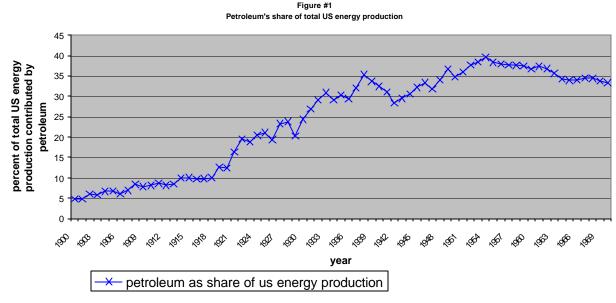
Past, Present, & Future of Petroleum

Petroleum has played an important role in the social, economic, and political history of the United States and the world. Since the nineteenth century, the United States has been using petroleum as a source of energy production. We have encountered major energy crises in 1973, 1979, and 1990. All three of these crises coincided with increased social usage of petroleum as well as political turmoil in major exporting countries. Today we face a fourth energy crises along with economic and political unrest. The future of our country's energy supply is uncertain, but we are sure the world will soon run out of petroleum and need other major sources of energy. The U.S. has dangerously relied on oil to play a major role in the past, present, and future of its social, economic, and political history.

Throughout the twentieth century and into the beginning of the twenty first century petroleum has played an increasingly important role in the economy of the United States. Petroleum has become an important input in nearly every form of production that is carried out in the United States. Farming, mining, and manufacturing of all kinds have come to depend on petroleum and as such the price of outputs in these sectors and the health of our economy has depended heavily on the price of petroleum. Fortunately the price of petroleum in the U.S. has remained relatively low and stable throughout history. However, there are a few small exceptions to this truth. The three most noticeable exceptions to low stable petroleum prices came in 1973, 1979, and 1990.

There are lessons to be learned from these exceptions that are now referred to as "energy crises" by historians.

To understand these energy crises one must first understand the importance of and dependence on petroleum in the United States. The importance that the production of petroleum has played in the U.S. leading up to the first crises in 1973, can be demonstrated by figure #1.



Source: Historical Statistics of the United States

As figure #1 demonstrates petroleum production was becoming a more and more crucial resource in terms of production in the United States. In 1900 petroleum was almost negligible as a source of energy production in the U.S., making up only 4.8% of total U.S. energy production. However by 1954 petroleum production had gained a 40% share of energy production and has continued to rise ever since. The demand for petroleum and the rate of consumption has continued to grow in the United States.

With the industrialization that was occurring in the early 1900's, petroleum was becoming a more important consumption resource. Petroleum was now needed in

internal combustion engines that were used for transportation as well as in machinery that was used in production. Petroleum was also becoming a more popular form of energy in residential and commercial areas for heating, cooking, and other uses. During this time period petroleum was gaining importance in the industrial sector as a new and very important part of production. Electricity also became an important use of petroleum that helped add to increasing demand for petroleum as well. The importance of petroleum to the U.S. is depicted in figure #2, which shows growing usage trends in every major sector of the U.S. economy with an emphasis on transportation and industrial.

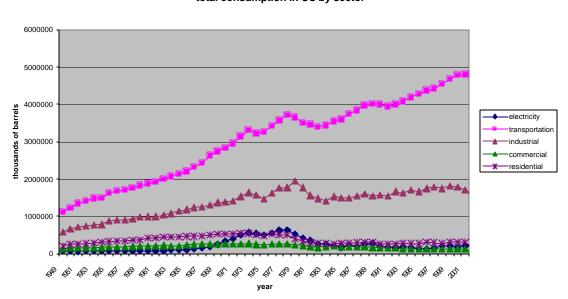
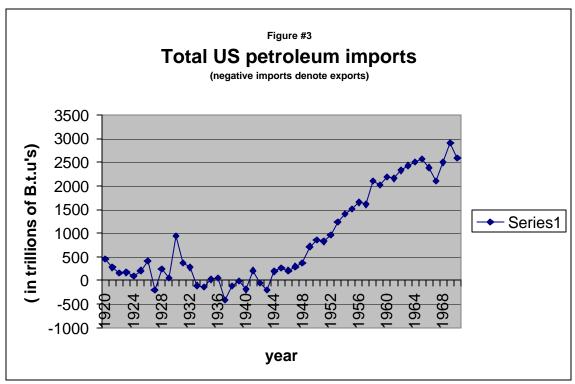


Figure #2 total consumption in US by sector

The growth of consumption in every sector of the economy shows that the U.S. was becoming heavily dependent on petroleum and as such was creating a very strong market for the increasing production of the U.S. petroleum industry. This high demand for petroleum drove higher investment into petroleum mining in the U.S. and was the reason for such an explosion in production during the twentieth century. Eventually, however,

domestic production was no longer able to keep pace with the growing demand for petroleum in the U.S. market and the U.S. had to turn elsewhere to fulfill its high demand for petroleum.

