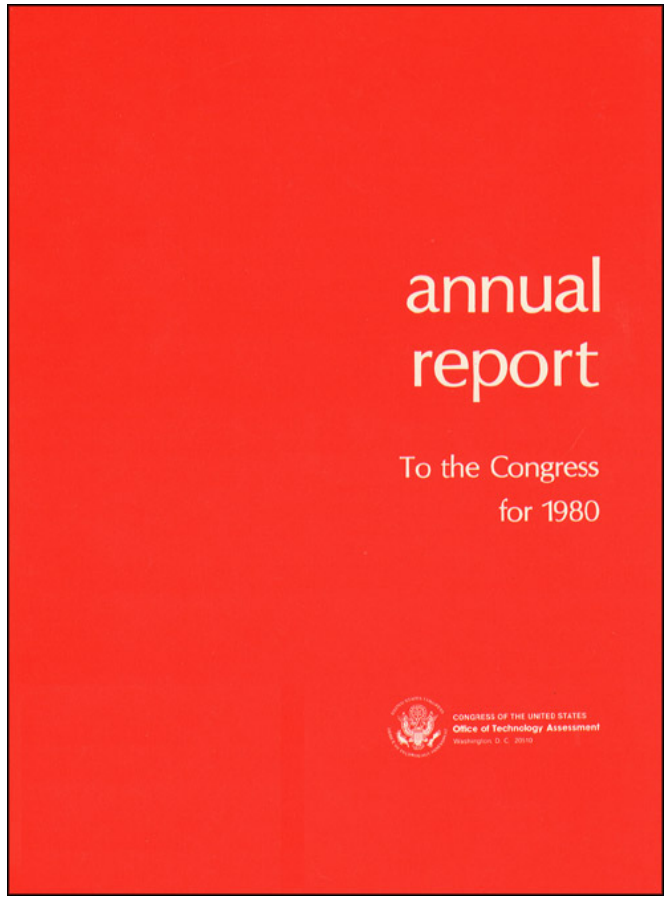
Annual Report to the Congress for 1980

March 1981





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Section I

STATEMENTS BY THE CHAIRMAN AND VICE CHAIRMAN OF THE BOARD AND THE DIRECTOR OF OTA

Section I
STATEMENTS BY THE CHAIRMAN AND VICE CHAIRMAN OF THE BOARD AND THE DIRECTOR OF OTA

Chairman's Statement—Congressman Morris K. Udall

As a charter member of the OTA Board, I take pride in the reputation the agency has built of doing some of the "best work in town ."

Last year, OTA demonstrated how deserved that reputation is as it produced a variety of useful work for Congress.

As Chairman of OTA's Congressional Board for the past 2 years, I'm happy to report that OTA's performance measures up to the high standards we have set. The agency merits our continued confidence and support.

I've had the good fortune to have Sen. Ted Stevens of Alaska serve as my Vice Chairman. His contributions have been a real asset to me and to the agency, and I look forward to working with him 2 more years,

We regret that Dr. Frederick C. Robbins resigned the chairmanship of the Technology Assessment Advisory Council to accept the presidency of the National Institute of Medicine, but we are pleased that he will remain an active member of the Council. We are delighted that Dr. Robbins will be succeeded by Dr. Charles N. Kimball, and that Dr. Jerome B. Wiesner will serve as Vice Chairman. Together, they will make an extraordinarily effective team in advising Congress and OTA on the difficult challenges posed by scientific and technological developments.

The Board especially appreciates the fine job that Dr. John H. Gibbons has done in strengthening and streamlining the internal management of the agency and thus enabling it to meet the needs of Congress more efficiently and effectively. The Office could not be in better hands.

OTA accomplished a lot last year. It delivered a total of 27 reports and other studies to various committees of Congress. OTA representatives testified 17 times before 9 different committees and gave 249 briefings and responses for Members of Congress, committees, and congressional staff. In terms of sheer volume, that is an impressive amount of work for a small agency to produce in a year's time —especially when it was, at the same time, engaged in an additional 33 other major projects.

Last year, OTA produced major and pathbreaking assessments on such subjects as the potential for producing energy from oil shale resources and from our "biomass" resources—our trees, crops, and other plant material; and the technological and competitive strength of our steel industry. The value of these and similar assessments to Congress, and to the larger com - munity of those informed and concerned about vital issues, is underscored by the fact that, according to a Government Printing Office (GPO) spokesman, OTA reports are among the bestselling in its category of any Government agency. During the calendar year 1980, GPO had sold over 48,000 copies of OTA reports for gross receipts of one-quarter of a million dollars. The National Technical Information Service of the Department of Commerce also sells individual copies and microfiche of all OTA reports and working papers. The demand is in the thousands with 20 titles on NTIS' bestseller list. In addition, an increasing number of OTA assessments are being reprinted by commercial publishers. By the end of the year, nine were either already in print or were in the process of being reprinted. Section V provides a more detailed listing of these highlights.

In **a** city overwhelmed by studies and analyses, OTA's work stands out for its integrity, its insight, and its usefulness to Congress.

I am proud to have served as Chairman of the OTA Board during the past 2 years. I look for-

ward with eagerness to working with Ted Stevens and my other colleagues in guiding the efforts of this important agency for another productive 2 years.

Vice Chairman's Statement—Senator Ted Stevens

As a member of the OTA Board since 1973, and as its Vice Chairman during the last Congress, I believe that 1980 must rank as the most productive and certainly the most satisfying year in the agency's young life.

The best evidence that our joint efforts have succeeded over the past year—is the fact that the committees keep coming back for more. While the volume of congressional requests for OTA studies and services increased, OTA demonstrated an ability to handle this increased volume, despite the fact that the size of its small staff remained the same.

As Chairman during the last Congress, Congressman Udall of Arizona guided the work of the Board with a deft hand. I know I speak for all on the Board when I say it was a pleasure to serve with him.

I look forward to working with other Members of the Board in helping OTA forge even more productive relationships with the committees of Congress. Science and technology will play an important role in maintaining the strength of the Nation's economy and national defense in the years ahead. Congress faces issues requiring the kind of expert, objective, and cross-cutting analysis that OTA performs while reflecting the perspectives of the private sector. Together, we can continue to build on OTA's already excellent record of meeting congressional needs for honest and unbiased advice.

Director's Statement—John H. Gibbons

OTA continued, in 1980, to work on some of the toughest and most important issues before Congress.

For example, one of the last bills Congress sent to the President in 1980 makes pneumococcal vaccine an acceptable medicare expense. Before that, medicare funds could be used for the more expensive and less effective task of treating pneumonia after it happened, but not for preventing it. OTA did some key analysis on this issue, showing that the vaccine was clearly cost effective.

In a similar vein, OTA did several comprehensive analyses on energy supply and availability. The work on liquids from shale showed both the promise and the problems of achieving significant shale oil production over the next 8 to 12 years. It also highlighted the inefficiencies inherent in either very modest or very ambitious production goals for 1990. Our work on oil shale also disclosed barriers to production which would limit plausible production by 1990 to a maximum of 1 million barrels of oil per day with severe regional impacts above 300,000 barrels per day. Our analysis of the energy potential of biomass underscored the major importance of producing methyl alcohol from nonfoodstuffs —which far outweighs the potential for production of ethanol from grains and sugars.

Our studies of the U.S. and foreign steel industry pointed out the opportunities provided by advanced, proven technologies such as continuous casting; the need for major capital investment in new, more productive facilities; and the need for higher levels of R&D spending to enable the industry to benefit from innovative technologies.

These are a few examples of the wide range of work we produced last year. Because much of that work centers around the comprehensive analysis of controversial issues, our studies typically require more than a year to complete. Thus, much of OTA's formal agenda of work for 1981 is already set, generally reflecting bipartisan requests from various congressional committees. On top of these formal assessments, which re-



Photo credit *O/f/cc of Technology Assessment*

Congressman Udall chairing a joint meeting of the Congressional Board and the Technology Assessment Advisory Council

quire staff expertise, the use of external contractors, and the advice of distinguished panels of private citizens, OTA provides a wide variety of assistance to committees, using information derived both from past and current assessment projects.

OTA's Congressional Board and the Technology Assessment Advisory Council provided key leadership and guidance throughout the year. The Board helped OTA's management make difficult choices between competing needs for OTA's resources. It gave wise counsel in such areas as choice of work, division of attention between long-term and near-term issues, and on ways to improve the transfer of technical information to Congress. The Advisory Council reviewed the Office's program of work and supplied important insights concerning its quality and comprehensiveness, as well as helping identify emerging issues that will likely be subjects for future OTA assessments.

As technology becomes increasingly important in maintaining a vigorous economy, OTA's unique capabilities to provide a variety of analytical services will be especially helpful to the 97th Congress. The OTA staff will continue to count on the leadership of the Technology Assessment Board, the advice of the Technology Assessment Advisory Council, and the generous devotion of time and wisdom of the scores of advisors, consultants, and contractors from the private sector. It is this remarkably broad involvement of people that is a hallmark of OTA.

Emerging Issues of the 1980's

OTA always tries to be as responsive as possible to the interests and priorities expressed by committees. At the same time, OTA is constantly made aware, from a wide variety of contacts, of emerging issues in science and technology. The following is a brief profile of a few issue areas in technology that we believe will be of increasing concern to Congress.

• Areas where science and technology are changing rapidly. Fruits of scientific research provide a richer understanding of our world and also serve as a main source for social progress through an advancing economy. Three examples illustrate this point:

1. Molecular engineering. —The present and prospective rate of advance in molecular biology research is phenomenal and is exceeded only by the diverse and powerful implications it holds for society. Areas in

which applications will probably be significant in this decade include production of complex biochemical needed to treat human disorders and diseases, development of improved food material, and creation of specialized enzymes and microbes to upgrade organic materials and digest toxic wastes. Perhaps the most important application of this new knowledge about how life works will be to improve the treatment of human illness.

2. Microelectronics. —A steady advance in research in another "micro world''—of surfaces, solids, semiconductors, and superminiature electronic circuits—promises continued technological developments that will have an impact on our national security and in virtually every sector of our economy. The same advances in the physics and chemistry of solid and liquid surfaces that will allow more effective computers and telecommunication devices will also lead to more effective ways to convert sunlight to storable, high-grade energy. Implications for society will be profound as "smart" electronics both create and displace jobs and create new patterns of social communication.
3. Energy. —Driven by higher oil prices and projected scarcities of current energy sources, research in both new energy sources (e. g., fusion) and in ways to use energy more productively (fuel substitution and conservation) is accelerating. The future will probably be characterized by higher costs of resources and uncertainty of supply. This implies continuing congressional interest, especially when market signals do not adequately reflect either marginal (replacement) costs of energy or nonmarket costs such as those associated with our dependence on imports.

• Situations where there are major socioeconomic impacts from existing technologies or where important opportunities exist for using technology to meet national needs. Toxic and hazardous wastes are current examples. These unwanted residuals from the processing and use of resources will not go away through protracted arguments and adversary proceedings. However, a variety of technologies strategies exist that can be employed to: 1) clean up old hazardous waste storage sites that pose a threat to health and the environment; 2) improve the way that presently generated wastes are handled; and 3) reduce waste in streams by process modifications that produce the same product, or other modifications that lead to somewhat different products that perform the same tasks.

A second major set of examples concerns international security. Threats to security derive from diverse origins such as shifts in comparative military capabilities of various nations and coalitions (especially NATO, the Warsaw Pact, and the PRC); short-term and protracted vulnerability of U.S. access to world oil supplies; and the erosion of U.S. competitiveness in international trade. In each instance, improved scientific and technological capabilities must play a critical role in improving American security.

• Long-term trends related to science and technology. One important responsibility of OTA is to provide foresight about the longer-term future, especially as it might be shaped by current policy, evolving technology, and underlying forces such as demographic change and resource depletion.

1. Much is known about the profound but sharply different demographic changes faced domestically and in less industrialized countries. But little thought has been given to the kinds of impacts the various demographic patterns will have on technological innovation or on demand for technological development.
2. The rapid advances in computers and telecommunications provide manifold opportunities to improve human productivity, use resources more efficiently, and provide new amenities. Substantially more comprehensive thinking about the broad social and economic implications of these new technologies (e. g., on employment) appears justified.
3. We are beginning to recognize some "diseconomies of scale, " e.g., with respect to powerplants. Major technological opportunities exist to allow efficient economic operations on a smaller or decentralized

scale. At the same time we must not lose sight of the tremendous contribution that economy of scale can make. The challenge is to find the optimum scale for each technological application in the face of changing prices of resources.

4. There is increasing concern that human activity is beginning to stress the capacity of the Earth to supply resources and absorb wastes. It is extremely important that we improve our understanding of the extent to which these concerns are justified. To the extent that they are, it is vital that we identify and assess the various courses of action that can ameliorate the situation. Advanced science and technology will be central to this effort.

Resolving the Issues of the 1980's

As science and technology provide greater capability both to provide amenities and to wage war; as human population increases and migrates: as extraction of mineral and energy resources leads inexorably to dependence on lower grade or less accessible resources; and as collective human activity increasingly affects the whole environment of our planet, we must respond with greater wisdom. Human ingenuity seems to be the one resource whose limits are not measured and certainly not fully engaged. This ingenuity becomes manifest in several ways, including science, technology, and institutional innovation.

Q Ingenuity expressed in science gives us understanding about the opportunities–and the limits—provided through natural law.

- Ingenuity expressed through technology provides us with diverse ways to achieve our many wants and needs. There are many ways in which technological ingenuity can provide amenities with more efficient use of increasingly scarce resources.
- Ingenuity expressed through institutions provides us opportunities to bring our accumulated learning and collective wisdom to bear on our needs and problems. New cooperative arrangements throughout our society and especially between the public and private sectors are needed to take full advantage of technology. New approaches to social, economic, and technological conflict resolution beyond adversary processes need to be devised.

How do we build a future that will offer to all our citizens the high standard of living and level of amenities that many already enjoy and that others aspire to, when that future will inevitably contain more people, more expensive resources, and less margin for error? How do we make this future sustainable, when many of our habits and ways of doing things were developed during an era of low population and inexpensive, seemingly inexhaustible resources? To what extent can technology help us make the transition to a more demanding and less forgiving future? Can an economy be devised which, like the mature ecosystem, is highly competitive and innovative while still in some form of overall equilibrium?

These are some of the difficult and searching questions that will confront Congress in the years ahead. Clearly, technology assessment has a major role to play in helping Congress explore them.

Section II
YEAR IN REVIEW

The assessments carried out by OTA cover a wide spectrum of major issues before Congress and the country and examine a broad range of policy options and their potential impacts. To provide examples of the breadth and depth of OTA's work, summaries of reports published by the Office in 1980 are presented in this section. Also included are summaries of Technical Memoranda, issued by OTA on specific subjects analyzed in recent OTA reports or on projects in progress at OTA. Technical Memoranda are neither reviewed nor approved by the Technology Assessment Board.

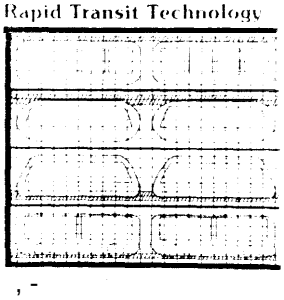
The reader is cautioned that these are summaries of reports. They do not cover the full range of options considered or all of the findings presented in any individual report.


Energy Programs of the
Department of Energy
A Critique
FORECASTS OF
PHYSICIAN
SUPPLY AND
REQUIREMENTS
THE IMPLICATIONS OF
COST-EFFECTIVENESS
ANALYSIS OF
MEDICAL TECHNOLOGY
AUGUST 1980
Impact of
Advanced Group
Rapid Transit Technology
IMPACT OF ADVANCED
AIR TRANSPORT
TECHNOLOGY
Part I
Advanced High-Speed
Aircraft
Explosives
Discrete Address
Beacon System (DABS)
An Assessment of
Oil Shale Technologies
ALTERNATIVE
ENERGY
FUTURES
Part I
Future of Liquefied Natural Gas Imports
LNG
Technology and
Steel Industry
Competitiveness
Energy From
Biological Processes

Section II
YEAR IN REVIEW

Group Rapid Transit Technology

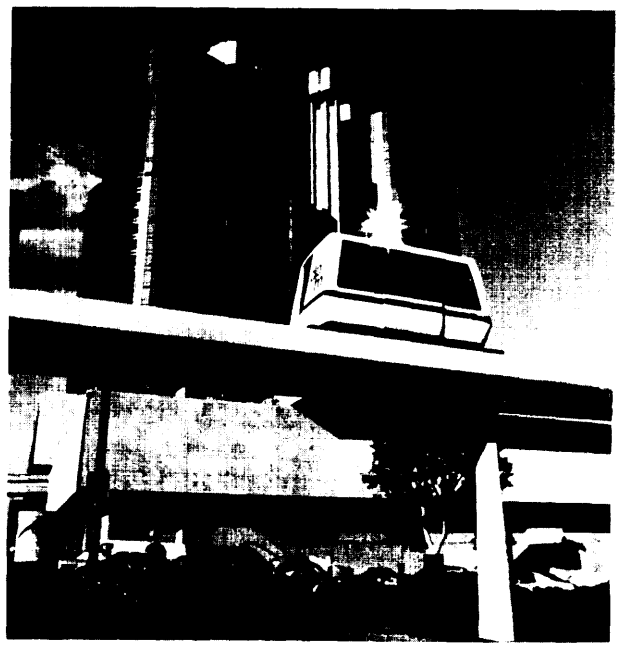
Driveless transit vehicles operating on ex - cl u sive g u i deways. known as automated guide- way transit (AGT). could with further development offer better service at less cost than current rail and trolley systems. This is among the major findings of an OTA study which evaluates the need for continued development of third-generation AGT technology. called advanced group rapid transit (AGRT), now funded by the Urban Mass Transportation Administration



First- and second-generation AGT systems are currently operating in airports, universities, hospital complexes, amusement parks, and shopping centers, Third-generation AGRT systems are being developed with vehicles that carry 12 passengers from origin to destination without transfers at speeds of up to 40 mph.

Users and nonusers alike are critical of the lack of amenities, infrequent service, unreliability, crowding, and inconvenience characteristic of transit services currently available in most cities, Technological innovations that may result from the AGRT program could help to address these problems by making transit more attractive through improved trip time, convenience, comfort, flexibility, and frequency of service. The public desires the further advances that AGT should be able to provide.

In the 1980's, cities will face increasing pressure to adopt more space- and fuel-efficient transit systems to meet the challenge of petroleum shortages, urban sprawl. and growing congestion, Barring major policy and lifestyle changes. traffic congestion in cities is expected to double by the year 2000. Automated systems are widely regarded as promising new options for addressing these in certain problem urban areas.



Downtown People Movers belng planned In several U S cities

It is too early in the development cycle, however. to predict which of several technologies currently being pursued will prove superior for most uses. The selection of a single-system con cept wou]d appear premature at this time.

Cost comparisons with existing urban rail technology look favorable, but will require validation in a real-world installation, Questions requiring further study include: reliability of new technology; community acceptance of elevated guideway designs: emergency evacuation from narrow elevated guideways; operating problems in ice and snow; and public attitudes toward sharing small, automated vehicles with strangers.

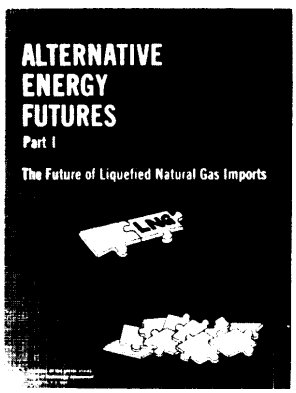
There is no guarantee that these systems will be marketed, even if the research and development (R&D) goals are met. Industry is finding it increasingly difficult to justify production of any transit technology, given a history of uncertain Federal support, unrealistic development timetables, complex institutional barriers, and the lack of established, stable markets. In West Germany

and Japan, a cooperative relationship between government and industry exists which has helped ensure an orderly program of long-range transit innovation and healthy transit equipment manufacturers. A closer examination of foreign government-industry relations is warranted.

While development of advanced AGT systems offers the prospect of improved transit services, urban transportation problems do not lend themselves to a single, all-encompassing solution. Other near- and long-term options which deserve consideration include expanded use of carpools and vanpools, transportation system management techniques, land use policies, and upgrading existing bus and rail technology.

Future of Liquefied Natural Gas Imports

Despite current administration policy of discouraging imports of liquefied natural gas (LNG) from overseas, such imports could be desirable as part of a strategy to meet future U.S. energy demand. Specific import proposals should be judged on their individual merits in the light of the following findings.



By 1990, LNG imports could double from the currently approved level of 0.8 trillion cubic feet per year (Tcf/yr) to between 1,3 and 1,8 Tcf/yr—less than one' -tenth of present domestic gas production. Imports will probably not exceed those levels because of political instability in [ran, the absence of any economic advantage in exporting gas for some other European and Japanese markets, and restrictions on trade with the Soviet Union. The likely sources of U.S. imports outside North America include Nigeria, Indonesia, Australia, Malaysia, Trinidad, Colombia. and Chile.

Since not all potential LNG exporters are major oil producers or members of OPEC, cutbacks in foreign oil supplies do not automatically mean cutbacks in gas supplies. Moreover, LNG exporters generally have a greater financial stake than oil producers do in uninterrupted shipments, because they cannot easily find alternative purchasers with appropriate terminals, and because project revenues must pay for the large amounts of debt exporters incur for liquefaction facilities. To the extent that Maritime Administration and Export-Import Bank programs promote involvement of U.S. owners and creditors in LNG ships and facilities, the exporter's stake in uninterrupted revenues diminishes. The United States could ease the adverse impacts of any interruption through the present priority curtailment system and by sales and exchanges among gas wholesalers.

Over the next decade, domestic gas production will probably satisfy essential requirements, but neither domestic sources nor pipeline imports from Canada and Mexico are likely to meet additional demand except at costs equal to or greater than that of LNG. Delivered gas from LNG is likely to cost about the same as competing fuels, less than synthetic fuels and distillates from foreign crude oil, and more than currently regulated domestic natural gas. Customers also assume part of the financial risks associated with an LNG project by paying gas prices regulated to allow investors to recover portions of their initial costs, regardless of the project's subsequent commercial success or failure,

Gas from LNG imports will generally be used at least partly, and possibly entirely, in manufacturing and electric generating applications. Under the Natural Gas Policy Act of 1978. the cost of added supplies will not necessarily be borne by the customers receiving them. Industrial customers will probably pay a price close to that of alternative fuels and of LNC~ itself, and electric utilities and purchasers of electricity will receive a subsidy in the form of "exempt" prices under the Act. Although households and commercial establishments would probably receive little additional gas, at least initially, the price levels in these sectors will rise or fall in response to the higher cost of LNG and to any savings that may result from the more economical use of transmission and distribution capacity that LNG makes possible.

