

Petroleum

ENERGY INDEPENDENCE IS UNREALISTIC

With heightened concerns about energy security and global warming, governments and businesses around the world are beginning to think seriously about a transition away from oil as the crucial fuel for transportation. The central policy question is how to push this transition forward without slowing or destabilizing the growth of economies to which rapid and convenient transportation has become essential.

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Crude oil prices have tripled over the past three years and this has sparked predictions of ever-rising prices in coming decades and exhaustion of the world's oil reserves. We heard these predictions before, during the energy crises of the 1970s; however, the subsequent two decades in fact saw falling prices, increasing world oil production, and expanding reserves as the market responded to higher prices. On the demand side, energy conservation and fuel-switching measures reduced the amount of oil used per unit of gross domestic product (GDP), in the U.S. case, by half over the last three decades (see Figure 1). And on the supply side, higher prices encouraged oil exploration and development of known but previously uneconomic fields, through improved technologies for locating and extracting reserves.

It is possible that we will see some reversal of recent price rises as these types of economic forces come into play again; for example, breakthroughs in converting oil shales and tar sands could significantly add to global supply. However, other factors appearing on the horizon suggest that things may turn out rather different, this time around. Most importantly, large developing countries, particularly China but also India, are beginning to embark on the path of wider automobile ownership that nearly all countries experience as they get richer. With four times the population of the United States, China currently has eight vehicles per thousand people compared with the United States's 780 vehicles per thousand—a ratio suggesting relentless pressure on oil markets in coming decades.

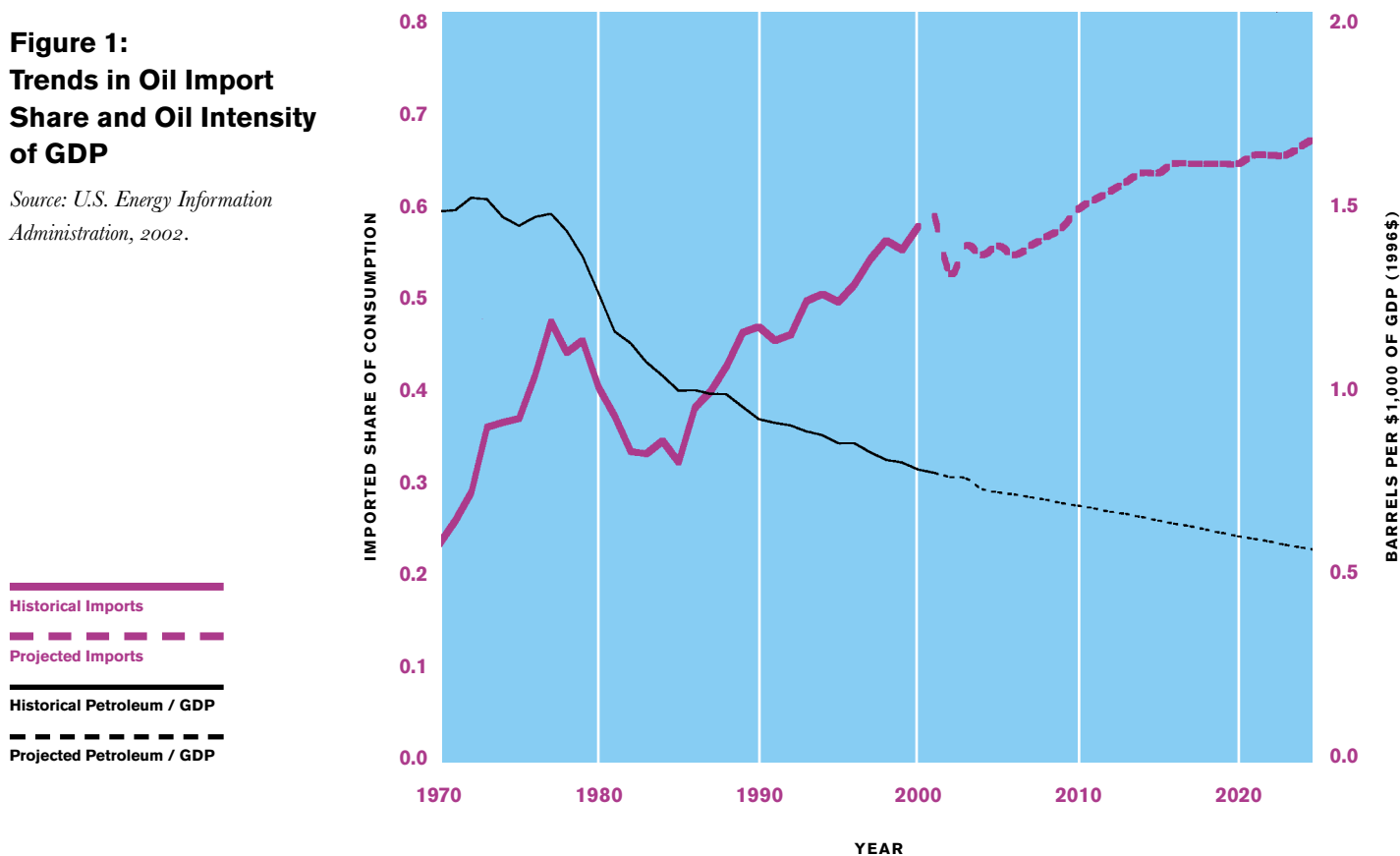
And now that U.S. electricity generators have more or less dispensed with oil, further reductions in oil intensity are harder to come by. Two-thirds of American oil consumption is now in transportation—highways, air routes, and long-distance railroads—and there is no other fuel that is currently viable (see page 14 for a discussion of ethanol's potential).

