The James Madison Institute

Backgrounder

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Number 49 • September, 2006

Elements of an Energy Policy To Benefit Florida and the Nation

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Executive Summary

Floridians could pay an especially steep price for the chronic failure of the nation's energy policy. Worse, political inertia concerning America's dependence on imported oil may create problems far worse than allowing high energy costs to stifle the tourism that fills the state's coffers. Indeed, an interruption in the nation's oil imports could have a devastating effect on the entire nation's economy, and it could also seriously compromise America's national security. Such a disruption, once unthinkable, is no longer farfetched in light of instability in the regions from which America imports most of its petroleum.

To craft an energy policy that addresses Florida's interests and the nation's long-term needs, lawmakers must overcome two obstacles. The first is short-term thinking linked to a political cycle in which many elected officials attend to problems only when there is a crisis that roils the electorate. From time to time since the Arab oil embargo of 1973, for instance, transitory phenomena such as long lines at the gas pump, spot shortages of fuel, and spikes in prices have combined to focus public attention on energy. Unfortunately, interest ebbed quickly when those highly visible symptoms of long-term problems faded.

A second obstacle blocking effective solutions is that many policy decisions are based on myths and misconceptions rather than facts. Fostered by a variety of factors including uninformed media coverage and self-serving assertions by organizations seeking to motivate their members and raise funds by manufacturing crises, these myths and misconceptions serve to divert attention from real problems and feasible solutions.

This paper has two major goals. The first is to inform policy makers and the public of the hard facts that must be addressed if the nation is to craft an energy policy that meets its long-term needs. The second is to illustrate why doing so is not only in the nation's best interests, but also absolutely essential to the future economic prosperity of Florida.

The James Madison Institute

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Elements of an Energy Policy To Benefit Florida and the Nation

The Oil Trap and How to Avoid It

It would be difficult to imagine any commodity that is central to as many areas of human endeavor as oil. From transportation to medicine, from agriculture to national defense, petroleum-derived products have had a profound effect.

Moreover, through most of our history, these products have been available at bargain basement prices. One consequence of this access to low-cost energy has been an unprecedented era of prosperity and economic growth. Another consequence for the United States has been an ever-increasing reliance on oil from abroad. Now, however, Americans are beginning to understand more fully that such a reliance poses a real and growing threat to America's national security.

The Threat to National Security

The potential threat of an undue dependence on imported oil has been acknowledged for almost five decades, beginning with the conclusions of an investigation conducted under the provisions of the Trade Agreements Extension Act of 1958. Subsequent reviews under Section 232 of the Trade Expansion Act of 1962 — reviews conducted in 1975, 1979, 1988, 1995 and 1999 — all came to the same conclusion: Reliance on oil imports poses a threat to national security. [1]

Yet, despite these repeated findings, the flow of imports has continued its inexorable rise, with our current dependence nearly 3.7 times what it was in 1959, when President Eisenhower imposed mandatory oil import quotas out of concern over the vulnerability created by reliance on foreign oil. Clearly, the policies employed to address our import vulnerability have failed. [2]

The Special Risk for Florida

It is important to recognize that failures at the national level can have disproportionate consequences in specific localities. Florida is a case in point. The state's economy benefits greatly from tourism. Therefore, any factor that can adversely affect travel is of special concern. Moreover, there is no reason to doubt that high oil prices and disruptions in the oil supply can have a profound effect on travel patterns.

For example, in the two years following the 1973 OPEC embargo, the number of air miles traveled was 24 percent below the level that normal growth would have dictated. Even the brief price spike that accompanied the 1990-91 Persian Gulf War caused a sharp decrease in commercial aviation travel, with domestic air miles traveled falling 4.3 percent short of normal levels, and international air travel suffering an even more significant decline. [3] During both the 1973 Arab oil embargo and 1979 Iranian oil boycott, automobile travel was also sharply curtailed.[4]

Yet travel patterns are not the only concern. Both the 1973 Arab oil embargo and 1979 Iranian oil boycott were accompanied by significant economic declines and employment losses — both factors that obviously have an adverse impact on tourism, an industry that relies on the availability of its customers' discretionary income — what's left over after they pay their taxes and buy necessities such as food, clothing, shelter, and energy.

The question facing policy makers, then, is how best to identify policies that will reduce the economic and security threats posed by our inordinate dependence on imported energy. For decision makers to make rational policy decisions to achieve this goal, however, they must first understand how our current situation came to be. Hence, it is essential to review a bit of history.

The First Oil Shock

On October 17, 1973, Americans were shocked out of their energy complacency when the Arab Organization of Petroleum Exporting Countries (AOPEC) announced that it would impose an embargo on sales of oil to the United States and raise the price of crude oil to its other customers by 70 percent. To enforce this action, AOPEC further announced that its members would cut production by 5 percent from the previous month's level and reduce production an additional 5 percent in each succeeding month.

Overnight, crude oil prices rose from a little more than \$3 a barrel to \$5.12. By March of the following year, the price of crude had peaked

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at $12.73 a barrel ($52.93 in 2005 dollars).[5] Gasoline prices skyrocketed as well, and filling stations in the United States were plagued by long lines of desperate motorists panicked over shortages at the pump.

The U.S. economy soon fell into a deep recession caused in part by an inflation rate that reached 12.3 percent by 1974.[6] This was more than thrice the 3.6 percent inflation rate of 1972, the year before the embargo.[7] Unemployment, which had been declining over the preceding two years, shot up by more than a full percentage point in just three months. By February of 1975, joblessness had more than doubled, rising from 4.2 percent when the embargo was announced in October of 1973 to 9.1 percent. More than 1.2 million people lost their jobs.[8]

But the effect of the embargo went beyond the apparent economic effects. The psychological impact of the oil shock on the United States was incalculable. Americans had long believed themselves immune from oil supply disruptions — and with good cause. Global petroleum markets had been severely disrupted several times prior to 1973, with only a negligible impact on the U.S. economy.[9] That was because domestic producers were able to increase their output to make up the shortfall. In two notable instances, the 1951 embargo of Iranian oil and the 1967 Suez Crisis, U.S. production not only alleviated the shortfalls in the United States, but those of its allies as well.[10]

But 1973 was different. Until 1947, the U.S. had been a net exporter of oil. Beginning in 1948, however, America's long-standing oil self-sufficiency began to erode. By 1973, the nation was importing almost 35 percent of its crude oil, and its "surge capacity" (the ability to quickly increase oil production from existing fields) had greatly diminished.[11]

Unaware of these facts, the public was unprepared for what would come in the aftermath of AOPEC's move. Pundits were quick to point fingers of blame and conjure up images of hidden conspiracies, but most missed the point. The real cause of our import vulnerability was right in front of them. It was the inevitable consequence of America's love affair with the automobile.

The Impact of the Automobile

In 1903, there were only 8,000 automobiles registered in the United States. Five years later were 78,000. But that was just the beginning. Until 1908, automobiles were mostly an expensive toy for the wealthy.[12] But in 1908 Henry Ford introduced the Model T, and the automobile became an American phenomenon. Some 10,000 Model T's were sold in their first production year, and sales increased roughly 100 percent in each of the three succeeding years to 34,500 in 1911. In 1912, over 78,000 were produced, matching the total number of automobiles registered in the United States just four years earlier.[13] By 1927, the fifteen-millionth Model T would roll off Ford's production line.[14]

After a brief slowdown during the Second World War, pent-up consumer demand, movement to the suburbs, and newfound affluence caused an explosive growth in the U.S. fleet of privately owned vehicles. By 1950, 40 million were on the road, and two decades later that figure had increased to more than 108 million.[15] Today, there are more than 220 million privately owned automobiles and light trucks in the United States. Indeed, it is the transportation sector that has driven the post-1973 growth in oil demand.[16]

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To illustrate, between 1973 and 2001, the amount of oil consumed by the electric utility sector dropped by 76 percent, the amount consumed by the commercial sector fell by 52 percent, and the amount used in the residential sector fell by 43 percent.[17] Although oil use in the industrial sector grew by 8.5 percent, the increase was substantially below the 13.8 percent overall increase in petroleum consumption during the same period.[18] Moreover, this modest increase took place even though Gross Domestic Product (GDP) more than doubled from $4,341.5 billion in 1973 to $9,890.7 billion (in 2000 chained dollars).[19]

