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Costs and Benefits of Climate Change Policies

Stack:	Row:	Section:	Shelf:	Position:
S	61	6	3	2

Founded in 1851

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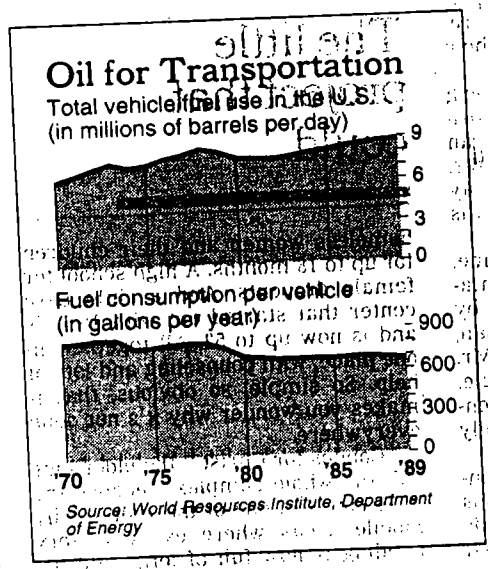
Save Gasoline a Better Way

The best way to reduce the use of fuel and clean up the atmosphere is for Congress to pass a stiff energy tax. But the Administration's national energy strategy virtually ignores tax hikes or any other conservation measure, an omission that many in Congress rightly want to reverse.

Yet Congress, too, seems determined to duck taxes. Senator Richard Bryan of Wisconsin has won considerable support for a different approach, a bill that would raise average fuel-efficiency standards for new cars from 27.5 miles per gallon to 40. Mr. Bryan's regulatory approach is tempting, but it won't work as well as higher taxes. That's because fuel-efficiency standards — known as CAFE standards — lower only fuel use *per vehicle* for new cars. But CAFE has not significantly lowered *total* fuel use. In recent years, fuel use per vehicle has gone down, and total fuel use has gone up.



Compared with a tax, CAFE standards affect a much smaller segment of the energy market. They apply only to new cars, which account for less than 10 percent of gasoline consumption. Worse yet, they hold down driving costs. And Congress treats CAFE as a substitute for a stiff gasoline tax, keeping gas prices down.

These lower driving costs encourage people to drive more miles, which offsets part of the impact of higher fuel economy. CAFE also works against itself in another way. Manufacturers may be forced to adopt expensive technologies, making new cars more expensive, encouraging drivers to keep old gas-guzzlers.

Safety is also a serious issue. To meet CAFE, manufacturers sell smaller cars. According to studies by Robert Crandall of the Brookings Institution, 1989 cars were 500 pounds lighter than they would have been without CAFE. That will boost fatalities in these cars by about 2,500 and serious injuries by 25,000. True, higher gas taxes would also make small cars more attractive, but less so. Taxes primarily encourage everyone to drive less.

Over all, the fuel savings generated by CAFE standards are small, according to studies by Prof. Robert Leone of Boston University. Energy taxes would be more effective. A higher gas tax would encourage everyone to drive less, buy more fuel-efficient cars, share rides and, eventually, live closer to work. According to some studies, a gasoline tax as small as 5 cents per gallon would achieve as much conservation as Mr. Bryan's bill, but at a fraction of the cost to the economy. A broad tax applying to all fossil fuels would fight pollution and global warming even better.

Congress, fearful of voter wrath over tax increases, could offset a higher gas tax with lower payroll taxes. That way the Federal deficit would be unaffected, one regressive tax would replace another and the nation's needs for energy, and clean air, would be protected. That's the core of a sensible national energy strategy.

In this 50th year since the outbreak of the war in the Pacific, the thrust of a Japanese Cabinet decision that you reported Jan. 23, 1941, and referred to in an editorial the next day, provides historical perspective on the bonuses for babies issue.

The Cabinet in Tokyo had approved a proposal to encourage every family to have five children so that Japan's population, then 67 million, would reach 100 million by 1960.

Four objectives were announced: "First, to maintain a perpetual increase; second, to outrival other nations in the rate of increase and quality; third, to supply the military and industrial manpower required by the state; fourth, to distribute the population properly to maintain Japan's leadership in Asia."

One official said that a large number of tanks and planes would serve no useful purpose unless there were enough men to operate them. Consequently, the Japanese people were called upon to abandon their "individualistic tendency to avoid pregnancy and enjoy their own lives only."

This brought editorial comment

the Government began pushing
idea of five children to a family
cause it insisted that more Japane
were needed to occupy and admin
ter the conquered territories. "P
haps one of these explanations is v
id," you wrote. "And perhaps
author of 'Alice in Wonderland,' if
were still alive, would be able to
the Mad Hatter to fit them togethe

Extraordinary changes have
curred in Japan since 1945, but the
way of thinking bubbles up occas
ally. In 1941, women who did not
the Cabinet's cannon-fodder
would have put themselves, t
families and perhaps even t
friends in danger if they had pub
voiced opposition. Today, Japa
women can express their anger o
ly, even if they are still fightin
achieve equality in their male-d
nated society.

The Japanese Government
pears to be harking back to
"breed and multiply" ideas of h
century ago to counter the decl
birthrate. You note that one
prefecture has begun an Oper

Equal Opportunity for Black Civilians

To the Editor:

It is commendable that President Bush has praised black military heroes in a White House speech. But while referring to the military as the "greatest equal employment opportunity employer," the President is unable or unwilling to sign the Civil Rights Acts of 1990 or 1991 (he vetoed the first), which would cure deficiencies in job-discrimination law.

My great-grandfather, a "contraband" from Wilmington, N.C., enlisted in the United States Navy in 1862, participated in the North Atlantic and European blockades of the Civil War. My grandfather was a sergeant in the Spanish-American War with the 6th Regiment of Massachusetts Volunteers. Five great-uncles were officers in World War I.

Those black veterans of other wars, like the black fighting men and women in the Persian Gulf, were the backbone of this nation. They were proud to serve their country and unalterably committed to the elimination of racial inequality. Surely, the President, who lauds the black military contribution in the gulf, owes blacks

in the armed services, p
present, the same standards
opportunity in the civilian se
he finds so praiseworthy in
ary.

WILLIAM B. G
Charles A. Beardsley
of Law, Stanford U
Stanford, Calif., Feb

From: Energy Lab, MIT Oct-Dec 1990

Economic Penalty of Reducing Carbon Emissions

An Energy Laboratory analysis suggests that imposing constraints on carbon emissions—one proposed method of preventing global warming—can have far-reaching and profound effects on the growth of an economy, especially if the constraints are imposed on each sector rather than on the economy as a whole. The analysis suggests that the resulting adjustments in economic activity are subtle and differ markedly depending on the strictness of the constraints. Such findings warn against simplistic diagnoses and policy prescriptions relating to the control of potential greenhouse effects.

One of today's most-debated environmental issues is the threat of global warming through an enhanced greenhouse effect. Will it cost more to prevent global climate change or to live with its consequences? Determining the cost of living with its consequences requires answering some complex questions. If the atmospheric concentration of greenhouse gases continues to increase, will the earth's surface temperature rise? If so, by how much? And how would higher temperatures affect glacial ice shelves, ocean and groundwater levels, and weather patterns? Until we better understand the science involved, we cannot answer those questions.

We can, however, begin to calculate the cost of preventing global climate change. Preventing such change requires reducing the amount of greenhouse gases we emit. It is relatively straightforward to calculate the cost, say, for a coal-burning electric utility company to install carbon-dioxide-removal equipment or to switch to a "cleaner" technology or a less carbonaceous fuel such as natural gas. But environmental policies—even those confined to a few sectors—have repercussions throughout the economy, changing the patterns of both consumption and production.

Estimating the overall cost of constraining emissions therefore falls to economists, who can simulate economic activity using computer models. Richard S. Eckaus, professor of economics, and his colleagues—Charles R. Blitzer of The World Bank, Supriya Lahiri of the University of Lowell, and Alexander Meeraus of GAMS Development Corporation—have been performing such simulations with a model well-suited to the task. Originally developed for analyzing energy policy in Egypt, their model simulates the Egyptian economy. It divides the economy into ten sectors: crude oil, natural gas, petroleum products, electricity, agriculture, manufacturing, construction, transport, services (insurance, financial services, communications, etc.), and non-competing imports. The model is relatively detailed with respect to sources and uses of energy and is sufficiently "disaggregated" to recognize the action of sectoral differences in emission rates. It has an overall time horizon of 25 years but reports results for five individual years spaced five years apart—an appropriate approach since both climate change and policies to prevent it will work themselves out only over a substantial period of time. Finally, the model measures the "cost" of emissions constraints as the change in the growth rate of the economy under study. That measure is more meaningful than a simple estimate in absolute dollars, which will tend to be bigger in the richer, developed nations than in the poorer, developing nations.

Most important, the model itself calculates all the adjustments that result from imposing emissions constraints. In the model, households, the government, the producing sectors, and exporters all purchase certain levels and types of goods and services; domestic producers and importers provide those goods and services. Consumers attempt to maximize their well-being by making selections based on the relative prices of the available goods and services and on their personal income levels, both of which are determined by the model. When the prices and income levels change (for example, due to the imposition of emissions constraints), consumers change their purchases accordingly. Producers behave similarly, making investment and other decisions that will maximize their profits.

All decisions in the model are made optimally over the 25-year period covered. And all adjustments are made within two restrictions: supply must equal demand; and the availabilities of natural resources, labor, foreign exchange, and technology are limited. In the short term, producers are limited by the capital equipment they own; but they can invest to satisfy growing demands. When there are changes in the relative prices of fuels, electricity, labor, and capital (as calculated by the model), producers can invest in other technologies that require a different mix of inputs.

Using this model, the researchers calculated the impact on economic activity and growth of various regulatory strategies that impose emissions constraints. Because carbon is the biggest potential contributor to greenhouse warming, they considered only carbon, specifically, carbon generated by use of petroleum and natural gas, the only significant fuels in Egypt.

To establish the basis for comparison, they first determined how the economy would grow in the absence of emissions restrictions. In the figure on page 8, the curve labeled "base case" plots the model's predictions of Egypt's gross domestic product (GDP) for 1987–2002.

The researchers then imposed regulatory plans calling for emissions constraints of varying severity. The first three plans, presented in the table on page 8 as E1, E2, and E3, limit total carbon emissions from all economic activity. As indicated in the table, the constraints are defined not as absolute reductions in emissions but as percentages of the total emissions that would be generated in each five-year period under the base case. These three "economy-wide" plans reflect the concept of "bubble" regulation, which places limits on the total output of a pollutant by a group of industries—an approach that permits the industries themselves to choose the most efficient means of meeting the overall target.

The changes in the simulated sectoral patterns of trade caused by imposing carbon constraints are too numerous to report here. The overall levels of GDP that result, however, are presented in the curves labeled E1, E2, and E3. Results are reported only for 1992, 1997, and 2002 because those years are relatively unaffected by the truncation of the model's time horizon.

Perhaps the most interesting feature of the results is the nonlinear relationship between reductions in carbon emissions and reductions in economic perfor-

mance. For example, reducing emissions by 5% (the 1992 requirement under Plan E1) reduces the estimated GDP by 0.6%. But reducing emissions by 10% (the 1992 requirement under Plan E2) reduces GDP by 2.9%. Thus, doubling the reduction in emissions does not double the decrease in economic growth but almost quintuples it. The cost of emission reduction grows more quickly than the benefit, and the impact on GDP of any reduction greater than 5% is substantial.

Professor Eckaus and his colleagues then considered the impact of plans that impose constraints sector by sector. These sectoral constraints are analogous to regulations that limit emissions from particular sources or particular types of activities, for example, from automobiles or from thermal-electric generating plants. (Adopting the sectoral rather than bubble approach can also be likened to placing constraints on individual power plants rather than on a group of plants.)

The researchers' first observation was that in some cases the model could not find a feasible solution, given the limits placed on resources, labor, foreign exchange, and technology. For example, when the researchers applied Plans E2 and E3 on each sector rather than on the total economy, the model was unable to adjust activity in the services sector. The services sector uses relatively little fuel, and the substitution possibilities among fuels and other inputs are limited. The researchers therefore had to exempt the services sector when they imposed the more stringent sectoral emissions constraints. The message here is important: constraints on emissions, if not applied with care, may create serious difficulties for an economy. A sector's inputs and the demands for its outputs may not be sufficiently flexible to make the necessary adjustment.

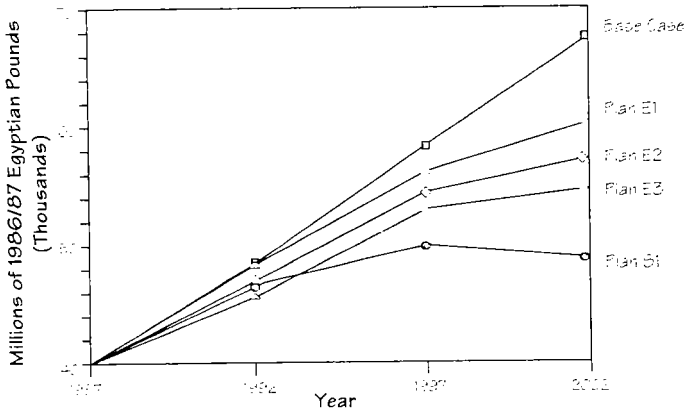
The second observation was that the economic penalty from limiting emissions is significantly greater with sectoral constraints than with economy-wide constraints. One sectoral plan, presented as Plan S1 in the table, involves percentage reductions identical to those in the economy-wide Plan E1. Yet, as the curves show, the negative impact on GDP is far greater under Plan S1 than under Plan E1. The flexibility to make trade-offs among sectors is clearly critical as an economy tries to adjust to emissions constraints.

The researchers are now using their model to examine the relationship between carbon emissions and increased fuel efficiency. Some experts believe there are changes in engineering and maintenance practices that are virtually costless and could lead to higher fuel efficiency and thus lower carbon emissions for the same output. The researchers' preliminary analyses confirm that making the proposed changes would reduce the economic impact of imposing emissions constraints but not by much: growth rates might increase by about 20% during the first 15 years. That finding is not surprising. An improvement in efficiency (and hence in emissions) is a one-time change, and a one-time change at today's level of economic activity will not dramatically reduce the impact of carbon constraints on the expanded economy of the future.

Proessor Eckaus and his coworkers are also adapting their model to describe India, a country that is larger than Egypt and uses a more diverse set of fuels. They are also extending the model so it can track not just carbon emissions from fuel use but also emissions of other pollutants from a variety of economic activities. Ultimately, they plan to develop a model that can, given a desired future level of greenhouse gases in the atmosphere, determine the path of annual emissions that will maintain that level with the least economic penalty.

This research was supported by the MIT Center for Energy Policy Research. Further information can be found in references 5 and 6.

Predicted Gross Domestic Product (GDP) for Egypt Under Various Emission Constraints



Constraints on Carbon Emissions as Percentages of Emissions in the Base Case

Plan	1987	1992	1997	2002	2007	2012
E1*	100	0.95	0.85	0.70	0.70	0.65
E2*	100	0.90	0.80	0.65	0.60	0.55
E3*	100	0.85	0.75	0.60	0.55	0.45
S1**	100	0.95	0.85	0.70	0.70	0.65

* Plans imposing constraints on carbon emissions from the overall economy.
**Plan imposing constraints on carbon emissions from each sector.

FAX TRANSMITTAL

Lawrence Berkeley Laboratory
Center for Building Science
FAX (415) 486-5394, phone -4834

March 11, 1991 Total pages faxed: 1

Fax to: Katie McGinty
Office of Senator Al Gore

From: Art Rosenfeld

Got your 2 pp. on Downey tax draft. I'm uncomfortable with two taxes, and the 2 pp. you sent don't give rationale.

My priority: 1. To delay the risk of global warming: a carbon tax, which Downey calls a Global Warming Surcharge. But under exemptions (b) is **electricity.** Why? The whole idea is to get utilities to switch out of coal.

2. Next priority might be an oil tax for balance of trade/security reasons. And since natural gas is partially convertible to oil, tax gas at about half the rate of oil.

3. Next priority: a **floor** on gasoline prices; if the price goes down, use the difference to reduce the deficit, fill SPR, etc.

4. But Downey's straight 5% tax on each $ of retail fuel comes low in my list.

Suggestion: I just spoke about this with Professor Richard Ottinger, Director, Center for Environmental Law, Pace University, White Plains, NY, former congressman from NY, who of course also knows Downey. He is a better advisor than I am on taxes/politics. Suggest you call him if you want serious wise advice: (914) 422-4324. But call me too if this fax doesn't make sense.

February 15, 1991
Publication: SR-3-Pt. 3-Energy

dpc special report

Part 3 of a Series

RENEWABLE ENERGY TECHNOLOGY

democratic policy committee

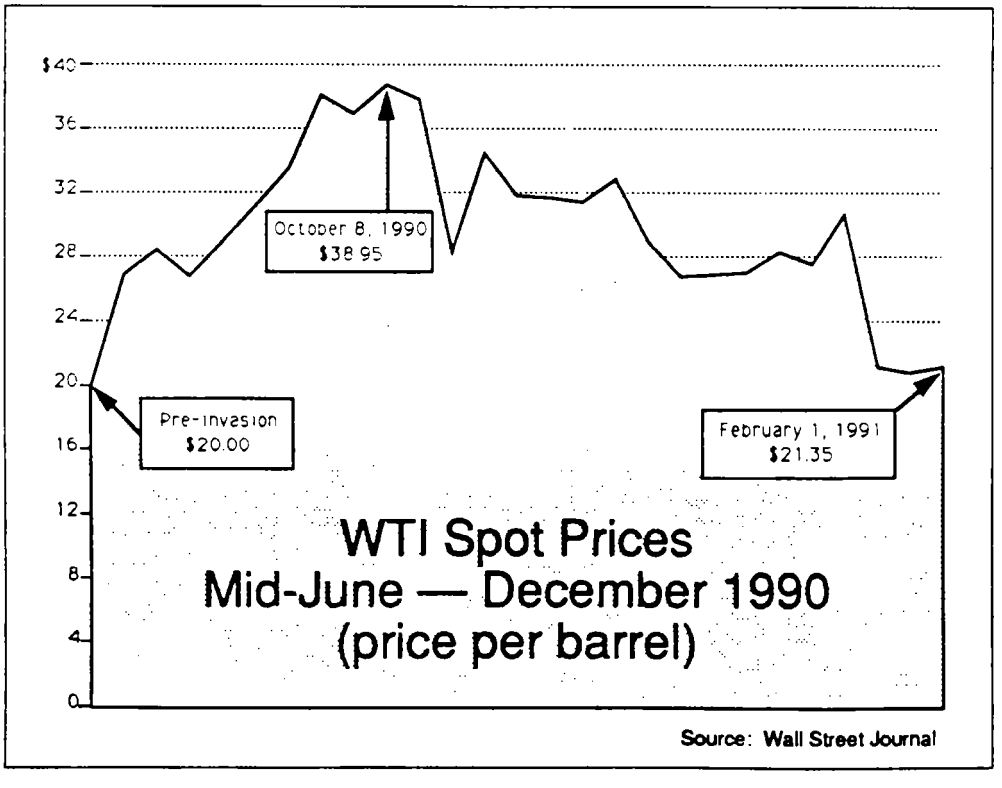
DPC Staff Contact: Mike Feldman (4-3232)

Democratic Policy Committee
United States Senate
Washington, D.C. 20510

George J. Mitchell, Chairman
Thomas A. Daschle, Co-Chairman

INTRODUCTION

More than seven months after the Iraqi invasion of Kuwait, as the price of oil fluctuates wildly between $20 and $40 a barrel, the United States is wrestling once again with the consequences of depending upon imported oil to meet basic energy needs. Changes in the price of oil are playing havoc with the American economy. The stability of the airline industry, as well as fuel costs affecting the delivery service industry, public transportation and goods that are transported, and, home heating/cooling costs, all are affected.



Complacency Despite Commitment

After severe disruptions in the flow of imported oil during the 1970s, the U.S. committed itself to a policy of conservation, innovation, and maintenance of a state of preparedness for future energy emergencies. The Reagan Administration rejected this commitment, and this rejection, combined with the low oil prices of the 1980s, had the effect of lulling the U.S. back into a state of complacency. Oil consumption and importation have now risen to their highest levels since the mid-1970s.

Our nation's lack of commitment to a well-thought-out energy policy also deeply affects the condition of our natural environment. Our continued dependence on fossil fuels leads to unacceptable national levels of carbon dioxide emission, as well as to other environmental pollution.

In addition, an apparent national inability to deal effectively with the by-products of our nuclear power facilities jeopardizes the environmental legacy we leave to future generations.

We need a national energy policy that brings about a reduction in carbon dioxide emissions sufficient to slow the process that leads to global warming, without jeopardizing future generations.

A Priority Once Again

Recent events have forced energy policy back to the top of our national agenda. The Administration and Congress both have announced intentions to make comprehensive national energy policy legislation a top priority in the 102nd Congress. The following is an examination of renewable energy technology.

RENEWABLE ENERGY

Any long-term comprehensive national energy plan must include a greater emphasis on renewable energy technology. As part of an alternative energy development plan, renewables could help reduce our dependence on exhaustible energy sources, strengthen our national security, and ease concerns about the environment. Furthermore, a globally-coordinated effort to enhance the research, development and implementation of renewable energy technology could ease the international stresses and strains exacerbated by the struggle to control the flow of oil worldwide.

An energy source is *renewable* only if, with proper management, its sustained use will not deplete supply. Wind, sunlight, flowing water, plants, and forests are examples of energy sources that do not necessarily need to be replenished.

- *Geothermal* energy is tapped from the heat below the earth's surface (usually derived from pressurized hot water reserves). The world currently has more than 5,000 megawatts of installed geothermal capacity at a cost of 4-8 cents per kilowatt-hour (KWh).

  Geothermal energy is used in direct heating applications, such as industrial process heat, space and water heating, and agriculture. At higher temperatures, geothermal energy can be used to generate electricity. Geothermal power emits few pollutants and comparatively less carbon than fossil fuels.

- *Solar Thermal* energy involves direct use of the heat created from the sun's radiation. Mirrors are often used to focus sunlight onto thin, oil-filled tubes. The tubes convey heat to a turbine and generator. Solar thermal converts 22 percent of the sunlight it receives into electricity at a cost of about 8 cents per kilowatt-hour.

  Other solar thermal technologies include solar ponds, parabolic troughs and parabolic dishes. A solar pond is a body of water that collects and stores solar heat. Parabolic troughs and dishes are solar thermal mirror configurations that individually track the sun.

- *Photovoltaics* convert solar radiation directly into electricity, using semiconductor cells. This is the most expensive, technologically advanced, versatile and rapidly growing renewable. The cost, currently around 30 cents per KWh, is expected to drop considerably with continued research and development.

  Consumer products such as solar-powered watches and calculators use photovoltaics and now account for one-third of all photovoltaic technology. Remote power and utility generation are the two other significant applications of photovoltaics. Eventually, grid-connected photovoltaic systems could become economically competitive on the nation's electric power system. The Solar Energy Research Institute estimates that photovoltaic energy will be capable of supplying more than half of U.S. electricity four to five decades from now.[1]

- *Wind power* involves harnessing the power of the wind to turn turbines which produce electricity. A quickly growing renewable energy source, wind power has made impressive gains in the last decade in spite of a drastic reduction in R&D funding. At a cost of 6-8 cents per KWh, there are currently more than 20,000 electricity producing wind machines worldwide. These machines have a combined capacity of 1,600 megawatts. At the commercial level, wind turbines are often clustered together into "windfarms". The power from each turbine is then collected into energy utility grids.

