6. Paraphrases of the opinions of reviewers may be made available to applicants upon request. The NSB is considering whether to release the names of reviewers under some circumstances.
7. *Congressional Record*, 24 June 1975, p. H6015.
8. Statement by Representative John B. Conlan (R–Ariz.) before the Subcommittee on Science, Research, and Technology of the U.S. House Committee on Science and Technology, 22 July 1975.
9. Office of Management and Budget, *Drug Research Reports*, **16** (No. 22), 4 (1973).
10. See, for example, the statement by J. L. Powell, Provost of Oberlin College, before the Subcommittee on Science, Research, and Technology of the House Committee on Science and Technology, 24 July 1975.
11. D. Shapley, *Science* **175**, 1090 (1972).
12. Charges such as these led to the formation by the National Academy of Sciences of a Committee on the Utilization of Young Scientists and Engineers in Advisory Services to Government. See the report of the Committee, *The Science Committee* (National Academy of Sciences, Washington, D.C., 1972).
13. N. Wade, *Science* **179**, 158 (1973).
14. Statement by R. C. Atkinson, Deputy Director, NSF, before the Subcommittee on Science, Research, and Technology of the House Committee on Science and Technology, 23 July 1975.
15. For a review of the issue of representative bureaucracy, see C. Mosher, *Democracy and the Public Service* (Oxford Univ. Press, New York, 1968); K. J. Meir, *Am. Political Sci. Rev.* **69**, 526 (1975).
16. Public Law 92–463. A crucial exception to the coverage of the act is the many advisory committees of the National Academy of Sciences–National Research Council, which account for nearly half of the total number of advisory committees in the federal government.
17. *Science & Government Report* **5** (No. 13), 8 (1975).
18. The median age of NSF advisers has undergone some interesting changes over the last 20 years. From 51 years in 1954, it dropped to 44 in 1966, and rose again to 47 years in 1970. (These data are drawn from a forthcoming study by N. Mullins *et al.* at Indiana University. I thank Professor Mullins for making some of his findings available to me.)
19. National Science Foundation, *NSF Management Statistics* (prepared by the NSF Administration Directorate, July 1975), p. 19. It should be observed that the apparent sex bias is no doubt a reflection of the age bias. That the percentage of Ph.D.'s awarded to women has been increasing in scientists would reflect the sex discrimination of graduate education 20 or 30 years ago.
20. NSF Administration Directorate, *An Analysis of the Geographical Distribution of NSF Awards as Compared with Other Selected Indicators* (National Science Foundation, Washington, D.C., 1975), p. 1.
21. Findings of the Public Policy Committee, Division of Biological Chemistry, American Chemical Society. I thank E. W. Westhead, professor of biochemistry at the University of Massachusetts (Amherst), for a summary of the committee's data.
22. Preliminary results of a study of the NSF advisory system by N. C. Mullins, *Social Stud. Sci.* (1 July 1975).
23. N. C. Mullins, *Sci. Stud.* **2**, 7 (1972).
24. Hagstrom's work is described in N. Wade, *Science* **188**, 429 (1975). It is conceivable, however, that this finding would not hold for peer review panels; since the latter are highly prestigious, they may draw more than proportionately from prestige institutions.
25. Data presented by NSF to the Committee on Science and Public Policy of the National Academy of Sciences, cited with permission.
26. Atkinson (*14*, pp. 13, 23). The success rate is defined as the ratio of successful applications to total applications.
27. D. Kuhlmann-Wilsdorf, University of Virginia, before the Subcommittee on Science, Research, and Technology of the House Committee on Science and Technology, Washington, D.C., 29 July 1975.
