search into NSF programs at large. Funds for engineering, for example, would rise about 20 percent to $104.6 million.

The Administration's special initiatives to support last summer's economic revitalization plan have not survived in the budget, or at least are not labeled as such. Originally, some $600 million in science and technology initiatives were contemplated. Subsequently, plans to seek a $300 million supplemental appropriation to the FY 1981 budget were abandoned. Press said at the budget briefing that revitalization initiatives totaling $300 million were integrated into budget requests for NSF and other civilian agencies, but that they were not identified as a package.

It should be emphasized that at this point in the process the Carter FY 1982 budget is an abstraction, and a particularly fragile one. The Carter budget is a product of a precarious balancing act. The budget-makers have proposed substantial increases in military expenditures while protecting nondefense programs, including civilian R & D, against deep cuts. At the same time they seek to avoid a bigger deficit that would send inflation to further heights. They would accomplish this through substantial tax increases aimed at limiting the gap between revenues and expenditures.

Some proposed cuts in social programs notwithstanding, the Carter budget runs generally counter to the Reagan pledge to cut taxes and reduce government spending. The reaction of Reagan budget director David A. Stockman to this budget was to characterize the Carter approach to control of the deficit as "cosmetic and artificial" and to reaffirm Reagan's goal of pursuing a 30 percent tax cut over 3 years.

From the Reagan Administration, aside from reports of a favorable estimate of the economic value of science and technology, there are as yet no solid clues to a Reagan R & D policy. However, with a major battle of the budget brewing within the Administration and Congress, the major influence on R & D funding is likely to be the shape of the new Administration's overall economic strategy.—JOHN WALSH

Utilities Lose Power on Wall Street

Electric companies start the decade in poor financial health; some will halt construction, seek emergency aid

America's electric utilities are in trouble, not as much trouble as the auto and steel industries, but enough to make Wall Street nervous about their future. Nineteen eighty-one may be an especially traumatic year for the investor-owned companies, which supply more than three-quarters of the nation's electric power, for some will have to change radically to survive. They are losing income because the demand for electricity has fallen, construction costs are rising rapidly, and the public is refusing to pay higher electric bills. Many companies are finding it impossible to finance new capacity, costly to stop work in progress, and dangerous to stand still.

Confronted with this situation, investment experts such as those at New York's bond rating company, Standard & Poor's, are beginning to echo the advice given to utilities in years past by conservationists. They are telling hard-pressed companies to cut back construction programs and try to cut demand.

The response to this advice is varied. A few big companies have scrapped the high-growth assumptions that have guided the industry for the last 20 years and set themselves up on an entirely new basis. They are promoting conservation as a low-cost source of new energy, aggressively installing equipment designed to cut demand, and investing in small-scale generating stations. Other companies maintain a traditional outlook, which stresses the need for steady economic growth (3 percent or more) to provide for social stability. The traditionalists tend to assume that growth in electric demand will increase at least as rapidly as general economic growth. Conservation is seen as desirable, but not essential.

Utilities that guess wrongly about the future—whether by over- or underestimating the need for new generating capacity—will pay dearly. The costs will be measured in billions of dollars. It is possible, one New York bond analyst says, that some companies will come down with Chrysler's syndrome this year. They may have to plead for emergency help to get them out of a financial jam. Should this happen, those who undertake the rescue missions will want to find out just what went wrong. As in the Chrysler case, they may want to set limits on the generosity of the bailouts, and they may demand that specific corrective steps be taken to prevent the need for future bailouts.

There is good evidence that trouble is brewing. In the month of December alone, the *Energy Daily* reported, six major utilities withdrew bond offerings from the market because the prospects for selling them were so poor. Company directors decided that the interest rates they were being offered were too high, and so chose to postpone the bond sales until later, when rates might be lower. One company that went ahead with a planned bond sale, the income-poor Public Service Company of New Hampshire, had to accept an interest rate of 17 percent, apparently the highest rate ever paid by an electric power company.

Utility managers who pulled bonds off the market in December said they made a strategic retreat because the market was "chaotic," churned up by increases in the prime rate and by expectations of more inflation. Bond analysts say electric utilities are being asked to pay high interest rates in part because their credit is not as good as it used to be. New York's bond raters downgraded appraisals of many utility bonds in 1980, sending a message to investors that these companies were not as sound as in the past.

Roger Taylor, vice president in charge of utility issues for Standard & Poor's, says, "We have cut more bond ratings than I would care to relate over the past several years, and we continue to cut. In 1980 we cut 28 or 29 out of a universe of 125 companies." The electric utilities, Taylor thinks, face problems that are "pretty serious indeed." Their credit has been deteriorating for a decade and will continue to deteriorate. "This doesn't mean the industry will go out of business tomorrow," although there may "a Chrysler or two."

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The fundamental problem, Taylor says, is that these companies do not make enough profits, or as he put it, they do not earn enough to pay out a "competitive" rate of return. He thinks an absolute minimum rate of return today should be 16 percent—not the 12 percent most utilities aim for, but fail to achieve. Because the utilities are not paying high rates of return, they are not attracting enough investors. "Couple that with a fairly ravenous appetite for new capital, and you have a problem," Taylor says.