Around 1948 the United States supply could no longer fulfill it's demand for oil and began to be a major importer of petroleum. Up until this point the U.S. supply had been very comparable to U.S. demand and depending on the year the U.S. might either be a net exporter or importer. This changed in 1948 when the U.S. finally became a major importer of petroleum and was never again a net exporter of petroleum. Figure #3 begins to show just how quickly the U.S. became a major petroleum importing country. By 1970 the U.S. was importing over 3 times more petroleum than they had ever imported before 1948. This begins to show just how dependent the U.S. was beginning to be on petroleum imports as they entered into the first energy crises of the 1970's.



Source: Historical Statistics of the United States

As the U.S. suddenly became a major petroleum importing country, it opened itself up to fluctuations in world petroleum prices. Before 1948, the U.S. was an exporter of petroleum, but the increased production and strong demand led the U.S. to become a major importer of petroleum. As seen in figure #4, U.S. consumption increased at the same rapid rate imports increased leading up to 1973.

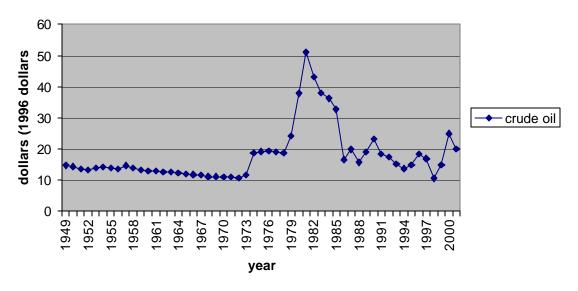
Figure #4
Percent of US petroleum consumption from imports

Source: Historical Statistics of the United States

At the dawning of the 1960's the U.S. was in uncharted territory. At no time in history had they been so dependent on foreign petroleum. Over one third of U.S. oil consumption came from foreign countries. However, throughout the 1960's things ran smoothly and the excess demand from the U.S. was easily fulfilled on the world market by petroleum exporting countries. The world market for petroleum throughout the 1960's was quite stable with prices actually dropping just slightly during the 1960's (figure #5). The ability of the world market to so easily fill excess demand in the U.S., while maintaining low, stable prices was an ideal situation for the U.S. The United States

didn't have to worry about their dependence on other countries for petroleum because they could buy it from other countries at a low and stable price.

Figure #5
Price per barrel of crude oil in real terms (based on 1996 dollars)



Source: Annual data 1949-2001

We can see that this period of low and stable prices for crude oil during the 1960's and early 70's was abruptly ended by a sharp price increase in 1973. This price increase was caused by the OPEC oil embargo against the U.S. OPEC is the Organization of Oil Exporting Countries and currently includes 11 members. The members at this time were Iran, Iraq, Kuwait, Saudi Arabia, Venezuela, Qatar, Indonesia, Libya, United Arab Emirates, Algeria, Nigeria, Ecuador and Gabon. The OPEC oil embargo was a political statement against the U.S., because the U.S. had given Israel its support in the Yom Kippur War. OPEC's oil embargo caused a drastic increase in the price of petroleum and made rationing an important part of the U.S. economy in 1973. During this time period President Nixon asked Americans to cut petroleum use by whatever means necessary.

People turned down thermostats, carpooled to work, and found other ways to voluntarily ration their petroleum consumption. Gas stations were even asked to limit their sales to 10 gallons per customer and were not allowed to sell gas on the weekends. In some cases your ability to buy gas would depend on if the last digit of your license plate was odd or even. Refer to figure #6 to see the effect of rationing in the U.S. during 1973. Notice the downturn in petroleum consumption. Here we see how political turmoil can lead to a petroleum crises when we rely heavily on exports.

