Municipal Technical Advisory Service
INSTITUTE FOR PUBLIC SERVICE

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Transportation

Dear Reader:

The following document was created from the MTAS website (mtas.tennessee.edu). This website is maintained daily by MTAS staff and seeks to represent the most current information regarding issues relative to Tennessee municipal government.

We hope this information will be useful to you; reference to it will assist you with many of the questions that will arise in your tenure with municipal government. However, the *Tennessee Code Annotated* and other relevant laws or regulations should always be consulted before any action is taken based upon the contents of this document.

Please feel free to contact us if you have questions or comments regarding this information or any other MTAS website material.

Sincerely,

The University of Tennessee
Municipal Technical Advisory Service
1610 University Avenue
Knoxville, TN 37921-6741
865-974-0411 phone
865-974-0423 fax
www.mtas.tennessee.edu

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Transportation

Reference Number: MTAS-252

Full power to acquire, construct, and operate any type of public transportation system is vested in counties and municipalities "or any combination thereof." T.C.A. §§ 7-56-101–109.

Train Regulations and Transit Systems

Reference Number: MTAS-548

Notification of State Department of Transportation of Train Regulations

Certified copies of any ordinances regulating trains within a city's limits "or newly extended limits" (annexation ordinances seem to be included) must be sent to the commissioner of transportation. Within seven days, the commissioner is to mail copies to the railroad's registered agent for service of process. Such ordinances shall be effective 15 days after receipt by the registered agent. An ordinance becomes effective when received by the executive director if a railroad fails to register an agent for service of process. T.C.A. §§ 7-51-801–804.

However, municipalities may not regulate train speeds within city limits. Such authority belongs only to the Federal Railroad Administration pursuant to the Federal Railroad Safety Act. 45 U.S.C. 421, *et seq.*, *CSX Transportation v. City of Tullahoma*, 705 F. Supp.385 E.D.Tenn. 1988.

Transit Authority

A transit authority may be created by ordinance or by resolution. Contracting for management of a transit system is specifically authorized as an alternative to direct operation by a municipality, county, or transit authority. Service may be extended beyond county lines and, with necessary approvals of its regulatory agencies, into adjoining states.

A municipality or transit authority may issue debt, exercise eminent domain, and enter into interlocal agreements with other cities, counties, and even other states regarding purchasing and operating public transportation systems. Additionally, a municipality, county, or combination thereof may empower a transit authority to "license and regulate all forms of public transportation," such as taxicabs and airport limousines.

If an existing system is acquired, a municipality is empowered to make "fair and equitable arrangements" to preserve employees' benefits typically included in union contracts. Collective bargaining and voluntary arbitration also are authorized. Strikes are prohibited. T.C.A. §§ 7-56-101, *et seq.*

Subsidized Private System

Any municipality, county, or combination thereof may pay a reasonable subsidy to a public or private company operating a transit system, "the amount thereof to be wholly in the discretion of the governing body." T.C.A. § 7-56-107.

Franchise of Transit Services

Regulating, controlling, and franchising street railways and bus lines are vested in a municipality's governing body, which may delegate such power to a "municipal regulatory agency" or to the state Department of Transportation. This jurisdiction shall extend seven miles beyond a city's boundary for cities of more than 100,000 in population, four miles for those with populations of between 50,000 and 100,000, and two miles for those with populations of less than 50,000. An operating company must obtain a municipality's consent before using any of its streets. T.C.A. § 7-56-101, T.C.A. § 7-56-105.

State Grants

The state may provide grants for mass transportation capital projects or technical studies. Funded projects must be approved by the state commissioner of transportation and must be consistent with the statewide, comprehensive plan for transportation. Cities and counties are empowered to acquire, operate, and maintain mass transportation facilities or to contract with private companies for such services. T.C.A. §§ 13-10-107–109.

Operation of Motor Vehicles

Reference Number: MTAS-595

Following Fire Apparatus

Drivers other than those on official business are prohibited from following within 500 feet of any fire apparatus answering a call and may not park in the same block as the fire equipment. No driver may cross an unprotected fire hose without permission from the fire department official in command. T.C.A. §§ 55-8-168–169.

Transporting Children in Pickup Trucks

It is a Class C misdemeanor under state law to transport upon any street or highway of any city a child under age 12 in the bed of a pickup truck of less than three-quarters of a ton. A city may, by ordinance, make it a local violation to transport upon any city street or highway a child between 6 and 12 years old in the bed of a pickup truck of less than three-quarters of a ton. However, people transporting children in parades or for agricultural purposes are exempt from this provision. T.C.A. § 55-8-189.

Vehicle Weight

Maximum weight, height, and length limits for trucks and trailer trucks are established by state law. It is the duty of municipal officers to prohibit any vehicle from exceeding such limits on a public highway unless a special permit has been issued by the state commissioner of transportation. T.C.A. §§ 55-7-101, *et seq.*

Accident Report

Any automobile accident that involves bodily injury, death, or damage to a person's property of more than $400 must be reported. Reports must include information on insurance policies of the drivers, including the name of the insurer, and a copy of the certificate of compliance with the financial responsibility law. An investigating officer must send a copy of the report to the state Department of Safety within seven days of completing the investigation (a copy is to be kept in the district Highway Patrol office). Standard report forms are supplied to any city police department by the Department of Safety. This report is a public record. T.C.A. § 55-10-107, T.C.A. § 55-10-108(b), T.C.A. § 55-10-111, T.C.A. § 55-12-104.

Accident Response Fees Prohibited

A municipality may not impose an accident response service fee on a driver or owner of a motor vehicle or an insurance company but may bill them for ambulance services provided in response to a motor vehicle accident. T.C.A. § 55-10-108.

Funeral Processions

T.C.A. § 55-8-183 governs the identification, escort, operation, and conduct of traffic with respect to funeral processions. Any municipality may adopt the provisions of this law by a two-thirds vote of its legislative body. The presiding officer must certify its adoption to the secretary of state.

This law provides that where a funeral procession is properly identified, it is an offense punishable by a fine of up to $50 for the operator of a motor vehicle to:

- knowingly fail to yield the right-of-way to the procession across an intersection;
- pass or attempt to pass the procession from behind on a two-lane street, road or highway; or
- drive or attempt to drive between the vehicles in the procession.

For the purposes of this law, a "properly identified" funeral procession must be "indicated by a flashing amber light, an auditory signaling device mounted on the lead vehicle, or by other properly identified escort, and a flag or other appropriate marking device on each vehicle in the procession indicating that such vehicle is part of the funeral procession."

Many municipalities provide police escorts to funeral processions. They may be held liable under the Tennessee Governmental Tort Liability Act for negligent escort. *Anderson v. City of Chattanooga*, 978 S.W.2d 105 (Tenn. App. 1998). Generally, T.C.A. § 55-8-153 does not appear to affect the liability of municipalities that provide funeral escorts. Whether or not a municipality provides funeral escorts, it probably has the right to impose reasonable time, place, and manner restrictions on funeral processions.

Oncoming traffic meeting a funeral procession is no longer prohibited from pulling over and stopping. Motorcycle escorts of funeral processions may have a green strobe light or a type approved by the county sheriff that is used only when escorting a funeral. Motorcycle escorts also may have a bell or siren approved by the sheriff that is used only when escorting a funeral procession. Motorcycle escorts may operate between lanes or rows of vehicles. T.C.A. § 55-8-183.

T.C.A. § 39-17-317 makes it a Class C misdemeanor to make any utterance, gesture, or display that is offensive to the sensibilities of an ordinary person within 500 feet of a funeral, funeral procession, burial or viewing of a dead person.

Disposal of Abandoned, Immobile or Unattended Motor Vehicles

A municipal police department may “take into custody” and dispose of certain abandoned, immobile or unattended vehicles on public or private property. Procedures for doing this, including definitions, notices, sale or demolition, and other detailed provisions may be found in T.C.A. §§ 55-16-101, *et seq.*

Emergency Vehicles and Yielding

Reference Number: MTAS-831

T.C.A. § 55-8-108 allows the driver of an authorized emergency vehicle responding to an emergency call, pursuing a suspected law violator, or responding to a fire alarm when the vehicle is making use of an audible and visual signal to:

- disregard parking and standing regulations;
- proceed past a red or stop signal or stop sign, but only after slowing down as may be necessary for safe operation;
- exceed speed limits as long as life or property is not thereby endangered; and
- disregard movement and turning regulations.

While parked or standing, an authorized emergency vehicle must use only visual signals.

The same statute provides that these provisions "shall not relieve the driver of an authorized emergency vehicle from the duty to drive with due regard for the safety of all persons, nor shall such provisions protect the driver from the consequences of the driver’s own reckless disregard for the safety of others."

