Clean Fuel Florida Advisory Board

Cornerstone Report

January, 2003

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Table of Contents

Chapter 1

Introduction

This report presents a background of the need to expand alternative fuel use in Florida and provides a set of recommendations to set in motion a comprehensive transportation energy plan for the State. Increased alternative fuel use can have a number of positive outcomes; enhanced quality of life, continued economic prosperity, a diversified fuel supply, and a reduced dependence on foreign oil.

The Clean Fuel Florida Advisory Board (CFFAB) has been established through the year 2004. The culmination of three years of effort by the CFFAB, this report to the Department of Community Affairs on behalf of the Florida Energy Office, outlines the benefits expanded alternative fuel use can bring to Florida, highlights the need to consider and act upon implementation of alternative fuel programs in the immediate future, and provides background on the mission of the CFFAB. Additionally, this report recommends specific actions in the mid and long term that will remove obstacles to the development of a sustainable alternative fuel market in Florida, create a business and consumer environment to support a thriving alternative fuel industry, provide direction for strategic investments to facilitate economic growth, improve air quality and reduce dependence on imported oil.

Alternative Fuels have traditionally included natural gas, (both liquid (LNG) and compressed (CNG)), propane (LPG), electricity, bio-diesel (diesel fuel produced from a source other than petroleum, alone or mixed with traditional diesel), alcohol, (both methanol and ethanol, alone or mixed with gasoline), hydrogen, and synthetic fuels. Vehicles that use these fuels are regarded as alternative fuel vehicles (AFVs). Vehicles using advanced drivetrain technologies such as fuel cells or hybrid-electric vehicles (which use both a traditional gasoline or diesel engine in conjunction with an electric motor) are also generally considered to be AFVs.

Rapid technological change and vehicle development have resulted in major advances in alternative fuel vehicles. The alternative fuel industry can be viewed as having three categories of vehicles and technologies, each with specific and viable applications. Traditional alternative fuels, such as natural gas and propane, have a place in centralized fleet situations and offer the promise of efficient, cost effective home refueling. Transitional fuels, such as ethanol and bio-diesel, provide environmental gains and reductions in foreign energy dependence, and are a "low cost" readily available alternative that can utilize existing refueling infrastructure. Emerging technologies, such as hydrogen and fuel cells, focus on unlimited resources of energy and virtually zero emissions, though require further development to bring them to commercial market status.

Promoting a comprehensive, sustainable and viable program of alternative fuel use offers large potential rewards for Florida with minimal risk. Expanded use of alternative fuels also reduces the nation's dependence upon imported oil, enhancing energy security. The State can benefit environmentally through cleaner air, and a lower risk of groundwater contamination, and can benefit economically through the local production of fuels and the possibility of becoming an energy exporter. By leveraging the leadership role of the NASA program, Florida can attract investment and higher income jobs as a leader in hydrogen and fuel cell development and production,.

In this report, the Clean Fuel Florida Advisory Board (CFFAB) has identified a number of areas in which the foundation for a comprehensive transportation energy plan incorporating alternative fuels can be set in motion. These range from Florida taking a proactive role with key industry sectors, to providing leverage to federal and private sector funds for infrastructure development; coordination across state agencies, and planning for the needs and consequences of emerging technologies such as hydrogen and fuel cells. This report considers sociological, geopolitical, and technological factors that will impact the provision of a sustainable energy source for Florida's transportation system, while addressing the short, medium and long-term needs of the State. There is a

need to act now to send a clear signal to industry that Florida is "open for alternative fuel business" and secure the necessary resources to meet the fueling needs of the State's transportation system.

Mission and Background of the CFFAB

Governor Jeb Bush signed the Florida Clean Fuel Act into law in 1999.[1] The Act established the Clean Fuel Florida Advisory Board to study the implementation of alternative fuel vehicles and formulate policy recommendations to the Secretary of the Department of Community Affairs on the expansion of their use. This report is the culmination of a multi-year effort by the CFFAB to present clear direction to the State to ensure a steady and predictable source of energy to fuel the Florida's transportation system.

The CFFAB consists of representatives from energy industries, motor vehicle manufacturers, vehicle fleet managers, Florida citizenry, transportation professionals, economic development and environmental interests along with state agencies, local governments, and others interested in alternative fuels. In a statement adopted in the summer of 2000, the CFFAB further refined its mission as:

> "The Clean Fuel Florida Advisory Board, representing diverse private sector, public agency and citizen perspectives, studies, develops and promotes policy recommendations regarding the expansion of alternative fuel vehicles in Florida."

The CFFAB also adopted a set of guiding principles to steer their deliberations and policy formulation:

1. Be Fuel Inclusive

[1] The Clean Fuel Florida Advisory Board was established in 1999 by FL statute 403.42, the Florida Clean Fuel Act. The purpose of the board is to serve as a resource for the Department of Community Affairs and to provide the Governor, the Legislature and the Secretary of Community Affairs with private sector and other public agency perspectives on achieving the goal of increasing the use of alternative fuel vehicles in the state. The statute enacts the board's existence for a period of 5 years

There are many potential markets for many different fuels, each with various benefits and applications. The CFFAB recognizes this and has put aside parochial perspectives.

2. Build on Past Work While Incorporating Creative Ideas
   The CFFAB has been adamant not to "reinvent the wheel." The CFFAB's efforts have focused on what alternative fuel programs have worked "where and why", and the CFFAB has incorporated unique elements of Florida in developing recommendations.
3. Focus on Results
   The CFFAB has a clear definition of success and has articulated specific measures to assess progress in the future.
4. Develop Statewide Policies through Consensus Decision-Making
   Given the diverse composition of the CFFAB and the diverse interests represented, recognition that recommendations must be developed in a collaborative manner.

In developing this report, the CFFAB took care to address the statutory charge as provided in the Clean Fuel Act, FS 403.42. As written, the statute directs the CFFAB to undertake the following:

> 403.42.2 **Identify Obstacles and Incentives.**
> The advisory board shall assess federal, state, and local initiatives to identify incentives that encourage successful alternative fuel vehicle programs; obstacles to alternative fuel vehicle use including legislative, regulatory, and economic obstacles; and programs that educate and inform the public about alternative fuel vehicles.
>
> 403.42.3 **Motor Fuel Taxes and Alternative Fuels.**
> The advisory board is charged with determining a reasonable, fair, and equitable way to address current motor fuel taxes as they apply to alternative fuels and at what threshold of market penetration.

403.42.4 **Findings and Recommendations on Future Alternative Fuel Programs and Legislative Changes.**

Based on its findings, the advisory board shall develop recommendations to the Legislature on future alternative fuel vehicle programs and legislative changes that provide the best use of state and other resources to enhance the alternative fuel vehicle market in this state and maximize the return on that investment in terms of job creation, economic development, energy security and emissions reduction.

The CFFAB has diligently followed the direction of the Florida Legislature in conducting its work. In this report, together with the CFFAB's previous reports (Appendix 1 - The Strategic Fit of Alternative Fuels in Florida – January 2001, and Fueling Florida's Future; January 2002), the CFFAB has identified the obstacles to be overcome and the areas of support required to foster the deployment of a viable alternative fuel vehicle program. The CFFAB has sought and will continue to pursue legislation (Appendix 2) to address a reasonable, fair, and equitable way to address motor fuel taxes. Furthermore, this report itself addresses the requirement for developing recommendations to the Legislature on programs and legislative changes to enhance the AFV market in this state.

Finally, the CFFAB sees this report as the genesis for all Florida agencies to incorporate an understanding of the need to consider alternative fuel use in all activities, be it regulation or planning activities, or departmental use of vehicles. The primary audience of this report is those responsible for the direction of policy in Florida –high-level executive officials and departmental heads, policy makers and legislators. By providing the basis to link environment, energy and economic development, the CFFAB seeks to promote a market-based approach incorporating government policy and consumer awareness to take advantage of economic development opportunities that alternative fuels can bring to Florida, and address the critical energy needs of the State.

Chapter 2

Understanding the Need for Alternatives

The fiscal demands and planning challenges of maintaining and developing a transportation system for one of the United States' most populous states is a daunting task. Florida ranks at or near the top in a number of particularly relevant transportation factors such as fuel use, vehicle miles traveled, population growth and urban densities. A review of the growth trends in Florida over the coming decades is a fundamental step in understanding the demands that will be placed on the State's transportation system, and the need to protect and develop Florida's investment in transportation infrastructure. Connecting these growth patterns to the demand for transportation highlights the need to introduce alternative sources of energy to foster growth and facilitate economic development.

Through a multiyear effort, the CFFAB has identified not just why there is a need to consider expanding the use of alternative fuels in Florida, but also why Florida is a particularly good fit for the early introduction of transitional alternative fuels and emerging AFV technologies. The following discussion addresses where Florida stands in relative terms of population growth and densities, how the State's demographics are particularly well suited to a viable AFV market, how federal mandates have failed to impact the Florida motor vehicle fleet and achieve desired outcomes of reduced emissions and petroleum use; it examines the driving forces behind petroleum demand, reviews the environmental issues associated with continued growth in petroleum use, considers the near term technological outlook for AFVs and examines the fundamental reality of the finite nature of petroleum based fuels.

Although many of the trends are a source of concern, the potential for addressing the State's needs with alternative fuels and alternative fuel vehicles is promising. High levels of urban density, a large proportion of elderly, and overall high growth rates are all precursors for a viable Alternative Fuel Vehicle (AFV) program where centralized refueling infrastructure, short trip lengths and growing markets are key to sustainable

markets. Rapidly advancing developments in alternative fuel vehicle technologies mean viable solutions are close to commercialization. Florida is well positioned to take a leadership role and secure a sound economic future.

1. Population

Six states were identified as peers to Florida using a statistical process known as Cluster Analysis. The purpose of cluster analysis is to organize observations (in this case Florida and other states) into groups, where members of the groups share properties in common. For the purpose of this report, transportation related factors such as population densities, population growth rates, vehicle miles traveled (VMT), fuel use, and vehicle registrations were considered. A full description of the Cluster Analysis process and the variables used to identify the peer states is provided in Appendix 3. Using the cluster analysis approach, the following states were found to be most similar to Florida (ranked in order of similarity);

- Pennsylvania
- Ohio
- New York
- Illinois
- North Carolina
- Michigan

This report will utilize the peer states as benchmarks for relative growth in population size and demographics, number of motor vehicle registrations, VMT, fuel demand and AFV activity.

A. Growth

Florida is one of the fastest growing states in the US. The State is challenged with providing a level of infrastructure to support this growth and risks serious disruptions to continued economic growth and prosperity unless a broad vision of transportation energy policy is adopted.

Using the most recent Census 2000 projections, Florida's population in 2001 was almost 16.4 million[2]. Using the average annual growth rate of population in Florida over the last decade the estimate for 2002 is almost 16.8 million. During the 1990's, Florida's population increased 3 million; only California and Texas grew by more during that decade. This represents nearly a 23.5 percent increase in population over that period, which is significant when compared to a national growth rate of only 13 percent. Should the current trend in the population growth continue as expected, the population of Florida will have increased 55 percent by 2022, reaching 25.5 million, and will have doubled by 2032.

Despite a recent slowing in the rate of growth in new residents, Florida remains one of the fastest growing states in the nation. Among the peer states identified using cluster analysis, Florida is by far the fastest growing state. (Refer Table 1).

State	Population, 2000	Average annual growth rate, 1990-2000 (%)
Florida	15,982,378	2.1
Pennsylvania	12,281,054	0.3
Ohio	11,353,140	0.5
New York	18,976,457	0.5
Illinois	12,419,293	0.8
North Carolina	8,049,313	1.9
Michigan	9,938,444	0.7

Table 1 – Peer State Population and Growth Rates

Florida remains the fourth largest state in the US behind California (population 33.9 million), Texas (population 20.9 million), and New York (population 19.0 million).

[2] US Census Bureau; http://quickfacts.census.gov/qfd/states/12000.html

Census Bureau projections are that Florida will become the nation's third largest state between 2015 and 2020.

B. Demographics

Currently, and for the foreseeable future, much of this growth comes from migration into Florida. In the 1990's over 85 percent of Florida's growth was from migration, with much of this from retirees. Already, persons aged 65 years or older comprise almost 18 percent of Florida's population, versus a little over 12 percent of the overall US population[3]. As early as 2010, this age group will comprise almost 20 percent of Florida's population (Table 2).

Age Group	2000	2010	Percent Change
0-4	964,590	1,124,735	+ 16.6
5-17	2,698,895	2,875,406	+ 6.5
18-24	1,339,053	1,628,171	+ 21.6
25-44	4,565,761	4,426,683	- 3.0
45-64	3,619,912	5,295,212	+ 46.3
65-84	2,469,342	3,048,141	+ 23.4
85+	324,825	468,339	+ 44.2
Total	15,982,378	18,866,687	+ 18.0

Table 2 - Florida Population by Age Group[4]

[3] US Census Bureau 2000
[4] US Census Bureau 2000

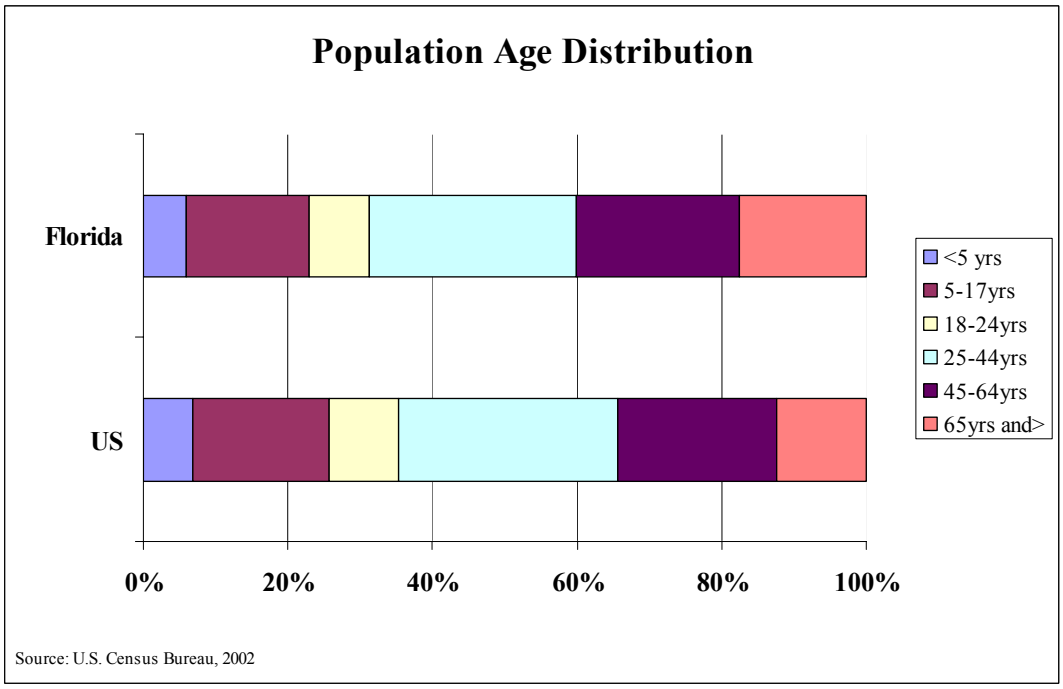

Figure 1 - Population Age Distribution, Florida vs. US

The proportion of older persons in Florida (Figure 1) is particularly significant for AFV deployment. Projections from the Commission for the Transportation Disadvantaged indicate considerable growth in demand for mobility options for the senior and disabled populations in Florida. Typically, widespread use of many types of AFVs is limited by range and access to refueling infrastructure. However, Neighborhood Electric Vehicles (NEVs) are commercially available for use on roadways that are speed limited to 35 mph, and have a range typically of 50 – 75 miles before the need to recharge, neither factor is a restriction to the typical mobility demands of senior and disabled populations. The use of NEVs in closed communities and retirement villages is an ideal AFV application and effectively replaces a traditional gasoline vehicle for short trips.

Additionally, data from the Nationwide Personal Transportation Survey (Figure 2) shows that trip lengths across certain age groups are shorter in Florida than the national average, most significantly in the 55-year plus bracket. Accordingly, Florida presents a strong market for manufacturers of vehicles with limited range.