28. Kuhlmann-Wilsdorf's statement has aroused considerable controversy, which is discussed in D. Shapley, *Science* **189**, 622 (1975). The explanation may be that metallurgy-materials research in the prestigious institutions is generously supported through the Materials Research Laboratory program, which is block-funded.
29. Kuhlmann-Wilsdorf (*27*, p. 607). Similar conclusions were reached by the Westheimer Panel in the mid-1960's. See National Academy of Sciences–National Research Council, Committee for the Survey of Chemistry, *Chemistry: Opportunities and Needs* (National Academy of Sciences, Washington, D.C., 1965).
30. T. J. Kennedy, Jr., J. F. Sherman, R. W. Lamont-Havers.
31. C. D. Douglass and J. C. James, *Science* **181**, 241 (1973).
32. F. J. Rauscher, Jr., *ibid.* **189**, 115 (1975).
33. Kennedy *et al.* (*30*, p. 604). In NSF the percentage of funds awarded to new proposals has averaged about 10 percent in recent years. NSF memorandum, *Selection of Physics Research Proposals for NSF Support*.
34. Data drawn from J. T. Kalberer, Jr., *Cancer Res.* **35**, 473 (1975).
35. The NSF studies were performed under C. Falk at the behest of the NSB.
36. In practice, the various categories are not as neat as I have painted them here. The NSF, for example, applies several criteria such as scientific merit primarily and geographic and disciplinary distribution secondarily. As Deputy Atkinson explained in a recent statement, NSF program officers have no set formula for weighing the merit and equity criteria; rather, when choosing between two proposals of roughly equal merit, they decide to a large extent on the basis of geography. But as Atkinson stressed, it is done largely "by intuition" (*14*).
37. G. M. Carter, *Peer-Review, Citations, and Biomedical Research Policy: NIH Grants to Medical School Faculty* (Rand Corporation, R-1583-HEW, December 1974).
38. Evidence in the same direction comes from D. Kuhlmann-Wilsdorf's study. For NSF as a whole, she found a close relation between the size of the NSF grant and the rate at which the applicants' overall work was cited (*27*, p. 7).
39. NSF report to National Academy of Sciences, Committee on Science and Public Policy, 1972. Cited with permission of K. Wilson.
40. To document this point it is instructive to compare the rosters of program officers listed in NSF's Annual Report for 1969 and 1974. Although reorganizations and expansions of disciplinary categories occasionally make comparison difficult, the overall picture that emerges is one of remarkable movement. Sections such as physics, atmospheric sciences, and oceanography underwent almost complete turnover. In fact, the only major research section for which the program officers in 1974 were the same as in 1969 was chemistry.
41. Wirt *et al.* (*2*, p. 60). On the other hand, in NSF all external advisors are appointed by the director.
42. U.S. Office of Science and Technology, *Biomedical Science and its Administration: A Study of the National Institutes of Health* (Government Printing Office, Washington, D.C., 1965), p. 193.
43. G. N. Eaves, *Fed. Proc.* **31** (No. 1), 3 (1972).
44. The NCI, which was the leader in this trend, is beginning to reverse itself. Some programs that were funded by contracts will be funded via special cancer research emphasis grants.
45. Representative Conlan has introduced legislation (HR 9892) that would establish a "peer review office" in NSF, which would maintain a detailed record of applications, reviews, and final actions. See J. Walsh, *Science* **190**, 253 (1975).
46. For interesting illustrations, see G. N. Eaves, *Fed. Proc.* **32** (5), 1541 (1973).
47. N. Wade, *Science* **182**, 36 (1973).
48. This article is based on a survey of American policy on fundamental science conducted for the Joint Working Group on Science Policy under the U.S.–U.S.S.R. Agreement on Cooperation in Science and Technology. A similar survey of Soviet science policy is being conducted simultaneously by the U.S.S.R. Academy of Sciences. I thank H. Brooks, D. K. Price, and W. W. Lowrance for advice and comments.

