

INITIATION AND IMPLEMENTATION OF AN ALTERNATIVE FUELS PROGRAM

*Glenn Hagler
Texas Department of Transportation*

The Texas Department of Transportation (TxDOT) has initiated an aggressive plan to convert its on-road motor vehicle fleet of 9,000 vehicles to alternative fuels. State legislation passed in 1989 requires that TxDOT have 90% of its fleet converted by 1998. This undertaking has radically changed the way the Department both purchases and manages its fleet and thus has required major changes in the planning, procurement and use of its vehicles. The initial implementation of an alternative fuels program should consider and account incentives in energy abundance, environmental protection and economic concerns; initiatives in (Federal) Clean Air Act Amendment, Energy Policy Act and individual state legislation; and barriers in equipment cost, fuel availability, market inertia and underdeveloped infrastructure.

INTRODUCTION

Texas passed clean air legislation in 1989 (and again in 1995) that significantly altered the manner by which the Texas Department of Transportation (TxDOT) could purchase and fuel its motor vehicles. These laws, which became effective September 1, 1991, established a means to use the vast natural gas reserves available within the state while simultaneously reducing harmful exhaust emissions. They require all state agencies consisting of 15 or more vehicles to use alternative fuels in their motor vehicle fleet. They also require that TxDOT have 90% of its fleet converted to alternative fuels by 1998.

REGULATION

Texas regulatory agencies have approved five alternative fuels that meet the intent of Texas clean air legislation: natural gas (compressed-CNG/liquid-LNG), liquid petroleum gas (LPG), methanol, ethanol and electricity. TxDOT currently considers only CNG and LPG as viable alternative fuels for its fleet operation.

The law mandates four critical milestones. After September 1, 1991, Texas governmental agencies may only purchase or lease motor vehicles that are capable of using alternative fuels. As of September 1, 1994, the fleet must consist of not less than 30% alternative fueled vehicles

(TxDOT exceeded compliance at 32%); by September 1, 1996, this percentage increases to 50% and to 90% by September 1, 1998. TxDOT has met or plans to meet and exceed these requirements.

The law affects 9,000 on-road TxDOT motor vehicles. TxDOT has placed into service more than 4,000 alternative fueled vehicles to date that represent more than 44% of its on-road fleet. TxDOT plans to purchase or convert more than 4,500 vehicles to alternative fuel use by 1996 and nearly 9,000 by 1998.

INCENTIVES

In the last few years, energy security and environmental concerns have become prominent incentives for transportation policy and planning. Dependence on foreign oil supplies and concern over urban pollution and global warming have led to a nationwide trend away from petroleum-based modes of transportation.

INITIAL BASIS FOR THE LAW

Texas produced 6.4 trillion cubic feet (181 billion cubic meters) of natural gas in 1995 that amounted to 32% of total US production. In addition, Texas has 35.9 trillion cubic feet (1.02 trillion cubic meters) of dry proven reserves. With this abundant natural resource as an incentive, Texas passed clean air legislation in 1989 that mandated the use of natural gas or other clean air alternative fuel in state agency motor vehicles.

The intent of the state legislature in passing this law was threefold: to clean the environment, to develop a market for Texas natural gas and to stimulate the Texas economy. As an example, one trillion cubic feet (28.3 billion cubic meters) of natural gas will provide fuel for one year for approximately eight million vehicles. In promoting a Texas resource that benefits both the economy and the environment, Texas hopes to become a leader in the use of alternative fuels.

INITIATIVES

As motor vehicles are the largest single source of pollution, several initiatives have been undertaken to

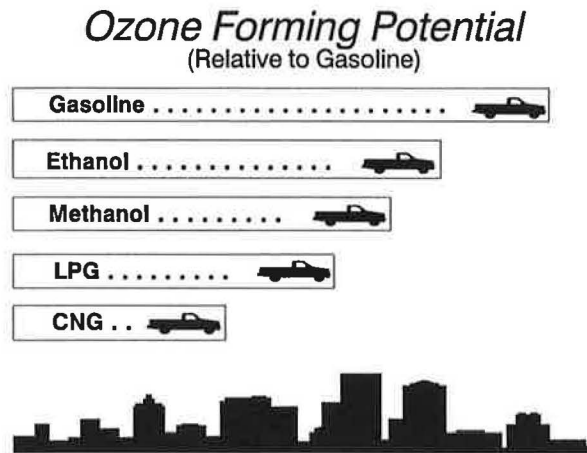


FIGURE 1 Ozone forming potential: Alternative Fuels Promises and Pitfalls; National Conference of State Legislatures 1991 Annual Meeting, Orlando Florida.

replace petroleum fueled vehicles with alternative fueled vehicles.