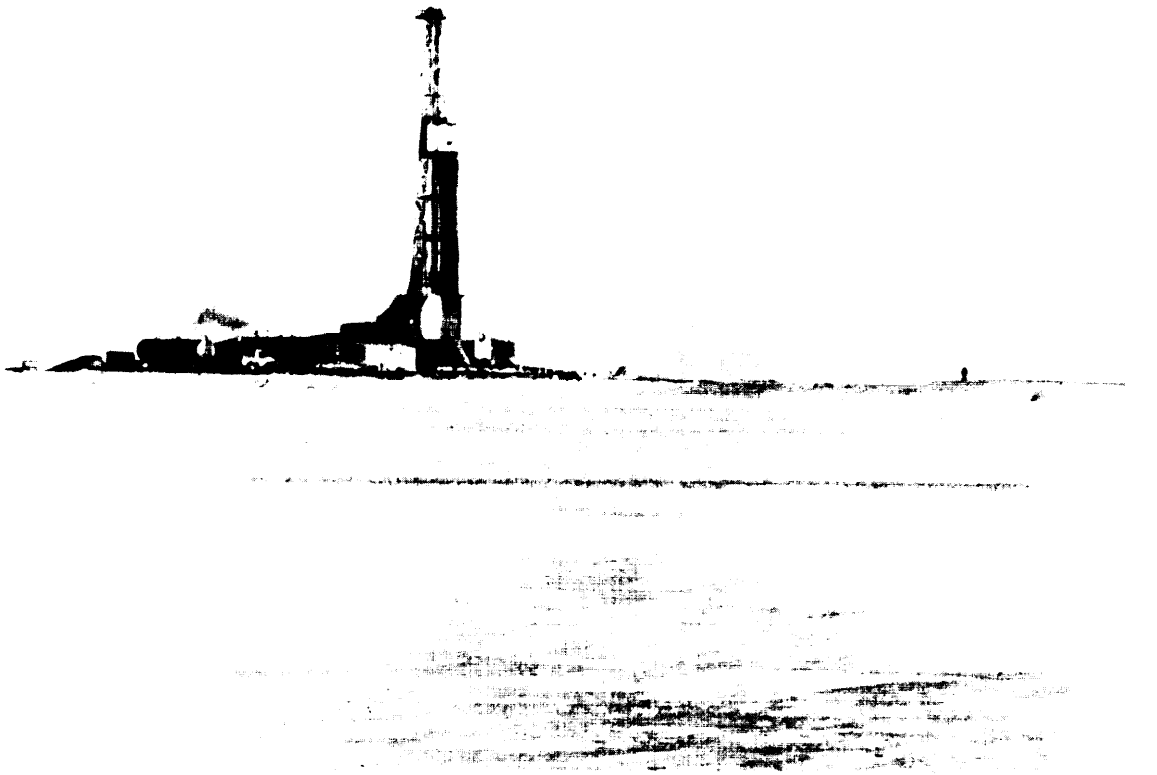


Photo credit Courtesy of American Gas Association

Alaska's North Slope contains new reserves of natural gas At Prudhoe Bay, this rig is typical of initial exploratory and productlon efforts

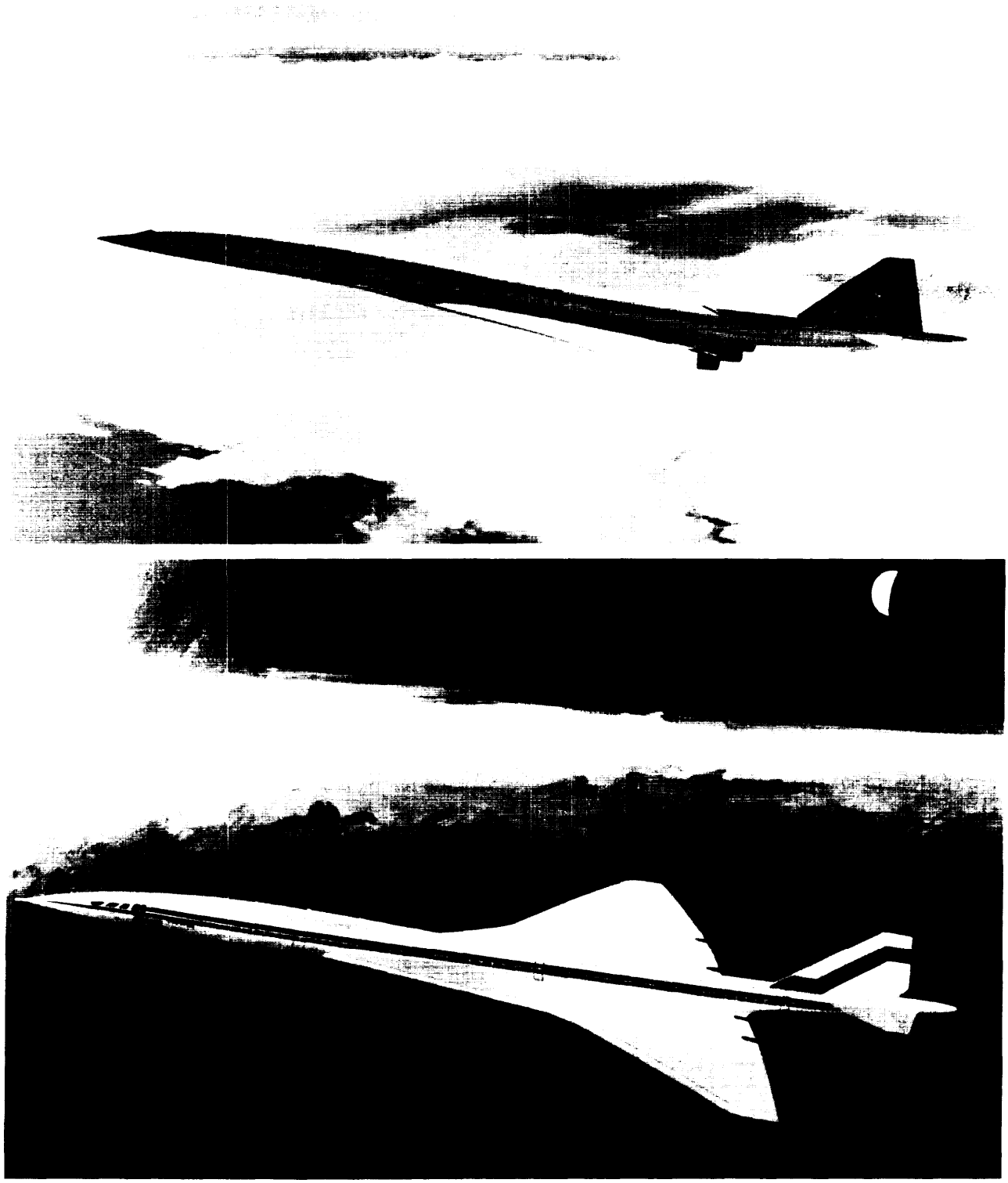
Advanced High-Speed Aircraft

Barring some major disruption in the growth of the world economy, and assuming reasonable success in coping with increasingly costly energy, the total market for air travel and commercial aircraft could continue to expand in the future. In the 1990's, the current fleet of jet transports may need replacement and the aerospace industry may want to consider technologically advanced transports of either subsonic or supersonic design. However, developing that new technology for either type of advanced aircraft will be extremely costly.



If an economically viable and environmentally acceptable advanced supersonic transport (AST) could be built in the 1990-2010 period, it could command some $50 billion of sales in 1979 dollars or about one-third of the total sales anticipated for the long-distance market through 2010. However, whether such an AST can or will be built depends on the future price and availability of fuel, the ability to meet increasing public sensitivity to noise around airports, and the ability to finance a highly advanced new commercial air transport. Such a development will almost certainly not occur in the near future without substantial Government participation.

An AST that could fly faster and haul more passengers than the Concorde would offer the



Artists' concepts of advanced supersonic transports

advantage of higher "productivity" compared to a new subsonic aircraft. ("Productivity" is a function of the speed of the aircraft, load factor, and hours used in revenue service per year,) However. higher productivity does not necessarily mean profitability, The AST now envisioned would be able to fly faster than 1,600 mph, allowing it to carry twice as many passengers a day on long-distance flights as a subsonic aircraft of equivalent size,

The major operating cost drawback to an AST is fuel consumption. An AST could burn two times more fuel per seat-mile than an advanced subsonic aircraft. This factor offsets the higher productivity of an AST and could mean higher fares–possibly up to one-third more than for the advanced subsonic plane. Passengers who highly value their time may tolerate this fare difference, However, greater fuel consumption raises energy concerns as well as objections to Government support for a project perceived by some as serving only selected classes.

In the United States a Supersonic Cruise Research (SCR) program, conducted by the National Aeronautics and Space Administration since the American SST was canceled in 1971, has made significant advances in the areas of aerodynamics. structures. propulsion, and noise reduction. While foreign manufacturers are becoming more competitive in the subsonic field, their willingness to embark on an AST is tempered by the same uncertainties as those facing the U.S jndustry,

Given the possibility of an expanded market. and the importance to the U.S. economy and international trade balance of capturing a share of that market, it would appear that. if Congress wishes to keep the supersonic option alive, the existing level of Federal support in the generic R&D is not adequate. While further generic R&D to validate the supersonic technologies should facilitate a decision on whether or not to initiate an AST development. it will not answer critical questions such as price and availability of future fuel supplies, sensitivity of the public to aircraft noise, and the ability to finance such a major capital commitment.

Forecasts of Physician Supply Requirements

The supply of physicians is growing at an unprecedented rate The United States is expected to have 600,000 physicians by 1990, as against 378,000 in 1975. As a result, Federal concern has shifted from the total number to the kinds needed and where they are needed.

FORECASTS OF PHYSICIAN SUPPLY AND REQUIREMENTS

Wide variations in forecasts of the number and kinds of physicians needed and where they should practice make it difficult to develop effective legislative policies.

Two main physician-forecasting efforts exist. The Bureau of Health Manpower (BHM) of the Department of Health and Human Services (DHHS) provides annual reports which include estimates of the present and future supply of and need for physicians and other health professionals. In addition, DHHS has chartered a Graduate Medical Education National Advisory Committee (GMENAC) to make recommendations on present and future requirements of physicians. their specialty and locational distribution, and methods for financing graduate medical education programs. These two groups use different forecasting methods. BHM relies on standard economic techniques, while GMENAC uses a medical opinion approach.

Forecasts of needed medical services reflect projected population growth and changes in its age, sex, and income distribution, as well as per capita use. Different assumptions about demographic changes, per capita use, and 'or physician productivity lead to different estimates of how many physicians are required. Adjusting only for demographic changes, BHM estimates that 415,000 physicians will be required in 1990. Decreases in productivity and/or increases in per

U.S.-Trained Physicians, Graduates (MD and DO); Projected 1978-79 Through 1989.90

Academic year	Total graduates	MD graduates	DO graduates
1978 -79 ....., ...	16,044	15,048	996
1979 -80., ...	16,375	15,346	1,029
1980-81	16,997	15,789	1,208
1981-82	17,662	16,354	1,308
1982 -83	18,333	16,956	1,377
1983-84	18,699	17,241	1,458
1984-85	18,818	17,322	1,496
1985-86	18,928	17,394	1,534
1986-87	19,036	17,464	1,572
1987-88	19,142	17,532	1,610
1988-89	19,201	17,554	1,647
1989-90	19,289	17,604	1,685

SOURCE *Interim Report of the Graduate Medical Education National Advisory Committee to* the Secretary, *Department of Health* Education, *and* Welfare, Washington DC Health Resources Administration, DHEW publication No (HRA) 19.633, p 147

capita use would increase the requirements. With the further assumption of increased per capita use, the BHM projection rises to 600,00().

Adequate forecasts of how many physicians are required in each specialty cannot be made until agreement is reached on what these specialties are. Experts disagree on what primary care is and what specialties it includes.

The Health Manpower Shortage Area (HMSA) designation is the vehicle for providing Federal support through the National Health Service Corps, determining eligibility for certain Federal grant programs, and obtaining Federal reimbursement for nurse practitioners' and physicians' assistants' services. In contrast to forecasting techniques for aggregate and specialty requirements, the methods used to identify HMSAs and the number of physicians they require contain assumptions on how physicians should be distributed and how much the Federal Government should be involved in such efforts.

Projections of physician supply and requirements depend on historical data to predict future events, but even recent historical data reflect past policies, not current ones. The limits of forecast must be fully understood if they are to serve as effective tools in the shaping of Federal medical policy. Those limits could be made clearer by explicitly describing the assumptions behind any forecasts, by making alternative forecasts based on different sets of assumptions, and by expanding the forecasting process to include policymakers as well as technicians in establishing the parameters.

Taggants in Explosives

A new technology to place "taggants" (miniature labeling devices) in commercial explosives and gunpowders could be a useful tool against many terrorist and other criminal bombers. However, there are questions of safety which would have to be resolved before a taggant program could be put into effect.



Two different kinds of taggants could be used for different purposes. Identification taggants are microscopic chips containing a code. designed so that the chips could be recovered from the debris of a bomb explosion. The code would provide law enforcement officials with a list of the last legal purchasers of the explosive material used in the bomb, and thus assist in finding the bomber. Detection taggants emit a vapor which would escape from a suitcase package containing a bomb, and which could be detected by a sensing machine placed at an airport, public building entrance, or other suitable site.

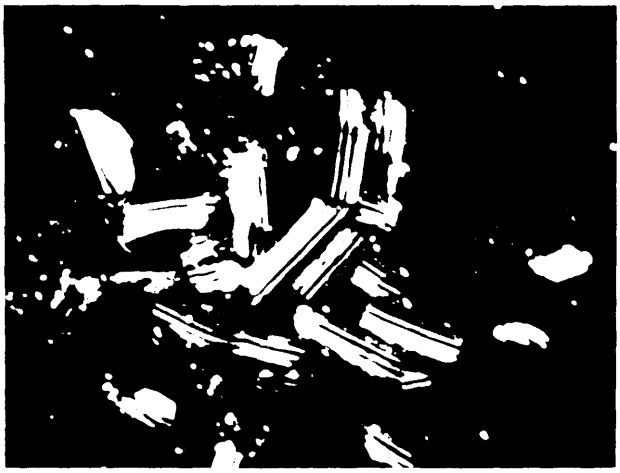


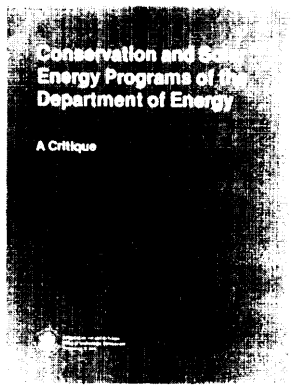
Photo credit U S Department of [he Treasury

Recovered taggants from OTA-sponsored test of low-power dynamite

There has been considerable controversy over the technical development, safety, cost and law enforcement utility of such taggants. OTA found that the taggants would probably work, although some of the claims made by those developing them are exaggerated. Questions about the safety of adding such taggants to explosive materials would have to be resolved before a program could go forward. The cost of a program varies depending on how extensive the program is; OTA assessed the costs of one possible program at about $25 million per year for either identification or detection taggants, and $45 million per year for both. A taggant program would be of significant value to law enforcement; however, it would not help much against bombings which caused little damage and the most sophisticated terrorists and professional criminals could probably find ways to evade the effects of a taggant program.

Conservation and Solar Energy Programs: A Critique

A lack of direction and leadership by the Department of Energy (DOE) management is hampering the progress of the DOE Conservation and Solar Energy (C&SE) Programs. Many C&SE programs suffer from inadequate planning, frequent and debilitating management changes and reorganizations, and other internal difficulties, although some are doing well and are staffed by many dedicated and competent people. This is the main finding of an OTA review of C&SE programs conducted with the aid of two panels of experts. The membership of the panels was designed to provide a balance of skills and viewpoints.



The national goals for solar energy outlined in the Administration's 1979 Domestic Policy Review (DPR), and endorsed in administration messages to Congress, have not been universally accepted within DOE, and C&SE programs have not been designed to meet them. No effort similar to the DPR has been made to establish conservation goals, which presently are defined implicitly. Conservation investments currently represent the most economic opportunity for dealing with the energy crisis.

Critical C&SE management problems include lack of both procedures and funding for program evaluation, extraordinary delays in processing contracts and filling staff vacancies, changing

Comparison of the DOE Fiscal Year 1981 Budget Request With DPR Solar Energy Goals for 2000 or Conservation Savings Expected in 1990

	Fiscal year 1981 budget request	Quad goal (2000)	Ratio	Ultimate potential (Quads)	Economics	Stage of development	Institutional and market barriers
Solar							
Active heating and coolIng ., .	$57.7	2	$ 30	B	B	A	c
Passive heating and cooling . . .	33.9	1	30	B	B	A	c
Industrial and agricultural.	49.0	2.6	20	B	B	B	A
Biomass	66.7	3.6'	20	A	B	A	A
Photovoltaics	175.6	1.0	180	A	7	c	B
Wind	80.0	1.7	50	A	A	B	c
Solar thermal (electricity) ...	117.5	0.4	290	A	?	c	c
Ocean ., . . .	39.2	0.1	390	A	7	c	c
Conservation		(1990)					
Residential/commercial	97.6[b]	9.5	10	c	A	A	c
Industrial.	58.9	25,9	2	c	A	B	A
Transportation ., ...	113.0	10.4	11	c	A	A	B

A = favorable outlook B = intermediate C = limlted potential or dIfficult problems

[a] Excl udes the 1 8 Quads already beIng used

[b] Does not include $202 5 million for th, Schools and Hospitals Grant Program or $19895 for the Weatherization Assistance Program The energy contribution of these programs presumably is includedin the 95 Quads but the highbudget levels result from the actual Implementation being done by DOE u nlike the other programs which are limited to R&D or demonstration projects

SOURCE Off Ice of Technology Assessment

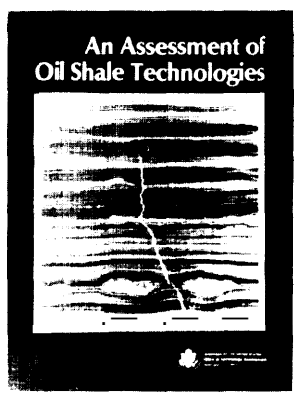
management and frequent reorganization, insufficient coordination between solar and conservation incentives, and difficulties in defining and implementing "commercialization" efforts.

C&SE also exhibits a number of institutional problems in such areas as coordination of energy policy and action within the Federal Government, assistance to the States, commercialization of solar conservation technologies, and questions of competing or conflicting roles among various units of the organization—headquarters offices, regional offices, the Regional Solar Energy centers, the Solar Energy Research Institute. and the National Laboratories.

From the view of specific program elements, OTA concludes: wind energy is a nearer term technology than DOE appears to believe; photovoltaics may not meet stated goals unless DOE acts more aggressively; biomass management should be tightened and the staff augmented; transportation should reevaluate its efforts in both advanced engines and electric vehicles; and solar active, passive, and conservation technologies must be integrated to achieve optimum energy use in new and existing residential and commercial buildings.

Oil Shale Technologies

An oil shale industry could benefit the Nation's economy and security and help ease the liquid fuel supply problem. However, the rapid deployment of a large industry (500,000 barrels per day (bbl/d) or more by 1990 would entail economic, environmental, and social risks, Financial incentives could spur production. Production tax credits, purchase agreements, and price supports would be the most effective. Federal debt guarantees or debt insurance would help smaller firms,



The high-grade oil shale reserves of the Western United States could, with existing technologies, produce at least 400 billion bbl of oil. This equals 57 years' worth of current U.S. petroleum consumption, and is over 2.5 times the estimated reserves of Saudi Arabia.

Recent increases in the price of world oil may make shale oil price-competitive with foreign crude, depending on: the reliability of current cost estimates for plants, the continuation of oil price increases, the effects of Federal and State regulatory action, and the required rate of return on capital.

About 80 percent of the richest shale is on Federal land. Four tracts (in Colorado and Utah) have been leased under the Federal Prototype Leasing Program. None of the extensive private holdings are now being developed commercially. Production beyond about 400,000 bbl/d is possible only if additional Federal land, with high-grade shale, is made available.

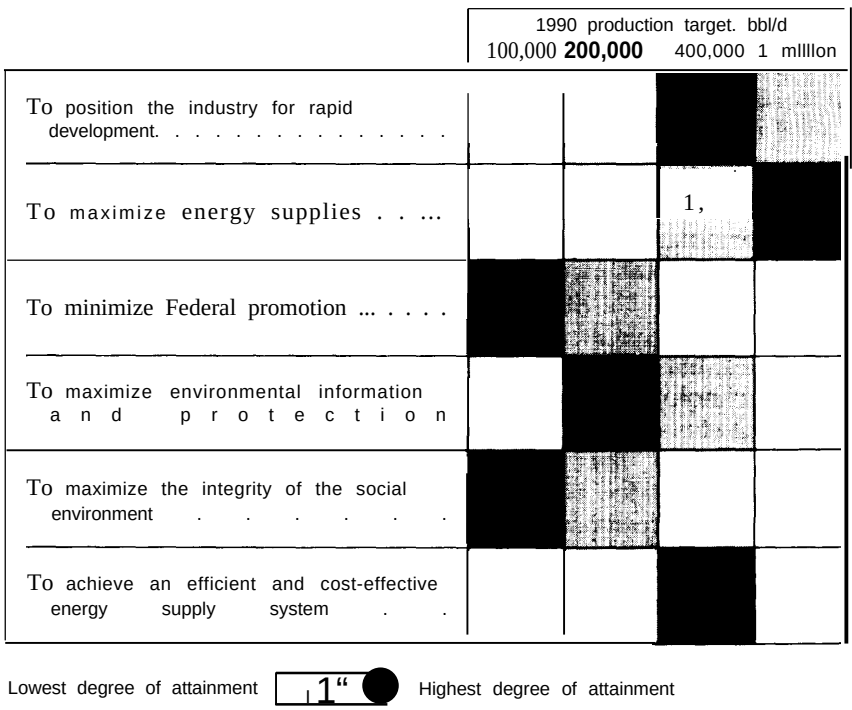
Of the three major processes for converting raw shale to oil, one is now being commercially developed, Crude shale oil, upgraded and refined, is a somewhat better source of jet and diesel fuel than of gasoline.

Oil shale development could have important environmental impacts. Many impacts are regulated by existing State and Federal environmental laws, although some wastes pose unique challenges and a number of serious uncertainties exist. The Clean Air Act, the only existing environmental law that might limit the industry, could hold production in Colorado to about 400,000 bbl/d, although additional production could occur in Utah.

A 500,000 -bbl/d industry would increase approximately 1.5 percent the surface water demands projected for the Upper Colorado River Basin in 2000. Surplus surface water could support this industry until at least 2000: some time after 2000, scarcities may limit all types of regional growth. Any large-scale industry will require additional storage and transportation of water within the region.

Development will change the communities in the sparsely populated rural region. Adverse effects could occur, especially if oil shale development accompanies other industrial expansion. Without strong preventive measures, social and personal distress (boomtowns) will happen. Between 1985-90, communities in Colorado could probably accommodate the growth of 200,000 -bbl/d industry. Anything larger would require extensive impact mitigation programs.

The Relative Degree to Which the Production Targets Would Attain the Objectives for Development



SOURCE Off Ice of Technology Assessment

Federal Prototype Oil Shale Leasing Program

This report is a companion to volume I of the OTA oil shale assessment. It describes the history and status of the Prototype Oil Shale Leasing Program.

About 80 percent of the U.S. high-grade oil shale is on Federal land in Colorado, Utah, and Wyoming. Under the Prototype Oil Shale Leasing Program, about 20,000 acres—less than 1 percent of the Federal oil shale land—have been leased to private developers. Four tracts, two each in Colorado and Utah, are under lease, but so far development has taken place only in Colorado.

The Department of the Interior (DOI) in May 1980 announced it would offer four more Prototype tracts. A permanent leasing program also is being planned with a target date for its establishment of 1982-83. DOI intends to foster oil shale development by asking Congress to amend the Mineral Leasing Act of 1920 and the Federal Land Policy and Management Act of 1976.

The stated goals of the Prototype Program are to provide a new energy source by stimulating development of a commercial industry, to ensure environmental integrity while developing safeguards and land restoration techniques, to permit an equitable return on development of the public resource, and to establish sound management practices.

Unforeseen problems have resulted in only partial realization of these goals. They have included economic, environmental, legal, and technological uncertainties. The difficulties led to suspension of the Prototype leases in 1976-77. Development has resumed, but there have been major changes in the technologies being used. The development may not attain the level of production they expected when the Program started, and it will take about twice as long as originally estimated to achieve commercial production.

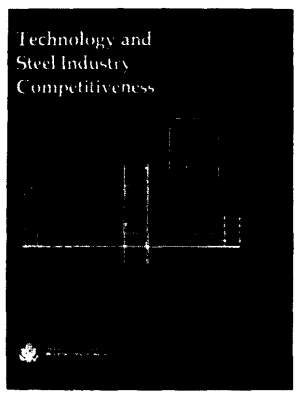
Several uncertainties remain. Unpatented mining claims from before 1920 cloud the picture. The U.S. Supreme Court recently found in favor of certain unpatented claimants in Colorado; the possible consequences of an extension of this doctrine to other Federal lands are unclear.

The Prototype Programs grew out of an unsuccessful DOI leasing effort during the 1960's. The effort failed to attract any private participation. The Prototype Program obtained responses to four of the six tracts offered. Increased interest in oil shale development should provide better prospects for success of additional leasing.

The outlook for shale development under the Prototype Program will depend on how the remaining uncertainties are resolved and on the success of overall Government efforts to solve the problems. Some of the Programs' goals are being met outside DOI'S framework. DOE and the Environmental Protection Agency are both involved in oil shale development, which complicates evaluation of the Prototype Program.

Technology and Steel Industry Competitiveness

Steel will probably remain the world's most important engineering material and the steel industry is vital to the Nation's security and economic prosperity. However, unless action is taken, continued low profitability and some Federal policies, such as long depreciation times for new facilities, will cause the domestic steel industry to contract substantially. Many jobs could be lost, and the Nation might become vulnerable to scarce and high-priced imports, which by 1990 could account for 40 percent of the domestic market, compared with recent levels of about 15 percent.