Growing Dependence on Foreign Oil

Concerns about the economy's dependence on oil are compounded by three trends. First is the steadily rising volume of imports, which currently account for well over half of the 20 million barrels a day that we consume (see Figure 1). Domestic American production is falling as long-worked fields are exhausted, but demand keeps rising relentlessly.

**Figure 1:
Trends in Oil Import
Share and Oil Intensity
of GDP**

Source: U.S. Energy Information Administration, 2002.



The problem of dependence on foreign oil is frequently misunderstood and overstated: for a given amount of domestic oil consumption, the increase in cost of producing goods in the economy following an oil price shock depends on the amount of oil used per dollar of production, and not the share of oil consumption that is imported. And given that the world oil market is fully integrated, the price we pay for imports is the same whether imports come from the Persian Gulf or from reliable sources such as Canada and Mexico. But import dependence does exacerbate the macroeconomic disruptions caused by oil price shocks: because extra dollar payments for imports go out of the economy to OPEC and other foreign suppliers, rather than being recycled within the economy to domestic oil companies, oil dependence leads to a further reduction in aggregate demand for U.S. goods.

The second trend is that production is expected to become increasingly concentrated in the Persian Gulf region, where an estimated two-thirds of global reserves are located; by contrast, estimated reserves for the United States are only about 2 percent of the global total. Intense concentration of supply in any one region would be cause for concern, but that concern is intensified by the history of political upheaval and violence in the Middle East.

A third trend is the growing U.S. trade deficit, which many economists consider unsustainable. For 2004 it will come to about \$650 billion dollars, well over 5 percent of GDP. At the current price—at this writing, over \$40 a barrel—U.S. oil imports total about \$175 billion a year, more than one-fourth of the total trade deficit. Pressure on the exchange rate of the U.S. dollar is rapidly becoming another prominent reason for Americans to look for ways to reduce oil use.

Calls for energy independence are unrealistic, to put it mildly, for the foreseeable future; cutting oil consumption to current domestic production would severely derail an economy in which cheap and rapid transportation is taken for granted. Like it or not, Americans must confront the reality that oil prices are set by worldwide markets that respond to many economic and political factors beyond the U.S. government's control. Of all the reasons that make policymakers uneasy about dependence on oil, the most immediate is the impact of sudden and prolonged price swings on economic growth, particularly given evidence that price increases harm the U.S. economy more than price reductions benefit it.



Environmental Concerns and Technological Challenges

Many of the traditional environmental concerns associated with oil use have been alleviated through a combination of regulation and technological improvements; for example, new passenger vehicles are more than 90 percent cleaner than 20 years ago and will become cleaner still with more stringent emissions standards.

The big environmental issue is the carbon dioxide emissions that form during fuel combustion and remain in the globe's atmosphere as a heat-trapping gas for hundreds of years. As consensus has solidified among most scientists that human-induced climate change is now occurring, calls for policies to slow down and eventually stop further increases in atmospheric greenhouse gas concentrations have intensified. But the challenges are immense: reductions in global emissions of 70 percent or more below current levels would ultimately be required if atmospheric greenhouse gas concentrations were ever to be stabilized before a doubling of atmospheric concentrations over preindustrial levels is reached.

No sector faces a tougher challenge for drastically reducing carbon dioxide emissions than the transportation sector;

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Ethanol at Every Pump? Not Quite Yet...

Consumption of ethanol has been rising fast in recent years, pushed by subsidies – currently set at 52 cents a gallon from the federal government, plus additional help in several states – and federal requirements for oxygenation of gasoline. Ethanol's only competitor as an oxygenating agent is MTBE (methyl tertiary butyl ether), which has been banned in some

states and may soon be banned nationally as a carcinogen that finds its way into drinking water supplies.

Ethanol represents only a tiny fraction, 2.4 percent, of the total automotive fuel used last year. However, it enjoys powerful political support from farm lobbies because nearly all of it is made from corn, using one-tenth of the corn crop and lifting corn

prices. Developing technologies may soon make it possible to make ethanol more cheaply from cellulosic biomass, such as cornstalks, sawdust, and waste paper. One question for the future of ethanol is whether its political support will continue if the industry moves away from grain toward less expensive raw materials.

where, unlike power generation, the possibility of substituting existing low-carbon fuels or capturing exhaust gases for underground or deep-ocean storage is simply infeasible.

