Annual Report to the Congress for 1977

March 1978



annual report

To The Congress for 1977

CONGRESS OF THE UNITED STATES

Office of Technology Assessment

WASHINGTON, D. C. 20510

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CONTENTS

Page

I. Director' s Statement 1
11. Excerpts From Completed OTA Reports 7
111. Program Descriptions 31
IV. Planning and Exploratory Activities 55
V. Organization and Operations. 61
VI. Summary Report of Advisory Council Activities. 67

Appendixes:

A. List of Advisors, Consultants, Panel Members 75
B. List of OTA Reports Published. 91
C. Roster of OTA Personnel 94
D. Technology Assessment Act of 1972 95

Section I

DIRECTOR'S STATEMENT

Section I
DIRECTOR'S STATEMENT

1977 was an extraordinary year in OTA's brief history. It was a period of ferment and transformation. The three cornerstones of the agency—the Technology Assessment Board, the Directorship, and the Technology Assessment Advisory Council–took on new looks, as resignations occurred and memberships changed

There was also retrenchment: the Legislative Appropriations Act for 1978 required that the OTA staff be heavily cut. People had to be let go, while tighter controls were placed on program budgets and expenditures. These and other factors eroded the morale of the staff—which was scattered among inadequate quarters at nine different locations on Capitol Hill.

Meanwhile, extensive congressional hearings were being held on OTA to review its performance and experience. This was the first time that the agency had been called to account before a legislative committee since it began its work in early 1974. although in 1976 both the House Commission on Information and Facilities and the Senate Commission on the Operation of the Senate had issued reports on their evaluations of OTA.

Despite the problems. the Office held its course and continued to do its work, sol idly backed by Chairman Kennedy and other Members of the OTA Board. Fourteen projects were completed during the year. They covered a rich array of issues: the spread of nuclear materials and weapons-making capability, cancer-testing technology and saccharin, the implications of the Carter Administration's National Energy Plan, the trade-offs between individual rights and massive computerization of the Nation's tax information system, ways to spur research on increasing the supply of food, the prospects of solar technology. increasing the yields of known oil wells and natural gas deposits in U.S. lands, conserving fish resources in the Nation coastal zone, and many more questions of concern to Congress.

The following report describes these projects in detail. They are cited briefly in these prefatory remarks merely to illustrate that 1977, OTA's fourth year of operations, was a productive one despite the retrenchment and other events that occurred. As William Jovanovich, the publisher, once said in the preface to an annual report: "More can be said of both our results and our plans during the present time, but having undergone recently a period of some adversity, it may be prudent neither to complain nor to explain. " I am compelled to say the same.

But some elaboration is in order. The most significant change that occurred during the year was the resignation, announced May 18, 1977, of OTA's first Director, Emilio Q. Daddario. It was he who had brought the concept of technology assessment into the public consciousness in the mid-1960's. when he began to lay the groundwork for the Technology Assessment Act of 1972. And when the Technology Assessment Board came to the selection of OTA's first Director in November 1973, Mr. Daddario was their unequivocal choice. In his letter of resignation three and one-half years later, he noted the many assessments that had been completed in the first phase of OTA's development and added: "I had always planned to leave OTA when that period of evolution had been reached. "

As Chairman Kennedy later observed: "Mire Daddario is one of those rare individuals who could both conceive a significant idea and have the opportunity to put it into practice. He had the vision to recognize the need for technology assessment before anyone else even knew what the term meant. He had the resourcefulness to build the legislative record which eventually led to the establishment of the Office of Technology Assessment. And as the first Director of OTA, he exhibited a high degree of statesmanship in demonstrating that OTA could function as a nonpartisan, objective analytical arm of the Congress. "

Following Mr. Daddario's announcement, over 200 nominations for the directorship were received during June, July, August, September, and October. Finally, on October 27, 1977, the OTA Board offered the position to Dr. Russell W. Peterson, the President of New Directions, and formerly Governor of Delaware, Chairman of the Council on Environmental Quality, and Director of the Research and Development Division of the du Pont Company's Development Department. On November 18, 1977, Governor Peterson accepted the Board's offer, effective January 16, 1978, when he will leave his post at New Directions.

There were also two resignations from the Technology Assessment Board during the year. The Board's Vice Chairman, Rep. Marjorie S. Holt (R-Md.), resigned effective July 1, 1977. She was succeeded by Rep. John W. Wydler (R-N. Y.). Senator Richard S. Schweiker (R-Pa.) resigned from the Board on June 14, 1977. He was succeeded by Senator Orrin G. Hatch (R-Utah). On September **20,** 1977, Rep. Larry Winn, Jr. (R-Kans.) was named Vice Chairman of the Board to succeed Mrs. HoIt.

During the first half of 1977 there were two unfilled vacancies on the Advisory Council. In July, after considering numerous candidates, the OTA Board decided to reappoint Mr. Fred Bucy, President of Texas Instruments, to a 4-year term on the Council and to appoint Dr. Charles N. Kimball, Chairman of the Midwest Research Institute, as a new member to fill the vacancy created by the resignation of Dr. Harold Brown on January 20, 1977.

By year-end, the reduction in personnel required by law had been largely achieved, but not without some travail and diminishment in the morale and efficiency of the staff. The practical consequence of this reduction is that greater reliance will have to be placed on assistance from contractors and consultants if OTA is to maintain the same level of effort that Congress has come to expect of it.

Quite apart from the makeup of the work force, a new programming, planning, and budgeting strategy was presented to the OTA Board and approved in July. Under this strategy, a reserve fund has been established for undertaking high-priority, longer term assessments that may not be of concern to Congress at present but probably will be in the future. This fund is about 25 percent of the total funds budgeted for assessment projects. The new strategy is an explicit commitment to OTA's responsibilities to look beyond current urgencies and "provide early indications of the probable beneficial and adverse impacts of the applications of technology, " as the OTA statute declares.

The congressional hearings on OTA were its first. They were held by OTA's legislative committee in the House, the Science and Technology Committee, through its Subcommittee on Science, Research, and Technology. It was in this Subcom -

mittee that the concept of technology assessment was spawned some 10 years earlier. The Committee was aware of the reports on OTA that had been issued by the House Commission on Information and Facilities and the Commission on the Operation of the Senate and which had made recommendations for improvement. The hearings, therefore, were intended as a comprehensive review of OTA's activities to determine what seems to be working well, what is not, and what might be done to correct any problems.

There were three sets of hearings during the year. I testified at the first and third sessions. In my first appearance in August, I described the background and organization of OTA, outlined the processes we follow in selecting and performing assessments, gave some basic statistics on our products and resources, and illustrated the ways in which our program capabilities have been developed.

In my second appearance in October, I discussed the principles that guide OTA in its work and addressed some basic questions. To what extent are we performing the "early warning" function? Do we consider the potential benefits of technology or are we preoccupied with negative effects? Would a better definition of technology assessment make OTA a more effective tool of the Congress? These are the kinds of questions that have plagued friends and foes of technology assessment alike.

The hearings, in my judgment, will have a salutary effect. OTA now has almost 4 years of experience. It is a good time to take stock, to assess this experience, and to measure it against OTA's congressional charter and the aspirations of those who conceived of the institution and principles of technology assessment and brought them to reality in the legislative branch of Government. Further hearings on OTA are planned by the House Science and Technology Committee in 1978, after which the Committee will publish its findings and recommendations and perhaps introduce legislation amending OTA's charter.

The year ended in another bright moment when, in December, we began moving to our new location at 600 Pennsylvania Avenue, S.E. For the second time since the creation of OTA, all of its staff will be housed under a single roof. The first time was when OTA began its assessment operations and the staff, all 10 of us, were located in three rooms of the old Congressional Hotel. Now, 4 years later, we have a full-time salaried staff of 130 (our statutory limit) and employ over 450 consultants and some 230 contractors. The new location will improve working conditions, eliminate many inefficiencies, and facilitate communications among the staff and all of the people who work with us.

Governor Peterson will assume the directorship of OTA in January and join us at the new location. We look forward to having him with us and working with him to build OTA to its full potential.



DANIEL DE SIMONE
Acting Director

Section II

EXCERPTS FROM OTA REPORTS COMPLETED IN 1977

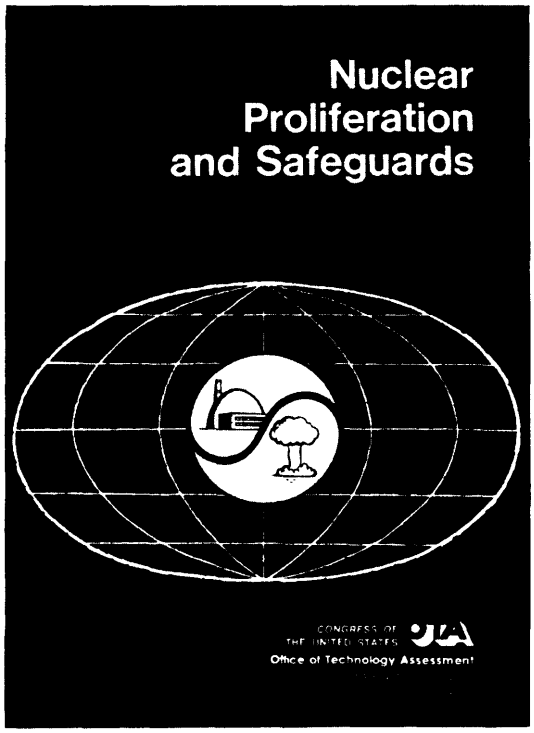
The assessments carried out by OTA cover a wide spectrum of major national issues and examine a broad range of policy options and their possible consequent impacts on numerous and diverse interests: To provide some examples of this range, depth, and breadth, excerpts from several reports produced by the Office in 1977 are presented in this section.

The reader is cautioned that these excerpts are samplings from those reports. These paragraphs were selected merely to illustrate their diversity. Thus it should not be inferred that these excerpts represent either the full range of options considered or the major findings presented in any individual OTA report.

The projects themselves are discussed in the descriptions of OTA program activities in sections III and IV. (A list of OTA reports published to date, and the sources from which they may be obtained, may be found in the appendix.)


Enhanced Oil Recovery Potential in the United States
POLICY IMPLICATIONS OF MEDICAL INFORMATION SYSTEMS
A Preliminary Analysis of the
IRS TAX ADMINISTRATION SYSTEM
Status Report on the
Gas Potential From Devonian Shales of the Appalachian Basin
Office of Technology Assessment
LIST OF PUBLICATIONS
DECEMBER 1977
Organizing and Financing Basic Research to Increase Food Production
STATES CONGRESS
March 1977
Technology Assessment in Business and Government
Nuclear Proliferation and Safeguards
Summary
PREPUBLICATION DRAFT
This copy is subject to editing before final publication
Application of
Solar Technology
to
Today's Energy Needs
June 1977
Transportation of Liquefied Natural Gas
Perspectives on Federal Retail Food Grading
Analysis of the Proposed National Energy Plan
August 1977
CANCER TESTING TECHNOLOGY AND SACCHARIN
Establishing a 200-Mile Fisheries Zone
CONGRESS OF THE UNITED STATES
Office of Technology Assessment

Section II
EXCERPTS FROM OTA REPORTS COMPLETED IN 1977



Nuclear Proliferation and Safeguards

At the root of the concern over proliferation is the fear that the spread of nuclear weaponry poses a grave and mounting threat to global stability. This threat could materialize in at least four ways. First is the obvious danger that nuclear weapons might actually be used. As is frequently pointed out, the statistical probability of use increases with the spread of weapons, other things being equal. Second, newly established nuclear powers could enter a nuclear arms race which might be politically destabilizing and, in itself, increase the likelihood of an outbreak of war. Third, the expanding quantity and distribution of weapons will increase the opportunities for theft, illicit sale, and sabotage. Finally, proliferation could undermine the present structure of the international political system as the acquisition of weapons alters the distribution of power. . . .

Reprocessing provides the strongest link between commercial nuclear power and proliferation. Possession of such a facility gives a nation access to weapons material (plutonium) by slow covert diversion which would be difficult for safeguards to detect. An overt seizure of the plant or associated plutonium stockpiles following abrogation of safeguards commitments could, if preceded by a clandestine weapons development program, result in the fabrication of nuclear explosives within days. Furthermore, such a plant reduces a nation's susceptibility to international restraints (sanctions) by enhancing fuel cycle independence. Finally, plutonium recycle is the most likely source for both black market fissile material and direct theft by terrorists. . . .

Given the weapons material and a fraction of a million dollars, a small group of people, none of whom have ever had access to the classified literature, could possibly design and build a crude nuclear explosive device. The group would have to include, at a minimum, a person capable of searching and understanding the technical literature in several fields, and a jack-of-all-trades technician. They would probably not be able to develop an accurate prediction of the yield of their device, and it could be a total failure because of either faulty design or faulty construction. If a member of the group is careless or incompetent, he might suffer serious or fatal injury. However, there is a clear possibility that a clever and competent group could design and construct a device which would produce a significant nuclear yield. . . .

Components of a nonproliferation policy would include: (a) steps designed to tip the balance of political incentives and disincentives regarding the acquisition of weapons in favor of disincentives; (b) a comprehensive safeguards regime to prevent the diversion of nuclear mater-

ial from civilian energy programs to weapons use; (c) controls over exports, particularly with regard to enrichment and reprocessing capabilities, in conjunction with arrangements for the return of spent fuel to the supplier or any international repository; (d) a broad range of domestic and foreign policy supporting actions, including steps to upgrade physical security measures to prevent theft of nuclear materials, expansion of reactor grade uranium production to obviate the need for reprocessing, and arms control negotiations; and (e) steps to assure that other countries can meet their energy requirements without resorting to enrichment and/or reprocessing national facilities. . . .

If the incentive for other nations to acquire national reprocessing plants is to be reduced, the United States will have to establish itself as a "reliable supplier" of low-enriched uranium. Other suppliers could be encouraged to take similar steps. Reliable supplier status presupposes a willingness to enter into binding agreements both to provide uranium enrichment services and to construct any additional enrichment capacity required. The more attractive the terms under which enrichment services are offered, the more likely their success in forestalling national facilities. . . .

The historical record provides no evidence that any criminal or terrorist group has ever made any attempt to acquire fissile nuclear material or radioactive waste material for use in an explosive or dispersal device.

One ought to take little comfort from this fact, however. The lack of intelligence or visible evidence does not mean that the option has not been discussed; that some group might move in this direction without providing clues or warning. It is disquieting to realize that, in the past, most new terrorist groups have not been detected before their terrorist act.

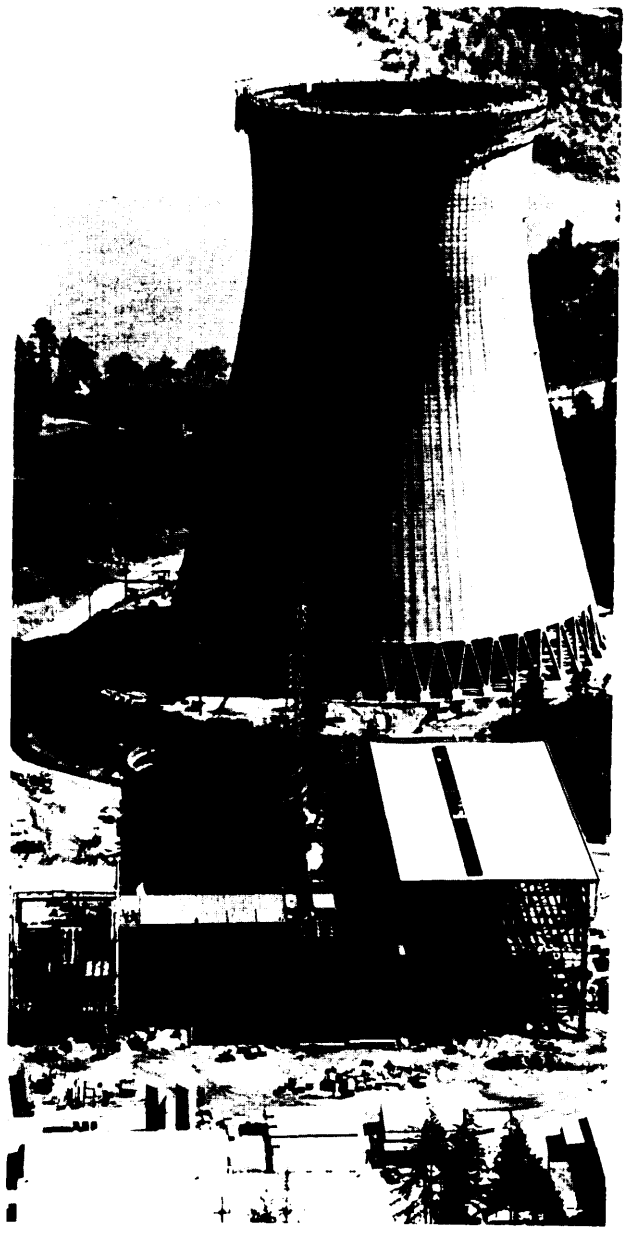
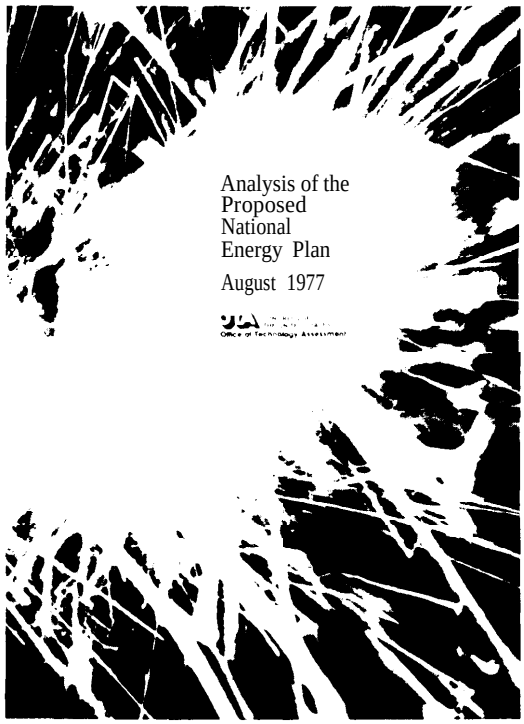


Photo Courtesy Jan Fardell for Portland General Elecfric Company

Trojan Nuclear Plant of the Portland General Electric Company is shown under construction near Prescott, Oreg., 42 miles northwest of Portland on the shores of the Columbia River



Analysis of the Proposed National Energy Plan

The National Energy Plan's assessment of the world energy crisis is accurate. The problems are complex and serious, and there is little time for fashioning new policies to respond to them. If the United States acts now, it may be able to reassert control over its energy future and prevent serious economic, social, and environmental impacts. To postpone decisions to raise energy prices and reduce waste is to risk losing that control, which would mean severe hardships for all Americans within the next 10 years.

The level of U.S. oil imports is the pressure gauge that will measure how well American policies are succeeding. If imports can be held close to the goals of the Plan, the United States and the rest of the world may well manage a relatively smooth and peaceful transition to sustainable energy resources. If not, the transition may be neither smooth nor peaceful. . . .

The levels of domestic supply projected by the Plan represent the upper limits of capacity, and supplies of all fuels are likely to fall below the Plan's production targets. . . If delays do occur, oil production could fall short of the Plan's objectives by as much as 1 million to 1.5 million barrels per day. Coal production could miss the Plan's target by up to 200 million tons per year. Nuclear power generation could fall short by as much as 15 percent. . . .

The indicated effects of the Plan on the overall economy and employment are likely to be minor but adverse: however, these costs appear small compared to the cost of increasing reliance on foreign energy sources. The basic energy choice to be made is between a series of immediate actions that may result in an economic slowdown which the Nation can endure, and a failure to act at all, which would lead to a major economic disruption in the future. . .

The cost of converting boilers and powerplants from oil or natural gas to coal will be high. Large industrial boilers, for example, would probably need pollution-control equipment averaging $4 million per installation. One major utility has estimated that it will cost about $4 billion to convert its 6,000 megawatts of generating capacity to coal. The question of whether these costs are lower than the penalty costs of continuing to burn oil or natural gas that would be imposed by the Plan must be decided case-by-case. . . .

There could be a further sizable incentive to U.S. solar equipment manufacturers in foreign sales. Current prices for fossil fuels, particularly in many developing nations, are considerably higher than in the United States, and in many of these nations solar heating systems are already economically competitive. Availability of U.S. -built solar power systems could also help defuse overseas resentment over U.S. moves to re-emphasize plutonium as a nuclear fuel. .

The market for coal that would be created by industrial users switching from oil and gas consists of a large number of widely dispersed installations, each of which can consume only relatively small amounts of coal. Therefore, the market would be incompatible with the present system of distributing coal. The disparity is important. For example, unit-train and other volume shipments of coal become justifiable at about

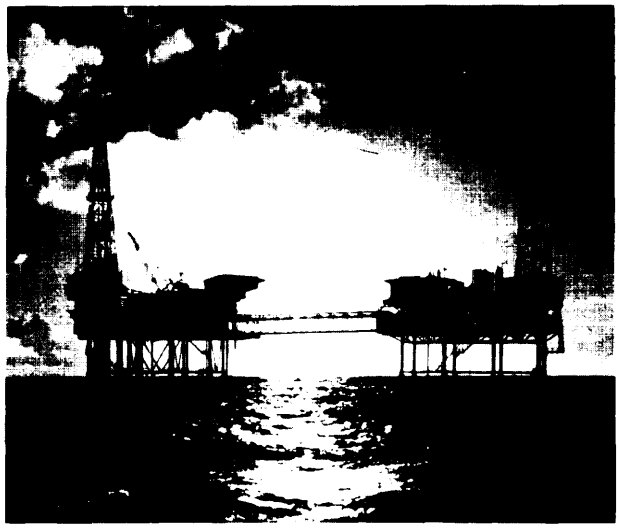


Photo Courtesy of EXXON Corporation

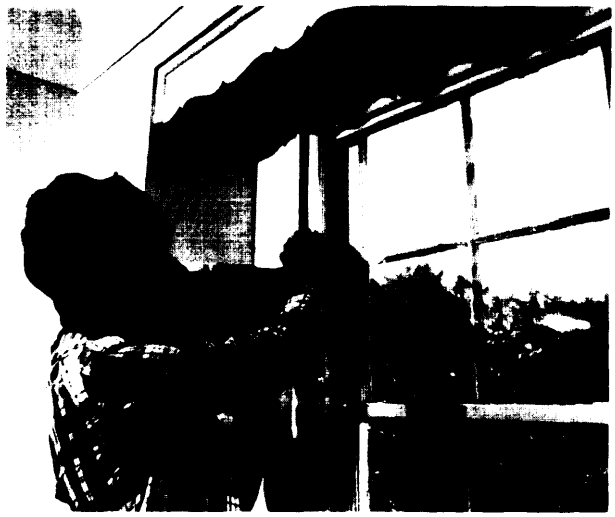
Production platform, Gulf of Mexico, 75 miles off the Louisiana coast

600,000 tons per year and become economically attractive at about 1 million tons per year, but a typical large-scale industrial facility can consume only about 80,000 tons per year; a very large industrial boiler plant may be able to consume as much as 130,000 tons a year. . . .

While the 1985 goal of weatherproofing 90 percent of all homes and new buildings is overly optimistic, the emphasis of the Plan on improving the thermal efficiency of buildings should accelerate an important energy-saving trend. It may be necessary to require either that information on thermal efficiency of housing be made available to potential buyers or that housing meet specified thermal efficiency standards at the time of sale if the goals are to be realized. The Plan's emphasis on single-family dwellings and duplexes could mean that large potential savings from conservation measures in commercial structures will not be achieved. Further, the Plan's lack of strong incentives for conservation in rental housing may result in a negative impact on the poor, because most low-income families are renters. . . .