The transportation sector, however, increased petroleum use by 46.4 percent between 1973 and 2001, more than offsetting the changes in the other sectors.[20] It should be noted that if the energy consumption in the transportation sector had remained constant, U.S. domestic oil consumption in 2001would have declined 24.3 percent overall from the 1973 levels.[21] This point is further demonstrated by the fact that between 1973 and 2001, the proportion of domestic oil consumption going into the transportation sector rose from 52.3 percent to 67.3 percent.[22] During that same period, transportation's overall share of domestic energy use rose from 18.6 percent to 27.1 percent.[23]

In Florida, transportation use mirrors the rest of the nation. In 2005 Floridians and visitors to the state consumed 28 million gallons of gasoline each day, with consumption expected to reach 32.5 million gallons daily over the coming decade.[24] Nor is transportation the only sector affected.[25] Small businesses, schools and other institutions are facing fuel price increases of up to 34 percent.[26]

With more than 17 million citizens and almost 1,000 new residents added daily, Florida already ranks third in national energy consumption. Demographic trends suggest that Florida's energy use is likely to grow at a higher rate than the nation as a whole. Indeed, with a growth rate that is more than double the national average, Florida's overall energy requirements are likely to increase at a faster rate than the nation as a whole.[27] Since Florida also has about 9 percent more vehicles per capita and a longer average commute time than the nation as a whole, motor fuels will be a particularly important component of that growth.[28] The question, however, is whether or not the fuel for those vehicles will be available.

Factors Constraining the Energy Supply

There are several factors that may threaten the availability of adequate supplies of motor fuels to meet the future of Florida and the nation as a whole. First among them is the growth of global demand.

Emerging Economies

Throughout most of the twentieth century, the U.S. economy was the engine that drove the world's oil export markets. By the 1980s, however, that began to change as several of the larger nations in what has been dubbed "the developing world" began to experience a surge of economic growth that greatly increased their need for energy. In lands where transportation once meant depending on trains, buses, ox carts, bicycles, and walking, there was a steep increase in the number of motor vehicles. That, along with industrial development and the energy demands of newly affluent families who, in a generation's time, had moved from peasant huts to homes reminiscent of American suburbia, combined to raise the demand for energy in those nations.

China's Economic Revolution

In 1978, the People's Republic of China began a process of instituting economic reforms that continues to this day. The process began with the liberalization of agriculture, essentially allowing farmers to retain a surplus that could be sold directly rather than through cooperatives. Soon afterward, villages were allowed to establish local enterprises, and then, most importantly foreign trade and investment were allowed.

These initial steps were followed with a phasing in of market prices and the transition from a command economy to a price-based market economy.

In the 1990s, China moved to streamline its economy, eliminating inefficient or unprofitable enterprises and establishing a modern banking system. The results have been dramatic. China now has the world's fourth-largest economy in terms of nominal GDP (treating the European Union as a single economy), and the second largest GDP in terms of purchasing power parity (PPP). This enormous expansion has been the product of an annual growth rate estimated at between 9 percent and 10 percent. In 2006, China's central bank predicts the growth rate will reach 10.3 percent, significantly exceeding the official target of 9.9 percent.[29]

Of particular significance is the fact that in 2005, the most recent year for which full figures are available, 47.8 percent of China's GDP was generated in the industrial sector — a proportion more than twice as great as the 20.7 percent GDP contribution of the U.S. industrial sector.[30] With this enormous emphasis on industry has come a corresponding appetite for energy, including oil. As a result, in recent years China has accounted for around 40 percent of the world's increase in demand for oil.

But Chinese industrial use is only part of the story. In 2005, China announced plans to add 120 million privately owned vehicles to its fleet over the next decade.[31] Fueling these vehicles will require an additional 7.2 million barrels per day of crude oil production by the year 2015, and as the fleet expands further, 9.6 million barrels per day by 2025.[32] What is happening in China, however, is not unique.

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India's Emerging Transportation Market

Like China, India has been growing at a breakneck pace, averaging over 7 percent annually since 1994 and posting a 7.6 percent growth rate in 2005.[33] Although India's economy is more service-oriented than China's, it still generates 28.1 percent of its GDP from the industrial sector.[34] Current Indian oil imports average a little more than 2 million barrels per day but are expected to rise rapidly in the years ahead.[35] Moreover, since India has one of the world's lowest per capita vehicle ownership rates — only about one car for every 1,000 people — its newly affluent population is a prime target for auto marketers.[36] This fact has not gone unnoticed in the industry, which is increasingly targeting India's 1 billion-plus citizens as potential new customers for their products. The rate of automobile sales in India has been growing at nearly 30 percent per year, but industry analysts believe this may only be the beginning. This trend has been accelerated by the relatively recent availability of affordable financing, which makes the acquisition of vehicles far easier for average Indian citizens.

Other Factors Fueling Demand for Energy

Asia is not the only region contributing to the enormous surge in world oil consumption. The newly independent states of Eastern Europe have also experienced dramatic economic gains that have helped to fuel the world's growing appetite for crude oil. In contrast to the industrialized nations of Western Europe, which have had anemic growth rates in recent years — 1.2 percent in 2005 and a projected 1.8 percent in 2006 — Eastern European countries averaged 5.5 percent in 2005 and are expected to achieve growth rates of at least 5.3 percent in 2006.[37]

The skyrocketing demand of emerging economies, however, is only part of the problem. Another factor is a simple fact of nature: Oil is a finite resource.

The Growing Energy-Supply Gap

In recent years, there has been increasing discussion concerning the possibility that global oil production is approaching its peak and will soon begin to decline. While various estimates of when this "peak" will occur range from as soon as 2007 to as late as 2019, there is no disagreement among petroleum experts regarding the fundamental point: Oil production will soon reach its zenith.

This is not to say that the world is running out of oil. What the imminent peak really signals is the end of "cheap" oil. It will also mean that the world will not be able to bring the oil that remains into production as quickly as it did in the past.

To illustrate, in the United States, when oil was first discovered, it was not uncommon to have wells with flow rates measured in the thousands or even tens of thousands of barrels per day. Even these prolific production rates, however, were dwarfed by the legendary Lucas Well Number 1 drilled at the Spindletop oil reservoir just south of Beaumont, Texas. It reputedly had a flow rate of 100,000 barrels per day.

In contrast, today an average U.S. oil well produces just 10.5 barrels per day.[38] The reason for this shift is simple: fewer and fewer large oil fields, the type that can have wells producing tens of thousands of barrels per day, are being discovered. Yet, the cost of drilling a well producing a few daily barrels can be as high as drilling one that produces thousands. The importance and rarity of these large oil fields cannot be overstated.

The Role of Large Oil Fields

Although more than 50,000 oil fields have been discovered since the oil industry began in the 19th Century, most of them have been relatively small.[39] Fewer than 40 of the oil fields fall into the category "Supergiant," which are the largest and contain at least 5 billion barrels each.[40] Roughly 280 others are classified as "Giant," meaning that they contain at least half a billion barrels.[41] Despite their relatively small numbers, these two classes of oil fields represent roughly half of all the oil discovered to date and 80 percent of current world oil production.[42] Between 14 percent and 16 percent of the remaining world oil production is accounted for by "Large" oil fields, which contain between 50 million and half a billion barrels.[43] Taken together, these three categories represent 95 percent of world oil production even though they comprise only about 2.6 percent of the total number of oil fields discovered since the industry began.[44]

To put this in further perspective, it is useful to consider what has been happening in relation to the discovery of "Giant" and "Supergiant" oilfields in the post World War II period. Prior to 1950, 19 of these largest categories of oil fields were found; they produced an average of 557,000 barrels per day.[45] During the 1950s, an additional 17 were discovered, but their average production was 330,000 barrels per day.[46] In the 1960s, things appeared to improve with the discovery of 29 oil fields in those largest categories, but their output was significantly lower than those found in the previous decade, averaging 242,000 barrels per day.[47] So even though the number of discoveries of new oil fields in the largest categories increased 70.5 percent, estimates of the world's remaining oil reserves increased by only 25.1 percent.[48]

But that was just the beginning. In the 1970s, 24 large oilfields were discovered, but their average output was 236,000 barrels per day — slightly less than the fields discovered in the previous decade, so they only added about 80 percent as much oil to world supplies as the previous decade's discoveries.[49] In the 1980s, despite record world oil prices, only 15 large fields were discovered, with an average output of 176,000 barrels per day adding less than half as much production capacity to global supplies as was added in the immediate post WWII decade.[50] In the 1990s, performance was even worse, with just 11 large oilfields producing an average of 126,000 barrels per day discovered.[51]

The diminishing number of large field discoveries and their declining output is to a large extent the product of a maturing of onshore oil exploration. After more than 100 years, a significant proportion of the "Supergiant" and "Giant" oilfields have been discovered. This is not to say that there are no promising prospects remaining onshore, but rather that the likelihood of discovering a field in one of the larger categories is relatively small. Further, the large oilfields that are found are less likely to be as prolific as those discovered in the past.

