The National Defense Council Foundation
Issue Alert

MEETING DEFENSE FUEL NEEDS: THE FISCHER TROPSCH PROCESS

June 7, 2005

INTRODUCTION

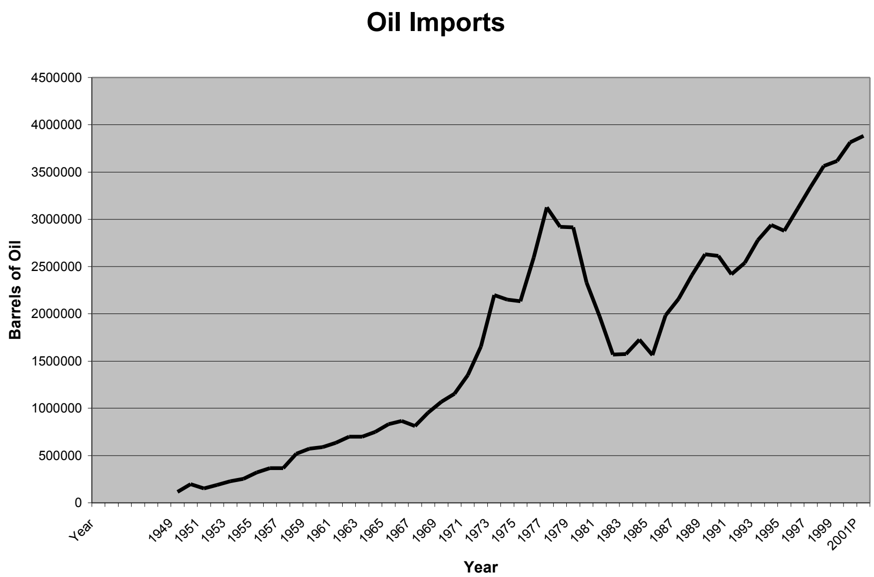
Oil is the lifeblood of both the American economy and its military establishment. Indeed, it would be difficult to imagine a commodity that has had such a pervasive impact on virtually every area of human endeavor. From transportation to medicine, from agriculture to manufacturing, oil remains an essential element. While most people take oil for granted, like the air that they breathe, its absence is soon noted. Yet, today, as never before in American history, access to this vital commodity is growing increasingly tenuous.

The consequences of our continuing reliance on imported oil cut across all sectors of the economy and impose an enormous economic penalty. Moreover, the evolving global threat environment makes U.S. import dependence more than just an economic issue, but rather, an issue with critical implications for national defense. Therefore addressing America's continued need for imported crude oil and refined petroleum products is a priority that requires urgent attention.

Fortunately solutions do exist, but in order to determine the best course to take, it is first necessary to understand the nation's current circumstances.

THE CURRENT IMPORT SITUATION

In 1973 at the time of the Arab Oil Embargo, the United States was importing 34.5% of its crude oil and refined petroleum products with 4.9% of our oil supplies coming from the Persian Gulf. (1) Despite the clear warning to reduce imports implicit in the Embargo and its consequences, nothing has been done. As a result, today, nearly 60% of our crude oil and refined products are imported, with 11.2% of domestic consumption accounted for by oil from the Persian Gulf. (2)



INSECURE SUPPLIERS

Yet, it is not just imports per se that are at issue. Of even greater concern is the fact that a substantial portion of the oil we import comes from nations that are unreliable suppliers. Specifically, four of the top six sources of U.S. imports, Saudi Arabia, Venezuela, Nigeria and Iraq cannot be considered secure sources of supply. Together these four nations provide 40.5% of U.S. imports and account for 24% of domestic oil consumption. (3)

Terrorism, domestic unrest and hostility to the United States all contribute to their questionable reliability.

In the case of Saudi Arabia, there has been rising hostility against the United States, and a growing al-Qaeda presence. In Venezuela, the current government is openly hostile to America and has even threatened to cut off oil exports. In Nigeria, ethnic unrest and lawlessness are currently causing the loss of 135,000 barrels of crude oil per day. (4) In Iraq, insurgents have targeted oil pipelines and production facilities as a key element of their strategy. (5)

COMPETITION FOR SUPPLIES

Even nations we consider secure sources of supply such as Canada and Mexico may no longer be as reliable as once thought. Because of their proximity, the prevailing view has long been that the U.S. would have first call on oil production from its near neighbors. Yet, overtures by China now call that assumption into question.

