U.S. electric reliability heads for Third World levels

The "creeping deterioration" of the American electric power system is reaching the point where serious shortages and even rationing are on the agenda. Marsha Freeman reports.

In its 1989 assessment of the reliability of electric power in the United States, the North American Electric Reliability Council (NERC) warns that in the near future, American cities could look like Buenos Aires, Argentina. In that city of 11 million inhabitants, electricity is rationed. Since 1988, neighborhoods have been scheduled for periods of rolling blackouts. People organize their daily activities according to when elevators, factories, and the subways are running. Street lights have been dimmed, and work hours cut.

The NERC report describes how food shopping is done there on a daily basis, since unreliable electric power has made home refrigeration a thing of the past. This situation has long existed in the major cities of the Third World such as New Delhi, India as they have struggled to industrialize. Reliable electric power is a prerequisite for and hallmark of economic health and industrial development.

The once-proud and unrivaled reliable, inexpensive, and growing electricity generation and supply system in the United States is quickly devolving toward that of a "lesser developed" nation. Even through depression and wars, the American people have never before experienced significant shortages of electric power.

This situation, which NERC describes as a "creeping deterioration" of reliability, was not produced overnight. Unfortunately, neither can it be solved overnight.

Turning point in 1988

The reliability of the U.S. electricity generating and transmission system has been slowly deteriorating since the mid-1980s, as the rate of addition of new capacity slowed to a snail's pace. But the extreme weather during the summer of 1988 brought into stark relief the consequences of abandoning capital investment in U.S. infrastructure.

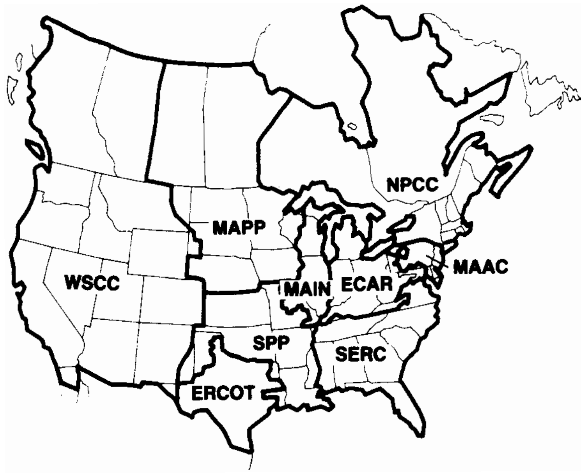
The electric utilities made it through the record heat and drought of that summer two years ago with a minimum of noticeable disruption to customers by instituting voltage reductions, appeals to the public for conservation, and by interrupting industrial customers. In the Mid-Continent Area Power Pool region, which includes all or part of Iowa, Minnesota, Nebraska, North Dakota, Illinois, Michigan, Montana, South Dakota, and Wisconsin, interruptible customers were cut off 22 times! **Figure 1** shows the nine NERC regions.

In most parts of the United States, there was none of the supposed "excess capacity"—which regulators and zero-growth malthusians complain about—available to meet the record peak demand. More widespread 5% voltage reductions, or "brownouts," and outright power blackouts were avoided, not because the utilities had enough reserve capacity, but because they took measures to *reduce demand* by more than 2,500 MW.

Emergency operating procedures, which were required in the summer of 1988, are implemented only after all available generating sources have been called upon, and after all contractually interruptible customer demands have been cut off, according to NERC's 1989 "Reliability Assessment." These procedures include public appeals for voluntary reduction, voltage reductions, and utility-controlled load-shedding.

NERC explains that these options are the alternative to "widespread uncontrolled disturbances." They point out that "there is concern that some of these procedures formerly relegated to system operators for alleviating system emergen-

FIGURE 1
Regions of the North American Electric Reliability Council



ECAR
East Central Area Reliability Coordination Agreement
ERCOT
Electric Reliability Council of Texas
MAAC
Mid-Atlantic Area Council
MAIN
Mid-America Interconnected Network
MAPP
Mid-Continent Area Power Pool
NPCC
Northeast Power Coordinating Council
SERC
Southeastern Electric Reliability Council
SPP
Southwest Power Pool
WSCC
Western Systems Coordinating Council

Source: NERC

cies, are beginning to be used as long-range system planning options to reduce the need for new facilities. . . . These actions will eventually degrade system reliability as there will be less system flexibility to handle emergencies."

