Alternative Fuel Options And Costs for Use In Kansas And Surrounding States

September 1998

Galen J. Suppes, Prashanth Ponnachath, and Jeff Doris

MATC Project No. MATC KU 97-1
KDOT Project No. K-TRAN: KU 97-7

Mid-America Transportation Center
University of Nebraska-Lincoln
W333.2 Nebraska Hall
Lincoln, NE 68588-0530
Telephone 402-472-1974
Fax 402-472-0859

Sponsored by the

Kansas Department of Transportation
2300 SW Van Buren Street
Topeka, KS 66611-1195
Telephone 785-296-3576
Fax 785-296-6944

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

PB99-123556

2. REPORT DATE	3. REPORT TYPE AND DATES COVERED

4. TITLE AND SUBTITLE	5. FUNDING NUMBERS
Alternative Fuel Options And Costs for Use In Kansas And Surrounding States	DTRS95-G-0007
6. AUTHOR(S)	
Galen J. Suppes, Prashanth Ponnachath, Rajan Aggarwal, and Jeff Doris	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	**8. PERFORMING ORGANIZATION REPORT NUMBER**
Mid-America Transportation Center University of Nebraska-Lincoln W333.2 Nebraska Hall Lincoln, NE 68588-0530	MATC KU97-1
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES	**10. SPONSORING /MONITORING NUMBER**
Kansas Department of Transportation 2300 Van Buren Street Topeka, KS 66611-1195	KTRAN/KU97-7
11. SUPPLEMENTARY NOTES	
12a. DISTRIBUTION/AVAILABILITY STATEMENT This document is available to the public	**12b. DISTRIBUTION CODE**

13. ABSTRACT ***(Maximum 200 words)***

To meet state and federal mandates, state fleets, federal fleets, and fuel provider fleets must acquire alternatively fueled vehicles (AFVs). Two pieces of legislation affect fleets in Kansas, the federal Energy Policy Act and the State House Bill 95-2161. Included in this report is information about who must comply with these regulations, what constitutes compliance, tax incentives and AFV availability.

14. SUBJECT TERMS	15. NUMBER OF PAGES
	17
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

PREFACE

This research project was funded by the Kansas Department of Transportation K-TRAN research program and the Mid-America Transportation Center (MATC). The Kansas Transportation Research and New-Developments (K-TRAN) Research Program is an ongoing, cooperative and comprehensive research program addressing transportation needs of the State of Kansas utilizing academic and research resources from the Kansas Department of Transportation, Kansas State University and the University of Kansas. The projects included in the research program are jointly developed by transportation professionals in KDOT and the universities.

NOTICE

DISCLAIMER

ALTERNATIVE FUEL OPTIONS AND COSTS FOR USE IN KANSAS AND SURROUNDING STATES

http://www.engr.ukans.edu/~altfuels

Introduction

To meet state and federal mandates, state fleets, federal fleets, and fuel provider fleets must acquire alternatively fueled vehicles (AFVs). Two pieces of legislation affect fleets in Kansas, the federal Energy Policy Act and the State House Bill 95-2161. Included in this report is information about who must comply with these regulations, what constitutes compliance, tax incentives, and AFV availability.

Compliance

State Fleets - The State of Kansas House Bill 95-2161 requires that fleets with 20 or more vehicles in the consolidated metropolitan areas (CSMA) of Wichita and Kansas City make 15% of their new vehicle purchases AFVs in the 1997 model year. These areas include the following counties: Johnson, Leavenworth, Miami, and Wyandotte for the Kansas City CSMA, and Butler, Harvey, and Sedgwick for the Wichita CSMA. This provision applies to light-duty vehicles (GVW less than 8,500 pounds). [1] State fleets are obligated as a result of HB 95-2161 to fuel their required AFVs with alternative fuels. HB 95-2161 exceeds EPACT regulations for state fleets. [2] Table 1 summarizes AFV purchase requirements for state fleets as mandated by House Bill 95-2161.