In the United States, the last remaining area with a high prospect for discovery of an onshore "Supergiant" or "Giant" oilfield is the North Slope of Alaska. In other major oil regions of the world, the potential for finding one of these oil behemoths is similarly limited. With world oil demand growing at a rapid pace, the lack of prospects for the discovery of large fields is, to say the least, a grave problem. The nature of the problem lies in what oil industry professionals call the "decline curve."

Consuming a Finite Resource

The term "decline curve" refers to the fact that the rate of production from an oilfield follows a bell curve. It rises rapidly to a point of "peak production" and then falls off at a similar rate. The rate at which the flow of oil diminishes following attainment of "peak production" is referred to as the field's "decline curve." The rate of decline can vary from oil field to oil field and even within a specific deposit. The key point is that oil production from all fields eventually declines because it is drawn from a finite resource. As a result, in order to meet continuing demand, new discoveries must be made to make up for what is used. This notion is easy enough to understand, but there is a complicating element: Because the resource base is finite, it will eventually be consumed. Moreover, in consuming this finite resource, the most readily available and least expensive sources of supply are used first. As a result, as the resource base is consumed, it becomes increasingly difficult and expensive to sustain production. Therein lies the problem.

Currently global oil consumption is increasing at a rate of between 1 percent and 2 percent annually. As a consequence, according to the latest Energy Information Agency projections, the world will require an additional 35 million barrels per day of oil production by the year 2025.[52]

However, global production from existing oil fields is declining at a rate of at least 3 percent per year.[53] Moreover, some oilfields such as those in Saudi Arabia are declining much faster. Therefore, the actual requirement for additional oil production by 2025 is not just the 35 million daily barrels needed to accommodate increased demand, but that amount plus another 45 million daily barrels to make up for what is consumed during the intervening period. This means that by the year 2025, new sources sufficient to produce 80 million barrels of oil per day must be discovered and brought on line — an amount nearly equal to what is being produced today.[54]

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> *"Since 1949, there have been 16 disruptions of global oil supplies with durations as long as 44 months and as short as one month."*

Meeting this production goal from small oilfields would be difficult if not impossible. At a minimum it would be extremely expensive. It is this fact that makes the discovery and development of oilfields in the largest categories so important. But the decline of global production and the difficulties that exist concerning replacing what is used is only part of the global supply problem. Of equal or even greater importance is the question of security of supply.

Uncertain Suppliers

The decline of U.S. domestic oil production has led, understandably, to a growing appetite for imports. In May of 2006, import of crude oil and refined petroleum products accounted for 71.8 percent of domestic supplies — an increase of 4.8 percent from the same period the previous year.[55] At the same time, U.S. domestic oil production in May of 2006 fell by 333,000 barrels per day from May 2005 levels, a decline of 6.1 percent.[56] In Alaska, North Slope production fell to 805,000 barrels per day, a decline of over 60 percent from the 1988 production peak of 2,028,400 barrels per day.[57]

Yet, it is not the level of imports per se that is a matter of concern. Indeed, a strong argument could be made that in a perfect market, importing oil from less expensive overseas sources made economic sense. The world trade in petroleum, however, does not remotely mimic the conditions required for a perfect market. More important, it is not just economic characteristics such as the existence of the OPEC cartel that give cause for concern. An even greater problem lies in the fundamental security of supply and the potential consequences of an oil supply disruption — an event that has occurred far more frequently than most people realize.

Disruptions Have Been Frequent

Since 1949, there have been 16 disruptions of global oil supplies with durations as long as 44 months and as short as one month.[57] The disruptions resulted in losses of as much as 3.5 million barrels per day of crude oil from world markets.[58] More important their frequency has increased since 1970. To illustrate, in the 21 years between 1949 and 1970, global oil supplies were disrupted 4 times — an average of roughly once every five years.[59] Over the 35 year period between 1971 and 2006, however, oil supplies were disrupted 14 times or roughly once every 2.5 years.[60]

More important, only two of the more recent disruptions were the result of natural disasters: In 1977, a two-month loss of 700,000 barrels per day of Saudi production due to damage to one of their oilfields, and in 2005 hurricane-related stoppages of production in the Gulf of Mexico, where lost production peaked at around 1.4 million barrels per day. The other 14 were a direct consequence of political action or conflict.

It is the potential for politically-motivated supply disruptions that makes the dependence on petroleum imports from unstable regions a threat to the nation's economic and military security. Moreover, the magnitude of the threat from such a politically motivated event has been greatly heightened by the decline of global "surge capacity," i.e., the availability of alternative sources of oil that can be brought into production quickly.

The Decline of Surge Capacity

Over the past several decades, the vast Saudi oilfields have provided much of the world's surge capacity. For example, when the world lost an estimated 4.3 million barrels of oil production from Iraq and Kuwait during the first Persian Gulf War, Saudi Arabia was able to surge its production by an estimated 3.5 million daily barrels to help offset the loss, with the balance replaced primarily with production from other Persian Gulf countries.[61] In the years that followed, the Desert Kingdom periodically used its enormous production capacity to protect its market share and keep world prices at levels it deemed optimum to achieve this objective. Throughout the 1990s and the early 2000s, it was generally accepted that Saudi surge capacity remained at around 3.5 million barrels per day.

Matt Simmons's Revelation

In 2003 Matt Simmons, a highly respected oil analyst, shocked the industry with his declaration that Saudi Arabia's oilfields were nearing their production peak and would soon begin to decline. Simmons did not come by this view lightly. In the late 1990s he had become concerned over the increasing unreliability of energy data. As a result, he had his firm undertake a review of some 200 technical papers addressing issues related to Saudi Arabia's oil fields. As he read and re-read the studies, a disturbing picture emerged.

First, most of Saudi Arabia's production came from a small number of huge fields that had been discovered decades earlier and, more important, had begun to peak. This is particularly true of the four "Supergiant" oilfields that have formed the core of Saudi oil production.

For example, the massive Ghawar oilfield, Saudi Arabia's crown jewel, was discovered in 1948 and has seen its production drop from a peak of 5.8 million barrels per day to its current 4.5 million barrels per day.[62] The Abqaiq oilfield was discovered in 1946 and currently produces around half a million barrels per day, a decline of almost 60 percent.[63] The Safaniyah oilfield, discovered in 1951, has dropped even more, from a peak of 1.6 million barrels per day to 600,000 barrels per day.[64] Berri, the fourth and most recent discovery was found in 1964 and has seen its production halved from 800,000 barrels per day to a current 400,000.[65]

Simmons also points out that the three "Giant" oilfields that are responsible for the bulk of remaining Saudi production are also aged and showing signs of decline. The Zuluf oilfield, discovered in 1965, has seen its production drop from a peak of 800,000 barrels per day to 500,000, and the Marjan oilfield, discovered in 1966, has declined from a peak of 300,000 barrels per day to a current 200,000.[66] Only the Shaybah oilfield, discovered in 1967, is currently maintaining its production at 500,000 barrels per day.[67] However, because it is the most recent large field discovery, there is every reason to believe it will follow the pattern of the other seven and soon begin to decline as well.

What these disturbing figures show is that overall production from Saudi Arabia's key oil fields has fallen by more than one-third from peak production levels, and that among the four "Supergiant" oil fields, the falloff is more than 36 percent. Among the three more recently discovered "Giant" oilfields, the falloff was 25 percent.[68]

Moreover, it is not just Saudi oil that appears to have peaked.

Other Key Producers Peak

U.S. oil production long since peaked at 11,297,000 barrels per day.[69] In May of 2005, domestic production (including 805,000 barrels per day from Alaska) stood at 5,124,000 barrels per day, or 45.3 percent of the peak level.[70] Yet, it is not just U.S. oil output that has declined. A number of other key producers have experienced sharp declines in their oil output over the past several decades. A review of what has happened to some of the world's key producers makes the severity of the situation clear.

