tific community nor a completely satisfactory sample of it. Response to register questionnaires tended to come from disproportionate numbers of younger scientists, especially those with Ph.D.'s. Still, its drawbacks were no more severe than those of similar but smaller scale samplings of scientists taken periodically by the Bureau of Labor Statistics and the National Academy of Sciences.

"The unique contribution of the National Register," its staff said in the 1968 manpower report, "is the ability to provide greater detail . . . field of science, educational level, current employment, work activity, salary and income . . . which permit the interpretation of totals reported by the BLS."

Falk says the register's "tremendous advantage" lay in the fact that its data came from individually identifiable scientists, whereas those from the Labor Department and other sources generally is compiled from aggregate information—such as "all R & D people in industry" or "all R & D people in universities." By its nature, data gleaned from register surveys lent itself to more detailed and varied analysis. And perhaps most significantly, it has permitted the NSF to compile a longitudinal history of nearly 50,000 persons in the register, delineating their changes in field, employment status, and education over a 17-year period.

Two years have passed, however, since the longitudinal history was last updated. A continuing hiatus, Humphreys believes, "could result in a significant data loss" as the persons involved change residence and become harder to trace through the mails.

Similar concerns were voiced by the House science and astronautics committee in May. In its report on NSF authorizations, the committee said it had no objection to NSF's looking for alternatives to the register, but it urged that this "historical data" be preserved. The committee also warned tartly that the "development of purely ad hoc methods, after a situation has reached crisis proportions, would appear to be an entirely inadequate procedure for the federal government."

Last Edition

As it happens, the dimensions of the scientific manpower crisis are known chiefly as a result of national register surveys. Right now, the staff is preparing its thick biennial volume of statistics from the 1970 manpower survey (a brief summary was issued last December), but that, for a while, will be the last publication of its kind. In addition, the register was used last spring for a special ad hoc survey of 300,000 scientists to measure the extent of unemployment. The results, released on 2 July, provided some of the best, and gloomiest, information available on jobless scientists. A similar poll of engineers' employment is nearing completion. Together, these documents may well be the national register's swan song on the subject.

Briefly summarized, these were the results of the survey last spring:

► Overall unemployment among scientists rose from 1.5 percent in spring 1970 to 2.6 percent in spring 1971. The jobless rate for scientists approached 6 percent in some West Coast cities, although in these locations and in the nation at large, unemployment among all workers generally ran about twice as high.

► In the natural sciences, the highest jobless rate, 3.9 percent, was reported by physicists. They were followed by specialists in computer sciences, mathematicians, chemists, geo- and space-scientists, and biological scientists in order of descending level of unemployment.

► Scientists under 30 years of age reported by far the highest unemployment rate, 5.3 percent, of any age group.

► The 5.2 percent unemployment rate for women scientists contrasted with 2.3 percent for men; 3.5 percent of bachelor's degree holders were unemployed as compared to 1.4 percent of doctorates.

► The average length of unemployment as of 1 June 1971 was 7 months; 45 percent of the unemployed scientists reported that their last science-related work was to some degree supported by the federal government.

► Of the 239,000 respondents who were then employed, 3900 had left science-related positions for nonscience jobs since March 1970. This "exodus," as the survey report called it, consisted almost entirely of scientists under 40; one-fourth were under 30.

The survey report said its figures on unemployment were to be considered "minimal." The report has since been widely taken as evidence that the job market for scientists is at its lowest ebb since World War II.

—ROBERT GILLETTE

Vermont: Forced to Figure in Big Power Picture

Contests over the siting of new power plants have become a form of ritual combat pitting power companies against environmentalists. Stiffer criteria on air and water pollution embodied in new state and federal laws are being invoked with increasing virtuosity by environmentalists. And recently, the controversy over radiation dangers from nuclear plants has been expanded to include broader questions of environmental impact. As a result, the legal and regulatory machinery meant to reconcile the rising demand for power with defense of the environment is proving inadequate to the task.