The margin of reserve capacity has shrunk dramatically and to such an extent, that the Northeast, parts of New York, and the Mid-Atlantic region can only keep the delicate electric generation and transmission system stable by instituting various austerity measures, to convince or even, increasingly, to coerce customers to cut demand. As an example, starting in January 1992, Consolidated Edison in New York City will be legally required to penalize customers who use electricity during peak demand hours, by *doubling* their rates. To continue to pay the "normal" rate, which is already double that of other parts of the country because of the use of imported oil, residents will have to cook, wash clothes and dishes, and use other appliances after 10 o'clock at night!

NERC projects that by 1998, 2.8% of peak demand will be under direct interruptible utility control, compared to 2.2% last year. That is, a larger share of electric power will become unreliable, being unavailable in peak demand periods. By 1997, debt-strapped utilities hope to reduce demand through this load management (read: austerity) by nearly 17,000 MW, avoiding the construction of approximately 17 new baseload power plants.

The electric generation industry, like agriculture, *must* maintain a margin of reserve, because such weather-dependent economic activity must be prepared for extremes in weather. But unlike agricultural products, electricity cannot be produced in a period of low demand and "stockpiled" for later use. At the level of today's technology, it must be produced and delivered instantaneously, on demand.

At least a 20% reserve margin, or capacity above expected demand, has been considered prudent, not only for unexpected weather extremes, but also for unscheduled power plant outages (breakdowns) and "acts of nature," such as electromagnetic storms, hurricanes, earthquakes, tornadoes, and the like.

Growing strains on the system

During the 1970s, electric utilities were building large baseload facilities, which were increasingly nuclear, trying to catch up to the increased demand from the previous decade, which had been spurred by the Kennedy-era industrial revitalization led by the aerospace and defense industries. During the 1960s, electricity growth peaked at 7% per year, and due to the lag time to get new facilities on line, it was not until the early 1970s that construction began to catch up to that growth, bringing the reserve margin back up to prudent levels.

But the economic shocks of the 1971 financial crisis, when the dollar was taken off the gold standard, the 1973 oil cutoff from the Middle East, and, finally, Federal Reserve chairman Paul Volcker's crippling interest rate hike of October 1979 and a second oil crisis that same year, put a halt to any real economic growth. Peak electricity growth fell to less than 2% per year between 1980 and 1985, and total electricity consumption actually declined in absolute kilowatt hours for the first time in history, in 1982.

The consumer credit explosion and increased "economic activity" largely in the service, commercial, and financial sectors in the past five years, did result in a resuscitation of the electricity growth rate. Between 1985 and 1988, electricity peak demand grew by an average of 3.3% per year. But due to the downturn in demand starting in the mid-1970s, and attacks on nuclear power by the burgeoning environmentalist movement, 100 nuclear plants were canceled, mothballed, or deferred. Financial and environmental warfare against the electric industry had also made it nearly impossible to build new coal-fired capacity, and 80 baseload coal plants were canceled. The industry was turning toward cannibalizing the generating and transmission capacity it had spent decades building and putting on line.

The blackout that crippled New York

The economic disruption to an industrial society due to unreliable electric power is now on the agenda, and has been experienced twice by millions of New Yorkers. Though the blackouts in 1965 and 1977 were caused by a combination of equipment failures and natural disasters such as lightning strikes, and not an overall lack of capacity, the effect of unscheduled shortage-produced blackouts would be similar.

In a June 1990 report, "Physical Vulnerability of Electric Systems to Natural Disasters and Sabotage," the congressional Office of Technology Assessment describes the impact of the 1965 New York City blackout on transportation:

The 1965 Northeast blackout occurred at 5:30 p.m. . . . and lasted for 13 hours. The worst potential hazard was in the air, where at peak hours between 5:00 and 9:00 p.m. some 200 planes from all over the world were headed to New York's Kennedy Airport. . . . Luckily, it was a clear night, and pilots would see the other planes over the darkened cities. . . . Kennedy was shut down for 12 hours.

In 1965, 630 subway trains in transit ground to a halt, trapping 800,000 passengers. Under the East River, 350 passengers had to slog to safety through mud, water, and rats. In the middle of the Williamsburg Bridge, 1,700 passengers were suspended in two trains swaying in the wind. It took police 5 hours to help everyone across a precarious 11-inch-wide catwalk running 35 feet from the tracks to the bridge's roadway. A total of 2,000 trapped passengers preferred to wait it out, including 60 who spent 14 hours in a stalled train under the East River.

