

What's the Big Deal about Oil?

HOW WE CAN GET OIL POLICY RIGHT

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America's massive transportation network runs almost exclusively on oil—and increasingly the country considers that reality to be a source of vulnerability. Effectively dealing with this problem will require reducing our consumption of oil, especially on the highway. How can we do that without damaging a huge economy that crucially depends on fast, inexpensive movement of people and goods?

We are now being forced to consider this question more seriously than at any time since the age of oil began more than a century ago, for a number of reasons. One is the recent series of disruptive swings, mostly upward, in oil prices. These price swings hurt both household budgets and the larger economy. Another is political instability in oil-exporting regions that, in many cases, involves a U.S. military presence. Importantly, there is also mounting evidence of global climate change caused by burning oil and the other fossil fuels, coal and natural gas.

These concerns were reflected in President Bush's much-quoted line in the 2006 State of the Union Address that "America is addicted to oil." That leads to all the hard questions about how to best address this problem, the role of the market and public policy in efficiently deploying options, and how to balance the search for expanded supplies with policies that can reduce demand. In this special issue of *Resources*, we put the president's comment in perspective and evaluate various policy options.

Where's the Oil?

Existing oil reserves are geographically concentrated in some of the world's most volatile regions, in many cases under the control of governments that are unfriendly to U.S. interests. This raises concerns about the possibility of oil supply disruptions due to war, revolution, terrorist attacks, or trade embargoes, as well as the likelihood of continued or increased U.S. military presence abroad. Although the United States contributes 10 percent of global oil production, it has just 2 percent of proven world reserves. In contrast, about 60 percent of proven oil reserves are located in the Middle East, 10 percent in Africa, 6 percent in Venezuela, and 5 percent in Russia. Canadian tar sands are a relative bright spot in this geopolitical picture, comprising about 14 percent of proven oil reserves.

Some analysts have also drawn recent attention to the view that world oil production has peaked. In the past, however, new discoveries and improved technology have continually led to increases in world oil reserves and production along with consumption growth. A case in point is Chevron's announcement in September that it has tapped petroleum reserves in the Gulf of Mexico that could rival Alaska's Prudhoe Bay in size. In the process, it set several records for ultra-deep drilling. And while conventional oil production will no doubt peak *at some point in time*, unconventional and synthetic sources of oil—such as tar sands and coal-to-liquids (CTL)—are already competitive at or near current price levels and could last for a long time to come.

Putting Prices in Perspective

At press time, the average price of gasoline at the pump was about \$2.30 per gallon, down from recent highs above \$3 per gallon. Since early 2002, gasoline prices have doubled, along with a tripling of crude oil prices from around \$20 per barrel to \$60 or more per barrel. Crude oil price changes tend to be quickly passed through to consumers at the rate of about 24 cents per gallon of gasoline, for every \$10 per barrel change in the price of crude (see the graph on next page).

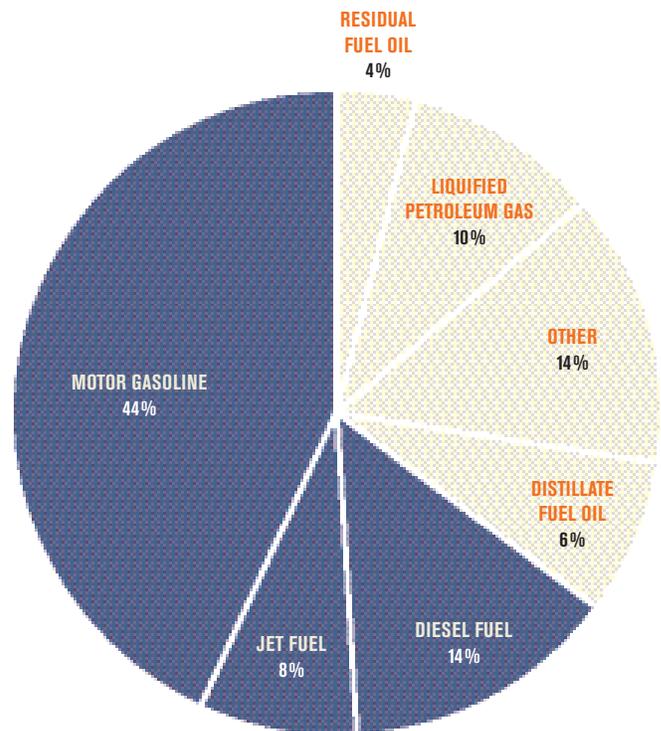
The vast majority of the gasoline price increases over the last several years are therefore attributable to crude oil price increases. Historically tight refining capacity and weather-related disruptions have played secondary roles. Refinery or pipeline shutdowns—such as during Hurricanes Katrina and Rita last year—can impede production and distribution of petroleum products, leading to short-term gasoline price spikes.