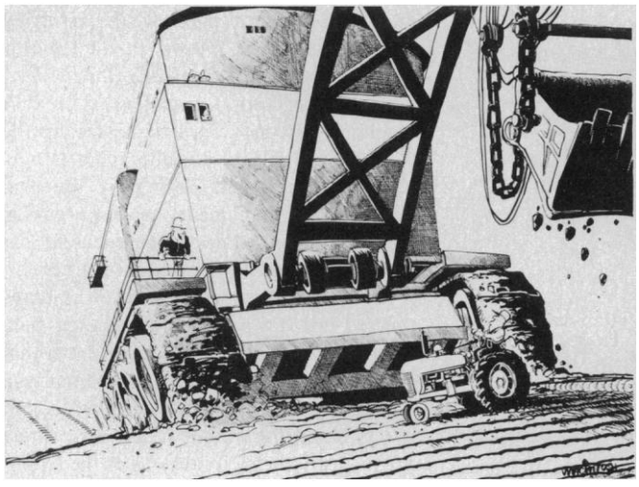
NEWS AND COMMENT

Energy: Plan to Use Peat as Fuel Stirs Concern in Minnesota

Minneapolis–St. Paul—In the northern reaches of Minnesota, in an area carved out by ancient glaciers, lie some of the largest and most desolate peat bogs in the world. Flat, swampy, mosquito-ridden in summer and frigid in winter, the region attracts few, if any, hunters and fishermen, and only an occasional stray scientist or self-styled "swamp freak." Early in this century, an effort to drain the bogs on a massive scale to turn the area into farmland proved a disastrous failure, partly because the drainage proved ineffective and partly because the farmers were unprepared for the intricacies of peat. Later attempts to find some other use for the peat resource—in small-scale agriculture, horticulture, forestry, or whatever—have met with only minimal success.

But now, as a result of the energy crisis, eyes in Minnesota are once more turning northward—this time with visions of tapping a new source of energy for this energy-deficient state. The Minnesota Gas Company (Minnegasco), the state's largest gas-distributing utility, has applied for a long-term lease on some 491 square miles of state-owned land—containing an estimated 200,000 acres (312.5 square miles) of peat—with the announced hope of eventually building a plant that would convert the peat to synthetic natural gas (methane). The Minnesota Energy Agency has received a proposal—submitted by the Midwest Research Institute (MRI) and Rouse S. Farnham, professor of soil science at the University of Minnesota—to investigate the possibilities of burning peat directly as a fuel for municipal power or heating plants. And the Minnesota Department of Natural Resources (DNR) has commissioned a preliminary technical and environmental assessment of peat use for fuel and other purposes. The assessment will be carried out by MRI with the help of a $93,960 grant to the Minnesota DNR from the Upper Great Lakes Regional Commission, a group whose other two members—Wisconsin and Michigan—also have substantial peat resources.

The scale of the gas company's proposal is staggering. The 491-square-mile tract it



Craig MacIntosh, Minneapolis *Star*

"Hi. Say. We're Looking for Peat. You Know, Sorta' Dried-Out Plant-Like Stuff."

A peat field in or near the area sought by the Minnesota Gas Company. The small linear forest islands appear to "swim" upstream against the drainage flow.

seeks is said to be far larger than the land area devoted to any other single industrial, agricultural, or mining enterprise in the state. And a commercial-sized demonstration plant proposed for the site would gobble up more peat each year than the entire nation of Ireland, which is currently a world leader in using peat as fuel.

Although the plans are much too preliminary to have stirred organized resistance, the momentum building behind peat development, and the massive scale of the gas company proposal, have caused alarm among some environmentalists and ecologists. Few, if any, have argued that there should be no development of the peatlands at all; instead, some environmentalists have raised questions as to the impact a large-scale peat-exploiting operation might have on surrounding areas and water resources, not to mention the fragile ecosystem of the peat bogs themselves. As Miron L. Heinselman, a forester who has spent years studying the Minnesota peatlands, expressed it: "Let's not go barging off and tearing up 200,000 acres of the face of the earth just to get 20 years worth of methane without investigating the alternatives. It might turn out to be a sensible thing to do after careful study, but I'd want the right questions asked in advance."