Table 1. Percentage of state fleet light duty vehicle purchases required by HB 95-2161. [3]

Model Year	State % AFV Purchases
1996	10%
1997	15%
1998	25%
1999	50%
2000 +	75%

Federal and Fuel Provider Fleets - The Federal Energy Policy Act of 1992 (EPACT) requires that purchases made by fuel provider fleets and federal fleets with a minimum size of 50 vehicles must be comprised of 30% and 25% AFVs, respectively, during the 1997 model year. EPACT applies to light-duty vehicles (GVW less than 8,500 pounds), and to the CSMAs of Wichita and Kansas City. [4]

On December 13, 1996, President Clinton signed Executive order 1301, which calls on each Federal agency to develop and implement ways to meet the alternative fuel vehicle (AFV) acquisition requirements of the Federal Policy Act (EPACT) of 1992. The executive order requires each agency to submit detailed reports within 60 days of signing of the order to the Office of Management and Budget detailing its compliance with EPACT. The order also states that each medium-duty vehicle and zero emission vehicle (ZEV) will be counted the same as two light-duty vehicles, and each dedicated alternative fuel heavy-duty vehicle will be counted as three light-duty AFV's. This Executive Order applies only to federal fleets.

Table 2 summarizes EPACT purchasing requirements for fuel providers and federal fleets. EPACT imposes no regulations on municipal fleets. HB 95-2161 exceeds EPACT regulations for state fleets. [5]

Table 2. New fleet vehicle purchases required by EPACT.[6]

Model Year	Federal % AFV Purchases	Fuel Provider % AFV Purchases
1997	25%	30%
1998	33%	50%
1999	50%	70%
2000 +	75%	90%

Fuel provider fleets are required to use alternative fuels in their AFVs. These fleets can be audited by the DOE to ensure alternative fuel usage. The term *fuel provider* can be broadly interpreted. For example, providers of electrical power may fall under this regulation since electricity is the fuel used in electrical vehicles.

An executive order is imminent which will require federal fleets to buy alternative fuels by either reallocating program funds or having congress appropriate more funds. Currently, federal fleets lack funding to use alternative fuels in all their AFVs. [7]

Credits

Credits can be earned, at the rate of one credit per AFV, if AFVs are acquired in excess of minimum requirements or in advance of requirement date. If a state or alternative fuel provider acquires an AFV before model year 1997, DOE will allocate one credit per AFV for each year the AFV is acquired before acquisition requirements apply. States and alternative fuel providers may earn credits for the purchase of medium and heavy duty AFV'S, only after they have fulfilled their light duty AFV percentage requirements for that model year. Credits earned in this manner may be used in subsequent model years. Credits may be transferred from one area to another between any covered fleets.

AFV Options

AFVs include vehicles fueled by ethanol, methanol, propane, natural gas, and electricity. Each of these fuels has predominant advantages and disadvantages as summarized by Table 3. Depending upon the number of vehicles in a fleet and the average usage, these advantages may translate into different bottom line costs per mile. For example, the low initial cost of an E85 flexible fuel vehicle makes it less costly if it is in a low usage application, while the low cost of the natural gas fuel may make it less costly for large fleets with high usage. Table 4. shows the results of three different studies comparing AFVs.

The following assumptions were used for the case studies of Table 4.

1. The costs of refueling stations for E-85, M-85, and propane are each $30,000.
2. There is no cost for gasoline or electric fueling stations because of their current availability.
3. The cost of a CNG station is $200,000.
4. The cost of a sedan is $14,000.
5. The cost of a van is $20,000.

The National Ethanol Vehicle Coalition estimates are based on 1996 dollars. Assumptions for this model are listed in Appendix C. [8]NREL findings are based on a four-year study of comments collected from drivers and service records.[9] Oak Ridge National Lab data come from spreadsheet models. Of equal importance to the costs of the vehicles is the availability of vehicles. Table 5 lists vehicles, which are presently available for purchase. Table 6 lists typical costs for converting vehicles to propane and natural gas.

Table 3. Key advantages and disadvantages of alternative fuel options.

Vehicle type	Key Advantages	Disadvantages
E-85	low incremental vehicle cost	high fuel cost
M-85	low incremental vehicle cost	high fuel cost
		toxicity
Propane	low fuel cost	moderate incremental vehicle cost
	good availability	gas at STP[a]
CNG	low fuel cost	significant sacrifice in range per fueling and
	home fueling capabilities	cargo carrying capacity.
		moderate incremental vehicle cost
		gas at STP[a]
Electric	quiet, zero pollution at vehicle	high incremental vehicle cost
	home fueling capabilities	

[a]**STP is standard temperature and pressure**

Table 4. Estimated cost of alternative fuel options for a base case. Present year as well as 2010 case models presented.