  Wind power is much less expensive than most nuclear power plants, and wind is approaching the cost of most fossil fuel based power. Most commercial wind turbines are located in Hawaii and California. The wind speeds in the regions average well over 15 mph. Many other locations in the U.S., which are conducive to the generation of power from wind, have not yet been exploited.

- *Biomass* energy requires the conversion (burning) of biological materials to create energy. These materials consist of organic matter that can be derived from plant photosynthesis, such as wood, forest residues, wood-processing wastes, agricultural crops, crop residues, aquatic plants and animal wastes. As a substitute for fossil fuels, biomass is used in industry, electric utilities, residences and transportation.

  Biomass is the leading renewable energy source in the United States and is much less harmful to the environment than the burning of fossil fuels. At a cost of about 7 cents per KWh, biomass provides roughly 4 percent of the nation's energy.

- *Hydropower* harnesses the energy created by falling or flowing water. First developed in the late 19th century, hydropower generates more electricity than any other renewable energy source. This power is relatively inexpensive, and while some older, larger projects can generate power at roughly 1 cent per KWh, most new hydro plants produce energy at a cost of between 3 and 6 cents per KWh.

  Although environmental concerns about the impoundment of water has had a negative affect on the development of new large-scale projects, hydropower contributes no carbon dioxide emissions to global warming.

- *Ocean Energy* can be tapped in a variety of ways. Tidal, wave, and ocean thermal energy conversion are three methods of exploiting the ocean as an energy resource. All three methods can be used to run power plants and generate electricity. Wave and tidal energy use the force of the ocean in the same way that hydroelectric plants use the forces of flowing rivers. Ocean thermal energy taps the drastic temperature differences between ocean water at various depths.

  At a cost of 8 to 15 cents per KWh, and with 70 percent of the earth's surface covered by oceans, the potential for ocean thermal energy is great.

- *Alcohol Fuels:* Ethanol and methanol are both alcohols which can used to fuel automobiles and other machinery.

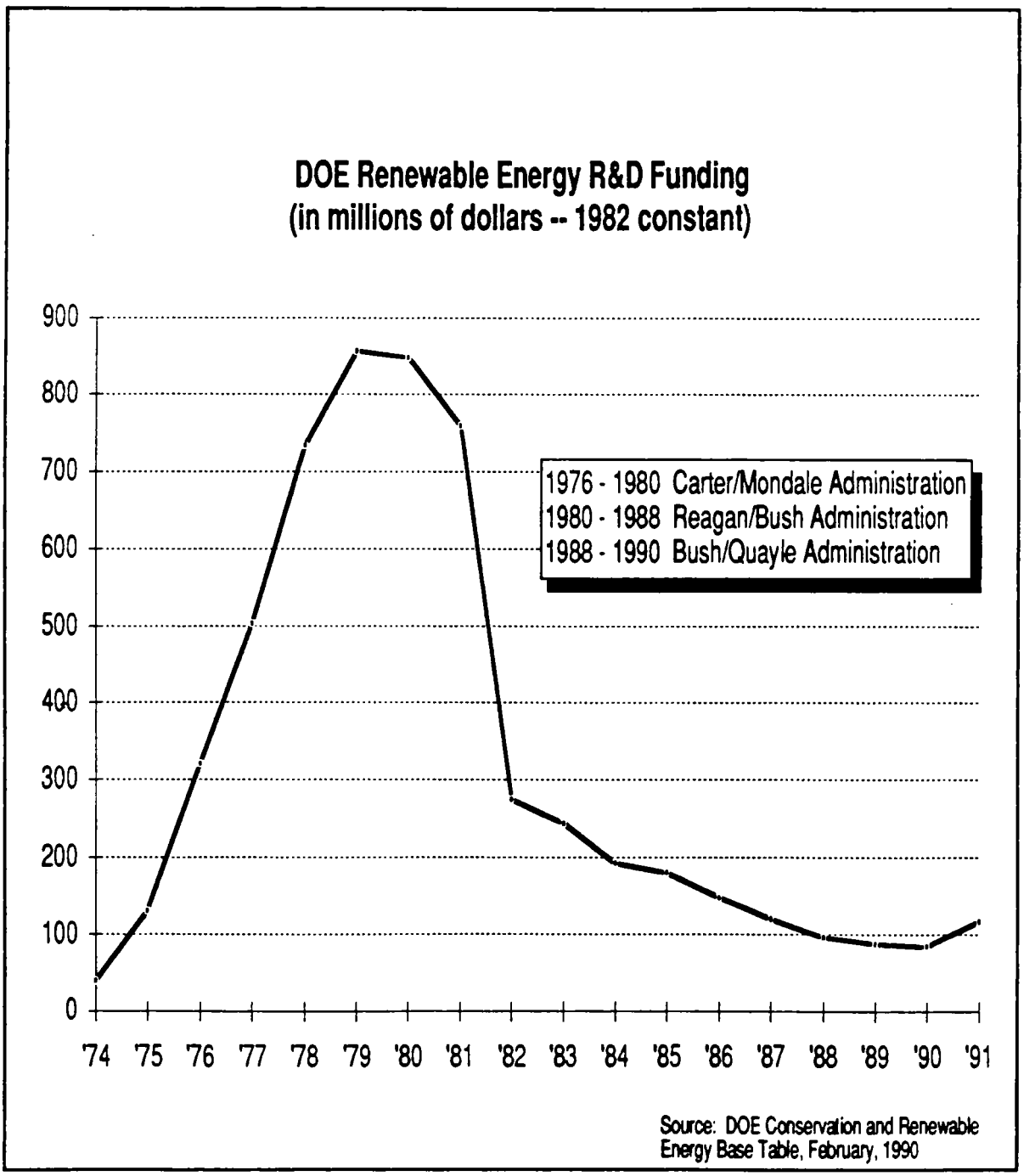
  Methanol: Methanol currently is derived from natural gas, but in the future could be obtained from coal or wood. Methanol is not in widespread use, as is ethanol , mostly because of methanol's incompatibility with engines in existing automobiles. Methanol tends to be too corrosive to hoses and gaskets for daily use in most engines. Instead, methanol derivatives, such as MTBE (methyl tertiary butyl ether) now are used in varying concentrations as octane enhancers in about 15 percent of the Nation's gas pool. The use of MTBE is expected to continue to grow, as cleaner-burning "reformulated" gasoline proliferates.

  Ethanol: Ethanol is derived primarily from corn, but also can be derived from other sources, such as wheat, potatoes, barley, sugar cane, and biomass. In the United States, it is primarily used with gasoline in a mixture called "gasohol" (10 percent ethanol). Gasohol already has found fairly widespread use in certain areas of the country, and already comprises eight percent of the Nation's gasoline supply. Currently, the United States uses approximately 800 million gallons of ethanol per year this way.

  Ethanol blends, such as gasohol, have several advantages over gasoline. Not only is ethanol a *domestic* resource (which helps strengthen U.S. energy security by reducing dependence on foreign oil), but ethanol blends also are better for the environment than gasoline. When ethanol is used in place of gasoline, less CO_2 is put into the atmosphere, which could reduce the threat of global warming. In addition, using ethanol blends significantly reduces amounts of toxic air emissions. According to the EPA, use of a 10 percent ethanol blend reduces carbon monoxide emissions by 25-30 percent and can reduce benzene emissions by as much as 50 percent.

Lack of fungibility has hindered ethanol in finding widespread acceptance in the marketplace. Ethanol generally cannot be shipped through a pipeline, because in a non-dedicated pipeline, it attracts water. This problem has been overcome in the development and recent commercialization of ETBE (ethyl tertiary butyl ether), a high-octane, low volatility, fully fungible ethanol derivative. ETBE will give refiners another tool for meeting the challenges of the *Clean Air Act.*

Although it is difficult to get precise figures on the amounts of CO_2 released in ethanol combustion, it is a matter of general consensus that ethanol is the only liquid transportation fuel that provides a negative or neutral CO_2 balance. The process of photosynthesis, which captures CO_2 in the growing of the next annual crop, compensates for any greenhouse gasses released in the production and combustion of ethanol.


DOE Renewable Energy R&D Funding
(in millions of dollars -- 1982 constant)
900
800
700
600
500
400
300
200
100
0
'74 '75 '76 '77 '78 '79 '80 '81 '82 '83 '84 '85 '86 '87 '88 '89 '90 '91
1976 - 1980 Carter/Mondale Administration
1980 - 1988 Reagan/Bush Administration
1988 - 1990 Bush/Quayle Administration
Source: DOE Conservation and Renewable Energy Base Table, February, 1990

RESEARCH AND DEVELOPMENT

Funding for the research and development of renewables was increased greatly under the Carter Administration in the mid-1970s. In spite of promises to continue to support the speedy development of renewable energy technology, the Reagan/Bush Administration cut funding from a level of $856.9 million in 1979 to a level of $96.8 million in 1988. The Bush-Quayle Administration has cut funding levels further to a level of $84.4 million in FY 1990. Under Presidents Bush and Reagan, total funding for Renewable Energy R&D has been cut by 90 percent since FY 1979.

As a percentage of the total U.S. R&D budget, renewables have not been given high priority. Countries like Italy, Spain, Denmark, Germany, Netherlands, Switzerland, and Sweden spend a larger percentage of their R&D budgets on renewables than the United States. Greece, for example, spends 86.2 percent of its R&D budget on renewables while the U.S. devotes only 5.19 percent of its share of R&D dollars to such exploration.

Government R&D Spending on Renewables in Selected Countries, 1989

	Renewables	
Country	R&D Spending (million dollars)	Share of Energy R&D Budget (percent)
Sweden	$19.31	21.28%
Switzerland	$18.28	18.08%
Netherlands	$18.72	14.18%
Germany	$93.24	18.90%
Greece	$17.07	86.20%
Japan	$99.69	3.66%
United States	$118.30	5.19%
Italy	$36.52	5.93%
Denmark	$9.37	28.13%
Spain	$6.87	13.33%
United Kingdom	$23.65	7.08%

RENEWABLE ENERGY USAGE WORLDWIDE

An examination of worldwide energy usage offers many examples of how renewable energy technology is successfully applied.

U.S. Lacks R&D, Loses Markets and Leadership in Technology

The United States is quickly losing its opportunity to compete in what is sure to become a renewable-intensive energy market. With the elimination of tax credits and other incentives for U.S. companies to research and develop renewable energy technology, foreign companies are gaining a large share of the U.S. renewable energy market. According to a report on a sustainable energy future published by Renew America, Danish companies have captured a large share of the U.S. wind power market, Germany and Japan are taking the lead in photovoltaics, and "the question for U.S. leaders is whether American companies will compete in these important new technologies or whether American consumers will have to import them from abroad."[2]

Wind Power: U.S. Lags Behind Denmark

Denmark spends roughly the same amount of money on the research and development of wind power as does the United States, which has a population 50 times larger. According to a review of the energy policies of various International Energy Agency (IEA) member countries, Denmark spent $6.74 million last year on wind R&D, which is 20.25 percent of its R&D budget. The U.S., by comparison, spent $9.1 million on wind energy technology development, which is only 4/10 of 1 percent of its R&D budget.[3] More importantly, the Danish government offers tax incentives, low-interest loans, and grants to those companies that invest in renewable energy technologies. This support has made Denmark the world's leader in wind energy technology. The U.S., on the other hand, has fallen to the rank of seventh in wind development behind the Netherlands, Italy, West Germany, United Kingdom, Sweden and Denmark.[4]

Photovoltaics: U.S. Concedes Leadership

Photovoltaics are another area in which the United States has lost its share of the renewable energy technology market. Having dominated the international photovoltaics market in the early 1980s, the United States promptly cut R&D funding in this area and now finds itself importing the technology of countries like Japan and Germany. According to the Congressional Research Service, research and development funding in the area of photovoltaics fell from a level of $151.6 million in FY 1981 to $34.7 million in FY 1990.[5] Concurrently, the U.S. share of the photovoltaics market has fallen from 50 percent in 1983 to 32 percent in 1988. At the same time, Japan has captured a great portion of what the U.S. has relinquished, and its share of the market has risen to a level of 37 percent.[6]

LOOKING TO THE FUTURE

The Administration's budget requests for renewable R&D funding in FY 1991 have increased this year. This reverses a trend that has seen eight consecutive years of Reagan and Bush Administration-proposed cuts in spending. Nevertheless, the funding levels are still low. More importantly, the U.S. is doing very little to encourage development of renewable energy technology in the private sector.

Public-Private Strategies Needed

While it is essential that the United States begin to increase R&D funding for renewable energy programs, the answer to our energy woes cannot rest entirely on a policy that simply throws additional government money into the research and development of renewable technology. An examination of the energy policies of some countries suggests that a balance between U.S. government funding and commercial investment can and needs to be achieved. Some strategies might be to:

- redirect funding from nuclear research and development toward renewable energy technologies.
- direct funds used to explore oil reserves, and utility funds that currently are being spent on fossil fuel burning facilities, toward renewable development.
- offer tax incentives, low-interest loans, and government-sponsored grants to companies or individuals that develop or invest in the development of renewable energy technology; or,
- expand Federal/private sector joint ventures in the commercialization of renewable energy technology.

Footnotes

[1] Christopher Flavin, *Slowing Global Warming: A Worldwide Strategy*, Worldwatch Institute: Washington, D.C., 1989, p. 41.

[2] Christopher Flavin & Rick Piltz with Chris Nichols, *Sustainable Energy*, (Renew America: Washington, D.C., 1989), p. 6.

[3] *Energy Policies and Programmes of IEA Countries, 1989 Review.* OECD Publications: Washington, D.C., 1989, pp. 100-101.

[4] Fred J. Sissine, *Renewable Energy: A New National Commitment?*, (Congressional Research Service: Washington, D.C.), p. 9.

[5] CRS IB87140

[6] *Sustainable Energy*, p. 27.

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THE
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GLOBAL ENVIRONMENT

20% less oil than today by 2015 tough

10% more oil in 2015

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oil in moderate case → slightly more than
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Department of Energy—Continued
(In thousands of dollars)

Account				1990 actual	1991 estimate	1992 estimate	1993 estimate
	Total, offsetting collections	271	BA/O	–255,117	–300,000	–300,000	–300,000
Total Energy supply, R&D activities (net)			BA	**2,210,993**	**2,527,082**	**2,821,428**	**2,937,434**
			O	2,086,417	2,107,870	2,608,144	2,829,622
Uranium supply and enrichment activities	Spending authority from offsetting collections, indefinite	271	BA	**1,408,371**	**1,450,400**	**1,547,000**	**1,734,200**
						[1] **–1,547,000**	[1] **–1,734,200**
	Outlays (gross)		O	1,268,106	1,346,556	1,402,357	1,587,157
						[1] –1,402,357	[1] –1,587,157
Uranium supply and enrichment activities (gross)			BA	**1,408,371**	**1,450,400**		
			O	1,268,106	1,346,556		
	Total, offsetting collections	271	BA/O	–1,408,371	–1,450,400	–1,547,000	–1,734,200
		271	BA/O			[1] 1,547,000	[1] 1,734,200
Total Uranium supply and enrichment activities (net)			BA				
			O	–140,265	–103,844		
Fossil energy research and development	Appropriation, current	271	BA	**412,801**	**458,750**	**227,005**	**232,369**
	Outlays		O	368,763	424,085	359,806	277,575
Naval petroleum and oil shale reserves	Appropriation, current	271	BA	**189,439**	**223,135**	**222,300**	**300,000**
							[1] **–270,000**
	Outlays		O	182,046	207,207	216,779	265,181
							[1] –238,663
Total Naval petroleum and oil shale reserves			BA	**189,439**	**223,135**	**222,300**	**30,000**
			O	182,046	207,207	216,779	26,518
Energy conservation	Appropriation, current	272	BA	**366,105**	**465,177**	**295,934**	**326,702**
	Spending authority from offsetting collections, indefinite		BA	**40,616**	**30,000**	**30,000**	
	Outlays (gross)		O	404,857	423,253	436,088	360,915
	Outlays for grants to State and local governments		O	(227,795)	(210,941)	(184,400)	(71,660)
Energy conservation (gross)			BA	**406,721**	**495,177**	**325,934**	**326,702**
			O	404,857	423,253	490,088	360,915
	Total, offsetting collections	272	BA/O	–40,616	–30,000	–30,000	
Total Energy conservation (net)			BA	**366,105**	**465,177**	**295,934**	**326,702**
			O	364,241	393,253	406,088	360,915
Strategic petroleum reserve	Appropriation, current	274	BA	**192,483**	**200,576**	**185,858**	**194,858**
	Outlays		O	182,881	195,028	191,064	193,384
SPR petroleum account	Appropriation, current	274	BA	**280,361**			
	Appropriation, permanent		BA		**122,685**		
	Advance appropriation		BA	**91,555**	**108,458**	**196,188**	
	Outlays		O	252,938	140,085	36,500	86,185
					[1] –122,685		
Total SPR petroleum account			BA	**371,916**	**231,143**	**196,188**	
			O	252,938	17,400	36,500	86,185
Energy information administration	Appropriation, current	276	BA	**64,319**	**68,940**	**76,454**	**76,454**
	Outlays		O	69,236	67,030	73,058	75,096
Emergency preparedness	Appropriation, current	274	BA	**6,551**	**7,080**	**8,300**	**8,300**
	Outlays		O	6,376	6,974	8,052	8,052
Economic regulation	Appropriation, current	276	BA	**18,300**	**16,728**	**14,428**	**12,425**
	Outlays		O	15,783	17,463	15,251	13,281
Federal Energy Regulatory Commission	Appropriation, current, indefinite	276	BA	**114,918**	**122,750**	**141,071**	**141,071**
	Outlays		O	113,298	121,842	138,323	141,071
Geothermal resources development fund	Appropriation, current	271	BA	**74**	**80**		
	Spending authority from offsetting collections, indefinite		BA	**175**			
	Outlays (gross)		O	498	80		
Geothermal resources development fund (gross)			BA	**249**	**80**		
			O	498	80		
	Total, offsetting collections	271	BA/O	–175			
Total Geothermal resources development fund (net)			BA	**74**	**80**		
			O	323	80		
Clean coal technology	Appropriation, current	271	BA	**–162,644**	**–565,000**	**–150,000**	**–225,000**
	Advance appropriation		BA	**710,000**	**956,000**	**465,000**	**475,000**
	Outlays		O	65,662	159,251	162,000	384,172
Total Clean coal technology			BA	**547,356**	**391,000**	**315,000**	**250,000**
			O	65,662	159,251	162,000	384,172
Alternative fuels production	Outlays	271	O	1,133			
Payments to states under Federal Power Act	Appropriation, permanent, indefinite	806	BA	**2,708**	**2,424**	**2,424**	**2,523**
	Outlays		O	2,212	2,708	2,424	2,424
	Outlays for grants to State and local governments		O	(2,212)	(2,708)	(2,424)	(2,424)

duction, storage, and distribution of produced petroleum and related products. The 1992 budget proposes to lease NPR-1 competitively at the end of 1992. The field would be leased competitively to the highest bidder at a royalty rate of 12.5 percent. The budget includes a lease bonus estimated at $2.5 billion. One billion dollars of the bonus bid would be payable in 1992; the balance would be payable in four equal annual installments between 1993 and 1996. The proposal also includes the creation of a 10 million barrel Defense Petroleum Inventory to be funded from lease proceeds. In addition, the State of California would share in the lease proceeds receiving 50 percent of the lease royalties and 7 percent of the lease bonus.

Object Classification (in thousands of dollars)

Identification code 89–0219–0–1–271		1990 actual	1991 est.	1992 est.
	Personnel compensation:			
11.1	Full-time permanent	3,790	4,443	4,554
11.3	Other than full-time permanent	51	35	32
11.5	Other personnel compensation	147	74	70
11.8	Special personal services payments	210	362	362
11.9	Total personnel compensation	4,198	4,914	5,018
12.1	Civilian personnel benefits	716	705	686
13.0	Benefits for former personnel	4	.....	119
21.0	Travel and transportation of persons	267	361	381
22.0	Transportation of things	2	58	31
23.2	Rental payments to others	15	10	10
23.3	Communications, utilities, and miscellaneous charges	.....	16	20
24.0	Printing and reproduction	5	4	5
25.0	Other services	193,583	224,705	215,660
26.0	Supplies and materials	121	40	370
99.9	Total obligations	198,911	230,813	222,300

Personnel Summary

Total compensable workyears: Full-time equivalent employment	87	90	90

Energy Conservation

For necessary expenses in carrying out energy conservation activities, [$497,784,000], *$325,934,000* to remain available until expended, including, notwithstanding any other provision of law, the excess amount for fiscal year [1991] *1992* determined under the provisions of section 3003(d) of Public Law 99–509 (15 U.S.C. 4502): *Provided,* That [$247,893,000] *$30,000,000* shall be for use in energy conservation programs as defined in section 3008(3) of Public Law 99–509 (15 U.S.C. 4507) and shall not be available until excess amounts are determined under the provisions of section 3003(d) of Public Law 99–509 (15 U.S.C. 4502)[: *Provided further,* That notwithstanding section 3003(d)(2) of Public Law 99–509 such sums shall be allocated to the eligible programs in the same proportion for each program as in fiscal year 1990: *Provided further,* That $1,000,000 of the amount provided under this heading shall be for establishment of a National Metal Casting Research Institute at the University of Northern Iowa and $1,000,000 of the amount under this heading shall be for establishment of a National Metal Casting Research Institute at the University of Alabama, such institutes to be established consistent with the provisions of Public Law 101–425: *Provided further,* That $2,250,000 of the amount provided under this heading shall be available for a grant to the National Center for Alternate Transportation Fuels: *Provided further,* That $3,000,000 of the amount provided under this heading shall be available for a project to develop an integrated manufacturing information system for the steel industry, and the government share of the costs of such project shall not exceed 50 per centum using the same criteria for acceptance of contributions as for steel and aluminum research below: *Provided further,* That $17,500,000 of the amount provided under this heading shall be available for continuing research and development efforts begun under title II of the Interior and Related Agencies portion of the joint resolution entitled "Joint Resolution making further continuing appropriations for the fiscal year 1986, and for other purposes", approved December 19, 1985 (Public Law 99–190), and implementation of steel and aluminum research authorized by Public Law 100–680: *Provided further,* That existing facilities, equipment, and supplies, or previously expended research or development funds are not accepted as contributions for the purposes of this appropriation, except as amortized, depreciated, or expensed in normal business practice: *Provided further,* That the total Federal expenditure under this proviso shall be repaid up to one and one-half times from the proceeds of the commercial sale, lease, manufacture, or use of technologies developed under this proviso, at a rate of one-fourth of all net proceeds]. *(Department of the Interior and Related Agencies Appropriations Act, 1991.)*

Program and Financing (in thousands of dollars)

Identification code 89–0215–0–1–272		1990 actual	1991 est.	1992 est.
	Program by activities:			
00.01	Buildings and community systems	38,906	52,606	.....
00.03	Industrial	54,290	61,122	.....
00.05	Transportation	65,558	80,260	.....
00.07	State and local assistance	223,074	277,440	.....
00.08	Multisector	36,360	36,132	.....
00.09	Building technologies	.....	.....	54,187
00.10	Industrial technologies	.....	.....	101,910
00.11	Transportation technologies	.....	.....	111,168
00.12	Technical and financial assistance	.....	.....	48,269
00.13	Utility technologies	.....	.....	6,800
00.14	Policy and management	1,633	3,610	3,600
10.00	Total obligations	420,021	511,170	325,934
	Financing:			
17.00	Recovery of prior year obligations	−2,273	.....	.....
21.40	Unobligated balance available, start of year	−27,802	−15,993	.....
24.40	Unobligated balance available, end of year	15,993	.....	.....
25.00	Unobligated balance lapsing	782	.....	.....
39.00	**Budget authority (gross)**	**406,721**	**495,177**	**325,934**
	Budget authority:			
	Current:			
40.00	Appropriation	368,071	467,785	295,934
40.75	Reduction pursuant to P.L. 101-512	.....	−2,608	.....
41.00	Transferred to other accounts	−2,071	.....	.....
42.00	Transferred from other accounts	105	.....	.....
43.00	**Appropriation (adjusted)**	**366,105**	**465,177**	**295,934**
	Permanent:			
68.00	**Spending authority from offsetting collections**	**40,616**	**30,000**	**30,000**
	Relation of obligations to outlays:			
71.00	Total obligations	420,021	511,170	325,934
72.40	Obligated balance, start of year	385,583	398,475	486,392
74.40	Obligated balance, end of year	−398,475	−486,392	−376,238
78.00	Adjustments in unexpired accounts	−2,273	.....	.....
87.00	Outlays (gross)	404,857	423,253	436,088
	Adjustments to budget authority and outlays:			
	Deductions for offsetting collections:			
88.40	Non-Federal sources	−40,616	−30,000	−30,000
88.90	Total, offsetting collections	−40,616	−30,000	−30,000
89.00	Budget authority (net)	366,106	465,177	295,934
90.00	Outlays (net)	364,241	393,253	406,088

The 1992 budget for Conservation programs is significantly higher than the 1991 request, and for the R&D programs it is significantly higher than 1991 appropriation. This emphasis reflects the Administration's commitment to research and development of promising technologies for improving energy end-use efficiency in the buildings, industry, transportation and utility sectors of the economy, and to the establishment of viable technical and financial assistance activities. The program will support activities designed to strengthen the technology base upon which industry can draw in developing new products and processes for the commercial market. These activities range from basic research in universities and national laboratories to applied research and development and proof-of-concept projects with industrial firms. An aggressive, balanced program is proposed for 1992 to contribute toward strengthening the nation's energy security, promoting energy

General and special funds—Continued

ENERGY CONSERVATION—Continued

efficiency, and increasing industrial competitiveness and Federal technology transfer.