The poor, and particularly the rural poor who probably comprise most of the half of the lower income group who own cars, will be hit most heavily by the increases in gasoline prices the Plan proposes. Not only do they spend a relatively larger proportion of their income on gasoline, they suffer from two other handicaps that would make it difficult to adjust to higher transportation costs. First, mass transit is not available for all essential travel, such as to work. Secondly, the poor generally cannot afford new, gas-economizing cars. They will be the purchasers in the secondhand market of "gas guzzlers" whose relative prices will fall as gas prices rise, bringing them within reach of lower income groups. Thus, those who can afford new, fuel-efficient cars will be saving money on gasoline while the poor will be spending more on gasoline. No element in the plan recognizes or offsets these possible inequities. . . .

But the possibility of sacrifice has already been raised for natural amenities—redwood forests, pristine valleys, and vulnerable species of plants and animals in danger of extinction. Can the Nation—should the Nation—protect these treasures against demands for more energy? Should workmen tear up a beautiful valley to get coal? Should a forest be demolished to get building materials? . . .



Enhanced Oil Recovery Potential in the United States

CONGRESS OF THE UNITED STATES
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Enhanced Oil Recovery

Between the years of 1946 and 1970, discoveries of new oil exceeded production from known domestic reserves. As a result, proved oil reserves (the amount of oil that can be recovered with current technology under existing economic conditions) increased from 20 billion barrels to 39 billion barrels, representing an average annual compound growth rate of 2.8 percent. Since 1970, however, production has outstripped new discoveries, and proved reserves have decreased at an average rate of 3.8 percent to about 31 billion barrels at the end of 1976. . .

There are two approaches to increasing domestic production of natural crude oil: locate additional oil through increased exploration; and develop more efficient methods for recovering oil from known reservoirs. This report assesses the potential for increasing domestic production by applying developing technologies, known collectively as enhanced oil recovery techniques, to known reservoirs. . . .

The 298 billion barrels that would remain in the ground after production of these primary and secondary reserves are the target for "tertiary" or enhanced oil recovery techniques that use heat or chemical fluid injections to drive out oil that has been left trapped in the pore spaces of sandstone and limestone reservoirs. . .

At the current world oil price of $13.75, the likely range of enhanced oil recovery production is from 11 billion to 29 billion barrels, representing a 31-percent to 83-percent increase in proved and indicated reserves from primary and secondary production. Increasing the price to the alternative fuels price of $22/bbl yields a range of from 25 billion to 42 billion barrels, an increase of from 71 percent to 120 percent in proved and indicated reserves. . . .

Enhanced oil recovery methods represent a developing and relatively unproven technology. For example, the two processes which represent over half of the total enhanced oil recovery potential—carbon dioxide miscible flooding and surfactant/polymer flooding–have received only limited field testing. Consequently, there are many uncertainties that must be considered when interpreting the results of assessments of the potential of enhanced oil recovery. . . .

Enhanced oil recovery processes in general require significant quantities of fresh or relatively fresh water, whereas secondary water flooding can use saline water. This consumption of fresh water not only will compete directly with domestic, agricultural, and other industrial uses, but also could result in a drawdown of surface water, which could, in turn, severely affect aquatic flora and fauna in the area of the drawdown. However, this impact usually would be localized and of short duration. The consumption of fresh water by enhanced oil recovery processes has been the greatest potential impact in California, Texas, and western Louisiana, where water supplies are limited. Development of enhanced oil recovery technologies to allow use of saline water could reduce this potential problem. . . .

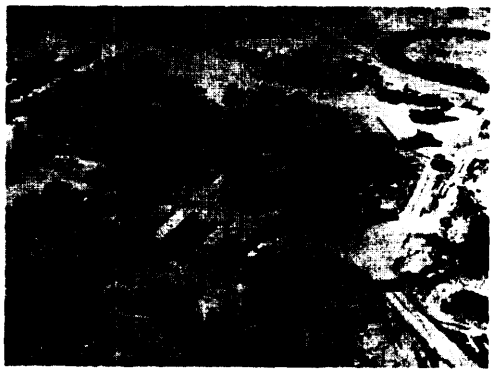
Oil does not occur in underground lakes, but rather is held within open spaces between the grains of rock that constitute the formation. The oil is retained in this open space in much the same way as water is held within a sponge. Almost invariably, water co-exists with oil in this open space between the grains; frequently gas is also present as a separate entity. . . .

Uncertainty concerning the physical and chemical nature of an oil reservoir is one of the most severe technological barriers to enhanced oil recovery processes. Not only are the reservoirs significantly different among themselves even within the same geological class (e. g., sandstones or limestones), but the place-to-place variations in thickness, porosity, permeability, fluid saturations, and chemical nature can be discouragingly large. The present capability to describe, measure, and predict such variability is extremely limited. Knowledge to measure and predict this variability within a reservoir is vitally important to forecast fluid movement and oil recovery efficiency. . . .

The law affects enhanced recovery of oil operations in many ways. Based upon the responses to questionnaires, price controls on crude oil constitute the most significant legal constraint to enhanced recovery operations. Approximately 65 percent of all producers responding to the questionnaire indicated that removal of price controls would make more projects economically feasibile or more attractive. . . .

Status Report on the

Gas Potential From Devonian Shales of the Appalachian Basin



November 1977

CONGRESS OF THE UNITED STATES
Office OS Technology Assessment
WASHINGTON, D.C.

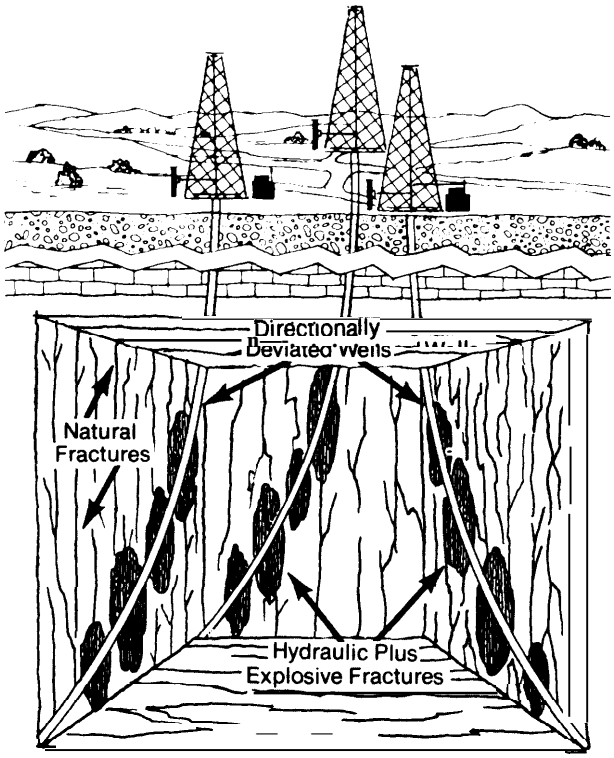
Gas Potential From Devonian Shales of the Appalachian Basin

The Devonian Brown shales of the Appalachian Basin, so-called because they accumulated during the Devonian age, have the potential of contributing significantly to the U.S. natural gas supply. It can reasonably be assumed that these shales contain as much as 15 to 25 trillion cubic feet of readily recoverable reserves that could be produced economically over a 20-year period at prices of $2.00 to $3.00 per thousand cubic feet. These reserves could ultimately support a production rate of about 1 trillion cubic feet of natural gas per year, which is about 5 percent of the current level of domestic gas production. Such a production rate is likely to require extensive drilling (on the order of 69,000 wells), a considerable expansion of the gas pipeline collecting network and, therefore, up to 20 years to achieve. . . .

Shale gas production has a slow flow rate over a long period of time, so ultimate recoverable reserves over the 30- to 50-year expected life of production could be 40 to 50 percent greater than the 15 to 25 Tcf estimate. . . .

The recoverable gas potential of the Brown shale depends on the (1) wellhead price and pro-

Figure 10. Deviated Wells and Earth Fracture Systems Process



Source Department of Energy

Deviated wells and earth frac ture systems process

duction costs, (2) extent of the Brown shale resource, and (3) the relat ive amounts of high-, medium-, and low-grade gas-producing Brown shales. .

The location of individual wells relative to potential pipeline connections (in addition to geologic promise) will continue to be an important determinant of the economic quality of Brown shale drilling prospects. Since Brown shale gas production is likely to be scattered over an extensive area, it is prudent to presume that Brown shale gas development will proceed at a gradual pace, probably requiring at least 20 years to reach a 1.0 Tcf production level (about 69,000 wells in the Brown shale will be needed to produce 1.0 Tcf per year). If improvements in drilling or stimulation technology are achieved and economic incentives provided, the time necessary for the development of the gas potential of the Brown shale might be reduced. . . .

If Congress takes no action on prices, existing prices would be the only incentive to encourage gas production from the Brown shale. Current maximum interstate gas prices encourage gas production with existing technology from only the high-quality Brown shale areas. Therefore, continuation of present gas-pricing policy could result in foregoing substantial additions to the U.S. natural gas supply which may be available from the Brown shale of the Appalachian Basin. . . .

Because of the importance of well stimulation in the production of gas from the Brown shale, improvement in the effectiveness and reductions in costs of stimulation techniques could make gas production from Brown shale more economically attractive. Price incentives can be expected to induce some private activity in these research and development areas. However, because much drilling, well stimulation, and production will be done by operators who do not control large shares of Brown shale resources, it is unlikely that these operators will invest large amounts in aggressive research and development programs. Therefore, it may be prudent to commit public funds for research and development activity directed specifically toward improvements in shale drilling and stimulation technology. . .

It should be noted that the Brown shale is not "oil shale" like that of Colorado and Wyoming. The organic matter is not the type of kerogen that characterizes such oil shales: rather, as noted above, the Brown shale are coal-like. . . .

The reservoir characteristics of Brown shale are vastly different from those of typical oil- and gas-producing formations. Porosity indicates how much space exists in a particular formation where oil, gas, and/or water may be trapped. A commercially oil- or gas-productive sandstone or limestone reservoir has porosities in the range of 8 to 30 percent. By contrast, gas-producing Brown shales have porosities of 4 percent or less. . . .

Policy options available to encourage production of gas from the Brown shale fall into four

generic categories: price incentives, tax policies, research and development funding, and information collection and dissemination. . . . There are three basic price strategies with respect to shale gas which could be pursued: exempt shale gas from FPC price control or establish higher prices for gas from the Brown shale, deregulate the wellhead price of all new natural gas supplies, or take no action. . . .

The tax policies available to Congress to encourage Brown shale gas production include: restoration of the general 22-percent depletion allowance, definition of Brown shale gas production as enhanced recovery so as to maintain the depletion allowance for small producers, retention of expensing of intangible drilling costs as a tax option, and creation of a 10-percent investment tax credit for gas production from the Brown shale. . . .

There are several areas in which research and development with special relevance to the Brown shale of the Appalachian Basin might be fruitfully pursued. These include: defining resource characteristics, development of drilling techniques and equipment, and improvement of logging and stimulation techniques. . . .

If the gas potential of the Brown shale is exploited, a large number of independent operators are likely to be drilling a large number of wells in many different locations on the Appalachian Plateaus. Under these conditions, particularly in the early years of the development effort, it might be desirable to fund publicly the collection, coordination, and dissemination of information and analyses detailing the results of actual operation experiences. . . .

Summary

PREPUBLICATION DRAFT
This copy is subject to editing before final publication.

Application of

Solar Technology

to

Today's Energy Needs

June 1977

CONGRESS of THE UNITED STATES
Office of Technology Assessment
WASHINGTON, D.C.

Application of Solar Technology to Today's Energy Needs

Small solar energy units that supply individual houses, apartment buildings, and commercial and industrial facilities (i. e., "onsite" solar energy systems) must be considered as a serious addition to the limited number of options available for meeting the world's demand for energy. Solar equipment is technically capable of providing almost any kind of energy: it can be used to heat and cool buildings, provide heat for industrial processes, provide mechanical power for pumps and other equipment, and generate electricity. Moreover, it can meet these demands with minimal adverse effect on society or the natural environment. In fact, onsite solar energy systems may have a favorable impact on employment by creating attractive new jobs, on international stability by easing the competition for conventional energy resources, and on the environment by replacing polluting energy sources. . . .

It is clear, however, that there is a market for some types of onsite solar equipment at today's prices and this market could expand rapidly if



Photo Courtesy of Bob Homan Photography

Solar collector installed on the Homan home. Indian Hills, NJ.

relatively modest increases occur in the cost of conventional energy. Solar equipment can produce hot water for domestic use at costs which are competitive with the cost of water heated by conventional electric water heaters. If the price of electricity increases by about 40 percent (in constant dollars) by the year 2000, it should be possible by 1980 to build solar systems which supply 100 percent of the heating and hot water needs of large buildings in three of the four cities examined in this report (Albuquerque, Fort Worth, Omaha, and Boston), at prices which are competitive with electric heating and hot water in all of the cities examined. .

The onsite solar systems examined in this work differ sharply from the equipment now used to provide most of the world's energy. Onsite devices are, by definition, intended to be located at the point of energy use, and would be designed, manufactured, installed, and operated much like today's conventional air-conditioners, heating systems, and process heat systems. In contrast, conventional nonsolar energy systems have become increasingly large, more complex, and centralized at locations remote from the point of end use. . .

The technology of energy storage is critical to the development of low-cost solar energy system. Storing energy directly in thermal form is by far the lowest cost method when the energy will ultimately be used to heat buildings or industrial processes. It should be possible in many parts of the country to install economically competitive solar heating systems using storage equipment of this type to provide 100 percent of the heating

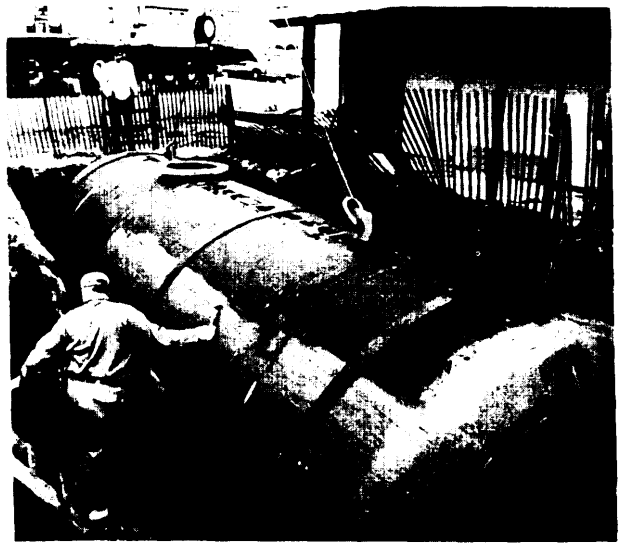


Photo Courtesy of Burger **Krig** *Corpora f/on*

Installation of Insulated, underground, storage tank at solar heated and air-conditioned Burger King, Camden, NJ.

needs of large buildings. A number of devices are being investigated which may greatly reduce the cost of storing electricity in onsite systems. . . .

Regional differences in the attractiveness of solar energy are often due more to differences in the price of conventional energy than to differences in the amount of sunlight available. . . .

One of the attractive features of onsite solar energy is that it can be developed and marketed with little special assistance from Federal or State governments. A small solar industry already exists and the analysis of this paper suggests that there may be a much larger market for unsubsidized equipment during the next decade. The technology, moreover, will fit easily into the framework of existing institutions: it can be produced by any of a large number of existing industries; financed in conventional ways; built and operated with existing labor skills. Moreover, it will not have a major negative environmental impact. As a result, its introduction will not need to be controlled by an elaborate set of new regulations, legislation, or regulatory agencies—modest adjustments of existing regulations governing conventional heating and cooling equipment should suffice in most cases. . . .

The Federal Government owns or leases approximately 446,000 buildings in the United States, with a combined floor area of nearly 3 billion square feet, and spends almost $1.7 billion annually to heat and cool them. (That figure is expected to reach $1.9 billion by the end of the year, and about $3.5 billion by 1985.) If 10 percent of the present heating/cooling costs were capitalized–-used for debt payments for the purchase of solar equipment—the Government could purchase nearly 100 million square feet of solar collectors annually. . . .

There is little doubt, however, that Federal legislation can accelerate the rate at which solar equipment enters the market if this is judged to be a desirable objective. The following types of policies can be effective:

- Direct incentives to potential customers (chiefly tax incentives, allowances for accelerated depreciation).
- Assistance to manufacturers (which include incentives for purchasing equipment to produce onsite devices, research and development grants, and Federal purchases) and assistance for testing laboratories certifying the performance of onsite equipment.
- Support of basic research and development programs in fields related to onsite solar energy.
- Legislation which might eliminate some barriers to usage of onsite solar systems (this would include freeing onsite equipment from regulation as a public policy and assisting States in designing local procedures for protecting the “sun rights” of owners of solar equipment).
- Encouragement of the use of solar energy in other countries through foreign assistance grants, joint research programs, and other techniques.
- Programs to support education and training in fields related to solar energy.

Perspectives on Federal Retail Food Grading



Perspectives on Federal Retail Food Grading

Present Federal food grades impart little information to the consumer. Federal grade criteria for sorting products are based on sensory characteristics—such as taste, flavor, color. or exterior appearance — and evolved as a mechanism to facilitate wholesale transactions in industry. To benefit consumers, simple, uniform terminology, increased nutritional information, and standardized systems for grading might be established. The question now arises as to whom grades should serve: consumers, industry, or both? . . .

Retail grade criteria should not be changed to reflect some combination of sensory and nutritional facts, as it is not meaningful to grade processed foods on both. Problems include an inverse relationship between sensory and nutritional characteristics and the timelag necessary to establish nutritional content and grade and label the products. For processed foods, analysis by OTA indicates that the most appropriate vehicle for conveying nutritional information to consumers is the nutritional labeling program already in operation. , . .

The first official Federal food grade standards were established for potatoes in 1917 . . . . The Government hoped the grading system would encourage farmers to grow higher quality produce, reasoning that since high-quality food would sell at higher prices, the farmer would receive more for what he produced and therefore would be persuaded to grow better quality food.

The primary reason for grades was to make wholesale transactions simple and more efficient, thereby cutting food costs to consumers in the long run. Because a common language would be used nationally at wholesale, transactions would be simplified and the time would be saved by wholesalers. Some of the cost reduction would be transferred to the consumer, and thus the consumer would benefit from wholesale grades by paying lower prices for food.

There are problems with the current Federal food-grading program, among them confusing nomenclature for grades and a general lack of

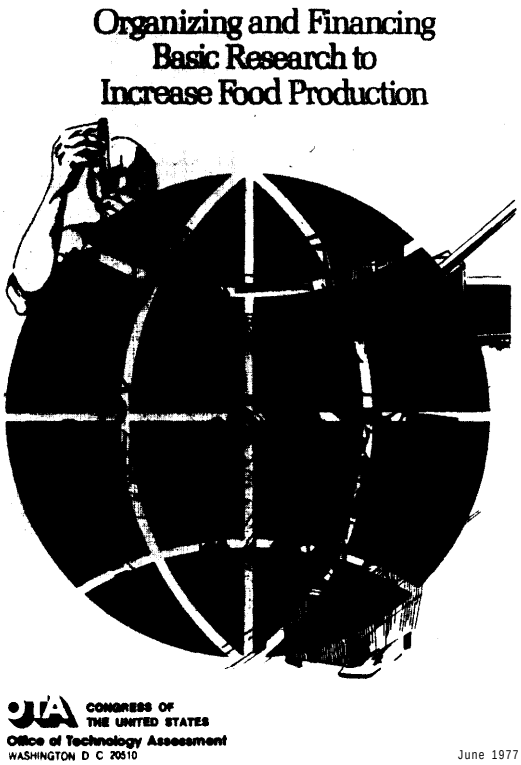


Photo Courtesy of U.S. Department of Agriculture

useful information conveyed by them to consumers.

The present confusion is a result of over 50 years of USDA allowing industry considerable latitude in deciding the grade nomenclature to be used so that there would be some degree of standardization. The reason for this latitude is that grading is optional: Industry has the option of not using the USDA grading system if it does not care for the USDA standards or grade designation for their products. Because different industries have differing concerns and requirements (or at least perceive them differently), the result is the present diversity of grades. . . .

While the cost of mandatory grade labeling is a legitimate concern of the food industry, a recent Grocery Manufacturers of America survey (March 6, 1975) concluded that $8.4 billion worth of food products would have nutritional labeling by the end of 1975. The survey indicated that for the $8.4 billion, the initial average cost of putting the information on labels per dollar of sales is .004 cents and that the average continuing cost of nutrition labeling is .00016 cents per dollar of sales. . . .



Organizing and Financing Basic Research to Increase Food Production

Studies of U.S. agricultural research productivity show annual rates of return of 30 to 40 percent. On the basis of past studies and the potential payoff from accelerated basic research to increase food production, it is highly probable that an investment of $300 million to $500 million over a 10-year period would yield returns of $1 billion to $2 billion over the next 20 years. . . .

Public support for research to increase food production has declined in the last two decades for a number of reasons. In the 1950's and 1960's, Congress was concerned more with the costs of storing surplus crops and maintaining farm income support programs than with food production research. . . .

There is substantial agreement among agricultural scientists that three high-priority basic research areas—photosynthesis, biological nitrogen fixation, and cell culture studies—offer unusual promise of high potential payoff over a moderate to long-term period. . . .

An increase in the efficiency of photosynthesis in a crop like soybeans could result in a 50-percent increase in yield per acre. The annual value of increased production, reduced acreage, and/or production costs would amount to no less than $1 billion, assuming this increase of only 50

percent in the yield of soybeans in the United States. . .

An even greater gain would be achieved with the development of symbiotic nitrogen fixation in corn, cereal grains, or any important crop other than legumes. Such a discovery could reduce the need for nitrogen fertilizer by millions of tons per year in the United States and throughout the world. A savings of half a billion dollars a year in the United States for nitrogen fertilizer is not an unrealistic expectation.

Cell-culture studies offer promise for developing new combinations of germ plasm and thus provide a means for genetic engineering which could lead to new strains of *Rhizobium* with much higher nitrogen-fixation capacity. They could also lead to new varieties of soybeans, cereals, potatoes, and other crops with substantially higher photosynthetic efficiency levels than occur in conventional plant-breeding methods.

CANCER TESTING TECHNOLOGY AND SACCHARIN

OCTOBER 1977

CONGRESS OF THE UNITED STATES
Office of Technology Assessment

Cancer Testing Technology and Saccharin

The "Delaney Clause" of the Food, Drug. and Cosmetic Act prohibits the use of any food additive that has been shown to cause cancer when ingested by humans or animals. Since saccharin has been shown to cause cancer in laboratory animals. the FDA must ban its use, .

Because saccharin is the only non-nutritive sweetener currently available to the American public, its ban has been widely criticized. The debate has prompted questions about the validity of the technology for testing whether a substance causes cancer, as well as the failure to consider the benefits as well as risks of a substance in determining whether it should be prohibited. . . .

Because carcinogenicity cannot be tested directly in humans, indirect methods are necessary. Current methods can predict that a particular substance is likely to cause cancer in humans. The technology for making quantitative extrapolations from animal experiments to human risk is progressing and has been verified in the few cases for which data are available, But this technology does not currently permit reliable estimates of the numbers or locations of cancers that might occur in humans. . . .

Animal tests are the best current methods for predicting the carcinogenic effect of substances in humans .-All substances demonstrated to be carcinogenic in animals are regarded as potential human carcinogens; no clear distinctions exist between those that cause cancer in laboratory anireals and those that cause it in humans. The empirical evidence overwhelmingly supports this hypothesis. . .

