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The rapid rise in gasoline prices following Iraq's invasion of Kuwait has stirred renewed interest in the idea that the United States should adopt an energy policy. That notion is reenforced by the fact that we now import one-half of the oil we use, which makes us very vulnerable to all sorts of overseas disruptions (see Figure 1).

The sad fact, which few Americans seem to remember, is that the United States did have an active energy policy in the 1970s. The Department of Energy controlled the price of gasoline (and of other fuels) and also allocated the supply of gasoline by state and type of user. Under the circumstances, there were no shortages of governmental rules, directives and prohibitions governing the production and use of energy.

The results, to put it kindly, were counterproductive — widespread fuel shortages and long lines at service stations. The contrast with Western Europe and Japan was striking. Although both of those regions were far more dependent on imported oil than the United States (Japan imports close to 100 percent of its oil supply), neither of them experienced the inconveniences and problems that American motorists suffered during the 1970s.

The reason was clear. Unlike the United States, these other nations did not try to keep the domestic price of gasoline below the world-market level.

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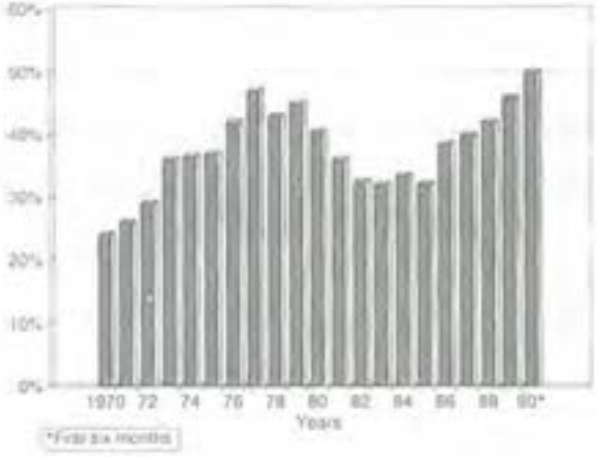
Figure 1

U.S. Dependence on Oil Imports
(Imports as Percentage of Domestic Demand)



Source: American Petroleum Institute.

Unfortunately, consumers in this country never made the obvious connection between price controls and shortages. Hence, pleas for Congress to do something about "price gouging" are becoming louder and shriller. But, as the *Washington Post* noted in a recent editorial, "The oil shortages of the 1970s and the gasoline lines were the result, not of OPEC price increases, but of American price controls."[1]

Under the circumstances, a brief refresher on the fundamental economics of energy would seem helpful. The basic concepts are straightforward and should be quickly recalled by anyone who has had a freshman course in economics.

Economics of Energy[2]

Two economic relationships are basic to energy economics. First, people will use more gasoline (and other forms of energy) when it is

cheaper, and less when it becomes more expensive. Second, those who supply energy will produce more at higher prices than at lower prices.

Higher energy prices account for about 80 percent of the total energy efficiency improvements in the United States since 1973.

The implications of these two statements, when we think them through, are compelling. Changes in energy prices are an important form of information: they provide signals to both producers and consumers. After correcting for the effects of shifts in the industrial sector, one study found that higher energy prices account for about 80 percent of the total energy efficiency improvements in the United States since 1973.[3]

The difficulty is, however, that the process of adjusting to price changes may not always be as rapid as we would like. On the demand side, many consumers own heavy "gas guzzling" automobiles, and live in houses with little insulation and large glass windows. Even if the price of gasoline and fuel oil rises substantially, they will still buy about as much as before. Thus, in the language of economists, the demand for energy is relatively "inelastic" in the short run.

Energy conservation originally was viewed simply as "doing without." Increasingly, however, it is becoming apparent that, by increasing the efficiency with which we use energy, we can produce the same or higher levels of goods and services with less energy. Building-related research, for example, has produced more efficient equipment such as the heat-pump water heater and the solid-state ballast for fluorescent lighting.

Over the longer run, demand for energy is more responsive to changes in price. Older and

less fuel-efficient cars are traded in for newer models that achieve more miles per gallon of gas. Homes are better insulated, and builders construct houses with fewer expansive "single-pane" windows. The result is a significant reduction in the demand for heating oil and other petroleum products.

On the supply side, the response to price movements may also be slow at first. Long lead times are required to develop new sources of energy. But higher-cost supplies — which were ignored at lower prices — become commercially attractive when prices rise high enough. The oil price increases of the 1970s also helped develop new oil sources outside of the United States, especially from Mexico and British and Norwegian North Sea fields. Overall, non-OPEC production in the non-communist world surged from 14 million barrels a day in 1976 to 23 million in 1985.