There appears to be little consensus on how best to describe peat. Some classify it as a fossil fuel or as "geologically young coal." It is essentially an accumulation of plant remains in varying stages of decomposition. Peat is usually formed in areas where water saturates or wholly covers dead vegetation that has accumulated on the ground. The water blocks the action of aerobic bacteria, thus greatly slowing the rate of decay of plant debris, with the result that most of the carbon of the cellulosic matter is retained and peat is formed. If the plant matter were exposed to the action of aerobic bacteria, decomposition would occur without the formation of peat. The fuel peat found in Minnesota is typically about 100 years old near the surface and up to 10,000 or more years old at the lower boundaries of the deposits, which average an estimated 6 feet in depth but can reach depths of 20 feet or more.

Other experts say peat is not a fossil fuel but rather a "renewable natural resource," albeit one whose renewal period is measured in thousands of years, considerably longer than, say, timber. Farnham, who is one of the strongest proponents of peat development in the state, calculates that Minnesota's peat bogs add the equivalent of 15 million tons of dry peat each year to their surfaces, enough to provide an energy value equal to 75 percent of the heating value of all natural gas consumed in Minnesota each year. "Even if we utilized only the amount produced naturally in our bogs each year," Farnham says, "the potential fuel value for peat is very significant and we would have an unlimited supply—a steady state situation." That statement is considered a bit "misleading" by the gas company which views peat, for its purposes, as essentially nonrenewable.

The terminology used to describe peat removal is also subject to differing interpretations. Some describe peat removal as a "mining" process and conjure up visions of rapacious strip miners gouging out the countryside (see cartoon above). Others prefer the more benign terminology of agriculture and speak of "harvesting" peat.

One peculiarity of the bogs in Minnesota is that they appear to be much larger than the ones now used in Europe. Farnham, who accompanied a recent fact-finding tour from Minnesota to Europe, told *Science*: "We have some of the largest developable bogs in the world. In Ireland, there was not one bog over 30,000 acres that they showed us. But in Minnesota, I can show you 50 over 100,000 acres. It just happens that ours are that way. The biggest glacial lake plain in North America starts in Minnesota and extends up into Manitoba."

Peat has a number of uses. In horticulture, it serves as a soil conditioner for improving the physical and chemical properties of soils (the familiar "peat moss" and similar products bought by gardeners). In agriculture, the bogs can be developed for growing such crops as vegetables, wild rice, various berries, forage grasses, and certain kinds of timber, including black spruce for Christmas trees and for pulp in making paper. One peat bog in extreme southern Minnesota near the Iowa border has been producing vegetable crops for more than 40 years, while other bogs near Minneapolis–St. Paul produce special vegetables and bluegrass turf. In the Netherlands, East and West Germany, and Poland, peat is used to produce activated carbon, and in Scotland, it is used for distilling Scotch whiskey. Other possibilities being talked about in Minnesota include using peat in waste treatment (it's already being used for such at a state park), as a feedstock for chemical plants, and as a base for "energy farms" that would grow cattails, sedges, reeds, and grasses that might be burned as a renewable energy source.

Peat has certain advantages and disadvantages as a fuel. Among the advantages, it is relatively easy to "mine" or "harvest," since it is located on the surface; it has a low sulfur content and hence poses less of a pollution problem than many fossil fuels; and it has considerable heating value. The heating value of air-dried peat is superior to that of wood, about equal to that of lignite, and about half that of high-grade coal. Among its dis-

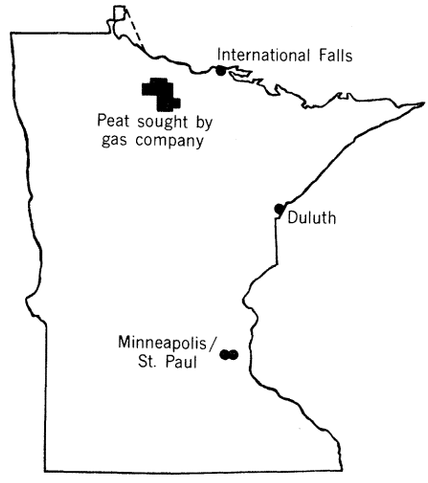
advantages, peat contains 70 to 95 percent water, which must be reduced substantially before it is burned; it is generally located in remote areas at some distance from major users; it is bulky and costly to transport; and the "harvesting" operation may pose environmental problems, although that is a matter of dispute.