The Chinese economy has been growing at between 9% and 10% for more than a decade. (6) As a result, its demand for oil has grown accordingly. Unable to provide for its oil needs from domestic sources, China has become an ever-larger factor in the world oil market, most recently accounting for 40% of the total increase in global oil demand. (7) To meet its burgeoning thirst for oil, China has sought to make inroads with traditional U.S. suppliers such as Mexico, Canada and Venezuela by offering large amounts of capital investment to help develop their resources. China is already operating two oil fields in Venezuela and has proposed a multi-billion dollar investment in Canadian tar sands. (8) In the future, as an investor and partner in developing resources in nations that were traditional U.S. suppliers, China may have an advantageous position in the competition for their oil production. As a result, import sources once believed a last resort in times of crisis may no longer be assured.

A SAUDI SHORTFALL?

Moreover, regardless of domestic unrest, the capability of Saudi Arabia to fulfill its traditional role as a moderating influence on world oil markets is also in question.

Although the Saudi Oil Ministry claims it will increase output by 3 million barrels per day by 2010, both external analyses and documents from Aramco, the consortium that produces Saudi oil raise serious doubts that the goal can be met.

Matt Simmons, a well-respected oil analyst first raised the issue in 2004, claiming that a lack of investment, poor production practices and other factors have combined to virtually eliminate Saudi Arabia's ability to increase its production. Moreover, Aramco has estimated that Saudi Arabia will be producing around 10.15 million barrels of oil per day in 2011. This is roughly what they currently produce. (9)

The potential failure of Saudi Arabia to meet its projected production growth holds significant implications for the global oil market.

WILL FUTURE DEMAND BE MET?

According to Energy Information Administration (EIA) world oil demand will grow from its current level of 79.5 million barrels per day to 120.3 million barrels per day by 2025. (10) This will require the production of an additional 40.8 million barrels of oil daily. (11) EIA further projects that of this amount, the share accounted for by *the Middle East will rise from 26.2% of world oil production to 31.9%. (12) This, in turn, means that increased production from the Middle East (primarily Saudi Arabia) will account for 42.9% of the total gain. (13) Moreover, the Energy Information Administration estimates that there is a total of 1,550,000 barrels per day of "surge" capacity among the world's oil producers. (14) Of this amount, however, 1,500,000 barrels per day – virtually the entire amount – lies in Saudi Arabia. (15)

In the short run this means that if Matt Simmons is correct, there is in fact almost no ability to quickly increase global oil production. In the long run, this means that if Saudi Arabia cannot meet its production targets, a serious shortfall of supply will inevitably evolve.

For the United States, such an eventuality would turn an anticipated oil supply shortfall into a crisis.

But why is this the case and how likely is it that a shortfall will in fact arise?

A WORSENING PROBLEM

At the heart of the problem is the burgeoning global demand for transportation fuels. While the automobile has long been a fixture in the industrialized nations of the West, it is becoming an increasing presence is the rest of the world as well. In 1970, there were some 246 million motor vehicles registered around the world. (16) Of these 44 percent were registered in the United States. (17) By 1992, a little more than two decades later, that number had mushroomed to 614 million – over two and a half times the 1970 level. (18) In fact, since 1970, the world has added 16 million vehicles to its inventory annually. (19) But what is more significant is that in 1992, the U.S. share of the global motor vehicle

fleet had declined to 31% and that trend has continued. (20) As of 2002, the most recent year for which final data is available, the U.S. accounted for 22.5% of world automobile registrations.
It is important to recognize that the decline in the proportional share of the fleet accounted for by American drivers does not reflect a decline in domestic automobile ownership. Rather it reflects an increase in automobile ownership in the rest of the world. Even at current growth rates – roughly 16 million new vehicles added each year – this means that the world's inventory of motor vehicles will rise to 1.1 billion by 2025. (21) But there is cause to believe that the rate at which new vehicles are added will rise.