The Clean Air Act Amendment of 1990 (CAAA 1990) became the primary driver to move the nation away from petroleum-based fuels. The Energy Policy Act of 1992 reinforced the intent of CAAA 1990 by mandating specific milestones for governmental fleets in the use of alternative fuel vehicles. Individual state legislation continues to increase the requirement for the use of alternative fuels.

It is imperative that all levels of government legislation be monitored on a continuous basis.

CLEAN AIR ACT AMENDMENT OF 1990

The Clean Air Act Amendment of 1990 became law after 11 years of deliberation. The law establishes twenty-one areas throughout the United States in nonattainment of National Ambient Air Quality Standards. By mandating that these areas come into compliance, the Amendment provides a strong impetus for use of low emission alternative fuels.

CAAA 1990 focused primarily with regard to emission standards and clean air defining specific transportation control measures directed toward emission reduction. By 1998, most governmental fleets operating more than 10 vehicles weighing up to 26,000 pounds (11,794kg) in these areas will be required to purchase up to ½ of all replacement vehicles capable of operation on an approved alternative fuel. Figure 1 shows the benefits of using various alternative fuels compared with the baseline reference for ozone forming potential of gasoline.

Targeted for concern with effect upon alternative fuel considerations are the ozone/carbon monoxide classifications in nonattainment counties. CAAA 1990 affects four major nonattainment metropolitan areas within the state: Houston/Brazoria/Galveston, Beaumont/Port Arthur, El Paso and Dallas/Fort Worth. Figure 2 compares the relative percentage contributions between mobile and stationary volatile organic compound (VOC) sources in the nonattainment areas.

The dates proposed for the required percentage achievement of alternative fueled vehicles are much later than those set forth in Texas clean air legislation (Texas Senate Bill 740, 74th Legislature). Other areas of amendment concern include the requirement for the use of oxygenated fuels and the reduction of particulate matter.

NONCOMPLIANCE

According to the Environmental Protection Agency, the enforcement arm of the Clean Air Act Amendment, operators not in compliance with the law could pay as much as \$25,000 a day.

ENERGY POLICY ACT OF 1992

The Energy Policy Act of 1992 was designed to encourage domestically produced fuel usage in both mandate and incentive provision for alternative fueled vehicles. The Energy Policy Act, broader in fleet requirement definition than CAAA 1990, will affect 125 metropolitan areas. The implementation of requirements set forth in this Act

VOC Emission Sources

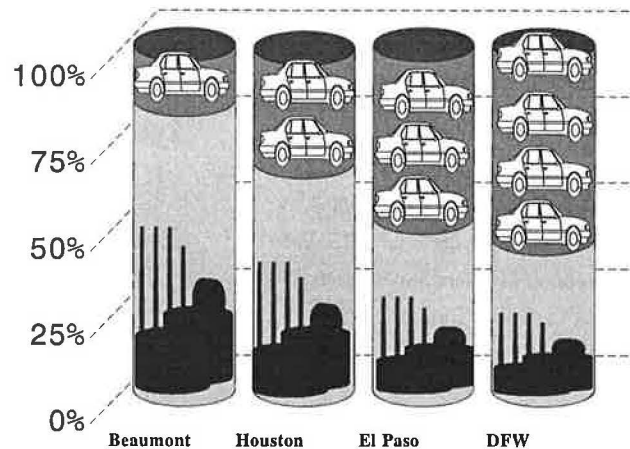


FIGURE 2 VOC Emission Sources: Texas General Land Office, 1995.

began in FY1993 for federal fleets with state fleets and alternative fuel providers to begin alternative fuel vehicle (AFV) purchase in MY1996 and possible private and municipal fleet AFV acquisition in MY1999. Alternative fuel providers are defined as gas and electric utilities, alternative fuel and large oil companies that conduct a substantive portion of alternative fuel business.