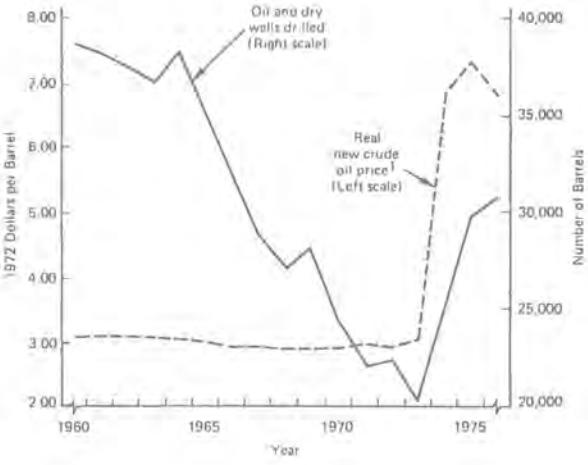
Certainly, historical evidence shows that price increases do provide incentives for the development of new domestic energy supplies. In Sutton and Edwards counties, Texas, total gas completions (a measure of wells being dug) were raised from less than 10 to 240 in the period 1968 to 1974 while the price of natural gas rose from 14.0 cents per million cubic feet to $1.40 per million cubic feet. In eastern Ohio, total gas completions rose from 200 to 1,400 during the same period.[4]

The aggregate pattern of supply response in terms of oil wells drilled is shown in Figure 2. The relationship between prices and supply is clear. The number of wells drilled in the United States declined while the price of crude oil was static (in real terms); drilling expanded sharply when the real price level rose. The key point is that price changes are the basic mechanism for equilibrating demand and supply. Since the price increases that began with the OPEC embargo in 1973, the United States as a whole has become a much less energy-intensive society.

One measure of energy efficiency is the ratio

Figure 2

New Crude Oil Prices and Drilling Activity



[1] Nominal price deflated by wholesale price index for finished goods.

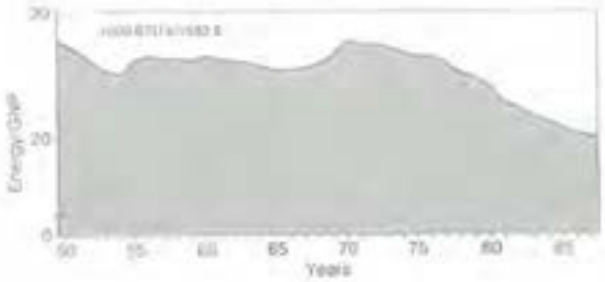
Source: Department of Energy, Department of Labor, and American Petroleum Institute.

of energy use per unit of gross national product. This energy/GNP ratio was 27 thousand BTUs per GNP dollar (in constant 1982 dollars) in 1949 and virtually the same in 1970 (Figure 3). Since then, steady improvement in energy efficiency produced a nearly continuous downward trend to 20 thousand BTUs per dollar in the late 1980s. The rate of improvement has fluctuated: there was moderate improvement in the early 1970s, greater improvement in the next decade or so as energy prices rose sharply, and then a slowing in the rate of improvement in the mid-1980s as energy prices declined.

Energy conservation can result from a variety of behavioral changes. Approximately one-third of the energy savings during the past 15 years, according to the Department of Energy, stemmed from individuals and businesses using

Figure 3

The Declining Energy/GNP Ratio



Source: Department of Energy.

existing energy-consuming equipment less intensively (for example, changing normal thermostat settings or reducing automobile trips).[5] The other two-thirds of the savings resulted from improvements in energy efficiency, such as adding insulation, buying more fuel-efficient vehicles, and building more efficient furnaces, power generators and other equipment. For example, in 1974, the average new car got 14 miles per gallon (mpg) and trucks 4 mpg. Currently, auto efficiency is double at 28 mpg, while truck efficiency is up 50 percent at 6 mpg. The newer 757 jet airliner burns 40 percent less fuel per seat than the plane it replaced, the 727.[6]

Other efficiency improvements included developing products and processes that are less energy intensive. For example, structural plastics replaced steel in many uses, glass fibers were used instead of copper wire and industrial processes were made more energy efficient.