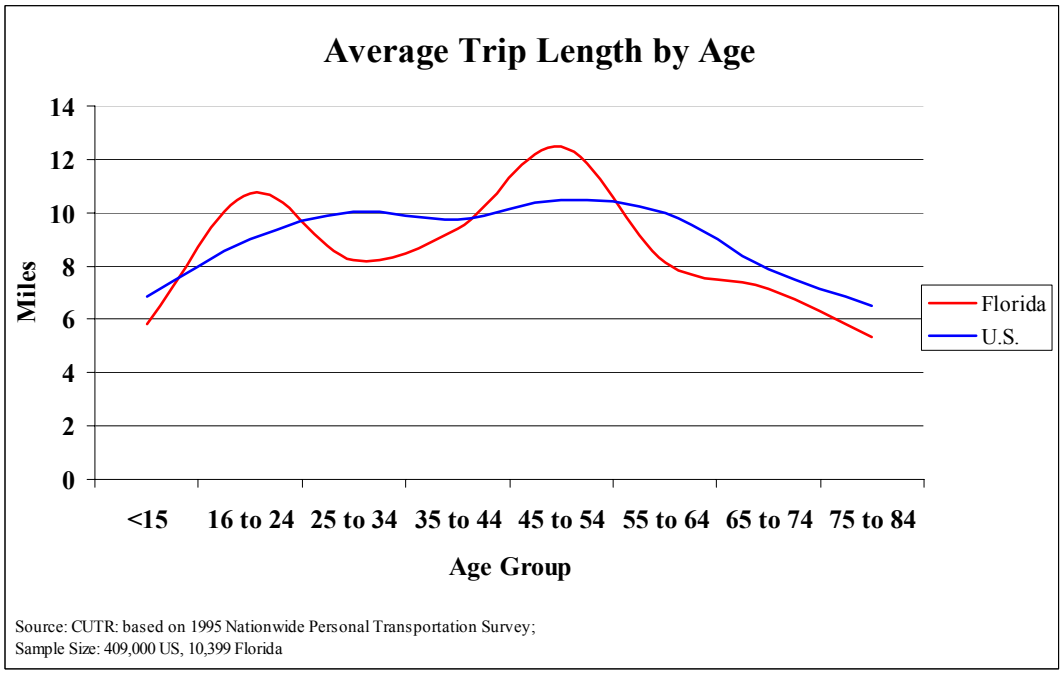

Figure 2 – Average Trip Length by Age

C. Urban Densities

Urban densities are also a factor for consideration in AFV programs. Higher densities justify infrastructure investments, make servicing of markets less costly, and are typically concurrent with shorter trip lengths and higher levels of pollution. Many AFVs, particularly the NEVs previously mentioned, are well suited to short trip lengths and generate fewer emissions than traditional petroleum-fuelled vehicles. Relatively, Florida ranks a close third behind New York and California for percentage of the population residing in metropolitan (urbanized) areas[5] (Figure 3)

[5] US Census Bureau http://eire.census.gov/popest/archives/metro/ma99-06.txt

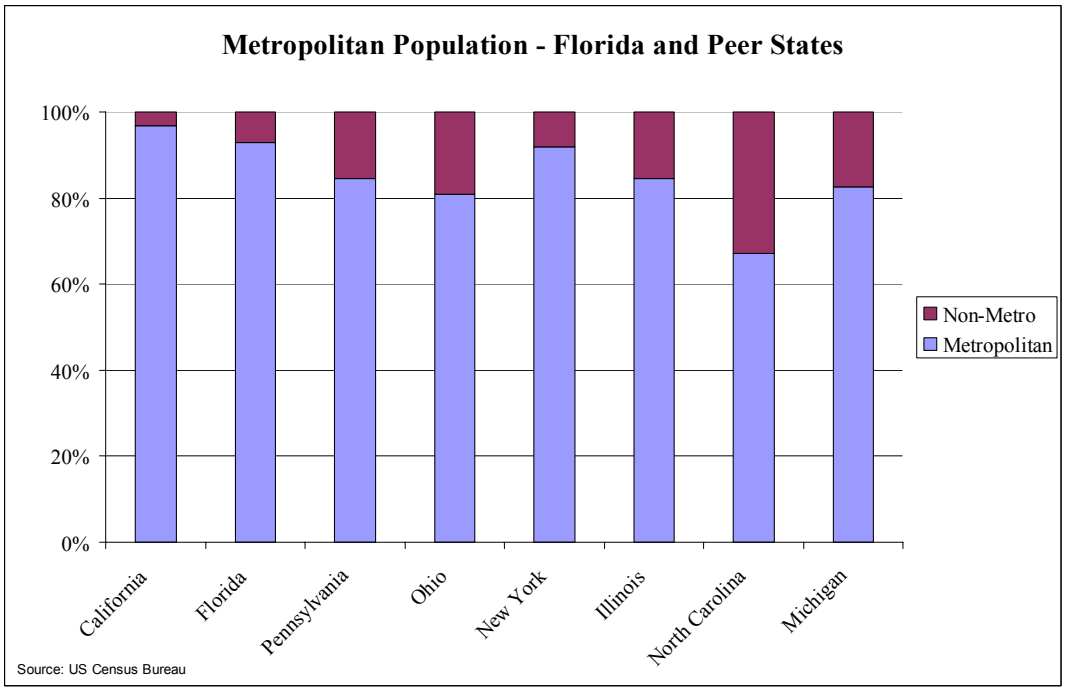

Figure 3 – Percent Metropolitan Populations

Florida's growth in housing units is also significant, increasing by over 1.2 million from 1990 to 2000[6], an overall rate of 19.7 percent, and an average rate of 1.81 percent per year. This is more than half a percentage point higher than the average growth for the US during the same time period. Significantly, much of this growth occurred in urban areas. In 1990, 84.8 percent of Florida's population lived in urban areas. In 2000, Florida's population density was 296 persons per square mile, and is projected to grow to 470 persons per square mile by 2020[7]. This is roughly equivalent to current year densities in New York.

[6] US Census Bureau 1990-2000
[7] Florida Statistical Abstract 2001. Prediction for 2020 is based on the medium estimate of the population for 2020

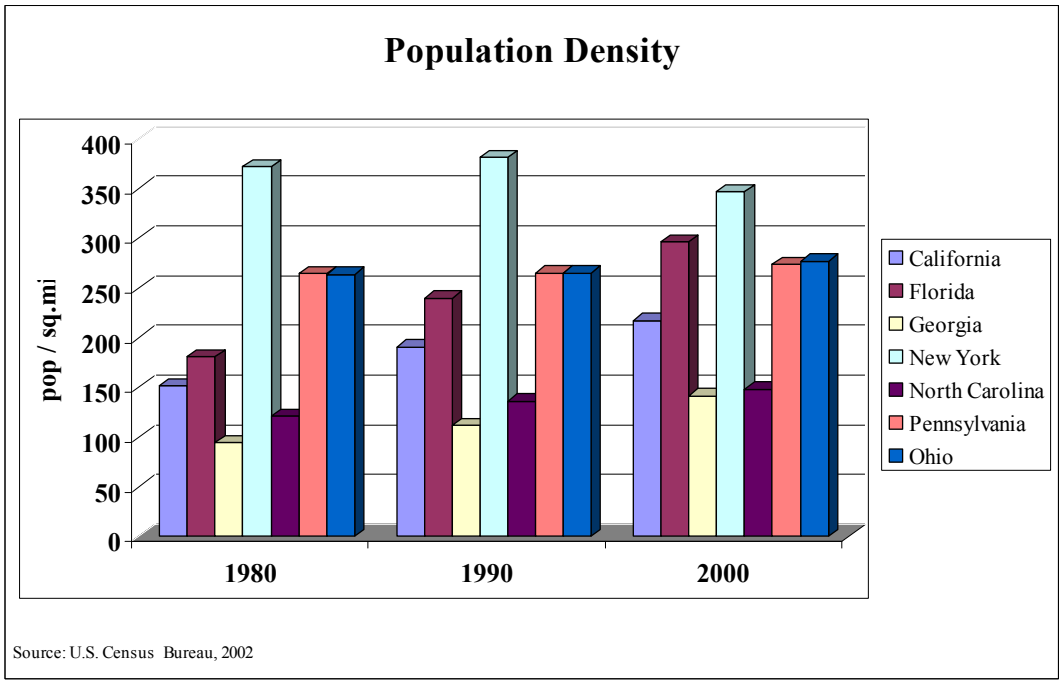

Figure 4 – Comparative Population Densities

2. Florida Motor Vehicle Fleet Composition

There is little doubt that the need for high levels of personal mobility will continue well into the future. As such, strong demand for motor vehicles will continue, and the need to fuel them in a sustainable manner will become more critical. Since 1980 the number of registered motor vehicles in Florida increased by more than 67 percent. Florida's average growth rate of approximately 2.4 percent is much greater than any of the peer states, such as that of Pennsylvania at an average rate of 1.48 percent a year, New York at 1.43 percent per year, or Ohio at 1.58 percent (refer Appendix 4). Notably, the motor vehicle registration growth rate is almost identical in magnitude with the population growth rate. Following the projected growth trend in the population of the state, the number of motor vehicles registered in Florida each year is expected to grow at an approximate annual rate of 2 - 2.5 percent over the next 20 years, increasing from 12.7 million passenger cars and trucks in 2002 to over 15.5 million by 2022.

At these rates of growth, by 2022 Florida will have 15,567,356 (according to a linear trend method estimate) or 20,518,819 (according to an average growth rate estimate) registered cars and trucks (Refer Appendix 4).

A. Alternative Fuel Vehicles

Alternative fuel vehicles (AFVs) are already in use in numerous areas across the State in both the public and private sector, albeit in relatively few numbers. However the lessons learnt and applications identified as particularly suitable for AFVs provide a sound basis for expanding their use in appropriate areas. Florida is a producer of the two main bio-fuels, ethanol and bio-diesel, and is a significant user of Hydrogen. Also, a topography, demography and climate particularly suited to electric vehicles place the State in a unique position to stake a leadership role in AFV deployment.

Although United States Department of Energy estimates indicate over 518,000[8] alternative fuel vehicles are on the road in the United States today, they still represent only a small fraction of the total US fleet. This does not include the over 2.6 million[9] flex-fuel vehicles (FFVs) that can operate on blends of up to 85 percent ethanol fuel (E-85) that are in use throughout the country. In order to clearly understand the extent of AFV use in Florida, the CFFAB, the Department of Community Affairs and the Florida Energy Office directed the Center for Urban Transportation Research at the University of South Florida (CUTR) to conduct an inventory of alternative fuel vehicles and alternative fuel refueling sites in Florida.[10] The purpose of the survey was to determine the true level of alternative fuel activity in the State.

[8] EIA, 2002
[9] Estimates from FoMoCo, GM, and DaimlerChrysler for production 1999 - 2002
[10] Inventory of alternative fuel vehicle users and fuel providers conducted by the Center for Urban Transportation Research at the University of South Florida (CUTR) under the direction of the Clean Fuel Florida Advisory Board and the Florida Department of Community Affairs, June – October 2000. Details of inventory results provided in Appendix A of this report.

The survey, conducted in mid-2000, identified 5,725 AFVs and 513 AFV refueling sites in Florida (Appendix 5). Florida's inventory of AFVs comprises vehicles operating on compressed natural gas (CNG), liquefied natural gas (LNG), liquefied petroleum gas or propane (LPG), ethanol (E-85), methanol (M-85), bio-diesel, and electric-powered vehicles (EV).

Immediately, a characteristic of AFVs that affected widespread deployment of vehicles shone through; many AFVs are equipped to operate on both an alternative fuel and a traditional petroleum fuel. These bi-fuel (operating on either of an alternative fuel *or* traditional petroleum fuel) or flex-fuel (operating on any *mix* of an alternative fuel or gasoline or traditional petroleum fuel) vehicles enabled purchasers to procure an AFV, although not necessarily operate it on an alternative fuel. The significance of this characteristic is twofold;

i) Typically, although a bi-fuel AFV is more expensive to purchase, it will meet federal procurement mandates such as EPACT[11] discussed below. This places a large number of AFVs on the road, yet does not create the demand for supporting infrastructure or fuel;

ii) Flex-fuel vehicles, such as E-85 cars and vans, are manufactured to meet federal mandates, yet are sold and operated in areas where the fuels are not available

The outcome has both positive and negative aspects. Mandated fleets expend greater capital costs in acquiring vehicles, yet the benefits of emission reductions and fuel displacement are not achieved. Accordingly, reported AFV activity falsely implies real market growth. However, given that the concentrations of AFVs exist, it is easy to identify where infrastructure investments would have the best payoff. Furthermore, the

[11] The Energy Policy Act (EPAct) mandates that for some Federal and State agencies a certain percentage of annual fleet vehicle acquisitions be AFVs. More information on the EPAct program can be found on the website of the US Department of Energy: http://www.ott.doe.gov/epact/

considerable number of E-85 flex-fuel vehicles provides a significant market for bio-fuel suppliers.

Accordingly, the inventory counted only E-85 flex-fuel vehicles actually using E-85 as a fuel, and did not account for the estimated 98,000[12] E-85 flex-fuel vehicles on the roads at that time. By the end of 2002, it is estimated that over 200,000 E-85 vehicles such as Ford's Taurus, Chrysler's minivans and GM's small pick-ups are on the road in Florida.[13] Full detail of the inventory is available in the January 2001 CFFAB report "Fueling Florida's Future (Appendix 5)

B. Federal Mandates - EPACT

The mandate that many of these vehicles were acquired under is known as EPACT, the Energy Policy Act of 1992 (Table 3).

EPACT Requirements

Year	Federal	State	AFP	Local / Municipal
1997	25%	10%		
1998	50%	15%	30%	
1999	75%	25%	50%	
2000	75%	50%	70%	
2001	75%	75%	90%	
2002	75%	75%	90%	20%*
2003	75%	75%	90%	40%*
2004	75%	75%	90%	60%*
2005	75%	75%	90%	70%*
2006	75%	75%	90%	70%*

* Ruling yet to be ratified

Table 3 – EPACT Requirements

In 1992, Congress passed EPACT, which was aimed at reducing the use of gasoline, diesel, and other petroleum fuels in transportation by encouraging the use of alternative

[12] Reports from FoMoCo, and DaimlerChrysler and CUTR estimates 2000
[13] CUTR 2002

fuels for cars and light trucks. However, the focus of this act was the acquisition of AFVs, and not the consumption of an alternative fuel, the thought being that large concentrations of AFVs owned and operated by government agencies would spur demand and prompt the development of supporting infrastructure. EPACT mandates require that affected fleets purchase an annually increasing percentage
of new vehicles as alternative fuel capable beginning in 1994. The percentages are capped, for federal and state fleets at 75 percent of certain vehicles in specified geographic areas, and at 90 percent of energy provider (AFP) fleet vehicle acquisitions in certain areas after the year 2000.

Clearly, the EPACT mandates are not achieving their goal of widespread alternative fuel vehicle use, as was found in the early stages of the CUTR AFV inventory. The mandates have had little impact in Florida, as they apply only to metropolitan areas designated by the EPA as having significant air quality problems, and only to fleets where a high concentration of vehicles are garaged at a central location. Other exemptions apply and, as a result, although fewer than 3,000 government operated AFVs have been acquired over a seven-year period, the State is in full compliance with all EPACT requirements. Accordingly, in order to meet the original intent of EPACT, that of reducing petroleum consumption and emissions, a program measuring fuel use would be more appropriate.

3. Petroleum Demand

To understand the nature of the transportation sector's demand for petroleum-based fuels, a number of factors such as the sectors' dependence on primarily one fuel type, total vehicle miles traveled, and vehicle efficiencies (fuel economy) must be considered. Motor fuel consumption in Florida exceeded 20 million gallons per day in 2001. At projected growth rates, daily consumption will exceed 28 million gallons by 2022[14]. By that time, the US dependence on foreign oil resources is projected to exceed 64 percent of annual consumption.

[14] Forecasts are based on the forecasting model of DOE, Annual Energy Outlook Forecasts for the South Atlantic Region. The module employed is based on three diverse scenarios that assume high, average, slow growth rates and oil prices respectively.

Indeed, Florida must be especially concerned, as it has experienced considerable growth in both population and affluence over the last 25 years, leading to above-average growth in motor vehicle ownership, vehicle miles traveled, and gasoline consumption. By the mid-1990s, southern states had among the highest rates of gasoline consumption in the nation. In 2000, median per-capita gasoline consumption in Florida (Figure 5) was almost 25 percent higher than the national average[15] (excluding California). Increased use of alternative fuels and AFVs will both reduce the amount of petroleum that the US and Florida imports and mitigate the threat associated with disruptions in the oil supply.

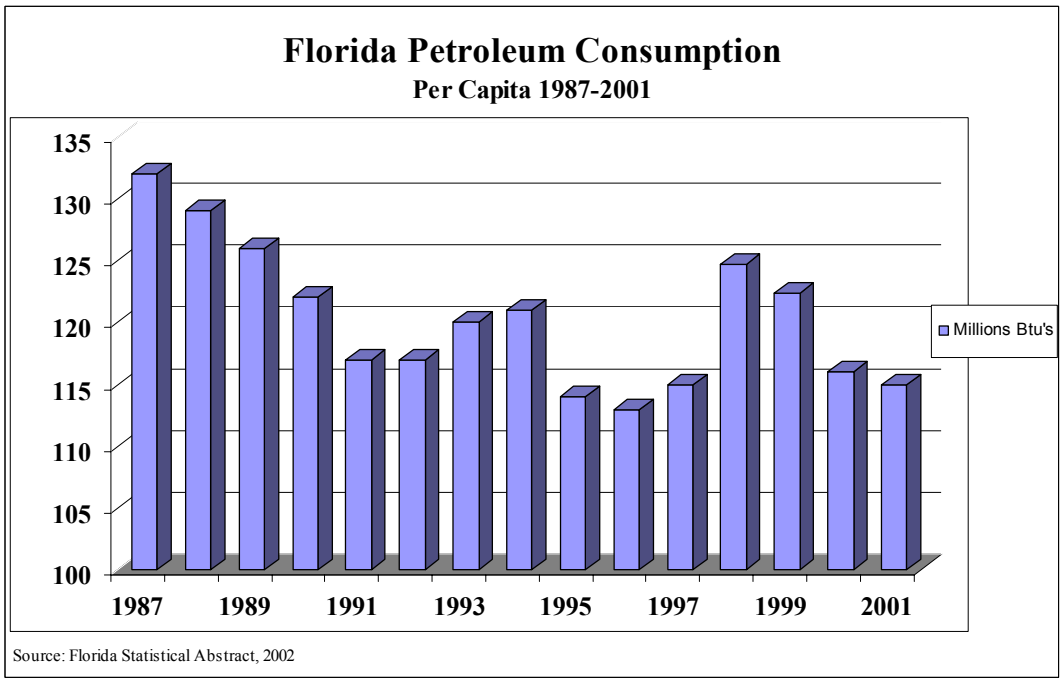

Figure 5 – Florida Petroleum Consumption per Capita

A. Transportation Sector Dependence

Florida and US dependence on gasoline as a transportation fuel source continues to grow while more and more of the oil is imported. Petroleum imports make up about one half of the US trade deficit and are estimated to account for up to 70 percent within the next 20 years,[16] imposing large penalties on the nation's economic growth and loss of

[15] Calculations are based on the data obtained from EIA 2002
[16] Imports as share of petroleum consumption, EIA Annual Energy Outlook.

domestic jobs. Military spending for the 1990-91 Gulf War's was estimated to exceed $61 billion.[17] Considerable debate is currently underway over how best to deal with the stronghold unstable governments have over significant Middle-Eastern oil reserves.

