THE ROLE OF NUCLEAR POWER IN THE U.S.A.

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Presently the United States has a total electrical generating capacity of about 600 gigawatts (600 000 MWe), of which 57 gigawatts is nuclear-fueled. Since the nuclear capacity is used preferentially in order to exploit its relatively low fuel cost, actual generation is currently about 12 percent nuclear.

The United States has in the construction phase another 90 gigawatts of nuclear capacity and 130 gigawatts of coal-fired electrical capacity. This will increase total electrical capacity about a third by 1990. Considering that the U.S. presently has an excess reserve capacity of about 10 percent, there will be effectively a 50 percent expansion available to meet increasing demands in the eighties. This can be compared with a doubling of generation every ten years in the period before 1973. The difference reflects price elasticity and conservation.

The electric share of U.S. total energy use is now 31 percent, having grown from 15 percent during World War II. The expansion currently underway, if maintained, may bring this share to about 40 percent by 1990. If U.S. utilities continue to expand at this rate this figure should grow to 45 or more percent by 2000--with the addition of at least another 400 gigawatts of coal and nuclear capacity in the nineties.

There is, of course, some question whether all the plants currently under construction will be completed. There is an even greater question whether the 400 gigawatts in needed additions in the nineties will be ordered in time, that is, during the eighties. These questions arise because of the financial weakness of most U.S. electric companies, making investments in future expansion exceedingly difficult.

U.S. experience has been that rather than ordering the 400 gigawatts for the nineties, that is, 40 gigawatts per year now, cancellations of nuclear capacity have exceeded gross coal ordering rates. In 1979, utilities ordered 4 gigawatts net of coal-fired capacity and cancelled 6 nuclear reactors totaling 7 gigawatts. No new nuclear was ordered. In 1980, again no nuclear capacity was ordered; in fact, some 16 units totaling 18 gigawatts were cancelled. The net of coal orders over coal cancellations was 4 gigawatts once again. These figures are far below the necessary ordering rate of 40 gigawatts per year, coal and nuclear combined.

One respected industry source predicts that nuclear orders in the U. S. will resume about 1984. Meanwhile, the same forecaster predicts 10 gigawatts of coal to be ordered in 1981, 15 gigawatts in 1982 and 20 gigawatts in 1983.

Some idea can be had of how likely further nuclear cancellations are in the U.S. by considering the degree of completeness of those under construction. Of the 83 units, 10 are zero percent complete, 24 are from 1 to 24 percent complete, 13 units from 25 to 49 percent, 19 units from 50 to 74 percent, and 17 from 75 to 99 percent. So far reactors cancelled have generally had less than $200 million in sunk costs. "Percent completed" may not always reflect commitments to purchase equipment. For example, there are another 15 reactors on order, but without construction permits, and one of these is known to have about $350 million in sunk costs.

Previously I have mentioned the need to order 400 gigawatts of additional generating capacity for initial service in the nineties. In prudence it should be about half coal and half nuclear. Since the nuclear units have a lead time of 10 to 14 years the first of this capacity should be ordered immediately.

The need for the additional capacity arises from consideration of the U.S. energy supply and demand situation in 2000. If conservation, which has already cut into usage considerably, is sufficiently effective to reduce future needs by about a third, then 30 percent more energy will still be needed. Industry and government demand estimates range from an additional 20 percent to 70 percent more energy being needed, depending on the degree to which conservation is effective. This is not surprising considering that the U.S. working population will be 130 million in 2000, compared to 100 million today. The additions will be from people already born, so they are not in doubt. Each new worker implies more product which in turn implies more energy needed. Furthermore, the U.S. population profile will be a generally more mature one, requiring more energy per citizen to match real income to today's level.

The supply available to meet this need is constrained. About three-quarters of U.S. energy comes from oil and natural gas. Considering that 40 percent of the oil is imported and domestic supplies are shrinking, this sector will decrease somewhat as efforts are made to cut imports. Even synthetic gas and oil will not make up the entire loss by 2000.

About twenty percent of U.S. energy comes from coal, 4 percent from nuclear energy and 4 percent from hydroelectric power. The coal and nuclear are greatly expandable, the hydro only a bit. Since the nuclear can only be used in electrical generation and a main use for the coal is in electrical generation, it follows that the utilities are the key to doing the necessary job.