Vehicle Type	Incremental Initial Costs ($/vehicle)	Operating Costs ($/mile)	Operating cost (3yr/75000mi) ($/vehicle)	Case 1[b] -Total Cost Per AFV ($)	Case 2[c] -Total Cost Per AFV ($)
National Ethanol Vehicle Coalition Tax-Exempt Estimates for Sedans					
Gasoline	0	0.025	1875	15875	15875
E-85	0	0.040	3000	**18500**	**17600**
M-85	0	0.042	3150	18650	17750
Propane	2500	0.031	2325	20325	19425
CNG	3400	0.026	1950	29350	23350
National Ethanol Vehicle Coalition Tax- Included Estimates for Sedans					
Gasoline	0	0.04	3000	17000	17000
E-85	0	0.058	4350	**19850**	**18950**
M-85	0	0.067	5025	20525	19625
Propane	2500	0.042	3150	21150	20250
CNG	3400	0.036	2700	30100	24100
National Renewable Energy Laboratory Findings for Sedans					
Gasoline	0	0.04-0.06	3000-4500	17000-18500	17000-18500
E-85	250	0.06-0.13	4500-9750	**20250-25500**	**19350-24600**
M-85	250	0.06-0.17	4500-12750	20250-28500	19350-27600
National Renewable Energy Laboratory Findings for Vans					
Gasoline	0	0.07-0.17	5250-12750	25250-32750	25250-32750
M-85	250	0.10-0.26	7500-19500	29250-41250	**28350-40350**
CNG	3500-7500	0.04-0.14	3000-10500	38500-46000	32500-40000
Oak Ridge National Laboratory Predictions for 2010					
Gasoline	0	0.062	4650	18650	18650
E-85	50	0.084	6300	21850	20950
M-85	50	0.062	4650	20200	19300
Propane	198	0.055	4125	**19820**	**18923**
CNG	525	0.062	4650	29175	23175
Electric	5855	0.121	9075	28930	28930

[b]Cost per vehicle in a fleet of 20 AFVs for 3 years (75,000 miles) including incremental initial cost and cost of fueling site ($/vehicle)

[c]Cost per vehicle in a fleet of 50 AFVs for 3 years (75,000 miles) including incremental initial cost and cost of fueling site ($/vehicle)

It should be noted that assumptions of 20 and 50 AFV fleets as well as average mileage of 25,000 miles per year do not apply to all fleets. Larger fleets and increased use of vehicles will tend to favor CNG since CNG is the least expensive fuel on an energy basis (see Figure 5 in APPENDIX A). It is possible that the total costs for using CNG may be lower than for using gasoline.

Fleets can refuel in existing AFV fueling sites (Table 7) or build their own stations (Table 8). Fuel costs for some AFVs are included in Table 8.

Table 5. AFVs offered by American auto-makers in the 1997 model year, including net cost over gasoline model when available.

Automaker	E-85 M-85	CNG bi-fuel	CNG dedicated	Propane	Electric
Ford[10]	Taurus (FFV) Save $345	Contour + $3,255	Crown Victoria + $3,255 F-250 + $2,360 [d] Econoline 250 + $1,130 [e] 350 Club Wagon + $0 [e]	none	Ranger (1998)
GM[11]	none	C2500 pickup [f] Sierra Pickup [f]	none	none	EV-1 (1998)
Chrysler[12] [g]	none	none	none	none	EPIC (Cali.)

[d] Cost increased by $1,220 for orders after 12/31/96

[e] Cost increased by $810 for orders after 12/31/96

[f] Pending final validation

[g] At a press conference held during the meeting of the Governors ' Ethanol Coalition, Chrysler announced that beginning in 1998 all Crysler minivans would come equipped with E-85 engines at no additional cost .

Table 6. Approximate cost of converting vehicles to AFVs.

Vehicle Type	Conversion Costs
LPG [13]	$2500-$3000 for trucks, $3000-$3700 for sedans
CNG [14]	$2700-$5000
E85 [15]	no retrofits available
M85 [16]	no retrofits available

Table 7. Number of refueling stations in Kansas and Missouri. [h, 17]

Vehicle Type	KS	MO
LPG	38	83
CNG	19	11
E85	1	1
M85	0	0

[h] see attached list of refueling locations in Kansas

Table 8. Approximate cost to build various AFV refueling stations.

Vehicle Type	Refueling Station Costs
LPG [18]	$15,000 - $30,000 for 2000 gallon tank
CNG [19]	$200,000
E85 [20] [i]	$40,000 for new site, $1,000 to convert gasoline site
M85 [21]	$20,000 for 2000 gallon tank

[i] see section below about FFVs

Tax Incentives

Section 6 of HB 95-2161 creates an income tax credit for taxpayer expenditures for qualified alternative fuels vehicle property, conversion equipment, and refueling property made after January 1, 1996. A qualified taxpayer is defined in this section as *any person, association, partnership, limited liability company, limited partnership, or corporation who owns and operates a fleet of 10 or more vehicles and the average fuel consumption for such a fleet of motor vehicles is equal to or greater than 2,000 gallons per year.* Between 1/1/96 and 12/31/96, the taxpayer may receive a tax credit of 50% of the total amount expended, not to exceed $2,500 per vehicle. After 1/1/99, the tax credit drops to 40% with a $2,000 per vehicle limit.