The U.S. steel industry can be revitalized through increased investment in R&D and the adoption of new technology. For that to happen, however, OTA estimates that steelmaker must

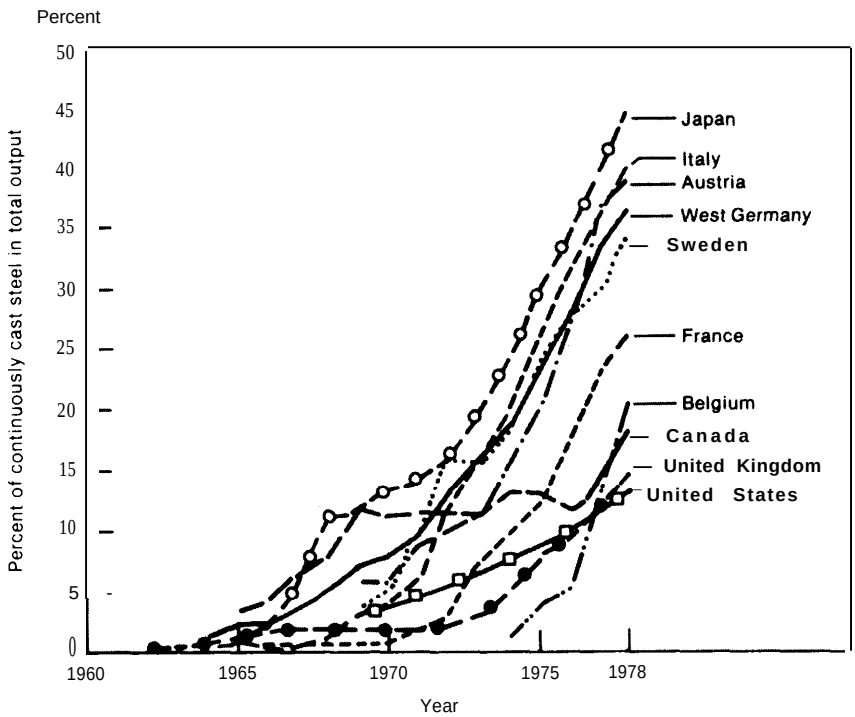
increase their capital spending on production facilities by at least 50 percent during the next decade, to approximately $3 billion per year as compared to industry estimates of $4.9 billion (1978 dollars), in order to modernize existing mills, expand capacity modestly, and bring profitability up to the level of most other domestic manufacturing industries. At the $3 billion level, supportive Federal policies would be required to generate at least $600 million of this additional capital per year.

Small nonintegrated steel plants that rely on ferrous scrap rather than iron ore to produce the simpler steel products could nearly double their market share (now at about 13 percent) in the coming decade, provided that adequate electricity and scrap are available in specific market areas. Considerable market potential could be exploited to increase exports by the highly competitive alloy /specialty steelmaker in the next 10 years, if the new Multilateral Trade Agreement is enforced vigorously.

Following restructuring, modernization, and expansion in the 1980's, the industry could adopt major new steelmaking innovations if the Federal Government supports more basic research in steelmaking, provides incentives for more industry R&D, and assists in pilot and demonstration projects. Such major process innovations could then bring the domestic industry a competitive advantage, rather than mere parity with foreign industries. This is the type of long-range strategic technology planning that the industry has not done well.

A well-designed and vigorously implemented government policy has nurtured the Japanese steel industry's expansion and adoption of new technology. The U.S. steel industry, on the other hand, has been hurt by a long series of Federal policies that have frequently been uncoordinated, contradictory, and inattentive to critical issues. A Federal policy that coordinates the industry's needs, the Nation's interests, and specific technical concerns is an important option.

The Diffusion of Continuous Casting, 10 Countries, 1962-78

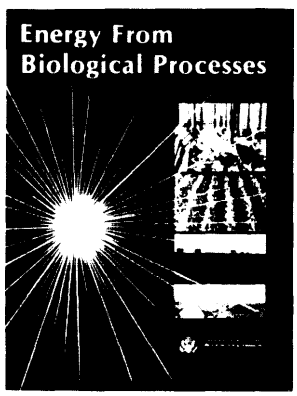


SOURCE Organizatlon for Economic Cooperation and Development

Neither technology nor capital, alone, will solve the steel industry's problems. New technologies could be adopted by the domestic industry if problems of insufficient capital and uncertain import policies are resolved. One such technology already used by major foreign competitors is the continuous casting of molten steel which reduces energy consumption, increases productivity, and expands steelmaking capacity. Another, the coal-based direct reduction of iron ore to produce a low-cost substitute for ferrous scrap and blast furnace iron, may be developed commercially within the next 5 to 15 years. Potential advantages include reduced capital costs, reduced pollution, and increased use of coal.

Energy From Biological Processes

By 2000, energy from biomass (wood and other plant material) could supply as much as 12 to 17 quadrillion Btu (Quads) of U.S. energy per year, depending on cropland availability and resource management. Of this, up to 10 Quads could come from wood and 1 to 6 Quads from plant herbage, including crop residues.



The most efficient processes for replacing oil with biomass energy are direct combustion and gasification for space-heating and process steam and heat. Combustion technology is now commercially available, and suitable gasification units are likely to be developed soon. With favorable conditions these technologies could supply the United States with as much as 10 Quads /yr by 2000 beyond 4 to 6 Quads/yr that probably will be used anyway. Ten Quads / yr are enough to displace the energy equivalent of 4,5 million bbl/d of premium fuels (oil and natural gas).

Biomass also can be converted into the liquid fuels ethanol (grain alcohol) and methanol (wood alcohol). Only ethanol is now produced commercially from biomass. Growing and converting crops to ethanol requires roughly the same amount of energy that the ethanol contains. However, each gallon of ethanol can save nearly a gallon of premium fuels if: 1) ethanol distilleries are not fueled with premium fuels and 2) the ethanol is added to gasoline as an octane booster rather than used as a stand-alone fuel. Methanol seems the least expensive near-term option for producing liquid fuels from wood and plant herbage. Although no biomass-to-methanol facilities are in operation in the United States, the needed technologies for alternative feedstocks either exist or can be developed soon.

The behavior of wood harvesters will critically affect both the amount of biomass energy the United States can produce on a renewable basis and the economic, environmental, and other impacts of doing so. For example, careless forest management could damage the forests and sharply reduce the amount of wood available for energy. Furthermore, the production of fuel from cropland (except from residues) can drive food prices up. Significant price increases could occur at ethanol production levels as low as 2 billion gal/yr, but this estimate is uncertain. Also an expansion of the acreage in intensive crop production will add to the already damaging level of soil erosion from U.S. croplands.

The development of bioenergy poses a number of policy issues that Congress may want to address. If Congress chooses to promote the rapid expansion of energy from biomass, vigorous policy support including economic incentives—will be needed. In addition, severe environmental and other impacts may be unavoidable unless the expansion of bioenergy production is accompanied by strong incentives for careful resource base and the adequacy of existing policies. Bioenergy is now accorded a low priority by DOE and the U.S. Department of Agriculture. A decision to promote it aggressively will require a significant shift in the priorities of these departments as well as extensive coordination among Federal agencies and among National, State, and local governments.



Photo credit USDA Soil Comservaton Service

Commercial forests: an excellent source of energy from biomass

Implications of Cost-Effectiveness Analysis of Medical Technology

The need to control the rapidly rising costs of health care while improving its quality and accessibility has heightened interest in using cost-effectiveness analysis [CEA) and cost-benefit analysis (CBA) as a means of making the medical care system more efficient. CEA and CBA are methods for comparing alternative ways to allocate resources.

THE IMPLICATIONS OF COST-EFFECTIVENESS ANALYSIS OF MEDICAL TECHNOLOGY

Mu. r]*

The process of analyzing costs and benefits can improve decision-making in the field of health care by structuring the problem, allowing an open consideration of all potential effects of a decision, and forcing the explicit treatment of key assumptions. However, CEA/CBA have too many limitations to serve as primary determinants of decisions in health care, Information produced by CEA CBA should be only one of several components of a decision process.

In CBA, both cost and benefits are expressed in dollars, resulting in a net plus or minus dollar figure or in a numerical ratio. With CEA, however, costs are expressed in dollars but effectiveness is measured in nonmonetary units such as lives saved or life years gained. Thus, both CEA and CBA are mainly designed to integrate the economic and the health aspects of decisions. However, CEA and CBA are only tools. Their use will not substitute for cost-containment programs. CEA and CBA could perhaps influence the distribution of expenditures, especially where

a program has a constrained budget, but in neither case would they limit the absolute amount of expenditures.

Health decisionmakers have only rarely used CEA and CBA in setting policy for medical technologies. Reimbursement programs, such as medicare, do not explicitly take costs into account in deciding whether or not to cover specific technologies. Professional Standards Review Organizations, which review the appropriateness of services provided under programs such as medicare, have not used information from CEAs or CBAs, though they potentially could incorporate that type of information in their review criteria. Health planning agencies have a mandate to consider both the costs and the benefits of a technology or service in making certain types of decisions. Yet those agencies have very infrequently used formal CEA or CBA. CEA and CBA have significant potential for use in health maintenance organizations because their budgets are fixed during any one time period.

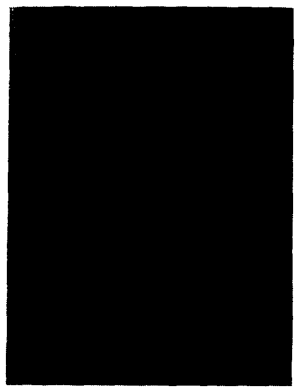
The use of CEA and CBA is likely to increase substantially. Users, however, should be cautious in interpreting results and avoid relying too heavily on numerical result, which tend to obscure ethical considerations and uncertainties in data.

Many of the limitations of CEA and CBA can be ameliorated by following 10 principles of CEA/CBA: Define the problem, state objectives of analysis, identify alternatives, analyze all relevant benefits, analyze all relevant costs, differentiate the perspective of the analysis, perform discounting of future costs and benefits, analyze uncertainties, address ethical issues, and interpret the results. In addition, to lessen the problems associated with a numerical 'bottom line," analysts should refrain from combining into an aggregate number the often complex sets of calculations, especially when nonquantifiable elements are important to the decision.

Technical Memoranda

Ocean Margin Drilling

Prepared in response to a request from the Chairman and the Ranking Minority Member of the HUD~Independent Agencies Subcommittee of the Senate Appropriations Committee. the Technical Memorandum evaluates the National Science Foundations' (NSF) plans for the development of an ocean margin drilling (OMD) program. The $700 million, 10-year program is both a continuation of deep ocean drilling under NSF auspices, and a new thrust to explore the geology of continental margins (the borders between the continents and the deep ocean) and ocean crust where deep drilling is required to penetrate unknown regions. Some of the margin regions could contain substantial oil and gas resources, according to most experts, but very little evidence of that has been collected.



Some major findings in OTA's analysis are:

1. The NSF plan for ocean margin drilling developed during 1980 contains many worthwhile scientific objectives. The plan is supported by NSF and the Joint Oceanographic Institutions (JOI) who assisted in its development, and a scientific consensus on the present program is developing. A major concern of many scientists has been the lack of specific plans for geophysical surveys that must precede the drilling: however, a planning effort did begin in late 1980.

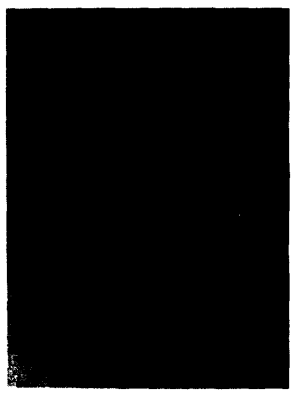
2. The probability of achieving the scientific objectives through the holes drilled and information collected will, in large part, be determined by the capabilities of the technology which is not yet developed. Some of the deep holes may not be completed as planned because of the technological uncertainty associated with deep ocean drilling in **as** yet unknown environments.
3, The potential for oil and gas resources in the continental margins is a subject of much speculation, but competent geologists claim that these areas hold significant promise at least to the extent that they should be carefully explored. The ocean margin drilling would provide better scientific information on which to base further speculation on oil and gas resources, but it is not a logical oil and gas exploration program.
4. A more sharply focused science program with fewer options than the present plan is advocated by several of the scientists OTA contacted. They have suggested alternatives which might result in lower initial costs and a postponement of the decision to fund major technology developments.

It is planned that NSF's ocean margin drilling program will be jointly funded by the Federal Government and the petroleum industry. The program calls for 4 years of preparation and 6 years of drilling. In carrying out the program, NSF plans to convert the Government-owned Glomar Explorer to a deep drilling ship, and to develop a riser system (a large pipe which channels drilling fluid down to the ocean floor and back up to the ship). The system will be used for controlled drilling at approximately 13,000-ft water depths and up to 20,000 ft below the ocean floor.

The scientific objectives stated in the plan include the investigation of: 1) passive and active continental margins; 2) the Earth's crust beneath the ocean; and 3) deep sea sediments that could reveal historical environmental information about the Earth, particularly the opening of the Atlantic Ocean and the Gulf of Mexico.

Recent Developments in Ocean Thermal Energy Conversion

Ocean thermal energy conversion (OTEC) is a proposed system for extracting energy from the solar heat stored in the surface water of tropical seas. The method uses the temperature difference between surface and cold, deep ocean water to operate huge, ocean-based electricity generating plants.



Prepared in response to a request from the Chairman of the Subcommittee on Energy Development of the House Committee on Science and Technology, this Technical Memorandum updates a 1978 report on OTEC. Since the original report, several significant technical accomplishments have occurred in the OTEC program. The Technical Memorandum discusses these achievements as well as technical uncertainties that remain.

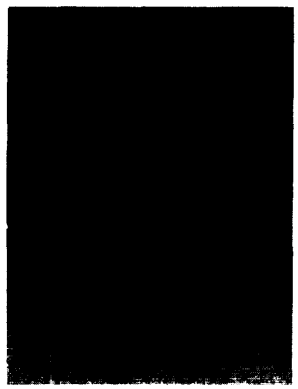
DOE is currently sponsoring a major effort to develop OTEC as a future energy resource. Funding for the program has grown from approximately $15 million to $40 million annually in the past 2 years. Recent DOE and industry reports were reviewed by OTA experts in order to provide an accurate update on the status of OTEC technology.

Some of the major findings in OTA's analysis are:

1. Outstanding technical achievements over the past 2 years have been: a) the operation of Mini-OTEC during the summer of 1979 in Hawaii, demonstrating that a small (10 kilowatt), barge-mounted system can generate net electrical output, and b) improvements in heat exchanger performance through laboratory and sea tests. The heat exchanger is the most important component for the OTEC plant due to its size, weight, and cost.
2. Over the past 2 years, the technology base for OTEC has improved, reducing the risk involved in building a midsize (10 to 40 megawatt) pilot plant. (The major technical risks include cold water pipes, heat exchangers, and electrical transmission cables.) However, development has not reached the point where the costs of large, commercial plants can be estimated.
3 Little has been done to assess the potential ocean thermal energy resources available for major OTEC commercialization. According to OTA, current DOE studies do not adequately consider future resource availability y.
4 OTA's analysis also questions whether DOE's project team, even though it is comprised of many competent technical groups, could adequately respond to a major acceleration requiring pilot plant construction before fiscal year 1982.

World Petroleum Availability: 1980-2000

Prepared partly in response to a request from the Senate Committee on Foreign Relations, this



Technical Memorandum critically assesses the prospects for world oil production for the rest of the century. It examines, on a country-by-country basis, current production capabilities, the likelihood of new discoveries, and the political, economic. and other factors that will affect actual production levels.

Even under favorable circumstances, there will most likely be little or no increase in world oil production * from conventional sources over the rest of the century, the Memorandum concludes. Not only will the United States be unable to expect increased imports over current levels, but the United States will probably face much stiffer competition for world supplies at even lower levels of imports. That is the likely future that current U.S. plans and efforts to reduce our heavy dependence on oil should prepare us to meet.

Forecasts of petroleum availability, in general, have fallen since the recent events in Iran. Never-

""0]1 production" includesliquids associated with the production of natural gas

theless, the range of OTA estimates falls much below those of other organizations. For example, Exxon has recently forecasted world petroleum availability from conventional sources in 2000 at 60 million bbl/d • which is at the upper end of the OTA range. Compared with earlier estimates, both the OTA study and the Exxon forecast are pessimistic on production possibilities for the United States. Exxon forecasts U.S. production at 6 million bbl/d in 2000, while OTA estimates a range of 4 million to 7 million bbl/d. All of these estimates are considerably below the 1979 production level of 10.2 million bbl/d.

While it may be physically possible to increase world oil production by perhaps as much as 33 percent by the 1990's, no substantial increases are likely to occur because the countries that must contribute to an increase of this size (such as the Arab OPEC countries or Mexico) have little financial or political incentive to do so and because any attempt to increase production would run into a number of practical as well as political problems.

Oil production in the non-Communist world could begin to decline by the early 1980's. Assuming political stability in the major exporters, and thus no interruptions in their production, OTA estimates that non-Communist world oil supply is likely to range between 45 million to 60 million bbl/d in 1985 and 40 million to 60 million bbl/d in 2000, compared to 52 million bbl/d in 1979. As a group, OTA projects, non-Communist industrialized countries will experience no significant increase in production, and may, in fact, experience a decrease of as much as 50 percent by 2000.

•Millions of (42 gal) barrels per day

U.S. production may decline from its current level of 10.2 million bbl/d to a level of 7.2 million to 8.5 million bbl/d in 1985 and to a level of 4 million to 7 million bbl/d in 2000. The high estimate of 7 million bbl/d for 2000 assumes both the annual addition of 1 billion bbl to proven reserves and the extensive use of enhanced recovery techniques.

The Communist countries may cease being a net exporter of oil to the free world by the early 1980's as a result of declines in Soviet production. The entry of the Eastern European countries (now more than 80 percent dependent on the Soviet Union for their imported oil) and conceivably the Soviet Union itself as buyers on the world oil market will intensify the pressure on world oil prices and have potentially serious implications for U.S. foreign policy.

OTA believes that OPEC production during the next 20 years will range around its current level of 31 million bbl/d. Except in Iran, only Saudi Arabia, Kuwait, and United Arab Emirates have the reserves, and Iraq the estimated potential, to increase production rates. Thus, substantial dependence on Arab OPEC is likely to continue.

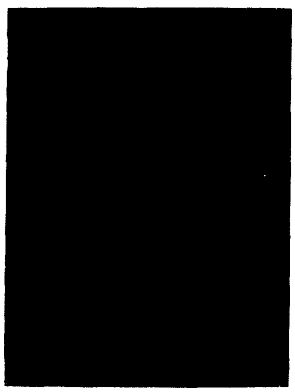
Although production in the non-OPEC less-developed countries (LDCs) will exceed current levels (mainly as a result of increases in Mexican production), much if not all of that increase will be absorbed by increases in LDC demand.

Although some large discoveries are possible outside the Middle East, there appears little possibility—outside of Mexico—that giant oil fields, such as those found in the Middle East, will be discovered elsewhere. Major additions to the

world's known oil supplies will likely come from additional recovery in known fields rather than from new field discoveries. These additions are not likely to alter the dominance of the Middle East, since over half of the new additions are expected to be in the Middle East. Moreover, experts generally agree that the world distribution of ultimately recoverable oil will not differ significantly from the known distribution today.

Compensation for Vaccine= Related Injuries

The issue of compensation for vaccine-related injuries came to congressional and public attention dramatically in 1976 in connection with the Federal Government's sponsorship of a mass immunization program against swine flu. The memorandum is OTA's response to a request from the House Interstate and Foreign Commerce Committee. It expands on a chapter in the 1979 OTA report, Federal Vaccine and Im-



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The 1979 OTA report pointed to a major decline in the number of active vaccine manufacturers and of licensed vaccine products, noting that some researchers-blamed Federal policies for at least part of the decline. That report suggested that liability problems may be eroding the commitments of vaccine manufacturers, Congress, and State health departments to public immunization programs.

All vaccines, even when properly manufactured and administered, may pose risks to users. Under the existing legal liability system, persons injured from vaccination must establish fault in court in order to receive compensation. The injured person generally sues one or more of the participants in the vaccination process (e. g., a party that manufactures, distributes, pays for, encourages the use of, or administers the vaccine). In four major cases in the past 11 years, including the recent swine flu decision, plaintiffs have won large judgments against vaccine manufacturers for injuries caused by nondefective and properly administered vaccines. This situation has affected manufacturers' willingness to produce and supply vaccines.

The Memorandum does not analyze the arguments for and against a Federal compensation program. Rather, it starts with the assumption that establishing such a program is desirable. The primary case for establishing a vaccine-injury compensation program is that society is obligated to minimize the consequences of injury when a vaccinee is harmed instead of protected in public immunization programs.

Six nations and the State of California have vaccine-injury compensation programs. These programs contain the elements that Congress may wish to consider in formulating a Federal compensation program: 1) the vaccines to be covered, 2) the injuries to be included, 3) the kinds of compensation, 4) the administrative mechanisms, and 5) the relationships with existing compensation programs (lawsuits, social insurance).

The memorandum sets out the Federal Government's current approach to compensation, the major arguments for and against a compensation program, the costs of such programs, the types and estimated numbers of vaccine-related injuries, current approaches to vaccine-injury compensation, and compensation in light of future developments in vaccines.

Section III
WORK IN PROGRESS

OTA's work is structured along three broad divisional lines: energy, materials, and international security; health and life sciences; and science, information, and natural resources. Within those broad divisions, OTA conducts studies in energy, international security and commerce, materials, food and renewable resources, health, human resources, communication and information technologies, oceans and environment, and space technology.

More than 60 projects were in progress during the year, including 14 new studies.

In this section, the broad concerns and current work schedule of each OTA program are described for 1981 and beyond.

Section III
WORK IN PROGRESS

Energy, Materials, and International Security Division

Energy

Several factors combined in 1980 to give the Nation a respite from the series of energy shocks which began in 1973. Conservation driven by higher prices, higher than normal winter temperatures, and the economic slowdown have reduced total energy use in the United States by nearly 4 percent from 1979. In particular, the higher oil prices have so reduced the Nation's oil consumption that it is currently importing about 30 percent less oil than in the peak year of 1978. In addition, domestic energy production, led by coal, is continuing the slow increase that began 4 years ago. Congressional activity on energy matters in 1980 was considerably below the 1979 level due partially to these circumstances. The principal effort was completion of the Energy Security Act which established the Synthetic Fuels Corp., greatly expanded biomass programs, and set up new conservation and solar finance programs.

Despite the apparent easing of the Nation's energy problems, considerable danger remains for the next decade. The United States is still critically dependent on imported oil, and the threat of future cutoffs continues. Although conservation has been substantial—beyond the expectations of the most optimistic forecasts of a few years ago—it is still not clear how much is a short-term cutback and how much is a long-term gain in efficiency. Domestic production is increasing but currently not fast enough to offset the expected declines in older oilfields in the years ahead. Thus, Congress will face a number of important issues in the coming years and activity is likely to increase dramatically in 1981.

OTA should continue to be an important resource for Congress in analyzing energy issues. OTA assisted Congress in the course of its work on the Energy Security Act. In particular, OTA's analysis of energy from biological processes was important in developing those portions of the bill concerning wood and alcohol fuels. In addition, the OTA study on the Department of Energy's (DOE's) Conservation and Solar Energy programs proved useful to congressional authorizing committees in treating that part of DOE's program. OTA also released an updated summary of the coal slurry pipeline study which was used extensively during the House debate on slurry pipeline legislation. Finally, OTA, by drawing on completed and ongoing studies, was able to help Congress meet immediate needs through testimony and other short-term responses on topics such as wood energy, methanol fuels, cogeneration, conservation in buildings, and enhanced oil recovery.

Currently, the Energy Program is working on a number of studies which should be of interest to the upcoming Congress. These include studies nearing completion on nuclear powerplant standardization and the solar power satellites. The former should contribute to the anticipated congressional debate on the future of nuclear power. Other studies include: dispersed electric energy systems, which will deal primarily with cogeneration; energy and city buildings, which addresses conservation in buildings and the particular energy problems facing cities; synthetic fuels for transportation, which is focused on the role of synfuels and increased automobile efficiency in meeting the Nation's liquid fuel needs; and industrial energy use. Finally, OTA will begin a study on technologies that could ease the effects created by an oil supply disruption or chronically tight oil markets. There will probably be strong congressional interest in contingency planning for possible long-term oil shortages and this study should contribute to that debate.

Alternative Energy Futures

Following an analysis of major issues involved in alternative energy futures, a number of separate but related studies have been initiated. Work on the future potential of "liquefied natural gas

imports" has been completed. The second study is "energy for city buildings, " which will focus on the interaction of technology and policy for new and existing buildings in U.S. cities for the next two decades. The massive current stock of buildings contains a high proportion of structures, both residential and commercial, constructed in a period of low energy cost when the continuing cost of energy use received no attention. Improving the energy efficiency of these structures is important in terms of energy policy, city viability, and the interests of individual owners and tenants.