Sporadic efforts to develop the Minnesota peatlands have been made for decades, but the current push stems largely from the energy crisis, which has hit Minnesota with middling severity. The state has no major energy resources of its own. It now obtains 46 percent of its energy from petroleum products that are chiefly refined from Canadian crude oil, but that source is in jeopardy because of a decision announced by the Canadian government to cut off oil and gas exports to the United States in the 1980's. It gets 32 percent of its energy from natural gas, mostly from the southwestern United States, but the pipeline company that transports most of that gas has projected a 5 percent annual decline in its gas supplies from the lower 48 states throughout the next decade. Any shortfall in the supply of natural gas would pose a serious threat to industries that depend heavily on gas in their manufacturing processes—notably agriculture, food processing, chemicals, and taconite processing.

Minnegasco's Analyses

It was the rising cost of fuel that led Minnegasco, in the middle of 1974, to start looking closely at peat. Analyses conducted in previous decades had always led to the conclusion that peat was too costly to compete with other fuels. But now, according to A. M. Rader, Minnegasco's assistant vice president for research, it seems possible that "ten years down the road, the economics might be more advantageous." Thus Minnegasco, which had been exploring the possibilities of coal gasification for at least a decade, commissioned two reports from the Chicago-based Institute of Gas Technology (IGT) on the feasibility of using peat as fuel. The reports are proprietary and have not been released, but Rader says both "came up favorable." Farnham, who is serving as a consultant to Minnegasco, puts it more emphatically when he says that the institute is "enthusiastic as hell" about peat.

The gas company's interest became public knowledge on 24 July when it applied to the Department of Natural Resources for a 25-year lease on a vast spread of state-owned peatland in north central Minnesota. The lease is needed soon, according to Rader, because the company is unwilling to commit more resources to its peat studies unless it is assured access to a supply of peat. The vast bulk of Minnesota's peat, particularly the large deposits needed to support an energy plant, lie on state-owned land, although suitable deposits might also be found on Indian lands should the state prove reluctant.



The next step in Minnegasco's efforts will be a proposal for government support of further work on the gasification process for producing high-Btu gas of pipeline quality from peat. The IGT has already drawn up a proposal—to be submitted to the federal Energy Research and Development Administration—that would cost $1,250,000 for 2 years of peat gasification research. The current assumption is that the most suitable gasification technology will be IGT's HYGAS process, which was developed to produce pipeline-quality gas from coal. Should the initial research prove successful, it would be followed by an actual pilot plant run on IGT's HYGAS plant that would cost $1 to $2 million and take 6 to 12 months, depending on the modifications needed to convert the pilot plant from coal to peat.

At this point, Rader says, Minnegasco is unwilling to commit its own funds to this research because the outlook is still too risky. Nor has the company tried to raise funds from private sources, such as a consortium of utilities that might benefit from using peat. Thus much will depend on ERDA's attitude toward the project. If ERDA is not interested in supporting further work on the HYGAS technology and wants to put its research money into another suitable technology, "we'd switch quickly," Rader says.

Rader told *Science* he sees no major problems in the development of a suitable gasification technology, since he believes that peat could be gasified by some or most of the processes already developed for coal or lignite. But he believes the harvesting operation and the preparation of peat as a feed material for gasification could prove to be "a stumbling block." The cheapest and most efficient method of harvesting used in Europe is known as the "milled peat" process. The bogs are drained, denuded of vegetation, and leveled so that machines can move in and loosen up the top half inch or so of soil, which is harrowed to accelerate drying by the sun. Then another machine moves in to suck up the peat by vacuum or mechanical action. The milled peat is then either burned directly to generate electricity or is compressed into briquettes for domestic fuel. One big drawback in the operation is that it is only practicable in the summer and during dry spells. Another problem is that it requires a high labor input, which may prove costly under conditions of the American labor market. Even though it is mechanized, a large peat-harvesting operation would employ perhaps 3000 to 4000 workers for harvesting, handling, and processing peat as raw material for a large synthetic natural gas plant. (The plant itself might employ some 1000 workers year-round.) The operation also requires a vast area to supply a power plant—perhaps 100,000 acres to provide peat for the 80-million-cubic-feet-per-day demonstration plant contemplated by Minnegasco. "We'd have to keep a tremendous large tract of peatland open and exposed for such a long time—20 years or longer—its surface void of vegetation, and drained," says Rader. "It's a rough way to do it."