Across the seventies the ravages of inflation, currently double digit; increased costs from new regulatory requirements; and tremendously higher fuel costs have had their effect. Most state utility commissioners have found it politically impossible to set rates sufficiently high so that earnings remained adequate. Today earnings are at about two-thirds the level needed for financial viability. Average return on equity is approximately 11 percent.

The result is that utility stocks are selling at about 70 percent of book value and long term bonds sell at about the 15 percent interest level. Under these circumstances large, long-term construction programs are essentially impossible to finance.

The situation can be remedied considerably if double digit inflation can be halted and if utility rates can then catch up with costs. Utility earnings could be restored to a viable level with a 10 to 15 percent increase in rates. After that inflation would have to be tracked.

Of course, there are still other problems faced by nuclear power in the U. S. Regulation has become slower and less efficient at the same time requirements have been greatly increased, especially since the TMI accident in March 1979. These new requirements were projected to cost between $25 million and $75 million at each reactor. Such estimates did not include substantial losses of operating time and some are occurring. For reactors awaiting operating licenses, delays have been even greater, one and two years being frequently the case. As yet no new construction permits have been issued, so that here delays are still open ended.

Since a completed unit may represent a billion dollar commitment, delaying operation of such a reactor will add about $150 million in increased interest charges per year of delay. In addition, the unavailability of the unit usually means that more expensive electricity must come from some alternate source.

Fortunately, increased political pressure is being directed to this deplorable situation and the regulators themselves seem to be seeking better ways of doing their work.

The new administration of President Reagan is, in general, favorably disposed toward nuclear power. At the same time their principal theme is for private enterprise to do most things independently of the government. Of course, their basic effort to reduce government spending, or even investing, goes along with this. In the case of nuclear power this creates a problem in those areas where the federal government has claimed a central role: uranium enrichment services, provision of away-from-reactor spent fuel storage, and the ultimate disposal of high level radioactive waste.

Although the Reagan administration supports the completion of the Clinch River Breeder Reactor, a key committee in the House of Representatives voted to discontinue it, partly as an economy measure. At this moment the issue is not settled and will be settled in the whole House of Representatives and Senate, and in a conference between the Senate and the House of Representatives.

President Carter had opposed reprocessing spent fuel; President Reagan is favorably disposed toward reprocessing, but wants the private sector to provide the capital. Unfortunately, private operation of a reprocessing plant is almost certainly not possible until confidence in the continuity of government policy is re-established and until uncertainty on regulatory requirements is removed.

In this complex situation the nuclear industry is left with a growing inventory of spent fuel and as yet no clear prospect of relief. About 1986 the first reactors to be affected will have used up their on-site spent fuel storage. In the absence of reprocessing services, away-from-reactor storage will be necessary. On that time scale only the use of the storage areas of one or more of the three inactive U.S. commercial reprocessing plants appears to be feasible: the Barnwell Nuclear Fuels Plant, Nuclear Fuel Services' plant at West Valley, New York, and General Electric's plant at Morris, Illinois.

A complication is that Secretary of Energy Edwards is unwilling for the federal government to sponsor away-from-reactor storage at such a site. If that storage also included a plan to reprocess the fuel, then he would be supportive. However, a formula would still be needed under which the capital could be raised off the government's balance sheet. If that can be worked out, it still would seem very important for the Clinch River Breeder Reactor to move forward, for the sake of progress in that key area, of course, but also as a first consumer of plutonium from reprocessing commercial fuel.

While pulling together the many factors affecting the back end of the fuel cycle will be difficult, a desire to do so soon is certainly shared by industry, the Congress, President Reagan and key members of his administration, such as Secretary Edwards.

In the international arena the new administration is restudying U.S. non-proliferation policy. It seems clear to many that the past policy of President Carter and of the U.S. Congress, as exemplified by the Nuclear Non-proliferation Act of 1978, have not won the support of most nuclear supplier nations. Nor have the developing nations, interested in applying nuclear power, accepted such an approach.