This study will analyze retrofit technologies, both to conserve energy and to employ renewable energy that can improve the energy efficiency of structures. Capital costs, energy savings, and factors such as reliability and maintenance will be identified. Second, the study will explore the types of building owners. Regional factors affecting city opportunities and constraints, choices of action open to Federal, State, and city governments, and the related impacts of various policy choices will be examined.

A third major effort for the alternative energy futures study, Industrial Energy Conservation, has recently been initiated. This project is designed to examine a series of four American industries (pulp and paper, steel, petroleum refining, and organic chemical production) for their potential to use energy more efficiently, and to predict the impact of selected legislative options on energy use and efficiency within those industries.

OTA will examine the available technologies designed to improve energy efficiency, as well as the barriers to such technology's implementation. The legislative options to be examined range from tax policy changes such as accelerated depreciation, to institutional changes in capital financing methods. Each option's effects will be evaluated through a series of case studies in which corporation executives, consultants, and computer-modeling techniques are used to forecast the impacts of possible congressional action. Option's will also be examined at the industry, industrial sector, and national energy use and economic levels using a similar series of modeling, management, and consultant evaluations.

The Energy Policy Forum will retain the broad scope of the original Alternative Energy Futures assessment, but will limit analysis to a systematic inventory of the most critical areas of agreement and disagreement over both factual assumptions and social values relating to energy use. This document will be used internally to guide related studies, and in 1981 to choose the remaining work necessary to complete *Alternatiue Energy Futures* study.

Delivery date: Early 1982. Call 226-2152 for further information.

Requesters House Committees: Banking. Finance, and Urban Affairs; Interstate and Foreign Commerce; Select Committee on Population.

Dispersed Electric Energy Generation Systems

The possibility of using cogeneration and solar energy in all its direct and indirect forms, and the rapidly escalating economic and environmental costs of large energy facilities have stimulated considerable interest in small, dispersed energy systems. In particular, problems faced by the electric utility industry, such as rapidly rising capital costs, long leadtimes for plant construction, and difficulty in finding suitable sites, make dispersed energy systems attractive. It is essential, however, to determine the benefits and costs of dispersed systems in setting effective policy. This study will examine the role that cogeneration and small energy conversion equipment could play in meeting the country's need for electric energy. It will review the economic, environmental, social, and institutional consequences of dispersed electric systems and their effect on the electric utility industry. Finally, it will analyze policy options Congress may wish to consider in addressing the issues about the development of such systems.

The study will examine the technical features of dispersed systems using a variety of dispersed cogeneration and small electric-generating equipment. It will then analyze the economic and technical effects of such systems on utilities using models developed for the OTA onsite solar study. Concurrently, evaluation of changes in utility structure would be carried out using decision models similar to those used by utilities.

Finally, a series about the effects on society (e.g., employment, risks, etc.) from dispersed systems would be examined. This would include public perception of small-scale, onsite energy facilities.

Delivery date. Spring 1981. Call 226-2152 for further information

Requester House Committee on Banking, Finance, and Urban Affairs.

Nuclear Powerplant Standardization

No new orders for nuclear plants are likely to be placed for the next several years, but new electric generating capacity will be needed soon. One of the greatest obstacles nuclear plants must overcome if they are to contribute to this new capacity is a lack of public confidence in reactor safety. Furthermore, there is probably general agreement among both proponents and opponents of nuclear power that the present licensing process is not an efficient means of ensuring either safety or economically viable reactors. Standardization of nuclear powerplants has been proposed to improve both safety and licensability. The potential benefits of standardization are clear and some progress has been made, but several issues have to be addressed before the concept can be implemented. For instance, the time needed to prepare and improve standard designs, the degree of standardization to be required, the number of designs to have available, and the period for which they should be valid will all affect the feasibility and desirability of standardization.

This study will examine many of the technical and institutional issues about nuclear powerplant standardization to determine its current status, whether it can enhance safety, and the extent to which standardization is possible.

Delivery date Early 1981 Call 226-2152 for further information.

Requester. House Committee on Interior and Insular Af - fairs

Solar Power Satellite Systems

This project will respond to congressional interest in a limited but independent assessment of the potential advantages, shortcomings, and impacts of solar power satellite systems. It is intended to aid in deliberations concerning the appropriate level of Federal commitment to future development of this technology. It also will provide an improved background against which to evaluate analytical results and program proposals arising out of a study by DOE and the National Aeronautics and Space Administration completed in August 1980.

Major topic areas, within which key uncertainties will be addressed in a balanced treatment of positive and negative impacts, include: 1) future markets and the need for power from solar satellites, 2) cost feasibility of alternative satellite systems, 3) environmental impacts, 4) social and institutional factors, and 5) competing energy technologies and approaches. Within these categories, material resource limitations, health effects of microwave radiation, implications of highly centralized electric generation systems, and the expanded role of the Federal Government in energy production that may be required. Strengths, weaknesses, and uncertainties associated with the solar satellite concept will be contrasted with those of other long-term energy sources such as nuclear fusion.

The study is designed to identify and analyze the key issues that need resolution before decisions whether or not to develop major solar power satellite systems can be made. The study is divided into four parts: alternative satellite concepts, public acceptance (including environmental concerns), institutional acceptance (including utility integration and international concerns), and programmatic context (competing long-term energy sources, e.g., fusion, land-based solar). In each, a background paper will be prepared summarizing the problems and alternatives. A workshop will then be held for each of the areas to identify and describe the major issues, highlighting the divergent views. The background papers will form the basis of the workshops. On completion of the workshops, a report will be prepared by the OTA staff with the key issues and their analysis along with a summary of the background material. This report will provide assistance to Congress in evaluating major studies now underway or being initiated to determine the feasibility of these systems.

Deliuery date Early 1981 Call 226-2152 for further information.

Requester House Committee on Science and Technology

Synthetic *Fuels for Transportation*

Synthetic Fuels for Transportation is a project in the Energy Program to assess various synthetic fuels that can be used for transportation and automotive technology that can increase passenger car fuel efficiency beyond 1985 standards, and to compare these two options. The issue is how best to balance these approaches, as the synthetic fuel program develops and efficiency increases are contemplated, to achieve the most effective and economic path to reduced dependency on imported oil.

The Energy Program will review the technical, economic, environmental, and social features of the major synthetic fuels and automotive technology (increased automobile fuel efficiency and electric vehicles) including information from reports by the Congressional Research Service, the Congressional Budget Office, and OTA studies on oil shale and biomass. In addition, potential oil savings through increased efficiency and fuel-switching in stationary uses of oil will be briefly described. Synthetic fuels and increased automobile fuel efficiency will then be compared using a variety of criteria, including consumer and investment cost, time frame for deployment, environmental impacts, and macroeconomic impacts. Selected issues related to these subjects will be discussed and policy options developed.

Delivery date: Summer 1981 Call 226-2152 for further information

Requester Senate Committee on Commerce, Science, and Transportation.

International Security and Commerce

The interdependence of world nations is becoming increasingly evident. A wide range of vital U.S. national goals can be achieved only with the cooperation of other nations, or by deterring them from acting in ways that threaten the Nation. U.S. national security requires both economic and military strength, and U.S. technology continues to be an indispensable ingredient in both. Technology must continue to be a distinctive U.S. asset in the future, and must be used wisely. The International Security and Commerce Program assists Congress when setting an appropriate national policy requiring a sophisticated understanding of the status and implications of key technologies.

As military forces grow more and more expensive, the United States relies on a relatively small number of military systems, each of which embodies a variety of advanced technologies. In 1980, OTA initiated a project to study the ways in which the MX intercontinental ballistic missile (ICBM) could be based. During the course of 1981, Congress will be informed about the advantages, costs, and technical uncertainties of the alternative proposals for deploying this new missile.

In connection with international trade, the Program continued during 1980 a major assessment of the international competitiveness of the U.S. electronics industry. This industry is a particularly useful subject for study because it includes areas of substantial U.S. technological leads (e.g. advanced semiconductors) and areas in which the United States has failed to retain markets in international competition (e. g., color television sets). We drew upon this ongoing study as well as on completed OTA work on other industries to assemble a comparative study of U.S. international competitiveness in the steel, automobile, and electronics industries. This study highlighted ways in which technology, governmental policies, and other factors affect U.S. industrial competitiveness.

The Program's final major study in 1981 will point out the ways in which international commerce and the traditional definitions of national security interact. This is a study of the impact which transfers of U.S. (and other Western) technology in energy production to the Soviet Union could affect Soviet energy supplies in the next 10 years, and how the level of Soviet energy supplies might affect U.S. national interests. This project will examine and compare the state of technology in the Soviet Union, the United States, and other Western countries: it also will examine the difficulties which the Soviets might

have in paying for Western technology and in absorbing it effectively; and finally it will examine the controversy over future Soviet energy production levels and the role Soviet production plays in world energy markets. These studies will assist in advising Congress about the likely consequences of alternative U.S. export policies.

Competitiveness of U.S. Electronics industry

There is growing concern that U.S. industries are losing, or have already lost, their position of international technical leadership and that this in turn adversely affects their position in world markets. OTA is examining this problem by studying industries chosen to illustrate a spectrum of issues and industry capabilities. The electronics industry is particularly appropriate because it is sensitive to a volatile and rapidly advancing technology and because it occupies a strategic position in the light of its contributions to innovation in other industries. The OTA assessment will look at three sectors of this industry: consumer electronics (where the United States has suffered heavily from Japanese competition), semiconductors (where a strong U.S. position is under challenge), and computers (where the United States still appears to lead the world).

The assessment focuses on those major contributors to the competitiveness of the electronics industry that could most readily be affected by U.S. Government policy. In each case, a comparison is made between the United States, Japan, and (to a lesser extent) Western Europe. The major factors are: 1) commercialization of research, development, and design: 2) manufacturing techniques and resources; 3) finance, including both private and public sources of funds; 4) human resources; and 5) overall governmental industrial policies.

Delivery date: Summer 1981. Call 226-2020 for further information.
Requester Senate Committee on Commerce, Science, and Transportation

MX Missile Basing

The Soviet Union may now be in the process of acquiring, through increases in the accuracy of its new generation of MIRVed missiles (SS0 17's, 18's and 19's), the capability of destroying our land-based ICBMs in their silos. The Department of Defense expects this Soviet capability to become substantial in the early 1980's. In response, the administration has proposed to deploy a new missile, the MX, in a series of multiple protective structure groupings in the southwestern desert. Proponents claim that the missile location uncertainty thus introduced will protect these missiles from Soviet attack. Opponents object to the system on many grounds, including cost, technical feasibility, environmental impact, and an escalation in the arms race.

OTA's objectives are to assess the technical feasibility, strategic utility, cost, impact on the region, and future consequences of various MPS basing modes, and of any alternative missile basing modes that merit serious attention.

OTA is examining the latest administration MPS proposal, important generic classes of MPS systems, and various alternative basing concepts. Each will be investigated for technical feasibility (including technical risk, survivability, and the availability of resources), utility in the context of a variety of generic future scenarios (peacetime deterrence, arms control negotiation, severe crisis, and war) cost, in the broadest sense (both dollars spent and impact on the region where MX is based), and possible future consequences (including Soviet responses, and U.S. counter responses).

Delivery date: Summer 1981 Call 226-2020 for further information.
Requester Chairman and Vice Chairman of OTA's Congressional Board,

U.S. Industrial Competitiveness: A Comparison of Steel, Electronics, and Automobiles

OTA's study of technology and the steel industry was recently published; a parallel study on the international competitiveness of the U.S. electronics industry is in process. The efforts have now been extended in the study of industrial competitiveness to a cross-industry comparison. This comparative project draws on OTA's work in steel and electronics, supplements it with a

brief examination of the U.S. automobile industry, and discusses the implications of these three case studies for U.S. policies toward industry.

The three industry sectors differ with respect to a wide range of factors which influence competitiveness —e. g., export orientation; level, nature, and maturity of technology; and frequency of innovation. These differences permit comparative analysis of the three industries, including the effects of Government policies on their competitive strengths.

The project includes a comparative economic analysis of the three sectors, drawing on the existing OTA work. "the analysis will include evaluations of the competitiveness of each industry, as indicated—e .g., by parameters such as import penetration, productivity, and return on assets. Based on the work discussed above, Government policies towards the three industries will be examined, with particular attention to the ways in which they might vary from industry to industry.

Delivery date: Early 1981. Call 226-2020 for further information.
Requester: Senate Committee on Commerce, Science, and Transportation

Technology and Soviet Energy Availability

There is general agreement that the oil industry in the U.S.S.R. is facing serious difficulties. It is increasingly clear that the extent of Soviet energy problems and the way in which the Soviets deal with them can have a major impact on U.S. interests–i. e., in the effects of Soviet entry into world oil markets, the repercussions on the political and economic stability of Eastern Europe; and the increased chances of Soviet adventurism in the Persian Gulf. The U. S.S.R.'S problems result from the depletion of its older fields, which obliges it to look offshore or to remote areas of Siberia for proven reserves or promising sites for new discoveries. The harshness and/or accessibility of these areas, together with the lack of adequate technology, infrastructure, and trained manpower, will slow down their development during this decade. Similarly, the continued exploitation of more accessible fields is hindered by technological lags in Soviet drilling and enhanced recovery techniques and equipment. Whether the United States can or should assist Soviet oil production through the export of technology is a matter of debate; substantial disagreement also exists over the degree to which exports of American oil equipment and know-how to the U.S.S.R. might expand production, and over the impact of existing or potential U.S. trade policies on Soviet energy policies. The objective of this study is to illuminate these uncertainties by investigating the role that American technology might play in Soviet energy development.

The study addresses the following questions:

- What equipment and technology are needed by the Soviet Union for development of its energy resources?
- What factors inhibit or enhance the efficient use of imported energy technology in the U. S. S. R.?
- To what extent is the United States the sole or preferred supplier of energy technologies likely to be sought by the U. S. S. R.?
- Who are potential suppliers of comparable technologies and what are the costs and benefits of resort to them by the U. S. S. R.?

Based on the answers to these questions, OTA will construct several cases which assume various levels of availability of U.S. and other Western energy technology. These will be examined in terms of impact of such availability on Soviet energy production to 1990. The range of energy supply estimates will be used in turn to discuss the policy options available to the Soviets vis-a-vis other Warsaw Pact countries, the Western importers of Soviet energy, and the Middle East.

Delivery date: Summer 1981. Call 226-2020 for further information.
Requesters: Senate Committee on Banking, Housing, and Urban Affairs. House Committee on Foreign Affairs.

Materials

The industrial base of a modern technological society requires a vast array of raw materials of many different types. The importance of materials to our society is suggested by the fact that annual consumption of minerals in the United States is about 40,000 lb per person. Society uses materials through what is called the materials cycle. The cycle starts with extraction of minerals or harvesting of renewable resources such as wood, proceeds through processing and end-product manufacture to use of the product by the consumer, followed by disposal of the product, and in some cases, reuse or remanufacturing of the product or recycling of the material.

At every stage of this cycle, the ways in which materials are handled are affected in complex and interlocking ways by institutional, economic, environmental, and technical factors. For example, the exploration, development, and production of a significant fraction of our minerals and timber are governed by the Federal land management laws and regulations; the degree to which materials are recycled after use depends partly on the relative costs of virgin and recycled materials and these costs partly depend, in turn, on institutional and technical factors; environmental concerns are leading to more stringent and costly controls on operations at all stages of the materials cycle from extraction through waste disposal; and new technology has simultaneously opened up hitherto untouched areas for exploration, development, and production, and helped to mitigate at least some of the associated impacts on the environment.

The Program has one ongoing project related to extraction (Federal coal leasing) and one ongoing project related to processing and manufacturing (nonnuclear hazardous waste management). The new projects started in 1981 will probably be concerned with the efficient management and use of materials resources, including renewable materials resources.

Development and Production Potential of Federal Coal Leases

The Federal coal leasing assessment, mandated under the Federal Coal Leasing Amendments Act (Public Law 94-377), involves an independent analysis of all outstanding Federal coal leases, which include 564 developed and undeveloped leases and 172 preference-right lease applications. The study analyzes all mining activities on Federal leases, assesses the present and potential value (development potential) of the outstanding coal leases, estimates revenues to the Federal Government, and examines the feasibility of using deep-mining technology in leased areas. The assessment addresses issues of interest to the Senate Committee on the Interior and its subcommittee on Mines and Mining in evaluating the need for new leasing and the role of coal in the Nation's energy future.

Delivery date Spring 1981. Call 226-2210 for further information.
Requester Mandated by Public Law 94-377,

Nonnuclear Industrial Hazardous Waste

Many nonnuclear industrial hazardous wastes must be stored or disposed of with great care or they may constitute a threat to health and the environment. Information on the nature and magnitude of the hazardous waste disposal and abandoned site problem will be reviewed. The reliability and efficacy of present containment, abatement, and disposal measures will be assessed. This information, coupled with criteria and techniques to judge relative health and environmental hazards of a given waste, will assist in identifying those wastes which could be reduced at the source—by modifications in process technologies, by recycle, or by an end-use substitution. Approaches for reducing hazardous waste generation with minimal undesirable economic effects on domestic industry will be identified.

This assessment has four objectives: 1) to assess criteria for defining hazardous waste and for judging the relative health and environmental hazards of a given waste; 2) to evaluate technologies for cleaning up present waste disposal sites that are hazardous to health and the environment; 3) to assess technologies and approaches for the safe storage or disposal of hazardous waste being presently generated; and 4) to assess technologies and approaches for reducing the volume of hazardous waste. The possible economic impacts on domestic industry of various approaches will be evaluated.

The project will focus initially on understanding the adverse consequences of present disposal strategies and techniques, and next on ways of reducing generation of industrial hazardous wastes economically. Alternative options will be developed to cope with hazardous waste disposal in the short-run and hazardous waste generation in the long-run.

Delivery date Summer 1982 Call 226-221O for further information

Requester House Committee on Energy and Commerce

Health and Life Sciences Division

Food and Renewable Resources

The disappearance of abundant, cheap energy, the accelerating rise in world population, and industrial and economic development have all combined to put increasing pressure on the world's—and the Nation's —food and other renewable resources. In their scale and intensity, these pressures have rendered obsolete the traditional and largely compartmentalized views of agriculture, forestry, wildlands, and water management. Increasing and competing demands for these resources threaten to undermine their very capacity for self-renewal. The world's ability to make available to an expanding population a nutritionally adequate supply of food is exceedingly uncertain.

The Food and Renewable Resources Program explores, in its assessments and studies, the effects of technology on the productivity and sustainability of all elements of food and fiber production, distribution, and marketing; all ecosystems (agricultural lands, forestlands, wetlands, rangelands, deserts, etc.), their inhabitants, and their service functions; and human health as it is affected by food quantity and quality.

In today's world of 4 billion people, perhaps as many as 10 percent are suffering from malnutrition and, in some cases, starvation. As the global population rises to a projected 6 billion by 2000, world food demands will rise and the world will continue to look to the United States for assistance. How can technology contribute to the solution of food problems?

Economic and environmental pressures in the United States are changing the natural resource base. The United States is rapidly losing some of its best soils to erosion and salinization. Competing uses strain the water resource and affect its availability and quality. What are the new technologies that can help sustain the land's natural productivity and maintain water quality?

To provide Congress with information on these and related problems, the Program identifies current and emerging technological issues that affect the United States and world food and renewable resources situation as well as issues affecting the sustainability of the renewable natural resource base.

Future food studies will deal with aspects of food and agricultural systems and of diet-health relationships.

Future renewable resource studies will fall within the following categories: land and soils, forests and other vegetation, ground and surface water, wildlands and wildlife. The studies may focus on aspects of or relationships between these resource systems and on ways of manufacturing, restoring, or improving them through the wise application of technology.

Impact of Technology on Productivity of the Land

Were it not for technological advances, world agriculture would never have been able to keep pace with world population growth. Historically, U.S. technology has had a pronounced positive impact on increasing the productivity of croplands and pastures. U.S. dependence on a continuing supply of renewable natural resources compels it to maintain the stability of the ecological systems from which the resources arise. Now, however, there is increasing documented evidence showing that human activities are straining parts of the biological and physical systems and that the land's productivity is in jeopardy.

The land productivity assessment is examining the effect of presently used technologies on the capacity of the cropland and rangeland resource base to sustain high levels of production, and on emerging technologies that might be used to offset adverse effects of some of the established technologies. The assessment includes evaluations of: 1) The adequacy of available data on the effect of technologies on land productivity, and 2) new technologies that have potential for restoring, maintaining, or improving the productivity of the cropland and rangeland resource base. Selected case studies are being developed to indicate how society is affected directly and indirectly where long-term productivity of agricultural ecosystems is being altered through innovative applications of technologies.

Delivery date Summer 1981 Call 226-2264 for further in - formation

Requesters Senate Committees. environment and Public Works: Appropriations House Committee on Agriculture

U.S. **Food and Agricultural Research**

The success of U.S. food and agriculture industries has been based on an ever-increasing use of new technologies. However, the effectiveness of these technologies and/or their development seems to be decreasing at a time when the research problem base is expanding and the intensity of some problems is increasing.

This assessment will examine the scientific base for establishing national, regional, and local research problems; identify the role of the Federal, State, and private research institutions in solving these problems; evaluate cooperative methods in identifying priority research areas; update evaluations of the adequacy of present basic and applied research efforts; and evaluate public policy options for Congress.

Delivery date: Summer 1981. Call 226-2264 for further information.

Requesters: Senate Committees: Appropriations, Agriculture, Nutrition, and Forestry.

Innovative *Biological Technologies for Developing Countries*

This study reviews innovative biological technologies that might be used by the Agency for International Development (AID) to assist developing countries enhance the fertility of their tropical/subtropical soils and improve food production while reducing the need for costly commercial fertilizers. OTA conducted a workshop on this topic attended by 45 people in November 1980. The workshop included scientists from universities and executive branch agencies, congressional staff, and AID agricultural specialists. The final report will summarize 10 papers on innovative biological technologies and evaluations of the technologies, and present a summary of how these technologies might be used by AID.

Delivery date Spring 1981. Call 2262264 for further information

Requester House Committee on Foreign Affairs

Health

The value American people place on health is reflected in the large number of Federal policies on health. Many of these policies address issues of health-related technology, directly and indirectly, while a great many others indirectly affeet the development and use of such technology. As a result, the Federal Government has become deeply involved in every aspect of the

process of development and diffusion of medical technologies —supporting R&D, evaluating safety and efficacy, and encouraging the use of beneficial technologies, while discouraging the use of unsafe or obsolescent technologies.

The Health Program assists Congress by: 1) examining the Federal role in anticipating and managing domestic and international impacts of health-related technology; 2) identifying and highlighting the social, political, economic, and ethical concerns surrounding the development and use of medical technologies; and 3) assessing the consequences of Federal policies involving the provision of and payment for particular medical technologies.

The work of the Health Program up to now has focused on methods of evaluating clinical medical technologies, and evaluation of computers in health care. However, although health may be viewed as being determined by four factors (genetics, personal behavior, environment, and health care), those two areas relate almost exclusively to only one of the four—health care. The field of genetics is the responsibility of another OTA program, but little work has been done by OTA in the other two areas. Because of this, in 1978 it was decided to initiate studies concerning health and the physical environment. The first study is examining cancer and the environment. In addition, the Health Program is working with other programs on aspects of their assessments where health effects may be an important factor. For example, the Program has taken some responsibility for developing information being carried out by the Materials Program.

Cost-Effectiveness Analysis of *Inactivated* Influenza Vaccine

This assessment examines the costs and health effects of vaccination against influenza. Data regarding several aspects of influenza, including hospitalization, physician visits, work loss, school loss, and disability from fiscal years 1970 through 1978 are analyzed through the use of a cost-effectiveness analysis model.

All costs and health effects are converted into ratios (e.g., cost/year of healthy life saved), which are used to compare the cost effectiveness of influenza vaccination for selected age groups. A sensitivity analysis is used to test the significance of certain variables, such as vaccine efficacy. Potential implications of Federal reimbursement for influenza vaccination are discussed.

Delivery date: Technical Memorandum, Early 1981 Call 226-2270 for further information.

Requester: House Committee on Interstate and Foreign Commerce.

Technologies for Determining Cancer *Risks From the Environment*

Reducing exposure to carcinogenic agents in the environment depends on identifying the causative agents, assessing the agent's potency, locating sites of exposure, and deciding on appropriate interventions. In addition, regulations to reduce exposure must be politically, socially, and economically acceptable. In this assessment, OTA examines four major issues:

1. Estimates of the percent of cancer due to environmental exposure. Of particular interest are the quality of the data used to make the estimates, how the data can be improved, and what effect different estimates might have on cancer policies.
2. Technologies used to test for carcinogenicity. Testing of chemicals in rats and mice has been the mainstay of carcinogenicity testing. Those tests, the rapidly developing "short-term" tests, and epidemiologic methods for determining carcinogenicity are discussed and compared.
3. Methods used for extrapolating data from animals to humans. Different methods of extrapolation lead to widely divergent estimates of human risk. The limited number of efforts made to compare carcinogenicity in animals and humans are described.
4. Regulatory pathways for controlling carcinogens. The application and utility of available data implicating agents as carcinogens vary under different health laws and pol-

icies. The various approaches to regulating these agents are examined.