Thousands of people were trapped in stalled elevators. In at least three skyscrapers, rescue workers had to break through walls to get to elevators and release 75 passengers. Elevator failure resulted in the only two deaths attributable to the 1965 blackout: one person fell down a flight of stairs and hit his head, and another died of a heart attack after climbing up 10 flights of stairs.

Traffic lights failed and main arteries snarled. At unlighted intersections, countless volunteers took over the job of directing traffic. Hundreds of drivers ran out of gas as they waited for traffic to clear, only to find that service station pumps cannot work without electricity.

TABLE 1

Demand for power exceeds forecasts

1998 summer peak demand growth over 1987, compared to forecast

Region	Growth over forecast
ECAR	10.5%
ERCOT	2.2%
MAAC	8.9%
MAIN	11.6%
MAPP	9.9%
NPCC	4.9%
SERC	3.1%
SPP	3.5%
WSCC	5.0%
National average	6.6%

Source: North American Electric Reliability Council

During the summer of 1988, it became painfully clear that the utilities' projections of growth in demand, which were still based on the depression-level performance of the early 1980s, were now being superseded. Four out of the nine NERC regions registered peak demand that summer, *more than 8% above* what had been projected (**Table 1**). Regions reached peak demands that summer which had not been projected to occur until the mid-1990s.

Company managers crossed their fingers, and hoped that the heat and drought of 1988, which had produced a rate of growth in demand for power more than double the preceding years, was an aberration in an otherwise lackluster electricity demand growth rate. The only way utilities knew they could get away with not building new baseload capacity, was if the real economy continued to stagnate.

Supply system is 'under siege'

During the winter of 1989, the Southeast and Mid-Atlantic regions of NERC were forced to reduce their peak demand through load management, voltage reductions, and the interruption of industrial customers. According to the U.S. Department of Energy report "Annual Outlook for U.S. Electric Power 1990," released on June 14 of this year, peak demand in Florida was 13% higher than the year before, and would have been 16 gigawatts (GW) and not just the 14 GW recorded, if all of the demand had been met. Since it could not be met, Florida Power and Light instituted rolling blackouts. The winter peak recorded had not been projected to occur until 1995.

Across the nation, the 1989 summer peak demand was .03% higher than projected, but the brutally cold December in the South pushed winter peaks up to a whopping 7.7% above forecasts. It was becoming clear that annual growth of consumption was once again on the rise.

In its 1989 Annual Report, NERC declares that the "bulk electric supply system is under siege." "It is not the growth in demand itself that presents the challenge, but the loss of flexibility to respond to that growth." Many forecasts are performed to try to project how demand and capacity availability will match up over the 1990s, but "all have one thing in common: a shortfall in electricity supply."

The summer of 1989 was not extraordinary in terms of the weather, yet demand continued to grow. Indeed, it has been estimated that during the brutally hot and dry summer of 1988, only half of the increase in peak demand was due to the weather. The continued growth in consumption from just the minimal increase in economic activity and from population growth, resulted in the fact that 9 out of the 12 utilities in the MAIN (Mid-America Interconnected Network) region exceeded their forecast peak demand, with the region as a whole averaging 2.8% over forecast.

The net energy for load for the nation in 1989 exceeded both the 1988 figure and what had been forecast. This figure is the annual electrical energy needed to serve customers, which includes the losses in the transmission of power.

Reality outstrips the forecasts

Because of the financial, regulatory, and environmental attacks on the electric utility industry over the past two decades, it has become nearly suicidal for utilities to plan the construction of baseload power plants. As a result, utilities are hoping, and predicting, that energy load will grow at a likely unreasonably low 2.1% average per year, for the period of 1990-99. Summer peak demand is projected to grow at an annual average of 2% over that period, and winter peak, at 2.1% These projections are *less than half* what the actual growth rate has been in the past three years.

In its "Reliability Assessment" report, NERC points out that, "while aggregate utility plans will support the *forecast* growth in peak demand, this report identifies a widespread trend of actual peak demands consistently exceeding forecasts. If this trend continues, supply deficiencies are *likely by the early 1990s, in the eastern half of the U.S. and Canada*" (emphasis added). This is a most remarkable statement, underlining the seriousness of the problem. The report points out that "several geographic areas of the electric reliability system are at serious risk."

Of interest in this regard, is the Department of Energy's report, "U.S. Energy 1980-1988," released nearly two years ago. It states, "The severe penalties that have been imposed on some utilities for building what eventually proved to be excess capacity [!] can only encourage utilities to underestimate future demand, resulting in shortages and loss of economic growth."