STATE LEGISLATION

Many states due to their own internal agendas be it pollution control and/or economic considerations have elected to incorporate alternative fuel legislation that supersedes the mandates of the Clean Air Act Amendment. Sixteen states presently have mandatory alternative fuel vehicle requirements for procurement of replacement governmental vehicles. They include California, Colorado, Iowa, Missouri, New Mexico and Texas. Twenty states have no alternative fuel program. The remaining fourteen states have incentives offered for converting vehicles to operate on alternative fuels. The definition for "alternative fuel" varies from state to state.

TEXAS SENATE BILL 740/769

Texas Senate Bill 740 mandates the use of alternative fuels. It requires certain entities to purchase alternative fuel vehicles and to increase over time the percentage of their fleet that must be capable of using alternative fuels. (Senate Bill 769 affects municipalities later in the decade.)

Effective September 1, 1991 state agencies must purchase or lease new vehicles capable of using these alternative fuels. Additionally, as of September 1, 1994, the fleet description must consist of not less than 30% alternative fuel vehicles (TxDOT achieved 32% by September 1, 1994). This percentage increases to 50% in two years and to 90% after four years.

The Texas Natural Resource Conservation Commission has defined which fuels qualify as an alternative fuel. Currently these include natural gas (CNG/LNG), liquefied petroleum gas (LPG), methanol, ethanol and electricity. The 1998 deadline applies only if the Texas Natural Resource Conservation Commission determines in 1996 that the program has been effective in reducing area total annual emissions. Table 1 compares the principal milestones of Senate Bill 740 with that of the Energy Policy Act.

TEXAS

To better appreciate the impact of Senate Bill 740 upon the Department and probable impact of the Clean Air Act Amendment upon the state is to begin with a description of how big is Texas. The second largest state in the union is called home by more than 16 million people driving to work every day in 12 million vehicles on 293,000 miles (471,525km) of highways. The state will need a large refueling infrastructure to make alternative fuels viable; 293,000 miles will demand frequent refueling locations.

TABLE 1 PRINCIPAL MILESTONES OF SENATE BILL 740 AND ENERGY POLICY ACT

ENERGY POLICY ACT	
Principal Milestone Comparative to SB740	
<u>Energy Policy Act</u>	<u>TEXAS SB740</u>
1992	
1993	Federal fleet purchase: 5,000 AFV
1994	Federal fleet purchase: 7,500 AFV <i>AFV: 30% of state fleet</i>
1995	Federal fleet purchase: 10,000 AFV
1996	AFV: 25% of state fleet <i>AFV: 50% of state fleet</i>
1997	
1998	<i>AFV: 90% of state fleet</i>
1999	AFV: 75% of state fleet
2000	AFV: 75% of federal fleet

TxDOT RESPONSIBILITY

With an annual budget of \$3.2 billion, the Department's 15,000 employees are responsible for maintenance of 293,000 miles (471,525km) of highways. This is the largest amount of state managed mileage pavement in the United States. The Department has subdivided the state into 25 districts consisting of 430 onsite refueling locations.

IMPACT UPON TxDOT

The impact of Senate Bill 740 upon the Department is great. The TxDOT fleet consists of more than 17,000 units of equipment with a replacement value worth more than \$400 million. Of these, 9,000 are classified on-road, 3,000 off-road and the balance as nonmotorized equipment. To meet the 90% criterion by 1998 this Department will either convert to or purchase more than 8,000 alternative fueled vehicles. The size of this task is apparent when one realizes that this law requires the Department to purchase more than 3,500 new alternative fueled vehicles between the present and 1998.

BARRIERS

Four major barriers persist in preventing the alternative fuel market from flourishing.

The high expense in both vehicle conversion and fuel station access for most alternative fuels have limited the number of operators changing fuel type. Costly vehicle

conversion when coupled with nominally cheaper fuel price offset does not readily meet short term payback and cost effectiveness requirement in many applications.