This statute also limits the liability of law enforcement officers and their employing governments for injuries to both suspected law violators and to innocent third parties arising from their pursuit of fleeing suspected law violators, in the following language:

Notwithstanding the requirement of this section that drivers of authorized emergency vehicles exercise due regard for the safety of all persons, no municipality or county ... nor their officers or employees shall be liable for any injury proximately or indirectly caused to an actual or suspected violator of a law or ordinance who is fleeing pursuit by law enforcement personnel. The fact that law enforcement personnel pursue an actual or suspected violator of a law or ordinance who flees from such pursuit shall not render the law enforcement personnel or his or their employers liable for injuries to a third party proximately caused by the fleeing party unless the law enforcement personnel were negligent in his or their conduct, and such negligence was a proximate cause of the injuries to the third party.

However, under *Haynes v. Hamilton County*, 883 S.W.2d 606 (Tenn. 1994), the above limitation on the liability of law enforcement officers and their employing governments in third-party injury cases is quite narrow. There, the Tennessee Supreme Court pointed out that while the above limitations on liability provided absolute immunity to local governments for the injury or death of a fleeing suspect, they did not necessarily have the same effect with respect to innocent third parties injured in police pursuits. The court said that in those cases, negligent "conduct" within the meaning of that statute could include the police officer’s decision to initiate or to continue the pursuit. The determination of whether such a decision is reasonable must weigh the risk of injury to the third party against the interest in apprehending suspects. "Factors relevant to that determination include the speed and area of the pursuit, weather and road conditions, the presence or absence of pedestrians and other traffic, alternative methods of apprehension, applicable police regulations, and the danger posed to the public by the suspect being pursued." Those factors are not exclusive, continued the court, and "overall, a police officer’s conduct should be viewed in light of how a reasonable, prudent police officer would respond under the circumstances and not judged with the perfect vision afforded by hindsight."

Municipal hot-pursuit policies should be drafted, and police officers should initiate and continue hot pursuits with *Haynes* in mind.

Failure to Yield to Emergency Vehicles

Failure to yield to an approaching emergency vehicle or failure to move over or slow down for a stopped emergency vehicle is a Class B misdemeanor (T.C.A. § 55-8-132). Therefore, municipal ordinances regulating these offenses are invalid and unenforceable. See T.C.A. § 16-18-302.

IRS Rules for Diesel Fuel and Gasoline Purchases

Reference Number: MTAS-1148

Gasoline, diesel and certain other fuels purchased for the exclusive use of a state or local government are exempt from the federal excise taxes on those fuels $0.244 per gallon for diesel fuel; $0.184 per gallon for gasoline. Since your city can buy the fuel tax free, it need not request a refund.

The Omnibus Budget Reconciliation Act (P.L. 103-66), enacted in August 1993, made the collection point for the excise taxes on diesel fuel the same as the collection point for gasoline. The act also provided that diesel fuel dyed in accordance with IRS regulations may be sold at a tax-excluded price if the fuel is for a nontaxable use (e.g., the exclusive use of a state or local government).

State and local governments can purchase dyed diesel fuel (blue for high-sulfur fuel for use in off-highway vehicles and red for low-sulfur fuel for use in motor vehicles) at a price that excludes the federal excise tax. Dyed fuel may be purchased from any vendor who sells it. The vendor will post a notice stating “DYED DIESEL FUEL, NONTAXABLE USE ONLY, PENALTY FOR TAXABLE USE.” This notice will appear on retail pumps, all bills, shipping paper, etc.

According to IRS rules, the only legal way to purchase undyed diesel fuel without paying taxes is to buy it from a certified vendor. The vendor alone is responsible for seeking a refund of excise taxes from the IRS. To obtain the refund, the vendor must be a “registered ultimate vendor,” and the local government must give the vendor a “Model Certificate A” certificate of farming use or state use to support the vendor’s claims for credit or payments under section 6427 of the Internal Revenue Code.

Local governments may purchase gasoline and diesel products from retail stations tax free provided such purchases are made through a fleet credit card or an oil company credit card that has been issued by the oil company to a governmental agency that holds an exemption permit issued by the state commissioner of revenue. The state gasoline tax rate is $0.24 from July 1, 2017 to June 30, 2018 - $0.25 from July 1, 2018 to June 30, 2019- $0.26 from July 1, 2019 and after; and $0.21 from July 1, 2017 to June 30, 2018- $0.24 from July 1, 2018 to June 30, 2019- $0.27 from July 1, 2019 and after for diesel fuel. For current taxes, see [1]https://www.tn.gov/revenue/taxes/motor-fuel-taxes.html [1]. Other taxes may also apply, such as an environmental assurance fee (on all petroleum products) currently at $0.0004 per gallon.

Anyone who illegally uses dyed diesel or gasoline fuels – fuels that have been exempted from the federal excise tax – will be severely penalized.

See Publication 510, (Rev. July 2012), Cat. No. 150141 "Excise Tax (Including Fuel Tax Credits and Refunds) http://www.irs.gov/pub/irs-pdf/p510.pdf [2] for the most current rates.

Compressed Natural Gas for Municipal Fleets

Reference Number: MTAS-705

The University of Tennessee Municipal Technical Advisory Service (MTAS), Clean Cities Coalition of Tennessee, Tennessee Renewable Energy and Economic Development Council (TREEDC) and the Tennessee Gas Association (TGA) are important resources available to interested fleets across the state. Natural gas is certainly abundant and much cheaper than petroleum. Natural gas can be used for city garbage trucks, police vehicles, and service vehicles. This guide presents the economic and environmental benefi ts of compressed natural gas along with case studies and siting tips for compressed natural gas stations.

Compressed natural gas, also known as CNG, is a fossil fuel substitute for gasoline (petrol), diesel or propane/LPG. More familiarly, it is the type of gas used in stoves. This gas remains clear, odorless and non-corrosive. Although its combustion does produce greenhouse gases, it is a more environmentally clean alternative to those fuels and is much safer than other fuels in the event of a spill. This is true because natural gas is lighter than air and disperses quickly when released.

Most natural gas is formed from three different types of wells; natural gas-and-condensate wells, oil wells and coal bed methane wells. However, more than 90 percent of the natural gas used in the United States comes from domestic or other North American sources. Increasing demand for natural gas in power plants will require new supplies from non-North American countries, increasing our dependence on foreign sources of energy. Delivering CNG is not as difficult as it may seem. With local vehicle fueling stations owned and operated by private companies and local governments, transportation can be easy and effective. CNG can also be imported via pipeline. The natural gas must be stored in thick-walled steel, aluminum or composite tanks built to last more than 20 years.

Environmental Benefits

Reference Number: MTAS-819

Natural gas is the cleanest of all the fossil fuels. 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 and lower levels of carbon dioxide, carbon monoxide and other reactive hydrocarbons. The chart below is based on the Environmental Protection Agency’s data and shows fossil fuel emission levels for 2010.

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

Pollutants emitted in the United States, particularly from the combustion of fossil fuels, have led to the development of many pressing environmental problems. Natural gas, emitting fewer harmful chemicals into the atmosphere than other fossil fuels, can help to mitigate some of these environmental issues. These issues include greenhouse gas emissions, smog, air quality and acid rain, industrial and electric generation emissions and pollution from natural gas vehicles.

Economic Benefits

Reference Number: MTAS-820

The use of CNG not only helps the environment, but it is also economically wiser as well. One of the biggest advantages CNG provides is an affordable price. As the world continues to experience ongoing hikes in the cost of gasoline, the low price of CNG offers a glimmer of hope. CNG is typically at least 30 percent cheaper than gasoline. Natural gas vehicles have been introduced in a wide variety of commercial applications, from light-duty trucks and sedans such as taxicabs, package delivery vans, postal vehicles, transit buses, street sweepers and even school buses. In California, transit agency buses are some of the most visible CNG vehicles. Below is a chart from the U.S. Department of Energy showing the difference in prices between gasoline, diesel and CNG.

U.S. Department of Energy Alternative Fuel Comparison Jan-March 2011		
	Nationwide Average Price for Fuel	**Nationwide average Price for Fuel 4th Quarter 2010**
Gasoline (regular)	$3.69	$3.08
Diesel	$4.04	$3.45
CNG	$2.06	$1.93

As you can see, the margin between the price of gasoline and CNG is significant and is clearly more efficient.

Examples of "Clean Cities"

Reference Number: MTAS-706

Cities now are jumping on the bandwagon and changing things so they can be classified as a “clean city.” Several cities have gone to great measures to help them become more economically friendly. For example, Kansas City, Mo., is well on its way to a green future with the guidance of Kelly Gilbert, the Kansas City Clean Cities Coalition director. Although she has only had this job for a few months, she is off to an exceptional start. She has spearheaded an ambitious proposal that led to a $15 million American Recovery and Reinvestment Act award. This grant provides the funding for the installation of 27 alternative fueling stations as well as the development of about 350 alternative fuel and advanced technology vehicles. Along with 17 partners, she created the Midwest Region Alternative Fuels Project.