What is evident is that production from many of the world's traditional suppliers, and particularly those in the critical Middle East, is declining. New production from discoveries and expansions elsewhere, particularly in the North Sea, the Gulf of Mexico, Alaska, and more recently the former Soviet Union, have helped to make up the difference. However, virtually all projections of future supplies continue to show a dramatically increased contribution from Middle East producers. The question is, are these projections based in fact or merely wishful thinking?

An Inexact Science

Given current reserve estimates neither Saudi Arabia nor the other Middle East producers are running out of oil. Saudi proved reserves were rated at nearly 262 billion barrels,

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	PEAK YEAR	PEAK AMOUNT (Million B/D)	CURRENT (Million B/D)	% DECLINE
Indonesia	1991	1.6	1.1	31.3%
Iran	1974	6.0	3.5	41.7%
Iraq	1979	3.4	2.0	41.2%
Kuwait	1972	3.5	2.0	42.9%
Libya	1970	3.3	1.4	57.6%
Venezuela	1981	3.3	2.5	24.2%
Saudi Arabia	1970	10.0	8.5-9.0	10%-15%

"What are the implications of the changing market for the nation's energy security? "

of which around 100 billion barrels have been produced. This would be sufficient to sustain current production rates or even an expansion for a significant period of time — *if* the figures are accurate.

The trouble is that estimating oil reserves is an inexact science at best. In fact, such estimates are typically expressed in terms of "confidence levels," with estimates based on a 95 percent confidence level, a 5 percent confidence level, and a "mean" estimate. As a general rule, the "mean" figure is generally accepted as the "official" estimate. Yet, until actual production occurs, estimates are nothing more than educated guesses.

For example, the U.S. Geological Survey's (USGS) initial estimates of the size of Alaska's Supergiant Prudhoe Bay oilfield indicated it contained between 8 billion and 10 billion recoverable barrels of oil.[71] To date it has produced around 13 billion barrels of oil and may ultimately produce as much as 16 billion, roughly twice the lower end of the initial estimate.[72] Similarly, USGS estimates of the amount of oil in Alaska's Naval Petroleum Reserve have been significantly increased.[73] In 1980, the USGS mean estimate placed the amount of oil that the reserve held at 2.1 billion barrels and the natural gas at 8.5 trillion cubic feet.[74] The most recent mean estimate (2002), however, indicates that the reserve holds at least 9.3 billion barrels of oil and 59.7 trillion cubic feet of natural gas.[75]

In other cases reserve estimates have had to be downgraded, as occurred recently with Shell Oil reserve estimates for Nigeria.

Production Rates Are Critical

The size of a discovery or a proved reserve base, though, is not the only consideration. Of perhaps even greater importance is the rate at which it can be produced, because it is the production rate that determines how much oil a given field will add to world supply in a given time frame. This attribute grows in importance when the additional production resulting from the discoveries is examined.

Implicit in these figures is the notion that future oil discoveries will be less productive and more expensive than those discovered in the past. Again, this is not to say that the world is running out of oil; it is not. Rather, it is likely running out of "cheap" oil, and more important, "quick" oil. In other words, it will take longer and be more expensive to bring future discoveries into production. While it is true that there are other sources of oil including tar sands and oil shale, developing them will take decades and will likely be more expensive than producing conventional petroleum using traditional techniques.

In short, even as world oil demand is projected to soar, the sources of new, readily produced supplies are diminishing, and current sources are rapidly being exhausted. But the question is: What are the implications of the changing market for the nation's energy security?

A Perilous Dependence on Imported Oil

As noted earlier, of the 14 supply disruptions that have occurred since 1970, only two were the result of natural disasters. The other 12 were the direct consequence of political action or conflict. This fact illustrates the reason for concern over the political stability of nations that make a substantial contribution to U.S. oil import totals.

Of the top ten foreign suppliers of crude oil and refined petroleum products to the United States, there are four that present special cause for concern: Venezuela, Saudi Arabia, Nigeria,

DISCOVERY DATE	NUMBER OF FIELDS	AVERAGE PRODUCTION	TOTAL PRODUCTION
Pre-1950s	19	557,000 b/d	10,538,000 b/d
1950s	17	330,000 b/d	5,610,000 b/d
1960s	29	242,000 b/d	7,018,000 b/d
1970s	24	236,000 b/d	5,664,000 b/d
1980s	15	176,000 b/d	2,640,000 b/d
1990s	11	126,000 b/d	1,386,000 b/d

and Iraq. Together, these four nations provide almost 39 percent of U.S. oil imports accounting for over 22 percent of total U.S. oil supplies.[76] Each has unique political circumstances that put into question their continuing reliability as sources of supply.

Saudi Arabia

Saudi Arabia holds a unique place in the pantheon of global oil producers. As both the world's largest producer and owner of putatively the world's largest reserve, it is the cornerstone of the extractive end of the industry. Moreover, it is the nation that most analysts say will serve to provide the most significant proportion of the new oil supplies required to meet skyrocketing demand in the years ahead.

But the Desert Kingdom is something else as well: a nation seething with domestic unrest and a principal target on international terrorism's hit list.

Demographics and Demagoguery: A Double Threat

One of the most important factors affecting Saudi Arabia's stability is that nation's demographics. Saudi Arabia has one of the world's highest birth rates, with an average of seven children born to each Saudi woman. The effect of the Saudi baby boom is evident in the fact that 70 percent of all Saudis are under the age of 30, and 40 percent were born since the 1991 Gulf War.[77]

At one time this might not have posed a problem, but the Saudi population explosion coincided with a period of declining oil revenues. As a result, a severe strain has been placed on its traditionally paternalistic government. Saudi per capita income peaked in 1980 at $28,000, more than $71,110 in current dollars.[78] After falling to $8,500, per capita income recovered somewhat in 2005 due to high oil prices, reaching $12,500.[79] This figure, however, is only around 17.6 percent of what it was at the peak.[80]

But the decline of per capita income is only one of the economic woes facing the Desert Kingdom. Unemployment, once unheard of in Saudi Arabia, stands officially at 15 percent.[81] Private analysts, however, place the actual unemployment rate at twice that figure or higher. Worse, among the young, estimates of unemployment run as high as 40 percent.[82] In addition, many of the traditional services offered to Saudi citizens by the royal family as a means of keeping unrest in check have been eliminated. Such benefits as free college educations, "do-nothing" jobs and dowries for all young women are no longer provided. The antipathy caused by the end of these benefits is heightened by reports of the continuing excesses by many members of the huge Saudi royal family. Their lavish lifestyles and profligate spending are deeply offensive to many members of the country's ultra-conservative population.

The rampant unemployment among Saudi Arabia's youth has been a special source of concern. With no prospects and often no skills, the young deeply resent their lack of opportunity. One consequence of this circumstance has been a spike in the crime rate among unemployed youth. A report by the Saudi Monetary Agency published in 2003 said that crime among jobless Saudis rose 320 percent between 1990 and 1996,[83] and was expected to rise by an additional 136 percent by 2005.[84] This change has been a profound shock to the conservative Saudi society, which finds it hard to accept. It is, nonetheless, real.

According to Saudi sources, the number of drug offenders rose by more than 400 percent between 1986 and 2001, rising from 4,279 to 17,199.[85] Between 2000 and 2003 there were 13,000 serious burglaries.[86] Nor is all crime nonviolent. An emergency surgeon working at King Fahd General Hospital reported to a Washington newspaper that in 2001 he would see about two shootings per month — mostly accidental. By 2003, he was seeing up to seven shootings and stabbings monthly, and they were not accidental.[87]

Still, as unsettling as the economic situation, it pales in comparison to the threat of internal subversion.

Radical Islam in Saudi Arabia

Although the Saudi government has finally begun to take the terrorist threat seriously, it may be too little too late. On February 24, 2006, suicide bombers attempted to attack the massive Saudi oil processing facility at Abqaiq in two explosives-laden vehicles. Although fire from security guards thwarted the attack, detonating the cars about a mile from the actual plant,

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"Of even greater concern is Venezuela, our third largest source of imports, providing 12.3 percent of the total and contributing 7.3 percent of the total U.S. supply."

it represented the most serious assault on oil facilities within the Kingdom to date, and was indicative of the extent of al-Qaeda's presence there. Indeed, the threat of terrorism is far greater than is generally acknowledged.