The widespread availability of most alternative fuel is near nonexistent. Even with access the use of such fuel as in compressed natural gas is deterred when long range is a requirement. Driving very far from the central fuel depot becomes an exercise in fuel allocation to assure a safe return.

Market inertia gives rise to an underdeveloped fuel support structure. Market interest currently exists in the public sector where visibility and acceptance have been limited. A broad selection of alternative fuels has not allowed for the singular momentum necessary within the private sector to develop the required infrastructure necessary to support any alternative fuel use on a broad scale.

Implementation

An ordered approach to implementing Senate Bill 740 has been undertaken by the Department. The process has been summarized as

- Gathering of information;
- Understanding of requirement;
- Assessment of available alternative fuel technology;
- Performance of life cycle cost/benefit analysis on all potential choices;
- Gainful experience of potential choices;

- Development of sound procurement specifications; and
- Investigation of different technologies and their respective exhaust emissions.

Although the fuels-of-choice are more tightly defined in Texas than those allowed under the Clean Air Act Amendment (by state law only natural gas, liquid petroleum gas, methanol, ethanol or electricity are allowed for large state agencies) these basic steps can be applied to any of the fuels allowed within the Clean Air Act Amendment or the Energy Policy Act.

Gathering of Information

The formal basis for effectively constructing any program lies in the proper gathering of available information. Thus, the most important step in the implementation process is the familiarization with all aspects of the alternative fuels arena. Alternative fuel selection yields to its local availability, job environment suitability and its physical property characteristics. Storage, both on-vehicle and at refueling location, is different for each fuel type. Some fuels are liquid at ambient temperature and pressure, some are liquid when under moderate pressure and some are liquid only when supercooled. Other fuels are stored in a gaseous state requiring bulky storage tanks.

The daily driving requirement of the vehicles in question must be analyzed and their drive range computed so that a reasonable amount of fuel can be carried onboard to complete daily demand. Vehicular performance could be impaired or enhanced due to the new fuel type required.

Vehicle conversion may be necessary for the selected fuel. Cost determination of conversion to existing equipment versus purchase of replacement equipment should be assessed.

Knowledge of all regulations pertaining to emissions control and alternative fuel use is mandatory. Federal, state and municipal mandates will require vigilant attention to implementation timetables and compliance to fleet size percentages. State legislation, as found in Texas Senate Bill 740, can supersede timetable requirements as proposed in CAAA 1990. Different cities of the US fall into nonattainment area by law and consequently fuel type requirement may be affected.

Many alternative fuel products are currently in use and it is important they meet test in both proof of operation and product safety. A leader recognized in this field is the California Air Resources Board (CARB) and special attention to their emission certified list of approved products for certain alternative fuel conversion kits is critical. Major industrial associations have also published

lists of approved and recommended equipment for alternative fuel use germane to their industry.

All aspects of the conversion system components along with the fuel storage cylinders and their installation should comply with the safety standards required by the National Fire Protection Association (NFPA) Pamphlets 52 and 58, the American National Standards Institute (AGA/ANSI/NGV1; AGA/ANSI/NGV2; AGA/ANSI/NGV3 proposed, AGA/ANSI/NGV4 proposed), the American Society of Mechanical Engineers (ASME) and the U.S. Department of Transportation (USDOT). Professional organizations such as the Transportation Research Board (TRB) and the Society of Automotive Engineers (SAE) have vast resource information on all alternative fuels currently in use.

The singular most valuable asset available to the fleet manager today is the user experience of others. In visiting operations already converted to alternative fuel(s) one can determine more readily what works and what does not work.

Understanding of Requirement

The understanding of requirement which links alternative fuel selection to operational need lies in accurate fleet assessment. Likewise, the understanding of requirement which links alternative fuel selection to overall cost effectiveness lies in certain aspects of fleet assessment such as vehicle number per refueling site, vehicle drive routine and useful life expectancy.

Two aspects should not be forgotten and when addressed early in the program can be a major contributor to the overall cost effectiveness. Depending on the type of alternative fuel selected the operational and maintenance facilities used to provide upkeep for these vehicles may have to be modified. Modifications could include new or expanded ventilation systems, gas leak detectors, automatic door opening systems, alarms, etc. Personnel involved in the operation and maintenance of the vehicles will have to be trained. The training program should include operator familiarization with safety, mechanical repair and preventive maintenance topics.