A general problem occurs when discussing experiments on dangerous substances. What conclusions are to be drawn when some experiments show the substance caused cancer in animals and other experiments do not? In the particular case of saccharin, all two-generation experiments have been positive. A number of other experiments have led some to conclude that saccharin is not a carcinogen. The Office of Technology Assessment reviewed those experiments and found none comparable in design to the three positive experiments. Furthermore, some others were too insensitive to have detected the carcinogenic effect of saccharin. This statement is no indictment of those experiments; cancer testing is rapidly evolving, and many older experiments are not now considered to be satisfactory. The postive two-generation studies come the closest of all that have been conducted to meeting the current testing standards. . . .

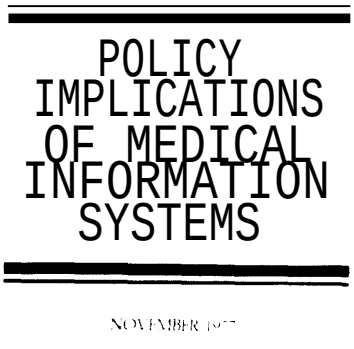
Saccharin was found to be among the weakest carcinogens ever detected in rats. Chemical carcinogens are very different in their carcinogenic potencies. For example, aflatoxin (AF-BI), a substance produced by certain fungi and found in moldy peanuts and certain grains, causes cancer in 50 percent of rats at a dose of more than one million times less than the dose of another carcinogen, trichloroethylene (TCE), a chemical that, until recently, was used to extract caffeine in the manufacture of instant coffee. . . . Where does saccharin fall on this millionfold scale? It actually extends the scale in the weak direction —it is slightly weaker than TCE. . . .

Standard procedure in animal tests is to feed substances at the "maximum tolerated dose. " In the case of saccharin, the "maximum tolerated dose" is 5 percent of the diet, even though humans are exposed to much lower doses. Contrary to popular opinion, all chemicals do not cause cancer at high dose levels. Many food additives and other chemicals have been tested in animals at this level without causing cancer. . . .

The rationale for feeding large doses of a substance in animal tests is as follows. As the dose of a substance that causes cancer is increased, the number of exposed animals that develop cancer also increases. To conduct a valid experiment at high dose levels, only a small number of animals (perhaps several hundred) is required. However, to conduct a valid experiment at low dose levels, a very large number of animals is required. . . .

After a test has been well validated, it can be reasonably assumed that if a previously untested substance is clearly positive in that test, it will probably be a carcinogen in animals. However, a negative result in a short-term test is more difficult to evaluate: such a result only suggests that the chemical is noncarcinogenic. Negative results are not necessarily definite because short-term tests do not detect promoting agents or cofactors in the carcinogenesis process, and such substances may be important in causing cancer. . . .

The best evidence to date for concluding that saccharin is a potential human carcinogen comes from the two-generation rat-feeding experiments. These tests demonstrated that, over a long period, diets high in saccharin produced bladder tumors in rats. Evidence for carcinogenicity by other routes of administration and in other species of laboratory animals, while not convincing by itself, supports the conclusions from the two-generation rat experiments. Recent results of short-term tests, including tests conducted as part of this study, also support the conclusion that it may be a carcinogen. These results do not rule out the possibility that the carcinogenic activity of commercial saccharin may reside in its impurities. Although further experiments are needed to identify the carcinogen(s), it is the manufactured product, not the isolated chemical, that is subject to regulation. . . .



Policy Implications of Medical Information Systems

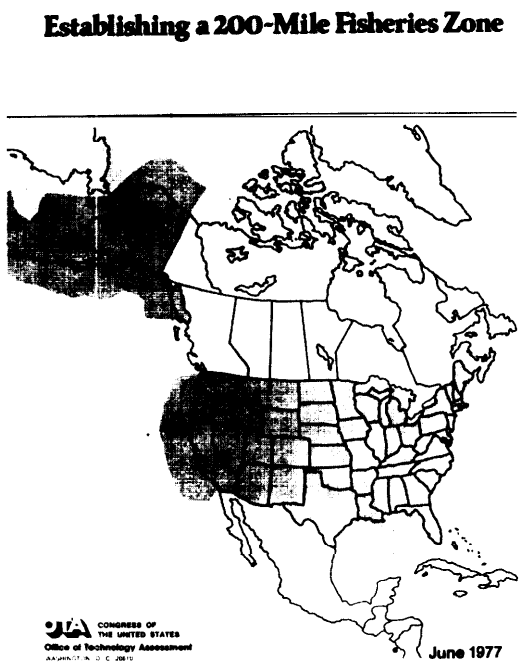
The complexity of medical care has greatly increased during the past 30 years. More technology. more professionals, and more support services are involved in the care of patients than ever before. Today's medical care institutions encounter problems coordinating and communicating massive quantities of data necessary for clinical care. Medical professionals must note and remember increasing amounts of data about each patient from an expanded number of diagnostic tests and therapeutic procedures. Physicians are also faced with the task of memorizing information about new diagnostic tests and treatments, knowledge that must be constantly updated. . . .

The application of computer technology offers a possible solution to these problems. Called medical information systems, this new application promises to change the medical record from a historical document to timely, accurate information that is instantly available to all those involved with patients. Medical information systems can be used to educate and assist medical professionals during clinical care, reducing the need to rely on memory. Potentially, they can increase efficiency and reduce or contain institutional costs. They can provide a way to monitor and evaluate the quality of medical services. They can eliminate data for evaluating and planning medical care services. Finally, they can be used to supply data that have been previously unavailable to researchers and policymakers. . . .

A medical information system is defined as a computer-based system that receives data normally recorded about patients, creates and maintains from these data a computerized medical record for every patient, and makes the data available for the following uses: patient care, administrative and business management, monitoring and evaluating medical care services, epidemiological and clinical research, and planning of medical care resources. .

If the role of computer systems in clinical decisionmaking increases in the future, medical education will change. Without the need to accumulate facts, students' education could emphasize the study of the processes involved in decisionmaking. as well as the social and psychological aspects of medical care. Such an educational experience would prepare students to take a new role as clinicians. . . .

The Federal Government could continue current policies and allow adoption of medical information systems to be determined in the open marketplace. However, this policy could result in medical information systems being marketed and adopted without additional investment in research to improve certain capabilities. Because capabilities to improve and monitor the quality of medical care and to facilitate research and planning are the least developed and require standardization, these potential benefits for patients and the medical care system might be lost. Computer systems limited to administrative and financial functions could continue to dominate the market. Medical information systems that might be used could also lack high standards of quality or provide inadequate protection for the confidentiality of patient data. . . .



Establishing a 200-Mile Fisheries Zone

Twenty years ago, the United States was the world's second largest fishing nation. But by 1974 American fishermen were fifth, catching only about 4 percent of the world's supply of fish. In that time, the U.S. catch had dropped only about 8 percent, but the catch of some foreign nations had increased by as much as 250 percent. In 1974, the world catch was nearly 70 million metric tons. Much of that was coming from waters off the United States where, within 200 miles of the coasts, about one-fifth of the world's fishery resources are located. . . .

Worldwide, the National Oceanic and Atmospheric Administration has projected that the oceans can sustain an annual catch of only 100 million metric tons, a catch figure they expect to be reached by 1980. Already, increased fishing has caused acute pressure on some stocks, depleting the supply and threatening their existence. For example, off the coast of the United States about **20** species of fish and shellfish are believed to be seriously depleted. . . .

.Technically sophisticated foreign fishing fleets have taken a heavy toll in traditional U.S. fisheries, particularly off the northeast and northwest coasts where there are several species of prime interest to U.S. commercial fishermen and consumers. The decline of the New England haddock fishery which was reduced from a major commercial enterprise in 1950 to a relatively small activity today, is a principal example of the effects of overfishing within 200 miles of the U.S. coasts. The U.S. haddock catch in 1950 was 20 times larger than it was in 1974. . . .

The task of husbanding the U.S. fishery resources is a major one. At stake is not only a major supply of animal protein, but also an American industry which provides employment for more than a quarter-of-a-million people and has a $6.5 billion impact on the U.S. economy. . . .

Management plans to be drawn up under provisions of the Act (Fishery Conservation and Management Act of 1976] will **lay** the groundwork for the types of regulations which will be required and which must be enforced. However, fish resources are already scarce enough and the demand for fish products high enough that it is logical to conclude that foreign nations can justify the risk of violating these regulations and the United States can justify the effort and expense of enforcing them. . . .

Current plans call for placing observers onboard 10 to 20 percent of the foreign vessels granted permits to fish in U.S. waters. These observers will be National Marine Fisheries Service (NMFS) personnel who will have no enforcement duties. They will be assigned randomly to vessels of foreign nations which in the past have been suspected of giving NMFS incomplete or inaccurate reports on their fishing activity. . . .

Foreign fishermen will realize that from their view the observer is primarily a policeman. The potential penalties for violations noted by the observer could be high, but the value of an illegal catch may be even higher. Therefore, foreign fishermen may attempt to bribe, harm, or deceive the observers, frustrating their scientific and enforcement functions. . . .

Use of new technology, particularly remote-sensing devices, may make it possible to improve enforcement of fisheries regulations in the future by better coverage, better performance, and a reduction of the need for expanding conventional ship and aircraft patrols. Although it may be possible for several agencies (such as the Coast Guard, the military, and NASA) to share the cost of new remote-sensing devices, these systems are extremely expensive and their use should be thoroughly evaluated before any one system is adopted. Any analysis of benefits and costs of remote-sensing systems should not ignore the argument that national security could be compromised by making some of these systems available for other than military missions. . .

In most cases, imposition of new fisheries regulations is likely to represent a loss of income to fishermen. This means that the costs of management (in terms of decreased catches) will be borne by the men currently in the fishery. The benefits will be gained by future generations of fishermen. . .

Fishermen can respond to the new economic opportunities presented by extended jurisdiction by adopting new boats and sophisticated fishing equipment or by using existing equipment coupled with new fishing and marketing strategies. If large numbers of people are willing and able to change existing practices or to invest in new boats and processing equipment embodying new technology, then the effects throughout the social and economic structure of the coastal communities will be enormous. If fishermen cannot or will not respond, offshore fishing may gradually be taken over by large corporations. . . .

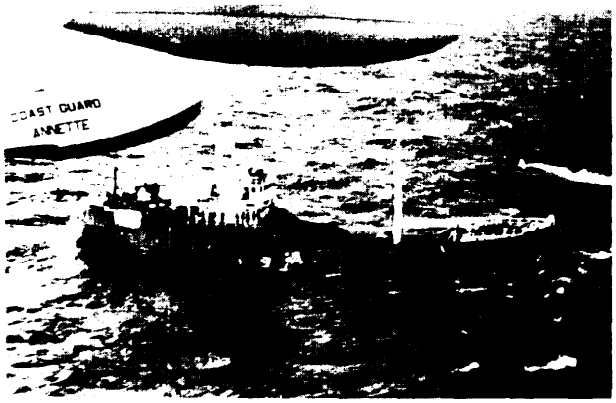


Photo Courtesy of National Marine Fisheries Service
U S Department of Commerce

U.S. Coast Guard "Albatross" keeping track of illegal fishing off the Alaskan coast

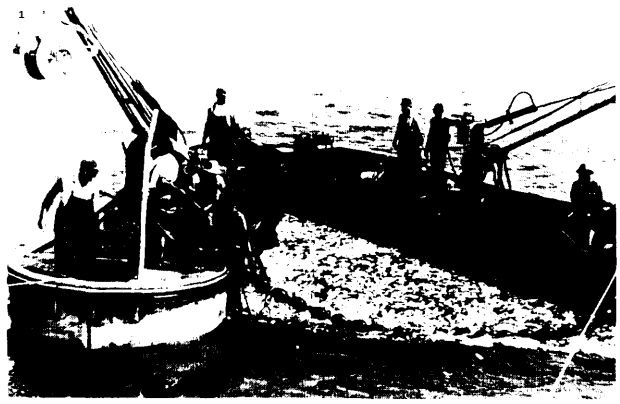
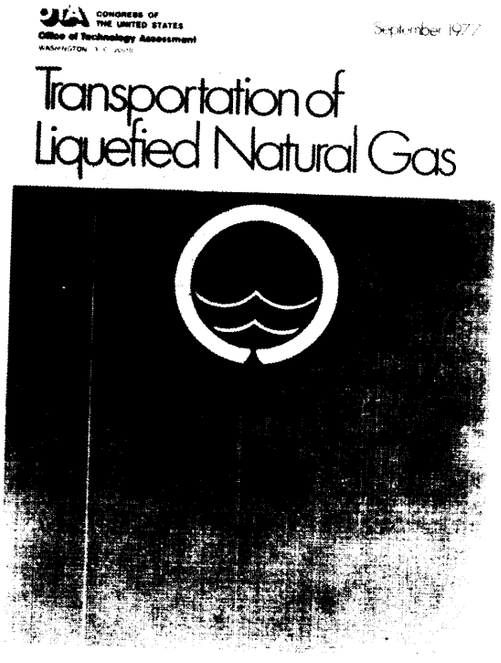


Photo Courtesy of NOAA

Menhaden being seined off the North Carolina coast



Transportation of Liquefied Natural Gas

It is possible that during the next two decades 5 to 15 percent of the U.S. natural gas consumption could be filled with liquefied natural gas (LNG) from Alaska or foreign countries. . . . To date, there have been few serious problems in the operation of small-scale LNG facilities existing in the United States. However, new ships and plants will be considerably larger than existing ones, and problems of scale and limited experience make it difficult to predict with any degree of certainty the safety of the LNG system. . . .

In order to import natural gas in a form practical for water transportation from Eastern Hemisphere nations, a system has been developed to convert the gas to liquid form at about l/600th the volume. The liquefied natural gas is then shipped in specially constructed tankers, introducing a marine link in the supply and demand of natural gas. This marine link is a large component, consisting of the liquefaction facility at the source of the gas, the LNG tanker, and the receiving terminal and regasification facility at a location near a gas distribution network. It is a very capital-intensive system which can cost more than $1 billion to construct. . . .

The United States is presently a net exporter of LNG. . . . Projects are now proposed which could bring as much as 3.5 trillion cubic feet of LNG per year to the United States from foreign sources within the next 10 to 15 years. , . ,

It is generally agreed that, if the vapor from a large LNG spill ignites, it would be beyond the capability of existing firefighting methods to extinguish it. Therefore, the key to reducing the hazard of an LNG fire is a strong prevention program. . . .

Only one major accident has marred the safety record of LNG plants. That accident occurred at the first LNG installation in 1944. At that time, a storage tank owned by East Ohio Gas Company in Cleveland ruptured, spilling 6,200 cubic meters of LNG into adjacent streets and sewers. The liquid evaporated, the gas ignited, and, where confined, exploded, The disaster remains the most serious LNG accident anywhere in the world. It resulted in 128 deaths, 300 injuries, and approximately $7 million in property damage. . . .

The location of a terminal can be **a** major factor in its safety. The magnitude and extent of any damage from an LNG spill can depend on the proximity of the terminal and storage sites to other industrial and residential areas. The site selection process is currently conducted by the company or consortium proposing the project. , . . There are, at present, no Federal siting criteria, and those projects which are now proposed have a variety of sites, ranging from remote coastal and riverine areas with 1,000-acre buffer zones to as little as a 90-acre site on Staten Island, . , .

The LNG industry has been particularly critical of the Federal Power Commission (FPC) in the realm of decisionmaking. One representative told OTA that the recurrent theme of industry's relationship with the FPC was "we can't follow the rules because we don't know what the rules are or will be. " One of the underlying problems

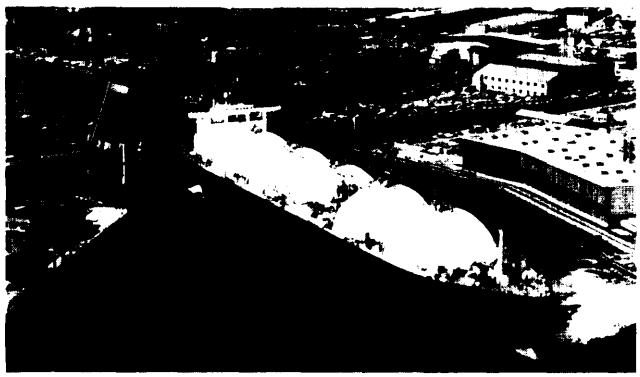


Photo Courtesy of Genera/ Dynamics



Photo by OTA

Two types of LNG tankers

which frustrates the FPC's decision making duties and processes is the fact that it is a regulatory agency, not a policymaking body. . . .

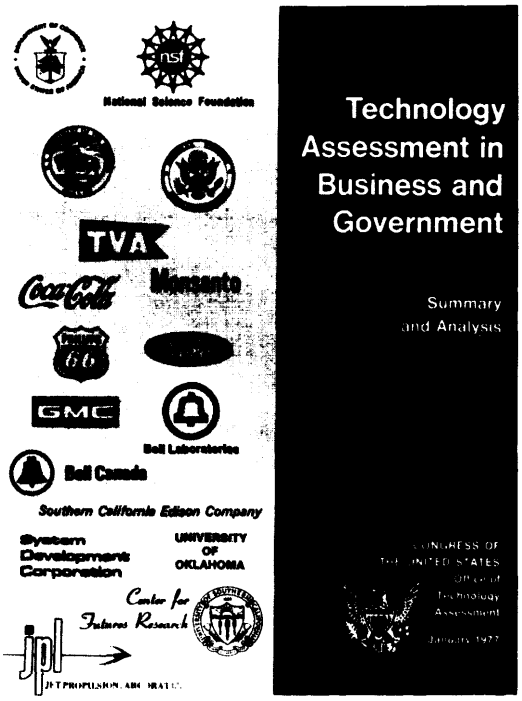
Before any LNG import or export project can begin operation, more than 130 permits must be obtained from Federal, State, and local agencies, and 12 different Federal agencies are involved in approvals and controls. . .

A ship collision could result in the rupture of one or more cargo tanks and spill a large amount of LNG onto the water. A water spill would spread much farther and evaporate much more quickly than a land spill. While it is most likely that a collision would produce some source of ignition which could fire the LNG vapor around the ship, a huge vapor cloud could be generated if no ignition occurred. . .

Imports of LNG to the United States currently come from Algeria, and there is some concern about the wisdom of becoming dependent upon any one country as the major source of supply. However, several other countries also control major portions of the world's natural gas reserves. . . .

A politically motivated disruption of LNG supplies is at least plausible and should not be dismissed quite as lightly as some LNG proponents have argued. . . .

Past research has produced conflicting results and predictions, and it is unlikely that the United States can afford the time and money to conduct enough research to resolve the differences and come to firm decisions about the safety and behavior of LNG. For this reason, decisions about LNG systems should be made on the basis of nonquantitative approaches which result in prudent siting criteria and strict design, construction, and operation standards. .



Technology Assessment in Business and Government

The study strategy of any particular technology assessment (TA) should be tailormade to fit the resources, timing, and needs of decision makers. A great premium is set on study strategies that are adaptable and flexible, yet stable, rather than routine or formalized. The TA process has been shown to be adaptable to a wide range of circumstances and needs. . . .

The private sector and the Government have substantially different orientations toward TA. The private sector is interested in TA as an aid in competing in the marketplace, for improving understanding of the future business environment, and for options for the decisionmaker. The Government sees TA as a better way to excercise its trusteeship, and to assist it in becoming more socially responsible. In the Government there also is a concern with understanding and trying to anticipate future events so that the introduction of new technologies does not cause, in terms of secondary impacts, too many positive and negative surprises for society. With an informed understanding through TA of what the impacts are, the policy makers and decision makers in the Government can better exercise their responsibilities to the general public. . . . They both see TA, however, as a fresh way to probe and explore mutual interests. . . .

Communication is essential for a TA's success. The effectiveness of an assessment depends on facilitating the creative free-flow of ideas among team members, as well as communicating with the ultimate users. There are two primary requisites for a TA to be useful: the first is the professional competence of the assessing team; and the second is the complete and open communication among all the concerned parties. . . .

A Preliminary Analysis of Demographic Trends Influencing the Elementary and Secondary School System

The present and past are decreasingly satisfactory models for the future, particularly for the future of the educational system which is undergoing major change. Planners and policy makers, therefore, need a substantive basis for understanding change. Demography is one such basis. It has the advantage of being quantitative and structural with regard to the organization of society, and quite reliable in its ability to forecast, from a policy point of view, over interesting intervals of time. . . .

For example, one can say with great certitude that the size of the high school population of 1990 will be about 25 percent smaller than in 1975. Judging from the "best guess" forecasts, recent declines in elementary school children are likely to continue through the mid-1980's. Thereafter, the number of school children will rise, leveling off about 1990 to present levels. . . .

Local mobility and internal migration are perhaps the two most important factors in producing State, regional, and local deviations from other large-scale national demographic trends. Movements between cities and suburbs, and between metropolitan and nonmetropolitan areas, as well as internal migration of subpopulations, such as blacks, Hispanics, and middle and working class families of all races, are major complicating demographic factors in elementary and secondary education planning. . . .

As a result of being in the labor force, fewer women will have time for voluntary service in the schools. At the same time that the availability of voluntary services may be declining, there may be an increase in demand for the kinds of services that volunteers can perform well. This decline of volunteers implies a decline in services offered or else greater demands on paid staff. . . .

The age of the onset of adolescence, which has been steadily declining at the rate of four months per decade since 1830, may now have leveled off. The junior high school has never adequately come to grips with the onset of puberty in terms of curricula, services, or goals. Especially critical is the increasing rate of early sexual activity among boys and girls of junior high school and high school age, creating both immediate and long-term social and educational problems and needs associated with adolescent childbearing. The only age group in the United States now undergoing significant expansion in birth rates are females under age 15. . . .

The importance of cultural shock among immigrants can be seen in the Chinese communities, particularly in New York City. The influx of large numbers of youths from Hong Kong results in all of the classic dislocations of foreign-language speaking, hard-to-acculturate students. The consequence is that what had been a model community, in terms of behavior, is experiencing an unfamiliar upswing in delinquency. One could anticipate the parallel and associated difficulties within the school system. Patterns of immigration, therefore, need to be better understood in terms of anticipating declining and growing needs of special services. Although the rate of immigration is low, because immigrants tend to collect in cities, one may anticipate continuing localized problems in already sorely troubled school systems. . . .

The highest payoff actions meeting the clearest needs are those involving the generation and distribution of knowledge about demographic trends to relevant State and local government planners. This generation and distribution could flow out of research, monitoring, surveys, data gathering, and to some extent from demonstration. . .

Familiarity with local circumstances can play a major part in whether a given forecast is policy useful or policy irrelevant. In general, there is not enough expertise now at the State and local levels to meet this need. . . .

The second major action area, therefore, is building capacity at the State and local level for more effective and timely planning in response to unfolding demographic trends. Building analytical capabilities and an information base focused on more fine-grain, detailed, and local analysis is needed. . . .

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A Preliminary Analysis of the

IRS TAX ADMINISTRATION SYSTEM



UNITED STATES CONGRESS
Office of Technology Assessment
March 1977

A Preliminary Analysis of the IRS Tax Administration System

As it is intended to be operated and used to administer and enforce the revenue laws, the proposed "Tax Administrative System" (TAS) will determine or affect the collection, use, maintenance, and dissemination of large amounts of information about citizens. It will play a pivotal role in governmental and private data banks and information systems which contain the details of personal, organizational, and business lives of Americans at home and abroad. Since TAS is proposed at a time of intense public concern over the potential for abuses of the information resources of Government and the private sector, the system could be perceived as posing a threat to civil liberties, privacy, and due process rights of taxpayers. These effects might include a potential for surveillance, harassment, or political manipulation of files for which specific controls and safeguards are of concern to Congress. . . .

In its design concepts, TAS is on the leading edge of the state of computer art. The proposed procurement has been described in the 1976 Senate Appropriations Committee report as the "largest data processing project ever undertaken by the Federal Government. " The total cost of the system was then estimated to be between $750 million and $1 billion. Potential vendors of the computer equipment told congressional committees that to respond to the requests for proposals would cost around $2 million per proposal. . . .