There is also considerable debate about the extent of petroleum reserves worldwide. Regardless, US reserves of petroleum are not matched by consumption patterns. According to the US Energy Information Administration, imports exceeded domestic supplies of petroleum in 1993 (Figure 6) and have been growing as a percentage of our supply ever since.[18] When Florida is examined, petroleum is by far the leading source of energy consumed in our state[19] (Figure 7). Coal and natural gas are the next two most significant energy sources, primarily for electric power generation.

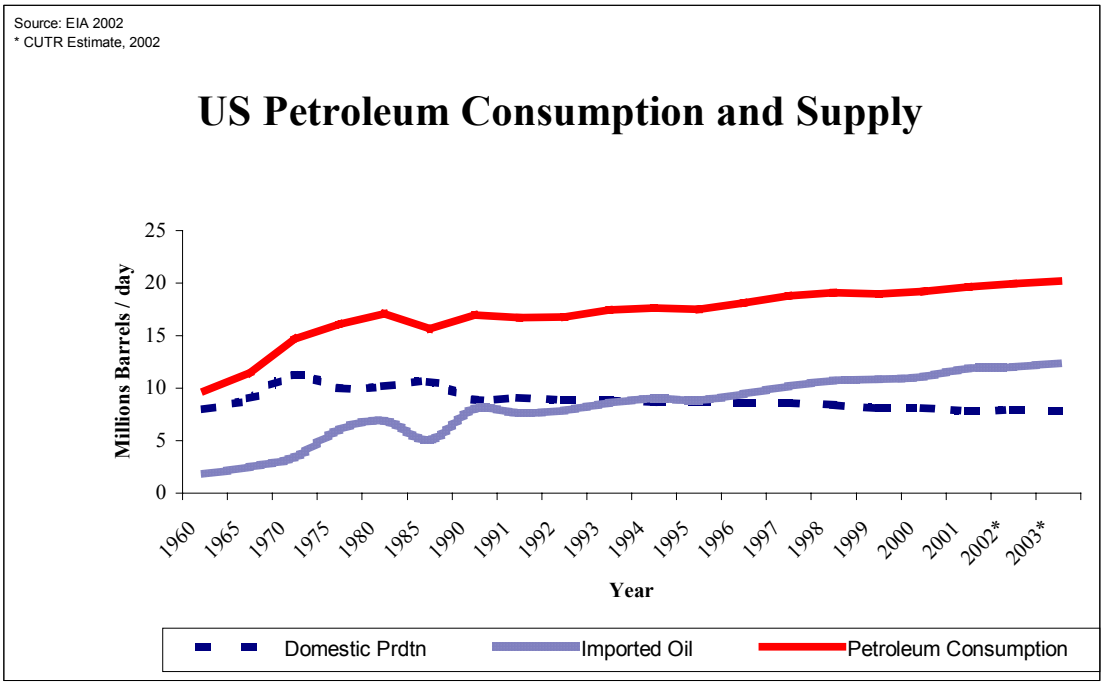

Figure 6 – US Petroleum Consumption and Supply

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http://www.eia.doe.gov/oiaf/aeo/results.html#tables
For major assumptions for the forecasts see: http://www.eia.doe.gov/oiaf/aeo/pdf/appg.pdf
[17] BBC World News http://news.bbc.co.uk/2/hi/business
[18] EIA State Energy Data Report: *http://www.eia.doe.gov/pub/state.data/pdf/FL.pdf*
[19] Florida Statistical Abstract, 2000, Bureau of Economic and Business Research, Warrington College of Business Administration, University of Florida (BEBR) 2000

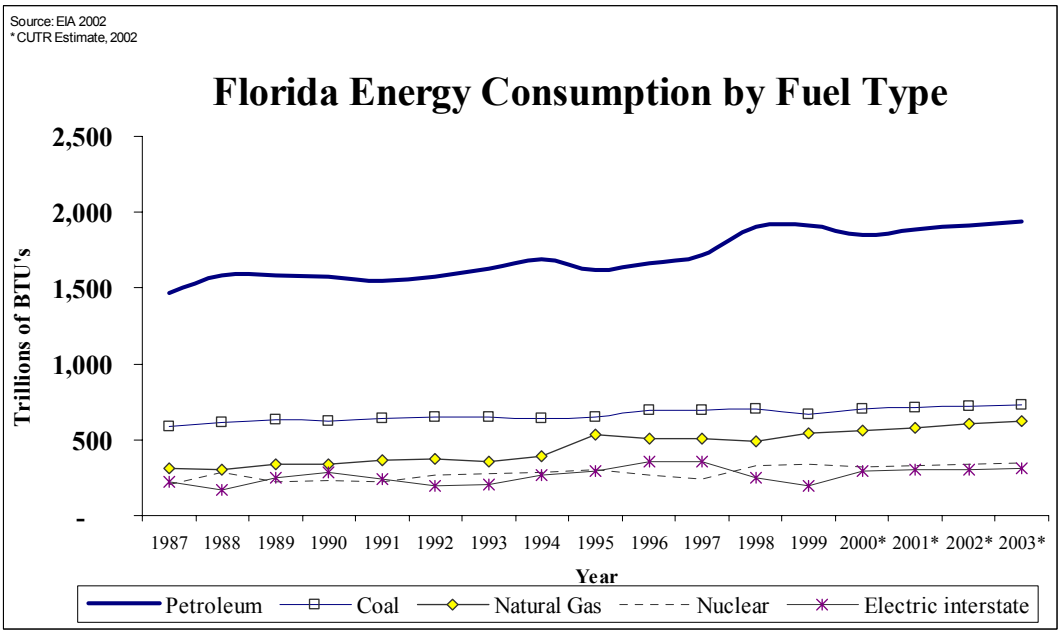

Figure 7 – Florida Energy Consumption by Fuel Type

When the State's energy uses are examined by sector, transportation use clearly leads residential, commercial and industrial uses[20] (Figure 8). Given the relative significance of transportation energy use, the State must look to find ways to preserve mobility and protect economic activity. The annual investment in the State's highway system is over $5 billion and revenue generated from the trucking industry alone is around $6 billion per year.[21]

[20] BEBR 2000

[21] Bureau of Labor Statistics, U.S. Industry and Trade Outlook, 2000. Automotive Parts and Accessories; Tables 37-3, 37-7.

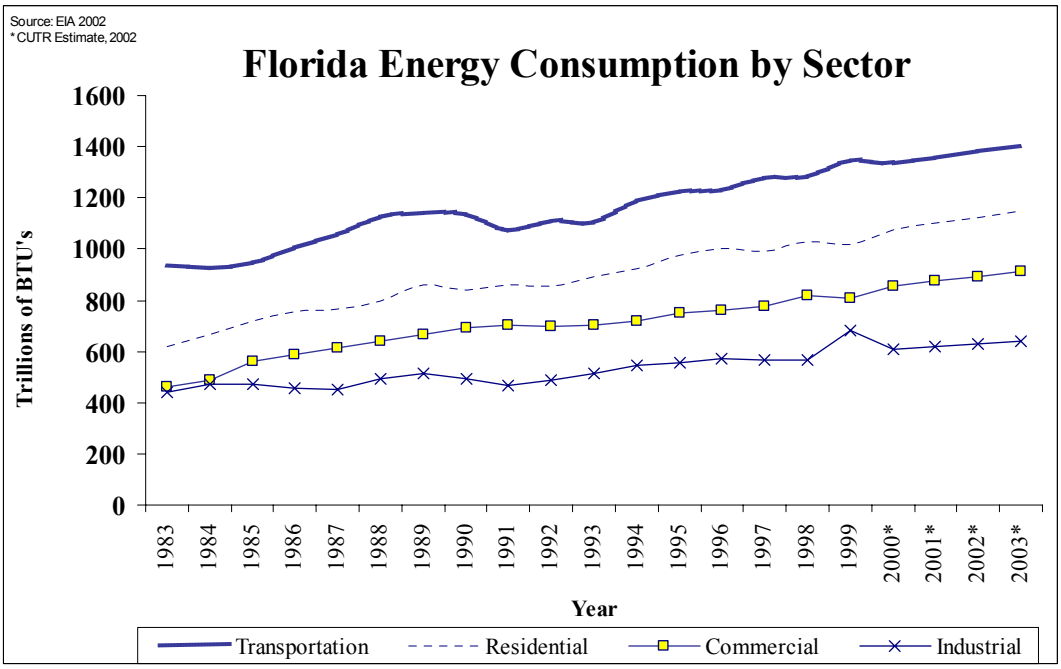

Figure 8 – Florida Energy Consumption by Sector

The annual growth rate in highway motor fuel consumption had slowed somewhat due to the higher fuel efficiency of cars and light trucks. However, the increased proportion of light duty trucks (LDTs) commonly referred to as Sport Utility Vehicles (SUVs) has more than compensated for the fuel efficiency improvement. Both U.S. Energy Information Administration (EIA) and the Environmental Protection Agency (EPA) have pointed out that fuel consumption is not dropping in spite of improvements in fuel technology. Rather, manufacturers have used fuel efficiency improvements to support heavier and higher horsepower vehicles thus negating an overall gain in efficiency.[22] When considering the continued climb in vehicle miles traveled (VMT), rates of population growth, consumption and the strong growth in new vehicle sales (predominantly less economical LDTs) the prospects for reductions in overall consumption are bleak. At the projected annual growth rate of only 1.8 percent per

[22] EIA 2002

annum, petroleum consumption will grow from over 20 million gallons daily[23] in 2000 to in excess of 28 million gallons (671,000 barrels) per day by 2020[24] (Figure 9).

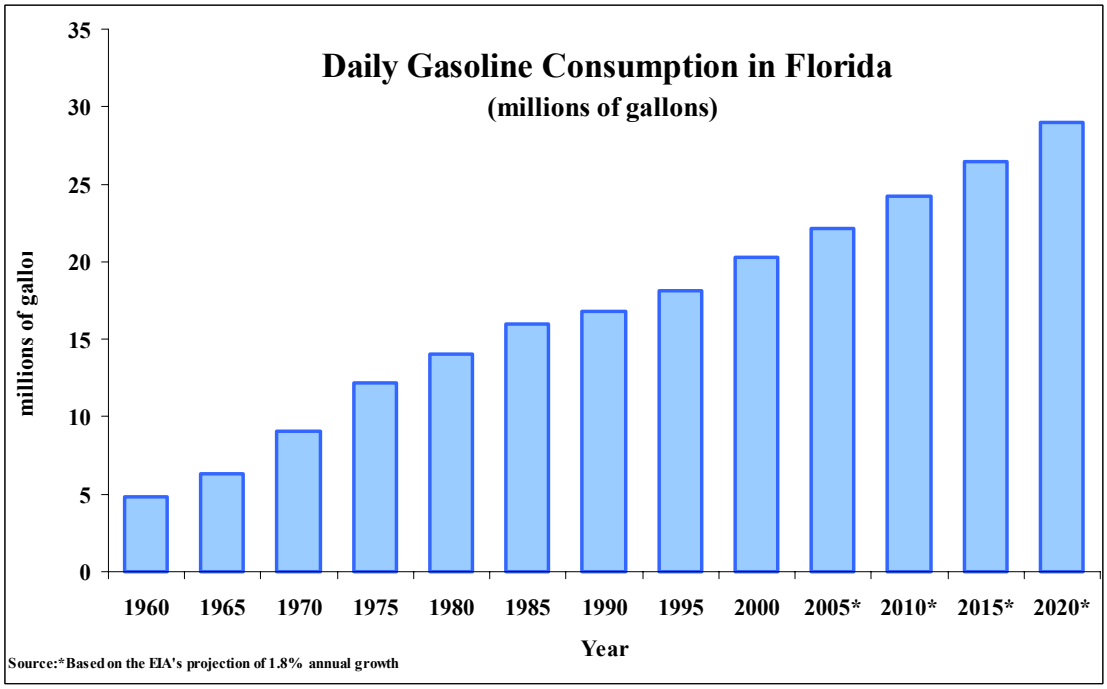

Figure 9 – Florida Daily Motor Fuel Consumption

Compared to the peer states, Florida ranks highly in petroleum consumption, and quite significantly in jet fuel consumption (Table 4). Given the lack of alternative fuels for air travel, the need to preserve petroleum-based fuels and thereby protect the important tourism industry in Florida becomes even more relevant.

[23] EIA 2002 Figures for 2000 were obtained using a projected growth rate for the South Atlantic Region as per the forecast in the Energy Information Administration (EIA) Annual Energy Outlook 2002, and using the EIA State Energy Data Report, 1997, Table 71, as a base.
[24] EIA 2002

	FL	PA	OH	NY	IL	NC	MI
Total Energy Consumption (quadrillion Btu)	3.9	3.7	4.3	4.3	3.9	2.4	3.2
Per Capita Energy Consumption (million Btu)	255	310	384	235	320	320	328
Total Petroleum Consumption (million gallons per day)	39.7	28.9	28.3	34.3	28.8	20.2	23.8
Gasoline Consumption (million gallons per day)	19.9	13.5	13.9	15.4	13.7	11.2	13.9
Distillate Fuel Consumption (million gallons per day)	5.5	7.4	5.6	8.4	5.0	3.7	3.7
Liquefied Petroleum Gas Consumption (million gallons per day)	0.8	0.7	1.5	0.8	2.6	1.4	1.8
Jet Fuel Consumption (million gallons per day)	3.3	1.8	1.9	1.0	2.1	0.8	1.0

Table 4 – Florida and Peer States Energy Use

B. *Vehicle Miles Traveled*

Vehicle miles traveled (VMT) in Florida have increased 24.3 percent since 1990 (Figure 10). If this trend continues as expected, VMT will grow another 58.9 percent by 2020.

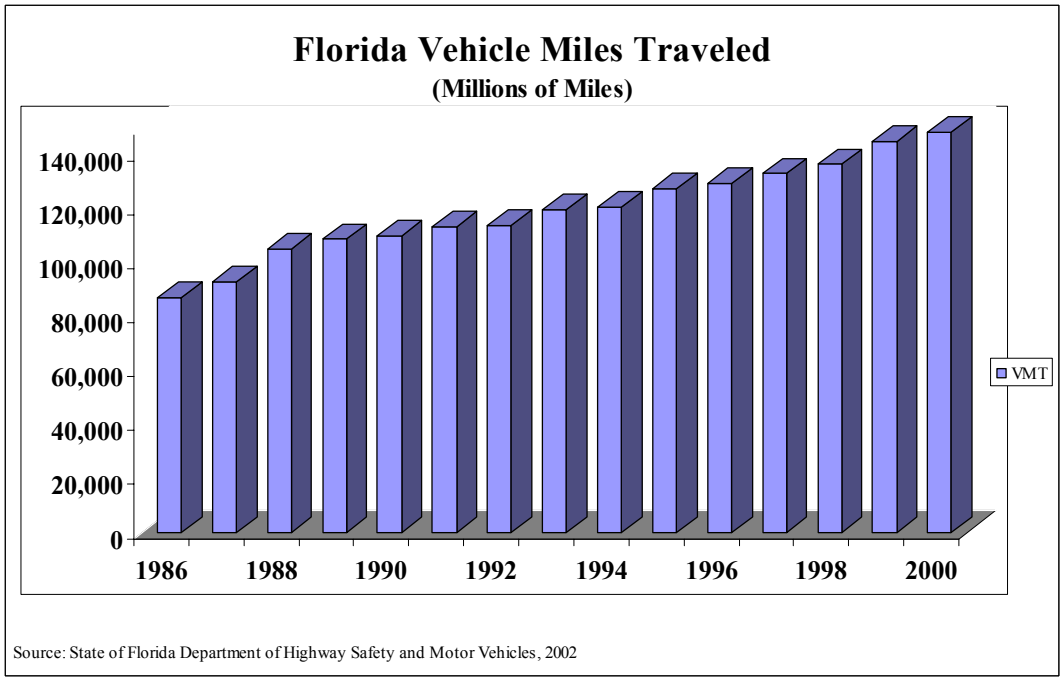

Figure 10 – Florida VMT 1986 – 2000

Compared to its peer states, Florida experienced the highest average growth rate in VMT over the last 20 years. Average annual growth of VMT in Florida was 3.55 percent; versus annual VMT growth in Pennsylvania of 2.00 percent, 2.48 percent in New York, and 2.17 percent in Ohio. If the current growth trend persists, total VMT in Florida will reach 226.9 billion by the year 2022 (based on a linear trend projection).

The message that continued growth in VMT provides is that solutions to mitigate petroleum demand must recognize the continued growth in demand for mobility. Unless alternatives to traditional gasoline and diesel vehicles provide at least the same levels of personal independent mobility, expectations for reductions in petroleum use and improvements in air quality will not be realized.