One straightforward solution would be for the utilities to raise prices. They have been trying to do that, but local commissions that control rates have not kept up with the utilities' demands. According to the Edison Electric Institute (EEI), the association of investor-owned companies, utilities asked for increases amounting to $797 million in 1970 and got $533 million—roughly two-thirds of what they wanted. Ten years later, they asked for $8.4 billion and got only $4 billion—less than half of what they sought. Rate commissions will probably continue to be tight-fisted in the 1980's, Taylor thinks, even though they may strangle the companies they regulate. The public is not in a mood to accept large rate increases, and will vote out of office commissioners seen as too generous to the utilities.

> "It just doesn't make sense to keep on building more and more plants ad nauseam," Taylor thinks.

Many companies ignored the public's attitude in the 1970's. They tried to finance growth as usual by borrowing money and using new accounting techniques to give balance sheets a healthier look. The results are reflected in two figures recently calculated by EEI, one dealing with debt and the other with accounting. A healthy company obviously takes in more income than it pays out in interest, and as a rule a company selling long-term bonds must earn at least twice what it pays in interest. The electric utility industry began the decade earning three times what it owed in interest. Now the industry is slipping again toward the low point it hit in the recession of 1974, when it earned only 2.4 times what was owed.

Meanwhile, an accounting gimmick called Allowance for Equity Funds Used During Construction (AFUDC) has become enormously popular. It allows a company to count as current income cash which will not be available until later when a plant has been completed and begins producing a marketable product. AFUDC is a bookkeeping fiction, "funny money," as one industry critic calls it. It is safe to use the gimmick, provided the equipment it pays for is built and brings in the promised cash. It is not safe if the plant is canceled, for then the utility must pay off its construction debts without being able to use the new plant as an income producer. According to EEI, the volume of AFUDC funds in industry accounts has doubled since 1970. In fact, more than half the total earnings of the electric utility industry are now AFUDC speculative dollars. Furthermore, if AFUDC dollars are eliminated from the accounts, the industry is just barely earning enough to pay twice its interest costs each year.

"They are buying electric plants on a Master Charge account," says Amory Lovins, the British representative of Friends of the Earth and a tenacious critic of the industry. Somebody will have to pay for the equipment bought on credit, and it will be difficult to charge the bill to customers if the plants prove to be unneeded. Lovins and others point out that this is the great flaw of AFUDC: it allows the account books to reflect a demand and a willingness to pay for electricity which may not exist in reality.

On average, the nation already has a surplus electric generating capacity of about 35 percent, with regional reserve capacities this winter ranging from a low of 22 percent in the West to a high of over 50 percent in the South. Because the utilities have consistently overestimated demand for power in the last 6 years, a number of analysts are suggesting that it may be time for a pause in construction. Financial and regulatory constraints have already put a damper on new projects. According to a Government Accounting Office (GAO) report issued on 8 December, 184 large generating units (over 250 megawatts) were canceled between 1974 and 1978. The GAO also found that most projects have been delayed, and that the length of the average delay has grown since 1974 from 14 to 23 months. More cutbacks may be coming.

The slowdown is desirable—according to Taylor of Standard & Poor's—if the public really is determined to forbid higher electric rates. For "if you can't earn a reasonable rate of return on investment, why continue to invest? It just doesn't make sense to keep on building

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Briefing

Carter Team Departs with Words of Warning

A doomsday clarion sounded in Washington this January, played with suitable dolor by members of the departing Carter Administration. The President led the event with his farewell address, speaking of our potential to create "a World War II every second" with nuclear weapons and of the "shadows that fall across our future" because we are running out of basic resources. Carter asked Americans to learn restraint and try to see domestic problems in terms of the "essential unity of our species and our planet."

Gus Speth, chairman of the Council on Environmental Quality (CEQ), got into the specifics the same day, 14 January, by releasing a report titled *Global Future: Time to Act.* Written jointly by the State Department and the CEQ, the 242-page document serves as an activist's antidote to an earlier work by the same authors, *The Global 2000 Report to the President* (see *Science*, 1 August 1980, p. 575), which forecast a future of scarcity. Both papers paint a grim 21st century, mired in poverty and pollution, except that the new paper offers dozens of suggestions for avoiding the misery it foretells.

The study was commissioned by the President last July and drew upon the work of planners in 19 federal agencies. It is a handbook for improving the world, and like all general manifestos of the kind, it is often bland. Major concerns are scattered everywhere, along with growing threats and essential needs. Nevertheless, the paper convincingly argues that, quite apart from moral duty, America's self-interest should impel us to do all that is possible to check the growth of the world's population and its appetite for resources.

Speth was asked to pick out the most important recommendation in the packet. His favorite, he told reporters, is the one that asks the federal government to create a new office in the White House whose sole task would be to worry about global resource and population problems, help the President write an annual message on the subject, and see to it that federal powers are used to attack

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more and more plants ad nauseam." Taylor thinks the electric utilities are beginning to see the situation as the financiers do. They are emphasizing efficiency and trying to reduce demand.