In the three years prior to the February attack, Saudi authorities reported 47 terrorist incidents involving at least one death and conducted at least 20 raids on terrorist cells capturing hundreds of weapons and tons of high explosives. Major incidents include:

- May 12, 2003: Militants attack a housing compound in Riyadh leaving 35 dead and 200 wounded.
- November 6, 2003: Suicide bombers attack a residential compound in Riyadh killing 11 and wounding 122.
- April 21, 2004: A suicide attack on Saudi government offices kills 5 and wounds 150.
- May 29, 2004: An attack on a western housing compound in Khobar leaves 16 dead; al-Qaeda takes credit.
- December 6, 2004: The U.S. Consulate General in Jeddah, five consular employees and three terrorists are killed during a three-hour gun battle.[88]

An important attribute of the attacks prior to February of 2006 is that they were primarily aimed at individuals — especially Westerners. The attack at Abqaiq was different — it was an attack on the nation's oil infrastructure, and therefore a cause for alarm. But perhaps it should have been expected.

In 1996, Osama bin Laden issued his first "fatwa" or legal opinion, "A Declaration of War Against the Americans Occupying the Land of the Two Holy Places." In that statement he specifically admonished his supporters to avoid doing anything to damage Saudi Arabia's oil facilities stating in part:

> *"I would like here to alert my brothers, the Mujahideen, the sons of the nation, to protect this (oil) wealth and not to include it in the battle as it is a great Islamic wealth and a large economical power essential for the soon to be established Islamic state."*

But on December 18, 2004, bin Laden reversed himself issuing a revised "fatwa" stating:

> *"We call on all the Mujahideen in the Arabian Peninsula to unify their ranks … and target the oil supplies that do not serve the Islamic nation but the enemies of this nation."*

The statement also urged:

> *"Be active and prevent them from getting hold of our oil and concentrate your operations on it (oil), in particular in Iraq and the Gulf."*

Up to the present, the most apparent consequence of the revised strategy has been the continuing attacks on pipelines and oil facilities in Iraq. Given that Iraq ranks fifteenth among the world's oil producers, the consequences of the disruptions these attacks have caused have been relatively minimal. However, if similar disruptions were to occur in Saudi Arabia, producer of roughly 10 percent of the world's oil supply, the consequences would be far different —in fact, potentially catastrophic.

But Saudi Arabia is not the only important source of U.S. oil imports that is of questionable reliability. Of even greater concern is Venezuela, our third largest source of imports, providing 12.3 percent of the total and contributing 7.3 percent of the total U.S. supply.[89]

In Venezuela: Oil and Turmoil

Oil has long been central to Venezuela's economy. The first commercial drilling in Venezuela took place in 1917.[90] In the years that followed, British and American firms discovered huge petroleum reserves at Lago de Maracaibo. Oil soon became the country's major export commodity, accounting for 91 percent of its exports in 1934.[91] In the years prior to World War II, Venezuela was the world's largest petroleum exporter after the United States. Today, oil remains that nation's most important export commodity, with petroleum and petroleum derivatives accounting for 80 percent of all Venezuelan products sold abroad.[92]

While Venezuela benefited richly from its oil wealth, like many exporting nations, it resented the control foreign companies exerted over its resources. As a result, in 1960, its Minister of Mines and Hydrocarbons Juan Pablo Perez Alfonszo was instrumental in the creation of the Organization of Petroleum Exporting Countries. Venezuela continues to play a major role in that institution.[93]

Today, Venezuela is America's third largest source of imports, behind Canada and Mexico.

In fact, most of Venezuelan petroleum not consumed in the domestic market is exported to the United States.[94] Yet, despite its oil wealth, Venezuela has one of South America's lowest per capita incomes, just $6,100 per annum, well below the world average of $9,500.[95] According to Transparency International, an organization that publishes an annual index of corruption, Venezuela is also one of the most corrupt nations in South America.[96]

Chavez and the New Era of Uncertainty

With the election of Hugo Rafael Chavez Frias, a former paratroop colonel, as President of Venezuela in 1998, that nation's relations with the United States took a markedly downward turn. Chavez ran as a left-wing populist promising to curb the country's widespread corruption and to address its rampant poverty. Chavez had first come to widespread attention when he led an unsuccessful coup attempt against then-President Carlos Andres Perez. Hundreds were killed in the violence, and Chavez spent two years in prison. Perez was impeached in 1993 and in 1994, his successor, President Rafael Caldera, pardoned Chavez. Upon his release, Chavez established the Quinta Republica Movement.

After his 1998 victory, Chavez moved aggressively to implement his program of social, political and economic change. His actions quickly divided the nation. Opposition to Chavez's programs grew so strong among Venezuela's elite and middle class that on April 12, 2002, they briefly deposed him in a coup led by the Inspector General of Venezuela's armed forces, General Lucas Rincon Romero. The coup was followed by a series of political maneuvers. First, the figurehead President appointed by the coup leaders resigned and was replaced by the sitting Vice President, who immediately appointed Chavez as Vice President and then promptly resigned as well, returning Chavez to office.

Even as the crisis generated by the coup began to subside, more trouble was brewing within the oil industry. On December 2, 2002, a general strike was called among Venezuelan oil workers. The strike shut down the industry for two months. Although some workers have been rehired since, according to Venezuelan sources there remains a "blacklist" of executives and technical staff who are barred from employment. The loss of these skilled workers has hampered efforts to restore Venezuelan production to previous levels.

Chavez's opponents were not, however, finished. In 2004 they forced a recall referendum in an attempt to have him removed from office. Despite their best efforts, Chavez won the election, which was held in August of 2004, ensuring his continuation in office until 2007. In addition, the decision of opposition parties to boycott the 2005 legislative elections allowed his supporters to win a majority and secure his power base.

But politics were not the only sector of Venezuelan society affected by Chavez's ascent to power. In January of 2002 a new "Hydrocarbon" law went into effect in Venezuela. It increased royalties from 16.67 percent to 30 percent and increased the mandatory ownership of Venezuela's oil company PDVSA in all operating arrangements to a minimum of 51 percent.[97]

In 2005, the government took steps to force 32 companies with existing operating agreements to shift to new arrangements subject to the terms of the new law. Under the new terms, the companies which had been paying royalties of 1 percent would see them rise to 30 percent, and their income taxes would be raised from 34 percent to 50 percent.[98] If the companies did not comply, their operations would be forfeited to the government. In addition, an extraction tax of 33.33 percent over and above the 50 percent income tax was imposed on foreign producers.[99] As a final move, the Venezuelan tax authority SEMIT announced that the previous 34 percent tax rate had been applied illegally and should have been 50 percent.[100] The tax authority then sent oil companies bills for back taxes totaling an estimated $3 billion.[101]

Chavez is also seeking to diversify Venezuela's customer base by seeking regional agreements in the Caribbean and in South America and by entering into joint ventures with China.[102]

Perhaps the most important aspect of Venezuela's oil industry under the Chavez regime is that he views it as a political tool as much as a source of revenue. As a consequence this makes the prospect of politically-motivated supply disruptions far more likely than might be the case with other producers. Indeed, he has been called "Castro with oil," and with

"With the election of Hugo Rafael Chavez Frias, a former paratroop colonel, as President of Venezuela in 1998, that nation's relations with the United States took a markedly downward turn."

good cause. Chavez has been linked to terrorist organizations, including Colombian rebels and Islamic militants. Venezuelan authorities have routinely issued false identification documents to foreign nationals. Of nearly 3,800 fraudulent documents known to have been distributed, at least 280 went to Arab nationals.

In another worrisome development, Venezuela has announced a plan to purchase military weapons and supplies, including fighter jets, from Russia. This comports with Chavez's ambitions for Venezuela to become the dominant military presence in the region. In the final analysis, then, the prospects for the Venezuelan oil industry are at best uncertain. Moreover, Chavez's open hostility toward the United States makes Venezuela at best a highly questionable source of supply.

"With an output of 2.45 million barrels per day, Nigeria ranks 12th among the world's oil producers and is the 5th largest U.S. supplier."