The 1992 budget incorporates a modest reorganization of the Conservation and Renewable Energy budgets. This restructuring puts all of the activities on a consistent conceptual basis, revolving around end-use sectors of the economy. The Conservation programs were largely organized this way already, with Buildings, Industry, and Transportation programs; the Solar and Renewable Energy program (in Energy Supply) has been focused mainly on electric utility-related technologies, and therefore most of its activities are transformed into a Utility program, although it also contains buildings, industry, and transportation activities related to the activities in this account. The restructured programs offer simplified management and reduced chances of redundancy or overlap, and will help to achieve a more results-oriented and market-sensitive management approach. Reorganization of specific activities are discussed in the paragraphs below.

Buildings and community systems.—This program area has been transferred almost in its entirety to the Building Technologies activity below. Least-Cost Utility Planning, now called Integrated Resources Planning, has been transferred to the Utility program in Energy Conservation, below. The Municipal Energy Management activity has been transferred to the Technical and Financial Assistance program below.

Industrial.—This program area has been transferred in its entirety, along with some activities from other programs, to the Industrial Technologies program below.

Transportation.—This program area has been transferred in its entirety, along with some activities from other programs, to the Transportation Technologies program below.

State and local assistance.—This program area has been transferred in its entirety, along with some activities from other programs, to the Technical and Financial Assistance program below.

Multisector.—The majority of this program has been transferred to the Industrial Technologies program below. Some ceramics and high-temperature materials activities have been transferred to related materials activities within the Transportation Technologies program below. The Energy-Related Inventions and Energy Innovations programs have been transferred to the Technical and Financial Assistance program below.

Building technologies.—The 1992 Building Technologies program contains most of the activities formerly in the Buildings and Community Systems program. The 1992 activities for the development of energy-efficient buildings will include research in materials and structures, lighting and appliances, heating and cooling equipment, indoor air quality, solar cooling technologies and building systems interactions. These activities will address both new and existing buildings. Research will continue for the integration of renewable energy technologies with energy-efficient building practices. An expanded effort is planned to encourage the implementation of building energy conservation standards and guidelines, and the program to achieve greater energy efficiency in Federal facilities will also be accelerated. Technology transfer activities will focus on information dissemination to architects, builders, and engineers, the business community, and the general public, including the development of programs to encourage the purchase of energy-efficient housing through energy-efficient mortgages and home energy rating systems.

Industrial technologies.—Industry accounts for about one-third of total energy use in the United States. In 1989, over 29 quads of energy were used by industry, at a cost of about $100 billion. Process improvements which minimize the production of waste materials and which utilize wastes by upgrading them to higher-value products are achievable in a variety of industrial settings. The DOE Office of Industrial Technologies supports industrial research and development of technologies that are directed towards these opportunities. These activities address both efficiency of energy demand and alternative energy supplies, and also the reduction of infrastructural barriers.

The 1992 Industrial Technologies program incorporates all of the activities previously funded in the Industrial Conservation program, biocatalysis, industrial applications of superconductivity, and other industrial R&D for the Conservation Multisector program, and plus R&D on the combustion of municipal solid wastes (MSW). MSW combustion is, in essence, a mix of industrial process technology and cogeneration, both of which have been previously funded in the Industrial program.

The 1992 activities related to energy demand reduction are aimed at important new technologies in both the near and long term. Near-term technologies include advanced drying systems for textiles and paper production, improved high-temperature heat pumps, improved steel-making processes, and advanced sensors for on-line process measurement. Long-term technologies include corrosion-resistant ultra-high temperature materials, low energy sulfur-free paper pulping, and materials and catalysts "by design."

Activities focused on supply will pursue technologies for the near- and mid-term, such as improved combustion and ash emissions management for waste-to-energy (MSW) systems, a solvent-recovery system, MSW cogeneration, and conversion of waste wood and plastic to feedstock chemicals.

Transportation technologies.—In 1992 the Transportation Technologies program incorporates all of the activities previously funded in Transportation Conservation, and also includes tribology and ceramics research in support of gas turbines and adiabatic diesels formerly funded in the Conservation Multisector program.

The 1992 program will support cross-cutting research and development on high-temperature materials, including work performed at the High Temperature Materials Laboratory and in alternative vehicle propulsion concepts such as the automotive gas turbine and adiabatic (low heat rejection) diesel. It will also support expanded activities required by the Alternative Motor Fuels Act.

A major initiative in 1992 will be the expansion and restructuring of the electric vehicles program to provide support for a four-year, $300 million program to accelerate development of advanced batteries for electric vehicles. This program is being initiated in 1991 by a cooperative R&D venture comprised of the major U.S. auto manufacturers, and including some electric utilities, using primarily industry funds in 1991. Industry will provide at least 50 percent cost-sharing.

Technical and financial assistance.—The 1992 Technical and Financial Assistance program combines all of the grants programs previously funded in the State and Local Assistance program, plus several other non-grant activities not specifically oriented toward any one end-use sector. The grants program will provide funds authorized under the Petroleum Overcharge Distribution and Restitution Act in order to support each State's management of its Oil Overcharge Funds. These Oil Overcharge Funds are used in DOE's four energy conservation grant programs and in the Department of Health and Human Services Low-Income Home Energy Assistance Program.

There are four non-grant programs incorporated into Technical and Financial Assistance from other programs. The Energy-Related Inventions/Energy Innovations program, formerly funded through the Conservation Multisector program, assists independent inventors to further develop their ideas. Information and Communications supports technical information "hot-line" services such as CARIERS and NATAS to

respond to inquiries on conservation and renewable energy from individuals, small businesses, and other organizations. The Municipal Energy Management program is designed to encourage municipal government managers to adopt energy efficiency technologies into municipal fleet and buildings operations. The Federal-State Ventures program will support cost-shared demonstrations through joint ventures among industry, State governments, and DOE.

Utility technologies.—The Integrated Resource Planning program (formerly Least-Cost Utility Planning) provides technical assistance to utilities and regulators to encourage a market environment in which demand-side and supply-side options compete equally to meet energy service requirements. District heating and cooling efforts focus on the development of more efficient and environmentally benign systems.

Policy and management.—Provides for overall management guidance and program evaluation for energy conservation programs to ensure effective program delivery.

Object Classification (in thousands of dollars)

Identification code 89–0215–0–1–272		1990 actual	1991 est.	1992 est.
	Personnel compensation:			
11.1	Full-time permanent	14,566	17,256	22,513
11.3	Other than full-time permanent	461	.....	.....
11.5	Other personnel compensation	253	1,723	2,251
11.9	Total personnel compensation	15,280	18,979	24,764
12.1	Civilian personnel benefits	2,385	1,923	3,475
13.0	Benefits for former personnel	1	.....	.....
21.0	Travel and transportation of persons	1,572	1,566	1,530
22.0	Transportation of things	335	.....	.....
23.2	Rental payments to others	567	.....	.....
24.0	Printing and reproduction	59	.....	.....
25.0	Other services	176,111	470,227	281,000
26.0	Supplies and materials	227	.....	.....
31.0	Equipment	3,152	3,475	12,495
32.0	Land and structures	.....	.....	2,670
41.0	Grants, subsidies, and contributions	220,333	15,000	.....
99.9	Total obligations	420,021	511,170	325,934

Personnel Summary

Total compensable workyears:			
Full-time equivalent employment	340	368	256
Full-time equivalent of overtime and holiday hours	2	.....	.....

Strategic Petroleum Reserve

[For expenses necessary to carry out the provisions of sections 151 through 166 of the Energy Policy and Conservation Act of 1975 (Public Law 94–163), $201,633,000, to remain available until expended: *Provided,* That appropriations herein made shall not be available for leasing facilities for the storage of crude oil for the Strategic Petroleum Reserve unless the quantity of oil stored in or deliverable to Government-owned storage facilities by virtue of contractual obligations is equal to 750,000,000 barrels.] *For necessary expenses for Strategic Petroleum Reserve facility development and operations and program management activities pursuant to the Energy Policy and Conservation Act of 1975 (Public Law 94–163, as amended), $185,858,000, to remain available until expended: Provided, That notwithstanding section 160(d) of the Energy Policy and Conservation Act of 1975, as amended (42 U.S.C. 6240(d)), the United States share of crude oil in Naval Petroleum Reserve Numbered 1 (Elk Hills) may be sold or otherwise disposed of to other than the Strategic Petroleum Reserve: Provided further, That the running of the 12 month period described in section 161(g)(6)(B) of the Energy Policy and Conservation Act of 1975, as amended (42 U.S.C. 6241(g)(6)(B)) shall be suspended during any period when the Strategic Petroleum Reserve purchases have been suspended in order to comply with the objective set out in 42 U.S.C. 6240(b)(4). (Department of the Interior and Related Agencies Appropriations Act, 1991.)*

Note.—Amounts for 1992 reflect expected savings associated with regulatory reforms under, and proposed legislative changes to, the Davis-Bacon Act.

Program and Financing (in thousands of dollars)

Identification code 89–0218–0–1–274		1990 actual	1991 est.	1992 est.
	Program by activities:			
00.01	Storage facility development	153,283	239,866	172,416
00.02	Management	12,241	20,092	13,442
10.00	Total obligations	165,524	259,958	185,858
	Financing:			
17.00	Recovery of prior year obligations	−1,014	.....	.....
21.40	Unobligated balance available, start of year	−31,421	−59,382	.....
24.40	Unobligated balance available, end of year	59,382	.....	.....
25.00	Unobligated balance lapsing	12	.....	.....
39.00	**Budget authority**	**192,483**	**200,576**	**185,858**
	Budget authority:			
40.00	Appropriation	192,483	201,633	185,858
40.75	Reduction pursuant to P.L. 101-512	.....	−1,057	.....
43.00	**Appropriation (adjusted)**	**192,483**	**200,576**	**185,858**
	Relation of obligations to outlays:			
71.00	Total obligations	165,524	259,958	185,858
72.40	Obligated balance, start of year	82,184	63,814	128,744
74.40	Obligated balance, end of year	−63,814	−128,744	−123,538
78.00	Adjustments in unexpired accounts	−1,014	.....	.....
90.00	Outlays	182,881	195,028	191,064

The objective of this program is to decrease the vulnerability of the United States to disruptions in world petroleum markets by creating a crude oil stockpile to be used in the event such disruptions occur.

The account provides for petroleum reserve storage facility construction, ongoing operations and maintenance activities, planning studies, and program administration. Funds are provided for the acquisition of facilities to implement 42 U.S.C. 6240(g) near existing Gulf Coast Strategic Petroleum Reserve facilities.

Object Classification (in thousands of dollars)

Identification code 89–0218–0–1–274		1990 actual	1991 est.	1992 est.
	Personnel compensation:			
11.1	Full-time permanent	6,002	6,849	7,348
11.3	Other than full-time permanent	176	145	207
11.5	Other personnel compensation	75	98	97
11.9	Total personnel compensation	6,253	7,092	7,652
12.1	Civilian personnel benefits	996	1,136	1,500
21.0	Travel and transportation of persons	496	652	606
22.0	Transportation of things	5	35	36
23.1	Rental payments to GSA	.....	95	96
23.2	Rental payments to others	4,005	1,013	1,173
23.3	Communications, utilities, and miscellaneous charges	4,124	7,878	5,570
24.0	Printing and reproduction	161	180	221
25.0	Other services	149,468	241,693	168,939
26.0	Supplies and materials	.....	75	35
31.0	Equipment	3	109	30
41.0	Grants, subsidies, and contributions	13	.....	.....
99.9	Total obligations	165,524	259,958	185,858

Personnel Summary

Total compensable workyears: Full-time equivalent employment	136	158	158

[SPR Petroleum Account]

[For the acquisition and transportation of petroleum and for other necessary expenses under section 167 of the Energy Policy and Conservation Act of 1975 (Public Law 94–163), as amended by the Omnibus Budget Reconciliation Act of 1981 (Public Law 97–35), $196,188,000 shall be made available until expended beginning October 1, 1991: *Provided further,* That notwithstanding 42 U.S.C. 6240(d) the United States share of crude oil in Naval Petroleum Reserve

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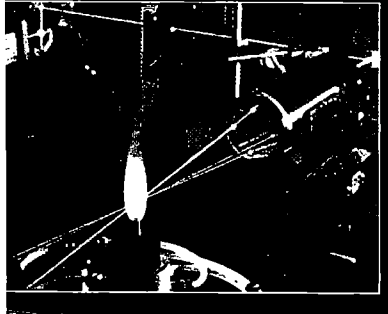
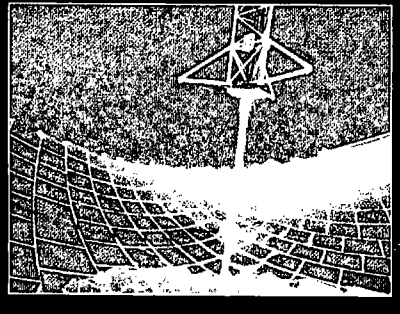
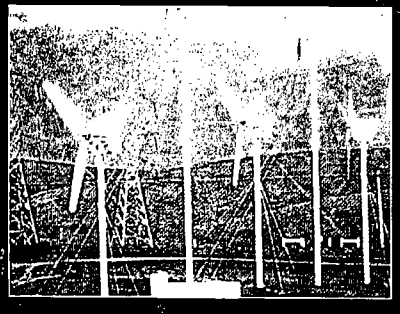
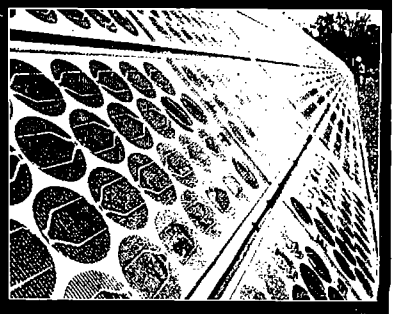
NATIONAL ENERGY STRATEGY

Executive Summary
First Edition
1991/1992









million for environmental restoration and 3.1 million for fuels conversion. The total budget is decreased from 1991, when the total was 511.2 million.

5) $222.3 million for Naval Petroleum and Oil Shale Reserves.

6) Energy conservation funding decreased to $295 million from 1991 when it was $465 million. Most of the decrease came from the virtual elimination of state and local grants for low income weatherization ($199 million to 24 million). Conservation funding for buildings increased from 49 million to 63 million, industrial funding from 60 million to 80 million and transportation conservation from 80 mimillion

Environmental Protection Agency: 7% increase over FY1991 to $6.2b

1) Air: An increase of $116.9 million in the air budget puts the total at $511.8 million for 1992. The 30% increase is due to the enactment of the Clean Air Act of 1990

a) Acid rain program includes 46 million for the Montreal Protocal facilitation fund to assist developing countries in shifting away from CFC use. This is a 20.5 million increase from 1991.

b) $162.7 million is alloted for state air pollution programs and $27.5 million for regional activities.

c) Research in air quality will be funded at $112.4 million, an increase of$25.8 million from last year. Specific programs include ozone nonatainmnet, mobile source polution, air toxics and acid deposition.

d) EPA gets $26 million for its portion of the global change research budget.

e) 42 million will go to mobile source pollution i.e. developing clean fuels, emission standards, etc.

f) Enforcement of stantionary and mobile source pollution is funded at $41.5 million - including developing a new chloroflourocarbon recycling regulations and enforcing reformulated gas requirements.

2) Water quality gets a cut of $5.7 million for 1992, to $412.8 million.

a) Non-point source state and local grants were drastically cut from 50.25 million to 24.25 million.

b) Wetlands protection gets a $5.9 million increase to support the President's goal of no net loss of wetlands.

c) The Great Lakes clean up program gets

d) The Office of Solid Waste and Emergency Response, which deals with oil spills, is getting a 7.9 million increase to $14.8 million.

1) $18.4 million to the International Fund for Agricultural Development (a decrease of nearly one half since 1990)
2) $13 million to the UN Environment Program (a decrease of $2.8 million from 1991)
3) $25 million to the International Atomic Energy Agency (increase of 1.5 million)
4) $1.277 billion to the Agency for International Development (an increase of 18 million from 1991).

Department of Agriculture:

1) 63.97 million to the Economic Research Service including $1.65 million for global climate change. Increase of $8 million total.
2) $183 million to the Agricultural Conservation program, a decrease of 7 million.
3) $ 1.6 billion to the Conservation Reserve Program, an increase of $330 million.
4) $124 million to the new Wetland Reserve Program to enroll 150,000 acres of current farmland into the conservation program.
5) $672 million to the Soil Conservation Service, an increase of $107 million.
6) $3.4 billion to the Forest Service. Decrease of $6 million in forest environment research. 9.335 million board feet of timber will be offered for sale this year, down from 9.546 in 1991.

Department of Commerce:

1) National Oceanic and Atmospheric Administration gets $1.949 billion, an increase of $100 million including a $7 million decease in the Oceanic and Atmoshperic Research budget. The budget says the decrease is due to cuts in the state and regional research programs and an increase in the global change research.

Department of Energy: $18.6 billion total

1) Reorganization of the solar and renewable energy funding created several different departments for the budget. Utilities technology receives $157 million, building technology 1.2 million, industrial technology 9.8 million, transportation technology 29.6 million, and technical assistance 4.01 million. All this totals $202 million, a $6 million decrease from the solar and technology base budget of 1991.
2) Nuclear fission research increased from $316 million to $400 million.
3) Small Business Innovation funding and Facilities Infrastructure Replacement and Modernization funding both were phased out from 1991.
4) Fossil Energy funding of 227 million includes 115 million for coal research and development, 60 million for oil and gas R+D, 8

Katie:

I spoke to HONDA Public relations about the high mileage car in the news. Here's the REAL story. Honda testified before Senate Commerce last week and the press picked up the story a bit inaccurately. Honda will be introducing a car in 1992 in the Civic line (will replace CRX, but won't be a CRX; may or may not be a 2+2). The target will be 65 mpg highway, 50 mpg city. These are unadjusted values (i.e., label value would be something like 54, I'd guess, but it hasn't been determined)

Apparently the point of the Honda testimony was to say that they couldn't meet the Bryan Bill's 20% goal....! Testimony in the mail; I'll copy mine for you if you don't get one sooner.

Attached are:

1. Dr. Gibbons testimony on what ANWR can supply and how that differs from the effect on oil imports CAFE can have. See Figures 5,6, & 7 (7 is the grand synthesis)

2. Appendix A on State Programs (in OTA's full report on climate change--which was mailed to you last week); Paul Komor said you wanted info on these.

3. A page from the back-up electricity document to the NES saying they consider 70% of existing nuclear plant can be extended to a 60 year lifetime! (OTA analysis extended lifetime by 10 years to total about 45 years and some people choked at that!)

4. Our full report in case yours is still "lost in the mail"

Take care, Rosina

1848 words

1338

NYT OPEDIT DRAFT #2/ASSEMBLING
2/26/91

Where the National Energy Strategy is concerned, the Bush Administration is like a drug addict or alcoholic confronting his problem. For 18 months, while he keeps feeding his addiction, he examines every alternative and every option. At the end of 18 months, still addicted, he has a startling breakthrough: the real problem isn't that he can't quit drinking or taking drugs, it's that he can't get enough drugs or drink. That's the Bush Administration's National Energy Strategy -- as timid as his Persian Gulf policy is bold.

An addict usually suffers a succession of worsening crises before he realizes the addiction is the problem. ~~If there is a sense of deja vu about this current energy debate, there ought to be~~. The Persian Gulf War is not just about oil, but it is the third in a series of geopolitical crisis related to oil. Carl Sagan is right when he quotes the rock music group Dire Straits: "denial ain't just a river in Egypt." It's real. We're refusing to recognize the environmental crisis our energy policy is creating. The last of these worsening crises ~~-- the one that will jolt us into startled awareness --~~ already has begun: it is global warming. There is a pattern here we must break; a crisis that will not be resolved by drilling for more oil.

The Bush Administration's National Energy Strategy is a sham, political deception at its worst. It will not reduce our reliance on foreign oil. ~~Even full implementation of~~ the NES will result in an overall increase in American oil imports, from 50 percent today to 60 percent in 2030 when the plan would be ~~fully in effect~~ implemented. The Administration may argue we'd be better off than we would be otherwise, but that assumes this strategy offers the only policy available. It ignores other courses that ~~could have and~~ should have been chosen and it discounts how the enormous resources that will be committed to developing oil supplies might be put to better use. It also exposes the principle weakness of the Bush Administration.

There is no doubt that this President's strength is in foreign policy. His experience is in foreign policy. His most trusted advisors are experts in foreign policy. But if this President's foreign policy muscles are developed enough to lift the heaviest weights, his domestic policy muscles are so atrophied they are vulnerable to even the slightest political pressures. ~~There is no ability for any heavy lifting on domestic~~

~~policy.~~ On the National Energy Strategy, politics weighed in and dictated the outcome.

There's a shortage of political courage in this Administration on the issues that affect the American people in their own homes and neighborhoods. For this President and his advisors, the 1992 campaign casts ~~an imposing and~~ terrifying shadow. They cannnot get out from under it or see beyond it. Afraid of the misstep now that will cost them later, their political cowardice limits their domestic policy vision to the near term. ~~What a contrast to the boldness of their foreign~~ policy. ~~Their efforts here at home are pitiful by comparison.~~

~~But we should have seen it coming.~~ It is a scene from the President's forced summer vacation that stands out now because it should have provided a clue about the energy policy to come. As Iraqi's massed forces in Kuwait and energy prices strained pocketbooks here at home, President Bush called on Americans to conserve. But you could barely hear him above the roar of his ~~high-powered~~, gas-guzzling cigarette boat in Kennebunkport. For President Bush, apparently it was enough to talk about conservation. He didn't have to do anything about it.