NEWFOUND WEALTH IN THE DEVELOPING WORLD

One of the principle reasons the rate at which new vehicles are added to the global inventory can be expected to rise is found in the explosive economic growth rates of China, India and the newly democratic states of Eastern Europe. The Chinese economy has been growing at between 9% and 10% annually. (22) India's economy grew at an average of 6.1% from 1992 to 2004. (23) In Eastern Europe the experience has been similar with GDP increasing from 6% to as much as 9% depending on the country. (24) In contrast, the U.S. economy grew at 4.4% in 2004, Japan at 2.9%, Germany at 1.7%, France at 2.1% and the United Kingdom at 3.2%. (25) Indeed, in 2004, while the world's economic growth rate averaged 5%, the industrialized nations of the OECD averaged 3.4%, while the developing non-OECD nations averaged 7.2%. (26)

THE DOMESTIC PICTURE

There can be little question that America's incipient energy crisis arises from the unique position occupied by motor vehicles in the U.S. economy. In 1900 there were only about 8,000 automobiles registered in the United States. (27) Five years later, that figure had grown to 78,000. By 1925 it was 17 million and by 1940, more than 40 million. (28) Today, there are roughly 220 million privately owned vehicles registered in the United States. (29)

As a result, at 784.5 vehicle registrations per 1,000 people, the U.S. has the highest rate of motor vehicle ownership in the world. (30) In contrast, the corresponding figure for Germany is 571.4, for France 614.7, for Japan 673.4 and for the United Kingdom 417.3. (31)In fact, there are actually 1.06 registered motor vehicles for each licensed driver in the United States, and some 18.3% of all U.S. households own 3 or more vehicles. (32)

But even these stunning figures do not tell the whole story.

Of even greater importance is the shift in the makeup of the domestic fleet of privately owned vehicles.

Through most of the early post-World War II period, the private vehicle market was dominated by automobile purchases. In fact, as late as 1985, automobiles accounted for 72.1% of light vehicle sales, with light trucks comprising the other 27.9%. (33) But in the 1990s, the growing popularity of Sport Utility Vehicles (SUVs) began to shift the balance in sales. In 1995, SUVs accounted for 40.5% of light vehicle sales – some 13.4% more than just a decade earlier. (34)

More important, the trend continued to accelerate with light truck sales surpassing automobile sales in 2002 when they won a 51% market share. In 2003, their market share rose further to 52.8%. (35)

What is particularly important about this shift in the makeup of the U.S. privately owned vehicle fleet is its impact on fuel consumption. While the average fuel economy of automobiles was 29.3 miles per gallon in 2004, for light trucks it was only 21.5 miles per gallon. (36) When light trucks comprised less than 20% of the private fleet as was the case in 1976, their impact on overall fleet fuel economy was far less significant than it is today when they comprise more than half. Indeed, as a result of the large numbers of trucks used for private travel, even though automobiles average 29.3 mpg, (37) the overall average fuel economy for private vehicles is only 21.7 mpg. (38)

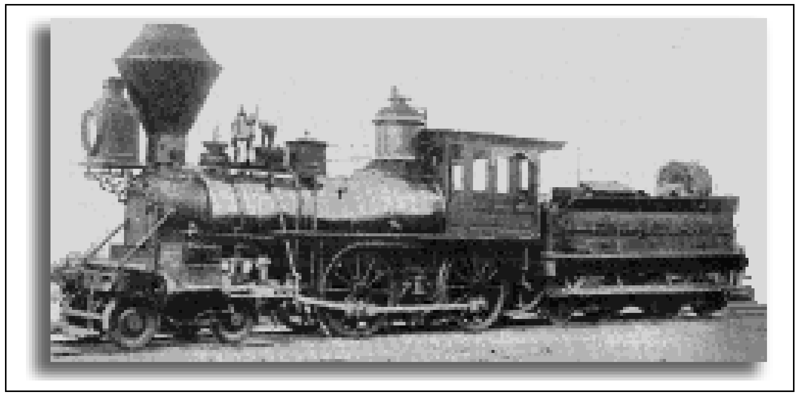
With the number of vehicles on the road increasing at an average of 2% annually, (39) and the number of miles traveled increasing at an annual rate of 2.4% (40) the implications of eroding fuel efficiency on the potential for increasing fuel use are enormous.