Another city showing great success is Grand Ledge, Mich. The GLACC (Greater Lansing Area Clean Cities) is reducing local petroleum consumption by engaging local school district bus fleets. Since 2007, they have been promoting their Clean the Air for School Kids program, which informs local school districts about school bus emission and encourages them to reduce school bus idle time, use cleaner fuels and install emission solutions. They have also worked with the statewide school bus company to eplace older buses with cleaner, more efficient buses and to install emission solutions on nearly 300 buses that carry 10,000 special education students and 5,000 general education students daily. This accomplishment earned GLACC more than $1 million in American Recovery and Reinvestment Act funding to expand the program given by the Environmental Protection Agency National Clean Diesel Funding Assistance Program. For the 2010-2011 school year, this program advanced further by replacing even more buses.

A less intense way in which cities are trying to help go toward a green future is by campaigning. In San Francisco, the American Lung Association and San Francisco Clean Cities partnered together to conduct a three-month idle reduction campaign at six area elementary schools. Idling contributes to outdoor air pollution, is linked to increases in indoor air pollution, stunts children’s lung developments and also wastes fuel. The goals of this campaign, called “Turn Off Your Engines: Idling Wastes Money and Hurts Children,” were to inform drivers about the costs of idling in school zones and to persuade them to change their behavior. With permission, representatives observed driver behavior at each site for 36 hours over a two-week period. They timed how long drivers idled their vehicles and compiled vehicle make and type data. One out of every four drivers idled for more than 30 seconds, while some idled foras long as 10 minutes. The next week, they created fl yers and passed them out with facts about idling, such as idling for 10 minutes a day wastes about $200 worth of fuel a year. This project might not be as big as the one in Kansas City but informing the public of certain dangers of everyday things can help lead a city to becoming “clean.”

Tennessee Cities

Knoxville was recently ranked by the Asthma and Allergy Foundation of America as the fourth worst city in the United States for asthmatics. Events to help the community raise awareness about air quality issues are critical to this region due to the statistics. For the past seven years, the East Tennessee Clean Fuels Coalition has hosted the Run for Clean Air in Knoxville. The participants enjoy a live band, food, prizes and the opportunity to drive and ride in hybrid vehicles.

In the city of Bristol, officials accepted the green challenge and began efforts to reduce the city's carbon footprint and overall environmental impact in order to create a more livable and responsible community. Bristol understands that "Going Green" is a continual process. Each year, Bristol commits to being more environmentally responsible and pledges to help make the process easy for the public to embrace as well. Bristol has developed a "Going Green" website, which contains a collection of resources and information from the world's leading environmental experts to help others start their own green lifestyle. The Bristol organizers emphasize that the program helps ensure a safe and beautiful community for generations to come.

In Gatlinburg, the Chamber of Commerce initiated a voluntary program for businesses working to reduce their environmental impact to preserve the natural beauty of this tourism center. Businesses receive information on products and actions to help them achieve green goals. In addition, the city uses biodiesel for its trolleys and LED lights for its holiday display.

Another city heavily involved in becoming greener is Nashville. Nashville created the Green Ribbon Committee, with its goal to become the greenest city in the Southeast. Award-winning Metro Parks Nature Centers work to increase environmental education and outdoor recreation areas. Pervasive programs are cropping up to take Tennessee into a greener future, including Adopt-a-Highway, TVA's environmental partnerships, Tennessee's Biofuels Initiative and land acquisition for further development of Tennessee parks.

Compressed Natural Gas (CNG) Stations

Reference Number: MTAS-707

CNG Station Siting Tips

There is clearly a need to develop the infrastructure for CNG fueling stations in Tennessee. Selecting the right configuration is critical to success. According to Energy International, a global energy consulting firm, the main considerations in choosing a station are the number and type of vehicles fueled and their fueling pattern. Secondary considerations include location, potential future growth, and permitting restrictions. The CNG Station Guide is available online at http://www.afdc.energy.gov/fuels/natural_gas_stations.html [3].

CNG Station Types

Energy International outlines four major station types:

Time-Fill Stations fill vehicles over a six- to eight-hour period. Compressors compress natural gas from pipeline pressure (5–100 psi) to the required vehicle pressure (2,400–3,600 psi) and dispense it into multiple vehicles simultaneously. These stations are best for vehicles such as school buses and utility trucks that return to a central location and can fuel while parked for an extended period. Among all options, they are least expensive to build and staff and require no full-time attendant. Extended fueling time is needed, however, because time-fill stations have relatively small compressors and no CNG storage.

Cascade Fast-Fill Stations provide fast and convenient fueling similar to that provided by conventional liquid fuel stations. CNG storage vessels arranged in cascades, or banks, are used to quickly fill vehicles during peak fueling times, when the compressors alone cannot meet demand. During offpeak times, the compressors refi ll the CNG storage cascades. These stations are suitable for fueling light-duty vehicles at public access stations where use patterns are random. They also are suitable for fueling fleets of light-duty vehicles, such as taxis and police cars, which require a fast-fill and have peak fueling periods. Cascade fast-fill stations are not appropriate for continuous, high-volume fueling because the compressors are not large enough to provide a fast fill once the CNG storage has been depleted. Most of the several hundred public access CNG stations in North America use a cascade fast-fill system.

Buffered Fast-Fill Stations provide fast, continuous, high-volume fueling. Relatively large compressors run continuously during fueling, filling ;vehicles and, in the interval between vehicles, a CNG storage buffer. The storage buffer provides CNG to vehicles at the beginning of the fueling cycle and allows the compressor to run for long periods. Unlike CNG storage in cascade fast-fill systems, buffer storage is not separated into separate banks. Buffered fast-fill stations are suitable for quickly fueling large numbers of heavy-duty, high-fuel capacity vehicles, such as transit buses.

Vehicle Refueling Appliances (VRAs) are like small time-fill stations, containing a small compressor and other equipment within a single unit. VRAs use natural gas from low-pressure pipelines found in many homes and businesses and require 220-volt, single-phase electricity. They are suitable for fueling individual vehicles over an extended period. Grouping multiple VRAs together and adding a cascade storage system provides small- to medium-sized light-duty fleets with fast-fill fueling. VRAs will soon be available for residential installation.

Infrastructure Resources and References

Reference Number: MTAS-821

Infrastructure Resources

AFDC Infrastructure Section – New addition to the Alternative Fuels Data Center provides info on equipment and installation, codes and standards, fuel providers, safety, training, success stories and contacts. Link to industry groups such as DOE's Natural Gas Vehicle Technology Forum. http://en.openei.org/wiki/Alternative_Fuels_and_Advanced_Vehicles_Data_Center [4].

Clean Cities Tiger Teams – Created to help coalitions overcome AFV and infrastructure challenges, with experts from various technical disciplines. Part of the Clean Cities Technical Assistance Program. http://www1.eere.energy.gov/cleancities/technical_assistance.html [5].

CNG Station Guide – Free online guide helps prospective and existing station owners build and operate efficient and cost-effective facilities. http://www1.eere.energy.gov/cleancities/pdfs/ngv_wkshp_adams.pdf [6].

For More About Clean Fuels, see http://www1.eere.energy.gov/cleancities/publications.html [7].

Federal and State Laws and Incentives: http://www.afdc.energy.gov/laws/ [8].

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[3] "Compressed Natural Gas (CNG) As A Transportation Fuel." California Energy Commission: Consumer Energy Center. (2010): 1-6.

[4] Smith, Dennis, and Linda Bluestein. "Clean Cities Now." U.S. Department of Energy: Energy Efficiency & Renewable Energy. 14.2 (2010): 1-8.

[5] "Tennessee Gets Serious About Natural Gas." Tennessee Clean Fuels Advisor. 2011: 1-4.

Municipal Biodiesel Production

Reference Number: MTAS-734

Biodiesel is an alternative fuel derived from various feedstocks such as soybean, other oil crops, waste vegetable oil and animal fats that can be used as a renewable fuel alternative to petroleum-based diesel fuel. Other potential next generation feedstocks include algae and jatropha. Biodiesel is biodegradable, nontoxic, and nonvolatile. It is produced through a chemical process called transesterification where methanol and sodium or potassium hydroxide are mixed with the feedstock. The process leaves behind two products: glycerin (a valuable co-product primarily used in soaps and in many cosmetics) and methyl esters (biodiesel). The methyl esters, after carefully washing to remove all remaining catalyst, alcohol and glycerol, are the biodiesel and can be used as a fuel in diesel engines. The esters are good solvents and cleaning gents. In addition to its other attributes, biodiesel reduces greenhouse gases. Used in its pure form, biodiesel reduces emissions of carbon dioxide by 78 percent, carbon monoxide by 40 to 50 percent and particulate matter by 50 percent.