Despite the importance of privacy in such a sensitive information system, there appears to be an element of secrecy about important aspects of the TAS which affect privacy. Nowhere in the testimony and materials given Congress did the IRS spell out the contents of the files to be consolidated in the new system; nor did it indicate how much of the specific information supplied by taxpayers on tax returns will be in an account in the new system. . . .

Another major management benefit planned under TAS is availability of a longer tax history through increased storage capacity. In light of what is known or perceived about the threats from other large computerized personal information systems containing financial data, and in light of recent public concerns about the IRS and other Government information practices, it is important to consider to what extent the longer retention time afforded by TAS might contribute to a public view of it as unfairly inhibiting people from starting new in society. There is a need to assure that, as programmed and operated, TAS will not stigmatize taxpayers long after their difficulties with IRS have been resolved in a satisfactory fashion. . . .

TAS will make large quantities of personal information about people available in the time it takes to snap two fingers. There may be a vastly increased potential afforded by TAS for speedier, more efficient invasion of privacy and breach of confidentiality of information, whether intentional or not, and whether authorized or not. This is true for inquiries and action in individual cases as well as for the initiation and pursuit of entire programs. Speed in obtaining access, retrieving and manipulating data may, without stringent rules, be a lure to repetition of past abuses affecting the privacy and due process of individuals and to pursuit of even more novel, wide-ranging programs for questionable or non-tax-related purposes. . .

Section III
PROGRAM DESCRIPTIONS

Congress enacts legislation authorizing and funding scientific and technological programs, and oversees them to ensure that they reflect congressional intent. Billions of dollars are also spent in the private sector on research and technological applications.

The role of OTA is to examine the probable effects—both beneficial and harmful—of the application of technologies. OTA assesses the social, economic, political, and environmental consequences for society of technological change. In addition, OTA evaluates the likely benefits and risks of various policy options available to the Congress for dealing with such impacts. OTA also provides early indications of the likely effects of future technological applications.

In carrying out its mission, OTA works primarily for the committees of Congress (see section V for a description of how assessments originate). The committees, usually working through their specialized subcommittees, draft legislation, evaluate administration proposals, determine funding levels, and oversee programs. OTA assessments provide technical and policy analysis, background information, and other data which assist the committees **in** fulfilling their responsibilities.

These assessments are organized and led by OTA program managers and staff (see section V for organization and operations). Each program area is staffed by a small core of professionals in various fields. The OTA staff is complemented by both full-time and temporary consultants who contribute specialized knowledge to particular projects. Contractors, such as universities and private research organizations, are employed for technical studies.

In addition, advisory panels, made up of recognized experts and representatives of groups most likely to be affected by a technology, are often formed to assist with projects. **By** reaching out into the scientific and

technical communities as well as the general public, OTA is thus able to bring a diversity of viewpoints and knowledge to bear on issues of national concern.

OTA's assessments help Congress in carrying out its legislative, authorization and appropriations, oversight, and policymaking responsibilities. OTA staff, consultants, and panel members brief committee members and their staffs and testify in committee hearings on the findings of assessments. Members of Congress use the OTA reports as background material for floor debate, in drafting legislation, and in conducting oversight hearings.

OTA assessments are programmatically structured in eight principal areas established by the OTA Board: energy, food, health, materials, national research and development policies and priorities, oceans, technology and world trade, and transportation.

During the year, reports on 14 major completed assessments were delivered to the requesting committees of Congress. More than 40 individual projects were in progress. In the remainder of this section, the broad concerns in each program area are sketched, along with a description of OTA activities to address these concerns.

Section III
PROGRAM DESCRIPTIONS

Energy Program

No issue has so preoccupied Congress in recent years as energy. The Nation relies on oil and natural gas for 75 percent of its energy needs. But while demand has been climbing, domestic oil and gas production has steadily declined. To close this growing gap between energy production and demand, oil imports have risen to a point where they now account for 47 percent of U.S. consumption.

This increase in imports has become a national issue of overriding concern. The combination of higher fuel prices, rising dollar outflows, and growing dependence on foreign suppliers has created serious economic and security problems.

To help Congress to deal with such complex problems, the Energy Program is broadly organized into energy supply and demand subprograms. Assessments which concern fossil, solar, and nuclear energy, and energy conservation have been or are being conducted.

During 1977, OTA completed three energy assessments and delivered two others in prepublication form to Congress. One report analyzed the facets of nuclear proliferation and safeguards. Another assessed the effectiveness of the President's proposed National Energy Plan and the broad range of its potential impacts on consumers, suppliers, and society as a whole. The third evaluated the potential for recovering natural gas from the extensive Devonian shale deposits found throughout the Appalachian region.

One of the prepublication drafts examined onsite solar energy systems' feasibility and potential for generating electricity, as well as heating and cooling. The other analyzed how using enhanced recovery methods in existing oil reservoirs might increase the Nation's petroleum supplies.

Three additional assessments are in various stages of completion. One, to be delivered to Congress in the spring, is evaluating methods and environmental effects of directly burning coal. Another, to be presented in January 1978, is analyzing the feasibility of using slurry pipelines to transport coal from where it is mined to where it will be used, and the impacts of pipelines on the environment and railroads. A third assessment is examining the technologies and potential for conserving energy in residential buildings.

Nuclear Proliferation and Safeguards

The concern for nuclear weapons proliferation has grown with the worldwide spread of nuclear energy plants and the rise in international terrorism. To help Congress determine how best to deal with this ominous problem, OTA analyzed proliferation risks which could arise during a transition from conventional nuclear power to plutonium reprocessing and breeder reactors. The study also evaluated the capabilities and motives of non-nuclear nations and terrorists for developing nuclear weapons, assessed international institutions and agreements, and examined various sets of policies which the United States could adopt to improve international safeguards. (Excerpts from this report may be found in section II.)

The report was requested by the Senate Committee on Government Operations. In April, during hearings held by the Committee's Subcommittee on Energy, Nuclear Proliferation and Federal Services on the Nuclear Non-Proliferation Act of 1977, OTA panel members testified on the report's findings. In the fall, Praeger Publishing Company reprinted the OTA report that was originally printed at the Government Printing Office, which now serves as a text for graduate courses in international relations at Johns Hopkins and Princeton universities' Schools of Foreign Affairs.

Analysis of the Proposed National Energy Plan

In April 1977, the Administration sent its proposed National Energy Plan (NEP) to the Congress. To help them analyze the complex package of proposals, the House Committees on Interior and Insular Affairs and on Science and Technology asked OTA to assess the effectiveness of the Plan and the broad impacts it would have on energy suppliers and users, the economy, environment, and State and local governments. At the same time, the General Accounting Office, Congressional Budget Office, and the Congressional Research Service also undertook analyses of the NEP at the request of congressional committees of jurisdiction.

To conduct the study, OTA established three task groups totalling more than 100 persons who represented a diversity of viewpoints, fields of expertise, and affected groups. A series of panel meetings identified and examined key issues of supply, demand, and societal impacts.

Within 8 weeks, these panelists and OTA staff completed their report on the strengths and weaknesses of the plan, its impact on energy supply and demand, and its effect on society. In addition, the report assessed alternative policies for achieving the plan's goals. (Excerpts from this report may be found in section II.) This rapid analysis was made possible by OTA's prior experience with evaluations of the ERDA budget and programs in 1975 and 1976 and of EPA's research plan in 1976.

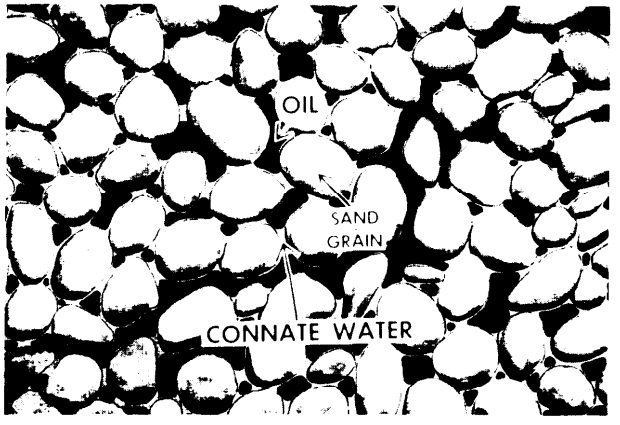
During the debates in both the House of Representatives and the Senate, Members of both political parties and on both sides of various issues frequently referred to or quoted from the OTA assessment. Reports of several committees also cited the study.

Enhanced Recovery of Oil

There has long been controversy over the potential recovery of oil from the Nation's known oil and gas reservoirs. To help resolve the question, OTA evaluated data from 50 percent of the operating oil fields in the United States to determine how much additional oil and gas could be recovered through so-called "tertiary" or enhanced recovery techniques. These include new and expensive technologies which involve injection of certain chemicals or carbon dioxide to free additional oil from reservoirs. OTA's survey took into account the most advanced recovery techniques now being tested.

The report concluded that significant amounts of oil can be recovered by such advanced technologies, but is cautioned that the OTA estimates were lower than those of earlier studies. According to the assessment, enhanced recovery techniques could yield from 11 to 29 billion barrels of oil, at current world oil prices, over the next 20 years. The report noted, however, that is doubtful that more than 51 billion barrels—about 20 percent of the known U.S. reserves–could be recovered under any economic conditions using current and foreseeable technology. (Excerpts from this report may be found in section II.)

Given current congressional concern about energy, a prepublication draft of the study was released in June. The final report, requested by Sen. Ted Stevens (R-Alaska) of the Technology Assessment Board, and the House Committee on Science and Technology, will be published in January 1978.



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Close-up of oil between grains of rock. A thin film of water called connate water clings to the surface of the rock grains. This water occupies part of the space in the rock along with the oil.

Gas Potential of Devonian Shales of the Appalachian Basin

This report assesses the potential for recovering natural gas from the vast shale deposits that accumulated during the Devonian geological age (310 million-350 million years ago) and that lie under the Appalachian regions of Pennsylvania, New York, West Virginia, and Kentucky. OTA based the study on data from 490 wells already operating in the area. Congress received a report on the current state of knowledge regarding the Devonian natural gas and its recovery. (Excerpts from this report may be found in section II.)

The OTA assessment was proposed by Senator Ted Stevens of the Technology Assessment Board and the Senate Committee on Commerce as part of a larger analysis of enhanced techniques for recovering oil and gas, The report has been used by the Joint Committee on Taxation to determine how various possible tax incentives would affect natural gas supply. The House-Senate conference committee used the report in its efforts to reconcile the House and Senate versions of the National Energy Plan regarding natural gas pricing policies.

Applications of Solar Technology to Today's Energy Needs

If the prices of fossil fuels and of electricity generated from conventional energy sources continue to rise, small, onsite solar energy equipment could supply increasingly significant amounts of energy. Such equipment, on location near homes or commercial buildings. could provide electricity as well as space cooling and heating. This was the principal finding of OTA's comprehensive assessment of solar technology. The preliminary results of the 3-year study were published in a two-volume, 1,400-page draft report for use by Congress in its deliberations on the National Energy Plan,

The OTA study evaluated the state of onsite solar technology and examined its effect on existing electric utility systems. A specially designed computer program also compared the economic viability of various types of solar equipment, under different ownership assumptions, with conventional energy sources at different future price ranges in four cities studied meticulously: Albuquerque. Boston, Fort Worth, and Omaha. The study also analyzed existing institutional constraints to solar energy: environmental. social. and economic implications; and the policies of the Federal Government regarding solar energy. (Excerpts from this report may be found in section 11.)

In support of the congressional debate on energy, and because of increasing interest in solar energy in particular, a prepublication draft of the report was issued in July. The final report, requested by the Senate Committee on Aeronautical and Space Sciences, will be published in 1978. Members of both the House and Senate quoted the study widely in debates on energy legislation in 1977.

Residential Energy Conservation

About one-fifth of all energy consumed in the United States heats and cools residential and commercial buildings. A significant amount of this energy could be saved by using both existing and newly developing technologies and better building design. The National Energy Plan, recognizing this fact, emphasized various proposed voluntary, incentive-based conservation measures for residential and commercial buildings.

At the request of the Senate Committee on Commerce, OTA is evaluating the opportunities for and the constraints on conserving energy in residential buildings over the next 15 years. The evaluation particularly stresses conservation through existing technologies, as well as the roles of consumers, builders, utilities, and Government in the decision making process as it affects the potential for saving energy.

The Senate Committee on Energy and Natural Resources used preliminary findings from this assessment in 1977 to evaluate the conservation provisions of the National Energy Plan.

Coal Utilization

To meet the demand for energy and to reduce dependence on dwindling supplies of oil and natural gas, the Administration has proposed shifting the U.S. fuel consumption in the coming years from oil and gas to coal. This shift could, however, create conflicts with environmental priorities. The question is how to burn increasing amounts of coal while maintaining clear air standards.

At the request of the Senate Committee on Public Works, OTA is assessing the social and environmental impacts and the economic and technical potential of existing and new methods of burning coal directly (i.e., in contrast to converting it to gas or liquids). In 1978, a survey of consumers, producers, and government officials will determine how the production and use of coal affect people and institutions. A second part of this assessment will evaluate methods and impacts of converting coal to gas or a liquid "synthetic" fuel.

Coal Slurry Pipeline

In recent years Congress has been compelled to sort out the conflicting claims of pipeline and railroad proponents over how coal from the Western States can best be transported from where it is mined to where it will be used. Slurry pipelines pump finely ground coal suspended in water or another liquid (a "slurry") over substantial distances. Proponents argue that pipelines will cut the costs of moving coal over long distances. Others, however, maintain that such pipelines will damage the environment and seriously hurt the railroads.

To address these and other issues for Congress, OTA is assessing the environmental and economic impacts of proposed coal slurry pipelines. The assessment involves four interrelated parts. The first forecasts to the year 2000 the amounts of coal to be transported. The second develops cost estimates and market scenarios to predict the impact of slurry pipelines on energy costs, the cost and quality of railroad service, employment, and other economic measures. The third assesses the environmental and social impacts of transporting coal by pipelines as opposed to railroads. The availability of water for use in slurry pipelines, particularly in the arid and semiarid West, commands particular attention. Finally, OTA is examining the legal and regulatory factors relating to rail and pipeline competition, water rights, environmental protection, and eminent domain.

The Senate Committees on Commerce and on Interior and Insular Affairs and the House Committee on Interstate and Foreign Commerce requested this OTA project. The House Committee on Interior and Insular Affairs has scheduled hearings for early 1978 on the question of eminent domain rights for the slurry pipelines. The assessment was virtually complete at year-end and will be delivered to the requesting committee in January 1978.

Food Program

Food production, processing and retailing account for one-third of the U.S. gross national product—about $600 billion per year. Approximately one in four persons employed by the private sector work in some area of the food industry. Eight million to ten million people produce, store, transport, process, merchandise, and serve the Nation's food. Although there are now fewer than 3 million farms in the United States, agriculture's assets equal about three-fifths of the capital assets of all manufacturing corporations in the Nation.

In 1972-73, shortages of foods, fuels, and fertilizers disrupted U.S. and world markets and shook the public. Since then, world food produc-

tion has greatly improved, although the overall situation remains fragile. Congress has had to contend with, on the one hand, issues of domestic surpluses and falling prices, and on the other, the realization that hunger and malnutrition persist in widespread areas of the world.

Likewise, major long- and short-term domestic problems confront the United States. Increased agricultural productivity has ensued from the use of new technology, which in turn requires heavy capitalization. The rising cost of farm labor is also forcing increased reliance on technology and capital.

Recent droughts in the American West and elsewhere in the world have vividly demonstrated the dependence of sufficient food supplies on the availability of water. Climatologists warn that if weather patterns become more varied, as many predict, greater year-to-year fluctuations in food supply can be expected.

The health and nutritional consequences of substituting processed for natural foods distress a number of people. Many have also expressed concern regarding the use of drugs in livestock feeds; the addition of chemicals to food products to retard spoilage, enhance flavor or appearance; and the hazards of chemical and microbiological contamination of foods.

To provide Congress with information on these and other food-related problems, the OTA Food Program embraces a wide range of issues relating to agriculture, food, and nutrition. Projects encompass three areas: 1) production, from input to the farm gate; 2) marketing, including processing, wholesaling, and retailing; and 3) consumption and nutrition. Assessments in these areas center on two primary elements of congressional attention: better use and management of technologies and resources, and the impact of U.S. food policies on producers and on the nutrition and health of consumers at home and abroad.

In 1977, OTA examined opportunities and institutional means for expanding basic research to increase food production in the United States. The report was the first of a two-part assessment of agricultural research and development. The second part analyzes the implications of increasing U.S. support for agricultural research in developing countries.

A report completed in 1977 evaluated the Nation's retail food grading system and assessed options that Congress might consider for improving that system's information to consumers. A second project, begun in 1976, analyzes the transfer of food processing technology to developing countries.

Two other assessments concerning marketing issues were approved by the Board and initiated in 1977. One in examining open-dating techniques for labeling processed foods. The other is evaluating new technologies that will affect future food marketing practices.

Two assessments relating to food safety and health were also begun in 1977. One studies the benefits and risks for humans of using drugs and chemical additives in livestock feed. The second examines alternative strategies for nutrition research conducted or sponsored by the Federal Government.

Another ongoing project, initiated by OTA in **1976,** deals with overall food and nutrition policies. This project assesses alternative food policies in order to provide Congress with information and policy options to consider as it legislates a national food policy.

Perspectives on Federal Retail Food Grading

Commodities and food products are graded on the basis of sensory characteristics such as flavor, color, texture, or appearance. In a report published in June, OTA examined the Federal system of food grading to determine how it might respond more effectively to the needs of consumers as well as producers. The assessment analyzed the grading of fresh fruits and vegetables, fresh meat, and processed foods. (Excerpts from this report may be found in section II.)

This report, requested by the Senate Committee on Agriculture and Forestry and the Senate Select Committee on Nutrition and Human Needs, is assisting the Subcommittee on Domestic Marketing, Consumer Relations, and Nutrition of the House Committee on Agriculture as it prepares for hearings on fresh meat, fruits, and vegetables. The U.S. Department of Agriculture is also studying the report to determine what changes that do not require legislation can be made in the food grading system.

Organizing and Financing Basic Research to Increase Food Production

This assessment examined alternatives for organizing and financing basic biological research aimed at increasing food production. The assessment focused on three areas of high-priority research that offer the greatest potential: photosynthesis, nitrogen fixation, and cell culture studies. (Excerpts from this report may be found in section 11.)

The report was requested by the House Committee on Science and Technology and the Joint Economic Committee. Its findings were reflected in the USDA appropriations in which Congress, for the first time, specifically funded $15 million for fiscal year 1978 in competitive grants for basic research on food production.

Increased Support of Agricultural Research and *Development in Developing Countries*

In the second part of the study of agricultural research and development, OTA is assessing the implications of increased U.S. funding for agricultural research in developing countries.

Many experts feel that the best long-range solution to the world food problem is to help developing countries become self-sufficient in food production. Thus, OTA is assessing the willingness and ability of developing countries to benefit from increased U.S. support for agricultural research. The project also examines the legislative and institutional means for providing such support and alternatives for bolstering research in developing countries.

The study was requested by the House Committee on Science and Technology and the Joint Economic Committee. During 1977, the Subcommittee on Foreign Assistance of the Senate Committee on Foreign Relations used OTA preliminary findings to question the Agency for International Development about the ability of its technical staff to carry out food and agriculture programs in developing countries.

Transfer of Food Processing Technology to Developing Countries

In a related assessment, OTA is evaluating alternatives for and consequences of exporting U.S. food-processing technology to developing countries. The project identifies the quality and range of foods available to such nations, as well as those technologies that might improve the nutritive value and/or lower the cost of high-quality food.

In addition, OTA is analyzing the methods, constraints and effectiveness of institutional channels for making such technology transfers, the options available to the Congress for stimulating the technology exports, and the international channels for accomplishing the transfers.

The project was requested by the Joint Economic Committee, the Senate Select Committee on Nutrition and Human Needs, and the House Committee on Agriculture.

Alternatives in U.S. Food Policy

This project draws on the resources and experience gained from other Food Program assessments. It is evaluating technological issues and problems in production, marketing, consumption and nutrition, and developing information to help Congress legislate a national food policy.

The OTA Food Program and its Food Advisory Committee have set three objectives for this assessment. First, it will spell out elements needed to formulate a national food policy. Second, it will identify and analyze public policy and technological issues for Congress. And third, it

will identify and assess emerging issues in the food area.

OTA has examined the policies and programs affecting each part of the food system, how they relate to one another, and the tradeoffs which result from conflicting goals (such as lower food prices for consumers and higher incomes for farmers).

The assessment was requested by Senator Hubert Humphrey of the OTA Board, the Senate Committee on Agriculture and Forestry, the Senate Select Committee on Nutrition and Human Needs, and the House Committee on Agriculture.

Drug and Chemical Additives in Livestock Feeds

In 1977, the Food and Drug Administration (FDA) proposed banning penicillin, tetracycline, and nitrofurans as livestock feed additives used to stimulate growth or improve the health of animals. The FDA is concerned that these drugs may cause cancer in the animals or lead to the growth of resistant strains of bacteria that can be transferred to humans.

At the request of the Senate Committee on Agriculture, Nutrition, and Forestry and the House Committee on Agriculture, OTA is assessing the benefits and risks of using drugs and chemicals as additives in livestock feeds. The project identifies acceptable risk and available native feed additives and will evaluate the options available to Congress for improved regulation of drug additives.

As part of the project, OTA workshops in late 1977 brought representatives of the food and drug industries, Government regulatory agencies, and farm and consumer groups together to discuss the issues and consider background papers prepared by OTA staff and consultants. This public participation effort will continue in 1978.

Nutrition Research Strategies

The public has become increasingly conscious in recent years of the role of nutrition in maintaining health. Both Congress and the executive branch have responded to the increased public interest in nutrition. The Senate Select Committee on Nutrition and Human Needs held hearings in 1976 and 1977 on the relationship of diet to desease. With the Food and Agriculture Act of 1977, Congress made nutrition research a separate and distinct mission of the U.S. Department of Agriculture.

To assist Congress in considering policies affecting research in human nutrition, the Board approved a project to evaluate the implications of alternative strategies for conducting such research. The assessment focuses on two principal areas: the priorities for nutrition research and the administration and coordination of Federal domestic and international nutrition research activities. In 1977, a planning session and two workshops identified and discussed the issues. The first workshop considered priorities and alternative mechanisms for coordinating and administering research on nutrition. The second workshop discussed the role of the private sector in nutrition research and related issues.

New Marketing Technologies

In this planning project, OTA is surveying new food marketing technologies and issues that may arise from their adoption, and identifying technologies that may come into use in the near- and long-term futures. These technologies include texturing, blending, and flavoring methods that produce new foods, the electronic checkout at grocery stores, and the reportable pouch for packaging precooked foods prior to sale.

At OTA's request, more than 200 specialists in various aspects of food marketing offered their views on how such possible new technologies might affect the overall food system. A citizens' advisory panel integrated the information in an October planning effort directed towards identifying priority areas that Congress might consider in need of assessment by OTA. The study was requested by the OTA Board.

Open-Dating Techniques for Processed Foods

Many food processors now print "sell by" or "use by" dates on their packages to indicate the last date on which the product will be fresh or offer maximum nutrition. However, there are no standards for such so-called "open-dating" techniques. Dates differ from product to product and from manufacturer to manufacturer. Indeed, there are no laws or regulations set by the Federal Government which require processors to list sale or use dates.

At the request of the Senate Committee on Commerce, Science, and Transportation, OTA is evaluating proposed legislation that would require comprehensive and informative food labeling, designed to prevent deception and to assure consumers that the food is safe. The project is analyzing various open-dating techniques which would require processors to label each food product with either an open sale or use date, or both. Other techniques are also being studied.