Thus Minnegasco has been spurring the local office of the U.S. Bureau of Mines to launch a research program aimed at finding a more efficient and environmentally acceptable way of harvesting and preparing peat. Rader hopes it may prove feasible to mine deeply in a relatively small area rather than open up a vast area for surface harvesting.

Environmental problems could also prove a major stumbling block. Forest expert Heinselman warns that the Minnegasco proposal would bring about "a massive change of the total landscape," with the land lowered some 10 to 20 feet, depending on the depth of the peat, and all vegetation removed from a large area, coupled with large-scale drainage. He fears that the change might exacerbate flooding and water-quality problems on the rivers feeding northward into Canada. "This is comparable to the strip mining of coal, though strip mining occurs in a more restricted area," he says. "That 200,000 acres is a hell of a big landscape to change into a wasteland. For 20 years of methane we're going to wipe out a massive chunk of the earth's surface. And if they're successful, there's nothing to say they're going to stop at 200,000 acres."

The chief environmental concern, in the opinion of Robert L. Herbst, state com-

missioner of natural resources, is whether the extensive drainage required for large-scale peatland development will upset the region's hydrology, thereby causing flooding; a change in water quality that might affect fish, vegetation, and wildlife; or a change in local and regional water tables. There might also be air and water pollution problems from the proposed fuel plant itself, as well as possible problems in reclamation of the exploited areas once the peat fuel operation had ended. The proponents of peat development do not believe that subsidence of the land after drainage will be a major problem as has proved the case in some areas of the country, largely because of differing hydrological and soil conditions in Minnesota.

Heinselman is also concerned that energy development might destroy the peat bogs as a resource for scientific study. As it happens, he says, the area sought by the gas company is in the very area which has "some of the most beautiful examples of peatland development and adjustment" to be found in this part of the world. "These peatlands are unique in the northern United States," he says.

Similarly, Eville Gorham, professor of ecology at the University of Minnesota, told *Science*: "I'm really concerned that we preserve a decent sample of a unique ecosystem in this country." Neither Gorham nor Heinselman flatly opposes peatland development, but each wants careful consideration of all factors before proceeding. Gorham, in a letter to the Minneapolis *Tribune*, even suggested that the initial land surveys should be made by helicopter rather than by tracked vehicles lest the delicate ecological patterns "be destroyed or damaged, for periods of decades to centuries." That suggestion is considered "far-out" by the gas company.

The proponents of development see the

Research May Escape Major Damage from $28 Billion Cutback

President Ford's announced plan to cut $28 billion from the federal budget has sent a tremor of apprehension through the scientific community, but at this point it's not clear that research and development will suffer much damage from the budget ax.

Spot checks at a few key control points in the federal budget-making process suggest that the money for R & D will be tight and that growth will be much less than anticipated. But no key official foresaw a major funding disaster for the research community.

To begin with, it should be understood that the proposed "cut" is not a reduction from current levels of spending, but rather a reduction from the spending that would occur in fiscal 1977 (the next fiscal year) if the federal programs expected to be in operation at the end of this fiscal year continue their normal course of development. The Ford Administration estimates that federal outlays in fiscal year 1976, the current year, will total about $370 billion. It also estimates that, if all these programs were allowed to grow as expected, expenditures in fiscal 1977 would reach $423 billion. In an effort to curb this growth, the President has proposed that the Administration and Congress agree to a ceiling of $395 billion next year. That would represent an increase of $25 billion over the current year—less than the $53 billion increase originally projected but still an increase. However, it should be noted that both projected "increases"—the $53 billion and $25 billion figures—are based on the assumption that there will be no major new programs, merely a continuation of existing programs, with some growth allowed in those programs.