8000000 7000000 60000000 5000000 3000000 1000000 1000000 1000000 1000000 year

Figure #6
US oil consumption and production (thousands of barrels)

Source: Annual data 1949-2001

The crises of 1973 wasn't the only crises of the 1970's. Less than ten years later, we can also see an even larger price increase between 1979 and 1981 (referring back to figure #5). This price increase was caused by the Iranian revolution and had many of the same effects as the energy crisis in 1973. Once again an energy crisis was caused by political unrest in a major oil-exporting region. This time Carter was president and many of the same rationing techniques were used. Referring to figure #6, we can see that consumption was hit even harder by this energy crisis and petroleum consumption took

almost 20 years to return to the same level as it was leading up to the crisis. This extended period of lower petroleum consumption was the affect of conscious efforts to use petroleum more efficiently at these higher prices. For instance, during this period of time cars were developed that got much better gas mileage than before. Other industrial advances were made as well. The new efficiencies in the U.S.'s use of petroleum led to lower demand for petroleum from importing countries and actually helped lower world petroleum prices and end this second energy crisis. This drop in prices caused a decline in demand for petroleum imports. The end of the Iranian revolution occurred around 1982 and can be seen in figure #6.

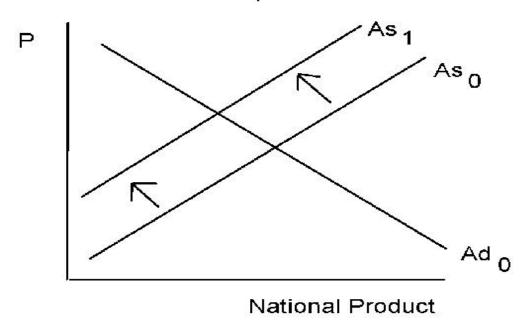
The last and smallest of the energy crises in U.S. history occurred in 1990. This crisis occurred when Iraq invaded Kuwait, and is once again characterized by a sharp increase in prices (also seen in figure #6). The severity of this energy crisis was less than the previous crises because the period of disrupt in Kuwait was short compared to previous crises and domestic petroleum reserves were able to minimize the affect of the price of petroleum imports. We see that this crisis was of less severity than the two preceding based on figure #6. Petroleum consumption fell minimally during this time period and that the period of declined consumption was shorter than that of the previous two crises.

These energy crises have played a large role in U.S. economic history in the latter half of the twentieth century and it is important to recognize what caused them to occur. First, there was growing demand for petroleum in the U.S. and domestic production grew to fulfill this demand. Eventually, however, domestic production could no longer keep up with petroleum demand and the U.S. became dependent on foreign countries to supply

enough oil to fulfill its demand. As the U.S. continued to have growing demand for oil, the percentage of petroleum consumption from imports continued to grow to around 35% percent as the U.S. entered into the 1970's. The U.S. was now at the mercy of world oil prices, but this did not seem to be a concern as oil prices in the past had been quite stable and low. As we have seen these low prices can be greatly affected by political actions or turmoil occurring in large petroleum exporting regions of the world.

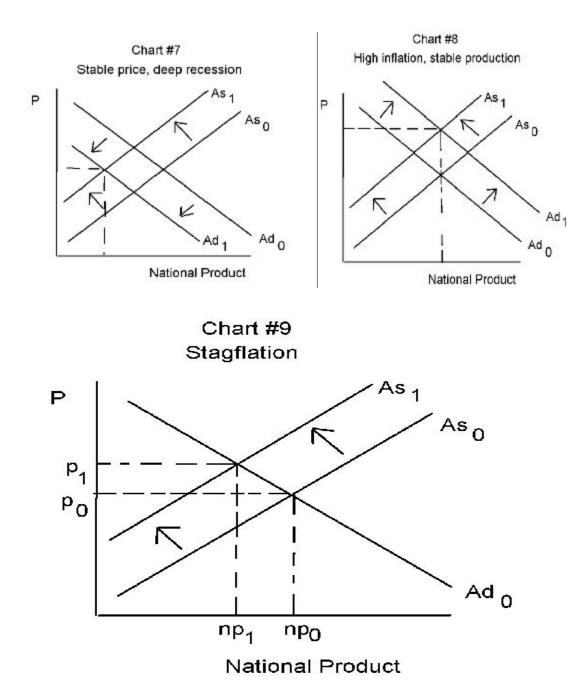
Characteristics of energy crises include sharp rises in petroleum prices, which in turn causes a reduction in consumption of petroleum. These high prices and lower consumption are the major driving force of an economic phenomenon, known as stagflation. Stagflation is the simultaneous occurrence of high inflation and low productivity within an economy. Stagflation occurs when there is an exogenous shift to the aggregate supply curve that moves it in an inward and upward direction. In the case of rising oil prices this shift occurred because petroleum is a crucial part of so many industries. Referring back to figure #2 you can see how important oil was becoming to the industrial sector, and with this large shift in oil prices the aggregate supply was shifted in a negative direction (refer to Chart #6 on next page).