Specifically, OTA is evaluating what information product labels should convey to consumers, how information can be conveyed, the characteristics of different processing technologies that would influence what open-dating techniques could be used for different products, and the consequences for producers as well as consumers of the various open-dating techniques.

Health Program

From 1950 to 1976, total expenditures for medical care in the United States rose from $12 billion to almost $140 billion. During this period, the percentage of the gross national product spent on health increased from 4.5 to 8.6 percent, and that portion of personal income devoted to medical care went from 5.8 to nearly 10 percent. In more recent years, the share of medical costs paid by the Federal Government more than doubled, climbing from 12 percent in 1965 to 28 percent in 1975; Federal spending for medical care increased from $20.2 billion in 1971 to $45.9 billion in 1977.

A substantial portion of the increase in health expenditures resulted from expanded use of medical technologies. In the past 20 years, medical technologies have led to improvements in the prevention, diagnosis, and treatment of disease. Other types of medical technologies have the potential to improve the efficiency with which medical care is delivered.

Members of Congress have expressed apprehension about rapid increases in medical expenditures. In recent years, these concerns have elicited the enactment of Federal legislation, restricting the development and use of medical technologies. Other congressional actions have been taken to minimize health hazards from technological applications related to the workplace, home, food supply, and the environment.

To assist Congress in evaluating these issues, the OTA Health Program is examining the implications of medical technologies on society. Medical technologies— including both hardware (devices and facilities) and software (methods and skills) —are defined as the set of drugs, devices, and procedures used to deliver medical care to individuals, and the organizational systems within which such care is delivered.

The health system can be viewed as a set of inputs, outputs, and processes. Inputs include devices and professionals, the demand of individuals for care, and the expenditures for health care. Outputs are the effects of care on the health of individuals. Processes include the use of technology, medical procedures, and financing and administrative mechanisms. A comprehensive view permits the Health Program to identify questions and select assessment topics which help the Congress resolve issues involving the delivery of medical care.

During 1977, the Health Program completed two studies. One evaluated methods of discern-

ing chemicals which cause cancer and reviewed evidence on whether saccharin causes cancer in humans. The second report assessed the policy implications of medical information systems. In addition, a background study on the therapeutic uses of drugs was completed.

Work also progressed on three additional assessments. One examines the policy implications of computed tomography scanners. A second study analyzes the safety and efficacy of medical technologies. The third assessment reviews congressional-mandated requirements for health data systems and the implementation of those requirements.

Cancer Testing Technology and Saccharin

In the wake of the decision by the Food and Drug Administration (FDA) to ban the use of saccharin as an artificial sweetener because of laboratory evidence indicating that it caused cancer in animals, OTA was asked by the Subcommittee on Health and Scientific Research of the Senate Committee on Human Resources to: 1) assess the capacity of current testing methodology to predict the carcinogenic potential of chemicals consumed by humans; 2) evaluate the potential risk of cancer from saccharin for humans; 3) evaluate the benefits of saccharin use, particularly for diabetics and those with special medical problems; and 4) assess the potential availability of alternate artificial sweeteners.

The study, conducted by the OTA staff with technical assistance from an 1 l-member panel of scientists and medical specialists, commissioned 12 short-term tests of mutagenicity to be conducted on saccharin. It marked the first time that scientific experiments were carried out as part of an OTA assessment. (Excerpts from this report may be found in section II.)

After completing the study, OTA panel members testified before the subcommittee on the preliminary findings and offered their personal observations on the safety and use of saccharin. In the debate on a bill to delay FDA's ban, seven different senators cited the OTA report in support of provisions requiring warning labels on products containing saccharin. The report was published in October 1977.

Policy Implications of Medical Information Systems

Published in November 1977, this report examines the policy implications of using computer-based information systems for clinical care as well as for business or administrative functions. In addition, the report presents analyses of the benefits and limitations of medical information systems, the factors influencing their adoption, and alternative Federal policies regarding their use. The study was requested by the Senate Committee on Human Resources. (Excerpts of this report may be found in section II.)

Policy Implications of Computed Tomography (CT) Scanners

The computed tomography (CT) scanner is a new radiological device that combines an on-line computer with sophisticated X-ray equipment to produce a cross-sectional image. CT scanners have been rapidly and enthusiastically accepted by the medical community and are used to diagnose a wide variety of diseases. Net expenditures on CT scanning in the United States have reached nearly $400 million per year and continue to grow rapidly. Medicare, Medicaid, private insurance companies, and individual patients must confront the problem of paying these bills.

The revolutionary nature of CT scanner technology, the speed of its acceptance, and its expense have produced many problems for the medical system. Because many of these problems are common to other new medical technologies, the case study of the CT scanner will highlight several important issues for health policy.

Requested by the Senate Committee on Finance, this OTA study is examining Federal policy regarding safety and efficacy; the effect of health planning and regulatory policies on diffusion; the relationship between efficacy and patterns of use; and the impact of reimbursement policies on expenditures.

Efficacy and Safety of Medical Technologies

Issues of efficacy arise when a new technology is introduced, when use of an existing technology is expanded or questioned, or when alternative medical technologies are compared. Although various Federal laws regulate drugs and medical devices, the basic responsibility for determining the safety and efficacy of medical technologies has traditionally rested with the medical profession.

Federal agencies and private groups recently have increased their activities related to efficacy and safety. For example, the number of tests conducted has increased, and dissemination of their results has attracted greater attention. However, such common procedures as tonsillectomy, appendectomy, and fetal monitoring have not been adequately assessed for efficacy or safety. Re-examination of other, widely used procedures, such as mammography, are underway.

Requested by the Senate Committee on Labor and Public Welfare, the study investigates the need for assessing efficacy and safety, the methods and procedures for making such evaluations, the types of assessment currently being supported by the Federal Government, and ways to improve existing policies.

Health Data Systems

The Federal Government engages in medical research, education, planning, regulation, delivery of services, and payment programs. Most of these programs collect data to aid in management and evaluation. The National Center for Health Statistics of the Department of Health, Education, and Welfare also provides general health data on the Nation's population. The total costs for some 282 separate data collection activities by the Federal Government amounted to more than $62 million in 1976.

This program-by-program approach to collecting health data results in a number of problems, such as duplication of efforts and data; lack of coordination, timeliness and relevance; uneven quality; and incompleteness. Moreover, some data that may prove important for policymaking in the future are presently not pursued.

Thus, OTA is reviewing congressional requirements for health data and how well those requirements are being satisfied. Requested by the House Committee on Interstate and Foreign Commerce, the study investigates Federal policies and their impact on data collection. It also evaluates alternative policies to coordinate the collection of data that would assist Congress in preparing for future needs.

Materials Program

The era of plentiful, cheap, and inexhaustible materials is ending. The supply, use, and eventual disposal of materials must be reconciled with environmental values. The environmental abuse caused by materials extraction and processing in past decades, for instance, is no longer tolerable. Efforts continue to restrict mineral and energy development on public lands.

Until recent years, waste disposal has been regarded as a distasteful burden. Conducted in the cheapest and most convenient manner, waste disposal gave little regard to the environment, esthetics, health, and the value of reuse. Responding to changing attitudes and the public demand for environmentally acceptable disposal of municipal wastes, Congress passed the Resource Conservation and Recovery Act in 1976.

Congress is also concerned about the use of materials, such as the desirability of standards or incentives to achieve more durable products. More durable products would reduce the demand for materials and deter waste.

In response to such congressional concerns, the Materials Program addresses issues spanning the entire materials cycle, from exploration and

extraction through production to use, reuse, and eventual disposal. This approach emphasizes the links between issues and problems at one phase of the cycle with those at another. Individual subprograms address issues relating to a national materials policy, supply and resource development, the use of materials, resource management, and health, safety, and environmental issues of the materials system.

During 1977, several projects neared completion. Two of the projects address the need to conserve materials by using them more efficiently. One examines the prospects for increased use of materials through recovery and recycling. The other evaluates methods of conserving materials in manufacturing and use by reducing waste.

Three additional projects are assessing issues and problems stemming from minerals exploration and exploitation. The first examines laws, policies, and practices that affect access to minerals on Federal lands. The second analyzes the effects of Federal land management and ownership on exploration and production of minerals on non-Federal lands. And the third assesses the value of past and future mining activity on existing Federal coal leases.

Two new projects begun during 1977 deal with the future supply of minerals and materials in the United States. The first examines the future availability of materials for which the United States depends on imports. The second assesses the prospects for and implications of recovering commodities, particularly shale oil, from marginally economic resources. The Energy and Oceans Programs are working with the Materials Program on this second project.

Engineering Implications of Chronic Materials Scarcity

This report, completed during 1977, covers the proceedings of the fourth biennial conference on national materials policy at Henniker, N. H., held August 8-13, 1976. The conference, sponsored by the Federation of Materials Societies and OTA, focused on the relationship between engineering and the scarcity of materials, and the implications for national policies (particularly involving the work of the OTA Materials Program and the National Commission on Supplies and Shortages).

Resource Recovery, Recycling, and Reuse

Millions of tons of usable materials are squandered each year. Solid wastes from municipal sources alone totalled 135 million tons in 1975. That figure could burgeon to 225 million tons by 1990, according to the U.S. Environmental Protection Agency. Wastes, costly to collect and dispose of, are a major potential source of reusable materials.

At the request of the House Committee on Science and Technology and the Senate Committee on Commerce, OTA is examining this potential for and barriers to recovering and recycling resources from municipal solid waste. This project aims to identify and analyze both the policy options for realizing the potential and the likely impacts of implementing those options.

The project has several parts: 1) an evaluation of markets for such recovered goods as paper, aluminum, ferrous metals, glass, and energy: 2) an analysis of the effects of freight rates on the movement and sale of recovered goods; 3) a study of the economic and technical feasibility of using centralized facilities for recovering resources; and 4) an analysis of the implications of mandatory deposits on beverage containers.

In 1977, the Members and staffs of the congressional committees responsible for overseeing the Resource Conservation and Recovery Act of 1976 received preliminary results of the assessment, OTA staff members testified on the findings before the Subcommittee on Transportation and Commerce of the House Committee on Interstate and Foreign Commerce at hearings on implementation of the Act held May 28, 1977.

Conservation through Reduced Wastage

Resource recovery involves the recycling of used materials, thereby conserving them. Elsewhere in the materials cycle, considerable savings can ensue from reducing the amount of materials lost in their manufacture and use. Such reduced

wastage would conserve resources, lower manufacturing costs, and help control wastes.

At the request of the Senate Committee on Commerce, OTA is examining the materials cycle to determine reasons for wastage, and to identify and evaluate alternative approaches to the design, manufacture, and conservation of materials. To provide focus, the scope of the assessment is limited to primary metals (chromium, nickel, copper, aluminum, and iron) and certain key products, such as autos and railroad rolling stock, appliances, and military and construction equipment.

Three congressional committees used preliminary findings from the assessment in 1977. Data developed by OTA on the flow and uses of materials were provided to the Senate Committee on Commerce, Science, and Transportation in developing legislation on product regulation. The findings were also made available to the Subcommittee on Consumer Protection and Finance of the House Committee on Interstate and Foreign Commerce and the House Committee on Science and Technology.

Management of Fuel and Nonfuel Minerals on Federal Lands

Government actions are key to the exploration for and recovery of minerals and other resources on publicly owned lands. OTA is assessing the effects of modifying or restructuring State and Federal laws, policies, and practices that significantly affect access to minerals on Federal lands.

The assessment seeks to provide alternative approaches to facilitate mineral development in ways that are environmentally acceptable and take other public land uses into account. The assessment has two parts. The first involves a compilation and analysis of information about the effects of current State and Federal laws, policies, and practices concerning mineral development on Federal lands. The second analyzes possible changes in the existing system and the impacts of such changes.

An interim report prepared in 1976 has been distributed to) various congressional committees and executive branch and State agencies. The 1977 annual report of the Department of the Interior cited data from the interim report on the availability of minerals on Federal lands. The joint Federal-State Land Use Planning Commission for Alaska named the interim report as the basis for the Commission's study of metalliferous and non-fuel minerals. The State of Wyoming has used the findings in its suit against the Department of the Interior's strip mining regulations.

In 1977, as part of the assessment, OTA also analyzed the effect of legislation to reorganize Federal responsibility for energy on the management of public lands. The Senate Committee on Governmental Affairs and the House Committee on Government Operations used the analysis to draft a more precise bill, spelling out the transfer of certain mineral leasing functions to the new Department of Energy and the continued control by the Department of the Interior over the allocation and management of multiple use lands.

Access **to** *Minerals on Non-Federal Lands*

In a related project, OTA is assessing various aspects of Federal land management and ownership that influence the exploration for and development of minerals on non-Federal lands. Particular attention focuses on public lands governed by the Alaska Native Claims Settlement Act of 1971. Under that Act, Congress must decide, by the end of 1978, how much of the 375 million acres in Alaska to preserve as wilderness and how much to open up for commercial development. Widely divergent bills in Congress would set aside from 25 million to 140 million acres as parks, wildlife refuges, national forests, or wild and scenic rivers, with only minimal development permitted.

Faced with a lack of published data, OTA, with assistance from the Congressional Research Service, undertook a search for information dealing with the amount of minerals and other natural resources and transportation needs and availability in five selected areas in Alaska. Representatives of citizen groups, mining companies, land owners, and State and Federal officials were interviewed to help OTA staff and consultants build a data base for the assessment.

The report also focuses on the influence of Federal land management and ownership on the exploration for and development of minerals on Federal lands where the surface and subsurface property rights are severed. OTA interviewed more than 500 knowledgeable persons in Alaska, Arizona, Nevada, Colorado, Wyoming, and North Carolina to learn how Federal authority for land management, as reflected by laws, policies, and practices, affects access across Federal lands to minerals located on non-Federal lands.

Preliminary findings of the assessment, which was requested by Senator Ted Stevens of the OTA Board, were presented to the House Committee on Interior and Insular Affairs and the Senate Committee on Energy and Natural Resources for use during hearings on the Alaskan lands issue. The Federal-State Land Use Planning Commission for Alaska has employed the OTA data in its resource planning. The findings have also been utilized in the study of energy facilities siting in coastal areas being conducted by the OTA Oceans Program.

Existing Federal Coal Developrnenf

In 1977, the Administration called for increased U.S. reliance on coal as a basic energy source. To help Congress determine if and how coal production can be increased, OTA is analyzing Federal coal leases, permits, and preference-right lease applications and how they relate to current and future plans for the development of coal reserves.

Mandated by Congress in section 10 of the Federal Coal Leasing Amendments Act of 1975, the study evaluates mining activities, the revenues from leases, and the feasibility of using deep mining technology in the leased areas.

Future A vailability of Materials Imported by the United States

Materials imports comprise vital elements for continued economic growth in the United States. OTA is assessing selected policy alternatives to deal with issues and problems which might affect future U.S. access to foreign resources, focusing on the impact of events or situations that could influence such future access. The study was requested by the House Committee on Science and Technology.

Recovering Commodities from Subeconomic Resources—Case Study of Shale Oil

As supplies of many natural resources from easily accessible deposits decline, potentially rewarding but costly development of untapped reserves could significantly increase domestic supplies. OTA is assessing the adequacy of current technology for recovering low-grade natural resources. Oil shale is the first such resource being assessed.

Oil shale, a porous sedimentary rock common across large areas of the Western United States, contains vast amounts of oil. The U.S. Bureau of Mines estimates that the total oil contained in the Green River Formation in Colorado, Utah, and Wyoming alone could be as much as 2 trillion barrels–almost the equivalent of the crude oil potentially recoverable throughout the world by conventional means.

However, most of that shale oil may remain out of reach because of technological, environmental, and economic constraints. For instance, no technology has yet emerged that can produce shale oil at competitive prices.

Accordingly, OTA is evaluating the current technology and Government policies for recovering shale oil. The conditions or requirements for producing shale oil in sufficient quantities and at competitive prices are under study. The project is also assessing the environmental effects, transportation requirements, water availability, and social and economic impacts of developing shale oil.

The Senate Committee on Energy and Natural Resources, which requested the assessment, utilized preliminary findings on the status of shale oil technology in its consideration of a Federal Oil Shale Commercialization Test Bill.

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National R&D Policies and Priorities Program

The Federal Government now spends about $28 billion per year on research and development activities and facilities in the United States. With another $20 billion per year from the private sector, the total national investment in R&D in the United States approaches $50 billion annually.

Recognizing the importance of this national investment, the OTA Board authorized a Program of R&D Policies and Priorities in October 1975. The Program was established by the Board according to a plan proposed by OTA's Advisory Council.

To implement the program, OTA has assembled a staff of seven professionals supplemented by consultants and contractors. The principal resource consists of the members of the three advisory panels plus a separate task force on appropriate technology created in 1977. The members constitute an outstanding group of leaders from science, engineering, and other professions drawn from academia, industry, labor, and environmental and public interest groups.

Program Structure and Issues

The program became operational with the establishment of interrelated advisory panels, the first meeting of which occurred in May 1976.

The first of these, the Panel on the Health of the Scientific and Technical Enterprise is chaired by Dr. Harvey Brooks, the Benjamin Peirce Professor of Technology and Public Policy of Harvard University. The second, the Panel on the Applications of Science and Technology, is chaired by Dr. Lewis Branscomb, Vice President and Chief Scientist of IBM. The third, the Panel on Decision Making on R&D Policies and Priorities is chaired by Dr. Gilbert White, Director of the Institute of Behavioral Science of the University of Colorado. •

•During most of 1977, this Panel was co-chaired by Professor Adam Yarmolinsky of the University of Massachusetts who late in the year resigned to become Counsel of the Arms Control and Disarmament Agency.

To supplement the work of these three panels, the R&D Program (in June 1977) established a Task Force on Appropriate Technology chaired by Lola Redford, a leader in solar energy and other environmental and consumer issues. This task force is examining "appropriate, " alternative, or intermediate technologies which might not receive adequate attention within the existing scientific and technical enterprise.

More specifically, the range of panel activities is as follows:

Health Panel. This panel has addressed the following questions: (1) What are the elements of the scientific and technical enterprise (e.g. universities, national laboratories, industrial laboratories, human resources, etc.); (2) How are they interrelated; (3) What do we mean by the health of the enterprise; (4) What criteria can we use for assessing its health; (5) How can we better shape science indicators to provide the basis for continuing assessment of the enterprise; (6) How can we set priorities among fields of science; (7) How can we enhance the institutional resources in the science and technical enterprise; (8) How can we better plan, develop, and utilize the human resources in the enterprise; and (9) How can we improve the quality control mechanisms which function in the enterprise?

The specific projects undertaken with the guidance of the Health Panel are: (1) Preparation of a paper defining the Health of the Scientific and Technical Enterprise, showing its implications for the development of improved science indicators. (2) Preparation of a paper on establishing priorities among fields of science. (3) Preparation of a paper on quality control mechanisms in the scientific and technical enterprise. (4) Research project on the extent to which Federal R&D funding may displace private funding of R&D. (5) Task Force study on Women and Minorities in Science. (6) Task Force study on National Laboratories as an institutional resource. (Although listed under the Health Panel, this task force is drawn from members of

all three panels and receives guidance from all three panels).

Applications Panel. This panel has examined the relative status of U.S. technology in the world economy and is considering the following questions: (1) What can the Federal Government do directly (e.g. through R&D contracts) to influence innovation in our society; (2) What can the Federal Government do indirectly (e.g. through regulation, tax policy, patent policy, etc.) to shape the environment within which innovation occurs in our society; (3) How can we influence the process of technology transfer between the United States and other nations; and (4) How can we better mobilize our scientific and technical resources to tackle specific national problems in areas such as health, energy, etc?

The specific projects undertaken with the guidance of the Applications Panel are: (1) Research Project on the Federal Role in influencing the innovation process; (2) Research Project on Role of Demonstrations; (3) Research project on implications of the Federal Grant and Cooperative Agreement Act of 1977; (4) Task Force study of Carcinogens in the Workplace; and (5) Analysis of technology transfer issues and planning for the forthcoming U. N. conference on Science and Technology for Development.

Decision-Making Panel. This Panel has been concerned with the decision processes whereby R&D policies and priorities are shaped within the Congress, the executive branch, the Judiciary, the regulatory agencies, State and local government, and the public. This panel has been particularly concerned with the integration of R&D policy within a broader framework of economic, social and regulatory policy.

The specific projects undertaken with the guidance of the Decision-Making Panel are: (1) Preparation of paper on integration of R&D policy with economics, social and regulatory policy; (2) Study of executive branch reorganization options regarding science and technology activities; (3) Preparation of a paper on expected impact of zero based budgeting on R&D Programs: **(4)** Development of congressional guidelines for evaluation of R&D budgets.

Appropriate Technology Task Force. The purpose of this task force is to define appropriate technology, survey ongoing work in the field, identify problems, potentials, opportunities, and obstacles which have been encountered. and finally to indicate what legislative options there may be for Congress to consider in dealing with appropriate technology. (Appropriate technology may be defined as technology which is decentralized or diversified, amenable to management by its users, and in harmony with the environment and our use of natural resources.) The task force, which met twice in **1977,** organized itself into several working groups to: (1) define the field; (2) survey relevant executive branch programs; (3) survey congressional plans and programs; and (4) undertake case studies of appropriate technology activities in fields such as urban community housing, agriculture, or energy.

Oceans Program

Half of all Americans live or work within 50 miles of a coastline—along the Atlantic or Pacific Oceans, the Gulf of Mexico, or the Great Lakes. That figure may grow to 80 percent of the U.S. population by the year 2000, according to a recent study by the Senate Committee on Commerce. Such concentrations of people on what amounts to less than 10 percent of U.S. territory have brought intense development and competition for land for housing, industry, commerce, energy facilities, resort communities, and transportation networks.

The increasing pressures on the coastal areas and oceans have already heightened congressional interest in the impacts of such development. It is unclear how much or what kind of development coastal areas can sustain before the complex relationships between land and sea as well as between human and marine life become

irreversibly disrupted. In 1977, Congress encountered issues involving the preservation of marine and coastal environments, the development of energy and other natural resources, the use of the oceans to feed a burgeoning world population, and the organization of the executive branch to meet ocean-related problems.

To provide Congress with information on these and other areas of concern, the Oceans Program focuses on a broad range of issues encompassing the use and quality of the oceans and the systems deployed on or in the oceans or along their shores. The impacts of energy development on the people and environment of the coastal areas and the possibilities of harnessing the oceans to help meet future U.S. energy needs especially have evoked keen study.

In 1976, OTA completed a major study of the effects of three proposed offshore energy systems—oil and gas exploration and development, deepwater ports for large tankers, and floating nuclear powerplants—on the coastal areas of New Jersey and Delaware. The experience and the methods derived from that study have contributed directly to two 1977 Oceans Program projects as well as to projects in other OTA program areas.

In response to continuing congressional concern about activities on the Outer Continental Shelf, OTA followed up the coastal effects assessment with an agency-by-agency analysis of the Federal role in offshore oil and gas leasing. A short staff paper and graphs of the entire Federal leasing process went to the House Ad Hoc Committee on the Outer Continental Shelf, which published the OTA document in a report on offshore oil and gas development. Another assessment, of the social and economic effects of locating the sites of energy facilities in coastal areas, is **also)** relying on methods developed and information gained from the coastal effects study.

During 1977, the Oceans Program completed two additional assessments. One examined alternatives for enforcing and managing the new U.S. 200-mile offshore fisheries zone. The second report identified issues raised by the transportation system for liquefied natural gas.

Work continued in 1977 on two other projects begun in 1976. One investigates the technology for and systems to be used in developing the oceans as a source of energy. The second project evaluates the current status of marine science and technology in the United States and its development over the past 15 years.