For this Administration, ~~if~~ the answer is in market place ~~is left alone, almost every problem will find an answer~~. Theirs is a narrow and naive view on energy policy. The hidden costs associated with burning fossil fuels, the externalities, such as national security impacts or increased pollution, that make it ridiculous for this Administration to say simply, "let the market work." It won't do the job. that fails to ~~take account of~~ decisively

In philosophical wars, capitalism has routed communism as decisively as the coalition forces are routing the Iraqis. And just as in the aftermath, we worry about winning the peace, ~~as decisively~~, we must recognize that in the philosophical war we simply cannot congratulate ourselves for the victory. We must recognize the shortcomings of the market system and accept the hidden costs, the externalities, as real costs.

The energy market place simply does not measure the true, full costs of the energy choices we make. ~~It doesn't reflect the national security dimension, the environmental costs, the opportunity costs of an investment made here in comparison to investments made abroad.~~

~~This Administration says it is committed to letting the~~ We energy ~~marketplace work unfettered by regulation or incentives.~~ ~~It~~ must ~~also~~ expand the workings of that marketplace so that it acknowledges the true costs of our policy. So that, for example,

the costs of burning fossil fuels includes the costs not paid directly out of pocket but paid in dirtier air or greater health problems, or in global warming and the crisis it represents.

AGJ DICTATE: REGULATORY & TAX POLICY?

With oil prices dropping, now is the time to act, to prevent the market from undermining our efforts and to take advantage of the options provided by lower fuel prices. Today, oil prices are dropping lower than they were before the Persian Gulf crisis began, if you discount federal levies imposed since then. These falling prices and the renewed, if illusory, promise of a return to cheap energy makes the need for National Energy Strategy even more urgent.

~~The price of oil is likely to drop even further after the war, as Saudi Arabia and Kuwait pump oil to maximize their revenues. That situation is likely to persist for years, considering the magnitude of their requirements for income and political accommodations with the United States.~~ 47 WC

Cheap oil and energy conservation are not naturally linked. ~~On the contrary,~~ the energy marketplace will discourage investment in more expensive energy sources and it will, at a minimum, dampen consumer interest in greater energy efficiency. The premium will be on political leadership and strong policy to encourage a shift toward energy efficiency and alternatives. +1

President Bush would instead sacrifice one of our last most pristine wilderness areas, the Alaskan National Wildlife Refuge, for an uncertain oil field that at best, would provide only a few months supply. What oil that might be found would be quickly depleted and yet a unique and fragile ecosystem would be forever devastated. There is no promise that could ensure its safety while drilling went forward.

~~The President says his National Energy Strategy is based on the market system and consumer choice, yet it ignores the testimony scores of Americans provided at hearings across the country in support of increased energy efficiency and alternatives. Furthermore, it stifles public resistance to the siting of expanded energy supply facilities.~~ 51 WC

The Administration's National Energy Strategy says that "the Department of Energy and other federal agencies will continue to provide assistance to States and utilities in their efforts to improve energy efficiency in residential and commercial buildings." But, ~~if you check the policy against the budget President Bush recently submitted, the promise rings~~

~~hollow.~~ The Department of Energy's state energy conservation budget has been slashed from this year's $280 million to $48 million in FY 1992 -- an 82 percent cut.

A small fortune will be paid to pull one more gallon of oil out of a nearly depleted well or to explore environmentally sensitive areas such as ANWR. How much better could those resources be used to instead develop alternatives, to promote efficiency to protect rather than destroy our environment. In fact, the massive amounts of money that will be expended trying to pull the last drop of oil could mean far more to our economic strength were it to be invested elsewhere. Reports tell us that $1 spent on energy efficiency, produced four times as many jobs as $1 invested in a new power plant.

We have the technology to improve efficiency and conservation. A recent report from the Office of Technology Assessment provides clear evidence that existing, off-the-shelf technologies can make a difference in helping us use energy more efficiently and reduce emissions of greenhouse gases. ~~It provides the course our policy should follow~~. It continues what is now an 18 year debate, ~~begun in 1973,~~ with a familiar refrain: the real heroes are efficiency and conservation but the market will not move us toward those heroes unless it is motivated to do so. We must provide the motivation, as the OTA report recommends, through incentives, performance standards, low-cost loans, research and development activities, energy audits and other steps.

There is an apparent, if not depressing, irony in the fact that the details on the President's National Energy Strategy were leaked as representatives of more than 100 nations were meeting in Chantilly, Virginia to begin negotiations to craft an agreement to confront global warming. As the rest of the world was struggling to find ways to reduce emissions from fossil fuels, the Administration was presenting an energy strategy that would sustain those emissions and undermine the international effort. Delegates from other nations were furious and frustrated almost to disbelief by the disingenous actions of this Administration.

The United States provided little to applaud at the ~~X~~ OSe negotiations. What the Administration's delegates presented to this international conference was a ~~separate~~ global warming "action plan" that represented a deftly played environmental slight of hand. The 'Chantilly Shell Game' moved around pieces of a hollow policy in the hope that no one would notice that underneath these shells there was no morsel of substantive action.

S

That plan was crafted carefully so that in a quick read it seemed we were offering to stabilize greenhouse gas emissions through the year 2000 and beyond. Watch carefully before the shells are moved: The plan offers one year of stabilizing one greenhouse gas, chloroflurocarbons, thanks not to a new initiative to combat global warming, but to an existing agreement, the Montreal Protocol, designed to protect the upper ozone. CFCs, principally responsible for ozone depletion, are not the main culprits in global warming. But they are the only culprits this Adminstration would identify. Take them out of the line-up and the Administration's plan offers nothing in the years before 2000 and nothing in the years after 2000.

Carbon dioxide is the major cause of global warming but this Administration doesn't want to discuss stabilizing emissions of CO2, the step most critical to controlling global warming, either in these international negotiations or in its energy policy. That would mean reducing our reliance on fossil fuels or promoting efficiency and conservation. The National Energy Strategy appears to back away from even this timid "action plan" by talking about stabilizing emissions not at 1987 levels -- as was proposed at Chantilly -- but at higher 1990 levels.

In both its energy strategy and its environmental policy, the Administration would feed our addiction before it helped us overcome ~~that~~ it. As a nation, we are ready to kick the habit. It is unfortunate we can't get any help from our President or his Administration.

##

Service Report

SR/NES/90-03

Electricity Supply: Supporting Analysis for the National Energy Strategy

National Energy Strategy

Energy Information Administration

Nuclear Life Extension/New Nuclear Orders Excursion

1. Introduction

The objective of this excursion is to examine the effect of restoring the nuclear option for U.S. electric power generation. This excursion represents a case in which the operating life of existing plants is extended by 20 years and new nuclear plants are ordered and begin to come on-line in 2000.

2. Methodology

Numerous factors are responsible for the nuclear life extension and new nuclear orders excursion. First, the United States will need baseload generating capacity in the post-1995 period. The need for large amounts of new capacity late in the 1990's and into the next century will require accelerated efforts to obtain the most power out of existing units. Second, electricity is an increasing fraction of the U.S. energy mix. Coal and nuclear power have the potential to supply large quantities of baseload electricity through 2030. Third, nuclear power unlike coal is a major electric-generating source that emits no carbon dioxide, a gas associated with global climate change.

3. Model Assumptions

Assumptions Regarding Life Extension

Nuclear power plants are currently licensed for 40 years from initial commercial operation. Older units were licensed for 40 years from receipt of the construction permit. Industry analyses suggest that many nuclear plants can operate safely and economically beyond these 40-year lifetimes with relatively modest refurbishment. It is assumed that 70 percent of existing capacity will be life-extended. Specific plants are not life-extended; rather, capacity of each unit, scheduled to be retired, is extended at 70 percent of original capacity. Any modifications for life extension are assumed to occur during the scheduled maintenance period for each plant. Total net plant life is 60 years. The cost of life extension is $534 per kilowatt (1988 dollars).

Assumptions Regarding New Plant Construction

It is assumed that obstacles to new nuclear plant construction will be surmounted and new orders will be placed. Identified deterrents to public acceptance of new nuclear plants include:

- Concerns about safety
- Concerns about the disposal of radioactive waste
- Uncertainty in the licensing and regulatory processes
- Uncertainty about power plant performance
- Concern about economic and financial risk.

This excursion assumes that (through research and development funded by the Department of Energy, legislative initiatives for one-step licensing supported by the Department of Energy and nuclear industry organizations, finanical risk sharing proposed by some reactor manufacturers, appointment of the nuclear waste negotiator, and establishment of the Institute of Nuclear Power Operations (INOP) for improved information sharing) progress will be made on these deterrents to public acceptance. Based on this assumption, the expected costs and performance of new nuclear power plants are as shown in Table 15; Appendix C also contains a detailed description of these technologies. Renewed national concern about the environment and about oil supply security may also promote more public acceptance of nuclear power.

from Full OTA report

Appendix B
State Initiatives

In the last 2 years, some States have taken an active role in addressing greenhouse gas emissions without waiting for the Federal Government to act—usually through legislation or executive orders, most often with respect to energy efficiency and use of chlorofluorocarbons. Table B-1 provides titles, dates enacted, and general substance of several legislative and executive actions.

A few States have developed quantitative reduction goals for greenhouse gas emissions. For example, Vermont's policy calls for greenhouse gases to be reduced at least 15 percent below current levels by the year 2000; it promotes measures to reduce per-capita nonrenewable energy use, increase alternative fuel use, and develop renewable energy sources (table B-1; ref. 15). Oregon's goal is to reduce greenhouse gas emissions 20 percent below 1988 levels by the year 2005 (20).

Other States, while not formulating specific reduction targets, have established relatively broad goals related to global warming. New Jersey is seeking to reduce emissions by decreasing energy consumption and encouraging energy conservation, public education, and tree planting (table B-1; ref. 22). Its educational initiative is unique in calling for improved public education about the causes and effects of climate change; it asks colleges and universities that train teachers to integrate environmental education activities into course material. Connecticut's 1990 global warming act includes a range of energy-efficiency goals, requirements for transportation (e.g., passenger vehicle occupancy levels, telecommuting), buildings standards, State vehicle fuel efficiency, recycling, and long-term energy use (table B-1; refs. 7 and 30). A 1990 Iowa bill contains provisions addressing energy efficiency in buildings, alternative fuels demonstration grants, an Iowa Energy Center, and energy-efficiency planning by utilities (table B-1; ref. 4).

Many State programs are specifically designed to address CO_2 emissions from individual sectors. Most involve energy use and efficiency in the buildings, transportation, and energy supply sectors. Many States also developed programs during the 1970s and 1980s that, although not designed to address concerns about global warming, nonetheless can help reduce emissions. Most of these programs have focused on energy supply (e.g., least-cost utility planning) and buildings (e.g., efficiency standards) (16).

Table B-1—State Legislation and Orders Addressing Greenhouse Gas Emissions

State	Document	Date enacted	Subjects emphasized
Arizona	House Bill 2206	1988	Air quality, natural gas, transportation control measures
Connecticut	Public Act 219	1990	Transportation control measures, building codes, State vehicles, tree planting, State energy plan, recycling
Hawaii	Senate Bill 1344	May 11, 1989	CFCs
Iowa	Senate File 2403	1990	Building energy efficiency, alternative fuels demonstration grants, utility energy-efficiency planning
Maine	Public Law 622	Feb. 23, 1990	CFCs
Minnesota	Comprehensive Groundwater Protection Act	1989	Nitrous oxides, agriculture
New Jersey	Executive Order 219	Oct. 23, 1989	CO_2 emissions, State equipment purchases, energy use, CFCs, tree planting
New York	Executive Order 118	Dec. 28, 1988	State Energy Plan, energy use, CO_2 emissions
Oregon	Senate Bill 576	1989	Greenhouse gas emissions, energy conservation, renewable resources, alternative fuels
Texas	Senate Bill 740	1989	State vehicles
	Senate Bill 760	1989	Natural gas, alternative fuels, technologies
Vermont	Act 59	May 24, 1989	CFCs
	Executive Order 79	Oct. 23, 1989	CO_2 emission reduction goals, energy efficiency, renewable energy, alternative fuels
Washington	House Bill 2198	Feb. 5, 1990	Residential buildings
Wisconsin	Act 284	Apr. 21, 1990	CFCs
	Public Service Commission Order 05-EP-5	Apr. 7, 1989	Utilities, cost of reducing CO_2 emissions

SOURCE: Office of Technology Assessment, 1991.

Most of the specific greenhouse gas-related actions have occurred in the last year or two and some are not yet legally effective, so the extent to which they will be implemented and enforced remains to be seen. This appendix presents examples of these actions, based primarily on responses to an OTA survey of different regions of the country; it is not intended to be an exhaustive list.

Chlorofluorocarbons (CFCs) and Halons

Of all the greenhouse gases, CFCs have been the most widely addressed by State legislatures. In 1989, Hawaii became the first State to enact legislation restricting the use of CFCs (table B-1; ref. 33). The statute, which goes into effect on January 1, 1991, requires mandatory recycling of CFCs and prohibits the sale of CFC coolants for air conditioners in containers smaller than 15 pounds (the latter as a means of deterring inexperienced installers).

Soon after Hawaii's action, Vermont enacted a statute that bans the sale of cleaning sprays, containers of CFCs smaller than 15 pounds, and halon fire extinguishers for home use (table B-1; ref. 15). The law also prohibits the sale of cars with CFC-using air conditioners, beginning with model year 1993, and requires service stations that repair automobile air conditioners to recycle CFCs.

Under Maine's CFC-related statute, new cars using CFCs may not be registered in the State after 1994, automobile CFCs must be recycled, and the sale of small quantities of CFCs is restricted (table B-1; ref. 17). The legislation bans the use of CFC foam board for household insulation, effective when alternative blowing agents are available.[1]

In Wisconsin, beginning in 1991, motor vehicle air conditioner refrigerant in containers holding less than 15 pounds will be banned (table B-1; ref. 31). Beginning in 1992, anyone servicing or installing refrigeration equipment containing at least 5 pounds of CFC refrigerant must use proper recycling procedures. In 1996, the distribution or registration of new motor vehicles using air conditioners that contain over a specified amount of CFCs will be prohibited.

Other States with legislation or directives that address CFC emissions include California (see box 5-A in ch. 5), Connecticut, Florida, Illinois, Iowa, Louisiana, Maryland, Minnesota, Missouri, New Jersey, New York, Rhode Island, and Oregon.[2] Legislation has been introduced in at least 7 other States (17).

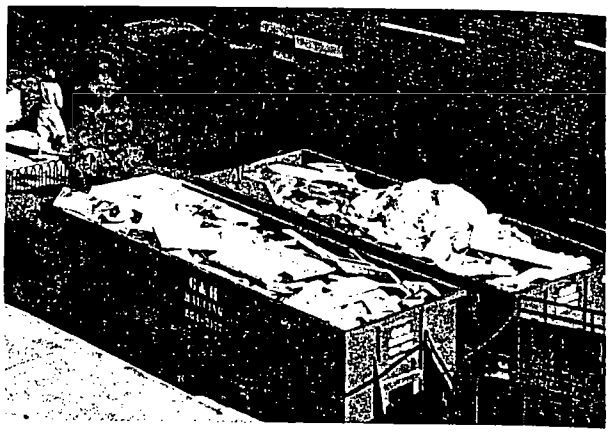


Photo credit: Chip Moore

Chlorofluorocarbon insulation at a demolition site. Currently, about 12 percent of CFC-11 and CFC-12 is used in rigid foams for insulating buildings. Most U.S. buildings constructed in the last two decades contain such foam.

Energy

Many States have had energy planning and assistance programs since the early 1970s and 1980s, largely in response to the 1973 oil embargo. As of 1988, for example, 24 States had collaborative energy-efficiency projects with utilities, and 15 had State energy tax credits for renewable energy sources (e.g., photovoltaics, wind, biomass) (1, 16). Since the mid-1970s, many utilities and State regulators have increased their interest in least-cost planning (LCP), which aims to balance supply- and demand-side management alternatives to meet energy needs at the least possible cost (8a) (see box 3-C in ch. 3 for more discussion of demand-side management). As of 1990, 23 States had LCP strategies.[3] Almost all States also received funding from the Oil Overcharge fund, to be used in energy conservation grants administered by the U.S. Department of Energy.[4] More recently, several States have enacted energy policies that directly address greenhouse gas emissions.

[1]Maine previously passed a law prohibiting the use of polystyrene foam food packaging made with CFCs; Minnesota and Rhode Island also passed similar laws (25).

[2]In addition, some municipalities have passed comprehensive ordinances regulating CFCs—including Irvine, California, in August 1989; and Denver, Colorado (refs. 6, 12) in April 1990.

[3]According to ref. 8a, legislatures have passed LCP laws or given authority to utility commissions to establish and enforce regulations in at least 16 States. Utilities also use LCP without legislative or regulatory mandates in a few other States.

[4]These funds are granted by the Department to the States for previously authorized conservation projects; they are derived from a 1986 U.S. District Court decision on alleged pricing violations by oil companies. The DOE grant programs are the Energy Extension Service, the State Energy Conservation Program, the Institutional Conservation Program, and the Weatherization Assistance Program (these are discussed in ch. 4).

As of September 1990, six State utility commissions had modified the selection procedures of their electric utility companies to account for residual environmental damages (32).[5] New York's Public Service Commission introduced guidelines for a competitive bidding process for new electricity supply that includes the estimated cost of environmental pollution, including CO_2 emissions; the cost is added to bids in order to make energy-efficient and environmentally cleaner technologies more competitive with traditional fossil fuel-fired generation technologies (21, 23, 24).[6] New York also has issued an Executive Order (table B-1; ref. 21) establishing a statewide energy planning process involving the State Energy Office, Department of Public Service, and Department of Environmental Conservation.

In Vermont, an Executive Order (table B-1) calls for increasing the effectiveness of energy-efficiency services provided by utilities, private businesses, and State agencies, and for increasing Vermont's reliance on renewable energy supplies. The State Agency Task Force on Energy was created to oversee the implementation of energy efficiency and emission reduction strategies.

New Jersey's goal of reducing greenhouse gas emissions includes directives to State agencies to foster energy conservation—for example, by purchasing and using efficient heating, ventilation, air-conditioning, and lighting equipment; increasing reliance on lower emitting fuels; and using alternatives to CFC- and halon-containing equipment (22). New Jersey's initiative is distinguished from other State plans by its emphasis on public education, as noted above.

In Wisconsin, the Public Service Commission issued an order in 1989 that requires the Wisconsin Utilities to assess the cost of using existing technologies to reduce CO_2 emissions by 20 percent below 1985 levels (31).

Some States are using Oil Overcharge funds to establish energy-related programs. In Arizona, funds are being used to construct a solar village on State Trust Land (11). In New Mexico, some funds are being used for municipal solid waste reduction and recycling projects that result in net energy savings (10).

Transportation

As of 1988, a number of States had programs dealing with public transportation, ridesharing, vehicle inspection and maintenance, and high-occupancy lanes (16). For example, at least 15 States provided some funding for ridesharing. In the last few years, States such as Arizona, California, Connecticut, and Texas have enacted legislation specifically designed to reduce CO_2 emissions in the transportation sector.

California probably has the most comprehensive plan in the country regarding transportation policies. In particular, the South Coast Air Quality Management plan sets forth an ambitious and far-reaching program of control measures that could greatly affect transportation emissions (see box 5-F in ch. 5 for details).

Arizona's 1988 air legislation (table B-1) includes a tax break for use of compressed natural gas (CNG) and funding for pilot projects on oxygenated fuels (29).[7] It also includes a variety of transportation control measures, such as travel reduction programs, compensation for vanpool costs, and prohibition of parking in certain areas.

Connecticut's 1990 legislation (table B-1) requires that new cars and trucks purchased by the State have an average MPG rating of 45 and 35, respectively, by 2000 (30) and that alternative fuel vehicles be considered in purchasing decisions. It also establishes a range of other transportation goals, including increasing average car occupancy levels, increasing use of public transportation, providing disincentives for free parking, and eventually, telecommuting for State agencies. The Department of Transportation must provide the State with an analysis of public transportation, paratransit (carpooling), and traffic management.

Two Texas acts are designed to reduce transportation CO_2 emissions (table B-1; ref. 26). One prohibits State agencies with 15 or more vehicles from purchasing or leasing vehicles (after September 1991) not capable of using CNG or other alternative fuels with lower emissions. By September 1994, 30 percent of a State agency's fleet must be capable of operating on CNG or other alternative fuels; the percentage will increase to 50 percent by 1996. The second act requires the Air Control Board to encourage use of natural gas, alternative fuels, and more efficient technologies. Some Oil Overcharge funds also have been allocated for transportation programs (e.g., traffic signal synchronization, traffic management, fleet management, alternative fuels).

[5]Massachusetts and New York are assigning specific costs to environmental damages, as described in this paragraph for New York; Colorado, New Jersey, and Vermont are using a point system that achieves a similar result without quantifying damages in monetary terms; and Wisconsin is assigning a penalty to account for environmental damages (32).

[6]The State (ref. 25) has estimated the additional cost of mitigating environmental impacts from coal-fired plants to be up to 1.405 cents/kWh; costs for specific damages were estimated at 0.10 cents/kWh for CO_2, 0.25 cents/kWh for SO_2, 0.55 cents/kWh for NO_X, 0.005 cents/kWh for particulates, 0.10 cents/kWh for water impacts, and 0.40 cents/kWh for land use (e.g., terrestrial impacts, fuel delivery, noise, transmission, solid waste, aesthetics).

[7]Use of unconventional automotive fuels for vehicles, such as natural gas or electricity, do not necessarily result in lesser climatic impacts. This depends on many variables, ranging from the type of energy source used, to leakage rates (in the case of natural gas) and efficiency levels (see ch. 5).

Buildings

Connecticut has several legislative provisions addressing energy use in buildings (table B-1). It requires stricter codes for commercial buildings; standards for State buildings that would reduce energy use per square foot by 30 percent by 2000 and 50 percent by 2010; and State purchases of energy-efficient appliances (30). It also requires that preference be given to energy-efficient projects in State housing grant and loan programs, and calls for utilities to charge higher rates for new energy-wasting buildings beginning in 1993.

Many States have started loan programs for retrofitting State, public school, and local government facilities, often using funds from the Oil Overcharge fund. The Loan-STAR program in Texas, which commenced in 1988, consists of a $98 million revolving loan program for energy conservation retrofits in Texas State, local government, and public school buildings (27).[8] The Governor's Energy Management Center expects that retrofits funded through November 1, 1990, will generate annual utility savings of $4.8 million and that retrofits now being funded will generate an additional savings of $4 million annually (26).

Both the California Energy Commission and the Northwest Power Planning Council (NPPC) have established model energy-efficient building codes for residential and commercial buildings (11). The California Legislature directed the California Energy Commission to prescribe, through regulations, various building design and construction standards (e.g., lighting, insulation, automatic control systems) that will increase energy efficiency in new buildings (8).[9] In 1990, the State of Washington enacted legislation adopting standards equivalent to the NPPC's Model Conservation Standards for residential buildings, requiring increased efficiency in new homes and apartments (table B-1; ref. 28).[10] The State estimates that resultant savings will be at least 200 megawatts of electrical power and 21 million annual therms of natural gas by 2010 (28). A State-utility collaborative program established by the act includes a public awareness and education element, as well as utility rebates.

Food and Forestry

We are unaware of any States with agricultural programs specifically designed to reduce greenhouse gas emissions. However, Minnesota has legislation addressing the use of nitrogen fertilizers (table B-1; ref. 5). A Nitrogen Fertilizer Task Force was established to study the effects of nitrogen fertilizer use on water resources so that the State can develop best management practices, a fertilizer management plan, and nitrogen fertilizer use regulations (14).

In Georgia, the State Office of Energy Resources has a program funded by Oil Overcharge funds to increase energy efficiency in the crop processing sector (19). The Agricultural Processor Energy Conservation Service provides technical know-how and audits to processing plants. For example, Georgia Tech University has noted that the energy used in processing peanuts, at a cost of around $11 million per year, could potentially be reduced by 10 to 20 percent if cost-effective technologies are used.