The data gathered from the Department fleet management data base has been manipulated in several different ways. Location criteria established the number of vehicles assigned to each of the 430 fuel sites in the state. Mileage-per-day data established mileage habits. Classification data sorted the vehicles into groups of sedans, light-to-medium duty trucks and heavy duty trucks. Engine-type data established the number of vehicles powered by gasoline and diesel engines.

The breakdown of these vehicles by classification showed an even distribution between light-to-medium

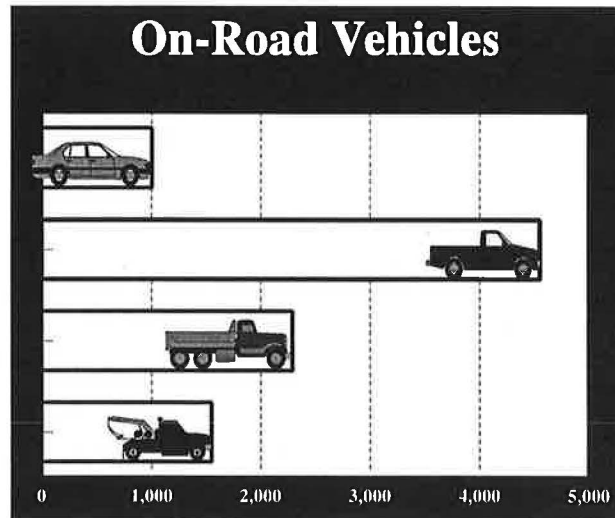


FIGURE 3 On-road vehicles: TxDOT Fleet Data Analysis, 1995.

duty trucks and heavy duty trucks with the sedans making up only about 12% of the fleet. Gasoline fueled vehicles outnumbered diesel fueled vehicles by a three-to-one margin. Most of the sedans and light-to-medium duty trucks are gasoline fueled. Figure 3 details the on-road fleet makeup.

Data from each of the 430 fueling locations was analyzed in detail. Types of fuel presently available at each location were compiled along with daily and weekly usage amounts. A delivery capacity analysis consisting of the number of pumps and associated nozzles provided an understanding for fuel delivery at each location. This data provided not only usage quantities but also a queue analysis of the pumps on a daily basis. It was determined that on average most vehicles travel approximately 50 miles (80.5 km) per day and use only 4 gallons (15.14 l) of fuel. Onsite storage capacity for each fuel type and refill service records provided a check and balance method for fuel usage in agreement with fuel purchases. A survey of each location determined if natural gas was available (it was in over half the locations) and if LPG was available (it was in all locations).

Assessment of Available Alternative Fuel Technology

The available fuel infrastructure associated with any alternative fuel selection is important to understand. Consideration must be given to whether an alternative fuel chosen will significantly alter current operation with new refill and access requirement. The preferred refueling method may be fuel onsite for easy access and control

from the outright purchase of refueling equipment to leasing option.

Alternative fuel technology is quickly outmoded. As was the large amount of older conversion equipment developed for vehicles prior to onboard computer circuitry, current conversion equipment is being designed to operate in conjunction to this circuitry for better performance vehicles with greater mileage and lower exhaust emission.

The ideal alternative fuel vehicle is still one produced by a major original equipment manufacturer (OEM) tested in accordance with governmental regulations and backed by the OEM warranty.

Performance of Life Cycle Cost/Benefit Analysis on All Potential Choices

After all the elements of the proposed alternative fuels program have been identified, it is important that they be used to prepare a life cycle cost/benefit analysis (LCCBA). The time value of money should be considered in the analysis. It is hoped that over the useful life of the involved equipment all of the benefits will offset all of the costs associated with converting the operation to run on alternative fuel. An example of one segment of LCCBA analysis which considers the tank size (and quantity) versus cost to refuel is shown in Figure 4.

