

TEXAS' AGGRESSIVE ALTERNATIVE FUELS PROGRAM

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ABSTRACT

Recent passage of Texas Clean Air Legislation has caused a furor of activity to be generated in the Texas Department of Transportation. Passage of Texas Senate Bill 740 requires the use of Compressed Natural Gas (CNG) or alternative fuels in 90% of the State Agencies' fleet by 1998. To undertake such a task, the Alternate Fuels Group has been established within the Division of Equipment and Procurement to assist in the development and implementation of an alternate fuel strategy for the Department.

TEXAS NATURAL GAS THE REAL BASIS FOR THE LAW

Texas produced 5.5 trillion cubic feet of natural gas in 1991 which amounted to 25% of total US production. In addition, Texas has 38 trillion cubic feet of proven reserves. With this abundant natural resource as an incentive, Texas passed Clean Air Legislation in 1989 which mandated the use of natural gas or alternative fuel in motor vehicles. As an example, one trillion cubic feet of natural gas will provide fuel for one year for approximately 8 million vehicles. The intent of the State Legislature, in passing this law, was threefold: clean up the air, develop a market for Texas natural gas and, in doing so, stimulate the Texas economy. By promoting a Texas resource that benefits both the economy and the environment, Texas hopes to become a leader in the use of alternative fuels.

TEXAS CLEAN AIR LEGISLATION SENATE BILL 740

Texas Senate Bill 740 mandates the use of alternative fuels. It requires certain entities to purchase alternative fuel vehicles and increases over time the percentage of their fleet that must be capable of using alternative fuels. Effective September 1, 1991, these organizations must purchase or lease new vehicles capable of using these alternative fuels. In addition, by September 1, 1994, the fleet description must consist of 30% or more alternative fuel vehicles. This percentage increases to 50% in two years and to 90% after four years.

The Texas Air Control board has defined which fuels qualify as an alternative fuel. Currently these

include natural gas, liquefied petroleum gas, methanol and electricity. The 1998 deadline applies only if the Texas Air Control Board determines that the program has been effective in reducing area total annual emissions.

TEXAS

To appreciate better the impact of Senate Bill 740 upon the Department, I would have to begin by describing just how big Texas is. The second largest state in the union is called home by over 16 million people driving to work every day in 12 million vehicles on 293,000 miles of highway. Texans are truly a mobile lot. We will need a large refueling infrastructure to make alternative fuels work. Having 262,000 square miles demands frequent refueling stations.

TxDOT RESPONSIBILITY

With an annual budget of \$2.7 billion dollars, the Department's 15,000 employees are responsible for maintaining 182,000 miles of highway. This is the largest amount of pavement mileage in the United States. The Department has subdivided the state into 24 districts consisting of 430 on-site refueling locations.

IMPACT UPON TxDOT

The impact of Senate Bill 740 upon the Department is tremendous. The Department's fleet is the nations' sixth largest government fleet comprising more than 18,000 vehicles with a replacement value of over \$400 million. Within these 18,000 vehicles, 8,800 meet the definition of a motor vehicle as drawn by the law. To meet the 90% criterion by 1998 this Department will either convert to or purchase nearly 8,000 alternative fueled vehicles. The magnitude of this task is apparent when one realizes that this law requires the Department to convert more than 30 existing vehicles per month through 1998, in addition to purchasing nearly 5,000 new alternative fueled vehicles during the same period.

IMPLEMENTATION PLAN

An ordered approach to implementing Senate Bill 740 has been undertaken by the Department. The process has been divided into five steps:

1. Monitor Federal Clean Air Legislation continuously,
2. Gain as much first hand experience within the Department as possible,

3. Develop sound procurement specifications,
4. Analyze Department fuel needs and availability of alternative fuels in each location, and
5. Choose the appropriate alternative fuel for each location.