Following this somewhat twisted admission of reality, the report proceeds to deny the severity of the problem: "Although DoE projections show an increasing gap between electricity supply and demand, such a gap will never occur. We will not awaken one morning to face a national blackout or to find that the U.S. needs 100 new electric power plants. The real danger is that the projected demand will not materialize—that economic growth will abate in those regions of the country where reserve margins are rapidly shrinking and future supplies are not ensured."

The report states that economic growth in New England is threatened by an inadequate power supply. While this is surely true, it is simply *not* the case that widespread power shortages will be avoided because demand will diminish from the industrial sector. It is not the industrial sector that has been leading the growth in electricity demand, but the residential, and secondarily, commercial sectors.

The gap between capacity and demand is widening every day. While it is not really possible to accurately project at what rate electricity demand will grow, it is knowable how much additional capacity will be available to come on line. If a baseload power plant is not already under construction by now, it will not be available until virtually the turn of the century. Even the increasingly popular small combustion turbine units for peak power take three years to put on line. Shortfalls in electric capacity cannot be remedied overnight.

Every year, NERC compiles from the electric utilities the projections of capacity additions for the succeeding 10 years, and the ability of the utilities to meet demand. Increasingly, these projections have depended upon assumptions which are unrealistic, such as low growth rates, non-utility capacity additions, and "conservation."

For the first time, forecasts of how to meet demand to the turn of the century now rely on significant expected reduction of demand. It would be comparable to the auto industry announcing that although its production of cars will not grow, it will meet the demand of the American consumer by convincing people that they only need one car per family.

In its 1989 "Reliability Assessment" report, NERC presents the picture in **Figure 2,** projecting that 72.2 GW (gigawatts, or thousand megawatts) of new capacity will be added to the electric grid by 1998. The report predicts that a modest 6.6 MW of capacity will be retired during the same time period. This will be a gross underestimate if utilities have to meet the new, more stringent standards contained in the amendments to the Clean Air Act. One hundred and seven existing coal-burning power plants will be out of compliance with the standard of this law.

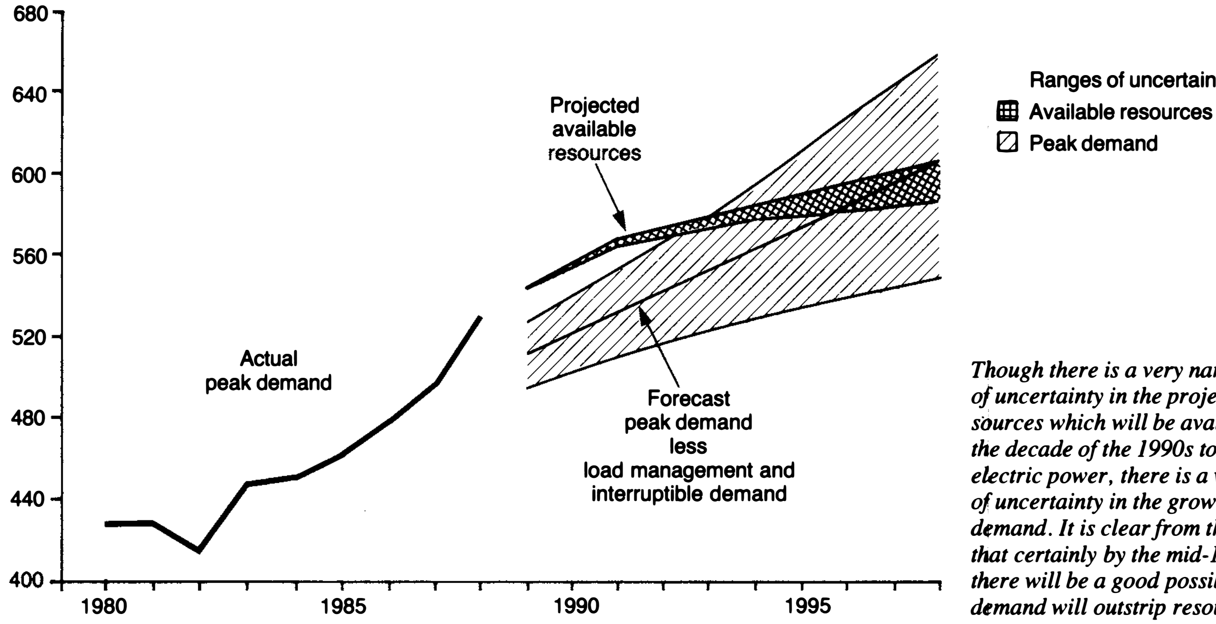
NERC estimates that 12,600 MW of coal-fired capacity could be permanently removed from service due to premature retirements, deratings, increased power used by the plants for the scrubbers, and anticipated poor availability of some plants that are retrofitted with emission controls, and, therefore, break down more frequently. This 12,600 MW of coal capacity *removed* from the system should be compared to the planned *addition* of coal-burning power plants totaling 13,500 MW over the next decade, which would barely balance the losses.