Changes in the energy/GNP ratio can, over time, make significant differences in a country's energy situation. Consider the consequences if the United States had not improved its energy efficiency since 1973, and the energy/GNP ratio had remained constant, rather than declining substantially. By 1989, it took 28 percent less energy to produce a given unit of economic activity in the United States than it did at the time of the first oil shock. In 1973, 27,100 BTUs of energy were required, on average, to produce $1 of GNP. By 1989, the BTU requirement per unit of output had declined to 19,600.[7]

By 1989, it took 28 percent less energy to produce a given unit of economic activity in the United States than it did in 1973.

However, energy efficiency cannot be regulated into existence. Past government attempts to force energy efficiency beyond economic feasibility proved ineffective. One example was the Residential Conservation Service, which required utilities to conduct home energy audits for customers wanting to improve energy efficiency. Only 6 percent of customers requested the appraisals, and even fewer followed up. Yet program costs of more than $500 million were passed on to ratepayers before Congress eliminated the program.

Historical Experience

It is useful to draw upon earlier experiences in order to provide some historical context. Over the course of our nation's history, the American people have successively shifted from relying primarily on one energy source to another. The development of new energy sources took place with little if any governmental intervention. For example, in 1800, illumination in the United States was provided by candles and oil lamps, with fuel for the lamps coming from whale oil. Yet whales did not become extinct as the demand for lighting expanded with a rapidly growing population. A very substantial increase did occur in the price of whale oil, however, from

23 cents a gallon in 1832 to $1.45 in 1865.

Price rises are always painful and unpopular. But citizens back then did not write to their legislators, nor did newspapers castigate the "price gougers" of the day. Consumers simply switched to cheaper substitutes such as coal gas, camphene distilled from vegetable oils, and lard oil.

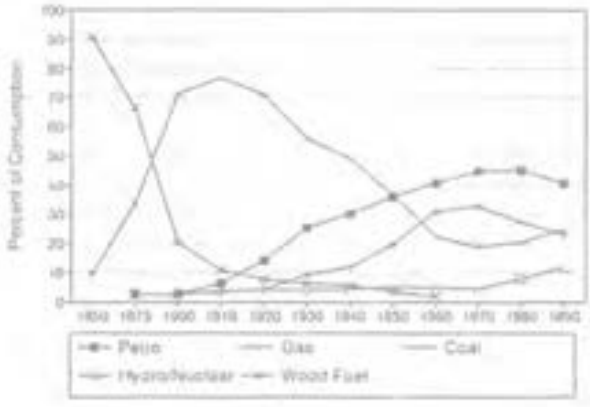
Changes in consumer demand from whale oil to kerosene to gasoline did not result from an act of Congress or a subsidy from the Treasury. The major force for change was successive movements in the price of the different forms of energy.

In the 1850s, coal oil or kerosene derived from coal distillation dominated the market for residential lighting. Its success was followed by an equally meteoric decline in favor of a new fuel that had appeared in the market. Petroleum was discovered in 1859 and quickly became the favored source for kerosene. As crude oil production swelled, its price fell — from $18 a barrel in early 1860 to 10 cents a barrel in late 1861. By 1863, virtually all coal refiners had shifted to refining crude oil. Many new refineries appeared on the scene although gasoline was considered at the time to be a waste byproduct.[8]

The changes in consumer demand from whale oil to kerosene to gasoline did not result from an act of Congress or a subsidy from the Treasury. The major force for change was successive movements in the price of the different forms of energy. As shown in Figure 4, there have been frequent shifts in the course of American history in the relative importance of different fuels. In the middle of the nineteenth century, wood was the major fuel and

Figure 4

Energy Sources in the United States



Source: Statistical Abstract of the United States, 1990; Historical Statistics of the U.S. Department of Commerce.

cries of alarm were sounded from time to time about the depletion of our forests. By late in the nineteenth century, however, people shifted to coal as relative prices changed. The implications for current policy would seem to be clear: The sooner government frees energy sources from artificial restraints, the sooner new energy sources will become commercially competitive.

In contrast, just consider what might have happened if the federal government had adopted a formal energy policy in the nineteenth century. Some government agency surely would have given a grant to a candlemaker to develop an improved wick. Another part of the bureaucracy would have subsidized carriage companies to test high-mileage hay for horses. It is unlikely that any stodgy government official would have given a grant to a maverick such as Thomas Edison.