Public transit systems can play a significant role in addressing not just the mobility needs of the state, but also in reducing petroleum consumption and reducing emissions. States with the least transit service consume nearly three times as much motor fuel per household as do states in which rail transit predominates.[25] Transit rider ship nationally has been increasing at a rate faster than that of VMT[26]. Most fixed rail transit systems operate on electric power, with significant benefits in air quality and energy use compared to individual passenger vehicles. More so, alternatively fueled transit buses are successfully in use in a number of areas in Florida (refer Appendix 9), either as battery electric, utilizing transitional fuels such as bio-diesel or emerging technologies such as hybrid electric systems.

c. Fuel Economy

Transportation's demand for energy, specifically petroleum-based fuels, is affected by a number of factors. First, although efficiency improvements have slowed the rate of growth in demand for fuel, fuel economy gains are projected to slow as a result of

[25] *World Almanac.* Newspaper Enterprise Association, New York, 1994
[26] US Department of Transportation, 2002 http://www.dot.gov/PerfPlan2004/mobility_ridership.html Transit ridership grew 5.0 percent in each of years 1999 and 2000, and by 4.3% in 2001. Growth is forecast at 3.5% for 2002

expected stable real fuel prices, the absence of new legislative mandates, and the increasing predominance of larger vehicles such as SUVs. Forecasts of increases in the demand for energy can be explained by the slowing in efficiency improvements, and projections are that efficiency levels for new cars, light trucks, and heavy trucks in 2020 will fall by 0.8, 0.9, and 0.6 miles per gallon, respectively relative to 2001 levels.[27]

Secondly, fuel economy improvements are unable to offset the effects of much faster growth in the total number of vehicles. The outcome is an increase in total fuel consumption as well as per capita fuel consumption. The wider availability of Hybrid electric vehicles by manufacturers such as Honda, Toyota and others will impact overall consumption levels in future years[28], but not to any significant extent. Additionally, any motor vehicle efficiency improvements reduce the fuel costs of travel, which tend to increase the demand for travel, thereby offsetting some of the energy-saving benefits of the efficiency improvement and creating a "rebound effect".

Another key factor is the elasticity of vehicle travel with respect to fuel cost per mile. Past studies offer a wide range of estimates depending on the model formulation and time period, with some recent studies indicating that travel is insensitive to fuel costs and efficiency.[29] An analysis of US light-duty vehicle miles traveled determined that the rebound effect has been quite small, about 5-15 percent, or less. The findings imply that the energy savings of technical fuel economy improvements to cars and light trucks will be (only slightly) reduced by increased vehicle travel. This also implies that gasoline taxes, or cost increases of fuel in total, would need to be very large in order to stimulate significant reduction in travel.

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[27] EIA 2002

[28] CUTR analysis of Hybrid vehicle sales projections for Florida estimates a total hybrid vehicle availability of approximately 14,500 vehicles per annum by 2006.

[29] Vehicle Use and Fuel Economy: How Big is the "Rebound" Effect? by David L. Greene, Center for transportation analysis, Oak Ridge National Laboratory, TN, USA

	1960	1970	1980	1990	1998
Number of vehicles (thousands)	73,858	111,242	161,490	193,057	215,496
VMT (millions)	719,000	1,110,000	1,527,000	2,144,000	2,625,000
Fuel consumed (million gallons)	57,880	92,329	114,960	130,755	154,884
Average miles per gallon	12.4	12.0	13.3	16.4	17.0
Average fuel consumed per vehicle (gallons)	787	830	712	677	719
Source: Bureau of Transportation Statistics http://www.bts.gov/itt/natf/Intro.pdf					

Table 5 – US VMT and Fuel Use Patterns 1960 – 1998

The effect of continued growth in vehicle ownership and demands for personal mobility are significant. Table 6 shows that since 1960 fuel economy (average miles traveled per gallon) has improved by 37 percent. However, growth in the number of vehicles has increased by 191 percent, and VMT have increased by 265 percent. Accordingly fuel consumption has increased by 167 percent.

4. Environment and Air Quality

Florida's attractiveness as a vacation destination stands threatened by the very growth it fosters and the tourist activity it consciously seeks. Combined with already significant growth levels of population, motor vehicles, VMT and energy demand, motor vehicle use (a mainstay of economic development for Florida and the nation), stands to harm not just the attractiveness of the State as a tourist destination, but also the health and well-being of the State's residents.

Over the past 25 years, the US population has increased 28 percent,[30] VMT have increased 116 percent[31] and gross domestic product (GDP) has increased 99 percent[32]. A

[30] US Census Bureau, 2000

negative effect of this growth is the impact on environmental quality and public health. Extensive data collected throughout the US have led to the recognition that a major contributor to our country's air quality problem is the exhaust from highway transportation vehicles. To address these problems, regulations and technology developments have targeted highway vehicles as specific pollutant sources. As a result of the enactment of a series of environmental laws and the introduction of new technologies, emissions per vehicle mile have been reduced by more than 90 percent since the 1960's[33]. However, due to the dramatic increase of VMT, transportation still remains a major contributor to US emissions of criteria pollutants.[34]

Criteria pollutants are those for which the US Environmental Protection Agency (EPA) has established standards to protect public health. There are six criteria pollutants: carbon monoxide (CO), lead, nitrogen oxide (NOx), ozone, particulate matter (PM) and sulfur oxide (SOx). Additionally, NOx and the volatile organic compounds (VOCs) react to form low-level ozone, a major component of smog in the presence of sunlight. These pollutants have numerous health and environmental impacts, including urban smog, and perhaps most worrisome, global climate change. Risks also exist in the transportation and storage of fuels, from shipping spills and container leaks.

The transportation sector is by far the largest consumer of petroleum fuels in Florida and the US and accounts for about one-third of CO_2 and NOx emissions, 77 percent of CO emissions, and more than one-third of VOCs[35]. Use of alternative fuels can reduce emissions of many of these pollutants. LPG and ethanol provide significant reductions in the emission of NOx and VOCs. CNG in place of diesel reduces NOx, SOx and PM, and electric vehicles reduce tailpipe emissions to zero (emissions of criteria pollutants are displaced to the point of power generation and are significantly more easily controlled).

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[31] Federal Highway Administration, 1999
[32] BEA 1998
[33] US Environmental Protection Agency, 1999
[34] US Environmental Protection Agency, 2000
[35] PNPPRC, 1999

Blends of Bio-diesel with petro-diesel, typically in mixes of 20 percent bio-diesel with 80 percent petro-diesel, can achieve significant emission reductions. The use of bio-diesel in conventional diesel engines can reduce unburned hydrocarbons, carbon monoxide, and particulate matter compared to emissions from diesel fuel. In more pure mixes of bio-diesel, emissions of sulfur oxides and sulfates (major components of acid rain) can also be significantly reduced or eliminated.

Medical researchers have determined that high levels of carbon monoxide (CO), which impedes the flow of oxygen in the body, can result in heart attacks, strokes, and death. Recent studies have documented an alarming increase in the level of carbon dioxide in the earth's atmosphere[36]. Sulfur-based pollutants irritate respiratory epithelium and aggravate asthma. Total suspended particulates (PM) causes inflammation of respiratory epithelium and can lead to death[37]. Ash soot and smoke also contain PM that can damage and discolor buildings and other important structures. Nitrogen oxides (NOx) can cause chronic obstructive pulmonary disease and decrease normal breathing capacity. SOx and NOx are two of the main ingredients in acid rain, which endangers ground water, trees, and lakes and can damage buildings. Estimates of the current cost of US fuel-cycle emissions of greenhouse gases range from $3 billion to $27 billion.[38] Predictions of a 2.5 degree centigrade warming of the world by 2025 translate into damages of over $60 billion annually from agricultural losses, increased mortality, increased electrical use from air conditioners, and loss of water supply.[39]

Major reductions in the level of air pollution in Florida have been achieved through agreements between electric power providers, the Florida Department of Environmental

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[36] Center for the Study of Carbon Dioxide and Global Change 2002 http://www.co2science.org/edit/v3_edit/v3n13edit.html
[37] Health Effects Institute (HEI) http://www.pmra.org in collaboration with the U.S. Environmental Protection Agency (EPA)
[38] Union of Concerned Scientists, 1996, estimates of annual cost.
[39] Union of Concerned Scientists, 1996

Protection and the Federal Environmental Protection Agency.[40] Further gains are anticipated from motor vehicles through the introduction of new technologies and cleaner burning fossil fuels. Nonetheless, the transportation sector is by far the largest energy consumer in the State. Assuming continued growth in the number of licensed motor vehicles, as well as continued growth in vehicle miles traveled, significant gains anticipated from new motor vehicle technologies will not be realized unless something is done to reduce aggregate demand for petroleum as a transportation fuel source. Many of the new motor vehicle powertrain technologies continue to use non-renewable petroleum as their primary fuel source.

In addition to the economic and environmental problems associated with petroleum combustion, an often-overlooked reason to reduce the large-scale burning of hydrocarbons is to preserve them for other important uses. Numerous medicines, plastics, clothing, and other consumer products are derived from petrochemicals. Fueling our transportation system with a non-petroleum-based alternative will have at least three beneficial effects. First, it will lessen or eliminate the need for imported oil, which will reduce the trade deficit. Secondly, it will reduce pollution if the right alternative fuels are selected. Lastly, reserves of a valuable and finite resource could be prolonged.

5. Geopolitical Outlook

Florida can do its part in reducing the US dependence on imported petroleum. A secure source of energy means both a stable supply and a stable price. The US only holds approximately six percent of current known oil reserves (Figure 11), and is highly dependent upon foreign sources of oil. By 2020, the US "will import nearly two of every three barrels of oil [it uses] – a condition of increased dependency on foreign powers that do not always have America's interests at heart"[41]. Overall, the US is one of the three

[40] An example of this was the agreement in 2000 between the Florida Environmental Protection agency and TECO

[41] Union of Concerned Scientists; Clean Energy Blueprint 2002
http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=44

greatest consumers of oil, next to Europe and Asia. Continuing strong economic growth in lesser-developed countries in Asia (and elsewhere) will impact the demand for oil from the world's suppliers. For both the US and Florida, a reduced dependence on imported oil can minimize the effects of oil price increases and protect the State from concerns over supply issues.

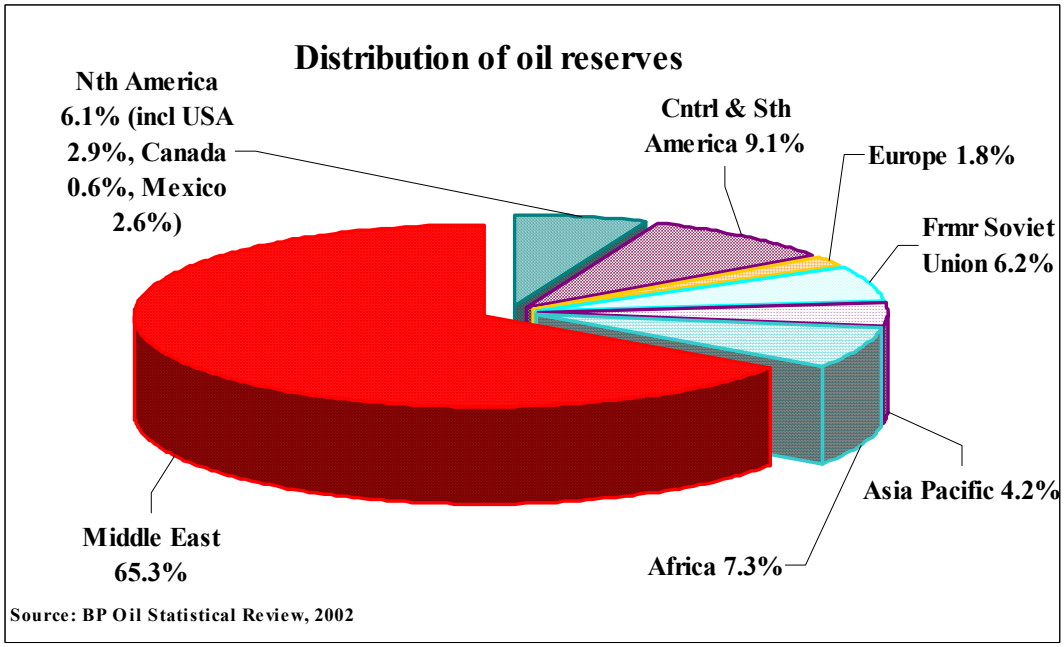

Figure 11: Location of Proven Oil Reserves

OPEC Dominance of Reserves

The world produces over 75 million barrels of crude oil a day; over 27 billion barrels a year. The US consumes just over 19 million barrels of oil per day, almost 26 percent of the world's daily oil output. Out of 75 million barrels of oil produced daily, the OPEC countries produce 29.46 million barrels, or 39 percent, and OPEC's share of world oil production is expected to rise as other well fields are depleted

Among the non-OPEC countries the biggest crude oil producers are the US producing 8.09 million barrels of oil a day and Russia at 6.22 million barrels a day. Other non-OPEC producers are Norway (3.48 million barrels/day), Mexico (3.33 million

barrels/day), China (3.20 million barrels/day), United Kingdom (2.94 million barrels/day) and Canada (2.68 million barrels/day). BP Amoco[42] reports OPEC's "proved reserves" at 77.6 percent of the world total. OPEC production from 1985 to 1999 grew at an average rate of 3.46 percent per year. In contrast, non-OPEC production grew at only 0.37 percent a year during the same period; effectively the OPEC nations' rate of oil production from 1985 to 1999 increased by 9.33 times that of the non-OPEC nations.

Historic world oil production data slowed from 1960 to 1999. The average rate of growth from 1960 to 1973 was 6.65 percent per year, however from 1973 to 1979 growth slowed to 1.49 percent per year, and from 1979 to 1999, it slowed yet further to 0.75 percent. Forecasts are that that total world oil production will reach an all-time peak in 2006. From 2006 to year 2040 world oil production is projected to fall by 58.8 percent, an average decline of 2.45 percent per year.

The OPEC/non-OPEC crossover event is predicted to occur in 2008. This event will divide the world into two camps: one with surplus oil, the other with none. (Figure 12) The following scenario is predicted; (i) by 2008, the 11 OPEC nations will produce more than 50 percent of the world's oil, (ii) thereafter OPEC will control nearly 100 percent of the world's oil exports.[43]

[42] BP statistical review of world energy 2002, http://www.bp.com/centres/energy2002/index.asp
[43] Richard C. Duncan, Ph.D., Geological Society of America, Summit 2000, Reno, Nevada

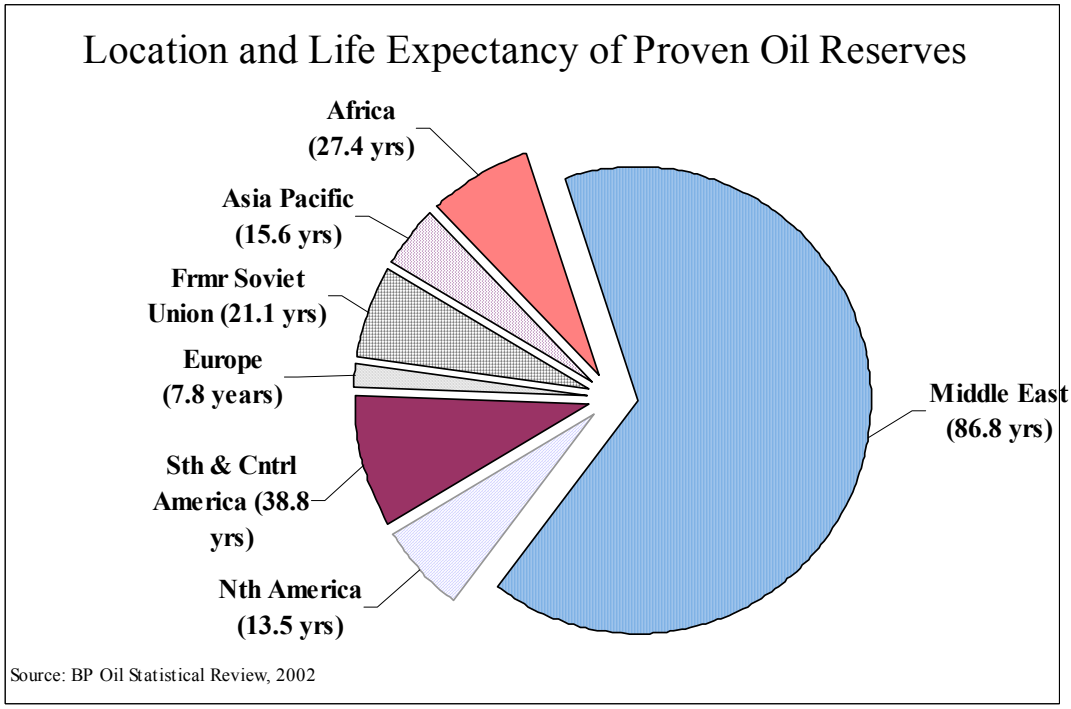

Figure 12 – Location and Life Expectancy of Proven Oil Reserves

Increasing demand from developing countries

The world consumption of more than 75 million barrels daily grows on average by more than 2 percent a year. The reason for this thirst for oil and other forms of energy is economic growth. As industrial production increases, industry itself needs more energy and also needs more fuel to transport products and raw materials. Businesses and offices need increasing amounts of energy to provide heat, lighting and air conditioning, transport goods and provide services. Economic growth also creates consumers who spend more on energy-hungry leisure activities, such as motoring.

As such economic growth depends on increased energy consumption. One positive aspect of developed countries energy use is a decline in the energy needed to maintain a healthy rate of growth in GDP. According to one estimate, a growth rate of 5 percent in

the 1970s was associated with a 7 percent increase in oil demand.[44] However, by the mid-1980s, this had decreased to 2 percent. In the rich countries, the relative decline of the manufacturing industry, which is energy intensive, in favor of the service sector has accentuated this trend. The situation is considerably different in developing countries. Manufacturing plays a key role in development for many, and increased levels of urbanization and car ownership have added to their demand for oil. According to the International Energy Agency (IEA), developing countries use more than twice as much oil to produce one unit of economic output as do developed countries. In the early 1970's, developing countries accounted for 26 percent of oil demand. Now their share is close to 40 percent and likely to continue growing, with the countries of South-East Asia and China being the most dominant.