Biodiesel also leads to energy independence by using renewable, American resources and can be a boost to the local economy through job creation and savings in operational costs. Biodiesel offers other services to communities seeking to minimize their energy related costs. It can be used in any diesel public works equipment such as dump trucks, service trucks, mowers and tractors. It can be used to develop heating systems if buildings have oil burners in their furnaces. Government buildings with steam radiators are good candidates to use biodiesel. It is possible to change out the natural gas burner for an oil burner and add an oil storage tank and use biodiesel for heating. Glycerin generated from production of biodiesel can be used to produce car wash soap to clean the vehicle fleet.

Foundations of Municipal Biodiesel Production

Reference Number: MTAS-816

Small-scale production of biodiesel is possible when an appropriate source of oil is secured, appropriate storage and processing equipment and labor are available, and an acceptable off-take of the glycerin by-product is developed. Interest in small-scale production of biodiesel by municipalities has grown considerably in recent years due to high costs of fuel and a desire to implement programs that prevent improper disposal of used cooking oils to municipal wastewater systems. Biodiesel serves a dual role in reducing fleet transportation costs and wastewater line clogs generated from household and restaurant grease (not to mention all it does for America). Another advantage in producing biodiesel is that it serves as good insurance during natural disasters, when fuel terminals are shut down, by ensuring that fleets have adequate supplies. In 2005, Hurricane Katrina caused many communities to be stranded without diesel.

Today, several municipalities in Alabama and Tennessee have developed and implemented recycling programs for both residential and commercial-used cooking oils. These progressive, proactive communities obtain the waste vegetable oil (WVO), and process it into biodiesel that is subsequently used in municipal vehicle fleets. Gadsden and Hoover, Ala. have become national models of municipal biodiesel recycling production systems. The Southern Alliance for Clean Energy (SACE) in partnership with the University of Tennessee Institute of Agriculture and the Tennessee Department of Environment and Conservation (TDEC) recently opened a Knoxville community-based biodiesel production facility. Built with an Alternative Fuels Innovations Grant from TDEC, the biodiesel production unit aims to convert waste fryer oil from local restaurants and other sources into useable fuel. Full production, doubleshift capacity for the mobile unit is approximately 380,000 gallons of biodiesel per year. SACE will collect waste fryer oil from participating restaurants and the new facility will convert the waste oil into biodiesel. The environmentally friendly fuel replaces volumes of petroleum-based diesel fuel.

The city of Clarksville recently received a Congestion Mitigation Air Quality grant to begin a municipal biodiesel recycling program. The cities of Crossville, East Ridge and Sweetwater also are making plans to produce their own biodiesel for city vehicles and equipment. This technical publication will examine some of the issues to be evaluated when municipalities consider initiating their own recycling and biodiesel production programs.

Biodiesel Quality

Reference Number: MTAS-817

Biodiesel is one of the most thoroughly tested alternative fuels on the market. ASTM International, originally known as the American Society for Testing and Materials, is an international organization that develops and publishes consensus technical standards for biodiesel. Producers who sell biodiesel must meet these specifications. Cities that produce biodiesel for their own use are not subject to these guidelines, however, it is recommended that cities follow them. Copies of specifications are available from ASTM at www.astm.org [9].

A number of independent studies — performed by the U.S. Department of Energy, the U.S. Department of Agriculture, Stanadyne Corp. (the largest diesel fuel injection equipment manufacturer in the U.S.), Lovelace Respiratory Research Institute, and Southwest Research Institute — have shown that biodiesel performs similar to petroleum diesel with greater benefits to the environment and human health. The National Biodiesel Board has set quality standards for biodiesel for more than 15 years. ASTM specifications exist for diesel fuel and biodiesel fuel blends from 6 to 20 percent [B6 – B20 (D7467-09)], biodiesel blends up to B5 to be used for on- and off-road diesel applications (D975-08a), and home-heating and boiler applications (D396-08b). ASTM approved the original specification for pure B100 (D6751) in December 2001. These ASTM specifications apply regardless of the fat or plant oil used to make the fuel.

One of the major advantages of biodiesel is that it can be used in most existing engines and fuel injection equipment in blends up to 20 percent with little impact to operating performance. Biodiesel has a higher cetane number than U.S. diesel fuel. In more than 50 million miles of demonstrations, B20 showed fuel consumption, horsepower, torque, and haulage rates similar to conventional diesel fuel. Biodiesel also has superior lubricity, and it has the highest BTU content of any alternative fuel (falling in the range between #1 and #2 diesel fuel). All major U.S. automakers and engine manufacturers accept the use of at least B5, and many major engine companies have stated formally that the use of high quality biodiesel blends up to B20 or even B30 will not void their parts and workmanship warranties. For a listing of specific statements from the engine companies, please visit the National Biodiesel Board website at www.biodiesel.org [10].

Feedstock Methodology

Reference Number: MTAS-736

The first step in the production of biodiesel is obtaining a suitable vegetable oil or animal fat (feedstock). The potential sources are:

- Collection of used oil commonly called yellow grease from restaurants and/or households;
- Collection of animal fat from slaughter houses and packing sheds;
- Purchasing yellow grease or tallow from an existing renderer;
- Contracting production of vegetable oil seeds from local farmers or processors;
- Purchasing clean seed from an existing warehouse or seedsman; and
- Purchasing vegetable oil from an existing crushing plant.

Municipal biodiesel producers generally use the potential source as the first option to produce the alternative fuel. If a city collects 1,000 gallons of used cooking oil then 1,000 gallons of biodiesel will be produced. The typical biodiesel production formula is as follows:

100 lbs. of used vegetable oil or other feedstock
+ 20 lbs. of methanol =
100 lbs. biodiesel + 20 lbs. glycerin

Best Practices of Municipal Biodiesel Production

Reference Number: MTAS-737

The city of **Gadsden, Alabama** initiated a WVO recycling program and biodiesel production program in the fall of 2007. Like many municipalities, it was faced with rising fuel costs. It was also faced with another common problem of municipalities: high maintenance costs in the wastewater treatment system due to grease from households and restaurants. After expressing its intention to start a recycling and biodiesel production program, the city was designated as an Auburn University Energy Partner. In this relationship, personnel from the Gadsden municipal fleet worked with personnel from Auburn University’s Center for Bioenergy and Bioproducts and the Alabama Cooperative Extension System to establish the biodiesel production system. Gadsden is currently recycling used cooking oils that are available from local restaurants and households to produce biodiesel, and as a result minimizing fleet fuel expenditures and wastewater treatment system maintenance. Additional financial support for this program was provided by the Energy Division of the Alabama Department of Economic and Community Affairs.

Best Practices in Biodiesel Production: Program Initiation

Reference Number: MTAS-1485

At the start of Gadsden's program, the biodiesel processing equipment and associated oil collection and processing equipment were bought by the city. This equipment included the following major items:

- Biodiesel processor capable of producing 55-gallon batches of biodiesel (manufactured by Biodiesel Logic, Inc.);
- Four 275-gallon chemical storage "totes" for storing WVO before processing;
- Two 150-gallon fuel tanks, pumps, and meters for storing and dispensing finished biodiesel;
- 20 55-gallon steel drums for WVO collection at restaurants
- 4,500 one-gallon plastic jugs for residential WVO collection;
- Seven collection bins for residential WVO jug
- Miscellaneous lab supplies for titration of WVO;
- Expendable supplies for biodiesel production (methanol, sodium hydroxide catalyst).

The collection bins for residential WVO jugs were built by personnel in the fleet management group in Gadsden. Other municipalities have purchased similar commercially available units. The one-gallon jugs were fitted with pre-printed labels that have information on procedures for recycling the WVO.

Best Practices of Biodiesel Production: Program Operation

Reference Number: MTAS-1486

When Gasden's program started, 55-gallon drums were distributed to participating restaurants. Fleet management personnel checked the drums once each week, and generally picked them up when the drum contained about 35 gallons, or every other week, whichever came first. When the full drum was picked up, another drum was left at the restaurant.

The residential WVO jugs were placed in the storage bins, which were located at seven community centers in Gadsden. While other cities have chosen to place the collection bins at grocery stores, Gadsden chose to use its network of community centers. The bins are configured so that empty, clean containers are placed on the top shelf, while full containers are placed on the bottom shelf. Also, the bins are designed so that larger containers of WVO (such as those two-gallon containers used for turkey frying, etc.) can be placed on the bottom shelf.

Once the oil is picked up and transported to the fleet management facility, it is poured (in the case of the one-gallon jugs) or pumped (in the case of the 55-gallon drums) into the chemical storage totes. If water is detected in the WVO, the oil is heated and allowed to cool to separate the water from the oil. Because there are several 275-gallon totes, a rotating procedure is used where the oil is allowed to settle for nearly one week before being used for biodiesel production. The WVO is pumped from the top portion of the tank through a filter and into the biodiesel processor.