Precise details on how the $28 billion "cut" will be parceled out among agencies are not yet available. James Schlesinger, former Secretary of Defense, has stated that $7 billion of the total is to be taken out of the defense budget. That figure, if correct, would leave $21 billion to come out of the budgets of civilian agencies. But how much of that would come out of R & D as opposed to other programs is not yet known, largely because most departments have not firmly decided how to distribute their share of the cuts among competing programs.

Well-placed officials at the National Science Foundation are optimistic that they will be able to accommodate to budgetary restrictions with minimal pain. One official speculated that, even after the cuts, NSF may end up receiving an increase comparable to the rise in the cost of living. Another official said that the main impact of the "cut" will be to wipe out a substantial increase that NSF had counted on to make up for the budgetary erosion caused by inflation in recent years. Before the cuts were imposed, Administration budgeteers had estimated that the NSF budget would grow by 14.3 percent.

Administrators at NSF are trying to work out tactics for meeting their new spending ceiling. The possibilities include slowing down programs scheduled to start this year so that they are not spending at full blast next year, and reducing the amount of money that would otherwise be devoted to new starts next year. "It looks like a survivable disaster," said one NSF official. "By and large we're coming out with a pretty good budget."

A key official at the Department of Health, Education, and Welfare also expressed cautious optimism that the budget stringencies will not pose major problems for the National Institutes of Health, the major supporter of biomedical research.

The picture at other agencies remains murky. Some observers suggest that agencies which have considered R & D a crucial part of their programs—such as the Department of Defense (DOD), the National Aeronautics and Space Administration (NASA), and the Energy Research and Development Administration (ERDA)—will protect their research programs, but that agencies with little experience in R & D may tend to consider it the most expendable item. Before the cuts were imposed, ERDA's growth was projected at 53.1 percent, DOD's at 16.7 percent, and NASA's at 8.6 percent.

Some leaders of the scientific community fear that budget cuts will hit research with particular severity because R & D falls into that portion of the budget that is deemed "controllable"—in contrast to veteran's benefits, medicare payments, and the like, which are mandated by legislation and thus deemed "relatively uncontrollable." However, Administration officials say they are working on ways to get at the "uncontrollable" programs—perhaps by proposing new legislation—in an effort to spread the cuts around more evenly.

One official with a broad view of budgetary matters predicted that, when all the figures are in, R & D outlays in fiscal 1977 will probably show a slight increase over the 1976 figure—although whether that increase will be enough to keep up with inflation is another question. He said that R & D "has not been singled out for cutbacks," but added: "R & D will have to take its lumps along with all the other programs."

—P.M.B.

peatlands as an unutilized wasteland that will actually be improved if the land is drained, mined, and then converted to farm- or timberland or some other purpose. The ecologists, while dubious that the grandiose visions of a future paradise will actually materialize, nevertheless are forced to admit that most people would consider the peatlands a "wasteland" at present. "They're a wasteland in the sense that many fine pieces of desert are wasteland," says Heinselman. "Nobody goes up there but people like me. The land's so soft it's like walking on pillows all day. You walk 100 yards and you have to sit down for 15 minutes to rest. And you can't sit down without getting your butt wet."

"It's a trackless waste," agrees Gorham, who describes himself as "a nut about wetlands, a wetlands freak."