Chart #6
Supply shift caused by increase
in oil prices



By looking at chart #6 one can see that there is no easy choice for the central bank. They can cut aggregate demand to stabilize prices and in the process cause a deep recession (chart #7), or they can increase aggregate demand to stabilize production and in the process cause high inflation (chart #8). The choice that has been used throughout U.S. history however is a choice somewhere between these two that leads to stagflation (chart

#9).



As is shown in chart #9, these energy crises were not just higher prices at the gas pumps but were major economic events that led the U.S. economy into periods of recession and inflation. This combination of recession and inflation is very hard on an economy and can be very difficult to rectify. An important byproduct of these events has been more efficient use of petroleum in the United States. During these time periods of

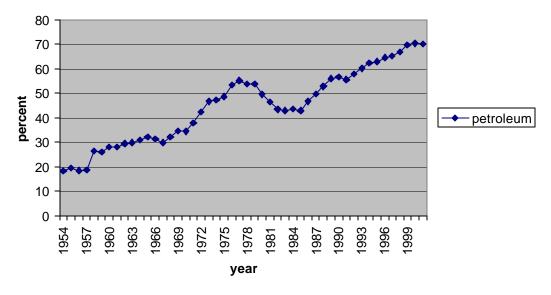
crisis there is an increased pressure to create new, more efficient uses for petroleum.

These new efficiencies are important because they symbolize something positive that can come out of an energy crisis.

Predicting an energy crises is a difficult task, but many key ingredients are necessary to create one of these crisis. For an energy crisis to occur there must be an inability of domestic production to keep pace with domestic demand. This in turn leads to a dependence on foreign production to fill domestic petroleum demand. Looking back at past oil crises we see that in 1973 nearly half of all petroleum consumption in the U.S. was imports and by the 1979 crisis imports accounted for 55% of petroleum consumption (refer to figure #10). This dependence on foreign petroleum is a necessary ingredient for the making of an energy crisis. Once these ingredients occur, all that is need is a political conflict in a major oil producing region of the world.

The same growing social dependence of the past energy crisis in the United States is present toady. Domestic production of petroleum cannot keep up with U.S. demand for oil. Americans continue to consume more oil every year (figure #6) while production remains the same. This means we are continuing to import more oil every year and thus depend on other countries oil even more (figure #10). The U.S. is becoming more dependent on foreign oil than ever before. In fact, the U.S. currently imports 70% of the petroleum it consumes (figure #10).

Figure #10
Percent of petroelum consumption from imports

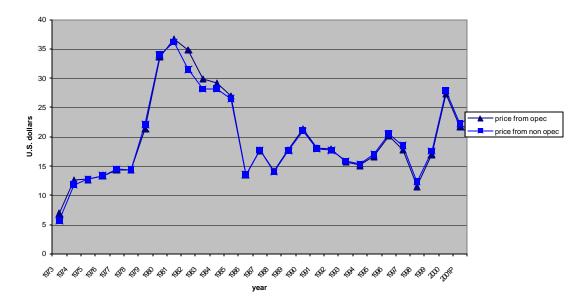


Source: Annual data 1949-2001

It appears as if war in the Middle East is a very strong possibility, plus the situation in Venezuela doesn't seem to be improving. These are the exact same ingredients that have led to past energy crises.

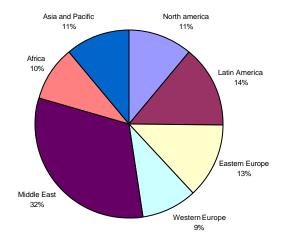
The possibility of war with Iraq is becoming a major factor in the recent price of oil (up to \$34/barrel). The Middle East consists of more than half OPEC's total oil exports and is a major factor in the price of oil in the world. Even though OPEC produces less than half the oil in the world, they still set the world price (figure #11).