After the oil is pumped into the biodiesel processor, minimal labor is required by the fleet management personnel to perform the process. The processor used by Gadsden is a relatively self-sufficient processor that will conduct most of the process automatically. Before starting the transesterification reaction, the WVO is heated to 140 degrees and a sample of oil is removed for the titration procedure, in order to determine how much catalyst is required for biodiesel production. After the titration process is complete, methanol is added to a separate methanol tank and the catalyst is poured into a methyl/oxide mixer drum. After starting the reaction process, it will take approximately one and a half hours for glycerin to begin separating from the biodiesel and another one and a half to two hours for the glycerin to be completely separated. The system uses a dry wash process that requires an additional three hours to complete. After being allowed to cool, the finished biodiesel can be filtered through a five micron filter, and pumped into the fuel storage tank. Biodiesel is splash blended with petroleum-based diesel to create blends of B10 or B20 for various fleet vehicles or machines.

Glycerin that results from the process is drained from the reactor vessel into a clean 55-gallon drum for later disposal. Disposal options have included composting and transferring to a nearby business that manufactures soaps.

Best Practices of Biodiesel Production: Program Results

Reference Number: MTAS-1487

During the first year of Gadsden's operation, approximately 2,000 gallons of biodiesel have been successfully produced. The fleet manager reported that much more fuel could be produced (as much as one 55-gallon batch each day) if more WVO was available in the community. The fleet manager indicated that the collection and processing operations do not place any undue burden on fleet personnel.

Of the 2,000 gallons of WVO collected, approximately 80 percent was from restaurants and other food industries while 20 percent was from residential sources. Approximately 10 restaurants participated during this period, and most of these were either new businesses or relatively small businesses that did not have existing contracts with WVO processors. The residential program has been successful; however, the fleet manager reports that there is a continuing need to educate the public on the opportunity to recycle WVO. The mayor and fleet manager both gave presentations to civic groups and took the one-gallon jugs with them to pass out to citizens. Also, local news media have been very willing to mention the program. The fleet manager reports that any mention of the program in the media results in an increase in oil collected at the community center bins.

The city does not conduct a formal fuel testing program on its fleet, but has had no vehicle maintenance problems since initiating the program. It does conduct periodic fuel tank cleaning to prevent algae growth. Also, it will conduct the 3/27 test periodically to determine if there is any unreacted WVO in the biodiesel. The only problem reported was with excess water in the WVO. This appears to have been the result of leaving the tops off of the 55-gallon drums while at the restaurants. Heating the WVO has been a successful method of removing water from the oil.

Handling the glycerin by-product has also been successful. While initial phases of the program composted the glycerin, the city has now developed a relationship with a nearby company that produces industrial soaps. This business comes to the fleet maintenance facility and picks up the glycerin for further processing, thereby alleviating the need to dispose of the glycerin.

Feasibility Model (2011)

Reference Number: MTAS-738

Feasibility Model: $45,000 Capital Outlay/20,000 Gallons of Annual Production

Using 2011 dollars, the initial cost of a similar system (55-gallon biodiesel processor, storage tanks and bins, and WVO drums and jugs) is approximately $60,000. Note that the 55-gallon processor is capable of producing two batches per day. If this fixed cost is spread over a five-year period, and if 20,000 gallons of fuel could be produced per year when the program is fully operational, this results in a fixed cost of $0.60 gallon of biodiesel excluding depreciation. Changing the production rate higher or lower will either lower or raise, respectively, the cost per gallon. The variable costs (methanol, sodium hydroxide, amberlite resin, and electricity) are listed in the table below and result in $0.99 per gallon of biodiesel. Therefore, a total cost of producing the fuel could be approximately $1.59 per gallon at the production rate of 20,000 gallons per year for five years. After five years, the costs to produce the biodiesel would consist only of the variable cost of $0.99 per gallon. The price per gallon of petroleum diesel as of November 28, 2011, was $3.63 per gallon. Using these figures, cities would save a minimum of $2.04 per gallon or a total annual savings of $40,800 during the first five years. Another way to explain the savings is that the biodiesel processor unit would pay for itself in approximately 18 months.

Variable Costs of Biodiesel Production

Ingredient	**Cost**	**Cost, $/gal biodiesel**
Methanol	$2.75/gal	0.55
Potassium Hydroxide	$0.50/lb	0.05
WVO	$0.00/gal	0.00
Amberlite	$10.7/lb	0.04
Electricity cost	$0.14/kWh	0.35
Total cost		**$0.99/gal+ $0.60/gal fixed ($1.59/gal)**

Overall, the fleet manager, mayor, and city council have been very happy with the program. Benefits from this program include fuel and cost savings to the city (and taxpayers), improved local air quality from using the biodiesel, greater community involvement through the household-used oil recycling program, and reduced sewer maintenance costs. The fleet manager is strongly committed to continuing and expanding the program into the future. For additional information in a video format, visit http://farmenergy.blogspot.com [11].

Biodiesel Partnership

Reference Number: MTAS-818

Tennessee Renewable Energy and Economic Development Council and East Tennessee Clean Fuels Coalition

Cities may want to consider pooling their resources to create a shared biodiesel recycling program. The Tennessee Renewable Energy and Economic Development Council (TREEDC) and East Tennessee Clean Fuels Coalition (ETCFC) began seeking funding assistance for small cities and counties to share in the development of several statewide biodiesel recycling programs. In order to develop a viable and sustainable biodiesel recycling program among communities, an assessment of annual diesel should be conducted. This inventory serves a dual role as 1) a foundation to benchmark fossil fuel reductions; and 2) as information to help determine how much fuel will be needed based on the biodiesel blends that the community wishes to use. TREEDC and ETCFC plan to collaborate with communities on a regional basis to understand their fuel needs, and develop a program to enhance local capacity to coordinate and build the necessary and appropriate infrastructure, logistics, and distribution systems to enable the delivery of sustainable alternative fuels to new markets in Tennessee.

TREEDC and ETCFC will work with participating local governments, transportation systems and utility companies to profile their current and past fuel usage and procurement practices for gasoline, diesel and natural gas. TREEDC will collect information from communities on fuel use by government, police, fire departments, emergency and regular service, utilities, schools and transportation systems. The council will compile regional renewable fuel market information and coordinate shared biofuel purchases and distribution.

ETCFC is the East Tennessee arm of the U.S. Department of Energy’s (DOE) Clean Cities program and serves the majority of the eastern half of Tennessee.

Since 2009, three communities in Tennessee started their biodiesel production activities. These communities are Clarksville, East Ridge and Crossville. Clarksville’s processor, which was funded by an

EPA Congestion Mitigation and Air Quality Improvement grant, was damaged during heavy rains in May 2010 and East Ridge suspended its operations due to a change in city management. Since Spring 2010, Crossville has produced 1,600 gallons of biodiesel. It uses a 10 percent blend of biodiesel in backhoes and mowers. The city also uses its biodiesel facility as an educational tool at an annual sustainability fair. Crossville uses a 100 percent blend in a 1997 one-ton service truck. According to Public Works Maintenance Manager Steve Powell, the biggest challenge in the operation is to secure enough usable and clean used oil from local grocery franchise stores and donors.

Conclusion

Small-scale production of biodiesel by municipalities has been conducted successfully by several cities in Alabama, and appears to be a concept that can be successfully duplicated in other municipalities across the state and nation. These programs use recycled WVO as their primary feedstock for biodiesel. The WVO can be obtained from the food service industry or from local citizens. Organizations such as the Tennessee Renewable Energy and Economic Development Council and the East Tennessee Clean Fuels Coalition can assist local governments with the implementation of sustainable small-scale biodiesel production systems.

By using commercially available biodiesel processors and relatively simple oil collection and storage equipment, the municipal fleet management team can produce high-quality biodiesel for use in vehicles and equipment. While there are technical challenges to overcome in any such program, challenges such as WVO quality assurance, fuel quality assurance, and glycerin offtake have all been successfully overcome by fleet operators.

The most important aspect of these programs is the successful involvement of local businesses and citizens in creating a community-based recycling and biofuel production program. Such programs alone will not solve the nation’s energy security problem; however, they can be a small step toward energy independence by producing renewable fuels from local resources while building community awareness for environmental protection. In short, these programs allow the local citizens to have a part in producing renewable fuels in their own community.