Because it accounts for only about 1.1 percent of the world's fossil fuel resources, according to data presented at a September 1975 symposium of the International Peat Society held in Finland, peat is not considered of major importance in meeting world energy needs. But it can be of considerable local significance. Indeed, it has been burned as a fuel for centuries. The Netherlands, Germany, and Denmark all used peat as fuel on a large scale until exhaustion of peat sources and competition from other fuels led to its abandonment. Currently the Soviet Union is far and away the major user of peat as fuel, burning an estimated 70 million tons in 1975, mostly to produce electricity in 77 power plants. The city of Leningrad, located near several large peatland areas, gets about 17 percent of its energy from peat, while the Soviet Union as a whole gets 2 percent. Ireland is the only other major user of fuel peat, burning an estimated 3.5 million tons this year, accounting for nearly a third of its total energy supply. Finland, which has been hit with an unusually sharp rise in oil prices, has begun to expand its fuel peat production rapidly. Sweden, which abandoned fuel peat in the 1960's, is now planning three peat-fueled heating and electricity power plants. And Greece has plans to use a peat bog for electricity generation. According to information presented to the international symposium, the United States, Canada, Norway, Denmark, and East Germany are not at present using peat as fuel, although Canada has shown interest in producing household peat for home heating. The countries that do use peat as fuel generally burn it directly or in a mixture with other fuels. None is known to be producing gas from peat, as has been proposed by Minnegasco.

The United States has relatively small reserves of peat compared to that of some other countries. The world's peat resources are concentrated in a relatively narrow area of the temperate zone, where the climate has been favorable for peat formation for at least the last few thousand years. The Soviet Union contains about 60 percent of the world's estimated peat deposits (exclusive of Alaska), while Canada and Finland account for perhaps another 20 percent between them and the United States, exclusive of Alaska, has roughly 5 percent. Minnesota is the leading peat state among the lower 48 states, with an estimated 7.5 million acres, covering about one-seventh of the state's total land area. Wisconsin, Michigan, Florida, New York, and Maine also have large reserves. Alaska is believed to have some 50 to 100 million acres of peat but much of it is in frozen, inaccessible regions above the Arctic Circle.

The lead role in assessing the economic, social, and environmental aspects of peatland development in Minnesota will be played by the Department of Natural Resources, which must recommend whether to lease the lands and under what conditions. Even before the Minnegasco proposal surfaced, the department had commissioned the technology assessment by MRI as an aid to developing an overall state policy for the peatlands. One possible result of the study will be a recommendation that the peatlands be used for a variety of purposes. Farnham, for example, has suggested that 40 percent might be devoted to energy production, 30 percent to crops, 20 percent for production of horticultural peat, and the remaining 10 percent preserved in their natural state because they have unique scientific or educational value or serve as scarce habitats for wildlife.

Before the gasification project could proceed, a state agency—probably DNR—would have to prepare a detailed environmental impact statement for review by a high-level council of agency heads and citizens. The final decision on leasing would be made by the State Executive Council, composed of the six highest-ranking elected officials.

State officials insist that they will give careful attention to possible adverse environmental impacts. But environmentalists fear that the state, in its eagerness to head off energy shortages, increase employment opportunities in the north, and rake in tax and royalty revenues from a gasification plant, may jump too quickly at a chance to develop the peat "wastelands," while giving short shrift to the environmental consequences.—PHILIP M. BOFFEY

Bulletin of the Atomic Scientists: Thirty Years of Clockwatching

Chicago. The *Bulletin of the Atomic Scientists* was founded here 30 years ago to warn the world away from impending nuclear catastrophe. While the world has escaped such a holocaust so far, it may be fair to say that the *Bulletin*'s survival is a mark of failure—a failure of scientists to succeed in eradicating the threat of nuclear war.

Bernard T. Feld, an MIT physicist who was recently appointed as the *Bulletin*'s editor in chief, wrote gloomily in the November issue that he had spent "half a lifetime" in arms control and lamented, "Why after almost 30 years of intensive efforts in this direction are we nowhere? Indeed, we are even behind where we started."

But the *Bulletin*'s founders, who were involved in developing the first atomic bombs in the Manhattan Project here at the University of Chicago, keep the faith that science and technology can be used to better the lot of mankind rather than to destroy it.

"I still, I think, term myself an optimist," Feld said in a telephone interview, and said that he agrees, even now, with the words of Eugene Rabinowitch, "The scientists for whom [the *Bulletin*] has been a labor of conviction and love are still anxious and frustrated, but not despairing of ultimate success." Rabinowitch, long the magazine's editor in chief, was the key figure in the *Bulletin*'s history from the first six-page issue on 10 December 1945—when it was little more than a few mimeograph sheets—until his death in 1973.