Crude oil is freely traded internationally and prices are determined by balancing supply and demand at the global level. Due to vigorous economic growth in the United States, China, and other countries, world petroleum demand has soared over the past several years.

At the same time, world oil production is very close to full capacity, and new production capacity has been slow to emerge. Industrialized countries have exhausted most low-cost domestic production opportunities, and oil companies face considerable risk and restrictions when making investments in less-developed countries. Global oil supply stands at 84 million barrels per day, while spare capacity is only 1 to 1.5 million barrels per day—the lowest level in three decades.

These tight market conditions, coupled with concerns over potential oil supply disruptions in locations such as Iraq, Iran, Nigeria, and Venezuela, are behind a roughly threefold increase in crude oil prices since early 2002. In a global oil marketplace, a disruption anywhere raises prices

Oil Used for Transportation, Heating, Power, and Other Purposes



U.S. Energy Information Administration, *Annual Energy Review* (2005)

What's all the oil for?

America runs on oil, by far our biggest single fuel source. About 40 percent of the energy used in the United States comes from consuming 21 million barrels per day of petroleum products, the majority of which is imported. Two-thirds of U.S. oil consumption is for transportation purposes and the majority of that goes into passenger vehicles. The balance of transport fuels, including diesel and jet fuel, go for the planes, trucks, and ships that make it possible for us to have raspberries in January

and get packages absolutely overnight. The U.S. industrial sector gets 37 percent of its energy from petroleum, and home-heating oil comprises a significant portion of energy costs for homes in the Northeast. Crude oil is also used for an array of other consumer and industrial products, including lubricants, asphalt, and plastics.

Crude Oil Prices Largely Determine Gasoline Prices



Monthly averages from U.S. Energy Information Administration

everywhere—regardless of how much is imported. The bottom line is that there is little the government can do to control the price of oil.

Implications for the Economy

The macroeconomic impact of oil price spikes is a distinct concern. Every major oil price increase since 1970, except the current one, has been associated with a recession. This raises worries about inflationary effects, interest rate hikes, increased production costs, slower GDP growth, and potential recession and job losses.

Then there's the fact that the United States imports 60 percent of the petroleum it consumes, about double the share we imported two decades ago. When oil prices spike, we send large additional amounts of wealth overseas to pay for an increasing oil-import bill—over \$240 billion in 2005. This has to be balanced, of course, against the fact that U.S. households and businesses benefit greatly from the same imports, particularly when prices are low.

So far, however, the price increases over the last several years have been only a modest drag on economic growth. In contrast to conditions during price shocks of the 1970s and early 1980s, global economic growth has been robust, inflation and interest rates have been historically low, and the oil intensity of the U.S. economy (the ratio of oil consumption to GDP) has declined.

Pricing the Alternatives

Although oil prices have risen to more than \$70 per barrel in recent months, they have also averaged as low as \$20 per barrel within the last five years. Having lived through the oil price spikes—and then dramatic declines—of the 1980s, oil companies typically use an expected oil price of less than \$40 per barrel when making long-term investments. Most current forecasts by government and private analysts project oil prices in the \$35–\$55 per barrel range over the next two decades, whereas the large capital investments associated with many alternatives would last for several decades.

Only conventional oil, tar sands, and gas-to-liquids (GTL—conversion of natural gas to transport fuel) are clearly profitable at these prices (see the figure on next page). The federal ethanol subsidy of 51 cents per gallon is equal to about \$30 per barrel of oil equivalent (that is, energy equal to one barrel of oil), making ethanol competitive at oil prices as low as \$20 per barrel of oil. Given these market signals, large-scale commercial production of Canadian tar sands and ethanol has already begun and is expanding rapidly. One million barrels of oil from Canadian tar sands are being produced per day, a rate that is projected to almost triple over the next decade. U.S. ethanol production, virtually all of which comes from corn, has risen from 106,000 to 250,000 barrels per day since 2000. It is expected to roughly double again by the end of the decade at projected oil prices and with current government subsidies.

GTL technology has developed rapidly in recent years, as higher oil prices have made it a more attractive option for “stranded” natural gas reserves that have no local market. Currently, only Malaysia and South Africa have commercial GTL operations, but new projects have been proposed for Algeria, Australia, Egypt, Iran, Nigeria, and Qatar. Commercial-scale CTL plants have operated in South Africa for several decades. Interest in other countries was limited until recently, but China now has plans to open two CTL plants after 2008 and a number of proposals have been floated in the United States.