Many States have long had forest management programs of one sort or another and some are now establishing tree-planting programs in response to global warming and other concerns (11, 13, 16). For example, New Jersey's 1990 Executive Order (table B-1; ref. 9) calls for maximizing the number of trees in the State; a program requiring replacement of trees lost as result of State construction activities has been instituted through the order.

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[8]Loans at a rate of 4.04 percent APR (Average Percentage Rate) are available for installation of energy-efficient lighting; heating, ventilation, and air-conditioning systems; building shell improvements; computerized energy management systems; boiler efficiency improvements; energy recovery systems; and load management hardware.

[9]The Commission also is studying specific measures and policy options to reduce greenhouse gases, in response to Assembly Bill 4420 of 1988.

[10]To offset any added costs to consumers because of the requirements, the law requires electric utilities to provide $900 for new homes under 2,000 square feet; these payments will be available from July 1, 1991 through June 30, 1995.

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in any effort to move away from fossil fuels—is the key to making a renewable energy system work. If a home's electricity needs are cut by two thirds, for example, the investment cost for a rooftop photovoltaic power plant could be halved. Similarly, a highly efficient electric car would go further and would need smaller batteries, reducing its cost and weight. The development of more energy-efficient technologies is thus as crucial to the viability of an economy based on renewable energy as the solar technologies themselves.

Employment Implications

Successful economies are dynamic, changing constantly as technologies develop and as societies' needs shift. This evolution naturally leads to changes in the jobs people hold. With the advent of the automobile, for example, blacksmiths and wainwrights were replaced by service station attendants and mechanics. Although this process is painful for those whose jobs disappear, it opens new opportunities for them and for other workers.

Industry lobbyists often argue that reduced energy consumption will lead to a massive loss of jobs in energy-producing industries. To the contrary, a sustainable energy economy would likely have more jobs than one based on fossil fuels—primarily because improving the efficiency of energy use creates more jobs than supplying energy. In the future, the number of jobs in energy will probably grow, and the skills in demand will shift dramatically.

Today, few countries have much of their work force involved in energy production. In Poland, Canada, and India, for example, 4.4, 2.5, and 1 percent of jobs respectively are in energy and mining. Some 1.5 million Americans—1.4 percent of the labor force—worked in energy production and conversion in 1988. This includes jobs in coal mining, the oil and gas industry, and electric and gas utilities.[51]

The trend in industrial countries is toward fewer such jobs. Coal mining jobs in the United States fell nearly 40 percent between 1980 and 1988, from 246,000 to 151,000, despite a 14-percent increase in total coal production. Those in the nation's oil and gas industry shrank from 715,000 to 528,000 over the same period. One minor exception is the electric utility sector, in which the number of employees, primarily service workers, rose 10 percent to 648,000 workers. However, most of this increase has likely been offset by the loss of construction jobs following a 40-percent decline in utility construction expenditures in the eighties.[52]

Harnessing energy entails relatively few jobs because these are among the most capital-intensive industries. The oil and gas industry in Alberta, Canada, for instance, generates 1.4 jobs for $1 million worth of capital investment, while other sectors of the economy average over 10 jobs. Manufacturing, by comparison, yields 9.2 jobs per $1 million; agriculture, 13; and services, more than 32.[53]

The electric power industry is also highly capital-intensive. One quarter of the foreign debts in Costa Rica and Brazil are due to borrowing by their power sectors. Centrally planned economies went the furthest in this direction: In the Soviet Union, energy accounted for nearly one fifth of all capital expenditures in the late eighties. Poland poured nearly 40 percent of total industrial investment into energy in 1986, with 21 percent in coal alone.[54]

Reduced employment in coal mining is among the trends likely to continue in the decades ahead. Governments will

need to compensate workers, ensure that they learn new skills, and cooperate with businesses to form new industries in the affected areas. Countries such as the United Kingdom and Germany have experience with this problem, since the number of coal miners is already falling as automation increases—despite the opposition of unions. Hundreds of thousands of Polish, Czech, and east German coal miners are poised to lose their positions as energy prices are deregulated. Even in China, with more than 4 million coal miners, increased automation and worker productivity ensures a leveling off of jobs in this sector.[55]

There is a way, however, to meet energy needs in the future while creating jobs. Theoretical studies and post-project evaluations have found the same thing: for each dollar invested, efficiency improvements generate more jobs than producing energy does. A 1979 Council on Economic Priorities report found that investments in energy efficiency, conservation, and solar technologies provided more than twice as much employment as those in new energy resources, whether oil, natural gas, or new power plants. At the local level, where the savings from efficiency improvements would be recirculated in the economy, a dollar spent on energy efficiency produced four times as many jobs as one invested in a new power plant.[56]

Similar conclusions were reached by a 1985 study of Denmark, France, the United Kingdom, and West Germany done by the Commission of the European Communities. Investments in district heating, building insulation, and biogas plants, for example, were found to save money and produce more jobs than traditional energy investments. A study in Alaska found that home weatherization created more jobs and personal income per dollar than any other investment studied, including the construction of hospitals, highways, or hydroelectric projects. Post-project evaluations of energy-saving programs in Connecticut and Iowa have found that they were less expensive and created more work than energy supply alternatives such as electric power stations.[57]

For each dollar invested, efficiency improvements generate more jobs than producing energy does.

As communities invest more in improving energy efficiency and tap local renewable energy resources, rather than purchase imported energy, economic benefits ripple through the economy. A city plan drawn up by San Jose, California, for example, would create 170 jobs over 10 years with an initial investment of just $645,000. The program includes education campaigns to show consumers how to save energy, and technical assistance, such as energy audits and the development of a home energy rating system. Prominent in the San Jose plan are initiatives to reduce energy use in government buildings and transportation, in effect providing an example for the community. The city investment, which would spur nearly $20 million in private spending, is expected to pay for itself in two-and-a-half years, and result in reduced carbon dioxide emissions.[58]

Even among electricity-generating technologies, there is a wide gap in employment levels. For the amount of energy produced, traditional fossil fuel and nuclear power plants employ fewer people than today's solar power systems do, even when coal mining is included. (See Table 2–4.) As the technologies are further refined, and as companies strive to cut costs, however, the difference between renewable and conventional technologies may be narrowed. Photovoltaic companies, for example, are now cutting

costs by opening fully automated manufacturing lines, as Maryland-based Solarex did in 1990.[59]

Biomass energy, particularly from sustainably harvested wood, also generates more jobs than fossil fuel alternatives. A recent Canadian study found that increasing wood use in New Brunswick over the next 20 years would create more income, more jobs, and more tax revenue for the province than would the same amount invested in oil or coal development. Researchers in the Northeast and Great Lakes regions of the United States have come to similar conclusions.[60]

In the move to a solar economy, the fastest growing jobs would be traditional skilled and semiskilled positions such as insulation installers, carpenters, and sheet metal workers. Wind prospectors, photovoltaic engineers, and solar architects are among the new professions that would expand rapidly. Numbering in the thousands today, jobs in these fields may total in the millions within a few decades. Some of the skills now used in a fossil-fuel-based energy system would still be valued. Petroleum geologists and oil-well crews, for example, could focus their energies on drilling for geothermal resources.

Table 2-4. United States: Direct Employment Generated by Electricity-Producing Technologies

Technology	Jobs (per terawatt-hour a year)
Nuclear	100
Geothermal	112
Coal[1]	116
Solar Thermal	248
Wind	542

[1]Includes coal mining.

SOURCE: Worldwatch Institute, based on Department of Energy (DOE), Energy Information Administration (EIA), *Electric Plant Cost and Power Production Expenses 1988* (Washington, D.C.: 1990); DOE, EIA, *Coal Production Statistics 1988* (Washington, D.C.: 1989); Mark Sisinyak, Vice President, California Energy Company, Coso Junction, Calif., private communication, June 19, 1990; Kathleen Flanagan, Director of Government Relations and Public Affairs, Luz International Limited, Los Angeles, Calif., private communication, June 18, 1990; Paul Gipe, Gipe & Assoc., Tehachapi, Calif., private communication, April 12, 1990.

The Iraqi invasion of Kuwait did not affect the cost of sugarcane ethanol in Brazil or of wind turbines in Denmark.

A highly efficient, renewable-energy-based economy would create not only more jobs, but cleaner and safer ones. Some of the jobs added by moving toward nuclear power, by comparison, would require people to clean up radioactive spills or decommission hot plants. Adding pollution equipment to coal plants also creates employment, but some of the new jobs involve disposing of toxic ash. Passive solar builders and energy service managers are spared such occupational hazards.

A few nations currently rely on energy production as the cornerstone of their economics. The Persian Gulf nations would experience vast changes if fossil fuel use declined precipitously, since petroleum exports generate virtually all their foreign exchange. The oil reserves of most countries, however, will be largely depleted over the next 50 years, leading to a gradual phasedown anyway as reserves are used up. Ironically, the Middle East may end up with another energy export in the future—solar energy, via hydrogen-bearing pipelines.

Oil-importing developing countries, particularly those burdened with high foreign debt, have a further incentive to follow a labor-intensive, improved-efficiency energy strategy. Most Latin

American and African nations have far more labor to spare than capital; indeed, underemployment and unemployment are creating major social problems in many developing countries. By following a solar strategy, developing countries would provide more jobs while reducing expenditures on imported oil and other fossil fuels.

As energy supplies become more diverse and less dependent on high-value fuels, local economies will be free from the boom-and-bust cycles that plague today's energy markets. The Iraqi invasion of Kuwait, it should be noted, did not significantly affect the cost of solar hot-water equipment in Jordan, of sugarcane ethanol in Brazil, or of wind turbines in Denmark. Indeed, the unquantifiable benefits of the greater self-reliance that flows from local jobs and investments based on local energy resources could offer stability in an otherwise volatile world.

Toward a Solar Economy

In 1976, *Foreign Affairs* published an article that challenged the comfortable assumptions of energy planners. In "Energy Strategy: The Road Not Taken?" physicist Amory Lovins proposed a heretical vision of the future in which the world relied on improved energy efficiency and renewable technologies instead of fossil fuels and nuclear power.[61]

The experience of the past 15 years is beginning to prove Lovins right. In the mid-seventies, conventional energy planners predicted that the United States would be using around 135 quadrillion Btus (quads) of energy in 1990, while Lovins projected just under 100 quads. The actual figure for 1990 was just 83 quads, only 10 percent higher than in 1973. Once portrayed as a wild-eyed advocate of "soft energy," Lovins actually underestimated the rapidity of efficiency's gains.[62]

It would seem, then, that the world has taken the first step down Lovins' road, though most policymakers remain oblivious to it. The big question is when we will take the next step—the building of a decentralized renewable energy system. The answer may be soon.

In contrast to the efficiency success story, Lovins' 1990 quota for solar energy has only been half met. This can be explained in large measure by government neglect and even hostility during the eighties. Still, renewable energy technologies are far more mature now than they were in the mid-seventies. Production costs have plummeted and reliability has substantially improved. A commercial takeoff can be predicted with confidence for several of these technologies during the next five years. This surge will be driven not only by technological progress but by the obvious unsustainability of world oil and climate trends.[63]

The shape of this new energy system is beginning to emerge and, as Lovins predicted, decentralization is its hallmark. In contrast to the huge coal and nuclear plants of today, power from renewable technologies—whether photovoltaic cells, wood-fired plants, or wind generators—can be developed cost-effectively in various sizes. Solar, wind, and cogeneration facilities can be built economically on a scale that is less than one one-thousandth the typical size of a large nuclear or coal-fired plant. Some renewable energy systems can be built, literally, for households.[64]

Wind turbine manufacturing currently focuses on 100-kilowatt machines that cost roughly $100,000 to install. The manufacturing processes and investments are more akin to today's automobile assembly lines than to central power plants. Costs will fall dramatically as the

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TABLE: Major Changes In Energy Programs 1/
(Budget authority in millions of dollars)

	Actual FY 1981	Actual FY 1983	Current FY 1991	President Bush FY 1992	Percentage Change 1992/ 1991	Real Percentage Change 1991/ 1981
Solar energy R&D.	504	202	131	143	+9	-82
Energy conservation R&D .	308	134	228	274	+20	-50
Conservation grants . . .	420	384	267	35*	-87	-57
Fossil energy R&D	994	330	459	227	-51	-69
Electric storage/systems.	87	43	41	38	-7	-68
Geothermal energy R&D . .	143	58	28	20	-29	-87
SPRO oil purchase	2,688	2,074	231	196	-15	-96
Rural Electrification Administration (REA)						
REA Insured Loans. . .	1,100	1,100	861	200	-77	-47
REA Loan Guarantees. .	5,145	4,745	933	...	-100	-88
Nuclear Regulatory Commission	441	465	467	514	+10	-28
Nuclear Fission	785	710	305	398	+30	-73
Magnetic Fusion	383	447	275	337	+23	-51

1/ 1992 dollars are worth only 96 percent of 1991 value, and 65 percent of 1981 value.

* The $35 million figure for energy conservation grant programs is funded by monies that are made available automatically under present law from oil overcharge fund recoveries. The administration assumes that additional funds will be available to the States for these kinds of programs from oil overcharge cases; thus, it requests no Federal appropriations for these programs.

HIGHLIGHTS OF MAJOR PROPOSALS

- Solar Energy R&D-The President's budget proposes a 9 percent increase in funding from $131 million in fiscal year 1991 to $143 million in fiscal year 1992.

- Energy Conservation R&D - The President's budget proposes a 20% increase in funding from $228 million in fiscal year 1991 to $274 million in fiscal year 1992.

- Fossil Energy R&D--The President's budget proposes a 51 percent reduction in funding from $459 million in fiscal year 1991 to $227 million in fiscal year 1992.

- Energy Conservation Grants (including low-income weatherization)-The President's budget proposes elimination of Federal funding for these programs, allowing only $35 million primarily in oil overcharge funds to be spent. This would reduce spending from $267 million in fiscal year 1991 to $35 million in fiscal year 1992. The administration argues that no funding is needed because the States still have oil overcharge funds available to them.

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ADDICTION:

Where the National Energy Strategy is concerned, the Bush Administration is like an alcoholic trying to stop drinking. For 18 months, while he keeps drinking, he examines every alternative and every option. At the end of 18 months, still addicted, he has a startling breakthrough: the real problem isn't that he can't quit drinking, it's that he can't get enough to drink. That's the Bush Administration's National Energy Strategy.

An addict usually suffers a succession of worsening crises before he realizes the addiction is the problem. For energy policy, the last of these worsening crises -- the one that will jolt us into startled awareness -- already has begun: it is global warming.

DE-NILE

Carl Sagan is right when he quotes the rock music group Dire Straits: denial is not just a river in Egypt. It's real. We're refusing to recognize the environmental crisis our energy policy is creating.

THREE STRIKES

If there is a sense of deja vu about this current energy debate, there ought to be. The Persian Gulf War is not just about oil, but it is the third in a series of geopolitical crisis related to oil.

IRONY: NES v CHANTILLY

There is an apparent, if not depressing, irony in the fact that the details on this National Energy Strategy were leaked as representatives of more than 100 nations were meeting in Chantilly, Virginia to begin negotiations to craft an agreement to confront global warming. As the rest of the world was struggling to find ways to reduce emissions from fossil fuels,

the Administration was presenting a plan that would sustain those emissions and undermine the international effort. Delegates from other nations were furious and frustated almost to disbelief by the disingenous actions of this Administration.

The Bush Administration's "action plan" represented an environmental slight of hand. The 'Chantilly Shell Game' moved around pieces of a hollow policy in the hope that no one would notice that underneath these shells there was no morsel of substantive action.

The plan was crafted carefully so that in a quick read it seemed we were offering to stabilize greenhouse gas emissions through the year 2000 and beyond. Watch carefully before the shells are moved.

The plan offers one year of stabilizing one greenhouse gas, chloroflurocarbons, thanks not to a new initiative to combat global warming, but to an existing agreement, the Montreal Protocol, designed to protect the upper ozone. CFCs, principally responsible for ozone depletion, are not the main culprits in global warming. But they are the only culprits this Adminstration would identify. Take them out of the line-up and the Administration's plan offers nothing in the years before 2000 and nothing in the years after 2000. Carbon dioxide is the major cause of global warming but this Administration doesn't want to discuss stabilizing emissions of CO2, the step most critical to controlling global warming.

The National Energy Strategy appears to back away from even this timid proposal by talking about stabilizing emissions not at 1987 levels -- as was proposed at Chantilly -- but at higher 1990 levels.

The National Energy Strategy is a sham, political deception at its worst. The strategy says that "the Department of Energy and other federal agencies will continue to provide assistance to States and utilities in their efforts to improve energy effiency is residential and commercial buildings." But, if you check the policy against the budget President Bush recently submitted, the promise rings hollow. The Department of Energy's state energy conservation budget has been slashed from this year's $280 million to $48 million in FY 1992 -- an 82 percent cut!

The President wants us to believe the energy strategy is an environmental initiative, but it will require that environmental regulations be modified if they impact the ~~oil~~ industry.

The President says the strategy is based on the market system and consumer choice, yet it ignores the testimony scores of Americans provided at hearings across the country in support of increased energy efficiency and alternatives. Furthermore, it stifles public resistance to the siting of exapnded energy supply facilities.

NES INCREASES DEPENDENCE ON FOREIGN OIL

The Bush Administration's National Energy Strategy will not reduce our reliance on foreign oil. Even full implementation of the NES will result in an overall increase in American oil imports from 50 percent today to (more than?) 60 percent in the year 2030, when the plan would be fully in effect.

The Administration may argue we'd be better off than we would be otherwise but that assumes this strategy offers the only policy available. It ignores the other courses that could have -- and should have --been chosen and, it discounts how the enormous resources that will be committed to developing oil supplies might be put to better use.

BUSH FOREIGN POLICY v DOMESTIC POLICY

There is no doubt that this Administration's strength is in foreign policy. The President's experience is in foreign policy. His most trusted advisors are experts in foreign policy. But if this President's foreign policy muscles are developed enough to lift the heaviest weights, his domestic policy muscles are so atrophied they are vulnerable to even the slightest pressures.

Politics weighed in on this National Energy Strategy and the Administration's vulnerability became apparent. On policies affecting Americans here at home, there is no ability for any heavy lifting. On the National Energy Strategy, politics dictated the outcome.

COWARDICE: 1992 FEARS

On the issues that affect the American people in their own homes and neighborhoods, there's a shortage of political courage in this Administration. For this President and his advisors, the 1992 campaign casts an imposing and terrifying shadow. They cannnot get out from under it or see beyond it. Afraid of the misstep now that will cost them later, their politial cowardice

limits their domestic policy vision to the near term. What a contrast to the boldness of their foreign policy. Their efforts here at home are pitiful by contrast.

POWERBOAT KENNEBUNKPORT:

It is a scene from the President's forced summer vacation that stands out now because it should have provided a clue about the energy policy to come. As Iraqi's massed forces in Kuwait and energy prices strained pocketbooks here at home, President Bush called on Americans to conserve. But you could barely hear him above the roar of his high-powered, gas-guzzling cigarette boat in Kennebunkport.

OIL PRICES DROPPING

Oil prices apparently have stopped their steep climb upwards. Today, oil prices are dropping lower than they were before the Persian Gulf crisis began if federal levies imposed since then are discounted. These falling prices and the renewed, if illusory, promise of a return to cheap energy makes the need for National Energy Strategy even more urgent.

The price of oil is likely to drop even further after the war, as Saudi Arabia and Kuwait pump oil to maximize their revenues. That situation is likely to persist for years, considering the magnitude of their requirements for income and political accommodations with the United States.

Cheap oil and energy conservation are not naturally linked. On the contrary, the energy marketplace will discourage investment in more expensive energy sources and it will, at a minimum, dampen consumer interest in greater energy efficiency. The premium will be on political leadership and strong policy to encourage a shift toward efficiency and alternatives.

EXTERNALITIES (?AGJ dictate?)

The energy market place simply does not measure the true, full costs of the energy choices we make. It doesn't reflect the national security dimension, the environmental costs, the opportunity costs of an investment made here in comparison to investments made abroad.

This Administration says it is committed to letting the energy marketplace work unfettered by regulation or incentives. It must also expand the workings of that marketplace so that it acknowledges the true costs of our policy. So that, for example, the costs of burning fossil fuels includes the externalities: the

costs not paid directly out of pocket but paid in dirtier air or greater health problems, or in global warming and the crisis it represents.

Regulatory & tax policy?

CAPITALISM v COMMUNISM

In philosophical wars, capitalism has routed communism as decisively as the coalition forces are routing the Iraqis. And just as in the aftermath, we worry about winning the peace as decisively, we must recognize that in the philosophical war we simply cannot congratulate ourselves for the victory. We must recognize the shortcomings of the market system and accept the externalities as real costs. Given these externalities, these hidden costs, associated with burning fossil fuels, it is ridiculous for this Administration to say simply, "let the market work." It won't do the job.

OTA REPORT → plus what we should do

A recent report from the Office of Technology Assessment provides clear evidence that existing, off-the-shelf technologies can make a difference in helping us use energy more efficiently and reduce emissions of greenhouse gases. It provides the course our policy should follow. It continues what is now an 18 year debate, begun in 1973. Over and over again, it becomes clear that the real heroes are efficiency and conservation but that the market will not move us toward those heroes unless it is motivated to do so.

ANWR

The Bush Administration would sacrifice one of our last most pristine wilderness areas for an uncertain oil field that at best, would provide only a few months supply. What oil that might be found would be quickly depleted and yet a unique and fragile ecosystem would be forever devastated. There is no promise that could ensure its safety while drilling went forward.

And what of the investment that would be required to develop ANWR? How much better could those millions (?) of dollars be used to instead develop alternatives, to promote efficiency, to protect rather than destroy our environment.

In fact, the massive amounts of money that will be expended drying to pull the last drop of oil from nearly depleted wells could mean far more to our economic strength were it to be invested elsewhere.

Jobs RenewABLE?

U.S. SENATE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

SUBCOMMITTEE ON ENVIRONMENTAL POLLUTION

MARCH 13, 1991

ENVIRONMENTAL AND ECONOMIC OPPORTUNITIES IN AN NATIONAL ENERGY STRATEGY

by

Roger Dower and Rafe Pomerance

World Resources Institute

Washington, D.C.

The debate on a national energy strategy offers an important opportunity to construct an energy policy that provides needed environmental and economic reforms. Much of the current energy policy controversy centers on the appropriate weight that should be assigned to energy production options versus conservation and efficiency programs. While this is an important discussion and highlights the nature of the tradeoffs that can characterize national energy policy, it does not get to the heart of the issue. A pollution-pricing strategy for energy resources can provide the basis for national environmental and economic benefits and supply the policy underpinning for strong conservation and renewable energy activities. Failure to accept the central role of energy prices in dictating energy production, consumption and investment decisions almost surely will result in a national energy program that achieves less than it could and costs more than it should.

PRICING ENERGY RIGHT

A national energy strategy that uses direct pricing or tax programs as one of its main tools, is assumed to be costly to the U.S. economy. Appropriate energy prices are low prices and therefore energy taxes can only be a burden to our economy. Further, low energy prices are assumed to be the only fair way to assure energy services for lower income households. We are not the only country where these assumptions are conventional wisdom. But with a few exceptions, artificially low energy prices are a characteristic of developing economies, not our major trading partners or global competitors. Higher energy prices in Japan and throughout most of western Europe do not appear to have hindered their ability to compete.

Our energy policy in this country is replete with examples of the economic and environmental costs of keeping energy prices artificially low. Gains in conservation and energy efficiency achieved in the late 1970's and early 1980's have been negated, in part, by the lower energy prices that have prevailed through most of the past decade. Similarly, we have not experienced the full environmental benefits of automobile efficiency improvements because of low gasoline prices that do not fully reflect the social costs of using gasoline. Oil use by the U.S. motor vehicle fleet has increased sharply even with a much more efficient fleet. While regulations have reduced the environmental damages associated with a new car, low energy prices have led to increases in the number of miles driven in automobiles.