In a very real sense, the United States does have an energy policy for the 1990s. It is similar to the clothing policy, the refrigerator pol-

icy, and soda pop policy! It's called reliance on the marketplace and it works better than any alternative, hands-on policy. Surely, the failure of the multibillion dollar synthetic fuels program initiated in the late 1970s reminds us of the dangers that arise when the federal government takes too active a role in attempting to forcefeed the pace of market adjustments.[9]

Interaction with Environmental Regulations

Despite the absence of any formal energy policy, many government actions affect the availability of energy in powerful ways. Today, the United States has by far the most comprehensive body of legislation to protect the environment of any nation. The interrelationships between energy and environmental policies are numerous and significant. Often they work at unintended cross-purposes.

For example, virtually every new energy project has been delayed via such actions as challenges to an environmental impact statement (EIS) or legal disputes over the process through which the cognizant federal agency has considered the environmental aspects or whether it has considered all of the aspects properly. In several instances — such as the Shoreham nuclear power plant in Long Island — energy projects have been abandoned even after construction has been completed and approved.

One major study of the effects of the EIS described it as an instrument of "legal and political warfare." The authors concluded, "There can be no doubt that a major effect of the EIS requirement has been to give environmental groups a legal and political instrument to cancel, delay, or modify development projects that they oppose."[10]

During the energy "shortages" of the 1970s, a task force of the President's Energy Resources Council analyzed the regulatory problems that would be faced in developing a domestic synthetic fuel industry. They specifically evaluated the effects of the environmental impact statements (EIS) required by the National Environmental Policy Act of 1969 (NEPA). The conclusions of the task force are worrisome for the development of any new energy source, especially when we consider that environmental restrictions have increased in the years since the report was written:

> . . . the major uncertainty under NEPA is not whether or not the project will be allowed to proceed, but rather the length of time it will be delayed pending the issuance of an EIS that will stand up in court. The cost of such delays (construction financing and inflated raw materials and labor costs) is an obvious potential hazard to any synfuels project. . . .
>
> In summary, the cost and delay occasioned by NEPA constitute a substantial disincentive, aggravated by the fact that in dealing with new processes it is very hard to anticipate what the EIS requirements will be and on what grounds the EIS may be attacked. The general guidelines offered by the Council on Environmental Quality (40 CFR Part 1500) provide a drafting framework but no assurance of compliance.

The Presidential Task Force also identified 14 different and often onerous regulatory constraints which would be faced in developing a new energy project such as a synthetic fuel facility:

- Preparing an environmental impact statement, as required by the National Environmental Policy Act of 1969.
- Meeting new source performance standards for air quality, under the Clean Air Act.
- Meeting the hazardous pollutant emission standards, under the Clean Air Act.
- Meeting the state air-quality implementation plans required by the Clean Air Act.
- Obtaining necessary point source discharge permits, under the Clean Water Act.
- Meeting state water quality standards and water quality management plans, as pro-

mulgated under the Clean Water Act.

- Complying with limitations applicable to "underground injections," under the Safe Drinking Water Act.
- Complying with the regulation of interstate pipeline transmissions, under the Interstate Commerce Act.
- Complying with the prohibition against a carrier transporting its own products, under the Interstate Commerce Act.
- Complying with the allocation of railroad cars transporting coal, under the Interstate Commerce Act.
- Complying with the regulation of interstate transmission of synthetic gas once it is mixed with natural gas, under the Natural Gas Act.
- Obtaining necessary plant and mine leases, from the U.S. Bureau of Land Management.
- Obtaining necessary water allocations, from the U.S. Bureau of Reclamation.
- Complying with the Coal Mine Health and Safety Act.

The task force's conclusion is noteworthy: "In summary, some of these requirements could easily hold up or permanently postpone any attempt to build and operate a synthetic fuels plant."[11] The more recent difficulties experienced by companies attempting to build and operate nuclear as well as conventional power plants tend to bear out the task force's concern. Surely, a sensible program of regulatory reform has an important role to play in enhancing the economic strength of the United States be it in regard to energy, the environment or other areas of public interest.

For instance, if Congress votes to allow exploration and development of the Coastal Plain of Alaska's Arctic National Wildlife Refuge, the result might be an increase of one-third in current U.S. oil reserves. The U.S. Department of Energy estimates that the area contains as much as 9.2 billion barrels of economically recoverable oil.[12]

Some Final Thoughts on Energy Policy

The development of government policy toward energy has been a perennial matter of controversy in the United States. Issues of regulation, taxation, budgeting, and national security are, at different times, very much involved. An effort needs to be made to reconcile the important but conflicting concerns for energy, the environment, and the economy.

If the price of gasoline had kept up with inflation in the 1980s, consumption in the United States today would be nearly 20 percent lower than it is.