In the past decade China has experienced rapid economic growth, and generated a strong increase in demand for petroleum and other primary energy sources. Between 1990 and 1999, China's gross domestic product (GDP) increased at a compound real annual rate of 10.4 percent, making China one of the fastest growing economies in the world. During the same period, petroleum consumption increased at a compound annual rate of 6.3 percent and China's oil production grew at a compound annual rate of 1.7 percent. Since 1996, China has been a net importer of oil.[45]

Strong demand for oil and petroleum is also expected from South Korea, which ranks fourth in petroleum imports, fifth in oil refining capacity and sixth in oil consumption. Korea's total demand last year was 201.3 million tons of oil equivalent (TOE), a year-on-year growth of 4.4 percent. Total energy demand is projected to reach 334.2 million TOE between in 2020, an average annual increase of 3.0 percent. Total primary energy consumption in December 2000 was 18,345 thousand TOE, up 2.7 percent from the year before. Petroleum consumption totaled 9.294 million TOE, up 2.5 percent and

[44] BBC News, Internet edition, "The world's thirst for oil" by economics correspondent Andrew Walker. http://news.bbc.co.uk/1/hi/world/686682.stm
[45] http://www.cnoocltd.com/front/html/company-about-6.html

accounting for 50.7 percent of total consumption last December. Coal consumption totaled 3.716 million TOE, up 10.2 percent, and natural gas consumption came to 2.543 million TOE, an increase of 10.6 percent. Total energy imports in December 2000 increased by 5.1 percent, compared with December 1999, and is expected to continue to rise.[46]

Led by burgeoning demand in Asia, world energy demand will continue to grow strongly over the next 20 years. According to the International Energy Outlook 2002 (IEO02) released by the Energy Information Administration (EIA), by 2020 world energy demand will rise 60 percent over 1999 levels, reaching 612 quadrillion Btu.

The newly emerging Asian economies (including China and India, but excluding the developed countries of Australia, Japan, and New Zealand) contribute 42 percent of the projected increase in world energy consumption between 1999 and 2020. Industrial sector growth, which motivates Asia's strong economic performance, is a driving force. Developing Asia accounts for 48 percent of energy demand outside the industrialized world in 2020. Energy consumption in developing Asia will exceed U.S. consumption by 9 percent in 2005, and by 44 percent in 2015 when it will surpass consumption in all of North America.[47]

Increasing population and economic growth in China and India will more than double oil consumption in those countries over the next 20 years. India already imports almost two-thirds of its petroleum. Similarly, oil demand is expected to double in Central and South American countries by 2020, with Brazil accounting for over 40 percent of that growth. Although world oil supplies are projected to grow over the next two decades[48] it will be at a rate less than the growth in demand. Moreover, world motorization contributes significantly to oil demand. The total number of light-duty vehicles is forecasted to

[46] Alaska Department of Community and Economic Development, "Korea, quarterly energy report, 2001
[47] EIA, International Energy Outlook 2002
[48] EIA Energy Forecast, 2002

increase by a factor of 3 to 5 over the next fifty years, bringing the worldwide total to 2 to 3 billion.

These projections are subject to much uncertainty especially in China, where energy demand in the transportation sector may undergo considerable change. In the IEO02 reference case, oil demand in developing Asia grows at an annual rate of 4 percent between 1997 and 2010; in China it increases by nearly 3.2 percent annually. If developments in China's transportation sector follow those already seen in Thailand and South Korea where double-digit growth rates in automobile ownership continued throughout the 1990s, the growth projected in IEO02 could be drastically underestimated.

The need to consider non-petroleum sourced alternative fuels is also driven by forecasts of significant increases in demand for crude oil by-products such as natural gas. Natural gas is the fastest growing primary energy source over the next 20 years (by more than 3 percent annually), gaining share relative to oil and coal. By 2015, gas demand should surpass coal consumption on a worldwide basis, as resource availability, cost, and environmental considerations all favor its use in industrial applications and electricity generation. Worldwide, natural gas consumption is estimated to reach nearly 145 trillion cubic feet by 2015 (85 percent more than in 1995), with the highest regional growth rates in developing countries. In developing Asia, gas demand has been increasing almost 8 percent annually.

World oil prices are forecast to reach $23 per barrel (in constant 1995 dollars) by 2020 in the IEO02[49] reference case despite a 51-percent increase in projected oil demand. Relatively stable long-term trends in oil prices are expected because of growing investment opportunities in resource rich producing areas, increased understanding of the world's oil resource base, and improved methods of oil recovery. As a result, large future oil supply increments should be available at relatively stable development and production costs. While oil prices at the end of 1996 were actually higher than those projected for

[49] EIA, International Energy Outlook 2002

2020, it is generally believed that higher prices will not continue in the long-term, although short-term issues can often introduce high levels of volatility in energy markets.

Conclusions

A significant expansion of alternative fuel use in Florida will not occur without comprehensive, clear and decisive policy action by the state. Florida's air quality needs alone will not be compelling enough over next two decades to drive a broad based shift in technology and a corresponding shift in energy use. It is unlikely that fuel cells will be affordable enough in next two decades to significantly impact emissions and oil dependency.

Hence, such policy action needs to be pre-emptive, as the need for alternative energy sources will most likely be driven from a challenge to the regular supply of oil from predominantly foreign sources. When assessed from an economic viewpoint (balance of payments, costs to transport, costs to "maintain political stability", etc), the need for a higher level of domestically available, renewable energy production and a lower rate of consumption is evident. Greater deployment of AFVs and a higher level of alternative fuel use is a viable solution to addressing this need.

Chapter 3

Alternative Fuel Programs

A key goal adopted by the CFFAB in formulating policy recommendations was that of not "re-inventing the wheel". Accordingly, close attention was given to AFV activity in the identified peer states, as well as recognized leaders in AFV deployment in the US and overseas. Many of the individual factors that have made other programs successful and sustainable are present in Florida. Motivations have been to reduce mobile source pollution, reduce dependency on imported fuels, and, in some cases, to be at the forefront of developing new technologies. Overseas, broader national efforts have had considerable impact on fuel use, with motivators ranging from air quality concerns, to availability and economic issues.

The following review outlines AFV activity in the six peer states identified by the cluster analysis (refer Appendix 3), and a review of a number of overseas national programs and public/private AFV partnerships. Through these, the CFFAB sought to identify and relate to Florida the successful program motivators, establish what approaches are successful and sustainable, determine to what extent standard practices have been established, and evaluate what opportunities for economic development, reduced dependence upon foreign oil and reductions in pollution exist for Florida. A review of successful ongoing AFV programs in Florida is provided in Appendix 9.

The review commences with a discussion of the federal Department of Energy's State Energy Program, an existing funding opportunity for AFV projects at a state level. Each of the six states identified as peers using the cluster analysis technique[50] have some form of AFV related program in place, either as prompted by State Energy Program funds, or by other initiatives. Examining the peer states provides a useful yardstick to evaluate the

[50] Cluster analysis classifies a set of observations into two or more mutually exclusive unknown groups based on combinations of interval variables. The purpose of cluster analysis is to organize observations (in this case Florida and other states) into groups, where members of the groups share properties in common.

relative effort and concern placed on the need to expand alternative fuel use within the US.

State Energy Programs

The State Energy Program[51] (SEP) was established in 1995 by the Federal Department of Energy to provide states the opportunity to apply for a variety of special projects funding. The program seeks to save energy, strengthen the economy, and realize a cleaner environment and a more secure future by helping states promote energy efficiency and use of renewable energy sources. The success of the SEP depends directly on the ability of each state's energy office to implement creative and insightful solutions to energy-related problems. States compete for funding to implement activities relating to several program areas such as building energy codes and standards, alternative fuels, industrial efficiency, building efficiency, and renewable energy technologies. The Office of Energy Efficiency and Renewable Energy is directly responsible for funding the SEP projects. Approximately $18.5 million was available for these projects in 2002.

Among the goals of the SEP are the direct involvement of states in activities that will accelerate deployment of renewable energy technologies. The most relevant areas of the program to this report and the transportation energy needs of Florida fall under a subsection titled " Transportation Technologies: Clean Cities/Alternative Fuels".

The State Energy Program's aim is to support the development and utilization of alternative fuels, as well as other creative methods for improving energy efficiency in transportation. The program has provided funds through State Energy Offices in support of Clean Cities Coalition (a federal initiative[52]) AFV projects, such as the development of infrastructure, niche markets, and strategic alliances between the Federal, State and local government partners and private sector Clean Cities stakeholders.

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[51] State Energy Program Source: http://www.eren.doe.gov/buildings/state_energy/participate.html
[52] US Department of Energy, Alternative fuels data center, http://www.afdc.doe.gov

The estimated funds available in 2002 for projects totaled $4.5 million for designated Clean Cities coalitions[53] across the nation in five categories:

- Acquisition of commercially-available AFVs that maximize alternative fuel use, (with a specific mention of AFV school buses)
- Projects that promote the development of AFV platforms;
- Projects that promote AFV infrastructure development;
- Projects that promote AFV visibility with vehicle signage; and
- Projects that provide cost sharing toward the salary of a Clean Cities Coordinator.

Cost sharing requirements for the projects range from 33.3 percent to 50 percent of total project cost. Several of the peer states have been the beneficiaries of funds awarded under this program area. North Carolina encouraged drivers to practice simple energy-saving habits through its "You Have the Power" marketing campaign. The program highlighted that the value of easy, low-cost steps such as regular oil and filter changes, proper tire inflation, observing speed limits, sharing rides, and avoiding "jack-rabbit" starts. North Carolina also teamed with its southern sister to increase awareness of AFVs. The *Electrical Vehicle Education Information Forum and Curriculum Development Project* provided non-technical information sessions to the general public and demonstrated how their implementation is a viable option.

The Greater Philadelphia Clean Cities Program partnered with neighboring states' programs to provide incentive rebates for the purchase of alternative fuel vehicles as well as the implementation of improved alternative fuel infrastructure. The Philadelphia program has also prompted AFV shuttle operations at the Philadelphia International Airport, local hotels, and universities.

[53] Pennsylvania Department of Environmental Protection, http://www.dep.state.pa.us/dep/deputate/pollprev/sep/SP-CleanCities.doc

Ohio partnered with neighboring Kentucky and Indiana to install AFV infrastructure in the tri-State area. Each partner tailored its efforts to meet its unique needs, while implementing a regional refueling network including natural gas and E-85. Specifically, Ohio converted several government fleets (including the City of Cincinnati) to E-85 and assisted in installing three 10,000-gallon underground E-85 storage tanks. Additional infrastructure improvements have been sponsored in Illinois. Chicago, having the nation's largest density of fleet vehicles, constructed ten E-85 refueling sites through the help of SEP. The project received $250,000 in federal funds.

Florida has benefited from several SEP awards. Two recent major projects, Eastward Ho! and the South Miami Corridor Redevelopment project focused on optimizing land use and integrating mass transit and multi-modal transit. The projects considered the impact of population densities in the study area and designed transportation solutions to maximize energy efficiency in the system. The Gold Coast Clean Cities Coalition is developing a network AFV refueling stations and providing incentives to public and private organizations for converting fleets to alternative fuels. Results have included a fueling network growing from eight to 20 stations, and the deployment of over 1,100 natural gas or electric powered vehicles.

(i) Pennsylvania

Pennsylvania has received close to $200,000 in State Energy Program (SEP) funds since 1998. Among the peer states reviewed, the State has the most Metropolitan Statistical Areas[54] (MSAs) under EPACT and had the ninth-highest total of AFVs reported for 2002 (15, 670[55]). Most recent DOE data show that there are 161 AFV refueling sites in Pennsylvania.[56] In 1992, the Commonwealth of Pennsylvania began offering grants under the Alternative Fuels Incentive Grant (AFIG) program to stimulate the use of

[54] MSAs – Metropolitan Statistical Areas as defined by The Office of Management and Budget (OMB)
[55] Energy Information Administration, US Department of Energy, data as of September 2002
[56] Alternative Fuels Data Center, US Department of Energy, http://www.afdc.doe.gov

alternative fuels. The program's goals were to improve air quality and reduce the state's dependence on imported oil.

The AFIG program receives between $3 million and $3.5 million annually form the State's general fund. No more than 10% of the funds may go to any one applicant each year, and no more than 15% of the funds may go to any one county. Projects funded through the AFIG program include providing a share of the incremental cost of alternative fuel vehicles (AFVs), conversion of eligible gasoline vehicles to alternative fuels, and construction of the refueling or recharging facilities. Small business and private individuals may also apply for grants through the AFIG program to install small "time-fill" Compressed Natural Gas (CNG) units on their property. Other agencies in Pennsylvania are also active in promoting alternative fuels. The differential cost of an Electric Vehicle (EV) is exempt from state sales tax, and the annual registration fee for EVs and conversions is waived.

A number of private sector fuel providers and distributors are actively involved in assisting the deployment of AFVs and providing supporting infrastructure. The Consolidated Natural Gas Company offers no-interest loans for conversions and refueling stations and may provide temporary refueling facilities. Equitable Gas has funded the acquisition of natural gas vehicles and refueling stations. Pennsylvania Gas and Water also provides financing and loan programs for AFVs. Pennsylvania Power and Light Company offers a $.02/kWh credit on electricity used to recharge an EV, while the Philadelphia Electric Company provides a $.03/kWh recharge credit. Philadelphia Electric also offers financial incentives on a case-by-case basis for CNG conversions and purchases of AFVs and refueling stations. Philadelphia Gas Works also offers rebates and other incentives on natural gas vehicles.

(iii) Ohio

Since 1995, Ohio has received 7 grants totaling more than $370,000 from the SEP program. The projects included acquisition of new compressed natural gas (CNG)

vehicles for the City of Columbus and infrastructure development in Cuyahoga County. Among the highlights of AFV promotion in the State are a rebate of up to $600 per vehicles converted to CNG from Cincinnati Gas and Electric, financing for CNG stations as well as technical assistance form East Ohio Gas, and a 10% income tax credit for fuel containing 10% by volume of ethanol. In 1990, the Governor signed legislation directing fleets of three state agencies to use E-10, a blend of 10% ethanol with regular gasoline, whenever possible. Under the requirements of the Energy Policy Act of 1992, the Ohio Department of Transportation has initiated a CNG pilot project in Cleveland involving 20 pick-up trucks.

Ohio is one of 16 states in the US that currently provide some form of incentive for ethanol production, use, or sale. These incentives take the form of tax credits for different purposes, sales or excise tax exemptions, or direct producer payments. Since July 1, 1981, Ohio provided a tax credit for ethanol or methanol not produced from natural gas or petroleum. This restricts the credit to ethanol produced at a facility that is coal-fired or has a capacity of less than two million gallons per year from "wood or the grain of a cereal grass." The tax credit reduction is based on a formula, which adjusts the credit inversely with the federal motor fuel tax exemption. This incentive was reduced to 10 cents per gallon through September 2000 and is capped at $15 million per year.

In December 2001 the Ohio State Senate unanimously passed SB 144 providing tax incentives for investors in ethanol-producing plants. The nonrefundable credit against income tax liability or the corporate franchise tax would be equal to 50 percent of the money invested in an ethanol-producing plant approved by the Ethanol Incentive Board (established by the bill) with a cap of $5,000.

Utility and private incentives are also available in Ohio. East Ohio Gas offers CNG station financing, construction management, temporary fueling facilities for up to two years, technical assistance, and vehicle conversion training. The natural gas refueling stations that East Ohio Gas uses for its fleet is accessible to the public. Beyond a certain

threshold of vehicles, East Ohio Gas will build and operate a CNG refueling station at the customer's site. The National Ethanol Vehicle Coalition (NEVC) is an ad hoc group created by the National Corn Growers Association (NCGA) and the Governor's Ethanol Coalition (GEC) to establish a national program to promote the use of 85% ethanol fuel (E85) as an alternative fuel to enhance agricultural profitability and further national energy independence. Through a cooperative effort with the NCGA and its state affiliates, the GEC, state energy offices, and the U.S. Department of Energy, NEVC provides forgivable loans for the installation of public E-85 fueling facilities.

(iv) New York

New York has received nine grants valued at almost $1.1 million through the State Energy Program. Funds received in 2002 will be used to install CNG infrastructure on Long Island, help create an E-85 fueling network for The New York State Energy Research and Development Authority (NYSERDA), and provide financial assistance and technical information to encourage fleets to purchase AFVs and install fueling or charging stations. Vehicles powered by natural gas, propane, and electricity, including certain hybrid-electric vehicles, are eligible under most of the programs NYSERDA offers. Incentives are also available to encourage use of bio-fuels such as ethanol and bio-diesel.

The recently passed Clean Water/Clean Air Bond Act is one of the largest environment bond programs ever sponsored by a state government. The act allocates $55 million in bond money for research into alternative transportation fuel projects, to be administered by the New York State Energy Research and Development Authority (NYSERDA), and another $20 million to the Department of Environmental Conversation for air quality improvement - which may be assigned to fund clean-fuel bus projects.

A Clean-Fueled Bus Program provides funds to state and local transit agencies, municipalities, and schools for up to 100% of the incremental cost of new alternative-fuel buses and associated infrastructure. The emissions reduction potential of alternative-fuel

buses is evaluated for project selection. Funds come from the Governor's Clean Water/Clean Air Bond Act. $25 million has been awarded for 538 buses including compressed natural gas, battery electric, and diesel hybrid-electric technology.

The New York State Clean Cities Challenge awards funds to members of New York's Clean City organizations to acquire AFVs and/or refueling infrastructure. Funds are awarded on a competitive basis, and can be used to cost-share up to 75% of the proposed project, including incremental purchase costs of alternative-fuel vehicles, the cost of installing fueling and recharging equipment, and the incremental costs associated with bulk alternative fuel purchases or contracts to purchase alternative fuels such as E-85 or bio-diesel. The New York State AFV Tax Incentive provides a tax credit equal to 50% of the incremental cost of electric vehicles and 60% of the incremental cost of other alternative-fuel vehicles. For electric and alternative fuel vehicles with gross weight ratings of 14,000 pounds or less, the maximum tax credit is $5,000. For all other vehicles the maximum tax credit is $10,000. In addition to the tax credit for AFVs, New York State has a sales tax exemption for the incremental cost of AFVs.