Any taxpayer who purchases a factory-equipped AFV and does not determine the exact basis attributable to such property shall be allowed a credit not exceeding the lesser of 5% of the cost of the vehicle or $750. This applies only if the 50% tax credit has not been taken, and only to the first owner. If the tax credit exceeds the taxpayer's liability, the amount that exceeds the liability may be carried over for deduction the following year or years until the total amount of the tax credit has been deducted from tax liability, except that no such tax credit shall be carried over for deduction after the third taxable year. [22]

Table 9. EPACT tax incentives.[23]

Per AFV Purchased						
Tax Incentives	**By gross vehicle weight (GVW) of AFV**			**Special AFVs**		**Per Fueling Site**
	Up to 10,000 lb.	10,001 to 26,000 lb.	over 26,000 lb.	Buses seating 20 or more	Electric Vehicles	
Credit					10% up to $4000 per EV	
Deduction	up to $2,000 per AFV	up to $5,000 per AFV	up to $50,000 per AFV	up to $50,000 per bus		Up to $100,000 per site

APPENDIX A

Flexible Fuel Vehicles

Flexible Fuel Vehicles (FFVs) are vehicles with a single tank and powered by any mixture of gasoline and alcohol fuel. The only FFV available for the 1997 model year is the Ford Taurus. [24] Taurus comes in an E-85 and an M-85 versions. These cars are designed to burn a mixture of gasoline and 85% ethanol or 85% methanol. The difference in FFVs and normal gasoline engines are in the engines' control systems, and not in the engine itself. FFVs monitor the oxygen content of the fuels entering the engine and adjust the fuel to air ratio to enhance efficiency. The Taurus E-85 and M-85 differ only in this control system. The only difference in the E-85 and M-85 vehicles lies in a replaceable electronic component called the chip that controls engine settings to minimize exhaust pollutants. Conversion can be achieved by replacing the chip. FFVs also have specially lined tanks and hoses to avoid corrosion and o-rings, gaskets, and seals constructed with special polymers. [25] Gasoline vehicles cannot be easily converted to FFVs. [26]

The Ethanol Vehicle Coalition provides a "Forgivable Loan" to public fueling stations. This entails the coalition paying for the E-85 infrastructure in return for the stations agreeing to sell E-85 for four years.[27]

Based on the findings reported in Table 4, the E-85 FFV is the current lowest cost option. It can conceivably be viewed as an even lower cost option by taking advantage of the Forgivable Loan from the Ethanol Vehicle Coalition and by using gasoline as the fuel for fleets in which use of alternative fuel is not mandated. The ethanol AFVs should remain the lowest cost options as long as current ethanol production tax incentives are in place. Without these producer based tax incentives, methanol would be the lower cost option.

Propane Vehicles

Propane vehicles, which are also known as liquid petroleum gas (LPG) vehicles, are not offered by any of the three major US automakers in the 1997 model year. Gasoline vehicles can be converted to propane. In Table 9 are some of the vendors that perform conversions and a cost estimate for converting. Attached is a list of propane refueling stations in Kansas. The range for propane vehicles is almost equivalent to that of a comparable gasoline vehicle. The power, acceleration, payload, and cruise speed are comparable with those of an equivalent internal-combustion engine. [28]

As shown in Table 4, the Oak Ridge National Lab (ORNL) predictions for 2010 report that propane will be the lowest cost option. This ORNL estimate is based on ethanol cost projections which are considerably higher than projections by the National Renewable Energy Laboratory (NREL). If NREL projections are used, ethanol would be the lowest cost AFV option.

CNG vehicles can be obtained by either purchasing those offered by Ford or GM or by converting gasoline vehicles. CNG conversions are less common than propane conversions. In Table 9 are some of the vendors in Kansas that perform conversions and a cost estimate for converting. Attached is a list of CNG refueling sites in Kansas. The range of CNG vehicles is at least one-half that of comparable gasoline-fueled vehicles. The power, acceleration, payload, and cruise speed are comparable to those of equivalent internal combustion engines. [29]

Table 4 shows that the operating costs for CNG vehicles is lower than for other AFV options. Therefore, for very high mileage applications, CNG vehicles could potentially be the lowest cost option.