So, too, is the continuation of the long-term trend towards shifting freight transportation from rail to trucks.

FREIGHT TRANSPORTATION

Most individual seldom give much thought to the transportation of freight within the economy – except when problems arise. Yet, freight transportation is an essential element of all economic activity. Nearly seven million businesses and over 100 million U.S. households rely on freight transportation to supply them with the entire range of goods and services essential to daily life. (41)

Throughout the 19th and early 20th centuries railroads were the principal means of transporting both individuals and freight in the United States. The expansion of U.S. rail service during this period was truly impressive with an average of 7,000 miles of track added annually, peaking at 254,251 miles in 1916. But the advent of the internal combustion spelled an end to the railroad monopoly on freight movement, and the automobiles provided an alternative means of personal transportation. (42)



Except for a brief resurgence during WW II when gasoline rationing constrained motor transport, the position of U.S. railroads steadily declined with the amount of route mileage falling to 147,210, a reduction of almost 42% from the 1916 peak. (43)

Today, trucks account for 65.9% of all freight moved in the U.S. when calculated in terms of tonnage, and 73.1% when calculated in terms of value.(44) Moreover, the lion's share of freight moved by rail is accounted for by coal shipments.

The rise of intermodal freight transport will further increase the dominance of truck transport.

Taken together, the anticipated increase in the automobile inventory and the continuing shift of freight to truck transport will nearly double the nation's motor fuel requirements by the year 2025. (45)

What remains to be determined, however, is not only the availability of sufficient crude oil to meet this need, but the availability of sufficient refining capacity as well.

THE CONTINUING REFINERY SHORTAGE.

Crude oil is only of use if it can be transformed into fuel through petroleum refining. From the early 1980s to the mid-1990s, U.S. refining capacity steadily declined, with numerous refineries closing and no new refineries being built. This trend was halted in 1996 with the addition of 1.4 million barrels of new refining capacity through additions to existing facilities. (46) Even with such additions, however, domestic refining capacity is only expected to reach 21.4 million barrels per day by 2025 – a time when domestic demand for refined products is projected to be between 27 million and 28 million barrels per day. (47)

Thus, under even the most optimistic projections, it is expected that the U.S. will have to import between 5 million and 6 million barrels of refined petroleum products daily.

IMPACT OF GROWING IMPORT DEPENDENCE

The consequences of America's dependence on imported oil are more than mere academic questions or theoretical premises. They are reflected in real and continuing economic costs manifest in both the civilian and military sectors.

In the civilian economy the need to send roughly $180 billion overseas to purchase foreign oil has a direct and tangible effect on U.S. GDP. Specifically, when all of the economic impacts are calculated total some $396.2 billion. (48) But the costs imposed on the civilian economy are not the only economic consequence of our import dependence. The U.S. also spends $49.1 billion to maintain the capability to assure the flow of oil from the Persian Gulf. (49) This figure it should be noted does not include the cost of Operation Iraqi Freedom.

Taken together, these costs are the equivalent of adding $5.04 to the price of a gallon of gasoline, or $211.68 to the cost of a barrel of oil. (50)

But the cost of imports is measured in more than dollars. It is also measured in jobs that are exported as a consequence of sending such huge amounts of capital abroad. The total job loss associated with foreign oil imports comes to roughly 1.5 million. (51)

In addition to the effect on America's economy, its reliance on foreign supplies of crude oil and refined petroleum products also has an adverse impact on the nation's ability to defend itself. This impact will become ever greater in the years ahead as a consequence of the new strategic paradigm.

DEFENSE TRANSFORMATION AND ENERGY SECURITY

With the demise of the Soviet Empire and its characteristic bipolar threat environment, it was necessary for the Department of Defense to develop a doctrine that took into account the new global threat environment.

In FM 100-5, its statement of doctrine, the United States Army succinctly described the problem:

> *"The global realities of today are in a period of significant change. Army forces may find themselves called upon to fight under conditions of rapid force projection, that can build to major sustained operations in war and peace or that can terminate quickly only to lead to other commitments elsewhere."* (52)

The recent experience in the Global War on Terrorism in which operation Enduring Freedom saw military operations rise to a peak and then subside only to be followed by Operation Iraqi Freedom is a testament to the validity of this concept.