The New York City Private Fleet Alternative-Fuel/Electric Vehicle Program assists private companies acquire AFVs. Funds are awarded on a competitive basis for up to 40% of incremental cost of new light-duty natural gas or electric vehicles, and up to 70% of incremental cost for new or converted medium and heavy-duty natural gas, electric, or hybrid-electric vehicles.

New York City has also undertaken a widespread effort to introduce alternative fuel vehicles into its transportation system. Local Law 6 law mandates that 80 % of the new light-duty vehicles and 20 % of newly purchased buses, must be powered by alternative fuels. Natural gas has been the fuel of choice so far.

Several other city agencies have implemented alternative fuel programs. The New York City Department of Transportation, which owns 1,100 buses operating mostly in the

city's outer boroughs, is currently building one of the largest natural gas bus fleets in the world, with 348 buses on order for delivery starting this year. Meanwhile, the Metropolitan Transportation Authority (MTA), which owns most of the transit buses operating in Manhattan, is in the process of purchasing 500 alternative fuel buses powered by natural gas, or possibly, by a hybrid-electric engine.

New York City has also begun a program to convert a significant portion of its 12,000-vehicle taxicab fleet to alternative fuels. A major marketing effort by the city's Taxi and Limousine Commission (TLC) and several private sector companies is attempting to convince taxi operators to take advantage of state and federal funds to switch to alternative fuels. The TLC is offering an added incentive: extending the life of alternative fuel vehicles two years beyond the mandatory five-year retirement deadline that applies to gasoline-powered cabs. Over 2, 600 taxis are scheduled for replacement in 2002.

Other recent initiatives in New York City include the Department of Sanitation's purchase of several alternative fuel vehicles; the testing of electric pickup trucks and an electric bus by the city; and private sector initiatives by companies, such as Brooklyn Union and United Parcel Service, aimed at converting hundreds of company vehicle fleets to natural gas. Additional incentives for alternative fuel vehicles in New York State include:

- A loaner program for CNG refueling stations from Niagara Mohawk Power.
- Financial incentives offered on a case-by-case basis for NGV fleets from Brooklyn Union Gas.
- Adoption of the California LEV program. Exempts the cost differential for EVs and charging infrastructure from the retail sales tax.

(v) Illinois

The State of Illinois has been awarded $425,000 through the State Energy Program since 1998. Several legislative items and state programs are in place to promote alternative fuels in the State. Among the alternative fuel laws and regulations are a two percent sales tax exemption for 10 percent ethanol blends (E-10) and a requirement that 75 percent of state owned passenger cars, light trucks, and vans must be operating on alternative fuels by the year 2000. The State offers a rebate of 80 percent of the conversion cost or 80 percent of the incremental cost of an AFV, up to $4,000 per vehicle. Illinois also offers a rebate for the purchase of 85 percent ethanol (E-85).

The Renewable Energy Resources Program (RERP) fosters investment in and the development and use of renewable energy resources within the state of Illinois. This program is funded by the Renewable Energy Resources Trust Fund, the state's public benefits fund and administered by the Illinois Department of Commerce and Community Affairs. RERP distributes funds in the form of grants (for large systems) and rebates (for small systems). RERP programs address alternative power generation and the development of fuel cell technology. Grant funds may only be used for actual equipment and installation expenses. Eligible applicants include associations, individuals, private companies, public and private schools, colleges and universities, not-for-profit organizations and units of state and local government. Applications are accepted on an ongoing basis. Potential recipients for program funding must be located within the service area of an investor-owned or a municipal gas or electric utility or an electric cooperative that imposes the Renewable Energy Resources and Coal Technology Development Assistance Charge.

Illinois also sponsors ethanol production and blending incentives. Gasohol, defined for tax purposes as a "motor fuel containing at least ten percent alcohol." is taxed at the rate of four percent per gallon, or a two percent sales tax exemption. Several utilities and private concerns offer incentives for alternative fuel use and development in Illinois. Peoples Energy partnered with Nicor Inc. to offer Chicago area fleet owners and operators Clean Fuel Services which include owning and maintaining natural gas fueling

equipment; arranging for the purchase of natural gas conversion systems, arranging for the purchase or transportation of natural gas or both, engaging in the buying and selling of emission allowances, and providing sources for conversion system manufacturers, cylinder suppliers, installers, and coordinating the installation of systems. Nicor Inc. also provide economic analysis to compare natural gas to other fuels and will provide technical support, loan portable CNG fueling facilities for 3-6 months, and loan CNG vehicles on a demonstration project basis to give customers the opportunity to try natural gas as a vehicle fuel. The four CNG fueling systems that Nicor uses for its own fleet are available to customers by arrangement. Additionally, Nicor Inc. has joined a partnership to offer Clean Fuel Services to Chicago area fleet owners and operators.

(vi) North Carolina

North Carolina has not been a recipient of any significant State Energy Program funding, and has few if any alternative fuel projects underway. The only project reported over the last five years in for the Triangle Clean Cities Coalition Coordinator. The project provided funding for the coordinator for the Triangle Clean Cities Program. The coordinators duties include working with a variety of State agencies to implement a Statewide corridor and strategy for increasing the numbers of, and the infrastructure for, alternative fuel vehicles (AFVs); to develop more public-private partnerships to increase stakeholder groups and coalition effectiveness; to assure that alternative fuels are considered in all transit decisions; and otherwise support the use and awareness of AFVs. Without strong and clear direction and support of alternative fuel programs for the State Energy Office, little AFV activity is present in North Carolina.

(vii) Michigan

Michigan provides a 10 percent tax credit for electric vehicles for vehicles purchased after June 30, 1993 and prior to January 1, 2005. The credit is based on the purchase price and can total up to $4,000. The tax credit will be phased out in later years; and is reduced by 1/4 in 2002, 1/2 in 2003, and 3/4 in 2004.

A tax deduction up to $2,000 per vehicle is allowed for clean-fuel vehicles that use ethanol, methanol, propane, electricity, or natural gas. The tax deduction is based on the differential cost of equipping the vehicle to use the alternative fuel. A $5,000 deduction is available for trucks and vans weighing between 10,000 and 26,000 lbs. A $50,000 deduction is available for trucks weighing more than 26,000 lbs. or busses that can seat at least 20 passengers. The deductions are available for vehicles purchased after June 30, 1993 and before January 1, 2005. A tax deduction of up to $100,000 can be claimed for clean fuel refueling sites. The deduction is available on property placed into service after June 30, 1993 and prior to January 1, 2003.

(viii) The Carl Moyer Program

The California Environmental Protection Agency's Air Resources Board (ARB) administers the Carl Moyer Clean Engine Incentive Program. Funds are distributed through local air districts. The incentive program is named for the late Dr. Carl Moyer, in recognition of his work in air quality. Incentives, in the form of grants for private companies or public agencies operating heavy-duty engines in California, cover an incremental portion of the cost of cleaner on-road, off-road, marine and locomotive engines.

The Governor of California's Budget allocated a one-time appropriation of $16 million dollars to fund the Carl Moyer program through the 2001/2002 fiscal year. Previously, $25 million in CARB's 1998-99 fiscal year budget, $19 million in CARB's 1999-2000 fiscal year budget, and $50 million in CARB's 2000/2001 were allotted for Carl Moyer Program incentive grants, as a means to reduce emissions from heavy-duty diesel engines that emit high levels of nitrogen oxide (NOx) with new clean-technology engines.

In the first year of the program, ARB distributed $24.5 million in project funds among sixteen local air districts, yet the demand for project funds was more than three times the available amount. Forty percent of those funds were used towards alternative fuel on-road projects, 25 percent towards marine vessel projects, 20 percent towards agricultural

irrigation pumps, 10 percent towards forklifts, and the remaining five percent towards other diesel re-powers (mostly off-road equipment). Staff estimated that projects funded in the first year of the program would reduce NOx emissions by about 4 tons per day, and PM emissions by about 100 lbs/day.

In 1999 the Legislature approved a one-time budget appropriation of $23 million to fund the Carl Moyer Program for fiscal year 1999/2000, the second year of the program. Of these funds, $19 million went to ARB to fund engine projects, and $4 million went to the CEC to fund infrastructure and advanced technology development. ARB has distributed over $18 million of these second year funds to 20 local air districts.

In October 1999, the Governor also signed AB 1571 formally establishing the framework for the Carl Moyer Program into the Health and Safety Code, Chapter 9. In accordance with that Health and Safety Code, section 44275, et. seq., ARB developed and presented a report to the Governor, Legislature, and the Advisory Board on the progress of program implementation. The Advisory Board, with the assistance of ARB, CEC, and the local air districts, also developed its own report (The Carl Moyer Program Advisory Board Report, March 31, 2000) with recommendations to the Governor and Legislature. The main recommendation of the Advisory Board was to continue the Carl Moyer Program through 2010 at a funding level of $100 million per year. Based on the Advisory Board Report and other considerations, the Governor and Legislature approved a one-time appropriation of $50 million ($45 million to ARB for engine projects and $5 million to CEC for infrastructure and advanced technology projects) to fund the Carl Moyer Program through a third year (fiscal year 2000/2001).

At an increased funding level, the Advisory Board and ARB recognized it would be a challenge for local districts to meet the matching fund requirement. The Advisory Board recommended to the Governor and the Legislature in its March 2000 report, that for third year funds and beyond the districts' matching fund requirement be capped at a level equivalent to the first year funding level ($25 million). The Governor and the Legislature

responded by modifying the Health and Safety Code to allow ARB to modify districts' matching fund requirement, if necessary to benefit the program. The new district matching fund requirement reflects the Advisory Board's recommendations in The Carl Moyer Program Advisory Board Report dated March 31, 2000.

Moyer Program grants offset the incremental cost of purchasing cleaner engines. For example, a company may be able to buy a new truck for $100,000, which meets the state's minimum emission standards, or buy a lower-emission truck for $125,000. The offsetting cost ($25,000) is available through the Moyer Program in order to buy the lower-emission truck. This framework is used to determine grants for off-road and other equipment; and for retrofitting or re-powering existing engines.

(ix) Greening UF

"Greening UF is a grassroots movement of students, faculty, and staff from a variety of administrative and academic units that was initiated in October 1997 at the University of Florida. The purpose of the movement is to increase environmental literacy on campus, examine current practices to reduce environmental impact and to create a culture of environmental stewardship." [57]

The program's vision centers around five points:

- A university culture with a core philosophy of environmental stewardship, sustainable development, and critical examination of all activities in light of their environmental impact.
- Environmentally knowledgeable faculty and staff
- Graduates with highly developed knowledge of the environment and natural systems and their contributions to human well-being
- Research that develops clean, resource efficient technologies with low environmental impacts
- A university with a small ecological footprint

[57] Greening UF http://www.sustainable.ufl.edu/GreenUF1/index.html

There are three distinct phases in the Greening program

a. **Greening the University Curriculum** – include "environmental literacy and the principles of sustainable development into most courses of study.
b. **Greening the University Operations** – incorporation of sustainability into its culture and operations
c. **Involve students and student organizations** – Key participants are Students for Environmental Action and Students for Sustainable Development. Others also involved.

Bio-fuels programs

Florida is a producer of two alternative bio-fuels in common use today; ethanol and bio-diesel. Significantly, much of the production of these fuels is exported to either other states with significant AFV activity or to markets overseas.

Bio-diesel production in Florida

The bio-diesel production facility in Lakeland, Florida has a capacity of 850,000 – 1 million gallons per month, and an annual capacity expandable to almost 20 million gallons. At this rate of production, and given current input costs (November 2002), the firm is able to retail the fuel between $1.40 to$1,80 per gallon. Overall, the most significant costs associated with bio-diesel are associated with raw materials, not the production process. Virgin oils tend to be more expensive than yellow grease, and accordingly the latter is the preferred raw input. Obtaining yellow grease at a cost of between $0.45 and $0.60 per gallon would achieve price parity with petro-diesel.[58]

[58] OceanAir Environmental, August 2002

The Lakeland producer is targeting school buses as a key market for bio-diesel. Because school districts are financially constrained (and obliged to select the lowest-cost suppliers), using bio-diesel for its benefits to air quality and performance is not enough. As an alternative approach, the producer is seeking to demonstrate that in the long run, a change to bio-diesel would cost less because of the high cost to replace onsite underground storage tanks (UST) and clean up spills. In addition, the question was raised about abandoning the UST in favor of an above ground storage tank (AST).

Bio-diesel use in Europe

Bio-diesel use is commonplace and accepted in many European countries. Demand for diesel in passenger cars is much greater than in the US, where diesel fuels are typically the domain of heavy-duty vehicles and some larger pick-ups. Some 35-40% of Europeans drive diesel passenger cars. In 1991, Germany, by far the largest user, consumed 200 million gallons of bio-diesel; ten times the maximum production capacity of the Lakeland, Florida facility. In 2001, Germany pumped 500 million gallons, and estimates for 2002 are in excess of 750 million gallons.

Most of the EU's oil used in producing bio-diesel is processed from rapeseed, produced on about 1.5 million hectares (3.7 million acres), although some soybean oil is blended in as well. In a smaller way, Malaysia and Indonesia are also players in the bio-diesel market by using palm oil in their production (Appendix 8). Under appropriate economic conditions, bio-diesel production could represent a significant absorbing potential for additional acreage resulting from accession of Central and Eastern European Countries to the EU. Bio-diesel has been produced on an industrial scale in EU since 1992, largely in response to positive signals from the EU institutions calling for reduction in fossil fuel use.

In 2001, some twenty plants produced around 1 million tons of bio-diesel across Austria, Belgium, France, Germany, Italy and Sweden. More than 500 million kilometers are driven annually using bio-diesel in the EU. Most of fossil diesel fuel in France is mixed with bio-diesel today. No other bio-fuel has been used to such an extent. Specific

legislation to promote and regulate the use of bio-diesel is in force in various countries (including Austria, France, Germany, Italy and Sweden).

European countries impose relatively high (compared to the US) excise duties for fuels for transportation. For bio-diesel there are exemptions in some countries such as in Germany, France, Italy, Sweden, Austria and the Czech Republic. The EU commission intends to develop a 5% market share for bio-fuels up to the year 2005 and recommends time-limited exemptions or reductions of taxes on bio-fuels to 0-10% of normal amounts for the first 10 years, then to increase stepwise.

The European Commission (EC) published an action plan and two directive proposals in November 2001 to encourage increased use of bio-fuels in the transport sector. The objectives of the action plan and the directives are to:

- Help reduce the European Union's dependence on external oil supply.
- Meet the objective of substituting 20% of diesel and gasoline fuels by alternative fuels in the road transport sector by 2020
- Establish a minimum level of bio-fuels as a proportion of fuels sold from 2005, starting at 2% and reaching 5.75% of fuels sold in 2010.

EU estimates released in November 2001 showed production of bio-diesel is more expensive than petroleum-based diesel. Bio-diesel has a production cost of approximately Euro500 per 1,000 liters, compared with Euro200-250 per 1,000 liters for traditional petroleum-based diesel, inclusive of refinery costs.

Ethanol use in Europe

In Europe more than 2 billion liters of alcohol is produced annually, however, less than 55 million liters is used as fuel. European ethanol production is still much smaller than bio-diesel production, and in 2000, France, Spain and Sweden together produced a total

of 191,000 tonnes.[59] France is the biggest European ethanol producer but does not use ethanol in its pure form, transforming the alcohol into fuel oxygenate ETBE (ethyl-tertiary-butyl-ether) for blended use with regular gasoline. In spite of much discussion in the European Union (EU) about fuel ethanol, the market for fuel ethanol in Europe is still comparatively small, with France being a possible exception. France is the largest ethanol producer within EU and 3-15 percent of organic oxygenated compounds with gasoline is allowed. Although major improvements in technology over the past decade have helped ethanol to narrow the gap in price with fossil fuels, legislative and or financial support such as tax concessions are still required to achieve price parity. The EU is planning to mandate the use of ethanol in diesel by 2005.

The oil-price shock of the 1970's sparked interest in ethanol, which can be made from any agricultural crop containing sugar, starch or even cellulose. In Europe, ethanol is commonly produced from wheat and sugar beets. In France, a major producer of ethanol, there are seven beet-ethanol distilleries, 16 integrated sugar and alcohol complexes as well as a large synthetic ethanol production factory.

The primary driving forces causing the differences in bio-fuels usage between countries appear to be the national policies of those countries. Over the past few decades, market prices of bio-fuels, either ethanol or bio-diesel, have been higher than the market price of petroleum-derived equivalents. It is therefore not surprising that bio-fuels have had significant impact only in those countries where policies or incentives have provided a means for bio-fuels to compete economically. The EU directive discussed previously with reference to bio-diesel use in Europe will be a catalyst for greater ethanol demand.

Conclusions

This review of federal and state programs in the US, local fuel producers and international programs provides much of the direction for the CFFAB recommendations at the close of this report. Furthermore, the recommendations provided by the CFFAB

[59] Platts Energy Information Provider, http://www.platts.com/features/biofuels/europe.shtml

are but a few of the many ideas, concepts and practices that could be effectively adopted by Florida to reduce foreign oil dependence, improve air quality, and promote economic development. As such, continued monitoring of these and other programs is worthwhile as a catalyst in expanding alternative fuel use in Florida.

Chapter 4

Economic Issues and Opportunities

An efficient, dependable and sustainable transportation system facilitating personal mobility and efficient movement of goods is an essential element of a strong, vibrant economy. The dependence of the transportation system in Florida, and the US, on primarily petroleum-based fuels should be a concern to policymakers and planners. Diversifying the fuel supply through increased use of alternative fuels and the expanded deployment of alternative fuel vehicles makes good business sense and will further benefit the state through preserving environmental health and providing economic development opportunities.