As documented in a 2002 National Academy of Sciences report, there appears to be a wide range of emerging technological possibilities for raising the fuel economy of new passenger vehicles through improvements in engine efficiency, reduced rolling resistance, and so on. Better fuel economy for conventional gasoline engines would be a significant, though not dramatic, help in reducing oil consumption and carbon emissions. So would a shift toward diesel passenger vehicles that use less fuel per mile driven. Although widespread in European countries, diesels have been held back in the United States for two reasons: they would complicate auto manufacturers' compliance with stringent federal emissions standards for their vehicle fleets, and unlike in most European countries, diesel fuel is not taxed at a lower rate than gasoline.

Hybrid vehicles, which supplement a conventional gasoline engine with an electric drive train, promise a significant increase in gasoline mileage, particularly when the vehicle is used in urban stop-and-start driving. Toyota led the way with its hybrid Prius, and within the next few months, several major manufacturers will have hybrids in their showrooms. How-

ever, whether hybrids will achieve substantial market penetration in the foreseeable future is unclear; unless gasoline prices reach unusually high levels, their cost, including fuel costs over vehicle lifetime, is likely to exceed that of equivalent all-gasoline models.

General Motors has put several experimental automobiles powered by fuel cells on the streets of Washington, D.C. However before the fuel cell becomes a standard source of power on the highway, chemists and engineers will have to resolve a number of formidable technological challenges.

Policy Responses

In an ideal world, the instrument of choice to reduce the country's use of oil would be a modest tax on all oil uses, perhaps \$5 a barrel to begin with and increasing gradually thereafter, to accelerate energy conservation measures and remind people of the full costs to society from oil use. The potential costs of global warming are not currently reflected in U.S. oil prices. Neither are the full costs of oil dependence: although businesses may try to account for risks to themselves from oil price volatility in their investment and inventory strategies, they may not consider other risks, such as the cost of temporarily idled labor and capital following

energy price shocks. An oil tax would have implications for productivity in an economy that depends on rapid and flexible transportation. Still, society would benefit overall, so long as the tax were appropriately scaled and revenues were used productively—for example, in other tax reductions or deficit reduction.

The Bush administration wants to expand domestic oil production, particularly through legislation to open the Arctic National Wildlife Refuge to drilling. The oil reserves there could produce, at peak, some 1 million to 1.3 million barrels a day, according to administration data. That would be a substantial contribution to correcting this country's foreign trade deficit. But since that new production would represent slightly over 1 percent of world oil consumption and 5 percent of American consumption, it would be unlikely to have a significant effect on oil prices.

Furthermore, unlike an oil tax, increased domestic production does nothing to reduce the overall oil intensity of GDP, and hence our exposure to oil price shocks. A broad oil tax would also be much more effective at reducing oil use than a hike in the federal gasoline tax or higher fuel economy standards for new passenger vehicles, since the broader tax would encourage energy conservation measures and innovation throughout the economy, rather than just in motor vehicles. Although the chance of new energy taxes in the next few years appears very remote, it is conceivable that this situation may change down the road, given continuing pressures to "do something" about U.S. greenhouse gas emissions and our looming deficit problems. There is strong opposition to raising any tax in the United States; however, unlike for income taxes, there is at least some support for in favor of higher energy taxes because of the security and environmental benefits.

But over the long haul, the problem is really a technological one: developing transportation vehicles with low or zero conventional fuel requirements that can be manufactured for prices consumers are willing to pay. Although the market is engaging in some early R&D efforts on its own, in response to higher oil prices and future anticipations of a carbon-constrained world, a case can be made for strengthening and expanding grants and tax breaks for the development and adoption of clean vehicles. Without such incentives, manufacturers are likely to underinvest in innovative efforts, as they are not fully compensated for the environmental and energy security benefits from cleaner vehicles, and the benefits to other firms in the United States that may adapt their innovations, let alone potential benefits to vehicle manufacturers in China and other parts of the world. ■

Oil Prices and Foreign Policy

When oil prices rise or fall, there's an impact on both world politics as well as on country economies.

In 2002, Russia was working to attract foreign investment and appeared to be concerned about its reputation in the West. Net direct foreign investment in Russia that year was a little over \$3 billion. But when oil prices rose by 50 percent in 2004, increasing Russian oil export earnings at a rate of perhaps \$30 billion a year, one consequence was to diminish Russian need for foreign capital. Last year, President Vladimir Putin renationalized the major part of the country's largest oil company, tightened the government's grip on the press, and accelerated the trend toward centralized authority in Russia.

Several European governments have been urgently negotiating with Iran to dissuade it from pursuing nuclear weapons. One of the most attractive incentives they could offer has been investment capital. But Iran suddenly needs it much less: since early 2005, Iran's oil export earnings are now projected to run about \$15 billion a year higher than the year before.

Throughout the Middle East, this wave of unexpected new revenue has flooded into countries not all of which are well equipped to keep it from reaching violent political factions and terrorists. The routes and magnitudes are unknown. But it is evident that the insurgency against the U.S. presence in Iraq is not suffering from inadequate financial support.

To the extent that Americans have contributed to the rise in oil prices through their steadily rising demand for oil, they appear to have undercut their own foreign policy goals and their own national security interests.

—J.W.A.