In order to accommodate the needs of the new global threat environment the Department of Defense has been developing a doctrine called *"Rapid Decisive Operations*," or

"*RDO.*" A central element of this doctrine is that *"Speed must be both absolute and relative to the adversary."* (53) To achieve that speed, in the future, the force must be mobile and flexible on a radically changed global threat landscape. As the RDO white paper notes:

> *"We can no longer plan on having months or even weeks to deploy massive theater forces into a region rich in unthreatened infrastructure, while delaying offensive action until favorable force ratios have been achieved. Instead we must plan to engage in the first few hours of the crisis with those capabilities that can be brought to bear quickly, informed by intimate knowledge of the adversary and focused on those objectives most likely to produce the desired effects."* (54)

Even as implementing RDO places new requirements for speed and mobility on our forces, it will also create an enormous new logistical requirement on those responsible for supply the force.

EVOLVING FUEL REQUIREMENTS

Speed and mobility have always been an important strategic element in modern warfare. During the American Civil War General Nathan Bedford Forrest said that the key to victory was to "*Get there first with the most*." That dictum remains valid today.

But achieving the amount of speed and flexibility envisioned by RDO will require substantially increased amounts of fuel, both to transport our forces and to operate them once they arrive in theater. This increased fuel requirement is not a new factor. Rather it is a continuation of a trend that has been in place since the advent of mechanized warfare in World War II.

To illustrate:

A contemporary U.S. Army Heavy Armored Division comprised of 17,500 soldiers uses roughly twice as much fuel on a daily basis as two World War II field armies. (55)

During Operation Desert Storm, the 582,000 U.S. forces deployed to the Middle East consumed over 450,000 barrels of oil per day, more than twice as much as the entire 2 million-man Allied Expeditionary Force that liberated Europe in World War II. (56)

Moreover, the military's requirements continue to grow.

During Operation Iraqi Freedom (OIF), the fuel requirement per deployed soldier increased by almost 23.1% from Operation Desert Storm requirements. (57)

In the years ahead this figure will grow even more.

THE STRYKER BRIGADE COMBAT TEAM

As part of the effort to address the new global threat environment, the Department of Defense is undergoing a process of force restructuring. Called Defense Transformation, the process is looking to create a new, more mobile and more flexible force that can be tailored to the mission at hand. A key element of Defense Transformation is the creation of the Stryker Brigade Combat Teams, or SBCTs, that will serve as a template for the future.

What makes the SBCTs unique is their self-contained nature. In addition to three infantry battalions, they also include a cavalry squadron, a field artillery battalion, a military intelligence company, an engineer company and signal and anti-tank companies. As integrated units, the SBCTs can be deployed independently and tailored to mission requirements.

The 19-ton Stryker Interim Armored Vehicle (IAV) is the key to the new unit's mobility providing a common chassis for a family of ten variants. It has a range of 300 miles at speeds in excess of 60 mph on 53 gallons of fuel. Air transportable by C-130, the Stryker can be sent where it is needed when it is needed. Over 2,000 Stryker variants will be deployed to the six new brigades. (58)

While the SBCT exemplifies the type of unit that will be required to defend America in the new global threat environment, it also underscores the critical role fuel will play as a military commodity on the 21st Century battlefield, because the new capability carries with it an intangible cost: higher fuel requirements. But the real challenge will be to get the fuel where it is needed. The recent experience in Operation Iraqi Freedom demonstrated just how difficult this can be.