While there are several factors that drive the importance of AFVs, two are particularly significant– the economy and the environment. Economic factors revolve around energy security (the need for an uninterrupted, plentiful and affordable energy source necessary to fuel a robust economy), the need to position the state to take advantage of emerging technologies, and the need to ensure continued growth in the living standards. Environmental factors include the numerous health and environmental effects of petroleum consumption such as urban smog and greenhouse gases. This section will present detail on the potential benefits of expanded AFV use with regards to environmental benefits, oil displacement and local production of fuels. The relevance of these issues to the mission of the Florida Energy Office and the Florida Department of Community Affairs, as well as other state departments such as The Florida Department of Environmental Protection, The Department of Management Services and the Florida Department of Transportation will be discussed.

1. Economic Issues

Florida's and the United States' dependence on gasoline as a transportation fuel source continues to grow while more and more of the oil used for transportation comes from foreign sources. Significantly, petroleum imports make up almost half of the US trade

deficit and are estimated to account for up to 70 percent within the next 20 years.[60] According to the US Energy Information Administration, imports exceeded domestic supplies of petroleum in 1993 and have been growing as a percentage of our supply ever since.[61] Of additional concern is the significant military spending to protect US interests in the Gulf region, where near term political stability is not assured.

Diversifying the supply of fuels used for transportation and identifying AFV receptive niche markets makes good business sense and has the potential to position Florida as a national leader in new technologies and transportation alternatives. Currently, almost half of the cost per gallon of fuel purchased by Florida consumers goes to crude oil producers[62] (Figure 12). At the least these revenues leave the State, and on the whole they leave the country. Developing a viable market for alternative fuels will not affect the economic viability of refiners, marketers or distributors, and can provide investment opportunities for in-state production of transportation fuels.

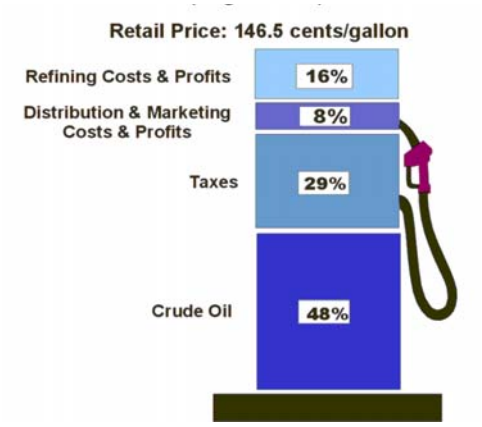

Figure 12: What We Pay For in a Gallon of Regular Gasoline

[60] Imports as share of petroleum consumption, EIA Annual Energy Outlook.
http://www.eia.doe.gov/oiaf/aeo/results.html#tables
For major assumptions for the forecasts refer: http://www.eia.doe.gov/oiaf/aeo/pdf/appg.pdf
[61] Energy Information Administration. Annual Report 1999
[62] EIA, August 2000

2. Economic Opportunities

Fuel Production

Three alternative fuel types, albeit in low quantities, are already produced in Florida[63]. Ethanol is produced in Bartow[64], bio-diesel is produced in Lakeland[65], and hydrogen in Pace.[66] E-85 and Bio-diesel can be used in certain vehicles without the need for either engine modification or extensive infrastructure investment. In the quest for increased fuel efficiencies and lower emission, many auto manufacturers are now developing hydrogen-fueled cars, either as direct hydrogen combustion engines, or for use in fuel cells for electric power generation.[67] Each of these fuels, plus existing LPG and CNG suppliers and electric energy providers, have a substantial market potential for their product in Florida.

An example of this is the bio-diesel facility in Lakeland, which has a production capacity expandable from 10 to 20 million gallons annually. All diesel vehicles can run on bio-diesel, with little if any modification[68]. For significant reductions of criteria pollutants, a B-20 blend (20% bio-diesel, 80% petro-diesel) is commonly used. A potential market for bio-diesel may be the Florida school system. Florida has the fifth largest school bus fleet in the nation[69], carrying over one million school children daily.[70] Operating this fleet on B-20 bio-diesel would displace 240,000 gallons of petro-diesel annually, achieve an estimated 10-ton reduction in hydrocarbon emissions and provide a $1.5 million market for bio-diesel producers in the state.

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[63] Renewable Fuels Association, 2002
[64] Parallel Products http://www.parallelproducts.com
3500 Highway 555, Bartow FL 33830, John Roth, Operations Manager (941) 533-9388 Planned production 2002 and thereafter 6m gallons
[65] OceanAir Environmental P.O. Box 2862 Lakeland, FL 33806. Jim Davis, (941) 683-7199 Florida production capacity 15m gallons/yr
[66] Air Products and Chemicals Inc, Pace FL. Venki Raman, Production Manager Production capacity of 32 tons /day of liquid hydrogen
[67] BMW, Daimler-Chrysler, Ford, General Motors, Honda and Toyota are each developing either Hydrogen fuel cell vehicles or Hydrogen combustion vehicles.
[68] National Biodiesel Board http://www.biodiesel.org
[69] Based on 1999-2000 school year
[70] School Bus Fleet Magazine, Internet edition: http://www.schoolbusfleet.com

Transit fleets in general are particularly well suited to the use of alternative fuels and the application of advanced technology drivetrains. Apart from mitigating congestion, pollution and fuel use through reducing personal vehicle use, proven and widely available drivetrains are available for transit fleets that can achieve even greater reductions in petroleum use. Diesel engined vehicles can be operated on blends of bio-diesel with little if any modification. Battery Electric transit vehicles are in regular use in a number of south Florida communities such as Miami and Fort Lauderdale and hybrid electric vehicles are being introduced in a number of transit and airport shuttle fleets (Appendix 9) across the State. Investments in the development of hybrid electric drivetrains for water taxi services has resulted in the deployment of a "clean transit" network of transit buses and water taxis in south Florida, with potential for national and overseas sale of vehicles.

A possible approach to demonstrate potential market size for fuel providers is to consider as a target replacing a proportion of total fuel consumption with that of an alternative fuel. Florida's annual consumption of (motor) gasoline alone exceeded 7.5 billion gallons in 2000[71], and is projected to grow at an annual average rate of 1.8 percent between 2000 and 2020,[72] an increase of approximately 156 million gallons per year.[73] Setting as a goal just 15 percent of the *incremental* growth in fuel consumed, alternative fuel providers could consider an annual market for over 500 million gallons of fuel annually by 2020[74] (Figure 2). At the projected fuel economies of new vehicles over the same period, this would equate to over 12 billion miles annually for which vehicles would be operated on an alternative fuel. Using a petroleum per gallon cost of $1.50,

[71] Florida Motor Gasoline and Diesel Fuel Report, May 2001
[72] EIA Prediction, 2000, based on the historic growth in the last 40 years
[73] Energy Information Administration, DOE 2002
[74] CUTR Prediction 2000, based on the historic data obtained from US DOE

these 500 million gallons and 12 billion miles are valued in excess of $750 million in revenues.[75]

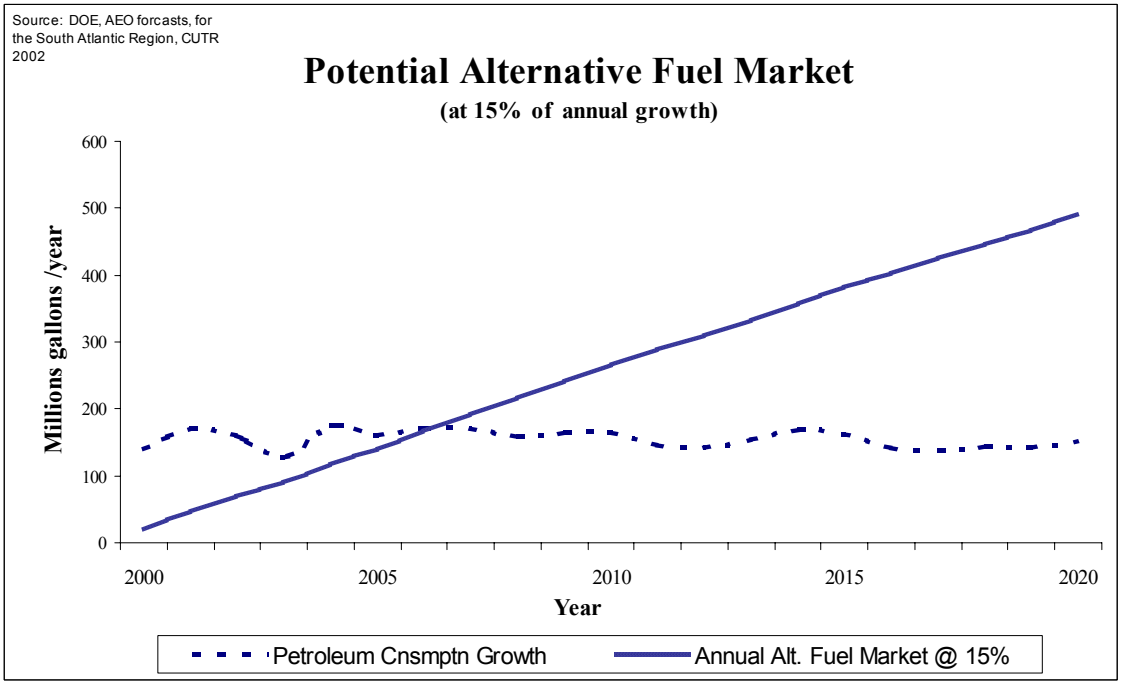

Figure 13: Potential Alternative Fuel Market

Presenting such scenarios as goals, targets or potential markets to fuel providers would assist in the identification and development of sustainable alternative fuel markets for Florida businesses, and the development of new industry for the state. E-85 and bio-diesel producers in Florida currently have a combined annual production capacity of approximately 30 million gallons. Companies within Florida have the knowledge and proven expertise to produce hydrogen on a commercial basis. The recent federal focus on hydrogen as a transportation fuel of the future presents significant opportunity for Florida to be an energy producer. In addressing the business potential of a 15 percent displacement of incremental petroleum use, each business would have a different focus. Electric vehicle manufacturers and hydrogen producers could target vehicle miles

[75] CUTR 2002 500 gallons @ $1.50/gallon gasoline equivalent = $750m At average consumption rates of US Fleet (23.4mpg) in 1999, this would equate to over 12bn miles for which vehicles would be operated using an alternative fuel.

traveled; other fuel producers could target annual fuel production. In either scenario, neither firm is looking to displace existing traditional fuel use in the early phases of market development, only the displacement of a small percentage of the incremental growth in petroleum use.

As a state with little heavy industry and yet considerable agricultural activity, expanded alternative fuel use and production in the state can provide other business opportunities. With over 10 million acres of farm acreage[76], the state has the potential to diversify farming activities and become a major producer of alternative fuel feedstock. Energy experts see the use of bio-engineered crops for fuels as one of the major economic innovations occurring in the next ten years. New genetic technologies that permit the cultivation of crops to produce fuels such as ethanol will allow regions to essentially grow fuel and reduce dependence on imported oil.

Vehicle Markets

Florida is the fourth most populous state in the US[77]. With a population over 16 million, 11.8 million licensed drivers, and 10.8 million licensed motor vehicles and light trucks[78], Florida's demand for motor vehicles and fuels is enormous. At current population growth rates, Florida adds an average of 100,000 households per year, creating an additional demand for new motor vehicles of almost 200,000 vehicles per year.

Growth in the Florida AFV market initially revolved around fleet use, and EPACT mandated government and energy provider operators. Under EPACT, Federal, state, municipal, fuel provider and private fleets are currently mandated by EPA's Clean Fuel Fleet Program (CFFP) as part of the Clean Air Act Amendments (CAAA) to ensure a certain percentage of new vehicle acquisitions be Clean Fuel Vehicles (CFV). However, EPACT mandates only address new vehicle acquisitions, not conversion of older

[76] Florida Agricultural Statistics Service, 2000
[77] US Census Bureau, 2000
[78] BEBR 2002

vehicles. Additionally, given the exemptions provided by EPACT, past experience has shown the impetus or critical mass for a sustainable alternative fuel market will not be achieved through only public sector vehicle acquisitions. Accordingly, future growth in the alternative fuel market must be derived concurrently from the expanded deployment of AFVs in public sector fleets as well as increased use in the private sector.

Opportunities for electric vehicles, with zero tailpipe emissions, abound in Florida. Commercially available low speed electric vehicles have numerous applications for landscape/nursery uses, ground support equipment, law enforcement, code enforcement, and security applications. Advanced, proven technologies are now available for marine applications such as Water Taxis, pleasure boating and other intercoastal marine applications. Appendix nine details the successful development of electric and hybrid electric marine vessels for commercial transit use in Florida.

Numerous communities exist throughout Florida, serving both senior citizens and tourists, which lend them perfectly to electric or neighborhood vehicles. The travel patterns of senior adult community residents and visitors to tourist resorts match well with the short-range characteristics of electric vehicle technology. Many retirement communities feature convenient shopping, banking and recreational facilities, making it less necessary for residents to leave their neighborhoods. According to the Commission for the Transportation Disadvantaged, home based community services have become the choice of senior and disabled consumers[79], driving demand for short-range low cost mobility options.

Additionally, many family neighborhoods today are master-planned communities where a homebuilder designs and builds the neighborhood. Most of these neighborhoods encompass schools, shopping centers, parks and playgrounds, and other conveniences that allow families to reduce their travel time outside the area. The potential market for Battery-electric vehicles is significant. Florida possesses a number of qualities essential

[79] Commission for the Transportation Disadvantaged, October 2002

particularly suitable to low-speed, short-range vehicles such as a typically flat topography, a relatively warm climate and the prevalence of two-car households with one of the vehicles being for short distance use. Shorter trip lengths associated with an aging population are all elements that point to a strong market for these vehicles in the state.

The potential for low speed, a short-range electric vehicle to become a key element of these communities is substantial. The emission benefits of EVs are considerable for short, low-speed trips. EPA emissions standards for gasoline-fueled vehicles primarily address pollutants that are emitted while a car is warmed up and running. They do not address the warm-up, or "cold-start," period, during which time today's cars and small trucks produce significantly high levels of emissions for a given driving cycle. The reason for such relatively high emissions during the cold-start period is due to current-technology catalytic converters that don't start to function at full efficiency until they reach a temperature of about 300^{o}C (572^{o}F). To attain this temperature typically takes about two minutes of operation running at constant speed. During those two minutes, the vehicle produces 60 to 80 percent higher levels of pollutants than when warm.

Continued efforts to encourage “neo-classical” development and shortening many trip lengths, are one of the most beneficial actions that can be taken towards encouraging AFV use. Furthermore, the ability to recharge electric vehicles in off-peak periods provides better utilization of generating capacity, a benefit for the states’ energy providers and electric ratepayers.

A market sector already exists for E-85 (ethanol/gasoline blend) in Florida. New flex-fuel E-85 vehicles are manufactured and sold by the major automakers such as Ford, GM, and DaimlerChrysler. The Florida Department of Transportation has taken the lead in procuring and using E-85 in their pool vehicles, with at least one District Office in the State both acquiring exclusively E-85 vehicles for all fleet needs for the next 24 months,

and committing to establishing E-85 refueling facilities to meet the needs of the fleet[80]. The extent of private ownership of E-85 vehicles in the state without access to refueling infrastructure for ethanol is significant. It is estimated that over 200,000 privately owned E85-capable vehicles are currently on the roads in Florida[81], all of them currently operating on regular gasoline. DaimlerChrysler alone will ship in excess of 30,000 E-85 minivans to Florida for sale during each of the model years 2002 and 2003, and estimates indicate that DaimlerChrysler, Ford and General Motors together will add another 50,000 E-85 vehicles to this count each year at least through 2006. Most consumers, and many vehicle retailers, are not aware of the flex-fuel E-85 capability of these vehicles. Although the awareness of flex-fuel E-85 capability is primarily a marketing problem, without infrastructure, any promotion will not be very effective. If E-85 refueling sites were more readily available, these consumers could be informed and provided with the option of refueling their cars with an alternative fuel.

3. Relevance to Florida State Agency Missions

Although the CFFAB's focus is on the transportation aspects of energy policy formulation for the Florida Energy Office (FEO) and the Department of Community Affairs (DCA), the issues of energy dependence, environmental quality and economic development are far reaching and of vital significance to the Florida as a whole, crossing departmental agendas. Accordingly, the CFFAB has been cognizant to consider the missions and goals of a number of State departments in formulating policy recommendations for Florida. Subsequently, the CFFAB recognizes that many of the recommendations provided in this report will not be the domain of just the FEO and DCA, but will be particularly pertinent to various departments acting in either a singular or collaborative manner. The findings of this report and the subsequent recommendations fit particularly well with the goals and mission of Community Affairs, Environmental Protection, Management Services and Transportation.

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[80] FDOT District Seven. Installation of four 1,000-gallon E-85 tanks completed November 2002. All programmed vehicle acquisitions 2002 – 2003 to be E-85 flex fuel capable.
[81] CUTR, 2002

Department of Community Affairs (DCA)[82]

The Department of Community Affairs mission to assist communities in the State meet the challenges of growth points to a strong and logical connection to the agency taking a lead role in promoting the use of alternative fuels and advanced transportation technologies throughout the State.

Examining the agency's core values reveals an even greater understanding for its role in this field. DCA is committed to freely sharing its ideas, resources, and talents throughout the State. The Agency also values continual learning, bold thinking, constant reevaluation, and creative problem solving; all of which are characteristics vital in the effort to reduce Florida's dependence on petroleum.

Department of Environmental Protection[83]

The Florida Department of Environmental Protection (FDEP), the lead agency in Florida government for environmental management and stewardship, administers regulatory programs and issues permits for air, water and waste management. According to Secretary David B. Struhs, "Our approach recognizes …by working together with Florida's citizens, businesses, environmental organizations and federal and local governments, we can achieve a cleaner environment, a higher quality of life and a stronger, more vibrant economy."[84]

Florida stands to gain environmentally in both the near and long term through the expanded use of alternative fuels in Florida by reducing mobile source emissions and the risk of groundwater contamination[85], and maintain the quality of life the State is renowned for while providing continued economic development opportunities.