Even if every plant planned were brought into service,

FIGURE 2

Can electric utilities keep up with demand?
Ranges of uncertainty for peak demand and projected available resources (1989-98 forecast)

Thousands of MW (summer)



Though there is a very narrow band of uncertainty in the projected resources which will be available over the decade of the 1990s to generate electric power, there is a wide band of uncertainty in the growth of peak demand. It is clear from this graph that certainly by the mid-1990s, there will be a good possibility that demand will outstrip resources.

Source: NERC

there is little chance the new capacity would meet requirements. But NERC reports that as of September 1989, a startling 63% of the projected 72.2 GW of new capacity was *not yet even under construction*. Two years ago, about 40% of planned new capacity for the next decade was not yet under construction. This should caution the reader to be very wary of the projected available resources shown on the graph.

While it is true that much of the new capacity will be relatively small oil and gas combustion turbines which can theoretically be put on line in about three years, the units not yet under construction will certainly not be available to alleviate supply shortfalls before the mid-1990s, even in the best-case scenario.

Of the utility additions which are 100 MW or larger, 29.7% are not yet under construction. Of these 27,500 MW, 2,100 MW have projected in-service dates of 1993 or earlier, which means they will not be available when forecast. As well, 10,500 MW of planned non-utility generating units scheduled for 1993 are not yet under construction, and will, therefore, not meet their projected schedule. This means that the crunch in electricity supply will not be put off to the second half of this decade, as the graph would indicate, but will accelerate over the next three years. Overall, only 26.7 GW of capacity are currently under construction, out of the 72.2 GW projected to be on line by 1998. For the capacity that *is* actually being built, a NERC survey indicates that 1998 planned capacity additions could easily be reduced by 7,400 MW, or 14% of the total, due to delays.

'Substantial uncertainty' about demand

In its 1989 "Reliability Assessment," NERC points out that demand forecasts have been consistently lower than actual demand by a significant percentage, and that the actual peaks have been outside the range considered to be 80% probable.

In addition to overestimates of the availability of new capacity, the forecast peak demand line in Figure 2 includes assumed reduction of demand through "load management," which is customer load under the direct control of the utility which can be interrupted, and "demand management," which includes incentives for voluntary cutbacks. NERC cautions that "inconsistent demand response has already been observed in experimental and pilot load management programs," so this figure includes "substantial uncertainty."

NERC projects that load management programs in 1997 are supposed to cut demand by 16,800 MW. This is an increase of 29% over the 1988 "Reliability Assessment" projection of load management savings. So, while there is no more indication this year that these austerity efforts will yield more savings than there was last year, the projected savings have been increased nearly 30%. Otherwise, the gap between growth in demand versus supply would look even worse.

The graph indicates that there is a range of uncertainty in the 10-year projections. If available resources end up on the low side, and peak demand grows faster than the projected unreasonably low 2% per year, the supply and demand lines cross over in 1992, not 1997. This is more likely to be the situation we are facing.

Because 1988 actual electricity demand was so much higher than what had been forecast, and significant growth continued in 1989, the utilities have recently taken another look at their long-range projections. In the year which elapsed between the 1988 and 1989 projections, for example, the amount of capacity expected to be on line in 1997, increased by over 17,000 MW.

In June, NERC published an advance release of its 1990 "Electricity Supply and Demand" report, which is customarily released in October. The report states that although there are no major differences in the projected annual growth rates in net energy and peak demand compared to last year's projections, the absolute values of peak demand projections in each year are about 1.8% higher than those made last year. This is because the peak was so much higher than the forecast starting in 1988, that the utilities would be forecasting lower demand than has already been achieved, if they did not start from a higher number!

Figure 3 illustrates the gap between forecast peak demand and reality. Many of the NERC regions had to re-do forecasts after the 1988 summer peaks, because the situation had changed. In the ECAR region, for example, the 1988 projection was not increased in terms of rate of growth, but the line starts at a higher point, in the revised 1989 forecast.