For other alternatives, such as oil shale and cellulosic ethanol, costs are uncompetitive even at the high prices recently experienced. The technologies needed for production require further research, development, and demonstration to bring down costs and establish commercial viability. Cellulosic ethanol is made from grasses, agricultural waste, and other sources of biomass rather than corn, sugar cane, or other higher-value agricultural feedstocks. Interest in cellulosic ethanol has increased considerably, and the federal renewable fuel standard passed in the Energy Policy Act of 2005 ensures that at least some commercial cellulosic ethanol will be produced in the next several years.

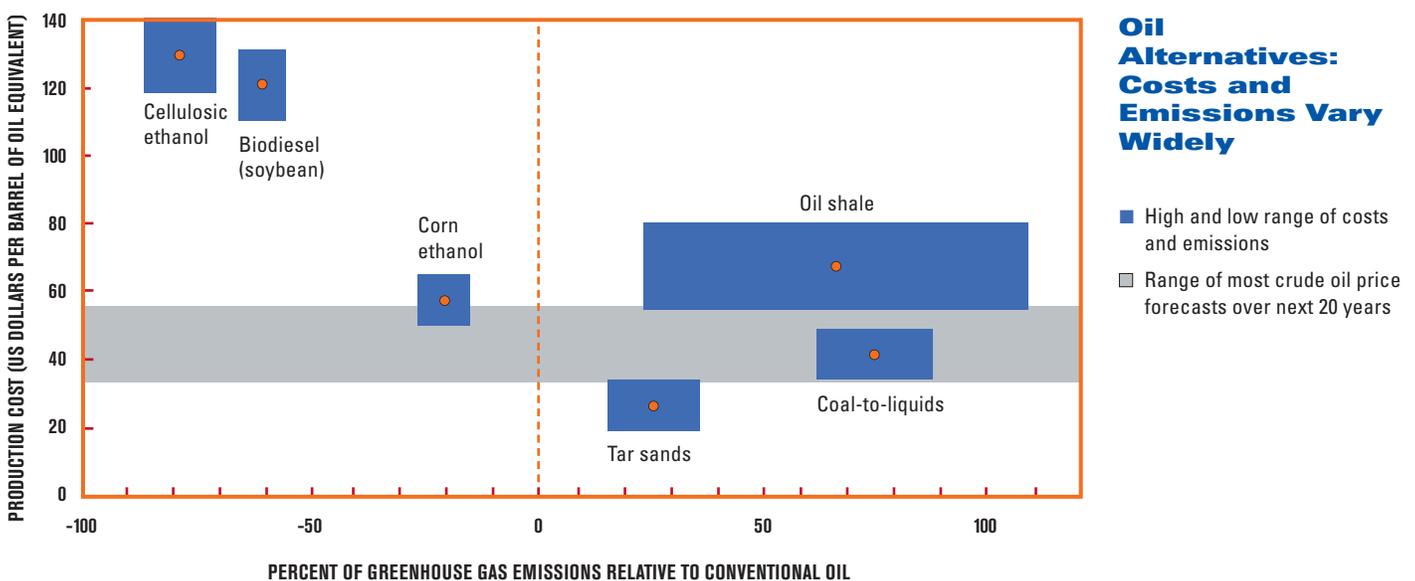
Dealing with the Environmental Consequences

While recent congressional debates have focused on the potential benefits and environmental risks of expanding access for drilling in the Outer Continental Shelf and Arctic Na-

tional Wildlife Refuge, the larger environmental issue looming is global climate change. Rising oil prices present both opportunities and risks from the perspective of reducing greenhouse gas (GHG) emissions, particularly carbon dioxide. The incentive that high oil prices bring for increasing fuel economy and encouraging other sources of demand reduction is a clear winner for the climate.

Renewable fuels like ethanol can also lead to moderate or more dramatic reductions in GHG emissions, depending on the feedstock. Although corn-based ethanol offers significant gains in terms of reducing petroleum use, it offers only moderate climate benefits. GHGs from corn-ethanol production and use are only about 20 percent lower than for gasoline because of the need to use fossil fuels like natural gas in the process of growing and processing the corn. More importantly, cellulosic ethanol has the potential to reduce GHG emissions by about 80 percent relative to gasoline.