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[82] Department Website: http://www.dca.state.fl.us/dcamisson.htm
[83] Department Website: http://www8.myflorida.com/air/
[84] http://www8.myflorida.com/secretary/org/eaffairs.htm
[85] Groundwater contamination can occur through leaking underground storage tanks, fuel dispensing spills and runoff. Many alternative fuels provide for lesser risk of toxic spills and storage leakages.

Department of Management Services (DMS)[86]

One of DMS's missions, is to "obtain the most effective and efficient use of motor vehicles…" (Chapter 287, F.S.) for purchase and use by state agencies and local governments. As such, DMS has the potential to play a key role in the promotion of alternative fuel use and alternative fuel vehicle implementation in Florida.

One pertinent function of the DMS is to develop technical specifications and guidelines for acquisition of alternative fueled vehicles to ensure state compliance with the federally mandated Energy Policy Act of 1992. DMS has additional responsibilities that have the potential to increase AFV use in Florida including administering rental vehicle contracts; evaluating vehicle contract bids; and monitoring vehicle and equipment approvals for purchase by state agencies. The CFFAB considers the issues addressed in this report as being particularly relevant to the mission that DMS is charged to fulfill.

Florida Department of Transportation (FDOT)

The stated mission of the FDOT is "to provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity and preserves the quality of our environment and communities."[87] The FDOT work program also governs distribution of Congestion Mitigation and Air Quality (CMAQ) funds that include provisions for AFV programs and AFV infrastructure projects. Effectively utilizing the States investment in infrastructure depends greatly on a reliable, available source of fuels. Diversifying the source of fuels for transportation through expanded use of alternative fuels will protect this investment and assist the FDOT in fulfilling its mission.

[86] Department Website: http://www.state.fl.us/dms/sec/dmsoverview.html
[87] Department Website: http://www11.myflorida.com/publicinformationoffice/moreDOT/mission.htm

Chapter 5

Transportation Energy Plan Recommendations

The following CFFAB policy themes and recommendations have been developed through a consensus process to highlight the contributions that the expanded use of alternative fuels and alternative fuel vehicles can make to Florida's Economic Prosperity, Environment and Community Quality. Implementation of these recommendations will

- Support and enhance Florida's AFV Infrastructure,
- Create an organizational structure to support expanded AFV use,
- Expand levels of public awareness and general understanding of transportation issues, and
- Garner the support for research into the best application of emerging technologies such as hydrogen and fuel cells.

Recommendation 1.

Emerging Transportation Technology Business Development:

Host Alternative Fuels and Advanced Transportation Technologies summit.

In evaluating the first steps to establish the sustainable development of an alternative fuels and advanced transportation technologies market in Florida, the CFFAB has determined that the State must create heightened awareness and incentives for private sector involvement. This is essential to communicating clearly the highly desirable market opportunities that Florida possesses and to creating leveraged funding opportunities with non-government organizations and the private sector.

Utilizing the material presented in this report, the CFFAB recommends that the Department of Community Affairs and the Florida Energy Office, Enterprise Florida and the Florida Chamber of Commerce host an "Alternative Fuels and Advanced Transportation Technologies" summit, at which the Governor and departmental heads can provide a forum for discussion among private and public interests of this report. A

key function of this forum is to highlight the economic development and business opportunities Florida can provide to alternative fuel vehicle manufacturers and alternative fuel providers. Co-hosts and participants should include:

- Enterprise Florida
- Clean Cities Coalitions
- Metropolitan Planning Organization Advisory Council
- Florida League of Cities
- Regional Planning Councils
- American Public Transit Agency (APTA)
- Community Transportation Association of America[88]
- Florida Public Transit Agency (FPTA)

Both government and industry representatives must understand the importance of private sector involvement and recognize that government investment can complement existing private sector plans to bring product to market at an earlier stage. Florida possesses a number of unique qualities that make it ideal for expanded alternative fuel use as highlighted by CFFAB. In addition, Florida presents a market of significant size and rapid growth that make it attractive for investment, product development and economic development opportunities.

Recommendation 2.

Government Agency Leadership:

Adopt rules for State fleets to achieve original EPACT intent of greater alternative fuel use.

The Energy Policy Act (EPACT) of 1992 mandated that a certain percentage of vehicle acquisitions in Federal, State and energy provider fleets be alternatively fueled, with the goal of diversifying fuel use and reducing the nation's dependence on foreign oil. The premise was that the demand for these vehicles and associated infrastructure by

[88] Community Transportation Association of America is the sister agency to APTA, and an advocate for rural and community transportation

government fleets would spur development of AFVs and assist manufacturers in lowering product costs and broadening model lines.

Research undertaken by the Center for Urban Transportation Research (CUTR) at the University of South Florida, at the direction of the CFFAB and the Department of Community Affairs and the Florida Energy Office, found that this critical mass of AFV activity and demand had not and would not be achieved through EPACT**.** Despite Florida's compliance with EPACT mandates, a sustainable and viable AFV market will not be created through current program requirements, as EPACT relies on vehicle procurement ratios that will neither achieve a critical mass of vehicles for a sustainable AFV market, nor significantly reduce the use of petroleum-based fuels. In addition to addressing the critical national security issue of the nations dependency on foreign oil, reductions in petroleum use can produce environmental and health gains and can improve the State's balance of payments.

Accordingly, the CFFAB recommends that The Florida Legislature direct the Department of Community Affairs, the Department of Transportation, the Department of Environmental Protection and the Department of Management Services to cooperatively adopt a set of rules for State fleets that complement EPACT requirements and achieve the original intent of greater alternative fuel use. These rules would shift focus to fuel use and gasoline/diesel displacement rather than vehicle acquisition, and should:

1. Encourage the use of alternative fuels in existing AFVs operated by fleets (such as with LPG and CNG bi-fuel vehicles).
2. Encourage the use of transitional fuels (such as Ethanol, and Bio-diesel) in existing fleet vehicles where appropriate.
3. Encourage the acquisition of emerging technology vehicles (such as Hybrid-Electric Vehicles with high fuel efficiencies).
4. Incorporate niche-market vehicles (such as Battery Electric Vehicles), that are matched to specific fleet applications where appropriate, in place of traditional gasoline powered vehicles.

Consideration should also be given to assisting local and municipal fleets to adopt the rules as goals. As such, the rules should be developed under the joint direction of the Department of Community Affairs (DCA) and the Florida Energy Office (FEO), the Department of Management Services (DMS), the Florida Department of Environmental Protection (FDEP) and the Florida Department of Transportation (FDOT). Consultation should be sought from the Metropolitan Planning Organization Advisory Council, Regional Planning Councils, the Clean Cities Coalitions, and other local regulatory and rule making entities.

The legislation and rules should be designed to achieve the level of fuel use and gasoline/diesel displacement intended by the original EPACT mandate (Table 7), which required a certain percentage of vehicle acquisitions annually (and therefore fuel use) be AFVs. The CFFAB recommends that each State fleet adopt the most suitable technology (bio-fuels, emerging technologies, etc) for their specific application to achieve these goals.

EPACT Requirements				
Year	Federal	State	AFP	Local / Municipal
1997	25%	10%		
1998	50%	15%	30%	
1999	75%	25%	50%	
2000	75%	50%	70%	
2001	75%	75%	90%	
2002	75%	75%	90%	20%*
2003	75%	75%	90%	40%*
2004	75%	75%	90%	60%*
2005	75%	75%	90%	70%*
2006	75%	75%	90%	70%*

* Ruling yet to be ratified

Table 7 – EPACT Mandates

Recommendation 3.

AFV Infrastructure and Vehicle Program Development:

Dedicated source(s) of funds for AFV infrastructure research, development and implementation.

Concurrent with creating a marketplace for increased AFV use, the CFFAB recognizes the importance of an effective, efficient and convenient refueling infrastructure. A determination of what level of funding is necessary, and a suitable funding source should be established. Private sector entities also provide opportunities for infrastructure investment cost sharing. A recurring source of funds to match these opportunities and encourage public/private partnerships is an essential step in developing a broad infrastructure base to support AFV deployment.

Therefore, the CFFAB recommends that the State identify a dedicated source(s) of funds for AFV infrastructure research, development and implementation. As one example of a dedicated source of funding, a $1 tag fee would generate in excess of $12.5 million based on year 2001 vehicle registrations.

Federal funding for almost 60 transportation related State Energy Program (SEP) projects in 2000 was in excess of $7.2 million. SEP awards require matching funds or cost sharing in a range of 20 percent to 50 percent of the award amount from the respective state energy offices. Awards in seven categories ranged from $25,000 to $250,000 and are awarded on a competitive basis. The CFFAB recommends the appropriation of funding dedicated to AFV transportation to effectively compete for federal matching funds and attract private sector investment. In 2000, matching funds of $355,000 would have been required to be successful in winning just one award from each category. The CFFAB recommends this level of funding be appropriated annually for SEP award matches, and for leverage with private sector projects on a minimum 50 percent cost share basis.

Recommendation 4.

Planning Code and Regulations:

Workshops to assist in developing alternative fuel vehicle regulations and infrastructure needs.

The CFFAB recognizes that implementation of AFV programs requires a collaborative effort between regulators and end users. Accordingly, the CFFAB recommends that the State, through the Department of Community Affairs provide assistance to local government and building officials to address in both comprehensive plans and building codes any needed provisions for alternative fuel vehicle refueling infrastructure in commercial and residential settings. This should also include better integration of plans, zoning and code provisions, and should draw upon successful experiences in Florida such as the South Florida Regional Planning Council (SFRPC) Strategic Regional Policy Plan. Additionally, the CFFAB recommends that DCA and the FEO host workshops for planners and regulators from Regional Planning Councils (RPCs), and other local regulatory and policy-making entities to assist them in developing regulations that address these needs. These workshops should be conducted as needed to help ensure that the aforementioned objectives are achieved.

The opportunities that advanced transportation technologies such as Neighborhood Electric Vehicles (NEVs), City cars and Fuel Cell Vehicles (FCVs) provide for more effectively meeting individual transportation needs, present challenges for planners and regulatory agencies. Understanding that these vehicle types are not dependent upon traditional refueling infrastructure, and that they can assist in more efficient community planning is essential to facilitating widespread adoption of these new technologies. In many instances, code for electric vehicle recharging already exists. These regulations should not conflict with any existing code or requirement. Recharging and refueling infrastructure must be provided for in comprehensive plans, building codes and local regulations to ensure safety and uniformity and to facilitate growth of an alternative fuel vehicle market.

Recommendation 5.

Transportation System Funding:

Study to develop a methodology to provide a revenue stream for transportation infrastructure.

Successful implementation of AFV programs could have an impact on State fuel tax revenues, which help fund its roadway system. An efficient transportation network is vital to the sustained economic prosperity of the State. Traditional means of funding roadways through gasoline taxes are already strained, and considerable efforts are underway by the Florida Department of Transportation to address projected funding shortfalls to maintain and expand the roadway system. Additionally, the fuels tax is a per-unit tax, and (in Florida) is not indexed to inflation. Therefore, in real terms, gas tax revenues are falling. The CFFAB recognizes the critical nature of this funding issue.

The push for more fuel-efficient vehicles, regardless of fuel type, has the added potential for significant impact on fuel tax revenues. Moreover, many of the emerging technologies do not use standard units of gasoline or diesel, and so would not create fuel tax revenues in the traditional manner, or at a similar rate. These new technologies utilize fuels and energy sources that are difficult to apply traditional fuel taxes.

Therefore**,** the CFFAB recommends a study be conducted in conjunction with the Florida Department of Transportation to develop a methodology to fairly and equitably provide a revenue stream that will protect and enhance the State's investment in transportation infrastructure. Concurrently, the need to provide an incentive for the early and widespread adoption of alternative energy sources for an increasing proportion of transportation energy use must also be addressed.

In the 2002 Legislative session, the CFFAB sought the introduction of language (Appendix 2) to fund a study identifying the impact of expanded use of non-petroleum fuel and the improved efficiencies of emerging technology vehicles. The study is yet to be approved for funding. In conducting the recommended study, the CFFAB considers

that the perspectives of alternative fuel providers and emerging technology vehicle manufacturers be an integral element in determining the projected levels of market penetration, and the resulting fiscal impact that improved fuel economies and expanded use of non-petroleum based fuels may have on state revenues. Such a study should incorporate not only the funding needs of the Florida Department of Transportation (FDOT), but also those of the Department of Community Affairs, the FEO, the FDEP, Enterprise Florida and other State agencies that may be involved in fostering an expanded alternative fuels market in the State. At the time of writing (December 2002), the FDOT is engaged at the national level in considering this issue. It is recommended that the study be completed within 12 months with summaries of completed work issued every 2 months. It is also recommended that the study include but not be limited to:

- Necessary partners for developing road funding policy
- AFV and alternative fuel use market projections 5, 15, 25 years
- Fuel price projections (traditional and alternative fuels)
- Fuel tax revenue projections 5, 15, 25 years
- Funding needs shortfalls 5, 15, 25 years (FDOT, FIHS, MPOAC)
- "best practices" of other states
- alternative road use tax collection methods, such as taxes based on energy use rather than road use

This study would be conducted by the FDOT as the lead agency and in collaboration with the FEO. Both agencies would contribute to the cost of the study.

The results of the study should be presented to the governor, department and agency directors, the legislature, the Florida Transportation Commission and others as deemed appropriate. The report will be used to build consensus and recommendations for acting on policy and programs that could address this issue.

Recommendation 6.

Clean Fuel Transit Systems;

Develop education and outreach programs related to alternative fuel transit.

In 2000, over 45,000 buses were in use in Florida. Over 5,000 of these were commercial or municipal transit and paratransit community transportation program vehicles; the balance consisted of school buses. A number of alternative fuel technologies such as bio-diesel, hybrid electric, and battery electric drive trains are ideally suited to certain transit and paratransit applications and can reap immediate benefits of reductions in emissions and dependence upon foreign oil. However, incremental capital costs for hybrid-electric and battery electric vehicles are significant, and per unit costs for fuels such as bio-diesel are not yet at parity with petro-diesel.

Accordingly, the CFFAB recommends that the State work in partnership with the Florida Transit Association, the Florida Public Transit Association and any other organizations as deemed appropriate to develop education and outreach to transit and paratransit agencies and other member organizations related to alternative fuel transit. This education and outreach effort will include information on the current, available AFV transit including but not limited to addressing the incremental costs between current transit technology and AFV technology, challenges related to acquisition, maintenance, re-fueling infrastructure, funding issues and other information needed to make informed decisions related to AFV transit and paratransit technologies. Utilizing the venue of conferences, meetings and other events held by Florida transit and paratransit organizations is an effective way to reach the intended audience and maximize limited resources. It is further recommended that FDOT be designated as the lead state agency on this AFV transit and paratransit technology education and outreach effort.

An on-going program of education and identification of funding needs and resources will position the state to best leverage existing investments and transit agency support. Overseen by DCA's Florida Energy Office, the forums should complement existing FDOT programs, and should be used to communicate to manufacturers the market potential for alternative fuel transit and paratransit vehicles in Florida. An approach to

address the funding needs for incremental operating costs should be identified and constrained to realistic targets for the market to achieve price-parity.

Recommendation 7.

Education and Outreach:

Education and outreach on an on-going statewide basis.

The diversity of the CFFAB membership has provided the State with a broad range of perspectives on the issues of alternative fuels for transportation. However, it also highlighted the limited extent of understanding that industry experts, as well as elected officials and the general public, have of the specifics of alternative fuel use. In 1999, the CFFAB, the Department of Community Affairs and the FEO initiated the development of a Resource Manual[89] to ensure that all CFFAB members were appropriately educated on alternative fuel issues.

Policy makers, planners, legislative staff and departmental managers have a range of knowledge of alternative fuel technologies, some with considerable expertise, and others with little knowledge or understanding. The CFFAB recommends that a planned education and outreach effort be undertaken on an on-going statewide basis, coordinated and jointly funded by DCA, FEO, FDEP and FDOT. Primary audiences for the initial phase of this program are elected officials, policy makers and legislators. Materials from the CFFAB "Cornerstone Report", previous CFFAB reports, as well as Clean Cities publications and other publications should be utilized in this program.

Recommendation 8.

State Energy Office:

Staffing, funding and leadership role of Florida Energy Office

[89] The Clean Fuel Florida Advisory Board's (CFFAB) Alternative Fuel Vehicle and Infrastructure Resource Manual was provided to each member of the CFFAB as well as the Florida Energy Office and Department of Community Affairs staff. At each meeting of the CFFAB, additional material was provided to board members and FEO staff for retention in the manual. Limited copies of this manual, incorporating periodic updates, datasets and reports are available from the FEO or CUTR.

The need for a strong Energy Office is critical as our nation faces the many challenges related to transportation energy security. The Energy Office must be strong, well staffed and appropriately funded to support the current and emerging needs and to help ensure that Florida has a comprehensive and well designed plan that effectively addresses the state's transportation energy security.

The role of the Energy Office should encompass serving as a transportation energy resource to the Governor, Legislature and state agencies. In this capacity, the Energy Office should be knowledgeable about emerging transportation technologies and develop strategies for incorporating these technologies into Florida's transportation energy plan.

It is also recommended that the Clean Cities Coalitions model be reviewed for consideration in establishing and supporting a statewide network of Coalitions. Given adequate funding by the State, a local and statewide network of Clean Cities Coalitions would be instrumental in conveying Florida's plan for transportation energy security to residents and businesses. Marketing the plan to select audiences would help spread the word that Florida is a transportation-security-safe-state where one feels confident in building a business, in establishing a home or in making Florida a vacation destination. Additionally, the CFFAB recommends that the Florida Energy Office not only continue with it's responsibility for developing, implementing and maintaining a strong, effective AFV education and outreach plan; but, also increase the efforts to ensure heightened awareness and promotion of AFV transportation technologies.

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