A pollution pricing energy strategy does involve economic and some obvious political risks. Energy prices cannot be unilaterally raised without the potential for significant impacts on domestic economic well-being. These risks can be minimized by properly designing a pollution pricing strategy that includes appropriate compensating policy measures. The combination of pricing and compensating programs can reduce environmental and economic burdens in the U.S. and provide economic signals for more efficient and cleaner supplies of energy services.

SHIFTING THE DOMESTIC TAX BURDEN

U.S. tax policy is predicated largely on the basis of taxing activities we think are good and ignoring those that are bad. We raise the bulk of our state and federal tax dollars from assessment activities such as working and saving, but allow pollution to occur at no cost. While raising money, these taxes also impose costs on our economy. By taxing productive activities, income and labor taxes discourage individuals from working and saving. The national economy is thus less productive than it could be. This cost is not trivial. It has been estimated that every one dollar collected from taxes on labor may cost our economy as much as 25 cents.

Significant economic benefits can be realized from reducing taxes on labor, income or savings and increasing taxes on pollution from the transformation of energy resources to energy services. Properly constructed pollution/energy taxes that were offset dollar for dollar by reducing the payroll taxes would:

- have little, if any, effect on measured GNP since the higher energy costs could be compensated by lower labor costs (offsetting the inflationary impact of an energy tax);
- increase the true economic welfare of the country by reducing the economic distortions caused by taxes on labor or income; and
- increase the true economic welfare of the country by efficiently providing environmental improvements.

Shifting the tax base of our economy in this way would raise money and encourage honest energy pricing, establish incentives for energy efficiency and renewable energy sources and improve the efficiency of our economy.

An example of the some of these effects are illustrated in an analysis of carbon taxes by Jorgenson and Wilcoxen. Carbon taxes are a form of pollution/energy tax that is designed to lower emissions of carbon dioxide from combustion of fossil fuels. The tax on a particular fuel is determined by the carbon content of the energy source. They found that a 20 percent reduction (by the year 2000) in CO_2 emissions could be achieved at a cost of around 1 percent of GNP when the carbon tax is offset with reductions in labor taxes. This is roughly half the cost of a similar reduction program, conducted by the Congressional Budget Office, that did not include a labor tax offset. Further, neither of these estimates include the benefits to social welfare of reductions in the risks of climate change.

A similar tax exercise was conducted recently by DRI/McGraw Hill. While their study focused on the economic impacts of a large gasoline tax, the results were similar. Specifically, DRI/McGraw Hill has estimated that a phased-in gasoline tax of 45 cents by the year 2000 and $1.30 by the year 2010 with a dollar for dollar offset in the employer share of payroll taxes would actually increase real

GNP, relative to what it would have been and, at the same time, stabilize CO_2 emissions from the light-duty vehicle fleet and reduce oil imports by around 3.5 billion barrels between 1991-2010.

These studies are not definitive and more analytical research is clearly needed. Other tax offsets including the lowering of personal and corporate income rates should be considered. They provide some empirical support for the hypothesis that an pollution/energy tax strategy does not have to be bad for the economy. In fact, the economy can be improved from a broad social welfare perspective.

CHOOSING THE RIGHT POLLUTION/ENERGY TAX

From the standpoint of providing environmental and economic benefits not all energy taxes are created equal. Taxing energy for the sake of taxing energy will provide little, if any economic or environmental benefit. While any energy tax will lower energy demand, it is not necessarily true that there is a corresponding environmental gain. Without environmental benefits, there is no strong case to prefer one set of tax burdens over another and little public policy justification for preferring energy taxes over labor taxes. The economic rationale for pollution-based energy taxes derives from the value of the environmental benefits from the tax. If the environmental benefits are too low, because the tax fails to reduce pollution efficiently the economic benefits of the tax, relative to some other tax base, may be difficult to assess. The economic merits of an energy tax may also be suspect if the energy tax reduces a pollutant too much (for example, where we are already regulating efficiently a particular pollutant).

Carbon dioxide emissions from fossil fuel combustion are currently not regulated and are partially responsible for one of the most significant environmental risks, our current domestic energy policy. CO_2 emissions would provide the basis for a pollution/energy tax strategy . The right tax program reducing carbon dioxide still has to be selected. For example, a tax on the carbon content of fuels, a tax on the BTU content of fuels and an Ad valorem (percent of price) tax of energy designed to reduce CO_2 emissions by the same amount have very different economic impacts. Jorgenson and Wilcoxen estimate that an Ad Valorem tax would reduce GNP by twice as much as a carbon tax (for the same level of CO_2 reductions). The converse is also true. A carbon tax is likely to have larger CO_2 benefits for a given level of revenue than a BTU or Ad Valorem tax.

DEALING WITH THE DISTRIBUTIONAL EFFECTS OF A POLLUTION/ENERGY TAX

A well-designed pollution/energy tax would leave the nation better off in terms of economic and environmental performance. From other vantage points, such taxes may not be viewed quite so positively. Energy taxes, for example, have been associated with adverse effects on lower income groups, energy producing and consuming states and regions of the country, and energy intensive industries. While the existence of these kinds of impacts do not affect the economic or environmental gains of pollution/energy taxes, they are quite real to the affected parties and involve

meaningful equity or fairness issues that should be addressed directly by the tax strategy. Two such issues are particularly important in terms of pollution/energy taxes.

1. Impacts on Lower Income Groups - Energy taxes as a whole have never fared well politically because of their "regressive" nature -- it is generally assumed that higher energy taxes hurt the poor more than they do the rich. Higher energy prices, resulting from a tax, will hit lower income groups harder than other if they tend to spend a higher fraction of their income on energy services and have less options for substituting high cost energy services for lower cost services. The potential effects of higher energy taxes on a lower income household can be reduced by combining the tax strategy with other income transfer systems or tax offsets that would help these households cope with higher energy prices. Reducing the employee share of the payroll tax is one possible solution. This would reduce a tax that is viewed by many analysts as regressive and provide increased income directly. Tax credit programs or more direct spending programs may have to be included in the tax strategy to alleviate burdens on non-wage earners or retirees.

2. Impact on Coal Production Regions - One form of a pollution/energy tax -- a carbon tax -- would reduce the wealth of those regions of the country that produce coal. More so than other energy taxes, carbon taxes do affect differentially certain areas and regions of the country. Economic model results suggest a carbon tax large enough to stabilize CO_2 emissions at 1990 levels by the year 2000 would result in substantially less coal production compared to what it would have been.

These are hardly trivial impacts no matter what environmental and economic gains might also accrue. Special programs could be designed to help the coal producing regions of the country and those whose livelihoods depend on coal production cope with the transition. It should also be remembered that industrial agricultural sectors and regions of the country go through economic transitions continually as technology, consumer preferences, social demands and trade conditions change. The U.S. has experience with programs designed to ease the transition and minimize the impact but not inhibit the change. Such programs and alternatives should be carefully considered. Dollars spent on these programs would reduce the amount of money available for tax offsets, but the need for these special approaches would disappear over time.

DEALING WITH AN ECONOMIC TRANSITION

A strong economic case can be made that a properly designed pollution tax strategy would make the economy better off than it was without the tax. This argument ignores, however, the adjustments that would occur as the result of a new set of pollution/energy taxes. Higher energy prices would result in economic adjustments as resources are shifted in response to changes in input prices. The nature and type of these economic adjustments will depend on the size and basis for the tax, among other things, but could have measurable impacts on economic performance (including inflation, and GNP) in the short-run regardless of the long-run outcomes.

The economic transition costs can be reduced by phasing-in a pollution/energy tax over a

number of years and by the kinds of tax reform discussed above. For example, the DRI/McGraw Hill study referenced earlier shows that the transition costs of a phased-in gasoline tax are less when the tax revenues are offset against lower labor taxes as compared to lower income taxes or no tax offset at all. Macroeconomic policy can also help to minimize the short-run economic impacts of rising energy prices. Douglas Bohi of Resources for the Future has found that Japan and several other countries fared better than the U.S. under the energy price spikes of the 1970's by adopting accommodating monetary policies.

CONCLUSIONS

It is common to hear the debate concerning appropriate energy policy or climate change policy couched in terms of tradeoffs between economic and environmental risks. On one side are a set of perceived impacts on our domestic economy and national competitiveness of raising energy prices. On the other side are the potential damages to health and welfare associated with our reliance on fossil fuels. Uncertainty exists concerning both types of risks. We have no formal economic model that is able to show convincingly the impact of energy policy changes on technological development. Yet, the pace and costs of new technological developments are critical to the ultimate economic costs of energy or climate change policy. Similarly, we may never be able to estimate accurately the full range of environmental damages associated with rising average global temperatures, at least until the information is too late.

Our testimony suggests that these perceived tradeoffs between energy, environment and the economy may not exist at all. Using pollution/energy taxes will ensure that energy is "priced right" and that low prices will not undermine other efficiency or renewable investment programs. Tax reform policies can be used to improve the economy and offset higher energy input costs by lowering labor costs. A pollution/energy tax program will also provide a source of revenue to fund any special program needed to alleviate the distributional impacts of raising energy prices. Taken together a pollution/energy tax strategy can provide the basis for addressing and managing the economic risks of a national energy strategy that effectively reduce environmental risks.

By ignoring the overriding importance of prices in guiding energy production, consumption, and investment decisions, we can be sure that we will have no energy strategy. We will have left the most important determinant of what types, levels and forms of energy we use to fate, not a market fate, but an artificial fate that does not recognize the costs of environmental damage.

PMI

See Figures 5, 6, 47 - - all permutations of same idea

TESTIMONY OF JOHN H. GIBBONS
DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT
UNITED STATES CONGRESS
BEFORE THE
HOUSE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON ENERGY AND POWER

February 20, 1991

ENERGY POLICY CONTEXT FOR THE 1990'S:
CONSIDERATIONS FOR A NATIONAL ENERGY STRATEGY

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to testify today on the subject of our nation's long-term energy strategy. As most of you are aware, OTA has been studying energy issues for the Congress since the mid-1970's. I have attached to my testimony today a selected list of reports which we have delivered to the Congress on energy topics that are relevant to today's hearing. I might also note that at the request of this Committee, we are currently completing the assessment, Technological Risks and Opportunities for Future U.S. Energy Supply and Demand, which we expect to deliver in the two months.

As we see and hear the haunting images of the war in the Middle East, many of us reflect on the events of the last decade that got us to this point. We must attribute at least some of the rationale for our military presence in that part of the world to our dependence on that region's oil reserves or, in the President's words, "U.S. economic interests there." Yet, despite the current sense of urgency about energy issues, it is imperative that energy policy be viewed from not only a short-term contingency plan but

also a long-term perspective that derives its direction from broader and more fundamental national goals of **economic health, environmental quality,** and **national security.** Therefore, as we consider the steps necessary to develop a national energy strategy, it only makes sense to develop that strategy in ways that do the best job of supporting these three and other related goals. Some energy options, particularly those that improve efficiency of production and use, may support one goal but run counter to the others. For example, increased reliance on coal could cut oil import dependence, but exacerbate problems of air pollution and global climate change. Some energy options support all three goals. Therefore, today I would like to recap the long-term U.S. policy interests in energy and offer several specific goals for your consideration.

First, I want to emphasize that it is important to recognize that there are no energy "fixes" that are easy or quick,i.e., no magic bullets. **We will succeed in easing U.S. oil import dependence only if we establish long-term efficiency and supply goals, and stick to the plan to achieve those goals through periods of both crisis and calm, and through periods of high and low oil prices.** During the past decade, steady supplies, easy efficiency gains, and a retreat in the price of oil seduced us into largely abandoning efforts to push research in energy efficiency and supply. The present oil crisis, too, will pass, possibly again beguiling us into a false sense of energy complacency. Major changes in energy systems--and major changes are what must occur--require decades and unwavering commitment from citizens, political leaders, and industry. The good news is that, given time, energy is a flexible component of a modern economy. However, a long time is required in order to effect a major turnover of the capital stock of energy supply and consuming equipment. Short-term strategies -- either to spur production or to curb consumption -- are usually inefficient and traumatic. Certainly, a sensible, comprehensive energy policy must be responsive to sudden changes of events, but it must be fundamentally grounded in long-term strategies.

CANDIDATE ENERGY POLICY GOALS TO REFLECT A NATIONAL ENERGY STRATEGY

Long-term energy policy goals must appeal to the three long-term policy interests of economic health, environmental quality, and national security. The following prospective energy goals are aimed at this end.

Oil. As we have found once again in recent months, diversity and flexibility in oil supply are intimately linked with national security. U.S. energy security is predominately threatened by growing dependence on imported oil, especially on the insecure and volatile sources of supply in the Middle East (see Figures 1 and 2). The Organization of Petroleum Exporting Countries (OPEC) controls three quarters of proved world crude-oil reserves, including all recent additions. Dependence on Middle East oil strains the economies of both the less developed and the industrialized world. Expenditures for oil imports have hampered the developing world's efforts to gain hard currency and repay debts. In the first half of 1990 the U.S. imported $24 billion worth of oil, an amount equal to 57% of our trade deficit for that period. In addition, during the same year, the Pentagon spent many billions of dollars to protect oil supplies. Today, as Operation Desert Storm enters its most costly phase by any measure, the this energy-linked bill makes 1989 look modest. As the Soviet Union, the U.S. and other non-OPEC nations deplete their oil reserves, the geopolitics of energy will repeatedly focus on the Middle East.

Candidate goals to reflect the strategy of limiting oil import dependence are (1) to limit overall oil imports to 50% of consumption and (2) diversify sources of world oil production and therefore U.S. sources of imports to regions of the world outside the Middle East where such imports an be aligned with other U.S. policy interests.

Supply mechanisms to achieve that goal include sustained domestic oil production, developing and producing alternative transportation fuels, and spurring development of petroleum in regions such as Asia and South America. Demand and fuel-switching mechanisms include improved efficiency of use in all sectors and shifting of industrial, residential and commercial oil use into other sources such as natural gas or electricity. We address some of these options in more depth later.

Energy Efficiency. OTA's studies over the past decade have consistently shown that energy efficiency is an essential cornerstone to a comprehensive energy policy framework. Overall energy intensity of the U.S. economy fell 2.5% per year over the last decade, most of which was due to improved efficiency (see Figure 3). Electricity use, historically faster growing than the economy, has fallen back to the same rate of change as GNP. Moreover, these **efficiency gains have generally come about with net cost savings.** Considerable future energy efficiency gains are still possible in all sectors of the economy using existing technology. Even greater cost savings and efficiency gains will be possible with technologies under current research and development. **An efficiency goal of sustained improvement of 2% percent per year for the next two decades is realistic for the U.S.** With more vigorous research on energy efficiency, coupled with leadership and investment, this goal can be met or exceeded--and with options that are no more costly than pursuing the supply-side path. Moreover, pursuing such a goal appeals to all three policy interests of economic health, environmental quality, and energy security.

Environmental Quality. A responsible energy policy will complement as much as possible a responsible environmental policy. Clearly there are some activities that might spur our economy and enhance national security but run **counter** to environmental goals (e.g., aggressively pursuing a long-term strategy of alternative transportation fuels such as

methanol, but allowing the ultimate feedstock of these fuels to become coal rather than biomass). But those should be seriously considered only if we've exhausted other options that more generally support all three goals (e.g., developing economically efficient fuel cells to power automobiles that burn fuel efficiently and cleanly).

With existing or in some cases near commercial technology we see no reason why existing environmental goals need to be compromised to achieve energy goals. Energy and environmental goals are, of course, closely linked and, therefore, neither energy nor environmental policies should be developed or changed in insolation. For example, today over sixty percent of U.S. electricity generation is fueled by coal, the major source of SO2 and CO2 emissions. Long term policies to improve the efficiency of electricity use directly translate to reduced emissions.

SOME FUTURE SCENARIOS: IMPLICATIONS OF ENERGY POLICY GOALS

In order to illustrate the implications of the policy goals I have outlined above, let me relate them more specifically to strategies affecting U.S. oil production and use and to concerns over reducing greenhouse gas emissions in U.S. electricity generation and use.

Future U.S. Oil Import Dependence

The current crisis in the Middle East has focussed attention once again on energy security concerns and, in particular, on strategies for reducing U.S. dependence on imported oil. In Figures 5 through 7, we summarize the impacts--in size and timing--of several aggressive strategies in supply, efficiency, and fuel shifting. The options include improving automotive fuel economy, increasing domestic production of oil, switching to

alternative fuels in transportation, and a mix of fuel-switching and improved efficiency steps in industry and the residential/commercial sector.

As you can see from the figures, **clearly, vigorous and sustained efforts would be required to hold down oil import dependence over the next several decades--even to a level of 50%.** The big opportunities lie on the demand side. Fortunately, these can provide good jobs and important new economic activity and strength at home. To the extent that we improve efficiency, supplies will last longer, economic competitiveness improves, environmental problems will be eased, and international tensions lessened. The opportunities on the supply side, such as enhanced domestic production in the lower 48 states, offshore and in Alaska, are more modest by comparison, but still important. The various opportunities for using alternative fuels to petroleum, especially in transportation such as methanol, CNG, electricity, and others, have extensive long-term implications. Last fall OTA released its assessment report, Replacing Gasoline: Alternatives for Light-Duty Vehicles, that addresses this subject in more depth.

Pacing of all the efforts described above is an essential feature: **like making a turn in a fully loaded supertanker, change in the energy system must be given time if it is to be non-violent.** Patterns of energy supply or demand can change radically as technology changes and as capital stock turns over but we have learned that short-term changes or policy and technology "quick-fixes" can frequently lead to economic hardship and inefficiency.

We focus on three basic scenarios in Figures 5-7. The first is a baseline adapted from the Energy Information Administration's (EIA) Annual Energy Outlook for 1990 (Base Case).

Scenario I: Baseline. Baseline values for oil production from Alaska and the lower 48 were extended to 2020 by continuing the 2005 to 2010 trend projected by the EIA. Natural Gas Liquids (NGL) were similarly left at the EIA projected levels to 2010, and then extended to 2020 following the same trend as 2005 to 2010. The category "Other" (e.g., miscellaneous refinery products) was frozen at the EIA 1995 level of 0.8 MMBbl/day; levels in the EIA projection above 0.8 MMBbl/day were separated out under the category "Alternative Fuels I" and were added in separately (see Figure 6).

The EIA projection assumes U.S. new vehicle fuel economy reaching 38 mpg for new cars and 24.4 mpg for new light trucks in 2010 -- designated the 38 mpg case in Figure 6. Our base case (Figure 5) adjusted the EIA projection to reflect a continuation of the current level for new cars of 28 mpg and for new light trucks of about 21 mpg -- the "Base Case" (28 mpg) case.[1]

Scenario II: New Supply and Efficiency Improvements. Figure 6 illustrates the impacts of three new sources of supply assumed to begin coming on line in the year 2000 and three levels of transportation efficiency improvements phased in gradually through the year 2020.

The line labeled "Alternative Fuels I" assumes that fuels such as methanol, ethanol, etc. are added beginning in 2000 reaching 500,000 barrels per day by 2020,

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[1]This resulted in a change in weighted (cars and light trucks) fleet average mileage from EIA projected levels of 23.5 mpg (38 mpg* case) in 2010 (on the road mileage is assumed to be 80% of that measured by a CAFE-type standard) to 20.5 mpg in 2000 (28 mpg* case) which was then kept at this level till 2020. Corresponding annual percentage changes in mileage are 1.18% in the EIA projection (38 mpg* case) carried through to 2020, and 1.0% in the 28 mpg* case until 2000 and then left unchanged from 2000 to 2020.Increasing light-duty vehicle efficiencies are counterbalanced, however, by EIA projections of an increase in Vehicle Miles Traveled (VMT) of 1.82% per year from 1988 levels through 2010. This was assumed to continue to increase at this rate through 2020. This is driven by such factors as population growth of 0.8%/year (246 million in 1988 to 307 million in 2025) and real GNP growth of 2.4% per year overall or about 1.6% per year per capita.

increasing at a capacity of 100,000 Bbls/day every five years.[2] The line labeled "Alternative Fuels II" is an accelerated development case.[3] The line labeled "Alaska II" assumes that a large new field is found in Alaska and an accelerated development effort is assumed to result in production levels rising to 500,000 Bbls/day by the year 2005.

Figure 6 also depicts three different transportation efficiency improvement strategies, shown as "Base Case (28 mpg)", "38 mpg", "50 mpg", and "Trucks". The case of 28 mpg and 38 mpg cases were discussed above. The 50 mpg case assumes that by 2020 both new cars and new light trucks have an overall weighted average fuel efficiency of 50 mpg, resulting in an average on-the-road total fleet fuel efficiency of 36 mpg by 2020 (allowing for turnover of the fleet stock and for the 20% reduction in actual on the road efficiencies from CAFE-type standards). The case "Trucks" assumes that half of the diesel fuel (heavy trucks, buses, etc.) projected to be consumed by 2020 (EIA projection to 2010 extended at the same growth rate to 2020) could be backed out by 2020 through, for example, the use of compressed natural gas and increased efficiency.

Scenario III: Aggressive Oil Backout. Figure 7 includes further oil backout. It assumes (in addition to 50 mpg and trucks) that one-half of the remaining non-transport uses of oil will be backed out in an aggressive oil conservation and fuel conversion program. This results in a savings of 2.7 MMBbl/day by 2020, phased in

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[2]These estimates are derived from the EIA Base Case as described above and are comparable to the estimate of the white paper, Solar Energy Research Institute, "The Potential of Renewable Energy" (SERI/TP-260-3674, March 1990) for the "Business as Usual" case.

[3]The accelerated development case listed in the above SERI white paper which forsees alternative biomass derived liquid fuels reaching 1.8 MMBbls/day more than in the base case by 2020 if additional RD&D funding is made available.

linearly.[4] Compared to current rates of use, this would suggest oil savings in the EIA Base Case of about one-half in the residential and commercial sectors, and one-third in the industrial and utility sectors from what it would have been in 2010 if energy use were to grow linearly with economic activity and/or population.

The lesson from these scenarios is that much **can** be done to countervail against the ominous projected growth of oil import dependence, but that even with relatively heroic measures we face a future of high dependence on imports.

Linking U.S. Energy Strategy to Global Climate Concerns

For decades we assumed that fossil fuels can supply our energy needs for several more centuries. Our only serious "bet-hedging" to fossil fuels has taken the form of work on harnessing nuclear power -- fission and fusion. While the latter goal remains frustrating and elusive, the former now accounts for 20% of U.S. electricity, or about 8% of our total primary energy budget. Other non-fossil (mostly-hydroelectric) adds another 4%, so our present non-fossil energy budget is about 12%. But the nuclear fission enterprise, for several reasons, is in deep trouble -- so deep that the requirement to rescue it could well be more difficult than the original task of creating it. And our long-term efforts to harness solar energy -- directly or indirectly through wind, biomass, hydropower or other means -- are minimal, ephemeral, and also troubling in terms of environmental impacts if massive use evolves.

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[4]The EIA Base Case Scenario already envisages annual residential and commercial consumption of oil decreasing at 2.6% and 1.8% respectively between 1990 and 2010 while population grows at 0.6% and total real GNP grows at 2.4% annually. Oil use in the utility and industrial sectors is assumed to increase at about 0.7% per year each, while electricity generation and manufacturing output are assumed to increase 3% and 2.8% respectively per year.