THE EXPERIENCE IN IRAQ

Initial planning for OIF assumed called for the 4th Infantry Division to enter Northern Iraq through Turkey. But on March 1, 2003, the Turkish Parliament refused the Coalition permission to use its territory. As a consequence, on March 26th, 2003, a Brigade of the 173rd Airborne was inserted by air into the region. Its normal contingent of light forces was augmented by heavy forces consisting of one Heavy Reaction Company and a Medium Reaction Company. Together, these units added the firepower of 5 M1A1 tanks, 5 M2A2 Bradley Fighting Vehicles 10 M113 Armored Personnel Carriers and 4 M1064 Mortar Carriers to the light infantry. (59)

The original operational plan called for establishment of an on-site fuel depot for the reaction forces containing a 10-day supply of fuel – roughly 22,000 gallons. It was anticipated that the fuel would be acquired locally since Iraq was an oil producing nation and there was, in fact, oil production in the country's northern region. The brigade's quartermasters soon discovered that the petroleum infrastructure in Northern Iraq had been allowed to deteriorate to the point that it was nonfunctional. There was no fuel to be had. (60)

As an alternative, the brigade sought to have the Air Force fly in the needed fuel. But again, the option proved impractical.

The Air Force was unwilling to allow its aircraft to remain on the ground more than 45 minutes, an insufficient amount of time to unload a meaningful amount of fuel. While this was a wise policy in an era of $500 shoulder-fired missiles, it frustrated efforts to assure adequate fuel supplies.

Ultimately the problem was solved when the Turkish government relented and allowed fuel convoys to transit its territory. Absent this concession, the Coalition armored forces in the region would have been rendered immobile. For the Stryker Brigade Combat Teams, the experience in Northern Iraq was a warning.

Just the Infantry battalion of an SBCT will require over 160,000 gallons of fuel for its basic combat load. The full SBCT will require substantially more. Further complicating the task of providing adequate supplies is the decentralized nature of the contemporary threat environment. (61)

Rather than facing a monolithic opponent was the case during the Cold War, the contemporary threat environment could easily give rise to a number of small simultaneous conflicts or non-combat operations of varying levels of intensity. In fact that is exactly what is occurring at the present time with continuing combat operations in Iraq and Afghanistan and recent non-combat operations associated with disaster relief following the December, 2004 Tsunami.

Given the tenuous conditions that pervade the current world oil market, the question is how can we assure that fuel will be available when and where it is needed?

FINDING FUEL FOR THE FUTURE

One of the ironies of America's current oil import dependence and the vulnerability it creates for our Armed Forces is that the United States does not suffer from a shortage of energy resources. For example, the U.S. has over 275 million tons of recoverable coal reserves: enough to last 250 years. (62) U.S. oil shale reserves are equal to 2 Trillion barrels of oil, and it has 189 trillion cubic feet of conventional natural gas reserves. (63) In addition, the U.S. also has the lion's share of the world's methane hydrate reserves. Methane Hydrates are comprised of natural gas trapped within an ice latticework. In total, the U.S. has 520,220 Trillion Cubic Feet of natural gas reserves in the form of methane hydrates – a supply adequate to provide all needs for a millennium. (64)

Although U.S. energy resources are abundant, they are also underutilized. A combination of environmental restrictions, economic factors and the availability of inexpensive foreign oil have hindered the development of domestic resources. But today, with access to overseas oil production constricting and military and civilian needs expanding, the development of additional domestic energy resources is now economically, and possibly politically feasible.

The question that remains is how to transform the raw materials of the resource base into usable energy commodities.

To determine how best to accomplish this goal, it is important to understand what the nation's energy needs are likely to be.

THE NEED: CONVENTIONAL MOTOR FUELS

Any rational analysis of future U.S. energy needs, whether for civilian or military purposes, must take into account one basic fact: for the intermediate term, the primary need will be for conventional motor fuels. The reason for this is quite simple. In the civilian sector, there are currently roughly 220 million privately owned vehicles. (65) These vehicles have a median service life of 16.9 years for automobiles and 15.5 years for light trucks. (66) The range of service life is from one to 25 years. (67) These vehicles will continue to require conventional fuels as long as they are on the road.

For the military the time frame is even longer.

