duced according to its investment.)

Critics have asked why Vermont won't get the total output of the new nuclear plant. The explanation lies in the economics and operating practices of big power systems. According to utility company canon, low generating costs are achieved by large units. These big units, however, must be shut down either for regularly scheduled maintenance and repairs or when there is a breakdown. "Backup" sources of power must be available at such times, and the Vermont Yankee plant would take turn and turnabout with big plants in other states in providing backup power. If each power company or each state built enough reserve capacity to create a self-sufficient system the effect would obviously be many more plants and much higher rates.

According to a study, *The Electric Power Situation in New England 1970–1990*, done in the late 1960's for the New England Regional Commission, Vermont's peak consumption was likely to rise from 540 Mw in 1970 (the estimate proved substantially low) to 1420 Mw in 1980. Unless generating capacity in the state was radically expanded it looked as if Vermont would, literally, be left out in the cold. Plans accordingly were made for a 400 Mw fossil-fueled plant to be completed in 1976. And the utility companies' working assumption is that another 800 Mw in capacity must be created by 1980–85 in the form of either a fossil-fueled or nuclear plant, and, tentatively, that a big, pumped storage, hydroelectric generating station should also be built with perhaps a 1200-Mw capacity.

Taking the initiative in finding sites for the new power plants was the Vermont Electric Power Company (Velco), the bulk power supply agency for the state. Velco owns the high voltage transmission lines which distribute purchased power to both private and consumer-owned companies in Vermont, but has no generating plants of its own. Majority owners of Velco are the state's two dominant private power companies, Vermont Central and Green Mountain, which are also majority investors in the Yankee Nuclear Power Company.

AEC's New Environmental Rules for Nuclear Plar

In response to a scathing court opinion of its environmental policies, the Atomic Energy Commission (AEC) has drastically revised its rules for assessing the environmental effects of nuclear power plants and a variety of allied facilities. The immediate effect of the new rules is to require electric utilities and the commission staff to take a detailed new look at all the effects—not just the radiological ones, as in the past—of virtually every power reactor, fuel processing facility, and uranium mill in the country.

AEC officials expect that reassessing the effects of nuclear power plants may take as long as a year. Delays in the licensing of some plants are likely, and other plants may be obliged to build cooling towers to prevent thermal pollution of nearby waters, although such towers could boost the cost of a nuclear plant by as much as 10 percent or $25 million.

But beyond these short-term implications, some knowledgeable attorneys believe the AEC's new rules may open for debate a wide range of controversial issues of safety and economy which the AEC has previously considered "off limits" and irrelevant in licensing hearings. Such debate could result in more meaningful public participation in reactor licensing, but it could also extend an already lengthy and arduous licensing process, thereby intensifying the conflict between the need for electric power and the need for protecting the environment from its production.

In so doing, the AEC's new regulations may indirectly serve to arouse Congress into acting on one or more of several power plant bills currently languishing in committee. The bills, one of which is being advanced by the Administration, would encourage long-range planning of power plants and transmission lines and set new procedures for power plant construction permits. In addition, the AEC is pushing new amendments to the Atomic Energy Act to streamline the public hearing process and to shift debate and public intervention to a period well before a reactor is ready to run.

The AEC's new rules stem from a Federal Appeals Court ruling on 23 July involving the Calvert Cliffs nuclear plant under construction on the Maryland shore of the Chesapeake Bay (*Science*, 27 August). In its decision, the court accused the AEC of making a "mockery" of the National Environmental Protection Act (NEPA) of 1970 by granting construction permits and operating licenses to atomic power plants without properly assessing their environmental effects.

The NEPA requires federal agencies to review thoroughly the impact of projects like nuclear power plants, to weigh a project's costs and benefits, and to examine alternatives to the project. But the AEC, the court found, ignored all nonradiological effects—like thermal pollution—for more than a year after NEPA became law. Later, the AEC relied on other state and federal agencies for advice on such matters, but never did perform the necessary cost-benefit balancing act.

Now, under its new rules, the commission says it will consider thermal effects of nuclear plants, and that it will balance the environmental costs against environmental, economic, and technological benefits. Henceforth, the AEC's director of regulation, Harold L. Price, said, the commission will be "directly responsible for evaluating the total environmental impact—including thermal effects—of nuclear plants, and for assessing this impact in terms of the available alternatives and the need for electric power."

In deciding not to appeal the Calvert Cliffs decision, AEC officials displayed a seemingly new concern for the environment, if not also for public relations. "This is not a foot-dragging, begrudging acceptance of the court's decision," Marcus Rowden, the acting general counsel, insisted. James R. Schlesinger, the new chairman, promised to be "responsive to the concerns of conservation and environmental groups," while trying to "reconcile a proper regard for the environment with the necessity for meeting the nation's growing requirements for electric power."