The primary benefit contributor will be savings associated with a lower alternative fuel price. If the price of the alternative fuel is not substantially lower than the price of the fuel, it is replacing it may be very difficult to

CNG TANK SIZE vs Cost To Refuel

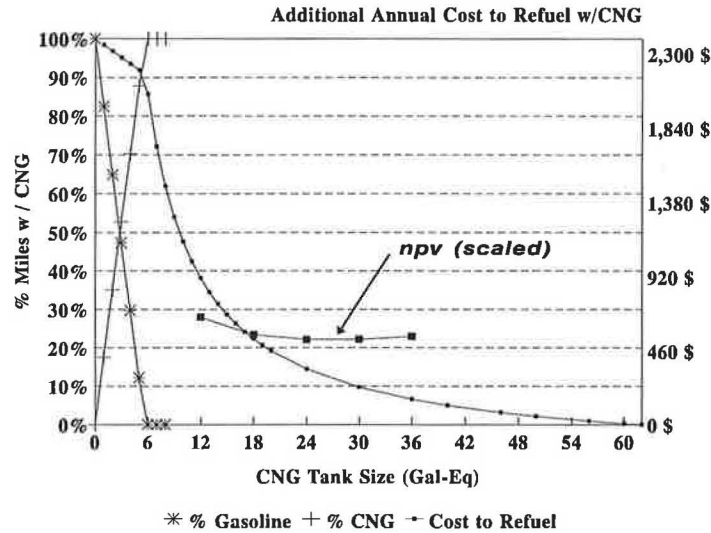


FIGURE 4 CNG tank size vs. cost to refuel: TxDOT Life Cycle Cost/Benefit Analysis Data, 1994.

show any payback over the expected useful life of the equipment. Figure 5 shows that the price spread between natural gas and gasoline may not be as large as expected and does not seem to shift significantly from one year to the next.

Although difficult to quantify, it is fair to include societal benefits resulting from the reduction in harmful effects of pollution on the environment. It is also fair where appropriate to examine possible benefits to the state/local economy.

Gainful Experience of Potential Choices

If vehicle conversion is elected, it is extremely important to know the vendor's reputation. Inspect prior year conversions and customer references. One valuable way to further personal understanding is to perform a pilot project aimed at conversion to a small vehicle number of alternative fuel(s) selected. This should allow through nominal cost an evaluation for both good and bad points inherent in each fuel. For onsite convenience, refill equipment may be leased. If funds allow, a research contract with a nearby university might gain insight to analysis of all relevant data through their manipulation.

To further departmental understanding of alternative fuel technologies, a series of demonstration projects were initiated in 1990. Twelve pickups were converted to run

on LPG each carrying a 40-gallon (151.4 l) fuel tank. In addition, 19 light duty pickups and five sedans were converted to run on CNG. Each sedan carried five gallons-equivalent (18.9 l) while each pickup carried 10 gallons-equivalent (37.9 l).

A quick-fill CNG compressor station (built by Corken International, Oklahoma City) was installed at the Austin District Office. The station consisted of a 50 cfm (85 cmh) compressor and 200 gallons-equivalent (757 l) of stored compressed natural gas. A commercial slow-fill CNG compressor called FuelMaker® was also installed at several locations.

To assist in the conduct and analysis of these conversions the Department worked jointly with the University of Texas at Austin Center for Transportation Research. They developed an evaluation framework including economical, environmental, operational and technical strategies. Their research concluded that no TxDOT sites were deemed economical for CNG quick-fill compressor service. The decision matrix did not include societal benefits from cleaner air or state economical benefits.

Development of Sound Procurement Specifications

To purchase sound conversion equipment, it is necessary to have sound procurement specifications.

Gasoline vs Wellhead Natural Gas

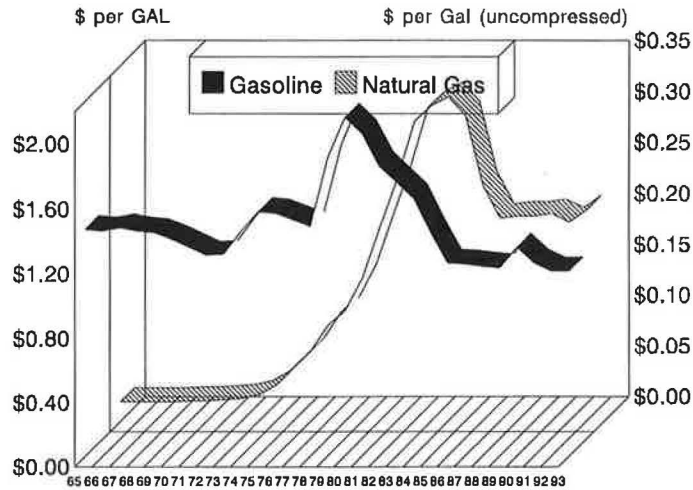


FIGURE 5 Gasoline vs. wellhead natural gas: Department of Energy 1993 Annual Energy Review