Summary of Lowest Cost Options

Based on the assumptions of fleet size and vehicle use of Table 4, the E-85 FFV is the lowest cost option for fleets. It is an even better cost option when the Ethanol Vehicle Coalition's Forgivable Loan program is applied, and when gasoline is used for fleets not mandated to use alternative fuels. The drawback of FFVs is their limited availability--the Ford Taurus is currently the only model available.

CNG vehicles currently have the lowest operating cost ($/mile), but have relatively high incremental initial cost and fueling station cost. Conceivably, for very high mileage applications, CNG vehicles could become the lowest cost option.

Table 4 shows that in 2010, propane vehicles are predicted to be the lowest cost option; however, supplier-controlled price fluctuations of propane ultimately leave the economics of propane utilization in the hands of the fuel suppliers.

Fuel price trends

Trends in prices for the last few years are summarized by Figures 1 through 5. As seen by these trends, the price of propane and natural gas can vary considerably. Prices of natural gas and propane reached its peak in 1997.

Ethanol prices and price trends have been relatively stable (except for the past year which has now been corrected). Due to advances in converting wood, grass, and municipal waste into ethanol, the prices for ethanol are expected to remain stable or decrease slightly over the long run.

With the exception of 1995, methanol prices have also been relatively stable. Price increases at this time were due to supply shortage due to a major production facility being off line for several months. If higher volumes of methanol were used, these type of supply shortages would not occur and methanol would potentially line out at prices less than ethanol even with ethanol tax incentives. These stable, low prices

are a good back-up option to use of ethanol vehicles since ethanol vehicles can be readily converted to methanol vehicles.

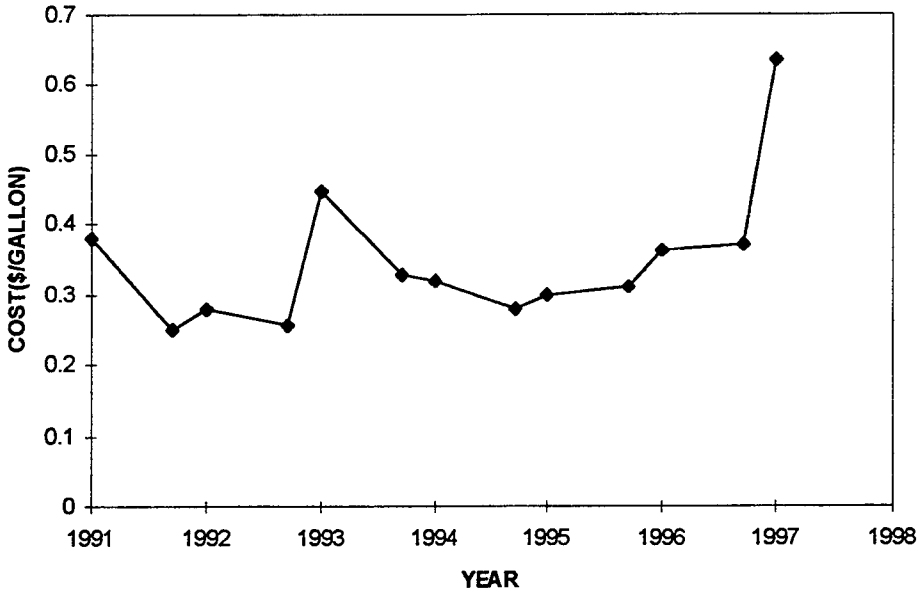

Figure 1. Price trends for propane (*Oil and Gas Journal*).