Three years ago Velco had selected a site on Lake Champlain for a new nuclear plant. The site was close to the "load center," the city of Burlington, the state's largest and fastest growing city, and had easy access to lake water for cooling. But the project was torpedoed, chiefly as a result of the opposition of the Lake Champlain Committee, recruited from both sides of the lake to fight pollution of Champlain's waters and general threats to the environment. A principal product of the committee's campaign against the plant was a law passed by the Vermont legislature requiring public hearings and an environmental review and formal approval of proposed sites for all new power plants. The committee has been regarded as strong enough to prevent building of power plants on the lake or in sight of it, but is now rallying its forces to meet what it sees as a move to locate a new plant on the New York side.

Anticipating a response from Vermont environmentalists to plans for a 400-Mw plant, Velco hired a Michigan consulting firm in 1970 to do a comprehensive survey of sites for generating units in the 1970's and early '80's. The firm was instructed to take into account environmental and esthetic, as well as economic, considerations in its search for sites for larger fossil- and nuclear-fueled plants. Possible sites for pumped storage hydro plants were also not to be overlooked.

The locations were to be within 75 or 80 miles of Burlington, and were to meet set criteria of topography and nearness to transmission lines and rail or barge connections. Since harmony with the surroundings and avoidance of damage to existing ecology were important factors, concealment of the plants in hillsides or quarries was regarded as a possibility. (Subsurface construction was later ruled out as being too expensive.)

The firm identified 69 potential sites for the 400-Mw fossil-fueled plant, and by spring it had narrowed the list down to nine preferred sites. Seven of these are in Addison County (see map), whose county seat is Middlebury, a town of about 6000 and the location

May Open New Debate, Extend Delays, Raise Plant Costs

Indeed, the commission overhauled its rules with such haste that, when officials announced them on 3 September, they were still not sure how many reactors would be affected. By the latest tally, however, 110 power reactors, designed to produce 96,600 megawatts of electricity—an amount equal to one-fifth the nation's present generating capacity, will be subject to new environmental reviews. In addition, the tally includes eight nuclear fuel facilities and three uranium mills. The only power reactors exempted are six older plants that received operating licenses before the NEPA became law in 1970.

Of the 110 reactors affected (some are still on the drawing boards and may have to undergo design changes), 46 could have their construction permits modified or revoked after a new environmental review and a public hearing. Five others, now producing 3200 megawatts of electricity in five states, are also subject to new reviews and hearings, and could have their operating licenses suspended. What's more, 18 reactors for which permit or license hearings are under way or imminent may be held up for several months until new environmental reviews are completed on them. Among these is the Vermont Yankee plant at Vernon (see page 1110).

Risk versus Benefit

More significant than this initial turmoil, however, is the prospect advanced by some attorneys familiar with AEC affairs that even a moderately liberal interpretation of the revised rules may allow the injection of fundamental new issues in the process of reactor licensing.

Traditionally, the AEC has restricted the hearings it holds before granting a construction permit or operating license to a narrow range of technical issues pertaining to plant design and construction. Any talk of the adequacy of radiation protection standards or the relative risks and benefits of nuclear power and fossil-fuel plants has been deemed inappropriate by the AEC, which has long insisted that all the necessary risk and benefit balancing was implicit in stipulations against "undue risk" written into the Atomic Energy Act and the commission's own regulations.

Now, there are some who believe all this may change. For one, Harold P. Green, a professor of law and head of the law, science, and technology program at George Washington University, believes the rules may allow an intervening group for the first time to challenge the adequacy of radiation standards in permit or license hearings. Further, he and others believe that the requirement for balancing costs and benefits of each new reactor can be stretched to encompass risks and benefits. The result, Green suggests, would be to oblige the AEC to define "undue risk" and to determine specific risks involved in specific power plants—neither of which it has ever done before.

"Now it becomes clearly possible to talk [in hearings] about exactly what a reactor means for people of a given city," Green said in a conversation. "Its safety and economics are going to have to be considered. I think that the utilities are going to have to justify their choice between nuclear and fossil fuels. And this has never happened before."

In large measure, the significance of the AEC's new regulations will depend on the spirit with which they are applied. In that regard, the commission has given no hint that it will do any more than it has ever done to curb thermal pollution, and the possibility that construction or operation of a plant may actually be halted seems remote. Moreover, the new regulations are only an "interim" policy, leaving open the opportunity for inserting loopholes and escape clauses. But environmentalists find Schlesinger's attitude heartening. "He understands that the AEC's problem is credibility," Green says. "He knows that these regulations, if implemented properly, can do a lot to restore the agency's credibility."—ROBERT GILLETTE