Acknowledgements: Hoover and Gadsden Ala., Jonathan Overly, ETCFC

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Reference Number: MTAS-749

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November 10, 2011 Interview with Steve Powell, Public Works Maintenance Manager City of Crossville, Tennessee

Additional Information on Biodiesel Production or Bioenergy

National Biodiesel Board: http://www.biodiesel.org/ [13]

Natural Resources Management & Development Institute: http://www.southerngrowth.com/innovators/downloads/2009/AL%20Innovator%20flyer.pdf [14]

Alabama Department of Economic and Community Affairs, Energy Division: http://adeca.alabama.gov/Energy/default.aspx [15]

Alabama Department of Agriculture and Industries, Center for Alternative Fuels: http://www.agi.state.al.us/alternative_fuels [16]

Alabama Clean Fuels Coalition: http://www.alabamacleanfuels.org/ [17]

Southern Alliance for Clean Energy: http://www.cleanenergy.org [18]

East Tennessee Clean Fuels Coalition: http://www.etcfc.org/ [19]

Information on Biodiesel Testing

Fleet Biodiesel Testing: http://www.fleetbiodiesel.com/ [20]

Wilks Infraspec Analyzer: http://www.wilksir.com/index.php [21]

Biodiesel water test: www.utahbiodieselsupply.com/biodieselwatertestkit.php [22]

Propane for Tennessee Fleets

Reference Number: MTAS-1320

Propane, also known as liquefied petroleum gas (LPG), is an odorless, non-toxic hydrocarbon gas at normal pressures and temperatures. When pressurized, it is a liquid with an energy density 270 times greater than its gaseous form. Aside from scientific terms, propane is used to power roughly 190,000 vehicles in the United States and more than 14 million vehicles worldwide. It is a smart choice for many fleet applications including school buses, shuttle buses, taxis, and light-duty trucks. Many people may ask what the differences are between propane and compressed natural gas (CNG). While natural gas occurs in nature as a mixture of methane and other gases, propane is actually a byproduct of both petroleum refining and natural gas processing. Natural gas must be cleaned before being used, and byproducts of this process include hydrocarbons such as propane in addition to butane, ethane, and pentane. The difference between propane and natural gas in domestic use comes down to their energy efficiency, cost, compression, storage, and risk factors.

Propane provides more energy per unit of volume than compressed natural gas. While propane is usually measured in gallons (or liters), natural gas is found in cubic feet (or cubic meters). Natural gas provides more than 1,000 BTUs per cubic foot (0.0283 cubic meters); the same volume of propane in gaseous form provides about 2,500 BTUs. This means that propane contains about two and a half times more usable energy content. So, less propane is needed to produce the same amount of energy as compressed natural gas. Both propane and compressed natural gas also can be used to power alternative fuel vehicles. Vehicles that run on either type require special tanks to hold the fuel; many cars are actually bi-fuel, which means they have additional tanks to hold gasoline. CNG must be kept at much higher pressure than propane, so the tanks are often larger and heavier, which can lower the vehicle’s mileage. Vehicles that run on CNG tend to be more expensive than those that use LPG. Also, propane has a narrow flammability range, and its tanks are 20 times more puncture-resistant than gasoline tanks.

Questions being asked are how a propane vehicle works and can they perform comparable to other types of vehicles? Propane vehicles operate much like gasoline vehicles with spark-ignited engines. They also are similar to their gasoline counterparts with regard to power, acceleration, and cruising speed. Two types of fuel-injection systems are available — vapor and liquid injections. In both types, the propane is stored as a liquid in a low-pressure tank. In a vapor-injected system, liquid propane is controlled by a regulator or vaporizer, which converts the liquid to a vapor. In a liquid-injected system, fuel is delivered to the combustion chamber, or intake port, in a liquid form. This publication guides you through the costs, the benefits, several examples and more to ensure a higher level of knowledge for this efficient type of energy.

Cost (Vehicles and Propane)

As far as the price for a propane vehicle, original equipment manufactured (OEM) light-duty propane vehicles can cost several thousand dollars more than comparable gasoline vehicles. However, due to federal tax credits, it may offset the increased vehicle cost. Many states have additional incentives that further support the purchase of a propane vehicle. Vehicle conversions may qualify as well for tax credits and other incentives. One of the driving forces for the popularity of this type of energy are lower maintenance costs. Propane’s high octane rating and low-carbon and oil-contamination characteristics have resulted in documented engine life of up to two times that of gasoline engines. The price of propane typically is based on the volume of fuel used. For the best success, fleet operators should develop relationships with their local propane marketers and station operators, who can provide them with the fair pricing and help them establish on site infrastructure at little or no cost if a fuel contract is executed. If no relationship is formed, the fuel price may be equal to or higher than gasoline. Local propane marketers are present in almost every community across the United States and can provide expertise and assistance.

Propane Fleet Benefits

Reference Number: MTAS-1321

Propane autogas is the term used when it is discussed as an alternate vehicle fuel. Autogas is the most widely used alternative fuel in the world and has proven time and again to be safe and reliable. Although tax incentives are a plus, even without them, the price historically averages $1 less per gallon than gasoline. Environmentally speaking, autogas vehicles emit significantly less harmful greenhouse gas emissions, reducing emissions by about 20 percent compared to gasoline vehicles. As mentioned earlier, propane is a non-toxic and nonpoisonous fuel meaning that it dissipates into the atmosphere with no harm to the environment. If a fleet operator wants to convert existing vehicles to autogas, it is significantly cheaper than purchasing new alternative fuel vehicles. Although, there is not a significant difference in the performance of propane vehicles and gasoline vehicles, some have reported that their autogas vehicles have a quieter, smoother ride. Basically, its domestic availability, safety, and clean burning qualities are just a few in the long list of benefits from using propane vehicles.

Southeast Propane Autogas Development Program

The Southeast Propane Autogas Development Program is a large-scale alternative fuel project. This project is especially aimed at building propane autogas infrastructure in the Southeast United States. It focuses on encouraging public and private fleets in the region to adopt propane autogas. This program will be able to convert more than 30 propane autogas fueling stations along high-traffic routes. It will also launch a wide-reaching communications campaign to increase awareness and usage of propane autogas in the Southeast. This program will be extremely beneficial. More than 1,200 vehicles are expected to stop using almost four million gallons of gasoline, and eliminate more than 4,000 tons of airborne pollutants annually. Other benefits to this program will be an increase in the number of clean tech jobs in the Southeast; reduced fuel and maintenance cost, which will save money for local businesses and municipalities alike; and hopefully a reinvestment in the economy because of savings on fuel.

Examples

Here are several examples of communities that have chosen this benefi cial alternative fuel. In western Michigan, the Zeeland Public School District is using propane autogas in its school bus fleet. This district transports 9,000 students daily, and its buses travel approximately 750,000 miles in a given year. The district has been able to cut costs (roughly 30 percent) as well as emissions by adding nine buses fueled by propane autogas.

Across the country in Washington, the Department of Transportation for King County has added diverse on-site refueling methods for fleet vehicles fueled by propane autogas. This has enabled it to ensure high-quality service with confidence in refueling abilities. This fleet has 16 vehicles fueled by propane autogas. In Indiana, the Department of Transportation has converted nearly 600 of its light-duty vehicles to a bi-fuel system using both gasoline and propane autogas. The INDOT has installed refueling dispensers at 115 of its facilities across the state. Both departments of transportation have realized the huge savings from installing these infrastructures.

The Muscogee County Police Department in Columbus, Ga., recently converted 31 of its police vehicles to propane. The propane conversion offered the department the ability to improve air quality, reduce carbon dioxide and fluorocarbons in the air, and save money. Muscogee County projects about a $35,000 to $40,000 in savings with 31 vehicles during the year. Because propane is a cleaner and more efficient fuel, it creates less wear and tear on engines and helps them last longer.

Using a federal stimulus grant Cobb County, Ga., fitted propane tanks in the trunks of patrol cars. This cost $5,800 to convert each patrol car. The county will have about 100 patrol cars running primarily on propane gas. Propane has many advantages. The county estimates it will save anywhere from $250,000 to $500,000 a year in fuel costs, depending on what gas prices are.

Conclusion

Propane is an affordable alternate fuel choice, and is environmentally friendly. Cities and communities that have already made the transition to using propane autogas for vehicles have noticed savings, and voice that it is a smart alternative. If more people learn about the benefits of switching to propane, and act on it, pollution levels may decrease and monetary savings could help the economy. To learn more about propane as a transportation fuel, visit the AFDC's Propane Fuels and Vehicles sections (www.afdc.energy.gov [23]), contact your local Clean Cities coordinator (www.cleancities.energy.gov [24]), or visit the Propane Education and Research Council (www.propanecouncil.org [25]), and the National Propane Gas Association (www.npga.org [26]) websites.

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[3] "Southeast Propane Autogas Development Program." *Overview*. N.p.. Web. 13 Dec 2012. http://www.usepropaneautogas.com [27]

[4] "U.S. Department of Energy." *Energy Efficiency and Renewable Energy*. Clean Cities, n.d. Web. 13 Dec 2012. http://www.cleancities.energy.gov [24]

Fleet Management Tips

Reference Number: MTAS-1955

Municipal fleets provide a variety of services to city residents. In many cases these services are provided on wheels. The ability to provide services in an effective and efficient manner is partly dependent on a fleet of vehicles and other equipment. Services range from fire and police to water distribution and wastewater collection and treatment to solid waste collection and others. Average citizens are not familiar with the structure of government and how city employees and departments interact with each other. They simply expect the potholes to be patched, to have a police car or fire engine respond when called and to see the garbage disappear when it is placed at the curb. Residents expect these tasks to be accomplished as economically as possible, with taxes and fees remaining low.