The rising specter of air pollution and climate change casts an ominous shadow over the fossil option. That era may need to end, not in centuries, but in a century or less. **This means that, unless we ignore, at our peril, global climate change, solar and nuclear power (fission and fusion) must be considered as the energy sources for mankind that may soon have to become globally dominant, perhaps within fifty years.** Developing and preserving nuclear and solar options are certainly possible. They also require long-term commitments of research, development, and investment which, in turn, means we must move ahead on that odyssey now. **A prudent candidate goal for U.S. energy policy is to reduce fossil intensity of U.S. energy use on average 1% per year for at least the next two decades.** The number I mention for this goal is less important than the will to pick a number and vigorously pursue it. Economically attractive energy efficiency improvements would dominate the first decade or two, securing time to allow alternative transportation fuels and alternative, non-fossil sources for electric power generation to develop systematically and efficiently .

Two weeks ago OTA released the summary of its assessment report, Changing by Degrees: Steps to Reduce Greenhouse Gas Emissions, that outlines the technical steps that would be necessary to reduce U.S. carbon dioxide emissions. In that analysis, we examined several alternative scenarios, summarized in Table 1 and Figure 8. In addition to a "Baseline" scenario, OTA constructed a so-called "Moderate" scenario that involved measures typically requiring some capital investment but later saving money through fuel savings, which in most cases more than compensated for initial costs (see Table 1). While none of the measures included in this scenario are difficult to achieve technically, inducing consumers to use them may not be easy. Another so-called "Tough" scenario, lowers energy demands further than the moderate case, but typically includes measures that cost more for the same level of convenience or comfort. All of the measures in the Tough case are technically feasible, but while most are not based on best available prototypes or

practices, OTA made judgments about what would be feasible for widespread use. Implementing the technically feasible Tough measures would be challenging--politically, logistically, and economically. **The net cost of the tough scenario would range from better than break-even to perhaps 2% of GNP, depending upon a variety of factors such as future energy prices.**

The detailed data for the OTA scenarios are not yet available (we expect to deliver the final assessment report in several weeks), but Figures 9, 10, and 11 show a similar set of three scenarios for **just the electric power sector.** The base case (Figure 9) shows the fuel mix that would accompany U.S. electricity consumption, projected through the year 2020. Figure 10 shows a scenario of reduction in carbon emissions in the electric power sector corresponding to about a 10 percent reduction in overall carbon emissions by 2010. Finally, Figure 11 shows a scenario of reduction in carbon emissions from electric power generation corresponding to about a 20 percent reduction in overall carbon emissions by 2010.

CONCLUSIONS

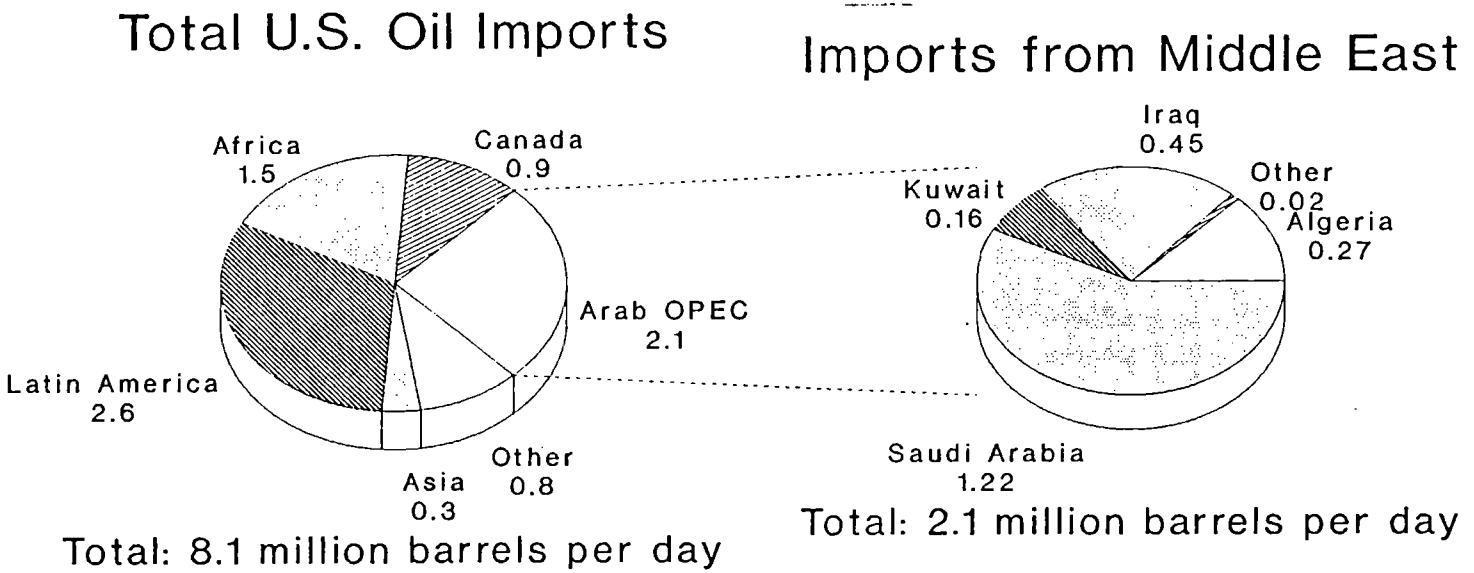
In addition to providing for contingencies and interruptions, we need to constrain our growing appetite for imported (especially Middle East) oil. We also need to make an explicit commitment to a smooth, multi-decade transition to the post-fossil fuel age as well as an era of constantly advancing energy efficiency. If we want accomplish such goals at minimum cost, it will take several decades from whenever we start to stabilize our dependence on imported oil, and it could take a century to get beyond fossil fuels. **Our long-term economic, environmental and national security future hangs on these transitions, and the specter of global warming could greatly foreshorten the time we once thought we could depend on fossil fuels.** The relationships among the long-term goals of

economy, environment, and security I have outlined provide some important guiding principles--principles from which a systematic, integrated, and comprehensive energy strategy, which is responsive to all three goals, can logically follow.

There is an ancient Chinese saying worth repeating here: "If we do not change our direction, we are very likely to end up where we are heading." We find little in what we have seen of the Administration's National Energy Strategy or in its position on responses to mitigating the agents of global climate change that gives us comfort that the need and opportunity for change is appreciated or perhaps even understood.

* * *

Figure 1
U.S. Oil Imports: 1989
(millions of barrels per day)



Total U.S. Oil Consumption, 17.3 MMB/Day

Figure 2
U.S. Energy and Oil Consumption
1989 in quadrillions of Btus (Quads)

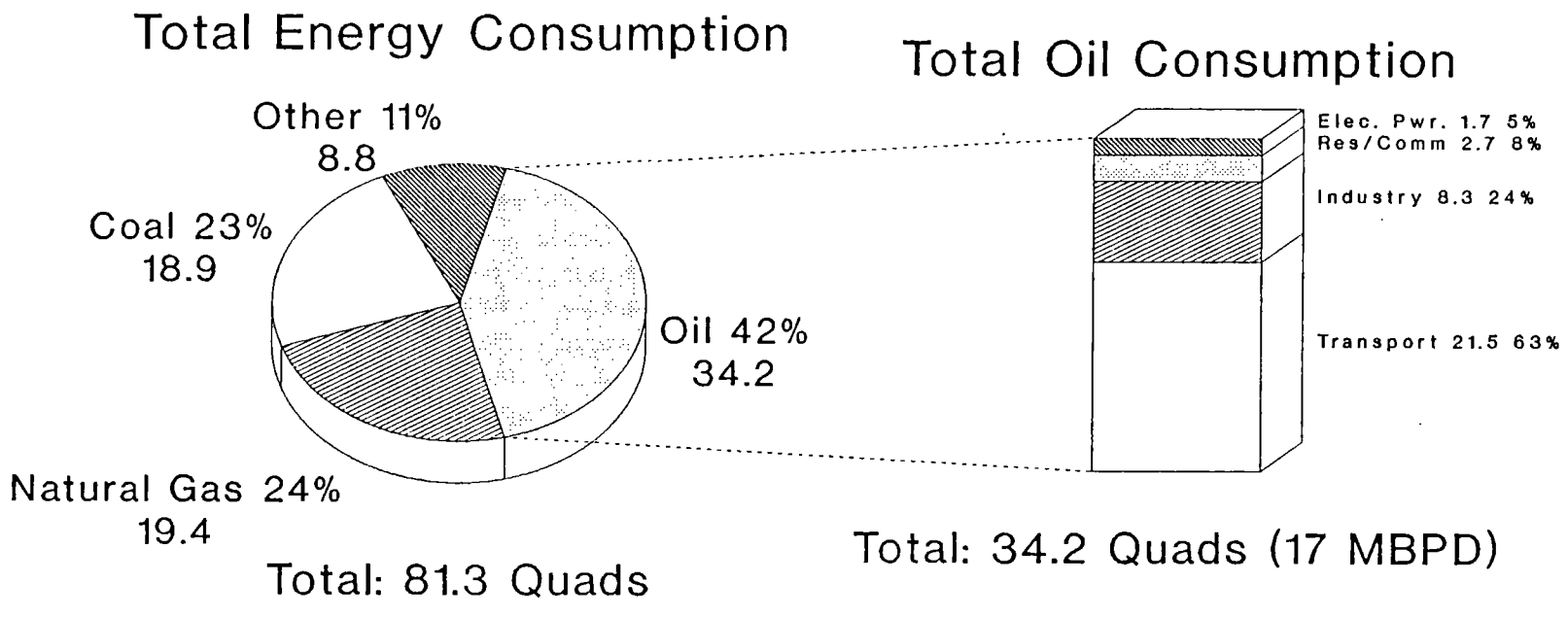
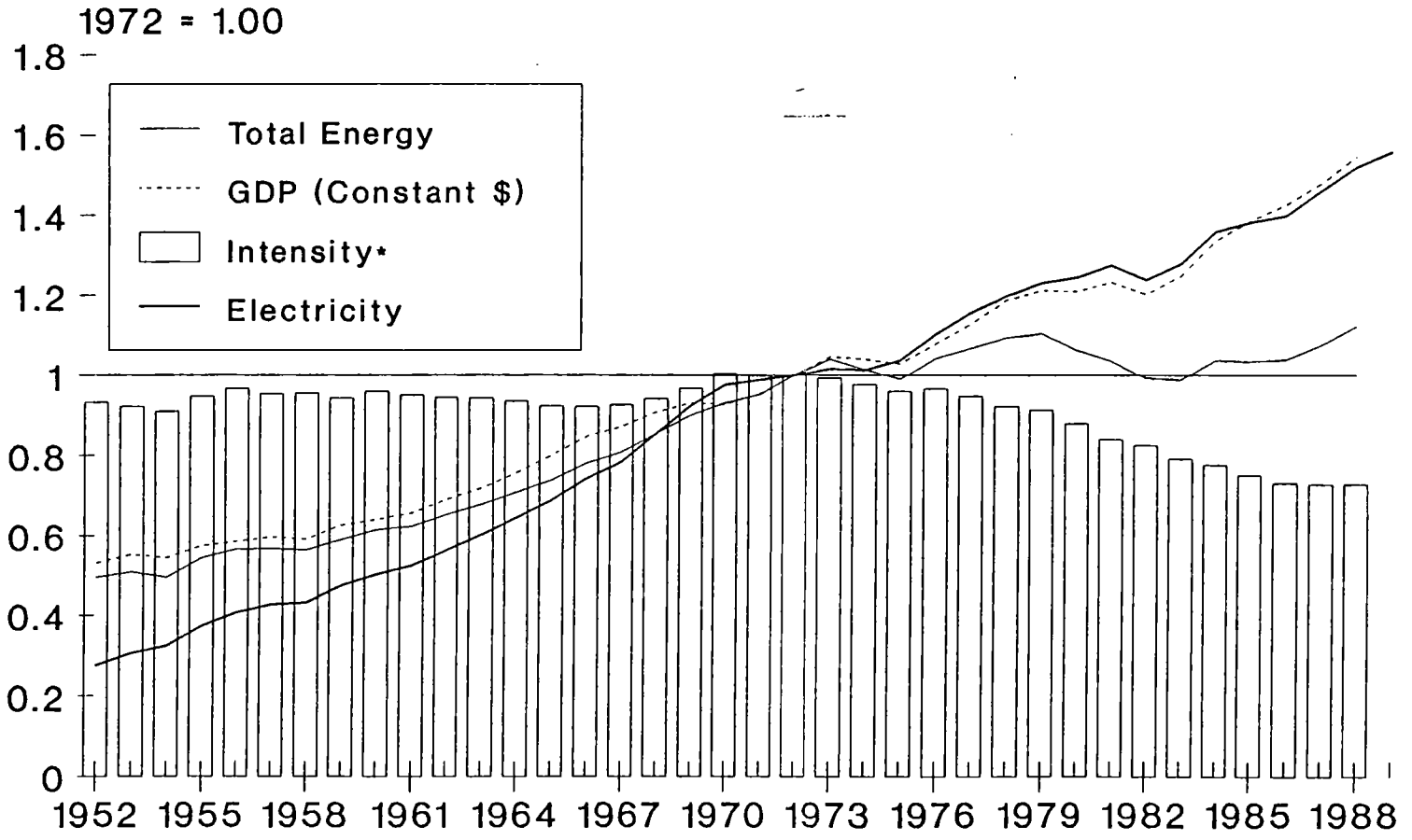
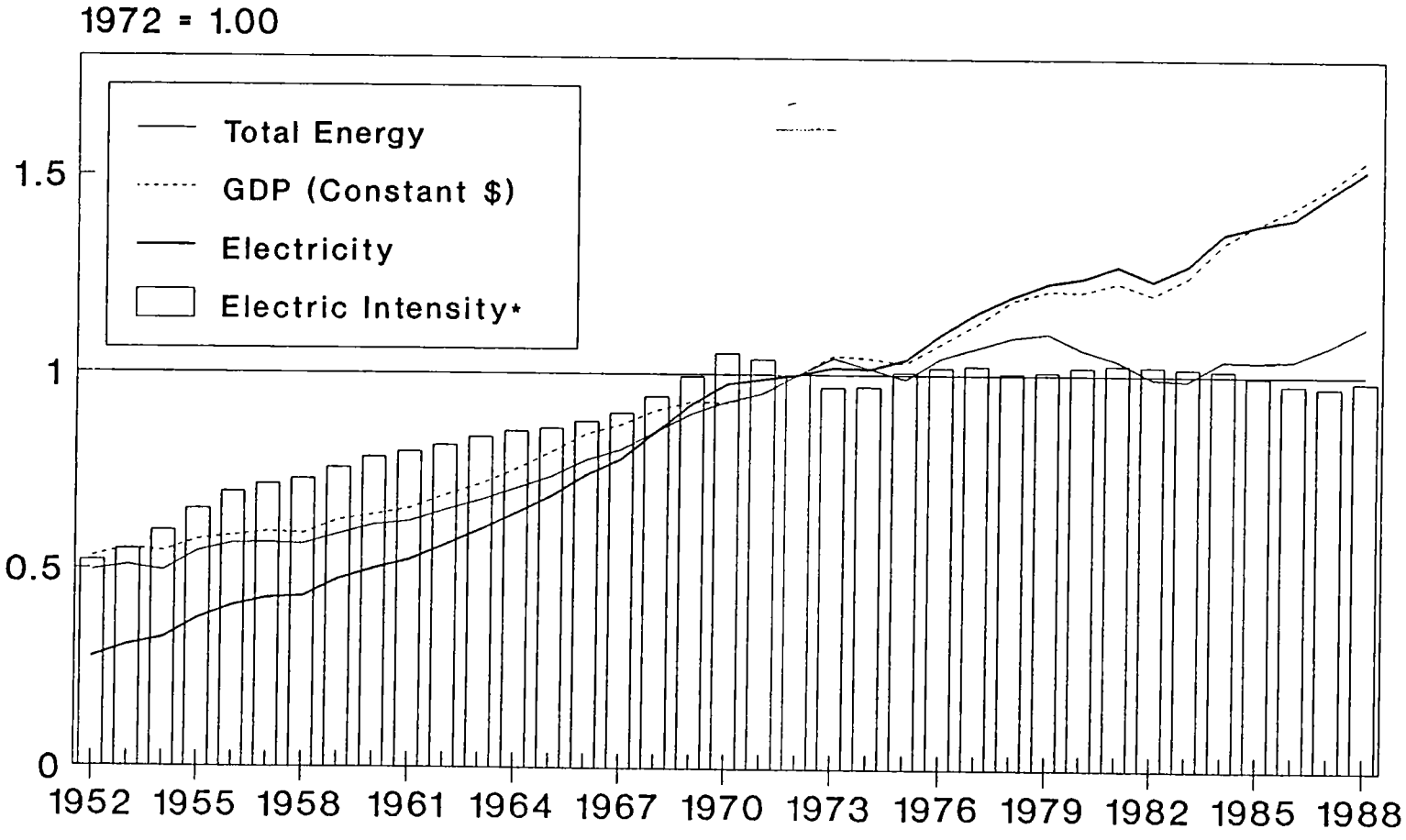


Figure 3
Index of U.S. GDP, Energy Intensity, Energy Use and Electricity Use



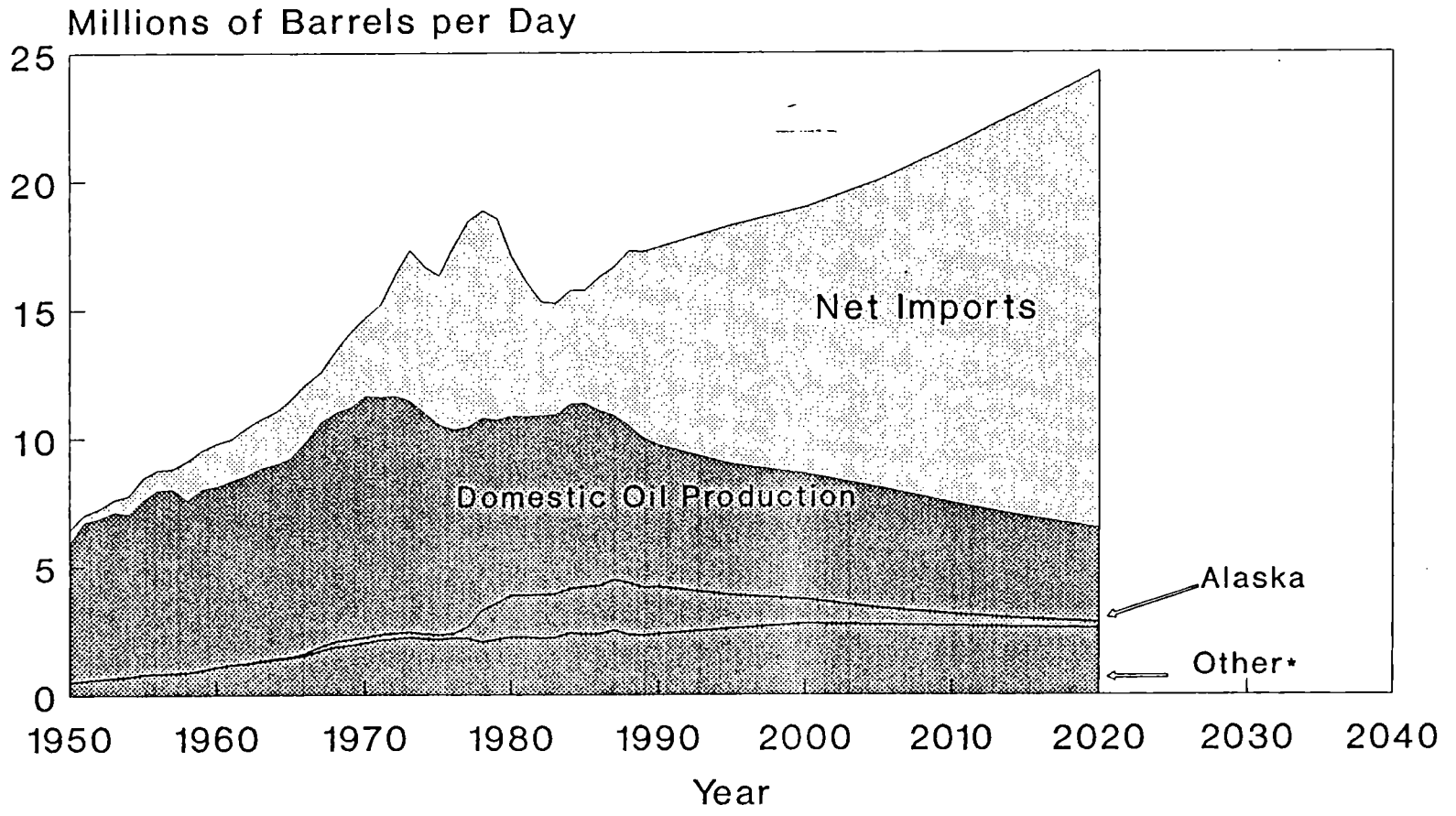
*Energy/GDP

Figure 4
Index of U.S. GDP, Electricity Intensity Energy Use and Electricity Use



*(Electricity/GDP)

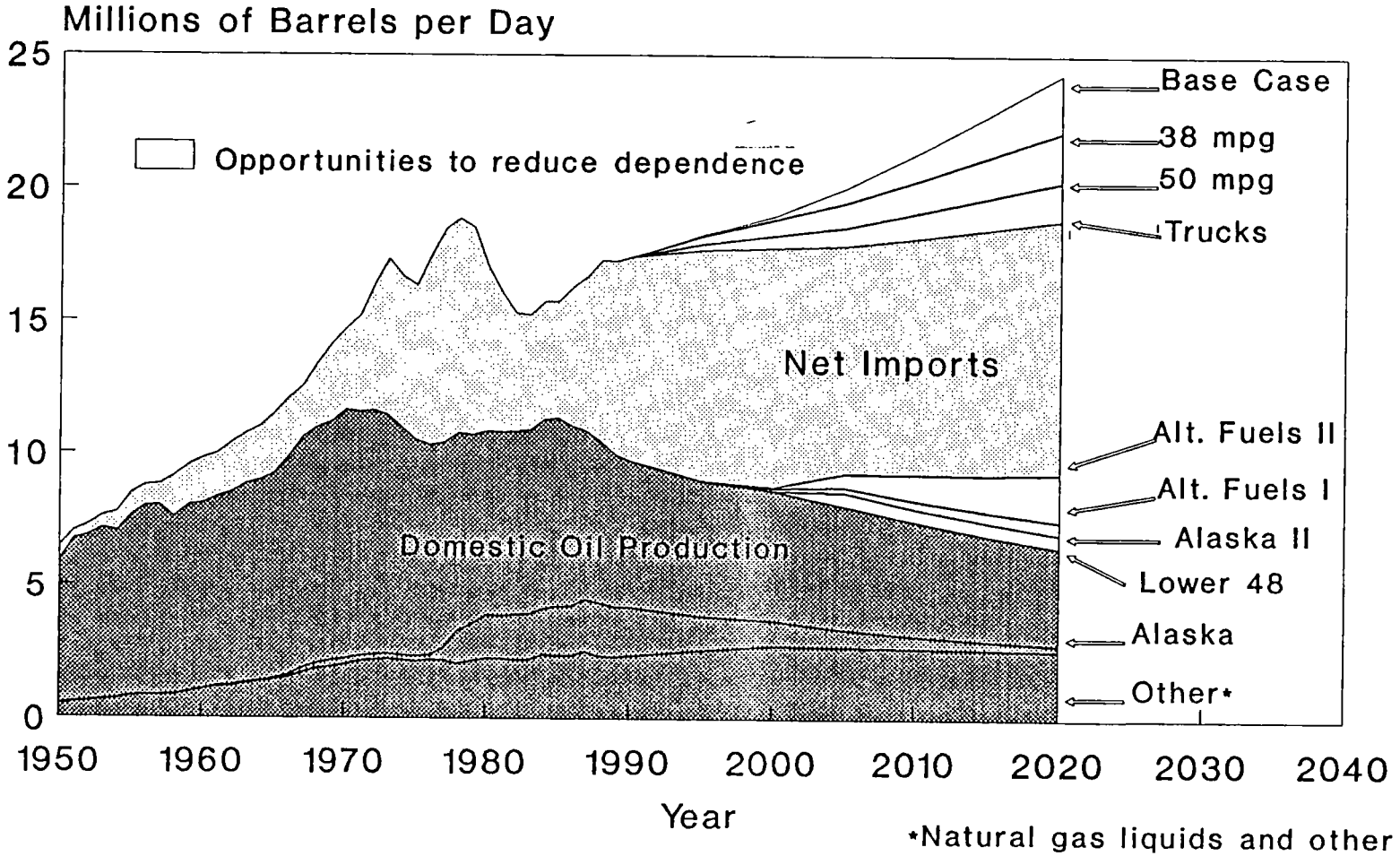
Figure 5
U.S. Oil Supply and Demand Futures
Baseline Projection