FEDERAL CLEAN AIR ACT

We have tried to make ourselves aware of existing Federal and State Clean Air requirements. As new regulations are constantly passed into law, it is imperative that all levels of government be monitored on a continuous basis. The Federal Clean Air Act Amendments of 1990 affect major metropolitan areas of our state and we must prepare ourselves for the regulations that are forthcoming.

The Clean Air Act Amendments describe three major non-attainment areas in Texas: Houston/Brazoria/Galveston, Beaumont/Port Arthur and El Paso. Targeted for concern with effect upon alternative fuel considerations are the ozone/carbon monoxide classifications in non-attainment counties. Clean alternative fueled vehicles may be required in these areas. Although the dates set forth in the Clean Air Act Amendments for achievement of the required percentage of alternative fuel vehicles are much later than those stated in Texas Senate Bill 740, we will continue to monitor this requirement. Other areas of concern include the requirements for the use of oxygenated fuels and the reduction of particulate matter.

EXPERIENCE FROM PILOT STUDY PROJECTS

To further our own understanding of alternative fuel technologies, a series of demonstration projects has been initiated. Twelve pickups have been converted to run on LPG, each carrying a 40 gallon fuel tank. In addition, we have converted 19 light duty pickups and five sedans to run on CNG. Each sedan carries five gallons equivalent of CNG while each pickup carries ten gallons-equivalent. A quick-fill CNG compressor station (built by Corken International, Oklahoma City) has been installed at our Austin District Office. The station consists of a 70 cfm compressor and 200 gallons-equivalent of stored compressed natural gas. A slow-fill CNG compressor, called FuelMaker, is being installed. We anticipate using a few small compressors in locations that have small quantity demands. To assist us in the conduct and analysis of these conversion projects, we are working jointly with the University of Texas at Austin, Center for Transportation Research. They are develop-

ing an evaluation framework including economical, environmental, operational and technical strategies.

DETERMINE FLEET LOGISTICS

The data gathered from our 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-perday 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.

MAKEUP OF THE FLEET

The breakdown of these vehicles by classification shows an even distribution between light-to-medium duty trucks and heavy duty trucks, with the sedans making up only about 12% of the fleet. Gasoline fueled vehicles outnumber diesel fueled vehicles by a three-to-one margin. Most of the sedans and light to medium duty trucks are gasoline fueled.

DETERMINE FLEET FUELING OPERATIONS

Data from each of the 430 fueling locations was analyzed in detail. Types of fuel now available at each location were compiled with daily and weekly usage amounts. A delivery capacity analysis consisting of the number of pumps and associated nozzles provided an understanding of fuel delivery for each location. This data provided not only usage quantities but also a queue analysis of the pumps on a daily basis. It was very interesting to learn that on average, most vehicles travel only 50 miles per day and use only 4 gallons of fuel. On-site storage capacity for each fuel type and refill service records provided a check and balance method for determining if fuel usage agreed 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).

INVESTIGATE IMPLEMENTATION STRATEGIES

Consideration of alternative fuels for replacement of gasoline or diesel necessitates a consideration for the required range and performance of each application. Some vehicles may require a driving range farther than that possible with CNG while others may not be able to

operate with the inherent power loss obtained when using LPG. Various fill station concepts also must be considered. Available for CNG are quick-fill and slow-fill designs that use on-site compressors, each varying considerably in cost and capability. Also available for CNG refueling applications are nurse trucks that service the fleet every night upon their return to the yard. The fuel storage and tank capacity requirements for both CNG and LPG must be accurately calculated to provide the required service at the lowest investment cost. The following points have been determined from our research:

- Most of the 430 locations in the state only have 20-30 vehicles per site.
- Most of the vehicles travel approximately 50 miles per day or less and refill with gasoline only once or twice per week.
- Our test CNG and LPG vehicles are averaging 10% less on CNG and 15-20% less on LPG.
- We believe a 10 gallon equivalent supply of CNG will be adequate for most light-duty pickup applications.
- We believe that a 5 gallon equivalent supply of CNG may be inadequate for most sedan applications.
- Due to the high cost of the stand alone CNG compressor fill stations, we believe that CNG may not be cost effective in small locations.