The status quo in public policy affecting energy is not adequate for the 1990s. The current result is that gasoline prices in the United States, despite the run-up following the Iraqi invasion of Kuwait, are still, in real terms (corrected for inflation), about the same as in 1973, prior to the huge increases in oil prices brought on by OPEC. U.S. gasoline prices are the lowest in the industrialized world. The current level of approximately $1.35 compares to $3.00 in West Germany, $3.50 in the United Kingdom, and $4.30 in France. Energy expert Philip Verleger, Jr., estimates that if the price of gasoline had kept up with inflation in the 1980s, consumption in the United States today would be nearly 20 percent lower than it is.[13]

Even more dramatic is the fact that, on average, each American uses twice as much energy as each resident of Japan and West Germany. If, by some stretch of the imagination, we could bring our energy use down to that of those two economic competitors, the United States might be able to eliminate its need for imported oil, and thus end its reliance on the unstable Middle East for a key part of its energy supply.[14]

The principles listed below are an effort to provide useful guidance in the emerging debate on energy policy in the 1990s.[15]

- Market forces should be depended upon to balance energy demand and energy supply.
- Changes in relative prices should be the key force determining the source and use of fuels and the introduction of new technologies.
- Energy prices should include the full societal costs of energy production and use, including the environmental impacts.
- Decisions on energy and environment policies should include careful consideration of the benefits and the costs.

Adhering to these principles is not as much fun as yelling at oil company executives every time prices rise, whether such actions are cost-based or not. However, the four principles do point the way to a better balance between the demand for energy in the United States and the supply available to American consumers.

Notes

1. "Riding the Roller Coaster," *Washington Post*, August 28, 1990, p. A16.
2. This section draws heavily on Murray Weidenbaum, *Business, Government, and the Public*, Third Edition (Englewood Cliffs, N.J.: Prentice-Hall, 1986), Chapter 6, "Energy Policy."
3. *Energy Security White Paper: U.S. Decisions and Global Trends* (Washington, D.C.: American Petroleum Institute, 1988), pp. 83-85.
4. James M. Collins and H. A. Merklein, "An Assessment of the Supply Effects of Natural Gas Deregulation," in Milton R. Copulos, ed., *Energy Perspective* (Washington, D.C.: Heritage Foundation, 1978), p. 38.
5. *The Projected Impact of Lower Oil Prices on U.S. Energy Conservation* (Washington, D.C.: U.S. Department of Energy, January 1988), p. 1.
6. "Standing Up to Oil Shock," *U.S. News and World Report*, August 27, 1990, p. 37; "Building a More Fuel-Efficient Jet," *The New York Times*, August 27, 1990, p. C15.
7. *Energy Security White Paper*, p. 91; "Has Conservation Paid Off?" *Los Angeles Times*, August 19, 1990, p. D8. See also U.S. Office of Technology Assessment, *Energy Use and the U.S. Economy* (Washington, D.C.: U.S. Government Printing Office, 1990).
8. Harold F. Williamson and Arnold R. Daum, *The American Petroleum Industry: The Age of Illumination, 1859-1899* (Chicago: Northwestern University Press, 1959), p. 13; M. Edgar Barnett and Mary Pat Cormack, *Management Strategy in the Oil and Gas Industries* (Houston: Gulf Publishing Co., 1983), p. 19.
9. *Synthetic Fuels: An Overview of DOE's Ownership and Divestiture of the Great Plains Project* (Washington, D.C.: U.S. General Accounting Office, 1989).

10. Eugene Bardach and Lucian Pugliaresi, "The Environmental Impact Statement vs. The Real World," *Public Interest*, Fall 1977, p. 23.

11. President's Energy Resources Council, Synfuels Interagency Task Force, *Recommendations for a Synthetic Fuels Commercialization Program*, vol. 1 (Washington, D.C.: U.S. Government Printing Office, 1975), p. 134.

12. *United States Energy Policy 1980-1988* (Washington, D.C.: U.S. Department of Energy, 1988), p. xi.

13. Cited in David Gergen, "A Perfect Time for a Gasoline Tax," *U.S. News and World Report*, August 27, 1990, p. 88. See also Associated Press survey of gasoline prices, "Gas Prices in Western Europe," *St. Louis Post-Dispatch*, September 2, 1990, p. E-1.

14. Based on data from Lawrence Berkeley Laboratory, cited in "How Countries Compare," *The New York Times*, March 12, 1989, p. E6.

15. Energy Working Group, *Energy Imperatives for the 1990s* (Washington, D.C.: Atlantic Council of the United States, 1990), pp. ii-iii.