Natural Gas Fill Ratio in 10" x 50" Aluminum Cylinder at End of 3,000 psia Charge

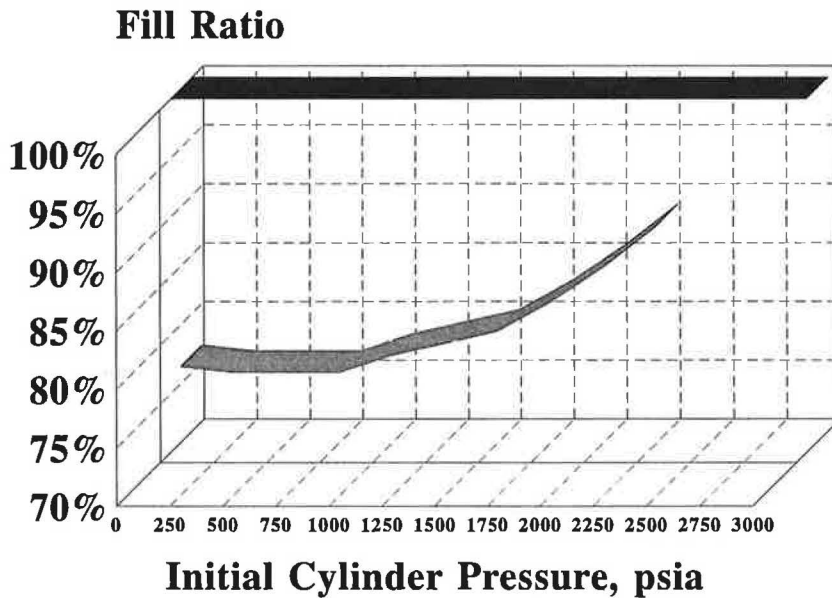


FIGURE 6 Natural gas fill ratio in 10" x 50" aluminum cylinder: Institute of Gas Technology; Storage Cylinder/Fueling Station Pressure Study, July 1993.

Several areas of concern, which left unspecified, could lead to poor fleet operation and performance. The conversion equipment should be approved by some regulatory entity (EPA, CARB, etc.) that has tested the equipment for both operation and safety. Life cycle tests should show that the equipment will perform over its expected useful life.

Sufficient fuel quantity for a full operational day should be designed into the vehicle. Consideration of the settled pressure effect for CNG fuel tanks should be taken into account. Figure 6 illustrates the fill ratios which result from fast-filling.

The converted vehicle should be setup on a dynamometer and the emissions tested before and after conversion to insure no degradation in power or quality of exhaust emissions. One potential weak link in an alternative fuel system is the electrical connectors used to attach it to the vehicle. These should be either OEM type connectors or the wires should be soldered directly to the vehicle wiring. An extended warranty should be a requirement within the conversion contract to afford as much protection as possible from early failure of poorly designed conversion equipment. Ensure that one party is ultimately responsible in the event of an impasse over the cause of equipment failure.

To ensure a reliable conversion, the Department has developed its own conversion specifications for gasoline fueled vehicles. These specifications require the conversion components be approved using EPA Memo-1A procedures and meet EPA standards.

Additional elements to the specification include the requirement for automatic fuel switch-over valves in CNG converted vehicles. This valve automatically switches fuel from CNG to gasoline when the CNG supply is depleted. Due to the almost instantaneous stalling that occurs when CNG is deplete, this device will be required for reasons of safety and driver acceptance.