Nigeria

With an output of 2.45 million barrels per day, Nigeria ranks 12th among the world's oil producers and is the 5th largest U.S. supplier.[103] Estimates of Nigeria's proved oil reserves as of January 2006 stood at 35.9 billion barrels according to *Oil and Gas Journal*.[104] The Nigerian government, however, plans to engage in exploration to expand its "proved" reserves to 40 billion barrels by 2010. It also hopes to expand its production to 3 million barrels per day by that year.[105]

Nigeria's oil production has been continually plagued by pipeline vandalism and by sectarian violence. In 2003, the Nigerian National Oil Company announced that it had lost an average of 336,000 barrels per day to theft and vandalism.[106] In 2004 it claimed that this figure had been significantly reduced, but even at the lower level it represented $2 billion per year in lost revenues.[107]

In recent months, pipeline vandalism and violence have both markedly increased. In October of 2005 a pipeline fire in southwest Nigeria killed 60 people.[108] In December of 2005, a Shell Oil pipeline in the Opobo Channel was dynamited.[109] Attacks on the Forcados oil terminal in February of 2006 led to a loss of 455,000 barrels per day of production.[110] In that same month, an attack on the Escravos pipeline forced a shutdown of the Warri refinery.[111]

Nor are attacks on facilities the only problem. Of even greater concern are attacks on and kidnappings of foreign oil workers. For example, in April of 2004, two Americans who were working for ChevronTexaco were killed in an attack near Warri.[112] On January 24, 2005, an estimated 300 armed villagers from Owaza, which is located in Nigeria's southeastern state of Abia, attacked two Royal Dutch Shell flow stations, shutting them down and forcing the evacuation of 18 workers.[113] In January of 2006, four foreign employees of Royal Dutch Shell were kidnapped and then held for 19 days before being released. In February 2006, nine more workers were kidnapped.[114]

Although Nigeria has great potential, the continuing political instability, violence, and vandalism of key oil facilities raise serious doubts concerning its reliability as a source of supply.

Iraq

Iraq's proved reserves of 100 billion barrels rank it third after Saudi Arabia and Canada.[115] Moreover, because much of the country remains unexplored, it is believed that Iraq has the potential to add from 45 billion to 115 billion barrels to its proved reserve base.[116] Iraq's production peaked in 1979 at 3.7 million barrels per day[117] and fell gradually to 3.5 million daily barrels by 1991.[118] After production was interrupted in the wake of the first Persian Gulf War, it began a slow recovery, reaching almost 2.6 million barrels per day by 2003, when Operation Iraqi Freedom was initiated. Currently the country has almost returned to pre-war levels. At present Iraq is America's 7th largest source of oil imports, providing 4.1 percent of the total imports and 2.3 percent of the total supply.[119]

Oil and Insurgency

Clearly the single most important factor regarding Iraq's reliability as a source of oil imports is the ongoing insurgency that has plagued the nation in the aftermath of Operation Iraqi Freedom. The threat to that nation's oil industry increased exponentially after Osama bin Laden issued his December 2004 "fatwa" calling on insurgents to target oil facilities there.[120]

Since June of 2003, there have been 315 attacks on oil pipelines and infrastructure in Iraq — an average of 8.75 per month.[121] The attacks were most heavy in 2004 and 2005, totaling 248 for the two-year period, an average of roughly one every three days.[122] The cost of these attacks in lost revenues is staggering.

In just one period, May of 2004, according to the U.S. Army Corps of Engineers, Iraqi exports fell to 860,000 barrels per day from their normal 1.6 million to 1.9 million daily barrels due to disruptions.[123] Even if the most conservative estimate of the impact of the disruptions exports is taken, it still means that Iraq lost over $20 million per day in oil revenues during this period.[124]

With over 4,300 miles of pipelines, preventing such attacks is a daunting task, and that, too, carries a cost. According to recent testimony by Stewart Bowen, the Special Inspector General for Iraq Reconstruction, some $147 million has already been spent on an unsuccessful program to harden vulnerable points within the country's oil and gas infrastructure — and that figure does not take into consideration the enormous cost of maintaining a force of some 14,000 guards to provide pipeline security.

But security is only one concern regarding Iraqi oil production. An even greater one is the condition of its existing oil fields and infrastructure.

The Legacy of Neglect and Greed

Two oil fields, Rumalia in the south and Kirkuk in the north, provide the bulk of Iraqi oil exports. There is concern, however, that both of these fields may have been damaged prior to the war through overproduction and poor maintenance. Moreover, the failure to repair critical infrastructure essential to oil field operations during the reign of Saddam Hussein has seriously hampered efforts to increase output.

At the Rumalia oilfield in the south, it is necessary to inject water into the formation to maintain sufficient pressure for the oil to flow. However, the Qarmat Ali treatment plant that provides water for this purpose was allowed to fall into disrepair, and repairs have yet to be completed as of this writing. The problem is that without adequate water flow, field pressure could be damaged reducing ultimate recovery.

In the north, the Kirkuk oilfield was operated at an excessively high rate in the weeks prior to Operation Iraqi Freedom (680,000 barrels per day vs. an optimum 250,000 rate) possibly damaging the formation and again jeopardizing ultimate recovery.

While high hopes have been expressed concerning Iraq's potential for expanded production, the first order of business must be to restore and repair facilities necessary to maintain current production, and this task is proceeding slowly. Once the political and military situation is stabilized, progress may accelerate, but the development of expanded production through the discovery of new fields will be a matter of years, at the least, and perhaps a matter of decades.

Indeed, there is a very real danger that current production levels could sharply decline if the concerns over possible damage to Iraq's existing fields prove justified. Given the early hope that increased Iraqi oil exports could help to offset declines in other, aging petroleum provinces and also help reduce the influence of authoritarian states on the global market, this potential is especially problematical.

The question is, given the questionable reliability of countries that in combination provide the U.S. with almost 40 percent of its imported oil, what should be done for the nation and, more specifically, for Florida?

Addressing the Energy Dilemma

The first task that must be accomplished in addressing our energy dilemma is to understand that we actually face two problems. The first is how to resolve the short-term need to ensure adequate supplies of liquid fuels over the short-to-intermediate term. The second is how to accomplish a transition to secure alternatives.

Understanding the First Problem

At the heart of the first problem is the need to ensure adequate supplies of liquid transportation fuels for the existing fleet. There are currently over 220 million privately owned vehicles (cars and light trucks) in the United States,[125] with an average age of around 6.8 years[126] and an effective useful life of 20 years.

More important, virtually all of the vehicles in the existing fleet require either gasoline or diesel fuel to operate. What this means is that even if every new car purchased from this point forward used an alternative fuel, there would still be a need for conventional fuels for at least two decades.

In reality, purchases of vehicles fueled by alternatives to petroleum are a miniscule

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proportion of vehicle sales. For example, in 2005 a total of 17,150,000 cars and light trucks were purchased for private use in the United States.[127] In 2004, according to Oak Ridge National Laboratory, the total number of alternative fueled vehicles in the U.S., including both dedicated and flex fuel models, was 547,904.[128] If the estimated 200,000 hybrid vehicles purchased in 2005 is added to that figure, it still yields a total of around 750,000 for all of the alternative-fuel-capable vehicles on the road in the U.S. This is equal to roughly 4.4 percent of annual new car purchases.[129] In terms of the total fleet, alternative fueled vehicles of all types amount to around one-ten thousandth of a percent. This is not to say that it is not important to move to alternative fueled vehicles. Rather it is to demonstrate that they do not represent a near-term solution.

The same holds true for most alternative fuels. Currently, the most important alternative fuel is ethanol, which contributes around 260,000 barrels per day to the total supply.[130] At present most fuel ethanol used in the United States is produced from corn, limiting the potential supply. Progress is being made, however, on the production of fuel ethanol from cellulose, which would allow dramatic expansions of production. Many members of Congress have endorsed a goal of producing at least 25 percent of domestic energy from renewable sources by the year 2025. Although admirable, and perhaps attainable under the right circumstances, it still does not address the near-term problem, and for Florida that is a critical point.

Florida, Tourism, and the Automobile

Clearly, tourism is the foundation of Florida's economy. In 2005, the estimated 85.8 million tourists who visited Florida spent an estimated $62 billion, generating $57 billion in taxable sales.[131] Fully 12 percent of all non-agricultural employment in Florida, equaling 912,700 jobs, is tourism-related.[132] It is expected that this year 87.9 million people will visit the state and that by 2014 the figure will reach 107.1 million[133] — unless disruptions in the nation's energy supply stifles the travel industry.