Regulatory lag is by no means the only problem facing the power industry. Technological hangups in the construction of big new generating plants are adding to the delays. While the power industry is trying to achieve economies of scale through use of these big units, the effort is plagued by traditional rivalries and animosities among companies, private and public, large and small and legal snarls arising from conflicts in state laws hinder effective financing and planning.

Vermont provides a classic example of the syndrome (*Science*, 17 September). The state's first nuclear plant is nearing completion and was scheduled to go into operation this fall. But in hearings for an operating license this summer, the opposing sides fired such a hail of "interrogatories" at each other

that the hearing was recessed until mid-October. At the same time, Vermont power companies have been carrying on a systematic search for plant sites for the next decade, particularly for a location for a 400-megawatt (Mw) fossil-fueled plant scheduled to be built by 1976. Activist opposition is already mustering to defend several of the potential sites.

In large part, because of the delay in getting the Vermont Yankee nuclear plant into operation, Vermont will go into the winter with no reserve generating capacity and power shortages an even bet. Vermont has imported about 80 percent of its power in recent years, and its dependent status gives the state a big stake in the regional solution of power problems based on an integrated system.

In New England, as elsewhere, environmental issues get fairly wide attention in the press; developments in regional planning, by and large, get much less notice. A few weeks ago the final touches were added to power pooling arrangements for the six New England states and the document went out to the companies in the region. Establishment of a New England Power Pool (NEPOOL) has been under discussion for about 5 years. NEPOOL is generally regarded as a good start on a regional power system, but falls far short of hopes originally held out for it. Many of the reasons that NEPOOL is a "lowest-common-denominator" pact are indigenous to New England.

The six New England states form a compact area, with the land boundaries of New York State on the west and south and Canada to the north. The power industry follows New England traditions of self-reliance and small-scale enterprise. The area is served by 144 power companies, 60 of them investor owned, 77 municipal, and 7 cooperative. The municipals tend to serve small cities, and big private companies are the dominant force. Some 73 percent of the generating capacity in the region is owned by 19 companies. Power in New England has never been abundant or cheap. New Englanders, according to 1968 figures, paid 30 percent more for power and used 24 percent less than people in other regions did.

Part of the explanation is that New England is a long way from the sources of fossil fuels. But the patchwork of small service areas and small generating units has limited efficiency and raised costs. At a time when big

OEO Hedges on Kentucky Program

The Office of Economic Opportunity's efforts to provide a program of comprehensive medical services for the poor people of Floyd County, Kentucky, are still generating an abundance of controversy (*Science*, 30 April), but no health care. What began as an experiment by OEO in trying to improve the health of the poor in the Appalachian county simply by transporting patients to existing private medical facilties has evolved into an ongoing lesson in the power of local politicians over the delivery of rural health care and, if necessary, over Washington bureaucrats.

After 4 years and $5 million, the Floyd County Comprehensive Health Care Program (*Science*, 30 April) had failed to provide anything approaching comprehensive health care. It did, however, supply the local power structure, headed by County Judge Henry Stumbo, with a number of jobs for patronage and the local doctors with a good deal of profits for providing care that, in some instances, was found by OEO medical audit teams to be "extremely poor."

Following a continuous barrage of criticism, most of it from the Eastern Kentucky Welfare Rights Organization (EKWRO), a group of 450 poor families in the county, OEO moved to improve the program. After several warnings brought no results, OEO formally charged the program's board of directors last spring with a series of violations of OEO regulations, including failure to provide services, intimidation of staff members and consumer representatives on the board, and conflicts of interest. In June, OEO held a hearing on the charges—it included a good deal of bickering and a statement by a county dentist and board member that "Sure there's been some people taking graft, but you should remember that one bad apple don't spoil the whole bunch." Following that hearing, OEO suspended its grant to the board of directors and began proceedings to terminate it altogether.

Meanwhile, EKWRO submitted a proposal to OEO to have the grant transferred to a new board of directors that would have included several professionals from outside the county, including the director of OEO's Park Duvalle Health Center in Louisville, representatives of antipoverty groups, and a number of consumer representatives. Privately, OEO officials assured EKWRO that the chances for the grant to the new board were excellent.

