. Therefore, a separate underground fuel tank and equipment would have to be established in order to fuel emergency equipment with pure diesel.

Emerging Fuels
Staff is staying apprised of the future of the fuel industry. There are many emerging fuels including Bioutanol, Biogas, Biomass to liquids, and gas to liquids, these fuels will be evaluated as they become more practical. By following the industry and being active in trade organizations, staff will continue to stay informed and keep the City on the forefront of implementation, recommending those fuels that have low environmental impact and are economically and operationally feasible.

VOLATILITY OF AFV MARKET

While staff has prepared and intends to pursue this five-year plan, it is important to note that there is continued uncertainty in the AFV market. The City's experience thus far is that CNG vehicles have been incorporated into the fleet. While many models are no longer available, aftermarket conversion kits can be installed at certified dealers. Many CNG vehicles are expected to be available in the up coming year; electric vehicles have been acquired which are no longer available. Flexfuel and biodiesel fuel are currently under consideration to meet the City's needs. Both of these recent technologies are likely transitional applications until a new fuel is identified. The industry continues to adjust and adapt and the City must do the same as new technologies emerge.

RECOMMENDED CAPITAL IMPROVEMENTS

Capital improvements are costly but the fuel budget will experience immediate savings. Compressed Natural Gas (CNG) in today's market is consistently between 30-50% less per gallon than diesel. The short term capital improvement recommendations are as

follow:

(1) Develop compressed natural gas infrastructure to include a “fast fill” station, an on-site pump that allows operators to fuel the vehicles within minutes depending on the storage capacity of the vehicle. It usually fills a vehicle to 75% of its fueling capacity. At a cost of 1.2 million. As an option, a “slow fill” station with five post (2 hose dispensers each) that will fuel up to 10 vehicles, depending on the daily fuel usage can be developed. This is a system designed to fuel vehicles overnight without an operator being present. Usually, this can be accomplished in 8 hours and provides a 95% fill, increasing driving range. Grant programs are being explored. The City may choose to hire a consulting firm to assist with the program and ensure that all available benefits of CNG are realized. The consulting services might include:

1. Writing of proposals for vehicle and infrastructure grant funds to federal, state, or local funding sources.
2. Support and provide explanation on any alternative fuel programs at Council meetings or management meetings when necessary.
3. Provide advice on all types of alternative fuels including possible layout of infrastructure facilities.
4. Advice on the real benefits of using alternative fuels (i.e. cost savings, longer engine life, lower personnel costs, etc.).
5. Seek possible strategic partners to use future fuel infrastructure.
6. Explain the tax benefits of owning natural gas vehicles and infrastructure.
7. Help the City of Norman obtain the $.50 per gallon fuel credit made available through the Energy Bill.
8. Explain the pros and cons of using LNG vs CNG.
9. Conduct life cycle cost analyses to help justify alternative fuels.
10. Develop component needs, i.e. number of dispensers, compressor sizing, proper dryer, oil filters, etc. along with the location and layout of the station.
11. Provide recommendations on hours of operation and the best way to utilize the City’s resources and cut refueling costs.
12. Write performance bid specifications for the fuel infrastructure.
13. Provide preliminary bid package.
14. Evaluate bids received by the City and make recommendations for award.
15. Unlimited phone calls to answer questions concerning alternative fuel issues.

(2) Fuel all Fire trucks at the OU facility at an additional cost of $0.19/gal. This approach will save staff time and vehicle travel. Currently, fire trucks consume approximately 21,000 gallons of diesel/year. The additional charge of $0.19/gal will cost $3,990. At today’s cost ($1.416) plus the markup ($0.19) the annual fuel charge for Fire would be $33,730.

(3) A south side fueling station should be developed to reduce the amount of mileage

and labor incurred by vehicles housed on the south side of Norman. There would be one automated dispenser for unleaded, one for diesel, and one for biodiesel. At today's cost, this is estimated at $300,000 if City property is used.

OTHER AFV RECOMMENDATIONS:

- Grants have become available from the Association of Central Oklahoma Governments (ACOG) and Clean Cities. City staff will request grant funds to use toward the purchase of CNG trucks, a CNG Slow Fill unit, and possibly other AFV technologies.
- With the possible FYE 2010 purchases, the City may exceed the goal of converting at least one third of the fleet to AFVs. The City would have 472 AFVs or 54 percent of the fleet of 867 vehicles and equipment by the end of FYE 2009 if biodiesel and E85 fuel become feasible. Each year on average, the City purchases fifty (50) vehicles. At least twenty five (25) of the 50 vehicles purchased each year could be AFV. Where an AFV is not available and a conventional vehicle must be purchased, City staff would ensure the vehicle is right-sized to the job and within the top three most fuel-efficient vehicles available in its class. It is anticipated that the City could add as many as 131 AFVs to the City fleet over the next five years. If biodiesel and E85 fuel become feasible, the City's AFV fleet could increase to 572 AFVs or 66 percent by 2013.
- E10 is not a recommended fuel option because it would increase the amount of gallons purchased and consumed. Focusing more on the City's Fuel Conservation Policy adopted in 2009 appears to be a better strategy for the city fleet in terms of fuel conservation and cost savings.
- Flexfuel vehicles are recommended as replacements in areas where these vehicles can be effectively used.
- The City of Norman will collaborate with the University of Oklahoma Fleet Services Division and Oklahoma Natural Gas Company for temporary CNG fueling facilities along with other fueling options until the City is able to develop its own south side fueling facility and enlarge its fuel infrastructure.