It is the job of city government – elected officials and staff – to deliver city services as effectively and efficiently as possible. To fulfill this mission, city staff must have a dependable fleet. It is tempting to keep operating the fleet the “way it’s always been operated” and to delay vehicle and equipment purchases, especially during economic downturns, but freezing equipment purchases is not a sustainable long-term solution. So, how should municipal decision makers manage and fund fleet operations?

Fleet Investment

Reference Number: MTAS-1956

First, *look at how much your city has invested in fleet*. Inventory the city’s vehicles and equipment – even those units sitting in the vehicle “bone yard.” It is not unusual for even small cities to have several million dollars invested in vehicles and equipment. The size of the investment dictates good management. When listing fleet costs, include:

- Capital costs – the sticker price of vehicles and equipment
- Operating costs – fuel, oil, etc.
- Overhead – administration, accounting, purchasing, etc.
- Repair and maintenance – both preventive and routine maintenance and repair costs – both in-house and out sourced work.

Fleet Software

Reference Number: MTAS-1957

Choose good fleet management software and use it in decision making. In order to properly track costs, fleet management software is a must. Software tied to make, model, class and department should track preventive and scheduled maintenance, fuel usage, repair time, etc., for each vehicle. Software should interface with fuel systems. Many good fleet management software systems are on the market. The main goals of any fleet management system are to provide information to improve efficiency, decrease downtime and in-service breakdowns, reduce inventory, lower ownership cost and avoid waste. The selected software should provide detailed vehicle information such as: downtime, percentage of downtime, total miles traveled and cost/mile. It should be able to provide information on mechanics’ efficiency and productivity. It should track parts inventory and have the capability to track/analyze all direct and indirect labor costs. This information should be used in purchasing decisions.

Fleet Management

Reference Number: MTAS-1958

Centralize fleet management under a professional manager. This centralizes ownership and maintenance of all city vehicles and equipment under a separate stand-alone department. For many cities, fleet has traditionally been organized as a division within the public works department. However, it is very difficult for fleet to keep the independence and objectivity it needs if the fleet manager reports to another department head.

Benefits of centralized fleet management include:

- The ability to obtain the optimum usage of every vehicle and piece of equipment and thereby reduce the size of the city's fleet. By having full ownership, fleet can decide the best time to surplus a vehicle or piece of equipment either because of its operating cost or its retail value. As the centralized owner, fleet would also be able to determine if a vehicle or piece of equipment could be used by another department versus being sent to surplus.
- The ability to right-size the fleet. According to *Smart Planning for Communities, Province of BC* (Fraser Basin Council and the Union of BC Municipalities copyright 2012) vehicle and fleet right-sizing is a core process that involves analyzing and understanding the collection of tasks that you need your fleet to accomplish. This includes coordination and scheduling considerations. Once you have a picture of the vehicles required to complete those tasks, you can minimize the assets that you do hold, and reduce the capital investment in your fleet, while still completing required tasks.
- The ability to standardize specifications. This would result in the development of one set of specifications for sedans, one set of specifications for backhoes, etc. It would ensure each set of specifications received the highest level of development expertise. Decisions on equipment acquisition would be made on an objective analysis versus driver/operator preference. Standardizing specifications equates to maintenance and repairs efficiencies.
- The ability to internalize the current repair cost issues in terms of returns, labor rates and parts mark-up through renting or leasing the vehicles and equipment to the user departments on a fixed rate basis. Detailed costs breakdowns show department managers where their dollars are being spent, and the true cost of owning/operating vehicles and equipment. Lease rates for each respective type of vehicle or piece of equipment could be based on (1) a fixed annual amount, (2) a fixed monthly amount, (3) a fixed hourly rate, (4) a rate per mile or (5) some combination of the above.
- The ability to alleviate the budget confusion and uncertainty for user departments.
- The ability to maximize the benefit of a "reserve" fleet, with minimum resources. Fleet would, where appropriate, either develop an internal reserve fleet of sedans, pickups, police cruisers, backhoes, etc., or secure an external rental option depending on which option is more cost efficient. This would reduce/eliminate user departments' lost production time due to equipment failure.
- The ability for the city to have a centralized focus in pride of ownership of its fleet, thereby keeping it clean, painted and in good operating order.
- The ability to develop a city-wide fleet replacement fund.

Procure a fleet manager to oversee operations. A good manager will have the training, skills and know-how to run fleet operations. He/she will be skilled in leadership and management and be a good communicator. Other attributes of a good manager include:

- Ability to analyze staff, organizational structures and business practices, and make changes as needed to obtain greater efficiency and effectiveness.
- Ability to examine/develop programs pertaining to vehicle disposal and replacement, parts management and fuel management. This includes asking:
    - Does the operating department have a continuing need for the vehicle or equipment?
    - Is the fleet effective and right sized?
    - Can the vehicle be shared?
    - Can a vehicle be reassigned for optimal utilization?
    - Can a shared construction equipment motor pool be established?
    - Can under-utilized vehicles be deleted from the fleet?
    - Will an alternative fuel, hybrid or electric vehicle meet the needs of the operating department?

- Someone who will evaluate green initiatives and be knowledgeable about and open to cost effective innovations and challenges such as:
    - Use of renewable fuels
    - Rising cost of emission control systems
    - Training of technicians to service new technologies
    - Fuel availability
- Be able to manage procurement, inventory control, financial accounting, preventive maintenance, mechanic certification, etc.
- Someone who will consider factors such as fuel economy, life cycle costs and improved productivity, as well as low bid in procurement decisions.

Fleet Funding

Reference Number: MTAS-1959

Operate fleet services as an internal service fund and establish a city-wide fleet replacement fund. The replacement fund should be business-oriented – i.e. develop an approach in which an initially capitalized fund would be replenished and expanded through annual amortization of vehicles and equipment. This amortization fund would be managed and paid by fleet, but the cost would be recouped from the user departments through lease and/or rental payments. In many cities, the fleet manager and chief finance officer work co-operatively to manage this fund.

If fleet services will also be maintaining items such as generators or pumps, mowers, etc., associated costs should be designated, tracked, and charged to the appropriate cost center.

Consolidating Fleet Management

Reference Number: MTAS-1960

So how does a city get started if it's changing from decentralized fleet management to consolidated fleet management? Once the decision has been made to form a department of fleet services, senior leaders (the city manager and/or mayor) should designate the fleet manager, and form a cross-functional team that represents the stakeholders impacted. It's important that this group has the support of the city administration. The team should include representatives from purchasing, financing and key department heads. The purposes of the group are to develop strategies on how to consolidate fleet functions, to pool data, define policies and procedures, develop goals and objectives, etc. This group should (1) discuss the needs of fleet customers; (2) gather data such as a listing of fleet inventory, budget information, staff training and certifications; (3) evaluate and/or develop policies; and (4) establish goals. Then the group working together or the fleet manager working independently should determine replacement priorities. (See example replacement priority list [28].)

The vehicle replacement sample plan [29] demonstrates a model vehicle/equipment plan developed by MTAS and is similar to the replacement plan for Polk County, Fla., and to other plans posted on the American Public Works Association (APWA) website. See www.apwa.net [30].

The hard part is starting funding for the plan. There are basically three ways to start a vehicle replacement fund: from cash, savings, or borrowing.

Funding Your Plan

Reference Number: MTAS-1961

Cash – If a city has uncommitted cash on hand, it could be used to start a vehicle replacement fund. Otherwise, this method is rarely available, and it is not viable as a sustainable strategy.

Savings – MTAS advocates the establishment of a replacement fund. Departments would make regular contributions in the form of monthly charges to the fund based on vehicles in department fleets, their cost and expected life. This method reduces volatility and keeps department heads focused on vehicle use levels. The fund will have to be carefully set-up and monitored to ensure that contributions are where they need to be – not too low as to fall short of having money available to follow the replacement plan and not too high as to invite raiding of the fund for other city uses. Note: the accounting of capital and operating funds will have to be kept separate.

Debt – Issuing debt for purchase of most city vehicles/equipment is not recommended as a long-term routine strategy. The perception is that it is fiscally irresponsible to use debt to pay for equipment essential for day-to-day operations. Debt issuance has generally been reserved for large, expensive equipment that is expected to last 15-plus years.

How does a city start a vehicle replacement fund – particularly when there is a backlog? The answer may be using a combination of cash on hand and issuing debt.