Then suddenly the picture changed. In August, an OEO lawyer went to Floyd County to make arrangements for the hearing on the final termination of the grant. But a few days before the hearing was to have been held, OEO announced that the old board had voluntarily relinquished the grant and that a new planning grant would be awarded to a new board, which would consist of Judge Stumbo, four representatives from outside the county, two consumer representatives to be chosen by the old board, and three consumers elected at large.

Members of EKWRO call the new arrangement "a total sellout by OEO." They claim that the judge will continue to exert power over the program, particularly since he will have a hand in selecting two of the consumer members, and, they claim, his political machine will be able to elect the other three.

Just what happened to OEO to cause it to change its course? According to sources in the county and at OEO, the judge simply told the OEO lawyer that, if he had no influence over a new program, then there would be no new program. Indeed, his powers as the county's chief judicial and administrative officer would make it possible for him to harass any program out of existence.

Officials at OEO claim to have gained a few chips in the bargaining process. The new health program, they say, must provide genuine comprehensive health care, including the employment of salaried clinic physicians, or it will be eliminated. Whether that is possible in an Eastern Kentucky coal mining county remains to be seen.

—ROBERT J. BAZELL

generating plants and the trade-offs they permit are regarded as necessary, it is generally agreed that small companies can't go on making independent decisions on the size and location of power plants.

Two years ago, the New England Regional Commission—a federal-state organization that provides a framework for cooperation between the six New England governors and the federal government—contracted for a study that both made a projection of power needs in the region in the next two decades and made recommendations on how these needs could be met on a regional basis.*

The report predicted a fourfold increase in demand for power in 20 years, from 12,000 Mw in 1970 to 53,000 Mw in 1990. In their recommendations, the report's authors adopted a "single system" concept under which it was assumed all major facilities in the system would be built and operated as if they were under one ownership. The report envisions by 1990 an installed capacity of 60,548 Mw for the system. Of this, 42 percent would be nuclear, 33 percent fossil fueled, 11 percent gas turbine or diesel, 12 percent pumped storage, and 2 percent hydroelectric.

Nuclear Plants on Coast

The availability of cold seawater on the New England coast, particularly the coast of Maine, for cooling purposes led the planners to see major developments of coastal sites for nuclear plants. In fact, they see nuclear plants as being the most efficient for generating power for base load and as producing 70 percent of the total kilowatt-hours for the system annually.

In order to achieve the cooperation and coordination necessary to implement the recommendation, the report's authors recommend the creation of a single, integrated, bulk-power supply agency, which the report describes as follows.

> The proposed regional agency should have sole authority to construct generating and transmission facilities in New England. With full responsibility and authority, it would be able to install the most economical units available without incurring undue expense for reserve capacity. In locating units, it could balance such factors as nearness to load and environmental considerations so as to obtain the lowest cost power consistent with such values. It could schedule operations in such manner as to obtain maximum efficiency. Given the best will in the world, bulk power arrangements involving numerous utilities could not hope to attain the same degree of efficiency from a regional viewpoint. A regional agency could also play a vital role in industrial development, since it would have sufficient resources and flexibility to be able to guarantee an adequate source of power to industries which are large power consumers.
>
> The vesting of power supply responsibilities in a single agency would also facilitate the interchange of power with other regions of the United States and Canada. Such an agency could improve the reliability and economy of its system by interchange arrangements with neighboring regions which would be beyond the capability of a smaller utility. Power supply has become not merely a regional, but a national problem†, and it is essential that New England take the steps necessary for proper coordination with other regions of the United States and Canada.
>
> A single power supply agency would also have an advantage in raising the massive amounts of money required for major generating and transmission facilities. Considerations of technology and environmental protection and the compounding load growth of power systems require ever-increasing investments in generating units and transmission facilities. The power systems of the region, and particularly the smaller ones, will have increasing difficulty in keeping pace with the obligations to provide adequate generation and transmission capacity of the kind and quality required by economic and environmental considerations.
>
> Ideally, the regional agency should be given authority to acquire, by lease, negotiated purchase, or condemnation, all existing generating plants and all transmission lines of more than local significance. An alternative would be to leave title to existing facilities in their present owners but vest in the agency authority to dispatch the electric energy from existing plants (or to purchase the output of such plants) in addition to the authority to build and operate new capacity as required. This alternative would have one major advantage. The initial cost of setting up the regional agency would be much less, since the agency would be spared the expense of acquiring the existing generation and transmission system. It would also spare the agency the distractions which would be involved in trying to reach agreement with the existing utilities and in litigating where agreement proved impossible. The major disadvantage would be that it would be more costly in the long run. Some duplication of effort would be involved and the regional agency would not have the same freedom in retiring outmoded plants that it would have if it owned them.