On the other hand, the most economically competitive, large-scale substitutes for conventional oil are currently not renewable fuels, but tar sands and CTL. Shale oil is currently expensive to produce, but the resource base is large, and costs could come down considerably. Reasonable estimates put GHG emissions associated with the production and use of tar sands at about 25 percent higher, oil shale at about 65 percent higher, and CTL at about 75 percent higher than conventional oil. These higher levels of GHG emissions are due to greater emissions during the production process, whereas GHG emissions from end-use combustion of these fuels are roughly the same.



Source: Costs. U.S. Energy Information Administration, *Annual Energy Outlook* (2006), other sources. Emissions. A. Brandt and A. Farrell (2006), M. Wang (GREET model 2006).

An Economic Perspective on Oil Policy

Economists have identified a number of problems related to oil production and use that may not be adequately incorporated in private market decisions in the absence of government policy. These include the macroeconomic impacts of oil price shocks, local environmental and global climate-related effects, and national security consequences associated with constrained foreign policy and military burdens.

Policy responses tend to fall into two broad classes: supply-side and demand-side approaches. Supply-side policy approaches typically focus on expanding domestic production of crude oil and its alternatives (such as ethanol and CTL). Demand-side approaches focus instead on reducing petroleum consumption through increased fuel economy, reduced driving, alternative modes of transportation, and non-transport conservation. The Strategic Petroleum Reserve serves a unique role, by holding public stocks of oil for potential release to mitigate price shocks due to severe supply disruptions.

Supply-side options

Increased access for domestic oil development is potentially justified based purely on traditional economic grounds—if the value of the oil is greater than the production and environmental costs. However, increased domestic supply does little to decrease our vulnerability to oil price shocks or associated national security threats. Since oil prices are determined in a global market, U.S. prices will rise by the same amount in the event of a disruption regardless of whether they are for domestic or foreign barrels. And money will flow to unfriendly regimes even if it is not U.S. dollars. Iran is a useful reminder: the United States has banned oil imports from Iran since 1979, but that does not reduce Iran’s oil wealth or the sway it holds over oil prices.

Policies oriented toward increasing the supply of alternative fuels through subsidies or mandates, such as ethanol and other liquid fuels, do little to reduce our vulnerability to price shocks. They are direct substitutes for oil and have relatively high production costs. In the event of an oil price shock, the price for fuel will therefore be determined largely by the international price of crude oil, not domestic fuel production costs. Only a dramatic shift to an alternative energy source that is not in direct competition with oil (for example, electricity or hydrogen) could remove this strong linkage. One way in which supply-side options can help, however, is by increasing the diversity of fuel supply types and locations.

As described earlier, the environmental impacts of expanding domestic alternatives to conventional oil could be either positive or negative, depending on the fuel type.

Demand-side options

In contrast, policies that encourage demand-side reductions in fuel consumption are better targeted at addressing all the major concerns related to oil production and use. With lower fuel use, households and businesses are affected less by oil price shocks, and other negative macroeconomic consequences are reduced, as are local environmental effects and GHG emissions. Two categories of relatively cost-effective policies are most often discussed: policies that directly or indirectly raise fuel prices, and policies that raise vehicle fuel economy. The first category includes taxes on gasoline or petroleum, as well as policies that put a price on GHG emissions, such as a cap-and-trade system or carbon tax. Each of these provides a direct monetary incentive to reduce petroleum consumption, although the breadth of a petroleum tax or a price on GHG emissions is much greater than a tax solely on gasoline.

Fuel economy policies, the second category, can take the form of either performance standards—as with Corporate Average Fuel Economy (CAFE) standards—or purchasing incentives, such as “feebates” that combine fees on inefficient vehicles with rebates for efficient ones. Each can be designed in a flexible, cost-effective manner or can be riddled with constraints and loopholes that render it ineffective and inefficient. Relative to policies that raise fuel prices, however, fuel economy policies have the disadvantage of not encouraging demand reduction through reduced driving.

Conclusion

The key to more effective policy on oil and its alternatives lies in correctly deciding which part of the oil “problem” to solve. Policymakers often look no further than high gasoline prices and oil imports, an orientation that leads to “solutions,” such as repealing the federal gasoline tax and expanding wasteful government subsidies for domestic energy production. These approaches can actually hurt rather than help.

The top priorities for oil policy should instead be reducing both our vulnerability to supply disruptions and GHG emissions. The emphasis would then turn to reducing our exposure to these risks through reduced fuel consumption, diversifying our options through research and development of low-emission alternative fuels and technologies, and insuring against disruptions through wise use of the Strategic Petroleum Reserve.

Proposals have been floated to target virtually all of the options laid out in this special issue of *Resources*, but few have passed Congress or reached the president’s desk. When that day comes, decisions should be guided by reason, not rhetoric: our economic and environmental future is at stake. ■