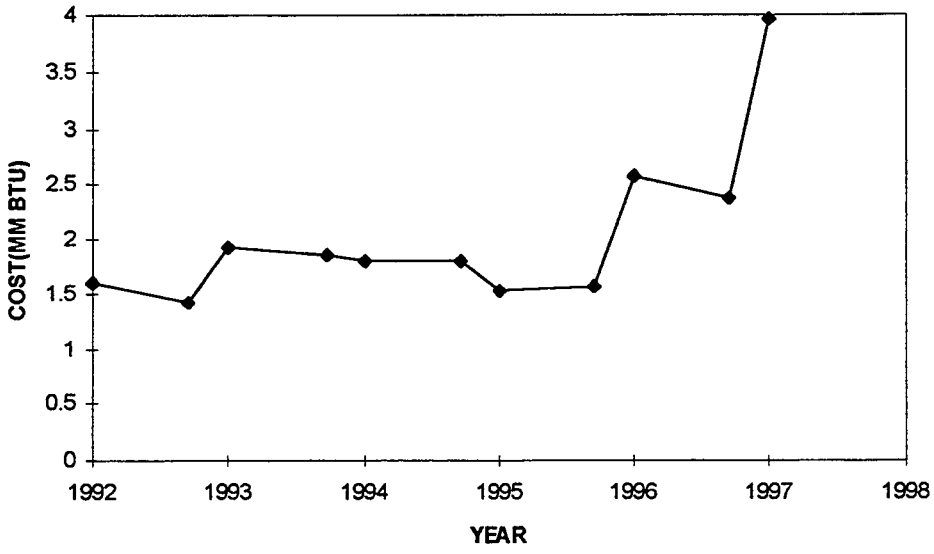

Figure 2. Price trends for natural gas (*Oil and Gas Journal*).

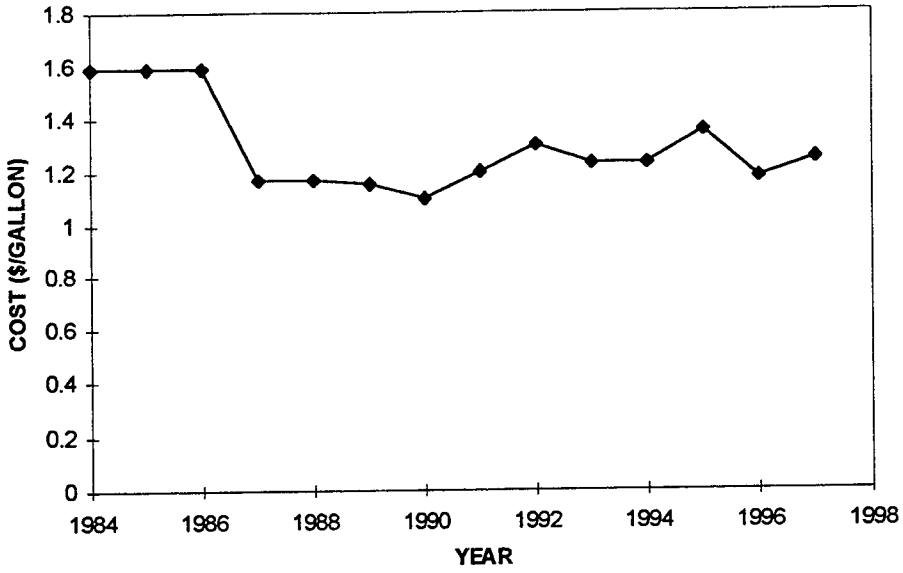

Figure 3. Price trends for ethanol (*Chemical Marketing Reporter*).

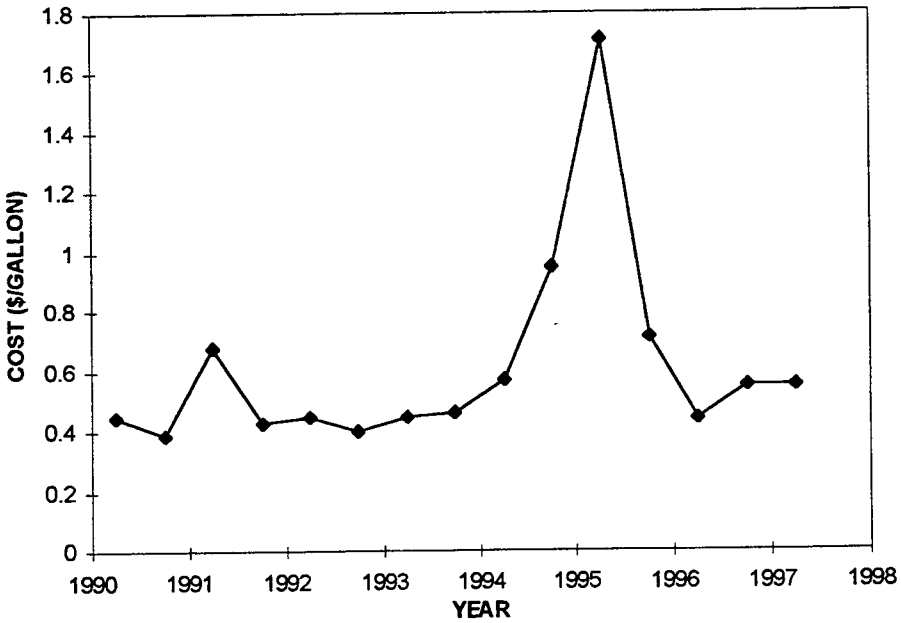

Figure 4. Price trends for methanol (*Chemical Marketing Reporter*).