The original equipment air filter must be kept whenever possible. Setup on a dynamometer is required also. The dyno ensures that converted engines maintain a horsepower rating of 85-100% after conversion. The Department is requiring ANSI/NGV1 (3,600 psi/248 bar) type refuel probes as industry standard. Emissions pre- and post-conversion are required.

Investigation of Different Conversion Technologies and Their Respective Exhaust Emissions

Many types of conversion technology are currently available and their performance as well as operation differs greatly. The preferred conversion system should have a complete closed loop (microprocessor controlled) feedback control mechanism capable of maintaining the air/fuel

mixture to manufacturer specifications when operating on the alternative fuel. The system should have an adaptive-learn capability which can analyze and act upon the engine sensors and their dynamic real-time outputs. Operation on the alternative fuel should not adversely affect driveability or emissions. TxDOT is currently working with the University of Texas Department of Mechanical Engineering on a two-year emissions-based program called *The Texas Project*. Twelve conversion technologies and one hundred vehicles are being researched and tested with the purpose of monitoring emissions and vehicle performance.

LOGISTICAL DETERMINATION WITHIN THE DEPARTMENT

- Most of the 430 onsite refueling locations in the state have only 20-30 vehicles per site.
- Most vehicles travel approximately 50 miles (80 km) per day or less with a refill only once to twice per week.
- Tested CNG vehicles are averaging 5% less MPG (kml) and tested LPG vehicles are averaging 10% less MPG (kml).
- A 10 gallon-equivalent (37.9 l) supply of CNG should be adequate for most light-duty pickup applications.
- A five gallon-equivalent (18.9 l) supply of CNG may be inadequate for most sedan applications.

Department preliminary conclusions suggest that diesel aftermarket conversion technology is premature. No large manufacturers are presently offering alternative fuel CNG or LPG engines in the small size needed for diesel conversion.

Life cycle cost/benefit analysis for both CNG and LPG conversions show them not as cost effective for TxDOT operation. Only as the price for alternative fueled vehicles is reduced, which is anticipated with large scale production of new vehicles, will lifetime cost effectiveness be realized. It also has been determined that CNG through high cost of the stand alone CNG compressor fill station is not cost effective at small onsite refueling locations.

AREAS OF CONCERN

- *Gas inconsistency*: Delivery variances in purity and BTU content may occur, specify in the contract (CNG & LPG).
- *"Oil-in-gas" and "Water-in-gas"*: Fouled gas injectors and frozen fuel nozzles have occurred, TxDOT

considering SAE J1616 (SAE *Recommendation only* at this point).

- *Refueling infrastructure:* CNG infrastructure is underdeveloped in Texas, nozzle standardization must be implemented.
- *Proven technology:* Conversion of diesel engines to alternative fuel use has potential problems related to engine durability and acceptable operational performance.
- *Warranty:* Converted vehicles should be warranted for at least three years.
- *Insufficient gas supply:* Natural gas delivery has been curtailed to commercial businesses in Texas during severe cold spells.
- *Fuel price fluctuation:* The greatest cost denominator for using alternative fuel is the price differential between it and gasoline/diesel fuel, irregular price makes saving predictions risky.
- *Conversion cost:* Varies vendor to vendor, competitive bidding will help contain price.
- *Conversion kit compatibility:* Ability of conversion kits to meet On Board Diagnostics II (OBD-II) requirements.
- *Narrow Application:* Availability of EPA-Compliant conversion kits for a variety of applications.

SUMMARY

In a continued effort to meet the requirements of Senate Bill 740, the Department plans to purchase nearly 500 alternative fuel vehicles this year. More than 90% will be fueled by LPG while less than 10% will be fueled by CNG. Assignment strategy is based primarily on the availability of natural gas in various TxDOT locations with an emphasis on nonattainment areas. When natural gas is available, a CNG vehicle will be assigned. If natural gas is not available, LPG will be assigned. Currently, the Department is requesting waivers on all diesel engines until proven technology is available from the original equipment manufacturer.

In conclusion, Texas has become very proactive in environmental protection measures and will move toward more stringent clean air legislation for the future. At present, Texas Senate Bill 740 represents a challenge to a way of life which has been standard for decades. Many ideas and many ideals will have to change for alternative fuels to be the widespread fuel of choice in Texas.