As noted above, MTAS recommends:

- An Internal Service Fund from which all maintenance of vehicles and equipment will occur. This fund will track and charge maintenance and repair costs to the appropriate department; and
- A Vehicle Replacement Capital Projects Fund within the city's general fund to provide a repository for funding of vehicles/equipment. Note: Enterprise funds should have vehicle replacement capital project funds separate from the city's general fund.

Fleet Tips Summary

Reference Number: MTAS-1962

In summary, MTAS recommends optimizing municipal fleet operations through:

- Considering municipal fleet as a large investment that requires excellent management.
- Using good fleet management software in decision making.
- Centralizing fleet management.
- Hiring an experienced fleet manager.
- Establishing a vehicle replacement plan and fund to buy future vehicles and equipment.
- Establishing an internal service fund to charge maintenance/repairs back to departments.

Example List of Vehicle Replacement Rank

Reference Number: MTAS-1963

VEHICLE #	PURCHASE DAT	DESCRIPTION	ODOMETER/HR	AMOUNT	CO
F303	7/7/2009	4WD Sports Utility	102,377	$32,000.00	
ENG. 48	3/4/2006	FREIGHTLINER PUMPER	42,000	$212,000.00	
P23	10/14/2011	SEDAN	131,000	$25,000.00	
PW52	2/21/2007	LEAF VAC	410 HRS.	$31,000.00	
PW36	8/8/2008	LIGHT DUMP TRUCK	120,960	$75,000.00	
P16	11/20/2013	SEDAN	149,000	$28,000.00	
PW65	2/21/2005	HEAVY DUMP TRUCK	87,000	$110,000.00	
P101	12/24/2008	LIGHT DUMP TRUCK	112,015	$77,000.00	
P10	12/24/2003	SEDAN	101,841	$15,707.75	
P17	11/20/2002	SEDAN	95,393	$15,336.14	
C89	12/24/2010	SEDAN	97,000	$23,500.00	
P95	7/14/2010	1987 MASCHIO TRACTOR TILLER	665 HRS.	$1,400.00	
P117	7/1/2013	MURRAY MOWER	578 HRS.	$1,900.00	
PW44	8/15/2007	HEAVY EQUIPMENT	1300 HRS.	$310,000.00	

Vehicle Replacement Sample Plan

Reference Number: MTAS-1964

Exhibit 2: MTAS SAMPLE VEHICLE REPLACEMENT PLAN

SCOPE

This program provides for the planned replacement of all fuel consuming vehicles and equipment, their attachments and implements. The current fleet's replacement value is approximately $ _______________ million and covers _______________ vehicles.

The Replacement Plan will be administered by the city's (suggested — fleet services manager). The Replacement Plan will be based on criteria and a point system as defined below.

OBJECTIVES

- Establish a Replacement Fund to provide funds for vehicle replacement in advance of need.
- Smooth the outflow of capital funding and the rotation of incoming and outgoing vehicles year to year to prevent spikes in cash and asset flow.
- Eliminate the requirement to request approval from the governing body for each replacement purchase.
- Meet the needs of the end user.
- Provide a central point of control to account for all fleet specifications, acquisition, assignment, utilization, maintenance, and repair.
- Maximize fleet resources by providing timely acquisition and disposal of vehicles and equipment.
- Right size the fleet. Ensure the city has the optimum number and type of vehicles and equipment and that fleet growth is planned and controlled.
- Promote standardization. This is needed for promoting cost effective maintenance/repair.
- Optimize vehicle utilization.
- Comply with state of Tennessee purchasing laws and financial procedures.

- Reduce per unit maintenance costs by eliminating old, expensive to maintain vehicles and equipment.

Vehicle Replacement Sample Criteria

Reference Number: MTAS-1965

VEHICLE REPLACEMENT CRITERIA

Suggested scoring categories: Age, Mileage, Annual Maintenance Cost and Use.

TABLE 1.

1. Vehicle Age (years)	Points
>15	5
13 – 15	4
10 – 12	3
7 – 9	2
4 – 6	1

TABLE 2.

2. Vehicle Mileage	Points
>100 K	5
70 – 99 K	4
50 – 69 K	3
30 – 49 K	2
<30 K	1

TABLE 3.

3. Annual Maintenance Cost ($)	Points
>$2,000	5
$1,500 – 1,999	4
$1,000 – 1,499	3
$500 – 999	2
<$500	1

TABLE 4.

4. Vehicle Use (Specialty)	Points
Special built/purpose	5
Medium duty	4
Single purpose w/attachments	3
4-wheel drive	2
Standard vehicle	1

Application of Fleet Ranking Criteria

Reference Number: MTAS-1966

APPLICATION OF RANKING CRITERIA

The American Public Works Association (APWA) vehicle replacement guide uses a weighted point system based on age, usage, type of service, maintenance and repair costs and overall condition of the vehicle. The city's ranking system could be used to develop vehicle replacement cost. Tables 5 and 6 provide examples.

Table 5.

Score	Condition	Needed from General Fund	No. Vehicles	Needed from Utility Enterprise Fund	No. Vehicles
< 9 points	Excellent to very good	$25,000	1	$75,000	3
9 – 12 points	Good	$456,855	10	$575,000	6
13 – 19 points	Qualifies for replacement	$1,290,210	18	$450,000	7
> 19 points	Needs immediate replacement	$131,500	2	$0	0
Total		**$1,903,565**	**31**	**$1,100,000**	**16**

The current total replacement cost is $3,003,565.

Fleet Plan Implementation

Reference Number: MTAS-1967

- Each year prior to budget preparation, the fleet manager and finance director will hold a meeting with each user department to confirm vehicle replacements for the upcoming budget.
- When new vehicle/equipment is purchased, a replacement cost will be established based on its economic life.
- The replacement cost will be applied as an expense against the new vehicle and charged to the department where it is assigned.
- The replacement expense will be credited to the Replacement Fund.
- Proceeds from vehicle/equipment sales will be credited to the Replacement Fund to provide a cushion against inflation.
- Expenditures from the Replacement Fund will be authorized by the finance director.
- The finance director will prepare and distribute to department heads a report detailing the replacement charge and remaining balance due for each unit. The report will be prepared and distributed on a frequency to be determined by the city.
- A unit's replacement fee is discontinued when the fund for that specific unit is fully reimbursed.

- If a vehicle is totaled due to an accident and for the amount not covered by insurance, the accumulated total of replacement fees for that vehicle can be used to help fund the replacement. Any additional funding needed to fully pay the replacement cost must be provided from sources beyond the Replacement Fund.
- At the end of the vehicle's economic life, funding for its replacement will be provided by the Replacement Fund.
- Table 6 provides an example of the annual cost needed from the general fund and the utility fund.
- The replacement plan assumes that an average life span can be established for a group (type) of equipment based on industry standards and analysis. The following life expectancy shown in Table 7 could be used for purposes of planning. Because this listing is an average, some equipment will operate beyond the stated life expectancy and some less.

Table 6.

	Number in Fleet	Replacement Cost	Annual Cost
General Fund	88	$5,500,000	$605,000
Fire Apparatus	6	$2,400,000	$145,000
Utilities	20	$1,100,000	$100,100
Total	**114**	**$9,000,000**	**$850,100**

Table 7.

VEHICLE DESCRIPTION	AGE/MILES
Car	8 years/100 K
Police pursuit car	6 years/100 K
Pickup, SUV, van, 1-ton truck	8 years/100 K
Medium- and heavy-duty trucks, utility trucks, bucket truck, flatbed	10 years/120 K
Front-load refuse truck	8 years/100 K
Track loader, track backhoe, rubber tire loader, curbing machine	10 years
Backhoe/loader combination	10 years
Skid-steer loader	10 years
Forklift	15 years
Grader	10 years
Small engine equipment, tractor, mower, sprayer, leaf loader	10 years
Trailer-mounted compressor	10 years
Trailers, snow plows and salt spreaders	15 years
Fire engine truck	10 – 15 years
Ladder truck	15 – 20 years
Rescue trucks	10 years

Links:
[1] https://www.tn.gov/revenue/taxes/motor-fuel-taxes/due-dates-and-tax-rates.html
[2] http://www.irs.gov/pub/irs-pdf/p510.pdf
[3] http://www.afdc.energy.gov/fuels/natural_gas_stations.html
[4] http://en.openei.org/wiki/Alternative_Fuels_and_Advanced_Vehicles_Data_Center
[5] http://www1.eere.energy.gov/cleancities/technical_assistance.html
[6] http://www1.eere.energy.gov/cleancities/pdfs/ngv_wkshp_adams.pdf
[7] http://www1.eere.energy.gov/cleancities/publications.html
[8] http://www.afdc.energy.gov/laws/
[9] http://www.astm.org
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[15] http://adeca.alabama.gov/Energy/default.aspx
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[17] http://www.alabamacleanfuels.org/
[18] http://www.cleanenergy.org
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[30] http://www.apwa.net/