Procurement officials at the Department of Defense have decided to recapitalize combat vehicles once they have completed 20 years of service for an additional 20 years. As a result, in most cases the service life of military vehicles will be at least 40 years and possibly longer. In fact, many of the aircraft in use today have been in service longer than four decades. The B-52 bomber celebrated its 50th year in service in 2002, and the C-130 marked its 50th service year in 2004. (68) The Abrams Tank was first produced in 1978, and 2005 is the Humvee's 20th year of service. (69)

Therefore, even if all new civilian vehicles sold were alternative-fueled, it would still be necessary to continue to produce conventional fuels for at least a quarter-century. Alternative fuel vehicles, however, account for only a small fraction of a percent of all automobile sales. As a result, it is likely to be much longer before their presence in the fleet has a significant impact on the consumption of conventional fuels.

For the military, it would appear necessary to continue to produce conventional fuels for possibly twice as long.

So the task facing the nation's energy planners is how to convert our vast resources into conventional fuel. Fortunately, the technology to do just that has existed for more than 80 years: the Fischer-Tropsch process.

FISCHER TROPSCH AS A SOLUTION

The Fischer-Tropsch process for converting gas to liquid fuels was developed in the late 1920s, with the first pilot plant commencing operations at Mulheim, Germany in 1932. During the WWII, Germany, lacking any domestic petroleum resources utilized the Fischer-Tropsch process in its synthetic fuels program, ultimately producing 200 million gallons of fuel.

In the 1950s, South Africa, which like German lacks domestic significant domestic petroleum resources, began developing a synthetic fuels capability using the Fischer-Tropsch process in combination with other technologies. Today it uses the Fischer-Tropsch process to produce around 165,000 barrels per day of liquid fuels. (70)

BENEFITS OF A DOMESTIC FISCHER-TROPSCH CAPABILITY

In addition to the obvious benefits that would derive from reducing foreign oil imports, there are a number of other ways in which developing a domestic Fischer-Tropsch capability would positively impact the U.S. economy – sometimes in unanticipated ways. Take for example using the process to make liquid fuels from Alaska's stranded natural gas.

ALASKA'S STRANDED GAS

Alaska currently has approximately 104 Trillion Cubic Feet (TCF) of so-called *"stranded*" natural gas. On the basis of energy content, this stranded gas is the equivalent of 16.6 billion barrels of oil. Converted to liquid fuels via the Fischer-Tropsch gas-to-liquids process, it is sufficient to produce 10.6 billion barrels of high-quality fuel. That is enough to add roughly 1.5 million barrels per day to domestic production for a period of twenty years. If the output were reserved for military needs, it would be sufficient to provide all military fuel requirements for 54 years.

But the actual impact on domestic energy supplies will actually be greater than the nominal production.

When a barrel of crude oil is refined, only two-thirds of what is produced is accounted for by gasoline and middle distillates. About 20% is in the form of heavier products such as bunker fuel, which has limited value and cannot be used as a transportation fuel. In contrast, 100% of the output of a gas-to-liquids is in the form of useful fuels. Therefore, each barrel of fuel produced from natural gas through the Fischer-Tropsch process actually replaces 1.5 barrels of crude oil. (71)

But that is not the only advantage.

Diesel fuel produced from natural gas using the Fischer-Tropsch process is a premium product. It contains no sulfur, and has an extremely high "*cetane*" number. (72) Cetane is to diesel fuels what octane is to gasoline. Conventional diesel fuels derived from crude oil have a cetane rating of between 46 and 50. (73) Diesel produced from natural gas has a cetane rating of between 70 and 75. (74) As a result, it will have superior cold weather starting characteristics, burn more efficiently and produce fewer particulate and toxic emissions. In fact, natural gas-derived diesel fuel exceeds the EPA's 2006 standards for ultra-low sulfur fuels.

Just as producing liquid motor fuels from Alaska's stranded gas yields unique environmental benefits, such a program could also yield unique economic benefits as well.

ECONOMIC BENEFITS OF DEVELOPING ALASKA'S STRANDED GAS

One aspect of using the Fischer-Tropsch process to produce fuel from Alaska's stranded gas that has not been considered is the potential of such a program to extend the useful life of the Trans-Alaska Oil Pipeline System (TAPS).