It is also clear that even in the revised forecasts for the four regions pictured here, none extrapolates the actual rate of growth from 1986-88 into the future; but that could well be the real picture, with the resultant gap between capacity and demand, to the turn of the century.

The impact on needed capacity from relatively small changes in average growth in demand projections, is shown in **Figure 4.** At the lowest rate of growth in the graph, currently planned capacity additions would be at least in the ballpark, because the demand at 1.2% per year would require about 58 GW of additional capacity by the year 1999, and 72.2 GW are theoretically planned. But at the NERC-projected 2.7% per year, lowered to about 1.8% through austerity measures, about 80 GW will be needed and though 72.2 GW are theoretically planned, some of the threats to these units actually being built have been discussed above.

At an average annual growth rate of 2.7%, which is at the upper limit of the 80% probability bandwidth in NERC's projections, but still considerably lower than the 3.3% average rate of growth of the past three years, *nearly 200 GW* of additional capacity would need to be on line, by the turn of the century. That is equivalent to more than 200 large, baseload plants. Because of the increased peak demand growth rate in the recent years, which was not, and really could not be, predicted, there is now a 50-50 chance that the peak demand growth rate will actually exceed the upper limit 2.7% rate, which had been considered only a 10% probability until last year.

The NERC 1990 report "Electricity Supply and Demand" projects an average 2.1% growth in net energy load, and a 2% per year growth in summer peak—both extremely low. But capacity resources are projected to grow only at an average 1.4% per year to meet summer peak demand. Capacity margins are projected, therefore, to fall from an average 22% this year, to 17.8% in 1999. As NERC has stated, considering regional differences, in the next three years, the *eastern half* of the United States could be under threat of shortages.

Clearly, the picture only worsens as the close of this century draws near, as there is little baseload capacity under construction now to come on line at that time.

Return to nuclear

It has begun to occur to planners that not only will new baseload power plants have to be built, but the dozens of gigawatts of nuclear capacity which were abandoned since the early 1970s, cannot afford to be sitting in mothballs, when the power is desperately needed.

Harold Finger, who heads the U.S. Council for Energy Awareness, pointed out in a speech in November 1989, that in 1988, nuclear power plants produced 527 billion kilowatt hours of electricity, "substantially more than all our electricity supply 32 years ago when the first civilian nuclear energy plant went on line."

At the Nuclear Energy Forum conference last November, Richard J. Slember, vice president and general manager of Westinghouse's energy systems business unit, stated that there was "once again a real option" for nuclear energy. He reported that utilities had expressed interest in his company's AP-600 light water nuclear reactor design, and that "creative financing" options were being discussed.