Also presented as part of the assessment are options for improving information gathering, processing, and decisionmaking.

Delivery date Spring 1981 Call 226-2070 for further information
Requester OTA Director, with approval of the OTA Congressal Board

Evaluation of *Veterans Administration Agent* Orange *Protocol*

The epidemiologic study by the Veterans Administration of the long-term health effects resulting from exposure to agent orange was mandated in the "Veterans Health Act of 1979, " Public Law 96-151. The same law requires OTA to review the study design. An advisory panel will be assembled to assist in the review.

Delivery date Indeterminate Call 226-2070" for further information.
Requester Mandated by Public Law 96-151.

Strategies for Medical *Technology Assessment*

Technology assessment is gaining increasing acceptance as a means of rationalizing health care. This trend has been stimulated by the rapidly rising costs of health care and technology's contribution to those costs. Since assessments can be expensive and time-consuming and can result in delaying the diffusion of beneficial technologies, and since not all technological developments can be systematically assessed, it is critical to select: 1) the right technologies to be assessed, 2) the optimum stage of technological development, and 3) the appropriate assessment methods. It is also important for the information gained from assessments to be disseminated in a timely and efficient manner. Currently, there is no coherent Federal policy regarding the selection process, and there are major problems with information dissemination. These issues are critical because many Federal agencies, as well as private organizations and individuals, depend on information from assessments to make decisions.

This study examines the appropriateness and validity of existing assessment methods, such as controlled clinical trials, epidemiological studies, consensus exercises, and computer models, with the intent of identifying alternative strategies for assessment. In addition, the MEDLARS information and retrieval system of the National Library of Medicine is evaluated with respect to the appropriateness of indexing, storage, and retrieval of useful information. The uses of that information by both governmental and private sectors are then examined in relation to the safe, efficacious, and efficient use of medical technologies.

Delivery date. Late 1981 Call 226-207(1 for further information
Requester. House Committee on Interstate and Foreign Commerce

Technology and *the Handicapped*

Approximately 45 million Americans–including 10 million children—have significant mental or physical handicaps. Technologies for aiding handicapped people are numerous, varied, and often complex and expensive. Such technologies are designed to alleviate. eliminate, or prevent the effects of handicapping conditions. They can be used to provide mobility and independence, restore or improve functional abilities, and help enable handicapped individuals to lead more productive and fulfilling lives.

The Federal Government's involvement in this area is extensive. A multitude of programs and agencies develop, evaluate, provide, pay for, and deliver technologies. Other actions—such as civil rights and education opportunity laws—provide conditions and incentives for further development of and investment in technologies for the handicapped.

Yet there are serious questions about whether technologies for the handicapped are being developed and used in as effective and efficient a manner as possible. Inadequate information exists regarding the overall process of technological development and use. Individual aspects of the technological process also remain troublesome. For example, what is the appropriate role for sophisticated technologies as opposed to (or in con-

cert with) the soft areas such as human service delivery systems that ultimately may determine the effectiveness of technologies? What methods exist for assessing the costs and benefits to society or to handicapped individuals of investment in or use of various technologies? What is the state of knowledge in regard to such costs and benefits? What effect will advances in medical technology have on the number and types of handicaps?

This assessment will provide information on general issues, such as the state of the art of evaluating efficacy, safety, and costs. In addition it will address definitional problems and their implications. Most critically, it will examine several theme issues in depth. For example, what are the causes and the effects of today's emphasis on sophisticated technology?

Delivery date Earlv 1982 Call 226-2070" for further Information
Requester Senate Committee on I.abor and Human Resources

Human Resources

The Human Resources Program explores technologies which directly affect human beings and their quality of life other than those which fall more appropriately into the Health or Food Programs. Examples are technologies affecting education, labor and population or deriving from genetics or other biological sciences.

Current assessments are in two areas: genetics and population. Interest in genetics arises from greatly expanded understanding of, and emerging capability for, altering or affecting the inherited characteristics of man, animals, and plants. The term "genetics" is used broadly and includes related biological technologies such as in vitro fertilization and artificial insemination. The importance of these emerging technologies is illustrated by the concern of the scientific community and the public over research with recombinant DNA, which led to development of the National Institutes of Health guidelines, the increasing use of procedures to detect genetic defects, and the recent successful human in vitro fertilization.

Rapidly growing population is a major factor influencing the quality of life everywhere. World population did not reach 2 billion until 1930, but only 45 more years were required to double it. Such rapid growth has placed great stress on the Earth and its resources as well as on economic and political stability, especially in those developing countries where population growth rates are highest. Increasing recognition of the importance of the rights of individuals to have children and to choose their number and spacing is illustrated by rising support for family-planning programs over the last 25 years. Prior to 1965 only a few Third World countries had developed such policies.

These assessments are of unusual interest because many of the issues they raise are rooted in individual and societal values, attitudes and beliefs.

Technology and World Population

World population has passed 4.4 billion and is expected to double in 70 years. Growth of this magnitude has major implications for the global biosphere and for international economic and political stability. Because of the serious consequences of rapid population growth—such as increasing demands for food, energy and jobs—most governments and international agencies have adopted policies and initiated programs in the last 20 years to modify birth rates.

OTA's study of global population examines how government policies and programs view planned birth technologies, and how new international population assistance has changed world population growth in the last 20 years. It projects probable impacts of population growth from 1980 to 2000 on food, energy, jobs, income, and other aspects of quality of life; and it assesses present and prospective planned birth technologies and factors determining their future development and use. The assessment focuses

on the Third World, where 92 percent of population growth in the next two decades will occur and where their governments seek to slow growth, It includes a research agenda relevant to their problems and presents policy alternatives open to the United States in dealing with world population issues. U.S. domestic population policies are not included in this assessment.

Delivery *date* Spring 1981 Call 226 2090 for further information
Requester The OTA Director, with the approval of the OTA Congressional Board

Impacts of *Applied Genetics*

"Applied genetics" refers to those technologies that can influence biological characteristics inherited by living organisms, Recent advances in knowledge are leading to greatly expanded capability to affect genetic characteristics and to use these techniques to improve the quality of life. Both industry and government in the United States and abroad are increasing their efforts to harness the gene for production of fuels, chemicals, and medicinal products. This assessment identifies and analyzes the impacts of nonhuman applications of genetic technologies. Animal, plant, commercial, and industrial applications are described. The costs and benefits. legal considerations, and social and ethical concerns associated with genetic technologies are identified and, where applicable, compared to those associated with nongenetic approaches. The potential of genetics in developing biological approaches to ensuring a sustainable future through renewab!e resources is considered. The study presents policy options with regard to such topics as the patentability of life forms, Government-industry relations in developing genetic technologies. and germplasm rnaintenancc.

delivery *date* Early 1981 Call 226- 2090" for further information
Requester The OTA Director, with the approval of the OTA Congressional Board

Science, Information, and Natural Resources Division

Communication and Information Technologies

Telecommunication and information systems technologies are rapidly advancing and becoming more integrated New facilities are being established, and new enterprises are merging in the United States and abroad. Governments are taking interest in the social and institutional implications of the new' technologies Government - tal and industrial reorganizations are occurring, new legislation is being proposed and adopted, and relevant international norms are being formulated in global and regional forums.

Because of the unprecedented growth in the new telecommunication systems investment. and the expanding impacts on society of emerging national information systems, several committees of Congress consider it essential to assess the developing technologies and their broad societal impacts. General policies affecting areas as such as innovation", education. use and management of radio frequency spectrum are also in a state of rapid change. The Communication and lnforma tion Technologies Program includes several projects, One, on national information systems. and another, on telecommunication systems, are be - ing conducted on a coordinated basis

The Parent System and New *Technological Enterprises*

The climate for generating new technologically based enterprises in the United States has worsened during the past decade Economists differ in their appraisals of the exact contribution such firms make to innovation, employment, and economic progress: however-. it is possible that the contribution level is high and that technologically based enterprises are essential to the growth and revitalization of our society. Fledgling entrepreneurs and independent innovators are frequently dependent on, and influenced by, the patent systcm to a much greater degree than are large, established firms. In almost all aspects of the patent system - e g , proscution, inter-

ferences, licensing, litigation–small firms and individual inventors face far more difficult obstacles and economic choices than do the large firms. The importance of new technologically based firms to the future economic vitality of the United States underscores the need to assess the impact of the patent system on the generation and stimulation of such enterprises.

Delivery date Spring 1982 Call 226-2249 for further information

Requesters House Committee on the Judiciary Senate Committee on the Judiciary.

Information Technology and Education

Over the last decade, the educational system has been increasingly pressed to meet a variety of new needs on a constant or even shrinking budget. The Federal and State governments now require that schools provide equal educational opportunities to groups traditionally outside the mainstream, such as the handicapped. Changing needs for job skills and changing demographic conditions also present new demands for education and training beyond the ages traditionally considered as the educational years. Information technology potentially provides opportunities for education systems to improve productivity and quality of instruction, and to offer more flexibility both in content, and in the time and place of offering. Previous attempts to enlist technology in education have had mixed outcomes, but the markedly lower cost and increased capability of new and projected computer technology, coupled with advances in telecommunication services, imply the need for a new look at educational use of technologies. The study will identify and project relevant technology and R&D activity and the providers and users of curricula, educational technology; and assess the likely impacts of selected alternative policies on the use of information technology.

Delivery *date:* Summer 1982. Call 226-2249 for further information.

Requester House Committee on Education and Labor.

Societal Impact of National Information Systems (NIS)

The NIS project comprises four interrelated information system studies, selected in response to several expressed Committee interests and grouped to ensure more efficient management and reduce cost. The National Crime Information Center (NCIC) of the Federal Bureau of Investigation and related State use of computerized criminal histories are being studied. OTA is examining operational aspects, access to and use of data, principal user categories, data quality in the system, State uses of and attitudes toward NCIC, and alternative managerial and technical futures. Future electronic message systems are being studied with emphasis on the U.S. Postal Service's role in such systems and implications of alternative national policies. Electronic funds transfer is studied with a view toward identifying likely growth rates in these services and the implications for society of alternative national policies in this area. An overall assessment of the broader implications of computer-based national information systems was nearing completion at year-end and will serve as an umbrella tying together the information systems studies in particular sectors.

De/iuery date Summer 1981 Call 226-2249 for further information

Requesters Senate Committee on the Judiciary House Committees: Judiciary, Post Office and Civil Service

Societal Impact *of Telecommunications Technology*

This study reviews the telecommunication technology base and industry structure and identifies major participants in the domestic common carrier telecommunication sector, their roles and interactions. A variety of future policy frameworks are being developed, including one that assumes no major change in the extant legislative base. The implications of these alternative policy frameworks are examined on the basis of a com-

mon set of key issues, and the projected implications will be set forth as far and as clearly as possible. Common issues being examined include aspects of rates, economics, and accounting; implications of regulation: competition and industry oversight: industry and market structures; role of the Bell system: the use of resources and impacts on R&D: and implications for using and affected publics.

Delivery date Spring 1981 Call 226-2249 for further information.

Requester Senate Committee~ On Commerce, Science. and Transportation

Impacts of the 1979 World Administrative Radio Conference

More than 150 nations' representatives met in Geneva, Switzerland, for 11 weeks in late 1979 to review and adjust the global allocation of uses of the radio magnetic spectrum. This major world meeting changed frequency allocations, adopted new definitions, planned additional future world and regional conferences, and modified the International Radio Regulations of the International Telecommunication Union (ITU). This study will review the U.S. preparations for and participation in that conference, identify its major results and project their impacts, and look at the future role of ITU and the U.S. participation in ITU and such future conferences.

Delivery date Fall 1981 Call 22(> -2249 for further inforrna tion

Requester Senate Committee on Commerce, Science. and Transporation

Oceans and Environment

Recent years have brought an increased awareness of the impact of the oceans on the well-being of humankind—the oceans' potential as a source of food, fuel, and hard minerals; their use as avenues of world commerce and communications; and their role in man's search for knowledge about his resources and environment. At the same time, we are beginning to understand that, although the oceans are vast, they are not inviolate to the interventions of man. Much more needs to be understood about the effects of such occurrences as oilspills, overfishing. the discharge of toxic substances and the role of the oceans in atmospheric carbon dioxide concentrations.

The United States, with a heavy marine interest, predicates its policies on facts derived from comprehensive ocean research. This effort is becoming increasingly more expensive as demands become more extensive. As a result, the job of Congress in determining the most effective allocation of Federal resources, both financial and institutional, has become more difficult and more critical.

To assist Congress in its deliberations. the Oceans and Environment Program focuses on a broad range of issues encompassing the uses and quality of the oceans and the systems deployed on or in the oceans or along their shores. The Program is particularly concerned with examining possible future uses of the oceans.

Fresh water Resources Management, Planning and Policy: An Assessment of Models and Predictive Methods

The effective management and protection of our freshwater is of far-reaching importance to the future of the Nation. Serious problems currently confronting the United States include inadequate surface water supply, ground water, hazardous drinking water, and erosion of our most productive soils into rivers and streams. As the Nation's water problems become more complex, the often

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conflicting advice presented to Congress by Federal agencies, advocacy groups, and expert witnesses is increasingly difficult to evaluate. Often this advice is based on the results of computer models and predictive methods of unknown quality or effectiveness. The information provided by these techniques becomes the basis for deciding such congressional water resource policy decisions as funding water supply structures. pollution control programs, and initiating the use of such new technologies as desalination. OTA's study of the tools that help supply this information will clarify which proposals are based on the best available analysis procedures and the assumptions and limitations of these tools. The assessment will consider a wider range of models and predictive methods, advising Congress of the credibility of the techniques used to predict the work of water resource projects and regulations, and the societal ennvironmental effects of these decisions.

Delivery date: Spring 1981. Call 226-2046 for futher information.
Requester: House Committee on Interior and insular Affairs

High-Level Radioactive Waste Management and Disposal

More than three decades into the nuclear age, this country still has no permanent disposal facilities for either military or commercial high-level radioactive waste. This assessment focuses on technologies for disposal of commercial high-level waste (spent fuel or solidified waste from processing). A clear understanding of the problem of managing radioactive waste from its generation to final disposal requires comprehensive analysis of the interactive relationships among possible storage and disposal technologies, transportation systems, regulatory considerations. and Federal, State, and local jurisdictional prerogatives. The OTA study is using a systems analysis technique to evaluate a range of strategies for developing and deploying a commercial high-level radioactive waste disposal system. Other waste forms are considered to the extent needed to deter-mine how their management and disposal will affect commercial high-level waste disposal plans and to provide a basis for analysis for the impacts of, and management problems presented by, a full-scale waste disposal system.

Delivery date Summer *1981* Call 226-2046 for further Information
Requesters House Committee on Merchant Marine and Fisheries Supported by House Committees Scienc~ and Technology. Foreign Affairs Senate Committee on Energy and Natural Resources

Impacts of Atmospheric Alterations

Many present day human activities—particularly the burning of fossil fuels—are altering the Earth's atmosphere in potentially harmful ways, The precise nature and extent of such activities is unclear. However, the potential consequences are severe enough to merit careful congressional consideration of domestic and international Federal policies.

Some of the consequences, such as acid rain, are occurring today. Others. such as global climate changes due to increasing carbon dioxide concentration, may appear within the next century. Increasing sulfur and nitrogen oxides and their transformation products (acid rains and oxidants) may damage thousands of lakes, decrease crop and forest productivity, deplete soil nutrients. and damage buildings and monuments. Increasing atmospheric carbon dioxide concentrations and other climate modifiers might result in global climate changes severe enough to disrupt present agricultural patterns and raise the sea level enough to flood major urban coastal areas throughout the world. Increasing sulfur and nitrogen oxides and certain climate modifiers may have adverse effects on human health.

The OTA study will develop a range of plausible impact scenarios covering the next several decades, describing the potential social, economic and environmental consequences of atmospheric changes caused by human activities. These scenarios will not attempt to "forecast" the future, but instead, present a range of plausible consequences of these changes, in terms responsive to near-term congressional decisions,

Delivery date Spring 1982 Call 226-2046 for further information
Requester HOUSe Committee on Interstate and Foreign Commerce

Ocean Research Technology

Federal ocean research efforts amount to about $1 billion per year and involve the operation of ships, satellites, buoys, aircraft, submersibles. and other- advanced technology. Our capabilities have increased in recent years. This has resulted in steady. repeatable data collection and survey work in several important areas. But such re se arc h work needs to be done with other ocean-related activities and phenonmena—in particular, weather and climate, marine pollution, undersea mineral exploration, and fisheries (especially krill). This assessment identifies the technologies and management systems that are most effective in researching these four areas. OTA will describe the options available for technology development as well as for getting the most out of existing equipment and management systems,

Delivery date Early 1981 Call 226 2406 for information
Requester. Senate Committee on Commerce, Science, and Transportation

Space Technology

The completion of the Apollo Program, the launchings of Landsat 1. the Synchronous Meteorological Satellite. and Applications Technology Satellite 6, and the arrival of the Viking spacecraft at Mars represented the culmination of U, S. civil space technology developments of the 1960's and early 1970's These activities were marked by international dissemination of American space "know-how" and the birth of commercializecl space systems, initially in communications. Since that time, advance in U, S, space technology capabilities have been slowecl by markedly reduced funding, except for- the Space Shuttle.

Many Federal. State, and local agencies use or are experimenting with uses of space-acquired data to support their missions. Private businesses in satellite communications have capital facilities valued at over $1 billion, based on the established space technologies. and private interest in commercializing new space ventures is growing. The United States faces competition from several other nations with declared space goals and funded. competitive technic-a] capabilities. The Space Shuttle is approaching operational capacity. but at present it serves only a limited orbital regime Controversy exists over the readiness of certain technologies to become operational, and the institutional arrangements, policies and procedures. if any. appropriate to their commercialization. Because the relatively straightforward things have largely been done. the next major advances in space technologies are likely to be more cost a n d to take longer Such advances are highly risky and long-term: they are widely seen as requiring government funding

Congressional committees have expressed concern about national policies for [J. S. civil space activities in the light of these conflicting developments. OTA has been asked to assess the U.S. civil space activities: the economic, social legal, and political impacts of the technologies and possible policy options dealing with the conflicts and issues suggested by the developments above,

The present study in this Program deals with overall issues and policy options and focuses on space applications. Topics such as science and exploration, the role of humans in space and their activities, and space transportation systems remain to be treated in depth.

Space Policy and Applications

The assessment explores the adequacy of the Nation's present and future civilian space technology base. It examines the possible reliance on that base for applications of space technology in the 1980-2000 time frame The focus will be on current and anticipated uses and management of remote sensing, communication satellites. materials processing in space. and the utilization of the space transportation system. A range of program and policy options will be developed, together with their societal, institutional, and economic implications. International impacts and cooperation and the U, S. space technology-based competitive position~ will also be considered. The

study has cross-cutting ties to the ongoing OTA assessments of solar power satellites, land productivity, and telecommunications, each with important space technology facets.

Delivery date: Summer 1981. Call 226-2209 for further information.
Requester: Senate Committee on Commerce, Science, and Transportation.

Transportation

Of major concern to Congress is the ability of the transportation system in the United States to provide fast, efficient, and inexpensive mobility for people and goods. Transportation industries have had to contend with increasing economic, operational, environ mental, and safety problems in recent years. In addition, there are a number of factors, growing In importance, which may force a change in transportation technology and policies in order to modify the system and the manner in which it is operated. These include:

- the almost complete dependence of the transportation system on petroleum in an era where dependence on imports must be reduced, and where supplies are dependent on the political stability of the Middle East;
- the rising percentage of the overall system cost represented by the cost of petroleum fuel;
- the physical deterioration of roadbeds and equipment at a more rapid rate than that of investment in their replacement; and
- the increasing cost of operating transportation systems--both public and private, freight and passenger-because productivity has not kept pace with demand for transportation services.

Since transportation supplies society with mobility for people and the wide range of goods and services needed, a degradation in the transportation system could significantly affect the character and lifestyle of society in the future.

In 1981, congressional interest will probably continue to focus on the influence of the cost and availability of petroleum and its effect on transportation systems, the deterioration of roadbeds and equipment, and the inability of the existing system (based on yesterday's technology) to meet the economic, environmental, and social needs of the future.

The Program will center its efforts on the effects of technological development in the areas of:

- goods movement technology—rail and truck systems—to improve service and reduce costs;
- urban transportation technology —evaluation of alternatives to the automobile to reduce petroleum consumption, emissions, and congestion;
- air transportation technology—to cope with changes in the system due to deregulation and increased costs of operation;
- reduction of the dependence on petroleum through the development of electrical propulsion and energy distribution systems.

Advanced Air Transportation Technology

This assessment examines the impact of introducing or not introducing advanced high-speed aircraft into our future commercial fleet and of other potential commercial aircraft developments. The assessment is being conducted in four parts: 1) advanced high-speed aircraft (completed), which examines the economic, energy, environmental, and societal impacts of introducing advanced subsonic and/or supersonic aircraft into the future commercial fleet; 2) program management and financing alternatives of advanced high-speed aircraft, which examines alternative structures for financing and managing new aircraft programs, specifically an advanced supersonic transport; 3) low-density air service which studies its historical evolution, the economics of low-density service and the determinants of market size, conditions of competition, future evolution of the domestic commuter airline industry and the impact of deregulation; and 4) air cargo operations, which includes the historical background and current status of the airfreight industry, economics of airfreight and

the potential market, competitive concerns, and the potential for technological change in future cargo aircraft, including lighter-than-air systems.

Delivery date Part 1, published April 1980, Parts 24. spring 1981 Call 226 2249 for further information
Requesters House Committee on Sciencce and Technology

Airport and Air Traffic Control System

Safety, performance in terms of capacity and delay, and productivity are vital concerns of our air transportation system, Increased traffic around many of our major and medium hubs, brought on partly through the Airline Deregulation Act of 1978, is contributing to safety, congestion, and delay problems. The cost of delay is becoming much more significant due to the increased cost of fuel, Also, public pressure against both noise and further expansion or development of airports is constraining possible solutions to these problems. However, there are a number of alternatives both technological and operational, which may help reduce or alleviate these problems. This is particularly true with regard to airport airside capacity. For example, in the next decade, proposed plans call for substantial investments to implement new technologies for air traffic control such as microwave landing, collision avoidance, navigation. communications, surveillance and higher levels of automation of the traffic control function. Other alternatives propose more efficient use of existing airports. development or improvement of reliever airports, more efficient ground transportation systems, and separation of traffic for various user groups as a means to improve airport airside capacity. In light of changing air transportation operational patterns, new aircraft technologies, and rapidly changing telecommunications and information systems technologies, this assessment will look at the process of growth of the commercial and general aviation sectors and examine the relative merits of alternatives to satisfy the air travel demand of the 1980 to 2010 time frame.

Delivery date Summer 1981 Call 226 2249 for further information
Requesters House Committee on Appropriations

Other Projects

Technology *for Local Development*

Technological innovations now being developed —such as land disposal of wastewater, distributed residential energy systems, and housing rehabilitation techniques—provide an alternative and possibly more effective approach to community and regional development. These technologies stress self-help and the use of renewable resources and are compatible with local capital and environmental requirements. This project assesses several prototype technologies, the local problems they may alleviate, and their feasibility and potential impacts, It examines options for Congress to build institutional structures that accrue the maximum benefits of these technologies to urban and rural communities,

Delivery date Early 1981 Call 226-2249 for further information
Requesters Senate Committee on Governmental Affairs
House Committees Select Committee on Population, Interior and Insular Affairs

Technological Innovation and Health, Safety, and Environmental Regulations

This assessment evaluates alternative regulatory policies with regard to their effectiveness and efficiency in ensuring that the rate and direction of technological change are compatible both with health. safety, and environmental goals and with the goal of maintaining economic vitality. The study includes an examination of how regulatory policies, when integrated with technical market and financial considerations at the corporate level. influence private investments in innovation,

Delivery date Summer 1981. Call 226-2060 for further information.
Requester Senate Committee on Commerce. Science. and Transportation

Section IV

TASK FORCE ON METHODOLOGY AND MANAGEMENT

Section IV
TASK FORCE ON METHODOLOGY AND MANAGEMENT

In November 1979, the OTA Director established an employee task force on Technology Assessment Methodology and Management with the following objectives:

- to improve the methodology and management of OTA's technology assessment projects;
- to build on OTA's 6 years of assessment experience, and on that of others in the public and private sectors and in other countries;
- to find ways to increase productivity and improve cost effectiveness in OTA; and
- to build a stronger team effort among OTA staff through cross-program and cross-divisional cooperation.