Establishing a 200-Mile Fisheries Zone

Published in June, this report analyzed four major aspects of the 200-mile U.S. fisheries zone: enforcement of regulations envolving the zone, management of the zone, information needed to implement or revise the legislation, and opportunities for expanding and revitalizing the U.S. fishing industry.

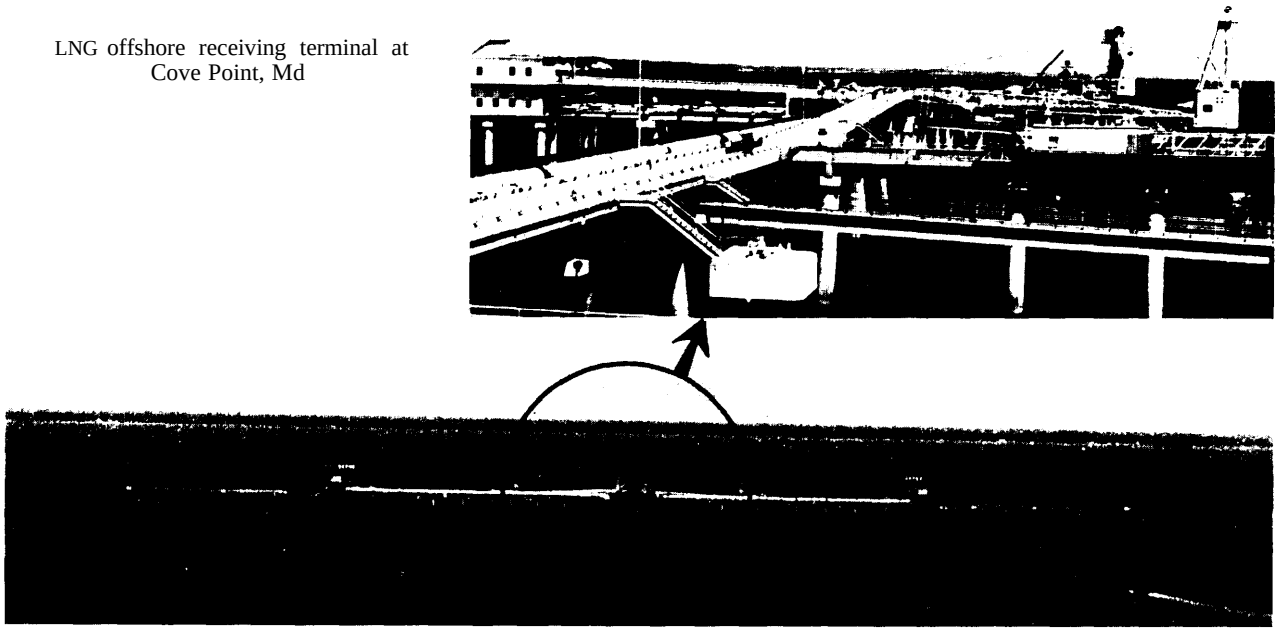
In the report, OTA indicated four pilot projects which might offer the Federal Government significant experience, enabling it to make decisions about appropriate methods and levels of enforcement. The pilot projects involve placing U.S. observers aboard foreign fishing vessels, joint research by various Federal agencies to adopt remote sensing technology for monitoring fishing grounds, development of a multipurpose ocean surveillance and information center, and the use of transponders with Loran-C for tracking and identifying fishing vessels. (Excerpts from this report may be found in section II.)

The study, requested by the House Committee on Merchant Marine and Fisheries and the Senate Committee on Commerce, has been used by several congressional committees that oversee establishment of the zone. The OTA staff testified before the Senate Committee on Commerce, Science, and Transportation on April 20, 1977, on enforcement of the zone. Information developed by OTA also served the Senate Committee on Appropriations, as it critiqued the Coast Guard's plans for acquiring new equipment for use in enforcing the zone.

Transportation of Liquefied Natural Gas

This report requested by the Senate National Ocean Policy Study, examined the current technology for transporting liquefied natural gas

LNG offshore receiving terminal at Cove Point, Md



Photos by OTA

(LNG) by tankers. The study described the Federal regulatory process governing the development and operation of LNG systems. It also identified several areas of note for congressional consideration concerning legislation regulating LNG-related activities. These include design, construction, regulation, and inspection of LNG tankers and terminal facilities; criteria for selecting sites for LNG facilities; the decisionmaking process for certifying LNG projects; liability for accidents; the reliability of foreign suppliers; the policies for pricing LNG; and the status of safety research on LNG. (Excerpts form this report may be found in section 11.)

Legislation introduced into both the House and Senate in 1977 to regulate the certification of LNG facilities in the United States reflects the findings of the report.

Renewable Energy from the Oceans

The search for nonpolluting, renewable energy sources free from foreign control has brought many people to perceive the potential of the world's oceans. A number of technologies have evolved to harness the energy in ocean wind, waves, tides, and temperature differentials.

OTA's analysis of the potential of such technologies and concepts will pinpoint the status of research efforts, and isolate the major outstanding problems that must be solved before the concepts will be technically and economically feasible. The project was requested by the Senate National Ocean Policy Study

Siting of Energy Facilities

Meeting the demand for energy requires new facilities, and this, in turn, raises questions and possible conflicts about these facilities' location. This is particularly the case in coastal areas where dense population finds industrial. residential, transportation, and recreational users competing for land. Furthermore, many view energy facilities as threats to the natural environment of the coastal areas.

These and other issues are the subjects of an OTA project assessing the implications of placing

energy-producing facilities in coastal areas. The study requires an analysis of the public decision-making process and the extent to which Federal laws and policies, such as those regulating air and water quality, influence the siting process.

During 1977, OTA staff members interviewed more than 100 Federal, State, and local government officials, and representatives from the energy industry in California, Maryland, and Massachusetts, to learn how well the current system for siting energy facilities works, and what the issues and problems are. A request from the House Committee on Interior and Insular Affairs and the Senate Committee on Commerce inaugurated the project.

Marine Science and Technology

OTA is reviewing the status and history of marine science and technology in the United States of the past 15 years. OTA was asked by the Senate National Ocean Policy Study to find out what knowledge and capabilities have and have not been gained from the investment of large sums of Federal funds, and the reasons why .

In response to the request, OTA submitted an extensive set of questions to a wide range of marine specialists in fields such as transportation, fishing, energy, hard minerals, ocean research and engineering, and meteorology. The results of the planning study completed to date have helped the Oceans Program to plan for future projects, and have been provided to the Senate National Ocean Policy Study.

Technology and World Trade Program

The impact of technology on the Nation's international trade has increasingly claimed the attention of Congress in recent years. More and more Americans believe that the U.S. balance of trade has suffered from the export of technology, and from American investment in foreign industry. Others argue, however, that the United States can only maintain a healthy economy and remain competitive in world markets through an open trade policy that encourages innovation and the continous exchange of new technology.

To evaluate such issues and provide a factual base from which to make accurate assessments, OTA created the Technology and World Trade Program in 1976. In 1977, this program continued planning studies which focus on the relationship of technology to the competitive position of the United States in international markets, and the related effects on the U.S. economy. OTA is currently examining the U.S. trade position as reflected in analyses of trade, productivity, and other statistics. Factors under study include the control of technology exports, trade with the Soviet Union, and better means of transferring technology to developing nations.

The Technology and World Trade Program has organized its planning efforts into three complementary categories. The first examines representative industries which have similar technological and economic characteristics. The second assesses technology and world trade issues that affect more than one industry or groups of industries. The third evaluates the relationship of geographical factors to technology and world trade.

During 1977, the Technology and World Trade Program began planning for two assessments slated for 1978. One assessment will examine the technological state of the U.S. steel industry and its relationship to international trade. The steel industry typifies a mature industry which is experiencing both declining foreign sales and serious domestic competition from imports.

OTA convened a panel of experts on world trade and the steel industry in the spring of 1977 to formulate issues for the planned assessment. Responding to congressional concern (and the work of the panel), the House Committee on Ways and Means asked OTA to examine the trade position of the U.S. steel industry vis-a-vis

its foreign competitors, assess how technology might bolster the industry's trade position, and present alternative policies by which the Congress could encourage technological innovation.

While the first panel felt that economic factors and business strategies outweighed and perhaps dictated technology developments during the postwar period, a second panel, assembled in late 1977, suggested that new steel technologies might restore the industry's world leadership position in the future.

In addition to providing Congress with factual data upon which to base decisions, the assessment of the steel industry is designed to provide insights into similar problems facing other businesses, such as the petrochemical, textile, and electronic industries.

A second planning study begun in 1977 by the Technology and World Trade program concerns the transfer of technology from the United States to other countries. Reflecting the questions arising within Congress about the possible impacts of such transfers on the traditional U.S. position of technological dominance, the House Committee on International Relations asked OTA to examine the issues involved in technology transfer. the future ability of U.S. industries to compete in world markets, and the extent to which U.S. industry requires technology developed by other nations.

This planning study focuses on how technology transfer affects U.S. technological leadership. It also examines the technological competitiveness of selected U.S. industries relative to foreign industries. The selected industries—steel, electronics, petrochemicals, and aerospace—are those which have long held a dominant position in world technology. a position of considerable strategic and economic importance.

Questions for future OTA study include the access by U.S. industry to foreign technology, the role of multinational corporations in the transfer of technology. and the transfer of soft technologies such as entrepreneurial, managerial, and scientific skills.

In considering this possible assessment, OTA participated in a workshop covering technology and world trade sponsored by the Congressional Research Service. OTA will continue to maintain close liaison with CRS as well as with the General Accounting Office and the Congressional Budget Office. OTA utilizes the resources of other Federal agencies and private institutions interested and experienced in technology and world trade. These include the Departments of State and Commerce, the National Science Foundation, the Export-Import Bank, and the National Academies of Sciences and Engineering.

When planning concludes, approval for these two assessments will be sought from the OTA Board. During 1978, the Technology and World Trade Program also expects to start planning studies of the electronics and aerospace industries, East-West and North-South trade relations and the relationships of employment, technology and trade.

Transportation Program

Transportation industries in the United States have had to contend with increasing economic, operational, environmental, and safety problems through the past several decades. To assist these industries and to assure that the Nation has an adequate transportation capability compatible with other national goals, Congress in recent years reorganized and refinanced the railroads, expanded and encouraged mass transit, sponsored research on new transportation systems, required automobile manufacturers to produce safer and more fuel-efficient cars, and required the use of vehicles that are environmentally acceptable.

To assist Congress in addressing such issues. the OTA Transportation Program to date has been structured around three key transportation

modes: the railroads, mass transit, and the automobile. Assessments undertaken in 1975 and 1976 resulted in a series of reports treating railroad reorganization and revitalization, the relationship of energy and the economy to mass transit, community planning for mass transit systems, and new means for automatic control of mass transit trains.

In 1977, work continued on three projects initiated in 1976. One assesses the future use and characteristics of the automobile. A second project evaluates the effectiveness of various laws in increasing the safety of railroads, and the third examines the research and demonstration methods for new urban transit vehicles. A fourth project begun in 1976, an examination of the possible uses and potential effects of coal slurry pipelines, was transferred in 1977 to the OTA Energy Program (q. v.).

Changes in Use and Characteristics of Automobiles

The private automobile has become the predominant form of personal transportation in the United States in the 20th century. By 1977, 83 percent of U.S. households owned at least one car, and more than 90 percent of the annual passenger miles travelled were by automobile. Available evidence further indicates that, despite recent increases in mass transit ridership, the automobile will continue to dominate the field of personal transportation for the foreseeable future.

At the same time, however, serious problems have emerged, clouding the future of the automobile. These include declining supplies of petroleum, increased costs for materials and labor, rising environmental and safety concerns, and widespread traffic congestion on the Nation's highways and urban streets. Consequently, at the request of the Senate Committee on Commerce, OTA undertook a major assessment of potential changes in the use and characteristics of automobiles over the short term (next decade) and the long term (to the year **2000).**

The assessment is probing the factors that influence the characteristics of automobiles, their use, and the services that support the automobile transportation system. It is identifying potential changes in the automobile and assessing the immediate and long range effects of alternative policies on automobile use and characteristics.

An examination of the future uses and characteristics of automobiles requires an assessment of the entire automobile system. This includes car owners, manufacturers, and parts suppliers; the maintenance and repair services; the highway, road, and street network; fuel producers and distributors; insurance and financing businesses; and Federal, State, and local laws and policies affecting the automobile system.

An analysis of factors such as the future availability of fuels and materials, the need to reduce harmful pollutants and to improve the safety of cars, and possible shifts in public attitudes, aims toward the development of public policy alternatives. By exploring several foreign countries' experiences with the automobile and other forms of personal transportation, OTA hopes to unearth solutions that might prove applicable in the United States.

Railroad Safety

In recent years, the Federal Government has attempted to solve the compelling financial, institutional, and operational problems of the U.S. railroad industry in order to maintain acceptable levels of service. To assist Congress as it examines issues and problems relating to the railroads, OTA conducted studies assessing the financial aspects of the reorganization of rail transportation, and published them in a series of reports in 1975.

The Railroad Safety Authorization Act of 1976, P.L. 94-348, required OTA to evaluate the effectiveness of the Railroad Safety Act of 1970 and other Federal laws aimed at improving the safety of our Nation's railroads. It further requested an examination of those programs, activities, and expenditures of the Government, railroad industry, and railroad unions designed to improve the railroad safety problem.

By year-end, OTA was completing the final report on its assessment of the safety problems

and issues in the railroad industry. The safety problems of people are reflected in the injuries and fatalities suffered by railroad employees, passengers, and the general public. Those problems of property are reflected in the loss and damage to railroad equipment, tracks, roadbeds, and freight. Hearings are planned to be held on this assessment early in 1978.

Urban Transit *Vehicle Demonstrations*

As part of its program to improve service and encourage increased ridership, the Federal Government has sponsored research, development and demonstration of new mass transit vehicles. At the request of the House Committee on Appropriations, OTA assessed whether the demonstration programs for three such vehicles: Transbus, State-of-the-Art Car (SOAC), and the Advanced Concept Train (ACT-1)—have made effective and appropriate use of Federal research dollars.

The Urban Mass Transit Administration (UMTA) of the Department of Transportation has sponsored demonstrations of Transbus, a prototype for the next generation of urban mass transit buses, the State-of-the-Art Car and the Advanced Concept Train rail transit cars to show how existing technology can be incorporated into car design and to encourage cost reduction through standardization. OTA examined alternatives for Federal R&D on transportation systems and assessed whether standardization of urban transit vehicles is a viable policy objective for R&D.

In 1977 the Subcommittee on Transportation of the House Committee on Appropriations used preliminary findings from this assessment during hearings on UMTA's R&D budget. The OTA preliminary findings also contributed to UMTA deliberations about mandating specifications derived from the Transbus demonstration.

Section IV

PLANNING AND EXPLORATORY ACTIVITIES

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Planning

The legislation which established OTA stipulates that a vital part of OTA's mission is to identify potential future technological issues. Thus OTA works to alert Congress to both potentially undesirable and beneficial consequences emanating from new, technology-related national problems and issues, or evolving current issues.

Through long-range planning, OTA not only identifies future issues, when appropriate, for the attention of Congress, but also probes those issues to define congressional interests and establish an internal agendum for the scheduling of OTA activities. Planning or preliminary analysis projects constitute a part of this process. While many activities typically lead to full-scale assessments, a number of OTA exploratory efforts yield reports which serve current congressional needs. Seven such activities are described below.

1977 saw the completion of three such projects and the issue of their reports. One involved the status and role of technology assessment as a tool for policy planning in Government, business, and academic organizations. Another evaluated demographic factors such as birth, marriage, and death rates and assessed how they might influence elementary and secondary education in the United States. A third examined civil liberty, privacy, and due process issues related to a new computer system proposed by the Internal Revenue Service.

Three other exploratory projects commenced in 1977. One scrutinizes issues and problems related to telecommunications, computers, and information policies. Its findings will help determine whether OTA should establish a formal program to deal with such issues. Complementing this effort, another project, similar to the analysis of the Internal Revenue Service (IRS) computer system, investigates issues related to proposed changes in the national crime computer operated by the Federal Bureau of Investigation (FBI). The third planning project assesses the implications of Federal programs dealing with the aftermath of natural hazards such as earthquakes, storms, and floods.

Work continued in 1977 on a Board-initiated "early warning" planning study examining larger, long-term issues and alternative approaches to important technological developments and needs. This effort endeavors to identify new and emerging technologies that may present significant issues at some future time.

Exploratory Activities

OTA's exploratory enterprise evaluates assessment requests and proposals which do not fall into other program areas. OTA analyzes the technological, economic, social, and legal matters involved with such requests, as well as the scope, parties at interest, and policy issues. These exploratory studies help the OTA Board decide whether major assessments are warranted. As noted above, OTA has found that many of the preliminary exploratory analyses, such as the one on the IRS Tax Administration System and the study of effects of demographic shifts on elementary and secondary schools, themselves offer substantial value to Congress.

Technology Assessment Activities in Government, Business, and Academia

This two-volume report examines the development and use of technology assessment as a policy planning technique in Government, business and academic organizations. The first volume records 4 days of hearings held by the OTA Board in June 1976. The second volume summarizes and analyzes the testimony presented in those hearings as well as the results of OTA staff work. (Excerpts from this report may be found in section II.)

The IRS Tax Administration System

This report examines civil liberty and due process issues related to a new computer system proposed by IRS. This Tax Administration System (TAS) would replace IRS's less efficient computer system which has been in operation since 1958. The preliminary analysis by OTA identifies issues and poses questions regarding congressional and administrative oversight of the system to help determine its possible consequences for due process, privacy, equity, confidentiality, and security. (Excerpts from this report may be found in section 11.)

Requested by the House Committee on Ways and Means and its Oversight Subcommittee, the report served as a reference to the Subcommittees on the Treasury, Postal Service, and General Government Appropriations of both the Senate and House Committees on Appropriations during 1977 hearings on the IRS request for TAS funds, and to other committees studying problems of privacy, information policy, and computer technology. At the request of the appropriations subcommittee and the suggestion of Members of Congress, IRS revised its TAS proposal to address issues and problems revealed in the OTA report. .

"In early 1978, the Office of Management and Budget postponed the budget item for purchasing TAS components.

Demographic Factors in Elementary and Secondary Education

This report examines recent and projected population changes and assesses how they will influence the future of elementary and secondary education in the United States. Demographic factors included birth, death, and marriage rates; population mobility; school enrollment trends; the family; and women in the work force. (Excerpts from this report may be found in section II.)

The OTA report, prepared at the request of the Subcommittee on Elementary, Secondary, and Vocational Education of the House Committee on Education and Labor (and published by this unit as a committee print), served in conjunction with OTA staff testimony at hearings held by the subcommittee. Those hearings constituted an early exercise of the foresight provision of the rules of the House of Representatives (rule X, section 2(b) (l)). This provision directs each House committee to study future issues and developments that may affect matters under the committee's jurisdiction. The OTA report marked the first analysis published by the House as a direct result of the foresight provision.

Telecommunications, Computers, and Information Policies

In 1977, OTA initiated a planning effort to identify possible assessment issues involving telecommunications, computers, and information policies. OTA is evaluating such factors as new technologies and services, the interface between computers and communications, the use of the frequency spectrum, high-speed information systems, and trade and technology transfer opportunities as possible parts of such an assessment program.

The Office convened a workshop of representatives of the communications industry, Government, academia, and citizens groups to identify issues and problems in these areas. Those deliberations will help the OTA Board to decide whether to establish a new program area and to

select assessments dealing with telecommunications, computers, or information policies.

National Crime Information Center

The Federal Bureau of Investigation operates a nationwide, computerized information system, the National Crime Information Center (NCIC), which provides State and local law enforcement agencies access to files on wanted and missing persons. and missing and stolen properties, In 1977, the FBI proposed updating its computer system and decentralizing its Computerized Criminal History file.

At the request of the House Committee on the Judiciary, late in 1977, OTA undertook a preliminary examination of issues stemming from operation and management of NCIC. A workshop of experts representing diverse views and fields of knowledge identified issues and helped define the nature and scope of a full assessment that would meet the committee's legislative and oversight needs. This project will examine civil liberty, privacy, and due process issues, among others, raised by the proposed NCIC changes,

Natural Hazards

Earthquakes, hurricanes and tornadoes, droughts, floods, and other so-called natural disasters cause billions of dollars in property damage each year, leave thousands homeless, bring injury and death to hundreds of people. and create a multitude of social, economic, and financial problems for Government and private industry. The Federal Government has responded with programs offering flood insurance, low-cost loans for rebuilding damaged property, weather forecasting to give advance warning of approaching storms, and research to improve prediction of or actually prevent disasters such as earthquakes.

Some Federal programs. however, may actually increase the danger for people and property. Federal mortgage and insurance programs, for instance, may encourage housing and other construction on flood plains or earthquake faults. Moreover, no program has taken a holistic approach to the study of, or Government planning for, the mitigation, prevention, or control of natural hazards or their aftermaths.

At the request of the House Committee on Banking, Finance. and Urban Affairs, the Senate Committee on Banking, Housing, and Urban Affairs, and the Senate Committee on Appropriations, OTA initiated a planning study on natural hazards and their social, economic. environmental, and political consequences in late 1977, At year's end, OTA staff were structuring appropriate analyses and surveying the responsibility of various Government agencies. Workshops planned for 1978 will identify and clarify issues and determine if a full assessment is warranted,

New and Emerging Technologies

OTA's Board-initiated "early warning" planning project. begun in the fall of 1976, is developing means of identifying and gauging the implications of new and emerging technologies. The Technology Assessment Advisory Council has substantially contributed to this effort. Noting that social values often determine technological choices, it has focused on the relationship between society and technology.

During 1977 the Emerging Technologies group, in cooperation with the Aspen Institute for Humanistic Studies, organized a 1-week workshop on Technology and Social Change in July 1977. The workshop determined that better information on the development of new technologies and on changing social values and attitudes could help Congress opportunely identify and assess issues and consequences of such emerging technologies.

In 1978, the Emerging Technologies group further plans to develop a data base considering the relationship between technology and society

by working with ongoing OTA assessments and conducting small, independent, pilot studies. The group will provide information on social change to all OTA program areas. The program areas, in turn, will supply the Emerging Technologies effort with information on the interrelationship between society and technology developed in the course of their assessments. In addition, the Emerging Technologies group will work closely with selected OTA assessments, investigating how changing attitudes and behavior affect the emergence of the particular technology under study.

Following a parallel, longer range approach, pilot studies will investigate less developed technologies and/or shifts in social attitudes and behavior found in small percentages of the general population. The results of these studies are expected to broaden the data base concerning the relationships between technology and society.

Section V

ORGANIZATION AND OPERATIONS

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Created by the Technology Assessment Act of 1972 (86 Stat, 797), OTA is a part of and is responsible to the legislative branch of the Federal Government. OTA received funding in November 1973 and commenced operations as the second session of the 93rd Congress convened in January 1974.

The Act provides for a bipartisan congressional Board, a Director, a Deputy Director, and such other employees and consultants as may be necessary to conduct the Office's work. The Board is assisted by a Technology Assessment Advisory Council comprising 10 public members eminent in scientific, technological, and educational fields, the Comptroller General of the United States, and the Director of the Congressional Research Service of the Library of Congress. When requested, the Council may offer the Board advice on technology assessment matters.

The congressional Board sets the policies of the Office and is the sole and exclusive body governing OTA. The OTA Director is the chief executive officer and is responsible solely to the Board, on which he serves as a nonvoting member.

The congressional Board is made up of six senators, appointed by the President Pro Tempore of the Senate, and six representatives, appointed by the Speaker of the House, evenly divided by party. In 1977, Senator Edward Kennedy, D-Mass. , and Congressman Larry Winn, Jr., R-Kansas, served as the Chairman and Vice Chairman respectively of the Board. The two posts rotate between the Senate and House in alternate congresses. The Board members from each house select their respective officer.