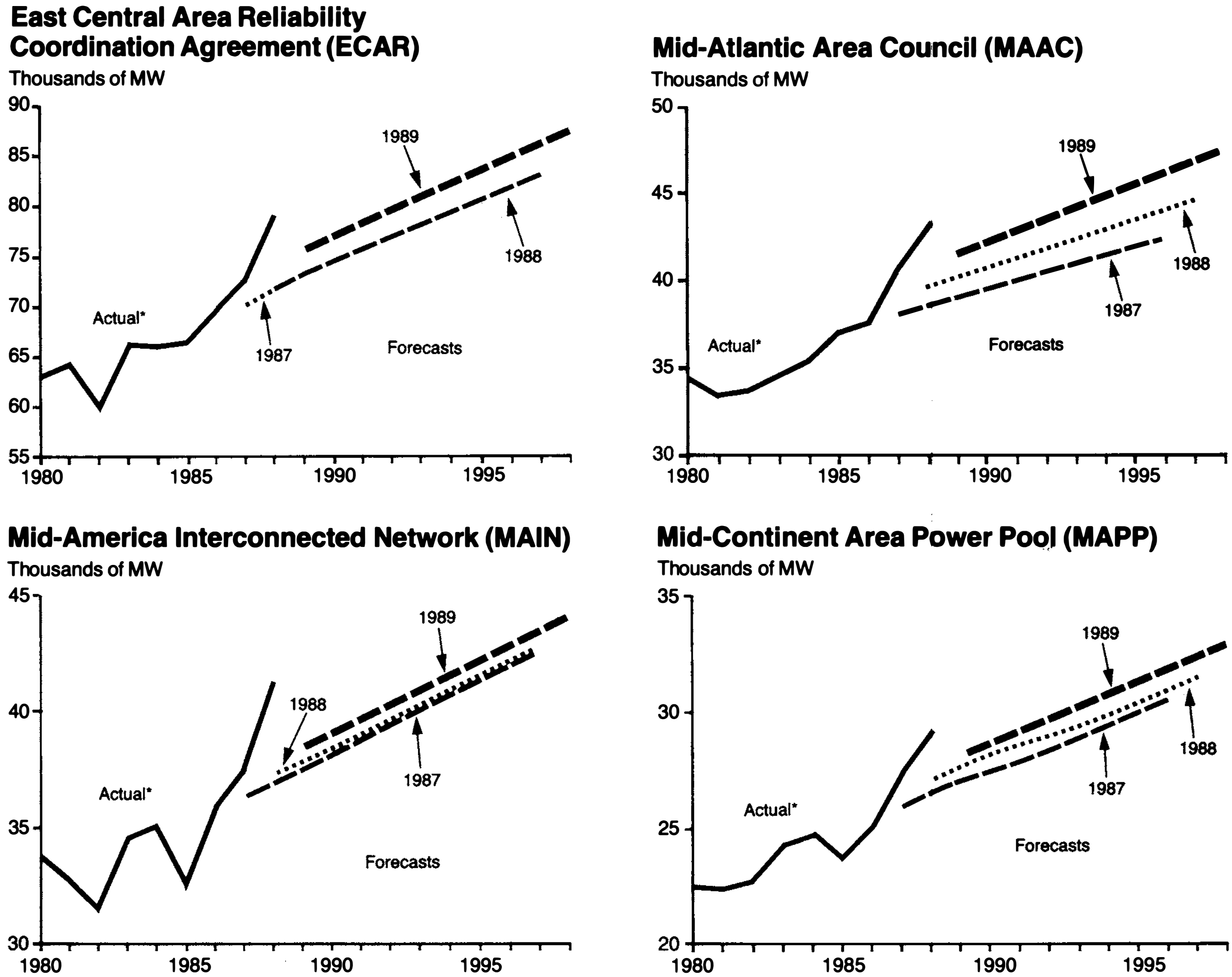
These include Westinghouse assuming the financial risks of construction, construction by independent (non-utility) power companies, and possibly government participation. In addition to the 600 MW advanced Westinghouse design, the small General Electric breeder design (PRISM) and the General Atomics modular high temperature gas cooled reactor could be available to utilities over the next few years, to restart the addition of baseload nuclear power to the grid.

In addition, according to an article by John Sillin and John Jackson in a November 1989 issue of *Public Utilities Fortnightly,* there are nine nuclear power plants which are already at least 25% complete, and could provide over 10 GW of electric capacity if they were finished and brought on line. These are listed in **Table 2.** The deferred plants hold construction licenses, have completed engineering and design work, and, in some cases, the major equipment and materials required to complete them are still on order.

As an example, the two Washington Public Power Supply

FIGURE 3

Actual versus forecast summer peak demands for several NERC regions



*Not adusted for weather or operator-controlled demand reductions.

Source: NERC

After the extraordinary growth in peak demand during 1988, many NERC regions revised upward their projected growth rate through the end of this century. As is clear from these graphs, however, none of the revised projections compare in magnitude with the actual growth rates experienced over the past three years, and therefore, they may prove to be very conservative.

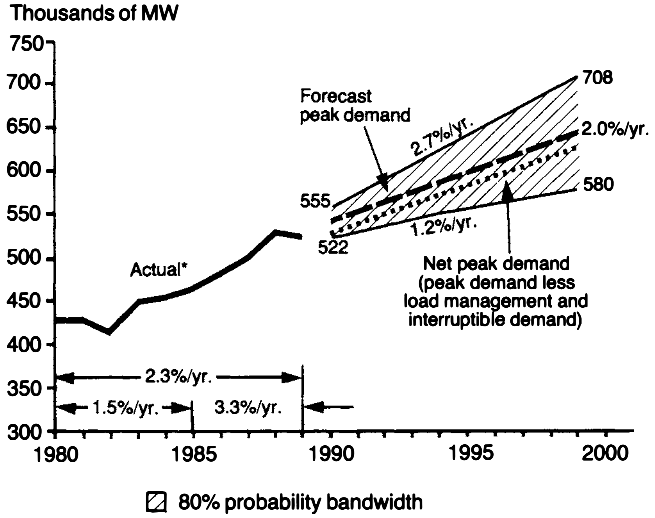
System (WPPSS) units were mothballed in 1982—the year electricity consumption collapsed into negative growth for the first time in history. WPPSS 1, which is two-thirds complete, is maintained at a cost of $5 million per year.