Four companies which are often mentioned as leaders in the move toward greater efficiency are Pacific Gas & Electric, Southern California Edison, Arkansas Power and Light, and New England Electric Systems. Southern California, for example, announced last October that it was reorganizing its capital investment program to accelerate small-scale and renewable resource projects. According to vice president Ed Myers, the company plan was rewritten to call upon "soft" and "alternative" energy projects—including windmills and solar voltaic generation—for two and one-half times as much power by 1990 as had been scheduled. By 1990, 30 percent of the company's electricity will come from renewable sources.

The changes are being made, Myers says, because the company wants to reduce the use of foreign oil rapidly. It is easier and quicker, although not necessarily cheaper, to get alternative energy projects built. Herein lies the financial benefit: money borrowed to pay for construction can be repaid sooner, and this quickened pulse in the cash flow makes the business look healthier to investors.

New England Electric is engaged in a similar campaign to reduce dependence on foreign oil. According to vice president Bruce McCarthy, the company relied on imports for 74 percent of its energy in 1979, and plans to cut that figure to 28 percent by the end of 1982. One large plant has been switched from oil to coal. The company has joined in partnerships with a couple of U.S. oil explorers and now owns 3.5 million barrels of domestic oil reserves. And the utility has "about a dozen other" nonfossil energy projects in the works, including two solid waste burning plants and a low-head hydroelectric generating station. In addition, McCarthy says, the company "aggressively" promotes conservation. For example, it has developed and patented a new device which can be used by the central station to turn off power at the user's end of the line in times of peak demand. McCarthy estimates that the company has been able to reduce its investment budget for the next 15 years by $2.6 billion. It has eliminated the need for 1000 megawatts of planned power—the equivalent, he says, of one large nuclear plant.

Although many utilities might want to trim their expansion plans as these have done, not all will be able to do so. In some parts of the country, electric demand will continue to grow rapidly. Nearly all utility executives are aware of the risks of overbuilding now, says Roger Taylor. That is an improvement over the situation 5 years ago, when Taylor thinks only a quarter of the managers understood the risks. He expects that the demand for electricity will grow at a rate of between 2 and 5 percent annually during the 1980's, and "the lower end of the range will probably turn out to be correct." Through their national organizations, the utilities are planning on a growth rate of about 4 percent annually. Amory Lovins, who argues that large-scale generating plants are no longer good investments, believes that demand will not grow by more than 1 percent a year through the end of the century. It may decline. Lovins thinks enough electric capacity has been built already to provide a 15 percent average national power surplus in the year 2000, even if all new plant construction were stopped today.

The Lovins outlook, although gaining respectability, seems utterly implausible to Gordon Corey, vice chairman of Commonwealth Edison of Chicago, a company that has invested heavily in nuclear power. He thinks demand is "temporarily flattened," but that there is an unbreakable tie between economic prosperity and energy use. "We could use a lot less energy if we decided to move to a village economy," Corey says, but in those "beautiful, soft village societies such as in India or Uganda, people have not had the leisure time, and certainly not the freedom that we have had." Utilities will have to continue building new plants, Corey thinks, if for no other reason than to replace oil-burning equipment. He also thinks there will be a growing need for electricity to power cars, buses, and trains.

Nevertheless, Corey agrees that the outlook is bleak at the moment. Many oil-dependent companies which should be switching rapidly to coal will not be able to do so, he claims, unless they receive direct federal aid.

Among the many financial cures the utilities have proposed, the approach which seems the most direct is also likely to be the most unpopular. The idea is to get customers to help pay the cost of building new plants as they are built, a concept known as allowing for Construction Work in Progress (CWIP) in the rate base. As a rule, rate commissions do not permit utilities to bill customers for new equipment until it has begun to supply power. This lag in payback time has put many companies at risk.

When managers miscalculate the amount of money or time needed to finish a project, it becomes necessary to underwrite huge debts which cannot be added into operating costs. For example, the Washington Public Power Supply System has run into cost increases of more than 400 percent and a delay of more than 6 years on a large nuclear project. Eventually consumers or taxpayers will have to pay for this venture, but for the present, it is being financed on borrowed money. Meanwhile, consumers get cheap electricity.

This company is not in trouble, but others like it are. Some students of the industry think that overextended companies will have no choice but to write off half-finished plants in coming years and beg for emergency help. One way to provide it would be to begin charging customers now for some of these projects, using CWIP. Rate commissions are moving in this direction. (Commonwealth Edison has been allowed, for example, to charge for one nuclear plant still in construction.) Although unpopular, this approach has two things to recommend it: it quickly bails out the utility and, by raising rates, lets customers know the real cost of providing electricity today. If increased prices discourage people from using electricity, that is good too, for then utilities will invest even less capital in construction.

Bailout by CWIP—if there are to be bailouts—seems to make more sense than granting new tax breaks or federal loans. The burden is placed directly on those who use the power, and not on the general taxpaying public. Many conservationists—although not Lovins—would be likely to support this remedy if they could be assured that CWIP would not become just a means of returning to business as usual in electric utility planning.—ELIOT MARSHALL

Many oil-dependent companies which should be switching to coal will not do so unless they receive direct federal aid.