Completed in 1977, the TAPS pipeline runs 800 miles from the Prudhoe Bay oil field to the port of Valdez. At its peak, the pipeline carried roughly 2 million barrels of oil daily, but production from the Alaskan North Slope oil fields has declined to 902,000 barrels per day and will continue to fall off. Although it is expected that production from the Arctic National Wildlife Refuge (ANWR) will eventually replace the lost Prudhoe Bay production, there is no guarantee that ANWR production will begin before other North Slope production falls to a level insufficient to sustain flow through the TAPS line. Should this occur, it is possible that the TAPS line could be damaged or even rendered inoperable. At a minimum, it would represent a significant loss of revenue to the state.

A G-T-L program on the North Slope could solve this problem by providing a sufficient volume of refined product to the pipeline to sustain minimum flow requirements. It would in essence act as a "*placeholder*" until ANWR production began. Moreover, it would not be necessary to utilize all of the stranded gas for this purpose – merely a sufficient amount to ensure that the pipeline could continue operations. This would leave a portion of the gas for other uses within the state.

Developing a G-T-L plant would also provide a significant number of jobs for Alaskans both in construction and operation of the facility.

Of course, before a full-scale facility is built, it would be necessary to test the feasibility of such a project. A test of this nature, however, could also have benefits beyond the obvious in that it could help to demonstrate how the Fischer-Tropsch process could be used to solve the military's fuel delivery dilemma.

THE FISCHER-TROPSCH PROCESS AND MEETING DEFENSE NEEDS

Clearly, the problem of meeting fuel requirements in a global threat environment that can require the projection of force on a virtually instantaneous basis to remote regions where infrastructure is either limited or nonexistent calls for novel solutions. The traditional approach of relying on centralized, CONUS-based fuel depots and an extended resupply chain may prove unacceptably cumbersome for successful implementation of RDO. But alternatives such as building and maintaining large stockpiles in theater or relying on local acquisition are not answers either. As demonstrated by the experience of the 173rd Airborne in Northern Iraq, there is no guarantee that it will be possible to deliver sufficient supplies from even nearby locations, or that local acquisition will be possible.

An alternative solution would be for deployed forces to use small Fischer-Tropsch units to manufacture their own fuel on site. While it would be necessary to have a feedstock to convert to liquid fuel, it is possible to manufacture "process gas" for this purpose from a wide variety of raw materials including natural gas, coal and biomass. In order to be feasible, however, a number of conditions must be met.

DESIGN REQUIREMENTS

In order to be practical, the design of a portable Fischer-Tropsch plant must meet a number of criteria.

- First, it must be essential air transportable.
- Second, the fuel it produces must be usable in military vehicles.
- Third, it must be capable of operating in a wide range of climates.
- Fourth, it must be cost effective under current market conditions.

In order to determine the feasibility of a portable fuel production plant, it will be necessary to conduct demonstration to validate its ability to meet the various design requirements.

CONDUCTING A DEMONSTRATION

Clearly the first step in conducting a demonstration would be to build a pilot plant. The obvious question is where to build it. Ideally, the location chosen would subject the facility to extremes of climate to help prove out its ability to function in difficult circumstances. Alaska's North Slope would clearly fulfill this requirement. Selecting Alaska as a location would also provide an environment in which the cold-weather performance of the fuel could be tested.

Once the plant is in operation, the next step would be to test the fuels in military and civilian vehicles to assure that its performance characteristics are acceptable. Implementing this step would also require the development of fuel standards. Initiating production would also make it possible to assess the economics of the plant. It should be noted that the delivered cost of fuel in Iraq is currently estimated at $13 per gallon, so the parameters that define economic feasibility may be somewhat broader than they would be for civilian fuels.

The final step in the demonstration would be to determine whether and if so, how the components of the pilot plant could be configured so that they were air transportable.

If successful the project would make a vital contribution towards realizing the transformation of our defense forces to meet the challenges of the 21st Century.

LOOKING AHEAD

Looking to the future one thing is certain: the global oil market will become increasingly competitive and Middle East suppliers will play an ever-more important role. As a consequence, the cost of imported oil is certain to rise and the security of oil imports will become ever more tenuous. Therefore reducing America's import dependence will be of critical economic and strategic importance. The Fischer-Tropsch process provides a means of utilizing America's enormous energy endowment to mitigate the dangers foreign oil imports pose and generate new benefits for both the economy and the environment.

ABOUT THE AUTHOR

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NOTES

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