The automobile is central to the continuing success of Florida tourism. According to the Florida Department of Transportation, roughly half of Florida's visitors arrive by automobile (49 percent in 2004).[134] Another 43 percent arrive on domestic airlines. Of the balance, 2 percent arrive on Canadian airlines and the remaining 6 percent by international air carriers.[135] Of those who arrived by air, roughly half rent an automobile. Therefore, 75 percent of Florida tourists will use an automobile during their stay.

Additionally, visitors who arrive by automobile tend to be in larger groups. Analysts attribute this to the lack of marginal cost for additional passengers — a point that is simple common sense. It costs no more to load up a family of four into a car than it does for an individual to travel by this mode. In contrast a ticket must be purchased for each air passenger.

It is also notable that from 2000 to 2004, the proportion of foreign travelers arriving in Florida fell by 27.3 percent, declining from 11 percent of the total to 8 percent.[136] Some of this decline has been attributed to post 9/11 restrictions on foreign travelers.

What is most important to recognize is that 92 percent of Florida tourism originates in the United States, and that it is heavily automobile dependent.[137] The Florida Department of Transportation notes that when combined with resident tourism, the vast majority of all Florida tourism is generated domestically. Therefore, ensuring a flow of liquid fuels within the U.S. domestic market is essential to the continuing health of the Florida tourist industry and the state's overall economy.

Meeting Florida's Energy Needs

To understand how to meet Florida's energy needs, it is first necessary to understand that the United States does not suffer from a lack of natural resources. Indeed, there isn't even a lack of oil resources. Consider the following:

According to the United States Geological Survey (USGS) the United States has almost 175 million barrels of oil reserves.[138] These include 21.9 billion barrels of "proved" reserves, e.g. reserves whose presence have been confirmed through drilling and can be developed and produced quickly at existing prices.[139] The USGS also estimates that the nation has more than 150 billion barrels of "undiscovered" reserves.[140]

The USGS also estimates that the United States has 1,430.6 trillion cubic feet of natural gas reserves, plus an estimated 23.6 billion barrels of natural gas liquids reserves — products such as propane, butane, and ethane — in the U.S. resource base.[141]

There's more: The United States has often been called "the Saudi Arabia of coal," with 496.1 billion tons of demonstrated reserves.[142] That's 27 percent of the entire world's total.[143]

Finally, the United States also has between 500 billion and 1.1 trillion barrels of oil in the form of oil shale.[144]

But the figures above represent only the conventional energy resources. According to Oak Ridge National Laboratory, the United States produces 1.366 billion tons of biomass waste annually.[145] Using a conservative estimate, this renewable resource could be used to produce at least 1.2 billion barrels of oil equivalent annually, roughly 3.3 million barrels per day. Moreover, this figure represents only the potential of waste biomass. Biomass specifically grown for energy purposes could significantly increase this figure.

A final alternative is what are called "methane hydrates," deposits of natural gas trapped in ice that is found deep in the ocean or underground in frigid regions such as Alaska. In total, methane hydrate deposits in U.S. territory and offshore are believed to contain 320,222 trillion cubic feet of natural gas, the equivalent of 51.1 trillion barrels of oil.[146] In fact, one onshore methane hydrate deposit in Alaska is known to contain 519 cubic feet of natural gas, the equivalent of 82.9 billion barrels of oil.[147] However, it would take time to develop these less conventional resources, and it may not be time the nation and Florida can spare.

In the short run, though there are steps that can be taken to ease the transition of other sources of liquid fuels. One of the most important of these is to in essence buy time by reducing non-transportation use. Indeed, non-transportation use may provide some of the best near-term alternatives for reducing our import dependence.

The Potential in the Non-Transportation Sector

The fact that roughly two-thirds of the oil America consumes is used in the transportation sector means that one-third is not. This fundamental truth is often overlooked when discussing the nation's oil import dilemma. In fact, roughly 26 percent of oil use is as industrial boiler fuel.[148] During the week of July 7, 2006, the most recent reporting period, our nation consumed roughly 4.8 million barrels per day of distillate and residual fuel oil.[149] Virtually all of this market could be served by bio-oil produced from waste material.

As noted, Oak Ridge National Laboratory estimates annual biomass waste at approximately 1.366 billion tons. Of this, at least 60 percent — about 820 million tons — is in the form of forestry and crop waste or other forms of cellulosic materials. A process that has recently become commercially available in Canada could transform this waste into over 1.8 billion barrels of bio-oil, or almost 5 million barrels per day — an amount sufficient to entirely replace the boiler fuel now refined from oil.[150]

DynaMotive Energy Systems of Vancouver, B.C., Canada, the developer of the process, has concluded its commercial demonstration of the technology with a pilot facility that transforms 50 tons per day of wood waste from a sawmill into sufficient fuel to power a 1.5 Megawatt electrical generating plant, and the company is expecting to initiate construction on several full-sized 200 ton per day plants this year.[151] This process is just one example of technologies that are currently available to make use of this vast waste resource.

A second area where vast strides could be made utilizing existing technology is in improving home efficiency, especially for heating and air conditioning. Over 170 million barrels per year are used for home heating, an average of nearly 500,000 barrels per day.[152]. Home heating, ventilation, and cooling (HVAC) consumed 356 billion kilowatt hours in 2005.[153] That's 31 percent of the total use by U.S. households. Virtually all of the oil used for home heating and a substantial portion of the electricity used could be eliminated with the widespread application of the appropriate existing technologies.[154]

For example, in Moline, Illinois, a small company, Alternative Energy Builders (AEB), has reduced residential energy consumption in the homes it builds by 80 percent or more by using a combination of geothermal (also called ground source) heat pumps, advanced lighting systems

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(compact fluorescent bulbs) and other existing technologies. More important, the homes that this particular firm builds actually sell for 15 percent less than conventional units that do not have the energy saving features.[155]

It is interesting to note, in regard to geothermal or ground source heat pumps, that despite their higher cost of installation, they actually save the consumer money from the day they are installed. For example, in the Southeastern United States, monthly HVAC costs averaged $182.25.[156] On new home construction, assuming conventional 30-year financing, including a geothermal or ground source heat pump in the original construction would add $36.46 to the buyer's monthly mortgage payment. That would amount to a net savings of $145.79 from the day the buyer moves into the house.

In the case of retrofitting a geothermal or ground source heat pump to replace a conventional system, assuming it is financed with a 10-year conventional home improvement loan, the monthly payment would be $141.12. That would amount to a monthly savings of approximately $41.13 for the term of the loan, rising to $182.25 once the loan is paid off and the system continues to function effectively. In short, installing such a system would not only serve to reduce energy consumption but would also save the purchaser money from the first day of operation.

The only real question is why such HVAC systems are not in wider use. Part of the answer is that for much of the post WWII era, both heating oil and electricity were so inexpensive that there was little incentive for consumers to seek other options. Also, their initial installation cost was higher than conventional HVAC systems, and that acted as a further deterrent to consumer interest. With the new realities of energy prices, however, they provide an attractive way of reducing energy costs and consumption.

High initial costs have served to deter consumer interest in several other energy-saving technologies. For example, compact fluorescent light bulbs use only about 25 percent as much electricity as a standard incandescent bulb and last up to five years. Nevertheless, even though their lifecycle costs are lower than incandescent bulbs, most consumers still opt for the older, less efficient lighting system.

Another barrier has been homebuilders' resistance to the adoption of new techniques. For example, using 2x6 studs rather than the traditional 2x4 allows the installation of an additional two inches of insulation in a wall, yielding greatly reduced heating and cooling requirements. But 2x4 studs are traditional, and despite the minimal incremental cost, most builders have not considered using the more efficient alternative.

Yet, employing existing, proven energy efficiency technologies could result in greatly reduced domestic energy consumption in the residential sector. To illustrate, if the estimated 600,000 homes destroyed by the recent Gulf Coast hurricanes were replaced with energy efficient homes like those built by AEB, electricity consumption in the region could be reduced by 960 Megawatts, roughly the equivalent of a large electric generating plant.

Even though substantial reductions in oil use and other energy requirements can be achieved by such practices as substituting bio-oil for industrial fuel oil and building energy-efficient homes, these actions will take time to implement. In the interim, steps must be taken to make the maximum possible use of our domestic oil and gas resources. Among the most important is the development of America's offshore oil resources.

Beginnings of the OCS

In the late 1880s, citizens living in Summerland, California began producing crude oil and natural gas from the prolific springs that were found in their area. After a time, they learned through experience that the most prolific wells were those nearest to the beach. Eventually, they began drilling on the beach itself.