The Task Force, which includes a representative from each OTA program, met 12 times during the year and submitted its recommendations to the OTA Director in August 1980. Following discussions with OTA senior management and presentations to the Technology Assessment Advisory Council and the Technology Assessment Board, the OTA Director is implementing a number of the recommendations.

Dr. Gibbons noted that the work of the Task Force is a major contribution to better understanding and strengthening of the OTA assessment process leading to constructive, internal improvements at OTA.

Task Force recommendations now being implemented are:

- Development of an orientation program to help new staff, contractors, and consultants gain an earlier and more complete understanding of the OTA assessment process. The orientation package will include tape, written materials, personal briefings, and small group discussions.
- Improvement of intraoffice communication, For example, the publication "FOCUS" is now serving as a staff newsletter as well as a library reference document. Information kiosks and publication racks have been installed on each floor to increase staff awareness of the full range of OTA work. The well-received "Brown Bag" Friday seminar series also is effective in stimulating cross-program discussion on a wide variety of topics.
- Completion of an OTA operations manual which will be looseleaf so that it can be easily updated.

Several additional recommendations will be put into effect soon. These include revised OTA policies and procedures on preparation of project proposals, on internal review and approval of reports, and on project review checkpoints and project followup time.

The checkpoints will help encourage cross-program and crossdivisional review of projects at key points in the process, for example, at the point where the research is complete and a report outline has been developed but before the actual drafting of a report has begun. This should enable OTA to identify problems and provide guidance or assistance far in advance of the final draft.

Effective dissemination of study results is an essential part of the assessment process. The Task Force found that in the past, OTA had frequently given inadequate attention to communicating study findings effectively. A new draft policy would establish a 60- to 90-day period after report publication during which key project staff would be encouraged to take part in a variety of followup activities. These might include informal briefings for the requesting and interested committees, press briefings held jointly with committees, meetings with committees to advise them on possible witnesses and issues for hearings, presentation of OTA testimony, preparation of articles based on the study results for publication in scientific journals, and presentation of findings at scientific conferences. These kinds of activities help derive maximum returns to Congress on the investment in each project, and also contribute to the professional development of

OTA staff and the stature of OTA in the scientific and technical community.

Finally, there are a few recommendations related to productivity and quality control which will take time to implement:

First, a Task Force working group is preparing a technology assessment "workbook" for internal staff use which will bring together experience from every program about each major step of the assessment process. Lessons learned from new assessments will be folded into the workbook on a continuous basis through the use of project close-out reports, to be completed at the end of each major study.

Second, the Director has appointed an internal task force on OTA information systems. This group will review OTA's current use of information handling equipment, including word processors, computers, electronic typewriting equipment, and telephones, and to determine how to improve it. The task force will draw in part on related work already completed by the House Administration and Senate Rules and Administration Committees. It will also examine whether new services such as computer mailing, video-conferencing, or electronic filing offer any potential benefits to OTA.

Third, over the next several months a series of staff development seminars will encourage a more regular exchange of learning within OTA and help sharpen the skills of the professional staff. Likely topics include policy analysis, Congressional relations, and assessment strategy and methodology.

OTA has already initiated a survey of TA methodology and strategy employed by selected private firms and foreign countries. Retrospective methodology reviews of selected completed OTA studies are also underway. The intent of this effort, in part a followup to the work of the Task Force and closely coordinated with NSF, has two dimensions. One is self-improvement. What can OTA learn from the experience and perspective of others regarding our own TA methodology and strategy? A second is to contribute to the broader TA professional community. It has been more than 4 years since OTA's last effort along these lines, which resulted in TAB hearings and a report on "Technology Assessment in Business and Govern merit,"

Section V

ORGANIZATION AND OPERATIONS

Section V
ORGANIZATION AND OPERATIONS

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 began operations as the second session of the 93d Congress convened in January 1974.

The Act provides for a bipartisan Congressional Board, a Director, and such other employees and consultants as may be necessary to conduct the Office's work.

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 1980, Cong. Morris Udall (D-Arizona) and Sen. Ted Stevens (R-Alaska) served as the Chairman and Vice Chairman, respectively, of the Board. The two posts alternate between the Senate and House with each Congress. The Board members from each House select their respective officer.

The Congressional Board sets the policies of the Office and is the sole and exclusive body governing OTA. The Board appoints the Director, who is OTA's chief executive officer, and a nonvoting member of the board.

The Act also calls for a Technology Assessment Advisory Council comprised of 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, The Advisory Council advises the Board and the Director on such matters as the balance, comprehensiveness, and quality of OTA's work, and OTA's nongovernmental resources.

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 of the applications of technology; identify alternative technological methods of implementing specific actions: 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 necessary.

Initiation, Processing, and Flow of Assessments

OTA's primary function is to provide congressional committees with assessments or studies that 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 alone, 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 early establishes priority areas of study, and approves individual assessment projects within those areas. To help in making 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 effectively by the requesting committee or another agency of Congress?
- How significant are the costs and benefits to society of the various policy options in-

volved, and how will they be distributed among various affected 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?

Assessment reports 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, 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 assessment methods.

All OTA assessments strive to be objective, fair, nonpartisan, and authoritative. They must also be timely so as to meet congressional schedules.

Organizational Structure

The Office is organized into three operating divisions, each headed by an assistant director. The three divisions are Energy, Materials, and International Security; Health and Life Sciences; and Science, Information, and Natural Resources. They encompass assessments grouped in the areas of energy, food and renewable resources, human rescources, health, materials, international security and commerce, oceans and environment, communication and information technologies, and space technology. A chart detailing OTA's organizational structure accompanies this section.

Staff professionals represent a wide range of disciplines and backgrounds, including the physical, biological, and environmental 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.

Private Sector Involvement

The private sector is heavily involved in OTA studies as a source of expertise and perspectives while an assessment is in progress. Contractors and consultants are drawn from industry, universities, private research organizations, and public interest groups.

OTA works to ensure that the views of the public are fairly reflected in its assessments. OTA involves the public in many ways—through advisory panels, workshops, surveys, and formal and informal public meetings. These interactions provide citizens with access to information and help OTA identify contrasts between the perspectives of technically trained and lay citizens.

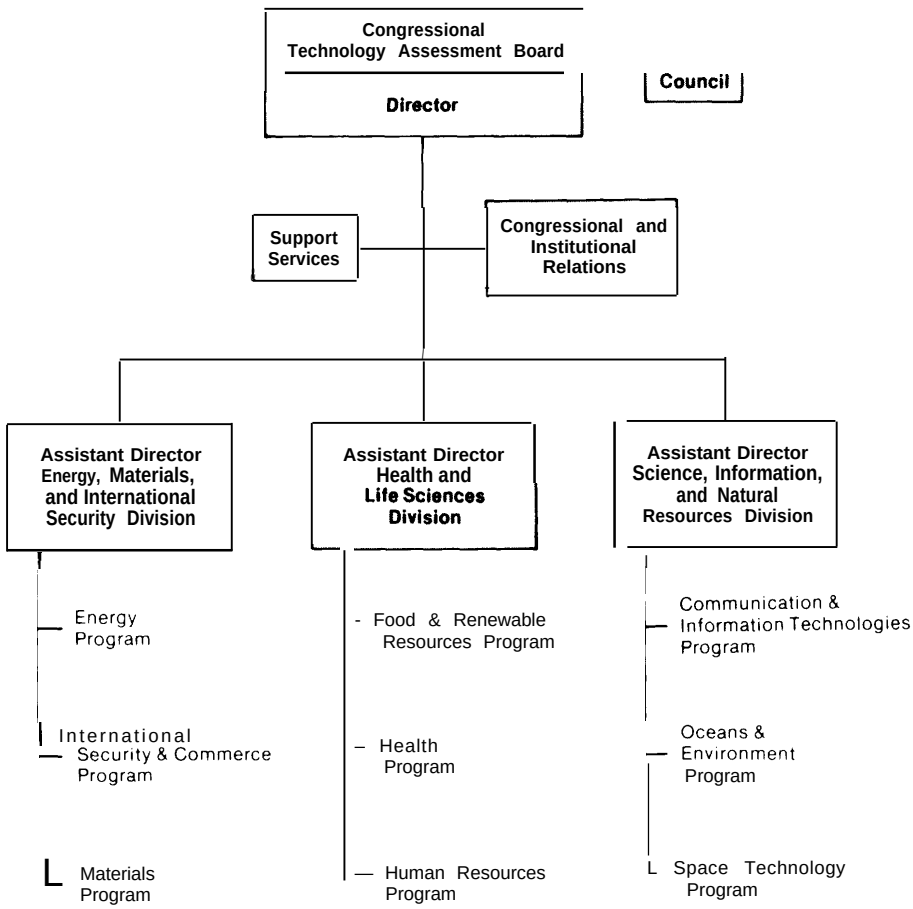
Operations

OTA's Public Communication and Publishing units provide a variety of services to Congress, the public, and the media. These activities are featured elsewhere in this section.

In addition, the Operations Division provides numerous services to the OTA staff, contractors and consultants, panelists, members of the Advisory Council, and others in the OTA "family. " Included among these services are the following:

- contract negotiation;
  personnel services;
- space, telephone, and equipment management;
  controllership and financial services;

OTA Organization Chart



- financial and management reporting;
- literature searches and legislative reference;
- book and periodical library/circulation services; and
- travel arrangements and property management.

Public Communications

The OTA Public Communications Office helps inform Congress and the public of OTA activities. The office acts as the main contact point with news media, handles public inquiries on OTA and its projects, directs special inquiries, and arranges press briefings. The office is also responsible for writing press releases and for coordinating and handling the initial distribution of reports, publication briefs, summaries, press releases, and other material to Congress, Board staff, and the public. Public Communications maintains the OTA mailing list, which includes over 25,000 names of leaders in virtually every phase of government, academia, and private industry, as well as representatives from major national news media.

Publishing Office

Production of OTA assessment reports and studies during 1980 has proven to be the most rewarding year of the agency's relatively short history. The Office has published and delivered to Congress 27 reports and studies that entailed 45 separate documents.

The recognition of the quality of information contained in the reports published is evidenced by:

- the numerous letter and phone requests received by the Publishing Office;
- the upsurge in sales of OTA reports and subsequent reprinting by the Government Printing Office (GPO);
- the sales recorded by the National Technical Information Service **(NTIS);**
- the number of private publishers that are reprinting OTA reports; and
- the Superintendent of Documents' selection of 24 OTA titles that will be displayed in six cities of the Peoples Republic of China in May 1981.

REQUEST FOR PUBLICATIONS

In order to expedite requests for OTA reports in a more efficient and timely manner to Members of Congress, congressional committees, Government agencies, and the general public, it was decided that the Publishing Office would be the central point for requests. This procedure enabled the Office to maintain an accounting of reports and keep an accurate inventory after the initial distribution was made to Congress. Since March 1980, the Publishing Office processed over 18,900 single and multiple requests. Of this total, 3,014 were requested by congressional offices (averaging 17.3/day) and 10,396 by the private sector (averaging 58.7/day).

SALES OF' PUBLICATIONS

Government Printing Office. -Sales of OTA publications by the Superintendent of Documents are proving to be quite popular with the public. According to a Superintendent of Documents spokesman:

> in comparison with other Federal agencies, OTA reports are considered good sellers. They have been selling at a higher and faster volume, they're better prepared than most agencies reports, and that they appear to be more understandable to the buying public .

The Superintendent of Documents sold 12,131 OTA reports for the period October 1 through December 30, 1980. Between January and December 1980, GPO sold 48,200 OTA reports for an estimated gross income of $280,000.

Summary of Sales of OTA Publications Through the Superintendent of Documents, GPO (July 1976 through December 1980)

	As of 12/79	As of 12/80	12 mos difference
Number of Individual titled publications put on sale to the publlc.	83	105	+ 22
Total number sold:	76,586	124,789	+ 48,203
Estimated GPO gross receipts from sales[a]	$271,880	$551,379	+ $279,499

[a]Based *on* **single copy** selllng price

National Technical Information Service. –NTIS sells scientific reports and papers that are, generally, not in great demand but are useful for scientific researchers. NTIS is the outlet for assessment working papers and contractor reports that are unavailable elsewhere.

During the past 18 months, NTIS informs us that sales of OTA reports have more than doubled and that 20 of OTA publications have made their bestseller list.

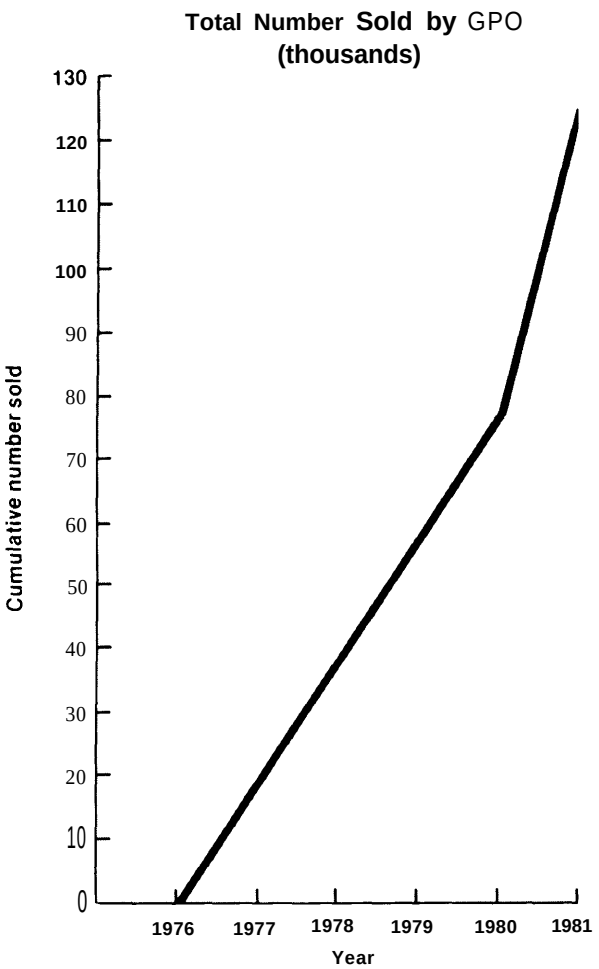
Summary of Sales of OTA Publications Through the National Technical Information Service (July 1976 through December 1980)

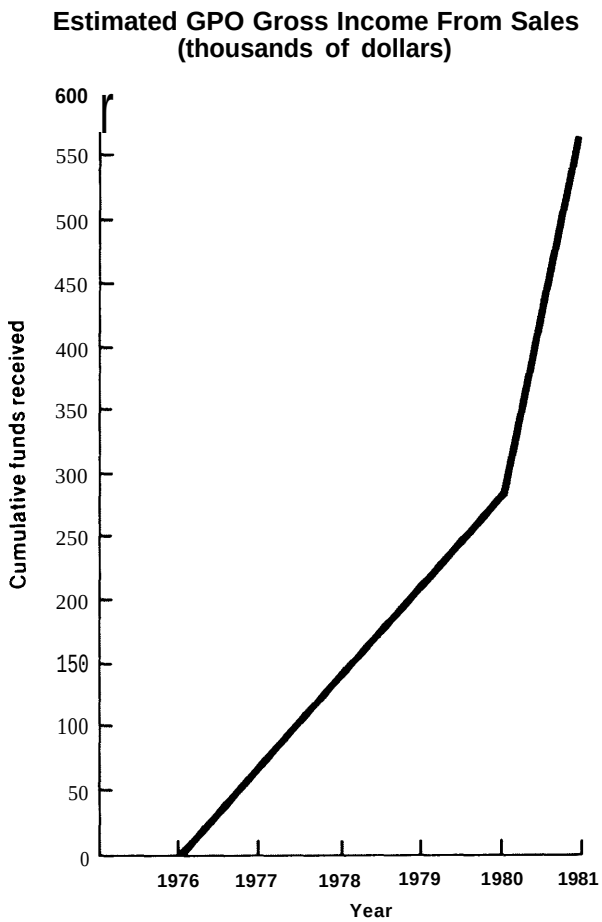
Number of Indlvldual titled publications put on sale to the public	102
Total number sold (hard copy)	5,200
(mlcrofiche)	10,971 } 16,171
Estimated NTIS gross receipts from sales	$77.183

Totals	No of copies sold	Estimated dollar amount
GPO	124,789	$551,379
NTIS	16,171	$ 77,183
Grand totals	140,960	$628.562

The Superintendent of Documents was recently requested by the Peoples Republic of China to exhibit U.S. Government publications in six cities of China in May 1981. Based on the specific interests of the Peoples Republic of China, the Superintendent of Documents chose 24 of OTA's publications for display. The following publications were chosen:

- Cancer Testing Technology and Saccharin
- Policy Implications of the Computed Tomography (CT) Scanner





An Evaluation of Railroad Safety
Ocean Thermal Energy Conversion
- Application of Solar Technology to Today's Energy Needs, VOLS. I &11
Assessing the Efficacy and Safety of Medical Technologies
- The Direct Use of Coal
Drugs in Livestock Feed: Technical Report
A Review of Selected Federal Vaccine and Immunization Policies Based on Case Studies of Pneumococcal Vaccine
- Technical Options for Conservation of Metals: Case Studies of Selected Metals and Products
. Gasohol: A Technical Memorandum
Technology and East-West Trade
- Environmental Contaminants in Food
Impact of Advanced Air Transport Technology, Part 1: Advanced High-Speed Aircraft
- Recent Developments in Ocean Thermal Energy: A Technical Memorandum
- Ocean Margin Drilling: A Technical Memorandum
- Technology and Steel Industry Competitiveness
- The Effects of Nuclear War
- Materials and Energy From Municipal Waste
- Computer Technology in Medical Education and Assessment: A Background Paper
- Pest Management Strategies in Crop Protection
- An Assessment of Oil Shale Technologies
- Energy From Biological Processes
- The Implications of Cost-Effectiveness Analysis of Medical Technology

75-319 0 - 81 - 5

PRIVATE SECTOR REPRINTING

Private publishers have expressed interest in several OTA publications. As of January 1981, nine OTA reports have been or are being commercially reprinted. This is in addition to the sales by GPO and NTIS. The following is a listing of the commercial publishers and the OTA publications that are being reprinted:

Friends of the Earth, Denver, Colo.
–Energy From Biological Processes– Summary

- McGraw Hill, New York
  —Enhanced Oil Recovery Potential in the United States
  —An Assessment of Oil Shale Technologies
  –World Petroleum Availability: 1980-2000
  –Energy From Biological Processes, vol. 11
- Allanheld, Osmun Publishers, New York
  —The Effects of Nuclear War
  –Technology and East-West Trade
  –Residential Energy Conservation, vol. I
- Westview Press, Boulder, Colo.
  –Energy From Biological Processes, vol. I

Praeger Publishing Co. , New York
—Nuclear Proliferation and Safeguards

OTHER ACTIVITIES

In a joint effort, OTA, CRS, CBO, and GAO put together an information kit containing a brochure about each agency and its functions. One hundred copies of the kit were used by the Secretary of the Senate and their personal staffs; 200 copies were distributed to CBO; 100 copies were distributed to GAO; and 1,100 copies were distributed to CRS to be used for their congressional staffs. OTA served as the coordinator in this effort.

Organizational Roster of OTA Staff as of December 1980

OFFICE OF THE DIRECTOR

John H. Gibbons, Director
Sue Bachtel, Executive Assistant
Barbara O'Bryan, Secretary
Sylvia Mokhtarian, Secretary

Congressional and Institutional Relations

Marvin Ott, Director CIR
Eugenia Ufholz, Assistant to Director CIR
Patricia Halley, Secretary'

Medical Services

Rose McNair, Resident Nurse

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

Lionel S. Johns. Assistant *Director*
Linda Riddiough, Division Assistant

Energy Program

Richard Rowberg, Program Manager
Thomas Bull, Project Director
Alan Crane, Project Director
Marian Grochowski. Secretary
Charles Holland, Senior Analyst
Nancy Naismith, Project *Director*
Stephen Plotkin, Senior *Analyst*
Lillian Quigg, Administrative Assistant
Jenifer Robison, *Project Director*
James Ryan, *OTA Fellow*
Joanne Seder, Research Assistant
Edna Saunders, Secretary
Paula Stone. Senior Analyst
Richard Thoreson, Senior Analyst
Ray Williamson, Project Director

International Security & Commerce Program

Peter Sharfman. program Manager
John Alic, Project Director
Martha Cal dwell, Analyst
Ronnie Lee Goldberg, *Project Director*
Helena Hassell, Secretary
Jeremy Kaplan. Project Director
Dorothy Richroath, Editorial Assistant
Jacqueline Robinson, Administrative Assistant

Materials Program

Audrey Buyrn, Program Manager
Patricia Canavan, Secretary
William E. Davis, Senior Analyst
Carol Drohan, Adiministrative Assistant
Joel Hirsch horn, Project Director
Gerd Kleineberg. OTA Fellow
Karen Larsen, Analyst
Phillip Robinson, Senior Analyst

HEALTH AND LIFE SCIENCES DIVISION

Joyce Lashof, Assistant Director
Ogechee Koffler, Division Assistant

Food and Renewable Resources Program

Walter E. Parham, Program Manager
Phyllis Balan, Administrative Assistant
Christine Elfring, OTA Fellow
Elizabeth Galloway, Secretary
Barbara Lausche, Analyst
Michael Phillips, Project Director
Bruce A, Ross, Project Director
Elizabeth Williams, Project Director

Health Program

H. David Banta, Program Manager
Clyde Behney. Project Director
Virginia Cwalina, Administrative Assistant
Shirley Gayheart, Secretary
Michael Gough, Project Director
Nancy Kenney, Secretary
Arthur Kohrman, OTA *Fellow*
Bryan Luce, Senior Analyst
Judith Randal, OTA Fellow
Michael A. Riddiough, Senior Analyst
Gloria Ruby, Analyst

Human Resources Program

Gretchen Kolsrud, Program Manager
Marya Breznay, Administrative Assistant
Susan Clymer, Secretary
David Cantor. Analyst
Les Corsa, Project Director
Zsolt Harsanyi, Project Director
Emiline Ott, *Senior Analyst*

SCIENCE, INFORMATION, AND NATURAL RESOURCES DIVISION

John Andelin, Assistant Director
Doris Smith, *Division Assistant*
Samuel Hale, *Executive Assistant*

Marci Conors, *Intern*
Scott Finer, Analyst
William Mills, *Senior Associate*
Marsha Mistretta, *Administrative Assistant*
John Young, Project Director

Communication and Information Technologies Program

Stephen Doyle, *Program Manager*
Norman Balmer, *Project Director*
Raymond Crowell, *Project Director*
Elizabeth Emanuel, *Administrative Assistant*
Teri Miles, *Secretary*
Zalman Shaven, *Senior Analyst*
Richard Weingarten, *Project Director*
Frederick Wood, *Project Director*

Oceans and Environment Program

Robert Niblock, Program *Manager*
Prudence Adler, *Analyst*
William Barnard, *Senior Analyst*
Kathleen Beil, *Administrative Assistant*
Rosina Bierbaum, *OTA Fellow*
Thomas Cotton, *Senior Analyst*
Robert Friedman, *Analyst*
Linda Garcia, *Analyst*
Nancy Ikeda, *Analyst*
Peter Johnson, *Associate*
Daniel Kevin, *Analyst*
Lucia Turnbull, *Analyst*
Linda Wade, *Secretary*

Space Technology Program

Richard Marsten, *Program Manager*
Marion Fitzhugh, *Secretary*
Donna Valtri, Analyst

Transportation Program

Robert Maxwell, Program Manager
Lee Dickinson, *Project Director*
Larry L. Jenney, *Project Director*
Jacqueline Mulder, *Secretary*
Paula Walden, *Administrative Assistant*
Jerry Ward, *Senior Associate*
Richard Willow, *Associate*

OPERATIONS DIVISION

Bart McGarry, *Operations Manager*

Administrative Services

Thomas P. McGurn, *Administrative* Officer
Susan Carhart, *Director of Contracts & Legal Services*
Lola Craw, Assistant to Administrative Officer
Alexandra Ferguson, Contract Specialist
Susan Klugerman, *Conference Center Coordinator*
Michael McIntyre, Research Assistant
Pearl Smulevitz, *Contract Specialist*
Geneva Watkins, *Travel & Admin. Training Coor.*

Financial Services

Alban Landry, *Controller*
Bill Burnett, *Voucher Examiner*
Loretta O'Brien, *Computer Technician*
Janice Perocchi, *Manager/Systems Planning Group*
Ann Woodbridge, *Manager/Operations Group*

Information Center

Martha Dexter, *Manager, Information Services*
Suzanne Boisclair, *lnformation Technician*
Carolyn Crenshaw, *Information Technician*
Marian Ulincy Starr, *Asst. Mgr., Information Services*

Personnel Office

William Norris, *Personnel* Officer
Katherene Mason, *Personnel Specialist*

Public Communications Office

John Burns, *Senior Editor*
Jean McDonald, *Press* Officer
Annette Taylor, *Assistant to the Press Officer*

Publishing Office

John C. Holmes, *Publishing* Officer
Kathie S. Boss, *Assistant Technical Specialist*
Debra Datcher, *Administrative Assistant*

APPENDIXES

Appendix A-Summary Report of Advisory Council Activities
Appendix B-Work in Progress (as of 12=31-80)
Appendix C—1980 Services to Congress
Appendix D-List of Published OTA Reports
Appendix E-List of Advisors and Panel Members
Appendix F–Technology Assessment Act of 1972

Summary Report of Advisory Council Activities

Charles N. Kimball, *Chairman*

It was with great pleasure that I accepted the chairmanship of the Technology Assessment Advisory Council, succeeding Dr. Frederick Robbins upon his assumption of the presidency of the National Institute of Medicine. I was particularly gratified that Dr. Jerome Wiesner agreed to serve with me as Vice Chairman of the Council.