In an effort to frame a constructive, negotiable policy the Committee on International Nuclear Policy of the U.S. Atomic Industrial Forum proposed in March of this year the following guiding principles for a new policy:

- Primary emphasis should be placed on the central concept of the Atoms-for-Peace program and of the Nuclear Non-Proliferation Treaty (NPT): cooperation with other countries in the development of nuclear power under IAEA safeguards is the most effective non-proliferation tool.

- The reliability of U.S. political and supply commitments and the predictability and timeliness of U.S. export actions are cardinal elements of an effective non-proliferation policy.

- A strong domestic nuclear program is essential to U.S. leadership in achieving its non-proliferation goals.

The AIF committee went on to propose the following implementing actions:

- Amend the Nuclear Non-Proliferation Act of 1978 (NNPA) to enhance the reliability of U.S. commitments and the efficiency of the export licensing process.

  - Assign to the Department of State the nuclear export licensing functions now performed by the Nuclear Regulatory Commission.

  - Avoid unilateral retroactive conditions on U.S. bilateral commitments and supply arrangements.

  - Reduce to the necessary minimum case-by-case U.S. export actions. Provide for life-of-reactor fuel licensing for countries meeting safeguards and non-proliferation commitments.

  - Establish workable criteria for spent fuel transfers.

- Provide fuel cycle management as well as enrichment services to user countries without such capabilities and encourage other supplier nations to do the same within a framework of commonly agreed non-proliferation measures.

- Reinvigorate the U.S. program for the development and demonstration of the breeder and of the supporting fuel cycle, including reprocessing.

- Cooperate in breeder R&D and in related fuel cycle activities with countries having an industrial justification therefor,

and provide for the orderly entry of other countries into such activities when they reach a comparable stage.

- Seek international consensus that would limit plutonium use to such countries.

- Actively support an international plutonium storage regime under IAEA auspices.

- Seek agreement with other countries to limit nuclear trade under arrangements made subsequent to such agreement to those non-nuclear weapon states that are NPT parties or are willing to accept full scope IAEA safeguards and peaceful use commitments.

- Support the IAEA and strengthen its safeguards capabilities.

Finally, public acceptance of nuclear power remains a problem in the U.S. Before the Three Mile Island accident the public generally favored more use of nuclear power by about two to one. Since then only a bare majority has favored increased use of nuclear power, although of late this majority has strengthened some.

If, however, the question to the public is, "Do you favor more use of nuclear power under tough government regulation?," then those in favor are three or four times those against. This indicates that the public understands the need for nuclear power and wants it under safe conditions.

In general, support is strongest among older vs. younger people, males vs. females, whites vs. minorities, the more educated vs. the less educated. Fortunately, the U.S. has a number of old, white, educated males.

The split in public opinion alone will not stop nuclear power so long as a majority still favor its increased use, as they now do. This support is reflected in the political arena, including the Congress. Obviously this support must be maintained and, if possible, increased. It seems likely that to increase the margin of support greatly it will be necessary to demonstrate the safe operation of nuclear power over a number of years. That may take much more than the current 600 U.S. reactor years of operating experience and the 1900 reactor years worldwide. Only then will the general population develop an intuitive feeling and belief in just how safe this energy source is.

The situation with regard to nuclear power in the U.S. is obviously affected by the political climate. The new Reagan administration is considerably more sympathetic than was the Carter administration, which was apathetic at best. Despite this better atmosphere, severe budget cuts are limiting the amount of direct government

assistance available. One example is the delay in action on proceeding with the Barnwell reprocessing plant. Secretary of Energy Edwards favored government purchase and completion of the plant, but funds were not available this year.

In the Senate and the House of Representatives there has been a shift toward conservative congressmen, generally more sympathetic to nuclear power. On the other hand, conservatives in the U.S. are generally less favorable to government assistance to industry. Also, they generally favor states rights over federal rights. That works against improvements in the regulation of nuclear power, federal action on waste disposal and federal intervention in setting utility rates.

This trend toward conservatism has also affected the political composition of state governments with more conservatives in power. That, in general, should help nuclear power.

Overall the political changes bode well for nuclear power. However, it may be that nothing short of more energy shocks to the U.S. supply over the coming years will turn the situation. Eventually, for the good of the country, changes must come.

Speech to the Canadian Nuclear Association
Ottawa, Canada
June 8, 1981