One local resident, H.L. Williams realized that the closer the wells were to the water, the more productive they were. He came up with the idea of building a wharf extending over the water and putting a drilling rig on it. He reasoned that if the beach was good, the ocean might be better. He built a pier extending about 300 feet offshore and drilled. His intuition proved right. The well was even more productive than those on land. In short order, many others followed suit with one pier stretching over 1,200 feet from shore.

Over the ensuing decades technology steadily improved, but it was not until 1947 that Kerr-McGee was able to drill the first well from a fixed offshore platform that was out of sight of land. With this innovation the modern offshore oil industry was born.

As oil revenues became an increasingly important source for federal coffers, the government stepped in to clear questions concerning ownership of offshore lands. In 1953, Congress passed the U.S. Submerged Lands Act that ceded title to all lands beyond the three-mile limit to the federal government. In that same year Congress also passed the Outer Continental Shelf (OCS) Lands Act, which gave control of mineral development within the OCS to the Secretary of the Interior. Over the years additional legislation was enacted to protect the environment when OCS resources were developed and to regulate the discharge of pollutants.

The Current Situation

Today, the offshore oil and gas resources are a vital factor in our domestic energy mix. Indeed, in 2003 the Gulf of Mexico alone accounted for 29 percent of the oil produced in the United States and 22 percent of domestic natural gas production.[157] To put the importance of this production in perspective, the roughly 1.5 million barrels of oil produced daily in the Central and Western Gulf of Mexico equaled or exceeded the volume of nine out of ten of America's top foreign oil suppliers, including Saudi Arabia, Venezuela, Mexico and Nigeria.[158] Further, the offshore areas of the Outer Continental Shelf have demonstrated their ability to sustain and expand production of domestic supplies of both oil and natural gas. Indeed, between 1995 and 2002, deepwater oil production rose by 535 percent and deepwater gas by 620 percent.[159]

According to the Minerals Management Service, there are 288 trillion cubic feet of undiscovered natural gas and 59 billion barrels of undiscovered oil in the offshore areas off the lower 48 states.[160] These resources are sufficient to:

- Replace all imports from the Persian Gulf for a period of 59 years;
- Maintain current levels of oil production for more than a century;
- Maintain current levels of natural gas production for 70 years;
- Heat 72 million homes for 60 years;
- Supply all defense needs for three and one-quarter centuries.

Moreover, these figures do not take into account an additional 27 billion barrels of oil and 132 trillion cubic feet of natural gas that remain to be discovered in areas off the coast of Alaska.[161]

Florida and Offshore Development

Given the critical importance of tourism to the Florida economy, there has been understandable concern regarding the impact offshore oil and gas development might have on that critical economic sector. The principal concerns arise from the potential for oil spills to damage Florida beaches and unsightly oil rigs to disrupt scenic vistas viewed from the shore.

The Potential for Oil Spills

The concern over the potential for oil spills to damage Florida beaches is entirely understandable. For most people, the phrase "oil spill" conjures up images of the January 29, 1969, oil spill off the California coast at Santa Barbara. The spill occurred when a Union Oil Company platform some six miles offshore suffered a blowout. As workers attempted to retrieve the drill pipe in order to replace the drilling bit, a natural gas blowout occurred. As workers attempted unsuccessfully to staunch the flow, the buildup of pressure caused a number of ruptures in the sea floor allowing oil and natural gas to erupt from the fissures that were created.

Over the next 11 days, as workers fought to close the ruptures, some 200,000 gallons of crude oil rose to the surface ultimately creating an 800-square-mile oil slick. The viscous crude oil soon blanketed a 35 mile long stretch from Ricon Point to Goleta. The oil slick also covered Frenchy's Cove on Anacapa Island, as well as the beaches on Santa Rosa, Santa Cruz, and San Miguel Islands.

It was an ecological disaster of enormous proportions that left a lasting impression on the public. But 1969 was 37 years ago and much has transpired since. The public outrage that arose in the wake of the Santa Barbara spill gave rise to a flurry of legislative actions in Congress, including enactment of the National Environmental Policy Act, the Coastal Zone Management Act, and the Federal Oil and Gas

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“*Moreover, the military needs the oil that could be produced in the Gulf even more than the civilian economy.*”

Royalty Management Act, which mandates protection of the environment and conservation of federal lands in the course of building oil and gas facilities.

The effectiveness of these measures is evident in the performance of the offshore industry over the last several decades. A study by the USGS Minerals Management Service examined spill data from offshore oil rigs, tankers, and barges over a 35-year period. The analysis looked at the entire period and also at the period between 1985 and 1999. It looked at the number of spills, their size, and their source. The most important finding of the analysis is that there had been no oil spills whatsoever from offshore platforms during the entire period.[162]

A report by the Coast Guard, which examined spill data through the year 2000, yielded similar results. It determined that 96.5 percent of all oil spills that occurred over a 10-year period were less than 100 gallons, with the average spill just 5 gallons.[163] Moreover, even during the recent Gulf of Mexico hurricanes, no significant spills occurred offshore. Indeed, the single largest source of spills is from pleasure boaters refueling their craft.

In short, there is little reason to be concerned about the prospect of a major spill from an offshore oil platform.

The Impact on Scenic Vistas

Another understandable concern is the potential for offshore platforms to spoil scenic vistas — an important consideration in a state such as Florida, which is dependent on tourism. This concern, however, is based on a misunderstanding about where offshore oil production takes place. Most offshore deposits are in regions as far as 100 miles from the coast. Due to the curvature of the Earth, however, nothing beyond roughly 12 miles can be seen from shore — it is below the horizon. As a result, offshore platforms would not be visible from tourist areas.

Other Concerns

One concern that has been expressed in some quarters is over the impact of offshore oil rigs on fishing — another important element of Florida tourism. Not only is the concern unfounded, the truth is that offshore rigs actually serve to enhance fisheries. In Louisiana, where some 90 percent of the Gulf of Mexico’s oil platforms are located, “rig” fishing has become a popular pastime. It has long been established that oil platforms act like artificial reefs providing additional habitats for fish and other marine life. In fact, there is a proposal to convert outdated or abandoned rigs into fish farms — something already being done in Asia.

Another concern that has been raised is that the presence of offshore oil platforms could interfere with military exercises — especially naval gunnery practice. This concern, however, can readily be addressed through lease stipulations — something that is already done. Moreover, the military needs the oil that could be produced in the Gulf even more than the civilian economy.

To illustrate, the 582,000 troops deployed to the Persian Gulf for Operation Desert Storm consumed more than twice as much oil on a daily basis as the entire 2-million man Allied Expeditionary Force that liberated Europe during World War II.[164] But military oil requirements rose even further in the years that followed.

The withdrawal of forward-positioned personnel in Europe that resulted from the end of the Cold War created an increasing reliance on troops stationed in the United States. At the same time, military operational planning came to rely increasingly on the deployment of Reserve and National Guard forces in times of conflict, creating even greater transportation fuel requirements. In addition, new strategies that relied more heavily on maneuver and air power resulted in yet another increase in the basic fuel requirement. As a result, the amount of oil needed per deployed military personnel increased by 20 percent between Operation Desert Storm and Operation Iraqi Freedom, now the equivalent of one barrel of refined petroleum products per soldier per day.[165] Clearly, then, it is in the interest of the military to have our nation depend on domestic sources for critical refined petroleum products to the greatest degree possible.

Conclusion

It is clear that over time, our nation must shift to alternative sources of energy to meet its needs. But in the short term, the likely contribution that these new forms of energy can make is limited by technical and infrastructural factors.

Meanwhile, the competition for petroleum and refined petroleum products in the global market is becoming more intense, and the security of the supply more uncertain. It is clear that our nation must take full advantage of the domestic resources it has at its disposal in order to ease the transition to a new energy future.

For Florida the need is especially great. As a state with an economy heavily dependent on tourism and— more specifically — on domestic tourism, the availability of liquid fuels for both automobile and air transportation is of critical importance.

Developing our nation's offshore oil and gas resources is a key element in any strategy aimed at maximizing the use of domestic energy resources. Moreover, on close examination, the objections raised in regard to offshore oil and gas development are based on a misunderstanding of the facts surrounding contemporary production techniques and safety measures.

In short, developing the oil and gas resources that can be found in the nation's offshore areas is imperative if the nation's economic and military security is to be ensured.

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