The scientific and technological capabilities of the United States are diffused broadly in the industrial, academic, and research communities—public and private. If this Nation is to successfully confront the problems of the 1980's, science and technology must play a central role. Progress in agriculture, energy, health, transportation, telecommunications. trade, environmental protection, resource extraction, and other major sectors of activity is dependent on the scientific and technological enterprise. Government policies in turn have a critical impact on the health of that enterprise. Consequently, it is particularly important that Congress have access to the best scientific and technological judgment available in establishing national policies and programs,

OTA plays a vital role in gathering and focusing expertise from around the country on major issues facing Congress. The Advisory Council, comprising distinguished individuals from various disciplines, locations, and professions, works with the Congressional Board and the Director in this process.

Under the direction of Dr. John Gibbons, OTA has become an increasingly potent instrument in bringing science and technology to bear upon the Nation's needs. That role will assume even greater importance as we confront the challenges and complexities ahead.

Work in Progress (as of 12-31-80)

1. Alternative Energy Futures
2. Solar Power Satellite Systems
3. Synthetic Fuels for Transportation
4. Dispersed Electric Energy Generating Systems
5. An Analysis of Nuclear Powerplant Standardization Problems
6. Impact of Technology on Competitiveness of U.S. Electronics Industry
7. U.S. Industrial Competitiveness: A Comparison of Steel, Electronics, and Automobiles
8. Technology and Soviet Energy Availability
9. MX Missile Basing
10. An Assessment of Development and Production Potential of Federal Coal Leases
12. An Assessment of Nonnuclear Industrial Hazardous Waste
13. U.S. Food and Agricultural Research
14. Impact of Technology on Productivity of the Land
15. Technologies for Determining Cancer Risks From the Environment
16. Evaluation of Veterans Administration Agent Orange Protocol
17. Technologies for the Handicapped
18, Strategies for Medical Technology Assessment
19. Impacts of Applied Genetics
20. Technology and World Population
21. Technological Innovation and Health, Safety, and Environmental Regulations
22. The Patent System and Its Impact of New Technological Enterprises
23. Assessment of the Societal Impact of National Information Systems
24. Societal Impact of Telecommunications Technology
25. Space Policy and, Applications
26. Impacts of the 1979 World Administrative Radio Conference
27. Information Technology and Education
28. An Assessment of High-Level Radioactive Waste Management and Disposal
29. Impacts of Atmospheric Alterations
30. Freshwater Resources Management, Planning, and Policy: An Assessment of Models and Predictive Methods
31. Ocean Research ‘Technology
32. Impact of Advanced Air Transport Technology
33. Airport and Air Traffic Control System
34. Automotive Fuel Efficiency and Alternative Energy Sources

Appendix C

1980 Services to Congress

Communications With Congress

Testimony

- House Committee on Science and Technology: National Academy of Sciences Report: Energy in Transition, 1985-2010.
- House Committee on Science and Technology, Subcommittee on Transportation, Aviation and Communications: Management and Financing Options for Advanced Air Transport.
- House Committee on Appropriations, Subcommittee on Legislative Branch: OTA Fiscal Year 1981 Appropriations Request.
- Senate Committee on Appropriations, Subcommittee on Legislative Branch: OTA Fiscal Year 1981 Appropriations Request.
- Senate Committee on Governmental Affairs, Subcommittee on Energy, Nuclear Proliferation and Federal Services: S. 1699, The Energy Impacts Assistance Act of 1979.
- House Committee on Science and Technology, Subcommittee on Energy Development and Applications: H.R. 6638, The Municipal Waste-to-Energy Act of 1980.
- House Committee on Interstate and Foreign Commerce, Subcommittee on Health and the Environment: Health Professions Educational Assistance Act of 1976.
- Senate Committee on Veterans' Affairs: Veterans Administration Agent Orange Study,
- Senate Committee on Commerce, Science, and Transportation; Subcommittee on Science, Technology, and Space: S. 2015, Transportation Energy Efficiency Act.
- House Committee on Science and Technology: H .R. 7178, The R&D Authorization Estimates Act.
- House Committee on Science and Technology, jointly with House Committee on Interstate and Foreign Commerce and International Trade Subcommittee on the House Committee on Banking, Finance, and Urban Affairs: Technology and East-West Trade.
- Committee on Interstate and Foreign Commerce, Subcommittee on Health and the Environment: Drugs in Animal Feed.
- Senate Committee on Commerce, Science, and Transportation: Subcommittee on Science, Technology, and Space: Oversight hearings on the implementation of the Science and Technology, Policy, Organization and Priorities Act of 1976 and the Operation of the Office of Science and Technology Policy.
- House Committee on Science and Technology, Subcommittee on Energy Development and Applications: Cogeneration.
- House Committee on Interstate and Foreign Commerce, Subcommittee on Energy and Power: Methanol Fuel.
- Senate Committee on Environment and Public Works: Steel Industry.
- Senate Committee on Budget, Subcommittee on Industrial Growth and Productivity: Steel Industry.

Director's Congressional Appointments

- The Hon. Melvin Price, Chairman, House Committee on Armed Services.
- The Hon. Jennings Randolph, Chairman, Senate Committee on Environment and Public Works.
- The Hon. James M. Hanley, Chairman, House Committee on Post Office and Civil Service.
- The Hon. Harley O. Staggers, Chairman, House Committee on Interstate and Foreign Commerce.
- The Hon. Harold T. Johnson, Chairman, House Committee on Public Works and Transportation.
- The Hon. Henry S, Reuss, Chairman, House Committee on Banking, Finance and Urban Affairs.
- The Hon. Robert N. Giaimo, Chairman, House Committee on the Budget.
- Richard A. Wegman, chief counsel and staff director, Senate Committee on Governmental Affairs.
- The Hon. Claiborne Pen, Chairman, Senate Committee on Rules and Administration.
- The Hon. Adam Benjamin, Jr., Chairman, Subcommittee on Legislative Branch, House Committee on Appropriations.
- The Hon. Carl D. Perkins, Chairman, House Committee on Education and Labor.
- Letitia Chambers, staff assistant to Sen, Harrison A. Williams, Chairman, Senate Committee on Labor and Human Resources.
- Jonathan W. Fleming, legislative assistant for Sen. Alan D. Cranston, Chairman, Senate Committee on Veterans' Affairs.
- Joan Drummond, staff assistant to Sen. Robert C. Byrd, Senate Majority Leader.
- The Hon. Herman E. Talmadge, Chairman, Senate Committee on Agriculture, Nutrition, and Forestry,

- The Hon. Edward J. Derwinski, Ranking Minority Member, House Committee on the Post Office and Civil Service.
- The Hon. Robert T. Stafford, Ranking Minority Member, Senate Committee on Environment and Public Works.
- The Hon. Robert Wilson, Ranking Minority Member, House Committee on Armed Services.
- The Hon. Donald H. Clausen, Ranking Minority Member, House Committee on Interior and Insular Affairs.
- The Hon. J, William Stanton, Ranking Minority Member, House Committee on Banking, Finance, and Urban Affairs.
- The Hon. Howard W. Cannon, Chairman, Senate Committee on Commerce, Science, and Transportation.
- Minority Chief Counsel, Senate Committee on the Judiciary.
- The Hon. John J. Rhodes, Minority Leader, U.S. House of Representatives.
- The Hon. Albert Gore, Jr., U.S. House of Representatives.
- The Hon. Alan Cranston, U.S. Senate.
- Staff Director, Senate Committee on Finance.
- Staff Director and Counsel, Subcommittee on Energy and Power, House Committee on Interstate and Foreign Commerce.
- Staff Director, Subcommittee on Energy Development and Applications. House Committee on Science and Technology.
- The Hon. Ted Stevens, U.S. Senate.
- The Hon. Morris K. Udall, U.S. House of Representatives.
- The Hon. John Wydler, U.S. House of Representatives.
- The Hon. Larry Winn, Jr., U.S. House of Representatives.
- The Hon. Edward M. Kennedy, U.S. Senate.
- The Hon. Joseph L. Fisher. U.S. House of Representatives.

Responses to Congressional Inquiries

OTA regularly receives inquiries from congressional offices concerning issues which are the subject of ongoing or recently completed assessments. Responses to such inquiries are provided both orally or in brief written communications.

Cong. Don Fuqua	Technological issues of the 1980's (other than energy or military)
Cong. Bill Green .	Energy advantages of high-density urban areas
Sen. Birch Bayh	Ohio River Basin energy study
Sen Howard Metzenbaum .,	Low head hydro
Congressmen Edward Markey and Joseph Fisher	Cogeneration
Cong. Paul Simon	Introduction of methanol as a transportation fuel
Sen. Thomas Eagleton	Conservation and Solar Energy Programs of the Department of Energy
Cong. Mike McCormack	Energy demand
Sen. Jacob Javits	Electric power transmission costs
Cong. Leon Panetta	Breeder reactor schedule
Cong. Morris Udall	Coal
Cong Robert McClory	Wood energy
Cong. Bill Green .,	Energy conservation in cities
Cong, Jerry Huckaby	Nuclear powerplant standardization
Cong. Henry Reuss	Energy and the cities
Cong. Charles Vanik	Technology and steel industry competitiveness
Congressmen Harley Staggers, John Dingell, Bob Eckhardt, and James Florio	Hazardous waste
Sen. John Glenn	Calderon process
Cong, John Dingell .,	Mandated study on toxic substances, DOE studies of ethanol/methanol toxicity
Sen. Herman Talmadge	Chiropractic in New Zealand, Report of the Commission of inquiry
Sen. Alan Cranston . .	Five Epidemiologic Studies about herbicides and cancer incidence, photovoltaic costs, relative safety features of fission and fusion, agent orange
Senators John Melcher, Max Baucus, and Cong. Ron Marlenee	Study of saline seeps–their causes. consequences. and correction —in the Fort Benton - Highwood Bench region of Montana
Sen. Spark Matsunaga .	Tropical/subtropical nutrition research
Sen. Daniel Inouye.	Ocean thermal energy conversion
Cong. Berkley Bedell	CO, problem, oil and gas reserves controlling ethanol imports
Cong. George E. Brown, Jr	Results of the public participation and Three Mile Island conference, regulating chemicals, health, hazardous waste assessment
Sen. Charles Percy. . .	Present storage capacity problem at nuclear reactors

Cong Tom Evans	Skills needed in future technicians
Cong Don Fuqua	Moon Treaty
Sen George McGovern	The effects of nuclear war
Cong Patricia Schroeder	Oil shale
Cong. Ronnie Flippo	Solar power satellites
Cong. Robert McClory	Kemeny report
Cong. Anthony Toby Moffett	Propane/natural gas
Cong. James Blanc ard	Biomass and oil shale
Cong Christopher Dodd	Coal transmission
Cong. Ted Weiss ,.	Coal slurry pipeline, cost-effectiveness study
Cong. Cecil Heftel	Mechanical cogeneration
Cong, James Sensenbrenner	Coal slurry pipeline
Cong Jack Kemp	Coal slurry pipeline
Sen. Paul E. Tsongas	International solar work, Massachusetts utilities
Sen Howard Metzenbaum	Synfuels processes and direct hydrogenation
Cong Sam Gibbons	Steel Industry competitiveness
Sen. Lowell P Weicker, Jr	Psychotherapy case study advisory panel
Cong Robert W Daws	Medical technologies: tough decisions for the hospital trustee
Cong Carlos J Moorhead	WARC 1979 study and air traffic control-collision avoidance
Cong. Robert Duncan	Air traffic control-collision avoidance
Cong Robert A, Young	Air traffic control -collision avoidance
Cong Nicholas Mavroules	Plant Varieties Act, HR. 999
Cong George E Brown, Jr,	Regulating chemicals, health Many inquiries regarding the psychotherapy background report and the periodontal disease case study
Sen. Bill Bradley.	Cogeneration, dispersed electricit y
Sen Paul Tsongas	Massachusetts utilities
Cong Charles E Grassley	Gasohol prices
Cong Bill Frenzel	Conservation marketing
Sen Edward Nl Kennedy .,	Review of JEC report
Cong. Caldwell Butler	Gasohol's energy balance
Cong Thomas S Foley	Agriculture water use

Briefings, Presentations, Workshops for Congressional Staff

Committee	*Topic*
SENATE:	
Appropriations	NSF work in population Ocean drilling National Oceanic Satellite Taggants Agent orange NSF/NASA appropriations
Armed Services . .	Hospital information systems
Banking, Housing & Urban Affairs	Residential energy conservation ITC study of international trade in integrated circuits Administration embargo of high technology exports to the U S.S. R. Electronic funds transfer assessment
Budget	Economic growth and productivity Productivity hearings
Commerce, Science & Transportation	Steel and electronics studies OTA space study Moon Treaty Proposed study on airports and air traffic control WARC 1979 Industrial competitiveness COMSAT/lNMARSAT Tanker accidents Proposed legislation to modify Communications Act of 1934 Wind machines Automotive development–GM, Ford, and Chrysler Draft of technology and oceanographic report
Energy & Natural Resources	Biomass for S. 923 conference DOE C&SE study Oil shale report Ocean thermal energy conversion Coal leasing assessment Utah task force results Technology and Soviet energy availability y
Environment & Public Works	Land Productivity Analysis of spent fuel storage

	Away-from-reactor siting question, disposal problems
	S. 1480-Environmental Emergency Response Act
	International Wildlife Resource Conservation Act of 1980
	Acid rain
Finance	Evaluation of chiropractors
	Liquefied natural gas
	The value of pneumococcal vaccine
	Psychotherapy case study
	Colonial Virginia Foundation for Medical Care
	Cost-effectiveness study
Foreign Relations	Soviet energy
	Technology and world population
	Relationship of OTA population assessment and Foreign Rela - tions Committee population study
	Subcommittee staff report on international population programs
Governmental Affairs	Taggants (includlng attendance at markup session at committee request)
	Office of Strategic Technology
	Energy technologies and oil supply disruptions
Judiciary NCIC	report
	Patent study
Labor and Human Resources	Cost-effectiveness study
	Physician supply and requirements
	Past OTA work
	Patent study
Rules & Administration	Congressional computer and graphics capabilities and possible use for population presenta tions
Small Business	Generic drugs
	Acid rain
Steel Caucus.	Steel Industry competitiveness
Veterans' Affairs	Health effects of agent orange
	Expected mortality for a population the size and age distribution of Vietnam
	Theater Veterans, 1970-79
	Ingestion and inhalation of radioactivity at Utah A-bomb tests
HOUSE:	
Agriculture	Gasohol
	Biomass for S 932 Conference
	Agricultural water use
	U S food and agricultural research study
Appropriations	Technology and world population
	FAA's discrete address beacon system (DABS)
	Future of electric vehicles
	An evaluation of the Cooperative Automotive Research Program (CARP)
	Proposed study on air traffic and air traffic control
	Agent orange
	Taggants
	Cost effectiveness and PSROs
Banking. Finance & (Urban Affairs	Transportation and the evolution of cities
Budget	Financial incentives of oil shale development
	Technology and world population
Education & Labor	Information technology and education
Foreign Affairs .,	U.S trade policy: technology transfer
	Tropical deforestation
Intelligence Acid	rain
	Nuclear role in satisfying future electricity demand
lnterior & Insular Affairs	Oil shale
	MX missile basing
	Mlnerals policy, nonfuels minerals
	Ground water models
	Management & disposal of nuclear waste, away-from-reactor siting
	Freshwater resource study
	Agricultural water use assessment
Interstate & Foreign Commerce	DOE authorization hearings
	Eliminating the deductible requirement in medicare's reimbursement policies for blood donations
	Use of the nonreplacement fee in blood banking
	Payment for vaccines under medicare
	Physician supply and requirements
	Drugs in Livestock feed report
	OTA studies on benefits and costs of medical technologies
	Cancer risks
	Environmental contaminants in food
	Drugs exports to developing countries

	Auto fuel economy improvements
	WARC 1979
	Auto assistance and automobile industry measures
	Prescription drug use, evaluation & exportation
	Compensation for damage from hazardous substances
	Transportation of radioactive waste
	COMSAT/ IN MARSAT
	Cost-effectiveness analysis, risk assessment
	National Library of Medicine
	Methyl fuels
	Dispersed electric study, PURPA & FUA
	Fate of used oil and possibility for recycling
	Hazardous waste management
	Oil refining as it applies to hazardous waste regulations
	Hazardous waste legislation
	Pneumococcal vaccine
	Use of information technology and application
	Service and maintenance of automotive electronics
Judiciary . ,	NCIC report
	Patent study
Merchant Marine and Fisheries	Military surveillance systems
Narcotics & Abuse Control	Substitute crops for opium in developing countries
Public Works & Transportation	Issues in radiation control
	Airport and air traffic control
	Aircraft cabin safety
	Aircraft occupant restraints
Science & Technology	DOE conservation and solar energy study
	Telecommunications and the information system studies
	Impact of WARC 1979 Conference
	Information technologies and education
	Conservation and small power production after PURPA
	Cancer report
	Ocean thermal energy conversion
	Impact of inflation on the Federal R&D investment
	Coordination of activities In information policy technology
	Availability of premium quality Federal coal-oil backout legislation
	Genetics study
	Space study
	information policy
	Renewable resources technology
	Technological issues of the 1980's
	Major issues in Health Program
Small Business	Patent study
	NCIC CCH study
Steel Caucus	Steel industry competitiveness
Joint Committee on Taxation	Biomass
Veterans' Affairs	Agent orange
	Quality of research regarding exposure of U S servicemen to residual radiation in Nagasaki and Hiroshima
Ways and Means	Federal vaccine and immunization policies
	Japanese industrial quality and management
	Steel Industry
	Assessment and reimbursement of drugs and other medical technologies

Interactions With Other Congressional Support Agencies

Agency	*Topic*
CBO	Reviewed the changing energy problem
	Costs of vaccines project being carried out by CBO
	OTA's cost-effectiveness analysis of pneumococcal vaccine
	The implications of cost-effectiveness analysis of medical technologies
	Nuclear waste disposal funding
	Transportation/energy projects
	MX missile basing costs
	Economics chapter of oil shale assessment
	Medical technology and the handicapped
	Oil shale costs
	Review of bill to modify the Communications Act of 1934
CRS	Biomass and analysis of wood policy issues
	Seminar on innovation

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Exportation of drugs produced in the United States
Genetics report prepared by CRS
World Administration Radio Conference (WARC) 1979
Moon Treaty Workshop
Retrofit of oil/gas boilers for wood
Total energy systems, cogeneration, photovoltaic/ thermal cogeneration
Soviet energy
Research regarding Soviet technology
European views of East-West trade
Coal leasing assessment
Ocean research technology
Status and plans for NCIC study
NIS study -transborder data flow study by CRS
Information policy
East European energy
East-West technology transfer
Critical technologies
1980 Henniker Conference on technological innovation in the basic materials industries
Handicapped technologies
Population
Multinational corporations and tropical deforestation
Computer modeling for congressional staff
Exploration of support options for space study
WARC 1979 Study
Cogeneration /district heat
Petroleum refineries
Inflation in food prices and indirect cost of gasohol production
Dispersed electric energy generation systems
Energy and Soviet foreign policy
Washington Environment Development Group
Medical technology and the handicapped
Security chapter of electronic funds transfer systems
Information and communication technologies
Coal export
Space policy and applications

GAO . . Dispersed electric energy generation systems
Technology and Soviety energy availability
Agriculture and nutrition
Medical technology and the handicapped
Department of Justice Management Information Systems
NSF research ship management
Outer Continental Shelf leasing
NASA remote sensing and satellite communications programs
Air navigation systems
Analysis of the DOE Conservation and Solar Energy Programs
Germplasm maintenance
Professional Standards Review Organizations (PSROs)
Proposed GAO study of the Delaney amendment to food and drug laws
2,4,5-T: A component of agent orange
Ocean margin drilling program
Coordination of telecommunication and information systems
ANFLOW process
Energy analysis, data, models
Energy and cities
Decentralized electric power
MX missile basing
Oil shale
Hazardous waste
Agricultural research
Land productivity
Germplasm maintenance
OCS oil and gas
Post- 1985 automobile fuel-economy standards
Budgetary implications of NAVSTAR global positioning satellite (GPS)
Gasohol
Bureau of Mines –synfuels plants in the 1950's
Energy analysis for synfuels
Global domestic energy consumption
MX missile basing
Coal leasing and regulation of mining activities
Briefing to AAAS science and engineering fellows
Coordination of health area projects
USMC personnel exposed to agent orange in Vietnam
Cost effectiveness study
Nutritional assessment research presently funded by NIH
Assessment on food and agricultural research

	WARC 1979 study
	Patent study
	Airport and air traffic control systems
CRS-GAO . .	Uniform tire quality standards
CBO-CRS-GAO	Coordination of various energy activities within each agency
	International affairs
	Food and renewable resources

Appendix D

List of Published OTA Reports

Annual Report to the *Congress,* March 15, 1974, OTA-A-1

Technology *Assessment Activities of the National* Science Foun. datlon, June 12 and 13, 1974, OTA-A-2 (Hearings before the OTA Congressional Board)

Drug Bioequivalence, July 1974. OTA- H-3 Examines the relationships between the chemical and therapeutic equivalence of drug products

Requirements for Fulfillin, a National Materials Policy, August 1974, OTA-M-4 Consists of the proceedings of a conference on a national materials policy sponsored by the Federation of Materials Societies from August 11-16, 1974, at Henniker, N.H.

Automobile Collision Date An *Assessment Of* Needs and *Methods of Acquisition, OTA-T-5* Analyzes the nationwide data base on automobile accidents In Iight of proposals by the National Highway Traffic Safety Administration to use crash recorders to relate crash forces to injuries

"An Analysis Of *the* Department Of *the* Interior's Proposed Acceleratlon of Developrnent of Oil and Gas on *the* Outer Continental *Shelf,* March 1975, (1) '

An Analysis ldentifying issues in *the Fisca/ Year 1976* ERDA Budget, March 1975, (2) [2]

Annual Report to *the Congress.* March 15, 1975, OTA-A-6

An Analysis of the Feasibility of Separating Exploration From Production of 0il and Gas *on the* Outer Continental Shelf, May 1975, OTA-O 7 Analyzes the potential for and the alternative methods by which exploration for and production of 011 and gas resources on the Outer Continental Shelf could be separated into two distinct operations

Automated *Guideway* Transit: An Assessment of PRT and Other New Systems, June 1975, OTA-T-8 Examines the social and economic implications of Introducing new mass transit technologies m U S cities

0il Transportation by Tankers An Analysis of Marine Pollution and Safety Measures, July 1975, OTA- O-9 Examines safety problems of oil tankers and their potential effect on the ecology and quality of the oceans and coastal areas

Analyses of Effects of Limited Nuclear War/are, September 1975. (3) Examines the social, economic. political, and health effects of varvous levels of nuclear attacks on the United States and the Soviet Union

The Financial Viability of Conrad. September 1975, OTA-T-10 Analyzes the ability of the Consolidated Rail Corp. to pay its own way in light of proposed new rates

A Review of Alternative Approaches to Federal Funding of Rail Rehabilitation, September 1975, OTA-T-11 Examines alternative approaches which the Federal Government might adopt to solve the financial and other problems of railroads located in the Northeast and Midwest, but whose difficulties are national m scope.