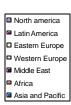
Figure #11 World price per barrel

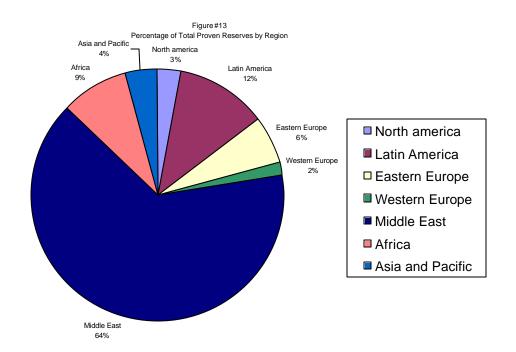


The Middle East itself produces 32% of the world's oil (figure #12), but even more impressive is they have 64% of the total proven oil reserves in the world (figure #13). This is significant because their reserves are depleting at a slower rate than any other region in the world. This amount of oil in the region that could potentially be in a war has resulted in higher prices of petroleum.

Figure #12
Percentage of petroleum production by region







Venezuela is also in a period of political unrest. The current battle between socialist President Hugo Chavez and the business elite of Venezuela has resulted in essential no production of oil in the country. The oil strike rallied by big business against Chavez has turned the fifth largest oil exporter in the world into an importer. In fact, the United States gets 13% (1.5 million barrels/day) of it's oil from this one country. It's the U.S.'s second largest importer. This situation is detrimental to Venezuela because oil accounts for half it's government's revenues and 1/3 of it's GDP. Venezuela produces about 3 million barrels/day and exports 75% of that. The political turmoil in Venezuela has shocked it's economy and helped pushed the U.S. into a crises.

However, the U.S. appears better prepared to handle a shock to oil prices than it was in 1973. The reason for this is the creation of a strategic petroleum reserve, which can be used in times of emergency. To see how quickly this reserve has grown since the 1970's, when energy crises were a major problem, refer to chart #14. This reserve is partially responsible for lessening the impact of the 1990 energy crisis and it is expected that it could be used in the same manner for other energy crises in the future. The U.S.'s strategic petroleum reserve currently consists of around 550 million barrels of petroleum. This is a nice safety net that has been developed to lessen the risk of future energy crises in the U.S., and with conditions being what they currently are this safety net may be needed sometime in the near future. However, 550 million barrels at our current consumption rate isn't all that much (figure #15). We currently consume 20 million barrels/day. This means that if we stopped producing and stopped importing completely, our resources would only last 28 days. If we stopped importing, but could continue to produce within our borders and use our strategic reserves, we would last 40 days.

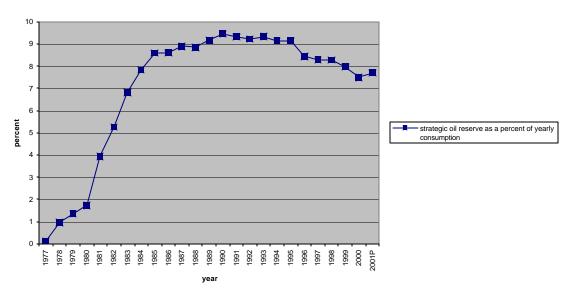
Basically, we could survive for a short period of time with importing, but not enough for a long war.

Figure #14
Strategic Petroleum Reserves

700,000
600,000
400,000
200,000
100,000
100,000
year
Figure #14
Strategic Petroleum Reserves

Source: Annual data 1949-2001

Figure #15 strategic oil reserve (as a percent of yearly consumption)



Eventually, the United States will get through our current energy crises and normal trade should resume in the Middle East and Venezuela. However, the world's oil supply won't last forever. Experts predict that around 2010, man will have consumed nearly half of all recoverable oil that ever existed on our planet. That's estimated at almost a trillion barrels of oil. Experts argue over how much oil we have remaining on our planet, but all agree it's about 1-1.8 trillion barrels. If the world continues to consume at the current rate, 25 billion barrels/year, we would only last 40 years until we are completely out of oil. As the world reserves continue to deplete, prices will rise forcing industry to use other sources of energy. Even with alternate energy sources, most agree the world will be "practically" out of oil within this century. The "practical end date" is when we essentially run out of oil. By the time our world resources become so depleted that it costs more money to drill that deep into the ground and becomes more expensive to get out than they can sell it, the world will be out of oil for all "practical" reasons.

As history has shown us, growing social dependence and consumption of petroleum along with any political turmoil can cause a major energy in the United States. We are currently seeing the same situations as we say in '73, '79, and '90. With the U.S. loosing 13% of all imports because of Venezuela's current political situation, plus the possible war with Iraq, the U. S. oil prices are continuing to rise. The United States contains 4.6% of the world's population, yet consumes 26% of the world's oil. This dependence on a product that we cannot self-maintain will eventually run out and other forms of energy must be used.

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