SPECIFICATIONS

To assure a reliable conversion, the Department has developed its own conversion specifications for gasoline fueled vehicles. These specifications require the conversion components be approved by EPA or CARB. Additional elements of the specifications include the requirement for automatic fuel switch-over valves in CNG converted vehicles. This valve automatically switches the fuel from CNG to gasoline when the CNG supply is depleted. Due to the almost instantaneous stalling that occurs when CNG is depleted, we will require this device for safety reasons. We require the original equipment air filter be kept, wherever possible. Setup on a dynamometer is also required. The dyno insures that converted engines maintain a horsepower rating of 85-100% after conversion. The Department is

using Sherex type refuel probes, and we understand that this style may become an industry standard.

INITIAL FINDINGS

Our initial findings indicate that diesel conversion technology is premature. No large manufacturers are presently offering alternative fuel CNG or LPG engines in the small sizes we need and there are no approved conversion kits on the market today approved by the EPA or CARB. Life cycle cost benefit analysis for both CNG and LPG conversions show that the higher priced conversions are not cost effective for the TxDOT operation. Only when the price for alternative fueled vehicles is reduced, which we anticipate will happen with large scale production of new vehicles, will lifetime cost effectiveness be realizable. The environment will benefit from long term use of dedicated alternative fuels, but such benefit is very difficult to quantify.

STRATEGY FOR 1992

We plan to initiate the following strategies in our first effort to meet the requirements of Senate Bill 740:

- We plan to purchase 559 alternative fuel vehicles this year.
- Three-hundred and sixteen will be fueled by CNG and 243 will be fueled by LPG.
- One-hundred of the CNG vehicles will be dedicated, mono-fuel GMC Sierra 3/4 ton pick-ups.

Our assignment strategy was based primarily on the availability of natural gas in various TxDOT locations. When natural gas was available, a CNG vehicle was assigned. If natural gas was not available, then LPG was assigned. We are currently requesting waivers on all diesel engines until proven technology is available from the original equipment manufacturer.

Two-hundred and eleven of the 430 locations received new vehicles for 1992. Thirty-eight locations have access to public CNG stations, so we placed 212 vehicles at these locations. Thirty-three additional locations have natural gas on-site (but no access to public stations) so we plan to install small, slow-fill compressors that will support a total of 104 vehicles. The remaining 140 locations will receive 243 LPG fueled vehicles.

AREAS OF CONCERN

The following areas of concern should be weighed before selecting an alternative fuel:

- Inconsistency of natural gas. Delivery pipeline variances in purity and BTU content occur unlike the consistency found within gasoline and diesel fuel.
- Proven technology. Converting diesel engines to alternative fuel use has potential problems related to engine durability and acceptable operational performance.
- Refueling infrastructure. The CNG infrastructure is small in Texas. Nozzle standardization must be considered.
- Warranty. Converted vehicles should be covered by a warranty for three years.
- Steady supply of CNG in the Wintertime. Natural gas delivery has been curtailed to commercial businesses during severe cold spells within Texas.

- Fuel prices. The greatest cost benefit for using alternative fuel is the price differential between the alternative fuel and gasoline or diesel fuel. These prices fluctuate regularly, sometimes greatly. Predicting savings is risky.
- Conversion Prices. Prices vary from vendor to vendor. Competitive bidding will help keep the prices low.

CONCLUSION

Texas has become very proactive in environmental protection in the last several years and will move toward more stringent Clean Air Legislation for the future. Senate Bill 740 represents a different approach to a way of life that has been standard for many decades. The idea of alternative fuel is hindered by the ready availability of gasoline and diesel fuel. A large infrastructure for CNG is currently not in place but is growing. Many ideas and many ideals will have to change for alternative fuels to become commonplace in Texas.