An Analysis of *the* ERDA Plan and Program, October 1975, OTA-E- 12 Analyzes 99 issues, ranging from nuclear safety to the research outlook for solar and other alternative energy systems, raised by the long-range plan and program developed by ERDA in 1975

An Analysis of the *Impacts of the Projected Natural Gas Curtailments for the Winter 1975-76,* November 1975, OTA-E- 13. Assesses the impact on residential and business consumers of the 18 percent shortfall in natural gas supplies below contract requirements that was projected by the Federal Power Commission

A Review of National Railroad Issues, December 1975, OTA-T- 14 Reviews a series of issues ranging from rate structure to public subsidies for the railroad industry m the United States.

Energy, the Economy, and Mass Transit, December 1975, OTA-T-15 Examines the relationship of mass transit ridership to the energy shortages and economic recession experienced following the 1973 oil embargo.

An Assessment o/ Community Planning for Mass Transit. February 1976. Assesses the ways cities plan for mass transit as well as the problems and possible solutions to mass transit needs in the context of changing relationships between the Federal Government and the transit industry

Volume 1: Summary, February 1976, OTA-T-16

Volume 2: Atlanta Case Study, March 1976, OTA-T-17

Volume 3: Boston Case Study, March 1976, OTA-T-18

Volume 4: Chicago Case Study, March 1976, OTA-T-19

Volume 5: Denver Case Study, March 1976, OTA-T-20

Volume 6: Los Angeles Case Study. March 1976, OTA-T-21.

Volume 7: Minneapois-St Paul Case Study, March 1976, OTA-T-22

Volume 8: San Francisco Case Study, March 1976, OTA-T- 23

Volume 9: Seattle Case Study, March 1976, OTA-T-24

Volume 10: Washington, D C Case Study. March 1976, OTA-T-25

Volume 11: Technical Report, February 1976, OTA-T-26

Volume 12: Bibliography, February 1976, OTA-T-27

Comparative Analysis of the 1976 ERDA Plan and Program, May 1976, OTA-E-28 Compares the revised ERDA plan and program put forth in 1976 with the earlier 1975 document

OTA Board Hearings Food in/ormatlon Hearings, OTA-F-29 (See OTA- F-35.)

Automat/c 7-rain Control in Rail Rapid Transit, May 1976, OTA-T-30. Evaluates the safety, maintenance, and cost of different levels of automation of mass transit trains

Annual Report to the Congress, March 15, 1976, OTA-A-31

A Review of the U S Environmental *Protect/on* Agency *Environmental Research Outlook FY 1976 Through 1980,* August 1976, OTA E-32 Reviews the ability of EPA to anticipate environmental problems, given the day-to-day demands of its regulatory responsibilities, as evidenced in the research plans submitted by EPA to Congress in February 1976

The Feasibility and Value of Broadband Communications in Rural Areas. A Preliminary Evaluation. April 1976, OTA-T-33. Examines the issues involved in using communication technologies—

such as cable television, ground or satellite based microwave Iinks, and automatic broadcast repeater stations—to provide community services in rural areas

Development of Medical Technology Opportunities for Assess ment, August 1976, OTA-H-34 Examines the need for assessing the potential social impacts of emerging medical technologies while they are being developed

Food Informatton Systems Summary and Analysis, August 1976. OTA-F-35 Summarizes and Integrates lnformation gener ated on information systems designed to collect data on world food supply and demand

An Assessment of Alternative Stockpilng Policies, August 1976. OTA-M-36 Assesses the social, political, and economic Impacts of six alternative policies for stockpiling materials for purposes other than national security

Coastal Effects of Offshore Energy Systems, November 1976, OTA-O-37 Assesses social. economic. and environmental impacts of three proposed offshore energy systems

Volume //– Work/rig Papers, November 1976, OTA O-38

Coastal Effects of 0ffshore *Energy Systems* (Pamphlet). December 1976, OTA O-39 Summarizes certain findings and publlc polrcy alternatives of OTA's assessment report

An Assessment of information *Systems* Capabilities Required to Support U S Materials Policy *declsions,* January 1977, OTA-M-40 Analyzes the ability of existing information systems, relied on by Government and business policy makers for data on the supply and demand for materials, to help avert future shortages and solve other materials-related problems

Technology Assessment Activities In the Industrial, Academic, and Governmental Communities (hearings before the OTA Congressional Board). December 1976, OTA-X 41

Technology Assessment *in* Business and Government Summary and Analysis, January 1977, OTA-X 42 Summarizes and analyzes the evolution and Influence of technology assessment as a tool for policymaking In Government, business and industry, and the academic research communities

A Preliminary Analysis of the IRS *Tax* Administration System, March 1977, OTA TCI-43 Raises questions about the civil liberties, privacy, and due process of millions of Americans that could arise from a new computer system

Engineering Implications of Chronic Materials Scare/ty, April 1977, OTA M-44 Consists of the proceedings of a conference on national materials policy conducted by the Federation of Materials Societies from August 8-13, 1976, at Henniker. N H

General Issues In *Elementary and Secondary Education* (hearings before the Subcommittee on Elementary, Secondary. and Vocational Education), May 10, 11, 1977 (4)'

Establishing a 200-Mile Fisheries Zone, June 1977, OTA-O-45 Evaluates the problems and opportunities presented by the new 200-mile U S fishery zone

Volume II– Working Papers, June 1977, OTA-O-46.

Perspectives on Federal *Retail* Food Grading, June 1977, OTA-F-47 Assesses the capability of the current food grading system used by the Federal Government, as well as that of alternative systems that could be adopted

Nuc/ear Proliferatron and Safeguards, June 1977. OTA-E-48 Examines several nuclear power fuel cycles and ancillary enrich ment and reprocessing technologies for their Impact on the risks of the proliferation of nuclear weapons to nations or other groups that do not now possess them

Organizing and Financing Basic Research to lncrease Food Production. June 1977, OTA-F-49 Evaluates alternative methods for organ and funding basic research in the biological sciences which Is designed to increase food production

Nuclear Proliferation and Safeguards – Appendixes. June 1977, OTA-E 50 Two-part volume containing background data for OTA's assessment report

Volume 1
Volume II

Analysis of the Proposed National Energy Plan. August 1977, OTA-E 51 Provides an evaluation of the administration's energy plan and its impact on energy supply. energy demand, and society

Annual Report to the Congress, March 15, 1977. OTA A 52

Transportation of Liquefied Natural Gas, September 1977, OTA-O-53 Evaluates the status and trends of ongoing and proposed projects involving the transportation and handling of liquefied natural gas

Brochure. 0il Shale Technology, October 1977, OTA-M-54 '

Cancer Testing Technology and Saccharin, October 1977, OTA-H-55 Assesses the capacity of current testing methodology to predict the carcinogenic potential of chemicals consumed by humans

Policy lmplications of Medical lnformation Systems, November 1977, OTA-H-56 Examines the potential of computer-based medical Information systems

Gas Potential *From Devonian Shales of the Appalachian Basin,* November 1977, OTA-E 57 Analyzes the potential for producing gas from Devonian shales using existlng technologies under a variety of economic assumptions

OTA *Publications Listing, October 1980,* OTA P 58 '

Enhanced Oil Recovery Potential in the United States. January 1978, OTA-E-59 Assesses the potential for increasing domestic production of 011 by applying developing technologies to known reservoirs

A Technology Assessment on Coal Slurry Pipelines. March 1978. OTA E-60 Compares the cost of transporting coal by slurry pipelines to rail for certain routes

An Evaluation of Railroad Safety, May 1978. OTA-T 61 Evaluates trends In railroad-related accidents

Renewable Ocean Energy Sources Part 1, Ocean Thermal *Energy Conversion,* May 1978, OTA-O-62 Examines the renewable ocean energy sources that are being considered as possible contributors to our future energy supply, and evaluates the technological problems and policy that will affect further development of these sources

Working Papers Renewable Ocean Energy Sources Part 1, Ocean Thermal Energy Conversion, May 1978, OTA-O-63. (See OTA-O-62.)

Working Papers An Evaluation of Railroad Safety, May 1978, OTA-T-64 (See OTA-T-61)

Application of R&D in the Civil Sector, June 1978, OTA-R-65 Examines the management policies of the Federal Government for research and development aimed at the civil sector in light of the Federal Grant and Cooperative Agreement Act of 1977

Volume 1 *Application of Solar Technology to Todays Energy Needs.* June 1978, OTA-E-66. Evaluates the economic, technical, and environmental impacts of solar energy systems located at the point of use

Brochure – The Automobile: It's Driving Us To Think, August 1978, OTA-T-67 '

Annual Report to the Congress, August 1978, OTA-A-68

Working Papers Volume II, Materials and Energy From Municipal Waste, July 1978, OTA-M-69 (See OTA- M-93.)

The Role of *Demonstrations In Federal* R&D Policy. July 1978, OTA-R-70 Analyzes the role of demonstrations In Federal R&D policy and gives criteria for evaluating their success or lack thereof

Impact of a Department of Education on Federal Science and Technology Activities, August 1978, OTA-R-71 Suggests criteria for evaluating the Impacts of a new Department of Education on education programs in science and technology run by the National Science Foundation, as well as on other Federal science and technology activties

Policy Implications of the Computed Tomography CT) Scanner, August 1978, OTA-H-72 Analyzes issues such as efficacy, health planning, use, and financing arising from the widespread adoption of the CT scanner

Government Involvement in the Innovation Process – A Confractor's Report, August 1978, OTA-R-73 Examines the role of the Federal Government in influencing the Introduction of new technologles, goods, and services in the marketplace

Nutrition Research Alternatives, September 1978, OTA-F-74 Evaluates alternative strategies to redirect Federal research toward examining the relationship between nutrition and the changing health problems of Americans

Assess/rig the Efficacy and Safety of Medical Technologies, September 1978, OTA-H-75. Evaluates the need for assessments of the efficacy and safety of medical technologies before they go into widespread use

Volume 11. Working Papers, Analysis of Laws Governing Access Across Federal Lands Options for Access in Alaska, September 1978, OTA-M-76 Analyzes laws, regulations, and policies affecting access across federally owned lands to minerals on non-Federal lands

Volume II: Application of Solar Technology to Today's Energy Needs, September 1978, OTA-E-77 (See OTA-E-66)

The Health of the Scientific and Technical *Enterprise,* October 1978, OTA-R-78 Suggests criteria for examining the state or health of the scientific and technical enterprise in the United States

Emerging Food Marketing Technologies, October 1978, OTA-F-79 Examines new and emerging technologies for marketing food

A Preliminary Assessment of *the* National Crime Information Center and the Computerized Crimnnal History System, December 1978, OTA-1-80 Identifies issues emanating from use of the FBI's National Crime Information Center and Computerized Criminal History system

OTA Priorities 1979, January 1979. OTA-P-81 '

Volume 1 Analysis of Laws Governing Access Across Federal Lands Options for Access *in* Alaska, February 1979. OTA-M-82 Analyzes laws, regulations, and policies affecting access across federally owned lands to minerals on non-Federal lands

Volume I: Summary and Findings, Technology Assessment of Changes in the Future Use and Characteristics of the Automobile Transportation System, February 1979, OTA-T-83 Describes energy, environmental, safely, and cost impacts of technological changes

Volume II: Technical Report, Technology Assessment of Changes in the Future Use and Characteristics of the Automobile Transportation System, February 1979, OTA-T-84

Annual Report to the Congress for 1978, March 1979, 01-A-A-85

The Direct Use of Coal– Prospects and Problems of Product/on and Combustion, April 1979. OTA- E-86 Assesses the prospects as well as the environmental, health, safety, and other problems of mining and burning significantly more coal than at present

Volume II: Working *Papers, Residential Energy Conservation,* April 1979, OTA-E-87 (See OTA-E-92)

Management of Fuel and Nonfuel *Minerals in Federal Land,* April 1979, OTA-M-88 Analyzes Federal laws and practices that govern the exploration, development, and production of fuel and nonfuel minerals in onshore Federal lands

The Effects of Nuclear War. May 1979. OTA-NS-89 Examines the social, economic. political, and health effects of various levels of nuclear attacks on the United States and the Soviet Union

Selected Topics in Federal Health Statistics, June 1979, OTA-1{ -90 Examines data systems used in Federal health programs and offers alternatives for their effective management

Drugs in Livestock Feed, June 1979, OTA-F-91 Analyzes the use of antibacterial and other drugs to promote growth and prevent disease in livestock

Volume I: Residential Energy Conservation, July 1979, OTA-E-92. Examines the prospects of existing and new technologies for reducing energy consumption in homes

Volume 1 Materials and Energy From Municipal Waste – Resource Recovery and Recycling From Municipal Solid Waste and Beverage Container Deposit Legislation. July 1979, OTA-M-93 Examines present and potential technologies for producing energy and recovering resources from municipal solid waste

Open Shelf-Life Dating of Food, August 1979, OTA-F-94 Addresses the practicality, benefits, and costs of open shelf-life dating of food products

Railroad Safety U S -Canadian Comparison, August 1979. OTA-T-95 Compares U S and Canadian rail systems and railroad safety programs

A Review of Selected Federal Vaccine and Immunization Policies: Based on Case Studies of Pneumococcal Vaccine, September 1979. OTA-H-96 Analyzes Federal policies related to four areas of vaccine and immunization activities

Computer Technology in Medical Education and Assessment, September 1979, OTA-BR-H-1 [7]

Technical Options for Conservation of Metals: Case Studies of Selected *Metals* and *Products,* September 1979, OTA-M-97 Explores the kinds and amounts of waste that occur in our use of eight critical metals and the technical options for reducing that waste

Volume I– *Summary, Pest Management Strategies,* September 1979, OTA-F-98. Reviews the array of tactics currently used to control agricultural pests

Volume 1/– Working Papers, Pest Management Strategies. September 1979, OTA-F-99

Gasohol A *Technical Memorandum,* September 1979, OTA-TM-E- 1 [8] Discusses the technology and economics of gasohol production.

Volume [I] Public Participation, Technology Assessment of

Changes in the Future Use *and Characteristics of the Automobile Transportation System,* September 1979, OTA-T- 100 (See OTA-T-83)

Benefits of Increased Use of Continuous Casting by the *U.S.* Steel *Industry A Technical Memorandum* October 1979. OTA TM-ISC-2 "Describes the **continuous** casting process and the rate of its adoption by U.S. and foreign steel Industries

Technology and *East-West* Trade, November 1979, OTA ISC 101 Examines the economic. military. and political implications of technology transfer to the Communist world

Environmental Contaminants in Food – Summary December 1979, OTA-F-102 [6]

Environmental Contaminants in Food December 1979, OTA F 103 Discussess the different types and sources of chemical and radioactive contaminants in food

OTA – What It Is, What it Does, ***How*** it Works, March 1981. OTA PC- 104 [6]

Current *Assessment* Activities. March 1981, OTA PC- 105 [6]

Impact of Advanced Group Rapid Transit Technology, January 1980, OTA-T-106 Examines second-generation automated guideway transit systems as part of a solution to the need for Improved urban mass transit

Impact of Advanced Group Rapid Transit Technology – *Sum mary* January 1980. OTA-T-107

U.S. Disaster Assistance to Developing Countries *Lessons Ap plicable to U.S. Domestic Dissaster* Programs – *Background* Paper, **January 1980. OTA-BP-X-1** Evaluates trends in disaster assist ance and preparedness

Criteria for Evaluating the Implementation Plan Required by the Earthquake Hazards Reduction Act of 1977, January 1980. OTA BP X-2

Issues and Options in Flood Hazards Management, February 1980, OTA-BP-X-3 [7]

Annual Report to the Congress, March 1980, OTA-A-108

ALternative Energy Futures, Part 1: The Future of Liquefied Natural Gas Imports – *Summary.* March 1980, OTA-E-109 [6]

Alternative Energy *Futures, Part 1: The Future of* Liquefied *Natural Gas* Imports. March 1980, OTA-E 110 Evaluates projected U S demand global availability, cost and financing. and security of foreign supplies

Impact of Advanced Air Transport *Technology},* Part 1: Ad*vanced High Speed Aircraft – Summary,* March 1980, OTA-T-111 [6]

impact of Advanced Air Transport Technology, Part 1: A d vanced High Speed Aircraft, April 1980, OTA T 112 Assesses the economics. feasibility, and uncertainties of developing advanced subsonic and/or supersonic passenger aircraft

Forecosts of Physician Supply *and Requirements,* April 1980, OTA-H-113 Analyzes the assumptions, methods. and conclusions of the technologies for forecasting both the need for and supply of physicians by specialty and geographical distribution

The Effects of Nuclear War – Summary, April 1980, OTA-ISC-114 [6](See OTA- NS-89)

Taggants in Explosives – Summary. April 1980. OTA-ISC-115 [6]

Taggants In Explosives, April 1980, OTA-ISC-1l6 Assesses the technical feasibility, safety ramifications. costs, and law. enforcement utility of a proposal to require that commercial explosives be man ufactured with "ldentification taggants "

Recent Developments in Ocean Thermal Energy, April 1980. *OTA-TM-O-3* Reviews status of ocean thermal *energy* conversion (OTEC) developments occurring after OTA's 1978 report

Ocean *Margin Drilling, May 1980. OTA-TM-O-4* [4]**Evaluates** *the newly proposed public private* cooperative research effort in marine geology

An Assessment of Oil Shale Technologies – Summary June 1980. OTA M 117 '

An Assessment of Oil Shale Technologies, June 1980, OTA-M-118 Assesses the status and potential of technologies for the development of 011 shale resources

Volume II: *History and* Analysis of the Federal Prototype Oil Shale Leasing Program, July 1980. OTA M- 119

Conservation and Solar Energy Programs of the Department of Energy –A *Critique,* June 1980. OTA-E-120 Analyzes the progress and direction of five major conservation and solar energy pro grams of the Department of Energy

Technology and *Steel Industry Competitiveness – Summary* June 1980, OTA-M-121 [6]

Technology and Steel Industry Competitiveness, June 1980, OTA-M 122 Assesses how and when new technology can Improve the International competitivenss of the U S steel industry

Energy From Biological Processes – *Summary.* July 1980. OTA-E- 123 '

Energy From Biological Processes. July 1980. OTA-E 124 Evaluates the energy potential of plant and animal matter (biomass) concentrating on four biomass fuel cycles –- wood, alcohol fuels, grasses and crop residues. and animal wastes.

Proceedings of the OTA Seminar on the *Discrete* Address Bea con System (DABS), July 1980, OTA BP- T-4 " Summary of find ings and proceedings of a seminar held to examine some impacts of the FAA proposal to Implement DABS and the Automatic Traffic Advisory and Resolution Service

Volume II: Technical and Environmental Analyses, Energy From Biological *Processes,* September 1980, OTA-E-128 (See OTA--E- 124)

The Implications of *Cost-Effectiveness Analysis of* Medical Tech nology — Summary, August 1980, OTA-H- 125 [6]

The Implications of Cost-Effectiveness Analysis of Medical *Technology,* August 1980, OTA H 126 Analyzes the feasibility. implica - tions. and usefulness of cost-effectiveness analysis (CEA) and cost benefit analysis (CBA) in health care decisionmaking

Background Paper # 1 Methodological issues and Literature Review, September 1980, OTA-BP-H 5 [6]

Background Paper #3 The Efficacy and Cost Effectiveness of Psychotherapy, October 1980. OTA- BP-H-6 '

Background Paper #4 The Management of *Health* Care Technology In Ten Countries, October 1980. OTA BP H 7 '

A Technology *Assessment* of Coal Slurry Pipelines – Summary, September 1980, OTA-E- 127 [6]

World Petroleum *Auailability 1980-2000,* October 1980, OTA-TM- E-5 " Examines prospects for world supplies and production in coming decades

Compensation for Vaccine-Related Injuries, November 1980, OTA-TM-H-6.[8] Discusses the questions that Congress must answer in developing a compensation program

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"Included in appendix in publication OTA O-7

[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 $21 50, hardcover Please direct all purchase orders to Holt, Rinehart and Winston, 383 Madison Avenue, New York N Y 10017

[6]Available at no charge from OTA Publishing Office, Tele (202) 2248996

[7]Published as a background paper, which is a document that contains Information believed to be useful to various parties The Information undergirds formal OTA assessments or is an out come of Internal exploratory planning and evaluation The material is usually not of Immediate policy interest such as is contained in an OTA report or technical memorandum nor does it pre sent options for Congress to consider

[8]Published as a technical memorandum, which is issued by OTA on specific subjects analyzed in recent OTA reports or on projects presently in process at OTA Technical memoranda are issued at the request of Members of Congress who are engaged in committee legislative actions which are expected to be resolved before OTA completes its assessment

For information and availability of these publications, please call OTA's Publishing Office, 224-8996

Appendix E

List of Advisors and Panel Members

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

ENERGY PROGRAM

Energy From Biological Processes Advisory Panel

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American Association for the Advancement of Science

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University of California at Santa Barbara

Stanley Barber
Department of Gronomy
Purdue University

John Benemann
Vacaville, Calif.

Paul Bente, Jr.
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Oak Ridge National Laboratory

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Exxon Research and Engineering Co.

Robert Hodham
Hodham Associates
Sacramento, Calif.

Kep Hewlett
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Ralph Keinker
Monsanto Co.

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Iowa Farm Bureau Foundation

Kevin Markey
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Technology Assessment Act of 1972

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

An Art

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 Assessment Act of 1972".

Technology Assessment Aot 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.

(b) Therefore, it is essential that, to the fullest extent possible. the consequences of technologies] applicat ions be anticipated, understood, and considered in determination of public policy on existing and emerging nnt ional problems.

(c) 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 t i mely in formal ion. independently developed, relating to tile potential impact of tech nological applicat ions, and

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

(d) Accordingly, it is necessary for the Cengress t*

(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 facter in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for. or management or regula tion of, tech nological applicat ions.

ESTABLISHMENT OF THE OFFICE OF TECHNOLOGY ASSESSMENT

SEC. 3. (a) In accordance with the findings and declaration of purpost' in section 2, t here is hereby created the office of Technology Assessment (hereinafter referred to as the "Office") which shall be within and responsible to t he legislat i ve 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 indicat ions of t he probable beneficial and adverse impacts of the applicat ions of technology and to develop other coordinate information which may assist the Congress. In carrying out such function, the Office sha11:

Duti es.

(1) ident ify exist ing or probable i mpacts 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 be 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 Representatives with each Congress. The chairman during each even-numbered Congress shall be selected by the Members of the House of Representatives 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.

Subpena.

(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.

DIRECTOR AND DEPUTY DIRECTOR

Appointment.

Compensation.

83 Stat. 863.

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.

(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,

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(Jr possession or any political subdivisi01) 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 3648 of the Revised Statutes (31 (". 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 ('ode, for persons serving without compensation;

00 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 governin, 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 m 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 prpose *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, suggestions, estimates, statistics, and technical assistance for the purpose of carrying out its functions under this Act. Each such executive department or agency shall furnish the 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 Office in carrying out its functions under this Act.

(f) The Director shall. in 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 tile "Council"). Tile Council shall he composed of the following twelve members:

(1) ten members from the public, to be appointed by the Board, who shall be persons eminent m one or more fields of the physical, biological, or social sciences or engineering or experienced in the administration of technological art ivities, 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.

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

(1) review and make recommendations to the Board on activities undertaken by the Office or on the initiation thereof in accordance with section :)(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 th, term for which his predecessor was appointed shall be appointed for the remainder of such term. No person shall be appointed a member of th, 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.

(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 regulat ions promulgated thereunder.

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

Compensation.

(2) The members of the Council appointed under subjection (a) (1) shrill 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 surh 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 tile 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 is, however, authorized to establish within the Congressional Research Service such additional divisions, groups, or other organizational entities as may be necessary to carry out the purpose of this Act.

(d) Services and assistance made available to the Office 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 (3 ENERAL ACCOUNTING ( )FFICE

SEC. 9. (a) Financial and administrative services (including those related to budgeting. accounting. financial reporting, personnel, and 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 the 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 ('ongress.

(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.

('(X)RDINATION WITH THE NATIONAL SCIENCE F(IL X" DATION

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

(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 mutters 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 Office 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; 32 Stat. 365. 42 USC 1873.

.\ NNUAL REP( )RT

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 nnd identification, insofar as may be feasible. of technological areas and programs requiring future analysis. Such report shrill be submitted not inter than March 15 of each year.

APPROPRIATIONS

SEC. 12. (a) To enable the 05ce 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 $5,000,000 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. 92469 (Comm. on Science and Astronautics) end No. 92.1436 (Comm. of Conference).
SENATE REPORT No. 92-1123 (Comm. on Rules and Administration).
2ONGRFSS1ONAI, RECORD, Vol. 118 (1972):
Feb. 8, considered and passed House.
Sept.14, considered and passed Senate, amended.
Sept .22, S crate agreed to conference report.
Oct. 4, House agreed to conference report.

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