Office of Technology Assessment
Adapted from EIA, Annual Energy Outlook

*Natural gas liquids and other

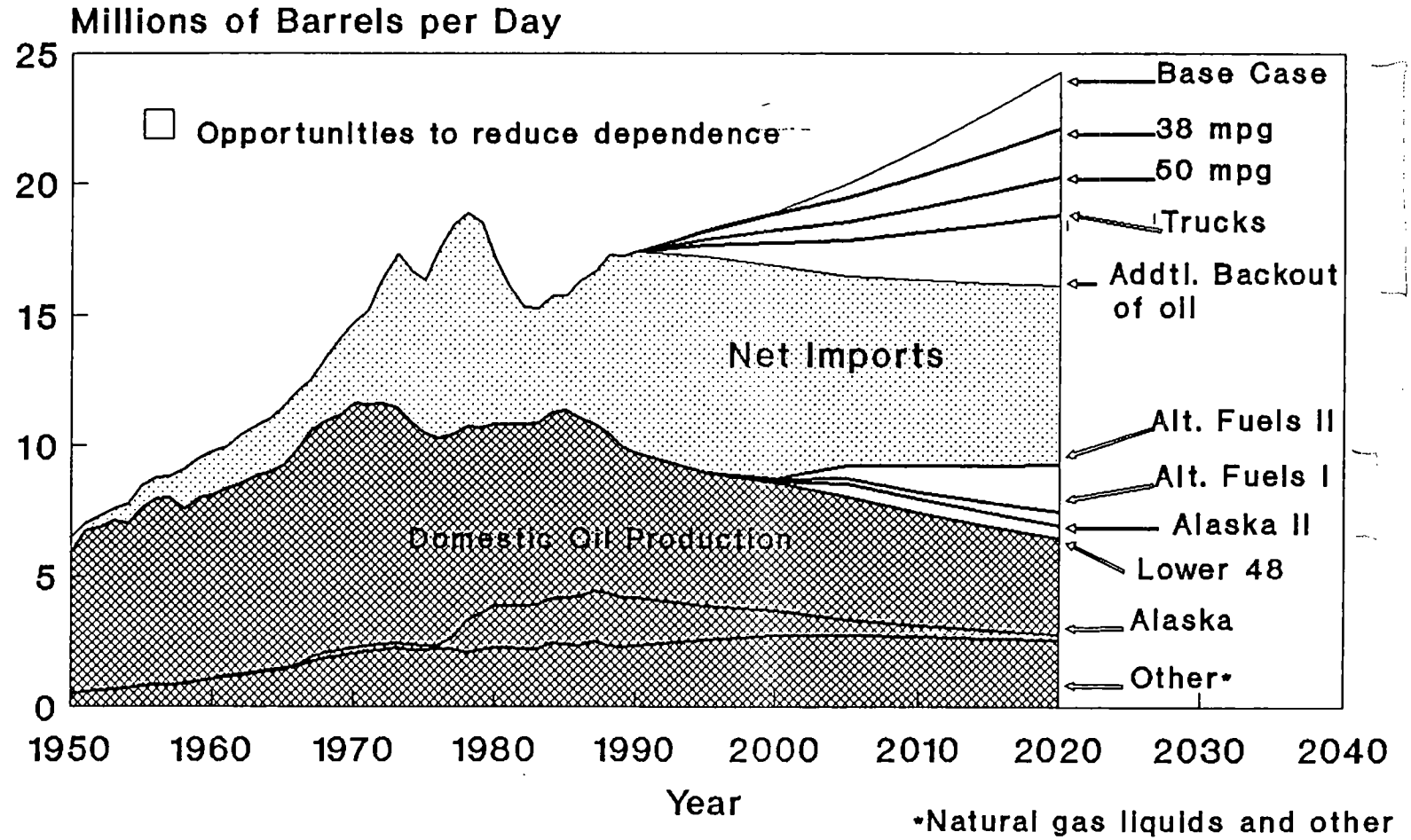
Figure 6
U.S. Oil Supply and Demand Futures
Increased Supply and Improved Mileage



*Natural gas liquids and other

Office of Technology Assessment

Figure 7
U.S. Oil Supply and Demand Futures
Improved Supply, Mileage, and Backout

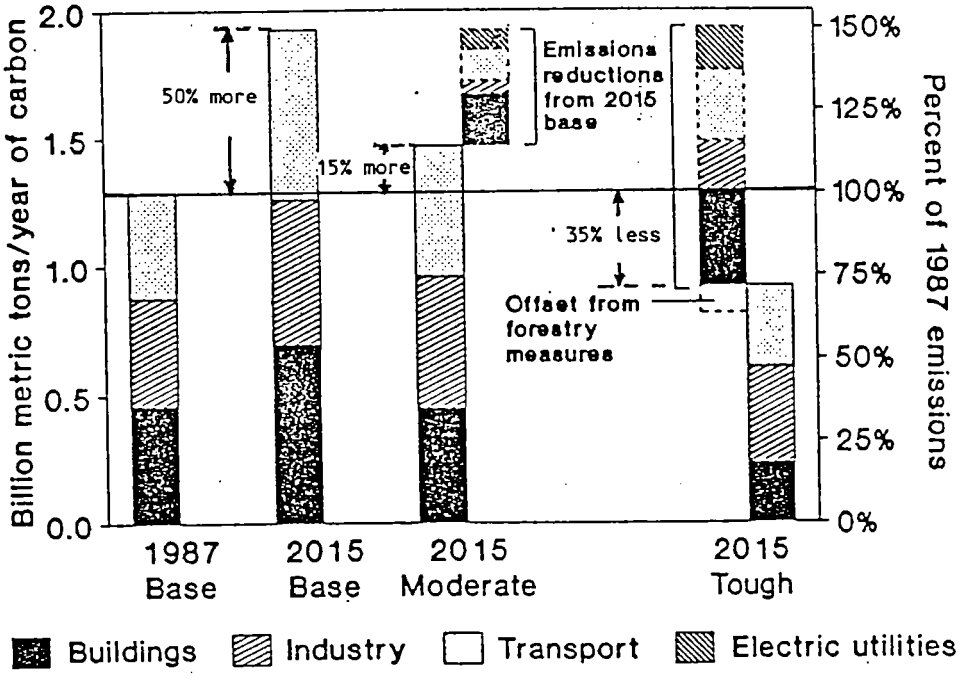


*Natural gas liquids and other

Office of Technology Assessment

Figure 8

Carbon Emissions Under the OTA Base Case, Moderate and Tough Scenarios



NOTE: The boxes outlined with dashed lines represent the *reductions* in carbon emissions associated with control measures applied in each of the three demand-side sectors (i.e., buildings, industry, and transportation) and electricity supply (electric utilities); additional carbon *offsets* afforded by forestry measures are also shown. The boxes outlined with solid lines represent *total emissions* from each demand-side sector. For the solid boxes, emissions associated with electricity generation have been allocated to the three demand-side sectors.

SOURCE: Office of Technology Assessment, 1991.

consumption to decline an additional 3 percent this year [see Table 2]. Much of the drop is likely to occur in the economically sensitive industrial sector, where we project a 7 percent fall in consumption, but we forecast declining oil consumption in every sector of the economy. If the consensus forecast of a short recession and vigorous recovery is correct, however, we expect U.S. petroleum demand to recover smartly in 1992 and grow at nearly 2 percent per year during the mid-1990s. The apparent reluctance of the Bush Administration to dampen energy consumption with higher taxes, combined with the likelihood that petroleum prices will remain relatively low at least until the mid-1990s [see above], points to steady growth in U.S. petroleum consumption and imports until the next round of price increases reduces demand.

By 1995, according to our projections in Table 2, U.S. petroleum consumption will have risen to 17.2 million b/d, of which approximately 7.6 million b/d will be imported. At an average acquisition cost of $25 per barrel (our forecast), the U.S. will spend approximately $70 billion on imported oil in 1995.

A Half-Hearted Energy Policy

The worldwide retreat from central economic planning has been widely applauded by Western economists, most of whom are convinced that economic efficiency and growth are best achieved by reliance on free markets. However, against economists' overwhelming preference for markets over central planning must be balanced the equally widespread understanding among economists that markets do not set efficient prices when the production or consumption of a good is associated with an external cost -- a cost that free markets cannot impose on producers. Air pollution is the classic example of an externality, since the inability of individuals to exercise any "property right" to clean air makes it impossible for them to charge for the damage done by pollutants. In that case -- termed a "market failure" by economists -- markets will set neither efficient prices for unpolluted air nor efficient charges for those who would pollute. Like it or not, in instances of market failure governments interested in promoting economic efficiency must intentionally interfere with the workings of the market.

There are many ways to interfere with market forces, some much worse than others. Setting uniform standards, such as mandating a fixed percentage reduction in every power plant's pollution emissions, is looked upon with disfavor by economists, since uniform standards ignore differences in compliance costs and virtually guarantee an inefficient solution to the external-cost problem. With few exceptions, economists prefer to tax externalities rather than set uniform standards, since the imposition of a tax will induce behavioral shifts among those who can most efficiently change production or consumption patterns.

A good many economists -- most emphatically including your editor -- have argued for years that a substantial tax on U.S. petroleum consumption is necessary to equate the price of oil to its full cost, since the true cost of imported oil includes a substantial "national security" premium. The expenditure of tens of billions of dollars on operations Desert Shield and Desert Storm has now moved that security premium from the realm of the hypothetical to the actual. There is nothing inefficient about a tax on petroleum products to recover those costs and the expected future expenditures necessary to protect our supplies of imported oil. Indeed, it is the failure to impose such a tax that guarantees an inefficient allocation of resources.

There are numerous ways to collect a "national security" tax on imported oil:

- A tax imposed only on imported oil, a strategy which would cause the price of domestic oil also to rise by the amount of the tax in order to reach parity with the price of imported crude. One's view of whether this will generate an unfair windfall for domestic producers or a much-needed stimulus to domestic production depends upon whether he is a producer or consumer of crude oil.

- A tax on all petroleum products; or

- A tax on motor gasoline only, a strategy which has much to recommend it because it avoids the risk of "disadvantaging" U.S. manufacturers relative to manufacturers in countries that choose not to tax industrial fuels.

To ease the economic (and political!) impact of higher gasoline taxes, the tax increase could be phased in slowly and take several years to have its full impact. Indeed, since automobiles are long-lived (the average car lasts about 14 years before being scrapped), an announcement that gasoline taxes were initially being increased by a modest 10 cents per gallon but would increase 10 cents per gallon per year through the year 2000 would begin immediately to encourage consumers to shift to more fuel-efficient automobiles and encourage planning for mass transit, all without having a dramatic impact on consumers' disposable income in the early years of the tax.

There are legitimate concerns about the income-distribution effects of a gasoline tax -- the tax is probably at least mildly regressive -- but the revenue associated with a gasoline tax is large enough to allow substantial cuts in income tax rates for low-income households in order to insure that no income group is unfairly burdened. In short, any income-distribution problems appear eminently solvable, and it seems absurd to argue that a significantly higher gasoline tax would have a negative impact on U.S. competitiveness or economic growth generally, when virtually all of our trading partners have gasoline taxes that are several times the magnitude of the current U.S. tax.

Although our projections in Table 2 presume that gasoline taxes will be increased by a very modest 10 cents per gallon by the year 2000, that U.S. petroleum consumption will increase by nearly 9 percent during just the next four years and that OPEC will be able to raise crude oil prices substantially at some point soon after 1995, a bolder national energy strategy could change the first two of those projections and reduce the odds of the third. Gradually increasing gasoline taxes by $1 per gallon could very well reduce our oil imports by as much as 500 million barrels per year by the end of the decade, improve our annual balance of trade by more than $12 billion -- by much more if oil prices rise above $25 per barrel -- and generate more than $90 billion per year in additional tax revenue. The reduced demand for gasoline, if combined with other sensible energy-saving strategies, would add slack to world oil markets and reduce the odds that OPEC would be able to make future price increases stick. In our view, now is the ideal time to implement an effective demand-reducing

Table 3: NATURAL GAS OUTLOOK BY QUARTER

	Q189	Q289	Q389	Q489	1989	Q190	Q290	Q390	Q490	1990	Q191	Q291	Q391	Q491	1991
						- Preliminary -					------- NERA Estimates/Forecasts ------				
END-USER PRICES ($/MCF):															
Electric Utilities	$2.47	$2.37	$2.37	$2.60	$2.43	$2.71	$2.21	$2.22	$2.75	$2.42	$2.65	$2.20	$2.25	$2.85	$2.45
Industrial Users [a]	3.28	2.80	2.69	3.02	2.97	3.33	2.69	2.53	3.10	2.91	3.25	2.65	2.55	3.15	2.91
Residential Users	5.41	6.02	6.93	5.64	5.64	5.54	6.05	6.95	5.80	5.83	5.60	6.00	6.95	5.90	5.88
Commercial Users [a]	4.80	4.66	4.64	4.71	4.74	4.99	4.68	4.53	4.75	4.80	5.00	4.65	4.55	4.90	4.85
WEIGHTED AVERAGE	4.33	3.69	3.32	4.05	3.91	4.68	3.57	3.15	4.09	3.89	4.40	3.60	3.23	4.21	3.94
SPOT WELLHEAD PRICES:															
U.S. Composite	$1.64	$1.55	$1.51	$1.79	$1.62	$1.83	$1.44	$1.39	$1.85	$1.63	$1.50	$1.40	$1.45	$1.95	$1.58
La. Gulf Coast Onshore	1.73	1.66	1.61	1.94	1.73	1.91	1.50	1.48	1.93	1.71	1.58	1.50	1.55	2.05	1.67
Tx. Gulf Coast Onshore	1.68	1.61	1.52	1.81	1.66	1.80	1.43	1.45	1.87	1.64	1.50	1.45	1.50	2.00	1.61
Tx. Gulf Coast Offshore	1.60	1.55	1.48	1.72	1.58	1.72	1.31	1.36	1.85	1.56	1.44	1.36	1.41	1.91	1.53
AVG. WELLHEAD PRICE [b]	$1.84	$1.61	$1.62	$1.75	$1.71	$1.89	$1.54	$1.55	$1.90	$1.72	$1.60	$1.50	$1.55	$2.00	$1.66
NATURAL GAS CONSUMPTION (Trillion Cubic Feet):															
Electric Utilities	0.53	0.74	0.89	0.61	2.77	0.46	0.73	0.97	0.66	2.82	0.58	0.75	0.85	0.63	2.80
Industrial Users [c]	1.77	1.64	1.60	1.81	6.82	1.75	1.78	1.73	1.75	7.01	1.70	1.60	1.65	1.75	6.70
Residential Users	2.14	0.83	0.39	1.42	4.78	1.97	0.81	0.39	1.25	4.42	1.95	0.85	0.40	1.30	4.50
Commercial Users	1.10	0.51	0.33	0.77	2.72	1.05	0.53	0.37	0.70	2.65	1.05	0.50	0.35	0.75	2.65
Lease, Plant Fuel	0.28	0.26	0.26	0.27	1.07	0.32	0.30	0.29	0.30	1.20	0.31	0.30	0.30	0.30	1.21
Pipeline Fuel	0.17	0.15	0.15	0.16	0.63	0.15	0.14	0.15	0.15	0.58	0.15	0.14	0.13	0.15	0.57
TOTAL CONSUMPTION	5.98	4.13	3.62	5.06	18.78	5.69	4.28	3.90	4.81	18.67	5.74	4.14	3.68	4.88	18.43

[a] Commercial and industrial prices do not include spot and third-party purchases.
[b] Overall U.S. average wellhead value, including spot and third-party sales.
[c] Excludes gas used as lease and plant fuel.

Historical Data: U.S. Energy Information Administration, Natural Gas Week.

energy strategy. Failure to act will simply force us to make more difficult choices in the future.

NATURAL GAS UPDATE

Recession, warm weather and lower oil prices have pushed natural gas prices down nearly to mid-summer levels, and the only uncertainty about gas markets during the next six months is whether prices will fall still lower. Although speculation about a post-war oil price collapse is overblown, in our view [see above], there is little doubt that inventory liquidation after the war will put at least some downward pressure on oil prices, and although it is probable that the economy has bottomed out, it is likely to be a while before natural gas demand starts rising again. This combination of weak demand and declining oil prices suggests that gas prices will stay low at least through the summer. Spot gas prices seem to be well below most companies' average replacement costs, a situation that cannot persist indefinitely, but as long as the country remains in recession gas consumers are likely to continue to enjoy low prices.

* call Australian embassy.

Jim McAfee — ENTH mob / conf of LOSea

① Duration of the ban.
② ~~wh~~ how is ban lifted — automatically at end of period (w/ consent to keep in place) / — only by consent of all parties
   ⓐ how many count for consent?
③ Smthg to fill legal void upon expiration
   ⓐ agree to CRAMRA — /or its equiv — NOW.
   ⓑ agree to agree.
   — set up a process now.

S.J. Res 206 — "for an indefinite period"
→ No CRAMRA presented to Senate until indef. pd. provision agreed
→ in interim just voluntary restraint

Kerry — indefinite ban / urge permanent ban.

ARTICLE VI !!
I. Permanent ban — NO — Japan, UK.
II Limited ban
   U.S. → 20-40 yrs. — lift unless consensus
   Chile → 50 yrs — remains in effect for 10 yr pds; after 8 yrs, petition; 2/3/4 cld allow moratorium lifted when new regime in place (at least as protective as CRAMRA) — CRAMRA or equally protective.

~~203 555 1212~~

*? : defined pd. of yrs contrary to "indefinite" prohibition??
* only way for it to be indef is for it to continue unless agrmt to lift
? : wld Australia / France go for "a regime at least as environmentally protective as CRAMRA

Contracting Parties -- orig. 12.
Consultative Parties -- 25 - (Art. IX)

modification/amendment — by unanimous agrmt. of Contracting parties then ratification

* (if don't ratify w/in 2 yrs - deemed to have withdrawn from the Treaty)

* after 30 yrs, any Contracting party can call Conference to review.

2 ways to modify:

① At any time = Modif is agreed to & ratified [UNAN] by Consultative parties.

② After 30 yrs (June, 1991) →
→ any Consultative party can call a Conference
→ modif agrd to by [MAJORITY] of Consultative
→ [UNAN] Ratif.
→ if Not agreed to -- any Consultative Party may withdraw → withdraw takes effect in 2 yrs.

* fear is that Australia - or some other party - will suggest an amend re mining that will be rejected & it will withdraw.

I. Permanent ban — #0

II. 20-40 yrs + auto termination + CRAMRA or equiv

III. 50 yrs + auto extension + at least equiv. of CRAMRA

?: provide that ban will not be lifted unless regime in place. - - but at any time Cda suggest a regime that is unacceptable & ∴ w/draw.

→ Need a backstop that ① while negs re new regime on-going, ban in place & failure of any
② while negs on-going, proposed regime & grds for w/draw from treaty.

Shoreham – Daved Greene
Debra Gordon
No problem from a technological pt of view
37.5 by 2000.

Credits for more eff – revenue neutral??

adjust the bad gelete structure over time
sales mix
fuel efficiency) substantial Δ's.

Base case yrs 2001
31.8. 34.2 35.8 → tech now not cost-effective.

63302

W.P. Oct 24, 1990 - OECD CO_2 emissions.

+ Alice LeBlanc - EDF - tradeable permits.

[+ ask CRISTOFARO for comments on budget]
* introduce Cooper Legis *
send for comments?? [- ask budget if other gases can be included.

get Policy Options for Stabilizing Global Climate - Lashof & Tirpak - EPA, 1989.

(1) get Sci Am Dec 1990 - Richard [illegible]

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

$Ca_2CO_3 + SO_2$

$CH_4 \xrightarrow{\Delta} CO_2 + H_2O$

(2) Applied Energy - "Technology & Cost of Recovery & Storage of CO_2 from IGCC Plant", Black & Turkenburg.

p. 136 Sci Am Sept 1990

Q: why CO_2 can't be sequestered as a solid

Fossil fuels, Fulkerson, Judkins & Sanghvi
- advanced coal & gas turbines / combined cycles.
- N.G. as a substitute for coal.
- sequestration of CO_2 from coal v. expensive (sea bed / NG well injection) & 3 tons CO_2 for ea. ton of coal)

biomass {
- electricity generation { burn → steam turbine; gasify → gas turbine.
- liquid fuels { methanol derived from wood; ethanol derived from sugar-containing [illegible]

Solar {
- solar thermal energy → electricity generation by heating of steam by concentrated solar radiation
- photovoltaics (solar cells) → electricity generated by production of e- from uv striking semiconductor.

H_2 electrolysis → from solar electrolysis / nuclear fission or fusion → H_2 oxidized at anode; e- generated; electricity generated by:
(fuel cells?) → fuel → burn (forms H_2O). (problems low energy & power density)
H_2 gas
v. coal gasification or nuclear [illegible] CH_4 to H_2.

Q for K Stork — negawatt mkt. p. 72 SciAm Dec, 1990.

- electric efficiency
  - lighting — compact fluorescent
  - motors — adjustable speed drive
  - appliances
    - ↑ stds
    - labelling
  - homes — ratings & listings.
  - utility rebate programs
    - efficiency investment write-offs.
    - tradeable "negawatts"
  - retrofit of federal bldgs.

- renewables
  - solar
    - solar thermal
    - PV
  - wind
  - biomass (w/ concomitant afforestation)
  - H_2
    - fuel cells
    - liquid (R&D)

- fossil fuel — fossil
  - switch to natural gas
  - CO_2 sequestration from coal.
  - ethanol / methanol — derived from woody biomass (too expensive (& envtlly poor) to derive from corn).

- nuclear
  - fission
    - Advanced lt. water reactors ~~[illegible]~~
    - reprocessing
    - breeder (converts U238 (not fissile) to plutonium (fissile)). — no need for enrichment.
  - fusion — not currently "clean" — neutrons make matls radioactive
  - hybrid — fusion plus capture of neutrons to make matls radioactive — then fission.

* no long-term storage facilities in world"

* accounting = 1° defense & proliferation

- vehicles
  - vehicle design / engine design / weight / aerodynamics
  - fuel — alts
    - H_2 — from electrolysis rather than coal gasification
    - biomass — methanol, ethanol — * make sure no net CO_2
    - electric — if charge is non-fossil fuel derived
  - mass transit / zoning / carpool.

Big pkg legis
- Conservative
- CO_2 trading scheme
- 1884
- VAT-E
- S.201
- call for another mtg of Montreal Protocol parties.
- With energy leg. slamm.
- highway bill -- mass transit / zoning?
- CORECT -- expert of energy eff. techs.

- Look @ Commerce Jr
  have NOAA, NASA, NSF do this w/ Commerce running the board
  → check out Cooper's Jr

get legis. to Leg Council