In providing assistance to Congress, OTA is to: identify existing or probable impacts of technology or technological programs; where possible, ascertain cause-and-effect relationships; identify alternative technological methods of implementing specific programs; identify alternative programs for achieving requisite goals; estimate and compare the impacts of alternative methods and programs; present findings of completed analyses to the appropriate legislative authorities; identify areas where additional research or data collection is required to provide support for assessments; and undertake such additional associated activities as may be directed.

Initiation, Processing, and Flow of Assessments

OTA functions primarily to provide congressional committees with assessments or studies which identify the range of probable consequences, social as well as physical, of policy alternatives affecting the uses of technology. Requests for OTA assessments may be initiated by:

- The chairman of any standing, special, select, or joint committee of Congress, acting for himself, at the request of the ranking minority member, or a majority of the committee members;
- The OTA Board; or
- The OTA Director, in consultation with the Board.

The authorization of specific assessment projects and the allocation of funds for their performance is the responsibility of the OTA Board. The Board has established priority areas of study, and has approved individual assessment projects within those areas. To facilitate these decisions, the Board considers recommendations and plans developed by OTA staff, and applies the following general selection criteria developed in consultation with the Advisory Council:

- Is this now or likely to become a major national issue?
- Can OTA make a unique contribution, or could the requested activity be done effec-

tively by the requesting committee or another agency of Congress?

- How significant are the costs and benefits to society of the various policy options involved, and how will they be distributed among various impacted groups?
- Is the technological impact irreversible?
- How imminent is the impact?
- Is there sufficient available knowledge to assess the technology and its consequences?
- Is the assessment of manageable scope can it be bounded within reasonable limits?
- What will be the cost of the assessment?
- How much time will be required to do the assessment?
- What is the likelihood of congressional action in response to this assessment?
- Would this assessment complement or detract from other OTA projects?

Assessments emerge from the combined effort of a staff with appropriate expertise, citizen advisory panels of experts, consultants, contractors, and other congressional information agencies. A particular assessment project may involve exploratory meetings or workshops of advisory panels, staff analyses and consultant studies.

Different approaches are used. The method employed, personnel involved, and the skills tapped depend on the technology under study, the requesting client, the nature of the issues at stake, and the time available for and the setting of the project. Required to consider the needs of Congress, the vast range of technological issues, and the resources available for a study, OTA remains flexible in its study methods.

All OTA assessments strive to be objective, nonpartisan, and authoritative. They must also be timely if they are to meet congressional timetables.

Staffing and Organizational Structure

Staff professionals represent a wide range of disciplines and backgrounds, including the physical and biological sciences, engineering, social sciences, law, and public administration. Professionals from executive branch agencies, detailed to OTA on a temporary basis, and participants in several congressional fellowship programs also contribute to the work of the Office.

A chart detailing OTA's organizational structure accompanies this section.

Financial and Administrative Activities

An administrative officer oversees administrative and financial aspects of OTA operations, including procurement and contracting, budget and financial accounting and control, payroll, travel, office space, security, accounts payable and receivable, and other miscellaneous administrative support services.

A personnel officer is responsible for the development of personnel policies and procedures and their implementation. These include recruitment, selection, orientation and processing, classification, salary structuring, and performance evaluation.

A publications officer is responsible for the production, editing, layout and design, graphics, printing, and sale of OTA publications and other printed material.

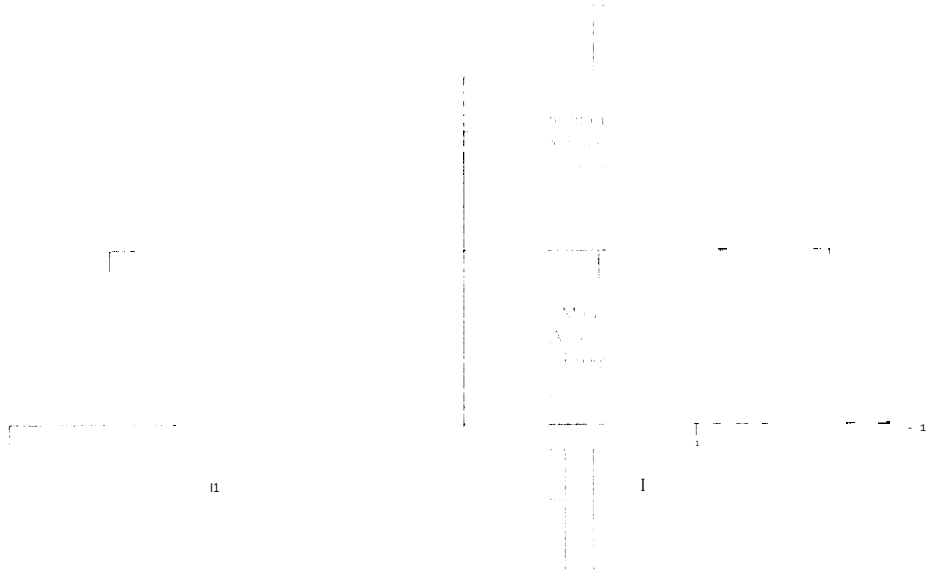
In response to the growth in demand for OTA assessments and increased costs, the OTA Board approved budget requests totalling $8.9 million for fiscal year 1978 for submission to Congress in 1977. Congress appropriated $7.4 million to OTA for fiscal year 1978. OTA carried over about $1.3 million from fiscal year 1977, and received $281,000 for the governmentwide pay raise.

Information Services

An information Services staff, which maintains an in-house library of books, reports, journals,

Office of Technology Assessment

Organizational Structure



Fiscal Year Summary of Obligations By Program Area, 1974-1979

Program	FY 1974	FY 1975	FY 1976 and Transition Qtr	FY 1977	Estimated Plan FY 1978	Estimated Budget Request FY 1979

and other materials on science, technology, and related areas, supports OTA activities. The library serves as a liaison to the Library of Congress as well as to other libraries and organizations throughout the Nation in order to meet the information needs of the OTA staff.

Current awareness tools and a computerized literature search service, the latter providing access to more than 75 computerized data bases, provide staff members with an extensive array of information services. The library is available to members of the general public who have a specific interest in technology assessment or in the work of the Office.

Public Participation and Public Affairs

Public involvement constitutes an important part of OTA's technology assessment process. In addition to the wide use of citizen advisory groups and consultants, the Office disseminates information to the various parties-at-interest so that they may become more effectively involved in OTA assessments. In keeping with this objective, meetings of OTA's congressional Board and Advisory Council are open to the public. An officer for public participation and a public affairs officer advise the OTA Director.

To support public involvement, the public affairs office through its mail list and the news media continually informs the general public, Congress, and affected or interested parties, of the initiation, status, and completion of assessments. The office responds to requests from both Congress and the general public for information about its activities. To further inform Congress and the public about OTA's activities, the public affairs office prepares and distributes the annual report.

Other Activities

OTA participates with the Congressional Budget Office (CBO), the Congressional Research Service (CRS) of the Library of Congress, and the General Accounting Office (GAO) in an interagency Research Notification System designed to coordinate the activities and exchange of information among the four congressional service organizations and avert duplication of effort. Representatives of the four agencies meet regularly, and each of the offices submits biweekly status reports on their program activities for publication in a central directory of congressional research activity.

Section VI

SUMMARY REPORT OF ADVISORY COUNCIL ACTIVITIES

Section VI
SUMMARY REPORT OF ADVISORY COUNCIL ACTIVITIES

Jerome B. Wiesner, Chairman

The primary activity of the Council is in working with the Technology Assessment Board (TAB) and the Director of OTA to promote and maintain a high standard of quality in OTA staff, programs, and products which Congress can use to improve decisionmaking about technological issues. In the past year, Council members increased their commitments of time and energy and accepted a number of special assignments from the Board. In doing so, the Council made progress in improving working relationships both within the Council and with members of the Board, particularly on the special assignments; productive performance of the Council is highly dependent upon close and efficacious communications between all parties involved.

With the conclusion of the special assignments and with the appointment of the new Director of OTA, the Council will now direct its energies towards establishing a better working relationship with the Director, towards stimulating improvements in OTA productivity, towards the identification of important issues to be studied, and toward oversight of programs for which the Council has particular responsibility. These plans for the future have been developed on the basis of the Council's progress in the past year.

The Council traditionally conducts much of its business of advising OTA at regularly scheduled meetings. In 1977, the Council increased the frequency of regular meetings to a monthly basis, because members felt that the previous schedule of bimonthly meetings did not provide sufficient opportunities to interact with each other and with other parts of OTA. At these meetings the Council reviewed the progress of ongoing OTA programs and assessments—such as the automobile assessment, and the materials assessments. These reviews provided occasions for the Council to monitor the progress of assessments and to make suggestions to OTA program managers on ways to improve their design and conduct. Regular meetings also included sessions with the Board Chairman, Senator Edward M. Kennedy, and Board Members, Congressmen Olin E. Teague, George Brown, and Clarence Miller. During interactions such as these, Members of both the Board and the Council offered suggestions, criticisms, and plans for OTA's progress. Increased frequency of meetings and interactions with the Board Members are an indication and a result of renewed commitment on the part of Council members to increase the efficacy of Council operations and to improve communications with the leadership of OTA.

The special assignments to which the Council was committed included: (1) screening prospective nominees for Council membership; (2) designing an evaluation of OTA to be conducted by the Council; and (3) screening candidates for the OTA Directorship. Each of these tasks involved substantial commitments from Council members, who responded generously.

The first assignment arose from the need to fill two vacant Council positions. One position was vacated when Dr. Harold Brown, then President of the California Institute of Technology, resigned upon accepting the post of Secretary of Defense. The other position was vacated by Dr. J. Fred Bucy, President of Texas Instruments, whose term expired at the end of 1976. The Board asked the Council to assist in nominating and screening prospective candidates for these positions. Council members responded by developing a set of criteria for Council membership, which they presented to the Board. Much of the discussion of these criteria focused on the need to expand the Council's resources by appointing members with diverse backgrounds. The Council then prepared a list of nominees, based upon their qualifications in accordance with the new criteria, and submitted this to the Board for con-

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sideration. From the group of highly qualified candidates, the Board appointed Dr. Charles Kimball, Chairman of the Board of the Midwest Research Institute, and reappointed Fred Bucy. Professor John McAlister had earlier been reappointed by the Board to a new term.

Even before completion of this first assignment, the Board requested that the Council undertake an extensive evaluation of the management and operations of OTA. Although the evaluation was later deferred, the Council did devote the greater part of 3 months to developing a plan of work for such an evaluation. Areas considered to be important for later analysis included: determination of those aspects of OTA's organization and practices that should be covered; consideration for those aspects of the evaluation that might duplicate or overlap with previous such efforts; determination of the greatest speed with which a thorough, high-quality study could be conducted; and determination of whom could be contracted to do the study and how such a selection would be made. After much discussion and hard work on a number of alternative work plans, the Council concluded that the resignation of OTA Director Emilio Daddario and a third assignment from the Board to aid in the search for a successor, precluded an extensive evaluation of OTA at that time. The Council then recommended, and the Board concurred, that the evaluation be postponed.

The third assignment, undertaken at the Board's request, was to screen and rate prospective nominees for the OTA Directorship. After Mr. Daddario, the first Director of OTA, resigned effective July 1, 1977, the Board decided to conduct a national search for suitable candidates. Board Chairman Kennedy sent out over 5,000 letters to scientific societies, technological enterprises, universities, and other appropriate groups, requesting nominees for an OTA Director. The response from all sources eventually totalled 219 names. Council members made special attempts to solicit names of qualified women and minority candidates. During the summer of 1977, the Council worked with the Civil Service Commission to compile and circulate dossiers on all propsective nominees. The Council then held multiple meetings to consider relevant criteria for choosing a Director, and to rank each prospective candidate based on those criteria. In mid-September, the Council submitted a complete set of dossiers and a final list of recommended nominees to the Board. After their own extensive deliberations, the Board offered the Directorship to Dr. Russell Peterson, President of New Directions. As part of his extensive qualifications, Dr. Peterson served as Governor of Delaware, as Chairman of the Council on Environmental Quality, and worked for the du Pont Company for 26 years as a research scientist and as manager of a variety of research, manufacturing, and sales organizations, the last 5 years as the Director of the Development Department's Research and Development Division, which he organized as an effort to get the du Pont Company into new fields.

Council members worked diligently on these special assignments, particularly the last one, and many of them reallocated time from other important pursuits to devote to the jobs requested by the Board. These tasks resulted in more opportunities for members of the Council to work closely with one another, and with the Board. The Council emerged from these tasks with strengthened commitment and unity, which can now be applied to its ongoing activities and responsibilities, as well as to any future special assignments from the Board.

The Advisory Council has a responsibility for promoting technology assessments in OTA of intermediate and long-term issues. In order to carry out this responsibility, the Council has become involved in two current programs at OTA. The Council oversees the R&D Policies and Priorities Program, and reviews the New and Emerging Technologies Program. Both of these programs progressed considerably in the past year. With the completion of special assignments, the Council will be able to devote energy more consistently to these responsibilities.

The R&D Policies and Priorities Program is composed of three panels of experts: Health of the Scientific and Technical Enterprise, R&D Decisionmaking, and R&D Applications. With the assistance of R&D Program staff and consult-

ants, the panels are mapping out many of the major issues of public policy and R&D, and they are preparing reports for Congress on the health of the scientific enterprise, national laboratories, social and technical demonstrations, possible reorganizations of science and technology in the executive branch, and other topics of importance in science policy. The R&D Program Steering Committee and the Advisory Council are now reviewing the staff, panels, and activities of the program, particularly in light of (1) the reduced FY 1978 OTA budget, (2) its urgent need to complete products useful to Congress, and (3) desire to present the new Director of OTA with maximum information regarding the work of the panels.

The New and Emerging Technologies Program covers another important and difficult-to-grasp aspect of OTA's operations. The ultimate purpose of this program is to explore ways in which OTA can anticipate, identify, and examine the effects of new technologies on society. The program is premised on the notion that decisions about technologies and policies to reduce anticipated negative effects will be more effective if implemented in the early stages of research and development. Early detection and warning may help ameliorate potential problems and negative impacts which could prove intractable at later stages of development. However, anticipation, prediction, and detection of impacts are no doubt most difficult at early stages of development when the implications of a technology are unclear. The New and Emerging Technologies Program is attempting to look at these tough problems, and to identify key issues and methods which might be used to solve them. As in the R&D Program, the Council will undertake a review of the New and Emerging Technologies Program in early 1978, and attempt to apply the insights it has gained to the continuing work of OTA.

A third aspect of the Council's responsibility to promote broader. longer term issues at OTA, is the Methodology Subcommittee, The Subcommittee, chaired by John McAlister of Stanford University, was active in early 1977, attempting to define criteria for the proposed Council evaluation of OTA management and operations. Because of the other urgent Council activities, this important task received relatively little attention from the Council members, and the Methodology Subcommittee was not able to develop a set of ongoing activities during this year. It is our expectation that the group will once again become active in the new year.

Individual Council members have contributed to selected aspects of OTA operations throughout the year. Frederick Robbins, on leave from his position as Dean of the Case Western Reserve University Medical School, chairs the OTA Health Advisory Panel; Hazel Henderson, of the Princeton Center for Alternative Futures, Inc., has participated in OTA's Appropriate Technology and Public Participation Task Forces; and Fred Bucy, President of Texas Instruments, contributed regularly to the Technology and World Trade activities at OTA.

In the past year the Council made some progress in working more effectively with the Board on OTA issues, though efforts must continue. Increased time commitments on the part of each Council member, special assignments from the Board, and the guidance of Board Chairman Kennedy, facilitated this development. Continued efforts in the new year should yield further improvements; one such effort currently underway is the plan to schedule joint monthly meetings of the Board and the Advisory Council.

The Council is now ready to work closely with the new Director in guiding OTA programs, and in promoting the consideration of broad, long-term issues at OTA. As one step in this direction, the Council hopes to aid the Director in establishing procedures for reviewing and making recommendations on requests for assessments and completed reports.

Despite some successes and ambitious future plans to aid OTA operations, the Council feels that it must improve its own activities if it is to justify its existence. Pressing commitments to full-time jobs often make it difficult for Council members to devote adequate time to Council matters and to attend Board meetings. For similar reasons, the Council's guidance of OTA pro-

grams and products is not often as careful and as close as it should be. Even so, the Council's activities in 1977 showed the members' abilities to commit time and energy to OTA when they were confronted with important problems. It may not be realistic to expect increased levels of participation from all members of the Council as it is presently constituted, but some additional effort appears possible.

One proposal to ameliorate limitations in time availability, and thus make the Council's operations more effective in the long run, is to expand the size of the Council. Such an expansion could build on the growing ability of the Council to work as a unit and on a desire on the part of Council members to aid the Board and the Director in serving the needs of Congress in analysis of complex technological issues.

The Council regards the opportunity to work with the OTA and Members of Congress as a rare privilege and a rewarding experience. With each passing day we appreciate more the extreme difficulty of making sound political judgments in areas where technical complexity and uncertainty dominate the consequences of decisions. OTA represents a daring innovation to provide Congress with assistance in its day-to-day tasks. We would hardly claim that an adequate process has evolved. However, we are greatly impressed with the amount and quality of analytical work that has been performed on a vast range of problems of importance to the Congress and the Nation. Working in the eye of the political storms has been a new and most exhilarating experience for nearly all members of the Council.

Despite the many complexities of the situation, important help has been given to the Congress and a start has been made toward creating the Technological Early Warning System that the original legislation mandated. The next year should see OTA truly become of age. Under the leadership of the new Director, Dr. Russell Peterson, and housed in adequate facilities for the first time, OTA faces a productive year ahead with many exciting challenges. The Council plans to join with the OTA Board, its Director, and staff, and all the members of Congress in actively encouraging the new thrust forward that OTA is poised to make.

APPENDIXES

Appendix A—List of Advisors, Consultants, Panel Members
Appendix B—List of OTA Reports Published
Appendix C-Roster of OTA Personnel
Appendix D-Technology Assessment Act of 1972

List of Advisors, Consultants, Panel Members

ENERGY ADVISORY COMMITTEE

Milton Katz. Chairman
Director, International Legal Studies, Harvard Law School

Thomas G Ayers
President and Chairman of the Board
Commonwealth Edison Company

Kenneth E Boulding
Institute of Behavioral Science
University of Colorado

Eugene G Fubini
Fubini Consultants, Ltd

John M Leathers
Executive Vice President
Dow Chemical USA

Wassily Leontief
Department of Economics
New York University

George E. Mueller
President and Chairman of the Board
Systems Development Corporation

Gerard Piel
Publisher
Scientific American

John Redmond
Executive Vice President (Retired)
Shell Oil Company

John C Sawhill
President
New York University

Chauncey Starr
President
Electric Power Research Institute

Direct Coal Utilization Panel

Harry Perry, Chairman
Resources for the Future, Inc

David Comey
Executive Director
Citizens for a Better Environment

A W Deurbrouck
Coal Preparation and Analysis Laboratory
Department of Energy

Michael Enzi
Mayor, City of Gillette. Wyo

Don Gasper
Director. Economic Studies
Consolidation Coal Co

D W Hallman
Engineering Department
E. I. du Pont de Nemours & Co

Lorin Kerr
Director. Department of Occupational Health
United Mine Workers of America

George Land
AMAX Coal Corporation

Ed Light
West Virginia Citizens Action Group

Robert Lundberg
Commonwealth Edison

Paul Martinka
American Electric Power Corp.

David Mastbaum
Staff Counsel
Environmental Defense Fund

Ken Mills
Tug Valley Recovery Center

Ralph Perhac
Electric Power Research institute

Michael Rieber
Center for Advanced Computation
University of Illinois at Urbana

Steve Shapiro
President, UMWA Local
New Hall, W. Va.

Ronald Surdam
Professor. Geology Department
University of Wyoming

Joanna Underwood
INFORM

Larry Williams
Electric Power Research Institute

Joseph Yancik
National Coal Association

Residential Energy Conservation Advisory Panel

John H. Gibbons, Chairman
Director. Environment Center
University of Tennessee

John Richards Andrews
Architect

Robert E. Ashburn
Manager, Economic Research Department
Long Island Lighting Company

Edward Berlin
Leva, Hawes. Symington, Martin & Oppenheimer

Ellen Berman
Director. Energy Policy Task Force
Consumer Federation of America

Joel Darmstadter
Senior Research Associate
Resources for the Future

Sherman B. Given
President
Morley Construction Company

Donald Holtzman
President
Holtzman Petroleum Co.

William Konyha
First General Vice President
United Brotherhood of Joiners & Carpenters

Bill Moore
Director of Construction
Gulf Reston

Donald Navarre
Vice President, Marketing
Washington Natural Gas Company

Harold Olin
Director of Construction Research
U.S. League of Savings Associations

David Rickelton
Consulting Engineer

Andy Sansom
Energy Institute
University of Houston

Samuel Stewart
Carlsen Co.

Grant Thompson
Director, Energy Conservation Project
Environmental Law institute

Solar Advisory Panel

Jerry Grey, Chairman
Consultant

William W. Caudill
Caudill, Rowlett & Scott

John J. Gunther
United Conference of Mayors

Klaus P. Heiss
ECON, Inc.

Morton Hoppenfeld
School of Architecture& Planning
University of New Mexico

Charles Luttman
The Ralph M. Parsons Company

James MacKenzie
Massachusetts Audubon Society

Majorie Meinel
University of Arizona

Larry T. Papay
Southern California Edison Company

Paul Rappaport
RCA—David Sarnoff Research Center

Floyd E. Smith
President
International Association of Machinists

Eph M. Sparrow
Department of Mechanical Engineering
University of Minnesota

Nuclear Proliferation and Safeguards Advisory Panel

Thomas L. Hughes, Chairman
Carnegie Endowment for International Peace

Frederick S. Carney
Perkins School of Theology
Southern Methodist University

Thomas B. Cochran
Natural Resources Defense Council, Inc.

David D. Comey
Executive Director
Citizens for a Better Environment

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Brookhaven National Laboratory

Leonid Hurwicz
Economics Department
University of California at Berkeley

George B. Kistiakowsky
Gibbs Memorial Laboratory
Harvard University

George Quester
Department of Government
Cornell University

Herbert Scoville, Jr.
Consultant

Henry deWolf Smyth
Department of Physics
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George J. Stathakis
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Nuclear Energy Programs Divison
General Electric Company

Theodore B. Taylor
Aerospace and Mechanical Space Sciences Department
Princeton University

Alvin M. Weinberg
Oak Ridge Associated Universities

Mason Willrich
School of Law
University of Virginia

Nuclear Weapons Technology Task Force

J. Carson Mark, Chairman
Los Alamos Scientific Laboratory

Thomas B. Cook
Sandia Laboratories

George B. Kistiakowsky
Gibbs Memorial Laboratory
Harvard University

Robert W. Selden
Lawrence Livermore Laboratory

Enhanced Oil and Gas Recovery Advjsory Panel

Richard Perrine, Chairman
Professor of Engineering& Applied Science
University of California at Los Angeles

Gerard Brannon
Chairman, Economics Department
Georgetown University

Frank Collins
Oil, Chemical and Atomic Workers International Union

Robert Earlougher
Chairman
Godsey-Earlougher, Inc.

Lloyd Elkins
Production Research
Amoco Production Company

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R&D PROGRAM

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National Legislative Director
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EXPLORATORY PROGRAM

Demographic Trends Influencing Elementary and Secondary Education

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* Member of Interagency Task Force.