The NEPOOL agreement now before the companies falls far short of the grand design embodied in the so-called Zinder Report to the Regional Commission. But the publicly owned power companies endorsed the recommendations, and this, as well as the fact that the governors were interested, doubtless influenced the development of NEPOOL.

Negotiations on NEPOOL have already led to the establishment of a New England Power Exchange (NEPEX), which provides for the centralized and computerized dispatch of power throughout the region and oversees the scheduling of maintenance and provision of emergency services to committed companies, both investor owned and public.

The new NEPOOL agreement's fundamental provision is the guarantee of access to bulk power to all signatories. The original concept of a pool-supported transmission network was abandoned, however, and purchasers will continue to pay for power according to contract agreements.

Major Impediment

The major impediment to unanimous acceptance of the NEPOOL agreement is a clash between private and public power companies over a legislative package aimed mainly at altering state laws to permit financing of new facilities on a system-wide basis. Some municipal companies are prohibited from selling revenue bonds and want such authority in order to participate. In the bargaining, private companies have been asking for "equalization" provisions, which would require public companies to pay states the equivalent of taxes. The basic issues hark back to the days of Willkie and Roosevelt, and the Northeast Public Power Association has asked its constituents not to sign the agreement.

An integrated planning staff, NEPLAN, is already in existence and is looking into the siting of new plants and the expansion of existing plants on a one-system basis. What NEPOOL lacks, observers say, however, is a mechanism to deal with the opposition to the siting of new plants, most of which is on environmental grounds.

The Zinder report, in proposing the powers that a regional bulk-supply agency should have, includes the following two:

- The power to make a final determination as to the sites needed for generating plants and transmission lines. The agency should be required, however, before final selection of a location for a generating station or a transmission line, to conduct hearings at which states, local governments, and other interested parties could present their views.

* *A Study of the Electric Power Situation in New England*, by H. Zinder Associates, Inc.

† See, for example, the proposal of Secretary Hickel for a national grid (*The Washington Post*, 9 April 1970).

• The power to make a final determination as to whether it is meeting state standards relating to air and water quality. The agency should be required to meet both federal and state standards, but should not be required to obtain state or local licenses or approvals.

Even suggesting the granting of such authority would send the environmentalists on the warpath, and the authors of the report recognize the hazards of giving responsibility for power development and regulation to a single agency. The point is that the task of reconciling the power needs of the region with the desires and prerogatives of states and local units is a problem to which little attention is now being given.

Vermont's Predicament

Vermont's predicament illustrates how a battle over a single plant, for example, can affect and be affected by the regional situation. The Vermont Yankee nuclear plant at Vernon has encountered, as one sympathetic observer put it, "every conceivable adversity." It was constructed during a period of high interest rates and of maximum environmental sensitivity. Expensive redesign work increased the cost, and a boost in water quality standards, plus pressure from environmentalists, caused the addition of cooling towers to the plan. Although Vermont's private power companies have had relatively amicable relations with publicly owned companies in the state, a bid from out-of-state public power companies for access to power from the new plant was settled only after threats of antitrust action had been bandied about. The change in the Atomic Energy Commission's stance on licensing as a result of the Calvert Cliffs decision (*Science*, 17 September) appears likely to mean a further delay. Even if that issue is settled with dispatch, environmentalists may appeal a predicted decision by state water resources authorities to allow Vermont Yankee to raise water temperatures by 1°C at the point of discharge.