Figure 5 clearly indicates the prices of various alternative fuels and gasoline. The prices here have been converted to gasoline equivalent. The gasoline equivalents are obtained by multiplying a fuel's cost by the ratio of per gallon energy content of gasoline to that of the particular fuel. The prices were taken on a tax-free basis.

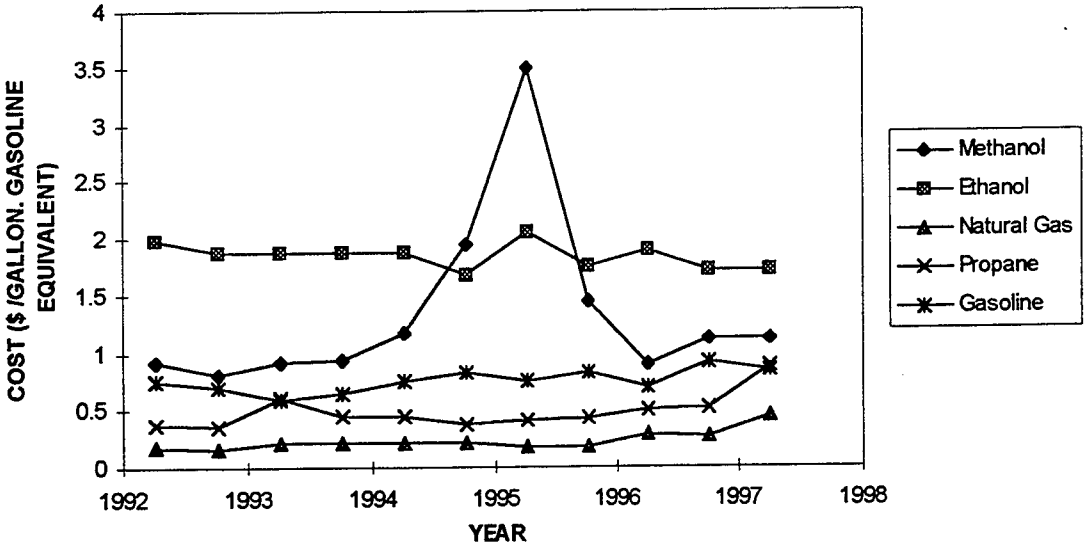

Figure 5. Comparative prices of fuels in gasoline equivalent.

APPENDIX B

Table 9. Vendors in Kansas performing conversions.

LPG	CNG
State Avenue Goodyear Kansas City, KS 913-788-7272	State Avenue Goodyear Kansas City, KS 913-788-7272
Dee's Auto & Truck Repair Arkansas City 316-442-2781	Dee's Auto & Truck Repair Arkansas City 316-442-2781
Lovett's Auto Junction City 913-762-5160	
Payne Oil Co. Salina 913-823-2287	
Carson's Mechanical Service Great Bend 316-793-5353	
Ten Penny's Nortonville 913-886-3333	
Yosemitie Sam's Topeka 913-246-2083	

Source: Each vendor has been contacted.

APPENDIX C

Assumptions made by Ethanol Vehicle Coalition for making cost estimations:

1. All vehicles are mid-size vehicles, such as Chevrolet Lumina or Ford Taurus. For the purpose o this comparison, it is also assumed that the fuel economy remains constant and that the vehicles are driven under identical conditions of climate and elevation, to identical destinations, by identical drivers.
2. 25 miles per gallon (all around usage) for gasoline vehicles.
3. 18 miles per gallon (all around usage) for E-85 vehicles.
4. 12.5 miles per gallon (all around usage) for M-85 vehicles.
5. 21.25 miles per therm (all around usage) for CNG vehicles.
6. 20.2 miles per gallon(all around usage) for propane vehicles.
7. $0.62 per gallon of gasoline (tax exempt purchased by midwest state).
8. $1.00 per gallon of gasoline (approximate current retail price).
9. $0.72 per gallon of E-85 (tax exempt purchased by midwest state with alcohol fuels tax credit applied).
10. $1.04 per gallon of E-85 (approximate retail pump price with alcohol fuels tax credit applied).
11. $0.52 per gallon of M-85 fuel (tax exempt).
12. $0.84 per gallon of M-85 fuel (approximate retail market price).
13. Cost of 1 therm natural gas = $0.55 (tax exempt).
14. Cost of 1 therm natural gas = $0.776 (appropriate retail price for use as motor fuel.
15. Propane cost = $0.63 per gallon (tax exempt).
16. Propane cost = $0.85 per gallon (approximate retail price).
17. One gallon of gasoline = 114,000 BTUs.
18. 1.14 therms of natural gas = 1 gallon of gasoline
19. 1.24 gallons of propane = one gallon of gasoline
20. Cost of natural gas conversion kit = $4500 per vehicle.
21. Cost of Propane conversion kit = $2500 per vehicle
22. Cost of M-85 OEM option = $1000 per vehicle.
23. Cost of E-85 OEM option = $1000 per vehicle.
24. Assume all other repair and maintenance costs are identical.