In 1981, the Philadelphia Electric Company halted construction work on the Limerick 2 nuclear plant because of finanicial constraints. Following the completion of an audit by the state utility commission, the utility restarted construction in February 1986. It was completed on time, $300 million below the cost cap that had been placed on it by the Public Utilities Commission, and received low-power testing permission from the Nuclear Regulatory Commission a year ago. The South Texas Project and Millstone 3 plant also restarted construction after a hiatus.

There are many obstacles standing in the way of any utility being willing to order a new nuclear plant. A May 1989 study by the accounting firm Touche Ross and Co., and Science Concepts, Inc., under contract to the Department of

FIGURE 4

1990-99 projections for summer peak demand



*Unadjusted for operator-controlled demand reductions, emergency operating procedures, or weather.

Source: NERC

The sensitivity of needed new capacity to changes in growth rates is seen in this graph. A still-modest 2.7% per year average annual growth rate in summer peak demand, which is lower than that experienced on average over the past few years, would require nearly 280 GW of new capacity on line.

TABLE 2

Construction status of deferred nuclear units

Unit	Size (MW)	Owner or lead utility	Construction completed
Bellefonte 1	1213	Tennessee Valley Authority	87%
Bellefonte 2	1213	Tennessee Valley Authority	58%
Grand Gulf 2	1250	Entergy Company	33%
Seabrook 2	1150	Public Service Company of New Hampshire	25%
Perry 2	1205	Centerior Corporation	57%
Watts Bar 1	1177	Tennessee Valley Authority	100%
Watts Bar 2	1177	Tennessee Valley Authority	86%
WPPSS 1	1250	Washington Public Power Supply System	63%
WPPSS 3	1240	Washington Public Power Supply System	76%

Source: U.S. Council for Energy Awareness

Energy, concluded that the attempt by the Nuclear Regulatory Commission to remove obstacles to building new nuclear plants, through changes in its rule-making, "is not sufficient to create a climate conducive to an investment in a new nuclear power plant absent congressional endorsement of the policies."

Though President Reagan, and also President Bush, have protested that they are really for the development of nuclear power, neither made the necessary changes in financial and economic policy to make such a revival possible.

EIR warned of what would happen back in 1981, after President Reagan had made a televised announcement of an optimistic new program to revive nuclear power, following the debacle of the Carter years (*EIR,* Nov. 3, 1981, "Reagan's nuclear policy: Can the U.S. make it work?"). "There were two crucial omissions in the President's statement," we wrote. "The first is the urgent and necessary development of thermonuclear fusion power. The second is the matter of financing: There cannot be any revival of American nuclear power resources without ending the usury that has swept the land at the instigation of Paul Volcker's Federal Reserve Board."

Instead of heeding our warning, as we shall show in a future article, Reagan and Bush—like Jimmy Carter before them—pursued such policies as deregulation, which *accelerated* the collapse of reliable electric power. In the October 1988 Department of Energy report, "U.S. Energy Policy 1980-1988," the statement is made that, "competition in electric power production should be increased. This would stimulate the flow of investment capital into new generating capacity, promote greater diversity and efficiency in sources of generating capacity, and improve the overall efficiency of the industry." This did not occur. As with the deregulation of the trucking, airlines, banking, and telecommunications industries, the opposite occurred.

As a sidelight, one benefit of the increased "competition" in the industry, and elimination of tax incentives for uneconomical projects in 1985, is that the "renewable" energy sources, such as small-scale hydroelectric and burning trash and animal waste, could not compete. Federal R&D support for these renewable "technologies" has fallen by 82% since 1980, and since 1985, one-third of the companies involved in renewable energy have dropped out of sight.

Nuclear power provides approximately 20% of the nation's electrical energy. As incredible as it may seem, current projections indicate that by the turn of the century, because mainly small, quick-start natural gas peaking units will be built, nonrenewable and precious chemical resources will provide more power than nuclear, assuming supplies and transport can support this growth. Natural gas would become second only to coal as the fuel for electricity, over this current decade, as 60% of the new capacity will be fueled by gas.

The reliability of U.S. electric power has already been seriously compromised by the hostility to economic growth which has characterized the policies of the past 15 years. Without a quick turnaround, Americans will indeed find themselves living in an underdeveloped country.