The delay of the Vermont Yankee plant has put a financial strain on Vermont's two biggest private companies, Central Vermont and Green Mountain, which are responsible for paying interest on 55 percent of the bonds on the nuclear plant and have had no return on their investment. Vermont Republican Senator George D. Aiken says that another year's delay for Vermont Yankee could mean that the Vermont companies would have to sell their interest in the plant and that the state might have to take over to prevent control from being taken over by out-of-state interests.

Vermont Yankee's problems are due in large measure to its being a nuclear plant. In Washington, the Joint Committee on Atomic Energy is aware that many nuclear plants are in a holding pattern these days, and has been conducting hearings on licensing procedures and related matters. In particular, the committee has been considering two Administration-backed bills that would contribute to simplifying the long and complex process by which nuclear plants are located, built, and licensed for operation. One bill, H.R. 9285, is designed to allow the Advisory Committee on Reactor Safeguards to cut short the approval process when dealing with reactors of similar design which are, for example, to be built on the same location. The other, H.R. 9286, would ease somewhat restrictions on the kind of work that could be done on a site before a construction permit was granted. The precise wording of the bills is still under debate, but the committee is expected to come up with a report and recommendations in the reasonably near future. "One-stop licensing" for nuclear plants, however, is still only a gleam in its proponents' eyes.

More than tinkering with federal regulations will be required to reconcile economic and environmental objectives. A kind of planning will be required for which there is yet no real precedent. The NEPOOL agreement, no matter how useful and overdue, is planning in the old style. As one lawyer put it, "the whole attention is on the bucks."

Effective planning must be done from more than one point of view. This is true for the environmentalists as well as the developers. In a state like Vermont, where the demand for new jobs is a weighty political fact of life, environmental absolutists could soon find themselves trumped by economic necessity. Vermont, on the other hand, has new land-use and development laws (*Science*, 3 September, page 895) which, while imperfect, could provide environmentalists with a negotiable grand design.

As for the power companies, they have tended to plan according to projections of demand for power, and these projections become self-fulfilling prophecies. For the power companies, growth has been the name of the game, and it is clearly time to reexamine the rules.

Environmentalists, for their part, are asking new questions. The April newsletter of the New York–Vermont Lake Champlain Committee, for example, carried this note:

> Many members of the Committee are coming to believe that we must seriously consider limiting our energy demands and that there must be far more rigorous self-discipline in conserving our non-renewable resources. While we strive to minimize the harmful effects of power generation and transmission for which a demonstrable need exists, we will continue to stimulate beneficial solutions to the technological problems and to question the reasons for the rate of increase in total energy demands.

Today, this amounts to a voice crying in the wilderness. There are yet few serious advocates of zero power growth. But in places like Vermont, there is a growing recognition that there is a conflict between unrestrained growth and preservation of the environment and that you can't have it both ways.

—JOHN WALSH

APPOINTMENTS

Robert H. Frost, acting head, physics department, California State Polytechnic College, elevated to head of the department. . . . **Patrick Donohoe**, California Provincial of the Society of Jesus, to chancellor, University of Santa Clara. . . . **Robert J. Kibbee**, vice president for administration and planning, Carnegie-Mellon University, to chancellor, City University of New York. . . . **Arthur V. Houghton**, director, Bureau of Engineering Research, University of New Mexico, to director, Eric H. Wang Civil Engineering Research Facility at the university. . . . **Richard A. Kenyon**, chairman, mechanical engineering department, Rochester Institute of Technology, to dean, College of Engineering at the institute. . . . **Robert M. Terry**, associate professor of sociology, University of Iowa, to chairman, sociology department, University of Akron. . . . **Richard A. Swalin**, professor of metallurgy and materials science, University of Minnesota, to dean, Institute of Technology at the university. . . . **T. Skipwith Lewis**, associate professor of engineering, University of Hartford, to dean, College of Engineering at the university. . . . **Bruce D. Martin**, professor of pharmaceutical chemistry, Duquesne University, to dean, School of Pharmacy at the university.