Appendix B

List of OTA Reports Published

		Available through U. S. Government Printing Office		Available through National Technical Information Service	
		Stock Number	Price	Stock Number	Price
1. OTA- A- 1	Annual, Report, March 15, 1974			PB 246191	$3.75
2. OTA- A- 2	Technology Assessment Activities of the National Science Foundation, June 12 and 13. 1974 (Hearings before the OTA Congressional Board)			PB 248382	$300
3. OTA -H -3	Drug Bioequivalence, July 1974	052003-000377	$ .95	PB244862	$475
4. OTA -M -4	Requirements for Fulfilling a National Materials **Policy** August 1974			PB 250631	$775
5. OTA -T-5	Automobile Collison Data –Assessment of Needs and Methods of Acquisition			PB 244861	$8.50
6. (1)	"An Analysis of the Department of the Interior's Pro posed Acceleration of Development of 011 and Gas on the Outer Continental Shelf, March 1975 '			PB 252202	$400
7. (2)	An Analysis ldentlfying Issues in the Fiscal Year 1976 ERDA Budget, March 19752			PB 244863	$5.25
8. OTA- A-6	Annual Report, March 15, 1975	052070 -03050-3	$1 15	PB 244833	$4.25
9. OTA- 0-7	An Analysis of the Feasibility of Separating Exploration From Production of 011 and Gas on the Outer Continental Shelf. May 1975	052 003 -00095-4	$2.80	PB 248381	$8.75
10. OTA- T -8	Automated Guideway Transit An Assessment of PRT and Other New Systems, June 1975	052-002 0002(1-6	$365	PB 244854	$1025
11. OTA- O- 9	Oil Transportation by Tankers An Analysis of Marine Pollution and Safety Measures, July 1975	052-070-030917	$2.80	PB 244457	$925
12. (3)	Analyses of Effects of Limited Nuclear Warfare, September 1975.				
13. OTA- T- 10	The Financial Viabililty of Conrail. September 1975			PB 250630	$500
14.OTA-T-11	A Review of Alternative Approaches to Federal Funding of RAil Rehabilitation, September 1975			PB 250632	$500
15 OTA- E-12	An Analysis of the ERDA Plan and Program. October 1975	052-010 -00457-3	$3.85	PB 250636	$10 .00
16 OTA- E-13	An Analysis of the Impacts of the Projected Natural Gas Curtailments for the Winter 1975-76, November 1975			PB 250623	$4 .00
17 OTA- T -14	A Review of Naional Railroad Issues, December 1975			PB 250622	$550
18. OTA- T- 15	Energy. the Economy. and Mass Transit, December 197.5	052-()()3 001322	$2.00	PB 250624	$6.75
19. OTA- T- 16	An Assessment of Community Planning for Mass Transit, February 1976 Volume 1 Summary	052-()()3 00133-1	$180	PB 253679	$500
20. OTA- T -17	Volume 2 Atlanta Case Study	052-00300138-1	$1 15	PB 253680	$4.00

		Available through			
		U S Government Prlnting Office		National Technical Information Service	
		Stock Number	Price	Stock Number	Price
21. OTA-T-18	Volume 3: Boston Case Study	052-003 -00140-4	$1 15	PB 253681	$400
22. OTA-T-19	Volume 4: Chicago Case Study	052-003 -00141-1	$ 95	PB 253682	$450
23. OTA-T-20	Volume 5: Denver Case Study	052-003 -00143-8	$145	PB 253683	$450
24. OTA-T-21	Volume 6: Los Angeles Case Study	052-003 -00145-4	$145	PB 253684	$450
25. OTA-T-22	Volume 7 : Minneapolis-St. Paul Case Study	052-003 -00146-2	$ 85	PB 253685	$400
26. OTA-T-23	Volume 8: San Francisco Case Study	052-003 -00148-9	$1.35	PB 253686	$450
27. OTA-T-24	Volume 9: Seattle Case Study	052-003 -00149-7	$1 15	PB 253687	$400
28. OTA-T-25	Volume 10: Washington, D C Case Study	052-003 -00136-5	$105	PB 253688	$400
29. OTA-T-26	Volume 11: Technical Report			PB 253641	$750
30. OTA-T-27	Volume 12: Bibliography			PB 253642	$600
31. OTA-E-28	Comparative Analysis of the 1976 ERDA Plan and Program, May 1976	052-070 -03404-1	$280	PB 254794	$775
32. OTA-F-29	OTA Board Hearings. Food Information Hearings. (See OTA-F-35)			PB 258171	$1100
33. OTA-T-30	Automatic Train Control in Rail Rapid Transit, May 1976	052-070 -03479-3	$315	PB 254738	$800
34. OTA-A-31	Annual Report, March 15, 1976	052-003 -00152-7	$155	PB 253989	$550
35. OTA-E-32	A Review of the U.S. Environmental Protection Agency Environmental Research Outlook FY 1976 Through 1980, August 1976	052-003 -00200-1	$245	PB 258191	$5.50
36. OTA-T-33	The Feasibility and Value of Broadband Communications in Rural **Areas.** A Preliminary Evaluation, April 1976			PB 258095	$1000
37. OTA-H-34	Development of Medical Technology Opportunities for Assessment, August 1976	052-003 -00217-5	$1.80	PB 258117	$550
38. OTA-F-35	Food information Systems: Summary and Analysis, August 1976.	052-003 -00219-1	$155	PB 258172	$550
39. OTA-M-36	An Assessment of Alternative Stockpiling Policies, August 1976.	052-003 -00230-2	$3.10	PB 273191	$1175
40. OTA-O-37	Coastal Effects of Offshore Energy Systems. November 1976	052-003 -00245-1	$445	PB 274033	$1100
41. OTA-O-38	Volume II– Working Papers	052-003 -00246-9	$1200	PB 274034	$25.00
42. OTA-O-39	Coastal Effects of Offshore Energy Systems (Pamphlet), December 1976				
43. OTA-M-40	An Assessment of Information Systems Capabilities Required to Support U S. Materials Policy Decisions, January 1977	052-003 -00263-9	$325	PB 273642	$950
44. OTA-X-41	Technology Assessment Activities in the Industrial, Academic, and Governmental Communities (Hearings before the OTA Congressional Board), December 1976.	052-003 -00295-7	$3.50	PB 273435	$1300
45. OTA-X-42	Technology Assessment in Business and Government: Summary and Analysis, January 1977	052-003 -00306-6	$100	PB 273164	$4.50

		Available through			
		U S Government Printing Office		National Technical Information Service	
		Stock Number	Price	Stock Number	Price
46 OTA-TCI-43	A Preliminary Analysis of the IRS Tax Administration System, March 1977			PB 273143	$900
47 OTA-M-44	Engineering implications of Chronic Materials Scarcity, April 1977	052-003 -00344-9	$3.50	PB 273193	$1200
48 (4)	General Issues in Elementary and Secondary Education (Hearings before the Subcommittee on Elementary, Secondary. and Vocational Education), May 10, 11, 19774				
49 OTA-O-45	Establishing a 200-Mile Fishery Zone, June 1977	052-003 -00380-5	$240	PB 273578	$725
50 OTA- O- 46	Volume II– Working Papers			PB 273579	$1300
51 OTA- F- 47	Perspectives on Federal Retail Food Grading, June 1977	052-003 -00384-8	$210	PB 273163	$600
52 OTA-E-48	Nuclear Proliferation and Safeguards, June 19775			PB 275843	$1075
53 OTA- F- 49	Organizing and Financing Basic Research to Increase Food Production, June 1977	052-003 -00398-8	$160	PB 273182	$450
54 OTA- E-50	Nuclear Proliferation and Safeguards—Appendixes Volume I Volume II			 PB 275844 PB 275845	 $1650 $1650
55 OTA-E-51	Analysis of the Proposed National Energy Plan, August 1977	052-003 -00420-8	$400	PB 273148	$950
56 OTA-A-52	Annual Report. March 15, 1977	052-003 -00432-1	$250	PB 273189	$650
57 OTA-O-53	Transportation of Liquefied Natural Gas. September 1977	052-003 -00436-4	$325	PB 273486	$650
58 OTA-H-54	CAT Scanner (in press)				
59 OTA-H-55	Cancer Testing Technology and Sachharin, October 1977	052-003 -00471-2	$325	PB 273499	$725
60 OTA-H-56	Policy Implications of Medical information Systems, November 1977	052003 -00496-8	$250	PB 274857	$525
61 OTA- E- 57	Gas Potential From Devonian Shales of the Appalachian Basin, November 1977	052003 -00500-0	$250	PB 274856	$600
62 OTA-P-58	OTA Publications Listing, ' December 1977				
63 OTA-E-59	Enhanced Oil Recovery Potential in the United States. January 1978	(In press)			
	Applications of Solar Technology to Today's Energy Needs–Volume I, II, and Summary	Prepublication Draft (Depleted)			

[1]Published as Committee Print, Senate Committee on Commerce

[2]Published as Joint Committee Print, House Committee on Science and Technology. Senate Committee on Interior and Insular Affairs, and Joint Committee on Atomic Energy

[3]Published as Committee Print, Senate Foreign Relations Committee

[4]Published as Committee Print. House Committee on Education and Labor

[5]Praeger Publishing Company has reprinted the OTA report that was originally printed at the Government Printing Office Price $2150. hardcover Please direct all purchase orders to HoIt, Rinehart and Winston, 383 Madison Avenue, New York, N Y 10017

[6]Available at no charge from OTA Public Affairs Off Ice, Tele (202) 546-3590

[7]Included in appendix in publication OTA-O-7

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Appendix D

Technology Assessment Act of 1972

Public Law 92-484
92nd Congress, H. R. 10243
October 13, 1972

An Act

86 STAT. 797

To establish an Office of Technology Assessment for the Congress as an aid in the identification and consideration of existing and probable impacts of technological application; to amend the National Science Foundation Act of 1950; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Technology Assessent Act of 1972". Technology Assessent Act of 1972.

FINDINGS AND) DECLARATION OF PURPOSE

SEC. 2. The Congress hereby finds and declares that:

(a) As technology continues to change and expand rapidly, its applications are—

(1) large and growing in scale; and

(2) increasingly extensive, pervasive, and critical in their impact, beneficial and adverse, on the natural and social environment,

(h) Therefore, it is essential that, to the fullest extent possible, the consequences of technological applications be anticipated, understood, and considered in determination of public policy on existing and emerging national problems.

(r) The Congress further finds that:

(1) the Federal agencies presently responsible directly to the Congress are not designed to provide the legislative branch with adequate and timely information independently developed, relating to the potential impact of technological applications, and

(2) tile present mechanisms of the Congress do not and are not designed to provide the legislative branch with such information.

((1) Accordingly, it is necessary for the Congress to—

(1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such applications; and

(2) utilize this information, whenever appropriate, as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to ronsider support for, or management or regulation of, technological applications.

ESTABLISHMENT OF THE OFFICE OF TECHNOLOGY ASSESSMENT

SEC. 3. (a) In accordance with the findings and declaration of purpose in section 2, there is hereby created the Office of Technology Assessment (hereinafter referred to as the "Office") which shall be within and responsible to the legislative branch of the Government.

(b) The Office shall consist of a Technology Assessment Board (hereinafter referred to as the "Board") which shall formulate and promulgate the policies of the Office, and a Director who shall carry out such policies and administer the operations of the Office. Technology Assessment Board.

(c) The basic function of the Office shall be to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress. In carrying out such function, the Office shall: Duties.

(1) identify existing or probable impacts of technology or technological programs;

(2) where possible, ascertain cause-and-effect relationships:
(3) identify alternative technological methods of implementing specific programs;
(4) identify alternative programs for achieving requisite goals;
(5) make estimates and comparisons of the impacts of alternative methods and programs;
(6) present findings of completed analyses to the appropriate legislative authorities:
(7) identify areas where additional research or data collection is required to provide adequate support for the assessments and estimates described in paragraph (1) through (5) of this subsection; and
(8) undertake such additional associated activities as the appropriate authorities specified under subsection (d) may direct.

(d) Assessment activities undertaken by the Office may be initiated upon the request of:
(1) the chairman of any standing, special, or select committee of either House of the Congress, or of any joint committee of the Congress, acting for himself or at the request of the ranking minority member or a majority of the committee members;
(2) the Board; or
(3) the Director, in consultation with the Board.

Information, availability.

(e) Assessments made by the Office, including information, surveys, studies, reports, and findings related thereto, shall be made available to the initiating committee or other appropriate committees of the Congress. In addition, any such information, surveys, studies, reports, and findings produced by the Office may he made available to the public except where—
(1) to do so would violate security statutes; or
(2) the Board considers it necessary or advisable to withhold such information in accordance with one or more of the numbered paragraphs in section 552(b) of title 5, United States Code.

81 Stat. 54.

TECHNOLOGY ASSESSMENT BOARD

Membership.

SEC. 4. (a) The Board shall consist of thirteen members as follows:
(1) six Members of the Senate, appointed by the President pro tempore of the Senate, three from the majority party and three from the minority party;
(2) six Members of the House of Representatives appointed by the Speaker of the House of Representatives, three from the majority party and three from the minority party; and
(3) the Director, who shall not be a voting member.

Vacancies.

(b) Vacancies in the membership of the Board shall not affect the power of the remaining members to execute the functions of the Board and shall be filled in the same manner as in the case of the original appointment.

Chairman and vice chairman.

(c) The Board shall select a chairman and a vice chairman from among its members at the beginning of each Congress. The vice chairman shall act in the place and stead of the chairman in the absence of the chairman. The chairmanship and the vice chairmanship shall alternate between the Senate and the House of Representativee with each Congress. The chairman during each even-numbered Congress shall be selected by the Members of the House of Repreeentatives on the Board from among their number. The vice chairman during each

Congress shall be chosen in the same manner from that House of Congress other than the House of Congress of which the chairman is a Member.

Meetings.

(d) The Board is authorized to sit and act at such places and times during the sessions, recesses, and adjourned periods of Congress, and upon a vote of a majority of its members, to require by subpena or otherwise the attendance of such witnesses and the production of such books, papers, and documents, to administer such oaths and affirmations, to take such testimony, to procure such printing and binding, and to make such expenditures, as it deems advisable. The Board may make such rules respecting its organization and procedures as it deems necessary, except that no recommendation shall be reported from the Board unless a majority of the Board assent. Subpenas may be issued over the signature of the chairman of the Board or of any voting member designated by him or by the Board, and may be served by such person or persons as may be designated by such chairman or member. The chairman of the Board or any voting member thereof may Administer oaths or affirmations to witnesses.

Subpena.

DIRECTOR AND DEPUTY DIRECTOR

Appointment.

SEC. 5. (a) The Director of the Office of Technology Assessment shall be appointed by the Board and shall serve for a term of six years unless sooner removed by the Board. He shall receive basic pay at the rate provided for level III of the Executive Schedule under section 5314 of title 5, United States Code.

Compensation.

83 Stat. 863.

(b) In addition to the powers and duties vested in him by this Act, the Director shall exercise such powers and duties as may be delegated to him by the Board.

(c) The Director may appoint with the approval of the Board, a Deputy Director who shall perform such functions as the Director may prescribe and who shall be Acting Director during the absence or incapacity of the Director or in the event of a vacancy in the office of Director. The Deputy Director shall receive basic pay at the rate provided for level IV of the Executive Schedule under section 5315 of title 5, United States Code.

Employment restriction.

(d) Neither the Director nor the Deputy Director shall engage in any other business, vocation, or employment than that of serving as such Director or Deputy Director, as the case may be; nor shall the Director or Deputy Director, except with the approval of the Board, hold any office in, or act in any capacity for, any organization, agency, or institution with which the Office makes any contract or other arrangement under this Act.

AUTHORITY OF THE OFFICE

SEC. 6. (a) The Office shall have the authority, within the limits of available appropriations, to do all things necessary to carry out the provisions of this Act, including, but without being limited to, the authority to—
(1) make full use of competent personnel and organizations outside the Office, public or private, and form special ad hoc task forces or make other arrangements when appropriate;

Contracts.

(2) enter into contracts or other arrangements as may be necessary for the conduct of the work of the Office with any agency or instrumentality of the United States, with any State, territory,

or possession or any political subdivision the reef, or with any person, firm, association, corporation, or educational institution, with or without reimbursement, without performance or other bonds, and without regard to section 3709 of the Revised Statutes (41 U.S.C. 5) :

(3) make advance, progress, and other payments which relate to technology assessment without regard to the provisions of section 36-M of the Revised Statutes (31 U.S.C. .529) ;

(4) accept and utilize the services of voluntary and uncompensated personnel necessary for the conduct of the work of the Office and provide transportation and subsistence as authorized by section 5703 of title 5, United States Code, for persons serving without compensation;

80 Stat. 499; 83 Stat. 190.

(.5) acquire by purchase, lease, loan, or gift, and hold and dispose of by sale, lease, or loan, real and personal property of all kinds necessary for or resulting from the exercise of authority granted by this Act; and

(6) prescribe such rules and regulations as it deems necessary governing the operation and organization of the Office.

Recordkeeping.

(b) Contractors and other parties entering into contracts and other arrangements under this section which involve costs to the Government shall maintain such books and related records as will facilitate an effective audit in such detail and in such manner as shall be prescribed by the Office, and such books and records (and related documents and papers) shall be available to the Office and the Comptroller General of the United States, or any of their duly authorized representatives, for the purpose of audit and examination.

(c) The Office, in carrying out the provisions of this Act, shall not, itself. operate any laboratories, pilot plants, or test facilities.

Agency cooperation.

(d) The Office is authorized to secure directly from any executive department or agency information, suggestion+ estimates, statistics, and technical assistance for the purpose of carrying out its functions under this Act. Each such executive department or agency shall furnish tile information, suggestions, estimates, statistics, and technical assistance directly to the Office upon its request.

Personnel detail.

(e) On request of the Office, the head of any executive department or agency may detail, with or without reimbursement. any of its personnel to assist the (Mice in carrying out its functions under this Act.

(f) The Director shall. m accordance with such policies as the Board shall prescribe, appoint and fix the compensation of such personnel as may be necessary to carry out the provisions of this Act.

ESTABLISHMENT OF THE TECHNOLOGY ASSESSMENT ADVISORY COUNCIL

Membership.

SEC. 7. (a) The Office shall establish a Technology Assessment Advisory Council (hereinafter referred to as the "Council"). The Council shall be composed of the following twelve members:

(1) ten members from the public, to be appointed by the Board. who shall be persons eminent in one or more fields of the physical. biological. or social sciences or engineering or experienced-in the administration of technological activities, or who may be judged qualified on the basis of contributions made to educational or public activities;

(2) the Comptroller General; and

(3) the Director of the Congressional Research Service of the Library of Congress.

Duties.

(b) The Council, upon request by the Board, shall-

(1) review and make recommendations to the Board on activities undertaken by the Office or on the initiation thereof in accordance with section 3(d):

(2) review and make recommendations to the Board on the findings of any assessment made by or for the Office; and

(3) undertake such additional related tasks as the Board may direct.

Chairman and Vice Chairman.

(c) The Council, by majority vote, shall elect from its members appointed under subsection (a)(1) of this section a Chairman and a Vice Chairman, who shall serve for such time and under such conditions as the Council may prescribe. In the absence of the Chairman, or in the event of his incapacity, the Vice Chairman shall act as Chairman.

Term of office.

(d) The term of office of each member of the Council appointed under subsection (a)(1) shall be four years except that any such member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed for the remainder of such term. No persons shall be appointed a member of the Council under subsection (a)(1) more than twice. Terms of the members appointed under subsection (a)(1) shall be staggered so as to establish a rotating membership according to such method as the Board may devise.

Travel expenses.

80 Stat. 498; 83 Stat. 190. 5 USC 5701.

(e)(1) The members of the Council other than those appointed under subsection (a)(1) shall receive no pay for their services as members of the Council. but shall be allowed necessary travel expenses (or, in the alternative, mileage for use of privately owned vehicles and a per diem in lieu of subsistence at not to exceed the rate prescribed in sections 5702 and 5704 of title 5, United States Code), and other necessary expenses incurred by them in the performance of duties vested in the Council. without regard to the provisions of subchapter 1 of chapter 57 and section 5731 of title 5, United States Code, and regulations promulgated thereunder.

Compensation.

(2) The members of the Council appointed under subsection (a)(1) shall receive compensation for each day engaged in the actual performance of duties vested in the Council at rates of pay not in excess of the daily equivalent of the highest rate of basic pay set forth in the General Schedule of section 5332(a) of title 5, United States Code. and in addition shall be reimbursed for travel, subsistence, and other necessary expenses in the manner provided for other members of the Council under paragraph (1) of this subsection.

UTILIZATION OF THE LIBRARY OF CONGRESS

SEC. 8. (a) To carry out the objectives of this Act, the Librarian of Congress is authorized to make available to the Office such services and assistance of the Congressional Research Service as may be appropriate and feasible.

(b) Such services and assistance made available to the Office shall include, but not be limited to, all of the services and assistance which the Congressional Research Service is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the Congressional Research Service under law performs for or on behalf

of the Congress. The Librarian rs, however, authorized to establish within the Congressional Research Service suc II additional divisions, groups, or other organizational entities as may be necessary to carry out the purposes of this Act.

(d) Services and assistance made available to the (Mice by the Congressional Research Service in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Librarian of Congress.

UTILIZATION OF THE GENERAL ACCOUNTING OFFICE

SEC. 9. (a) Financial and administrative services (including those related to budgeting, accounting, financial reporting, personnel, rind procurement) and such other services as may be appropriate shall be provided the Office by the General Accounting Office.

(b) Such services and assistance to the Office shall include, but not be limited to, all of tile services and assistance which the General Accounting Office is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the General Accounting Office under law performs for or on behalf of the Congress.

(d) Services and assistance made available to the Office by the General Accounting (Mice in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Comptroller General.

COORDINATION WITH THE NATIONAL SCIENCE FOUNDATION

SEC. 10. (a) The Office shall maintain a continuing liaison with the National Science Foundation with respect to—

(1) grants and contracts formulated or activated by the Foundation which are for purposes of technology assessment; and

(2) the promotion of coordination in areas of technology assessment, and the avoidance of unnecessary duplication or overlapping of research activities in the development of technology assessment techniques and programs.

Scientific programs, financing. 92 Stat. 360.

(b) Section 3(b) of the National Science Foundation Act of 1950, as amended (42 U. S.C. 1862 (b)), is amended to read as follows:

"(b) The Foundation is authorized to initiate and support specific scientific activities in connection with matters relating to international cooperation, national security, and the effects of scientific applications upon society by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such activities. When initiated or supported pursuant to requests made by any other Federal department or agency, including the (Mice of Technology Assessment, such activities shall be financed whenever feasible from funds transferred to the Foundation by the requesting official as provided in section 14(g), and any such activities shall be unclassified and shall be identified by the Foundation as being undertaken at the request of the appropriate official."

64 Stat. 156; 82 Stat. 365. 42 USC 1873.

ANNUAL REPORT

SEC. 11. The Office shall submit to the Congress an annual report which shall include, but not be limited to, an evaluation of technology assessment techniques and identification, insofar as may be feasible, of technological areas and programs requiring future analysis. Such report shall be submitted not later than 11 March 15 of each year.

APPROPRIATIONS

SEC. 12. (a) To enable the Office to carry out its powers and duties, there is hereby authorized to be appropriated to the Office, out of any money in the Treasury not otherwise appropriated, not to exceed $5,006,000 in the aggregate for the two fiscal years ending June 30, 1973, and June 30, 1974, and thereafter such sums as may be necessary.

(b) Appropriations made pursuant to the authority provided in subsection (a) shall remain available for obligation, for expenditure, or for obligation and expenditure for such period or periods as may be specified in the Act making such appropriations.

Approved October 13, 1972.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 92-469 (Comm. on Science and Astronautics) and No. 92-1436 (Comm. of Conference).
SENATE REPORT No. 92-1123 (Comm. on Rules and Administration).
CONGRESSIONAL RECORD, Vol. 118 (1972):
Feb. 8, considered and passed House.
Sept. 14, considered and passed Senate, amended.
Sept. 22, Senate agreed to conference report.
Oct. 4, House agreed to conference report.