REFERENCES

[1] "State of Kansas Alternative Fuel Vehicle Incentives Summary of HB 2161". Prepared by the Kansas Corporation Commission, Alternative Fuels, 1500 SW Arrowhead Road, Topeka, KS 66044-4027.

[2] "Taking an Alternative Route". Prepared by the US Department of Energy/Argonne National Laboratory.

[3] "State of Kansas Alternative Fuel Vehicle Incentives Summary of HB 2161". Prepared by the Kansas Corporation Commission, Alternative Fuels, 1500 SW Arrowhead Road, Topeka, KS 66044-4027.

[4] "Taking an Alternative Route". Prepared by the US Department of Energy/Argonne National Laboratory.

[5] "State of Kansas Alternative Fuel Vehicle Incentives Summary of HB 2161". Prepared by the Kansas Corporation Commission, Alternative Fuels, 1500 SW Arrowhead Road, Topeka, KS 66044-4027.

[6] "Taking an Alternative Route". Prepared by the US Department of Energy/Argonne National Laboratory.

[7] Jill Hamilton at the DOE's National Alternative Fuels Hotline, 1-800-423-1DOE, Oct. 3, 1996

[8] National Ethanol Vehicle Coalition newsletter, Volume 1, No. 1.

[9] Alternative Fuels Data Center newsletter, "AFDC Update", Volume 5, Issue 2.

[10] Fax from Chad Levitt of Ford's Alternative Fuel Program Headquarters, 1-800-ALT-FUEL.

[11] Fax from DOE National Alternative Fuels Hotline, "GM's Alternative Fuel Vehicle Program."

[12] Mike Climit at Chrysler Corporation, 810-948-3644

[13] Bob Meyers at the Propane Vehicle Coalition, 714-253-5757. Phone conversation 10/24/96

[14] "Taking an Alternative Route". Prepared by the US Department of Energy/Argonne National Laboratory.

[15] Kurt Ettinger at the National Ethanol Vehicle Coalition, 1-800-E-85-8895. Phone conversation Oct. 24, 1996.

[16] Kurt Ettinger at the National Ethanol Vehicle Coalition, 1-800-E-85-8895. Phone conversation Oct. 24, 1996.

[17] Alternative Fuels Data Center World Wide Web site (http://www.afdc.doe.gov.).

[18] Bob Meyers at the Propane Vehicle Coalition, 714-253-5757. Phone conversation 10/24/96

[19] Greg Zibelfarb at the Natural Gas Vehicle Coalition, 703-527-1315. Phone Conversation Oct. 31, 1996.

[20] National Ethanol Vehicle Coalition newsletter, Volume 1, No. 1

[21] Greg Dolan at the American Methanol Institute, 202-467-5050. Phone conversation Nov. 1, 1996

[22] "State of Kansas Alternative Fuel Vehicle Incentives Summary of HB 2161". Prepared by the Kansas Corporation Commission, Alternative Fuels, 1500 SW Arrowhead Road, Topeka, KS 66044-4027.

[23] "Taking an Alternative Route". Prepared by the U.S. Department of Energy/Argonne National Laboratory.

[24] National Ethanol Vehicle Coalition E-85 Hotline, 1-800-E-85-8895.

[25] National Ethanol Vehicle Coalition newsletter, Volume 1, No. 1.

[26] Kurt Ettinger at the National Ethanol Vehicle Coalition, 1-800-E-85-8895. Phone conversation Oct. 24, 1996.

[27] National Ethanol Vehicle Coalition. 573-635-8445.

[28] "Taking an Alternative Route". Prepared by the U.S. Department of Energy/Argonne National Laboratory.

[29] "Taking an Alternative Route". Prepared by the U.S. Department of Energy/Argonne National Laboratory.